

Vegetable Crop Protection Guide

2018

PUBLICATION 838



Discard old editions of this publication. Each year the appropriate sub-committee of the Ontario Pest Management Research and Services Committee reviews the pesticides listed in this publication.

To the best knowledge of the committee, at the time of printing, the pesticide products listed in this publication were:

- federally registered
- classified by the Ministry of the Environment and Climate Change (MOECC)

The information in this publication is general information only.

The Ontario Ministry of Agriculture, Food and Rural Affairs 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 merit and 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. Conditional Registration

Conditional registration may be granted for a specified, limited time period, where the registrant agrees to produce additional scientific or technical information.

3. Emergency Registration

An emergency registration is a temporary, time-limited registration of no more than 1 year, approved to deal with serious pest outbreaks that have limited control options.

Maximum Residue Limits

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

You **MUST** obtain a supplemental label and follow all the label directions when PMRA approves new uses for a registered pesticide that do not appear on the current label.

Examples of when you must use a supplemental label include:

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

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

For more information on the federal registration status, search Pest Management Regulatory Agency at www.canada.ca or call 1-800-267-6315.

Regulation of Pesticides in Ontario

The MOECC 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/e-laws or by calling the ServiceOntario Publications Toll-Free number: 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

The Ontario Pesticides Advisory Committee (OPAC) is responsible for reviewing and recommending to the MOECC, the classification of pesticide products before they can be sold or used in Ontario. Once approved by the MOECC, classified products are posted on the MOECC website: ontario.ca/pesticides.

Certification and Licensing

Growers and Their Assistants

For information about certification for growers and training for assistants, check the Ontario Pesticide Education Program website: www.opec.ca or call 1-800-652-8573.

Commercial Applicators (Exterminators) and Their Assisting Technicians

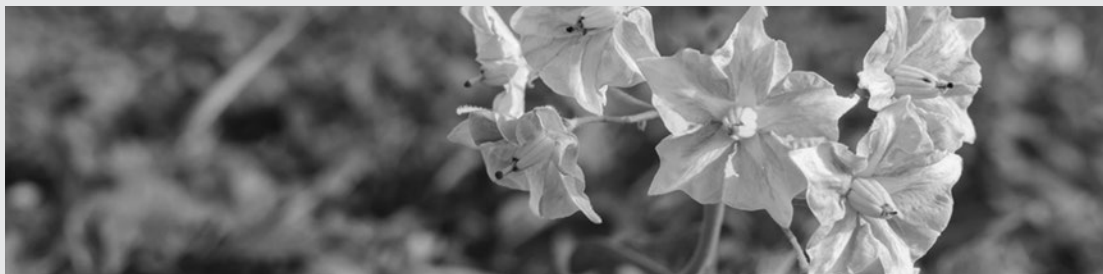
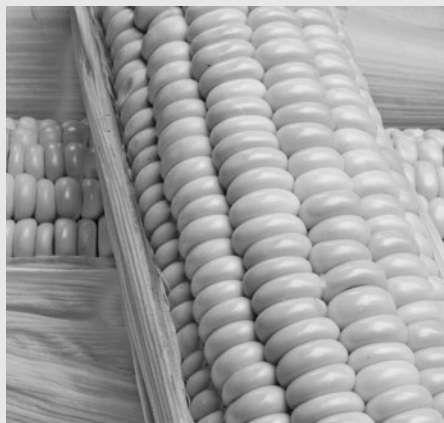
For more information about exterminator licensing and technician training, visit:

- the Ontario Pesticide Training and Certification website at www.ontariopesticide.com/index.cfm/home-page or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council's Pesticide Technician Program website at www.hort-trades.com 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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Acknowledgements

The information contained in this publication is printed following review by the Vegetable Sub-Committee under the Ontario Pest Management Services Committee.

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 January 31, 2017 on field vegetable crops in Ontario. Any supplements to this publication will be posted on the OMAFRA website at ontario.ca/crops.

This publication is a companion to OMAFRA Publication 839, *Ontario Field Vegetable Guide* (expected release date: 2019). This publication will contain more comprehensive information on disease and insect pest biology and management strategies, and other information related to the production of field vegetables in Ontario.

Cover images

Front cover photo: (left to right) cabbage looper (credit: Jim Chaput, Ontario Ministry of Agriculture, Food and Rural Affairs) banana pepper, cutworms (credit: Elaine Roddy, Ontario Ministry of Agriculture, Food and Rural Affairs), tomatoes (credit: Shutterstock), pumpkins, sweet corn (credit: Shutterstock), potato flowers (credit: Shutterstock)

Back cover small photos: top left: spinach (credit: Shutterstock), bottom left: gourds, top right: tomatoes (credit: Shutterstock), bottom right: bean leaves

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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		Appendix D. Production Insurance	308
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cucumber, melons (including cantaloupe, muskmelon, watermelon and bittermelon), pumpkin, squash and gourds			
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Introduction

Products Listed in This Book

Products listed in this book are registered for use on field vegetable crops and have been reviewed by the registrants and the Vegetable Sub-Committee under the Ontario Pest Management Services Committee.

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: www.canada.ca.

Levels of Control for Fungicides and Insecticides

The Efficacy Guidelines for Plant Protection Products in the *Pest Management Regulatory Agency Directive 2003–04* define levels of control as follows:

Fungicides

Control: The product, when applied in accordance with the label directions, consistently reduces disease incidence and severity to a commercially acceptable level.

Suppression: Consistent control at a level that is not optimal, but still of commercial benefit. Suppression is not used for products that show highly variable performance.

Insecticides

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 must 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:

- Publication 839, *Ontario Field Vegetable Guide* (expected release: 2019)
- *Ontario CropIPM*, ontario.ca/cropIPM
- Publication 700, *Integrated Pest Management for Onions, Carrots and Lettuce in Ontario: A handbook for growers, scouts and consultants*
- Publication 12, *Sweet Corn Production Manual*

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 3, 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. 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 19, for information on preventing bee poisoning. Also, search “Protecting Pollinators during Pesticide Spraying”, at www.canada.ca 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.

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

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

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

- Actara 240SC
- Fortenza
- Supresto 75WS
- Cruiser 5FS
- Poncho 600FS
- Titan ST

Do not use during crop or weed flowering period:

- Closer
- Lagon 480 E
- Lorsban 4E/Lorsban NT
- Pyrifos 15G
- Cygon 480
- Lorsban 15G
- Movento 240SC¹
- Pyrinex 480EC
- Fulfill 50WG
- Lorsban 50W
- Nufos 4E
- Warhawk 480 EC

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

- Actara 240SC²
- Concept
- Imidan 70-WP
- Rimon 10 EC
- Actara 25WG²
- Delegate WG
- Lannate TNG
- Silencer 120 EC
- Admire 240F²
- Diazinon 500E
- Malathion 25W
- Success
- Agri-Mek 1.9%-EC
- Diazinon 50WSP
- Malathion 85E
- Thionex 50W WSP
- Agri-Mek SC
- Entrust 80
- Matador 120EC
- Thionex EC
- Alias 240SC
- Entrust
- Oberon Flowable¹
- Voliam Xpress
- Assail 70WP
- Exirel
- Orthene 75% SP
- Vydate L
- Clutch 50WDG
- Grapple
- Radiant SC

Avoid spraying when bees are foraging:

- Ambush 500EC
- Perm-UP
- Sivanto Prime
- UP-Cyde 2.5 EC
- Decis 5 EC
- Pounce 384EC
- Sevin XLR
- Dibrom
- Mako
- TwinGuard

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 Bees may be exposed directly, through spray drift, or to residues on/in leaves, pollen and nectar in flowering crops and weeds.

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 <http://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 Infosheet *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 on 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., Bioprotec).

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 9.
- **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 10.

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, Pynex 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*, on page 6, and *Table 1–2. Fungicide Groups Based on Mode of Action*, on page 7, for a list of chemical families and their modes of action.

The pest control tables in Chapter 3, *Crop Protection*, starting on page 25, 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 75 SP, Pyrifos 15G, Pyrinex 480 EC, Thimet 20-G, Warhawk 480 EC
3A	sodium channel modulators	pyrethroids	Ambush 500EC, Capture 240EC, Concept, Decis 5 EC, Force 3.0G, Mako, Matador 120EC, Perm-Up Pounce 384EC, Silencer 120 EC, UP-Cyde 2.5 EC, Voliam Xpress
4A	nicotinic acetylcholine receptor competitive modulators	neonicotinoids	Admire 240 F, Admire 240 SPT, Assail 70 WP, Actara 240 SC, Actara 25WG, Alias 240 SC, Clutch 50 WDG, Concept, Cruiser 5FS, Gaucho 480 FL, Grapple ₂ , Poncho 600 FS, Sepresto 75 WS, Titan
4C		sulfoximines	Closer, TwinGuard
4D		butenolides	Sivanto Prime
5	nicotinic acetylcholine receptor allosteric modulators	spinosyns	Delegate WG, Entrust, Entrust 80, Success, TwinGuard
6	Glutamate-gated chloride channel allosteric modulators	avermectins	Agri-Mek 1.9% EC, Agri-Mek SC
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
9B	selective homopteran feeding blockers	pymetrozine	Fulfill 50WG
11A	microbial disruptors of insect midgut membranes	<i>Bacillus thuringiensis</i>	Bioprotec 3P, Bioprotec CAF, Dipel 2X DF, Thuricide HPC
15	inhibitors of chitin biosynthesis, type 0	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
28	ryanodine receptor modulators	diamides	Coragen, Exirel, Fortenza, Verimark, Voliam Xpress
29	chordotonal organ modulators	flonicamid	Beleaf 50SG
NC	not classified	not classified	BotaniGard 22WP, BotaniGard ES, Kopa Insecticidal Soap, Opal Insecticidal Soap, Safer's Trounce, Sluggo Professional, Superior 70 Oil, Surround WP

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 2016.

Group #	Mode of Action (Target Site)	Group Name	Product Name(s) ¹	Risk of Developing Resistance
1	mitosis and cell division (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 synthesis in membranes (C14-demethylase)	DMI (demethylation inhibitors)	Aprovia Top, Bumper 432 EC, Caramba, Dividend XL RTA, Emesto Silver, Folicur 432F, Inspire, Maxim D, Mettle 125 ME, Nova, Proline 480 SC, Quadris Top, Quash, Quilt, Stadium, Stratego PRO, Tilt 250E	medium
4	nucleic acids synthesis (RNA polymerase I)	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, Emesto Silver, Fontelis, Kenja 400SC, Lance WDG, Luna Tranquility, Pristine WG, Pro-Gro, Sercadis, Vertisan, 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, Cabrio EG, Cabrio Plus, Dynasty 100FS, Flint, Headline EC, Pristine WG, Quadris Flowable, Quadris Top, Quilt, Reason 500SC, Stadium, Stratego PRO, Tanos 50 DF	high
12	signal transduction (MAP/Histidine-kinase)	PP (phenylpyrroles)	Apron Maxx RFC, Maxim 480FS, Maxim D, Maxim Liquid PSP, Maxim MZ PSP, Maxim PSP, Maxim XL, Scholar 230SC, Stadium, Switch 62.5 WG	low to medium
13	signal transduction	aza-naphthalenes	Quintec	medium
17	sterol biosynthesis in membranes (3-keto reductase, C4-demethylation)	hydroxyanilides	Decree 50 WDG	low to medium
21	respiration (complex III: cytochrome bc1)	Qil (quinone inside inhibitors)	Ranman 400SC, Torrent 400SC	medium to high
22	mitosis and cell division (β-tubulin assembly)	benzamides	Gavel 75DF	low to medium
24	amino acids and protein synthesis (protein synthesis)	hexopyranosyl antibiotic	Kasumin 2L	medium
27	unknown	cyanoacetamide oxime	Curzate 60 DF, Tanos 50 DF	low to medium
29	respiration (uncoupler of oxidative phosphorylation)	2,6-dinitroanilines	Allegro 500F	low
33	unknown	phosphonates	Aliette WDG, Confine Extra, Phostrol, Rampart	low
40	cell wall synthesis (cellulose synthase)	carboxylic acid amides	Acrobat 50 WP, Forum, Orondis Ultra A, Revus, Zampro	low to medium
43	mitosis and cell division (delocalization of spectrin-like proteins)	benzamides	Presidio	resistance not known
44	lipid synthesis and membrane integrity (microbial disrupters of pathogen cell membranes)	microbial	Cease Biological, Serenade Opti, Serenade SOIL	resistance not known

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

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Table 1–2. Fungicide Groups Based on Mode of Action				
This classification scheme is based on the Fungicide Resistance Action Committee (FRAC) List, February 2016.				
Group #	Mode of Action (Target Site)	Group Name	Product Name(s)¹	Risk of Developing Resistance
45	respiration (complex III: cytochrome bc1)	QoSI (Quinone outside Inhibitor)	Zampro	medium to high
46	cell membrane disruption (proposed)	plant extract	Timorex Gold	resistance not known
M1	multi-site contact	inorganic	Copper 53W, Copper Spray, Coppercide WP, Cueva, Kocide 2000, Parasol Flowable, Parasol WG, Coppercide WP	low
M2	multi-site contact	inorganic	Microthiol Disperss, Microscopic Sulphur	low
M3	multi-site contact	dithiocarbamates	Cabrio Plus, Dithane Rainshield, Dithane F-45, 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
M4	multi-site contact	phthalimides	Folpan 80 WDG, Maestro 80DF, Supra Captan 80 WDG	low
M5	multi-site contact	chloronitriles	Bravo ZN, Echo 720, Echo 90DF	low
U8	actin disruption (proposed)	aryl-phenyl-ketone	Vivando SC	medium
U15	oxysterol binding protein (OSBP) inhibition (proposed)	piperidinyl-thiazole-isoxazolines	Orondis Ultra B	medium to high
P1	host plant defence induction (salicylic acid pathway)	benzo-thiadiazole	Actigard 50WG	resistance not known
P5	host plant defence induction	plant extract	Regalia Maxx	resistance not known
NC	not classified (unknown)	diverse	Actinovate SP, Bio-Save 10 LP, Contans WG, Fracture, MilStop, Mycostop, Prestop, PureSpray Green Spray Oil 13E, Rootshield Granules, Rootshield HC, Storox, Tivano	resistance not known

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

- 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.
- 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 pest control products 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.

- When tank-mixing pest control products, ensure that each component belongs to a different chemical group with a different mode of action. Also ensure that they 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.
- If you experience a control failure 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*, on this page, illustrates the paper manufacturer’s recommended droplet density per square centimeter for insecticide, herbicide and fungicide applications.

Table 1–3. Water-and-Oil Sensitive Paper — Recommended Droplet Density

Number of droplets per cm ²	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 hours of completing the application can lead to vapour drift. This occurs when fine particles or volatilizing pesticide gets 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 20, 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 hours 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 hours 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 license 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 license 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 hours 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 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 control): • nematodes • root knot nematode • root lesion nematode (on root vegetables (CG1) only for Pic Plus; on root vegetables (CG1), tomatoes, peppers and potatoes for Chloropicrin 100) • diseases, certain species of • <i>Phytophthora</i> spp. • <i>Thielaviopsis</i> spp. • <i>Fusarium</i> spp. • <i>Pythium</i> spp. • <i>Verticillium</i> spp. (Pic Plus only) Application Notes 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. Leave soil undisturbed for 10–14 days. Aerate for at least 5 days after cultivation. Fumigation may temporarily raise the level of ammonia nitrogen and soluble salts in the soil. This is most likely to occur when heavy rates of fertilizer and fumigant are applied to soils that are either cold, wet, acid or high in organic matter. To avoid injury to plant roots, fertilize as indicated by soil tests taken after fumigation. See label for details. 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	55 L/ha	
		root vegetables (Crop group 1) including: table beets, carrots, horseradish, parsnip, radish, rutabaga, sweet potatoes, sugarbeets, turnips	broadcast or banded ²	93 L/ha	
	Pic Plus (28715)	tomatoes, peppers	broadcast or banded ²	108 L/ha	
		potatoes	banded	64 L/ha	
		root vegetables (Crop group 1) including: table beets, carrots, horseradish, parsnip, radish, rutabaga, sweet potatoes, sugarbeets, turnips	broadcast or banded ²	108 L/ha	
dazomet	Basamid Granular (15032)	eggplant, lettuce, pepper, tomato	seedbeds	3.25–5 kg/100 m ²	• nematodes (unencysted only — will not control cyst nematode) • most germinating weed seeds • soil fungi Application Notes 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.

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 Use the following formula to calculate the rate for banded application: rate for banded application = (product rate (L/ha) x 30)/row spacing (cm).

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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 potassium	Busan 1180 (25124)	vegetables	seedbed (injection)	430–553 L/ha	Soil-borne pests: • nematodes • weeds and germinating weed seeds (see label for list of weeds) • diseases • <i>Rhizoctonia</i> spp. • <i>Pythium</i> spp. • <i>Phytophthora</i> spp. • <i>Verticillium</i> spp. • <i>Sclerotinia</i> spp. • clubroot of crucifers Application Notes 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.
			field (injection)	231–576 L/ha	
metam sodium	Enfuse M 510 (29142)	agricultural	broadcast	0.78 L/30 m ²	Soil-borne pests: • nematodes • weeds • fungi Application Notes 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. Rake again 7 days later to a depth of 5 cm. 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.

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#.

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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 (cont'd)	Busan 1020 (19421)	vegetables	seedbed (injection)	700–900 L/ha	Soil-borne pests: • nematodes • germinating weed seeds (see label for list of weeds) • diseases: • <i>Rhizoctonia</i> spp. • <i>Pythium</i> spp. • <i>Fusarium</i> spp. (Vapam HL only) • <i>Phytophthora</i> spp. • <i>Verticillium</i> spp. • <i>Sclerotinia</i> spp. • clubroot of crucifers Application Notes 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.
			field (injection)	375–935 L/ha	
	Busan 1236 (25103)	vegetables	seedbed (injection)	511–657 L/ha	
			field (injection)	274–683 L/ha	
	Vapam HL (29128)	vegetables	seedbed (injection)	410–670 L/ha	
			field (injection)	279–696 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. Using Pesticides in Ontario

The information in this chapter is updated regularly. For up-to-date information, visit ontario.ca/usingpesticides. Some of the information 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.
www.opep.ca/index.cfm/learning-resources/manual
Keep detailed spray records.

Federal Registration of Pesticides

Before a pesticide can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCP Act) and be classified under the provincial *Pesticides 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 the product has value. It also ensures that any human health and environmental risks associated with its proposed uses are acceptable.

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. 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

The pesticide label is a legal document. Follow all label directions. Labels for all registered pesticides are under "Search Pesticide Labels" on the Government of

Canada website at www.canada.ca. Ensure you have the most current label and are aware of any re-evaluation decisions.

Regulation of Pesticides in Ontario

The Ministry of the Environment and Climate Change (MOECC) 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/e-laws or by calling ServiceOntario at 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

Before a federally registered pesticide can be sold or used in Ontario, it must be classified under the provincial *Pesticides Act*. The Ontario pesticide classification system consists of 12 classes. Ontario's Pesticides Advisory Committee (OPAC) is responsible for assessing new pesticide products and recommending to the MOECC the classification of these products. Pesticide products are classified on the basis of their toxicity, environmental and health hazard, persistence of the active ingredient or its metabolites, concentration, usage, federal class designation (e.g., domestic, commercial, restricted) and registration status. The provincial classification system provides the basis for regulating the distribution, availability and use of pesticide products in Ontario. Once approved by the MOECC, classified products are posted on the MOECC website at ontario.ca/pesticides.

Certification and Licensing

Certified Farmers and Their Assistants

Growers must be certified through the Grower Pesticide Safety Course in order to buy and use Class 2 and 3 pesticides on their farms. They do not require this certification to buy and use Class 4, 5, 6 or 7

pesticides, however, a grower needs to provide his/her Farm Business Registration Number or a signed “Farmer Self Declaration to Enable Purchase of a Class 4 Pesticide” form to the vendor when buying Class 4 pesticides. For information about certification for growers and training for assistants to growers, visit the Ontario Pesticide Education Program website at www.opep.ca or call 1-800-652-8573.

Class 12 Requirements for Growers

Starting on July 1, 2015, new requirements were phased in for growers who plan to purchase or plant neonicotinoid-treated corn (silage or grain) or soybean seed in Ontario. For more information on the training and reporting requirements for growers, visit the MOECC website at ontario.ca/pesticides, then click on “Neonicotinoid regulations.”

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

Exception Uses Under the Cosmetic Pesticide Ban

Pesticides listed in this publication are meant for Exception Uses (e.g., agriculture) under the Cosmetic Pesticide Ban unless the active ingredient is listed under Class 11 pesticides in Ontario Regulation 63/09.

For information about requirements under the *Pesticides Act* and Regulation 63/09, for golf courses and other excepted uses for turfgrass, including mandatory golf course IPM accreditation, go to ontario.ca and search for:

- Pesticides and Golf Courses
- Specialty Turf and Specified Sports Fields

For more information about requirements in the *Pesticides Act* and Regulation 63/09 for the exception regarding the use of pesticides to maintain the health of trees, go to ontario.ca and search for:

- Tree Care Specialists

For more information about pesticide regulations, certification and licensing, see:

- Inside front cover of this publication
- Pest Management Regulatory Agency (PMRA) website: search “Pest Management Regulatory Agency” at www.canada.ca
- PMRA Pest Management Information Service: 1-800-267-6315 or TTY 1-800-465-7735 (from within Canada) or 1-613-736-3799 (from outside Canada)
- Ontario Ministry of the Environment and Climate Change (MOECC) website: ontario.ca/pesticides
- Regional MOECC Pesticides Specialist (See Appendix B. *Ontario Ministry of the Environment and Climate Change — Regional Contact Information*)
- Ministry of Agriculture, Food and Rural Affairs (OMAFRA) website: ontario.ca/omafra
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) website: www.opep.ca
- Ontario Pesticide Training & Certification website: www.ontariopesticide.com
- Pesticide Industry Council’s Pesticide Technician Program website at www.horttrades.com/pesticide-technician
- IPM Council of Canada website: www.ontarioipm.com or www.ipmcouncilcanada.org
- Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca

Pesticide Application Information

When you decide to use a pesticide, choose the most appropriate formulation and application method for your situation. Use only properly calibrated sprayer equipment. Choose less toxic and less volatile alternatives when possible. Take all possible precautions to prevent the exposure of people and non-target organisms to the pesticide. Read the most current pesticide label thoroughly before application. 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/nozzle type, application equipment, timing, appropriate weather conditions)
- required personal protective equipment (PPE)
 - hazard symbols and warnings
 - restricted entry intervals
 - pre-harvest intervals
 - buffer zones
 - precautionary statements
 - steps to be taken in case of an accident
 - disposal

For more information on hazards, consult the Material Safety Data Sheet (MSDS) 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/index.cfm/learning-resources/videos
- 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 — Recommendations on Avoidance, Clean-up and Responsibilities*

Restricted Entry Intervals

Restricted Entry Interval (REI) is the period of time after a pesticide has been applied that agricultural workers or anyone else must not do hand labour tasks in treated areas. The REI allows the pesticide residues and vapours to dissipate to safe levels for work to be done.

An REI can range from 1 hr to several days. A pesticide label may state different REIs that are specific to a crop and post-application task (e.g., scouting, harvesting). If the REI is not stated on a label for agricultural crops, use a 12-hr REI. For golf courses and residential turf applications, the spray solution must be dry before entry can occur.

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 do 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.

A Certified Farmer or Licensed Commercial Applicator (i.e., a holder of the appropriate Exterminator Licence, such as an Agriculture Exterminator Licence or a Greenhouse/Interior Plant Exterminator Licence) may need to re-enter a treated area to do short-term tasks before the end of the REI. In these cases, the Certified Farmer or Licensed Commercial Applicator may re-enter 4 hr after the application wearing a NIOSH-approved respirator and any other protective clothing (PC) and the 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.

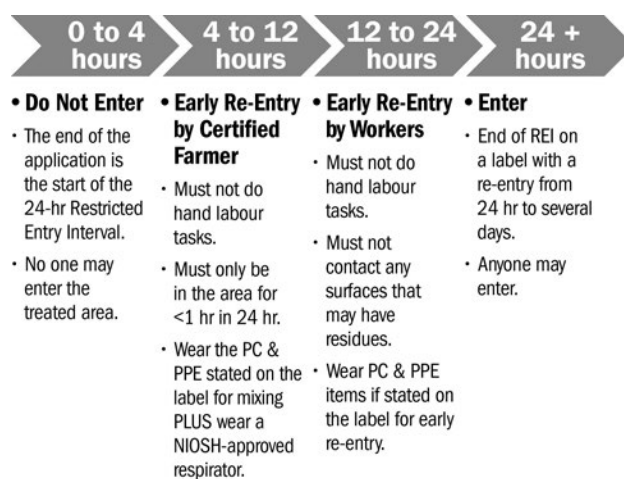


Figure 2–1. Example of a 24-hr REI on a pesticide label.

Certified Farmers and Licensed Commercial Applicators should plan pesticide applications around work tasks so that no one needs to re-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 passed, 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.

Buffer Zones

Buffer zones, or no-spray areas, are areas left untreated to protect an adjacent sensitive area, such as sensitive terrestrial and aquatic habitats. Generally, a buffer zone is the downwind distance separating the point of direct pesticide application from the nearest boundary of a sensitive habitat. For soil fumigation, a buffer zone is an area established around the perimeter of each application block.

Leave a suitable buffer zone between the treatment area and adjacent sensitive area. Buffer zones may vary depending on the method of application (e.g., aerial, field boom, air blast). Check the pesticide labels for buffer zone requirements.

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.

Health Canada’s PMRA has an online spray drift calculator that allows applicators to modify the buffer zones specified on the product label based on weather conditions, the category of the spray equipment and the droplet size. For more information, search Buffer Zone Calculator at www.canada.ca.

Setback Distances for Water Bodies

It is an offence under the federal *Fisheries Act* to introduce into water any material that may be harmful to fish or fish habitat, and under the *Species at Risk Act*, to impact endangered or threatened fishes and fresh water mussels. To protect these waters, applicators must determine a suitable setback distance between the area to be protected and the area where pesticide treatments are planned (if the setback distance is not specified on the pesticide label). The protected area includes the water body as well as adjacent riparian (riverbank) areas that contribute to fish food and habitat.

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 — Recommendations on Avoidance, Cleanup and Responsibilities*
- 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

Honeybees, native bee species 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. 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 honeybees 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 *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.
- Beekeepers should remove honeybee colonies as soon as pollination is complete in the crop and before any insecticides are applied post bloom. 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.
- If there is a risk of honeybee 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 label for guidance.
- Before applying a pesticide or planting with insecticide-treated seed, advise local beekeepers so they can move colonies out of the danger area, if this is an option.

Manage Drift

Pesticide drift is the aerial movement and unintentional deposit of pesticide outside the target area. Drift results in wasted product and may compromise crop protection and also may 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 speeds are high or gusty. These conditions increase the potential for spray and vapour drift. Check pesticide labels for allowable wind speeds for spraying. However, not all labels provide this specific information.
- Constantly monitor wind conditions during spraying using a good-quality wind meter. Record the wind speed and direction. As wind conditions change, you may need to make adjustments to further reduce the drift potential, such as increasing water volume, minimizing nozzle-to-target distance, changing nozzle technology, stopping spraying until conditions improve or, if possible, moving to another field where wind conditions are acceptable for spraying.
- Do not spray during periods of dead calm. Periods of dead calm may occur in early morning or late evening, at which time the temperature is usually cooler and the relative humidity is typically higher, which can result in the spray droplets remaining aloft, like fog. When the wind picks up, these spray droplets can move away from the target area, possibly causing injury to adjacent non-target areas. Off-target drift in calm conditions can occur hours after the spray event was completed.

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

- stay concentrated for long periods over the target
- move with the cool air over considerable distances when the breeze picks up
- move down slopes and concentrate in low-lying regions
- drift unpredictably as the inversion dissipates during the morning

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. Spray applicators can recognize a temperature inversion when:

- there is a big difference between the daytime and nighttime temperatures
- early evening and nighttime wind speeds are considerably less than during the day
- sounds seem to carry farther
- odours seem more intense
- daytime cumulus clouds collapse toward evening
- overnight cloud cover is 25% or less
- mist, fog, dew or frost occur
- smoke or dust hangs in the air and/or moves laterally in a sheet

Temperature inversions start to form 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.**

- Use the sprayer output specified on the pesticide label.
- Use a nozzle that will produce the droplet size specified on the pesticide label or delivers droplets appropriate for the job. Nozzles that produce fine droplets are rarely, if ever, required.
- Where practical, use air induction nozzles, which significantly reduce drift compared to conventional nozzles.
- Check the height of the boom to the target or distance from airblast boom to the target. Minimize the distance 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 spray plume protection where practical or available (hoods, shrouds, screens or air curtains).
- Use drift-reducing adjuvants in the spray tank as directed on the label. Mechanical or hydraulic agitations have been shown to reduce the effectiveness of certain drift-reducing adjuvants. Be aware that certain combinations of anti-drift adjuvants and air-induction nozzles have been shown to increase the incidence of fine droplets that will drift.
- 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) videos *How to Manage Spray Drift* and *Spray Drift Reduction Through Air Induction*, available at www.opep.ca/index.cfm/learning-resources/videos/chapter-18-drift-of-pesticides

Waste Management (container disposal)

Empty Pesticide Containers Up to 23 L

Never re-use empty containers.

The Ontario Empty Pesticide 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 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 1-877-622-4460) or info@cleanfarms.ca.

Empty Pesticide Containers Greater Than 23 L

Growers and commercial applicators should return pesticide containers that are greater than 23 L in size to the point of sale or to the manufacturer for disposal. Contact your local dealer for details on disposal of these containers, or contact CleanFARMS at 416-622-4460 (toll-free at 1-877-622-4460) 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 1-877-622-4460) 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 waste hauler who is licensed under Part V of the *Environmental Protection Act* to carry hazardous wastes. Look in the Yellow Pages of your telephone directory under Liquid Waste Removal.
- CleanFARMS operates a free Obsolete Pesticide Collection Program throughout the province every three 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 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 2–1, the storage requirements that must be followed are dependent on which classes of pesticides you store.

Table 2–1. Requirements for farm pesticide storage facilities

Storage requirements	Pesticide Classes		
	Class 2	Class 3	Class 4, 5, 6 & 7
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	NO	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 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 MOECC Spills Action Centre (1-800-268-6060) should also be readily available.			

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 "Learning."

Pesticide Spills

If a pesticide spill causes, or is likely to cause, an adverse effect that is greater than that which would result from the proper use of the pesticide, you must notify the Ministry of the Environment and Climate Change Spills Action Centre at 1-800-268-6060 (24 hr a day, 7 days a week) and your municipality.

A spill is defined as a discharge of pollutant that is abnormal in quality or quantity, from or out of a structure, vehicle or other container into the environment. An incident such as an overturned pesticide sprayer that results in the loss of the 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.

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 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.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.opep.ca. Select “Learning.”

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

Poison Information Centre: 1-800-268-9017

**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. See product labels for complete 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

— = 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	—	—
	Tilt 250 E	—	—	—	C	—	—
tebuconazole	Folicur	—	—	—	C	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	C	—
trifloxystrobin	Flint	—	—	—	C	C	—
<i>Bacillus subtilis</i>	Serenade SOIL ¹	—	—	—	—	—	S
metiram	Polyram DF	—	—	—	C	—	—
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	—	—	—	—
	UP-Cyde 2.5 EC	—	C	—	—	—	—
deltamethrin	Decis 5 EC	—	C	—	—	—	—
lambda-cyhalothrin	Matador 120EC	C	SC	—	—	—	—
	Silencer 120 EC	C	SC	—	—	—	—
permethrin	Ambush 500EC	—	—	C	—	—	—
	Perm-UP	—	—	C	—	—	—
	Pounce 384EC	—	—	C	—	—	—
acetamiprid	Assail 70 WP	C	C	—	—	—	—
spinetoram	Delegate	—	S	—	—	—	—
spinosad	Entrust	—	C	—	—	—	—
	Success	—	C	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	C	—	—	—	—	—

¹ Applied at the time of planting.

² Late-season climbing cutworms only.

Table 3–2. Asparagus Disease Control

For resistance management, rotate between fungicides 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
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 use in areas treated with product the previous season. Do not make sequential applications of any group 11 fungicide. 12-hr restricted entry interval.
	trifloxystrobin	Flint	210–280 g/ha (85–113 g/acre)	180	Begin application after harvest, prior to disease development. 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.
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	Make the first application after harvest, as soon as fern growth begins. Do not make sequential applications of any group 3 fungicide. 12-hr restricted entry interval.
		Tilt 250E	250 mL/ha (101 mL/acre)	240	Make the first application after harvest, as soon as fern growth begins. Do not make sequential applications of any group 3 fungicide. 12-hr restricted entry interval.
	tebuconazole	Folicur 432F	292 mL/ha (118 mL/acre)	240	Apply as a foliar spray as soon as ferns are 30 cm (12 in.) high. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 3 fungicide. Do not use on areas treated with product the previous season. See label for recropping restrictions. 12-hr restricted entry interval.
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.
dithiocarbamate (group M3)	metiram	Polyram DF	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	—	Post-harvest use only. Use high rate on full-grown fern.
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 44)	<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 hours.

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.

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	2.3 L/ha (0.9 L/acre)	—	Post-harvest only. 12-hr restricted entry interval.
		Lagon 480 E	2.3 L/ha (0.9 L/acre)	—	
pyrethroid (group 3A)	lambda- cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	180	Post-harvest only. 24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)	180	
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	1	Begin applications when treatment thresholds have been reached. 12-hr restricted entry interval.
soap	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	86 mL/ha (35 mL/acre)	1	Apply when beetles or larvae are first observed.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	1	Apply when beetles are first observed. 12-hr restricted entry interval.
	deltamethrin	Decis 5 EC	200 mL/ha (81 mL/acre)	—	Post-harvest use only.
neonicotinoid (group 4A)	acetamiprid	Assail 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.
		Entrust	294 mL/ha (119 mL/acre)	60	
	spinosad	Success	145 mL/ha (59 mL/acre)	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	140 mL/ha (57 mL/acre)	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.
		Perm-UP	180 mL/ha (73 mL/acre)	2	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.

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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.					
LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS CONTINUED					
pyrethroid (group 3A)	permethrin	Pounce 384EC	180 mL/ha (73 mL/acre)	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.

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

This information has been provided as a guideline only. Pest control products listed in these tables are not necessarily registered on all types of beans. See the most up-to-date pest control product labels to ensure the registration on a specific crop.

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 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

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.

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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 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

Active Ingredient(s)	Trade Name	Insects			Seedling Blights					Notes
		Seedcorn Maggot	Wireworm	Potato Leafhopper	Anthraxnose	Phytophthora	Pythium	Fusarium	Rhizoctonia	
INSECTICIDE ONLY										
imidacloprid	Gaucha 480 FL ¹	—	—	C	—	—	—	—	—	For use in commercial or on-farm seed-treatment equipment only. Use 130 mL/100 kg of seed. Gaucha-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 ² + 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
 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	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	—
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

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

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

Legend: C = control 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	Root Rots	Bacterial Blights	White Mold (Sclerotinia)	Anthracnose	Angular Leafspot	Rust	Phytophthora Blight
<i>Bacillus subtilis</i>	Serenade Opti	—	—	S	—	—	—	—
	Serenade SOIL	S	—	—	—	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	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 Control**

For resistance management, rotate between fungicides 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
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.
WHITE MOLD (SCLEROTINIA)					
dicarboximide (group 2)	iprodione	Rovral	1.5 kg/ha (0.6 kg/acre)	15	Snap beans only. Spray at 50% bloom. Tank mix with a non-ionic surfactant. 12-hr restricted entry interval.
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. See label for recropping restrictions. 12-hr restricted entry interval.
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.

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Table 3–6. Snap and Lima Bean Disease Control

For resistance management, rotate between fungicides 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
WHITE MOLD (SCLEROTINIA) CONTINUED					
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 44)	<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 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, 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.
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. See label for rotational crop restrictions. 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	Snap beans. 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 44)	<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. Tank-mix with a non-ionic or organosilicone surfactant. Do not make sequential applications. See label for recropping restrictions. 12-hr restricted entry interval.

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.

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Table 3–6. Snap and Lima Bean Disease Control

For resistance management, rotate between fungicides 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
PHYTOPHTHORA BLIGHT CONTINUED					
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	1	Edible-podded beans only. Tank-mix with a non-ionic surfactant. Do not make sequential applications. See label for recropping restrictions. 12-hr restricted entry interval.

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	—	—
methomyl	Lannate TNG	—	—	—	—	S	C	—	—	—	—
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	—
permethrin	Ambush 500EC	—	—	—	—	—	C	—	—	—	—
	Perm-UP	—	—	—	—	—	C	—	—	—	—
	Pounce 384EC	—	—	—	—	—	C	—	—	—	—
lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	C	C	—	—	—	C	C	—	C	—
imidacloprid	Admire 240 F	C	S	—	—	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	C	C	—	—	—	—	—	—	—	—
spinetoram	Delegate	—	—	—	—	—	C	—	—	—	—
spinosad	Success	—	—	—	—	—	C	—	—	—	—
	Entrust	—	—	—	—	—	C	—	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec CAF	—	—	—	—	—	C	—	—	—	—
novaluron	Rimon 10 EC	—	—	—	—	—	C	—	—	—	—
methoxyfenozide	Intrepid	—	—	—	—	—	C	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	C	—	C	C	—	—	—
cyantraniliprole	Exirel	C	—	—	C	—	C	—	—	S	—
ferric phosphate	Sluggo Professional	—	—	C	—	—	—	—	—	—	—
soap	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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS, BEAN BEETLES, APHIDS					
Soil Application					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	7.5 mL/100 m of row (2.3 mL/100 ft of row)	21	Aphids. See label for application details. Do not use in 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.
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.
		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.
	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	Matador 120EC	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.
		Silencer 120 EC	83–233 mL/ha (34–94 mL/acre)	7	Snap 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. See label for rotational crop restrictions. 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. See label for rotational crop restrictions. 12-hr restricted-entry interval.

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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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications Continued					
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 tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
soap	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, Brown Marmorated Stink Bugs

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)

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.
	methomyl	Lannate TNG	550 g/ha (223 g/acre)	7	12-hr restricted entry interval.
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	Snap 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.
	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.

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

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)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORERS CONTINUED					
spinosyn (group 5)	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. Re-entry permitted when residues are dry.
		Success	83 mL/ha (34 mL/acre)	3	
Bacillus thuringiensis (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	2.8–4.0 L/ha (1.1–1.6 L/acre)	1	Snap beans only. Allow 5–10 days between applications.
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. 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	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 tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
WESTERN BEAN CUTWORMS					
pyrethroid (group 3A)	lambda-cyhalothrin ¹	Matador 120EC	83–187 mL/ha (34–76 mL/acre)	7	Do not graze or feed treated foliage to livestock. 24-hr restricted entry interval.
		Silencer 120 EC	83–187 mL/ha (34–76 mL/acre)	7	Snap 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	Matador 120EC	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.
		Silencer 120 EC	83 mL/ha (34 mL/acre)	7	Snap 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.

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

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)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS CONTINUED					
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 hours. 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 hours. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry.
SLUGS					
not classified	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	0	Apply to moist soils. Use higher rates on severe infestations.
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	550 g/ha (223 g/acre)	7	Suppression. Apply when insect first appears. 12-hr restricted entry interval.

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. See product labels for complete 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 (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 M3)	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

— = 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
fluxapyroxad	Sercadis	C	—	C	—
penthiopyrad	Fontelis	—	—	C	—
azoxystrobin	Quadris	—	—	—	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 Control

For resistance management, rotate between fungicides from different chemical groups.

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CERCOSPORA LEAF SPOT					
Qol (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 recropping restrictions and restricted entry intervals.
inorganic (group M1)	copper sulphate	Copper 53W	4 kg/ha (1.6 kg/acre)	1	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					
Qol (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. See label for recropping restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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 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	1–1.75 L/ha (0.4–0.7 L/acre)	0	Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
Qol (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 recropping restrictions and restricted entry intervals.

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	Lygus Bugs	Stink Bugs	White Grubs
carbaryl	Sevin XLR	—	—	C	C	C	N	—
dimethoate	Cygon 480	C ¹	—	—	C ¹	C ¹	—	—
	Lagon 480 E	C ¹	—	—	C ¹	C	—	—
malathion	Malathion 85E	N	—	—	C	—	—	—
permethrin	Ambush 500EC	—	C	—	—	—	—	—
	Perm-UP	—	C	—	—	—	—	—
	Pounce 384EC	—	C	—	—	—	—	—
imidacloprid	Admire 240	C ²	—	C	C ²	—	—	RN ²

¹ Beet greens only.² See label for details.

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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	Lygus Bugs	Stink Bugs	White Grubs
thiamethoxam	Actara 25WG	C	—	—	C	—	—	—
sulfoxaflor	Closer	C	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	C	—	—	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	—	—	—	—	—	—

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.

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 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.
Foliar Applications					
organophosphate (group 1B)	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	12	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 use on areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a soil application. See label for rotational crop restrictions. 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. See label for recropping restrictions. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	Not for use on beet greens. See label for recropping restrictions. 12-hr restricted entry interval.

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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.

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					
butenolides (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. 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	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 tank-mix and crop tolerance information and rotational crop restrictions. 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. See label for recropping restrictions. 12-hr restricted entry interval.
soap	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 tank mix and crop tolerance information. Avoid spraying during full sun.
CUTWORMS					
pyrethroid (group 3A)	permethrin	Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	—	Beets only. See label for application details. Re-entry permitted once spray deposit has dried.
		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.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 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. See label for tank-mix and crop tolerance information and rotational crop restrictions. 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 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.

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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.					
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 Continued					
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 and rotational crop restrictions. 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 tank-mix and crop tolerance information and rotational crop restrictions. 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.					
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 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.
Foliar Applications					
organophosphate (group 1B)	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	12	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 use on areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a soil application. See label for rotational crop restrictions. 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. See label for recropping restrictions. 12-hr restricted entry interval.

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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.					
LEGEND: PHI = Pre-Harvest Interval (in days)					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAFHOPPERS — Foliar Applications Continued					
butenolides (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. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
TARNISHED PLANT BUG					
organophosphate (group 1B)	dimethoate	Cygon 480	700 mL/ha (283 mL/acre)	12	Beets only. 3-day restricted entry interval.
		Lagon 480 E	700 mL/ha (283 mL/acre)	12	Beets only. 3-day 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 use on areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a soil application. See label for rotational crop restrictions. 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

In this section:

- Table 3-16.** Brassica Crop Seed Treatments
- Table 3-17.** Activity of Fungicides on Brassica Crop Diseases
- Table 3-18.** Brassica Crop Disease Control for Transplants
- Table 3-19.** Brassica Crop Disease Control — Downy Mildew
- Table 3-20.** Brassica Crop Disease Control — Alternaria, Sclerotinia (White Mold, White Rot, Watery Soft Rot)
- Table 3-21.** Brassica Crop Disease Control — Powdery Mildew, Botrytis Gray Mold, Root Rots
- Table 3-22.** Activity of Insecticides on Brassica Crop Insects
- Table 3-23.** Brassica Crop Insect Control for Transplants
- Table 3-24.** Brassica Crop Insect Control — Aphids
- Table 3-25.** Brassica Crop Insect Control — Cutworms, Leafhoppers, Slugs
- Table 3-26.** Brassica Crop Insect Control — Cabbage Maggot
- Table 3-27.** Brassica Crop Insect Control — Flea Beetles
- Table 3-28.** Brassica Crop Insect Control — Thrips
- Table 3-29.** Brassica Crop Insect Control — Imported Cabbageworm, Cabbage Looper, Diamondback Moth Caterpillars
- Table 3-30.** Brassica Crop Insect Control — Swede Midge
- Table 3-31.** Brassica Crop Insect Control — Leafminers

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. This information is provided as a guideline only. See product labels for complete 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 (pythium)	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 (fusarium and rhizoctonia)	See label for complete list of brassica crops, including specialty brassicas. For use in commercial seed treatment facilities.

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Table 3–16. Brassica Crop Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Pests Controlled	Notes
SEED AND SEEDLING DISEASE CONTINUED					
PP (group 12)	fludioxonil	Maxim 480FS	5.2–10.4 mL/ 100 kg seed	seed- and soil-borne diseases (fusarium, rhizoctonia, aspergillus, penicillium)	Cauliflower. 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.
not classified (group NC)	<i>Streptomyces</i>	Mycostop	8 g/ 1 kg of seed	damping-off (fusarium)	Suppression. See label for application details.
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	Clubroot
iprodione	Rovral WP	—	—	—	C	—	—	—	—
metalaxyl-M and S-isomer	Apron XL LS	C	—	—	—	—	—	—	—
fluxapyroxad	Sercadis	—	—	—	S	S	—	—	—
penthiopyrad	Fontelis	—	—	—	C	S	C	C	—
boscalid/pyraclostrobin	Pristine WG	—	—	S	—	—	—	C	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	S	—	C	—	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—	—	—
azoxystrobin	Quadris	—	—	—	S	—	—	—	—
fenamidone	Reason 500SC	—	—	S	—	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	C	—	C	—	—
fludioxonil	Maxim 480FS	C	—	—	—	—	—	—	—
cyazofamid	Torrent 400SC	C	—	S	—	—	—	—	—
fluazinam	Allegro 500F	—	—	—	—	—	—	—	C ¹
fosetyl-AL	Aliette WDG	—	—	C	—	—	—	—	—
mono- and di-basic sodium, potassium and ammonium phosphites	Phostrol	—	—	S	—	—	—	—	—

¹ Chemical control of clubroot is inconsistent.

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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	Clubroot
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	S	—	—	—	—	—
dimethomorph	Forum	—	—	S	—	—	—	—	—
mandipropamid	Revus	—	—	C	—	—	—	—	—
mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	—	—	C	—	—	—	—	—
fluopicolide	Presidio	—	—	C	—	—	—	—	—
<i>Bacillus subtilis</i>	Cease	—	—	S	S ²	—	S	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	—	S	S ²	S	—	—	—
<i>Bacillus subtilis</i>	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	—	—	—	—	—	—	—
chlorothalonil	Bravo ZN	—	—	C	C	—	—	—	—
chlorothalonil	Echo 90DF	—	—	C	C	—	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	—	—	S	—	—	—
<i>Gliocladium catenulatum</i>	Prestop WG	S	—	—	—	—	—	—	—
<i>Streptomyces</i>	Mycostop	S	—	—	—	—	—	—	—
<i>Trichoderma harzianum</i>	RootShield HC	S	—	—	—	—	—	S	—

² Alternaria/Xanthomonas complex (pin rot).

Table 3–18. Brassica Crop Disease Control for Transplants

For resistance management, rotate between fungicides 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
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.

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Table 3–18. Brassica Crop Disease Control for Transplants

For resistance management, rotate between fungicides 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
GREENHOUSE TRANSPLANT DISEASE CONTROL (DAMPING-OFF, ROOT ROT) CONTINUED					
phthalimide (group M4)	captan	Maestro 80DF	1.25 kg/1,000 L of water Apply 50–85 L of solution/100 m².	—	Soil drench treatment. 48-hr restricted entry interval.
not classified (group NC)	<i>Gliocladium catenulatum</i>	Prestop 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.
	Streptomyces	Mycostop	Refer to label for rates and instructions	—	Fusarium. Suppression. Drench or soil spray application. Apply first spray after emergence using lower rate.
	<i>Trichoderma harzianum</i>	RootShield HC	55–110 g/m³ of loose planting mix, soil or planting beds	—	See label for complete list of brassica crops, including specialty brassicas. Root rots caused by rhizoctonia, pythium and fusarium. Suppression. Potting mix application or drench. 4-hr restricted entry interval.
CLUBROOT – transplant treatments¹					
Head and stem brassicas: Broccoli, Chinese broccoli, Brussels sprouts, cabbages, Chinese napa cabbage, Chinese mustard cabbage, cauliflower, cavalo broccolo, kohlrabi — see label					
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	50 mL in 100 L of water Apply 100 mL of solution per plant.	65	Transplant treatment. Apply immediately after transplanting. See label for recropping restrictions. 24-hr restricted entry interval.
			2.9 L in 500 L water/ha	65	Pre-transplant treatment. See label for application details. See label for recropping restrictions. 24-hr restricted entry interval.
Leafy brassica greens: broccoli raab, bok choy, Chinese cabbage, collards, kale, mizuna, mustard greens, rape greens — see label					
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	50 mL in 100 L of water Apply 100 mL of solution per plant.	30	Transplant treatment. Apply immediately after transplanting. See label for recropping restrictions. 24-hr restricted entry interval.
			2.9 L in 500 L water/ha	30	Pre-transplant treatment. See label for application details. See label for recropping restrictions. 24-hr restricted entry interval.
PIN ROT (ALTERNARIA/XANTHOMONAS COMPLEX)					
microbial (group 44)	<i>Bacillus subtilis</i>	Cease	1–2 L/100 L water	0	See label for complete list of brassica crops, including specialty brassicas. Suppression.
POWDERY MILDEW, DOWNY MILDEW					
microbial (group 44)	<i>Bacillus subtilis</i>	Cease	1–2 L/100 L water	0	See label for complete list of brassica crops, including specialty brassicas. Suppression.

¹ Chemical control of clubroot is inconsistent.

Table 3–19. Brassica Crop Disease Control — Downy Mildew

For resistance management, rotate between fungicides from different chemical groups.

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. Preventive 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 (group 40) + piperidinyl-thiazole-isoxazolines (group U15)	mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	400–600 mL/ha (162–243 mL/acre) + 175–350 mL/ha (71–142 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. Do not make sequential applications of any group 40 or U15 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.

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Table 3–19. Brassica Crop Disease Control — Downy Mildew

For resistance management, rotate between fungicides from different chemical groups.

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 group any 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 44)	<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	2.5–4.8 L/ha (1–1.9 L/acre)	7	Broccoli, Brussels sprouts, cabbage and cauliflower. 48-hr restricted entry interval.
		Echo 90DF	1.4–2.7 kg/ha (0.6–1.1 kg/acre)		

¹ Fixed copper may be phytotoxic to cauliflower.**Table 3–20. Brassica Crop Disease Control — Alternaria, Sclerotinia (White Mold, White Rot, Watery Soft Rot)**

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA					
dicarboximide (group 2)	iprodione	Rovral WP	3 kg/ha (1.2 kg/acre)	7	Storage cabbage. Apply 7–14 days prior to harvest. 12-hr restricted entry interval.
				5	Cauliflower. Apply 1–2 days prior to tying. 12-hr restricted entry interval.
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.
QoI (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.
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.
chloronitrile (group M5)	chlorothalonil	Bravo ZN	2.5–4.8 L/ha (1–1.9 L/acre)	7	Broccoli, Brussels sprouts, cabbage and cauliflower. 48-hr restricted entry interval.
		Echo 90DF	1.4–2.7 kg/ha (0.6–1.1 kg/acre)	7	Broccoli, Brussels sprouts, cabbage and cauliflower. 48-hr restricted entry interval.

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Table 3–20. Brassica Crop Disease Control — *Alternaria*, *Sclerotinia* (White Mold, White Rot, Watery Soft Rot)

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA CONTINUED					
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 44)	<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.
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. 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, increase application rate to 3–6 kg/ha (1.2–2.4 kg/acre). See label for application details and chemical compatibility precautions.
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

For resistance management, rotate between fungicides from different chemical groups.

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 group any 7 fungicides. See label for tank-mix precautions and rotational crop restrictions. 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	Mustard greens only. Powdery mildew. 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.

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

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW CONTINUED					
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 44)	<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.

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 75%	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	—	—	—	—	—	—	—
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	—	—

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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
deltamethrin	Decis 5 EC	—	—	—	—	—	C	—	C	C	C	—	—
lambda-cyhalothrin	Matador 120EC	—	—	—	—	—	C	C	C	C	C	C	—
	Silencer 120 EC	—	—	—	—	—	C	C	C	C	C	C	—
permethrin	Ambush 500EC	—	C	—	—	—	C	—	C	C	C	—	—
	Perm-UP	—	C	—	—	—	C	—	C	C	C	—	—
	Pounce 384EC	—	C	—	—	—	C	—	C	C	C	—	—
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	—	C	—	—	—	—	C	—	—	—	—	C
acetamiprid	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
sulfoxaflor	Closer	C	—	—	—	—	—	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	C	—	—	—	—	—	—	—	—	—	—	—
spinosad	Entrust	—	—	—	—	—	S	S	C	C	C	RD	—
	Success	—	—	—	—	—	S	S	C	C	C	RD	—
spinetoram	Delegate	—	—	—	—	—	—	S	C	C	C	—	—
<i>Bacillus thuringiensis</i>	Dipel 2X DF	—	—	—	—	—	—	—	C	C	C	—	—
	Bioprotec CAF	—	—	—	—	—	—	—	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	—
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.

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.
		Success	12.5 mL in 2 L of water Apply 2 L of solution/1,000 plants as a drench before transplanting		

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.

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 75%	563–825 g/ha (228–334 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.

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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.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
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.
			0.7 L/ha (0.28 L/acre)	14	Kale. 3-day restricted entry interval.
	malathion	Malathion 85E	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.
	naled	Dibrom	1.05 L/ha (0.4 L/acre)	4	Broccoli, Brussels sprouts, cabbage and cauliflower. 48-hr restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 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.
	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.
	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.
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 or soil application. See label for rotational crop restrictions. 12-hr restricted entry interval.

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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.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications Continued					
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. 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.
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.
soap	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.

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			

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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.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS CONTINUED					
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.
	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	180–390 mL/ha (73–158 mL/acre)	—	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.
			500 mL/ha (202 mL/acre)	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.
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.
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	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)

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	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.
		Pyrifos 15G			
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			

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.

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.

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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.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Soil Applications Continued					
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.
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.
	deltamethrin	Decis 5 EC	150–200 mL/ha (61–81 mL/acre)	3	Cabbage only. Do not apply after August 1. See label for precautions on high organic content soils.
	lambda- cyhalothrin	Matador 120EC	42 mL/ha (17 mL/acre)	1	Cabbage. 24-hr restricted entry interval.
				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	Ambush 500EC	70–140 mL/ha (28–57 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.
		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.

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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.

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)	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.

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

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.
	lambda-cyhalothrin	Matador 120EC	188 mL/ha (76 mL/acre)	1	Mechanical harvest. Cabbage. Onion thrips. See label for restricted entry intervals.
		Silencer 120 EC	188 mL/ha (76 mL/acre)	3	Mechanical 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.

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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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications Continued					
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.

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.

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.

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

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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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications Continued					
carbamate ¹ (group 1A)	methomyl	Lannate Toss-N-Go	270–540 g/ha (109–219 g/acre)	7	Broccoli, Brussels sprouts and cauliflower. See label for restricted entry intervals.
organophosphate (group 1B)	acephate	Orthene 75%	563–825 g/ha (228–334 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.
				4	Broccoli, Brussels sprouts, cabbage and cauliflower. Imported cabbageworm and diamondback moth. 48-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.
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.
	deltamethrin	Decis 5 EC	150–200 mL/ha (61–81 mL/acre)	1	Brussels sprouts. Do not apply after August 1. See label for precautions on high organic content soils.
				3	Broccoli, cabbage and cauliflower. Do not apply after August 1. See label for precautions on high organic content soils.
			200 mL/ha (81 mL/acre)	1	Kale. Do not apply after August 1. See label for precautions on high organic content soils.
	lambda-cyhalothrin	Matador 120EC	42 mL/ha (17 mL/acre)	1	Cabbage. Imported cabbageworm and diamondback moth larvae. 24-hr restricted entry interval.
		Silencer 120EC	42 mL/ha (17 mL/acre)	3	Broccoli, Brussels sprouts and cauliflower. Imported cabbageworm and diamondback moth larvae. 24-hr restricted entry interval.
		Matador 120EC	83 mL/ha (34 mL/acre)	1	Cabbage. Cabbage looper. 24-hr restricted entry interval.
		Silencer 120EC	83 mL/ha (34 mL/acre)	3	Broccoli, Brussels sprouts and cauliflower. Cabbage looper. 24-hr restricted entry interval.
	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.

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

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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.

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)	permethrin	Pounce 384EC	90–180 mL/ha (36–73 mL/acre)	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.
		Ambush 500EC	70–140 mL/ha (28–57 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.
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.
				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. 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.

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

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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.

LEGEND: PHI = Pre-Harvest Interval (in days); — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications Continued					
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	7	Broccoli raab (rapini), Chinese cabbage (bok choy), collards, kale, mizuna, mustard greens, mustard spinach and rape greens. 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	Bok choy, broccoli, cabbage, cauliflower, Chinese broccoli, Chinese cabbage, collards, kale and mustard greens. Cabbage loopers.
			55–140 g/ha (22–57 g/acre)	0	Broccoli. Diamondback moth and imported cabbageworms.
			55–275 g/ha (22–111 g/acre)	0	Cabbage. Imported cabbageworm.
			275 g/ha (111 g/acre)	0	Bok choy, cabbage, Chinese broccoli and Chinese cabbage. Diamondback moth.
			55–140 g/ha (22–57 g/acre)	0	Bok choy, cauliflower, Chinese broccoli and Chinese cabbage. Imported cabbageworm.
		Bioprotec CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	See label for complete list of brassica crops, including specialty brassicas.
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.

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.

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	Matador 120EC	83 mL/ha (34 mL/acre)	1	Cabbage, Chinese cabbage (napa) and Chinese mustard cabbage (gai choy). 24-hr restricted entry interval.
				3	Broccoli, Brussels sprouts, cauliflower, Chinese broccoli, cavolo broccolo and kohlrabi. 24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)	1	Cabbage. 24-hr restricted entry interval.
				3	Broccoli, Brussels sprouts and cauliflower. 24-hr restricted entry interval.
neonicotinoid (group 4A)	acetamiprid	Assail 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.
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.

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

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. Liriomyza 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.
		Voliam Xpress	500 mL/ha (202 mL/acre)	8	Hand harvest. See label for complete list of brassica crops, including specialty brassicas. Liriomyza 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	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.

CARROTS

In this section:

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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, Flea Beetles, European Chafer Grubs

This information is provided as a guideline only. See product labels for complete 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 (pythium)	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/ 1000 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	—	—	—
penthiopyrad	Fontelis	—	C	—	S	—	—	—	C
fluxapyroxad	Sercadis	—	C	—	C	—	—	—	—
boscalid	Cantus WDG	—	C	—	—	—	—	—	—
boscalid/pyraclostrobin	Pristine WG	—	C	—	—	—	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	C	—	—	—	—	—	C
pyraclostrobin	Cabrio EG	—	C	C	C	—	—	—	—
trifloxystrobin	Flint	—	C	C	—	—	—	—	—
fenamidone	Reason 500SC	C	—	—	—	C	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	—	C	—	—
azoxystrobin/difenoconazole	Quadris Top	—	C	C	—	—	—	—	—
cyazofamid	Torrent 400SC	—	—	—	—	S ¹	—	—	—
fluazinam	Allegro 500F	—	C	—	—	—	—	C	—
<i>Bacillus subtilis</i>	Serenade Opti	—	—	—	—	—	—	S	—
copper sulphate	Copper 53W	—	—	C	—	—	—	—	—
mancozeb	Manzate Pro-Stick	—	C	C	—	—	—	—	—
	Dithane Rainshield	—	C	C	—	—	—	—	—
	Penncozeb 75DF Raincoat	—	C	C	—	—	—	—	—
metiram	Polyram DF	—	C	C	—	—	—	—	—
chlorothalonil	Bravo ZN	—	C	C	—	—	—	—	—
	Echo 90DF	—	C	C	—	—	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	—	—	—	—	S	—

¹ Suppression of cavity spot, root dieback/forking caused by *Pythium* spp.

Table 3–34. Carrot Disease Control — Leaf Blights

For resistance management, rotate between fungicides from different chemical groups.

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 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	1.25–2.25 L/ha (0.5–0.9 L/acre)	0	Alternaria leaf blight. Also suppresses powdery mildew. 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	Alternaria leaf blight. Also controls powdery mildew. 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	580–735 g/ha (234–297 g/acre)	0	Alternaria leaf blight. 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.
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 fungicides. See label for rotational crop restrictions and restricted entry intervals.
			0.56–0.84 kg/ha (226–340 g/acre)	3	Cercospora leaf blight. Do not make sequential applications of any group 11 fungicides. See label for rotational crop restrictions and restricted entry intervals.
	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 fungicides. 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. See label for rotational crop restrictions. 12-hr restricted entry interval.
PP/AP (group 12/9)	fludioxonil/ cyprodinil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	Alternaria leaf blight. Also controls botrytis gray mold. See label for rotational crop restrictions. 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. See label for rotational crop restrictions. 24-hr restricted entry interval.
inorganic (group M1)	copper sulphate	Copper 53W	4 kg/ha (1.6 kg/acre)	1	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			
	metiram	Polyram DF	2.25 kg/ha (0.9 kg/acre)	7	Alternaria and cercospora leaf blights. Do not feed treated tops to livestock.
chloronitrile (group M5)	chlorothalonil	Bravo ZN	2.4–3.2 L/ha (0.1–1.3 L/acre)	2	Alternaria and cercospora leaf blights. 48-hr restricted entry interval.
		Echo 90DF	1.3–1.8 kg/ha (0.53–0.73 kg/acre)		Alternaria and cercospora leaf blights. 48-hr restricted entry interval.

Table 3–35. Carrot Disease Control — Damping-Off, Cavity Spot, Rhizoctonia Crown Rot and Root Rot, Sclerotinia White Mold

For resistance management, rotate between fungicides 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
DAMPING-OFF (PYTHIUM SPP.)					
Qol (group 11)	fenamidone	Reason 500SC	600 mL/ha (243 mL/acre)	14	Post-plant application. Do not make sequential applications of any group 11 fungicides. See label for rotational crop restrictions. Re-entry permitted once spray deposit has dried.
CAVITY SPOT (PYTHIUM SPP.)					
phenylamide (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	Post-plant application. First application made within 7 days after planting. See label for rotational crop restrictions. 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 44)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. May be applied at planting and/or post-planting. See label for application instructions.
RHIZOCTONIA CROWN ROT AND ROOT ROT					
Qol (group 11)	azoxystrobin	Quadris Flowable	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 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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					
2,6-dinitroaniline (group 29)	fluazinam	Allegro 500F	1.16 L/ha (0.47 L/acre)	7	See label for rotational crop restrictions. 24-hr restricted entry interval.
microbial (group 44)	<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	<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 Leafhoppers	Cutworms	Aphids	Flea Beetle
carbaryl	Sevin XLR	—	—	C	C	—	—	—
chlorpyrifos	Lorsban 4E/NT	—	—	—	—	C	—	—
	Pyrinex 480 EC	—	—	—	—	C	—	—
	Nufos 4E	—	—	—	—	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	Matador 120EC	C	C	—	—	—	—	—
	Silencer 120 EC	C	C	—	—	—	—	—
permethrin	Ambush 500EC	—	—	—	—	C	—	—
	Perm-UP	—	—	—	—	C	—	—
	Pounce 384EC	—	—	—	—	C	—	—
imidacloprid	Admire 240 F	—	—	C or S ¹	—	—	C	C
thiamethoxam	Actara 25WG	—	—	—	C	—	C	—
sulfoxaflor	Closer	—	—	—	—	—	C	—
flupyradifurone	Sivanto Prime	—	—	C	C	—	C	—
novaluron	Rimon 10 EC	RD	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	C	—	—
cyantraniliprole	Exirel	—	—	—	—	C	—	C
	Verimark	—	—	—	—	—	—	C
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.

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 (0.6 kg/acre)	40	See label for application details, crop safety information and restricted entry intervals.
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	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.
		Silencer 120 EC	83 mL/ha (34 mL/acre)	7	
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	3	Reduction in damage. 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	Matador 120EC	83 mL/ha (34 mL/acre)	14	24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)	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. See label for application details and rotational crop restrictions. 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. 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 of leafhoppers. 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.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Aster leafhoppers. 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. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Leafhoppers and aster leafhoppers. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
not classified	kaolin	Surround WP	12.5–25 kg in 500 L water/ha (5–10 kg in 45 gal water/acre)	0	May reduce damage caused by aster leafhopper.

Table 3–38. Carrot Insect Control — Cutworms, Flea Beetle, 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.

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	2.4–4.8 L/ha (0.9–1.9 L/acre)	60	See label for application details and rotational crop restrictions. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Nufos 4E			
		Warhawk 480 EC			
pyrethroid (group 3A)	permethrin ¹	Ambush 500EC	140–300 mL/ha (57–121 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.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)	—	
		Pounce 384EC			
	cypermethrin ¹	Mako	175 mL/ha (71 mL/acre)	21	Do not disturb soil for 5 days after application. 12-hr restricted entry interval.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	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.
			250–375 mL/ha (101–152 mL/acre)	1	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.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 mL/acre)	7	Variegated cutworm. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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 BEETLE					
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 and rotational crop restrictions. 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. 24-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/ 100 m of row or 750–1,000 mL/ha (304–405 mL/acre)	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. See label for rotational crop restrictions. 12-hr restricted entry interval.

¹ Seedling treatments.

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Table 3–38. Carrot Insect Control — Cutworms, Flea Beetle, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
FLEA BEETLE — Foliar Applications					
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	Also controls Cabbage Looper, Armyworm, Beet Armyworm, Fall Armyworm, European Corn Borer, Corn Earworm and Aphids. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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.
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	Reduction in numbers of larvae only. Soil application, field drench. See label for application details and rotational crop restrictions. 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. 24-hr restricted entry interval.

CELERY

In this section:

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- Table 3–40.** Activity of Fungicides on Celery Diseases
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This information is provided as a guideline only. See product labels for complete information.

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

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
SEED TREATMENTS				
Qol (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				
microbial (group 44)	<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 fungus root rot. Soil treatment. 48-hr restricted entry interval.
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. 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	Late Blight	Pink Rot (Sclerotinia)	Botrytis Gray Mold	Leaf Curl (Anthracnose)
penthiopyrad	Fontelis	—	C	—	C	—
fluxapyroxad	Sercadis	—	—	C	—	—
boscalid/pyraclostrobin	Pristine WG	S	S	S	—	—
azoxystrobin	Quadris Flowable	C	C	—	—	C
trifloxystrobin	Flint	C	C	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	—	S	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	C	C	—	—	—
	Echo 90DF	C	C	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	S	—	—

Table 3–41. Celery Disease Control — Leaf Blights

For resistance management, rotate between fungicides from different chemical groups.

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.
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.
	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.

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Table 3–41. Celery Disease Control — Leaf Blights

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LEAF BLIGHTS CONTINUED					
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	1.6–2.4 L/ha (0.6–0.9 L/acre)	7	Early blight. 48-hr restricted entry interval.
			2.4–4 L/ha (0.9–1.6 L/acre)	7	Late blight. 48-hr restricted entry interval.
		Echo 90DF	0.9–1.3 kg/ha (0.4–0.5 kg/acre)	7	Early blight. 48-hr restricted entry interval.
			1.3–2.3 kg/ha (0.5–0.9 kg/acre)	7	Late blight. 48-hr restricted entry interval.

Table 3–42. Celery Disease Control — Celery Leaf Curl (Anthracnose), Pink Rot, Botrytis Gray Mold

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CELERY LEAF CURL (ANTHRACNOSE)					
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. For information on emergency use registrations of alternative fungicides, contact an OMAFRA specialist. 12-hr restricted entry interval.
PINK ROT (SCLEROTINIA)					
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.

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Table 3–42. Celery Disease Control — Celery Leaf Curl (Anthracnose), Pink Rot, Botrytis Gray Mold

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PINK ROT (SCLEROTINIA) CONTINUED					
microbial (group 44)	<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 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.
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.
ROOT ROTS					
microbial (group 44)	<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 75%	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	—
	Warhawk 480 EC	—	—	—	—	—	—	C	—
malathion	Malathion 85E	C	—	C	—	—	—	—	—
cypermethrin	Mako	—	C ²	—	—	—	—	—	—
	UP-Cyde 2.5 EC	—	C ²	—	—	—	—	—	—
lambda-cyhalothrin	Matador 120EC	—	—	—	—	C	—	—	—

¹ Green peach aphids only.² Potato leafhopper only.

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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
acetamiprid	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	—	—
spinetoram	Delegate WG	—	—	—	—	—	C	—	—
abamectin	Agri-mek SC	—	—	—	—	—	—	—	C ³
pymetrozine	Fulfill 50WG	C	—	—	—	—	—	—	—
<i>Bacillus thuringiensis</i>	Thuricide HPC	—	—	—	—	—	C	—	—
	Bioprotec CAF	—	—	—	—	—	C	—	—
cyromazine	Citation 75WP	—	—	—	—	—	—	—	C
methoxyfenozide	Intrepid	—	—	—	—	—	C	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	C	C	C ⁵
cyantraniliprole	Exirel	C	—	—	—	—	—	C	C ⁴
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	C	—	—	—	—	—	—	—
kaolin clay	Surround WP	—	—	RD	—	—	—	—	—

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.

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.

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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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Soil Applications Continued					
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 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 75%	563–825 g/ha (228–334 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	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.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	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.
soap	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.

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.
		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 75%	563–825 g/ha (228–334 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	Matador 120EC	83 mL/ha (34 mL/acre)	3	24-hr restricted entry interval.
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.

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.

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

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.
<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 CAF	1.4–2.8 L/ha (0.6–1.1 L/acre)	0	See label for application details.
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.
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			
		Warhawk 480 EC			
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.

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	Assail 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.
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.
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
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Table 3-53. Activity of Insecticides on Cucurbit Insects
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Table 3-55. Cucurbit Insect Control — Two-Spotted Spider Mite, Cutworms, Brown Marmorated Stink Bug

This information is provided as a guideline only. See product labels for complete information.
Pest control products listed in these tables are not necessarily registered on all cucurbit crops.
See the most up-to-date pest control product labels to ensure the registration on a specific crop.

Table 3-48. Cucurbit Seed and Planting Treatments for Damping-off and Early Season Root Rots¹

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 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.
azoxystrobin	Dynasty 100FS	25–50 mL/ 100 kg seed	—	C	—	For import use only; do not treat seeds in Canada. Not for domestic, commercial or on-farm treatment. See label for crop rotation restrictions.
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.
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.

¹ See Table 3-54, Cucurbit Insect Control – Cucumber Beetles, Aphids, for soil applied insect control

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Table 3–48. Cucurbit Seed and Planting Treatments for Damping-off and Early Season Root Rots¹

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
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.
<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>	RootShield HC	55–110 g/m ³ of loose planting mix, soil or planting beds	S	S	S	Drench application to potting soil or mix. See label for a complete list of cucurbit crops.
<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	—	—	Seed treatment. See label for application instructions.

¹ See Table 3-54, Cucurbit Insect Control – Cucumber Beetles, Aphids, for soil applied insect control**Table 3–49. Activity of Fungicides on Cucurbit Diseases**For information on seed decay and root rots, see 3–48. *Cucurbit Seed and Planting Treatments for Damping-off and Early Season Root Rots*

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	Downy Mildew	Powdery Mildew	Angular Leaf Spot	Scab	Anthrachnose	Alternaria	Gummy Stem Blight/ Black Rot	Phytophthora Blight	Fusarium
myclobutanil	Nova	—	C	—	—	—	—	—	—	—
prothioconazole	Proline 480 SC	—	C	—	—	—	—	C	—	C
azoxystrobin/difenconazole	Quadris Top	—	C	—	—	C	C	C	—	—
benzovindiflupyr	Aprovia	—	C	—	—	C	C	C	—	—
boscalid	Cantus WDG	—	—	—	—	—	C	C	—	—
fluxapyroxad	Sercadis	—	C	—	—	—	—	S	—	—
penthiopryad	Fontelis	—	C	—	—	—	—	—	—	—
boscalid/pyraclostrobin	Pristine WG	—	C	—	—	—	C	C	—	—
fenamidone	Reason	N	—	—	—	—	—	—	—	—
pyraclostrobin	Cabrio EG	N	N	—	—	C	C	C	—	—

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Table 3–49. Activity of Fungicides on Cucurbit DiseasesFor information on seed decay and root rots, see 3–48. *Cucurbit Seed and Planting Treatments for Damping-off and Early Season Root Rots*

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	Downy Mildew	Powdery Mildew	Angular Leaf Spot	Scab	Anthrachnose	Alternaria	Gummy Stem Blight/ Black Rot	Phytophthora Blight	Fusarium
quinoxifen	Quintec	—	C	—	—	—	—	—	—	—
cyazofamid	Torrent 400SC	C	—	—	—	—	—	—	—	—
mono- and dibasic sodium potassium and ammonium phosphites	Phostrol	S	—	—	—	—	—	—	—	—
mandipropamid	Revus	S	—	—	—	—	—	—	S	—
dimethomorph	Forum	S	—	—	—	—	—	—	S	—
mandipropamid + oxathiapiprolin	Orondis Ultra	C	—	—	—	—	—	—	C	—
ametoctradin/dimethomorph	Zampro	C	—	—	—	—	—	—	C	—
fluopicolide	Presidio Fungicide	N	—	—	—	—	—	—	—	—
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	S	—	—	—	—	—	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	—	—	—	—
	Supra Captan 80 WDG	—	—	—	C	C	—	—	—	—
folpet	Folpan 80 WDG	S	—	—	—	C	—	—	—	—
chlorothalonil	Bravo ZN	S	C	—	C	C	SC	SC	—	—
	Echo 90DF	—	C	—	C	C	SC	SC	—	—
citric and lactic acid	Tivano	—	S	—	—	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	S	—	—	—	—	—	—	—
potassium bicarbonate	MilStop	—	S	—	—	—	—	—	—	—
extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	—	S	—	—	—	—	—	—	—
metrafenone	Vivando SC	—	C	—	—	—	—	—	—	—

Table 3–50. Cucurbit Downy Mildew Fungicides

For resistance management, rotate between fungicides from different chemical groups.

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	4.8 L/ha (1.9 L/acre)	2	See label for a complete list of registered cucurbit crops. 48-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.					
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. May be tank mixed with Bravo. 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.
CAA (group 40) + piperidinyl- thiazole- isoxazoles (group U15)	mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	400–600 mL/ha (162–243 mL/acre) + 87.5–350 mL/ha (35–142 mL/acre)	0	Will also suppress phytophthora blight, see label for application details. Do not make sequential applications of any group 40 or group U15 fungicide. Do not use on areas treated with product the previous season. Do not apply foliar applications in the same season as a soil application. Must be tank-mixed with Bravo fungicide. See label for rotational crop restrictions. 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.
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 Bravo fungicide. Also provides suppression of phytophthora blight. Do not make sequential applications. See label for crop rotation restrictions. Do not use on areas treated with product the previous season. 48-hr restricted entry interval.
microbial (group 44)	<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.

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

For resistance management, rotate between fungicides from different chemical groups.

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			
	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.
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. See label for rotational crop restrictions. Do not make sequential applications of any group 11 or group 3 fungicide. 12-hr restricted entry interval.
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.
	penthiopyrad	Fontelis	1.25 L/ha (0.5 L/acre)	1	See label for a complete list of registered cucurbit crops. See label for rotational crop restrictions. 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)	0	Also suppresses gummy stem blight at the high rate. Do not apply to any cucurbit crops as a tank-mix with anything other than water. 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 rotational crop restrictions. 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.

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

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW CONTINUED					
SDHI/QoI (group 7/11)	boscalid/ pyraclostrobin	Pristine WG	0.9–1.3 kg/ha (0.3–0.5 kg/acre)	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.
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. See label for rotational crop restrictions. Do not make sequential applications of any group 11 fungicide. See label for restricted entry intervals.
aza-naphthalene (group 13)	quinoxifen	Quintec	300–440 mL/ha (121–178 mL/acre)	3	Melons, pumpkin and winter squash. See label for crop rotation restrictions. Do not make sequential applications. 12-hr restricted entry interval.
microbial (group 44)	<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.
plant extract (group P5)	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	See label for a complete list of registered cucurbit crops. Suppression. Begin applications prior to disease development.
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	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. 48-hr restricted entry interval.
		Echo 90DF	2.7 kg/ha (1.1 kg/acre)	1	
not classified (group NC)	citric and lactic acid	Tivano	12–16 L/ha (5–6 L/acre)	0	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.
	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.
	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.
aryl-phenylketone (group U8)	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 U8 fungicide. See label for guidance on adjuvant use and recropping restrictions. 12-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.

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 Damping-off and Early Season Root Rots</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.
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. See label for rotational crop restrictions. 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/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.
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. See label for rotational crop restrictions. 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. See label for rotational crop restrictions. 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.

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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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA, ANTHRACNOSE, GUMMY STEM BLIGHT, SCAB CONTINUED					
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/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.
		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	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)		
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.
microbial (group 44)	Bacillus amyloliquefaciens	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.
	Bacillus subtilis	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 hours, if required.
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.
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. Cucurbit Seed and Planting Treatments for Damping-off and Early Season Root Rots), 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
 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	—
	Warhawk 480 EC	—	—	—	—	C	—
malathion	Malathion 85E	—	C	N	C	—	—
lambda-cyhalothrin	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	—	—	—
	Grapple ₂	—	C	SC	—	—	—
thiamethoxam	Actara 240SC	—	—	C	—	—	—
thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	—	S	C	—	—	—
flupyradifurone	Sivanto Prime	—	—	C	—	—	—
spiromesifen	Oberon Flowable	—	—	—	C	—	—
spirotetramat	Movento 240 SC	—	—	C	—	—	—
cyantraniliprole	Exirel	—	—	C	—	C	—
chlorantraniliprole	Coragen	—	—	—	—	C	—
flonicamid	Beleaf 50SG	—	—	C	—	—	—
kaolin clay	Surround WP	—	C	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	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.

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. See label for rotational crop restrictions. 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. See label for rotational crop restrictions. Do not use on areas treated with product the previous season. 24-hr restricted entry interval.
		Grappe ₂	0.98 L/ha (0.36 L/acre) ²		
		Admire 240 F	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. See label for rotational crop restrictions. Do not use on areas treated with product the previous season. 24-hr restricted entry interval.
		Alias 240 SC	Transplant water: 25 mL/1,000 plants		
		Grappe ₂	Transplant water: 25 mL/1,000 plants		
	thiamethoxam	Actara 240SC	375–625 mL/ha (151–252 mL/acre)	—	Aphids. Apply in-furrow or banded during planting. 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)	—	Early-season suppression of cucumber 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.
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. See label for rotational crop restrictions. 12-hr restricted-entry interval.
Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	5	See label for a complete list of cucurbit crops and 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. 24-hr restricted entry interval.
			1,100–1,345 mL/ha (445–544 mL/acre)	3	Melons. Do not apply unless plants are dry. 24-hr restricted entry interval.

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

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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.

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	Matador 120EC	187–233 mL/ha (76–94 mL/acre)	1	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.
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 foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for rotational crop restrictions. 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 foliar apply 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. See label for rotational crop restrictions. 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. See label for tank-mix directions and rotational crop restrictions. 12-hr restricted entry interval.
not classified	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.
soap	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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
TWO-SPOTTED SPIDER MITE					
tetrionic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (202–243 mL/acre)	7	Apply before mite populations begin to build. Slow activity; control may not be apparent for 2–3 weeks. 12-hr restricted entry interval.
not classified (group NC)	mineral oil	PureSpray Green Spray Oil 13E	10 L in 1000 L water/ha (1% solution) to ensure thorough coverage	—	Suppression. Begin applications when mites appear. See label for crop safety and chemical compatibility precautions. 12-hr restricted-entry interval.
soap	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.
CUTWORMS					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	5	Climbing cutworms. Do not apply during bloom. 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			
		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 hrs. 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.
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. See label for tank-mix directions and rotational crop restrictions. 12-hr restricted entry interval.

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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.

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.					
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 foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for rotational crop restrictions. 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

This information is provided as a guideline only. See product labels for complete 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 M3)	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)	Streptomyces	Mycostop	5 g/1 kg of seed	Fusarium damping-off. Suppression. See label for application details.
Soil Treatments				
pthalamide (group M4)	captan	Maestro 80DF	1.25 kg in 1,000 L of water	Damping-off, fungus root rot. 48-hr restricted entry interval.
		Supra Captan 80 WDG	Apply 50–85 L of solution per 100 m ² .	
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	Phytophthora blight. Suppression. Make one application as a drench, immediately before transplanting. Do not make sequential applications of any group 40 fungicides. 12-hr restricted entry interval.
microbial (group 44)	<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 preventative 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.

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

Table 3–57. Activity of Fungicides on Eggplant Diseases		
LEGEND: C = control	S = suppression	P = partial suppression
— = not registered for control of this pest, or activity on this pest has not been documented		

¹ See label for details.

Table 3–58. Eggplant Disease Control

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ANTHRACNOSE, ALTERNARIA (EARLY BLIGHT)					
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Alternaria and anthracnose. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
	boscalid	Cantus WDG	175–315 g/ha (71–127 g/acre)	0	Alternaria. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for recropping restrictions. 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 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 (0.51–0.71 L/acre)	0	Alternaria. Suppression. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 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. See label for recropping restrictions. 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 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 recropping restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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 M1)	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.
PHYTOPHTHORA BLIGHT					
phosphonate (group 33)	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. See label for tank-mix and crop tolerance information.

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Table 3–58. Eggplant Disease Control

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHYTOPHTHORA BLIGHT CONTINUED					
CAA (group 40)	mandipropamid	Orondis Ultra A	600 mL/ha (243 mL/acre)	1	Foliar blight. Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 40 or group U15 fungicide. Do not apply foliar applications in the same season as a soil application. See label for rotational crop restrictions. 12-hr restricted entry interval.
+	+	+	+		
piperidinyl-thiazole- isoxazolines (group U15)	oxathiapiprolin	Orondis Ultra B	175–350 mL/ha (71–142 mL/acre)		
microbial (group 44)	<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.
QxI/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. See label for recropping restrictions. 12-hr restricted entry interval.
BOTRYTIS (GRAY MOLD)					
SDHI (group 7)	boscalid	Cantus WDG	420 g/ha (170 g/acre)	0	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for recropping restrictions. 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. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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. Use sufficient volume to thoroughly cover foliage.	—	Suppression. Foliar application.
POWDERY MILDEW					
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 mL/acre)	1	Do not make sequential applications of group 7 fungicides. Do not use on areas treated with product the previous season. See label for recropping restrictions. 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 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 recropping restrictions. 12-hr restricted entry interval.

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Table 3–58. Eggplant Disease Control

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW CONTINUED					
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.
benzophenone (group U8)	metrafenone	Vivando SC	0.75–1.12 L/ha (0.3–0.45 L/acre)	7	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.

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	—	—	—	—
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	—	—	C	—	—	—	—	—	C
imidacloprid	Admire 240	C ¹	C ¹	—	—	—	—	—	—	—
	Alias 240 SC	—	C	—	—	—	—	—	—	—
	Grapple ₂	—	C	—	—	—	—	—	—	—
thiamethoxam	Actara 25WG	C	—	—	—	—	C ¹	RD	C ¹	—
	Actara 240SC	C	C	—	S ¹	—	—	—	—	—
thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	C	C	—	S ¹	—	—	—	—	C
flupyradifurone	Sivanto Prime	C	C	—	—	—	—	—	—	—
spinosad	Entrust	—	C	—	—	—	—	—	—	—
	Success	—	C	—	—	—	—	—	—	—
acequinocyl	Kanemite 15 SC	—	—	—	—	C	—	—	—	—
bifenazate	Acramite 50WS	—	—	—	—	C	—	—	—	—
spiromesifen	Oberon	—	—	—	—	C	—	—	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—	—	—	—	—

¹ See label for details.

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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)
chlorantraniliprole	Coragen	—	C	C	—	—	—	—	—	C
cyantraniliprole	Exirel	C	C	C	C	—	—	—	—	C
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	—	S	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	C	—	—	—	C	—	—	—	—
potassium salts of fatty acids	Opal Insecticidal Soap	C	—	—	—	C	—	—	—	—

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.

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					
neonicotinoid (group 4A)	imidacloprid	Admire 240	7–12 mL/100 m of row (2–4 mL/100 ft of row)	—	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.
	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL water/plant.	30	Transplant water application. See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. See label for recropping restrictions. 12-hr restricted entry interval.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. See label for recropping restrictions. 12-hr restricted entry interval.
		Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. See label for recropping restrictions. 12-hr restricted entry interval.

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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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Soil or Transplant Applications Continued					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	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.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	750–1,000 mL/ha (304–405 mL/acre)	45	See label for application details. Do not use on areas treated with product the previous season. Do not use subsequent foliar group 4D insecticides in the same season. See label for rotational crop restrictions. 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.
neonicotinoid (group 4A)	imidacloprid	Admire 240	200 mL/ha (81 mL/acre)	7	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 soil or transplant application. See label for rotational crop restrictions. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	1	Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. See label for recropping restrictions. 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. Do not apply foliar group 4D insecticides in the same season as a soil or transplant application. 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	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use. See label for 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 guidance on adjuvant use. 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.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	See label for recropping restrictions. 12-hr restricted entry interval.
soap	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 3–61. 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.

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 or Transplant Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240	7–12 mL/100 m of row (2.1–3.7 mL/100 ft of row)	—	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.
		Alias 240 SC	7–10 mL/100 m of row (2.1–3.0 mL/100 ft of row)	70	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.
		Grapple ₂	7–10 mL/100 m of row (2.1–3.0 mL/100 ft of row)		
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	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 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 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)	imidacloprid	Admire 240	200 mL/ha (81 mL/acre)	7	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 soil or transplant application. See label for rotational crop restrictions. 24-hr restricted entry interval.
		Alias 240 SC	200 mL/ha (81 mL/acre)		
		Grapple ₂	200 mL/ha (81 mL/acre)		
butenolides (group 4D)	flupyradifurone	Sivanto Prime	750–1000 mL/ha (304–405 mL/acre)	1	Do not use on areas treated with product the previous season. Do not apply foliar group 4D insecticides in the same season as a soil or transplant application. See label for rotational crop restrictions. 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)		
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. 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 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 use on areas treated with product the previous season. 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.

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.

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") band over row. See label for restricted entry intervals.
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 soil or transplant application. 24-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 use on areas treated with product 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	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 tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.
FLEA BEETLES					
Soil or Transplant Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	Early-season suppression. 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. 12-hr restricted entry interval.
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Early season suppression. 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					
carbamate (group 1A)	carbaryl	Sevin XLR	2.5 L/ha (1 L/acre)	2	See label for restricted entry intervals.
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 tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.
MITES					
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. See label for recropping restrictions. 12-hr restricted entry interval.
bifenazate (group 20D)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	3	12-hr restricted entry interval.

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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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
MITES CONTINUED					
tetrone 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. See label for rotational crop restrictions. 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.
soap	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 3–63. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STINK BUG AND TARNISHED PLANT BUG					
Soil or Transplant Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL water/plant.	30	Suppression. Transplant water application. See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. See label for recropping restrictions. 12-hr restricted entry interval.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	Suppression. See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. See label for recropping restrictions. 12-hr restricted entry interval.
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 intervals.
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	500–700 mL/ha (202–283 mL/acre)		
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	105–210 g/ha (42–85 g/acre)	1	Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. See label for recropping restrictions. 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)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	1	Reduction in damage. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. See label for recropping restrictions. 12-hr restricted entry interval.

GARLIC

In this section:

Table 3–64. Activity of Fungicides on Garlic Diseases

Table 3–65. Garlic Disease Control — Penicillium, Downy Mildew, Root Rots, Pink Root

Table 3–66. Garlic Disease Control — Botrytis Leaf Blight, Purple Blotch, Stemphylium Leaf Blight

Table 3–67. Activity of Insecticides on Garlic Insects

Table 3–68. Garlic Insect Control — Onion Maggot, Thrips

Table 3–69. Garlic Insect Control — Aphids, Leek Moth, Cutworms

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

Table 3–64. 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	Penicillium (Green Mold)	Botrytis Leaf Blight	Botrytis Neck Rot	Downy Mildew	Purple Blotch	Stemphylium Leaf Blight	Root Rots (Pink Root)
iprodione	Rovral	C	—	—	—	—	—	—
penthiopyrad	Fontelis	—	C ¹	—	—	C	—	—
fluxapyroxad	Sercadis	—	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	—	—
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 3–65. Garlic Disease Control — Penicillium, Downy Mildew, Root Rots, Pink Root

For resistance management, rotate between fungicides 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
PENICILLIUM OR GREEN MOLD					
dicarboximides (group 2)	iprodione	Rovral	4 g/L of water	—	Dip cloves into the Rovral suspension for 30 minutes immediately before planting. 12-hr restricted entry interval.
DOWNY MILDEW					
SDHI/QoI (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.
QoI (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.
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.
phosphonates (group 33)	mono- and dibasic sodium, potassium, and ammonium phosphite	Phostrol	2.9–4.3 L/ha (1.2–1.7L/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	Dry bulb onions and shallots. 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 (group 40) + piperidinyl- thiazole- isoxazoles (group U15)	mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	400 mL/ha (162 mL/acre) + 87.5–350 mL/ha (35–142 mL/acre)	7	Do not make sequential applications of any group 40 or group U15 fungicide. Do not use on areas treated with product the previous season. Tank-mix with a non-ionic surfactant. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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 44)	<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.

Table 3–66. Garlic Disease Control — Botrytis Leaf Blight, Purple Blotch, Stemphylium Leaf Blight

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS LEAF BLIGHT					
SDHI (group 7)	penthiopyrad	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.
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 44)	<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)	penthiopyrad	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.

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

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Table 3–66. Garlic Disease Control — Botrytis Leaf Blight, Purple Blotch, Stemphylium Leaf Blight

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PURPLE BLOTCH CONTINUED					
QoI (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.
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 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.
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.
QoI/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.

Table 3–67. 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
	Warhawk 480 EC	C	—	—	—	C
malathion	Malathion 85E	—	C	C	—	—
lambda-cyhalothrin	Matador 120EC	—	C	—	C	—
	Silencer 120 EC	—	C	—	—	—
spinetoram	Delegate WG	—	S	—	S	—
spinosad	Entrust	—	S	—	S	—
	Success	—	S	—	S	—
<i>Bacillus thuringiensis</i>	Bioprotec CAF	—	—	—	S	—
abamectin	Agri-mek SC	—	C	—	—	—
spirotetramat	Movento 240 SC	—	C	—	—	—
cyantraniliprole	Exirel	—	S	—	—	—

Table 3–68. 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.

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			
		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	Matador 120EC	188 mL/ha (76 mL/acre)	14	24-hr restricted entry interval.
		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.
tetrionic 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 two 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 3–69. 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.

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	Matador 120EC	188 mL/ha (76 mL/acre)	14	24-hr restricted entry interval.
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (81–136 g/acre)	3	Suppression. Apply 1 week 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.
		Success ¹	218–262 mL/ha (88–106 mL/acre)	3	Suppression. Apply 1 week 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)	3	Suppression. Apply 1 week 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.
<i>Bacillus thuringiensis</i> (group 11)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	1.4–2.8 L/ha (0.5–1.1 L/acre)	0	Suppression. Apply 7–10 days after peak pheromone capture.
CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	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.
		Pyrinex 480 EC			
		Nufos 4E			
		Warhawk 480 EC			

¹ Maintain a spray water pH of 6 or greater.

HERBS

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

In this section:

Table 3-70.	Products Registered on Herbs Grown in Ontario
Table 3-71.	Herb Seed Treatments
Table 3-72.	Greenhouse Herb Transplant Insect and Disease Control
Table 3-73.	Herb Disease Control
Table 3-74.	Herb Insect Control

Herb Crop Groups

This chapter covers pest control products for the major herbs grown in Ontario: basil, cilantro, chives, dill, lavender, lemon balm, marjoram/oregano, parsley, rosemary, sage, savory, tarragon, thyme and mint. Products covered in this chapter are for herbs intended for **fresh market use only**. Herb seeds, dried leaves and spices have different pest control products and the products listed in this chapter are not necessarily registered on these crops. For these products, consult product labels or an OMAFRA crop specialist to determine if a product is permitted for use.

To facilitate the registration of pest control products, the Pest Management Regulatory Agency uses numbered crop groups. Individual crops are allocated to a crop group based on botanical criteria and cultivation practices. Crop groups simplify pesticide registrations because residue data can be used for a few crops considered representative of that group 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.

Herbs 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, the Pest Management Regulatory Agency is currently reviewing and revising all crop groups, and this process has involved moving some herbs from one crop group to another. This has further complicated pesticide registrations for herbs.

Many culinary herbs fall into Crop Subgroup 19A, the Herb subgroup of Crop Group 19, Herbs and Spices. The following herbs covered in this chapter are currently included in this group:

- balm (lemon balm)
- basil
- cilantro (leaves)*
- chive*
- dill*
- lavender
- marjoram (*Origanum* spp., including sweet marjoram and oregano)
- rosemary
- sage
- savory (summer and winter)
- tarragon
- thyme

This partial list of the crops included in Crop Subgroup 19A is current as of January 2017. The Herb Crop Group is currently being revised and an updated crop group is expected in the near future. **Herbs marked with an asterisk (*)** have recently been moved, to other crop groups, but currently remain in Subgroup 19A until that group is revised.

Fresh parsley leaves have always been in Crop Group 4, *Leafy Vegetables*. In 2014, a revised leafy vegetable crop group, numbered 4-13, was created, and fresh cilantro and dill were added to this group. Similarly, in 2008, bulb vegetables were revised to form Crop Group 3-07, *Bulb Vegetables* Group, and fresh chive leaves were moved into this new group.

These changes will apply to new registrations on the new crop groups (4-13 and 3-07) only — products registered on the old Crop Group 4 cannot be applied to fresh dill or cilantro and products registered on the old Crop Group 3 cannot be applied to fresh chives.

At present, mint is not included in any crop 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 3–70, 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 herbs commonly grown in Ontario. Products included in the table may be listed on additional herbs not covered in this chapter (see labels for full list of registered crops).

Table 3–70. Products Registered on 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 (lemon)	Basil	Cilantro	Chive	Dill	Lavender	Marjoram/ Oregano	Mint	Parsley	Rosemary	Sage	Savory	Tarragon	Thyme
INSECTICIDES AND MITICIDES														
Actara 25 WG	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Actara 240 SC	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Admire 240	R	R	R	R	R	R	R	—	R	R	R	R	R	R
Assail 70 WP	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Beleaf 50 SG	—	—	—	—	—	—	—	R	R	—	—	—	—	—
Bioprotec CAF	—	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	—	—	—	—	—
Dipel 2X DF	—	R	—	—	R	—	—	R	R	—	—	—	—	—
Entrust	—	R	R	R	R	—	—	—	R	—	—	—	—	—
Exirel	—	—	—	R	—	—	—	—	R	—	—	—	—	—
Fulfill 50WG	—	—	—	—	—	—	—	—	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
Malathion 85E	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Minecto Duo	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Movento 240 SC	—	—	—	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

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Table 3–70. Products Registered on 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 (lemon)	Basil	Cilantro	Chive	Dill	Lavender	Marjoram/ Oregano	Mint	Parsley	Rosemary	Sage	Savory	Tarragon	Thyme
FUNGICIDES														
Apron XL	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Cease	R	R	—	R	R	R	—	—	R	R	R	R	—	R
Confine	—	R	—	—	—	—	—	—	—	—	—	—	—	—
Cueva	—	—	—	R	—	—	—	—	R	—	—	—	—	—
Dynasty 100 FS	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Fontelis	—	—	—	R	—	—	—	—	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
Mycostop	R	R	R	R	R	R	R	—	R	R	R	R	R	R
Prestop	—	R	—	—	R	—	R	—	R	—	—	—	—	R
Phostrol	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Pristine WG	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Quadris	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Quadris Top	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Quilt	—	—	—	—	—	—	—	R	—	—	—	—	—	—
Revus	—	R	—	—	—	—	—	—	—	—	—	—	—	—
RootShield HC	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
Serenade SOIL	—	—	—	—	—	—	—	—	R	—	—	—	—	—
Sirocco	R	R	R	R	R	R	R	—	—	R	R	R	R	R
Switch 62.5 WG	—	—	—	R	—	—	—	—	—	—	—	—	—	—
Torrent 400SC	—	R	—	—	—	—	—	—	—	—	—	—	—	—

This information is intended as a guideline only. See product labels for complete information.**Table 3–71.** Herb Seed Treatments

For resistance management, rotate between fungicides from different chemical groups.

Trade Name	Active ingredients	Rate	Pests Controlled	Notes
Maxim 480FS	fludioxonil	5.2–10.4 mL/100 kg seed	Seed decay, damping-off and seedling blights	Do not apply to lemon balm, mint or savory. For use in commercial seed treatment facilities.
Mycostop	Streptomyces	8 g/kg seed	Fusarium damping-off	Do not apply to mint. Greenhouse use only. Suppression. Do not apply on seed to be planted directly in the field. See label for application instructions.

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Table 3–71. Herb Seed Treatments

For resistance management, rotate between fungicides from different chemical groups.

Trade Name	Active ingredients	Rate	Pests Controlled	Notes
Apron XL LS	metalaxyl-M and S-isomer	20–40 mL/100 kg seed	damping-off (pythium)	Parsley only. Do not apply to parsley seed destined to be grown in the greenhouse — label treated seed accordingly.
Dynasty 100FS	azoxystrobin	25–50 mL/100 kg seed	damping-off (<i>Rhizoctonia solani</i>)	Parsley only. For import use only; do not treat seed in Canada. See label for recropping restrictions.

Table 3–72. Greenhouse Herb Transplant Disease and Insect Control**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					
Qil (group 21)	cyazofamid	Torrent 400SC	0.2–0.22 L/ha (0.08–0.09 L/acre)	0	Basil only. Downy mildew. Tank mix with a non-ionic surfactant, as per label instructions. Do not make sequential 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. Downy mildew. Suppression. Re-entry to greenhouse permitted after spray mist has cleared and treated surface is dry.
CAA (group 40)	mandipropamid	Revus	583 mL/ha (233 mL/acre)	1	Basil only. Downy mildew. Tank mix with a non-ionic surfactant. Do not make sequential applications of any group 40 fungicide. 12-hr restricted entry interval.
microbial (group 44)	<i>Bacillus subtilis</i>	Cease Biological	1–2 L/100 L water	0	Do not apply to cilantro, marjoram/oregano, mint or tarragon. Greenhouse use only. Botrytis gray mold and sclerotinia white mold. Suppression.
	<i>Trichoderma harzianum</i>	RootShield HC	55–110 g/m ³ soil	—	Do not apply to mint. 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.
not classified (group NC)	potassium bicarbonate	MilStop	0.28–0.56 kg/1,000 m ²	0	Do not apply to mint or parsley. Powdery mildew. Suppression. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.
		Sirocco		0	
	<i>Gliocladium catenulatum</i>	Prestop	Refer to label for rates and application instructions	—	Basil, dill, oregano, parsley and thyme. 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.
GREENHOUSE TRANSPLANT INSECT CONTROL					
not classified	<i>Beauveria bassiana</i>	BotaniGard ES	0.5–1 L/400 L spray volume	0	Do not apply to mint. Greenhouse use only. Aphids and whitefly. 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.
			2 L/400 L spray volume	0	Do not apply to mint. Greenhouse use only. 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.

Table 3–73. Herb Disease Control

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DAMPING-OFF					
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.6 L/acre)	0	Parsley only. Suppression of root rots caused by <i>Pythium</i> spp. and <i>Rhizoctonia solani</i>. See label for application details.
POWDERY MILDEW					
QoI/DMI (group 11/3)	azoxystrobin/ propiconazole	Quilt	1 L/ha (0.4 L/acre)	7	Mint only. Begin applications when plants are 5–10 cm (2–4 in.) high or conditions favour disease development. 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.
not classified	potassium bicarbonate	MilStop	2.8–5.6 kg/ha (1.1–2.2 kg/acre)	0	Do not apply to mint or parsley. Suppression. Not all herbs or herb varieties have been tested for phytotoxicity. 4-hr restricted entry interval.
		Sirocco			
RUST					
QoI/DMI (group 11/3)	azoxystrobin/ propiconazole	Quilt	1 L/ha (0.4 L/acre)	7	Mint only. Begin applications when plants are 5–10 cm (2–4 in.) high or conditions favour disease development. 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.
SEPTORIA LEAF SPOT					
QoI (group 11)	azoxystrobin	Quadris	0.45–1.12 L/ha (180–450 mL/acre)	1	Parsley only. Will also control <i>Alternaria</i> leaf blight. 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.
inorganic (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 (100–133 mL/acre)	7	Parsley only. Sclerotinia. Do not use on areas treated with product the previous season. 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.
	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 sequential applications of any group 7 fungicides. See label for tank mix precautions and rotational crop restrictions. 12-hr restricted entry interval.
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade OPTI	0.6–1.7 kg/ha (0.2–0.7 kg/acre)	0	Parsley. Suppression.
			1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Other herbs; do not apply to cilantro, marjoram/oregano, mint or tarragon. Suppression.
BOTRYTIS LEAF BLIGHT					
SDHI (group 7)	fluxapyroxad	Sercadis	333–666 mL/ha (133–266 mL/acre)	7	Chives only. Do not use on areas treated with product the previous season. 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.

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Table 3–73. Herb Disease Control

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS LEAF BLIGHT CONTINUED					
SDHI (group 7)	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.71 L/acre)	3	Chives only. 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/AP (group 7/9)	fluopyram/ pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	Chives only. Do not make sequential applications of any group 7 or group 9 fungicide. See label for recropping restrictions and restricted entry intervals.
AP (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Chives only. Do not make sequential applications of any group 9 fungicides. See label for recropping restrictions and restricted entry intervals.
AP/PP (group 9/12)	cyprodinil/ fludioxonil	Switch 62.5 WDG	775–975 g/ha (314–394 g/acre)	7	Chives only. Do not make sequential applications of any group 9 or group 12 fungicides. See label for recropping restrictions and restricted entry intervals.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (284–400 mL/acre)	7	Chives only. 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 recropping restrictions. 12-hr restricted entry interval.
QoI/SDHI (group 11/7)	pyraclostrobin/ boscalid	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Chives only. Do not make sequential applications of any group 11 or group 7 fungicides. See label for recropping restrictions and restricted entry intervals.
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–2.5 kg/ha (0.68–1 kg/acre)	0	Chives only. Suppression.
inorganic (M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L water/ha (180–390 L/acre)	1	Chives 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.
BASIL DOWNY MILDEW					
Qil (group 21)	cyazofamid	Torrent 400SC	0.2–0.22 L/ha (0.08–0.09 L/acre)	0	Basil only. Tank-mix with a non-ionic or organosilicone surfactant. Do not make sequential 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.
CAA (group 40)	mandipropamid	Revus	583 mL/ha (233 mL/acre)	1	Basil only. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 40 fungicide. 12-hr restricted entry interval.
ONION DOWNY MILDEW					
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	710–1,000 mL/ha (284–400 mL/acre)	7	Chives only. 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 recropping restrictions. 12-hr restricted entry interval.
QoI/SDHI (group 11/7)	pyraclostrobin/ boscalid	Pristine WG	1.3 kg/ha (0.5 kg/acre)	7	Chives only. Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 or group 7 fungicides. See label for recropping restrictions and restricted entry intervals.
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	Chives only. Suppression. 12-hr restricted entry interval.

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Table 3–73. Herb Disease Control

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ONION DOWNY MILDEW CONTINUED					
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.68–1.3 kg/acre)	0	Chives only. Suppression.
inorganic (M1)	copper octanoate	Cueva	0.5%–2% solution, applied at 470–940 L water/ha (190–380 L/acre)	1	Chives 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.
PURPLE BLOTCH					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Chives only. Do not use on areas treated with product the previous season. 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.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Chives only. Also suppresses botrytis fleck caused by <i>Botrytis cinerea</i> ¹ . Do not make sequential applications of group 7 fungicides. See label for tank mix precautions and rotational crop restrictions. 12-hr restricted entry interval.
SDHI/AP (group 7/9)	fluopyram/pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	Chives only. Do not make sequential applications of any group 7 or group 9 fungicides. See label for recropping restrictions and restricted entry intervals.
AP (group 9)	pyrimethanil	Scala SC	2 L/ha (0.8 L/acre)	7	Chives only. Do not make sequential applications of any group 9 fungicides. See label for recropping restrictions and restricted entry intervals.
AP/PP (group 9/12)	cyprodinil/fludioxonil	Switch 62.5 WDG	775–975 g/ha (314–394 g/acre)	7	Chives only. Suppression. Do not make sequential applications of any group 9 or group 12 fungicides. See label for recropping restrictions and restricted entry intervals.
QoI/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (284–400 mL/acre)	7	Chives only. Also controls cladosporium leaf blotch. 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 recropping restrictions. 12-hr restricted entry interval.
QoI/SDHI (group 11/7)	pyraclostrobin/boscalid	Pristine WG	1–1.3 kg/ha (0.4–0.5 kg/acre)	7	Chives only. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 or group 7 fungicides. See label for recropping restrictions and restricted entry intervals.
STEMPHYLIUM LEAF BLIGHT					
SDHI (group 7)	fluxapyroxad	Sercadis	250–333 mL/ha (101–135 mL/acre)	7	Chives only. 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.
SDHI/AP (group 7/9)	fluopyram/pyrimethanil	Luna Tranquility	1,200 mL/ha (486 mL/acre)	7	Chives only. Suppression. Do not make sequential applications of any group 7 or group 9 fungicide. See label for recropping restrictions and restricted entry intervals.
QoI/DMI (group 11/3)	azoxystrobin/difenoconazole	Quadris Top	710–1,000 mL/ha (284–400 mL/acre)	7	Chives only. Suppression. 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 recropping restrictions. 12-hr restricted entry interval.

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

Table 3–74. Herb 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.

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

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)	21	Parsley. 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. Do not use on areas treated with product the previous season. Not all herbs or herb varieties have been tested for phytotoxicity. See label for rotational crop restrictions. 24-hr restricted entry interval.
				14	Other herbs; do not use on mint. See label for application details. Do not use subsequent foliar group 4 insecticides in the same season. Do not use on areas treated with product the previous season. Not all herbs or herb varieties have been tested for phytotoxicity. See label for rotational crop restrictions. 24-hr restricted entry interval.
	thiamethoxam	Actara 240SC	375–625 mL/ha (150–250 mL/acre)	—	Parsley only. Also suppresses early-season flea beetles. See label for application details. 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)	—	Parsley only. 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.
APHIDS – Foliar Applications					
organophosphate (group 1B)	malathion	Malathion 85E	1,000–1,345 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 (80 mL/acre)	7	Do not use on mint. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. Do not use on areas treated with product the previous season. Not all herbs or herb varieties have been tested for phytotoxicity. See label for rotational crop restrictions. 24-hr restricted entry interval.
	acetamiprid	Assail 70 WP	56–86 g/ha (22–34 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. 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	Parsley only. See label for tank mix precautions and recropping restrictions. 12-hr restricted entry interval or until residues have dried.

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Table 3–74. Herb 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS – Foliar Applications Continued					
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Cilantro, dill and parsley. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Parsley only. Aphids will stop feeding shortly after application but may remain on plants for several days. Apply with an adjuvant for optimum control under drought stress, as per label instructions. See label for recropping restrictions. 12-hr restricted entry interval.
tetrone and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	220–365 mL/ha (88–146 mL/acre)	3	Parsley only. 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 (200–600 mL/acre)	1	Parsley only. See label for guidance on adjuvant use. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for tank mix and crop tolerance precautions, and rotational crop restrictions. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (48–64 g/acre)	0	Parsley. Use high rate on high populations or dense foliage. See label for recropping restrictions. 12-hr restricted entry interval.
				7	Peppermint and spearmint. Use high rate on high populations or dense foliage. See label for recropping restrictions. 12-hr restricted entry interval.
soap/pyrethroid (soap/group 3A)	potassium salts of fatty acids/ pyrethrins	Safer's Trounce	5 L/ha (2 L/acre)	1	Do not apply to mint. Reduction in populations. Also reduces populations of spider mites and earwigs. See label for application instructions and rates for parsley.
soap	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 apply to mint. Also controls mites. 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	8 L in 400 L of water. Apply dilute solution at a rate of 700–1,900 L/ha. (283–770 L/acre)		
THRIPS					
spinosyn (group 5)	spinetoram	Delegate	200–280 g/ha (80–112 g/acre)	1	Basil. Suppression. Apply when larvae are small. 12-hr restricted entry interval. Do not make more than two sequential applications of any group 5 insecticide.

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Table 3–74. Herb 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
THRIPS CONTINUED					
spinosyn (group 5)	spinetoram	Delegate	200–336 g/ha (80–135 g/acre)	1	Cilantro, dill and parsley. Suppression. Apply when larvae are small. 12-hr restricted entry interval. Do not make more than two sequential applications of any group 5 insecticide.
	spinosad	Entrust	364 mL/ha (146 mL/acre)	1	Basil. Suppression. Apply when larvae are small. Ensure spray solution penetrates the leaf axils. Use high rate when pressure is high. Do not make more than two sequential applications of any group 5 insecticide. Re-entry permitted when residues are dry.
			437–527 mL/ha (177–213 mL/acre)	3	Chives. Suppression. Apply when larvae are small. Ensure spray solution penetrates the leaf axils. Use high rate when pressure is high. Do not make more than two sequential applications of any group 5 insecticide. Re-entry permitted when residues are dry.
		Success	182 mL/ha (73 mL/acre)	1	Basil. Suppression. Apply when larvae are small. Ensure spray solution penetrates the leaf axils. Use high rate when pressure is high. Do not make more than two sequential applications of any group 5 insecticide. Re-entry permitted when residues are dry.
			218–262 mL/ha (88–106 mL/acre)	3	Chives. Suppression. Apply when larvae are small. Ensure spray solution penetrates the leaf axils. Use high rate when pressure is high. Do not make more than two sequential applications of any group 5 insecticide. Re-entry permitted when residues are dry.
tetronic and tetramic acid derivatives (group 23)	spirotetramat	Movento 240 SC	365 mL/ha (147 mL/acre)	3	Parsley. Onion thrips larvae. Use only when populations are low. Reduction in numbers of thrips larvae may take 3–4 days. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.
				7	Chives. Onion thrips larvae. Use only when populations are low. Reduction in numbers of thrips larvae may take 3–4 days. See label for guidance on adjuvant use and recropping restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (0.4–0.6 L/acre)	1	Chives only. Suppression. Use only when populations are low. See label for guidance on adjuvant use. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for tank mix and crop tolerance precautions, and rotational crop restrictions. 12-hr restricted entry interval.

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Table 3–74. Herb 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER					
Soil Applications					
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	750 g/ha (303 g/acre)	—	Parsley only. 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.
Foliar Applications					
spinosyn (group 5)	spinetoram	Delegate	140–200 g/ha (56–81 g/acre)	1	Basil, cilantro, dill and parsley. Apply when larvae are small. 12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (146 mL/acre)	1	Basil, cilantro, dill and parsley. Apply when larvae are small. Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (73.6 mL/acre)	1	
diacylhydrazine (group 18)	methoxyfenozide	Intrepid	0.3–0.6 L/ha (0.1–0.2 L/acre)	1	Parsley. Apply when larvae are small and actively feeding. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval
			0.58–1.6 L/ha (0.2–0.6 L/acre)	1	Other herbs; do not apply to chives or mint. Apply when larvae are small and actively feeding. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Dipel 2X DF	275 g/ha (110 g/acre)	0	Parsley. Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants.
			275–550 g/ha (110–220 g/acre)	0	Other herbs. Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants.
		Bioprotec CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	Apply to small, actively feeding larvae. Use higher rate for higher infestations or larger plants.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (100 mL/acre)	1	Parsley. 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. 12-hr restricted entry interval.
				3	Mint. 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 (100–200 mL/acre)	1	Parsley only. See label for guidance on adjuvant use. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for tank mix and crop tolerance precautions, and rotational crop restrictions. 12-hr restricted entry interval.

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Table 3–74. Herb 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (100 mL/acre)	1	Parsley. Black cutworms. Apply to small plants, when no rain is forecast in the next 24 hours. 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. 12-hr restricted entry interval.
			250–375 mL/ha (101–151 mL/acre)	1	Chives. Black cutworms. Apply to small plants, when no rain is forecast in the next 24 hours. 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. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (200–300 mL/acre)	1	Parsley only. Apply to small plants, when no rain is forecast in the next 24 hours. See label for guidance on adjuvant use. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for tank mix and crop tolerance precautions, and rotational crop restrictions. 12-hr restricted entry interval.
LEAFHOPPERS					
Soil Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (150–250 mL/acre)	—	Parsley only. Also suppresses early-season flea beetles. See label for application details. 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)	—	Parsley only. 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					
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. See label for restricted entry intervals.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (80 mL/acre)	7	Do not apply to mint. Suppression. Do not apply foliar group 4 insecticides in the same season as a soil or transplant application. Do not use on areas treated with product the previous season. Not all herbs or herb varieties have been tested for phytotoxicity. See label for rotational crop restrictions. 24-hr restricted entry interval.
not classified	kaolin clay	Surround WP	12.5–25 kg/ha (5–10 kg/acre)	0	Parsley only. Aster leafhopper. 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.

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Table 3–74. Herb 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
TARNISHED PLANT BUG					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (84 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.
DIPTERAN LEAFMINERS					
Soil Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (150–250 mL/acre)	—	Parsley only. Also suppresses early-season flea beetles. See label for application details. 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)	—	Parsley only. 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	86 g/ha (34 g/acre)	7	Parsley only. Pea leafminer. 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 (75 g/acre)	7	Parsley only. Pea leafminer. Use sufficient water to achieve adequate coverage. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	1–1.5 L/ha (0.40–0.6 L/acre)	1	Parsley only. See label for guidance on adjuvant use. Do not apply foliar group 28 insecticides in the same season as a soil application. See label for tank mix and crop tolerance precautions, and rotational crop restrictions. 12-hr restricted entry interval.
LEEK MOTH					
spinosyn (group 5)	spinosad	Entrust	437–527 mL/ha (177–213 mL/acre)	3	Chives only. 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 are dry.
		Success	218–262 mL/ha (88–106 mL/acre)		
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	1.4–2.8 L/ha (0.6–1.1 L/acre)	0	Chives only. Suppression. Apply 7–10 days after peak pheromone capture.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–151 mL/acre)	1	Chives only. Suppression. 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. 12-hr restricted entry interval.

HORSERADISH

In this section:

Table 3-75. Activity of Fungicides and Insecticides on Horseradish Diseases and Insects

Table 3-76. Horseradish Disease Control

Table 3-77. Horseradish Insect Control — Aphids, Flea Beetles

Table 3-78. Horseradish Insect Control — Leaf-Eating Caterpillars, Cutworms, Swede Midge, European Chafer Grubs

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

Table 3-75. Activity of Fungicides and Insecticides on Horseradish Diseases and Insects

LEGEND: C = control

RD = reduction in damage

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

Common Name	Trade Name	Alternaria	Cercospora	Powdery Mildew	Botrytis Gray Mold	Rhizoctonia	Aphids	Flea Beetles	Leaf-Eating Caterpillars	Cutworms	Leafhoppers	Swede Midge
FUNGICIDES												
penthiopyrad	Fontelis	—	—	—	C	—	—	—	—	—	—	—
fluxapyroxad	Sercadis	S	—	C	—	—	—	—	—	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	C	—	—	—	—	—	—	—
pyraclostrobin	Cabrio EG	C	C	C	—	—	—	—	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	C	—	—	—	—	—	—
trifloxystrobin	Flint	C	—	—	—	—	—	—	—	—	—	—
<i>Bacillus subtilis</i>	Serenade SOIL	—	—	—	—	S	—	—	—	—	—	—
INSECTICIDES												
carbaryl	Sevin XLR	—	—	—	—	—	—	C	C ¹	—	C	—
permethrin	Pounce 384EC	—	—	—	—	—	—	C	—	—	—	—
	Perm-UP	—	—	—	—	—	—	C	—	—	—	—
	Ambush 500EC	—	—	—	—	—	—	C	—	—	—	—
imidacloprid	Admire 240 F	—	—	—	—	—	C	C	—	—	C or S ²	—
thiamethoxam	Actara 25WG	—	—	—	—	—	C	—	—	—	—	—
sulfoxaflor	Closer	—	—	—	—	—	C	—	—	—	—	—
flupyradifurone	Sivanto Prime	—	—	—	—	—	C	—	—	—	C	—
spinosad	Success	—	—	—	—	—	—	—	C	—	—	—
	Entrust	—	—	—	—	—	—	—	C	—	—	—
spinetoram	Delegate WG	—	—	—	—	—	—	—	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	—	C	C	—	C
cyantraniliprole	Exirel	—	—	—	—	—	C	C	C	C	—	—
flonicamid	Beleaf 50SG	—	—	—	—	—	C	—	—	—	—	—

¹ For control of imported cabbageworm and diamondback moth only.

² Level of control for leafhoppers depends on application method.

Table 3–76. Horseradish Disease Control

For resistance management, rotate between fungicides from different chemical groups.

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. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicide. See label for rotational crop restrictions. 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 fungicide. See label for restricted entry intervals.
	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	Do not make sequential applications of any group 7 fungicide. See label for rotational crop restrictions. 12-hr restricted entry interval.
PP/AP (group 12/9)	cyprodinil/fludioxonil	Switch 62.5 WG	775–975 g/ha (314–395 g/acre)	7	See label for rotational crop restrictions. 12-hr restricted entry interval.
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)	40	See label for application details and rotational crop restrictions. Do not use on areas treated with product the previous season. 12-hr restricted entry interval.
microbial (group 44)	<i>Bacillus subtilis</i>	Serenate 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. May be applied at planting and/or post-planting. See label for application details.

Table 3–77. 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.

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	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.
Foliar Applications					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not use on areas treated with product the previous season. Do not apply a foliar group 4 insecticide in the same season as a soil application. See label for rotational crop restrictions. 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.

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Table 3-77. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS — Foliar Applications Continued					
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	See label for rotational crop restrictions. 12-hr restricted entry interval or restricted entry permitted once spray deposit has dried.
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. See label for rotational crop restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (202–607 mL/acre)	7	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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	See label for rotational crop restrictions. 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 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.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row, or 750–1,000 mL/ha (304–405 mL/acre)	21	Early season damage reduction. See label for application details and rotational crop restrictions. 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	Ambush 500EC	140 mL/ha (57 mL/acre)	2	12-hr restricted entry interval.
		Perm-UP	180 mL/ha (73 mL/acre)	2	
		Pounce 384EC	180 mL/ha (73 mL/acre)	2	
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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 3–78. Horseradish Insect Control — Leaf-Eating Caterpillars, Cutworms, Swede Midge, 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.

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	
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not use on areas treated with product the previous season. 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. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm. Use low rate for black cutworm. Do not use on areas treated with product the previous season. 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. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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.
SWEDE MIDGE					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not use on areas treated with product the previous season. 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.
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	Reduction in numbers of larvae only. Soil application. See label for application details and rotational crop restrictions. Do not use on areas treated with product the previous season. Do not apply a foliar group 4 insecticide in the same season as a soil application. 24-hr restricted entry interval.

LETTUCE AND ENDIVE

For information on parsley, see *Herbs* section.

In this section:

- Table 3-79.** Lettuce and Endive Seed Treatments
- Table 3-80.** Activity of Fungicides on Lettuce and Endive Diseases
- Table 3-81.** Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce Drop
- Table 3-82.** Lettuce and Endive Disease Control — Downy Mildew
- Table 3-83.** Activity of Insecticides on Lettuce and Endive Insects
- Table 3-84.** Lettuce and Endive Insect Control — Aphids
- Table 3-85.** Lettuce and Endive Insect Control — Cutworms, Tarnished Plant Bug
- Table 3-86.** Lettuce and Endive Insect Control — Leafhoppers
- Table 3-87.** Lettuce and Endive Insect Control — Leafminers
- Table 3-88.** 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.

Table 3-79. 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 (Pythium)	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 (Pythium)	Head and leaf lettuce and endive. For use in commercial seed treatment facilities. Not for use on greenhouse lettuce.
QoI (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/ 1000 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 3-81. Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce Drop.

Table 3–80. Activity of Fungicides on Lettuce and Endive 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/Root Rot	Botrytis Gray Mold	Downy Mildew	Lettuce Drop	Powdery Mildew
iprodione	Rovral	—	C	—	—	—
metalaxyl-M and S-isomer/mancozeb	Ridomil Gold MZ 68WG	—	—	C	—	—
boscalid	Cantus WDG	—	C	—	S	—
fluxapyroxad	Sercadis	—	—	—	C	—
penthiopyrad	Fontelis	—	C	—	S	—
isofetamid	Kenja 400SC	—	—	—	C	—
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	—	—
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	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	—	S	—
<i>Trichoderma harzianum</i>	Rootshield HC	S	S	—	—	—

Table 3–81. Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce Drop

For resistance management, rotate between fungicides 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
DAMPING-OFF/ROOT ROT					
Greenhouse Application					
Oil (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	<i>Gliocladium catenulatum</i>	Prestop	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.

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Table 3–81. Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce Drop					
For resistance management, rotate between fungicides 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
DAMPING-OFF/ROOT ROT — Greenhouse Application Continued					
Not Classified	<i>Trichoderma harzianum</i>	RootShield HC	55–110 g/m ³ of loose planting mix, soil or planting beds	—	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 44)	<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 hours.
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.
Field Application					
dicarboximide (group 2)	iprodione	Rovral	1.5 kg/ha (0.6 kg/acre)	4	Lettuce only. Start after thinning. 12-hr restricted entry interval.
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.
microbial (group 44)	<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.
not classified	<i>Trichoderma harzianum</i>	Rootshield HC	10 g/1 L water	—	Lettuce only. Suppression. See label for application details.
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.

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Table 3–81. Lettuce and Endive Disease Control — Damping-Off, Botrytis Gray Mold, Lettuce Drop					
For resistance management, rotate between fungicides 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
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.
microbial (group 44)	<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	<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. 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 3–82. Lettuce and Endive Disease Control — Downy Mildew					
For resistance management, rotate between fungicides from different chemical groups.					
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.
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. See label for recropping restrictions. 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.

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Table 3–82. Lettuce and Endive Disease Control — Downy Mildew

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW CONTINUED					
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. 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 recropping restrictions and restricted entry intervals.
	mandipropamid	Revus	400–600 mL/ha (162–243 mL/acre)	1	Head and leaf lettuce. 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.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	2	Lettuce only. Tank-mix with Aliette WDG fungicide. Do not use on areas treated with product the previous season. Do not make sequential applications. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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.
QxI/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 group 40 fungicides. See label for recropping restrictions and restricted entry intervals.

Table 3–83. 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	Tarnished Plant Bug	Leafhoppers	Aster Leafhopper	Cabbage Looper	Leafminers
carbaryl	Sevin XLR	—	—	C	C	C	—	—
methomyl	Lannate TNG	—	—	—	—	—	C	—
acephate	Orthene 75%	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	—	—
	UP-Cyde 2.5 EC	—	C	—	—	C	—	—
lambda-cyhalothrin	Matador 120EC	—	C	C	—	—	C	—
	Silencer 120 EC	—	C	C	—	—	C	—
permethrin	Ambush 500EC	—	C	—	—	—	—	—
	Perm-UP	—	C	—	—	—	—	—
	Pounce 384EC	—	C	—	—	—	—	—
acetamiprid	Assail 70 WP	C	—	—	—	—	—	RD ¹
imidacloprid	Admire 240 F	C	—	—	S	—	—	—
	Alias 240 SC	C	—	—	—	—	—	—
	Grapple ₂	C	—	—	—	—	—	—
thiamethoxam	Actara 25WG	C	—	RD	—	—	—	—
	Actara 240SC	C	—	—	C	—	—	C ²
thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	C	—	—	C	—	C	C
sulfoxaflor	Closer	C	—	—	—	—	—	—
spinetoram	Delegate WG	—	—	—	—	—	C	—
spinosad	Entrust	—	—	—	—	—	C	—
	Success	—	—	—	—	—	C	—
pymetrozine	Fulfil 50WG	C	—	—	—	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec CAF	—	—	—	—	—	C	—
	Dipel 2X DF	—	—	—	—	—	C	—
	Thuricide-HPC	—	—	—	—	—	C	—
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
flonicamid	Beleaf 50SG	C	—	—	—	—	—	—
kaolin clay	Surround WP	—	—	—	—	RD	—	—

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

Table 3–84. 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.
		Grapple ₂	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/ 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					
organophosphate (group 1B) ¹	acephate	Orthene 75%	563–825 g/ha (228–334 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.
		Lagon 480 E	700 mL/ha (283 mL/acre)	7	Leaf lettuce only. Do not use on head lettuce. 3-day restricted entry interval.
	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

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Table 3–84. 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	Assail 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.
	imidacloprid	Admire 240 F	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.
		Alias 240 SC	200 mL/ha (81 mL/acre)	7	Head and leaf lettuce. 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.
		Grapple ₂	200 mL/ha (81 mL/acre)	7	
	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. Re-entry permitted once spray deposit has dried.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Head and leaf lettuce and endive. Apply when aphids first appear. 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)	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)	cyantraniliprole	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.
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.

Table 3–85. 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.

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.
		UP-Cyde 2.5 EC	285 mL/ha (115 mL/acre)	21	Lettuce only. Do not disturb soil surface for 5 days after application. 12-hr restricted entry interval.
	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	3	Head lettuce only. Dark-sided and white cutworms. 24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)		
	permethrin	Ambush 500EC	140–300 mL/ha (57–121 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.
		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.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Head and leaf lettuce and endive. Black cutworms. Apply to small plants, when no rain is forecast in next 24 hours. 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 hours. 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.
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	Matador 120EC	83 mL/ha (34 mL/acre)	3	Head and leaf lettuce. 24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)		
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.

Table 3–86. 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.

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	700 mL/ha (283 mL/acre)	7	Leaf lettuce only. Do not use on head lettuce.
		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.
				14	Leaf lettuce. 1-day restricted entry interval.
pyrethroid (group 3A)	cypermethrin	Mako	125 mL/ha (51 mL/acre)	14	Lettuce only. Aster leafhoppers.
		UP-Cyde 2.5 EC	200 mL/ha (81 mL/acre)	14	Lettuce only. Aster leafhoppers. 12-hr restricted entry interval.
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	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 3–87. 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.

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	Assail 70 WP	86 g/ha (35 g/acre)	7	Head and leaf lettuce and endive. Reduction in damage. 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.
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.

Table 3–88. 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.

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

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					
carbamate (group 1A)	methomyl	Lannate TNG	0.51–1 kg/ha (0.2–0.4 kg/acre)	7	Lettuce only. See label for restricted entry intervals.
organophosphate (group 1B)	acephate	Orthene 75%	563–825 g/ha (228–334 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	Matador 120EC	83 mL/ha (34 mL/acre)	3	Head lettuce only. 24-hr restricted entry interval.
		Silencer 120 EC			
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)	1	
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	Lettuce only. Treat when larvae are young (early instars) before the crop is damaged.
		Dipel 2X DF	275–550 g/ha (111–222 g/acre)	0	
		Thuricide HPC	2–4.25 L/ha (0.8–1.7 L/acre)	0	
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.

ONIONS, LEEKS AND SHALLOTS

In this section:

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Table 3–90. Activity of Fungicides on Onion, Leek and Shallot Diseases
Table 3–91. Onion, Leek and Shallot Disease Control — Botrytis Leaf Blight
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Table 3–93. Onion, Leek and Shallot Disease Control — Stemphylium Leaf Blight, Purple Blotch
Table 3–94. Onion, Leek and Shallot Disease Control — Onion Smut, Bacterial Soft Rot, Pink Root
Table 3–95. Activity of Insecticides on Onion, Leek and Shallot Insects
Table 3–96. Onion, Leek and Shallot Insect Control — Onion Maggot
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Table 3–98. 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.

Table 3–89. Onion, Leek and Shallot Seed Treatments and Transplant Disease Control

LEGEND: RP = registered pest

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

SEED TREATMENTS

Active Ingredient	Trade Name	Rate	Insects and Diseases			Notes
			Onion Maggot	Damping-Off	Onion Smut	
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 pythium. 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 rhizoctonia. 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.
Streptomyces	Mycostop	8 g/kg of seed	—	RP	—	Fusarium damping-off. Suppression. See label for application instructions.

GREENHOUSE TREATMENTS

<i>Trichoderma harzianum</i>	Rootshield HC	55–110 g/m ³ of loose planting mix, soil or planting beds	—	S	—	Onions, leeks and shallots. Suppression only. 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 for greenhouse applications.

Table 3–90. 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	Stemphylium Leaf Blight
iprodione	Rovral	—	C	—	C ¹	—	—
metalaxyl-M and S-isomer/mancozeb	Ridomil Gold MZ 68WG	—	—	—	C	—	—
boscalid	Cantus WDG	—	C	—	—	C	—
fluxapyroxad	Sercadis	—	C	—	—	C	S
penthiopyrad	Fontelis	—	C	—	—	C	—
fluopyram/pyrimethanil	Luna Tranquility	—	C	—	—	C	S
boscalid/pyraclostrobin	Pristine WG	—	C	—	S	C	—
pyrimethanil	Scala SC	—	C ²	C	—	C	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	C	—	—	S	—
pyraclostrobin	Cabrio EG	—	—	—	C	C	—
fenamidone	Reason 500SC	—	—	—	S	—	—
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 A	—	—	—	C	—	—
	Orondis Ultra B	—	—	—	—	—	—
<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 ¹	C	—
chlorothalonil	Bravo ZN	—	C ²	—	—	—	—
	Echo 720	—	C	—	—	—	—

¹ When in a tank-mix of Rovral and Manzate Pro-Stick.

² When in a tank-mix of Scala SC and Bravo ZN.

Table 3–91. Onion, Leek and Shallot Disease Control — Botrytis Leaf Blight

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS LEAF BLIGHT					
dicarboximide (group 2)	iprodione	Rovral	1.5 kg/ha (607 g/acre)	15	Dry bulb onions and leeks. 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)	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.
	penthiopyrad	Fontelis	1.25–1.75 L/ha (0.5–0.7 L/acre)	3	Onions, leeks and shallots. Also suppresses botrytis fleck caused by <i>Botrytis cinerea</i> . 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/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 or 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/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.
microbial (group 44)	<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	2.25–3.25 kg/ha (0.9–1.3 kg/acre)		
		Penncozeb 75 DF Raincoat	2.25–3.25 kg/ha (0.9–1.3 kg/acre)		
chloronitrile (group M5)	chlorothalonil	Bravo ZN	2.4–4.8 L/ha (1–1.9 L/acre)	7	Dry bulb onions. 48-hr restricted entry interval.
				14	Green onions. 48-hr restricted entry interval.
		Echo 720	1.7–3.3 L/ha (0.7–1.3 L/acre)	7	Dry bulb onions. 48-hr restricted entry interval.
				14	Green onions. 48-hr restricted entry interval.

Table 3–92. 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 preventative sprays.

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW					
dicarboximide (group 2)	iprodione	Rovral	0.75 kg/ha (0.3 kg/acre)	15	Dry bulb onions only. This tank-mix combination will help reduce the chance of resistance to Rovral developing. 24-hr restricted entry interval.
+	+	+	+		
dithiocarbamate (group M3)	manzate	Manzate Pro-Stick	2.25–3.25 kg/ha (0.9–1.3 kg/acre)		
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 only. 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 (1.2–1.7L/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)	0	
	mandipropamid	Revus	400 mL/ha (161 mL/acre)	7	Dry bulb onions and shallots. Tank-mix with a non-ionic surfactant. Do not make sequential applications of any group 40 fungicide. See label for rotational crop restrictions. 12-hr restricted entry interval.
CAA (group 40)	mandipropamid	Orondis Ultra A	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 sequential applications of any group 40 or group U15 fungicides. Tank-mix with a non-ionic surfactant. See label for rotational crop restrictions. 12-hr restricted entry interval.
	+	+	+		
piperidinyl- thiazole- isoxazoles (group U15)	oxathiapiprolin	Orondis Ultra B	120–350 mL/ha (49–142 mL/acre)		

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Table 3–92. 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 preventative sprays.					
For resistance management, rotate between fungicides from different chemical groups.					
LEGEND: PHI = Pre-Harvest Interval (in days)					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
DOWNY MILDEW CONTINUED					
microbial (group 44)	<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.
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 3–93. Onion, Leek and Shallot Disease Control — Stemphylium Leaf Blight, Purple Blotch					
For resistance management, rotate between fungicides from different chemical groups.					
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.
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	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.

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Table 3–93. Onion, Leek and Shallot Disease Control — Stemphylium Leaf Blight, Purple Blotch

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PURPLE BLOTCH CONTINUED					
SDHI (group 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.
SDHI/AP (group 7/9)	fluopyram/ pyrimethanil	Luna Tranquility	1200 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.
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 3–94. Onion, Leek and Shallot Disease Control — Onion Smut, Bacterial Soft Rot, Pink Root

For resistance management, rotate between fungicides 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
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	4.4–8.8 kg/ha (1.8–3.5 kg/acre)		
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.

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Table 3–94. Onion, Leek and Shallot Disease Control — Onion Smut, Bacterial Soft Rot, Pink Root

For resistance management, rotate between fungicides 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
PINK ROOT					
microbial (group 44)	<i>Bacillus subtilis</i>	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 <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.

Table 3–95. 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
 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
	Warhawk 480 EC	—	—	—	—	C
diazinon	Diazinon 500 E	C	—	—	—	—
malathion	Malathion 85E	—	—	C	—	—
naled	Dibrom	—	C	C	—	—
cypermethrin	Mako	—	C	N ²	—	C
	UP-Cyde 2.5 EC	—	C	N ²	—	—
deltamethrin	Decis 5 EC	—	—	N ²	—	—
lambda-cyhalothrin	Matador 120EC	—	—	N ²	C	—
	Silencer 120 EC	—	—	N ²	—	—
permethrin	Pounce 384EC	—	—	—	—	C
	Perm-UP	—	—	—	—	C
	Ambush 500EC	—	—	—	—	C
spinetoram	Delegate WG	—	—	S	S	—
spinosad	Success	—	—	S	S	—
	Entrust	—	—	S	S	—
abamectin	Agri-mek SC	—	—	C	—	—
<i>Bacillus thuringiensis</i>	Bioprotec CAF	—	—	—	S	—
spirotetramat	Movento 240 SC	—	—	C	—	—
cyantraniliprole	Exirel	—	—	S	—	—
chlorantraniliprole	Coragen	—	—	—	S	C

¹ Green onions only.² Resistance to these insecticides in onion thrips has been observed in Ontario muck soils.

Table 3–96. 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.

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	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	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. 48-hr restricted entry interval.
pyrethroid (group 3A)	cypermethrin	Mako	175 mL/ha (71 mL/acre)	3	Onions only. 12-hr restricted entry interval.
		UP-Cyde 2.5 EC	280 mL/ha (113 mL/acre)	3	Onions only. 12-hr restricted entry interval.

¹ Based on 30–38-cm (12–15 in.) row spacing.

Table 3–97. 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.

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Table 3–97. 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					
pyrethroid ¹ (group 3A)	lambda-cyhalothrin	Matador 120EC	188 mL/ha (76 mL/acre)	14	Onions, leeks and shallots. See label for restricted entry intervals.
		Silencer 120 EC			
	cypermethrin	Mako	175 mL/ha (71 mL/acre)	3	Onions only. 12-hr restricted entry interval.
		UP-Cyde 2.5 EC	280 mL/ha (113 mL/acre)	3	Onions only. Apply at 10-day intervals. 12-hr restricted entry interval.
	deltamethrin	Decis 5 EC	200 mL/ha (81 mL/acre)	5	Onions only. Resistance has been documented on muck soils in Ontario.
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.
	spinosad	Entrust	437–527 mL/ha (177–213 mL/acre)	3	Onions, leeks and shallots. Suppression. Re-entry permitted once spray deposit has dried.
		Success ²	218–262 mL/ha (88–106 mL/acre)	3	Onions, leeks and shallots. Suppression. Re-entry permitted once spray deposit has dried
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.
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.

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 3–98. 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	Matador 120EC	188 mL/ha (76 mL/acre)	14	Onions, leeks and shallots. See label for restricted entry intervals.
spinosyn (group 5)	spinetoram	Delegate WG	200–336 g/ha (81–136 g/acre)	3	Onions, leeks and shallots. Suppression. Apply 1 week after peak pheromone trap capture. 12-hr restricted entry interval.
	spinosad	Entrust	437–527 mL/ha (177–213 mL/acre)	3	Onions, leeks and shallots. Suppression. Apply 1 week 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 CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	Onions, leeks and shallots. Suppression. Apply 7–10 days after peak pheromone capture.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Green onions and leeks. Suppression. Do not use on areas treated with product the previous season. Do not apply more than two sequential applications of any group 28 insecticide. 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.
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	—	
	Perm-UP				
	Ambush 500EC		140–300 mL/ha (57–121 mL/acre)		
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 3–99. Parsnip Seed Treatments

Table 3–100. Activity of Fungicides on Parsnip Diseases

Table 3–101. Parsnip Disease Control

Table 3–102. Activity of Insecticides on Parsnip Insects

Table 3–103. Parsnip Insect Control — Aphids, Leafhoppers,

Table 3–104. Parsnip Insect Control —Cutworms, Flea Beetles, European Chafer Grubs

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

Table 3–99. 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.
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 3–100. Activity of Fungicides on Parsnip Diseases

LEGEND: C = control

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

Common Name	Trade Name	Damping-Off (Pythium)	Damping-Off	Phoma Canker	<i>Alternaria</i> spp.	Botrytis Gray Mold
metalaxyl-M and S-isomer	Apron XL LS	C	—	—	—	—
azoxystrobin	Dynasty 100FS	—	C	—	—	—
fludioxonil	Maxim 480FS	—	C	—	—	—
penthiopyrad	Fontelis	—	—	—	—	C
fluxapyroxad	Sercadis	—	—	—	C	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	C
trifloxystrobin	Flint	—	—	—	C	—
chlorothalonil	Bravo ZN	—	—	C	—	—
	Echo 720	—	—	C	—	—

Table 3–101. Parsnip Disease Control

For resistance management, rotate between fungicides from different chemical groups.

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	2.8 L/ha (1.1 L/acre)	7	48-hr restricted entry interval.
		Echo 720	1.9 L/ha (0.76 L/acre)	7	
ROOT ROTS					
microbial (group 44)	<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. May be applied at planting and/or post-planting. See label for application instructions.
ALTERNARIA SPP.					
SDHI (group 7)	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 sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 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 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	Also controls powdery mildew. Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 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	See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–102. 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
carbaryl	Sevin XLR	—	C	—	—	—	C
malathion	Malathion 85E	N	—	—	—	—	—
imidacloprid	Admire 240 F	C	C or S ¹	—	—	RD	—
thiamethoxam	Actara 25WG	C	—	C	—	—	—
sulfoxaflor	Closer	C	—	—	—	—	—
flupyradifurone	Sivanto Prime	C	C	—	—	—	—
cyantraniliprole	Exirel	C	—	—	C	—	C
	Verimark	—	—	—	—	—	RD
chlorantraniliprole	Coragen	—	—	—	C	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—	—

¹ Level of control for leafhoppers depends on application method.

Table 3–103. 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.

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 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.
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	Aphid control. Leafhopper 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 soil application. See label for rotational crop restrictions. 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. See label for rotational crop restrictions. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–60 mL/acre)	7	Aphids. 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)	7	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	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. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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. See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–104. Parsnip Insect Control — Cutworms, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
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 any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. 12-hr restricted entry interval.
			250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm. Do not use on areas treated with product the previous season. 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. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
FLEA BEETLES					
Soil Applications					
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row; or 750–1,000 mL/ha (304–405 mL/acre)	21	Early season damage reduction. See label for application details and rotational crop restrictions. 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. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
EUROPEAN CHAFER GRUBS - SOIL APPLICATION					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	Reduction in numbers of larvae only. 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.

PEAS

In this section:

Table 3–105. Pea In-Furrow and Seed Treatments

Table 3–106. Activity of Fungicides and Insecticides on Pea Diseases and Insects

Table 3–107. Pea Disease Control

Table 3–108. Pea Insect Control

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

Table 3–105. Pea In-Furrow and Seed Treatments

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

C = control S = suppression — = not registered for control of this pest, or activity 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>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.
<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.
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 3–106. Activity of Fungicides and Insecticides on Pea Diseases and Insects

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: C = control

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	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	Quadris Flowable	C	—	C	—	—	—	—	—
pyraclostrobin	Headline EC	C	—	SC	—	—	—	—	—
azoxystrobin/ propiconazole	Quilt	C	—	C	—	—	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	S	—	—	—	—	—	—
copper octanoate	Cueva	C	—	C	—	—	—	—	—
sulfur	Microthiol Disperss	—	—	C	—	—	—	—	—
INSECTICIDES									
naled	Dibrom	—	—	—	—	—	N	—	—
methomyl	Lannate TNG	—	—	—	—	S	C	—	—
dimethoate	Cygon 480	—	—	—	—	—	C	—	—
	Lagon 480 E	—	—	—	—	—	C	—	—
malathion	Malathion 85E	—	—	—	—	—	N	—	—
lambda-cyhalothrin	Matador 120EC	—	—	—	—	—	C	C	C
	Silencer 120 EC	—	—	—	—	—	C	C	C
permethrin	Ambush 500EC	—	—	—	—	—	—	C	—
	Perm-UP	—	—	—	—	—	—	C	—
	Pounce 384EC	—	—	—	—	—	—	C	—
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	—	—	—	—	—	C	—	C
acetamiprid	Assail 70 WP	—	—	—	—	—	C	—	—
imidacloprid	Admire 240 F	—	—	—	—	—	C	—	—
flupyradifurone	Sivanto Prime	—	—	—	—	—	C	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	C	C
cyantraniliprole	Exirel	—	—	—	—	—	—	C	C
ferric phosphate	Sluggo Professional	—	—	—	C	—	—	—	—
soap	Kopa Insecticidal Soap	—	—	—	—	—	C	—	—

Table 3–107. Pea Disease Control

For resistance management, rotate between fungicides from different chemical groups.

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. See label for recropping restrictions. 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. See label for rotational crop restrictions. 12-hr re-entry interval.
QoI (group 11)	azoxystrobin	Quadris Flowable	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.
	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	Quilt	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. See label for rotational crop restrictions. 12-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	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	Quadris Flowable	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.
QoI/DMI (group 11/3)	azoxystrobin/ propiconazole	Quilt	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. See label for rotational crop restrictions. 12-hr restricted entry interval.
Microbial (group 44)	<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.
inorganic (group M2)	sulfur	Microthiol Disperss	1.5 kg/ha (0.6 kg/acre)	1	Powdery mildew. 24-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.

Table 3–108. 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.

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	7.5 mL/100 m of row (2.3 mL/100 ft of row)	21	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.
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 Lagon 480 E	275–425 mL/ha (111–172 mL/acre)	3	Processing only. Do not feed or graze vines within 21 days of last application.
	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. 12-hr 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	
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.
	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Also suppresses leafhoppers. 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.
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. See label for rotational crop restrictions. 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 tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
soap	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.
SLUGS					
not classified	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	0	Apply to moist soils. Use higher rates on severe infestations.

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Table 3-108. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
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	
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	
	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.
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 hours. 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 tank-mix directions, crop tolerance information and rotational crop restrictions. 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:

Table 3–109. Pepper Transplant Production Disease and Insect Control (Greenhouse)

Table 3–110. Activity of Fungicides on Pepper Diseases

Table 3–111. Pepper Disease Control — Bacterial Spot, Alternaria, Anthracnose

Table 3–112. Pepper Disease Control — Botrytis Gray Mold, Phytophthora Blight, Powdery Mildew

Table 3–113. Activity of Insecticides on Pepper Insects

Table 3–114. Pepper Insect Control — Aphids

Table 3–115. Pepper Insect Control — Cutworms, European Corn Borer

Table 3–116. Pepper Insect Control — Mites, Pepper Maggot, Pepper Weevil

Table 3–117. Pepper Insect Control — Stink Bug, Brown Marmorated Stink Bug, Tarnished Plant Bug

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

Table 3–109. 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 M3)	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. Do not make sequential applications of any group 40 fungicides. 12-hr restricted entry interval.
microbial (group 44)	<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 preventative 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.

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Table 3–109. 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 M4)	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		
not classified (group NC)	Gliocladium catenulatum	Prestop WG	Refer to label for rates and application details.	Damping-off caused by Pythium sp. and Rhizoctonia solani. Suppression. Growing media or drench application. Do not tank-mix with any fungicides, insecticides, herbicides or adjuvants.
	Streptomyces	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.
	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.
		RootShield HC	55–110 g/m³ of loose planting mix or 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.
Foliar Applications				
microbial (group 44)	Bacillus subtilis	Cease	1–2 L/100 L water	Botrytis gray mold. Suppression.
not classified (group NC)	Gliocladium catenulatum	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 44)	Bacillus subtilis	Cease	1–2 L/100 L water	Bacterial speck. Suppression.
inorganic (group M1)	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. See label for rotational crop restrictions.
Foliar Applications				
Bacillus thuringiensis (group 11A)	Bacillus thuringiensis	Bioprotec CAF	1.6 L in 1,000 L of water See label for application instructions.	Duponchelia fovealis.

Table 3–110. Activity of Fungicides on Pepper Diseases

C = control		S = suppression				P = 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)	Anthracnose	Bacterial Spot	Botrytis Gray Mold	Phytophthora Blight	Powdery Mildew
benzovindiflupyr	Aprovia	—	—	—	—	C	C	—	—	—	C
boscalid	Cantus WDG	—	—	—	—	C	—	—	C	—	—
fluxapyroxad	Sercadis	—	—	—	—	C	—	—	—	—	—
penthiopyrad	Fontelis	—	—	—	—	S	—	—	C	—	—
cyprodinil/fludioxinol	Switch 62.5 WG	—	—	—	—	—	C	—	C	—	—
pyraclostrobin	Cabrio EG	—	—	—	—	C	C	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	—	C	C	—	—	—	C
cyazofamid	Torrent 400SC	—	C	—	C	—	—	—	—	—	—
kasugamycin	Kasumin 2L	—	—	—	—	—	—	S	—	—	—
fluazinam	Allegro 500F	—	—	S	—	—	—	—	—	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	—	—	—	—	—	—	—	S ¹	—
dimethomorph	Forum	—	—	—	—	—	—	—	—	S	—
mandipropamid	Revus	—	—	S ¹	—	—	—	—	—	S ¹	—
ametoctradin/dimethomorph	Zapro	—	—	—	—	—	—	—	—	S	—
mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	—	—	—	—	—	—	—	—	S ¹	—
fluopicolide	Presidio	—	—	—	—	—	—	—	—	S	—
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	—	P	—	S	—	—	S	P	—
<i>Bacillus subtilis</i>	Cease	S	—	—	—	—	—	—	—	—	—
	Serenade Opti	—	—	—	—	S	—	S	S	—	S
	Serenade SOIL	—	—	—	—	—	—	—	—	S ¹	—
tea tree oil	Timorex Gold	—	—	—	—	—	—	—	—	—	C
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	—	—	—	—	—	—
<i>Gliocladium catenulatum</i>	Prestop WG	—	S	—	S	—	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	—	—	—	—	—	—	S
potassium bicarbonate	MilStop	—	—	—	—	—	—	—	—	—	C
<i>Streptomyces</i>	Mycostop	—	S	—	S	—	—	—	—	—	—
<i>Streptomyces lydicus</i>	Actinovate SP	—	—	—	—	—	—	—	—	—	S
<i>Trichoderma harzianum</i>	RootShield Granules	—	—	—	S	—	—	—	—	—	—
	RootShield HC	—	—	—	S	—	—	—	S	—	—
Extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	—	—	—	—	—	—	S	—	—	S
metrafenone	Vivando SC	—	—	—	—	—	—	—	—	—	C

¹ See label for details

Table 3-111. Pepper Disease Control — Bacterial Spot, Alternaria, Anthracnose

For resistance management, rotate between fungicides from different chemical groups.

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 44)	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.7 kg/ha (0.24–0.69 kg/ha)	0	Suppression. Apply at 7–10 day intervals. Rotate with bactericides with a different mode of action.
inorganic (group M1)	copper hydroxide	Coppercide WP	2.25–3.25 kg/ha (0.91–1.32 kg/acre)	1	Apply at 7–14 day intervals.
		Kocide 2000	2.52–3.2 kg/ha (1–1.3 kg/acre)	2	Apply at 7–10-day intervals. 48-hr restricted entry interval.
		Parasol WG	2.25–3.25 kg/ha (0.91–1.32 kg/acre)	2	Apply at 7–14-day intervals. 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	Apply at 5–10 day intervals. 4-hr restricted entry interval.
ALTERNARIA, ANTHRACNOSE					
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 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 recropping restrictions. 12-hr restricted entry interval.
	boscalid	Cantus WDG	175–315 g/ha (71–127 g/acre)	0	Alternaria. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for recropping restrictions. 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 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 (0.51–0.71 L/acre)	0	Alternaria. Suppression. Do not make more than two sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 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	Anthracnose only. Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 9 or group 12 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
QoI (group 11)	pyraclostrobin	Cabrio EG	560–840 g/ha (227–340 g/acre)	0	Do not make sequential applications of any group 11 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.

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Table 3–111. Pepper Disease Control — Bacterial Spot, Alternaria, Anthracnose

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ALTERNARIA, ANTHRACNOSE CONTINUED					
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 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 recropping restrictions. 12-hr restricted entry interval.
microbial (group 44)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.5–2 kg/ha (0.2–0.8 kg/acre)	0	Alternaria only. 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 only. Suppression.
inorganic (group M1)	copper sulphate	Copper 53W	4 kg/ha (1.6 kg/acre)	2	48-hr restricted entry interval.

Table 3–112. Pepper Disease Control — Botrytis Gray Mold, Phytophthora Blight, Powdery Mildew

For resistance management, rotate between fungicides from different chemical groups.

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

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 use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. See label for recropping restrictions. 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. See label for rotational crop restrictions. 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 use on areas treated with product the previous season. Do not make more than two sequential applications of any group 9 or group 12 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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.
PHYTOPHTHORA BLIGHT					
phosphonate (group 33)	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. See label for tank-mix and crop tolerance information.

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Table 3–112. Pepper Disease Control — Botrytis Gray Mold, Phytophthora Blight, Powdery Mildew

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHYTOPHTHORA BLIGHT CONTINUED					
CAA (group 40)	dimethomorph	Forum	450 g/ha (182 g/acre)	0	Suppression. Do not make sequential applications of any group 40 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
CAA (group 40) + piperidinyl- thiazole- isoxazolines (group U15)	mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	600 mL/ha (243 mL/acre) + 175–350 mL/ha (71–142 mL/acre)	1	Foliar blight. Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 40 or group U15 fungicide. Do not apply foliar applications in the same season as a soil application. See label for rotational crop restrictions. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	2	Suppression. Tank mix with Revus when targeting phytophthora blight. Do not use on areas treated with product the previous season. Do not make more than two sequential applications of any group 43 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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.
QxI/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. See label for recropping restrictions. 12-hr restricted entry interval.
POWDERY MILDEW					
SDHI (group 7)	benzovindiflupyr	Aprovia	500–750 mL/ha (202–304 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 recropping restrictions. 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 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 recropping restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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. See label for tank-mix and crop tolerance information. 4-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.

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Table 3–112. Pepper Disease Control — Botrytis Gray Mold, Phytophthora Blight, Powdery Mildew

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
POWDERY MILDEW CONTINUED					
not classified (group NC)	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	Spray at 7-day intervals. See label for water volumes and chemical compatibility precautions. 4-hr restricted entry interval.
not classified (group NC)	<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).
aryl-phenylketone (group U8)	metrafenone	Vivando SC	0.75–1.12 L/ha (0.3–0.45 L/acre)	7	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.

Table 3–113. 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

Common Name	Trade Name	Greenhouse (Transplant)	Field									
		<i>Duponchella fovealis</i>	Aphids	Cutworms	European Corn Borer	Flea Beetle	Mites	Pepper Maggot	Pepper Weevil	Stink Bug	Brown Marmorated Stink Bug	Tarnished Plant Bug
acephate	Orthene 75%	—	C	—	C	—	—	C	—	—	—	—
chlorpyrifos	Lorsban NT	—	—	C	—	—	—	—	—	—	—	—
	Nufos 4E	—	—	C	—	—	—	—	—	—	—	—
	Pyrinex 480 EC	—	—	C	—	—	—	—	—	—	—	—
	Warhawk 480 EC	—	—	C	—	—	—	—	—	—	—	—
dimethoate	Cygon 480	—	C	—	—	—	—	C	—	—	—	—
	Lagon 480 E	—	C	—	—	—	—	C	—	—	—	—
malathion	Malathion 85E	—	N	—	—	—	—	C	C	—	—	—
deltamethrin	Decis 5 EC	—	—	—	C	—	—	—	—	—	—	—
permethrin	Ambush 500EC	—	—	C	C	—	—	—	—	—	—	—
	Perm-UP	—	—	C	C	—	—	—	—	—	—	—
	Pounce 384EC	—	—	C	C	—	—	—	—	—	—	—
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	—	—	C	C	—	—	—	—	—	—	—
acetamiprid	Assail 70 WP	—	C	—	—	—	—	—	—	—	—	—
imidacloprid	Admire 240	—	C ¹	—	—	—	—	—	—	—	—	—
thiamethoxam	Actara 25WG	—	C	—	—	—	—	—	S	C ¹	RD	C ¹
	Actara 240SC	—	C	—	—	S ¹	—	—	—	—	—	—

¹ See label for details.

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Table 3–113. 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

Common Name	Trade Name	Greenhouse (Transplant)	Field									
		<i>Duponchella fovealis</i>	Aphids	Cutworms	European Corn Borer	Flea Beetle	Mites	Pepper Maggot	Pepper Weevil	Stink Bug	Brown Marmorated Stink Bug	Tarnished Plant Bug
thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	—	C	—	—	S ¹	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	—	C	—	—	—	—	—	—	—	—	—
spinosad	Entrust	—	—	—	C	—	—	—	—	—	—	—
	Success	—	—	—	C	—	—	—	—	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec CAF	C	—	—	C	—	—	—	—	—	—	—
novaluron	Rimon 10 EC	—	—	—	C	—	—	—	—	—	—	—
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	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	C	—	—	—	—	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	—	—	S	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	—	C	—	—	—	C	—	—	—	—	—
	Opal Insecticidal Soap	—	C	—	—	—	C	—	—	—	—	—

¹ See label for details.**Table 3–114.** 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.

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	7–12 mL/100 m of row (2–4 mL/100 ft of row)	—	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.

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Table 3–114. 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.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Soil and Transplant Applications Continued					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL water/plant.	30	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.
		Actara 25WG	3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	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.
		Actara 240SC	375–625 mL/ha (152–253 mL/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 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 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.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	750–1,000 mL/ha (304–405 mL/acre)	45	Soil or irrigation application. See label for application details. Do not use on areas treated with product the previous season. Do not use subsequent foliar group 4D insecticides in the same season. See label for rotational crop restrictions. 12-hr restricted entry interval.
Foliar Applications					
organophosphate (group 1B)	acephate	Orthene 75%	562 g/ha (228 g/acre)	7	Sweet bell pepper only. 24-hr restricted entry interval.
	dimethoate	Cygon 480	0.7–1.0 L/ha (0.3–0.4 L/acre)	3	12-hr restricted entry interval.
		Lagon 480 E			
	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	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.
	imidacloprid	Admire 240	200 mL/ha (81 mL/acre)	7	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, soil or transplant application. See label for rotational crop restrictions. 24-hr restricted entry interval.

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Table 3–114. 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.

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)	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	1	Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for recropping restrictions. 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. Do not apply foliar group 4D insecticides in the same season as a soil or transplant application. See label for rotational crop restrictions. 12-hr restricted entry interval.
tetrone and tetrone 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. See label for recropping restrictions. 12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	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, tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	See label for recropping restrictions. 12-hr restricted entry interval.
soap	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 3–115. Pepper Insect Control — Cutworms, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS					
Soil Applications					
organophosphate (group 1B)	chlorpyrifos	Lorsban NT	2.4 L/ha (1 L/acre)	40	Green pepper only. Apply as a soil treatment 3–7 days before transplanting. See label for recropping restrictions. 24-hr restricted entry interval
		Pyrinex 480 EC			
		Warhawk 480 EC			
Foliar Applications					
organophosphate (group 1B)	chlorpyrifos	Lorsban NT	1.2–2.4 L/ha (0.5–1 L/acre)	40	Green pepper only. See label for recropping restrictions. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Warhawk 480 EC			

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Table 3–115. Pepper Insect Control — Cutworms, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS — Foliar Applications Continued					
pyrethroid (group 3A)	permethrin	Ambush 500EC	140–300 mL/ha (57–121 mL/acre)	1	See label for application details. Re-entry permitted once spray deposit has dried.
		Perm-UP	180–390 mL/ha (73–158 mL/acre)	1	See label for application details. 12-hr restricted entry interval.
		Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	1	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 use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 24-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 use on areas treated with product 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	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 tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.
EUROPEAN CORN BORER					
organophosphate (group 1B)	acephate	Orthene 75%	825 g/ha (334 g/acre)	7	Sweet bell pepper only. 24-hr restricted entry interval.
pyrethroid (group 3A)	deltamethrin	Decis 5 EC	250–300 mL/ha (101–121 mL/acre)	3	No additional information.
	permethrin	Ambush 500EC	140 mL/ha (57 mL/acre)	1	Re-entry permitted once spray deposit has dried.
		Perm-UP	180 mL/ha (73 mL/acre)	1	12-hr restricted entry interval.
		Pounce 384EC	180 mL/ha (73 mL/acre)	1	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 use on areas treated with product the previous season. 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	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)		
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	2.8 L/ha (1.1 L/acre)	1	Sweet pepper only. Apply to young larvae at first signs of infestation.
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	Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.

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Table 3–115. Pepper Insect Control — Cutworms, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORER 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 use on areas treated with product 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	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 tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.

Table 3–116. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
MITES					
bifenazate (group 20D)	bifenazate	Acramite 50WS	851 g/ha (344 g/acre)	3	12-hr restricted entry interval.
tetronec and tetramic acid derivative (group 23)	spiromesifen	Oberon	500–600 mL/ha (202–243 mL/acre)	7	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. See label for rotational crop restrictions. 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.
soap	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.
PEPPER MAGGOT					
organophosphate (group 1B)	acephate	Orthene 75%	562 g/ha (227 g/acre)	7	Sweet bell pepper only. 24-hr restricted entry interval.
	dimethoate	Cygon 480 Lagon 480 E	0.7–1.0 L/ha (0.28–0.40 L/acre)	3	12-hr restricted entry interval.
PEPPER WEEVIL					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	280 g/ha (113 g/acre)	1	Suppression. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for recropping restrictions. 12-hr restricted entry interval.

Table 3–117. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
STINK BUG ¹ AND TARNISHED PLANT BUG					
Soil and Transplant Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL water/plant.	30	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.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	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.
Foliar Applications					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	105–210 g/ha (42–85 g/acre)	1	Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for recropping restrictions. 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)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	1	Reduction in damage. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for recropping restrictions. 12-hr restricted entry interval.

¹ Does not include brown marmorated stink bug.

POTATOES

In this section:

Table 3–118. Potato Seed Treatments

Table 3–119. Activity of Fungicides on Potato Diseases

Table 3–120. Potato Disease Control — Pythium Leak, Pink Rot, Rhizoctonia, Silver Scurf, Fusarium Dry Rot

Table 3–121. Potato Disease Control — Broad-Spectrum Protectant Fungicides

Table 3–122. Potato Disease Control — Early Blight Fungicides

Table 3–123. Potato Disease Control — Early Blight and Late Blight Fungicides

Table 3–124. Potato Disease Control — Late Blight Targeted Fungicides

Table 3–125. Potato — Nematode Control

Table 3–126. Activity of Insecticides on Potato Insects

Table 3–127. Potato Insect Control — Colorado Potato Beetle

Table 3–128. Potato Insect Control — Potato Leafhopper, Flea Beetle, Tarnished Plant Bug

Table 3–129. Potato Insect Control — Late-Season Cutworms, Spider Mites, Wireworms, European Chafer Grubs

Table 3–130. Potato Insect Control — European Corn Borer, Cabbage Looper, Armyworms, Tomato Hornworm

Table 3–131. Potato Insect Control — Aphids, Potato Psyllid

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

Table 3–118. 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 and seed-borne verticillium.
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.
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.

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Table 3–118. Potato Seed Treatments

Group Name (Group #)	Common Name	Trade Name	Rate	Diseases or Insects Controlled
INSECTICIDES				
neonicotinoid ² (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		
		Grapple ₂		
	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. See label for rotational crop restrictions. 12-hr restricted entry interval.
INSECTICIDE + FUNGICIDE				
neonicotinoid ² (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. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season. Diseases — Fusarium tuber rot, seed-borne Rhizoctonia, silver scurf.
neonicotinoid (group 4A) ² + DMI/PP (group 3/12)	thiamethoxam + difenoconazole/ fludioxonil	Cruiser Maxx Potato Extreme	20 mL/ 100 kg seed	Insects — Colorado potato beetle, aphids, potato leafhopper. Do not use any subsequent soil or foliar applications of a group 4 insecticide in the same season. Diseases — Stem and stolon canker (<i>Rhizoctonia solani</i>), fusarium dry rot, silver scurf (<i>Helminthosporium solani</i>). Suppression of black scurf.
GROWTH REGULATOR				
carboxilic 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.

² Bees can be exposed to product residues in flowers, leaves, pollen and/or nectar resulting from seed treatments.

Table 3–119. 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	Nematodes
metconazole	Quash Fungicide	—	—	—	—	—	C	—	—	—	—	—	—
difenoconazole/benzovindiflupyr	Aprovia Top	—	—	—	—	—	C	—	—	S	—	—	—
fludioxonil/difenoconazole/azoxystrobin	Stadium	—	—	—	S	C	—	—	—	—	—	—	—
metalaxyl-M/mancozeb	Ridomil Gold MZ 68WG	S	N	—	—	—	C	—	—	—	—	—	—
metalaxyl-M and S-isomer/chlorothalonil	Ridomil Gold/Bravo Twin Pak	S	N	—	—	—	C	N	C	—	—	—	—
metalaxyl-M and S-isomer	Ridomil Gold 480 SL	—	N	—	—	—	—	N	—	—	—	—	—
benzovindiflupyr	Aprovia	—	—	S	S	—	—	—	—	—	—	—	—
boscalid	Cantus WDG	—	—	—	—	—	C	—	—	—	—	—	—
fluxapyroxad	Sercadis	—	—	C	—	—	C	—	—	—	—	S	—
penthiopyrad	Vertisan	—	—	S	—	—	S	—	C	—	—	—	—
fluopyram	Velum Prime	—	—	—	—	—	S	—	—	—	—	—	C
fluopyram/pyrimethanil	Luna Tranquility	—	—	—	—	—	C	—	—	C	S	C	—
pyrimethanil	Scala SC	—	—	—	—	—	C ¹	—	—	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	C	S	—	C ¹	—	—	—	—	—	—
azoxystrobin/difenoconazole	Quadris Top	—	—	—	—	—	C	—	—	S	S	S	—
pyraclostrobin	Headline EC	—	—	—	—	—	C	C ³	—	—	—	—	—
pyraclostrobin/metiram	Cabrio Plus	—	—	—	—	—	C	C	—	—	—	—	—
fenamidone	Reason 500 SC	—	—	—	—	—	C ²	C ²	—	—	—	—	—
famoxadone/cymoxanil	Tanos 50 DF	—	—	—	—	—	C	C	—	—	—	—	—
cyazofamid	Ranman 400SC	—	—	—	—	—	—	C	—	—	—	—	—
	Torrent 400SC	—	—	—	—	—	—	C	—	—	—	—	—
zoxamide/mancozeb	Gavel DF	—	—	—	—	—	C	C	—	—	—	—	—
cymoxanil+ mancozeb	Curzate 60 DF+ Manzate Pro-Stick	—	—	—	—	—	—	C	—	—	—	—	—
fluazinam	Allegro 500F	—	—	—	—	—	—	C	—	—	—	—	—
mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	—	S	—	—	—	—	C	—	—	—	—	—
mono- and di-potassium salts of phosphorous acid	Confine Extra	—	S	—	S	—	—	S	—	—	—	—	—
	Rampart	—	S	—	—	—	—	S	—	—	—	—	—
dimethomorph	Acrobat 50 WP	—	—	—	—	—	—	C ⁴	—	—	—	—	—
dimethomorph	Forum	—	—	—	—	—	—	C	—	—	—	—	—
ametoctradin/dimethomorph	Zampro	—	—	—	—	—	—	C	—	—	—	—	—
mandipropamid	Revus	—	—	—	—	—	—	C	—	—	—	—	—
mandipropamid + oxathiapiprolin	Orondis Ultra	—	—	—	—	—	—	C	—	—	—	—	—
fluopicolide	Presidio	—	C	—	—	—	—	C ¹	—	—	—	—	—

¹ When tank-mixed with Bravo.² When tank-mixed with Bravo or mancozeb.³ When tank-mixed with Bravo or Polyram DF⁴ When tank-mixed with Bravo, mancozeb or Polyram DF.

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Table 3–119. 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	Nematodes
<i>Bacillus subtilis</i>	Serenade SOIL	S	S	S	C	S	—	—	—	—	—	—	—
	Serenade Opti	—	—	—	C	—	S	—	—	—	—	—	—
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	—	—	—	—	S	—	—	—	—	—	—
hydrogen peroxide	StorOx	—	—	—	—	S	—	—	—	—	—	—	—
copper hydroxide	Kocide 2000	—	—	—	—	—	—	C	—	—	—	—	—
	Parasol Flowable	—	—	—	—	—	—	C	—	—	—	—	—
	Coppercide WP	—	—	—	—	—	—	C	—	—	—	—	—
copper octanoate	Cueva	—	—	—	—	—	C	C	—	—	—	—	—
copper oxychloride	Copper Spray	—	—	—	—	—	—	C	—	—	—	—	—
copper sulphate	Copper 53W	—	—	—	—	—	—	C	—	—	—	—	—
mancozeb	Dithane F-45	—	—	—	—	C	—	—	—	—	—	—	—
	Manzate Pro-Stick	—	—	—	—	—	C	C	—	—	—	—	—
	Dithane Rainshield	—	—	—	—	—	C	C	—	—	—	—	—
	Penncozeb 75 DF Raincoat	—	—	—	—	—	C	C	—	—	—	—	—
metiram	Polyram DF	—	—	—	—	—	C	C	—	—	—	—	—
chlorothalonil	Bravo ZN	—	—	—	—	—	C	C	C	—	—	—	—
	Echo 90 DF	—	—	—	—	—	C	C	C	—	—	—	—

Table 3–120. Potato Disease Control — Pythium Leak, Pink Rot, Rhizoctonia, Silver Scurf, Fusarium Dry Rot

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days) N/A = not applicable					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PYTHIUM LEAK, PINK ROT, RHIZOCTONIA, SILVER SCURF, FUSARIUM DRY ROT					
Soil Applications					
phenylamide (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	500–750 mL/ha (202–304 mL/acre)	—	Rhizoctonia stem canker, stolon canker, verticillium wilt, silver scurf and black scurf. Suppression. Use high rate for suppression of verticillium wilt. Do not use on areas treated with product the previous season. See label for rotational crop restrictions and application details. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	333 mL/ha (135 mL/acre). See label for rate/1000 m of row.	7	Rhizoctonia canker. Do not use on areas treated with product the previous season. In-furrow application. See label for application details and rotational crop restrictions. 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. See label for application details. 12-hr restricted entry interval.

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Table 3–120. Potato Disease Control — Pythium Leak, Pink Rot, Rhizoctonia, Silver Scurf, Fusarium Dry Rot

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days) N/A = not applicable					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Soil Applications Continued					
Qol (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–2 mL/100 ft of row)	—	Rhizoctonia stem canker and stolon canker control. Silver scurf suppression. Do not use on areas treated with product the previous season. See label for application details and rotational crop restrictions. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	292 mL/ha (118 mL/acre)	30	Pink rot. Do not use on areas treated with product the previous season. See label for application details and tank-mix partners. Do not apply a foliar application of a group 43 fungicide following an in-furrow or soil application. 12-hr restricted entry interval.
microbial (group 44)	<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.
Foliar Applications					
phenylamide/ 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. Failure to control the diseases will result in crop damage and/or yield losses in the field or in storage. 24-hr restricted entry interval.
phenylamide/ chloronitrile (group 4/M5)	metalaxyl-M and S-isomer/ chlorothalonil	Ridomil Gold/Bravo Twin Pak	1 jug/4 ha (1 jug/10 acre)	14	Pythium leak and pink rot. Suppression. Also controls Botrytis vine rot. 48-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.	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.

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Table 3–120. Potato Disease Control — Pythium Leak, Pink Rot, Rhizoctonia, Silver Scurf, Fusarium Dry Rot

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days) N/A = not applicable					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Post-Harvest Continued					
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	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 44)	<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. Suppression. Apply prior to storage.
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 3–121. Potato Disease Control — Broad-Spectrum Protectant Fungicides

Start spraying prior to row closure. For resistance management, rotate between fungicides from different chemical groups.

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			
	metiram	Polyram DF	1.1–2.25 kg/ha (0.4–0.9 kg/acre)	1	Early and late blight. 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 control. 48-hr restricted entry interval.
			1.6–2.4 L/ha (0.64–0.97 L/acre)		Early blight and botrytis vine rot. 48-hr restricted entry interval.
		Echo 90 DF	0.7–1.3 kg/ha (0.3–0.5 kg/acre)	1	Late blight. 48-hr restricted entry interval.
			0.9–1.3 kg/ha (0.4–0.5 kg/acre)		Early blight and botrytis vine rot. 48-hr restricted entry interval.

Table 3–122. Potato Disease Control — Early Blight Fungicides

Begin applications prior to disease development.

For resistance management, rotate between fungicides from different chemical groups.

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	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 use on areas treated with product the previous season. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 3 or group 7 fungicide. See label for rotational crop restrictions. 12-hr restricted entry interval.
SDHI (group 7)	boscalid	Cantus WDG	175–315 g/ha (70–126 g/acre)	30	Do not use on areas treated with product the previous season. 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	Do not use on areas treated with product the previous season. Also suppresses white mold at high rate. See label for application details. Follow label instructions regarding use of a non-ionic surfactant. See label for rotational crop restrictions. Do not make 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 sequential applications of any group 7 fungicides. 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. Do not make sequential applications of any group 7 or group 9 fungicides. 12-hr restricted entry interval.
			800 mL/ha (324 mL/acre)	7	Also controls white mold and suppression of black dot. Do not make 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. See label for rotational crop restrictions. 48-hr restricted entry interval.
QoI (group 11)	azoxystrobin	Quadris Flowable	500–800 mL/ha (200–320 mL/acre)	2	Tank-mix with Bravo. 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.
	pyraclostrobin	Headline EC	450–670 mL/ha (180–268 mL/acre)	3	Do not make sequential applications of any group 11 fungicide. 48-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (226–400 mL/acre)	14	Also suppresses brown spot, black dot and white mold. 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.
microbial (group 44)	<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. See label for application details. Re-entry permitted once spray deposit has dried.

Table 3–123. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
phenylamide/ dithiocarbamate (group 4/M3)	metalaxyl-M and S-isomer/ mancozeb	Ridomil Gold MZ 68WG	2.5 kg/ha (1 kg/acre)	3	24-hr restricted entry interval.
phenylamide/ chloronitrile (group 4/M5)	metalaxyl-M and S-isomer/ chlorothalonil	Ridomil Gold/ Bravo Twin Pak	1 jug/4 ha (1 jug/10 acre)	14	48-hr restricted entry interval.
QoI (group 11)	fenamidone	Reason 500 SC	200 mL/ha (80 mL/acre)	14	Tank-mix with mancozeb or Bravo. Do not make sequential applications of any group 11 fungicides. See label for rotational crop restrictions. 24-hr restricted entry interval.
	pyraclostrobin	Headline EC	450–670 mL/ha (180–268 mL/acre)	3	Tank-mix with Polyram DF or Bravo. Do not make sequential applications of any group 11 fungicides. 48-hr restricted entry interval.
QoI/ 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 fungicides. 24-hr restricted entry interval.
QoI/ dithiocarbamate (group 11/M3)	pyraclostrobin/ metiram	Cabrio Plus	2.25–3.35 kg/ha (0.91–1.35 kg/acre)	3	Do not make sequential applications of any group 11 fungicides. 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	See label for rotational crop restrictions. 48-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	See label for application details. 4-hr restricted entry interval.

Table 3–124. 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.

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. Do not make sequential applications of any group 21 fungicides. 30-day rotational crop interval. 12-hr restricted entry interval.
		Torrent 400SC	100–200 mL/ha (40–80 mL/acre)	7	
benzamide/ dithiocarbamate (group 22/M3)	zoxamide/ mancozeb	Gavel DF	1.7–2.25 kg/ha (0.7–0.9 kg/acre)	3	See label for rotational crop restrictions. 48-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	Do not make more than three sequential applications of group 29 fungicides. 24-hr restricted entry interval.

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Table 3–124. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
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 make sequential applications. Do not for use on potatoes intended for seed. 12-hr restricted entry interval.
		Rampart	3–8 L in 1,000 L of water/ha (1.2–3.2 L in 405 L water/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.
	mono- and dibasic sodium, potassium and ammonium phosphites	Phostrol	2.9–11.6 L/ha (1.2–4.6 L/acre)	0	Preventive control. See label for list of tank-mix partners. Do not make sequential applications. 12-hr restricted entry interval.
CAA (group 40)	dimethomorph	Acrobat 50 WP	450 g/ha (180 g/acre)	14	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. 120-day recropping interval. 48-hr restricted entry interval.
		Forum	450 mL/ha (182 mL/acre)	4	Also suppresses tuber blight. Tank-mix with another fungicide with activity against late blight. Do not make more than two sequential applications of any group 40 fungicides. See label for rotational crop restrictions. 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 make more than two sequential applications of any group 40 fungicides. See label for rotational crop restrictions. 12-hr restricted entry interval.
CAA (group 40) + piperidinyl-thiazole-isoxazolines (group U15)	mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	400–600 mL/ha (162–243 mL/acre) + 120–350 mL/ha (49–142 mL/acre)	14	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 40 or group U15 fungicide. 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.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (91–120 mL/acre)	7	Tank-mix with Bravo. Do not use on areas treated with product the previous season. 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. See label for rotational crop restrictions. 48-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. See label for rotational crop restrictions. 12-hr restricted entry interval.
inorganic (group M1)	copper hydroxide	Kocide 2000	0.8–1.6 kg/ha (0.3–0.6 kg/acre)	1	Combine with 1.75–2.25 kg/ha (0.7–0.9 kg/acre) Manzate Pro-Stick. Use 2.4 kg/ha (1 L/acre) at vine kill. 48-hr restricted entry interval.
		Parasol Flowable	0.8–1.8 L/ha (0.32–0.7 L/acre)	1	
		Coppercide WP	1.1–2.25 kg/ha (0.4–0.9 kg/acre)	1	Combine with 1.75–2.25 kg/ha (0.7–0.9 kg/acre) of a mancozeb product. 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 (1.4 kg/acre). 48-hr restricted entry interval.

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Table 3–124. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
inorganic (group M1)	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.
	copper oxychloride	Copper Spray	4 kg/ha (1.6 kg/acre)	1	48-hr restricted entry interval.
	copper sulphate	Copper 53W	5.5 kg/ha (2.2 kg/acre)	1	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 3–125. Potato — Nematode Control**LEGEND:** PHI = Pre-Harvest Interval (in days)

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SDHI (group 7)	fluopyram	Velum Prime	500 mL/ha (202 mL/acre) or 4.5 mL/100m row (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. Soil application. See label for application details. When applied as a soil application, use another mode of action for the first foliar fungicide application. See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–126. 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	Potato Psyllid	Wireworm
oxamyl	Vydate L	C	C	C	C	C	—	—	—	—	—	—	—	—	—
acephate	Orthene 75%	—	C	C	C	C	—	—	—	—	—	—	—	—	—
chlorpyrifos	Lorsban 4E/NT	—	—	C	C	—	C	—	—	—	—	—	—	—	—
	Nufos 4E	—	—	C	C	—	C	—	—	—	—	—	—	—	—
	Pyrinex 480 EC	—	—	C	C	—	C	—	—	—	—	—	—	—	C
	Warhawk 480 EC	—	—	C	C	—	C	—	—	—	—	—	—	—	—
dimethoate	Cygon 480	—	C	—	—	C	—	—	—	—	—	—	—	—	—
	Lagon 480 E	—	C	—	C	C	—	—	—	—	—	—	—	—	—
naled	Dibrom	C	C	C	—	—	—	—	—	—	—	—	—	—	—

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Table 3–126. 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	Potato Psyllid	Wireworm
phosmet	Imidan 70-WP	C	C	C	—	C	—	—	—	—	—	—	—	—	—
phorate	Thimet 20-G	—	—	—	—	—	—	—	—	—	—	—	—	—	C
bifenthrin	Capture 240EC	—	—	—	—	—	—	—	—	—	—	—	—	—	C
cypermethrin	Mako	C	C	C	C	—	C	—	—	—	—	—	—	—	—
	UP-Cyde 2.5 EC	C	C	C	C	—	—	—	—	—	—	—	—	—	—
deltamethrin	Decis 5 EC	C	C	C	C	C	—	—	—	—	—	C	—	—	—
lambda-cyhalothrin	Matador 120EC	C	C	C	C	—	—	—	—	—	—	C	—	—	—
	Silencer 120 EC	C	C	C	C	—	—	—	—	—	—	C	—	—	—
permethrin	Pounce 384EC	C	C	C	C	—	C	—	—	—	—	C	—	—	—
	Perm-UP	C	C	C	C	—	C	—	—	—	—	C	—	—	—
	Ambush 500 EC	—	C	C	C	—	C	—	—	—	—	C	—	—	—
lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	—	—	—	—	—	C ¹	—	C	C	—	—	C	C	—
acetamiprid	Assail 70 WP	C	—	—	—	C	—	—	—	—	—	—	—	—	—
clothianidin	Clutch 50 WDG	C	—	—	—	—	—	—	—	—	—	—	—	—	—
	Titan	C	C	—	—	—	—	—	—	—	—	—	—	—	—
imidacloprid	Admire 240 F	C	C	—	—	C	—	—	—	—	RD	—	—	—	—
	Grappe ₂	C	C	—	—	C	—	—	—	—	—	—	—	—	—
	Alias 240 SC	C	C	—	—	C	—	—	—	—	—	—	—	—	—
thiamethoxam	Actara 240 SC	C	C	—	—	C	—	—	—	—	—	—	—	—	—
	Actara 25WG	C	—	—	—	—	—	—	—	—	—	—	—	—	—
thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	C	C	C	—	C	—	—	—	—	—	—	—	—	—
sulfoxaflor	Closer	—	—	—	—	C	—	—	—	—	—	—	—	—	—
sulfoxaflor/ spinetoram	TwinGuard	C	—	—	—	C	—	—	—	—	—	C	—	—	—
flupyradifurone	Sivanto Prime	C	C	—	—	C	—	—	—	—	—	—	—	—	—
spinetoram	Delegate WG	C	—	—	—	—	—	—	—	—	—	C	—	—	—
spinosad	Success	C	—	—	—	—	—	—	—	—	—	C	—	—	—
	Entrust	C	—	S	—	—	—	—	C	—	—	C	—	—	—
abamectin	Agri-mek SC	C	—	—	—	—	—	C	—	—	—	—	—	C	—
pymetrozine	Fulfill 50WG	—	—	—	—	C	—	—	—	—	—	—	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec CAF	—	—	—	—	—	—	—	C	—	—	—	—	—	—
novaluron	Rimon 10 EC	C	—	—	—	—	—	—	—	—	—	C	—	—	—
spirotetramat	Movento 240 SC	—	—	—	—	C	—	—	—	—	—	—	—	—	—

¹ Black and variegated cutworm only.

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Table 3–126. 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															
		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	Potato Psyllid	Wireworm
Common Name	Trade Name														
spiromesifen	Oberon Flowable	—	—	—	—	—	—	C	—	—	—	—	—	—	—
chlorantraniliprole	Coragen	C	—	—	—	—	C ²	—	C	C	—	C	C	—	—
cyantraniliprole	Exirel	C	—	—	—	C	C ²	—	C	C	—	C	C	—	—
	Verimark	C	—	C ³	—	—	—	—	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	—	—	—	C	—	—	—	—	—	—	—	—	—
kaolin	Surround WP	—	S	—	—	—	—	—	—	—	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	—	—	—	—	C	—	C	—	—	—	—	—	—	—
mineral oil	Superior 70 Oil	—	—	—	—	RD	—	—	—	—	—	—	—	—	—

² Black and variegated cutworm only.³ 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 3–127. Potato Insect Control — Colorado Potato Beetle

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
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 and rotational crop restrictions. 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.
		Grapple ₂			
		Alias 240 SC			

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Table 3-127. Potato Insect Control — Colorado Potato Beetle

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
Soil Applications Continued					
neonicotinoid (group 4A)	thiamethoxam	Actara 240 SC	3.4–4.4 mL/ 100 m 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	266–448 g/ha (108–181 g/acre)	—	See label for rotational crop restrictions. 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. 12-hr restricted entry interval.
		Titan	221–373 mL/ha ¹ (89.4–150 mL/acre) ¹	—	See label for rotational crop restrictions. 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. See label for rotational crop restrictions. 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 or 750–1,000 mL/ha (300–400 mL/acre) ¹	—	See label for application details and worker safety protocols. 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)	oxamyl	Vydate L	2.3–3.0 L/ha (0.9–1.2 L/acre)	7	24-hr restricted entry interval.
organophosphate (group 1B)	naled	Dibrom	1.05 L/ha (0.4 L/acre)	4	48-hr restricted entry interval.
	phosmet	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.
pyrethroid (group 3A)	lambda- cyhalothrin	Matador 120EC	83–125 mL/ha (34–51 mL/acre)	7	24-hr restricted entry interval.
		Silencer 120 EC			
	deltamethrin	Decis 5 EC	100–150 mL/ha (40–61 mL/acre)	1	12-hr restricted entry interval.
	cypermethrin	Mako	62.5–125 mL/ha (25–51 mL/acre)	7	12-hr restricted entry interval.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	7	12-hr restricted entry interval.
	permethrin	Pounce 384EC	180–260 mL/ha (73–105 mL/acre)	1	12-hr restricted entry interval.
		Perm-UP			

¹ Row spacing: 90 cm (36 in.)

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Table 3–127. Potato Insect Control — Colorado Potato Beetle

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)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	See label for application details and rotational crop restrictions. 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. 24-hr restricted entry interval.
		Grapple ₂	200 mL/ha (81 mL/acre)		
		Alias 240 SC	200 mL/ha (81 mL/acre)		
	acetamiprid	Assail 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 or soil application. 12-hr restricted entry interval.
	clothianidin	Clutch 50 WDG	70–105 g/ha (28–42 g/acre)	14	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. 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. 12-hr restricted entry interval.
		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. 12-hr restricted entry interval.
sulfoxaflor/ spinosyn (group 4C/5)	sulfoxaflor/ spinetoram	TwinGuard	200–300 g/ha (81–121 g/acre)	7	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	Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
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.
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	Do not use on areas treated with product the previous season. Do not apply any subsequent applications of group 28 insecticides for Colorado potato beetle control following a seed treatment or soil application. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	750–1,000 mL/ha (300–400 mL/acre)	7	Do not apply any subsequent applications of group 28 insecticides for Colorado potato beetle control following a seed treatment or soil application. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.

Table 3–128. 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.

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. See label for application details and rotational crop restrictions. 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.
		Alias 240 SC			
		Grapple ₂			
	thiamethoxam	Actara 240 SC	3.4–4.4 mL/100 m of row	—	Potato leafhopper. 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. 12-hr restricted entry interval.
	clothianidin	Titan	221–373 mL/ha ¹ (89.4–150 mL/acre) ¹	—	Potato leafhopper. See label for application details and rotational crop restrictions. 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. See label for application details and rotational crop restrictions. 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 or 750–1,000 mL/ha (300–400 mL/acre) ¹	—	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.
organophosphate (group 1B)	dimethoate	Lagon 480 E	0.55–1.1 L/ha (0.22–0.4 L/acre)	7	Leafhoppers and tarnished plant bug. 12-hr restricted entry interval.
		Cygon 480			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 75%	0.75–1.1 kg/ha (0.3–0.4 kg/acre)	21	24-hr restricted entry interval. Re-entry with significant foliar contact requires gloves and cotton overalls for one week after REI.
	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	1 L/ha (0.4 L/acre)		
		Pyrinex 480 EC	1 L/ha (0.4 L/acre)		
		Warhawk 480 EC	1 L/ha (0.4 L/acre)		

¹ Based on 90 cm (36 in.) row spacing.

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Table 3–128. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Foliar Applications Continued					
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.
pyrethroid (group 3A)	lambda- cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)		
	deltamethrin	Decis 5 EC	100–150 mL/ha (40–61 mL/acre)	1	12-hr restricted entry interval.
	permethrin	Pounce 384EC	180–260 mL/ha (73–105 mL/acre)	1	12-hr restricted entry interval.
		Perm-UP	180–260 mL/ha (73–105 mL/acre)		
		Ambush 500 EC	140–200 mL/ha (57–81 mL/acre)	—	
	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.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	7	Potato leafhopper and flea beetle. 12-hr restricted entry interval.
			200 mL/ha (81 mL/acre)	7	Tarnished plant bug. 12-hr restricted entry interval.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Potato leafhopper. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. Do not apply foliar group 4 insecticides in the same season as a seed treatment or soil application. 24-hr restricted entry interval.
		Alias 240 SC	200 mL/ha (81 mL/acre)		
		Grapple ₂	200 mL/ha (81 mL/acre)		
	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. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	1	Leafhoppers. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 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.
not classified	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 per 250 L of water; follow-up applications may only require the lower labelled rate per 250 L of water.

Table 3–129. Potato Insect Control — Late-Season Cutworms, Spider Mites, Wireworms, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
LATE-SEASON CUTWORMS					
organophosphate (group 1B)	chlorpyrifos	Lorsban 4E/NT	1.2–2.4 L/ha (0.5–1 L/acre)	7	24-hr restricted entry interval.
		Nufos 4E	1.2–2.4 L/ha (0.5–1 L/acre)		
		Pyrinex 480 EC	1.2–2.4 L/ha (0.5–1 L/acre)		
		Warhawk 480 EC	1.2–2.4 L/ha (0.5–1 L/acre)		
pyrethroid (group 3A)	cypermethrin	Mako	175 mL/ha (70 mL/acre)	7	Do not disturb soil surface for 5 days after application. 12-hr restricted entry interval.
	permethrin	Ambush 500EC	140–200 mL/ha (57–81 mL/acre)	1	Variegated cutworm. Do not disturb ground for 5 days following application. 12-hr restricted entry interval.
		Perm-UP	180 mL/ha (73 mL/acre)	1	
		Pounce 384EC	180–390 mL/ha (73–158 mL/acre)	1	Do not disturb ground 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)	7	Black cutworm and variegated cutworm. For black cutworm, apply when rain is not expected in next 24 hours. 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.
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–151 mL/acre)	1	Variegated cutworm. Do not use on areas treated with product the previous season. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (200–300 mL/acre)	7	Variegated cutworm. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
SPIDER MITES					
avermectin (group 6)	abamectin	Agri-mek SC	225 mL/ha (91 mL/acre)	14	Apply with a non-ionic surfactant as per label instructions. 12-hr restricted entry interval.
tetrionic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (202–243 mL/acre)	7	See label for rotational crop restrictions. 12-hr restricted entry interval.
soap	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.

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Table 3–129. Potato Insect Control — Late-Season Cutworms, Spider Mites, Wireworms, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
WIREWORMS – Soil Applications					
organophosphate (group 1B)	chlorpyrifos	Pyrinex 480 EC	21.6 mL in 5 L water/100 m of row; or 2.4 L/ha (1 L/acre) ¹	70	Caution: No Pyrinex residue is allowed on potatoes exported to the U.S.A. Efficacy of wireworm insecticides depends on the wireworm species infesting the soil. The species of wireworms found in Ontario might not be susceptible to Pyrinex. See label for application details. 24-hr restricted entry interval.
	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 and rotational crop restrictions. 48-hr restricted entry interval.
pyrethroid (group 3A)	bifenthrin	Capture 240EC	8.3–14.1 mL/ or 100 m row 925–1404 mL/ha (374–568 mL/acre)	21	12-hr restricted entry interval.
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	—	Reduction in numbers of larvae. See label for application details and rotational crop restrictions. 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. 24-hr restricted entry interval.

¹ Based on 90 cm (36 in.) row spacing.**Table 3–130.** Potato Insect Control — 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORER					
pyrethroid (group 3A)	deltamethrin	Decis 5 EC	150–250 mL/ha (61–101 mL/acre)	1	12-hr restricted entry interval.
	lambda-cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	24-hr restricted entry interval.
		Silencer 120 EC			
	permethrin	Pounce 384EC	180 mL/ha (73 mL/acre)	1	12-hr restricted entry interval.
		Perm-UP			
		Ambush 500 EC	140 mL/ha (57 mL/acre)	1	12-hr restricted entry interval.

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Table 3–130. Potato Insect Control — 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORER CONTINUED					
sulfoxaflor/ spinosyn (group 4C/5)	sulfoxaflor/ spinetoram	TwinGuard	200 g/ha (81 g/acre)	7	Control of small larvae. 12-hr restricted entry interval or re-entry permitted once spray deposit has dried.
spinosyn (group 5)	spinetoram	Delegate WG	160 g/ha (65 g/acre)	7	12-hr restricted entry interval.
	spinosad	Entrust	250 mL/ha (101 mL/acre)	7	12-hr restricted entry interval.
		Success	125 mL/ha (51 mL/acre)	7	12-hr restricted entry interval.
benzoylurea (group 15)	novaluron	Rimon 10 EC	410–820 mL/ha (166–332 mL/acre)	14	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. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500–750 mL/ha (202–304 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. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
CABBAGE LOOPER					
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.
spinosyn (group 5)	spinosad	Entrust	334 mL/ha (135 mL/acre)	7	12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	1.4–2.8 L/ha (0.56–0.11 L/acre)	0	See label for application details.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not use on areas treated with product the previous season. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	250–500 mL/ha (100–200 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. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. 12-hr restricted entry interval.

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Table 3–130. Potato Insect Control — 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ARMYWORMS					
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 any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	500 mL/ha (200 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. See label for tank-mix directions and crop tolerance information. See label for rotational crop restrictions. 12-hr restricted entry interval.
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.
TOMATO HORNWORM					
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.
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 any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil or seed piece application. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 12-hr restricted entry interval.
	cyantraniliprole	Exirel	750 mL/ha (304 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. See label for tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.

Table 3–131. Potato Insect Control — Aphids, 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.

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

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	See label for application details and rotational crop restrictions. 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. 24-hr restricted entry interval.
		Alias 240 SC	7.5–12 mL/100 m of row (2.1–3.7 mL/100 ft of row)		
		Grapple ₂	7.5–12 mL/100 m of row (2.1–3.7 mL/100 ft of row)		
	thiamethoxam	Actara 240 SC	3.4–4.4 mL/100 m of row	—	
neonicotinoid/ diamide (group 4A/28)	thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	440–700 g/ha (178–283 g/acre)	—	See label for application details and rotational crop restrictions. 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	0.55–1.1 L/ha (0.22–0.4 L/acre)		
	acephate	Orthene 75%	0.75–1.1 kg/ha (0.3–0.4 kg/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 REI.
	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.
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	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.
		Alias 240 SC	200 mL/ha (81 mL/acre)		
		Grapple ₂	200 mL/ha (81 mL/acre)		
	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.

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Table 3–131. Potato Insect Control — Aphids, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS — Foliar Applications Continued					
neonicotinoid (group 4A)	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. See label for rotational crop restrictions. 12-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–60 mL/acre)	7	See label for rotational crop restrictions. 12-hr restricted entry interval or until residues have dried.
sulfoxaflor/ spinosyn (group 4C/5)	sulfoxaflor/ spinetoram	TwinGuard	200–300 g/ha (81–121 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	Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG ¹	193 g/ha (78 g/acre)	14	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)	7	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 (200–600 mL/acre)	7	See label for application details. 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.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (48–64 g/acre)	7	See label for rotational crop restrictions. 12-hr restricted entry interval.
soap	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.
not classified	mineral oil	Superior 70 Oil	10 L/ha (4 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.
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	Apply with a non-ionic surfactant as per label instructions. 12-hr restricted entry interval.

¹ Fulfill 50WG causes cessation of aphid feeding shortly after application. Aphids may remain on the plant for 2–4 days before they die.

RADISHES

In this section:

Table 3–132. Radish Seed Treatments

Table 3–133. Activity of Fungicides on Radish Diseases

Table 3–134. Radish Disease Control

Table 3–135. Activity of Insecticides on Radish Insects

Table 3–136. Radish Insect Control — Cabbage Maggot, Flea Beetles, Cabbage Looper, Imported Cabbageworm, Diamondback Moth, Cutworms

Table 3–137. Radish Insect Control — Swede Midge, Aphids, European Chafer Grubs

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

Table 3–132. 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.
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. Seed box and commercial seed treatment.

Table 3–133. 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	Damping-Off	Alternaria	Powdery Mildew	Downy Mildew	Rhizoctonia Root Rot, Crown Rot, Stem Canker	Botrytis Gray Mold
metalaxyl-M and S-isomer	Apron XL LS	C	—	—	—	—	—
	Ridomil Gold 480SL	—	—	—	S	—	—
thiram	Thiram 75 WP	C	—	—	—	—	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—
fludioxonil	Maxim 480FS	C	—	—	—	—	—
fluxapyroxad	Sercadis	—	C	C	—	—	—
penthiopyrad	Fontelis	—	—	—	—	—	C
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	—	C
pyraclostrobin	Cabrio EG	—	C	C	—	—	—
trifloxystrobin	Flint	—	C	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	C	—

Table 3–134. Radish Disease Control

For resistance management, rotate between fungicides from different chemical groups.

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	Radish and Oriental radish. Powdery mildew control; alternaria 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.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Radish and Oriental radish. Do not make sequential applications of any group 11 fungicides. See label for restricted entry intervals.
	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 44)	<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. Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
				40	Oriental radish (daikon). Do not use on areas treated with product the previous season. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Radish and Oriental radish. 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	Radish and Oriental radish. 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	Radish and Oriental radish. See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–135. Activity of Insecticides on Radish Insects

LEGEND: C = control
 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	—	—	—	—	—	—	—	—
	Warhawk 480 EC	C	—	—	—	—	—	—	—	—
malathion	Malathion 85E	—	C	N	—	—	—	—	—	—
permethrin	Pounce 384EC	—	C	—	—	—	—	—	—	—
	Perm-UP	—	C	—	—	—	—	—	—	—
	Ambush 500EC	—	C	—	—	—	—	—	—	—
imidacloprid	Admire 240 F	—	C	C	—	—	—	—	—	RD
thiamethoxam	Actara 25WG	—	—	C	—	—	—	—	—	—
sulfoxaflor	Closer	—	—	C	—	—	—	—	—	—
flupyradifurone	Sivanto Prime	—	—	C	—	—	—	—	—	—
spinosad	Success	—	—	—	C	C	C	—	—	—
	Entrust	—	—	—	C	C	C	—	—	—
spinetoram	Delegate WG	—	—	—	C	C	C	—	—	—
<i>Bacillus thuringiensis</i>	Dipel 2X DF	—	—	—	C	C	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	C	C	C	C	C	—
cyantraniliprole	Verimark	C	C	—	—	—	—	—	—	—
flonicamid	Beleaf 50SG	—	—	C	—	—	—	—	—	—
soap	Kopa Insecticidal Soap	—	—	C	—	—	—	—	—	—

Table 3–136. 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.

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 and rotational crop restrictions. 24-hr restricted entry interval.
		Pyrinex 480 EC			
		Nufos 4E	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 rotational crop restrictions. 24-hr restricted entry interval.
		Warhawk 480 EC	210 mL in 1,000 L water/1,000 m of row (64 mL in 79 gal water/1,000 ft of row)		
diamide (group 28)	cyantraniliprole	Verimark	10–15 mL/100 m of row; or 1,100–1,700 mL/ha (445–687 mL/acre)	21	Radish and Oriental radish. See label for application details and rotational crop restrictions. 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	Radish and Oriental radish. 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.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row or, 750–1,000 mL/ha (304–405 mL/acre)	21	Radish and Oriental radish. Early season damage reduction. See label for application details and rotational crop restrictions. 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	Ambush 500EC	140 mL/ha (57 mL/acre)	2	Radish only. 12-hr restricted entry interval.
		Perm-UP	180 mL/ha (73 mL/acre)	2	
		Pounce 384EC	180 mL/ha (73 mL/acre)	2	

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Table 3–136. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
FLEA BEETLES — Foliar Applications Continued					
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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.
CABBAGE LOOPER, IMPORTED CABBAGEWORM, DIAMONDBACK MOTH					
spinosyn (group 5)	spinosad	Entrust	364 mL/ha (147 mL/acre)	3	Radish and Oriental radish. Re-entry permitted once spray deposit has dried.
		Success	182 mL/ha (74 mL/acre)	3	
	spinetoram	Delegate WG	140–200 g/ha (57–81 g/acre)	3	Radish and Oriental radish. 12-hr restricted entry interval.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Dipel 2X DF	55–550 g/ha (22–223 g/acre)	0	Asian radish. Imported cabbageworm.
			275–550 g/ha (111–223 g/acre)	0	Asian radish. Cabbage looper.
			275 g/ha (111 g/acre)	0	Asian radish. Diamondback moth.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Radish and Oriental radish. Do not use on areas treated with product the previous season. 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	Radish and Oriental radish. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Radish and Oriental radish. Variegated cutworm. Use low rate for black cutworm. Do not use on areas treated with product the previous season. 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	Radish and Oriental radish. Variegated cutworm. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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 3–137. Radish Insect Control — Swede Midge, Aphids, 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.

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 use on areas treated with product the previous season. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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	Radish and Oriental radish. 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 application details and rotational crop restrictions. 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	Radish and Oriental radish. Do not use on areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a soil application. See label for application details and rotational crop restrictions. 24-hr restricted entry interval.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Radish and Oriental radish. 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	Radish and Oriental radish. 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)	7	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	500–1,500 mL/ha (202–607 mL/acre)	7	Radish and Oriental radish. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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	Radish and Oriental radish. See label for rotational crop restrictions. 12-hr restricted entry interval.
soap	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.

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Table 3–137. Radish Insect Control — Swede Midge, Aphids, 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.					
LEGEND: PHI = Pre-Harvest Interval (in days)					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CHAFER GRUBS – Soil Application					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	Radish and Oriental radish. Reduction in numbers of larvae only. 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.

RHUBARB

In this section:

Table 3–138. Activity of Fungicide and Insecticides on Rhubarb Diseases and Insects

Table 3–139. Rhubarb Disease and Insect Control

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

Table 3–138. Activity of Fungicide and Insecticides on Rhubarb Diseases and Insects

LEGEND: C = control — = 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	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	—	—
	Success	—	C	C	—	—
pymetrozine	Fulfill 50WG	C	—	—	—	—
flonicamid	Beleaf 50SG	C	—	—	—	—
methoxyfenozide	Intrepid	—	—	C	—	—
spirotetramat	Movento 240 SC	C	—	—	—	—
chlorantraniliprole	Coragen	—	—	C	—	—
cyantraniliprole	Exirel	C	—	C	—	—
ferric phosphate	Sluggo Professional	—	—	—	C	—

Table 3–139. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ROOT ROTS					
microbial (group 44)	<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-hrs.
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. 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	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	12-hr restricted entry interval or until residues have 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 restriction. 12-hr restricted entry interval.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Apply when aphids first appear. Minimum 30-day plant-back restriction for all crops. 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.
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. See label for rotational crop restrictions. 12-hr restricted entry interval.

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Table 3–139. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
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.
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. 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.
SLUGS					
not classified	ferric phosphate	Sluggo Professional	12–50 kg/ha (5–20 kg/acre)	0	Use higher rates on severe infestations.

RUTABAGAS

In this section:

Table 3–140. Rutabaga Seed Treatments

Table 3–141. Activity of Fungicides on Rutabaga Diseases

Table 3–142. Rutabaga Disease Control

Table 3–143. Activity of Insecticides on Rutabaga Insects

Table 3–144. Rutabaga Insect Control — Cabbage Root Maggot, Flea Beetles, Leaf-Eating Caterpillars

Table 3–145. Rutabaga Insect Control — Cutworms, Aphids

Table 3–146. Rutabaga Insect Control — European Chafer Grubs, Swede Midge

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

Table 3–140. 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.
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 3–141. Activity of Fungicides on Rutabaga Diseases

LEGEND: C = control

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

Common Name	Trade Name	Damping-Off	Downy Mildew	Powdery Mildew	Rhizoctonia	Alternaria	Botrytis Gray Mold
metalaxyl-M and S-isomer	Apron XL LS	C	—	—	—	—	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—
fludioxonil	Maxim 480FS	C	—	—	—	—	—
penthiopyrad	Fontelis	—	—	C	—	—	C
fluxapyroxad	Sercadis	—	—	C	—	S	—
fosetyl-AL	Aliette WDG	—	C	—	—	—	—
fluopicolide	Presidio	—	C	—	—	—	—
<i>Bacillus subtilis</i>	Serenade Opti	—	S	—	—	—	—
propiconazole	Tilt 250E	—	—	C	—	—	—
	Bumper 418 EC	—	—	C	—	—	—
pyraclostrobin	Cabrio EG	—	—	C	—	C	—
azoxystrobin	Quadris Flowable	—	—	—	C	—	—
trifloxystrobin	Flint	—	—	—	—	C	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	—	C
sulphur	Microscopic Sulphur	—	—	C	—	—	—

Table 3–142. Rutabaga Disease Control

For resistance management, rotate between fungicides 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
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.
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. See label for 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 sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 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. See label for restricted entry intervals.
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.
MOSAIC VIRUS					
not classified	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.
DOWNY MILDEW					
phosphonate (group 33)	fosetyl-AL	Aliette WDG	2.25–3.12 kg in minimum 100 L water/ha (0.9–1.26 kg in minimum 10 gal water/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 use on areas treated with product the previous season. Do not make sequential applications. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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.
ALTERNARIA					
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 sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 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 fungicides. 12-hr restricted entry interval.

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Table 3–142. Rutabaga Disease Control

For resistance management, rotate between fungicides 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
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. See label for rotational crop restrictions. 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	See label for rotational crop restrictions. 12-hr restricted entry interval.
RHIZOCTONIA – Soil Application					
QoI (group 11)	azoxystrobin	Quadris Flowable	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 use on areas treated with product the previous season. See label for rotational crop restrictions. Do not make sequential applications of any group 11 fungicides. 12-hr restricted entry interval.
ROOT ROT (RHIZOCTONIA SOLANI, PYTHIUM SPP. AND FUSARIUM SPP.) – Soil Application					
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade SOIL	2.7–14 L/ha (1.1–5.7 L/acre)	0	Suppression. See label for application details.

Table 3–143. Activity of Insecticides on Rutabaga Insects**LEGEND:** C = control 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	—	—	—
	Warhawk 480 EC	C	—	—	C	—	—	—
diazinon	Diazinon 500 E	C	—	—	—	—	—	—
malathion	Malathion 85E	—	—	C ²	—	N	—	—
cypermethrin	Mako	—	C	—	—	—	—	—
	Up-Cyde 2.5 EC	—	C	—	—	—	—	—
acetamiprid	Assail 70 WP	—	—	—	—	—	—	C
thiamethoxam	Actara 25WG	—	—	—	—	C	—	—
imidacloprid	Admire 240 F	—	C	—	—	C	RD	—
sulfoxaflor	Closer	—	—	—	—	C	—	—
flupyradifurone	Sivanto Prime	—	—	—	—	C	—	—
spinosad	Success	—	—	C	—	—	—	—
	Entrust	—	—	C	—	—	—	—
spinetoram	Delegate WG	—	—	C	—	—	—	—

¹ For control of cabbage looper only.² For control of imported cabbageworm and diamondback moth only.

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Table 3–143. Activity of Insecticides on Rutabaga Insects

LEGEND: C = control 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
cyantraniliprole	Verimark	C	RD	—	—	—	—	—
	Exirel	—	C	C ³	C	C	—	—
chlorantraniliprole	Coragen	—	—	C	C	—	—	C
flonicamid	Beleaf 50SG	—	—	—	—	C	—	—

³ For control of imported cabbageworm and cabbage loopers only.**Table 3–144.** 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.

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	See label for rotational crop restrictions. 24-hr restricted entry interval.
		Pyrifos 15G	0.6–1 kg/1,000 m of row (0.18–0.3 kg/1,000 ft of row)		See label for rotational crop restrictions. 24-hr restricted entry interval.
	diazinon	Diazinon 500 E	2.2 L/ha (0.9 L/acre)	14	Apply as a banded soil drench application only. See label for tank-mix restrictions. 4-day restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	10–15 mL/100 m of row or 1,100–1,700 mL/ha (445–687 mL/acre)	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. See label for rotational crop restrictions. 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 and rotational crop restrictions. 24-hr restricted entry interval.
		Nufos 4E	210 mL/1,000 m of row (64 mL/1,000 ft of row)		
		Warhawk 480 EC	210 mL/1,000 m of row (64 mL/1,000 ft of row)		
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 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.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row or 750–1,000 mL/ha (304–405 mL/acre)	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. See label for rotational crop restrictions. 12-hr restricted entry interval.

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Table 3–144. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
FLEA BEETLES — Foliar Applications					
carbamate (group 1A)	carbaryl	Sevin XLR	1.25–2.5 L/ha (0.5–1 L/acre)	7	See label for restricted entry intervals.
pyrethroid (group 3A)	cypermethrin	Mako	123 mL/ha (50 mL/acre)	21	Crucifer flea beetle. 12-hr restricted entry interval
		UP-Cyde 2.5 EC	200 mL/ha (81 mL/acre)	21	12-hr restricted entry interval.
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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.
LEAF-EATING CATERPILLARS					
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 (56–81 g/acre)	3	12-hr restricted entry interval.
	spinosad	Entrust	364 mL/ha (147 mL/acre)	3	Re-entry once spray deposit has dried.
		Success	182 mL/ha (74 mL/acre)	3	
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not use on areas treated with product the previous season. 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. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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 3–145. 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.

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 and rotational crop restrictions. 24-hr restricted entry interval.
		Pyrinex 480 EC	1.2–2.4 L in 200–400 L water/ha (0.5–1 L in 20–40 gal water/acre)		
		Nufos 4E	1.2–2.4 L in 200–400 L water/ha (0.5–1 L in 20–40 gal water/acre)		
		Warhawk 480 EC	1.2–2.4 L in 200–400 L water/ha (0.5–1 L in 20–40 gal water/acre)		
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm. Use low rate for black cutworm. Do not use on areas treated with product the previous season. 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. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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	Also controls leafhoppers. 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.
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. Ensure thorough coverage. Apply when temperature is at or above 20°C. 12-hr restricted entry interval.

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Table 3-145. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS — Foliar Applications Continued					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	200 mL/ha (81 mL/acre)	7	Do not use on areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a soil application. See label for rotational crop restrictions. 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. See label for rotational crop restrictions. 24-hr restricted entry interval.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	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)	7	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	500–1,500 mL/ha (202–607 mL/acre)	7	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. See label for rotational crop restrictions. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–146. Rutabaga Insect Control — European Chafer Grubs, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CHAFER GRUBS – Soil Application					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	Reduction in numbers of larvae. 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.
SWEDE MIDGE					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	86 g/ha (34 g/acre)	7	Do not apply foliar group 4 insecticides in the same season as a soil application. 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. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. See label for rotational crop restrictions. 12-hr restricted entry interval.

SPINACH

In this section:

Table 3-147. Spinach Seed Treatments

Table 3-148. Activity of Fungicides on Spinach Diseases

Table 3-149. Spinach Disease Control — Damping-Off, Root Rots, Downy Mildew, White Rust

Table 3-150. Spinach Disease Control — Anthracnose, Botrytis Gray Mold

Table 3-151. Activity of Insecticides on Spinach Insects

Table 3-152. Spinach Insect Control — Aphids

Table 3-153. Spinach Insect Control — Leafminers, Cutworms

Table 3-154. Spinach Insect Control — Cabbage Looper, Thrips

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

Table 3-147. 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 (Pythium)	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 3-148. 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	—	—	—
fenamidone	Reason 500SC	—	S	—	—	—
cyazofamid	Torrent 400SC	—	—	S	—	—
fosetyl-AL	Aliette WDG	—	S	S	—	—
mandipropamid	Revus	—	C	—	—	—
mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	—	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 3–149. Spinach Disease Control — Damping-Off, Root Rots, Downy Mildew, White Rust

For resistance management, rotate between fungicides 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
DAMPING-OFF/ ROOT ROTS					
microbial (group 44)	<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 hours.
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	1.6 kg/ha (0.6 kg/acre)	0	Suppression. 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.
QoI (group 11)	azoxystrobin	Quadris Flowable	1.125 L/ha (455 mL/acre)	7	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 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. See label for recropping restrictions. Do not make sequential applications of any group 11 fungicide. Re-entry permitted once spray deposit has dried.
CAA (group 40) + piperidinyl-thiazole-isoxazolines (group U15)	mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	400–600 mL/ha (162–243 mL/acre) + 175–350 mL/ha (71–142 mL/acre)	1	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 40 or group U15 fungicide. Tank-mix with a non-ionic surfactant. See label for rotational crop restrictions. 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. Do not use on areas treated with product the previous season. 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. See label for rotational crop restrictions. 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.

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Table 3–149. Spinach Disease Control — Damping-Off, Root Rots, Downy Mildew, White Rust

For resistance management, rotate between fungicides 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
WHITE RUST					
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. See label for recropping restrictions. 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 44)	<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 3–150. Spinach Disease Control — Anthracnose, Botrytis Gray Mold

For resistance management, rotate between fungicides from different chemical groups.

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.
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 3–151. 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	—	—
	Success	—	—	C	—	—
spinetoram	Delegate WG	—	—	C	—	S
pymetrozine	Fulfill 50WG	—	C	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec CAF	—	—	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 3–152.** 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.

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	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	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.

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Table 3–152. 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.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Soil and Transplant Applications Continued					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/acre)	—	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)	—	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.
	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	7	Also effective at reducing damage by tarnished plant bug at a 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.
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.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Apply when aphids first appear. 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)	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.
soap	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 3–153. 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.

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/ cyantraniliprole	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					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Black cutworm. Apply when no rain is forecast in the next 24 hours. 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 hours. 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 3–154. 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.

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 CAF	1.4–2.8 L/ha (0.56–1.1 L/acre)	0	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 (0.8–1.72 L/acre)	0	
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:

Table 3–155. Sugarbeet Seed Treatments

Table 3–156. Activity of Fungicides on Sugarbeet Diseases

Table 3–157. Sugarbeet Disease Control — Cercospora Leaf spot

Table 3–158. Sugarbeet Disease Control — Powdery Mildew, Rhizoctonia Root and Crown Rot

Table 3–159. Activity of Insecticides on Sugarbeet Insects

Table 3–160. Sugarbeet Insect Control — Cutworms, Flea Beetles, Leafhoppers and Spider Mites

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

Table 3–155. 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 spp.</i> , <i>Rhizoctonia solani</i>)	Suppression. For application with commercial seed treatment equipment only. See label for recropping restrictions.
phenylamide (group 4)	metalaxyl	Allegiance FL	93 mL/ 100 kg seed	Pythium seed rots, seedling blights	For application with commercial seed treatment equipment only.
phenylamide (group 4)	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. See label for recropping restrictions. 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. See label for recropping restrictions.
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 M3)	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 3–156. Activity of Fungicides on Sugarbeet 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	Cercospora Leaf Spot	Rhizoctonia Root and Crown Rot	Powdery Mildew
thiophanate-methyl	Senator 50SC	C	—	—
metconazole	Caramba	C	—	—
prothioconazole	Proline 480 SC	C	C	—
tetraconazole	Mettle 125 ME	C	—	C
azoxystrobin/ difenoconazole	Quadris Top	C	—	C
penthiopyrad	Vertisan	—	C	S
azoxystrobin	Quadris	—	C	—
pyraclostrobin	Headline EC	C	—	C
trifloxystrobin	Flint	—	—	C
<i>Bacillus subtilis</i>	Serenade SOIL	—	S	—
copper hydroxide	Coppercide WP	C	—	—
	Kocide 2000	C	—	—
	Parasol WG	C	—	—
copper octanoate	Cueva	C	—	—
sulfur	Microthiol Disperss	—	—	C
mancozeb	Manzate Pro-Stick	C	—	—
metiram	Polyram DF	C	—	—

Table 3–157. Sugarbeet Disease Control — Cercospora Leaf Spot

For resistance management, rotate between fungicides from different chemical groups.

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 Cercospora 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	420–560 g/ha (170–227 g/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. See label for recropping restrictions. 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. See label for recropping restrictions. 24-hr restricted entry interval.

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Table 3–157. Sugarbeet Disease Control — Cercospora Leaf Spot

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CERCOSPORA LEAF SPOT CONTINUED					
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.					
DMI (group 3)	tetraconazole	Mettle 210 ME	565 mL/ha (229 mL/acre)	14	Maximum one application/year. Do not use on areas treated with product the previous season. See label for recropping restrictions and restricted entry intervals.
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. See label for recropping restrictions. 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. Do not use on areas treated with product the previous season. Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 3 or group 11 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
inorganic (group M1)	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)	2	Follow label instructions regarding addition of a suitable non-herbicidal agricultural oil at 5.5 L/ha (2.22 L/acre). 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	4-hr restricted entry interval.
dithiocarbamate (group M3)	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.
	metiram	Polyram DF	2.25 kg/ha (0.91 kg/acre)	21	Do not use treated beet tops for feed.

Table 3–158. Sugarbeet Disease Control — Powdery Mildew, Rhizoctonia Root and Crown Rot

For resistance management, rotate between fungicides from different chemical groups.

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	Maximum one application/year. Do not use on areas treated with product the previous season. See label for recropping restrictions and restricted entry intervals.
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. See label for rotational crop restrictions. 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. See label for recropping restrictions. 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. See label for recropping restrictions. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (229–405 mL/acre)	7	Do not use on areas treated with product the previous season. Always tank-mix or rotate with a different fungicide group. Do not make sequential applications of any group 3 or group 11 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
inorganic (group M2)	sulfur	Microthiol Dispers	6 kg/ha (2.4 kg/acre)	1	24-hr restricted entry interval.
RHIZOCTONIA ROOT AND CROWN ROT					
Soil and In-Furrow Applications					
SDHI (group 7)	penthiopyrad	Vertisan	15.5 mL/100 m of row (4.7 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. See label for rotational crop restrictions. 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	Do not use on areas treated with product the previous season. See label for recropping restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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. See label for recropping restrictions. 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. Do not use on areas treated with product the previous season. See label for recropping restrictions. 12-hr restricted entry interval.

Table 3–159. 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	—	—	—
malathion	Malathion 85E	C	—	—	—	—
naled	Dibrom	—	—	—	C	C
permethrin	Ambush 500EC	—	C	—	—	—
	Perm-UP	—	C	—	—	—
	Pounce 384EC	—	C	—	—	—
sulfoxaflor	Closer	—	—	C	—	—
chlorantraniliprole	Coragen	—	C	—	—	—

Table 3–160. 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.

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	See label for recropping restrictions. 24-hr restricted entry interval.
		Pyrinex 480 EC	1.2–2.4 L/ha (0.5–1.0 L/acre)	90	
		Warhawk 480 EC	1.2–2.4 L/ha (0.5–1.0 L/acre)	90	
pyrethroid (group 3A)	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.
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Early application on larval stages provides best control. Do not use on areas treated with product the previous season. 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.

SWEET CORN

In this section:

Table 3–161. Sweet Corn Seed Treatments

Table 3–162. Activity of Fungicides on Sweet Corn Diseases

Table 3–163. Sweet Corn Disease Control

Table 3–164. Activity of Insecticides on Sweet Corn Insects

Table 3–165. Sweet Corn Insect Control — Corn Rootworm, Cutworms, Slugs

Table 3–166. Sweet Corn Insect Control — European Corn Borer

Table 3–167. Sweet Corn Insect Control — Corn Earworm, Western Bean Cutworm, Fall Armyworm, Armyworm

Table 3–168. Sweet Corn Insect Control — Brown Marmorated Stink Bug, Aphids

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

Table 3–161. Sweet Corn Seed Treatments

LEGEND: C = control

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

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

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	SC	SC	—	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 label 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.
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. See label for rotational crop restrictions.

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.

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Table 3–161. Sweet Corn Seed Treatments

LEGEND: C = control — = not registered for control of this pest, or activity on this pest has not been documented SC = some control of this pest may be expected when the product is used to control labelled pests										
Active Ingredient(s)	Trade Name	Insects				Seedling Blights ¹				Notes
		Seedcorn Maggots	Wireworm	European Chafer	Flea Beetles	Penicillium	Pythium	Fusarium	Rhizoctonia	
INSECTICIDE ONLY CONTINUED										
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	—	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. See label for rotational crop restrictions.
INSECTICIDE + FUNGICIDE										
thiamethoxam ² + fludioxonil + metalaxyl-M and S-isomer	Cruiser 5FS ² + 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 5FS ² + 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 3–162. Activity of Fungicides on Sweet Corn Diseases**For information on seed decay, root rots and 3–5 leaf dieback, see *Table 3–161. 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	—	—
	Tilt 250E	C	C	—	—
prothioconazole	Proline 480 SC	C	C	—	—
penthiopyrad	Vertisan	C	—	—	—

¹ See Flea Beetles in *Table 3–161. Sweet Corn Seed Treatments*.

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Table 3-162. Activity of Fungicides on Sweet Corn DiseasesFor information on seed decay, root rots and 3-5 leaf dieback, see *Table 3-161. 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
azoxystrobin	Quadris Flowable	C	—	—	—
picoxystrobin	Acapela	—	C	—	—
pyraclostrobin	Headline EC	C	—	—	—
azoxystrobin/propiconazole	Quilt	C	C	—	—
trifloxystrobin/ prothioconazole	Stratego PRO	C	C	—	—
chlorothalonil	Bravo ZN	C	—	—	—
	Echo 90DF	C	—	—	—

¹ See Flea Beetles in *Table 3-161. Sweet Corn Seed Treatments*.**Table 3-163. Sweet Corn Disease Control**

For resistance management, rotate between fungicides from different chemical groups.

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.
		Tilt 250E	250–500 mL/ha (101–202 mL/acre)	14	
	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 nonionic 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.
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 rotational crop restrictions and restricted entry intervals.
QoI (group 11)	azoxystrobin	Quadris Flowable	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.
	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. See label for rotational crop restrictions. 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.
QoI/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.

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Table 3–163. Sweet Corn Disease Control

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
RUST, NORTHERN CORN LEAF BLIGHT CONTINUED					
QoI/DMI (group 11/3)	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.
chloronitrile (group M5)	chlorothalonil	Bravo ZN	3.2 L/ha (1.3 L/acre)	14	Rust. 48-hr restricted entry interval.
		Echo 90DF	1.8 kg/ha (0.7 kg/acre)		

Table 3–164. Activity of Insecticides on Sweet Corn InsectsFor information on seed corn maggot, wireworm, white grubs and flea beetles, see *Table 3–161. 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 75%	—	—	—	—	—	—	C	—	—
chlorpyrifos	Lorsban 4E/NT	—	—	C	—	—	—	—	—	—
	Nufos 4E	—	—	C	—	—	—	—	—	—
	Pyrifos 15G	C	—	S	—	—	—	—	—	—
	Pyrinex 480 EC	—	—	C	—	—	—	—	—	—
	Warhawk 480 EC	—	—	C	—	—	—	—	—	—
cypermethrin	Mako	—	—	C	—	—	SC	C	N	—
	UP-Cyde 2.5 EC	—	—	C	—	—	SC	C	—	—
deltamethrin	Decis 5 EC	—	—	—	—	—	SC	C	N	C
lambda-cyhalothrin	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	—
	Ambush 500EC	—	—	C	—	—	C	C	N	—
tefluthrin	Force 3.0G	C	—	C	—	—	—	—	—	—
lambda-cyhalothrin/chlorantraniliprole	Voliam Xpress	—	—	—	—	—	C ¹	C	C	C
acetamiprid	Assail 70WP	—	—	—	C	—	—	—	—	—
flupyradifurone	Sivanto Prime	—	—	—	C	—	—	—	—	—
spinetoram	Delegate	—	—	—	—	—	—	C	—	C

¹ Also controls common armyworm.

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Table 3–164. Activity of Insecticides on Sweet Corn Insects

For information on seed corn maggot, wireworm, white grubs and flea beetles, see Table 3–161. 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
spinosad	Entrust	—	—	—	—	—	—	C	—	—
	Success	—	—	—	—	—	—	C	—	—
<i>Bacillus thuringiensis</i>	Dipel 2X DF	—	—	—	—	—	—	C	—	—
	Bioprotec CAF	—	—	—	—	—	—	C	—	—
methoxyfenozide	Intrepid	—	—	—	—	—	—	C	—	—
spirotetramat	Movento 240 SC	—	—	—	C	—	—	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	C ¹	C	C	C
ferric phosphate	Sluggo Professional	—	C	—	—	—	—	—	—	—
soap	Kopa Insecticidal Soap	—	—	—	C	—	—	—	—	—

¹ Also controls common armyworm.**Table 3–165.** 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.

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 ²)	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 ²)	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.
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	1.2–2.4 L/ha (0.5–1 L/acre)		
		Pyrinex 480 EC	1.2–2.4 L/ha (0.5–1 L/acre)		
		Warhawk 480 EC	1.2–2.4 L/ha (0.5–1 L/acre)		

¹ Row spacing: 75 cm.² Row spacing: 30 in.

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Table 3–165. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS CONTINUED					
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.
		Up-Cyde	285 mL/ha (115 mL/acre)		
	lambda-cyhalothrin	Matador 120EC	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.
		Silencer 120 EC			
	permethrin	Ambush 500EC	140–300 mL/ha (57–121 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. Re-entry permitted when dry.
		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.
		Pounce 384EC	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. Re-entry permitted when dry.
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	ferric phosphate	Sluggo Professional	25–50 kg/ha (10–20 kg/acre)	0	Use high rates on severe infestations.

Table 3–166. 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.

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. See label for restricted entry intervals.
organophosphate (group 1B)	acephate	Orthene 75%	563–825 g/ha (228–334 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.
		UP-Cyde 2.5EC	280 mL/ha (113 mL/acre)	5	
	deltamethrin	Decis 5 EC	250–300 mL/ha (101–121 mL/acre)	5	Apply when egg masses begin to hatch, but no later than when the first pinhole feeding is seen on the leaves.

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.

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Table 3-166. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CORN BORER CONTINUED					
pyrethroid ¹ (group 3A)	lambda-cyhalothrin	Matador 120EC	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.
		Silencer 120 EC	83 mL/ha (34 mL/acre)		
	permethrin	Ambush 500EC	200–275 mL/ha (81–111 mL/acre)	1	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.
		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	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. 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	
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	2.8–4 L/ha (1.1–1.6 L/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.
		Dipel 2X DF	0.56–1.12 kg/ha (0.22–0.45 kg/acre)	0	
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. 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	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 3–167. 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.

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. See label for restricted entry intervals.
pyrethroid ^{1,2} (group 3A)	cypermethrin	Mako	175 mL/ha (71 mL/acre)	5	Ensure good coverage of ears and silks.
	deltamethrin	Decis 5 EC	250–300 mL/ha (101–121 mL/acre)	5	Target spray to ensure coverage of ears and green silk.
	lambda-cyhalothrin	Matador 120EC	83–187 mL/ha (34–76 mL/acre)	1	Target spray to ensure coverage of ears and green silk. 14-day PHI for silage. 24-hr restricted entry interval.
		Silencer 120EC	83 mL/ha (34 mL/acre)		
	permethrin	Ambush 500EC	200–275 mL/ha (81–111 mL/acre)	1	Target spray to ensure coverage of ears and green silk. Re-entry permitted when dry.
		Perm-UP	275–375 mL/ha (111–152 mL/acre)	1	Target spray to ensure coverage of ears and green silk. 12-hr restricted entry interval.
		Pounce 384EC	275–375 mL/ha (111–152 mL/acre)	1	Target spray to ensure coverage of ears and green silk. Re-entry permitted when dry.
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	Time applications to coincide with peak egg hatch. 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 5 EC	250–300 mL/ha (101–121 mL/acre)	5	No additional information.
	lambda-cyhalothrin	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.

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.² Corn earworm resistance to pyrethroid insecticides has been documented in some regions.

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Table 3–167. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
FALL ARMYWORM, ARMYWORM					
pyrethroid ¹ (group 3A)	lambda-cyhalothrin	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)	1	Fall armyworm. 14-day PHI for silage. 24-hr restricted entry interval.
	permethrin	Ambush 500EC	140 mL/ha (57 mL/acre)	1	Fall armyworm. Re-entry permitted when dry.
		Perm-UP	180 mL/ha (73 mL/acre)	1	Fall armyworm. 12-hr restricted entry interval.
		Pounce 384EC	180 mL/ha (73 mL/acre)	1	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 3–168. 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.

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. See label for restricted entry intervals.
APHIDS					
neonicotinoid (group 4A)	acetamiprid	Assail 70 WP	56–86 g/ha (23–35 g/acre)	10	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.
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. 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)	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.
soap	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

Table 3–169. Sweet Potato Disease and Nematode Control

Table 3–170. Sweet Potato Postharvest Disease Control

Table 3–171. Sweet Potato Insect Control — European Chafer Grubs, Flea Beetles, Two-Spotted Spider Mites

Table 3–172. Sweet Potato Insect Control — Aphids, Variegated Cutworm, Armyworm, Slugs

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

Table 3–169. 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.

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

N/A = not applicable

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/100m row (1.37 mL/100 ft of row)	—	Root lesion nematode, root knot nematode, potato cyst nematode. Suppression. See label for application details. If foliar fungicides against alternaria leaf blights are required after a soil application of this product, use another mode action for the first application. See label for recropping restrictions. 12-hr restricted entry interval.
STEM ROT, SCURF					
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. See label for rotational crop restrictions. 12-hr restricted entry interval.
dithiocarbamate (group M3)	thiram	Thiram 75 WP Granuflo-T	1.75 kg/1,000 L of water	N/A	Only for roots to be used for slip production. Not for greenhouse use. Dip roots of sprouts for 30 seconds in suspension, then plant promptly. 24-hr restricted entry interval for Granuflo.
DAMPING-OFF / ROOT ROTTS					
microbial (group 44)	<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.
LEAF BLIGHTS					
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. See label for rotational crop restrictions. 12-hr restricted entry interval.
	fluxapyroxad	Sercadis	167–333 mL/ha (67–135 mL/acre)	7	Leaf blights caused by <i>Alternaria solani</i>. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 7 fungicides. Tank mix with a non-ionic surfactant. See label for rotational crop restrictions. 12-hr restricted entry interval.
QoI/DMI (group 11/3)	azoxystrobin/ difenoconazole	Quadris Top	566–1,000 mL/ha (229–404 mL/acre)	14	Leaf blights caused by <i>Alternaria solani</i>. 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 recropping restrictions. 12-hr restricted entry interval.

¹ Based on 90 cm (36 in.) row spacing.

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Table 3–169. 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.

LEGEND: PHI = Pre-Harvest Interval (in days) N/A = not applicable

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
SCLEROTINIA ROT					
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade Opti.	1.1–2.2 kg/ha (0.4–0.9 kg/acre)	0	Suppression.

Table 3–170. 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	Spray diluted solution on newly harvested roots. Additional applications can be made daily as a direct injection into humidification water. See product label for details. Do not enter treated areas or storage bins until residues have dried and hydrogen peroxide air concentrations are below mandated safe exposure levels.
FUNGAL ROTS				
PP (group 12)	fludioxonil	Scholar 230SC	473 mL/378 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.
PP/DMI/Qol (group 12/3/11)	fludioxonil/ difenoconazole/ azoxystrobin	Stadium	32.5 mL/metric tonne	Rhizopus and fusarium rots. Dilute in 2 L water/tonne. Apply post-harvest as an in-line aqueous spray application to roots immediately before storage. See product label for detailed application instructions. Do not apply to roots that will be used for slip production.
not classified	<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 3–171. Sweet Potato Insect Control — European Chafer Grubs, 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.

LEGEND: PHI = Pre-Harvest Interval (in days); N/A = not applicable

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CHAFER GRUBS – Soil Applications					
neonicotinoid (group 4A)	clothianidin	Clutch 50WDG	448 g/ha (179 g/acre)	N/A	Apply pre-plant incorporated, prior to transplanting slips. Ensure application is followed by sufficient water for optimal uptake. 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. 12-hr restricted entry interval.

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Table 3–171. Sweet Potato Insect Control — European Chafer Grubs, 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.

LEGEND: PHI = Pre-Harvest Interval (in days); N/A = not applicable					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
EUROPEAN CHAFER GRUBS – Soil Applications Continued					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1.2 L/ha (0.5 L/acre)	125	Reduction in numbers of larvae only. Do not use on areas treated with product the previous season. 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 use subsequent foliar group 4 insecticides in the same season. See label for rotational crop restrictions. 24-hr restricted entry interval.
		Grapple ₂	1.2 L/ha (0.5 L/acre)		
		Alias 240 SC	1.2 L/ha (0.5 L/acre)		
FLEA BEETLES					
pyrethroid (group 3A)	lambda-cyhalothrin	Matador 120EC	83 mL/ha (33 mL/acre)	7	Will also control potato leafhoppers. 24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (33 mL/acre)		
TWO-SPOTTED SPIDER MITES					
tetronic and tetramic acid derivatives (group 23)	spiromesifen	Oberon Flowable	500–600 mL/ha (200–240 mL/acre)	7	Will also control whiteflies. Effective against egg and nymphal stages. An adjuvant may be used to improve coverage and control. See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–172. Sweet Potato Insect Control — Aphids, Variegated Cutworm, Armyworm, Slugs

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					
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. See label for recropping crop restrictions. 12-hr restricted entry interval.
sulfoximines (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–60 mL/acre)	7	See label for recropping restrictions. 12-hr restricted entry interval or when spray residues have dried.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–304 mL/acre)	7	Also controls leafhoppers. Do not use on areas treated with product the previous season. Tops or greens from treated crops may not be fed to livestock as feed or used for human consumption. 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 (88–146 mL/acre)	7	Will also control psyllids and whiteflies. Most effective on young stages of aphids. Has slow activity; control may not be apparent for up to 2–3 weeks. See label for guidance on adjuvant use and rotational crop restrictions. 12-hr restricted entry interval.

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Table 3–172. Sweet Potato Insect Control — Aphids, Variegated Cutworm, Armyworm, Slugs

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 CONTINUED					
diamide (group 28)	cyantraniliprole	Exirel	500–1,500 mL/ha (200–600 mL/acre)	7	See label for guidance on adjuvant use, tank-mix and crop tolerance information, and rotational crop restrictions. 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. See label for rotational crop restrictions. 12-hr restricted entry interval.
CUTWORM, ARMYWORM					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (100–150 mL/acre)	1	Use low rate for black cutworm. Apply when rain is not expected in the next 24 hours. Do not use on areas treated with product the previous season. 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 (200–300 mL/acre)	7	Variegated cutworm and armyworms. Use low rate for armyworms. See label for tank-mix directions, crop tolerance and rotational crops restrictions. 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.
pyrethroid/ diamide (group 3A/28)	lambda-cyhalothrin/ chlorantraniliprole	Voliam Xpress	500 mL/ha (202 mL/acre)	7	Black cutworm. Apply when rain is not expected for 24 hours. Do not use on areas treated with product the previous season. 24-hr restricted entry interval.
SLUGS					
not classified	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 3–173. Swiss Chard Seed Treatments

Table 3–174. Activity of Fungicides and Insecticides on Swiss Chard Diseases and Insects

Table 3–175. Swiss Chard Disease Control — Root Rots, Damping-off, Botrytis Gray Mold

Table 3–176. Swiss Chard Insect Control — Aphids

Table 3–177. Swiss Chard Insect Control — Leafminers, Cutworms, Cabbage Looper

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

Table 3–173. 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 3–174. 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	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	—
	Success	—	—	—	—	C	—
spinetoram	Delegate WG	—	—	—	—	C	—

¹ Pea leafminers only.

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Table 3–174. 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							
pymetrozine	Fulfill 50WG	—	—	—	C	—	—
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 3–175.** Swiss Chard Disease Control — Root Rots, Damping-off, Botrytis Gray Mold

For resistance management, rotate between fungicides from different chemical groups.

LEGEND: PHI = Pre-Harvest Interval (in days)					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
ROOT ROTS, DAMPING-OFF					
microbial (group 44)	<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 hours.
not classified	<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 44)	<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 3–176. 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.

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

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	No additional information.
		Lagon 480 E	700 mL/ha (283 mL/acre)		
	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	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.
	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.
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.
sulfoxaflor (group 4C)	sulfoxaflor	Closer	100–150 mL/ha (40–60 mL/acre)	3	See label for recropping restrictions. Re-entry permitted when dry.
pymetrozine (group 9B)	pymetrozine	Fulfill 50WG	193 g/ha (78 g/acre)	14	Apply when aphids first appear. 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)	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 3–177. 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.

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

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	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					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Black cutworm. Apply when no rain is forecast in the next 24 hours. 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 hours. 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.
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.

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Table 3–177. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER CONTINUED					
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:

- Table 3-178.** Tomato Transplant Production Disease and Insect Control (Greenhouse)
Table 3-179. Activity of Fungicides on Tomato Diseases
Table 3-180. Tomato Bacterial Disease Control
Table 3-181. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leaf Spot
Table 3-182. Tomato Fungal Disease Control — Botrytis Gray Mold, Sclerotinia White Mold
Table 3-183. Tomato Fungal Disease Control — Phytophthora Blight, Powdery Mildew
Table 3-184. Activity of Insecticides on Tomato Insects
Table 3-185. Tomato Insect Control — Aphids, Cutworms
Table 3-186. Tomato Insect Control — Colorado Potato Beetle
Table 3-187. Tomato Insect Control — Cabbage Looper, Tomato or Tobacco Hornworm
Table 3-188. Tomato Insect Control — Stink Bug, Brown Marmorated Stink Bug
Table 3-189. Tomato Insect Control — Tarnished Plant Bug, Two-Spotted Spider Mite

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

Table 3-178. 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 M3)	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)	Streptomyces	Mycostop	5 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 44)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	25–250 g in 100 L of water See label for application instructions.	Phytophthora capsici (soil). Partial suppression. Make preventative 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.

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Table 3–178. 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 M4)	captan	Maestro 80DF	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.
		Supra Captan 80 WDG	1.25 kg in 1,000 L of water Apply 50–85 L of solution per 100 m².	
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	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.
		RootShield HC	55–110 g/m³ of loose planting mix or 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 for greenhouse applications.
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 44)	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 44)	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.

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Table 3–178. Tomato Transplant Production Disease and Insect Control (Greenhouse)

Group Name (Group #)	Common Name	Trade Name	Rate	Notes
INSECTS CONTINUED — Foliar Application				
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	1.6 L in 1,000 L of water See label for application instructions.	<i>Duponchelia fovealis</i> .

Table 3–179. 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	Anthraxnose	Bacterial Disease ¹	Early Blight	Botrytis Gray Mold	Late Blight	Phytophthora Blight	Powdery Mildew	Septoria Leaf Spot	Sclerotinia White Mold
benzovindiflupyr	Aprovia	—	—	—	—	—	C	—	C	—	—	—	C	C	—
boscalid	Cantus WDG	—	—	—	—	—	—	—	C	C	—	—	—	—	—
fluxapyroxad	Sercadis	—	—	—	—	—	—	—	C	—	—	—	—	—	—
penthiopyrad	Fontelis	—	—	—	—	—	—	—	S	C	—	—	—	—	—
fluopyram/pyrimethanil	Luna Tranquility	—	—	—	—	—	—	—	C	—	—	—	—	C	—
pyrimethanil	Scala SC	—	—	—	—	—	—	—	C	C	—	—	—	—	—
cyprodinil/fludioxinol	Switch 62.5 WG	—	—	—	—	—	—	—	—	C	—	—	—	—	—
azoxystrobin	Quadris	—	—	—	—	—	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	—	—	—	—	—	—	—	—	—	—	—
cyazofamid	Torrent 400SC	C	C	—	—	—	—	—	—	—	C	—	—	—	—
kasugamycin	Kasumin 2L	—	—	—	—	—	—	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	—	—	—
dimethomorph	Forum	—	—	—	—	—	—	—	—	—	C	—	—	—	—
mandipropamid	Revus	—	—	—	—	—	—	—	—	—	C	—	—	—	—
amectotradin/dimethomorph	Zampro	—	—	—	—	—	—	—	—	—	C	S	—	—	—
mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	—	—	—	—	—	—	—	—	—	C	C ¹	—	—	—
fluopicolide	Presidio	—	—	—	—	—	—	—	—	—	C	S	—	—	—
<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	—	—	—	—	—	—	—	S	S	—	S ¹	—	—	—

¹ See label for details.

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Table 3–179. 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	Anthraxnose	Bacterial Disease ¹	Early Blight	Botrytis Gray Mold	Late Blight	Phytophthora Blight	Powdery Mildew	Septoria Leaf Spot	Sclerotinia White Mold
<i>Bacillus subtilis</i>	Cease	—	—	—	—	—	—	S	—	S	—	—	—	—	—
	Serenade Opti	—	—	—	—	—	—	S	S	S	—	—	S	—	—
	Serenade Soil	S	S	—	—	—	—	—	—	—	—	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	—
mancozeb	Dithane Rainshield	—	—	—	—	—	C	—	C	—	C	—	—	—	—
	Manzate Pro-Stick	—	—	—	—	—	C	—	C	—	C	—	—	—	—
	Penncozeb 75DF Raincoat	—	—	—	—	—	C	—	C	—	C	—	—	—	—
metiram	Polyram DF	—	—	—	—	—	C	—	C	—	C	—	—	C	—
captan	Maestro 80DF	C	C	—	—	—	C	—	—	—	—	—	—	C	—
	Supra Captan 80 WDG	C	C	—	—	—	C	—	—	—	—	—	—	C	—
folpet	Folpan 80 WDG	—	—	—	—	—	C	—	—	—	—	—	—	—	—
chlorothalonil	Bravo ZN	—	—	—	—	—	C	—	C	C	C	—	—	C	—
	Echo 90DF	—	—	—	—	—	C	—	C	C	C	—	—	C	—
BLAD polypeptide	Fracture	—	—	—	—	—	—	—	—	C	—	—	—	—	—
citric and lactic acid	Tivano	—	—	—	—	—	—	S	—	—	—	—	—	—	—
<i>Coniothyrium minitans</i>	Contans WG	—	—	—	—	—	—	—	—	—	—	—	—	—	S
<i>Gliocladium catenulatum</i>	Prestop WG	S	S	—	—	—	—	—	—	—	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	—	—	—	—	—	—	—	—	S	—	—
<i>Streptomyces</i>	Mycostop	—	S	—	—	—	—	—	—	—	—	—	—	—	—
<i>Streptomyces lydicus</i>	Actinovate SP	—	—	—	—	—	—	—	—	—	—	—	S	—	—
<i>Trichoderma harzianum</i>	RootShield Granules	—	S	—	—	—	—	—	—	—	—	—	—	—	—
	RootShield HC	—	S	S	—	—	—	—	—	S	—	—	—	—	—
extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	—	—	—	—	—	—	S	—	S	S	—	S	—	—
metrafenone	Vivando SC	—	—	—	—	—	—	—	—	—	—	—	C	—	—

¹ See label for details.

Table 3–180. 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 44)	<i>Bacillus subtilis</i>	Serenade Opti	0.6–1.7 kg/ha (0.2–0.7 kg/acre)	0	Bacterial spot. Suppression.
inorganic (group M1)	copper hydroxide	Coppercide WP	2.25 kg/ha (0.9 kg/acre)	1	Bacterial spot. Tank-mix with mancozeb; see label for directions. 24-hr restricted entry interval.
		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. Re-entry permitted once spray deposit has dried.
plant extract (group P5)	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. Repeat applications at 7–10 day intervals depending upon crop growth and disease pressure. 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 3–181. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leaf Spot

For resistance management, rotate between fungicides from different chemical groups.

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					
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. See label for recropping restrictions. 12-hr restricted entry interval.
	boscalid	Cantus WDG	175–315 g/ha (71–127 g/acre)	0	Early 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 recropping restrictions. 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 use on areas treated with product the previous season. Do not make sequential applications of group 7 fungicides. Tank-mix with a non-ionic surfactant. See label for rotational crop restrictions. 12-hr restricted entry interval.

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Table 3–181. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leaf Spot

For resistance management, rotate between fungicides from different chemical groups.

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					
SDHI (group 7)	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. See label for rotational crop restrictions. 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. See label for recropping restrictions. 12-hr restricted entry interval.
AP (group 9)	pyrimethanil	Scala SC	750 mL/ha (304 mL/acre)	2	Early blight. Tank-mix with Bravo. Do not make sequential applications of any group 9 fungicides. See label for recropping restrictions. 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 use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
	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. See label for recropping restrictions. 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. See label for recropping restrictions. 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 Bravo. Apply a non-group 11 fungicide within 7–10 days after every Reason application. See label for recropping restrictions. 12-hr restricted entry interval.
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 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 recropping restrictions. 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. See label for rotational crop restrictions. 12-hr restricted entry interval.
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. See label for recropping restrictions. 12-hr restricted entry interval.
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2.0–4.1 L/acre)	1	Late blight. Suppression. See label for tank-mix and crop tolerance information. May be applied as foliar sprays or through sprinkler chemigation.

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Table 3–181. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leaf Spot

For resistance management, rotate between fungicides from different chemical groups.

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					
phosphonate (group 33)	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. See label for tank-mix and crop tolerance information. 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. See label for recropping restrictions. 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 Bravo is suggested for resistance management. Do not make sequential applications of any group 40 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
CAA (group 40) + piperidinyl- thiazole- isoxazolines (group U15)	mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	400–600 mL/ha (162–243 mL/acre) + 175–350 mL/ha 71–142 mL/acre)	1	Late blight. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 40 or group U15 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.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	2	Late blight. Must be used in tank mix with Bravo when targeting late blight. Do not use on areas treated with product the previous season. Do not make more than two sequential applications. See label for rotational crop restrictions. 48-hr restricted entry interval.
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade Opti	2.5 kg/ha (1 kg/acre)	0	Early blight. Suppression.
QxI/ 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. See label for recropping restrictions. 12-hr restricted entry interval.
inorganic (group M1)	copper hydroxide	Kocide 2000	2.52 kg/ha (1.0 kg/acre)	2	Early blight and late blight. Should be combined with 1.75–2.25 kg/ha (0.7–0.9 kg/acre) mancozeb (80% active). 48-hr restricted entry interval.
	copper hydroxide	Kocide 2000	2.24 kg/ha (0.9 kg/acre)	2	Septoria leaf spot. Should be combined with 1.75–2.25 kg/ha (0.7–0.91 kg/acre) mancozeb (80% active). 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 M3)	mancozeb	Dithane Rainshield	1.1–3.25 kg/ha (0.45–1.32 kg/acre)	7	Anthracnose, early blight and late blight.

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Table 3–181. Tomato Fungal Disease Control — Anthracnose, Early Blight, Late Blight, Septoria Leaf Spot

For resistance management, rotate between fungicides from different chemical groups.

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					
dithiocarbamate (group M3)	mancozeb	Manzate Pro-Stick	1.75–3.25 kg/ha (0.71–1.32 kg/acre)	7	Anthracnose, early blight and late blight. 24-hr restricted entry interval.
		Penncozeb 75DF Raincoat	1.1–3.25 kg/ha (0.45–1.32 kg/acre)	7	Anthracnose, early blight and late blight. 24-hr restricted entry interval.
	metiram	Polyram DF	2.25 kg/ha (0.91 kg/acre)	7	Early blight and late blight.
			3.25 kg/ha (1.32 kg/acre)	7	Anthracnose and septoria leaf spot.
phthalimide (group M4)	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.
	captan	Supra Captan 80 WDG	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.
	folpet	Folpan 80 WDG	5 kg/ha (2 kg/acre)	1	Anthracnose. 24-hr restricted entry interval.
chloronitrile (group M5)	chlorothalonil	Bravo ZN	2.4–4.0 L/ha (1.0–1.6 L/acre)	2	Anthracnose, early blight, late blight and septoria leaf spot. 48-hr restricted entry interval.
		Echo 90DF	1.3–2.2 kg/ha (0.5–0.9 kg/acre)	1	Anthracnose, early blight, late blight and septoria leaf spot. 48-hr restricted entry interval.

Table 3–182. Tomato Fungal Disease Control — Botrytis Gray Mold, Sclerotinia White Mold

For resistance management, rotate between fungicides from different chemical groups.

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

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. See label for recropping restrictions. 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. See label for rotational crop restrictions. 12-hr restricted entry interval.
AP (group 9)	pyrimethanil	Scala SC	750 mL/ha (304 mL/acre)	2	Must be tank-mixed with Bravo. Do not make sequential applications of any group 9 fungicides. See label for recropping restrictions. 48-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 use on areas treated with product the previous season. Do not make sequential applications of any group 9 or group 12 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade Opti	1.7–3.3 kg/ha (0.7–1.3 kg/acre)	0	Suppression.

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Table 3–182. Tomato Fungal Disease Control — Botrytis Gray Mold, Sclerotinia White Mold

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
BOTRYTIS GRAY MOLD CONTINUED					
microbial (group 44)	<i>Bacillus amyloliquefaciens</i>	Double Nickel 55	0.9–1 kg/ha; or 1.25–3.6 kg/ha (0.36–0.4 kg/ac; or 0.51–1.46 kg/ac)	0	Suppression. See label for details on choosing a rate. Re-entry permitted once spray deposit has dried.
chloronitrile (group M5)	chlorothalonil	Bravo ZN	4.8 L/ha (1.9 L/acre)	2	48-hr restricted entry interval.
		Echo 90DF	2.7 kg/ha (1.1 kg/acre)	1	48-hr restricted entry interval.
Not Classified (NC)	BLAD polypeptide	Fracture	1.5–3.3 L/ha (0.6–1.3 L/acre)	0	No additional information.
	<i>Trichoderma harzianum</i>	RootShield HC	3.75–7.5 g/L of water Spray to wet, but avoid runoff.	—	Suppression. Foliar application.
plant extract (group P5)	extract of <i>Reynoutria sachalinensis</i>	Regalia Maxx	0.25% (v/v) solution applied in sufficient volume to ensure thorough coverage	0	Suppression. Repeat applications at 7–10-day intervals depending upon crop growth and disease pressure. 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.
SCLEROTINIA WHITE MOLD					
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 3–183. Tomato Fungal Disease Control — Phytophthora Blight, Powdery Mildew

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHYTOPHTHORA BLIGHT					
phosphonate (group 33)	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha (2–4 L/acre)	1	Foliar blight. Suppression. See label for tank-mix and crop tolerance information. May be applied as foliar sprays or through sprinkler chemigation.
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	1	Foliar blight. Suppression. Do not make sequential applications of any group 40 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.

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Table 3–183. Tomato Fungal Disease Control — Phytophthora Blight, Powdery Mildew

For resistance management, rotate between fungicides from different chemical groups.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
PHYTOPHTHORA BLIGHT CONTINUED					
CAA (group 40)	mandipropamid	Revus	600 mL/ha (243 mL/acre)	1	Root and crown rot (soil phase). Suppression. In-furrow or drip irrigation application. See label for application details. Do not make sequential applications of any group 40 fungicides. See label for recropping restrictions. 12-hr restricted entry interval.
CAA (group 40) + piperidinyl- thiazole- isoxazolines (group U15)	mandipropamid + oxathiapiprolin	Orondis Ultra A + Orondis Ultra B	400–600 mL/ha (175–350 mL/ha) + 162–243 mL/acre (71–142 mL/acre)	1	Foliar blight. Suppression. Do not use on areas treated with product the previous season. Do not make sequential applications of any group 40 or group U15 fungicides. Do not apply foliar applications in the same season as a soil application. See label for rotational crop restrictions. 12-hr restricted entry interval.
benzamide (group 43)	fluopicolide	Presidio	220–292 mL/ha (89–118 mL/acre)	2	Suppression. Must be tank-mixed with Revus when targeting phytophthora blight. Do not use on areas treated with product the previous season. Do not make more than two sequential applications. See label for rotational crop restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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.
QxI/CAA (group 45/40)	ametoctradin/ dimethomorph	Zapro	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. See label for recropping restrictions. 12-hr restricted entry interval.
POWDERY MILDEW					
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 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 recropping restrictions. 12-hr restricted entry interval.
microbial (group 44)	<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).
	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.
benzophenone (group U8)	metrafenone	Vivando SC	0.75–1.12 L/ha (0.3–0.45 L/acre)	7	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.

Table 3–184. 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>Du</i> <i>p</i> <i>on</i> <i>ch</i> <i>ella</i> <i>fo</i> <i>vealis</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
carbaryl	Sevin XLR	—	—	—	N	C	—	C	C	—	N	—	C	C	—
methomyl	Lannate Toss-N-Go	—	C	—	—	C	—	—	—	—	—	S	—	C	—
acephate	Orthene 75%	—	C	—	N	C	—	C	—	—	—	—	—	—	C
dimethoate	Cygon 480	—	C	—	—	—	—	—	—	—	—	—	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	—	—	—	—	—	—	—
deltamethrin	Decis 5 EC	—	—	—	C	—	—	—	—	—	—	—	—	—	—
lambda-cyhalothrin	Matador 120EC	—	—	—	C	C	—	C	—	—	—	—	C	—	—
	Silencer 120 EC	—	—	—	C	C	—	C	—	—	—	—	C	—	—
permethrin	Ambush 500EC	—	—	—	C	C	—	C	C	—	—	—	—	C	—
	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	—	—	—	—	—	—	—	—	—	—
imidacloprid	Admire 240	—	C ¹	—	C ¹	—	—	—	—	—	—	—	—	—	—
	Alias 240 SC	—	—	—	C	—	—	—	—	—	—	—	—	—	—
	Grapple ₂	—	—	—	C	—	—	—	—	—	—	—	—	—	—
thiamethoxam	Actara 240SC	—	C	—	C	—	—	S ¹	—	—	—	—	—	—	—
	Actara 25WG	—	C	—	—	—	—	—	—	—	C ¹	RD	C ¹	—	—
imidacloprid/ deltamethrin	Concept	—	—	—	C	—	—	—	C	—	—	—	—	—	—
thiamethoxam/ cyantraniliprole	Minecto Duo 40WG	—	C	C ¹	C	—	—	S ¹	—	—	—	—	—	RD	—
flupyradifurone	Sivanto Prime	—	C	—	C	—	—	—	—	—	—	—	—	—	—
spinetoram	Delegate	—	—	C	—	—	—	—	—	—	—	—	—	—	—
spinosad	Entrust	—	—	C	C	—	—	—	—	—	—	—	—	—	—
	Success	—	—	C	C	—	—	—	—	—	—	—	—	—	—
<i>Bacillus thuringiensis</i>	Bioprotec CAF	C	—	C	—	—	—	—	C	—	—	—	—	C	—
	Dipel 2X DF	—	—	C	—	—	—	—	C	—	—	—	—	C	—

¹ See label for details.

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Table 3–184. 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
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	—
cyantraniliprole	Exirel	—	C	C	C	C	—	C	S	—	—	—	—	C	—
flonicamid	Beleaf 50SG	—	C	—	—	—	—	—	—	—	—	—	—	—	—
mineral oil	PureSpray Green Spray Oil 13E	—	—	—	—	—	—	—	—	S	—	—	—	—	—
potassium salts of fatty acids	Kopa Insecticidal Soap	—	C	—	—	—	—	—	—	C	—	—	—	—	—
	Opal Insecticidal Soap	—	C	—	—	—	—	—	—	C	—	—	—	—	—

Table 3–185. 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.

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 75%	900 g in 2,000 L water/ha (364 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.
neonicotinoid (group 4A)	imidacloprid	Admire 240	7–12 mL/100 m of row (2–4 mL/100 ft of row)	—	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.

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Table 3–185. 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.

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 Continued					
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL water/plant.	30	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.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	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.
	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/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 insecticides in the same season. See label for recropping restrictions. 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 on areas treated with product the previous season. Do not use subsequent foliar group 4D 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)	—	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)	methomyl	Lannate Toss-N-Go	270–540 g/ha (109–219 g/acre)	1	12-hr restricted entry interval.
organophosphate (group 1B)	dimethoate	Cygon 480	0.55–1 L/ha (0.22–0.4 L/acre)	7	12-hr restricted entry interval.
		Lagon 480 E	0.55–1 L/ha (0.22–0.4 L/acre)		
	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	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.
	imidacloprid	Admire 240	200 mL/ha (81 mL/acre)	7	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, soil or transplant application. See label for rotational crop restrictions. 24-hr restricted entry interval.

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Table 3–185. 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.

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 (group 4A)	thiamethoxam	Actara 25WG	105 g/ha (42 g/acre)	1	Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for recropping restrictions. 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. Do not apply foliar group 4D insecticides in the same season as a soil or irrigation application. See label for rotational crop restrictions. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	0	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	Most effective on young stages. Has slow activity; control may not be apparent for 2–3 weeks. See label for guidance on adjuvant use. See label for 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 guidance on adjuvant use. 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. See label for rotational crop restrictions. 12-hr restricted entry interval.
soap	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.
CUTWORMS					
Soil Applications					
organophosphate (group 1B)	acephate	Orthene 75%	900 g in 2,000 L water/ha (364 g in 810 L water/acre)		Transplant water treatment. 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. See label for restricted entry intervals.
	methomyl	Lannate Toss-N-Go	270–540 g/ha (109–219 g/acre)	1	12-hr restricted entry interval.
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	83 mL/ha (34 mL/acre)		
	permethrin	Ambush 500EC	140–200 mL/ha (57–81 mL/acre)	1	Re-entry permitted once spray deposit has dried.
		Perm-UP	180–260 mL/ha (73–105 mL/acre)	—	12-hr restricted entry interval.
		Pounce 384EC	180–260 mL/ha (73–105 mL/acre)		Re-entry permitted once spray deposit has dried.

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Table 3–185. 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.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CUTWORMS — Foliar Applications Continued					
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 soil or transplant application. 24-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 use on areas treated with product 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	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 tank-mix and crop tolerance information. See label for rotational crop restrictions. 12-hr restricted entry interval.

Table 3–186. 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.

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 75%	900 g in 2,000 L water/ha (364 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.
neonicotinoid (group 4A)	imidacloprid	Admire 240	7–12 mL/100 m of row (2.1–3.7 mL/100 ft of row)	—	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	7–10 mL/100 m of row (2.1–3.0 mL/100 ft of row)	—	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.
		Grappe ₂	7–10 mL/100 m of row (2.1–3.0 mL/100 ft of row)	—	

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Table 3–186. 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.

LEGEND: PHI = Pre-Harvest Interval (in days) — = not specified on label					
Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
Transplant or Soil Applications Continued					
neonicotinoid (group 4A)	thiamethoxam	Actara 240SC	375–625 mL/ha (152–253 mL/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 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 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	85 mL/ha (34 mL/acre)	3	No additional information.
		UP-Cyde 2.5 EC	140 mL/ha (57 mL/acre)	3	12-hr restricted entry interval.
	deltamethrin	Decis 5 EC	100–150 mL/ha (40–61 mL/acre)	3	Do not apply after August 1. See label for precautions on high organic content soils.
	lambda- cyhalothrin	Matador 120EC	83–125 mL/ha (34–51 mL/acre)	7	24-hr restricted entry interval.
		Silencer 120 EC	83–125 mL/ha (34–51 mL/acre)		
	permethrin	Ambush 500EC	140–200 mL/ha (57–81 mL/acre)	1	Re-entry permitted once spray deposit has dried.
		Perm-UP	180–260 mL/ha (73–105 mL/acre)	—	12-hr restricted entry interval.
		Pounce 384EC	180–260 mL/ha (73–105 mL/acre)	—	Re-entry permitted once spray deposit has dried.
neonicotinoid (group 4A)	acetamiprid	Assail 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, soil or transplant application. 12-hr restricted entry interval.
	imidacloprid	Admire 240	200 mL/ha (81 mL/acre)	7	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, soil or transplant application. See label for rotational crop restrictions. 24-hr restricted entry interval.
		Alias 240 SC	200 mL/ha (81 mL/acre)	7	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, soil or transplant application. See label for rotational crop restrictions. 24-hr restricted entry interval.
		Grapple ₂	200 mL/ha (81 mL/acre)		

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Table 3–186. 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.

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/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	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, soil or transplant application. See label for rotational crop restrictions. 12-hr restricted entry interval.
butenolides (group 4D)	flupyradifurone	Sivanto Prime	750–1,000 mL/ha (304–405 mL/acre)	1	Do not use on areas treated with product the previous season. Do not apply foliar group 4D insecticides in the same season as a soil or irrigation application. See label for rotational crop restrictions. 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)		
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Early application on larval stages provides best control. 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 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 tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.

Table 3–187. 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.

LEGEND: PHI = Pre-Harvest Interval (in days)					
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)	—	Early-season control. 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					
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 soil or transplant application. 24-hr restricted entry interval.

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Table 3–187. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
CABBAGE LOOPER — Foliar Applications Continued					
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.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	1.4–2.8 L/ha (0.6–1.1 L/acre)	0	Apply at first signs of infestation when larvae are small.
		Dipel 2X DF	275–550 g/ha (111–223 g/acre)		
diacylhydrazines (group 18)	methoxyfenozide	Intrepid	300–600 mL/ha (121–243 mL/acre)	1	Acts primarily through ingestion by larvae. 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	Early application on larval stages provides best control. 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 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. See label for tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.
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. See label for restricted entry intervals.
pyrethroid (group 3A)	permethrin	Ambush 500EC	140–200 mL/ha (57–81 mL/acre)	1	Re-entry permitted once spray deposit has dried.
		Perm-UP	180–260 mL/ha (73–105 mL/acre)	—	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 use on areas treated with product the previous season. Do not apply foliar group 28 insecticides in the same season as a soil or transplant application. 24-hr restricted entry interval.
neonicotinoid/ pyrethroid (group 4A/3A)	imidacloprid/ deltamethrin	Concept	650 mL/ha (263 mL/acre)	7	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.
<i>Bacillus thuringiensis</i> (group 11A)	<i>Bacillus thuringiensis</i>	Bioprotec CAF	0.65–1.1 L/ha (0.26–0.45 L/acre)	0	Apply at first signs of infestation when larvae are small.
		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 use on areas treated with product 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.

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Table 3–187. 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
HORNWORM, TOMATO OR TOBACCO CONTINUED					
diamide (group 28)	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. See label for tank-mix and crop tolerance information, and rotational crop restrictions. 12-hr restricted entry interval.

Table 3–188. 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.

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. See label for restricted entry intervals.
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL water/plant.	30	Suppression. Transplant water application. 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.
			3.4–4.4 g/100 m of row (1.0–1.3 g/100 ft of row)	30	Suppression. Transplant water application. 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.
			105–210 g/ha (42–85 g/acre)	1	Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for recropping restrictions. 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 Toss-N-Go	540 g/ha (219 g/acre)	1	Suppression. 12-hr restricted entry interval.
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	210 g/ha (85 g/acre)	1	Reduction in damage. Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for recropping restrictions. 12-hr restricted entry interval.

Table 3–189. Tomato Insect Control — Tarnished Plant Bug, Two-Spotted Spider Mite

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)

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	See label for restricted entry intervals.
organophosphate (group 1B)	dimethoate	Cygon 480	0.55–1 L/ha (0.22–0.4 L/acre)	7	12-hr restricted entry interval.
		Lagon 480 E	0.55–1 L/ha (0.22–0.4 L/acre)		
pyrethroid (group 3A)	lambda- cyhalothrin	Matador 120EC	83 mL/ha (34 mL/acre)	7	24-hr restricted entry interval.
		Silencer 120 EC	83 mL/ha (34 mL/acre)		
neonicotinoid (group 4A)	thiamethoxam	Actara 25WG	365–468 g/ha (148–189 g/acre) Apply in 100–200 mL water/plant.	30	Suppression. Transplant water application. 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.
			3.4–4.4 g/100 m of row 1.0–1.3 g/100 ft of row	30	Suppression. Transplant water application. 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.
			105–210 g/ha (42–85 g/acre)	1	Do not apply foliar group 4 insecticides in the same season as a seed treatment, soil or transplant application. See label for recropping restrictions. 12-hr restricted entry interval.
TWO-SPOTTED SPIDER MITE					
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. See label for rotational crop restrictions. 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)	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.
soap	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.

TURNIPS

In this section:

Table 3–190. Turnip Seed Treatments

Table 3–191. Activity of Fungicides and Insecticides on Turnip Diseases and Insects

Table 3–192. Turnip Disease Control

Table 3–193. Turnip Insect Control — Flea Beetles, Leaf-Eating Caterpillars, Cutworms

Table 3–194. Turnip Insect Control — Aphids, European Chafer Grubs, Cabbage Maggot, Swede Midge

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

Table 3–190. 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 (pythium)	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.
Thiram 75 WP	thiram	90 g/ 25 kg seed	seed decay and damping-off	Seed box and commercial seed treatment.

Table 3–191. Activity of Fungicides and Insecticides on Turnip Diseases and Insects

LEGEND: C = control 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	Alternaria	Powdery Mildew	Cercospora	Rhizoctonia	Botrytis Gray Mold	Flea Beetles	Leaf-Eating Caterpillars	Cutworms	Aphids	Cabbage Maggot	Swede Midge
FUNGICIDES													
metalaxyl-M and S-isomer	Apron XL LS	C	—	—	—	—	—	—	—	—	—	—	—
azoxystrobin	Dynasty 100FS	C	—	—	—	—	—	—	—	—	—	—	—
fludioxonil	Maxim 480FS	C	—	—	—	—	—	—	—	—	—	—	—
thiram	Thiram 75 WP	C	—	—	—	—	—	—	—	—	—	—	—
fluxapyroxad	Sercadis	—	S	C	—	—	—	—	—	—	—	—	—
penthiopyrad	Fontelis	—	—	—	—	—	C	—	—	—	—	—	—
cyprodinil/fludioxonil	Switch 62.5 WG	—	—	—	—	—	C	—	—	—	—	—	—
azoxystrobin	Quadris Flowable	—	—	—	—	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	—	—	—	—	—
	UP-Cyde 2.5 EC	—	—	—	—	—	—	C	—	—	—	—	—
permethrin	Pounce 384EC	—	—	—	—	—	—	C	—	—	—	—	—
	Perm-UP	—	—	—	—	—	—	C	—	—	—	—	—
	Ambush 500EC	—	—	—	—	—	—	C	—	—	—	—	—
imidacloprid	Admire 240 F	—	—	—	—	—	—	C	—	—	C	—	—
thiamethoxam	Actara 25WG	—	—	—	—	—	—	—	—	—	C	—	—
sulfoxaflor	Closer	—	—	—	—	—	—	—	—	—	C	—	—
flupyradifurone	Sivanto Prime	—	—	—	—	—	—	—	—	—	C	—	—
spinosad	Success	—	—	—	—	—	—	—	C	—	—	—	—
	Entrust	—	—	—	—	—	—	—	C	—	—	—	—
spinetoram	Delegate WG	—	—	—	—	—	—	—	C	—	—	—	—
cyantraniliprole	Verimark	—	—	—	—	—	—	C	—	—	—	C	—
	Exirel	—	—	—	—	—	—	C	C	C	—	—	—
chlorantraniliprole	Coragen	—	—	—	—	—	—	—	C	C	—	—	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 3–192. Turnip Disease Control

For resistance management, rotate between fungicides from different chemical groups.

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 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.
QoI (group 11)	pyraclostrobin	Cabrio EG	0.56–1.1 kg/ha (226–445 g/acre)	3	Alternaria and cercospora. Do not make sequential applications of any group 11 fungicides. See label for restricted entry intervals.
	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 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	1–1.75 L/ha (0.4–0.7 L/acre)	0	Do not make sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 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. See label for restricted entry intervals.
RHIZOCTONIA - SOIL APPLICATION					
QoI (group 11)	azoxystrobin	Quadris Flowable	4–6 mL/100 m of row (1.2–1.8 mL/100 ft of row)	40	Do not use on areas treated with product the previous season. Do not make sequential applications of any group 11 fungicides. See label for application details and rotational crop restrictions. 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 sequential applications of any group 7 fungicides. See label for rotational crop restrictions. 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	See label for rotational crop restrictions. 12-hr restricted entry interval.
WHITE MOLD					
microbial (group 44)	<i>Bacillus subtilis</i>	Serenade Opti	1.1–2.2 kg/ha (0.4–0.9 kg/acre)	0	Suppression. See label for application instructions.
ROOT ROTS (RHIZOCTONIA SOLANI, PYTHIUM SPP. AND FUSARIUM SPP.)					
microbial (group 44)	<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. See label for application instructions.

Table 3–193. 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.

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 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.
diamide (group 28)	cyantraniliprole	Verimark	6.75–9 mL/100 m of row or 750–1,000 mL/ha (304–405 mL/acre)	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. 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)	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
		UP-Cyde 2.5 EC	200 mL/ha (81 mL/acre)	21	12-hr restricted entry interval.
	permethrin	Pounce 384EC	180 mL/ha (73 mL/acre)	—	12-hr restricted entry interval.
		Perm-UP	180 mL/ha (73 mL/acre)		
		Ambush 500EC	140 mL/ha (57 mL/acre)	—	
diamide (group 28)	cyantraniliprole	Exirel	500–1,000 mL/ha (202–405 mL/acre)	7	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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.
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	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 (73 mL/acre)	3	
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not use on areas treated with product the previous season. 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.

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Table 3–193. 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.

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) CONTINUED					
diamide (group 28)	cyantraniliprole	Exirel	250–500 mL/ha (101–202 mL/acre)	7	Cabbage looper. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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					
diamide (group 28)	chlorantraniliprole	Coragen	250–375 mL/ha (101–152 mL/acre)	1	Variegated cutworm. Use low rate for black cutworm. Do not use on areas treated with product the previous season. 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. See label for tank-mix directions, crop tolerance information and rotational crop restrictions. 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 3–194. Turnip Insect Control — Aphids, European Chafer Grubs, Cabbage Maggot, 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.

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 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.
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 use on areas treated with product the previous season. Do not apply foliar group 4 insecticides in the same season as a soil application. See label for rotational crop restrictions. 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. See label for rotational crop restrictions. 24-hr restricted entry interval.

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Table 3–194. Turnip Insect Control — Aphids, European Chafer Grubs, Cabbage Maggot, 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.

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

Group Name (Group #)	Common Name	Trade Name	Rate	PHI	Notes
APHIDS — Foliar Applications Continued					
sulfoxaflor (group 4C)	sulfoxaflor	Closer	50–150 mL/ha (20–61 mL/acre)	7	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)	7	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	500–1,500 mL/ha (202–607 mL/acre)	7	See label for tank-mix directions, crop tolerance information and rotational crop restrictions. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. See label for rotational crop restrictions. 12-hr restricted entry interval.
flonicamid (group 29)	flonicamid	Beleaf 50SG	120–160 g/ha (49–65 g/acre)	3	See label for rotational crop restrictions. 12-hr restricted entry interval.
soap	potassium salts of fatty acids	Kopa Insecticidal Soap	8 L in 400 L of water Apply at 700–1900 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.
EUROPEAN CHAFER GRUBS					
neonicotinoid (group 4A)	imidacloprid	Admire 240 F	1,200 mL/ha (486 mL/acre)	21	Reduction in numbers of larvae only. Soil application, field drench. 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.
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 tank-mix restrictions. 4-day restricted entry interval.
diamide (group 28)	cyantraniliprole	Verimark	10–15 mL/100 m of row or 1,100–1,700 mL/ha (445–687 mL/acre)	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. See label for rotational crop restrictions. 12-hr restricted entry interval.
SWEDE MIDGE					
diamide (group 28)	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	1	Do not use on areas treated with product the previous season. Do not apply any subsequent applications of group 28 insecticides for a minimum of 60 days following a soil application. See label for rotational crop restrictions. 12-hr restricted entry interval.

4. Pesticides Used on Vegetable Crops in Ontario

In this section:

- Table 4-1.** Pesticides Used on Vegetable Crops in Ontario
Table 4-2. Pest Control Product Companies
Table 4-3. Restricted Entry Intervals (REI) for Pesticides Used on Vegetable Crops

**The information is provided as a guideline only.
 Consult each product label before use for most up-to-date information.**

Table 4-1. Pesticides Used on Vegetable Crops in Ontario

USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide m = miticide n = nematocide pgr = plant growth regulator r = rodenticide s = seed treatment							
Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
<i>abamectin</i>	See AGRI-MEK						
ACAPELA	picoxystrobin	30470	f	250 g/L	4	sweet corn	DUQ
<i>acephate</i>	See ORTHENE						
<i>acequinocyl</i>	See KANEMITE						
<i>acetamiprid</i>	See ASSAIL						
ACRAMITE 50WS	bifenazate	27925	m	50	4	eggplant, peppers, tomatoes	AVV/ PLG
ACROBAT 50 WP	dimethomorph	27700	f	50	3	brassica crops (see label), cucurbit crops (see label), garlic, lettuce (head and leaf), onions (dry bulb and green), leeks, shallots, peppers, potatoes, tomatoes	BAZ
ACTARA 240SC	thiamethoxam	28407	i	240 g/L	3	brassica crops (see label), celery, cucurbit crops (see label), eggplant, parsley, lettuce (head and leaf), endive, peppers, potatoes, spinach, tomatoes	SYZ

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Class 2: Restricted or commercial use only; very hazardous and/or persistent

Class 3: Restricted or commercial use only; moderately hazardous and/or moderately persistent

Class 4: Restricted or commercial use only; less or least hazardous and/or low persistence

⁴ See Table 4-2. Pest Control Product Companies, on page 291.

Table 4–1. Pesticides Used on Vegetable Crops in Ontario

USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide m = miticide n = nematocide pgr = plant growth regulator r = rodenticide s = seed treatment							
Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
ACTARA 25WG	thiamethoxam	28408	i	25	3	beets (table), carrots, celery, eggplant, parsley, horseradish, lettuce (head and leaf), endive, parsnips, peppers, potatoes, radishes, rutabagas, spinach, sweet potatoes, Swiss chard, tomatoes, turnips	SYZ
ACTINOVATE SP	<i>Streptomyces lydicus</i>	28672	f	1.0 x 10 ⁷ CFU/g	4	peppers, tomatoes	PLG
ADMIRE 240 F	imidacloprid	24094	i	240 g/L	4	beans, beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, herbs (see label), parsley, horseradish, lettuce (head and leaf), endive, parsnips, peas, peppers, potatoes, radishes, rutabagas, spinach, sweet potatoes, Swiss chard, tomatoes, turnips	BCZ
AGRI-MEK SC	abamectin	31607	i	19 g/L	3	celery, garlic, onions (see label), shallots, potatoes	SYZ
ALIAS 240 SC	imidacloprid	28475	i	240 g/L	4	brassica crops (see label), cucurbit crops (see label), eggplant, lettuce, potatoes, sweet potatoes, tomatoes	UAG
ALIETTE WDG	fosetyl-AL	24458	f	80	3	brassica crops (see label), lettuce, onions, rutabagas, spinach	BCZ
ALLEGIANCE FL	metalaxyl	26674	s	310 g/L	3	beans, peas, sugarbeets, sweet corn	BCZ
ALLEGRO 500F	fluzinam	27517	f	40	3	beans (snap), brassica crops (see label), carrots, potatoes	ISK
AMBUSH 500EC	permethrin	14882	i	500 g/L	4	asparagus, beans (snap), beets (table), brassica crops (see label), carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radishes, sugarbeets, sweet corn, tomatoes, turnips	ENG
ametoctradin/ dimethomorph	See ZAMPRO						
APRON MAXX RFC	fludioxonil/ metalaxyl-M and S-isomer	28817	s	3.46/ 2.31	3	beans, peas, sweet corn	SYZ

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USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide m = miticide n = nematocide pgr = plant growth regulator r = rodenticide s = seed treatment							
Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
APRON XL LS	metalaxyl-M and S-isomer	25585	s	33.3	3	beans, beets (table), brassica crops (see label), carrots, cucurbit crops (see label), eggplant, parsley, lettuce (head and leaf), endive, onions (dry and bunching), parsnips, peas, peppers, radishes, rutabagas, spinach, sugarbeets, sweet corn, tomatoes, turnips	SYZ
APROVIA	benxovindiflupyr	31981	f	100 g/L	2	cucurbit crops (see label), eggplant, peppers, potatoes, tomatoes	SYZ
ASSAIL 70 WP	acetamiprid	27128	i	70	4	asparagus, brassica crops (see label), celery, herbs (see label), lettuce (head and leaf), endive, peas, peppers, potatoes, rhubarb, rutabagas, spinach, sweet corn, Swiss chard, tomatoes	ENG
azoxystrobin	See DYNASTY, QUADRIS FLOWABLE						
azoxystrobin/ difenoconazole	See QUADRIS TOP						
azoxystrobin/ difenoconazole/ fludioxonil	See STADIUM						
azoxystrobin/ propiconazole	See QUILT						
Bacillus amyloliquefaciens	See DOUBLE NICKEL 55						
Bacillus subtilis	See CEASE, SERENADE						
Bacillus thuringiensis	See BIOPROTEC, DIPEL, THURICIDE						
BASAMID GRANULAR	dazomet	15032	h, f, n	97	3	pre-plant preparation for eggplant, lettuce, peppers, tomatoes	ENG
Beauveria bassiana	See BOTANIGARD						
BELEAF 50SG	flonicamid	29796	i	50	4	beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, herbs (see label), horseradish, lettuce (head and leaf), endive, parsnips, peppers, potatoes, radishes, rhubarb, rutabagas, Swiss chard, sweet potatoes, tomatoes, turnips	UAG
benxovindiflupyr	See APROVIA						
bifenazate	See ACRAMITE						

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USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide m = miticide n = nematocide pgr = plant growth regulator r = rodenticide s = seed treatment							
Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
BIOPROTEC 3P	<i>Bacillus thuringiensis</i>	27750	i	21.7	4	peppers (transplants), sweet corn, tomatoes (transplants)	AFG
BIOPROTEC CAF	<i>Bacillus thuringiensis</i>	26854	i	12.7 x 109 CLU/mg	3	beans (snap), brassica crops (see label), celery, garlic, herbs (see label), lettuce, onions (see label), peppers, potatoes, spinach, sweet corn, tomatoes	PLG/ AFG
BIO-SAVE 10 LP	<i>Pseudomonas syringae</i>	29673	f	29.8	4	sweet potatoes	AUG
BLAD polypeptide	See FRACTURE						
boscalid	See CANTUS, LANCE						
boscalid/ pyraclostrobin	See PRISTINE						
BOTANIGARD 22WP	<i>Beauveria bassiana</i>	29321	i	4.4 x 10 ¹³ conidia/kg	3	eggplant, peppers, tomatoes	BWI
BOTANIGARD ES	<i>Beauveria bassiana</i>	29320	i	2.2 x 10 ¹³ conidia/kg	3	herbs (greenhouse transplants)	BWI
BRAVO ZN	chlorothalonil	28900	f	500 g/L	3	asparagus, brassica crops (see label), carrots, celery, cucurbit crops (see label), onions (dry bulb and green), parsnips, potatoes, sweet corn, tomatoes	SYZ
BUMPER 432 EC	propiconazole	28017	f	432 g/L	3	asparagus, rutabagas, sweet corn	AMA
BUSAN 1020	metam sodium	19421	h, f, n	33	4	pre-plant preparation	BUL
BUSAN 1180	metam potassium	25124	h, f, n	54	3	pre-plant preparation	BUL
BUSAN 1236	metam sodium	25103	h, f, n	42	4	pre-plant preparation	BUL
CABRIO EG	pyraclostrobin	27323	f	20	4	beets (table), carrots, cucurbit crops (see label), eggplant, garlic, horseradish, onions, leeks, shallots, peppers, radishes, rutabagas, tomatoes, turnips	BAZ
CABRIO PLUS	pyraclostrobin/ metiram	30395	f	5/ 55	3	potatoes	BAZ

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Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
CANTUS WDG	boscalid	30141	f	70	2	carrots, cucurbit crops (see label), eggplant, lettuce (head and leaf), onions (dry and green), leeks, shallots, peppers, potatoes, tomatoes	BAZ
<i>captan</i>	See MAESTRO, SUPRA CAPTAN						
CARAMBA	metconazole	29767	f	90 g/L	3	sugarbeets	BAZ
<i>carbaryl</i>	See SEVIN XLR						
<i>carbathiin/thiram</i>	See PRO-GRO, VITAFLO						
CEASE BIOLOGICAL	<i>Bacillus subtilis</i>	30522	f	1 x 10 ⁹ CFU/g	3	green house transplants of brassica crops, celery, eggplant, herbs, lettuce, endive, peppers, tomatoes	BWI
<i>chlorantraniliprole</i>	See CORAGEN						
<i>chloropicrin</i>	See CHLOROPICRIN 100, PIC PLUS						
CHLOROPICRIN 100	chloropicrin	25863	f, n	99	2	root and tuber vegetables in crop group 1, peppers, potatoes, tomatoes	DAS
<i>chlorothalonil</i>	See BRAVO, ECHO						
<i>chlorpyrifos</i>	See LORSBAN, NUFOS, PYRIFOS, PYRINEX, WARHAWK						
CITATION 75WP	cyromazine	24465	i	75	3	brassica leafy greens (see label), celery, parsley, lettuce (head and leaf), endive, spinach, Swiss chard	SYZ
<i>citric/lactic acid</i>	See TIVANO						
<i>clothianidin</i>	See CLUTCH, PONCHO, TITAN						
CLOSER	sulfoxaflor	30826	i	240 g/L	3	beets (table), brassica crops (see label), carrots, celery, herbs (see label), horseradish, lettuce and endive, parsnips, potatoes, radishes, rhubarb, rutabagas, spinach, sweet potatoes, Swiss chard, turnips	DWE
CLUTCH 50 WDG	clothianidin	29382	i	50	2	cucurbit crops (see label), potatoes, sweet potatoes	VAL
CONCEPT	imidacloprid/ deltamethrin	29611	i	75 g/L/ 10 g/L	3	brassica crops (see label), tomatoes	BCZ
CONFINE EXTRA	mono- and di-potassium salts of phosphorous acid	30648	f	53	4	brassica crops (see label), eggplant, basil, lettuce, endive, radicchio, peppers, potatoes, tomatoes	ACC/ WIN
<i>Coniothyrium minitans</i>	See CONTANS						

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Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
CONTANS WG	<i>Coniothyrium minitans</i>	29066	f	5	4	beans (snap), cabbage, carrots, celery, lettuce, tomatoes	BCZ
COPPER 53W	copper sulphate	9934	f	53.4	3	beans, beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, peppers, potatoes, spinach, tomatoes	LVP
<i>copper hydroxide</i>	See <i>COPPERCIDE, KOCIDE, PARASOL</i>						
<i>copper octanoate</i>	See <i>CUEVA</i>						
<i>copper oxychloride</i>	See <i>COPPER SPRAY</i>						
COPPER SPRAY	copper oxychloride	19146	f	50	4	celery, cucurbit crops (see label), onions, potatoes, tomatoes	LVP
<i>copper sulphate</i>	See <i>COPPER 53W</i>						
COPPERCIDE WP	copper hydroxide	16047	f	50	3	beans, cucumbers, peppers (field and transplants), potatoes, sugarbeets, tomatoes (field and transplants)	LVP
CORAGEN	chlorantraniliprole	28982	i	200 g/L	2	beans, beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, herbs (see label), horseradish, lettuce and endive, onions (see label), parsnips, peas, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, sweet corn, sweet potatoes, Swiss chard, sugarbeets, tomatoes, turnips	DUQ
CRUISER 5FS	thiamethoxam	27045	s	47.6	3	beans, peas, sugarbeets, sweet corn	SYZ
CRUISER MAXX POTATO EXTREME	thiamethoxam + difenoconazole/ fludioxonil	31024	s	250 g/L 123 g/L 62.5 g/L	2	potatoes	SYZ
CUEVA	copper octanoate	31825	b, f	1.8	4	beans, beets (table), brassica crops (see label), celery, cucurbit crops (see label), garlic, herbs (see label), onions (see label), peas, peppers, potatoes, sugarbeets, tomatoes	NEF
CURZATE 60 DF	cymoxanil	26284	f	60	3	potatoes	DUQ
<i>cyantraniliprole</i>	See <i>EXIREL, FORTENZA, VERIMARK</i>						
<i>cyazofamid</i>	See <i>RANMAN, TORRENT</i>						
<i>cyflumetofen</i>	See <i>NEALTA</i>						

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Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
CYGON 480	dimethoate	8277	i	480 g/L	3	asparagus, beans, beets (table), brassica crops (see label), eggplant, lettuce (leaf), peas, peppers, potatoes, Swiss chard, tomatoes	BAT
<i>cymoxanil</i>	See <i>CURZATE</i>						
<i>cypermethrin</i>	See <i>MAKO, UP-CYDE</i>						
<i>cyprodinil/fludioxonil</i>	See <i>SWITCH</i>						
<i>cyromazine</i>	See <i>CITATION, GOVERNOR</i>						
<i>dazomet</i>	See <i>BASAMID</i>						
DECIS 5 EC	deltamethrin	22478	i	50 g/L	3	asparagus, brassica crops (see label), onions, peppers, potatoes, sweet corn, tomatoes	BCZ
DECREE 50 WDG	fenhexamid	26132	f	50	3	tomatoes (transplants)	AVV
DELEGATE	spinetoram	28778	i	25	3	asparagus, beans (snap), brassica crops (see label), celery, garlic, herbs (see label), horseradish, lettuce and endive, onions (see label), potatoes, radishes, rhubarb, rutabagas, spinach, sweet corn, Swiss chard, tomatoes, turnips	DWE
<i>deltamethrin</i>	See <i>DECIS</i>						
<i>diazinon</i>	See <i>DIAZINON</i>						
DIAZINON 50WSP	diazinon	29976	i	50	3	carrots, onions, parsnips	LVP
DIAZINON 500 E	diazinon	11889	i	500 g/L	3	onions (bulb and green), parsnips	LVP
DIBROM	naled	7442	i	900 g/L	3	beans (lima), brassica crops (see label), lettuce, onions (bulb), peas, potatoes, sugarbeets, tomatoes	LVP
<i>difenoconazole/metalaxyl-M and S-isomer</i>	See <i>DIVIDEND</i>						
<i>dimethoate</i>	See <i>CYGON, LAGON</i>						
<i>dimethomorph</i>	See <i>ACROBAT, FORUM</i>						
DIPEL 2X DF	<i>Bacillus thuringiensis</i>	26508	i	57	4	brassica crops (see label), herbs (see label), parsley, lettuce, Asian radish, spinach, sweet corn, tomatoes	VAL
DITHANE RAINSHIELD	mancozeb	20553	f	75	4	carrots, celery, cucurbit crops (see label), onions (dry bulb), potatoes, tomatoes	DWE
DITHANE F-45	mancozeb	20552	f	37	4	seed potatoes (post-harvest)	DWE

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DIVIDEND XL RTA	difenoconazole/ metalaxyl-M and S-isomer	25777	s	3.37/ 0.27	3	sweet corn	SYZ
DOUBLE NICKEL 55	<i>Bacillus amyloliquefaciens</i>	31888	f, b	5 x 1010 spores/g	3	cucurbit crops (see label), eggplant, lettuce, peppers, potatoes, tomatoes,	CIT
DYNASTY 100FS	azoxystrobin	28394	s	100 g/L	3	brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, parsley, lettuce (head and leaf), endive, onions (dry bulb and green), leeks, shallots, parsnips, peppers, radishes, rutabagas, spinach, sweet corn, Swiss chard, sugarbeets, tomatoes, turnips	SYZ
ECHO 720	chlorothalonil	29355	f	720 g/L	4	onions (dry bulb and green), parsnips	UAG
ECHO 90DF	chlorothalonil	29356	f	90	4	brassica crops (see label), carrots, celery, cucurbit crops (see label), potatoes, sweet corn, tomatoes	UAG
EMESTO SILVER	penflufen/ prothioconazole	30361	f	100 g/L/ 18 g/L	4	potatoes	BCZ
ENFUSE M 510	sodium methylthiocarbamate	29142	h, f, n	41.98	4	pre-plant preparation	ENG/ TAO
ENTRUST	spinosad	30382	i	240 g/L	4	asparagus, beans (snap), brassica crops (see label), celery, eggplant, garlic, herbs (see label), horseradish, lettuce and endive, onions (see label), peppers, potatoes, radishes, rhubarb, rutabagas, spinach, sweet corn, Swiss chard, tomatoes, turnips	DWE
EXIREL	cyantraniliprole	30895	i	100 g/L	3	beans, beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, garlic, herbs (see label), horseradish, lettuce and endive, onions (see label), parsnips, peas, peppers, potatoes, radish, rhubarb, rutabaga, spinach, sweet potatoes, Swiss chard, tomatoes, turnips	DUQ
FALGRO TABLET	gibberellic acid	27653	pgr	1 g/tablet	4	potatoes	NRA
famoxadone/ cymoxanil	See <i>TANOS</i>						
fenamidone	See <i>REASON</i>						

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USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide m = miticide n = nematocide pgr = plant growth regulator r = rodenticide s = seed treatment							
Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
<i>fenhexamid</i>	See <i>DECREE</i>						
<i>ferbam</i>	See <i>FERBAM</i>						
FERBAM 76 WDG	ferbam	20136	f	76	4	lettuce (transplants)	LVP
<i>ferric phosphate</i>	See <i>SLUGGO</i>						
FLINT	trifloxystrobin	30619	f	50	4	asparagus, carrots, celery, horseradish, parsnips, radishes, rutabagas, sugarbeets, turnips	BCZ
<i>flonicamid</i>	See <i>BELEAF</i>						
<i>fluazinam</i>	See <i>ALLEGRO</i>						
<i>fludioxonil</i>	See <i>MAXIM, SCHOLAR</i>						
<i>fludioxonil/difenoconazole</i>	See <i>MAXIM D</i>						
<i>fludioxonil/mancozeb</i>	See <i>MAXIM MZ PSP</i>						
<i>fludioxonil/metalaxyl-M and S-isomer</i>	See <i>APRON MAXX RFC, MAXIM XL</i>						
<i>fluopicolide</i>	See <i>PRESIDIO</i>						
<i>fluopyram</i>	See <i>VELUM PRIME</i>						
<i>fluopyram/pyrimethanil</i>	See <i>LUNA</i>						
<i>flupyradifurone</i>	See <i>SIVANTO PRIME</i>						
<i>fluxapyroxad</i>	See <i>SERCADIS</i>						
FOLICUR 432 F	tebuconazole	25940	f	432 g/L	3	asparagus	BCZ
FOLPAN 80 WDG	folpet	27733	f	80	4	cucurbit crops (see label), tomatoes	AMA
<i>folpet</i>	See <i>FOLPAN</i>						
FONTELIS	penthiopyrad	30331	f	200 g/L	4	beans, brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, garlic, herbs (see label), horseradish, lettuce (head and leaf), endive, onions (see label), parsnips, peas, peppers, radishes, rutabagas, spinach, Swiss chard, tomatoes, turnips	DUQ
FORCE 3.0G	tefluthrin	23917	i	3	3	sweet corn	SYZ
FORTENZA	cyantraniliprole	30899	s	600 g/L	3	sweet corn	SYZ

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Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
FORUM	dimethomorph	32026	f	500 g/L	3	brassica crops (see label), cucurbit crops (see label), garlic, lettuce (head and leaf), onions (see label), peppers, potatoes, tomatoes	BAZ
<i>fosetyl-AL</i>	See ALIETTE						
FRACTURE	BLAD polypeptide	32139	f	20	4	tomatoes	FMC
FULFILL 50WG	pymetrozine	27274	i	50	3	celery, herbs (see label), lettuce and endive, potatoes, rhubarb, spinach, Swiss chard	SYZ
GAUCHO 480 FL	imidacloprid	26124	s	480 g/L	4	beans, sweet corn	BCZ
GAVEL 75DF	zoxamide/ mancozeb	26842	f	8.3/ 66.7	4	onions (bulb), potatoes	GOW
<i>gibberillic acid</i>	See FALGRO						
<i>Gliocladium catenulatum</i>	See PRESTOP						
GOVERNOR 75WP	cyromazine	24464	s	75	2	imported onion seed (dry bulb and green)	SYZ
GRANUFLO-T	thiram	30548	f	75	3	sweet potatoes	ENG
GRAPPLE ₂	imidacloprid	29048	i	240 g/L	3	cucurbit crops (see label), eggplant, lettuce (head and leaf), potatoes, sweet potatoes, tomatoes	FMC
HEADLINE EC	pyraclostrobin	27322	f	250 g/L	3	beans, peas, potatoes, sugarbeets, sweet corn	BAZ
<i>hydrogen peroxide</i>	See STOROX						
<i>imidacloprid</i>	See ADMIRE, ALIAS, GAUCHO, GRAPPLE ₂						
<i>imidacloprid/ deltamethrin</i>	See CONCEPT						
IMIDAN 70-WP	phosmet	29064	i	70	3	carrots, celery, potatoes	GOW
INTREPID	methoxyfenozide	27786	i	240 g/L	3	beans, brassica crops (see label), celery, herbs (see label), lettuce and endive, peppers, rhubarb, spinach, sweet corn, Swiss chard, tomatoes	DWE
<i>iprodione</i>	See ROVRAL						
<i>isofetamid</i>	See KENJA						
KANEMITE 15 SC	acequinocyl	28641	m	15.8	3	eggplant	AVV
<i>kaolin</i>	See SURROUND						
<i>kasugamycin</i>	See KASUMIN						
KASUMIN 2L	kasugamycin	30591	b	2	3	peppers, tomatoes	AVV

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Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
KENJA 400SC	isofetamid	31758	f	400 g/L	3	lettuce	ISK
KOCIDE 2000	copper hydroxide	27348	f, s	53.8	3	beans, peppers (field and transplants), potatoes, tomatoes (field and transplants)	DUQ
KOPA INSECTICIDAL SOAP	potassium salts of fatty acids	31433	i	47	4	asparagus, beans, brassica crops (see label), beets (table), celery, cucurbit crops (see label), eggplant, herbs (see label), lettuce, peas, peppers, potatoes, radish, spinach, sweet corn, tomatoes, turnips	NEF
LAGON 480 E	dimethoate	9382	i	480 g/L	3	asparagus, beans (snap), beets (table), brassica crops (see label), celery, eggplant, lettuce (leaf), peas, peppers, potatoes, Swiss chard, tomatoes	LVP
<i>lambda-cyhalothrin</i>	See MATADOR, SILENCER						
<i>lambda-cyhalothrin/chlorantraniliprole</i>	See VOLIAM XPRESS						
LANCE WDG	boscalid	27495	f	70	2	beans, peas	BAZ
LANNATE TOSS-N-GO (TNG)	methomyl	10868	i	90	2	beans (snap), brassica crops (see label), lettuce, peas, sweet corn, tomatoes	DUQ
LORSBAN 15G	chlorpyrifos	16458	i	15	4	brassica crops (see label), onions (bulb and pickling), shallots, rutabagas	DWE
LORSBAN 4E	chlorpyrifos	14879	i	480 g/L	3	brassica crops (see label), carrots, celery, cucumber, garlic, onions (bulb and pickling), onions (green), pepper (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn	DWE
LORSBAN 50W	chlorpyrifos	20944	i	50	3	cabbage	DWE
LORSBAN NT	chlorpyrifos	29650	i	452 g/L	3	brassica crops (see label), carrots, celery, cucumber, garlic, onions (bulb and pickling), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn	DWE
LUNA TRANQUILITY	fluopyram/ pyrimethanil	30510	f	125 g/L/ 375 g/L	2	garlic, herbs (see label), onions (see label), potatoes, tomatoes	BCZ
MAESTRO 80DF	captan	26408	f	80	3	cucumber, tomatoes, vegetable transplants in greenhouse (crucifers, celery, eggplant, peppers, tomatoes)	AVV

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Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
MAKO	cypermethrin	30316	i	407 g/L	4	asparagus, brassica crops (see label), carrots, celery, lettuce, onions, potatoes, rutabagas, sweet corn, tomatoes, turnips	ENG
<i>malathion</i>	See MALATHION						
MALATHION 85E	malathion	8372	i	85	3	asparagus, beans, brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, garlic, parsley, lettuce (head and leaf), parsnips, peas, peppers, radishes, rutabagas, spinach, sugarbeets, Swiss chard, tomatoes, turnips	LVP
<i>mancozeb</i>	See DITHANE, MANZATE PRO-STICK, PENNCOZEB, PSPT, SOLAN, TUBERSEAL						
<i>mandipropamid</i>	See ORONDIA ULTRA A, REVUS						
MANZATE PRO-STICK	mancozeb	28217	f	75	3	carrots, celery, cucurbit crops (see label), onions (dry bulb), potatoes, sugarbeets, tomatoes	UPI
MATADOR 120EC	lambda-cyhalothrin	24984	i	120 g/L	2	asparagus, beans, brassica crops (see label), carrots, celery, cucurbit crops (see label), garlic, lettuce (head and leaf), onions (dry bulb and green), leeks, shallots, peas, potatoes, sweet corn, sweet potatoes, tomatoes	SYZ
MAXIM 480FS	fludioxonil	27001	s	40	3	beets (table), brassica crops (see label), cucurbit crops (see label), eggplant, herbs, peppers, sugarbeets, sweet corn, tomatoes	SYZ
MAXIM D	fludioxonil/ difenoconazole	30599	s	19.4 g/L/ 19.4 g/L	3	potato seed piece	SYZ
Maxim Liquid PSP	fludioxonil	29110	s	40.3	3	potato seed piece	SYZ
MAXIM MZ PSP	fludioxonil/ mancozeb	27965	s	0.5/ 5.7	3	potato seed piece	SYZ
MAXIM PSP	fludioxonil	26647	s	0.5	3	potato seed piece	SYZ
MAXIM XL	fludioxonil/ metalaxyl-M and S-isomer	27071	s	21/ 8.4	3	sweet corn	SYZ
<i>metalaxyl</i>	See ALLEGIANCE						
<i>metalaxyl-M and S-isomer</i>	See APRON XL LS, RIDOMIL GOLD						

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<i>metalaxyl-M and S-isomer/ chlorothalonil</i>	See RIDOMIL GOLD SL/BRAVO						
<i>metalaxyl-M and S-isomer/ mancozeb</i>	See RIDOMIL GOLD MZ						
<i>metam potassium</i>	See BUSAN 1180						
<i>metam sodium</i>	See BUSAN 1020, BUSAN 1236, VAPAM						
<i>metconazole</i>	See CARAMBA, QUASH						
<i>methomyl</i>	See LANNATE						
<i>methoxyfenozide</i>	See INTREPID						
<i>metiram</i>	See POLYRAM						
<i>metrafenone</i>	VIVANDO						
METTLE 125 ME	tetraconazole	30673	f	125 g/L	2	sugarbeets	ISG
MICROSCOPIC SULPHUR	sulphur	14653	f	92	4	rutabagas	LVP
MICROTHIOL DISPERS	sulfur	29487	f	80	4	peas, sugarbeets	UPI/ UAG
MILSTOP	potassium bicarbonate	28095	f	85	4	cucurbit crops (see label), herbs, peppers	BWI
MINECTO DUO	thiamethoxam/ cyantraniliprole	30900	i	20/20	2	brassica crops (see label), celery, cucurbit crops (see label), eggplant, herbs (see label), lettuce and endive, peppers, potato, rhubarb, spinach, tomatoes, swiss chard	SYZ
<i>mineral oil</i>	See PURESpray GREEN, SUPERIOR 70 OIL						
<i>mono- and di-potassium salts of phosphorous acid</i>	See CONFINE, RAMPART						
<i>mono- and dibasic sodium, potassium and ammonium phosphites</i>	See PHOSTROL						
MOVENTO 240 SC	spirotetramat	28953	i	240 g/L	4	brassica crops (see label), celery, cucurbit crops (see label), eggplant, garlic, herbs (see label), lettuce and endive, onions (see label), peppers, potatoes, rhubarb, spinach, sweet corn, sweet potatoes, Swiss chard, tomatoes	BCZ

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<i>myclobutanil</i>	See NOVA						
MYCOSTOP	Streptomyces	26265	f	108 cfu/g	4	brassica crops (see label), cucurbit crops (see label), eggplant, herbs (see label), onions (see label), peppers, tomatoes	PLG
<i>naled</i>	See DIBROM						
NEALTA	cyflumetofen	31284	m	200 g/L	3	tomatoes	BAZ
NOVA	myclobutanil	22399	f	40	3	asparagus, cucurbit crops (see label)	DWE
<i>novaluron</i>	See RIMON						
NUFOS 4E	chlorpyrifos	25831	i	480 g/L	3	brassica crops (see label), carrots, celery, cucumber, garlic, onions (bulb), peppers (green), potatoes, radishes, rutabagas, sweet corn	FMC
OBERON FLOWABLE	spiromesifen	28905	i, m	240 g/L	3	cucurbit crops (see label), eggplant, peppers, sweet potatoes, tomatoes	BCZ
OPAL INSECTICIDAL SOAP	potassium salts of fatty acids	28146	i	47	4	herbs	OMD
ORONDIS ULTRA A	mandipropamid	32145	f	250 g/L	3	brassica crops (see label), cucurbit crops (see label), eggplant, garlic, lettuce (head and leaf), onions (see label), peppers, potatoes, spinach, tomatoes	SYZ
ONONDIS ULTRA B	oxathiapiprolin	32146	f	100 g/L	3	brassica crops (see label), cucurbit crops (see label), eggplant, garlic, lettuce (head and leaf), onions (see label), peppers, potatoes, spinach, tomatoes	SYZ
ORTHENE 75%	acephate	14225	i	75	3	brassica crops (see label), celery, lettuce (head), peppers (sweet bell), potatoes, sweet corn, tomatoes	AVV
<i>oxamyl</i>	See VYDATE						
<i>oxathiapiprolin</i>	See ORONDIS ULTRA B						
PARASOL FLOWABLE	copper hydroxide	25901	f	24.4	4	potatoes	NUA
PARASOL WG	copper hydroxide	29063	f	50	3	beans, cucumbers, peppers, sugarbeets, tomatoes	NUA
<i>penflufen/ prothioconazole</i>	See EMESTO						
PENNCOZEB 75DF RAINCOAT	mancozeb	30241	f	75	3	carrots, celery, cucurbit crops (see label), onions (dry bulb), potatoes, tomatoes	UPI

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<i>penthiopyrad</i>	See <i>FONTELIS, VERTISAN</i>						
<i>permethrin</i>	See <i>AMBUSH, PERM-UP, POUNCE</i>						
PERM-UP	permethrin	28877	i	384 g/L	3	asparagus, beans (snap), beets (table), brassica crops (see label), carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radish, sugarbeets, sweet corn, tomatoes, turnips	UPI
<i>phorate</i>	See <i>THIMET</i>						
<i>phosmet</i>	See <i>IMIDAN</i>						
PHOSTROL	mono- and dibasic sodium, potassium and ammonium phosphites	30449	f	53.6	4	brassica crops (see label), cucurbit crops (see label), herbs (see label), lettuce (head and leaf), endive, garlic, radicchio, potatoes, tomatoes	ENG
PIC PLUS	chloropicrin	28715	f, n	85.1	2	root and tuber vegetables in crop group 1, peppers, potatoes, tomatoes	DAS
<i>picoxystrobin</i>	See <i>ACAPELA</i>						
POLYRAM DF	metiram	20087	f	80	4	asparagus, carrots, celery, potatoes, sugarbeets, tomatoes	BAZ
PONCHO 600 FS	clothianidin	27453	s	600 g/L	2	sweet corn	BCZ
<i>potassium bicarbonate</i>	See <i>MILSTOP</i>						
<i>potassium salts of fatty acids</i>	See <i>KOPA INSECTICIDAL SOAP, OPAL INSECTICIDAL SOAP</i>						
<i>potassium salts of fatty acids/pyrethrins</i>	See <i>SAFER'S TROUNCE</i>						
POUNCE 384EC	permethrin	16688	i	384 g/L	4	asparagus, beans (snap), beets (table), brassica crops (see label), carrots, horseradish, lettuce, onions, peas, peppers, potatoes, radish, sugarbeets, sweet corn, tomatoes, turnips	UAG/ FMC
PRESIDIO	fluopicolide	30051	f	39.5	2	brassica crops (see label), cucurbit crops (see label), lettuce (head and leaf), potatoes, rutabagas, spinach, tomatoes	VAL
PRESTOP	<i>Gliocladium catenulatum</i>	28820	f	2 x 10 ⁸ CFU/g	3	greenhouse transplants of: brassica crops, cucumbers, herb (see label), lettuce, peppers, tomatoes,	PLG

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PRISTINE WG	boscalid/ pyraclostrobin	27985	f	25.2/ 12.8	2	brassica crops (see label), carrots, celery, cucurbit crops (see label), garlic, herbs (see label), onions (see label), spinach	BAZ
PRO-GRO	carbathiin/ thiram	10959	s	30/ 50	4	onions	MCD
PROLINE 480 SC	prothioconazole	28359	f	480 g/L	3	cucurbit crops (see label), sweet corn, sugarbeets	BCZ
<i>propiconazole</i>	See <i>BUMPER</i> , <i>TILT</i>						
<i>prothioconazole</i>	See <i>PROLINE</i>						
<i>prothioconazole/trifloxystrobin</i>	See <i>STRATEGO PRO</i>						
PureSpray Green Spray Oil 13 E	mineral oil	27666	f, i	99	4	cucurbit crops (see label), eggplant, peppers, rutabagas, tomatoes	ITL
PSPT 16%	mancozeb	24734.01	s	16	4	potatoes	LVP
<i>Pseudomonas syringae</i>	See <i>BIO-SAVE</i>						
<i>pymetrozine</i>	See <i>FULFILL</i>						
<i>pyraclostrobin</i>	See <i>CABRIO EG</i> , <i>HEADLINE</i>						
<i>pyraclostrobin/metiram</i>	See <i>CABRIO PLUS</i>						
PYRIFOS 15G	chlorpyrifos	24648	i	15	4	brassica crops (see label), onions (dry bulb and pickling), rutabagas, sweet corn	LVP
<i>pyrimethanil</i>	See <i>SCALA</i>						
PYRINEX 480 EC	chlorpyrifos	23705	i	480 g/L	3	brassica crops (see label), carrots, celery, cucumbers, garlic, onions (dry bulb and pickling), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn	UAG/ AMA
QUADRIS FLOWABLE	azoxystrobin	26153	f	250 g/L	3	asparagus, beets (table), cabbage, carrots, celery, herbs (see label), horseradish, peas, potatoes, radishes, rutabagas, spinach, sugarbeets, sweet corn, tomatoes, turnips	SYZ
QUADRIS TOP	azoxystrobin/ difenoconazole	30518	f	200 g/L/ 125 g/L	3	brassica crops (see label), carrots, cucurbit crops (see label), eggplant, garlic, herbs (see label), onions (see label), peppers, potatoes, sugarbeets, sweet potatoes, tomatoes	SYZ

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USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide m = miticide n = nematocide pgr = plant growth regulator r = rodenticide s = seed treatment							
Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
QUASH FUNGICIDE	metconazole	30402	f	50	3	potatoes	VAL
QUILT	azoxystrobin/ propiconazole	28328	f	75 g/L/ 125 g/L	3	mint, peas, sweet corn	SYZ
<i>quinoxifen</i>	See <i>QUINTEC</i>						
QUINTEC	quinoxifen	29755	f	250 g/L	3	cucurbit crops (see label), lettuce (head and leaf)	DWE
RAMPART	mono- and dipotassium salts of phosphorous acid	30654	f	53	4	potatoes	LVP
RANMAN 400SC	cyazofamid	30716	f	34.5	4	potatoes	ISK
REASON 500SC	fenamidone	27462	f	500 g/L	3	beans, brassica crops (see label), carrots, onions (dry bulb and green), leeks, shallots, potatoes, spinach, tomatoes	BCZ
REGALIA MAXX	extract of <i>Reynoutria sachalinensis</i>	30199	f	20	3	cucurbit crops (see label), tomatoes	MQO
REVUS	mandipropamid	29074	f	250 g/L	3	beans, brassica crops (see label), cucurbit crops (see label), eggplant, garlic, herbs (see label) lettuce (head and leaf), onions (see label), pepper (transplants), potatoes, spinach, tomatoes	SYZ
<i>Reynoutria sachalinensis</i> , extract of	See <i>REGALIA</i>						
RIDOMIL GOLD 1G	metalaxyl-M and S-isomer	26612	f	1	3	carrots, lettuce (head)	SYZ
RIDOMIL GOLD 480SL	metalaxyl-M and S-isomer	28474	f	480 g/L	3	beans (snap), cucumbers, potatoes, radish, spinach	SYZ
RIDOMIL GOLD MZ 68WG	metalaxyl-M and S-isomer/mancozeb	28893	f	4/ 64	3	lettuce (head), onions, potatoes	SYZ
RIDOMIL GOLD/ BRAVO twin pak	metalaxyl-M and S-isomer/ chlorothalonil	29239	f	480 g/L/ 500 g/L	3	potatoes	SYZ
RIMON 10 EC	novaluron	28515	i	10	2	beans (snap), brassica crops (see label), peppers, potatoes	AMA
ROOTSHIELD HC	<i>Trichoderma harzianum</i>	27115	f, s	1.0 x 10 ⁷ CFU/g	4	beans, brassica crops (see label), celery, cucurbit crops (see label), eggplant, herbs (see label), lettuce and endive, onions (see label), peas, peppers, swiss chard, tomatoes	BWI

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Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
ROVRAL	iprodione	15213	f, s	500 g/kg	3	beans (snap), brassica crops (see label), carrots (imported seed), garlic, lettuce, onions (dry bulb), leeks	FMC
SAFER'S TROUNCE	potassium salts of fatty acids/ pyrethrins	24363	i	20/ 0.2	4	herbs	SFR
SCALA SC	pyrimethanil	28011	f	400 g/L	3	garlic, chives, onions (bulb and green), leeks, shallots, potatoes, tomatoes	BCZ
SCHOLAR 230SC	fludioxonil	29528	f	230 g/L	4	carrots, sweet potatoes	SYZ
sedaxane	See VIBRANCE						
SENATOR 50SC	thiophanate-methyl	32096	f	500 g/L	4	sugarbeets	NPS
SENATOR PSPT	thiophanate-methyl	26236	s	10	4	potato seed piece	NPS
SERENADE OPTI	<i>Bacillus subtilis</i>	31666	f	1.31 x 10 ¹⁰ CFU/g	3	beans, brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, garlic, herbs (see label), lettuce and endive, onions (see label), peas, peppers, potatoes, radishes, rutabagas, spinach, sweet potatoes, Swiss chard, tomatoes, turnips.	BCZ
SERENADE SOIL	<i>Bacillus subtilis</i>	30647	f	1 x 10 ⁹ CFU/g	3	asparagus, beans, beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, garlic, herbs (see label), horseradish, lettuce, onions (see label), parsnips, peas, peppers, potatoes, radish, rhubarb, rutabaga, spinach, sugarbeets, sweet potato, Swiss chard, tomato, turnip	BCZ
SERCADIS	fluxapyroxad	31697	f	300 g/L	2	beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, garlic, herbs, horseradish, lettuce and endive, onions, parsnips, peppers, potatoes, radish, rutabaga, sweet potatoes, tomatoes, turnips	BAZ

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USE CODES: a = acaricide b = bactericide cp = crop protectant f = fungicide h = herbicide i = insecticide m = miticide n = nematocide pgr = plant growth regulator r = rodenticide s = seed treatment							
Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
SEVIN XLR	carbaryl	27876	i	466 g/L	3	asparagus, beans (snap), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, parsley, horseradish, lettuce (head and leaf), endive, peppers, radish, rutabagas, tomatoes, turnips	TKI
SILENCER 120 EC	lambda-cyhalothrin	29052	i	120 g/L	2	asparagus, beans, brassica crops (see label), carrots, garlic, lettuce (head and leaf), onions (dry bulb and green), leeks, shallots, peas, potatoes, sweet corn, sweet potatoes, tomatoes	UAG/ AMA
SIROCCO	potassium bicarbonate	31091	f	85	4	herbs (see label)	AFG
SIVANTO PRIME	flupyradifurone	31452	i	200 g/L		beans, beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, herbs (see label), horseradish, lettuce and endive, parsnips, peas, peppers, potatoes, radish, rhubarb, rutabaga, spinach, sweet corn, sweet potatoes, swiss chard, tomatoes, turnips	BCZ
SLUGGO PROFESSIONAL	ferric phosphate	30025	i	0.76	4	beans, brassica crops (see label), peas, rhubarb, sweet corn, sweet potatoes	ENG
sodium methylthiocarbamate	See <i>ENFUSE</i>						
SOLAN MZ POTATO ST FUNGICIDE	mancozeb	29377	s	16	4	potato seed piece	NRA
spinetoram	See <i>DELEGATE</i>						
spinosad	See <i>ENTRUST, SUCCESS</i>						
spiromesifen	See <i>OBERON</i>						
spirotriamat	See <i>MOVENTO</i>						
STADIUM	azoxystrobin/ difenoconazole/ fludioxonil	31050	f	143 g/L/ 112 g/L/ 143 g/L	4	potatoes, sweet potatoes	SYZ
STOROX	hydrogen peroxide	27432	f	27	2	potatoes, sweet potatoes	BIB
STRATEGO PRO	prothioconazole/ trifloxystrobin	31436	f	175 g/L/ 150 g/L	4	sweet corn	BCZ
<i>Streptomyces lydicus</i>	See <i>ACTINOVATE</i>						

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Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
<i>Streptomyces strain K61</i>	See MYCOSTOP						
SUCCESS	spinosad	26835	i	480 g/L	4	asparagus, beans (snap), brassica crops (see label), celery, eggplant, garlic, herbs (see label) horseradish, lettuce and endive, onions (see label), peppers, potatoes, radishes, rhubarb, rutabagas, spinach, sweet corn, Swiss chard, tomatoes, turnips	DWE
<i>sulfoxaflor</i>	See CLOSER						
<i>sulfoxaflor/spinetoram</i>	See TwinGuard						
<i>sulphur/sulfur</i>	See MICROSCOPIC SULPHUR, MICROTHIOL DISPERS						
SUPERIOR 70 OIL	mineral oil	14981	i	99	4	potatoes, rutabagas	LVP
SUPRA CAPTAN 80 WDG	captan	24613	f	80	3	cucumbers, tomatoes, vegetable transplants in greenhouse (eggplant, peppers, tomatoes)	LVP
SURROUND WP	kaolin	27469	cp	95	4	carrots, celery, cucurbit crops (see label), parsley, lettuce, potatoes	BAT/ TKI
SWITCH 62.5 WG	cyprodinil/ fludioxonil	28189	f	37.5/ 25	3	beans, beets (table), brassica crops (see label), carrots, garlic, herbs (see label), horseradish, onions (see label), parsnips, peppers, radishes, rutabagas, spinach, tomatoes, turnips	SYZ
TANOS 50 DF	famoxadone/ cymoxanil	27435	f	25/ 25	3	potatoes, tomatoes	DUQ
tea tree oil	See Timorex Gold						
tebuconazole	See FOLICUR						
tefluthrin	See FORCE						
tetraconazole	See METTLE						
thiamethoxam	See ACTARA, CRUISER						
thiamethoxam/ cyantraniliprole	See MINECTO DUO						
THIMET 20-G	phorate	29000	i	20	2	potatoes	AMV/ ENG
thiophanate-methyl	See SENATOR						
thiram	See GRANUFLO-T, THIRAM						

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Examples of Brand Name/ Trade Name ¹	Active Ingredient/ Common Name	Registration Number/ PCP # ²	Use	Guaranteed % Active Unless Stated	Ontario Class ³	Crop Registrations	Company or Agent's Code ⁴
THIRAM 75 WP	thiram	27556	f, s	75	3	beans (snap), beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, lettuce, onions, peas, peppers, radishes, spinach, sugarbeets, sweet corn, sweet potatoes, tomatoes, turnips	MCD
THURICIDE HPC	<i>Bacillus thuringiensis</i>	11302	i	15	4	brassica crops (see label), celery, lettuce, spinach, tomatoes	CIT
TILT 250E	propiconazole	19346	f	250 g/L	3	asparagus, rutabagas, sweet corn, sugarbeets	SYZ
TIMOREX GOLD	tee tree oil	30910	f	23.8	3	peppers	ENG
TITAN ST	clothianidin	27449	s	600 g/L	2	potatoes	BCZ
TIVANO	citric/lactic acid	30468	f, b	10.73 g/L/ 21.37 g/L	4	cucurbit crops (see label), tomatoes	AFG
TORRENT 400SC	cyazofamid	30392	f	34.5	4	beans, brassica crops (see label), carrots, cucurbit crops (see label), herbs (see label), lettuce, spinach, tomatoes, greenhouse transplants (tomatoes, peppers, cucumber, brassicas and lettuce)	ENG/ ISK
<i>Trichoderma harzianum</i>	See <i>ROOTSHIELD</i>						
<i>trifloxystrobin</i>	See <i>FLINT</i>						
TUBERSEAL	mancozeb	17042	s	16	4	potato seed piece	NRA
TWINGUARD	sulfoxaflor/ spinetoram	31442	i	20/ 20	3	potatoes	DWE
UP-CYDE 2.5 EC	cypermethrin	28795	i	250 g/L	3	asparagus, brassica crops (see label), carrots, celery, lettuce, onions, potatoes, rutabagas, sweet corn, tomatoes, turnips	UPI
VAPAM HL	metam sodium	29128	h, f, n	42	4	pre-plant preparation (see label)	UAG
VERIMARK	cyantraniliprole	30892	i	200 g/L	3	beets (table), brassica crops (see label), carrots, horseradish, parsnips, potatoes, radishes, rutabagas, turnips	DUQ
VERTISAN	penthiopyrad	30332	f	200 g/L	4	potatoes, sugarbeets, sweet corn, sweet potatoes	DUQ
VELUM PRIME	fluopyram	32108	f	500 g/L	2	potatoes, sweet potatoes	BCZ

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VIBRANCE 500FS	sedaxane	30438	s	500 g/L	3	sugarbeets	SYZ
VITAFLO 280	carbathiin/ thiram	11423	s	15.59/ 13.25	4	beans (snap), peas	MCD
VIVANDO SC	metrafenone	29765	f	300 g/L	2	cucurbit crops (see label), eggplant, peppers, tomatoes	BAZ
VOLIAM XPRESS	lambda-cyhalothrin/ chlorantraniliprole	30325	i	50 g/L/ 100 g/L	2	beans, brassica crops (see label), cucurbit crops (see label), eggplant, peas, peppers, potatoes, sweet corn, sweet potatoes, tomatoes	SYZ
VYDATE L	oxamyl	17995	i	240 g/L	2	potatoes	DUQ
WARHAWK 480 EC	chlorpyrifos	29984	i	480 g/L	3	brassica crops (see label), carrots, celery, cucumbers, garlic, onions (bulb), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn	LVP
ZAMPRO	ametoctradin/ dimethomorph	30321	f	300 g/L/ 225 g/L	3	brassica crops (see label), cucurbit crops (see label), eggplant, garlic, lettuce (head and leaf), endive, radicchio, onions (dry bulb and green), leeks, shallots, peppers, potatoes, tomatoes	BAZ
zoxamide/mancozeb	See GAVEL						

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Table 4–2. Pest Control Product Companies

Code¹	Company/Agent	Website²	Contact Number
ACC	Agronomy Company of Canada	—	519-461-9057
AFG	AEF Global Inc.	www.aefglobal.com	1-866-622-3222
AMA	ADAMA Agricultural Solutions Canada Ltd	www.adama.com/canada	1-855-264-6262
AMV	AMVAC Chemical Corp.	www.amvac-chemical.com	1-888-462-6822
AUG	JET Harvest Solutions (Austin Grant Inc.)	www.jetharvest.com	1-877-866-5773
AVV	Arysta LifeScience North America	www.arystalifescience.ca	1-866-761-9397
BAT	Bartlett, N.M. Inc.	www.bartlett.ca	1-800-263-1287
BAZ	BASF Canada Inc.	www.agsolutions.ca	1-877-371-2273
BCZ	Bayer CropScience Inc.	www.cropscience.bayer.ca	1-888-283-6847
BIB	BioSafe Systems	www.biosafesystems.com	1-860-290-8890
BUL	Buckman Laboratories of Canada Ltd.	www.buckman.com	1-450-424-4404
BWI	BioWorks Inc.	www.bioworksinc.com	1-800-877-9443
CIT	Certis USA LLC.	www.certisusa.com	1-800-847-5620
DAS	Douglas Agricultural Services Inc.	—	519-426-0813
DUQ	E.I. du Pont Canada Co.	www.dupont.ca	1-800-667-3925
DWE	Dow Agrosciences Canada Inc.	www.dowagro.com/ca	1-800-667-3852
ENG	Engage Agro Corp.	www.engageagro.com	1-800-900-5487
FMC	FMC Corporation	www.fmccrop.ca	306-979-9225
GOW	Gowan Company	www.gowanco.com	1-800-883-1844
ITL	Intelligro	www.intelligro.com	1-855-300-3997
ISG	Isagro USA, Inc.	www.isagro-usa.com	919-321-5200
ISK	ISK BioSciences Corp.	www.iskbc.com	1-877-706-4640
LVP	see UAG		
MCD	Macdermid Agricultural Solutions Canada	—	1-800-350-1745
MQO	Marrone Bio Innovations, Inc.	www.marronebioinnovations.com	1-877-664-4476
NEF	Neudorff North America	www.neudorffpro.com	250-652-5888
NRA	Norac Concepts Inc.	www.noracconcepts.com	519-821-3633
NPS	Nippon Soda Co., Ltd.	www.nippon-soda.co.jp/e	212-490-0350
NUA	Nufarm Agriculture Inc.	www.nufarm.ca	1-800-868-5444
OMD	Omex Agriculture Inc.	www.omexcanada.com	1-866-860-9660
PLG	Plant Products	www.plantproducts.com	1-800-387-2449
SYZ	Syngenta Crop Protection Canada Inc.	www.syngenta.com	1-877-964-3682
TAO	Taminco, Inc.	www.taminco.com	
TKI	Tessenderlo Kerley, Inc.	www.tkinet.com	1-800-525-2803
UAG/LVP	United Agri Products Canada Inc. (Loveland Products Canada Inc.)	www.uap.ca	1-800-265-4624
UPI	United Phosphorus Inc.	www.upi-usa.com/canada	1-800-438-6071
VAL	Valent Canada Inc.	www.valent.ca	519-767-9262
SFR	Woodstream Canada Corporation	www.woodstream.com	1-800-800-1819
WIN	Winfield Solution, LLC	winfieldcustomerservice@winfieldsolutions.com	

¹ The three-letter manufacturers' codes represent the codes listed in Table 4–1. *Pesticides Used on Vegetable Crops in Ontario*, on page 269.

² Where possible, Canadian websites are listed.

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Acapela	picoxystrobin	12 hr	sweet corn
Acramite 50WS	bifenazate	12 hr	eggplant, peppers, tomatoes
Actara 240SC	thiamethoxam	12 hr	brassica crops (see label), celery, cucurbit crops (see label), eggplant, parsley, lettuce (head and leaf), endive, peppers, potatoes, spinach, tomatoes
Actara 25WG	thiamethoxam	12 hr	beets (table), carrots, celery, eggplant, endive, parsley, horseradish, lettuce (head and leaf), parsnips, peppers, potatoes, radishes, rutabagas, spinach, sweet potatoes, Swiss chard, tomatoes, turnips
Actinovate SP	<i>Streptomyces lydicus</i>	1 hr	peppers, tomatoes
Admire 240	imidacloprid	24 hr	beans, beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, herbs (see label), parsley, horseradish, lettuce (head and leaf), endive, parsnips, peas, peppers, potatoes, radishes, rutabagas, spinach, sweet potatoes, Swiss chard, tomatoes, turnips
Agri-mek SC	abamectin	Re-entry permitted once spray deposit has dried.	celery, garlic, onions (dry bulb), shallots
		hand weeding: 13 days hand-set irrigation: 4 days thinning, scouting: 24 hr all other activities: 12 hr	leeks, onions (green)
		not specified	potatoes
Alias 240 SC	imidacloprid	24 hr	brassica crops (see label), cucurbit crops (see label), eggplant, lettuce (head and leaf), potatoes, sweet potatoes, tomatoes
Aliette WDG	fosetyl-AL	12 hr	brassica crops (see label), lettuce, onions, rutabagas, spinach
Allegro 500F	fluazinam	24 hr	beans, brassica crops (see label), carrots, peppers, potatoes
Ambush 500EC	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
Aprovia	benzovindiflupyr	12 hr	cucurbit crops (see label), eggplant, peppers, potatoes, 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: 48 hr all other activities: 4 days	brassica crops (see label)
		hand-detasselling: not permitted hand-harvesting: 10 days all other activities: 12 hr	sweet corn
Beleaf 50SG	flonicamid	12 hr	beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, horseradish, lettuce (head and leaf), endive, mint (see label), parsley, parsnips, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, sweet potatoes, Swiss chard, tomatoes, turnips

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Botanigard ES	<i>Beauveria bassiana</i>	4 hr	herbs (greenhouse transplants)
Bravo ZN	chlorothalonil	48 hr	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, cucurbit crops (see label), onions (dry bulb and green), parsnips, potatoes, sweet corn, tomatoes
Bumper 432 EC	propiconazole	12 hr	asparagus
		hand-harvesting, detasselling: 24 hr 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	carrots, cucurbit crops (see label), eggplant, lettuce (head and leaf), onions (dry and green), leeks, shallots, peppers, potatoes, tomatoes
Caramba	metconazole	12 hr	sugarbeets
Chloropicrin 100	chloropicrin	See label for re-entry information.	root and tuber vegetables in crop group 1, peppers, potatoes, tomatoes
Citation 75WP	cyromazine	12 hr	brassica crops (see label), celery, endive, lettuce (head and leaf), parsley, spinach, Swiss chard
Closer	sulfoxaflor	12 hr or until spray deposit has dried	beets (table), brassica crops (see label), carrots, celery, endive, horseradish, lettuce (head and leaf), parsley, parsnips, potatoes, radishes, rhubarb, rutabagas, spinach, sugarbeet, 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), 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, onions (green), parsley, parsnips, peas, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, sugarbeets, sweet corn, sweet potatoes, Swiss chard, tomatoes, turnips

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
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
Cygon 480	dimethoate	12 hr	asparagus, beans, brassica crops (see label), eggplant, peas, peppers, potatoes, Swiss chard, tomatoes
		3 days	beets (table), kale, lettuce (leaf), turnip greens
		4 days	bok choy, Chinese broccoli
		5 days	broccoli, cauliflower
		48 hr	Brussels sprouts
Decree 50 WDG	fenhexamid	4 hr	tomatoes (transplants)
Delegate	spinetoram	12 hr	asparagus, beans (snap), brassica crops (see label), celery, endive, garlic, herbs (see label), horseradish, leeks, lettuce (head and leaf), onions (dry bulb and green), parsley, potatoes, radishes, rhubarb, rutabagas, shallots, spinach, sweet corn, Swiss chard, tomatoes, turnips
Diazinon 500 E	diazinon	3 days	onions (bulb and green)
		4 days	rutabagas, turnips
Dibrom	naled	48 hr	beans (lima), broccoli, Brussels sprouts, cabbage, cauliflower, lettuce, onions (bulb), peas, potatoes, sugarbeets, tomatoes
Double Nickel 55	<i>Bacillus amyloliquefaciens</i>	Re-entry permitted once spray deposit has dried.	cucurbit crops (see label), eggplant, lettuce, peppers, potatoes, tomatoes
Echo 720	chlorothalonil	48 hr	onions (dry bulb and green), parsnips
Echo 90DF	chlorothalonil	48 hr	broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, cucurbit crops (see label), potatoes, sweet corn, tomatoes
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
		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), broccoli (transplants)
		12 hr	eggplant, peppers, potatoes, tomatoes
		hand-harvesting, detasselling: 7 days Re-entry permitted for all other activities once spray deposit has dried.	sweet corn

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
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
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, 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: 48 hr all other activities: 12 hr	cucurbit crops (see label)
		thinning: 48 hr all other activities: 12 hr	garlic, leeks, onions (dry bulb), shallots
		hand-harvesting: 48 hr all other activities: 12 hr	lettuce (head and leaf), onions (green)
		12 hr	peppers, potatoes, tomatoes
		12 hr	celery, endive, parsley, lettuce (head and leaf), potatoes, rhubarb, spinach, Swiss chard
Fulfill 50WG	pymetrozine	12 hr	celery, endive, parsley, lettuce (head and leaf), potatoes, rhubarb, spinach, Swiss chard
Gavel DF	zoxamide/mancozeb	48 hr	onions (bulb), potatoes
Granuflo-T	thiram	24 hr	sweet potatoes
Grapple ₂	imidacloprid	24 hr	cucurbit crops (see label), eggplant, lettuce (head and leaf), potatoes, sweet potatoes, tomatoes
Headline EC	pyraclostrobin	12 hr	beans, peas, potatoes, sugarbeets, sweet corn
Imidan 70-WP	phosmet	5 days See label for details on restricted entry interval.	carrots, celery, potatoes
Intrepid	methoxyfenozide	12 hr	beans, brassica crops (see label), celery, endive, herbs (see label), lettuce (head and leaf), parsley, peppers, rhubarb, spinach, sweet corn, Swiss chard, tomatoes
Kanemite 15 SC	acequinocyl	12 hr	eggplant

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Kasumin 2L	kasugamycin	12 hr	peppers, tomatoes
Kenja 400SC	isofetamid	12 hr	lettuce (head and leaf)
Kocide 2000	copper hydroxide	field applications: 48 hr greenhouse transplants: 24 hr	beans, peppers (field and transplants), potatoes, sugarbeets, tomatoes (field and transplants)
Lagon 480 E	dimethoate	12 hr	asparagus, beans, eggplant, peas, peppers, potatoes, tomatoes
		3 days	beets (table and greens), celery, kale, lettuce (leaf), turnip greens
		4 days	bok choy, Chinese broccoli
		5 days	broccoli, cauliflower
		48 hr	Brussels sprouts
		not specified	Swiss chard
Lance WDG	boscalid	12 hr	beans, peas
Lannate Toss-N-Go (TNG)	methomyl	12 hr	beans, Brussels sprouts, peas, tomatoes
		hand-pruning, hand-harvesting: 48 hr all other activities: 12 hr	broccoli, cabbage, cauliflower
		hand-pruning, hand-harvesting, thinning: 24 hr all other activities: 12 hr	lettuce
		hand-detasselling: 18 days all other activities: 12 hr	sweet corn
Lorsban 15G	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, onions (bulb and pickling), shallots, rutabagas
		10 days	cauliflower
Lorsban 4E	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, Chinese broccoli, Chinese cabbage, pak choy, carrots, celery, cucumbers, garlic, onions (bulb and pickling), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
		not specified	onions (green)
Lorsban 50W	chlorpyrifos	24 hr	cabbage
Lorsban NT	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, Chinese broccoli, Chinese cabbage, carrots, celery, cucumbers, garlic, onions (bulb and pickling), pak choy, peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
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), tomatoes (field and transplants)

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Malathion 85E	malathion	12 hr	asparagus, eggplant, garlic, leeks, onions (bulb and green), peppers, radishes, rutabagas, shallots, sugarbeets, tomatoes
		24 hr	beans, beets (table), carrots, celery, collards, cucurbit crops (see label), 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)
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, peppers
Minecto Duo	thiamethoxam/ cyantraniliprole	12 hr	brassica crops (see label), celery, cucurbit crops (see label), eggplant, endive, lettuce (head and leaf), parsley, peppers, potatoes, rhubarb, spinach, Swiss chard, tomatoes
Movento 240 SC	spirotetramat	12 hr	brassica crops (see label), celery, chives, cucurbit crops (see label), eggplant, endive, garlic, leeks, lettuce (head and leaf), onions (dry bulb and green), parsley, peppers, potatoes, rhubarb, shallots, spinach, sweet corn, sweet potatoes, Swiss chard, tomatoes
Nealta	cyflumetofen	12 hr	tomatoes
Nova	myclobutanil	48 hr	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 choy, peppers (green), potatoes, radishes, rutabagas, sweet corn
		10 days	cauliflower
Oberon Flowable	spiromesifen	12 hr	cucurbit crops (see label), eggplant, peppers, sweet potatoes, potatoes, tomatoes

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Orondis Ultra A + Orondis Ultra B	mandipropamid + oxathiapiprolin	12 hr	brassica crops (see label), cucurbit crops (see label), eggplant, garlic, onions (bulb), peppers, potatoes, shallots, spinach, tomatoes
Orthene 75%	acephate	12 hr	Brussels sprouts, cabbage, cauliflower, tomatoes
		24 hr	celery ¹ , lettuce (head) ¹ , peppers (sweet bell), potatoes ¹
		5 days	sweet corn ¹
Parasol Flowable	copper hydroxide	48 hr	potatoes
Parasol WG	copper hydroxide	48 hr	beans, cucumbers, peppers, sugarbeets, tomatoes
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, sweet corn, tomatoes, turnips
Phostrol	mono- and dibasic sodium, potassium and ammonium phosphites	12 hr	brassica crops (see label), chives, cucurbit crops (see label), garlic, leeks, lettuce (head and leaf), endive, onions, potatoes, shallots, tomatoes
Pic Plus	chloropicrin	See label for re-entry information.	root and tuber vegetables in crop group 1, peppers, potatoes, tomatoes
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	cucurbit crops (see label), lettuce (head and leaf), peppers, potatoes, rutabagas, spinach, tomatoes
		hand-pruning, irrigation: 24 hr all other activities: 12 hr	brassica crops (see label)
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)
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

¹ 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.

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
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
Purespray Green Spray Oil 13E	mineral oil	12 hr	cucurbits, eggplant, peppers, rutabagas, tomatoes
Pyrifos 15G	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, onions (dry bulb and pickling), rutabagas, sweet corn
		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, 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: 24 hr all other activities: 12 hr	brassica crops (see label)
Quash	metconazole	hand set irrigation: 7 days roguing: 48 hr scouting: 12 hr	potatoes
Quilt	azoxystrobin/ propiconazole	12 hr	mint, peas
		hand harvesting, detasseling: 24 hr all other activities: 12 hr	sweet corn
Quintec	quinoxifen	12 hr	lettuce (head and leaf), melons, pumpkins, winter squash
Rampart	mono- and dipotassium salts of phosphorous acid	4 hr	potatoes
Ranman 400SC	cyazofamid	12 hr	potatoes
Reason 500SC	fenamidone	48 hr	brassica crops (see label)
		Re-entry permitted once spray deposit has dried.	cucurbit crops (see label), onions (dry bulb and green), leeks, shallots, potatoes
		12 hr	beans, tomatoes
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, brassica crops (see label), cucurbit crops (see label), eggplant (transplants), garlic, lettuce (head and leaf), onions (dry bulb), shallots, pepper (transplants), potatoes, spinach, tomatoes
Ridomil Gold 1G	metalaxyl-M and S-isomer	12 hr	carrots, lettuce (head)

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Ridomil Gold 480SL	metalaxyl-M and S-isomer	12 hr	beans (snap), cucumbers, radishes, spinach, potatoes
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, peppers, potatoes
Rootshield Granules	<i>Trichoderma harzianum</i>	greenhouse applications: 4 hr	cucumbers, peppers, tomatoes
Rootshield HC	<i>Trichoderma harzianum</i>	greenhouse applications: 4 hr	brassica crops (see label), celery, cucurbit crops (see label), endive, eggplant, herbs (see label), leeks, lettuce, onions, parsley, peppers, shallots, swiss chard, tomatoes
Rovral WP	iprodione	12 hr	beans (snap), cabbage, cauliflower, garlic, leeks, lettuce, onions (dry bulb)
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: 12 hr high contact activities: 6 days	asparagus, tomatoes
		low contact activities: 12 hr high contact activities: 6 days hand-harvesting: not permitted	beans (snap)
		low contact activities: 12 hr high contact activities: 5 days	beets (table), celery, Chinese cabbage, horseradish, kohlrabi, lettuce (head), mustard greens, parsley, parsnips, radishes, rutabaga, turnip
		low contact activities: 12 hr	carrots
		low contact activities: 12 hr high contact activities: 48 hr	cucurbit crops (see label)
		low contact activities: 3 day high contact activities: 7 days	eggplant
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)

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
Sivanto Prime	flupyradifurone	12 hr	beans, beets (table), brassica crops (see label), carrots, celery, cucurbit crops (see label), eggplant, horseradish, parsnips, peas, peppers, potatoes, radishes, rhubarb, rutabagas, spinach, sweet corn, sweet potatoes, Swiss chard, tomatoes, turnips
Stratego Pro	trifloxystrobin/ prothioconazole	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), broccoli (transplants)
		12 hr	eggplant, peppers, potatoes, tomatoes
		hand-harvesting, detasselling: 7 days Re-entry permitted for all other activities once spray deposit has dried.	sweet corn
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)
Switch 62.5 WG	cyprodinil/fludioxonil	12 hr	beans, brassica crops (see label), carrots, 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, detasselling: 24 hr all other activities: 12 hr	sweet corn
		12 hr	asparagus, rutabagas, sugarbeets,
Timorex Gold	tea tree oil	4 hr	peppers
Titan	clothianidin	12 hr	potatoes
Tivano	citric and lactic acid	Re-entry permitted once spray deposit has dried.	pumpkins, squash, tomatoes
Torrent 400SC	cyazofamid	12 hr	beans, brassica crops (see label), brassica crops (transplants), carrots, cucumber (transplants), cucurbit crops (see label), basil, lettuce (transplants and field; head and leaf), pepper (transplants), spinach, tomatoes (transplants and field)

Table 4–3. 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 that the REI is 12 hr. See *Restricted Entry Intervals*, on page 17, for more information.

Trade Name(s)	Active Ingredient	Restricted Entry Interval	Crops
TwinGuard	sulfoxaflor/ spinetoram	12 hr or until spray deposit has dried	potatoes
UP-Cyde 2.5 EC	cypermethrin	12 hr	asparagus, broccoli, Brussels sprouts, cabbage, cauliflower, carrots, celery, lettuce, onions, potatoes, rutabagas, sweet corn, tomatoes, turnips
Velum Prime	fluopyram	12 hr	sweet potatoes, potatoes
Verimark	cyantraniliprole	12 hr	beets (table), brassica crops (see label), carrots, horseradish, parsnips, potatoes, radishes, rutabagas, turnips
Vertisan	penthioopyrad	12 hr	potatoes, sugarbeets, sweet potatoes
		hand-detasselling: 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: 24 hr all other activities: 12 hr	potatoes
Warhawk 480 EC	chlorpyrifos	24 hr	broccoli, Brussels sprouts, cabbage, Chinese broccoli, Chinese cabbage, pak choi, carrots, celery, cucumbers, garlic, onions (bulb), peppers (green), potatoes, radishes, rutabagas, sugarbeets, sweet corn
		10 days	cauliflower
Zampro	ametoctradin/ dimethomorph	hand-harvesting, irrigation: 6 days scouting: 4 days all other activities: 12 hr	brassica crops (see label)
		hand-harvesting, pruning, thinning: 24 hr all other activities: 12 hr	cucurbit crops (see label)
		12 hr	eggplant, peppers, potatoes, tomatoes
		hand-harvesting, thinning: 24 hr all other activities: 12 hr	garlic, leeks, onions (dry bulb and green), shallots
		hand-harvesting: 24 hr all other activities: 12 hr	endive, lettuce (head and leaf)

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: 519-426-8934 Fax: 519-428-1142	jason.deveau@ontario.ca
Crop Protection Specialist	Denise Beaton	Tel: 519-826-6594 Fax: 519-826-4964	denise.beaton@ontario.ca
Entomologist, Horticulture	Hannah Fraser	Tel: 905-562-1674 Fax: 905-562-5933	hannah.fraser@ontario.ca
Horticulture IPM Specialist, Specialty Crops	Melanie Filotas	Tel: 519-426-4434 Fax: 519-428-1142	melanie.filotas@ontario.ca
Minor Use Coordinator	Jim Chaput	Tel: 519-826-3539 Fax: 519-826-4964	jim.chaput@ontario.ca
New Crop Development Specialist	Evan Elford	Tel: 519-426-4509 Fax: 519-428-1143	evan.elford@ontario.ca
Horticulture Sustainability Specialist	Deanna Németh	Tel: 905-562-1170 Fax: 905-562-5933	deanna.nemeth@ontario.ca
Soil Fertility Specialist, Horticulture	Christoph Kessel	Tel: 519-824-4120, ext. 52480 Fax: 519-824-5730	christoph.kessel@ontario.ca
Pathologist, Horticulture	Michael Celetti	Tel: 519-824-4120, ext. 58910 Fax: 519-767-0755	michael.celetti@ontario.ca
Weed Management Specialist, Horticulture	Kristen Obeid	Tel: 519-738-1232 Fax: 519-738-4564	kristen.obeid@ontario.ca
Soil Management Specialist, Horticulture	Anne Verhallen	Tel: 519-674-1614 Fax: 519-674-1564	anne.verhallen@ontario.ca
Vegetable Crops Specialist	Travis Cranmer	Tel: 519-826-4963 Fax: 519-826-4964	travis.cranmer@ontario.ca
Vegetable Crops Specialist	Elaine Roddy	Tel: 519-674-1616 Fax: 519-674-1564	elaine.rodody@ontario.ca
Vegetable Crops Specialist	Dennis Van Dyk	Tel: 519-826-4587 Fax: 519-826-4964	dennis.vandyk@ontario.ca
Vegetable Crops Specialist	Vacant	Tel: 519-674-1699 Fax: 519-674-1564	

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. Ministry of the Environment and Climate Change Regional Contact Information

Region/County/Branch	Address	Telephone/Fax	
Central Region Toronto, Halton, Peel, York, Durham, Muskoka, Simcoe	5775 Yonge St. 8 th Floor Toronto, ON M2M 4J1	Tel:	416-326-6700
		Toll-Free:	1-800-810-8048
		Fax:	416-325-6345
West-Central Region Haldimand, Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	Ontario Government Building 119 King St. W. 12 th Floor Hamilton, ON L8P 4Y7	Tel:	905-521-7640
		Toll-Free:	1-800-668-4557
		Fax:	905-521-7820
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry, Haliburton, Peterborough, Kawartha Lakes, Northumberland, Renfrew, Ottawa, Lanark, District of Nipissing (Twp. of South Algonquin)	1259 Gardiners Rd. Unit 3 P.O. Box 22032 Kingston, ON K7M 8S5	Tel:	613-549-4000
		Toll-Free:	1-800-267-0974
		Fax:	613-548-6908
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth	733 Exeter Rd. London, ON N6E 1L3	Tel:	519-873-5000
		Toll-Free:	1-800-265-7672
		Fax:	519-873-5020
Northern Region (East) Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma (East), Timiskaming, Sault Ste. Marie	199 Larch St. Suite 1201 Sudbury, ON P3E 5P9	Tel:	705-564-3237
		Toll-Free:	1-800-890-8516
		Fax:	705-564-4180
Northern Region (West) Algoma (West), Cochrane, Kenora, Rainy River, Timmins, Thunder Bay	435 James St. S. Suite 331 Thunder Bay, ON P7E 6S7	Tel:	807-475-1205
		Toll-Free:	1-800-875-7772
		Fax:	807-475-1745
Standards Development Branch	Pesticides Section 40 St. Clair Ave. W. 7 th Floor Toronto, ON M4V 1L5	Tel:	416-327-5519
		Fax:	416-327-2936
Approvals Branch	Pesticides Licensing 2 St. Clair Ave. W. 12A Floor Toronto, ON M4V 1L5	Tel:	416-314-8001
		Toll-Free:	1-800-461-6290
		Fax:	416-314-8452

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: aginfo@alcanada.com	Greg Patterson Ian McLachlin
Eurofins Environment Testing Canada Inc. www.exova.com	8-146 Colonnade Road, Ottawa, ON K2E 7Y1	Tel: 613-727-5692 Fax: 613-727-5222	Scott Clark
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: jbrackman@blinc.com	Jackie Brackman Mark Flock
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.	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

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 16,000 producers and 2 million hectares (5 million acres) of Ontario farmland are insured each year.

Production Insurance is part of federal-provincial-territorial programming (Growing Forward 2). In most plans, producers pay 40% of the total premium cost and none of the administration cost. Together, the federal and provincial governments contribute the other 60%. Administrative costs are fully funded by both levels of government.

PI is available to all Ontario farmers, landlords and sharecroppers who grow an eligible crop. Coverage is available on approximately 90 commercially grown crops in Ontario in the following sectors:

- forage
- fresh vegetables
- fruit
- grains and oilseeds
- processing vegetables
- specialty crops

For more information, call Agricorp weekdays, 7 a.m. to 5 p.m., at 1-888-247-4999 or visit www.agricorp.com.

Agricorp

1 Stone Rd. W.
Box 3660, Stn. Central
Guelph, ON N1H 8M4

Tel: 1-888-247-4999

TTY: 1-877-275-1380

Fax: 519-826-4118

E-mail: contact@agricorp.com

www.agricorp.com

ONTARIO CROPS COVERED BY PRODUCTION INSURANCE

General Crops

- barley
- canola
- coloured beans (adzuki, black, cranberry, kidney, Japanese/other)
- corn (conventional, organic options)
- established forage (excess and insufficient options)
- flax
- mustard
- premium new forage seeding (newly seeded hay and pasture)
- oats
- peanuts
- popping corn
- rye
- seed corn
- soybeans (conventional, tofu, natto and organic options available)
- spring grain
- sorghum
- spring wheat
- standard new forage seeding
- sunflower
- white beans
- winter spelt, organic

- winter wheat (soft white, hard white, soft red, hard red, organic options)

Specialty Crops

- bees
- ginseng
- honey
- industrial hemp
- tobacco (black, burley, flue-cured)

Fruit Crops

- apples and apple trees
- cherries (sweet, sour)
- grapes and grape vines
- peaches/nectarines
- pears
- plums
- strawberries

Vegetable Crops — Average Farm Yield or Total Production

- asparagus
- butternut squash (processing)
- carrots (fresh)
- carrots (processing)
- cucumbers (processing)
- green beans and wax beans (processing)
- lima beans (processing)
- onions (seed, set,

- spanish, yellow)
- peas (processing)
- peppers (banana, bell)
- potatoes (fresh)
- potatoes (processing)
- red beets (processing)
- rutabagas
- sweet corn (processing)
- tomatoes (processing)

Fresh Market Vegetables

— Acreage Loss

Root Vegetables

- carrots
- celeriac
- French shallots
- garlic
- green onions
- leeks
- parsnips
- radishes
- red beets
- rutabagas
- Spanish onions
- sweet potatoes
- turnips
- yellow onions

Leafy Vegetables

- bok choy
- broccoli
- Brussels sprouts
- cauliflower
- celery

- Chinese cabbage
- gai lan
- kale
- lettuce
- mesclun
- spinach
- summer cabbage
- winter cabbage
- yu choy

Fruit Vegetables

- bell and specialty peppers
- cucumbers
- eggplant
- melons
- pumpkins
- squash
- tomatoes
- watermelon
- zucchini

Other Vegetables

- broad beans
- green and wax beans
- green peas
- sweet corn

Appendix E. Other Contacts

AGRICULTURE AND AGRI-FOOD CANADA RESEARCH CENTRES

www.agr.gc.ca/index_e.php

Eastern Cereals and Oilseeds Research Centre

960 Carling Ave.
Ottawa, ON K1A 0C6
Tel: 613-759-1858

Greenhouse and Processing Crops Centre

2585 County Road 20
Harrow, ON NOR 1G0
Tel: 519-738-2251

Southern Crop Protection and Food Research Centre

1391 Sandford St.
London, ON N5V 4T3
Tel: 519-457-1470

Vineland Research Farm

4902 Victoria Ave. N.
Vineland, ON L0R 2E0
Tel: 905-562-4113

Guelph Food Research Centre

93 Stone Road West
Guelph, N1G 5C9
Tel: 519-829-2400

CANADIAN FOOD INSPECTION AGENCY REGIONAL OFFICES (PLANT PROTECTION)

www.inspection.gc.ca

Belleville

345 College St. E.
Belleville, ON K8N 5S7
Tel: 613-969-3333

Brantford

625 Park Rd. N., Suite 6
Brantford, ON N3T 5P9
Tel: 519-753-3478

Hamilton

709 Main St. W., Ste. 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., PO Box 19
St. Catharines, ON L2N 7N6
Tel: 905-937-8232

Ottawa District

38 Auriga Dr., Unit 8
Ottawa, ON K2E 8A5
Tel: 613-274-7374, ext. 221

Toronto

1124 Finch Ave. W., Unit 2
Downsview, ON M3J 2E2
Tel: 416-665-5055

Guelph

174 Stone Rd W
Guelph, N1G 4T1
Tel: 519-837-9400

UNIVERSITY OF GUELPH

Main Campus

Guelph, ON N1G 2W1
Tel: 519-824-4120
www.uoguelph.ca

Ridgetown Campus

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. 56083
Fax: 519-763-8933

Department of Plant Agriculture, Simcoe

1283 Blueline Road, PO Box 587
Simcoe, ON N3Y 4N5
Tel: 519-426-7127
Fax: 519-426-1225

Department of Plant Agriculture, Vineland

4890 Victoria Ave. N., PO Box 7000
Vineland Station, ON L0R 2E0
Tel: 905-562-4141
Fax: 905-562-3413

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

Tel: 519-767-6485

Vineland Research and Innovation Centre

4890 Victoria Ave. N.
Vineland Station, ON L0R 2E0
Tel: 905-562-0320
Fax: 905-562-0084
www.vinelandresearch.com

APPENDIX F. Diagnostic Service

Samples for disease diagnosis, insect or weed identification, nematode counts and Verticillium testing can be sent to:

Pest Diagnostic Clinic

Laboratory Services Division Tel: 519-767-6256
University of Guelph Fax: 519-767-6240
95 Stone Rd. W. www.afl.uoguelph.ca
Guelph, ON N1H 8J7

Payment must accompany samples at the time of submission. Submission forms are available at:
<http://afl.uoguelph.ca/submitting-samples>

Submitting plants for disease diagnosis or identification**Sample submission forms**

Forms can be obtained from your local Ontario Ministry of Agriculture, Food and Rural Affairs office. Carefully fill in all of 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 (8–10 in.) 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. Samples shipped at the end of the week are more likely to be destroyed while sitting in transit over the weekend.

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.

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

From small plants, sample the entire root system plus adhering soil. For large plants 10–20 g (0.5–1 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 (40°F–50°F) 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.

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 m² = 1 hectare (ha)

100 ha = 1 square kilometre (km²)

Cubic measures (volume)

Dry measure

1,000 cubic millimetres (mm³) = 1 cubic centimetre (cm³)

1,000,000 cm³ = 1 cubic metre (m³)

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 cm³ = 1 mL

1 m³ = 1,000 L

Metric conversions

5 mL = 1 tsp

15 mL = 1 tbsp

28.5 mL = 1 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 × 0.015 = 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

Area

1 square centimetre (cm ²) = 0.16 square inches
1 square metre (m ²) = 10.77 square feet
1 square metre (m ²) = 1.20 square yards
1 square kilometre (km ²) = 0.39 square miles
1 hectare (ha) = 107,636 square feet
1 hectare (ha) = 2.5 acres

Volume (dry)

1 cubic centimetre (cm ³) = 0.061 cubic inches
1 cubic metre (m ³) = 1.31 cubic yards
1 cubic metre (m ³) = 35.31 cubic feet
1,000 cubic metres (m ³) = 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

Pressure

1 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

$$^{\circ}\text{F} = (^{\circ}\text{C} \times 9/5) + 32$$

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

Area

1 square foot = 0.09 m ²
1 square yard = 0.84 m ²
1 acre = 0.40 ha

Volume (dry)

1 cubic yard = 0.76 m ³
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

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) \times 5/9$$

Abbreviations

%	= per cent	kg	= kilogram
ai	= active ingredient	km/h	= kilometres per hour
AP	= agricultural powder	kPa	= kilopascal
cm	= centimetre	L	= litre
cm ²	= square centimetre	m	= metre
CS	= capsule suspension	m ²	= square metre
DF	= dry flowable	mL	= millilitre
DG	= dispersible granular	mm	= millimetre
DP	= dispersible powder	m/s	= metres per second
E	= emulsifiable	SC	= sprayable concentrate
EC	= electrical conductivity	SP	= soluble powder
e.g.	= for example	t	= tonne
F	= flowable	W	= wettable (powder)
g	= gram	WDG	= water dispersible granular
Gr	= granules, granular	WG	= wettable granule
ha	= hectare	WP	= wettable powder

Emergency and First-Aid Procedures for Pesticide Poisoning

For pesticide poisonings and pesticide injuries, call the Poison Information 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 Material Safety Data Sheets (MSDS) 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 Poison Information Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, MSDS sheet or 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 Poison Information Centre **IMMEDIATELY**. Emergency numbers are listed at the front of each Bell telephone directory.

To obtain copies of other OMAFRA publications, please order:

- online at ontario.ca/publications
- by phone through the ServiceOntario Contact Centre, Monday to Friday, 8:30 a.m. to 5:00 p.m. ET
- 416-326-5300
- 1-800-668-9938, toll-free across Canada
- 1-800-268-7095 (TTY), toll-free across Ontario

For a major spill, a theft or a fire involving a pesticide:

Call the Ministry of the Environment and Climate Change **Spills Action Centre** at

1-800-268-6060 (24 hr a day, 7 days a week).

Notify your municipality.

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Agricultural Information Contact Centre

1-877-424-1300

1-855-696-2811 (TTY)

E-mail: ag.info.omafra@ontario.ca

ontario.ca/omafra

