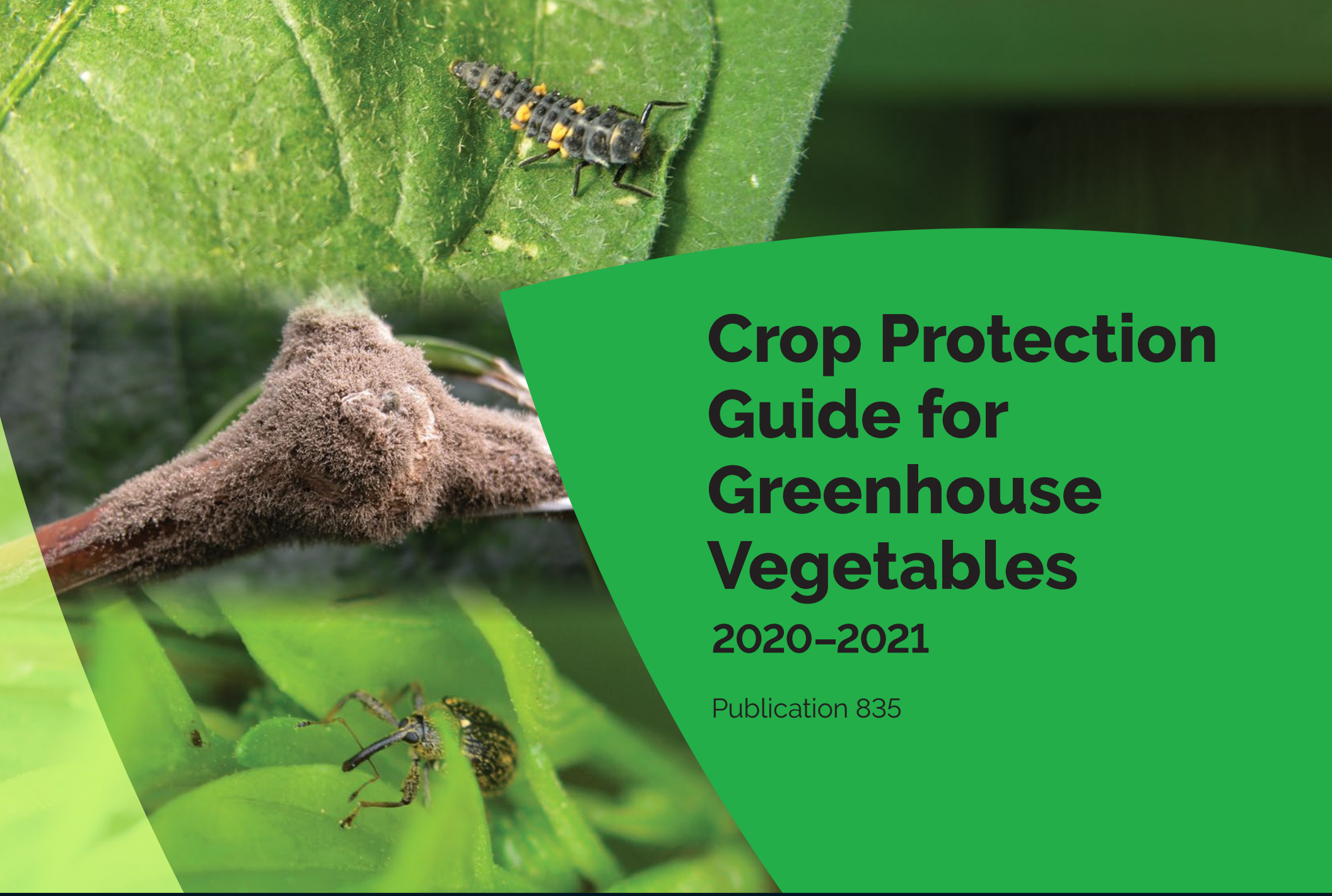


Crop Protection Guide for Greenhouse Vegetables

2020–2021

Publication 835

Ministry of Agriculture,
Food and Rural Affairs

Ontario

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

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

- federally registered
- classified by the Ontario Ministry of the Environment, Conservation and Parks (MECP)

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

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

The Pesticide Label

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

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

Registration of Pesticide Products

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

1. Full Registration

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

2. Emergency Registration

An emergency registration is a temporary, time-limited registration of no more than 1 year, approved to deal with serious pest outbreaks. An emergency is generally deemed to exist when both of the following criteria are met:

A. An unexpected and unmanageable pest outbreak or pest situation occurs that can cause significant health, environmental or economic problems; and

B. Registered pesticides and cultural control methods or practices are insufficient to address the pest outbreak.

Maximum Residue Limits

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

Supplemental/Amended Labels

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

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

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

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

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

Regulation of Pesticides in Ontario

The MECP is responsible for regulating pesticide sale, use, transportation, storage and disposal in Ontario. Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09.

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

Classification of Pesticides

The Ontario pesticide classification system provides the basis for regulating the distribution, availability and use of pesticide products in Ontario. Classified products are posted on the MECP website: ontario.ca/pesticides.

Certification and Licensing

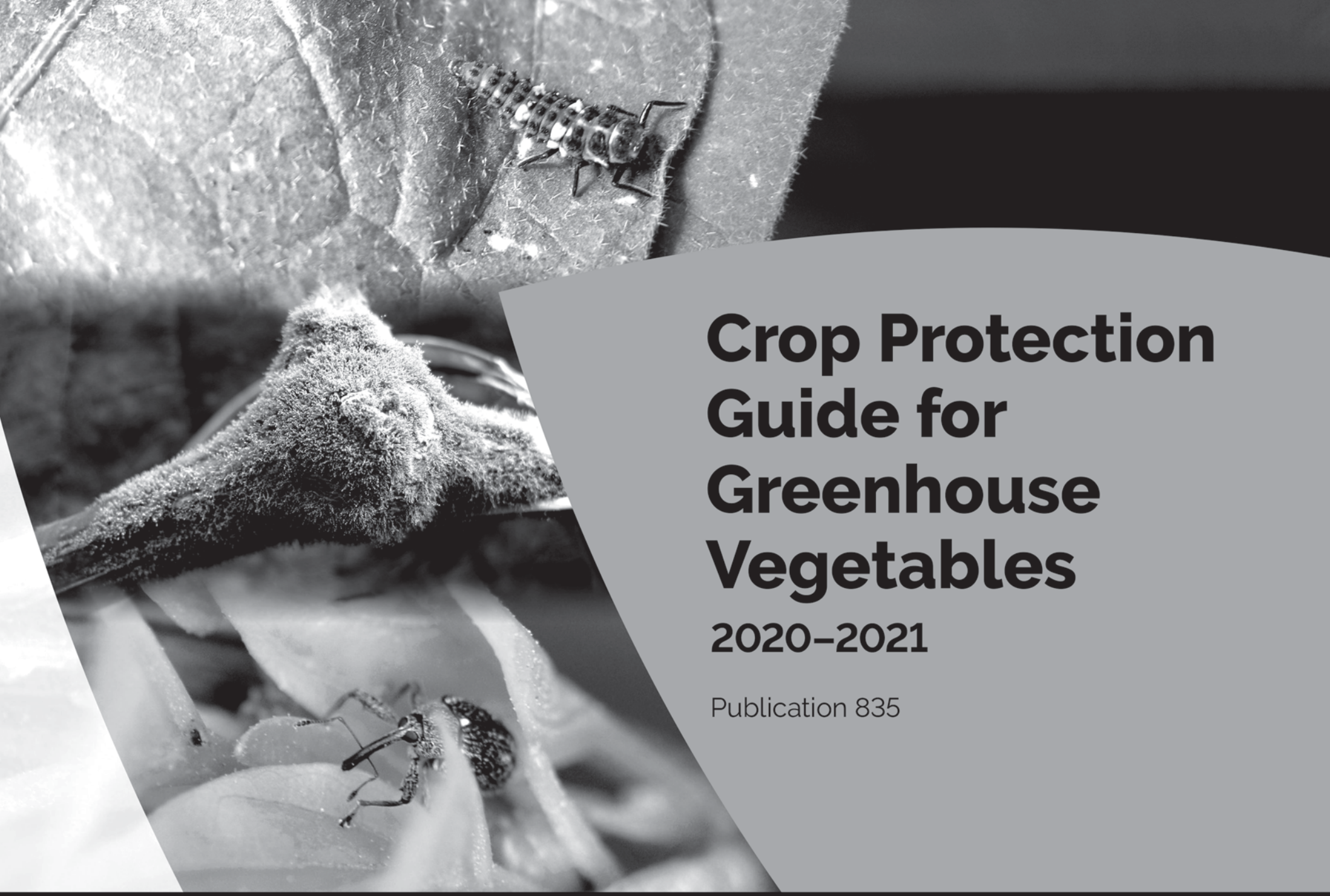
Growers and Their Assistants

For information about certification for growers and training for assistants, check the Ontario Pesticide Education Program website: www.opep.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 or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council's Pesticide Technician Program website at www.horttrades.com/pesticide-technician or call 1-800-265-5656 or e-mail pic@hort- trades.com
- the Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca.



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Acknowledgements

The information contained in this publication has been reviewed by the Greenhouse Vegetable Pest Management Technical Working Group.

If you need technical and business information, contact the

Agricultural Information Contact Centre at

1-877-424-1300

or ag.info.omafra@ontario.ca

If you are looking for greenhouse production information on the internet, check the OMAFRA website at ontario.ca/crops

This publication contains all pesticide products that have been registered as of September 2019 for use on greenhouse vegetable crops. For more comprehensive information on pest management strategies, pest life histories and diseases, and for information related to production of the major greenhouse vegetables in Ontario, see OMAFRA Publication 836, *Growing Greenhouse Vegetables in Ontario*. Information on ordering OMAFRA publications is found on the inside back cover of this book. Additional information on greenhouse vegetable crops can be found at www.medium.com/ongreenhousevegetables.

Cover Images

Front

Top:	lady beetle larva
Middle:	*Botrytis cinerea*
Bottom:	pepper weevil

Contents

Introduction

Products Listed in This Book

This book lists products that are registered for use on greenhouse vegetables, and contains registrations obtained up to September 2019. Products are listed according to pest for each greenhouse vegetable crop.

Information within the tables is based on labels approved by the Pest Management Regulatory Agency and is included so that growers can consider options when implementing their pest management programs.

When selecting a product to use, growers should consider several factors, including compatibility with beneficial insects, safety to the user, pre-harvest and re-entry intervals (also referred to as restricted entry intervals or REI) and resistance management.

Integrated Pest Management

Integrated pest management (IPM) is a pest control philosophy that uses all available management strategies to keep populations of harmful pests below an economic injury level. It does not advocate relying on pesticide spray programs to "eradicate" pests. Instead, it promotes the integration of cultural, physical, biological and chemical management strategies.

There are several reasons to reduce the unnecessary use of pesticides in greenhouses. First, overapplication or misapplication of pesticides can lead to concerns over environmental pollution and ground water contamination. Second, pests can develop resistance to pesticides. Developing and registering new pesticides takes significant time and resources. It is essential to use available pesticides minimally and efficiently to reduce the development of resistance in pests. The best approach to slowing down the development of resistance is using a combination of management strategies, reserving pesticides as a last resort. Finally, the potential exposure of applicators and workers to pesticides and pesticide residues in greenhouses requires a critical evaluation of frequency of use and pesticide safety during application.

Resistance Management Strategies

Different pesticides control pests in different ways. This is called the mode of action. Pesticides are grouped into chemical families/groups based on their mode of action.

Using the same pesticide with the same mode of action season after season or several times within the same season could result in the target pest becoming resistant to the chemical family.

A pest can develop resistance to one chemical family but still be very susceptible to another. Therefore, to reduce the risk of a pest developing resistance, use the following strategies:

- Avoid repeated use of pesticides from the same chemical subgroup (indicated by the IRAC and FRAC Mode of Action Group number — see Appendix D and Appendix E).
- For insecticides, rotate between chemical groups/families. Use products within one group only for the duration of one generation of the target insect before switching to another group for the following generation.
- Only use pesticides when necessary and integrate them as much as possible with other management strategies in an Integrated Pest Management (IPM) program.

  For example, to manage insect and mite pests, major strategies should include crop monitoring and biological control.

  Cultural controls such as sanitation and mass trapping should also be considered to minimize pesticide use and thereby reduce the risk of a pest developing resistance to a pesticide.

To manage diseases, major strategies should include sanitation, maintaining optimum levels of moisture and nutrients in the growing media and manipulation of environmental parameters (e.g., relative humidity and temperature) to minimize conditions that favour development of disease. For further details on insect pests, mite pests and diseases, as well as IPM strategies for managing them, see OMAFRA Publication 836, *Growing Greenhouse Vegetables in Ontario*.

- Do not exceed the total number of applications allowed per year for each product. Do not apply the product at rates lower than the recommended rate on the label.
- Monitor recently treated pest populations for signs of resistance.
- See the pesticide label for more information on resistance management. For more information on resistance management strategies or IPM options for a specific pest, contact your local OMAFRA specialist or IPM consultant.

1. Using Pesticides in Ontario

The information in this chapter is up to date as of October 31, 2019. At that point in time, amendments were being proposed on the Environmental Registry of Ontario to the *Pesticides Act* and O.Reg. 63/09 to reduce the complexity and modernize pesticide management in Ontario while ensuring protection of human health and the environment. Please visit the Environmental Registry for further information related to the proposal, or the Ministry of Environment, Conservation and Parks' Pesticides webpage at ontario.ca/pesticides for the most up to date information on pesticide management in Ontario, including licences, permits, training and certification requirements.

For the most up to date version of this chapter, 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/certification/

Keep detailed spray records.

Federal Registration of Pesticides

Before a pesticide (pest control product) can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCP Act) 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 any human health and environmental risks associated with its proposed uses are acceptable, and that the products have value.

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

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

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

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

Regulation of Pesticides in Ontario

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

There are regulatory requirements in place 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 MECP 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: www.healthcanada.gc.ca/pmra
- 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, Conservation and Parks (MECP) website: ontario.ca/pesticides
- Regional MECP Pesticides Specialists Directory infogo.gov.on.ca/infogo/home.html#orgProfile/-270/en
- 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 Safety Data Sheet (SDS) or contact the manufacturer.

For more information on pesticide application, see:

- Sprayers 101 at www.sprayers101.com
- OMAFRA Factsheet *Pesticide Drift from Ground Applications*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos at www.opep.ca/resources/
- OMAFRA Agriculture and Agri-Food Canada booklet Best Management Practices — *Pesticide Storage, Handling and Application*, Order No. BMP13
- OMAFRA Factsheet *Pesticide Contamination of Farm Water Supplies*

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 0 hours 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 re-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 License, such as an Agriculture Exterminator Licence or a Greenhouse/Interior Plant Exterminator Licence) may need to enter a treated area early to do short-term tasks before the end of the REI. In these cases, the Certified Farmer or Licensed Commercial Applicator may enter between 4–12 hr after the application wearing a NIOSH-approved respirator and any other protective clothing (PC) and 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 1–1 for an example of a 24-hr REI on a pesticide label.

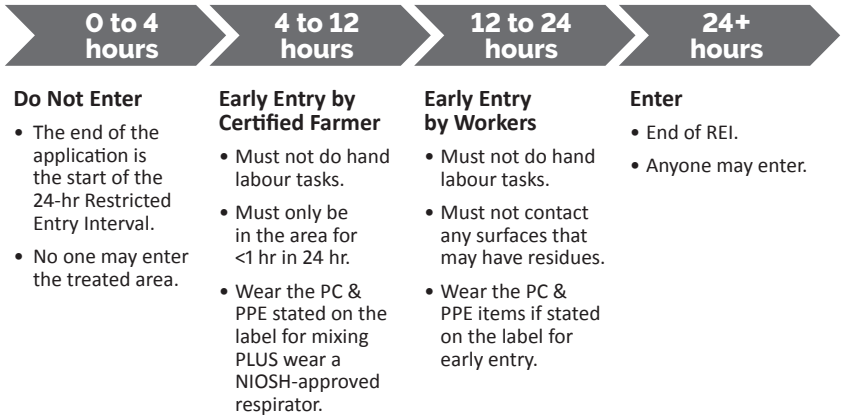

Figure 1–1. Example of a 24-hr REI on a pesticide label.

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

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

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

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

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

Spray Buffer Zones

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

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

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

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

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

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

Vegetative Filter Strips

A vegetative filter strip is:

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

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

Protect the Environment

Protect Water sources

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

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

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

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

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

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

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

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

Bee Poisoning

Honeybees, native bee species (e.g., bumble bees, squash bees) and other pollinating insects are important pollinators for many Ontario crops. Insecticides, some of which may negatively affect bees, require careful management to achieve both pollination and insect control. 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 for “Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices” at www.canada.ca.

- Systemic insecticides may also pose a high risk to bees and other insect pollinators. Bees can be exposed to insecticide residues in or on flowers, leaves, pollen, nectar and/or surface water. Do not apply insecticide or allow it to drift onto blooming crops or off-site habitat if bees are foraging in or adjacent to the treatment area.
- In crop settings where pesticide use is highly likely, beekeepers should remove honeybee colonies as soon as pollination and bloom are complete in the crop and before any insecticides are applied post bloom. In emergency situations, if the colonies cannot be removed in time, beekeepers can place burlap or cloth soaked in water at the entrance of the hive to disrupt the flight of the bees for up to 12 hr and provide more time for spray to dry. To help prevent overheating of the hive during this time, keep an opening of 2.5 cm on each side of the hive entrance so bees can still get out and ventilate the hive. Also, the water on the burlap or cloth will help cool the colony.
- Not all pesticides are equally toxic to bees. If there is a risk of 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 pesticide label for guidance. Some pesticides cannot be used when bees are active in the crop.

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

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

Manage drift

Pesticide drift is the aerial movement and unintentional deposit of pesticide outside the target area. Drift results in wasted product 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 direction is changeable, or wind speeds are high or gusty. These conditions increase the potential for off-target drift. While most pesticide labels indicate allowable wind speeds, some do not.
- Regularly monitor wind conditions during spraying, preferably in the field with a handheld wind meter at nozzle height. Record the wind speed and direction. As conditions change, make adjustments to manage drift potential. Adjustments may include a coarser droplet size, minimizing nozzle-to-target distance, slowing travel speed, changing nozzle technology, using a drift reducing spray additive or discontinuing spraying until conditions improve.
- Do not spray during periods of dead calm. Periods of dead calm may occur between late evening and early morning and can result in the vapor or fine spray droplets remaining aloft, like fog. Spray-filled air can move unpredictably over great distances several hours after the spray event is completed.

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

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

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

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

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

- 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.
- Where practical, use air induction nozzles, which significantly reduce drift compared to conventional nozzles.
- Minimize the distance between nozzle and target as much as possible while still maintaining spray uniformity.
- Establish buffer zones for the protection of adjacent sensitive areas. Some pesticide labels will state buffer zone setbacks; follow these carefully.
- Use drift reduction technology, such as hoods, shrouds, screens or air curtains.
- If appropriate, use drift-reducing adjuvants in the spray tank. The intense agitation in airblast sprayers has been shown to reduce the effectiveness of drift-reducing adjuvants. Certain combinations of drift-reducing adjuvants and air- induction nozzles have been shown to increase the incidence of fine droplets.
- When possible, use non-volatile pesticide formulations or products.

For more information about spray drift, see:

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

Waste Management (Container Disposal)

Empty Pesticide and Fertilizer containers up to 23 L

Never re-use empty pesticide containers.

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

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

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

Empty Seed And Pesticide Bags

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

Surplus Spray Mix

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

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

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

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

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

Surplus Pesticide Disposal

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

- Contact the supplier. It is sometimes possible to return unused pesticide if it is still in its original, unopened container.
- Hire a licensed waste hauler who is licensed under Part V of the *Environmental Protection Act* to carry hazardous wastes.
- Cleanfarms operates a free Obsolete Pesticide and Animal Health Product Collection Program throughout the province every 3 years. To locate the closest collection point and date, visit the Cleanfarms website (www.cleanfarms.ca), contact Cleanfarms at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca or contact your local dealer for program details.
- Contact your municipality to see if any hazardous waste collection days are scheduled and verify whether quantities of agricultural pesticides will be accepted.

Storing Pesticides

Ontario's *Pesticides Act* and Regulation 63/09 provide details on storage requirements for pesticide storage facilities. As shown in Table 1–1, the storage requirements that must be followed are dependent on which classes of pesticides you store.

Table 1–1. Requirements for Pesticide Storage Facilities

	Pesticide Classes		
Storage requirements	**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 MECP 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 Ontario Ministry of the Environment, Conservation and Parks 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 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:

Ontario Poison Centre: 1-800-268-9017
(TTY) 1-877-750-2233

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

2. Pesticide Toxicity and Activity

LD_{50} is a measure of relative toxicity. It is the amount of product in milligrams used, per kilogram of body weight, that kills 50% of the test animals. This is commonly measured as the acute oral LD_{50}, which refers to the toxicity of the chemical when it is ingested through the mouth or nose. Dermal LD_{50} figures are also available. These refer to the toxicity of the chemical when it enters the body through the skin. The lower the LD_{50} figure, the more toxic the product is to humans.

The LD_{50} of various pesticides is listed in Table 2–1. *Insecticide and Miticide Toxicity* and Table 2–2. *Fungicide Toxicity*.

Note: Many pesticides with low acute toxicity cause long-term effects in laboratory animals. Users are therefore warned that even pesticides with high LD_{50} values could be detrimental to human health. Reduce exposure to all pesticides to a minimum by wearing protective clothing, including latex gloves, goggles and long-sleeved shirts. See Chapter 1 for more details.

Read every product label to ensure that the product is used properly and safely.

Pesticide Injury to Vegetable Crops

Although greenhouse pesticides have been selected and formulated to avoid plant injury, damage can still occur under some conditions. Consider these general rules before applying pesticides:

- No product is safe on all plants under all conditions, although wettable powders are generally less injurious than liquid formulations.
- Weather conditions at the time of application are important. Pesticides are more likely to harm plants when applied during bright, sunny weather than if applied during dull, overcast conditions.
- Well-watered, unstressed plants are less likely to be damaged by pesticides.
- Low-volume applications are generally less likely to cause plant injury than high-volume applications.
- Excessive spray pressure may damage leaf tissue.

Table 2–1. Insecticide and miticide toxicity

Common Name or Active Ingredient	Trade Name	Oral LD_{50} (mg product/ kg body weight)*
abamectin	Avid 1.9% EC	300
acequinocyl	Shuttle 5 SC	>5,000
acetamiprid	Tristar 70 WSP	1,064
Autographa californica Nucleopolyhedrovirus FV11	Loopex	not available
Bacillus thuringiensis subsp. *aizawai* strain ABTS-1857	XenTari WG	>5,000
Bacillus thuringiensis subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	>5,000
Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF DiPel WP	>5,050
	Foray 48BA	>5,000
Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	BioProtec 3P BioProtec CAF	not available
Bacillus thuringiensis subsp. *kurstaki* strain SA-12	Thuricide HPC	not available
Beauveria bassiana strain ANT-03	Bio-Ceres G WB Bio-Ceres G WP	>5,000
Beauveria bassiana strain GHA	BotaniGard 22WP	>5,000
Beauveria bassiana PPRI 5339	Velifer	>5,000
bifenazate	Floramite SC	>5,000
buprofezin	Talus	>5,000
canola oil	Vegol Crop Oil	>5,000
chlorantraniliprole	Coragen SC	>5,000
chlorfenapyr	Pylon	560–567
cyantraniliprole	Exirel	>5,000
cyprodinil + fludioxonil	Palladium WG	>5,000
cyromazine	Citation 75 WP	>4,460
dichlorvos	DDVP 20% EC	56
etoxazole	TetraSan 5 WDG	4,500
fenbutatin oxide	Vendex 50W Vendex 50WP	>5,000
fenpyroximate	FujiMite	Male: 7,193 Female: 6,789
flonicamid	Beleaf 50 SG	>2,000
flupyradifurone	Altus	Female: >2,000
garlic	Influence LC Influence WP	>5,000
imidacloprid	Intercept 60 WP	1,858
lambda-cyhalothrin	Matador 120 EC	93
malathion	Fyfanon 50% EC	89
	Malathion 85 E	5,500
Metarhizium anisopliae strain F52	Met52 EC	not available
mineral oil	Purespray Green Spray Oil 13E	>5,000
naled	Dibrom	235
novaluron	Rimon 10 EC	3,914
permethrin	Ambush 50 EC	2,280
	Bio-environmental Permethrin	not available
	Pounce 384 EC	1,030
potassium salts of fatty acids	Kopa Insecticidal Soap Neudosan Commercial Opal Insecticidal Soap Opal2 Insecticidal Soap Safer's Insecticidal Soap	>5,000
potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap	>5,000
pymetrozine	Endeavor 50 WG	>5,000
pyridaben	Dyno-Mite 75 WP SanMite	1,930
pyriproxyfen	Distance	>3,773
spinetoram	Delegate WG	>5,000
spinosad	Entrust 80 W Entrust SC Success	>5,000
spiromesifen	Forbid 240 SC	>2,000
spirotetramat	Kontos	>2,000
tebufenozide	Confirm 240 F	>5,000
thiamethoxam	Flagship WG	>5,000

* Figures obtained from Safety Data Sheets for each individual product.

Table 2–2. Fungicide toxicity

Common Name or Active Ingredient	Trade Name	Oral LD_{50} (mg product/ kg body weight)*
ametoctradin + dimethomorph	Zampro	
Aureobasidium pullulans DSM 14940 and DSM 14941	Botector	>2,000
Bacillus amyloliquefaciens strain D747	Double Nickel 55 Double Nickel LC	>5,000
Bacillus mycoides isolate J	LifeGard WG	>5,000
Bacillus subtilis strain MBI 600	Serifel	>5,000
Bacillus subtilis strain QST 713	Cease Rhapsody ASO	>5,000
Bacillus subtilis var. *amyloliquefaciens* strain FZB24	Taegro2 WP Taegro WP	very low acute oral toxicity
bacteriophage of *Clavibacter michiganensis* subsp. *michiganensis*	AgriPhage-CMM	no toxicity reported
BLAD polypeptide	Fracture Problad Plus	>5,000
boscalid + pyraclostrobin	Pristine	>1,490
captan	Captan 50 WP Captan 80 WP Maestro 80 DF Supra Captan 80 DF	>5,000
citric and lactic acid	Cyclone	Citric acid: >3,000 Lactic acid: >4,000
copper hydroxide	Kocide 3000 DF	1,847
copper octanoate	Cueva Commercial	>2,000
copper oxychloride	Copper Spray Fungicide WP	1,600
cyazofamid	Torrent 400 SC	>5,000
cyprodinil + fludioxinil	Palladium WG	>5,000
fenhexamid	Decree 50 WDG	>2,000
ferbam	Ferbam 76 WDG	>5,000
garlic powder	Influence LC Influence WP	not available
Gliocladium catenulatum strain J1446	Prestop	>2,000
hydrogen peroxide	StorOx	330
hydrogen peroxide + peroxyacetic acid	OxiDate OxiDate 2.0	3,622
iprodione	Rovral 50 WP Rovrol WDG	>2,000
kasugamycin	Kasumin 2L	>5,000
mancozeb	Manzate 200 WP Manzate DF Manzate Pro-Stick	>5,000
mandipropamid	Micora Revus	>5,000
metalaxyl-m	Ridomil Gold 480 EC Ridomil Gold 480 SL Subdue Maxx	1,172
mineral oil	Purespray Green Spray Oil 13E	>5,000
mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	>5,000
mono- and di-potassium salts of phosphorous acid	Confine Extra Rampart	>5,000
myclobutanil	Nova 40 W	3,129
oxathiapiprolin	Orondis Orondis Ultra B Zorvec Enicade	>5,000
penthiopyrad	Fontelis	>5,000
polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	not available
potassium bicarbonate	MilStop Sirocco	2,700
propamocarb hydrochloride	Previcur N	2,000
pyrimethanil	Scala SC	>5,000
Reynoutria sachalinensis (extract)	Regalia Maxx	>5,000
Streptomyces griseoviridis strain K61	Mycostop WP	>5,000

* Figures obtained from Safety Data Sheets for each individual product.

Table 2–2. Fungicide toxicity

Common Name or Active Ingredient	Trade Name	Oral LD_{50} (mg product/ kg body weight)*
Streptomyces lydicus strain WYEC 108	Actinovate SP	no toxicity reported
sulphur	Agrotek Vaporized Sulphur Bartlett Microscopic Wettable Sulphur Cosavet DF Edge Kumulus DF Microscopic Sulphur WP	>5,000
	Kumulus DF	>2,200
	Microthiol Disperss	>2,000
tea tree oil	Timorex Gold	>2,000
Trichoderma harzianum Rifai strain KRL-AG2	Bora HC Bora WP	Active ingredient is practically non-toxic and non-pathogenic to mammals
Trichoderma harzianum Rifai strain KRL-AG2	RootShield Granules RootShield HC RootShield WP	Active ingredient is practically non-toxic, non-allergenic and non-pathogenic to mammals
Trichoderma harzianum Rifai strain KRL-AG2 + Trichoderma virens strain G-41	BW240 WP	not available
Trichoderma harzianum Rifai strain T-22	Trianum G Trianum P	not available

* Figures obtained from Safety Data Sheets for each individual product.

3. Biological Control Agents Used in Greenhouse Vegetable Crops

Greenhouse vegetable growers use biological control (biocontrol) agents as an integral part of their IPM programs for managing insect and mite pests. Table 3–1 lists commercially available biocontrol agents for major pest species in greenhouse vegetables.

Table 3–1. Biocontrol agents for major greenhouse pests

Use caution when using pesticides along with biocontrols because many pesticides are harmful to beneficial insects. Using even one application of harmful pesticide can prevent any further use of biocontrol agents for an extended period of time. Check the following websites for information on compatibility of pesticides with biocontrols: https://www.biobestgroup.com/en/side-effect-manual and https://www.koppert.ca/en/products/side-effects/.

LEGEND: * = Parasitoids: These usually require only one host for completion of development, often killing it by living on or in its body.
** = Predators: These feed on their prey (pest) by catching them but otherwise live independently of them. They must consume more than one individual to reach maturity.
*** = Entomopathogen (i.e. microorganisms that are pathogenic to arthropods)

Pests	Biocontrol Agent
Aphids: various species	*Aphelinus abdominalis* (parasitic wasp)*
Foxglove aphid (*Aulacorthum solani*)	*Aphidius colemani* (parasitic wasp)*
Green peach aphid (*Myzus persicae*)	*Aphidius ervi* (parasitic wasp)*
Melon aphid (*Aphis gossypii*)	*Aphidius matricariae* (parasitic wasp)*
Potato aphid (*Macrosiphum euphorbiae*)	*Aphidoletes aphidimyza* (predatory midge)**
	Beauveria bassiana (fungus sold as BotaniGard, Bio-Ceres)***
	Chrysopa carnea (lacewing)**
	Hippodamia sp. (lady beetle)**
Caterpillars (loopers, European corn borers)	*Autographa californica* Nucleopolyhedrovirus (baculovirus sold as Loopex)***
	Bacillus thuringiensis subsp. *aizawai* (bacterium sold as XenTari)***
	Bacillus thuringiensis subsp. *kurstaki* (bacterium sold as DiPel, Foray, Bioprotec, Thuricide)***
	Trichogramma spp. (parasitic wasps)*
Fungus gnat (*Bradysia* and *Corynoptera* spp.)	*Bacillus thuringiensis* subsp. *israelensis* (bacterium sold as VectoBac)***
	Dalotia coriaria (predatory beetle)**
	Gaeolaelaps gillespiei (predatory mite)**
	Steinernema sp. (nematode)**
	Stratiolaelaps scimitus (=*Hypoaspis miles*) (predatory mite)**
Leafminer (*Liriomyza* spp.)	*Dacnusa sibirica* (parasitic wasp)*
	Diglyphus isaea (parasitic wasp)*

Table 3–1. Biocontrol agents for major greenhouse pests

Use caution when using pesticides along with biocontrols because many pesticides are harmful to beneficial insects. Using even one application of harmful pesticide can prevent any further use of biocontrol agents for an extended period of time. Check the following websites for information on compatibility of pesticides with biocontrols: https://www.biobestgroup.com/en/side-effect-manual and https://www.koppert.ca/en/products/side-effects/.

LEGEND: * = Parasitoids: These usually require only one host for completion of development, often killing it by living on or in its body.
** = Predators: These feed on their prey (pest) by catching them but otherwise live independently of them. They must consume more than one individual to reach maturity.
*** = Entomopathogen (i.e. microorganisms that are pathogenic to arthropods)

Pests	Biocontrol Agent
Two-spotted spider mite (*Tetranychus urticae*)	*Amblyseius andersoni* (predatory mite)**
	Chrysopa carnea (lacewing)**
	Feltiella acarisuga (predatory midge)**
	Metarhizium anisopliae (fungus sold as Met52)***
	Neoseiulus (=*Amblyseius*) *californicus* (predatory mite)**
	Neoseiulus (=*Amblyseius*) *fallacis* (predatory mite)**
	Phytoseiulus persimilis (predatory mite)**
	Stethorus punctillum (predatory beetle)**
Whitefly (*Trialeurodes vaporariorum* or *Bemisia* spp.)	*Amblydromalus limonicus* (predatory mite)**
	Amblyseius swirskii (predatory mite)**
	Beauveria bassiana (fungus sold as BotaniGard, Bio-Ceres)***
	Chrysoperia carnea (lacewing)**
	Delphastus catalinae (predatory beetle)**
	Dicyphus hesperus (predatory bug)**
	Encarsia formosa (parasitic wasp)*
	Eretmocerus eremicus (parasitic wasp)*
	Metarhizium anisopliae (fungus sold as Met52)
Western flower thrips (*Frankliniella occidentalis*)	*Amblydromalus limonicus* (predatory mite)**
	Amblyseius swirskii (predatory mite)**
	Beauveria bassiana (fungus sold as BotaniGard, Bio-Ceres)
	Chrysoperia carnea (lacewing)**
	Dalotia coriaria (predatory beetle)**
	Metarhizium anisopliae (fungus sold as Met52)***
	Neoseiulus (=*Amblyseius*) *cucumeris* (predatory mite)**
	Orius spp. (predatory bug)**
	Steinernema feltiae (nematode)**
	Stratiolaelaps scimitus (= *Hypoaspis miles*) or *Gaeolaelaps gillespiei, Gaeolaelaps aculeifer* (=*Hypoaspis aculeifer*) (predatory mite)**

4. Tomatoes

Products registered for greenhouse tomato insect and mite pests are listed in Table 4–1.
Products registered for greenhouse tomato diseases are listed in Table 4–2.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval
* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L/100 m^2). **REI: 24 hr (must be fully ventilated before re-entry)**
	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paintbrush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	imidacloprid	Intercept 60 WP	16 g/60 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not exceed 1 application per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
4D	flupyradifurone	Altus	**Foliar:** 500–750 mL/ha **Drench:** 750–1,000 mL/ha (7.5–10 mL/100 m^2)	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Drench: Application to soil or soilless media should be made with sufficient water to ensure Incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. **REI: 12 hr**
9B	pymetrozine	Endeavor 50 WG	100–200 g in a minimum of 1,000 L water/ha	3	**Green peach aphid (*Myzus persicae*), melon aphid (*Aphis gossypii*)** Do not exceed 200 g in 1,000 L water per application. Do not exceed 2 applications per crop cycle or 3 applications per year in greenhouses with multiple crop cycles. Apply as a foliar spray. Minimum interval between applications is 7 days. On hard-to-wet plants, label recommends adding a non-ionic or organosilicone-based surfactant to improve coverage. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
23	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate per single application:** 300 mL/ha (72 g a.i./ha)	3	Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712–1,000 L per hectare (30–42 mL concentration). Use the higher concentration for higher pest infestation levels. Minimum interval between applications is 7–14 days. Do not exceed 900 mL per hectare (216 g a.i./ha) per crop cycle. Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**
UNF	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB* Bio-Ceres G WP*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when used early, before high insect populations develop. Repeat applications within 7 days as needed This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Do not re-enter treated areas until the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days (2–5 days for high populations). Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0 hr**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
NC	canola oil	Vegol Crop Oil*	1-part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pests appear. Repeat applications every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water		Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
BANANA MOTH (*Opogona sacchari*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.8 kg/1,000 L water	0	Foliar application. Make application just prior to egg hatch. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stems is necessary (minimum of 300 L water per hectare). Repeat application every 7 days as needed. **REI: NS**
		Bioprotec CAF*	1.6 L/1,000 L water		
BEET ARMYWORM (*Spodoptera exigu*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
CORN EARWORM (TOMATO FRUITWORM) (*Helicoverpa (=Heliothis) zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Do not re-enter treated areas until the spray has dried.**
DUPONCHELIA FOVEALIS					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	625 g/1,000 L water	0	Make applications when egg hatch is essentially complete, when larvae are small, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stem is necessary. Repeat applications every 7 days as needed. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.8 kg/1,000 L water	0	Foliar and drench application. Make application when egg hatch is essentially complete, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well, and into the top layer of the soil around the base of the plant. Thorough coverage of foliage and stems is necessary. Repeat applications every 7 days as needed. **REI: NS**
		Bioprotec CAF*	1.6 L/1,000 L water		
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap Concentrate			
EUROPEAN CORN BORER (*Ostrinia nubilalis*)					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	Do not exceed application volume of 2,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L water **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**
LEAFHOPPERS					
4D	flupyradifurone	Altus	**Foliar:** 500–750 mL/ha **Drench:** 750–1,000 mL/ha (7.5–10 mL/100 m^2)	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Drench: Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. **REI: 12 hr**
LEAFMINERS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paintbrush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	1	***Liriomyza* spp.** Application should be made, preferably in 2,000–4,000 L water per hectare. Do not exceed 1,200 mL or apply less than 600 mL product per hectare per application. Use sufficient water to obtain uniform coverage. Do not exceed 3,600 mL product per hectare per crop cycle. Do not apply through any type of irrigation system. **REI: Re-entry only after residues have dried.**

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LEAFMINERS (cont'd)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	**Tomato leafminer (*Tuta absoluta*)** Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-entry only after treated areas have dried.**
	Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	500–1,000 g/ 1,000 L water	0	**Lepidopteran leafminers** Apply at egg hatch. Thorough coverage of foliage and stems is necessary. Repeat application every 7–10 days as needed. **REI: NS**
18	tebufenozide	Confirm 240F	0.6 L/ha	2	**Lepidopteran leafminers** For suppression. Foliar application only. Use a high-volume sprayer. Apply at first egg hatch. Do not exceed 4 applications per crop cycle, if monitoring indicates it is required. Minimum interval between applications is 10 days. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. Do not use tebufenozide-treated tomatoes for processing. **REI: 12 hr**
28	chlorantraniliprole	Coragen	200 mL/1,000 L water	1	**Lepidopteran leafminers** Apply at egg hatch. Re-apply if monitoring indicates it is necessary. Thorough coverage is important to obtain optimum control. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not exceed a total of 750 mL product per hectare per crop cycle. Apply in a maximum finished spray volume of 1,250 L per hectare. **REI: 12 hr**
LEAFROLLERS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paintbrush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
LOOPERS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 1,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	240 mL/1,000 L water		
		Success	120 mL/1,000 L water		

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter only after spray is dried.**
	Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	75–150 g/250 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply at egg hatch to target young larvae (early instars). For best control, thorough coverage is required. Under heavy population pressure, or for larger larvae, shorten the spray interval or use the higher rate range. Repeat applications every 3–14 days as needed. Do not exceed 4 applications per season. **REI: NS**
		DiPel WP*	150–300 g/ 250 L water/4,000 m^2	NS	**Cabbage looper (*Trichoplusia ni*)** Apply to upper and lower portions of the leaves to run-off. Repeat applications will be necessary if a new hatch occurs. **REI: NS**
		Foray 48BA	0.6–1.8 L/ 500–1,000 L water/ha (60–180 mL/1,000 m^2)	NS	**Cabbage looper (*Trichoplusia ni*)** Apply using a high-volume spray. Repeat applications every 10 days when loopers first appear. In general, larvae should be treated when they are newly hatched. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.92 kg/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain SA-12	Thuricide HPC	5 L/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply at first sign of infestation when larvae are small. Repeat applications every 7–10 days as needed. **REI: NS**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	**Alfalfa looper (*Autographa californica*), Cabbage looper (*Trichoplusia ni*)** For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
18	tebufenozide	Confirm 240F	0.6 L (144 g a.i.)/ha	2	**Cabbage looper (*Trichoplusia ni*)** Foliar application only. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 10 days. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. Do not use tebufenozide-treated tomatoes for processing. **REI: 12 hr**

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
28	chlorantraniliprole	Coragen	125 mL/1,000 L water	1	**Cabbage looper (*Trichoplusia ni*)** Begin applications when treatment thresholds have been reached. Thorough coverage is required to obtain optimum control. Repeat applications if monitoring indicates it is necessary. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not exceed a total of 750 mL product per hectare per crop cycle. The maximum finished spray volume is 1,400 L per hectare. **REI: 12 hr**
28	cyantraniliprole	Exirel	250 mL/ha	1	**Cabbage looper (*Trichoplusia ni*)** Thorough coverage is required to obtain optimum control. Select a spray volume appropriate for the size of plants and density of foliage. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex*	50–200 mL/400 L water	0	Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L per hectare). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days as needed. **REI: Re-entry into treated areas only after mists have settled.**
MEALYBUGS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap Concentrate			

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES					
1B	naled	Dibrom	9.6 mL/100 m^3	2	**Two-spotted spider mite (*Tetranychus urticae*)** Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Application should be made preferably in 2,000–4,000 L water per hectare. Do not exceed 1,200 mL or apply less than 600 mL product per hectare per application. Use in sufficient water to obtain uniform coverage. Do not exceed 3,600 mL product per hectare per crop cycle. Do not apply through any type of irrigation system. **REI: Re-entry into treated areas only after spray has dried.**
10B	etoxazole	TetraSan 5 WDG	226.8–453.6 g (4–8 packets)/ 378.5 L water	1	**Two-spotted and carmine spider mite (*Tetranychus urticae*)** Apply sufficient spray volume to ensure thorough coverage, to a maximum of 1,870 L per hectare. Kills mite eggs and nymphs, but not adult mites. Apply at first sign of infestation and before large numbers of adult mites are present. Two applications may be made only if each application falls below a rate of 95 g a.i./ha. Make a second application if necessary, but no sooner than 21 days after the first application. Do not exceed 2 applications per crop cycle or within a 6-month period. This product is transovarial, therefore treated adult female mites will produce significantly fewer viable eggs. Use higher rates for moderate-to-heavy infestations, especially in dense plant canopies. **REI: 12 hr**
12B	fenbutatin oxide	Vendex 50W Vendex 50WP	50 g/100 L water	5	**Two-spotted spider mite (*Tetranychus urticae*)** Begin applications when mites appear and repeat as necessary to maintain control. Thorough coverage of all foliage, especially the under surface of leaves, is essential. The addition of a suitable spreader-sticker will usually result in superior mite control. Not highly injurious to beneficial mites and is non-toxic to honeybees. Do not spray when the temperature in the greenhouse is over 32°C. **REI: 12 hr; 48 hr for high foliar-contact activities**
13	chlorfenapyr	Pylon	20–30 mL/100 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**

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MITES (cont'd)					
20B	acequinocyl	Shuttle 15 SC	0.21–0.46 L/500 L water (0.07–0.15 g a.i./L of solution)	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage. Thorough coverage is essential for effective control. Actual spray volume will vary depending on the size of the plants being sprayed. Application should be made as soon as the mite population reaches economic infestation levels. Apply the higher concentration for heavy pest infestations. Minimum interval between applications is 21 days. Do not exceed 2 applications per crop cycle (0.69 kg a.i./ha). **REI: 12 hr**
20D	bifenazate	Floramite SC	125 mL (30 g a.i.)/ 400 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to obtain uniform coverage. Actual spray volume will vary depending on the size of the plants being treated. Application should be made as soon as mites appear and will provide residual control for up to 28 days. Do not exceed 2 applications per crop cycle. Make only 1 application of this product before rotating to products of an alternate chemical class. This product is primarily active on the motile stages of mites. It is not effective against rust mites, broad mites and flat mites. **REI: 12 hr**
21A	pyridaben	Dyno-Mite WP SanMite WP	284 g/1,000 L water/ha	2	**Two-spotted spider mite (*Tetranychus urticae*)** Do not exceed 2 applications per crop cycle. Minimum interval between applications is 28 days. Do not apply this product through any type of irrigation system. Do not apply as a fog. Do not use pyridaben-treated tomatoes for processing. **REI: 12 hr**
	fenpyroximate	FujiMite	2.5 L/ha	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1,000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Two-spotted spider mite (*Tetranychus urticae*)** Repeat applications every 10–14 days as needed. Do not exceed 2 applications per crop cycle. Avoid applying during the warmest part of the day. Mite juvenile stages are often more susceptible than adults. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**

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MITES (cont'd)					
UNF	*Beauveria bassiana* PPRI 5339	Velifer	450–900 mL/1,000 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat applications every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-entry only after the spray has dried.**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in the morning, in the evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Repeat application once per week for 2–3 weeks. **REI: NS**
		Safer's Insecticidal Soap Concentrate			

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of mite presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Mites, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	For suppression. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water		**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Repeat application once per week for 2–3 weeks. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Spray all plant parts once weekly for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**
PSYLLIDS					
6	abamectin	Avid 1.9% EC	30 mL/100 L water	1	**Tomato psyllid (*Bactericerca cockerelli*)** Application should be made in 2,000–4,000 L water per hectareha. Do not exceed 1,200 mL or apply less than 600 mL product per hectare per application. Use in sufficient water to obtain uniform coverage. Apply no more than 3,600 mL product per hectare per crop cycle. Do not apply through any type of irrigation system. **REI: Re-entry into treated areas only after the spray has dried.**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PSYLLIDS (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
SCALE					
NC	canola oil	Vegol Crop Oil	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
THRIPS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Use the higher rate when insect populations are high and/or insects are large. Apply when western flower thrips first appear. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Maximum application volume that can be used is 2,000 L per hectare. Apply when western flower thrips first appear. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
28	cyantraniliprole	Exirel	500–1,000 mL/ha	1	For suppression. Use the higher listed rate and higher spray volumes for large plants or dense foliage. If thrips populations are above thresholds, use a registered knockdown product before application. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
THRIPS (cont'd)					
UNF	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB* Bio-Ceres G WP*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when used early, before high insect populations develop. Repeat applications within 7-days as needed. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Re-entry into treated areas only after the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Foliar application method: Spray to wet but avoid run-off. Repeat applications every 5–10-days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/ 1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat applications every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water **Drench:** 108 mL/10 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat applications every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL per 4-L pot or grow bag. Repeat applications as needed. Do not apply via drip irrigation. **REI: Re-entry into treated areas only after the spray has dried.**
NC	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	For suppression. Apply when pests appear. Repeat applications every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
TOBACCO BUDWORM (*Heliothis virescens*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-entry into treated areas only after the spray has dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
TOMATO HORNWORM (*Manduca quinquemaculata*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.46–0.92 kg/ 1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain SA-12	Thuricide HPC	2.5–5 L/1,000 L water	0	Apply at first sign of infestation when larvae are small and repeat at 7–10-day intervals when needed to maintain control. **REI: NS**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and other beneficial insects. **REI: 12 hr**
WHITEFLIES					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L per 100 m^2). Thoroughly ventilate premises before re-entering on the day following treatment. **REI: 24 hr**
	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
3A	permethrin	Ambush 50 EC	20 mL/100 L water	1	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Apply to cover all foliage thoroughly. Repeat application as necessary to maintain control. **REI: NS**
		Bio-environmental permethrin	185 mL/L water	1	Spray for thorough coverage of upper and lower leaf surfaces or treated area. Apply when insects or damage first appears and then as necessary. Do not use when air temperature is less than 12°C or greater than 30°C. **REI: NS**
		Pounce 384 EC	260 mL/1,000 L water	1	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Apply to thoroughly cover all foliage. Repeat as necessary. **REI: Re-entry into treated areas is permissible as soon as the spray deposit has dried.**
4A	acetamiprid	Tristar 70 WSP	15 packs/2 ha (1 pack/1,333 m^2)	1	Do not exceed 2 applications per year. Apply through drip irrigation to the growing media. Alternate applications with an insecticide with a different mode of action. Repeat applications every 21 days as needed. **REI: 12 hr**
	imidacloprid	Intercept 60 WP	16 g/60 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not exceed one application per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
4D	flupyradifurone	Altus	**Foliar:** 750–1,000 mL/ha **Drench:** 1,500–2,000 mL/ha (15–20 mL/100 m^2)	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Drench: Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate Irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. **REI: 12 hr**
7C	pyriproxyfen	Distance	45 mL/100 L water	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci B biotype*) and sweet potato whitefly (*Bemisia tabaci*)** Apply as a foliar spray mixture uniformly to all plant surfaces and to the point of run-off. Make first application when adult insects begin to appear. Repeat application after 14–28 days as needed. Use longer interval when plants are not growing rapidly. Do not exceed 2 applications per crop cycle. If the cropping cycle is less than 6 months, do not exceed 2 applications per 6 months. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
15	novaluron	Rimon 10 EC	650–835 mL/ha	2	For suppression. Apply in sufficient water volume to ensure thorough coverage. Apply In a maximum spray volume of 935 L water per hectare. Use the higher application rate when pest pressure is high, or foliage is mature. Repeat applications every 7–10 days as needed. Do not exceed 3 applications per crop cycle. Toxic to certain beneficial insects (e.g. predatory mites, parasitoid wasps) and may be toxic to bee colonies exposed to direct treatment, drift, or residues on flowering crops or weeds. **REI: 12 hr**
16	buprofezin	Talus	36–43 g/100 L	2	Apply when adults first appear. Use the higher application rate when pest pressure is high. Minimum interval between applications is 21 days. Do not exceed 2 applications per crop cycle. When using 36 g per 100 L, apply no more than 870 L spray solution per hectare. When using 43 g per 100 L, apply no more than 730 L of spray solution per hectare. **REI: 48 hr**
21A	fenpyroximate	FujiMite	2.5 L/ha	1	For suppression. Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci B biotype*) and sweet potato whitefly (*Bemisia tabaci*)** Repeat application every 10–14 days as needed. Do not exceed 2 applications per crop cycle. Avoid applying during the warmest part of the day. Effective against nymphs and has some effect on the pupal stage. Will not reduce adult whitefly populations. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**
	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate/ single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712–1,000 L per hectare (42–30 mL concentration). Use the higher concentration for higher pest infestation levels. Minimum interval between applications is 7–14 days. Do not exceed 900 mL (216 g a.i./ha) per hectare per crop cycle. Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**
28	cyantraniliprole	Exirel	750–1,000 mL/ha	1	Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
29	flonicamid	Beleaf 50 SG	0.2 g/L water	0	Foliar application. Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle. Apply sufficient volume to ensure good coverage. The spray volume can vary from 500–1,000 L per hectare, depending on the size of the plants. The maximum volume should be used when plant foliage is dense. **REI: 12 hr**
UNF	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB* Bio-Ceres G WP*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when applied before high insect populations develop. Repeat application within 7 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Re-entry into treated areas only after the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but avoid run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/ 1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-entry into treated areas only after the spray has dried.**

[1] See Appendix F for IRAC group definitions.

Table 4–1. Products registered for greenhouse tomato insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC[1] Group No.	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 100 parts water		Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**
		Safer's Insecticidal Soap*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2-week intervals. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BACTERIAL CANKER (BACTERIAL STEM CANKER) (*Clavibacter michiganensis subsp. michiganensis*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not exceed 3 applications per season. Minimum interval between applications is 7 days. Do not exceed 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
M 01	copper hydroxide	Kocide 3000 DF*	1.86 kg (558 g a.i.)/ha	1	For suppression. Repeat applications to propagation house tomatoes every 5 days. Do not exceed 5 applications over a 4-week period. Repeat applications to production house tomatoes every 7–10 days. **REI: 24 hr**
	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat applications every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
	copper oxychloride	Copper Spray Fungicide WP*	3 kg/1,000 L water/ha	2	Apply early in the growing season. Repeat applications every 7–10 days. Do not exceed 10 applications per year. **REI: 24 hr**
NC	bacteriophage of *Clavibacter michiganensis* subsp. *michiganensis*	Agriphage — CMM*	**Seedling treatment:** 12 mL/100 m^2 **Production treatment:** 40 mL/100 m^2	0	For suppression. Begin applications to seedlings (at the 4-leaf stage), immediately after planting or grafting. Repeat applications every 3–4 days. Apply prior to or at the early onset of disease development, or when conditions are conducive to heavy disease pressure, and continue throughout the growing season. Thorough coverage and wetting of all foliage is essential for effective disease control. **REI: NS**
	citric and lactic acid	Cyclone*	2.4% dilution in water solution	0	For suppression. Apply prior to, or at the early stages of disease development. Apply as foliar spray until runoff. Repeat applications every 5–10 days. Can leave white hydrosoluble residues on treated crop. Label recommends using a surfactant to achieve better coverage of leaves and better efficacy. **REI: 4 hr**
BACTERIAL SPECK (BACTERIAL BLIGHT) (*Pseudomonas syringae* pv. *tomato*)					
44	*Bacillus subtilis* var. *amyloliquefaciens* strain FZB24	Taegro 2 WP*	187.5–375 g/ha in minimum of 187 L water	0	For partial suppression. Apply after emergence as a foliar spray. Repeat applications every 7–14 days when conditions are conducive to disease development. **REI: 0**
	Bacillus subtilis strain QST 713	Cease*	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat applications every 7–10 days as needed. **REI: NS**
		Rhapsody ASO*			
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat applications every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	1.25–2.5 mL/L water (0.125%–0.25% v/v)	0	For suppression. Begin applications at the first sign of disease or when conditions become conducive for disease development. Repeat applications every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-entry into treated areas only after the spray has dried.**

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BACTERIAL SPECK (BACTERIAL BLIGHT) (*Pseudomonas syringae* pv. *tomato*) (cont'd)					
P 06	*Bacillus mycoides* isolate J	LifeGard WG*	0.33 g/L water	0	For partial suppression. Apply in sufficient volume to provide uniform coverage. Do not apply less than 70 g per hectare. Repeat applications every 7–14 days. **REI: 4 hr**
BACTERIAL SPOT (BACTERIAL BLIGHT, BACTERIAL LEAF SPOT) (*Xanthomonas campestris* pv. *vesicatoria*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not exceed 3 applications per season. Minimum interval between applications is 7 days. Do not exceed 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
44	*Bacillus subtilis* var. *amyloliquefaciens* strain FZB24	Taegro 2 WP*	187.5–375 g/ha in minimum of 187 L water	0	For partial suppression. Apply after emergence as a foliar spray. Repeat applications every 7–14 days when conditions are conducive to disease development. **REI: 0**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat applications every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	1.25–2.5 mL/L water (0.125%–0.25% v/v)	0	For suppression. Begin applications at the first sign of disease or when conditions become conducive for disease development. Repeat applications every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-entry into treated areas only after the spray has dried.**
P 06	*Bacillus mycoides* isolate J	LifeGard WG*	0.33 g/L water	0	For suppression. Apply in sufficient volume to provide uniform coverage. Do not apply less than 70 g per hectare. Repeat applications every 7 days. **REI: 4 hr**
EARLY BLIGHT (*Alternaria solani*)					
7	fluopyram	Luna Privilege	150–300 mL/ha	0	Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Use a higher rate when disease pressure is high or when conditions are favourable for disease development. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.2 m: 1,000 L/ha 2.7 m: 1,000–1,500 L/ha **REI: 12 hr**
	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	For suppression. Begin applications prior to disease development. Repeat application after 7–10 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 5.25 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
EARLY BLIGHT (*Alternaria solani*) (cont'd)					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	537–926 mL/ha (29–50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain suppression. Do not apply more than 150 g a.i. per hectare per year. **REI: Re-entry into treated areas only after the spray has dried.**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	0.5–2 kg/ha	0	Apply from flowering to fruiting. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Re-entry into treated areas only after the spray has dried.**
		Double Nickel LC*	2.5–10 L/ha		
	Bacillus subtilis var. *amyloliquefaciens* strain FZB24	Taegro 2 WP*	187.5–375 g/ha in minimum of 187 L water	0	For partial suppression. Apply after emergence as a foliar spray. Repeat applications every 7–14 days when conditions are conducive to disease development. **REI: 0**
46	tea tree oil	Timorex Gold*	1.5–1.88 L/ 400–1,200 L water/ha	2	For suppression. Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage are required. For preventative treatments, repeat application every 7–14 days, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
M 03	mancozeb	Manzate 200 WP	2.25 kg/ha	7	Repeat application every 7–12 days to keep new growth covered. **REI: NS**
		Manzate DF	2.4 kg/ha		Repeat application every 7–12 days to keep new growth covered. **REI: 24 hr**
		Manzate Pro-Stick			
P 06	*Bacillus mycoides* isolate J	LifeGard WG*	0.33 g/L water	0	For suppression. Apply in sufficient volume to provide uniform coverage. Do not apply less than 70 g per hectare. Repeat applications every 7 days. **REI: 4 hr**

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*)					
2	iprodione	Rovral WP Rovral WDG	100 g/100 L water	2	Spray to run-off ensuring good coverage of the plants, particularly stem nodes, immediately following any pruning. Begin application at the first sign of disease. **REI: 12 hr**
7	fluopyram	Luna Privilege	**Foliar:** 500 mL/ha **Drench:** 40 mL/1,000 plants	0	Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 2 applications per crop cycle. Minimum interval between applications is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.2 m: 1,000 L/ha 2.7 m: 1,000–1,500 L/ha Drench: Do not apply prior to flowering on the 9th truss or before March 1st. Apply as part of a normal irrigation cycle, late in the day on last watering. Avoid applications when conditions favour rapid growth. **REI: 12 hr**
	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	Begin applications prior to disease development. Repeat application every 7–10 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 5.25 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
9	pyrimethanil	Scala SC	2 L/ha (800 g a.i./ha)	1	Apply at first sign of disease. Use a minimum spray volume of 250–600 L per hectare. Do not exceed 2 applications per growing season. Do not apply more than 1 application before alternating with a fungicide with a different mode of action. Ventilate for at least 2 hr after application. Proper ventilation after spraying is essential to avoid brown or necrotic spots that can be caused by the vapour activity of Scala SC. **REI: 24 hr**
17	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.75 kg a.i./ha)	1	Begin application when conditions favour disease development. Do not exceed 3 applications per crop cycle. Fenhexamid-treated greenhouse tomatoes cannot be used for processing. **REI: 4 hr**
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25-50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–10 days as needed to maintain suppression. Do not apply more than 150 g a.i. per hectare per year. **REI: Re-entry into treated areas only after the spray has dried.**

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*) (cont'd)					
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	**Foliar:** 1.25–3.6 kg/ha **Low disease pressure:** 0.9–1 kg/ha	0	For suppression. Apply from flowering to fruit maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Re-entry into treated areas only after the spray has dried.**
		Double Nickel LC*	**Foliar:** 6.25–18 L/ha **Low disease pressure:** 4.5–5 L/ha		
	Bacillus subtilis strain QST 713	Cease*	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat application every 7–10 days as needed. **REI: NS**
		Rhapsody ASO*			
46	tea tree oil	Timorex Gold*	1.5–2 L/ 400–1,200 L water/ha	2	Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventative treatments, repeat applications every 7–14 days as needed. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.6 kg in a minimum of 250 L water/ha	0	One application will provide control for a period of 10–14 days, depending on disease pressure. Do not apply using any type of foggers or misters. Do not exceed 1 application per crop cycle. Do not use on plants that will be transplanted. **REI: Re-entry into treated areas only after the spray has dried.**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ha in a minimum of 200–3,000 L water	1	First application should be made when disease first appears. Repeat application after 7–10 days. Do not exceed 2 applications per crop cycle. Test product on a small portion of the crop to ensure that a phytotoxic response will not occur. **REI: 24 hr**
BM 01	BLAD polypeptide	Fracture	1.5–3.3 L/ha in a minimum of 200 L water/ha	0	Begin applications prior to onset of disease development. Repeat applications every 7–10 days. Use a higher rate and shorter interval when disease pressure is moderate to high. Do not exceed 5 applications per crop cycle. **REI: NS**
		Problad Plus			
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks, with shorter intervals used under conditions of moderate to high disease pressure. **REI: 4 hr**
	Trichoderma harzianum Rifai strain KRL-AG2	Bora HC*	3.75–7.5 g/L water	NS	For suppression. Repeat application every 7–14 days as needed. **REI: 4 hr**
		RootShield HC*			For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet but avoid run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: 4 hr**

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*) (cont'd)					
M3	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	1	Apply at weekly intervals. **REI: NS**
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	2.5 mL/L (0.25% v/v)	0	For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-entry into treated areas only after the spray has dried.**
NC	*Aureobasidium pullulans* DSM 14940 and DSM 14941	Botector*	1 kg/ha in 500–2,000 L water	0	Apply preventatively if climatic conditions are favourable for infection or at first sign of disease onset. Repeat application every 7–10 days as needed. Do not exceed 5 applications per year. **REI: 4 hr**
	hydrogen peroxide	StorOx*	Dilute 100 mL in 10 L water Apply 300–950 L of diluted product/ha	0	For suppression. Spray when disease first appears or when conditions are favourable for disease development. Good coverage and wetting of the foliage is required. Under severe disease conditions, reduce spray intervals and use stronger dilution rates. **REI: Re-entry into treated areas only after the spray has dried.**
	hydrogen peroxide and peroxyacetic acid	OxiDate* OxiDate 2.0*	100 mL/10 L water (1.0% v/v)	0	For suppression. Begin applications preventatively, at the first sign of disease, or when conditions are favourable for disease development. Repeat application every 7 days. Under severe disease conditions, repeat application every 5 days. Do not exceed 8 applications. **REI: 4 hr**
LEAF MOULD (*Cladosporium fulvum (=Fulvia fulva)*)					
NC	hydrogen peroxide and peroxyacetic acid	OxiDate* OxiDate 2.0*	100 mL/10 L water (1.0% v/v)	0	For partial suppression. Begin applications preventatively or at the first sign of disease and/or when conditions are favourable for disease development. Repeat application every 7 days. Under severe disease conditions, repeat application every 5 days. Do not exceed 8 applications. **REI: 4 hr**

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PHYTOPHTHORA BLIGHTS (LATE BLIGHT, PHYTOPHTHORA FOLIAR BLIGHT)					
40	mandipropamid	Micora	400–600 mL/ha (100–150 g a.i./ha)	1	***Phytophthora infestans*** Begin applications prior to disease development. Repeat applications every 7–10 days. Use of a non-ionic adjuvant (0.25% v/v) is recommended on the label. Do not exceed 4 applications per crop cycle. Water volumes guidelines: small crop (0.6 m), use 285 L/ha; medium crop (1.2 m), use 627 L/ha; large crop (2.7 m), use 1,200–1,400 L/ha
		Revus	400–600 mL/ha (100–150 g a.i./ha)	1	***Phytophthora capsici (foliar phase), Phytophthora infestans*** Water volume guidelines: small crop (0.6 m), use 285 L/ha; medium crop (1.2 m), use 627 L/ha; large crop (2.7 m), use 1,200–1,400 L/ha. Applications should begin prior to disease development. Do not exceed 4 applications per season. **REI: 12 hr**
44	*Bacillus subtilis* var. *amyloliquefaciens* strain FZB24	Taegro 2 WP* Taegro WP*	375 g/935 L water/ha	0	***Phytophthora infestans*** For suppression. Apply after emergence as a foliar spray. Repeat applications every 7 days when conditions are conducive to disease development. **REI: 0**
46	tea tree oil	Timorex Gold*	2–12 L/ 400–1,200 L water/ha	2	***Phytophthora infestans*** For suppression. Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventive treatments, repeat applications every 7–14 days, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
49	oxathiapiprolin	Orondis Orondis Ultra B Zorvec Enicade	0.175–0.35 L/ha	0	***Phytophthora infestans, Phytophthora capsici*** Foliar application only. Begin applications prior to disease development. Repeat applications every 5–14 days. Use the higher rate and shorter interval when disease pressure is high. Do not exceed 4 applications per crop cycle per year. Where multiple crop cycles are produced in the same year do not exceed 6 foliar applications or 1.4 L per hectare per year. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	***Phytophthora infestans*** Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
M 03	mancozeb	Manzate 200 WP	2.25 kg/ha	7	Repeat applications every 7–12 days to keep new growth covered. **REI: NS**
		Manzate DF Manzate Pro-Stick	2.4 kg/ha	7	Repeat applications every 7–12 days to keep new growth covered. **REI: 24 hr**
P 06	*Bacillus mycoides* isolate J	LifeGard WG*	0.33 g/L water	0	For suppression. Apply in sufficient volume to provide uniform coverage. Do not apply less than 70 g per hectare. Repeat applications every 7 days. **REI: 4 hr**

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PHYTOPHTHORA BLIGHTS (LATE BLIGHT, PHYTOPHTHORA FOLIAR BLIGHT) (cont'd)					
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora capsici*** For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 4 applications per year. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha in a minimum of 100 L water	1	***Phytophthora* spp., *Phytophthora infestans*** For suppression. Do not exceed 5 foliar and/or chemigation applications per growing season. Begin applications when conditions are favourable for disease development. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
		Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1,000 L water	0	***Phytophthora capsici*** For suppression. Use the higher rate and shorter application interval when disease pressure is high. **Foliar:** Apply lower rate every 2–4 weeks after plants become established. **Drench:** Apply with normal irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
NC	garlic powder	Influence WP*	6.9 kg/1,000 L water/ha	0	***Phytophthora infestans*** May inhibit symptoms when used in conjunction with integrated pest management strategies. Apply preventively at first signs of disease. May be applied to crop foliage or to the substrate surface, depending on the targeted disease. Repeat applications every 7–14 days. **REI: Re-entry into treated areas only after the spray has dried.**
POWDERY MILDEW					
3	myclobutanil	Nova WSP	340 g/1,000 L water/ha	3	Do not exceed 1 application per crop cycle. Apply as soon as possible after initial infection. **REI: 12 hr**
7	fluopyram	Luna Privilege	100 mL/ha	0	***Leveillula taurica*** Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.2 m: 1,000 L/ha 2.7 m: 1,000–1,500 L/ha **REI: 12 hr**

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POWDERY MILDEW (cont'd)					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	278–926 mL/ha (15–50 g a.i./ha)	0	***Oidium neolycopersici*** Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain suppression. Use a higher rate under conditions of high disease pressure. Do not exceed 150 g a.i. per hectare per year. **REI: Re-entry into treated areas only after the spray has dried.**
44	*Bacillus subtilis* var. *amyloliquefaciens* strain FZB24	Taegro 2 WP*	187.5–375 g/ha in minimum of 187 L water	0	***Leveillula taurica, Oidium neolycopersici*** For partial suppression. Apply after emergence as a foliar spray. Repeat applications every 7–14 days when conditions are conducive to disease development. **REI: 0**
46	tea tree oil	Timorex Gold*	2–12 L/ 400–1,200 L water/ha	2	***Leveillula taurica, Oidium lycopersici, O. neolycopersici*** Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventive treatments, repeat applications every 7–14 days, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.6 kg in a minimum of 250 L water/ha	0	***Erysiphe polygoni, Leveillula taurica, Oidium lycopersici*** For suppression. Do not apply using any type of foggers or misters. Do not exceed 1 application per crop cycle. Do not use on plants that will be transplanted. **REI: Re-entry into treated areas only after the spray has dried.**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 200–3,000 L water/ha	1	***Oidium lycopersici, O. neolycopersici*** First application should be made when disease first appears. Repeat application every 7–10 days. The shorter interval should be used when disease pressure is expected to be high. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. Do not exceed 3 applications per crop cycle. **REI: 24 hr**
M 02	sulphur	Agrotek Vaporized Sulphur*	0.4–3.2 g/1,000 m^2	NS	***Oidium lycopersici*** Use 1 vaporizer/1,000 m^2. Start using before plants show signs of infection. Use for 1–8 hr per night, 2–7 days/week. Do not apply if temperature is above 24°C and high humidity prevails. Certain species of beneficial insects are sensitive to sulphur. **REI: 2 hr**
		Bartlett Microscopic Wettable Sulphur*	750 g/1,000 L water/ha	1	Do not exceed 10 applications per crop cycle. Apply weekly from onset of first symptoms and during conditions favouring disease. Two applications may be sufficient to control each incidence of disease. May cause slight foliar phytotoxicity. **REI: 24 hr**

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	1.25–2.5 mL/L water (0.125%–0.25% v/v)	0	***Erysiphe cichoracearum, Leveillula taurica, Oidium neolycopersici*** For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-entry into treated areas only after the spray has dried.**
NC	garlic powder	Influence LC*	1.8% with high volume sprayer	0	***Oidium neolycopersici*** For suppression. Apply preventively or at first signs of disease. Repeat applications every 7–10 days. Ensure thorough coverage of foliage. Do not exceed 18 L per hectare. Do not use with ultra-low-volume sprayers. **REI: Re-entry into treated areas only after the spray has dried.**
		Influence WP*	6.9 kg/1,000 L water/ha	0	***Oidium neolycopersici*** For suppression. Apply preventively at first signs of disease. May be applied to crop foliage or to the substrate surface, depending on the targeted disease. Repeat applications every 7–14 days. **REI: Re-entry into treated areas only after the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	***Leveillula taurica*** For suppression. Apply when conditions are favourable for disease development and/or when first symptoms appear. Repeat applications every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium bicarbonate	MilStop*	5.6 kg/2,000 L water/ha	0	***Leveillula taurica, Oidium lycopersici*** Start application at first sign of disease. Uniform and complete coverage of the foliage is essential for the most effective results. Number of applications will depend on disease pressure. Repeat application every 7 days. Do not exceed 10 applications per season. Do not apply through any type of irrigation system. **REI: 4 hr**
		Sirocco*	5.6 kg/ha	0	***Leveillula taurica, Oidium lycopersicium*** Begin applications at the first sign of disease or when conditions are conducive to disease development. Label recommended spray volume is 1,000–2,000 L per hectare. Repeat application every 7 days. Do not exceed 10 applications per year. **REI: 4 hr**
	Streptomyces lydicus strain WYEC 108	Actinovate SP	425–840 g/ 700 L water/ha	NS	***Leveillula taurica, Oidium lycopersici*** For suppression. Make the first application when conditions are conducive to disease development. Repeat application every 7–14 days. Use the shorter application interval under high disease pressure. Spray to wet but not to the point of run-off. **REI: Re-entry into treated areas only after the spray has dried.**

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
SEPTORIA LEAF SPOT					
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	***Septoria lycopersici*** Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
M 03	mancozeb	Manzate 200 WP	2.25 kg/ha	7	Repeat application every 7–12 days to keep new growth covered. **REI: NS**
		Manzate DF	2.4 kg/ha		Repeat application every 7–12 days to keep new growth covered. **REI: 24 hr**
		Manzate Pro-Stick			
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
21	cyazofamid	Torrent 400SC	30 mL/100 L water	60	***Pythium* spp.** Apply as a soil drench to thoroughly wet the growing medium immediately after seeding. Do not exceed 1 application. Do not use any surfactant. **REI: 12 hr**
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant	1	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 seeding/seedling applications per crop cycle. Do not exceed 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (DAMPING OFF) (cont'd)					
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-entry into treated areas only after the spray has dried.** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
	Streptomyces strain K61	Mycostop WP*	See **Remarks.**	NS	***Fusarium* spp.** For suppression. Apply immediately after transplanting. Repeat applications every 3–6 weeks. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)
	Trichoderma harzianum Rifai strain KRL-AG2 and *Trichoderma virens* strain G-41	BW240 WP	30–60 g/100 L water/ m^2 of soil/potting mixture surface	0	***Fusarium* spp., *Phytophthora* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Apply immediately after sowing seed or planting. Repeat application after 8–10 weeks if conditions are favourable for disease development. Do not use overhead boom chemigation for second application or after the four-leaf stage. Use a higher rate and shorter interval when disease pressure is high. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (DAMPING OFF) (cont'd)					
M 04	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			
NC	garlic powder	Influence WP*	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Do not enter treated area until spray is dried.**
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	1	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 seeding/seedling applications per crop cycle. Do not exceed 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
40	mandipropamid	Revus	600 mL/ha (150 g a.i./ha)	1	***Phytophthora capsici* (soil phase)** Applications should begin prior to disease development. Do not exceed 4 applications per season. **REI: 12 hr**
44	*Bacillus subtilils* strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates:** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP	See **Remarks.**	NS	For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-entry into treated areas only after the spray has dried.** **Rates:** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
	Streptomyces strain K61	Mycostop WP*	See **Remarks.**	NS	***Fusarium* spp., *Phytophthora* spp.** For suppression. Apply immediately after transplanting. Repeat application every 3–6 weeks. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates:** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield Granules*	600–750 g/m^3 (loose) planting mix or soil	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. For best results, thoroughly incorporate granules during mix preparation or pot filling, or incorporate into planting beds by raking or tilling. **REI: 4 hr**
		Bora HC*	**Drench:** 55–110 g/m^3	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: 4 hr**
		Bora WP*			
		RootShield HC*			
		RootShield WP*			

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
BM 02 (cont'd)	*Trichoderma harzianum* Rifai strain T-22	Trianum G*	See **Remarks.**	NS	***Fusarium oxysporum*** For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. **REI: NS** **Rates:** **Before filling seed trays or containers:** 750 g/m^3 **Subsequent applications at transplanting or repotting:** 375 g/m^3 **Crops on substrate, when transplanting:** 1 g/planting hole
		Trianum P*	See **Remarks.**	NS	***Fusarium oxysporum*** For suppression. Sowing application method: For the best results, begin use from propagation onwards, before occurrence of disease. Transplanting high crop density: Use a water volume equivalent to 10% of the substrate volume or 2–5 L/m^2. Low crop density: Use a water volume equivalent to 10% of the substrate volume or 100 L/1,000 plants. **REI: NS** **Rates:** **Sowing:** 1.5 g/m^2 of cultivated area, suspended in 2.5–5 L water **Transplanting high crop density:** 3 g/m^2 of cultivated area (1.5 g/m^2 if plants have been treated previously) **Transplanting low crop density:** 30 g/1,000 plants (15 g/1,000 plants if plants have been treated previously).
M 04	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			

[1] See Appendix G for FRAC group definitions.

Table 4–2. Products registered for greenhouse tomato diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC[1] Group	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora* spp., *Pythium* spp.** For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 4 applications per year. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha in a minimum of 100 L water	1	***Pythium* spp.** For suppression. Do not exceed 5 foliar and/or chemigation applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
		Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1,000 L water	0	***Phytophthora* spp., *Pythium* spp.** For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal Irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
NC	garlic powder	Influence WP*	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Re-entry into treated areas only after the spray has dried.**

[1] See Appendix G for FRAC group definitions.

5. Cucumbers

Products registered for greenhouse cucumber insect and mite pests are listed in Table 5–1.
Products registered for greenhouse cucumber diseases are listed in Table 5–2.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval
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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L/100 m^2). Thoroughly ventilate premises before re-entering on the day following treatment. **REI: 24 hr**
	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	imidacloprid	Intercept 60 WP	16 g/80 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not exceed 1 application per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
4D	flupyradifurone	Altus	**Foliar:** 500–750 mL/ha **Drench:** 750–1,000 mL/ha (7.5–10 mL/100 m^2)	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Drench: Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. May cause some leaf yellowing and/or mottling. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
9B	pymetrozine	Endeavor 50 WG	100–200 g (50–100 g a.i.) in a minimum of 1,000 L water/ha	3	**Green peach aphid (*Myzus persicae*), melon aphid (*Aphis gossypii*)** Do not exceed 2 applications per crop cycle or 3 applications per year in greenhouses with multiple crop cycles. Apply as a foliar spray. Minimum interval between applications is 7 days. On hard-to-wet plants, label recommends adding a non-ionic or organosilicone-based surfactant to improve coverage. **REI: 12 hr**
23	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate per single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712–1,000 L per hectare (42–30 mL concentration). Use the higher concentration for higher pest infestation levels. Repeat application every 7–14 days. Do not exceed 900 mL per hectare (216 g a.i./ha) per crop cycle. Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**
29	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 12.5 mg/plant	0	Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L/ha. The maximum volume should be used when plant foliage is dense. Do not exceed 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
UNF	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB* Bio-Ceres G WP*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when used early, before high insect populations develop. Repeat application within 7 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Re-enter into treated areas only after the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/ 1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in the morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water		Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
BANANA MOTH (*Opogona sacchari*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.8 kg/1,000 L water	0	Foliar application. Make application just prior to egg hatch. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stems is necessary (minimum of 300 L water/ha). Repeat application every 7 days as needed. **REI: NS**
		Bioprotec CAF*	1.6 L/1,000 L water		
BEET ARMYWORM (*Spodoptera exigu*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage, but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter into treated areas only after the spray has dried.**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
CORN EARWORM (tomato fruitworm) (*Helicoverpa (=Heliothis) zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage, but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter into treated areas only after the spray has dried.**
DUPONCHELIA FOVEALIS					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	625 g/1,000 L	0	Make applications when egg hatch is essentially complete, when larvae are small, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stem is necessary. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.8 kg/1,000 L water	0	Foliar application. Make application when egg hatch is essentially complete, but before crop damage occurs. Apply the product such that it flows along the stem, coating it well, and into the top layer of the soil around the base of the plant. Thorough coverage of foliage and stems is necessary. Repeat application every 7 days as needed. **REI: NS**
		Bioprotec CAF*	1.6 L/1,000 L water		
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
EUROPEAN CORN BORER (*Ostrinia nubilalis*)					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	Maximum application volume that can be used is 2,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L water **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**
LEAFHOPPERS					
4D	flupyradifurone	Altus	**Foliar:** 500–750 mL/ha **Drench:** 750–1,000 mL/ha (7.5–10 mL/100 m^2)	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Drench: Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. May cause some leaf yellowing and/or mottling. **REI: 12 hr**
LEAFMINERS					
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	***Liriomyza* spp.** Application should be made preferably in 2,000–4,000 L water/ha. Do not exceed 1,200 mL or apply less than 600 mL product per hectare per application. Use in sufficient water to obtain uniform coverage. Make no more than 5 applications per crop cycle. Do not exceed 6,000 mL product per hectare per crop cycle. Do not apply through any type of irrigation system. **REI: Re-enter into treated areas only after the spray has dried.**
LEAFROLLERS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including 1 postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**

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Table 5–1. Products registered for greenhouse cucumber insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 1,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	240 mL/1,000 L water		
		Success	120 mL/1,000L water		
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	75–150 g/250 L	0	**Alfalfa looper (*Autographa californica*), Cabbage looper (*Trichoplusia ni*), Chrysodeixis spp.** Apply at egg hatch to target young larvae (early instars). For best control, thorough coverage is required. Under heavy population pressure, or for larger larvae, shorten the spray interval or use a rate at the higher end of the range. Repeat application every 3–14 days. **REI: NS**
		Foray 48BA	0.6–1.8 L/ 500–1,000 L water/ha (60–180 mL/1,000 m^2)	NS	**Cabbage looper (*Trichoplusia ni*)** Apply using a high volume spray. Repeat application every 10 days when loopers first appear. Larvae should be treated when they are newly hatched. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.92 kg/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
	Bacillus thuringiensis subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter into treated areas only after the spray has dried.**
28	chlorantraniliprole	Coragen	125 mL/1,000 L	1	**Cabbage looper (*Trichoplusia ni*)** Begin applications when treatment thresholds have been reached. Thorough coverage is required to obtain optimum control. Repeat applications if monitoring indicates it is necessary. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not exceed a total of 750 mL product per hectare per crop cycle. The maximum finished spray volume is 2,000 L/ha. **REI: 12 hr**

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Table 5–1. Products registered for greenhouse cucumber insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
28	cyantraniliprole	Exirel	250 mL/ha	0	**Cabbage looper (*Trichoplusia ni*)** Thorough coverage is required to obtain optimum control. Select a spray volume appropriate for the size of plants and density of foliage. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex*	50–200 mL/400 L water	0	**Cabbage looper (*Trichoplusia ni*)** Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days as needed. **REI: Re-enter into treated areas only after mists have settled.**
LYGUS BUGS (TARNISHED PLANT BUG)					
15	novaluron	Rimon	835 mL/ha	1	For control of nymphs of Lygus bugs including *Lygus lineolaris*. Apply when the majority of the population is at egg hatch to the second instar. Apply in a maximum spray volume of 935 L water per hectare. Use higher spray volumes when foliage canopy is dense and pest pressure is high. Repeat application every 7–10 days as needed. Do not exceed 3 applications per crop cycle. Toxic to certain beneficial insects (e.g. predatory mites, parasitoid wasps) and may be toxic to bee colonies exposed to direct treatment, drift, or residues on flowering crops or weeds. **REI: 12 hr**
29	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 12.5 mg/plant	0	Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L per hectare. The maximum volume should only be used when plant foliage is dense. Do not exceed 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**

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Table 5–1. Products registered for greenhouse cucumber insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MEALYBUGS					
1B	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Opal2 Insecticidal Soap Safer's Insecticidal Soap Concentrate	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
MITES					
1B	naled	Dibrom	9.6 mL/100 m^3	2	**Two-spotted spider mite (*Tetranychus urticae*)** Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	**Two-spotted spider mite (*Tetranychus urticae*)** Application should be made preferably in 2,000–4,000 L water per hectare. Do not apply more than 1,200 mL or less than 600 mL product per hectare per application. Use in sufficient water to obtain uniform coverage. Do not exceed 5 applications per crop cycle. Apply no more than 6,000 mL product per hectare per crop cycle. Do not apply through any type of irrigation system. **REI: Re-enter into treated areas only after residues have dried.**
12B	fenbutatin oxide	Vendex 50W Vendex 50WP	50 g/100 L water	3	**Two-spotted spider mite (*Tetranychus urticae*)** Begin applications when mites appear and repeat as necessary to maintain control. Thorough coverage of all foliage, especially the under-surface of leaves, is essential. The addition of a suitable spreader-sticker will usually result in better mite control. Not highly injurious to beneficial mites and is non-toxic to honeybees. **REI: 12 hr; 48 hr for high foliar-contact activities.**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
13	chlorfenapyr	Pylon	20–30 mL/100 L water	0	**Two-spotted spider mite (*Tetranychus urticae*), Broad mite (*Polyphagotarsonemus latus*)** Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. Do not use on tomato varieties with a diameter of less than 2.5 cm when mature. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
20B	acequinocyl	Shuttle 15 SC	0.21–0.46 L/500 L water (0.07–0.15 g a.i./L of solution)	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage. Thorough coverage is essential for effective control. Actual spray volume will vary, depending on the size of the plants being sprayed. Application should be made as soon as the mite population reaches economic infestation levels. Apply the higher concentration for heavy pest infestations. Minimum interval between applications is 21 days. Do not exceed 2 applications per crop cycle (0.69 kg a.i./ha). **REI: 12 hr**
20D	bifenazate	Floramite SC	125 mL (30 g a.i.)/ 400 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to obtain uniform coverage. Actual spray volume will vary depending on the size of the plants being treated. Application should be made as soon as mites appear and will provide residual control for up to 28 days. Do not exceed 2 applications per crop cycle. After 1 application of this product rotate to products of an alternate chemical class. This product is primarily active on the motile stages of mites. It is not effective against rust mites, broad mites and flat mites. **REI: 12 hr**
21A	pyridaben	Dyno-Mite WP SanMite WP	284 g/1,000 L water/ha	2	**Two-spotted spider mite (*Tetranychus urticae*)** Do not exceed 2 applications per crop cycle. Minimum interval between applications is 28 days. Do not apply this product through any type of irrigation system. Do not apply as a fog. **REI: 12 hr**
	fenpyroximate	FujiMite	2.5 L/ha	7	**Two-spotted spider mite (*Tetranychus urticae*)** Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1,000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Two-spotted spider mite (*Tetranychus urticae*)** Under high pest population pressure, repeat application every 10–14 days as needed. Do not exceed 2 applications per crop cycle. Avoid applying during the warmest part of the day. Mite juvenile stages are often more susceptible than adults. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
UNF	*Beauveria bassiana* PPRI 5339	Velifer	450–900 mL/1,000 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3-10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage, but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter into treated areas only after the spray has dried.**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of mite presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Mites, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	For suppression. Apply when pest first appears. Repeat applications every 7–14-days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water		**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Repeat application every week for 2–3 weeks and thereafter repeat as needed. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Spray all plant parts once weekly for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**

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PSYLLIDS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
SCALE					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
THRIPS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Use the higher rate when insect populations are high and/or insects are large. Apply when western flower thrips first appear. Do not exceed 3 applications per crop cycle, with a minimum of 7 days between applications. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Maximum application volume that can be used is 2,000 L per hectare. Apply when western flower thrips first appears. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
28	cyantraniliprole	Exirel	500–1,000 mL/ha	0	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. If thrips populations are above thresholds, use a registered knockdown product before application. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**
29	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 12.5 mg/plant	0	Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L per hectare. The maximum volume should be used when plant foliage is dense. Do not apply more than 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**

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THRIPS (cont'd)					
UNF	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB* Bio-Ceres G WP*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when used before high insect populations develop. Repeat application every 3–5 days as needed. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Re-enter into treated areas only after the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	500–1,000 g/400 L	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L **Drench:** 108 mL/10 L	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. The need for and timing of re-application should be determined by monitoring. Repeat application in 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. **REI: Re-enter into treated areas only after the spray has dried.**
NC	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	For suppression. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
TOMATO HORNWORM (*Manduca quinquemaculata*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.46–0.92 kg/ 1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
WHITEFLIES					
1B	dichlorvos	DDVP 20% EC	6 mL/1 L water	7	Spray foliage to the point of run-off (approximately 5 L/100 m^2). Thoroughly ventilate premises before re-entering on the day following treatment. **REI: 24 hr**
	naled	Dibrom	9.6 mL/100 m^3	2	Vapour treatment. Do not exceed 3 applications per crop cycle (including one postharvest). Minimum interval between applications is 7 days. Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Avoid over-treatment and direct application to plants, as injury may result. **REI: 48 hr (must be fully ventilated before re-entry)**
3A	permethrin	Ambush 50 EC	20 mL/100 L water	1	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Apply to cover all foliage thoroughly. Repeat application as necessary to maintain control. **REI: NS**
		Pounce 384 EC	260 mL/1,000 L water	1	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Apply to cover all foliage thoroughly. Repeat application as necessary to maintain control. **REI: Re-enter into treated areas only after the spray deposit has dried.**
4A	imidacloprid	Intercept 60 WP	16 g/80 L water/ 1,000 mature plants	1	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not exceed 1 application per season. May harm pollinators and certain beneficial insects. **REI: NS**
4D	flupyradifurone	Altus	**Foliar:** 750–1,000 mL/ha **Drench:** 1,500–2,000 mL/ha (15–20 mL/100 m^2)	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. **Foliar:** Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. **Drench:** Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. May cause some leaf yellowing and/or mottling. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 5–1. Products registered for greenhouse cucumber insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
7C	pyriproxyfen	Distance	45 mL/100 L water	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Apply as a foliar spray mixture uniformly to all plant surfaces and to the point of run-off. Make first application when adult insects begin to appear. Repeat application after 14–28 days. Use longer interval when plants are not growing rapidly. Do not exceed 2 applications per crop cycle. If the cropping cycle is less than 6 months, do not apply more than 2 applications per 6 months. **REI: 12 hr**
16	buprofezin	Talus	36–43 g/100 L	2	Apply when adults first appear. Use the higher application rate when pest pressure is high. Minimum interval between applications is 21 days. Do not exceed 2 applications per crop cycle. When using 36 g/100 L, apply no more than 870 L spray solution/ha. When using 43 g/100 L, apply no more than 730 L of spray solution/ha. **REI: 48 hr**
21A	fenpyroximate	FujiMite	2.5 L/ha	7	For suppression. Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1,000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Under high pest population pressure, repeat application every 10–14 days as needed. Do not exceed 2 applications per crop cycle. Avoid applying during the warmest part of the day. Effective against nymphs and has some effect on the pupal stage. Will not reduce adult whitefly populations. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**
	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate per single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712 L per hectare (42 mL concentration) to 1,000 L per hectare (30 mL concentration). Use the higher concentration for higher pest infestation levels. Minimum interval between applications 7–14 days. Maximum product allowed per crop cycle is 900 mL per hectare (216 g a.i./ha). Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
28	cyantraniliprole	Exirel	750–1,000 mL/ha	0	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. If thrips populations are above thresholds, use a registered knockdown product before application. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**
29	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 12.5 mg/plant	0	Suppression only for foliar application. Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Minimum interval between applications is 7 days. Do not apply more than 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). **Foliar:** Apply sufficient volume to ensure good coverage, up to 1,000 L per hectare. The maximum volume should be used when plant foliage is dense. Do not apply more than 1 foliar application per crop cycle. **Drip:** Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**

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Table 5–1. Products registered for greenhouse cucumber insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
UNF	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WB* Bio-Ceres G WP*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L of spray volume will typically be required for 1 ha. This product is most effective when used early, before high insect populations develop. Repeat application every 7 days. In the case of a pest outbreak, repeat application every 3–5 days. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Re-enter into treated areas only after the spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Repeat application every 5–10 days. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter into treated areas only after the spray has dried.**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pest first appears. Repeat application every 7–14-days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning, evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 100 parts water	0	Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2-week intervals. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ALTERNARIA LEAF BLIGHT (*Alternaria cucumerina*)					
M1	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L water/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
ANTHRACNOSE (*Colletotrichum orbiculare*)					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25-50 g a.i./ha)	0	Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–10 days as needed. Do not exceed 150 g a.i. per hectare per year. **REI: Re-enter into treated areas only after the spray has dried.**
M1	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L water/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
ANGULAR LEAF SPOT (*Pseudomonas syringae* pv. *orbiculare*)					
M1	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L water/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
BACTERIAL WILT (*Erwinia tracheiphila*)					
M1	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L water/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
NC	hydrogen peroxide and peroxyacetic acid	OxiDate* OxiDate 2.0*	100 mL/10 L water (1.0% v/v)	0	For suppression. Begin applications preventatively, at the first sign of disease, or when conditions are favourable for disease development. Repeat application ever 7 days. Under severe disease conditions, repeat application every 5 days. Do not exceed 8 applications. **REI: 4 hr**
CERCOSPORA LEAF SPOT (*Cercospora citrullina*)					
44	*Bacillus subtilis* strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat applications every 7–10 days as needed. Thorough coverage is essential. **REI: NS**

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
DOWNY MILDEW (*Pseudoperonospora cubensis*)					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25–50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 5–8 days as needed to maintain suppression. Do not exceed 150 g a.i. per hectare per year. **REI: Re-enter into treated areas only after the spray has dried.**
21	cyazofamid	Torrent 400SC	0.15–0.2 L/400–2,000 L water/ha	1	For late downy mildew control, repeat applications every 7–10 days beginning with initial flowering or when disease conditions are favourable for disease development. Use a higher rate and shorter interval under moderate to heavy disease pressure. Label recommends tank-mixing with a non-ionic or organosilicone surfactant at the lowest label rate for water volumes below 600 L per hectare. At water volumes above 600 L per hectare, a surfactant is not needed. Do not exceed 4 applications per crop cycle. **REI: 12 hr**
28	propamocarb hydrochloride	Previcur N	1.5 L/ha	2	For suppression. Apply foliar treatment when plants begin to vine or when conditions first become favourable for disease development, but before infection. Do not exceed 1 application per crop cycle. **REI: 12 hr**
40	mandipropamid	Revus	400 mL/ha with 1.5 L/ha of Previcur N	2	For suppression. Apply as a resistance management tool as a foliar application when plants begin to vine or when conditions are favourable for disease development. Do not exceed 1 application per crop cycle. Do not apply by chemigation. **REI: 12 hr**
44	*Bacillus subtilis* strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat application every 7–10 days as needed. Thorough coverage is essential. **REI: NS**
46	tea tree oil	Timorex Gold*	2–8 L/400–800 L water/ha	2	For suppression. Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventative treatments, apply at 7–14-day intervals, depending on disease level. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
49	oxathiapiprolin	Orondis Orondis Ultra B Zorvec Enicade	0.0875–0.35 L/ha	0	Foliar application only. Begin applications prior to disease development. Repeat applications every 5–14 days. Use the higher rate and shorter interval when disease pressure is high or for susceptible varieties. Do not exceed 4 applications per crop cycle per year. Where multiple crop cycles are produced in the same year do not exceed 6 foliar applications or 1.4 L per hectare per year. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
40 + 45	ametoctradin + dimethomorph	Zampro	0.8–1 L/2,000 L water/ha	0	For suppression. Begin applications prior to disease development. Repeat applications every 5–7 days. Use the higher rate and shorter interval when disease pressure is high. Do not exceed 3 applications per crop cycle. **REI: NS**

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
DOWNY MILDEW (*Pseudoperonospora cubensis*) (cont'd)					
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat applications every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	2.5 mL/L water (0.25% v/v)	0	For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not to the point of runoff. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-enter into treated areas only after the spray has dried.**
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 7 applications per year. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–5 L/ha in a minimum of 100 L water	1	For suppression. Do not exceed 6 foliar applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
		Rampart	3–5 L/ha	0	For suppression. Begin applications after plants become established. Repeat applications every 2–4 weeks. Use the higher rate and shorter application interval when disease pressure is high. The suggested water volume is 1,000 L per hectare when cucumber plants are medium sized. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
NC	citric and lactic acid	Cyclone*	8% dilution in water solution	0	For suppression. Apply prior to, or at the early stages of disease development. Apply as foliar spray until runoff. Repeat application every 7–10 days. Can leave white hydrosoluble residues on treated crop. Label recommends using a surfactant to achieve better coverage of leaves and better efficacy. **REI: 4 hr**
	garlic powder	Influence WP*	6.9 kg/1,000 L water/ha	0	May inhibit symptoms when used in conjunction with integrated pest management strategies. Spray the foliage and substrate surface. Ensure thorough coverage. Repeat application every 7–14 days. **REI: Re-enter into treated areas only after the spray has dried.**
	hydrogen peroxide and peroxyacetic acid	OxiDate* OxiDate 2.0*	100 mL/10 L water (1.0% v/v)	0	For partial suppression. Begin applications preventatively, at the first sign of disease, or when conditions are favourable for disease development. Repeat application every 7 days. Under severe disease conditions, repeat application every 5 days. Do not exceed 8 applications. **REI: 4 hr**

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GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*)					
2	iprodione	Rovral WP	100 g/100 L water/ha	2	Spray to run-off ensuring good coverage of the plants, particularly stem nodes, immediately following any pruning. Begin application at the first sign of disease. **REI: 12 hr**
		Rovral WDG	100 g/100 L water		
7	fluopyram	Luna Privilege	500 mL/ha	0	Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 2 applications per crop cycle. Minimum application interval is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.1 m: 1,000 L/ha 2.1 m: 2,500 L/ha **REI: 12 hr**
	penthiopyrad	Fontelis	1–1.5 L/ha	1	Begin applications prior to disease development. Repeat application every 7–14 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 4.9 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
9	pyrimethanil	Scala SC	2 L/ha	1	Apply at first sign of disease. Spray volumes will vary depending on crop canopy height. Use appropriate spray volume to ensure thorough coverage of leaf canopy and stems. Use a minimum of 485 L per hectare for smaller plants, increasing to 1,000–2,500 L per hectare for larger plants. Repeat application every 7–14 days as needed. Do not exceed 2 applications per growing season. Do not apply more than 1 application before alternating with a fungicide with a different mode of action. Ventilate for at least 2 hr after application. Proper ventilation after spraying is essential to avoid brown or necrotic spots that can be caused by the vapour activity of Scala SC. **REI: 24 hr**
17	fenhexamid	Decree 50 WDG	**Small plants:** 1.5 kg/ha (0.75 kg a.i./ha)	1	Apply in a spray volume of approximately 500 L (small plants) to 1,500 L (large/ mature plants). Begin applications when conditions favour disease development. Repeat application after 7 days if conditions continue to favour disease. Do not exceed 2 applications per crop cycle. Do not exceed 3 kg per hectare per season. **REI: 4 hr**
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to the point of run-off. Most effective when applied preventively, before disease starts. Repeat application every 3–4 weeks, with shorter intervals used under conditions of moderate to high disease pressure. **REI: 4 hr**
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield HC*	3.75–7.5 g/L water	NS	For suppression. Use a volume of spray solution to thoroughly cover foliage. Spray to wet but not to the point of run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: 4 hr**
M 03	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	1	Repeat application every week. Causes severe injury to seedless English cucumbers. **REI: Re-enter into treated areas only after the spray has dried.**

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GUMMY STEM BLIGHT (*Didymella bryoniae*)					
2	iprodione	Rovral WP Rovral WDG	100 g/100 L water	2	Apply label rate using 1,000–2,000 L water per hectare. Spray to run-off ensuring good coverage of the plants, particularly stem nodes, immediately following any pruning. Begin application at the first sign of disease. **REI: 12 hr**
3	myclobutanil	Nova WSP	340 g/ha	2	Do not exceed 1 application per crop cycle. Apply when disease first appears. **REI: 12 hr**
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25-50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain suppression. Do not exceed 150 g a.i. per hectare per year. **REI: Re-enter into treated areas only after the spray has dried.**
44	*Bacillus subtilis* strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat application every 7–10 days as needed. Thorough coverage is essential. **REI: NS**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.3 kg in a minimum of 250 L water/ha	0	For suppression. Apply when conditions favour disease development. Do not apply this product using any type of foggers or misters. Do not exceed 1 application per crop cycle. Do not use on plants that will be transplanted. **REI: Re-enter into treated areas only after the spray has dried.**
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	1% aqueous suspension (50 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to the point of run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks, with shorter intervals used under conditions of moderate to high disease pressure. **REI: 4 hr**
PHYTOPHTHORA BLIGHT (Phytophthora foliar blight)					
49	oxathiapiprolin	Orondis Orondis Ultra B Zorvec Enicade	0.175–0.35 L/ha	0	***Phytophthora capsici*** Foliar application only. Begin applications prior to disease development. Repeat applications every 5–14 days. Use the higher rate and shorter interval when disease pressure is high. Do not exceed 4 applications per crop cycle per year. Where multiple crop cycles are produced in the same year do not exceed 6 foliar applications or 1.4 L per hectare per year. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PHYTOPHTHORA BLIGHT (Phytophthora foliar blight) (cont'd)					
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora capsici*** For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 7 applications per year. **REI: Allow entry only after thorough ventilation and spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–6 L/ha in a minimum of 100 L water	1	***Phytophthora capsici, P. nicotianae*** For suppression. Do not exceed 6 foliar applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
		Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1,000 L water	0	***Phytophthora capsici*** For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
POWDERY MILDEW					
3	myclobutanil	Nova WSP	340 g/ha	2	Do not exceed 1 application per crop cycle. Apply when disease first appears. **REI: 12 hr**
7	fluopyram	Luna Privilege	100 mL/ha	0	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.1 m: 1,000 L/ha 2.1 m: 2,500 L/ha **REI: 12 hr**
	penthiopyrad	Fontelis	1.25 L/ha	1	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** Begin applications prior to disease development. Repeat application every 7–14 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 4.9 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25–50 g a.i./ha)	0	Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain control. When disease is present, suppression is provided. Do not apply more than 150 g a.i. per hectare per year. **REI: Re-enter into treated areas only after the spray has dried.**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55 *	**Foliar:** 1–2.5 kg/ha **Low disease pressure:** 0.5–1 kg/ha	0	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply from fruit formation to end of maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Do not re-enter until sprays have dried.**
		Double Nickel LC*	**Foliar:** 5–12.5 L/ha **Low disease pressure:** 2.5–5 L/ha		
	Bacillus subtilis strain QST 713	Cease*	1–2 L/100 L water	0	***Erysiphe* spp., *Sphaerotheca* spp.** For suppression. Begin applications soon after emergence or transplant when environmental conditions and plant stage are conducive to rapid disease development. Repeat application every 7–10 days. Thorough coverage is essential. **REI: NS**
		Rhapsody ASO*			
46	tea tree oil	Timorex Gold*	2–8 L in 400–800 L water/ha	2	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventive treatments, repeat application every 7–14 days as needed. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.3 kg in a minimum of 250 L water/ha	0	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply when conditions favour disease development. Do not apply this product using any type of foggers or misters. Do not exceed 1 application per crop cycle. Do not use on plants that will be transplanted. **REI: Re-enter into treated areas only after the spray has dried.**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/200–3,000 L water/ha	1	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Do not exceed 3 applications per crop cycle. First application should be made when disease first appears. Repeat application after 7–10 days. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. **REI: 24 hr**

[1] See Appendix G for FRAC group definitions.

Table 5–2. Products registered for greenhouse cucumber diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
BM 02	*Streptomyces lydicus* strain WYEC 108	Actinovate SP	420 g/470–800 L water/ha	NS	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Make the first application when conditions are conducive to disease development. Repeat application every 7–14 days. Use the shorter application interval under high disease pressure. Spray to wet but not the point of run-off. **REI: Re-enter into treated areas only after the spray has dried.**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
M 02	sulphur	Cosavet DF Edge	0.12 kg/100 L water	1	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** Use sufficient volume to provide thorough coverage. Repeat applications every 5 days as needed. Do not exceed 8 applications per year. **REI: 24 hr**
		Kumulus DF*	120 g/100 L water	1	Repeat application every 5 days as needed. Do not exceed 8 applications per season. Do not apply if temperature is above 27°C (in shade) and high humidity prevails or is expected within 3 days after the treatment. Do not apply under intense sunshine. **REI: 24 hr**
		Microscopic Sulphur WP*	105 g/100 L water	1	Apply at weekly intervals as needed. Do not make more than 8 applications per season. Do not apply if high temperatures (above 25°C) and high humidity prevail or are expected during the 3 days following application. **REI: 24 hr**
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	1.25–2.5 mL/L water (0.125%–0.25% v/v)	0	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not exceed a spray volume of 1,500 L per hectare. **REI: Re-enter into treated areas only after the spray has dried.**

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Begin applications when conditions are favourable for disease development or when disease first appears. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	citric and lactic acid	Cyclone*	1.2% dilution in water solution	0	***Erysiphe cichoracearum (=Golovinomyces cichoracearum), Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply prior to, or at the early stages of disease development. Apply as foliar spray in sufficient spray volume to ensure thorough coverage. Repeat application every 7–10 days. Can leave white hydrosoluble residues on treated crop. Label recommends using a surfactant to achieve better coverage of leaves and better efficacy. **REI: 4 hr**
	garlic powder	Influence LC*	1.8% with high volume sprayer **Tank mix:** 0.45% with Cyclone at 0.3% without surfactant	0	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply preventively or at first signs of disease. Repeat application every 7–10 days. Ensure thorough coverage of foliage. Do not exceed 18 L per hectare. Do not use with ultra low volume sprayers. **REI: Re-enter into treated areas only after the spray has dried.**
		Influence WP*	6.9 kg/1,000 L water/ha	0	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Spray the foliage and substrate surface. Ensure thorough coverage. Repeat application every 7–14 days. **REI: Re-enter into treated areas only after the spray has dried.**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/ 1,000 L water (1% solution)/ha	NS	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** For suppression. Apply when conditions are favourable for disease development and/or when first symptoms appear. Repeat application every 7–14 days. For effective control thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium bicarbonate	MilStop*	5.6 kg/2,000 L water/ha	0	***Sphaerotheca fuliginea (=Podosphaera xanthii)*** Start application at first sign of disease. Uniform and complete coverage of the foliage is essential for the most effective results. Number of applications will depend on disease pressure. Repeat application every 7 days. Do not exceed 10 applications per season. Do not apply through any type of irrigation system. **REI: 4 hr**
	potassium bicarbonate	Sirocco	5.6 kg/ha	0	***Sphaerotheca fuliginea (=Podosphaera xanthii, P. fusca)*** Begin applications at the first sign of disease or when conditions are conducive to disease development. Label recommended spray volume is 1,000–2,000 L per hectare. Repeat application every 7 days. Do not exceed 10 applications per year. **REI: 4 hr**
SEPTORIA LEAF SPOT					
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	***Septoria cucurbitacearum*** Repeat application every 5–10-days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
21	cyazofamid	Torrent 400SC	30 mL/100 L water	60	***Pythium* spp.** Apply as a soil drench to thoroughly wet the growing medium immediately after seeding. Do not exceed 1 application. Do not use any surfactant. **REI: 12 hr**
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 applications per crop cycle to seeding beds or seedlings. Do not exceed 2 applications per crop cycle after-transplanting. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant-growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a growing medium treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat application every 3–6 weeks, with shorter intervals used under conditions of moderate to high disease pressure. **REI: 4 hr** **Rates** **Growing media:** 125–250 mL suspension/10 L growing media **Soil drench:** 20 L suspension/m^2 growing media
	Trichoderma harzianum Rifai strain KRL-AG2 and *Trichoderma* virens strain G-41	BW240 WP	30–60 g/100 L water/ m^2 of soil/ potting mixture surface	0	***Fusarium* spp., *Phytophthora* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Apply immediately after sowing seed or planting. Repeat application after 8–10 weeks if the disease is expected. Do not use overhead boom chemigation for second application or after the four-leaf stage. Use a higher rate and shorter interval when disease pressure is high. **REI: 4 hr**
	Streptomyces lydicus strain WYEC 108	Actinovate SP	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-enter into treated areas only after the spray has dried.** **Rates** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (DAMPING OFF) (cont'd)					
BM 02 (cont'd)	*Streptomyces* strain K61	Mycostop WP*	See **Remarks.**	NS	***Fusarium* spp., *Pythium* spp.** For suppression. Apply immediately after transplanting. Repeat applications every 3–6 weeks. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates** **Rockwool:** 5–10 mg/plant (for spraying and drenching. use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)
	Trichoderma harzianum Rifai strain T-22	Trianum G*	See **Remarks.**	NS	***Pythium ultimum*** For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. **REI: NS** **Rates** **Before filling seed trays or containers:** 750 g/m^3 **Subsequent applications at transplanting or repotting:** 375 g/m^3 **Crops on substrate, when transplanting:** 1 g per planting hole
		Trianum P*	See **Remarks.**	NS	***Pythium ultimum*** For suppression. Sowing application method: For the best results, begin use from propagation onwards, before occurrence of disease. Transplanting high crop density: Use a water volume equivalent to 10% of the substrate volume or 2–5 L/m^2. Low crop density: Use a water volume equivalent to 10% of the substrate volume or 100 L/1,000 plants. **REI: NS** **Rates** **Sowing:** 1.5 g/m^2 of cultivated area, suspended in 2.5–5 L water **Transplanting high crop density:** 3 g/m^2 of cultivated area (1.5 g/m^2 if plants have been treated previously) **Transplanting low crop density:** 30 g/1,000 plants (15 g/1,000 plants if plants have been treated previously)
NC	garlic powder	Influence WP*	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Re-enter into treated areas only after the spray has dried.**

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ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
4	metalaxyl-M	Ridomil Gold 480 EC Ridomil Gold 480 SL	250 mL of solution (0.75–1.25 mL/ 10 L water) to base of each plant	21	***Pythium* spp.** Do not exceed 1 application per crop cycle, immediately after transplanting as a drench to the growing media at the base of each plant. Do not use in the propagation house. Do not apply to cucumbers intended for transplant out to fields. Do not apply to cucumbers grown in soil. **REI: 12 hr**
12	fludioxonil	Medallion	300 mL/1,000 L water	1	***Fusarium oxysporum f. sp. radicis-cucumerinum*** For suppression. Use as drench application of 250 mL solution per plant. Apply to seedling crop prior to transplanting. Do not exceed 1 application per crop cycle. Do not apply to the foliage. **REI: 12 hr**
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 seeding/seedling applications per crop cycle. Do not exceed 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant-growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) to 1% aqueous suspension (50 g/5 L water) See **Remarks.**	NS	***Fusarium oxysporum; Pythium* spp.** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-enter into treated areas only after the spray has dried.** **Rates** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
BM 02 (cont'd)	*Streptomyces* strain K61	Mycostop WP*	See **Remarks.**	NS	***Fusarium* spp.** For suppression. Apply immediately after transplanting. Repeat applications every 3–6 weeks. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield Granules*	600–750 g/m^3 (loose) planting mix or soil	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. For best results, thoroughly incorporate granules during mix preparation or pot filling, or incorporate into planting beds by raking or tilling. **REI: 4 hr**
		Bora HC*	**Drench:** 55–110 g/m^3	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: 4 hr**
		Bora WP*			
		RootShield HC*			
		RootShield WP*			***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: NS**
	Trichoderma harzianum Rifai strain T-22	Trianum G*	See **Remarks.**	NS	***Pythium aphanidermatum*** For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. **REI: NS** **Rates** **Before filling seed trays or containers:** 750 g/m^3 **Subsequent applications at transplanting or repotting:** 375 g/m^3 **Crops on substrate, when transplanting:** 1 g/planting hole

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ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora spp., Pythium spp.*** For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 7 applications per year. **REI: Allow entry only after thorough ventilation, the spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–6 L/ha in a minimum of 100 L water	1	***Pythium spp.*** For suppression. Do not exceed 6 drench applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation, the spray mist has cleared and the treated surface has dried.**
		Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1,000 L water	0	***Phytophthora spp., Pythium spp.*** For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal Irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
NC	garlic powder	Influence WP*	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium spp., Rhizoctonia solani*** For partial suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Re-enter into treated areas only after the spray has dried.**

[1] See Appendix G for FRAC group definitions.

6. Peppers

Products registered for greenhouse pepper insect and mite pests are listed in Table 6–1.
Products registered for greenhouse pepper diseases are listed in Table 6–2.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable
* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, only after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	acetamiprid	Tristar 70 WSP	3 water soluble packs/ 1,000 L water	3	Do not exceed 5 water soluble packs (1,667 L of spray solution) per hectare. Do not exceed 2 applications per year. Do not re-apply more than once every 7 days. **REI: 12 hr**
	imidacloprid	Intercept 60 WP	**Mature plants:** 16 g/70 L water/ 1,000 plants **Transplant tray plug drench:** 4.1 g/1,000 seedling plants	3	**Green peach aphid (*Myzus persicae*)** For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Irrigate moderately but thoroughly after application, allowing no leaching and runout from container for at least 10 days after application. Do not exceed 1 application per season. Mature plants: Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. Transplants: Apply to 2–3-week-old seedlings in flats at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m^2 of seedling trays. May harm pollinators and certain beneficial insects. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
4D	flupyradifurone	Altus	**Foliar:** 500–750 mL/ha **Drench:** 750–1,000 mL/ha (7.5–10 mL/100 m^2)	3	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Drench: Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 10 days. Do not exceed 2,000 mL per hectare per crop cycle. **REI: 12 hr**
9B	pymetrozine	Endeavor 50 WG	100–200 g in a minimum of 1,000 L water/ha	3	**Green peach aphid (*Myzus persicae*), melon aphid (*Aphis gossypii*)** Do not exceed 200 g in 1,000 L per application. Do not exceed 2 applications per crop cycle or 3 applications per year in greenhouses with multiple crop cycles. Apply as a foliar spray. Minimum interval between applications is 7 days. On hard-to-wet plants, label recommends adding a non-ionic or organosilicone-based surfactant to improve coverage. **REI: 12 hr**
23	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate/ single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712–1,000 L per hectare (42–30 mL concentration). Use the higher concentration for higher pest infestation levels. Minimum interval between applications is 7–14 days. Do not exceed 900 mL (216 g a.i./ha) per hectare per crop cycle. Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**
29	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 30 mg/plant	0	Suppression only for foliar application. Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L per hectare. The maximum volume should only be used when plant foliage is dense. Do not exceed 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
UNF	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WP*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when used early, before high insect populations develop. Repeat application within 7 days as needed. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Re-enter into treated areas only after spray has dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal, and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of run-off. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	2 L/100 L water applying 250 L/4,000 m^2		Repeat application bi-monthly or when aphids reach treatment levels using concentrated high-volume power sprayers. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L and apply 250 L spray solution/ 4,000 m^2	1	Repeat application bi-monthly or when aphids reach treatment levels using concentrated high-volume power sprayers. **REI: NS**
BANANA MOTH (*Opogona sacchari*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.8 kg/1,000 L water	0	Foliar application. Make application just prior to egg hatch. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stems is necessary (minimum of 300 L water/ha). Repeat application every 7 days as needed. **REI: NS**
		Bioprotec CAF*	1.6 L/1,000 L water		
BEET ARMYWORM (*Spodoptera exigu*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter into treated areas only after spray is dried.**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
CORN EARWORM (Tomato Fruitworm) (*Helicoverpa (=Heliothis) zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter into treated areas only after spray is dried.**
DUPONCHELIA FOVEALIS					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	625 g/1,000 L water	0	Make applications when egg hatch is essentially complete when larvae are small but before crop damage occurs. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stem is necessary. Repeat application every 7 days as needed. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.8 kg/1,000 L water		
		Bioprotec CAF*	1.6 L/1,000 L water		
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
EUROPEAN CORN BORER (*Ostrinia nubilalis*)					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	Maximum application volume that can be used is 2,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
18	tebufenozide	Confirm 240F	0.6 L/400 L water/ha	3	Good spray coverage is essential for control. Repeat application every 7 days. Do not exceed 4 applications per year. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**
LEAFHOPPERS					
4D	flupyradifurone	Altus	**Foliar:** 500–750 mL/ha **Drench:** 750–1,000 mL/ha (7.5–10 mL/100 m^2)	3	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. **Foliar:** Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. **Drench:** Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 10 days. Do not exceed 2,000 mL per hectare per crop cycle. **REI: 12 hr**
LEAFMINERS					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	**Tomato leafminer (*Tuta absoluta*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter into treated areas only after spray is dried.**
	Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	500–1,000 g/1,000 L water	0	**Lepidopteran leafminers** Apply at egg hatch. Thorough coverage of foliage and stems is necessary. Repeat application every 7–10 days as needed. **REI: NS**
18	tebufenozide	Confirm 240F	0.6 L/ha	3	**Lepidopteran leafminers** For suppression. Foliar application only. Use a high-volume sprayer. Apply at first egg hatch. Repeat application as needed. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 10 days. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**
28	chlorantraniliprole	Coragen	200 mL/1,000 L water	1	**Lepidopteran leafminers** Apply at egg hatch. Repeat application as needed. Thorough coverage is important to obtain optimum control. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not exceed a total of 750 mL product per hectare per crop cycle. Apply in a maximum finished spray volume of 1,250 per hectare. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LEAFROLLERS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
LOOPERS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 1,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	240 mL/1,000 L water		
		Success	120 mL/1,000 L water		
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	75–150 g/250 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply at egg hatch to target young larvae (early instars). For best control, thorough coverage is required. Under heavy population pressure, or for larger larvae, shorten the spray interval or use the higher rate range. Repeat application every 3–14 days as needed. Do not exceed 4 applications per season. **REI: NS**
		DiPel WP*	150–300 g/250 L water/ 4,000 m^2	NS	**Cabbage looper (*Trichoplusia ni*)** Apply to upper and lower portions of the leaves to the point of run-off. Repeat applications will be necessary if a new hatch occurs. **REI: NS**
		Foray 48BA	0.6–1.8 L/ 500–1,000 L water/ha (60–180 mL/1,000 m^2)	NS	**Cabbage looper (*Trichoplusia ni*)** Apply using a high-volume spray. Repeat applications every 10 days. In general, larvae should be treated when they are newly hatched. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.92 kg/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply to young larvae at first signs of infestation. Repeat applications as needed to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
11A (cont'd)	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter into treated areas only after spray is dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	**Alfalfa looper (*Autographa californica*), Cabbage looper (*Trichoplusia ni*)** For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
18	tebufenozide	Confirm 240F	0.6 L (140 g a.i.)/ 400 L water/ha	3	**Cabbage looper (*Trichoplusia ni*)** Foliar application only. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**
28	chlorantraniliprole	Coragen	125 mL/1,000 L water	1	**Cabbage looper (*Trichoplusia ni*)** Begin applications when treatment thresholds have been reached. Thorough coverage is required to obtain optimum control. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not exceed a total of 750 mL product per hectare per crop cycle. The maximum finished spray volume is 2,000 L per hectare. **REI: 12 hr**
28	cyantraniliprole	Exirel	250 mL/ha	1	**Cabbage looper (*Trichoplusia ni*)** Thorough coverage is required to obtain optimum control. Select a spray volume appropriate for the size of plants and density of foliage. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex*	50–200 mL/400 L water	0	**Cabbage looper (*Trichoplusia ni*)** Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days as needed. **REI: Re-enter into treated areas only after spray is dried.**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LYGUS BUGS (TARNISHED PLANT BUG)					
15	novaluron	Rimon 10 EC	835 mL/ha	1	For control of nymphs of Lygus bugs including *Lygus lineolaris*. Apply when the majority of the population is at egg hatch to the second instar. Apply in a maximum spray volume of 935 L water per hectare. Apply in sufficient water volume to ensure thorough coverage. Use the higher spray volumes when foliage canopy is dense and pest pressure is high. Repeat applications every 7 days as needed. Do not exceed 3 applications per crop cycle. Toxic to certain beneficial insects (e.g. predatory mites, parasitoid wasps) and may be toxic to bee colonies exposed to direct treatment, drift, or residues on flowering crops or weeds. **REI: 12 hr**
29	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 30 mg/plant	0	Suppression only for foliar application. Apply before populations reach economic thresholds or as populations begin to increase, but before damaging populations become established. Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L per hectare. The maximum volume should be used when plant foliage is dense. Do not exceed 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**
MEALYBUGS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MEALYBUGS (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as needed. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
MITES					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	**Two-spotted spider mite (*Tetranychus urticae*)** Do not exceed 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	**Two-spotted spider mite (*Tetranychus urticae*)** Application should be made in 2,000–4,000 L water per hectare. Do not exceed 1,200 mL or apply less than 600 mL product per hectare per application. Use in sufficient water to obtain uniform coverage. Application is limited to between February and October and/or when daily light intensity in the greenhouse is at levels higher than 700 joules per cm^2 per day. Do not exceed 5 applications per crop cycle. Do not exceed 6,000 mL product per hectare per crop cycle. Do not apply through any type of irrigation system. **REI: Re-enter treated areas only after spray is dried.**
13	chlorfenapyr	Pylon	20–30 mL/100 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**

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Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
20B	acequinocyl	Shuttle 15 SC	0.21–0.46 L/500 L water (0.07–0.15 g a.i./L of solution)	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage. Thorough coverage is essential for effective control. Actual spray volume will vary depending on the size of the plants being sprayed. Application should be made as soon as the mite population reaches economic infestation levels. Apply the higher concentration for heavy pest infestations. Minimum interval between applications is 21 days. Do not exceed 2 applications per crop (0.69 kg a.i./ha). **REI: 12 hr**
20D	bifenazate	Floramite SC	125 mL (30 g a.i.)/ 400 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to obtain uniform coverage. Actual spray volume will vary depending on the size of the plants being treated. Application should be made as soon as mites appear and will provide residual control for up to 28 days. Do not exceed 2 applications per crop cycle. Make only 1 application of this product before rotating to products of an alternate chemical class. This product is primarily active on the motile stages of mites. It is not effective against rust mites, broad mites and flat mites. **REI: 12 hr**
21A	pyridaben	Dyno-Mite WP SanMite WP	284 g/1,000 L water/ha	3	**Two-spotted spider mite (*Tetranychus urticae*)** Do not exceed 2 applications per crop cycle. Apply when mites first appear and before the threshold of 5 mites per leaf is reached. Do not apply this product through any type of irrigation system. Do not apply as a fog. **REI: 12 hr**
	fenpyroximate	FujiMite	2.5 L/ha	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1,000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Two-spotted spider mite (*Tetranychus urticae*)** Apply under high pest population pressure. Repeat application every 10–14 days as needed. Do not exceed 2 applications per crop cycle. Avoid applying during the warmest part of the day. Mite juvenile stages are often more susceptible than adults. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
UNF	*Beauveria bassiana* PPRI 5339	Velifer	450–900 mL/1,000 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter treated areas only after spray is dried.**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of mite presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Mites, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/ 1,000 L water (1% solution)/ha	NS	For suppression. Apply when pest first appears. Repeat applications every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water		**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Repeat application every week for 2–3 weeks. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Repeat application every week for 2–3 weeks, and thereafter as needed. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**

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Table 6–1. Products registered for greenhouse pepper insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PEPPER MAGGOT (*Zonosemata electa*)					
28	cyantraniliprole	Exirel	1,000–1,500 mL/ha	1	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. Must be controlled at adult stage. Control may not be possible once oviposition has occurred. Do not apply in irrigation water. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**
PEPPER WEEVIL (*Anthonomus eugenii*)					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	thiamethoxam	Flagship WG	14 g/100 L water	1	For suppression. Apply before pests reach damaging levels. Apply in sufficient water volume to ensure thorough coverage, up to a maximum of 2,000 L per hectare. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and other beneficial insects. Avoid application when bees or other beneficial insects are actively visiting the treatment area. **REI: 12 hr**
15	novaluron	Rimon 10 EC	835 mL/ha	1	Reduces pest numbers. Apply at initial flowering stage. Apply in a maximum spray volume of 935 L water per hectare. Apply in sufficient water volume to ensure thorough coverage. Use higher spray volumes when foliage canopy is dense and pest pressure is high. Repeat application every 7 days as needed. Do not exceed 3 applications per crop cycle. Toxic to certain beneficial insects (e.g. predatory mites, parasitoid wasps) and may be toxic to bee colonies exposed to direct treatment, drift, or residues on flowering crops or weeds. **REI: 12 hr**
28	cyantraniliprole	Exirel	1,000–1,500 mL/ha	1	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. Do not apply in irrigation water. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PSYLLIDS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	**Tomato psyllid (*Bactericerca cockerelli*)** Do not exceed 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
6	abamectin	Avid 1.9% EC	30 mL/100 L water	3	**Tomato psyllid (*Bactericerca cockerelli*)** Application should be made in 2,000–4,000 L water per hectare. Do not exceed 1,200 mL or apply less than 600 mL product per hectare per application. Use in sufficient water to obtain uniform coverage. Application is limited to between February and October and/or when daily light intensity in the greenhouse is at levels higher than 700 joules/cm^2 per day. Do not exceed 5 applications per crop cycle. Do not exceed 6,000 mL product per hectare per crop cycle. Do not apply through any type of irrigation system. **REI: Re-enter treated areas only after spray is dried.**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
SCALE					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**

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Table 6–1. Products registered for greenhouse pepper insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
THRIPS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Use the higher rate when insect populations are high and/or insects are large. Apply when western flower thrips first appear. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Maximum application volume that can be used is 2,000 L per hectare. Apply when western flower thrips first appears. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
28	cyantraniliprole	Exirel	500–1,000 mL/ha	1	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. If thrips populations are above thresholds, use a registered knockdown product before application. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**
29	flonicamid	Beleaf 50 SG	**Foliar:** 0.3 g/L water **Drip:** 30 mg/plant	0	Suppression only for foliar application. Minimum interval between applications is 7 days. Do not exceed 2 applications per crop cycle (no more than 1 application per crop cycle may be foliar). Foliar application method: Apply sufficient volume to ensure good coverage, up to 1,000 L per hectare. The maximum volume should be used when plant foliage is dense. Do not apply more than 1 foliar application per crop cycle. Drip application method: Apply through drip (trickle) irrigation systems or drench by hand using sufficient water volume to ensure delivery of the product to the roots. Do not apply this product through any other type of irrigation system. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
THRIPS (cont'd)					
UNF	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WP*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when used early, before high insect populations develop. Repeat application within 7 days as needed. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Re-enter treated areas only after spray is dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days as needed. High populations may require 2–5-day intervals. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of run-off. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water **Drench:** 108 mL/10 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. **REI: Re-enter treated areas only after spray is dried.**
NC	mineral oil	Purespray Green Spray Oil 13E*	10 L/ 1,000 L water (1% solution)/ha	NS	For suppression. Apply when pest first appears. Repeat application every 7–14-days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
TOBACCO BUDWORM (*Heliothis virescens*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter treated areas only after spray is dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
TOMATO HORNWORM (*Manduca quinquemaculata*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.46–0.92 kg/ 1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
WHITEFLIES					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
4A	imidacloprid	Intercept 60 WP	**Mature plants:** 16 g/70 L water/ 1,000 plants **Transplant tray plug drench:** 4.1 g/ 1,000 seedling plants	3	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Irrigate moderately but thoroughly after application, allowing no leaching and run-out from container for at least 10 days after application. Do not exceed 1 application per season. Mature plants: applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. Transplants: Apply to 2–3-week-old seedlings in flats at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m^2 of seedling trays. May harm pollinators and certain beneficial insects. **REI: NS**
4D	flupyradifurone	Altus	**Foliar:** 750–1,000 mL/ha **Drench:** 1,500–2,000 mL/ha (15–20 mL/100 m^2)	3	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Drench: Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 10 days. Do not exceed 2,000 mL per hectare per crop cycle. **REI: 12 hr**
7C	pyriproxyfen	Distance	45 mL/100 L water	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Apply as a foliar spray mixture uniformly to all plant surfaces and to the point of run-off. Make first application when adult insects begin to appear. Repeat application after 14–28 days as needed. Use longer interval when plants are not growing rapidly. Do not exceed 2 applications per cropping cycle. If the cropping cycle is less than 6 months, do not exceed 2 applications per 6 months. **REI: 12 hr**

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
16	buprofezin	Talus	36-43 g/100 L	3	Apply when adults first appear. Use the higher application rate when pest pressure is high. Minimum interval between applications is 21 days. Do not exceed 2 applications per crop cycle. When using 36 g/100 L, apply no more than 870 L spray solution/ha. When using 43 g/100 L, apply no more than 730 L of spray solution/ha. **REI: 48 hr**
21A	fenpyroximate	FujiMite	2.5 L/ha	1	For suppression. Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1,000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype) and sweet potato whitefly (*Bemisia tabaci*)** Repeat application after 10–14 days as needed. Do not exceed 2 applications per crop cycle. Avoid applying during the warmest part of the day. Effective against nymphs and has some effect on the pupal stage. Will not reduce adult whitefly populations. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**
	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate per single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712–1,000 L per hectare (42–20 mL concentration). Use the higher concentration for higher pest infestation levels. Minimum interval between applications is 7–14 days. Do not exceed 900 mL (216 g a.i.) per hectare per crop cycle. Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**
28	cyantraniliprole	Exirel	750–1,000 mL/ha	1	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
UNF	*Beauveria bassiana* strain ANT-03	Bio-Ceres G WP*	2–4 g/L water	0	Reduces pest numbers. Begin treatment of crops at the first appearance of the pest. Application rates, frequency, spray coverage and insect numbers impact the speed at which acceptable control is achieved. Depending on crop treated, 500–1,000 L per hectare of spray volume will typically be required. This product is most effective when used early, before high insect populations develop. Repeat application within 7 days as needed. This product may be toxic to bees exposed to direct treatment or drift. Do not apply this product while bees are actively foraging. **REI: Re-enter treated areas only after spray is dried.**
	Beauveria bassiana strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10-days as needed. High populations may require 2–5-day intervals. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter treated areas only after spray is dried.**

[1] See Appendix F for IRAC group definitions.

Table 6–1. Products registered for greenhouse pepper insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 100 parts water		Insects must be sprayed directly to achieve proper control. Repeat application every 2 weeks. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	Repeat application every 2 weeks as needed. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BACTERIAL CANKER (*Clavibacter michiganensis* subsp. *michiganensis*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not exceed 3 applications per season. Minimum interval between applications is 7 days. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
BACTERIAL SPECK (BACTERIAL BLIGHT) (*Pseudomonas syringae* pv. *tomato*)					
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin application soon after emergence/transplant and when conditions are conducive to disease development. Repeat application every 7–10days as needed. **REI: NS**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
P 06	*Bacillus mycoides* isolate J	LifeGard WG*	0.33 g/L water	0	For suppression. Apply in sufficient volume to provide uniform coverage. Do not apply less than 70 g per hectare. Repeat applications every 7 days. **REI: 4 hr**
BACTERIAL SPOT (BACTERIAL LEAF SPOT) (*Xanthomonas campestris* pv. *vesicatoria*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not exceed 3 applications per season. Minimum interval between applications is 7 days. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
44	*Bacillus subtilis* strain QST 713	Cease Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin application soon after emergence or transplant and when conditions are conducive to disease development. Repeat application every 7–10 days as needed. **REI: NS**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	1.25–2.5 mL/L water (0.125%–0.25% v/v)	0	For suppression. Begin applications at the first sign of disease or when conditions become conducive for disease development. Repeat application every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-enter treated areas only after spray is dried.**
P 06	*Bacillus mycoides* isolate J	LifeGard WG*	0.33 g/L water	0	For partial suppression. Apply in sufficient volume to provide uniform coverage. Do not apply less than 70 g per hectare. Repeat applications every 7–14 days. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
EARLY BLIGHT (*Alternaria solani*)					
7	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	For suppression. Begin applications prior to disease development. Repeat application every 7–10 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 5.25 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	537–926 mL/ha (29–50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain suppression. Do not exceed 150 g a.i. per hectare per year. **REI: Re-enter treated areas only after spray is dried.**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	0.5–2 kg/ha	0	Apply from flowering to fruiting. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Re-enter treated areas only after spray is dried.**
		Double Nickel LC*	2.5–10 L/ha		
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
P 06	*Bacillus mycoides* isolate J	LifeGard WG*	0.33 g/L water	0	For suppression. Apply in sufficient volume to provide uniform coverage. Do not apply less than 70 g per hectare. Repeat applications every 7 days. **REI: 4 hr**
GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*)					
7	fluopyram	Luna Privilege	500 mL/ha	0	Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 2 applications per crop cycle. Minimum application interval is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.7 m: 1,000 L/ha 3.4 m: 1,500–2,000 L/ha **REI: 12 hr**
	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	Begin applications prior to disease development. Repeat application every 7–10 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 5.25 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT, STEM CANKER) (*Botrytis cinerea*) (cont'd)					
17	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.75 kg a.i./ha)	1	Begin application when conditions favour disease development. Repeat application every 7–10 days If conditions continue to favour disease. Do not exceed 3 applications per crop cycle. **REI: 4 hr**
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25–50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–10 days as needed to maintain suppression. Do not exceed 150 g a.i. per hectare per year. **REI: Re-enter treated areas only after spray is dried.**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	**Foliar:** 1.25–3.6 kg/ha **Low disease pressure:** 0.9–1 kg/ha	0	For suppression. Use from flowering to fruit maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Re-enter treated areas only after spray is dried.**
		Double Nickel LC*	**Foliar:** 6.25–18 L/ha **Low disease pressure:** 4.5–5 L/ha		
	Bacillus subtilis strain QST 713	Cease	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat application every 7–10 days as needed. **REI: NS**
		Rhapsody ASO*			
BM 01	BLAD polypeptide	Fracture	1.5–3.3 L/ha in a minimum of 200 L water/ha	0	Begin applications prior to onset of disease development. Repeat applications every 7–10 days. Use a higher rate and shorter interval when disease pressure is moderate to high. Do not exceed 5 applications per crop cycle. **REI: NS**
		Problad Plus			
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks. Use shorter intervals under conditions of moderate-to-high disease pressure. **REI: 4 hr**
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield HC*	3.75–7.5 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet but not to the point of run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: 4 hr**
NC	*Aureobasidium pullulans* DSM 14940 and DSM 14941	Botector*	1 kg/ha in 500–2,000 L water	0	Apply preventatively if climatic conditions are favourable for infection or at first sign of disease onset. Repeat application every 7–10 days as needed. Do not exceed 5 applications per year. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PHYTOPHTHORA BLIGHTS (LATE BLIGHT, PHYTOPHTHORA FOLIAR BLIGHT)					
21	cyazofamid	Torrent 400 SC	25 mL/100 L water	0	***Phytophthora capsici*** Make the first application of the solution as a soil drench to thoroughly wet the growing medium immediately at transplant. The second application, if needed, can be made 6–8 weeks later. Do not make sequential applications of other fungicides in the same group. Do not use a surfactant with this drench application. Do not apply a drench volume greater than 200 mL per plant per application. **REI: 12 hr**
40	mandipropamid	Revus	600 mL/ha (150 g a.i./ha)	1	***Phytophthora capsici (foliar phase)*** Applications should begin prior to disease development. Do not exceed 4 applications per season. **REI: 12 hr**
49	oxathiapiprolin	Orondis Orondis Ultra B Zorvec Enicade	0.175–0.35 L/ha	0	***Phytophthora infestans, Phytophthora capsici*** Foliar application only. Begin applications prior to disease development. Repeat applications every 5–14 days. Use the higher rate and shorter interval when disease pressure is high. Do not exceed 4 applications per crop cycle per year. Where multiple crop cycles are produced in the same year do not exceed 6 foliar applications or 1.4 L per hectare per year. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora capsici*** For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 4 applications per year. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha in a minimum of 100 L water	1	***Phytophthora* spp., *Phytophthora infestans*** For suppression. Do not exceed 5 foliar and/or irrigation applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation,spray mist has cleared and the treated surface has dried.**
		Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1000 L water	0	***Phytophthora capsici*** For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	***Phytophthora infestans*** Repeat application every 5–10-days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
P 06	*Bacillus mycoides* isolate J	LifeGard WG*	0.33 g/L water	0	For suppression. Apply in sufficient volume to provide uniform coverage. Do not apply less than 70 g per hectare. Repeat applications every 7 days. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW					
3	myclobutanil	Nova WSP	340 g/ 1,500–3,000 L water/ha	3	Do not exceed 1 application per crop cycle. Apply as soon as possible after initial infection. **REI: 12 hr**
7	fluopyram	Luna Privilege	100 mL/ha	0	***Leveillula taurica*** Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.7 m: 1,000 L/ha 3.4 m: 1,500–2,000 L/ha **REI: 12 hr**
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	278–926 mL/ha (15–50 g a.i./ha)	0	***Oidium neolycopersici*** Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain suppression. Use a higher rate under conditions of high disease pressure. Do not exceed 150 g a.i. per hectare per year. **REI: Re-enter treated areas only after spray is dried.**
46	tea tree oil	Timorex Gold*	1–1.5 L/ 400–800 L water/ha	2	***Leveillula taurica*** Do not spray during the warm hours of the day and in hot seasons with temperatures above 35°C. Do not apply through any type of irrigation system. Good coverage and wetting of foliage is required. For preventive treatments, repeat application every 7–14 days as needed. Use shorter application intervals under conditions that promote rapid disease development. Do not apply with captan or sulphur, which could cause phytotoxicity. **REI: 24 hr**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.2 kg in a minimum of 250 L water/ha	1	***Leveillula taurica*** For suppression. Begin applications prior to disease development. Do not apply this product using any type of foggers or misters. Do not exceed 1 application per crop cycle. Do not use on plants that will be transplanted. **REI: 12 hr**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 475–2,000 L water/ha	1	***Leveillula taurica*** For suppression. Begin applications when conditions become favourable to disease but before infection. Repeat application every 7–10 days as needed. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. Do not exceed 3 applications per crop cycle. **REI: 24 hr**
BM 02	*Streptomyces lydicus* strain WYEC 108	Actinovate SP	425 g/1,100 L water/ha	NS	***Leveillula taurica*** For suppression. Apply as a foliar spray to leaves and blossoms. Begin applications at transplant. Repeat application every 7 days. Spray to wet but not to the point of run-off. **REI: Do not enter treated area until spray is dried.**

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
M 02	sulphur	Agrotek Vaporized Sulphur*	0.4–3.2 g/1,000 m^2	NS	***Leveillula taurica*** Use 1 vaporizer per 1,000 m^2. Start using before plants show signs of infection. Use for 1–8 hr per night, 2–7 days per week. Do not apply if temperature is above 24°C and high humidity prevails. Certain species of beneficial insects are sensitive to sulphur. **REI: 2 hr**
		Bartlett Microscopic Wettable Sulphur*	543–760 g/ 1,000 L water/ha	NS	Do not exceed 10 applications per crop cycle. Minimum interval between applications is 14 days. Do not apply if high temperatures (above 26°C) and high humidity prevail or are expected during the 3 days following application. **REI: 24 hr**
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	1.25–2.5 mL/L water (0.125%–0.25% v/v)	0	***Erysiphe cichoracearum, Leveillula taurica, Oidium neolycopersici*** For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not to the point of run-off. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-enter treated areas only after spray is dried.**
NC	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	***Leveillula taurica*** For suppression. Apply when conditions are favourable for disease development and/or when first symptoms appear. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium bicarbonate	MilStop*	5.6 kg/2,000 L water/ha	0	***Leveillula taurica*** Start application at first sign of disease. Uniform and complete coverage of the foliage is essential for the most effective results. Number of applications will depend on disease pressure. Repeat application every 7 days. Do not exceed 10 applications per season. Do not apply through any type of irrigation system. **REI: 4 hr**
		Sirocco*	5.6 kg/ha	0	***Leveillula taurica, Oidium lycopersicium*** Begin applications at the first sign of disease or when conditions are conducive to disease development. Label recommended spray volume is 1,000–2,000 L per hectare. Repeat application every 7 days. Do not exceed 10 applications per year. **REI: 4 hr**
SEPTORIA LEAF SPOT					
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	***Septoria lycopersici*** Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
4	Metalaxyl-M and S-isomer	Subdue Maxx	1.5–2.5 mL/10 L water	2	***Pythium aphanidermatum*** Apply 250 mL of solution as a drench to the growing media at the base of each plant. Irrigate within 1–2 days to ensure product reaches the root zone. Apply immediately after transplanting or when Pythium root rot is present. Use the higher rate under conditions of high disease pressures, or when there is a history of high disease pressure. Do not exceed 1 application per crop cycle. Do not apply to the foliage. Do not use in the propagation house. **REI: 12 hr**
21	cyazofamid	Torrent 400SC	30 mL/100 L water	60	***Pythium* spp.** Apply as a soil drench to thoroughly wet the growing medium immediately after seeding. Do not exceed 1 application. Do not use any surfactant. **REI: 12 hr**
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	1	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 seeding/seedling applications per crop cycle. Do not exceed 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilils* strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates:** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-enter treated areas only after spray is dried.** **Rates:** **Seed treatment:** 7.5–42 g in 300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (DAMPING OFF) (cont'd)					
BM 02 (cont'd)	*Streptomyces* strain K61	Mycostop WP*	See **Remarks.**	NS	***Fusarium* spp.** For suppression. Apply immediately after transplanting. Repeat applications every 3–6-weeks. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates:** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)
	Trichoderma harzianum Rifai strain KRL-AG2 and *Trichoderma virens* strain G-41	BW240 WP	30–60 g/100 L water/ m^2 of soil/potting mixture surface	0	***Fusarium* spp., *Phytophthora* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Apply immediately after sowing seed or planting. Repeat application after 8–10 weeks if the disease is expected. Do not use overhead boom chemigation for second application or after the four-leaf stage. Use a higher rate and shorter interval when disease pressure is high. **REI: 4 hr**
M 04	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			
NC	garlic powder	Influence WP*	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Do not enter treated area until spray is dried.**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
12	fludioxonil	Medallion	300 mL/1,000 L water	1	***Fusarium solani*** For suppression. Use as drench application of 250 mL solution per plant. Apply to seedling crop prior to transplanting. Do not exceed 2 applications per crop cycle. Do not apply to the foliage. **REI: 12 hr**
21	cyazofamid	Torrent 400 SC	25 mL/100 L water	0	***Phytophthora capsici*** Make the first application of the solution as a soil drench to thoroughly wet the growing medium immediately at transplant. Repeat application after 6–8 weeks as needed. Do not make sequential applications of other fungicides in the same group. Do not use a surfactant with this drench application. Do not apply a drench volume greater than 200 mL per plant per application. **REI: 12 hr**
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	1	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 seeding/seedling applications per crop cycle. Do not exceed 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
40	mandipropamid	Micora	600 mL/ha (150 g a.i./ha)	1	***Phytophthora capsici*** For suppression. Begin applications prior to disease development. Apply as a drench to the base of the plant in sufficient water to ensure the root area is covered. Apply as a foliar spray in sufficient water to ensure good coverage of foliar tissues. Repeat applications every 7–10 days. Do not exceed 1 drench and 3 foliar applications per crop cycle.
		Revus	600 mL/ha (150 g a.i./ha)	1	***Phytophthora capsici (soil phase)*** Applications should begin prior to disease development. Do not exceed 4 applications per season. **REI: 12 hr**
44	*Bacillus subtilis* strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates:** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-enter treated areas only after spray is dried.** **Rates:** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
	Streptomyces strain K61	Mycostop WP*	See **Remarks.**	NS	***Fusarium* spp., *Phytophthora* spp.** For suppression. Apply immediately after transplanting. Repeat application every 3–6-weeks. For seedling production, apply first spray after emergence using lower rate. **REI: NS** **Rates:** **Rockwool:** 5–10 mg/plant (for spraying and drenching, use 10–20 mL/plant of 0.05% suspension) **Beds:** 5–10 g/100 m^2 (for spraying and drenching, use 0.1–0.2 L/m^2 of 0.05% suspension)
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield Granules*	600–750 g/m^3 (loose) planting mix or soil	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. For best results, thoroughly incorporate granules during mix preparation or pot filling, or incorporate into planting beds by raking or tilling. **REI: 4 hr**
		Bora HC*	**Drench:** 55–110 g/m^3	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: 4 hr**
		Bora WP*			
		RootShield HC*			
		RootShield WP*			

[1] See Appendix G for FRAC group definitions.

Table 6–2. Products registered for greenhouse pepper diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
M 04	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora* spp., *Pythium* spp.** For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 4 applications per year. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha in a minimum of 100 L water	1	***Pythium* spp.,** For suppression. Do not exceed 5 foliar and/or chemigation applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
		Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1,000 L water	0	***Phytophthora* spp., *Pythium* spp.** For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
NC	garlic powder	Influence WP*	10–20 kg/ 1,000 L water/300 m^2	0	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a drench to the substrate surface at seeding. Use the higher rate under high disease pressure or when conditions are conducive to disease development. **REI: Re-enter treated areas only after spray is dried.**

[1] See Appendix G for FRAC group definitions.

7. Lettuce

Products registered for greenhouse lettuce insect and mite pests are listed in Table 7–1.
Products registered for greenhouse lettuce diseases are listed in Table 7–2.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval
* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. **REI: 12 hr**
		Malathion 85 E	735–1,345 mL/ha	7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. The product is more effective if the temperature is 20°C or more or when temperatures will reach or exceed this minimum. **REI: 12 hr**
4A	imidacloprid	Intercept 60 WP	**Transplant tray plug drench:** 4.1 g/1,000 seedling plants	28	**Green peach aphid (*Myzus persicae*), lettuce aphid (*Nasonovia ribis-nigri*), melon aphid (*Aphis gossypii*)** For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not exceed 1 application per crop cycle. Apply product at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m^2 of seedling trays. May harm pollinators and certain beneficial insects. **REI: NS**
4D	flupyradifurone	Altus	**Foliar:** 500–750 mL/ha **Drench:** 750–1,000 mL/ha (7.5–10 mL/100 m^2)	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. **Foliar:** Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. **Drench:** Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2000 mL/ha per crop cycle. **REI: 12 hr**
23	spirotetramat	Kontos	43–60 mL/100 L water Maximum of 72 g a.i./ha/ application	7	Rate selected for use should depend on infestation level of those pests. Minimum interval between applications is 7 days. Re-apply only when monitoring indicates it is necessary. Do not exceed 900 mL (216 g a.i.) per hectare per crop cycle. Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/ on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
NC	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but avoid run-off. Repeat application every 5–10 days as needed. High populations may require 2–5-day intervals. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/ 1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water		Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**
		Safer's Insecticidal Soap Concentrate			

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ARMYWORMS					
1B	malathion	Malathion 85 E	735–1,345 mL/ha	7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. **REI: 12 hr**
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	**Beet armyworm (*Spodoptera exigu*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter treated areas only after spray is dried.**
CORN EARWORM (TOMATO FRUITWORM) (*Helicoverpa* (=*Heliothis*) *zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter treated areas only after spray is dried.**
LEAFHOPPERS					
4D	flupyradifurone	Altus	**Foliar:** 500–750 mL/ha **Drench:** 750–1,000 mL/ha (7.5–10 mL/100 m^2)	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. **Foliar:** Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. **Drench:** Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS					
3A	lambda-cyhalothrin	Matador 120 EC	83 mL/ha	3	**Cabbage looper (*Trichoplusia ni*)** Apply when insects or damage first appear. For best results, apply against early developmental stages of the pest. Do not exceed 2 applications per year. Apply in sufficient water to ensure adequate coverage. For best results, apply during the early morning before temperatures rise and during the evening, past the heat of the day. **REI: 24 hr**
		Warrior	83 mL/ha	3	**Cabbage looper (*Trichoplusia ni*)** Apply when insects or damage first appear. For best results, apply against early developmental stages of the pest. Do not exceed 2 applications per year. Repeat application every 7 days. Apply in sufficient water to ensure adequate coverage. For best results, apply during the early morning before temperatures rise and during the evening, past the heat of the day. **REI: 24 hr**
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 500 L/ha. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	240 mL/1,000 L water		
		Success	120 mL/1,000 L water		
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	Foray 48BA	0.6–1.8 L/ 500–1,000 L water/ha (60–180 mL/1,000 m^2)	NS	**Cabbage looper (*Trichoplusia ni*)** Apply using a high-volume spray. Repeat application every 10 days after loopers first appear. In general, larvae should be treated when they are newly hatched. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.92 kg/1,000 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply to young larvae at first signs of infestation. Repeat applications as needed to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**
	Bacillus thuringiensis subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter treated areas only after spray is dried.**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
18	tebufenozide	Confirm 240F	0.6 L/ha	14	**Cabbage looper (*Trichoplusia ni*)** Apply on early instars. Apply in sufficient water to ensure thorough coverage. Begin applications when first signs of feeding damage appear. Repeat application every 10–14 days if needed. Do not exceed 2 applications per crop cycle. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex	50–200 mL/400 L water	0	**Cabbage looper (*Trichoplusia ni*)** Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days as needed. **REI: Re-enter treated areas only after spray is dried.**
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap* Safer's Insecticidal Soap Concentrate*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L water **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**
17	cyromazine	Citation 75WP	75 g (1 water soluble bag)/ 570 L water	14	***Bradysia* sp.** Apply to the foliage and moist surfaces where the insects breed and feed. Apply sufficient amount of mixture for thorough coverage. Do not exceed 1,010 L spray solution per hectare. Minimum interval between applications is 7 days. Do not exceed 4 applications per growing season. Do not apply through any type of irrigation equipment. May adversely affect some species of predatory mites and leafminer parasitoids. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MEALYBUGS					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as needed. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
MITES					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. **REI: 12 hr**
		Malathion 85 E	735–1,345 mL/ha	7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. **REI: 12 hr**
UNF	*Beauveria bassiana* PPRI 5339	Velifer	450–900 mL/1,000 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter into treated areas only after spray has dried.**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of mite presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Mites, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water		**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Repeat application every week for 2–3 weeks. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Repeat application every week for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**
PSYLLIDS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
SCALES					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
THRIPS					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. **REI: 12 hr**
		Malathion 85 E	735–1,345 mL/ha	7	
UNF	*Beauveria bassiana* strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water **Drench:** 108 mL/10 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/ grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. **REI: Re-enter into treated areas only after spray has dried.**
TOMATO HORNWORM (*Manduca quinquemaculata*)					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain EVB113-19	Bioprotec 3P DF*	0.46–0.92 kg/1,000 L water	0	Apply to young larvae at first signs of infestation. Repeat applications as necessary to maintain control of young larvae. The timing and number of applications will depend on foliage development and larval activity, including egg hatch, stage of larval development and population pressure. Best results are obtained if applications are made in the evening or on a cloudy day. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES					
1B	malathion	Fyfanon 50% EC	1.5–2.75 L/ha	leaf: 21 head: 7	Do not exceed 2 applications per year. Minimum interval between applications is 10 days. **REI: 12 hr**
		Malathion 85 E	735–1,345 mL/ha	7	**Greenhouse whitefly (*Trialeurodes vaporariorum*)** Do not exceed 2 applications per year. Minimum interval between applications is 10 days. **REI: 12 hr**
4D	flupyradifurone	Altus	**Foliar:** 750–1,000 mL/ha **Drench:** 1,500–2,000 mL/ha (15–20 mL/100 m^2)	1	Thorough, uniform coverage of the crop is required for optimum control. Use the higher rate for higher pest infestation levels. Minimum application volume is 500 L per hectare. Foliar: Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Drench: Application to soil or soilless media should be made with sufficient water to ensure incorporation into the root zone. Follow with moderate irrigation. Irrigate carefully within the next 10 days to avoid loss of active ingredient due to leaching. Minimum interval between applications is 7 days. Do not exceed 2,000 mL per hectare per crop cycle. **REI: 12 hr**
4A	imidacloprid	Intercept 60 WP	**Transplant tray plug drench:** 4.1 g/1,000 seedling plants	28	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Do not exceed 1 application per crop cycle. Apply product at least 10 days prior to transplanting. Do not use less than 15 L solution/100 m^2 of seedling trays. May harm pollinators and certain beneficial insects. **REI: NS**
UNF	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa*, and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**

[1] See Appendix F for IRAC group definitions.

Table 7–1. Products registered for greenhouse lettuce insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
UNF (cont'd)	*Beauveria bassiana* PPRI 5339	Velifer	450–900 mL/1000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter into treated areas only after spray has dried.**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 100 parts water		Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2-week intervals. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 7–2. Products registered for greenhouse lettuce diseases

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BLUE MOULD (*Peronospora effusa*)					
40	mandipropamid	Micora	400–600 mL/ha (100–150 g a.i./ha)	7	Begin applications prior to disease development. Repeat applications every 7–10 days. Use of a non-ionic adjuvant (0.25% v/v) is recommended on the label. Do not exceed 4 applications per crop cycle.
		Revus	400–600 mL/ha (100–150 g a.i./ha)	7	Applications should begin prior to disease development. Do not exceed 4 applications per season. **REI: 12 hr**
BOTTOM ROT (*Rhizoctonia solani*)					
44	*Bacillus subtilis* var. *amyloliquefaciens* strain FZB24	Taegro WP*	190 g/935.4 L water/ha	0	For suppression. Applications should be made to the plant base and soil/growing medium surface to protect the contact between the soil/growing medium and leaf tissue as the lettuce develops. Repeat application every 7 days when conditions are conducive to disease development. Water in solution immediately after application. **REI: 0 hr**
DOWNY MILDEW (*Bremia lactucae*)					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25–50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage. Begin as a preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain suppression. Do not exceed 150 g a.i. per hectare per year. **REI: Re-enter into treated areas only after spray has dried.**
40	mandipropamid	Micora	400–600 mL/ha (100–150 g a.i./ha)	7	Begin applications prior to disease development. Repeat applications every 7–10 days. Use of a non-ionic adjuvant (0.25% v/v) is recommended on the label. Do not exceed 4 applications per crop cycle.
		Revus	400–600 mL/ha (100–150 g a.i./ha)	7	Applications should begin prior to disease development. Do not exceed 4 applications per season. **REI: 12 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	1–2.5 kg/ha	0	For suppression. Begin applications preventively when conditions are favourable for onset of disease. Repeat application every 7–10 days for as long as conditions favour disease development. **REI: Re-enter into treated areas only after spray has dried.**
		Double Nickel LC*	5–12.5 L/ha		
	Bacillus subtilis strain QST 713	Cease*	1–2 L/100 L water	0	For suppression. Begin application soon after emergence or transplant and when conditions are conducive to disease development. Repeat application every 7 days as needed. **REI: NS**
		Rhapsody ASO*			
40 + 45	ametoctradin + dimethomorph	Zampro	0.8–1 L/1,000 L water/ha	0	For suppression. Begin applications prior to disease development. Repeat applications every 5–7 days. Use the higher rate and shorter interval when disease pressure is high. Do not exceed 3 applications per crop cycle. **REI: NS**

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
DOWNY MILDEW (*Bremia lactucae*) (cont'd)					
P 07	mono- and di-potassium salts of phosphorous acid	Confine Extra	3–7 L/ha in a minimum of 100 L water	1	For suppression. Do not exceed 6 foliar applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
		Rampart	3–8 L/1,000 L water/ha	0	***Pythium* spp.** For suppression. Apply lower rate every 2–4 weeks after plants become established. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 7 applications per year. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
NC	hydrogen peroxide and peroxyacetic acid	OxiDate*	100 mL/10 L water (1.0% v/v)	0	For suppression. Begin applications preventatively or at the first sign of disease and/or when conditions are favourable for disease development. Repeat application every 7 days. Under severe disease conditions, repeat application every 5 days. Do not exceed 8 applications. **REI: 4 hr**
		OxiDate 2.0*			
GREY MOULD (BOTRYTIS BLIGHT) (*Botrytis cinerea*)					
2	iprodione	Rovral WP	1 kg/2,000 L water/ha	14	Use a high-volume sprayer. Do not exceed 1 application per year at the 3-leaf stage. **REI: 12 hr**
		Rovral WDG			
7	fluopyram	Luna Privilege	500 mL/ha	7	First application can be made one week after transplanting at the earliest crop stage BBCH 12 (2nd leaf developed) and can be repeated once before the latest crop stage BBCH 49 (final head size for harvest is reached). Do not exceed 2 applications per crop cycle. Minimum application interval is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.2 m - 1000 L/ha 2.7 m - 1000–1500 L/ha Drench: Do not apply prior to flowering on the 9th truss or before March 1st. Apply as part of a normal irrigation cycle, late in the day on last watering. Avoid applications when conditions favour rapid growth. **REI: 12 hr**
17	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.75 kg a.i./ha)	3	Begin application when conditions favour disease development. Repeat application after 7 days if conditions continue to favour disease. Do not exceed 2 applications per crop cycle. **Do not exceed 3 kg per hectare per season. REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT) (*Botrytis cinerea*) (cont'd)					
44	*Bacillus subtilis* strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin applications soon after emergence or transplant. Repeat application every 7–10 days as needed. When environmental conditions are conducive to rapid disease development, use in a rotational program with other registered fungicides. Thorough coverage is essential. **REI: NS**
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water)	NS	For suppression. Apply as a foliar spray treatment to plant stems and leaves. Spray to wet but not to the point of run-off. Most effective when applied preventively, before disease starts. Repeat applications every 3–4 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr**
	Trichoderma harzianum Rifai strain KRL-AG2	RootShield HC*	10 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet but not to the point of run-off. Repeat applications every 7–14 days. **REI: NS**
M 03	ferbam	Ferbam 76 WDG	2 kg/1,000 L water	NS	Spray seedlings before first transplanting. Repeat application after 10 days. **REI: NS**
NC	*Aureobasidium pullulans* DSM 14940 and DSM 14941	Botector*	1 kg/ha in 500–2,000 L water	0	Apply preventatively soon after emergence or transplant if climatic conditions are favourable for infection or at first sign of disease onset. Repeat application every 7 days as needed. **REI: 4 hr**
POWDERY MILDEW					
44	*Bacillus subtilis* strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	***Erysiphe cichoracearum*** For suppression. Begin applications when conditions are conducive to disease development. Repeat application every 7–10 days as needed. Apply sufficient water to ensure complete coverage of entire plant. **REI: NS**
7 + 11	boscalid + pyraclostrobin	Pristine WG	1.3–1.6 kg in a minimum of 250 L water/ha	0	***Erysiphe cichoracearum*** For suppression. Begin application prior to disease development. Will provide suppression for a period of 10–14 days depending on disease pressure. Do not apply this product using any type of foggers or misters. Do not exceed 1 application per crop cycle. Do not use on plants that will be transplanted. **REI: 24 hr**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 200–3,000 L water/ha	1	***Erysiphe cichoracearum*** Begin applications prior to or at the onset of disease. Repeat application every 7–10 days if conditions remain favourable for disease development. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. The third application can be made if conditions remain favourable for disease development. Do not exceed 3 applications per crop cycle. **REI: 12 hr**

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
NC	potassium bicarbonate	MilStop*	2.8–5.6 kg/1,000 L water/ha	0	***Golovinomyces*** For suppression. Start application at first sign of disease. Uniform and complete coverage of the foliage is essential for the most effective results. Number of applications will depend on disease pressure. Repeat application every 7–14 days. Do not exceed 10 applications per season. Do not apply through any type of irrigation system. **REI: 4 hr**
	hydrogen peroxide and peroxyacetic acid	OxiDate* OxiDate 2.0*	100 mL/10 L water (1.0% v/v)	0	For suppression. Begin applications preventatively, at the first sign of disease, or when conditions are favourable for disease development. Repeat application ever 7 days. Under severe disease conditions, repeat application every 5 days. Do not exceed 8 applications. **REI: 4 hr**
SCLEROTINIA ROT (SCLEROTINIA DROP, LETTUCE DROP)					
2	iprodione	Rovral WP Rovral WDG	1 kg/2,000 L water/ha	14	Use a high-volume sprayer. Do not exceed 1 application per year at the 3-leaf stage. **Toxic to certain beneficial insects. REI: 12 hr**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	**Foliar:** 1–2.5 kg/ha **Low disease pressure:** 0.2–1 kg/ha	0	***Sclerotinia minor, Sclerotinia sclerotiorum*** For suppression. Apply from planting to formation of the head of lettuce. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Re-enter into treated areas only after spray has dried.**
		Double Nickel LC*	**Foliar:** 5–12.5 L/ha **Low disease pressure:** 1–5 L/ha		
	Bacillus subtilis strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	***Sclerotinia minor, Sclerotinia sclerotiorum*** For suppression. Head and leaf drop: Apply as a directed spray with multiple nozzles to each seed line in sufficient water to ensure thorough coverage of lower plant leaves and surrounding soil surface within 7 days of thinning or transplanting. Repeat application every 10–14 days if conditions for disease development persist. Use high rate and lower applications intervals under conditions of moderate to high disease pressure. **REI: NS**

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
4	Metalaxyl-M and S-isomer	Subdue Maxx	1.5–2.5 mL/10 L water	21	***Pythium aphanidermatum*** Apply as a soil drench after the cotyledons have fully expanded to the 2nd true leaf stage and at least one day before transplanting. Do not exceed one application per crop cycle. Apply 50–200 mL of solution per m^2 at the base of seedlings. Irrigate within 1–2 days to ensure product reaches the root zone. Use the higher rate under conditions of high disease pressures, or when there is a history of high disease pressure. Do not apply to the foliage. **REI: 12 hr**
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp., *Rhizoctonia solani*** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-enter treated areas only after spray has dried.** **Rates** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

[1] See Appendix G for FRAC group definitions.

Table 7–2. Products registered for greenhouse lettuce diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (DAMPING OFF) (cont'd)					
BM 02	*Trichoderma harzianum* Rifai strain KRL-AG2 and *Trichoderma virens* strain G-41	BW240 WP	30–60 g/100 L water/ m^2 of soil/potting mixture surface	0	***Fusarium* spp., Phytophthora spp., *Pythium* spp., *Rhizoctonia spp.*** For suppression. Apply immediately after sowing seed or planting. Repeat application after 8–10 weeks if the disease is expected. Do not use overhead boom chemigation for second application or after the four-leaf stage. Use a higher rate and shorter interval when disease pressure is high. **REI: 4 hr**
	Trichoderma harzianum Rifai strain T-22	Trianum G*	See **Remarks.**	NS	***Rhizoctonia solani*** For suppression. For the best results, begin use from propagation onwards, before occurrence of disease. Mix evenly in growing medium before filling seed trays at propagation and transplanting. **REI: NS** **Rates:** **Before filling seed trays or containers:** 750 g/m^3 **Subsequent applications at transplanting or reporting:** 375 g/m^3 **Crops on substrate, when transplanting:** 1 g/planting hole
		Trianum P*	See **Remarks.**	NS	***Rhizoctonia solani*** For suppression. Sowing application method: For the best results, begin use from propagation onwards, before occurrence of disease. Transplanting high crop density: Use a water volume equivalent to 10% of the substrate volume or 2–5 L/m^2. Low crop density: Use a water volume equivalent to 10% of the substrate volume or 100 L/1,000 plants. **REI: NS** **Rates:** **Sowing:** 1.5 g/m^2 of cultivated area, suspended in 2.5–5 L water **Transplanting high crop density:** 3 g/m^2 of cultivated area (1.5 g/m^2 if plants have been treated previously) **Transplanting low crop density:** 30 g/1,000 plants (15 g/1,000 plants if plants have been treated previously)

[1] See Appendix G for FRAC group definitions.

Table 7–2. Products registered for greenhouse lettuce diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
BM 02	*Gliocladium catenulatum* strain J1446	Prestop*	0.5% aqueous suspension (25 g/5 L water) See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a growing media treatment or as a drench treatment. Most effective when applied preventively, before disease starts. Treat the growing media prior to seeding, transplanting or potting, or else make a drench application immediately after seeding, transplanting or potting. Additional applications can be made as a drench. Repeat applications every 3–6 weeks, with shorter intervals used under conditions of moderate-to-high disease pressure. **REI: 4 hr** **Rates** **Growing media:** 125–250 mL of suspension/10 L growing media **Soil drench:** 20 L suspension/10 m^2 growing media
	Streptomyces lydicus strain WYEC 108	Actinovate SP	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-enter treated areas only after spray has dried.** **Rates** **Seed treatment:** 7.5–42 g/300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Pythium* spp.** For suppression. Begin applications when conditions favour disease development. Repeat application every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 7 applications per year. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1,000 L water	0	***Pythium* spp.** For suppression. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal Irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**

[1] See Appendix G for FRAC group definitions.

8. Eggplants

Products registered for greenhouse eggplant insect and mite pests are listed in Table 8–1.
Products registered for greenhouse eggplant diseases are listed in Table 8–2.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable
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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, only after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	imidacloprid	Intercept 60 WP	16 g/70 L water/ 1,000 mature plants	3	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Irrigate moderately but thoroughly after application, allowing no leaching and runout from container for at least 10 days after application. Do not exceed 1 application per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**
9B	pymetrozine	Endeavor 50 WG	100–200 g in a minimum of 1,000 L water/ha	3	**Green peach aphid (*Myzus persicae*), melon aphid (*Aphis gossypii*)** Do not exceed 200 g in 1,000 L per application. Do not exceed 2 applications per crop cycle or 3 applications per year in greenhouses with multiple crop cycles. Apply as a foliar spray. Minimum interval between applications is 7 days. On hard-to-wet plants, label recommends adding a non-ionic or organosilicone-based surfactant to improve coverage. **REI: 12 hr**
23	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate/ single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712–1,000 L per hectare (42–30 mL concentration). Use the higher concentration for higher pest infestation levels. Minimum interval between applications is 7–14 days. Do not exceed 900 mL (216 g a.i.) per hectare per crop cycle. Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS (cont'd)					
UNF	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/ 1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap			
		Opal2 Insecticidal Soap	1 part concentrate: 50 parts water		Insects must be sprayed directly to achieve proper control. Repeat applications as needed. **REI: NS**
		Safer's Insecticidal SoapConcentrate			

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BEET ARMYWORM (*Spodoptera exigu*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter treated areas only after spray has dried.**
CORN EARWORM (TOMATO FRUITWORM) (*Helicoverpa* (=*Heliothis*) *zea*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter treated areas only after spray has dried.**
DUPONCHELIA FOVEALIS					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	625 g/1,000 L water	0	Make applications when egg hatch is essentially complete, when larvae are small but before crop damage occurs. Apply the product such that it flows along the stem, coating it well. Thorough coverage of foliage and stem is necessary. Repeat applications every 7 days as needed. **REI: NS**
EARWIGS					
NC	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
EUROPEAN CORN BORER (*Ostrinia nubilalis*)					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	Maximum application volume that can be used is 2,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
FUNGUS GNATS					
11A	*Bacillus thuringiensis* subsp. *israelensis*, serotype H-14, strain AM 65-52	VectoBac 600L	**Light to moderate infestation:** 2–4 L/1,000 L **Heavy infestation:** 4–8 L/1,000 L water	NS	Apply weekly as a soil drench or when pest monitoring indicates the need. This product is a larvicide and will not control adult gnats. **REI: NS**
LEAFROLLERS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
LEAFMINERS					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	**Tomato leafminer (*Tuta absoluta*)** Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter treated areas only after spray has dried.**
	Bacillus thuringiensis subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	500–1,000 g/ 1,000 L water	0	**Lepidopteran leafminers** Apply at egg hatch. Thorough coverage of foliage and stems is necessary. Repeat application every 7–10 days as needed. **REI: NS**
18	tebufenozide	Confirm 240F	0.6 L/ha	3	**Lepidopteran leafminers** For suppression. Foliar application only. Use a high-volume sprayer. Apply at first egg hatch. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 10 days. Effective against larval Lepidoptera, however, it is essentially non-toxic to adult bees and does not adversely affect beneficial insects such as predatory mites, beetles, wasps and spiders. **REI: 12 hr**
28	chlorantraniliprole	Coragen	200 mL/1,000 L water	1	**Lepidopteran leafminers** Apply at egg hatch. Thorough coverage is important to obtain optimum control. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not exceed 750 mL product per hectare per crop cycle. Apply in a maximum finished spray volume of 1,250 L per hectare. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Use the higher rate when insect populations are high and/or insects are large. Apply when eggs hatch and first instar larvae are present. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	72 g/1,000 L water	2	**Cabbage looper (*Trichoplusia ni*)** Maximum application volume that can be used is 1,000 L per hectare. Apply when eggs hatch and first instar larvae are present. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	240 mL/1,000 L water		
		Success	120 mL/1,000 L water		
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	75–150 g/250 L water	0	**Cabbage looper (*Trichoplusia ni*)** Apply at egg hatch to target young larvae (early instars). For best control, thorough coverage is required. Under heavy population pressure, or for larger larvae, shorten the spray interval or use the higher rate range. Repeat applications every 3–14 days as needed. Do not exceed 4 applications per season. **REI: NS**
	Bacillus thuringiensis subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	**Cabbage looper (*Trichoplusia ni*), tomato looper (*Chrysodeixis chalcites*)** Treat when larvae are young (early instars), before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter treated areas only after spray has dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	**Alfalfa looper (*Autographa californica*), Cabbage looper (*Trichoplusia ni*)** For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
28	chlorantraniliprole	Coragen	125 mL/1,000 L water	1	**Cabbage looper (*Trichoplusia ni*)** Begin applications when treatment thresholds have been reached. Thorough coverage is required to obtain optimum control. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not exceed 750 mL product per hectare per crop cycle. The maximum finished spray volume is 2,000 L per hectare. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
LOOPERS (cont'd)					
28	cyantraniliprole	Exirel	250 mL/ha	1	**Cabbage looper (*Trichoplusia ni*)** Thorough coverage is required to obtain optimum control. Select a spray volume appropriate for the size of plants and density of foliage. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**
NC	*Autographa californica Nucleopolyhedrovirus* FV11	Loopex*	50–200 mL/400 L water	0	**Cabbage looper (*Trichoplusia ni*)** Application timing should target small larvae and be applied using high-volume spray systems (minimum 400 L/ha). Uniform spray deposit coverage of the foliage is essential for optimum control. Repeat applications every 7–14 days as needed. **REI: Re-enter treated areas only after mists has have settled.**
MEALYBUGS					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Opal2 Insecticidal Soap* Safer's Insecticidal Soap Concentrate*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as needed. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
13	chlorfenapyr	Pylon	20–30 mL/100 L	0	**Two-spotted spider mite (*Tetranychus urticae*)** For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
20B	acequinocyl	Shuttle 15 SC	0.21–0.46 L/500 L water (0.07–0.15 g a.i./L of solution)	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to drip. Actual spray volume will vary depending on the size of the plants being sprayed. Application should be made as soon as the mite population reaches economic infestation levels. Apply the higher concentration for heavy pest infestations. Minimum interval between applications is 21 days. Do not use product in successive miticide applications. Do not exceed 2 applications per crop (0.69 kg a.i./ha). **REI: 12 hr**
20D	bifenazate	Floramite SC	125 mL (30 g a.i.)/ 400 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply as a full coverage spray to the foliage to obtain uniform coverage. Actual spray volume will vary depending on the size of the plants being treated. Do not exceed a maximum finished spray volume of 2,000 L per hectare per application. Application should be made as soon as mites appear and will provide residual control for up to 28 days. Do not exceed 2 applications per crop cycle. Make only 1 application of this product before rotating to products of an alternate chemical class. This product is primarily active on the motile stages of mites. It is not effective against rust mites, broad mites and flat mites. **REI: 12 hr**
21A	fenpyroximate	FujiMite	2.5 L/ha	1	**Two-spotted spider mite (*Tetranychus urticae*)** Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Two-spotted spider mite (*Tetranychus urticae*)** Under high pest population pressure. Repeat application every 10–14 days as needed. Do not exceed 2 applications per crop cycle. The maximum application volume is 2,000 L water per hectare. Avoid applying during the warmest part of the day. Mite juvenile stages are often more susceptible than adults. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval N/A = not applicable

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES (cont'd)					
UNF	*Beauveria bassiana* PPRI 5339	Velifer	450–900 mL/ 1,000 L water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10-day intervals. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter treated areas only after spray has dried.**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of mite presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Mites, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	For suppression. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water		**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Repeat application every week for 2–3 weeks. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	**Two-spotted spider mite (*Tetranychus urticae*)** Spray all plant parts once weekly for 2–3 weeks, and thereafter as required. If possible, foliage should be misted daily with water until mite control is achieved. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PSYLLIDS					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	potassium salts of fatty acids	Opal2 Insecticidal Soap*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
SCALES					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
THRIPS					
5	spinetoram	Delegate WG	92–132 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Use the higher rate when insect populations are high and/or insects are large. Apply when western flower thrips first appear. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. Do not apply by a fogger or mister. **REI: 12 hr**
	spinosad	Entrust 80 WG*	30 g/1,000 L water	2	**Western flower thrips (*Frankliniella occidentalis*)** For suppression. Maximum application volume that can be used is 2,000 L per hectare. Apply when western flower thrips first appears. Do not apply by a fogger or mister. Do not exceed 3 applications per crop cycle. Minimum interval between applications is 7 days. **REI: 12 hr**
		Entrust SC*	100 mL/1,000 L water		
		Success	50 mL/1,000 L water		
28	cyantraniliprole	Exirel	500–1,000 mL/ha	1	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. If thrips populations are above thresholds, use a registered knockdown product before application. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
THRIPS (cont'd)					
UNF	*Beauveria bassiana* strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 day. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani*, *Amblyseius swirskii*, *Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/ 1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat applications every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water **Drench:** 108 mL/10 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Re-apply as required. Repeat application every 5–10 days. Spray to wet all foliage, but not to the point of run-off. Do not apply through a thermal pulse fogger. Drench application method: May reduce pest numbers. Drench application should be thoroughly watered-in without causing water to come out of the bottom of the pots/grow bags. Depending on the growing media type and moisture, this will be around 250 mL/4-L pot or grow bag. Re-apply as required. The need for and timing of re-application should be determined by monitoring. Do not apply via drip irrigation. **REI: Re-enter treated areas only after spray has dried.**
NC	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	For suppression. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate otherwise phytotoxicity may result. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
TOBACCO BUDWORM (*Heliothis virescens*)					
11A	*Bacillus thuringiensis* subsp. *aizawai* strain ABTS-1857	XenTari WG*	500–1,000 g/ha	0	Treat when larvae are young (early instars) before the crop is damaged. Use sufficient spray volume to ensure thorough coverage but not to the point of run-off. Best results are obtained if applications are made in the evening or on a cloudy day. Repeat applications every 3–14 days as needed. This product is toxic to bees and certain beneficial insects. **REI: Re-enter treated areas only after spray has dried.**
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Maximum number of applications per crop cycle is 1. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
TOMATO HORNWORM (*Manduca quinquemaculata*)					
13	chlorfenapyr	Pylon	30 mL/100 L water	0	For suppression. Do not exceed 1 application per crop cycle. Do not apply using a spray volume greater than 1,000 L per hectare. Do not apply as an ultra-low-volume (ULV) spray. Do not apply through any type of irrigation equipment. This product is toxic to bees and certain beneficial insects. **REI: 12 hr**
WHITEFLIES					
1B	naled	Dibrom	**Vapour:** 9.6 mL/100 m^3 **Fog:** 6.7–13.4 mL/100 m^2	N/A	Do not exceed 1 application per crop cycle, only after the last harvest at the end of the cropping cycle. Vapour treatment: Apply to cold pipes using a plastic squeeze bottle when plants are dry. Do not apply using a paint brush or any other method. Do not apply to hot pipes. Fogging treatment: Apply with automated fogging equipment only. All workers must evacuate the premises during the fogging operations. **REI: 48 hr (must be fully ventilated before re-entry)**
4A	imidacloprid	Intercept 60 WP	16 g/70 L water/ 1,000 mature plants	3	For use as a soil drench using micro-irrigation, drip irrigation, overhead irrigation, or hand-held or motorized calibrated irrigation equipment. Do not apply as a foliar application. Irrigate moderately but thoroughly after application, allowing no leaching and runout from container for at least 10 days after application. Do not exceed 1 application per season. Applications should be made when infestation pressure surpasses threshold and beneficials are not able to maintain pest populations below damage thresholds. May harm pollinators and certain beneficial insects. **REI: NS**

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Table 8–1. Products registered for greenhouse eggplant insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
7C	pyriproxyfen	Distance	45 mL/100 L water	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype), and sweet potato whitefly (*Bemisia tabaci*)** Do not exceed a maximum finished spray of 2,000 L per hectare per application. Apply as a foliar spray mixture uniformly to all plant surfaces and to the point of run-off. Make first application when adult insects begin to appear. If necessary, make a second application between 14 and 28 days after the first application. Use longer interval when plants are not growing rapidly. Do not exceed 2 applications per crop cycle. If the crop cycle is less than 6 months, do not exceed 2 applications/6 months. **REI: 12 hr**
21A	fenpyroximate	FujiMite	2.5 L/ha	1	For suppression. Apply when pests are in immature stages or when populations reach economic thresholds. Apply in a minimum spray volume of 1,000 L per hectare to ensure thorough coverage of the foliage. Do not exceed 1 application per crop cycle. Toxic to certain beneficial insects. **REI: 12 hr**
23	spiromesifen	Forbid 240 SC	30–50 mL/100 L water (0.03%–0.05% solution)	3	**Greenhouse whitefly (*Trialeurodes vaporariorum*), silverleaf whitefly (*Bemisia tabaci* B biotype), and sweet potato whitefly (*Bemisia tabaci*)** Under high pest population pressure, repeat application every 10–14 days as needed. Do not exceed 2 applications per crop cycle. The maximum application volume is 2,000 L water per hectare. Avoid applying during the warmest part of the day. Effective against nymphs and has some effect on the pupal stage. Will not reduce adult whitefly populations. Toxic to certain beneficial insects. Residues on pollen and nectar may harm bee brood. **REI: 12 hr**
	spirotetramat	Kontos	30–42 mL/100 L water **Maximum use rate/ single application:** 300 mL/ha (72 g a.i./ha)	3	Use appropriate spray volume for adequate crop foliage spray coverage. Spray crop to wet but not to the point of run-off. Do not exceed a spray volume of 712–1,000 L per hectare (30–42 mL concentration). Use the higher concentration for higher pest infestation levels. Minimum interval between applications is 7–14 days. Do not exceed 900 mL (216 g a.i.) per hectare per crop cycle. Do not exceed 3 applications per crop cycle. Not acutely toxic to adult bees. Residues in/on pollen and nectar may harm bee brood. This product is toxic to certain beneficial insects. **REI: 12 hr**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
28	cyantraniliprole	Exirel	750–1,000 mL/ha	1	For suppression. Thorough coverage is required to obtain optimum control. Use the higher listed rate and higher spray volumes for large plants or dense foliage. Do not apply in irrigation water. Use of mist blowers, thermal foggers, ultra-low volume (ULV) and electrostatic sprayers is not permitted. Do not exceed 4 applications per crop cycle. Minimum interval between applications is 7 days. Toxic to bees and certain beneficial insects. **REI: 12 hr**
UNF	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Foliar application method: Spray to wet but not to the point of run-off. Repeat application every 5–10 day. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. Pollinator application method: For suppression. Uses a microbial inoculum dispenser that is attached to the front of the bumble bee hive. When used as directed, the impact on bees is minimal and is compatible with the release of some biological control agents, including *Aphidius colemani, Amblyseius swirskii, Encarsia formosa* and *Eretmocerus eremicus*. Do not release *Orius insidiosus* in the presence of bee-vectored BotaniGard 22WP. See label for more details. **REI: Foliar: 4 hr; Bee-vectored: 0**
	Beauveria bassiana PPRI 5339	Velifer	450–900 mL/ 1,000 L water	0	Apply in sufficient water volume for uniform coverage, but not to the point of runoff. Repeat application every 3–10 days. Use the higher concentration and shorter application intervals when pest population densities are high. May be harmful to beneficial insects and bees. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	**Foliar:** 0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter treated areas only after spray has dried.**

[1] See Appendix F for IRAC group definitions.

Table 8–1. Products registered for greenhouse eggplant insect and mite pests

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES (cont'd)					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. **REI: NS**
	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	Deters feeding. Apply when pest first appears. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
	potassium salts of fatty acids	Kopa Insecticidal Soap*	8 L/400 L water	0	Spray early in morning or evening or when overcast. Combining this product with sulphur or applying this product within 3 days of sulphur application may increase the plant damage caused by sulphur on sensitive plants. Do not tank mix with sulphur when temperatures are higher than 32°C. **REI: NS**
		Neudosan Commercial*			
		Opal Insecticidal Soap*			
		Opal2 Insecticidal Soap*	1 part concentrate: 100 parts water		Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**
		Safer's Insecticidal Soap Concentrate*			
NC + 3A	potassium salts of fatty acids + pyrethrins	Safer's Trounce Insecticidal Soap*	5 L/100 L water	1	Spray all plant surfaces as required by pest pressure at 2-week intervals. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 8–2. Products registered for greenhouse eggplant diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
BACTERIAL CANKER (*Clavibacter michiganensis* subsp. *michiganensis*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not exceed 3 applications per season. Minimum interval between applications is 7 days. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
BACTERIAL SPECK (BACTERIAL BLIGHT) (*Pseudomonas syringae* pv. *tomato*)					
44	*Bacillus subtilis* strain QST 713	Cease* Rhapsody ASO*	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat application every 7–10 days as needed. **REI: NS**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
BACTERIAL SPOT (BACTERIAL LEAF SPOT) (*Xanthomonas campestris* pv. *vesicatoria*)					
24	kasugamycin	Kasumin 2L	1.2 L/240 L water/ha (100 ppm)	1	For suppression. Do not exceed 3 applications per season. Minimum interval between applications is 7 days. Do not make more than 2 sequential applications before switching to a product with a different mode of action. **REI: 12 hr**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
EARLY BLIGHT (*Alternaria solani*)					
7	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	For suppression. Begin applications prior to disease development. Repeat application every 7–10 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 5.25 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
19	*polyoxin D zinc salt*	Polyoxin D Zinc Salt 5SC	537–926 mL/ha (29–50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain suppression. Do not exceed 150 g a.i. per hectare per year. **REI: Re-enter treated areas only after spray has dried.**

[1] See Appendix G for FRAC group definitions.

Table 8–2. Products registered for greenhouse eggplant diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
EARLY BLIGHT (*Alternaria solani*) (cont'd)					
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	0.5–2 kg/ha	0	Apply from flowering to fruiting. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Re-enter treated areas only after spray has dried.**
		Double Nickel LC*	2.5–10 L/ha		
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
GREY MOULD (BOTRYTIS BLIGHT) (*Botrytis cinerea*)					
7	fluopyram	Luna Privilege	500 mL/ha	0	Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 2 applications per crop cycle. Minimum application interval is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.7 m: 1,000 L/ha 3.4 m: 1,500–2,000 L/ha **REI: 12 hr**
	penthiopyrad	Fontelis	1.25–1.75 L/ha	0	Begin applications prior to disease development. Repeat application every 7–10 days. Use higher rate and shorter interval when disease pressure is high. Do not exceed 5.25 L per hectare per season. Make no more than 2 sequential applications before switching to a fungicide with a different mode of action. **REI: 12 hr**
17	fenhexamid	Decree 50 WDG	1.5 kg/ha (0.75 kg a.i./ha)	1	Begin application when conditions favour disease development. Repeat application every 7–10 days If conditions continue to favour disease. Do not exceed 3 applications per crop cycle. **REI: 4 hr**
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25–50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–10 days as needed to maintain suppression. Do not exceed 150 g a.i. per hectare per year. **REI: Re-enter treated areas only after spray has dried.**

[1] See Appendix G for FRAC group definitions.

Table 8–2. Products registered for greenhouse eggplant diseases

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT) (*Botrytis cinerea*) (cont'd)					
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	**Foliar:** 1.25–3.6 kg/ha **Low disease pressure:** 0.9–1 kg/ha	0	For suppression. Use from flowering to fruit maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Re-enter treated areas only after spray has dried.**
		Double Nickel LC*	**Foliar:** 6.25–18 L/ha **Low disease pressure:** 4.5–5 L/ha		
	Bacillus subtilis strain QST 713	Cease*	1–2 L/100 L water	0	For suppression. Begin application when environmental conditions are conducive to disease development. Repeat application every 7–10 days as needed. **REI: NS**
		Rhapsody ASO*			
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 475–2,000 L water/ha	1	Begin applications when conditions become favourable to disease but before infection. If favourable conditions persist, repeat applications every 7–10 days. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. Do not exceed 3 applications per crop cycle. **REI: 24 hr**
BM 01	BLAD polypeptide	Fracture	1.5–3.3 L/ha in a minimum of 200 L water/ha	0	Begin applications prior to onset of disease development. Repeat applications every 7–10 days. Use a higher rate and shorter interval when disease pressure is moderate to high. Do not exceed 5 applications per crop cycle. **REI: NS**
		Problad Plus			
BM 02	*Trichoderma harzianum* Rifai strain KRL-AG2	RootShield HC*	3.75–7.5 g/L water	NS	For suppression. Use a quantity of spray solution to thoroughly cover foliage. Spray to wet but not to the point of run-off. Use higher rates when conditions favour disease development or high disease pressure is anticipated. **REI: 4 hr**
NC	*Aureobasidium pullulans* DSM 14940 and DSM 14941	Botector*	1 kg/ha in 500–2,000 L water	0	Apply preventatively if climatic conditions are favourable for infection or at first sign of disease onset. Repeat application every 7–10 days as needed. Do not exceed 5 applications per year. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 8–2. Products registered for greenhouse eggplant diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
PHYTOPHTHORA BLIGHTS (LATE BLIGHT, PHYTOPHTHORA FOLIAR BLIGHT)					
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora capsici*** For suppression. Begin applications when conditions favour disease development. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 4 applications per year. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha in a minimum of 100 L water	1	***Phytophthora* spp., *Phytophthora infestans*** For suppression. Do not exceed 5 foliar and/ or chemigation applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
		Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1,000 L water	0	***Phytophthora capsici*** For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	***Phytophthora infestans*** Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**
POWDERY MILDEW					
7	fluopyram	Luna Privilege	100 mL/ha	0	***Leveillula taurica*** Begin fungicide applications preventatively. Use sufficient water volume and spray pressure to provide thorough and uniform coverage. Do not exceed 3 applications per crop cycle. Minimum application interval is 6 weeks. Do not apply under low light conditions as crop injury may occur. Suggested spray volumes by crop height: 1.7 m - 1000 L/ha 3.4 m - 1500–2000 L/ha **REI: 12 hr**

[1] See Appendix G for FRAC group definitions.

Table 8–2. Products registered for greenhouse eggplant diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW (cont'd)					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	278–926 mL/ha (15–50 g a.i./ha)	0	***Oidium neolycopersici*** Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as preventative application when conditions favour disease development. Repeat application every 7–14 days as needed to maintain suppression. Use a higher rate under conditions of high disease pressure. Do not apply more than 150 g a.i. per hectare per year. **REI: Re-enter treated areas only after spray has dried.**
9 + 12	cyprodinil + fludioxonil	Palladium WG	775 g/ 475–2,000 L water/ha	1	***Leveillula taurica*** For suppression. Begin applications when conditions become favourable to disease, but before infection. If favourable conditions persist, repeat application every 7–10 days. Make no more than 2 sequential applications before alternating with a treatment with another mode of action. Do not make more than 3 applications per crop cycle. **REI: 24 hr**
M 02	sulphur	Agrotek Vaporized Sulphur*	0.4–3.2 g/1,000 m^2	NS	***Leveillula taurica*** Use 1 vaporizer per 1,000 m^2. Start using before plants show signs of infection. Use for 1–8 hr per night, 2–7 days/week. Do not apply if temperature is above 24°C and high humidity prevails. Certain species of beneficial insects are sensitive to sulphur. **REI: 2 hr**
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	1.25–2.5 mL/L water (0.125%–0.25% v/v)	0	***Erysiphe cichoracearum, Leveillula taurica, Oidium neolycopersici*** For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-enter treated areas only after spray has dried.**
NC	mineral oil	Purespray Green Spray Oil 13E*	10 L/1,000 L water (1% solution)/ha	NS	***Leveillula taurica*** For suppression. Apply when conditions are favourable for disease development and/or when first symptoms appear. Repeat application every 7–14 days. For effective control, thorough coverage is essential. Do not exceed label rate, otherwise phytotoxicity may result. **REI: 12 hr**
SEPTORIA LEAF SPOT					
M 01	copper octanoate	Cueva Commercial*	0.5%–2% solution applied at 470–940 L/ha	1	***Septoria lycopersici*** Repeat application every 5–10 days. Do not exceed 15 applications per year. If concerned about sensitivity of plants, apply to individual plants or small areas to determine if plant damage occurs. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 8–2. Products registered for greenhouse eggplant diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT DISEASES					
ROOT ROTS (DAMPING OFF)					
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 seeding/seedling applications per crop cycle. Do not exceed 2 after-transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
44	*Bacillus subtilils* strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
BM 02	*Trichoderma harzianum* Rifai strain KRL-AG2 and *Trichoderma virens* strain G-41	BW240 WP	30–60 g/100 L water/ m^2 of soil/potting mixture surface	0	***Fusarium* spp., Phytophthora spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Apply immediately after sowing seed or planting. A second application may be made after 8–10 weeks if the disease is expected. Do not use overhead boom chemigation for second application or after the four-leaf stage. Use a higher rate and shorter interval when disease pressure is high. **REI: 4 hr**
M 04	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			
NC	*Streptomyces lydicus* strain WYEC 108	Actinovate SP	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-enter treated areas only after spray has dried.** **Rates:** **Seed treatment:** 7.5–42 g in 300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media

[1] See Appendix G for FRAC group definitions.

Table 8–2. Products registered for greenhouse eggplant diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
28	propamocarb hydrochloride	Previcur N	10 mL/10 L water Apply solution at a rate of 100–200 mL/plant.	2	***Pythium* spp.** Do not mix with other products. Prevent intense sunlight after application. Do not exceed 4 applications per crop cycle. Do not exceed 2 seeding/seedling applications per crop cycle. Do not exceed 2 after transplanting applications per crop cycle. The higher rate should be used for second and third application. **REI: 12 hr**
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora* spp., *Pythium* spp.** For suppression. Begin applications when conditions favour disease development. Repeat application every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 4 applications per year. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	5–10 L/ha in a minimum of 100 L water	1	***Pythium* spp.** For suppression. Do not exceed 5 foliar and/or chemigation applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
		Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1,000 L water	0	***Phytophthora* spp., *Pythium* spp.** For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
44	*Bacillus subtilils* strain MBI 600	Serifel*	50 g/12.5 L water/ 21.9 m^3 growing media	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia solani*** For suppression. Prior to planting, apply as a spray while suspended onto 21.9 m^3 of plant growing media (potting soil, peat moss or peat-based mixtures). Mix thoroughly to ensure adequate distribution of the product. **REI: NS**
BM 02	*Streptomyces lydicus* strain WYEC 108	Actinovate SP	See **Remarks.**	NS	***Pythium* spp.** For suppression. Apply as a seed treatment through mist-type commercial seed treatment equipment, slurry or other comparable methods that provide thorough coverage of treated seeds. Prior to planting, dissolve product in water and spray directly on seed. For hydroponic systems, apply solution to the growing media or apply as a soil drench. Repeat application every 7–14 days. **REI: Re-enter treated areas only after spray has dried.** **Rates** **Seed treatment:** 7.5–42 g in 300 mL water/kg of seed **Hydroponic systems:** 420–840 g/ha **Soil drench:** 42–84 g/100 L water/m^3 of growing media
	Trichoderma harzianum Rifai strain KRL-AG2	Bora WP* RootShield WP*	**Drench:** 55–110 g/m^3	NS	***Fusarium* spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Can be applied through low-pressure watering nozzles such as fan nozzles or other watering systems. **REI: NS**

[1] See Appendix G for FRAC group definitions.

Table 8–2. Products registered for greenhouse eggplant diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT) (cont'd)					
M 04	captan	Captan 50 WP	2.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–19 cm of soil before planting. **REI: 48 hr**
		Captan 80 WP	1.5 kg/1,000 L water applied at rates of 50–85 L/100 m^2	NS	Use as a soil treatment. Work into the upper 7.5–10 cm of soil before planting. **REI: 48 hr**
		Maestro 80 DF	1.25 kg/1,000 L water applied at rates of 50–85 L/100 m^2		
		Supra Captan 80 WP			

[1] See Appendix G for FRAC group definitions.

9. Strawberries

Products registered for greenhouse strawberry insect and mite pests are listed in Table 9–1.
Products registered for greenhouse strawberry diseases are listed in Table 9–2.

Table 9–1. Products registered for greenhouse strawberry insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval
* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
APHIDS					
29	flonicamid	Beleaf 50 SG	0.3 g/L water	0	Apply when pests first appear and before populations reach high levels. Do not exceed 1 application per crop cycle. Thorough spray coverage of plant foliage is essential for optimum control. Use a maximum spray volume of 650 L. Do not apply using fogging or ultra low-volume equipment. Do not apply using handheld mistblowers or handheld airblast equipment. This product will stop pest feeding rapidly but it may take several days to see a reduction in pest numbers. **REI: 12 hr**
UNF	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. **REI: 4 hr**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. Do not use when temperatures are high. **REI: NS**
	potassium salts of fatty acids	Safer's Insecticidal Soap Concentrate*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 9–1. Products registered for greenhouse strawberry insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
EARWIGS					
NC	potassium salts of fatty acids	Safer's Insecticidal Soap Concentrate*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
LEAFROLLERS					
11A	*Bacillus thuringiensis* subsp. *kurstaki* strain ABTS-351	DiPel 2X DF*	525–1,125 g/600 L water/ha	0	**Fruittree leafroller, European leafroller, Obliquebanded leafroller, Three-lined leafroller** Apply at egg hatch to target young larvae (early instars). Repeat applications every 3–14 days. **REI: NS**
	Bacillus thuringiensis subsp. *kurstaki* strain EVB113-19	Bioprotec CAF*	1.4–2.8 L/ha	0	**Fruittree leafroller, European leafroller, Obliquebanded leafroller** Begin applications when larvae are young (early instar) before crop is damaged. Apply in sufficient volume to provide thorough coverage. Repeat applications every 3–14 days.
LYGUS BUGS					
29	flonicamid	Beleaf 50 SG	0.3 g/L water	0	**Tarnished plant bug (*Lygus lineolaris*)** Apply when pests first appear and before populations reach high levels. Do not exceed 1 application per crop cycle. Thorough spray coverage of plant foliage is essential for optimum control. Use a maximum spray volume of 650 L. Do not apply using fogging or ultra low-volume equipment. Do not apply using handheld mistblowers or handheld airblast equipment. This product will stop pest feeding rapidly but it may take several days to see a reduction in pest numbers. **REI: 12 hr**
MEALYBUGS					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. Do not use when temperatures are high. **REI: NS**
	potassium salts of fatty acids	Safer's Insecticidal Soap Concentrate*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. Repeat applications as required. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 9–1. Products registered for greenhouse strawberry insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
MITES					
UNF	*Metarhizium anisopliae* Strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days. Spray to wet all foliage, but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter into treated areas only after spray is dried.**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of mite presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Mites, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. Do not use when temperatures are high. **REI: NS**
	potassium salts of fatty acids	Safer's Insecticidal Soap Concentrate*	1 part concentrate: 50 parts water	0	**Two-spotted spider mite (*Tetranychus urticae*)** Insects must be sprayed directly to achieve proper control. Repeat application every week for 2–3 weeks. **REI: NS**
PSYLLIDS					
NC	potassium salts of fatty acids	Safer's Insecticidal Soap Concentrate*	1 part concentrate: 50 parts water	0	Insects must be sprayed directly to achieve proper control. **REI: NS**
SCALES					
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Apply at first sign of insect presence. Thoroughly spray plants until the plant parts are wet, including underside of leaves. Insects, including eggs, must be contacted with spray. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. Do not use when temperatures are high. **REI: NS**
THRIPS					
UNF	*Beauveria bassiana* strain GHA	BotaniGard 22WP	500–1,000 g/400 L water	0	Spray to wet but not to the point of run-off. Repeat application every 5–10-days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days as needed. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter into treated areas only after spray has dried.**

[1] See Appendix F for IRAC group definitions.

Table 9–1. Products registered for greenhouse strawberry insect and mite pests

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

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IRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
WHITEFLIES					
UNF	*Beauveria bassiana* strain GHA	BotaniGard 22WP	250–500 g/400 L water	0	Spray to wet but not to the point of run-off. Repeat application every 5–10 days. High populations may require 2–5-day intervals. Repeat applications for as long as pest pressure persists. Product use, especially at higher rates, may result in commercially unacceptable visible residues. Fungicides, some insecticide formulations, and some wetting agents and spreaders may kill the spores. **REI: 4 hr**
	Metarhizium anisopliae strain F52	Met52 EC	0.5–5 L/1,000 L water	0	Foliar application method: Reduces pest numbers. Use the higher application concentration when pest pressure is high. Repeat application every 5–10 days. Spray to wet all foliage but not to the point of run-off. Do not apply through a thermal pulse fogger. **REI: Re-enter into treated areas only after spray has dried.**
NC	potassium salts of fatty acids	Safer's Insecticidal Soap Concentrate*	1 part concentrate: 100 parts water	0	Insects must be sprayed directly to achieve proper control. Spray all plant surfaces thoroughly at 2-week intervals. **REI: NS**

[1] See Appendix F for IRAC group definitions.

Table 9–2. Products registered for greenhouse strawberry diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ANTHRACNOSE (*Colletotrichum acutatum*)					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	463–926 mL/ha (25–50 g a.i./ha)	0	Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–10 days as needed to maintain control. Do not apply more than 150 g a.i. per hectare per year. **REI: Re-enter into treated areas only after spray has dried.**
NC	*Aureobasidium pullulans* DSM 14940 and DSM 14941	Botector*	1 kg/ha in 500–2,000 L water	0	Apply preventatively if climatic conditions are favourable for infection or at first sign of disease onset. Repeat application every 7–10 days as needed. Do not exceed 6 applications per year. **REI: 4 hr**
GREY MOULD (BOTRYTIS BLIGHT) (*Botrytis cinerea*)					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	259–926 mL/ha (14–50 g a.i./ha)	0	For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–10 days as needed to maintain suppression. Do not apply more than 150 g a.i. per hectare per year. **REI: Re-enter into treated areas only after spray has dried.**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	**Foliar:** 1–2.5 kg/ha **Low disease pressure:** 0.6–1 kg/ha	0	For suppression. Apply at or just before flowering until fruit maturity. Repeat application every 3–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Re-enter into treated areas only after spray has dried.**
		Double Nickel LC*	**Foliar:** 5–12.5 L/ha **Low disease pressure:** 3–5 L/ha		
BM 01	BLAD polypeptide	Fracture Problad Plus	1.5–3.3 L/ha	0	Begin applications at early bloom. Repeat applications every 7–10 days if conditions favour disease development. Use a higher rate and shorter interval when disease pressure is moderate to high. Do not exceed 5 applications per crop cycle. **REI: NS**
BM 02	*Streptomyces lydicus* strain WYEC 108	Actinovate SP	425 g/1,100 L water/ha	NS	For suppression. Make the first application when conditions are conducive to disease development. Apply to foliage and blossoms. Repeat application every 7–14 days. Use the shorter application interval under high disease pressure. **REI: Re-enter into treated areas only after spray has dried.**
	Trichoderma harzianum Rifai strain KRL-AG2	Bora HC* RootShield HC*	10 g/L water	NS	For suppression. Repeat application every 7–14 days as needed. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 9–2. Products registered for greenhouse strawberry diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
GREY MOULD (BOTRYTIS BLIGHT) (*Botrytis cinerea*) (cont'd)					
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	0.25% v/v in 500–1,000 L water/ha	0	For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-enter into treated areas only after spray has dried.**
NC	*Aureobasidium pullulans* DSM 14940 and DSM 14941	Botector*	1 kg/ha in 500–2,000 L water	0	Apply preventatively if climatic conditions are favourable for infection or at first sign of disease onset. Repeat application every 7–10 days as needed. Do not exceed 6 applications per year. **REI: 4 hr**
LEATHER ROT					
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora cactorum*** For suppression. Begin applications at 10% bloom and early fruit set. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 4 applications per year. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1000 L water	0	***Phytophthora cactorum*** For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
PHOMOPSIS LEAF BLIGHT (PHOMOPSIS OBSCURANS)					
NC	*Aureobasidium pullulans* DSM 14940 and DSM 14941	Botector*	1 kg/ha in 500–2,000 L water	0	For partial suppression. Apply preventatively if climatic conditions are favourable for infection or at first sign of disease onset. Repeat application every 7–10 days as needed. Do not exceed 6 applications per year. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 9–2. Products registered for greenhouse strawberry diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
POWDERY MILDEW					
19	polyoxin D zinc salt	Polyoxin D Zinc Salt 5SC	259–926 mL/ha (14–50 g a.i./ha)	0	***Podosphaera aphanis*** For suppression. Apply as a foliar spray in sufficient water to provide thorough coverage of foliage (and fruit when present). Begin as a preventative application when conditions favour disease development. Repeat application every 7–10 days as needed to maintain suppression. Do not apply more than 150 g a.i. per hectare per year. **REI: Re-enter into treated areas only after spray has dried.**
44	*Bacillus amyloliquefaciens* strain D747	Double Nickel 55*	**Foliar:** 1–2.5 kg/ha **Low disease pressure:** 0.5–1 kg/ha	0	***Sphaerotheca macularis*** For suppression. Apply at or just before flowering until fruit maturity. Repeat application every 7–10 days (or 3–7 days under high disease pressure) for as long as conditions favour disease development. **REI: Re-enter into treated areas only after spray has dried.**
		Double Nickel LC*	**Foliar:** 5–12.5 L/ha **Low disease pressure:** 2.5–5 L/ha		
BM 01	BLAD polypeptide	Problad Plus	1.5–3.3 L/ha	0	***Sphaerotheca aphanis (syn. S. macularis)*** For suppression. Begin applications at early bloom. Repeat applications every 7–10 days if conditions favour disease development. Use a higher rate and shorter interval when disease pressure is moderate to high. Do not exceed 5 applications per crop cycle. **REI: NS**
		Fracture			
BM 02	*Streptomyces lydicus* strain WYEC 108	Actinovate SP	425 g/1,100 L water/ha	NS	***Sphaerotheca macularis*** For suppression. Make the first application when conditions are conducive to disease development. Apply to foliage and blossoms. Repeat application every 7–14 days. Use the shorter application interval under high disease pressure. **REI: Re-enter into treated areas only after spray has dried.**
M 02	sulphur	Agrotek Vaporized Sulphur	0.4–3.2 g/1,000 m^2	NS	***Sphaerotheca macularis*** Use 1 vaporizer per 1,000 m^2. Start using before plants show signs of infection. Use for 1–8 hr per night, 2–7 days per week. Do not apply if temperature is above 24°C and high humidity prevails. Certain species of beneficial insects are sensitive to sulphur. **REI: 2 hr**
P 05	*Reynoutria sachalinensis* extract	Regalia Maxx*	0.125%–0.25% v/v in 500–1,000 L water/ha	0	***Sphaerotheca macularis*** For suppression. Begin applications at the first sign of disease, or when conditions become conducive for disease development. Repeat application every 7–10 days as needed. Use the shorter spray interval under high disease pressure. Spray to achieve complete coverage but not runoff. Do not apply in a spray volume of more than 1,500 L per hectare. **REI: Re-enter into treated areas only after spray has dried.**
NC	potassium bicarbonate	Sirocco*	2.8–5.6 kg/ha	0	***Sphaerotheca macularis*** For suppression. Begin applications at the first sign of disease or when conditions are conducive to disease development. Label recommended spray volume is 1,000 L per hectare. Repeat application every 7–14 days. **REI: 4 hr**

[1] See Appendix G for FRAC group definitions.

Table 9–2. Products registered for greenhouse strawberry diseases

For more information on pesticide application, visit www.sprayers101.com — search keywords "greenhouse" or "airblast 101."

LEGEND: PHI = pre-harvest interval (in days) NS = no information was provided on the product label REI = re-entry interval

* = product is potentially acceptable for organic production. Organic growers must always check with their certifying bodies to verify the acceptability of any product prior to using it.

FRAC Group[1]	Common Name/ Active Ingredient	Trade Name/ Formulation	Rate	PHI	Remarks
ROOT DISEASE					
ROOT ROTS (DAMPING OFF)					
BM 02	*Trichoderma harzianum* Rifai strain KRL-AG2 and *Trichoderma virens* strain G-41	BW240 WP	30–60 g/100 L water/ m^2 of soil/potting mixture surface	0	***Fusarium* spp., Phytophthora spp., *Pythium* spp., *Rhizoctonia* spp.** For suppression. Apply immediately after planting. Repeat application after 8–10 weeks if the disease is expected. Do not use overhead boom chemigation for second application or after the four-leaf stage. Use a higher rate and shorter interval when disease pressure is high. **REI: 4 hr**
ROOT ROTS (CROWN AND ROOT ROT, ROOT AND STEM ROT, ROOT AND STEM WILT)					
P 07	mono- and dibasic sodium, potassium, and ammonium phosphites	Phostrol	2.9–5.8 L/ha in a minimum of 225 L water/ha	0	***Phytophthora* spp., *Pythium* spp** For suppression. Begin applications at 10% bloom and early fruit set. Repeat applications every 7–14 days. Use the higher rate and shorter application interval when disease pressure is high. Do not exceed 4 applications per year. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
	mono- and di-potassium salts of phosphorous acid	Confine Extra	4–5 L/ha in a minimum of 100 L water	1	***Phytophthora* spp., *Pythium* spp.** For suppression. Do not exceed 5 foliar and/or chemigation applications per growing season. Begin applications when conditions are favourable for disease. **REI: Allow entry only after thorough ventilation, spray mist has cleared and the treated surface has dried.**
		Rampart	**Foliar:** 3–8 L/1,000 L water/ha **Drench:** 5–7 L in a minimum of 1,000 L water	0	***Phytophthora* spp., *Pythium* spp.** For suppression. Use the higher rate and shorter application interval when disease pressure is high. Foliar: Apply lower rate every 2–4 weeks after plants become established. Drench: Apply with normal irrigation schedule. **REI: 4 hr. After REI, re-entry into treated areas is only permitted after thorough ventilation, spray mist has cleared and the treated surface has dried.**
NC	canola oil	Vegol Crop Oil*	1 part concentrate: 50 parts water (2% solution)	0	Begin applications when conditions are favourable for disease development or when disease first appears. Do not exceed 4 applications per year. Minimum interval between applications is 7 days. Toxic to beneficial insects. Do not use when temperatures are high. **REI: NS**

[1] See Appendix G for FRAC group definitions.

Appendices

Appendix A. Ontario Ministry of Agriculture, Food and Rural Affairs Greenhouse Vegetable Staff

Cara McCreary
Greenhouse Vegetable IPM Specialist
Harrow Research and Development Centre
2585 County Road 20
Harrow, ON N0R 1G0

Tel: 519-738-1258
Fax: 519-738-4564
E-mail: cara.mccreary@ontario.ca

Agricultural Information Contact Centre
Provides province-wide, toll-free technical and business information to commercial farms, agri-businesses and rural businesses.

1 Stone Rd. W.
Guelph, ON N1G 4Y2

Toll-free: 1-877-424-1300
E-mail: ag.info.omafra@ontario.ca

Samples for disease diagnosis, insect or weed identification, nematode counts and verticillium testing can be sent to:

Agriculture & Food Laboratory
Laboratory Services Division
University of Guelph
95 Stone Rd. W.

Guelph, ON N1H 8J7
Tel: 519-767-6299
Fax: 519-767-6240
E-mail: aflinfo@uoguelph.ca
www.guelphlabservices.com

Payment must accompany samples at the time of submission. Submission forms are available at: http://afl.uoguelph.ca/submitting-samples#forms

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. If the soil is bare, remove the top 2 cm prior to sampling. A sample should consist of 10 or more subsamples combined. Mix well in a clean pail or plastic bag. Then take a sample of 0.5–1 L from this. No one sample should represent more than 2.5 ha.

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	10 subsamples
500 m^2–0.5 ha	25 subsamples
0.5 ha–2.5 ha	50 subsamples

Roots

For small plants, sample the entire root system plus adhering soil. For large plants, 10–20 g, 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.

Sample Handling

Soil samples

Place soil samples in plastic bags as soon as possible after collecting.

Root samples

Place in plastic bags and cover with moist soil from the sample area.

Storage

Store samples at 5°C–10°C and do not expose them to direct sunlight or extreme heat or cold (freezing). Only living nematodes can be counted. Accurate counts depend on proper handling of samples.

Submitting Plant for Disease Diagnosis or Identification

Sample submission forms

Forms can be obtained from the Laboratory Services website at www.guelphlabservices.com. 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 this year's pesticide use records.

Choose a complete, representative sample showing early symptoms. Submit as much of the plant as is practical, including the root system, or several plants showing a range of symptoms. If symptoms are general, collect the sample from an area where they are of intermediate severity. Completely dead material is usually inadequate for diagnosis.

With plant specimens submitted for identification, include at least a 20–25-cm sample of the top portion of the stem with lateral buds, leaves, flowers or fruits in identifiable condition. Wrap plants in newspaper and put in a plastic bag. Tie the root system off in a separate plastic bag to prevent it from drying out and to prevent the soil from contaminating the leaves. Do **not** add moisture, as this encourages decay in transit. Cushion specimens and pack them 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 Agriculture & Food Laboratory as soon as possible by first class mail or courier at the beginning of the week.

Submitting Insect Specimens for Identification

Collecting samples

Place dead, hard-bodied insects in vials or boxes and cushion with tissues or cotton. Place soft-bodied insects and caterpillars in vials containing alcohol. Do not use water, as this results in rot. Do not tape insects to paper or send them loose in an envelope.

Place live insects in a container with enough plants for them to feed on during transit. Be sure to write "live" on the outside of the container.

Appendix C. Other Contacts

Agriculture & Agri-Food Canada Research Centres

www.agr.gc.ca/index_e.php

Harrow Research and Development Centre
2585 County Road 20
Harrow, ON N0R 1G0
Tel: 519-738-2251

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

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

Vineland Research and Innovation Centre

www.vinelandontario.ca

4890 Victoria Ave. N.
Vineland Station, ON L0R 2E0
Tel: 905-562-0320
Fax: 905-562-0084

Canadian Food Inspection Agency Area and Regional Offices (Plant Protection)

www.inspection.gc.ca/english/toce.shtml

Ontario Area
174 Stone Rd. W.
Guelph, ON N1G 4S9
Tel: 226-217-8555 (General line)

Ontario Regional Offices
Central
259 Woodlawn Rd. W.
Suite A
Guelph, ON N1H 8J1
Tel: 226-217-1200 (51200)

South West
1200 Commissioners Rd. E.
Unit 19
London, ON N5Z 4R3
Tel: 519-691-1300

North East
500 Huronia Rd.
Unit 103
Barrie, ON L4N 8X3
Tel: 705-739-0008

Toronto
1124 Finch Av. W.
Unit 2
Toronto, ON M3J 2E2
Tel: 647-790-1100

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.on.ca

Department of Plant Agriculture

www.plant.uoguelph.ca

Department of Plant Agriculture, Guelph
50 Stone Rd. E.
Guelph, ON N1G 2W1
Tel: 519-824-4120, ext. 56083
Fax: 519-763-8933

Department of Plant Agriculture, Simcoe
1283 Blueline Rd., Box 587
Simcoe, ON N3Y 4N5
Tel: 519-426-7127
Fax: 519-426-1225

Department of Plant Agriculture, Vineland
Box 7000, 4890 Victoria Ave. N.
Vineland Station, ON L0R 2E0
Tel: 905-562-4141
Fax: 905-562-3413

Lab Services Division

www.uoguelph.ca/labserv

P.O. Box 3650, 95 Stone Rd. W.
Guelph, ON N1H 8J7
Tel: 519-767-6299
Fax: 519-767-6240

Trace Organic and Pesticide Contaminants
Tel: 519-767-6485
Fax: 519-767-6240

Agriculture & Food Laboratory
Tel: 519-767-6256

Appendix D. Pesticide Groups Based on Sites of Action — Insecticides and Miticides

The classification scheme listed below is adapted from information developed by the Insecticide Resistance Action Committee Mode of Action Working Group. Products with the same group number have a similar mode of action. For details on this classification system, see www.irac-online.org/eClassification/.

Group #	Primary Site of Action	Sub-group or Exemplifying Active Ingredient	Product Name(s)
1B	**Acetylcholinesterase (AChE) inhibitors** Nerve action	organophosphate	DDVP 20% EC, Dibrom, Malathion 25 W, Malathion 85 E
3A	**Sodium channel modulators** Nerve action	pyrethroids, pyrethrins	Ambush 50 EC, Matador 120 EC, Pounce 384 EC, Bio-environmental Permethrin, Safer's Trounce Insecticidal Soap (pyrethrins = 3A + potassium salts of fatty acids = NC)
4A	**Nicotinic acetylcholine receptor (nAChR) competitive modulators** Nerve action	neonicotinoids	Flagship, Intercept 60 WP, Tristar 70 WSP
4D		butenolides	Altus
5	**Nicotinic acetylcholine receptor (nAChR) allosteric modulators – Site I** Nerve action	spinosyns	Delegate WG, Entrust, Entrust 80 W, Success
6	**Glutamate-gated chloride channel (GluCl) allosteric modulators** Nerve and muscle action	avermectins, milbemycins	Avid 1.9% EC
7C	**Juvenile hormone mimics** Growth regulation	pyriproxyfen	Distance
9B	**Chordotonal organ TRPV channel modulators** Nerve action	pyridine azomethine derivatives	Endeavor 50 WG
10B	**Mite growth inhibitors affecting CHS1** Growth regulation	etoxazole	TetraSan 5 WDG
11A	**Microbial disruptors of insect midgut membranes**	*Bacillus thuringiensis* and the insecticidal proteins they produce	Bioprotec 3P, Bioprotec CAF, DiPel 2X DF, DiPel WP, Foray 48BA, Thuricide HPC, VectoBac 600 L, Xentari
12B	**Inhibitors of mitochondrial ATP synthase** Energy metabolism	organotin miticides	Vendex 50 WP
13	**Uncouplers of oxidative phosphorylation via disruption of the proton gradient** Energy metabolism	pyrroles dinitrophenols sulfuramid	Pylon
15	**Inhibitors of chitin biosynthesis affecting CHS1** Growth regulation	benzoylureas	Rimon 10 EC
16	**Inhibitors of chitin biosynthesis, type 1** Growth regulation	buprofezin	Talus

[1] A compound with an unknown mode of action or where consensus does not exist on mode of action or an unknown mode of toxicity will be held in category "un" until evidence becomes available to enable that compound to be assigned to a more appropriate mode of action class.

Appendix D. Pesticide Groups Based on Sites of Action — Insecticides and Miticides

The classification scheme listed below is adapted from information developed by the Insecticide Resistance Action Committee Mode of Action Working Group. Products with the same group number have a similar mode of action. For details on this classification system, see www.irac-online.org/eClassification/.

Group #	Primary Site of Action	Sub-group or Exemplifying Active Ingredient	Product Name(s)
17	**Moulting disruptors, Dipteran** Growth regulation	cyromazine	Citation 75 WP
18	**Ecdysone receptor agonists** Growth regulation	diacylhydrazine	Confirm 240 F
20B	**Mitochondrial complex III electron transport inhibitors** Energy metabolism	acequinocyl	Shuttle 15 SC
20D		bifenazate	Floramite SC
21A	**Mitochondrial complex I electron transport inhibitors (METI)** Energy metabolism	METI insecticides and acaricides	DynoMite 75 WP, FujiMite, SanMite
23	**Inhibitors of acetyl CoA carboxylase** Lipid synthesis, growth regulation	tetronic and tetramic acid derivatives	Forbid 240 SC, Kontos
28	**Ryanodine receptor modulator** Nerve and muscle action	diamides	Coragen, Exirel
29	**Chordotonal organ modulators – undefined target site** Nerve action	flonicamid	Beleaf 50 SG
31	**Baculoviruses** Host-specific occluded pathogen viruses	Granuloviruses (GVs) Nucleopolyhedroviruses (NPVs)	Loopex
UNF	**Fungal agents of unknown or uncertain mode of action (MoA)**[1]	*Beauveria bassiana* strains, *Metarhizium anisopliae* strain F52, *Paecilomyces fumosoroseus* Apopka strain 97	Bio-Ceres G WB, Bio-Ceres G WP, BotaniGard 22WP, Met52 EC, Velifer
NC	**Not classified**	canola oil, mineral oil, potassium salts of fatty acids, *Autographa californica* Nucleopolyhedrovirus FV	Purespray Green Spray Oil, Vegol Crop Oil, Kopa Insecticidal Soap, Neudosan Commercial, Opal Insecticidal Soap, Opal2 Insecticidal Soap, Safer's Insecticidal Soap Concentrate, Safer's Trounce Insecticidal Soap (pyrethrins = 3A + potassium salts of fatty acids = NC)

[1] A compound with an unknown mode of action or where consensus does not exist on mode of action or an unknown mode of toxicity will be held in category "un" until evidence becomes available to enable that compound to be assigned to a more appropriate mode of action class.

Appendix E. Pesticide Groups Based on Sites of Action — Fungicides

This classification scheme is adapted from information developed by the Fungicide Resistance Action Committee to distinguish fungicide groups according to their cross-resistance behaviour. For further details on this classification system, see https://www.frac.info/publications/accept.

LEGEND: M = multi-site inhibitor U = unknown mode of action and unknown resistance risk NC = not classified

Group #	Mode of Action and Target Site	Group Name	Product Name(s)	Risk of Developing Resistance
2	**Signal transduction** MAP/Histidine-Kinase In osmotic signal transduction (*os-1, Daf1*)	dicarboximides	Rovral WP, Rovral WDG	medium to high
3	**Sterol biosynthesis in membranes** C14-demethylase in sterol biosynthesis (*erg11/cyp51*)	DMI-fungicides(DeMethylation Inhibitors) (SBI: Class I)	Nova WSP	medium
4	**Nucleic acids metabolism** RNA polymerase I	PA-fungicides (PhenylAmides)	Ridomil Gold 480 EC or Ridomil Gold 480 SL, Subdue Maxx	high
7	**Respiration** Complex II: succinate-dehydrogenase	SDHI (Succinate-dehydrogenase inhibitors)	Fontelis, Luna Privilege, Pristine WG (boscalid = 7 + pyraclostrobin = 11)	medium to high
9	**Amino acids and protein synthesis** Methionine biosynthesis (proposed) (*cgs gene*)	AP-fungicides (Anilino-pyrimidines)	Scala SC, Palladium (cyprodinil = 9, fludioxonil = 12)	medium
11	**Respiration** Complex III: cytochrome bc1 (ubiquinol oxidase) at Qo site (*cyt b gene*)	QoI-fungicides (Quinone outside Inhibitor)	Pristine WG (boscalid = 7 + pyraclostrobin = 11)	high
12	**Signal transduction** MAP/Histidine-Kinase in osmotic signal transduction (*os-2, HOG1*)	PP-fungicides (PhenylPyrrole)	Medallion, Palladium (cyprodinil = 9, fludioxonil = 12)	low to medium
17	**Sterol biosynthesis In membranes** 3-keto reductase, C4-de-methylation (*erg1*)	hydroxyanilides	Decree 50 WDG	low to medium
19	**Cell wall biosynthesis** Chitin synthase	polyoxins	Polyoxin D Zinc Salt 5SC	medium
21	**Respiration** Complex II: cytochrome bc1 (ubiquinone reductase) at Qi site	QiI-fungicides (Quinone inside Inhibitor)	Torrent 400 SC	unknown but assumed to be medium to high
24	**Amino acids and protein synthesis** Protein synthesis (ribosome, initiation step)	hexopyranosyl antibiotic	Kasumin 2L	resistance known in fungal and bacterial (*P. glumae*) pathogens. medium
28	**Lipid synthesis or transport/membrane integrity or function** Cell membrane permeability, fatty acids (proposed)	carbamates	Previcur N	low to medium
40	**Cell wall biosynthesis** cellulose synthase	CAA-fungicides (Carboxylic Acid Amides	Micora, Revus, Zampro (ametoctradin = 40, dimethomorph = 45)	resistance known In *Plasmopara viticola* but not In *Phytophthora infestans*. low to medium

Appendix E. Pesticide Groups Based on Sites of Action — Fungicides

This classification scheme is adapted from information developed by the Fungicide Resistance Action Committee to distinguish fungicide groups according to their cross-resistance behaviour. For further details on this classification system, see https://www.frac.info/publications/accept.

LEGEND: M = multi-site inhibitor U = unknown mode of action and unknown resistance risk NC = not classified

Group #	Mode of Action and Target Site	Group Name	Product Name(s)	Risk of Developing Resistance
44	**Lipid synthesis transport/membrane Integrity or function** Microbial disrupters of pathogen cell membranes	microbial (*Bacillus* sp.)	Cease, Double Nickel 55, Double Nickel LC, Rhapsody ASO, Serifel, Taegro 2 WP, Taegro WP	resistance not known
45	**Respiration** Complex III: cytochrome bc1 (ubiquinone reductase) at Qo site, stigmatellin binding sub-site	QoSI fungicides (Quinone outside Inhibitor, stigmatellin binding type)	Zampro (ametoctradin = 40, dimethomorph = 45)	resistance risk assumed to be medium to high
46	**Lipid synthesis transport/membrane Integrity or function** Cell membrane disruption	Plant extract	Timorex Gold	resistance not known
49	**Lipid synthesis transport/membrane Integrity or function** Lipid homeostasis and transfer/storage	OSBPI oxysterol binding protein homologue inhibition	Orondis, Orondis Ultra B, Zorvec Enicade	resistance risk assumed to be medium to high
BM 01	**Biologicals with multiple modes of action** Multiple effects on cell wall, ion membrane transporters; chelating effects	Plant extract	Fracture, Problad Plus	resistance not known
BM 02	Biologicals with multiple modes of action	microbial (living microbes or extract, metabolites)	Actinovate, Bora HC, Bora WP, BW240 WP, Mycostop, Prestop,Rootshield Granules, Rootshield HCm Rootshield WP, Trianum G, Trianum P	resistance not known
M 01	**Chemicals with multi-site activity** Multi-site contact activity	inorganic (electrophiles)	Copper Spray Fungicide, Cueva Commercial, Kocide 3000	low
M 02	**Chemicals with multi-site activity** Multi-site contact activity	inorganic (electrophiles)	Cosavet DF Edge, Kumulus DF, Microthiol Disperss, Sulphur (Bartlett's Microscopic Sulphur 92%), Agrotek Ascend Vaporized Sulphur	low
M 03	**Chemicals with multi-site activity** Multi-site contact activity	dithiocarbamates and relatives (electrophiles)	Ferbam 76 WG, Manzate 200 WP	low
M 04	**Chemicals with multi-site activity** Multi-site contact activity	pthalilimides (electrophiles)	Maestro 80 DF, Supra Captan 80 WDG	low
P 05	**Host plant defence induction** Anthraquinone elicitors	plant extract	Regalia Maxx	resistance not known
P 07	**Host plant defence induction** Phosphonates	phosphonates	Confine Extra, Phostrol, Rampart	low
NC	Unknown	diverse	Agriphage-CMM, Cyclone, Influence, MilStop, OxiDate, OxiDate 2,0, Phostrol, Purespray Green Spray Oil, Sirocco, StorOx, Vegol Crop Oil	unknown

Appendix F. IRAC (Insecticide Resistance Action Committee) Chemical Sub-group or Exemplifying Active Ingredient

To reduce the risk of a pest developing resistance, rotate between chemical groups and/or families within the same crop cycle or year.

1B	organophosphates
3A	pyrethroids, pyrethrins
4A	neonicotinoids
4D	butenolides
5	spinosyns
6	avermectins, mibemycins
7C	pyriproxyfen
9B	pyridine azomethine derivatives
10B	etoxazole
11A	*Bacillus thuringiensis* and the insecticidal proteins they produce
12B	organotin miticides
13	pyrroles, dinitrophenols, sulfuramid
15	benzoylureas
16	buprofezin
17	cyromazine
18	diacylhydrazines
20B	acequinocyl
20D	bifenazate
21A	METI acaricides and insecticides
23	tetronic and tetramic acid derivatives
28	diamides
29	flonicamid
31	Granuloviruses (GVs) Nucleopolyhedroviruses (NPVs)
UNF	*Beauveria bassiana* strains, *Metarhizium anisopliae* strain F52, *Paecilomyces fumosoroseus* Apopka strain 97
NC	not classified

Appendix G. FRAC (Fungicide Resistance Action Committee) Chemical or Biological Groups

To reduce the risk of a pathogen developing resistance, rotate between chemical groups and/or families within the same crop cycle or year.

2	dicarboximides
3	triazoles
4	acylalanines
7	pyridinyl-ethyl-benzamides; pyrazole-4-carboxamides; pyridine-carboxamides
9	anilino-pyrimidines
11	methoxy-acetamide
12	phenylpyrroles
17	hydroxyanilides
19	peptidyl pryimidine nucleoside
21	cyano-imidazole
24	hexopyranosyl antibiotic
28	carbamates
40	cinnamic acid amides; mandelic acid amides
44	*Bacillus* sp. and the fungicidal lipopeptides produced
45	triazolo-pyrimidylamine
46	terpene hydrocarbons, terpene alcohols and terpene phenols
49	piperidinyl-thiazole-isoxazolines
BM 01	polypeptide (lectin)
BM 02	fungal *Trichoderma* spp., fungal *Gliocladium* spp., bacterial *Streptomyces* spp.
M 01	inorganic
M 02	inorganic
M 03	dithio-carbamates and relatives
M 04	phthalimides
P 05	complex misture, ethanol extract (anthraquinones, resveratrol)
P 07	ethyl phosphonates
NC	not classified/unknown

Appendix H. The Metric System

Metric units

Linear measures (length)
10 millimetres (mm) = 1 centimetre (cm)
100 centimetres (cm) = 1 metre (m)
1,000 metres = 1 kilometre (km)
Square measures (area)
100 m × 100 m = 10,000 m^2 = 1 hectare (ha)
100 ha = 1 square kilometre (km^2)
Cubic measures (volume)
Dry measure
1,000 cubic millimetres (mm^3) = 1 cubic centimetre (cm^3)
1,000,000 cm^3 = 1 cubic metre (m^3)
Liquid measure
1,000 millilitres (mL) = 1 litre (L)
100 L = 1 hectolitre (hL)
Weight-volume equivalents (for water)
(1.00 kg) 1,000 grams = 1 litre (1.00 L)
(0.50 kg) 500 g = 500 mL (0.50 L)
(0.10 kg) 100 g = 100 mL (0.10 L)
(0.01 kg) 10 g = 10 mL (0.01 L)
(0.001 kg) 1 g = 1 mL (0.001 L)
Weight measures
1,000 milligrams (mg) = 1 gram (g)
1,000 g = 1 kilogram (kg)
1,000 kg = 1 tonne (t)
1 mg/kg = 1 part per million (ppm)
Dry–liquid equivalents
1 cm^3 = 1 mL
1 m^3 = 1,000 L

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

Liquid equivalents (approximate)

50 L/ha	=	4.45 gal/acre	(5.35 US gal/acre)
100 L/ha	=	8.90 gal/acre	(10.70 US gal/acre)
150 L/ha	=	13.35 gal/acre	(16.05 US gal/acre)
200 L/ha	=	17.80 gal/acre	(21.40 US gal/acre)
250 L/ha	=	22.25 gal/acre	(26.75 US gal/acre)
300 L/ha	=	26.70 gal/acre	(32.10 US gal/acre)

Application rate conversions

Metric to Imperial or U.S. (approximate)
litres per hectare × 0.09 = Imp. gallons per acre
litres per hectare × 0.11 = U.S. gallons per acre
litres per hectare × 0.36 = Imp. quarts per acre
litres per hectare × 0.43 = U.S. quarts per acre
litres per hectare × 0.71 = Imp. pints per acre
litres per hectare × 0.86 = U.S. pints per acre
millilitres per hectare × 0.014 = U.S. fluid ounces per acre
grams per hectare × 0.014 = ounces per acre
kilograms per hectare × 0.89 = pounds per acre
tonnes per hectare × 0.45 = tons per acre
Imperial or U.S. to metric (approximate)
Imp. gallons per acre × 11.23 = litres per hectare (L/ha)
U.S. gallons per acre × 9.35 = litres per hectare (L/ha)
Imp. quarts per acre × 2.8 = litres per hectare (L/ha)
U.S. quarts per acre × 2.34 = litres per hectare (L/ha)
Imp. pints per acre × 1.4 = litres per hectare (L/ha)
U.S. pints per acre × 1.17 = litres per hectare (L/ha)
Imp. fluid ounces per acre × 70 = millilitres per hectare (mL/ha)
U.S. fluid ounces per acre × 73 = millilitres per hectare (mL/ha)
tons per acre × 2.24 = tonnes per hectare (t/ha)
pounds per acre × 1.12 = kilograms per hectare (kg/ha)
pounds per acre × 0.45 = kilograms per acre (kg/acre)
ounces per acre × 70 = grams per hectare (g/ha)

Metric conversions

5 mL = 1 tsp
15 mL = 1 tbsp
28.5 mL = 1 imp. fl. oz.

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	
°F = (°C × ⅘) + 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	
°C = (°F – 32) × ⅝	

Handy Approximate Metric Conversion Factor
litres per hectare × 0.4 = litres per acre
kilograms per hectare × 0.4 = kilograms per acre

Abbreviations

%	=	per cent
a.i.	=	active ingredient
AP	=	agricultural powder
cm	=	centimetre
cm^2	=	square centimetre
CS	=	capsule suspension
DF	=	dry flowable
DG	=	dispersible granular
DP	=	dispersible powder
E	=	emulsifiable
EC	=	electrical conductivity
e.g.	=	for example
F	=	flowable
g	=	gram
Gr	=	granules, granular
ha	=	hectare
kg	=	kilogram
km/h	=	kilometres per hour
kPa	=	kilopascal
L	=	litre
m	=	metre
m^2	=	square metre
mL	=	millilitre
mm	=	millimetre
m/s	=	metres per second
SC	=	sprayable concentrate
SP	=	soluble powder
t	=	tonne
v/v	=	volume/volume
W	=	wettable (powder)
WDG	=	water dispersible granular
WG	=	wettable granule
WP	=	wettable powder

Calculating Parts per Million (ppm)
1 ppm = 1 g active ingredient per 1,000 L water

Emergency and First-Aid Procedures for Pesticide Poisoning

For pesticide poisonings and pesticide injuries, call the Ontario Poison Centre: Toronto 1-800-268-9017

Prevent accidents

- **Read the label.** Follow all the precautions the label recommends. Read the First Aid section of the label BEFORE you begin to handle any pesticide.
- **Make sure that someone knows** what pesticides you are working with and where you are.
- **Keep a file of labels and product Safety Data Sheets (SDS) for the pesticides you use.** Make sure everyone knows where to find this in case of an emergency.
- **Post emergency numbers near all telephones.**
- **Keep clean water, paper towels, extra gloves and clean coveralls close by** in case you spill pesticide on yourself.

If someone has been working with pesticides and you see any possible symptoms of pesticide poisoning or injury, take emergency action immediately.

If an accident or poisoning happens

- protect yourself from injury first.
- Stop the exposure to the pesticide. Move the victim away from the contaminated area.
- Check the four basic facts — identify the pesticide, the quantity, the route of entry and time of exposure.
- Call an ambulance or the Ontario Poison Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, SDS sheet, container or a clear photo of the container to emergency personnel** at the scene — or take it with you to the hospital. Do not transport pesticide containers in the passenger compartment of the vehicle.

First Aid

If a pesticide comes in contact with skin:

- remove all contaminated clothing; wash skin thoroughly with lots of soap and warm water.
- dry skin well and cover with clean clothing or other clean material.

If pesticide comes in contact with eyes:

- hold eyelids open; wash the eyes with clean running water for 15 minutes or more.

If pesticide was inhaled:

- move the victim to fresh air and loosen tight clothing.
- give artificial respiration if the victim is not breathing.

Do not breathe in the exhaled air from the victim — you could also be poisoned.

If a pesticide was swallowed:

- call the Ontario Poison Centre IMMEDIATELY.

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  - 1-800-268-7095 TTY, toll-free across Ontario

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Agricultural Information Contact Centre
1-877-424-1300
1-855-696-2811 (TTY)
email: ag.info.omafra@ontario.ca
ontario.ca/omafra

For a major spill, a theft or a fire involving a pesticide:

Call the Ontario Ministry of the Environment, Conservation and Parks **Spills Action Centre** at **1-800-268-6060** (24 hr a day, 7 days a week).
Notify your municipality.

ontario.ca/crops

Ontario