Publication 840

Crop Protection Guide

For Nursery and Landscape Plants

2021

Ministry of Agriculture,
Food and Rural Affairs

Ontario

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

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

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

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

THE PESTICIDE LABEL

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

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

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 crop specialists or PMRA's Pest Management Information Service.

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

REGULATION OF PESTICIDES IN ONTARIO

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

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

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

CLASSIFICATION OF PESTICIDES

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

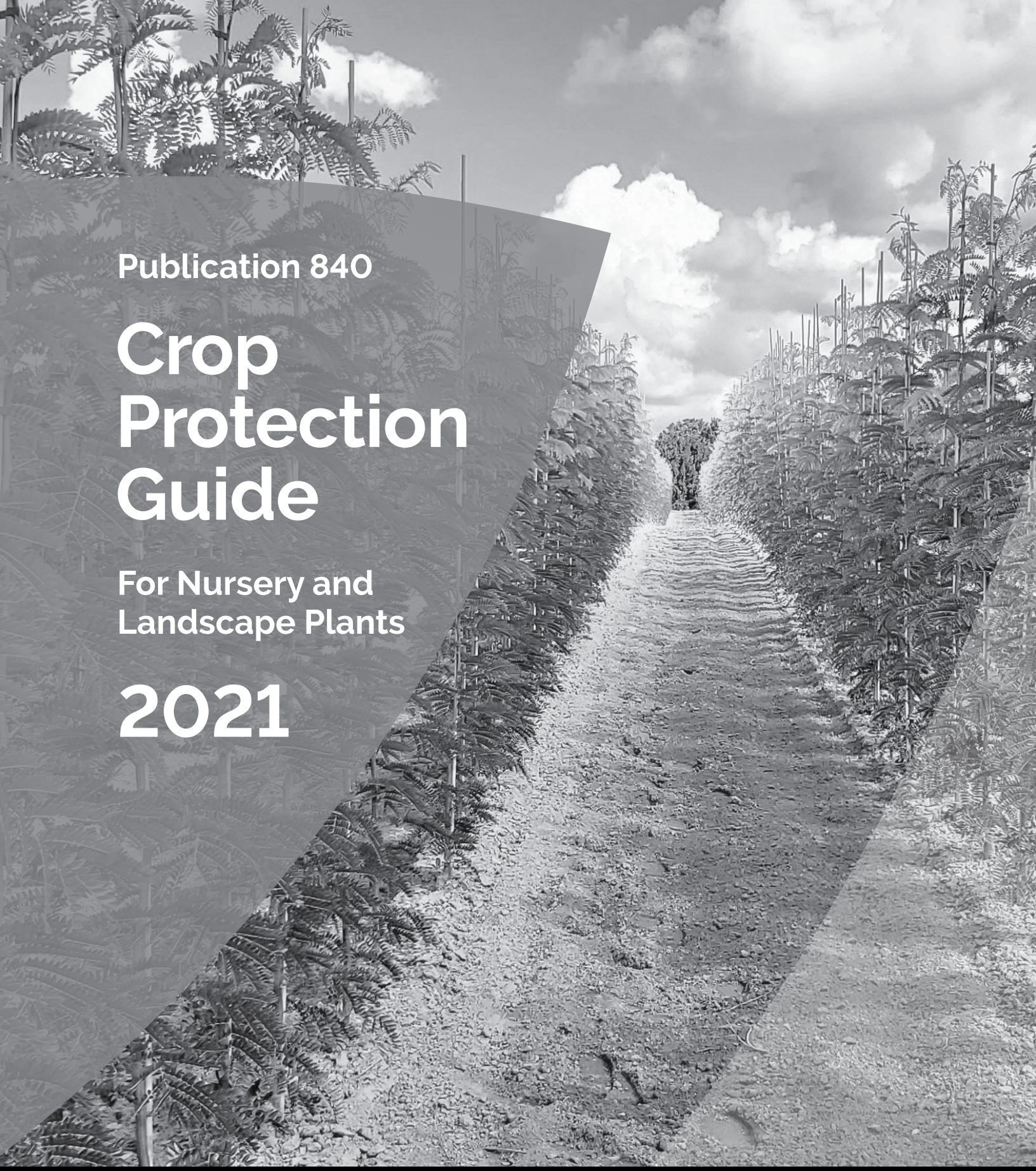
CERTIFICATION AND LICENSING

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

Pesticide Commercial Applicators (Exterminators) and Their Assisting Technicians
For more information about exterminator licensing and technician training, visit:

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

Cette publication est aussi disponible en français.



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Acknowledgements

The information contained in this publication is supplied by Crop Specialists of OMAFRA's Agriculture Development Branch.

OMAFRA Publication 840, *Crop Protection Guide for Nursery and Landscape Plants 2021* and Publication 841, *Guide to Nursery and Landscape Plant Production and IPM*, together replace OMAFRA Publication 383, *Nursery and Landscape Plant Production and IPM*.

OMAFRA Publication 840 contains information about pesticide products that have been registered as of December 31, 2020, on outdoor ornamentals.

OMAFRA Publication 840 is a companion to OMAFRA Publication 841, *Guide to Nursery and Landscape Plant Production and IPM*. Publication 841 contains more comprehensive information on pest management, nutrition and water quality and includes colour photos for many common pests.

Need technical or business information?

Contact the Agricultural Information Contact Centre at

1-877-424-1300
or
ag.info.omafra@ontario.ca

If you are looking for nursery and landscape plant information on the Internet, check ontario.ca/crops.

It's one-stop shopping for factsheets, articles and photos about the production and maintenance of woody plants.

If you are looking for timely information on the production and maintenance of outdoor ornamentals, check out the Nursery and Landscape Blog at www.onnurserycrops.com.

Subscribe by entering your email address and selecting "Follow" to receive email notifications of new posts.

Special thanks to Kate Hubbs, Summer Field Technician, Ontario Ministry of Agriculture, Food and Rural Affairs for the creation of the illustrations for the schematics and hand drawn icons in Chapter 2.

Cover Images

FRONT COVER: Honeylocust trees in summer. Photo courtesy of Winkelmolen Nursery Ltd.

BACK COVER: Maple trees in fall. Photo courtesy of Kobes Nurseries Inc.

COMING SOON!

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

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

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

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

Updates can be found at:

ontario.ca/crops

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1. Using Pesticides in Ontario

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

Read the label before use.

Product labels may change.

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

Keep detailed spray records.

FEDERAL REGISTRATION OF PESTICIDES

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

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

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

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

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

Maximum Residue Limit (MRL)

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

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

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

When exporting your food product, it is important to confirm the importing country's MRLs because it

may be different than ours. Processors or retailers may demand more restrictive limits. Growers should seek advice of their intended market to determine if more restrictive limitations apply. Keep accurate and up-to- date records on pesticide use in each crop.

For more information on MRLs, see:

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

REGULATION OF PESTICIDES IN ONTARIO

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

CLASSIFICATION OF PESTICIDES

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

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

Table 1–1. Federal and Provincial Classification

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

* Class E pesticides do not apply to:
- popping corn
- sweet corn
- corn used for the production of seed
- soybean seed planted for the purpose of producing a soybean seed crop of certified status under contract
- corn seed and soybean seed treated only with fungicide.

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

CERTIFICATION AND LICENSING

Certified Farmers and Their Assistants

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

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

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

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

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

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

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

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

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

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

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

Pesticide Commercial Applicators (Exterminators) and Their Assisting Technicians

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

For more information on how to become certified, refer to Ontario Pesticide Training and Certification

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

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

For information on technician training, visit:

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

Ontario's Cosmetic Pesticide Ban and Excepted Uses

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

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

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

To locate your local MECP District Office: https://www.ontario.ca/environment-and-energy/ministry-environment-district-locator

To speak with your local MECP Pesticide Specialist:

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

PESTICIDE APPLICATION INFORMATION

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

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

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

For more information on pesticide application, see:

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

Restricted Entry Intervals

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

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

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

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

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

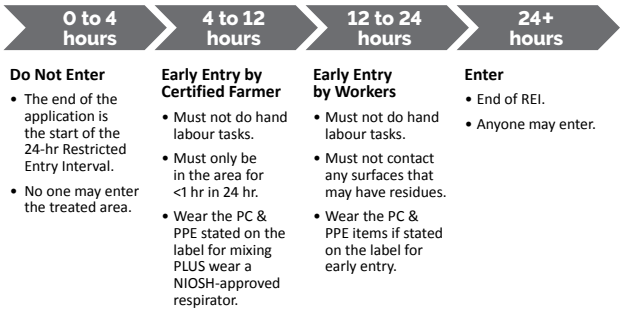

Figure 1–1. Example of a 24-hr REI on a pesticide label.

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. Other labels will recommend a vegetative filter strip as a best management practice.

PROTECT THE ENVIRONMENT

Protect Water Sources

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

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

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

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

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

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

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

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

Bee Poisoning

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

- Time insecticide applications to minimize bee exposure (e.g., apply post bloom). Daytime treatments, when bees are foraging, are most hazardous. Insecticide applications in the evening are the safest, unless there is evidence of a strong temperature inversion or high humidity. Under normal circumstances, spraying after 8 p.m. allows the spray to dry before the bees are exposed to it the next day. Spraying during early morning is the next best time, when fewer bees are foraging, but pesticide residues may still be present. Spraying should be completed well before 7 a.m. While honey bees and most other pollinating insects do not usually forage at temperatures below 13°C, bumblebees do. If you plan to spray in the morning, contact beekeepers who have bees within 5 km of your crop and spray site. The beekeepers may then have the option of taking any possible protective action.

- Do not apply insecticides while fruit trees are in bloom. The *Bees Act* makes it an offence to do so in Ontario. Do not spray any flowering crop on which bees are foraging.

- To prevent drift toward nearby hives, do not apply insecticides on windy days or when there is evidence of a strong temperature inversion.

- Bees and other pollinators may be poisoned by visiting flowering weeds, trees and cover crops that have come into contact with an insecticide via spray drift or drift of insecticide-contaminated dust during planting. Avoid spray drift to flowering weeds that are adjacent to or within the target field. Where possible, mow down flowering cover crops or flowering weeds in and bordering target fields prior to spraying to help safeguard the bees. Control dandelions and other flowering weeds within fields before spraying or planting seeds treated with an insecticide. Take measures to reduce movement of dust from insecticide seed treatments to flowering trees, weeds and water sources that are in or adjacent to the target field. For more information on reducing dust movement, search for "Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices" at www.canada.ca.

- Systemic insecticides may also pose a high risk to bees and other insect pollinators. Bees can be exposed to insecticide residues in or on flowers, leaves, pollen, nectar and/or surface water. Do not apply insecticide or allow it to drift onto blooming crops or off-site habitat if bees are foraging in or adjacent to the treatment area.

- In crop settings where pesticide use is highly likely, beekeepers should remove honey bee colonies as soon as pollination and bloom are complete in the crop and before any insecticides are applied post bloom. In emergency situations, if the colonies cannot be removed in time, beekeepers can place burlap or cloth soaked in water at the entrance of the hive to disrupt the flight of the bees for up to 12 hr and provide more time for spray to dry. To help prevent overheating of the hive during this time, keep an opening of 2.5 cm on each side of the hive entrance so bees can still get out and ventilate the hive. Also, the water on the burlap or cloth will help cool the colony.

- Not all pesticides are equally toxic to bees. If there is a risk of honey bee poisoning, try to choose an insecticide that is not highly toxic to bees. When there is a choice, choose a product formulation that is less hazardous to bees.

- Always read the most current pesticide label for guidance. Some pesticides cannot be used when bees are active in the crop.

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

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

Manage Drift

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

- Do not spray when wind direction is changeable, or wind speeds are high or gusty. These conditions increase the potential for off-target drift. While most pesticide labels indicate allowable wind speeds, some do not.

- Regularly monitor wind conditions during spraying, preferably in the field with a handheld wind meter at nozzle height or elevated to the top of the target canopy from within the planted area. Record the wind speed and direction. As conditions change, make adjustments to manage drift potential. Adjustments may include a coarser droplet size, minimizing nozzle-to-target distance, adjusting air energy or vector on air-assisted sprayers, slowing travel speed, using a drift reducing adjuvant or discontinuing spraying until conditions improve.

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

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

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

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

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

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

- If specified, use the sprayer output indicated on the pesticide label.

- Use a nozzle at a pressure that will produce the droplet size specified on the pesticide label or delivers droplets appropriate for the job.

- Coarser droplets reduce drift significantly. Air induction nozzles used above 2bar (30psi) will produce Coarse to Ultra Coarse droplets. They can be used in the top nozzle positions on air-assist sprayers in specialty crops, or along conventional horizontal booms. Ensure the droplet size and volume are appropriate for the application being performed.

- Minimize the distance between nozzle and target as much as possible while still maintaining spray uniformity.

- Establish buffer zones for the protection of adjacent sensitive areas. Some pesticide labels will state buffer zone setbacks; follow these carefully.

- Use drift reduction technology, such as hoods, shrouds, screens or air curtains.

- If appropriate, use drift-reducing adjuvants in the spray tank. The intense agitation in air-assist sprayers for specialty crops has been shown to reduce the effectiveness of drift-reducing adjuvants. Certain combinations of drift-reducing adjuvants and air-induction nozzles have been shown to increase the incidence of fine droplets. Consult with the adjuvant manufacturer.

- When possible, use non-volatile pesticide formulations or products.

For more information about spray drift, see:

- Sprayers 101: www.sprayers101.com
- OMAFRA website: ontario.ca/spraydrift
- OMAFRA Factsheet *Pesticide Drift from Ground Applications*
- OMAFRA *Best Management Practices (BMP13) book — Pesticide Storage, Handling and Application*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Drift of Pesticides* video series, available at www.opep.ca/resources (click the "YouTube" icon)

WASTE MANAGEMENT

Empty Pesticide and Fertilizer Containers up to 23 L

Never re-use empty pesticide containers.

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

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

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

Empty Seed and Pesticide Bags

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

Surplus Spray Mix

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

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

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

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

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

Surplus Pesticide Disposal

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

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

STORING PESTICIDES

Ontario's *Pesticides Act* and Regulation 63/09 provide details on storage requirements for pesticide storage facilities. As shown in Table 1–2, the storage requirements that must be followed are dependent on which classes of pesticides you store.

TABLE 1–2. Requirements for Pesticide Storage Facilities

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

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

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

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

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

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

For more information about storing pesticides, see:

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

PESTICIDE SPILLS

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

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

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

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

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

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

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

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

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

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

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

- **For a dust, granular or powder spill** — Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.

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

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

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

For information on preventing spills, see:

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

For pesticide poisonings and pesticide injuries, call:

Ontario Poison Centre: 1-800-268-9017

(TTY) 1-877-750-2233

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

2. Crop Protection: Insects, Mites and Diseases

USING PESTICIDES

As of May 1, 2020, Ontario's pesticides classes have been aligned with the federal government's pesticide categories to remove duplication and reduce complexity for the sale and use of pesticides in Ontario, while ensuring continued protection of human health and the environment. The PMRA classifies a pesticide into one of four classes – manufacturing, restricted, commercial and domestic. The MECP automatically classifies pesticides in Ontario as Class A, B, C or D based on the federal classification system plus one additional class (Class E) for regulating the sale and use of neonicotinoid-treated corn and soybean seed.

Table 2–1. Classification System for Pest Control Products (as of May 1st, 2020)

Federal Pesticide Class	Pre- 2020 Ontario Pesticide Class	Post- 2020 Ontario Pesticide Class
Manufacturing	Class 1	Class A
Restricted	Class 2, 3, 4 ,7	Class B
Commercial	Class 2, 3, 4	Class C
Domestic	Class 5, 6, 7, 8	Class D
N/A	Class 12	Class E – Treated Seeds

Class A pesticides, or Manufacturing pesticides are those products which are used only in the manufacturing of a pest control product which is regulated under either the *Fertilizers Act* or the *Feed Act*. Class B pesticides, also known as Restricted pesticides, are those that have limitations to their distribution, use or require qualifications of a person to use these products due to potential health or environmental risks associated with their use. Class C pesticides, also known as Commercial pesticides, are products to be used commercially in accordance with their respective labels. Class D pesticides, also known as Domestic pesticides, are those products to be used by the general public for personal use. Lastly, Class E, or Treated seeds, are neonicotinoid treated corn or soybean seeds (treated with clothianidin, imidacloprid or thiamethoxam). Farmers must be certified through the Grower Pesticide Safety Course (GPSC) in order to buy and use Class B and C pesticides on their farms. Certification is not required to buy and use Class D pesticides for agricultural purposes. Farmer assistants and supervised farmers using Class B or C pesticides must complete training and assist or be supervised by a certified farmer.

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

In Ontario, a licence is required for exterminators or technicians to apply herbicides for any other commercial use. For further information training and certification, visit the Ontario Pesticide Training and Certification website at www.ontariopesticide.com or call 1-888-620-9999.

Cosmetic Pesticide Ban in Ontario

The Cosmetic Pesticides Ban Act, 2008, and Ontario Regulation 63/09 came into effect in 2009 from the Ministry of Environment, Conservation and Parks (MECP). The cosmetic use of pesticides is considered a non-essential use. Ontario bans the cosmetic use of pesticides to protect Ontarians from unnecessary risk by only allowing certain, low-risk pesticides for controlling weeds and pests on lawns and gardens.

Pesticides can only be used for cosmetic purposes if the a) use is permitted under an exception to the ban, or b) the active ingredient in the pesticide is included on the Allowable List.

A List of Active Ingredients Authorized for Cosmetic Uses (Allowable List) was created so you know what products you can and can't use. The Allowable List includes the active ingredients in pesticides that a) meet certain ministry criteria b) are considered low-risk and c) are allowed for use in Ontario. Anyone can use these pesticides to control weeds and other pests on lawns, gardens, driveways, parks and around the home. The ministry updates the list periodically by adding or removing active ingredients based on changes to federally-registered pesticides and requirements under the cosmetic pesticide ban. Please check the list to ensure you use the most current version at: ontario.ca/page/using-pesticides-ontario.

Toxicity Information

The "relative toxicity" of a pesticide is expressed in the LD_{50} value. The higher the LD_{50} value of a pesticide, the less toxic the product is to humans.

LD_{50} is the number of milligrams of a pesticide per kilogram of body weight that will kill 50% of the tested subjects. LD_{50} is commonly measured as the Acute Oral LD_{50}, which means the chemicals are ingested through the mouth or nose. In addition, toxicity values for penetration through the skin (Dermal LD_{50}) can usually be found on the material safety data sheet (MSDS) and are available from the manufacturer.

Prevent Bee Poisoning

Honeybees, as well as other bees and insects, are important pollinators of crops. Many crops also offer bees important sources of nectar for honey production. For more information on the prevention of bee poisoning, see *Bee Poisoning* on page 7. Most organophosphate and carbamate insecticides are highly toxic to bees. Examples of insecticides used in greenhouse and outdoor ornamental crop production that are toxic to bees are listed in *Table 2–2, Relative Toxicity of Pesticides to Honeybees.*

Read each pesticide label for specific precautions regarding bees.

Table 2–2. Relative Toxicity of Pesticides to Honeybees

For more detailed information on the toxicity of specific pesticides to honeybees, see the pesticide label.

Trade Name	Active Ingredient
Group 1 — Highly toxic. **Severe losses may be expected if the following materials are used when bees are present at treatment time or within a few days thereafter.**	
AceCap 97	acephate
Actara, Flagship 25 WG	thiamethoxam
Admire 240	imidacloprid
Ambush 50 EC	permethrin
Avid 1.9% EC	abamectin
Cygon 480	dimethoate
DeltaGard	deltamethrin
Diazinon	diazinon
Dyno-Mite SC, Dyno-Mite WP	pyridaben
Ima-jet, Ima-jet 10	imidacloprid
Imidan 50-WP Instapak, Imidan WP	phosmet
Lagon 480	dimethoate
Lorsban 4E	chlorpyrifos
Malathion	malathion
Orthene 75 SP	acephate
Pounce 384 EC	permethrin
Pyrate 480 EC	chlorpyrifos
SanMite WP	pyridaben
Silencer 120EC	lambda-cyhalothrin
Sevin	carbaryl

Table 2–2. Relative Toxicity of Pesticides to Honeybees

For more detailed information on the toxicity of specific pesticides to honeybees, see the pesticide label.

Trade Name	Active Ingredient
Group 2 — Moderately toxic. **These can be used around bees if dosage, timing and method of application are correct, but do not apply them directly on bees, in the field or at the colonies.**	
Floramite SC	bifenazate
Horticultural oil	mineral oil
Kontos	spirotetramat
Landscape Oil	mineral oil
Maestro 80 DF	captan
Movento 150 OD, Movento 240 SC	spirotetramat
Purespray Green Spray Oil	mineral oil
Success	spinosad
Supra Captan 80 WDG	captan
Treeazin	azadirachtin
Tristar 70 WSP	acetamiprid
Group 3 — Pesticides relatively non-toxic to bees.	
Acelepryn, Acelepryn G	chlorantraniliprole
Actinovate SP	*Streptomyces lydicus*
Aliette Aliette WDG, Chipco Aliette Ornamental, Aliette WP	fosetyl AL
Apollo SC	clofentezine
Bioprotec 3P DF, Bioprotec Plus	*Bacillus thuringiensis*
Bravo 500	chlorothalonil
Confirm 240 F	tebufenozide
Daconil 2787, Daconil 720, Daconil Ultrex	chlorothalonil
Decree 50 WDG	fenhexamid
Dipel 2X DF	*Bacillus thuringiensis*
Elevate 50WDG	fenhexamid
Folpan 50WP, Folpan 80 WDG	folpet
Forbid 240 SC	spiromesifen
Funginex DC	triforine
Insecticidal soap	potassium salts of fatty acids
MilStop	potassium bicarbonate
Nova	myclobutanil
Pristine WG	boscalid + pyraclostrobin
Rhapsody ASO	*Bacillus subtilis*
Rovral 50 WP	iprodione
Senator 70 WP	thiophanate-methyl
Serenade	*Bacillus subtilis*
Shuttle 15 SC	acequinocyl
Subdue Maxx	metalaxyl

CHEMICAL FAMILIES

Most agricultural chemicals belong to a chemical "family" which is a group of substances that share important characteristics that are based on their mode of action. Chemical families are designated by a chemical family "name" and also a group "number". To prevent pests from becoming resistant to a particular product, rotate between pesticides from different chemical families and groups. All pesticide mode of action classification guidelines are sourced from the Insecticide Resistance Action Committee (IRAC) and the Fungicide Resistance Action Committee (FRAC). This information can also be found on the pesticide label.

The following Tables 2–3 to 2–12 and Figures 2–1 to 2–5, Insecticides and Fungicides Used to Protect Ornamentals, list pesticide products and active ingredients in alphabetical order and by chemical family. These reference tables and figures can be used to help make decisions (e.g. pesticide resistance management) about pesticide applications by providing information on toxicity, chemical family and classification. Pest Control Products (PCP) registered in Canada can be found by searching "Pesticide Label Search" on the Health Canada website at: https://www.hc-sc.gc.ca/. For mobile devices, use the "Pesticide Labels" app from Health Canada.

*The information in the following tables does not replace the information found on pesticide labels. Always read each pesticide label prior to making any pesticide application.

Table 2–3. Insecticides Used to Protect Ornamentals by Product Name (as of January 1st, 2021)

Product Name	Active Ingredient	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
AceCap97	acephate	1,000	Organophosphate	1B	C
Acelepryn, Acelepryn G	chlorantraniliprole	> 5,000	Diamide	28	C
Actara 25WG	thiamethoxam	> 5,000	Neonicotinoid	4A	C
Altus	flupyradifurone	> 2,000	Butenolides	4D	C
Ambush 500 EC	permethrin	3,129	Pyrethroid	3A	C
Avid	abamectin	300	Glycosides	6	C
Beleaf 50SG	flonicamid	> 2,000	Chorodotonal organ modulators	29	C
BioProtec 3P DF, BioProtec Plus	*Bacillus thuringiensis*	> 15,000	Biological	11A	C
Citation 75WP	cyromazine	4,460	Moulting disruptor	17	C
Closer	sulfoxaflor	> 5,000	Sulfoximine	4C	C
Confirm 240F	tebufenozide	> 5,000	Diacylhydrazine	18	C
Cygon 480 E	dimethoate	425	Organophosphate	1B	C
Delegate	spinetoram	> 5,000	Spinosyn	5	C
Demand CS	lambda-cyhalothrin	> 5,000	Pyrethroid	3A	C
Dipel 2X DF	*Bacillus thuringiensis*	> 5,000	Biological	11A	C
Dragnet FT EC	permethrin	998	Pyrethroid	3A	B, C
Dyno-Mite SC, Dyno-Mite WP	pyridaben	1,930	METI acaricides and insecticides	21A	C
Endeavor 50WG	pymetrozine	> 5,000	Pyridine azomethine	9B	C
Ference	cyantraniliprole	> 5,000	Diamide	28	C
Flagship 25WG	thiamethoxam	> 5,000	Neonicotinoid	4A	C
Forbid 240 SC	spiromesifen	> 2,000	Lipid biosynthesis inhibitor	23	C
Heterorhabditis bacteriophora	*Heterorhabditis bacteriophora (H.b.)*	Non-toxic	Biological	NC	NC
Heterorhabditis megidis	*Heterorhabditis megidis (H.m.)*	Non-toxic	Biological	NC	NC
IMA-jet, IMA-jet 10	imidacloprid	410	Neonicotinoid	4A	B, C
Imidan WP, Imidan 50-WP Instapak	phosmet	230	Organophosphate	1B	C
Insecticidal soap	potassium salts of fatty acids	> 5,000	Insecticidal soap and botanical	UNM	C
Intercept 60 WP	imidacloprid	1,858	Neonicotinoid	4A	C
Kontos	spirotetramat	> 2,000	Tetramic acid	23	C
Lagon 480 E	dimethoate	425	Organophosphate	1B	C
Landscape Oil	mineral oil	> 15,000	Horticultural oil	UNM	C
Lannate	methomyl	23	Carbamate	1A	B
Lorsban 4E, Lorsban NT	chlorpyrifos	300	Organophosphate	1B	B, C
Mako	cypermethrin	760	Pyrethroid	3A	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

** Please note that Sevin T&O Insecticide is NO LONGER AVAILABLE, remaining product MUST be used by March 31st, 2022.

NC - Please note that this product is not classified under this group heading.

Table 2–3. Insecticides Used to Protect Ornamentals by Product Name (as of January 1st, 2021)

Product Name	Active Ingredient	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
Malathion 85E, Malathion 500 EC	malathion	> 550	Organophosphate	1B	C
Met52 G, Met52 EC	*Metarhizium anisopliae* strain F52	> 2,000	Biological	UNF	C
Mimic 240 LV	tebufenozide	> 5,000	Insect growth regulator	18	C
Movento 240 SC, Movento 150 OD	spirotetramat	> 2,000	Tetramic acid	23	C
Opal Insecticidal Soap	potassium salts of fatty acids	> 5,000	Insecticidal soap and botanical	UNM	C
Orthene 75 SP, Orthene 97 SG	acephate	1,494	Organophosphate	1B	C
Pounce 384 EC	permethrin	3,129	Pyrethroid	3A	C
Purespray Green Spray Oil	mineral oil	> 5,000	Horticultural oil	UNM	D
Pyganic	pyrethrin	> 2,000	Pyrethrin	3A	C
Pyrate	chlorpyrifos	409	Organophosphate	1B	B, C
ReVokBTK	*Bacillus thuringiensis*	> 5,000	Biological	11A	C
Rimon 10 EC	novaluron	3,914	Benzolureas	15	C
Ripcord 400 EC	cypermethrin	760	Pyrethroid	3A	C
SanMite WP	pyridaben	1,930	METI acaricides and insecticides	21A	C
Sevin T&O**	carbaryl	699	Carbamates	1A	C
Silencer 120 EC	lambda-cyhalothrin	98	Pyrethroid	3A	C
Success	spinosad	> 5,000	Spinosyn	5	C
Thuricide	*Bacillus thuringiensis*	> 5,000	Biological	11A	B, C
TreeAzin	azadirachtin	> 2,000	Unknown	UN	C
Tristar 70 WSP	acetamiprid	1,064	Neonicotinoid	4A	C
Trounce	potassium salts of fatty acids and pyrethrin	> 5,000	Insecticidal soap and botanical	3A	C
Vectobac	*Bacillus thuringiensis* subsp. *israelensis*	> 5,000	Biological	11A	C
Ventigra	afidopyropen	> 2,000	Pyropene	9D	C
Xentari WG	*Bacillus thuringiensis* subsp. *aizawai*	> 15,000	Biological	11A	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

** Please note that Sevin T&O Insecticide is NO LONGER AVAILABLE, remaining product MUST be used by March 31st, 2022.

NC - Please note that this product is not classified under this group heading.

Table 2–4. Insecticides Used to Protect Ornamentals by Active Ingredient (as of January 1st, 2021)

Active Ingredient	Product Name	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
abamectin	Avid	300	Glycosides	6	C
acephate	AceCap97	1,000	Organophosphate	1B	C
acephate	Orthene 75 SP, Orthene 97 SG	1,494	Organophosphate	1B	C
acetamiprid	Tristar 70 WSP	1,064	Neonicotinoid	4A	C
afidopyropen	Ventigra	> 2,000	Pyropene	9D	C
azadirachtin	TreeAzin	> 2,000	Unknown	UN	C
Bacillus thuringiensis	BioProtec 3P DF, BioProtec Plus	> 15,000	Biological	11A	C
Bacillus thuringiensis	Dipel 2X DF	> 5,000	Biological	11A	C
Bacillus thuringiensis	ReVokBTK	> 5,000	Biological	11A	C
Bacillus thuringiensis	Thuricide	> 5,000	Biological	11A	B, C
Bacillus thuringiensis	Vectobac	> 5,000	Biological	11A	C
Bacillus thuringiensis	Xentari WG	> 15,000	Biological	11A	C
carbaryl	Sevin T&O**	699	Carbamates	1A	C
chlorantraniliprole	Acelepryn, Acelepryn G	> 5,000	Diamide	28	C
chlorpyrifos	Lorsban 4E, Lorsban NT	300	Organophosphate	1B	B, C
chlorpyrifos	Pyrate	409	Organophosphate	1B	B, C
cyantraniliprole	Ference	> 5,000	Diamide	28	C
cypermethrin	Mako	760	Pyrethroid	3A	C
cypermethrin	Ripcord 400 EC	760	Pyrethroid	3A	C
cyromazine	Citation 75WP	4,460	Moulting disruptor	17	C
dimethoate	Cygon 480 E	425	Organophosphate	1B	C
dimethoate	Lagon 480 E	425	Organophosphate	1B	C
flonicamid	Beleaf 50SG	> 2,000	Chorodotonal organ modulators	29	C
flupyradifurone	Altus	> 2,000	Butenolides	4D	C
Heterorhabditis bacteriophora (H.b.)	*Heterorhabditis bacteriophora*	Non-toxic	Biological	NC	NC
Heterorhabditis megidis (H.m.)	*Heterorhabditis megidis*	Non-toxic	Biological	NC	NC
imidacloprid	IMA-jet, IMA-jet 10	410	Neonicotinoid	4A	B, C
imidacloprid	Intercept 60 WP	1,858	Neonicotinoid	4A	C
lambda-cyhalothrin	Demand CS	> 5,000	Pyrethroid	3A	C
lambda-cyhalothrin	Silencer 120 EC	98	Pyrethroid	3A	C
malathion	Malathion 85E, Malathion 500 EC	> 550	Organophosphate	1B	C
Metarhizium anisopliae strain F52	Met52 G, Met52 EC	> 2,000	Biological	UNF	C
methomyl	Lannate	23	Carbamate	1A	B
mineral oil	Landscape Oil	> 15,000	Horticultural oil	UNM	C
mineral oil	Purespray Green Spray Oil	> 5,000	Horticultural oil	UNM	D
novaluron	Rimon 10 EC	3,914	Benzolureas	15	C
permethrin	Ambush 500 EC	3,129	Pyrethroid	3A	C
permethrin	Dragnet FT EC	998	Pyrethroid	3A	B, C
permethrin	Pounce 384 EC	3,129	Pyrethroid	3A	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

** Please note that Sevin T&O Insecticide is NO LONGER SOLD, remaining product MUST be used by March 31st, 2022.

NC - Please note that this product is not classified under this group heading.

Table 2–4. Insecticides Used to Protect Ornamentals by Active Ingredient (as of January 1st, 2021)

Active Ingredient	Product Name	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
phosmet	Imidan WP, Imidan 50-WP Instapak	230	Organophosphate	1B	C
potassium salts of fatty acids	Insecticidal soap	> 5,000	Insecticidal soap and botanical	UNM	C
potassium salts of fatty acids	Opal Insecticidal Soap	> 5,000	Insecticidal soap and botanical	UNM	C
potassium salts of fatty acids and pyrethrin	Trounce	> 5,000	Insecticidal soap and botanical	3A	C
pymetrozine	Endeavor 50WG	> 5,000	Pyridine azomethine	9B	C
pyrethrin	Pyganic	> 2,000	Pyrethrin	3A	C
pyridaben	Dyno-Mite SC, Dyno-Mite WP	1,930	METI acaricides and insecticides	21A	C
pyridaben	SanMite WP	1,930	METI acaricides and insecticides	21A	C
spinetoram	Delegate	> 5,000	Spinosyn	5	C
spinosad	Success	> 5,000	Spinosyn	5	C
spiromesifen	Forbid 240 SC	> 2,000	Lipid biosynthesis inhibitor	23	C
spirotetramat	Kontos	> 2,000	Tetramic acid	23	C
spirotetramat	Movento 240 SC, Movento 150 OD	> 2,000	Tetramic acid	23	C
sulfoxaflor	Closer	> 5,000	Sulfoximines	4C	C
tebufenozide	Confirm 240F	> 5,000	Diacylhydrazine	18	C
tebufenozide	Mimic 240 LV	> 5,000	Insect growth regulator	18	C
thiamethoxam	Actara 25WG	> 5,000	Neonicotinoid	4A	C
thiamethoxam	Flagship 25WG	> 5,000	Neonicotinoid	4A	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

** Please note that Sevin T&O Insecticide is NO LONGER SOLD, remaining product MUST be used by March 31st, 2022.

NC - Please note that this product is not classified under this group heading.

Figure 2–1. Insecticides Mode of Action Schematic

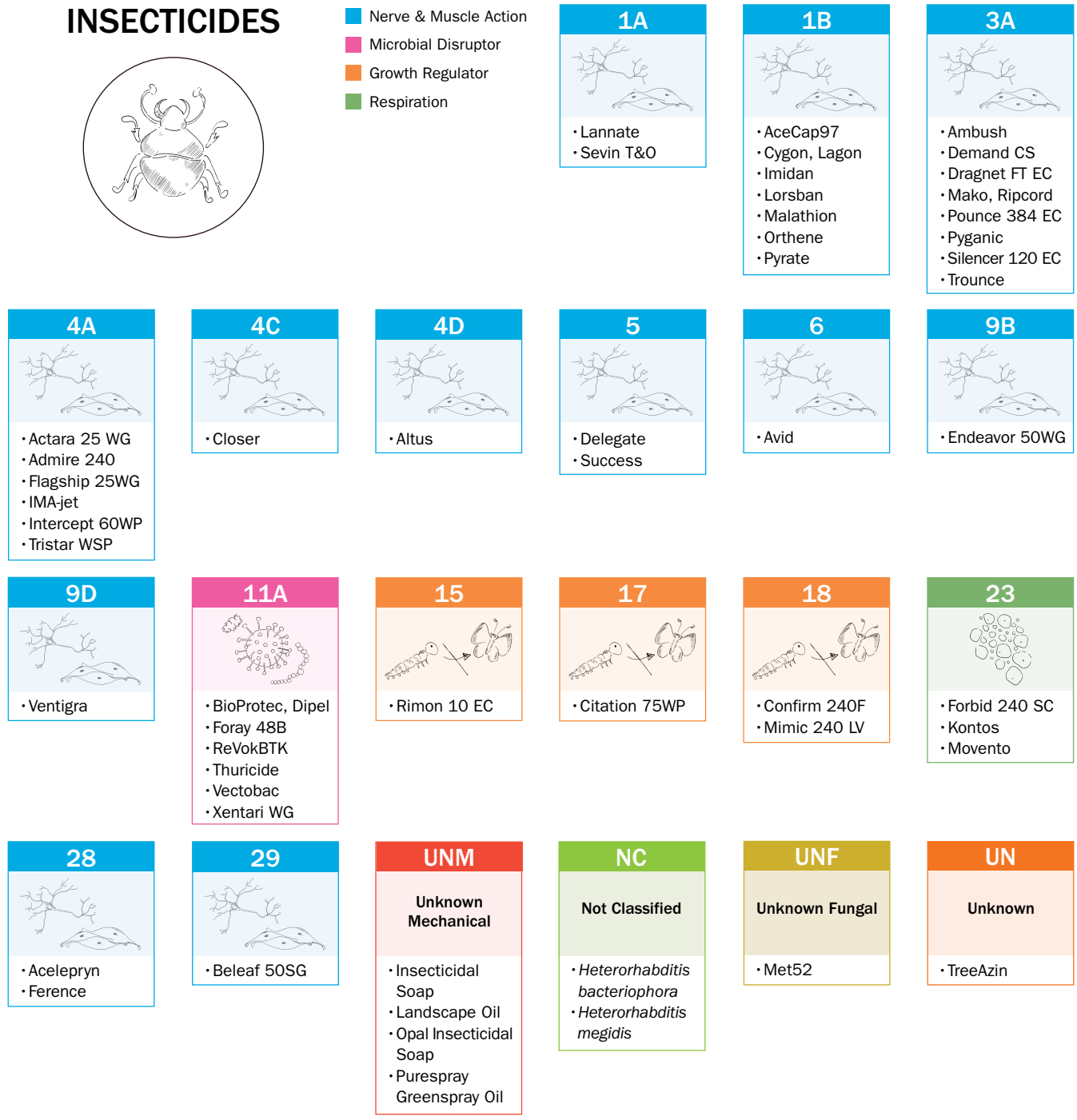

Figure 2–1 lists all of the insecticides that are registered for nursery crops and/or landscape plants in Ontario as of January 1, 2021. Products belonging to the same chemical mode of action group are categorized together. To avoid resistance, rotate between pesticides in different chemical mode of action groups and do not use products containing the same chemical group in consecutive applications. The risk of cross-resistance between subgroups (e.g., 1A, 1B) is considered low. However, where alternatives are available, rotate with other groups. Some products are categorized as Unknown (UN) because the mode of action has not been determined.

Table 2–5. Fungicides Used to Protect Ornamentals by Product Name (as of January 1st, 2021)

Product Name	Active Ingredient	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
Acrobat 50 WP	dimethomorph	2,939	Cinnamic acid amides	40	C
Aliette WDG, Chipco Aliette Ornamental, Aliette WP	fosetyl-AL	2,860	Ethyl phosphonate	P 07	C
Aprovia, Aprovia Top	benzovindiflupyr, difenoconazole	550	Pyrazole-4-carboxamides, triazoles	7, 3	C
Arbotect 20-S	thiabendazole	> 5,000	Benzimidazole	1	C
Banner MAXX, Banner EC 130	propiconazole	4,340	Triazole	3	C
BlightBan A506	*Pseudomonas fluorescens* (strain A506) non-toxic biological	> 5,000	Biological	Bio	C
BlightBan C9-1	*Pantoea agglomerans* (strain C9-1)	> 5,000	Biological	Bio	C
Bloomtime Biological FD	*Pantoea agglomerans* (strain E325)	Non-toxic	Biological	Bio	C
Captan 50-WP	captan	> 5,050	Phthalimide	M 04	C
Compass 50WG	trifloxystrobin	5,050	Strobilurin / Oximino-acetates	11	C
Copper 53W	copper sulphate	1,000	Inorganic	M 01	C
Copper Spray	copper oxychloride	1,600	Inorganic	M 01	C
Daconil 2787, Daconil 720, Daconil Ultrex	chlorothalonil	4,200	chloronitrile	M 05	C
Decree 50 WDG	fenhexamid	> 2,000	Hydroxyanilides	17	C
Dithane M-45, Dithane Rainshield, Dithane 80, Dithane DG 75	mancozeb	> 5,000	Dithio-carbamates	M 03	C
Dutch Trig	*Verticillium albo-atrum* strain WCS850	Non-toxic	Biological	Bio	B
Dygall	*Agrobacterium radiobacter* strain K84	Non-toxic	Biological	Bio	C
Equal 65WP	dodine	1,456	Guanidines	U 12	C
Ferbam 76WDG	ferbam	> 5,000	Dithio-carbamates	M 03	C
Flint, Flint 50WG	trifloxystrobin	> 5,050	Oximino-acetates	11	C
Folpan 50WP, Folpan 80 WDG	folpet	2,636	Phthalimides	M 04	A, C
Funginex DC	triforine	3,487	Piperazine	3	C
Guardsman Copper Oxychloride 50	copper oxychloride	1,700	Inorganic	M 01	C
Heritage MAXX	azoxystrobin	1,714	Methoxy-acrylates	11	C
Inspire Super	difenoconazole, cyprodinil	5,000	Triazole, anilino pyrimidines	3, 9	C
Kasumin	kasugamycin	> 5,000	Hexopyranosyl antibiotic	24	C
Maestro 80 DF, Maestro 80 WSP	captan	> 5,000	Phthalimide	M 04	C
Manzate	mancozeb	> 5,000	Dithio-carbamate	M 03	C
Medallion	fludioxonil	> 5,000	Phenylpyrrole	12	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

NC - Please note that this product is not classified under this group heading.

Table 2–5. Fungicides Used to Protect Ornamentals by Product Name (as of January 1st, 2021)

Product Name	Active Ingredient	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
Micora	mandipropamid	> 5,000	Mandelic acid amide	40	C
Microscopic sulphur	sulphur	5,000	Inorganic	M 02	C
MilStop	potassium bicarbonate	2,700	Inorganic	NC	C
Nova	mycobutanil	> 2,500	Triazole	3	C
Palladium	cyprodinil, fludioxonil	> 5,000	Anilino-pyrimidines, phenylpyrrole	9, 12	C
Phostrol	phosphorus acid and salts	> 5,000	Phosphonates	P 07	C
Phyton 27	copper	481	Inorganic	M 01	C
Presidio	fluopicolide	> 2,000	Pyridinylmethyl-benzamides	43	C
Previcur N	propamocarb	> 5,000	Carbamate	28	C
Pristine WG	boscalid, pyraclostrobin	~ 1,490	Pyridinecarboxamides, Methoxy-carbamates	7, 11	C
Regalia Maxx	*Reynoutria sachalinensis*	> 5,000	Host Defence	P 05	C
Rhapsody ASO	*Bacillus subtilis* QST 713	> 5,000	Biological Multiple	BM 02	C
Rootshield WP, Rootshield G, Rootshield	*Trichoderma harzianum*	Non-toxic	Biological Multiple	BM 02	C
Rovral WDG, Rovral WP	iprodione	> 2,000	Dicarboximides	2	C
Senator 70 WP, Senator 50 SC	thiophanate-methyl	1,000	Thiophanates	1	C
Serenade Max	*Bacillus subtilis*	> 2,000	Biological Multiple	BM 02	C
Streptomycin 17	streptomycin sulphate	> 5,000	Glucopyranosyl antibiotic	25	C
Subdue MAXX	metalaxyl-M and S-isomer	2,965	Acylalanines	4	C
Supra Captan 80 WDG, Supra Captan 80 WSP	captan	3,573	Phthalimides	M 04	C
Tivano	citric acid, lactic acid	None known	Biologicals	Bio	C
Torrent 400SC	cyazofamid	> 5,000	Cyano-imidazole	21	C
Truban 30 WP, Truban 25 EC	etridiazole	1,077	Thiadizole	14	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

NC - Please note that this product is not classified under this group heading.

Table 2–6. Fungicides Used to Protect Ornamentals by Active Ingredient (as of January 1st, 2021)

Active Ingredient	Product Name	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
Agrobacterium radiobacter strain K84	Dygall	-	Biological	Bio	C
azoxystrobin	Heritage MAXX	1,714	Methoxy-acrylates	11	C
Bacillus subtilis	Serenade Max	> 2,000	Biological Multiple	BM 02	C
Bacillus subtilis QST 713	Rhapsody ASO	> 5,000	Biological Multiple	BM 02	C
benzovindiflupyr, difenoconazole	Aprovia, Aprovia Top	550	Pyrazole-4-carboxamides, triazoles	7, 3	C
boscalid, pyraclostrobin	Pristine WG	~ 1,490	Pyridinecarboxamides, Methoxy-carbamates	7, 11	C
captan	Captan 50-WP	> 5,050	Phthalimide	M 04	C
captan	Maestro 80 DF, Maestro 80 WSP	> 5,000	Phthalimide	M 04	C
captan	Supra Captan 80 WDG, Supra Captan 80 WSP	3,573	Phthalimides	M 04	C
chlorothalonil	Daconil 2787, Daconil 720, Daconil Ultrex	4,200	Chloronitrile	M 05	C
citric acid, lactic acid	Tivano	None known	Biologicals	Bio	C
copper	Phyton 27	481	Inorganic	M 01	C
copper oxychloride	Guardsman Copper Oxychloride 50	1,700	Inorganic	M 01	C
copper sulphate	Copper 53W	1,000	Inorganic	M 01	C
cyazofamid	Torrent 400SC	> 5,000	Cyano-imidazole	21	C
cyprodinil, fludioxonil	Palladium	> 5,000	Anilino-pyrimidines, phenylpyrrole	9, 12	C
difenoconazole, cyprodinil	Inspire Super	5,000	Triazole, anilino pyrimidines	3, 9	C
dimethomorph	Acrobat 50 WP	2,939	Cinnamic acid amides	40	C
dodine	Equal 65WP	1,456	Guanidines	U 12	C
etridiazole	Truban 30 WP, Truban 25 EC	1,077	Thiadizole	14	C
fenhexamid	Decree 50 WDG	> 2,000	Hydroxyanilides	17	C
ferbam	Ferbam 76WDG	> 5,000	Dithio-carbamates	M 03	C
fludioxonil	Medallion	> 5,000	Phenylpyrrole	12	C
fluopicolide	Presidio	> 2,000	Pyridinylmethyl-benzamides	43	C
folpet	Folpan 50WP, Folpan 80 WDG	2,636	Phthalimides	M 04	A, C
fosetyl-AL	Aliette WDG, Chipco Aliette Ornamental, Aliette WP	2,860	Ethyl phosphonate	P 07	C
iprodione	Rovral WDG, Rovral WP	> 2,000	Dicarboximides	2	C
kasugamycin	Kasumin	> 5,000	Hexopyranosyl antibiotic	24	C
mancozeb	Dithane M-45, Dithane Rainshield, Dithane 80, Dithane DG 75	> 5,000	Dithio-carbamates	M 03	C
mancozeb	Manzate	> 5,000	Dithio-carbamates	M 03	C
mandipropamid	Micora	> 5,000	Mandelic acid amide	40	C
metalaxyl-M and S-isomer	Subdue MAXX	2,965	Acylalanines	4	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

NC - Please note that this product is not classified under this group heading.

Table 2–6. Fungicides Used to Protect Ornamentals by Active Ingredient (as of January 1st, 2021)

Active Ingredient	Product Name	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
mycobutanil	Nova	> 2,500	Triazole	3	C
Pantoea agglomerans (strain C9-1)	BlightBan C9-1	> 5,000	Biological	Bio	C
Pantoea agglomerans, (strain E325)	Bloomtime Biological FD	Non-toxic	Biological	Bio	C
phosphorus acid and salts	Phostrol	> 5,000	Phosphonates	P 07	C
potassium bicarbonate	MilStop	2,700	Inorganic	NC	C
propamocarb	Previcur N	> 5,000	Carbamate	28	C
propiconazole	Banner MAXX, Banner EC 130	4,340	Triazole	3	C
Pseudomonas fluorescens (strain A506) non-toxic biological	BlightBan A506	> 5,000	Biological	Bio	C
Reynoutria sachalinensis	Regalia Maxx	> 5,000	Host Defence	P 05	C
streptomycin sulphate	Streptomycin 17	> 5,000	Glucopyranosyl antibiotic	25	C
sulphur	Microscopic sulphur	5,000	Inorganic	M 02	C
thiabendazole	Arbotect 20-S	> 5,000	Benzimidazole	1	C
thiophanate-methyl	Senator 70 WP, Senator 50 SC	1,000	Thiophanates	1	C
Trichoderma harzianum	Rootshield WP, Rootshield G, Rootshield	Non-toxic	Biological Multiple	BM 02	C
trifloxystrobin	Compass 50WG	5,050	Strobilurin / Oximino-acetates	11	C
trifloxystrobin	Flint, Flint 50WG	> 5,050	Oximino-acetates	11	C
triforine	Funginex DC	3,487	Piperazine	3	C
Verticillium albo-atrum strain WCS850	Dutch Trig	Non-toxic	Biological	Bio	B

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

NC - Please note that this product is not classified under this group heading.

Figure 2–2. Fungicides Mode of Action Schematic

Figure 2–2 lists all of the fungicides that are registered for nursery crops and/or landscape plants in Ontario as of January 1, 2021. Products belonging to the same chemical mode of action group are categorized together. To avoid resistance, rotate between pesticides in different chemical mode of action groups and do not use products containing the same chemical group in consecutive applications. Multi-site (M) fungicides (e.g., M 01, M 02) are not prone to resistance. Some products are categorized as Unknown (U) because the mode of action has not been determined.

Table 2–7. Acaricides (miticides) Used to Protect Ornamentals by Product Name (as of January 1st, 2021)

Product Name	Active Ingredient	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
Apollo SC	clofentezine	> 5,000	Mite growth inhibitor	10A	C
Avid 1.9% EC	abamectin	~ 300	Avermectin	6	C
Dyno-Mite SC, Dyno-Mite WP	pyridaben	1,930	METI acaricides and insecticides	21A	C
Floramite SC	bifenazate	> 5,000	Bifenazate	20D	C
Kanemite 15 SC	acequinocyl	> 5,000	Naphthaquinone derivative	20B	C
Nealta	cyflumetofen	> 2,000	Cyenopyrafen	25	C
SanMite WP	pyridaben	1,930	METI acaricides and Insecticides	21A	C
Shuttle 15 SC	acequinocyl	> 5,000	Naphthaquinone derivative	20B	C
Vendex 50W	fenbutatin oxide	> 5,000	Organotin	12	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

Table 2–8. Acaricides (miticides) Used to Protect Ornamentals by Active Ingredient (as of January 1st, 2021)

Active Ingredient	Product Name	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
acequinocyl	Kanemite 15 SC	> 5,000	Naphthaquinone derivative	20B	C
acequinocyl	Shuttle 15 SC	> 5,000	Naphthaquinone derivative	20B	C
abamectin	Avid 1.9% EC	~ 300	Avermectin	6	C
bifenazate	Floramite SC	> 5,000	Bifenazate	20D	C
clofentezine	Apollo SC	> 5,000	Mite growth inhibitor	10A	C
cyflumentofen	Nealta	> 2,000	Cyenopyrafen	25	C
fenbutatin oxide	Vendex 50W	> 5,000	Organotin	12	C
pyridaben	Dyno-Mite SC, Dyno-Mite WP	1,930	METI acaricides and insecticides	21A	C
pyridaben	SanMite WP	1,930	METI acaricides and Insecticides	21A	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

Figure 2–3. Acaricides Mode of Action Schematic

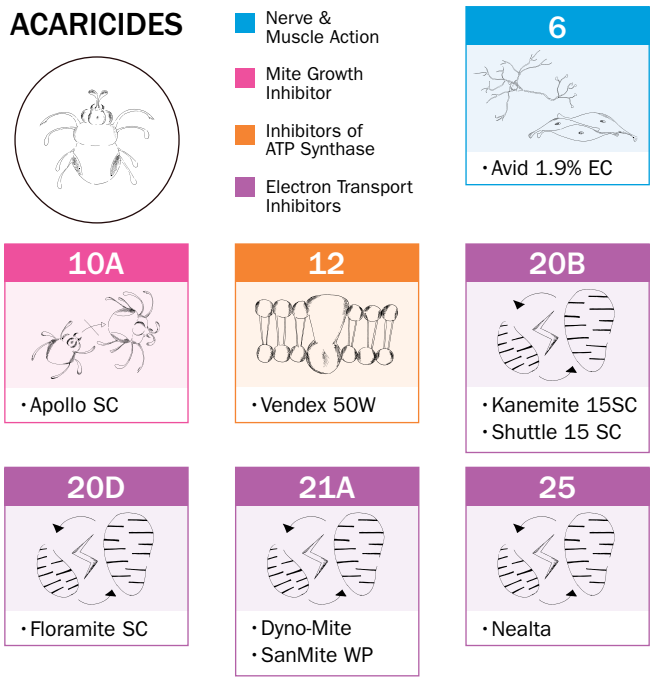

Figure 2–3 lists all of the acaricides that are registered for nursery crops and/or landscape plants in Ontario as of January 1, 2021. Products belonging to the same chemical mode of action group are categorized together. The risk of cross-resistance between subgroups (e.g., 20B, 20D) is considered low. However, where alternatives are available, rotate with other groups. To avoid resistance, rotate between pesticides in different chemical mode of action groups and do not use products containing the same chemical group in consecutive applications.

Table 2–9. Molluscicides Used to Protect Ornamentals by Product Name (as of January 1st, 2021)

Product Name	Active Ingredient	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
Deadline M-PS	metaldehyde	> 5,000	-	-	C
Sluggo	ferric phosphate	> 5,000	Mineral	-	C, D

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

- Please note that this product is not classified under this group heading.

Table 2–10. Molluscicides Used to Protect Ornamentals by Active Ingredient (as of January 1st, 2021)

Active Ingredient	Product Name	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
ferric phosphate	Sluggo	> 5,000	Mineral	-	C, D
metaldehyde	Deadline M-PS	> 5,000	-	-	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

- Please note that this product is not classified under this group heading.

Figure 2–4. Molluscicides Mode of Action Schematic

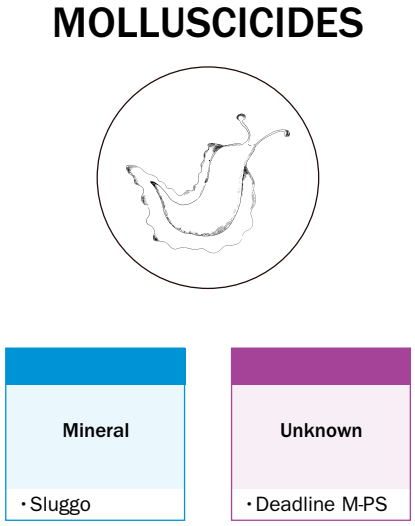

Figure 2–4 lists all of the molluscicides that are registered for nursery crops and/or landscape plants in Ontario as of January 1, 2021. Products belonging to the same chemical mode of action group are categorized together. To avoid resistance, rotate between pesticides in different chemical mode of action groups and do not use products containing the same chemical group in consecutive applications.

Table 2–11. Rodenticides Used to Protect Ornamentals by Product Name (as of January 1st, 2021)

Product Name	Active Ingredient	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
Boothill, Maki, Resolv, Revolver	bromadiolone	> 5,000	Anticoagulant	-	C
First Strike, Generation, Hombre	difethialone	> 5,000	Anticoagulant	-	C
Ground Force, Rozol	chlorophacinone	> 5,000	Anticoagulant	-	C
Ramik Brown, Ramik Green	diphacinone	> 7	Anticoagulant	-	C
Ratak+	brodifacoum	> 5,000	Anticoagulant	-	C
Waxed Mouse Bait	zinc phosphide	> 5,000	Phosphide	-	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

- Please note that this product is not classified under this group heading.

Table 2–12. Rodenticides Used to Protect Ornamentals by Active Ingredient (as of January 1st, 2021)

Active Ingredient	Product Name	Oral LD_{50} (mg a.i./kg)	Chemical Family	Group*	Federal Classification (Post- May 1, 2020)
brodifacoum	Ratak+	> 5,000	Anticoagulant	-	C
bromadiolone	Boothill, Maki, Resolv, Revolver	> 5,000	Anticoagulant	-	C
chlorophacinone	Ground Force, Rozol	> 5,000	Anticoagulant	-	C
difethialone	First Strike, Generation, Hombre	> 5,000	Anticoagulant	-	C
diphacinone	Ramik Brown, Ramik Green	> 7	Anticoagulant	-	C
zinc phosphide	Waxed Mouse Bait	> 5,000	Phosphide	-	C

* Pesticide Group classifies the compound according to mode of action. This system helps the user rotate among pesticides with different modes of action in order to reduce the risk of resistance to a specific pesticide product.

- Please note that this product is not classified under this group heading.

Figure 2–5. Rodenticides Mode of Action Schematic

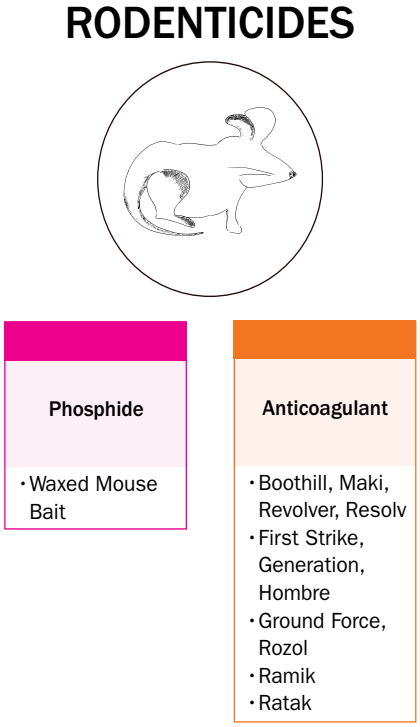

Figure 2–5 lists all of the rodenticides that are registered for nursery crops and/or landscape plants in Ontario as of January 1, 2021. Products belonging to the same chemical mode of action group are categorized together. To avoid resistance, rotate between pesticides in different chemical mode of action groups and do not use products containing the same chemical group in consecutive applications.

TABLE 2–13. A COMPENDIUM OF PESTS AND DISEASES WITH RECOMMENDED MANAGEMENT PRACTICES — AS OF JANUARY 1, 2021

Common pests and diseases found on nursery crops are listed below. The list is organized according to the host plant genus. The pesticide products listed appear alphabetically within the tables and the order in which products appear does not constitute a preference ranking. The pesticide mode of action Group number is also listed to help users make resistance management decisions.

If no product is listed in the following table, either a pesticide application would not be effective, or there is no product registered at the time of printing of this publication. The "Notes" column contains information on pest biology and monitoring and additional remarks about the use of registered pesticides.

See *Tables 2–3 to 2–12. Insecticides, Fungicides, Acaricides, Mollscicides and Rodenticides Used to Protect Ornamentals*, on page 16–28, for a list of pesticides registered on outdoor ornamentals and their chemical properties, such as toxicity.

***ABIES* — FIR**				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *ABIES*				
Balsam gall midge (*Paradiplosis tumifex*)	Movento 240SC	23	585 mL/ha	A pest of Christmas trees in Eastern Canada. Balsam gall midge damage appears on current-year needles as early as late June and persists until fall. The larvae initiate the formation of galls, which appear as swollen growths at the base of the needles; several galls can be seen on a single needle. Each gall contains a larva, which feeds on the internal tissue of the needle. Galled needles turn yellow and dry out, causing them to drop prematurely in the fall. Repeated severe infestations can cause tree growth loss but does not result in mortality. The appearance of the adults in May coincides with the development of fir buds. The female lays her eggs between the tight needles of the opening buds. Each newly hatched larva crawls to the base of a needle, where it settles and begins to feed, initiating the growth of gall tissue, which ultimately completely encloses the larva, thus forming the gall. The larva leaves the gall in the fall and drops to the ground where it overwinters. First application of Movento should be timed for egg hatch stage when adult emergence has peaked. This normally occurs after bud break when needles start flaring. Maximum number of applications: 2. Interval between applications: 7 days.
Balsam twig aphid (*Mindarus abietinus*)	Admire 240	4	250 mL/ha	The eggs overwinter on bark and hatch into first-generation nymphs ("stem mothers") in early spring when bud caps begin to loosen, but before new growth emerges. Second-generation nymphs feed on newly developing needles, causing the needles to become distorted and discoloured. Monitor for stem mothers by tapping twigs on a dark surface and look for tiny, off-white aphids. Treat when stem mothers first hatch (about 180–250 GDD Base 10°C) which coincides with bud swell. Second-generation nymphs are more difficult to manage due to their protective, waxy covering. Use up to 2 applications of Closer per crop cycle. Do not apply more than 2 applications of Beleaf per year. Do not make more than 2 applications of Ference per year.
	Beleaf 50SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Endeavor 50WG	9B	193 g/ha in 275 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Malathion 500 EC	1B	1.4-3 L/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks	

ABIES — FIR

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *ABIES* (cont'd)				
Cutworms (various species)	Confirm 240 F	18	0.5 L/ha	Cutworms are moth larvae (caterpillars) that hide in shallow soil burrows during the day and crawl up plant stems to harvest plant parts at night. Injury appears as chewed or girdled stems on woody species (and clipped stems on herbaceous plants). Larvae are greyish-brown in colour, often with black spots along their sides and stripes along their body. They have three pairs of true legs, four pairs of fleshy prolegs and one pair of "claspers" at the end of their abdomen. They can be up to 3 cm long. Late instar larvae overwinter and pupate in spring. Use insecticides to reduce cutworm populations at the first sign of feeding injury. Treat plants with insecticides in the evening since the larvae feed at night. Applications of Confirm should be made with a high-volume spray and sprayed to run-off (for greenhouse use). Applications of Pounce 384 EC should be made under warm, moist conditions when larvae are small.
	Pounce 384 EC	3A	180 mL/ 1,000 L water	
Spruce budworm (*Choristoneura fumiferana*)	Dragnet FT EC	3A	160 mL/ 1,000 L water	Larvae have a black head and brownish body with four light spots on the back of each segment. This pest is a widespread, important defoliator of balsam fir and spruce. Tiny overwintering larvae begin to feed as buds break and continue feeding until late spring. Larvae can often be found feeding inside emerging shoots from suspiciously persistent bud caps. There is 1 generation per year. Apply Mimic to control early instar larvae; allow 3–7 days for larval mortality. A second application may be required. Apply a general coverage spray for broad-spectrum insecticides in mid-May to reduce larval populations.
	Malathion 85 E	1B	2.93 L/ 1,000 L water	
	Mimic 240 LV	18	290 mL/ha	
	Pounce 384 EC	3A	45–90 mL/ha	
	ReVokBTK	11A	see label	
Spruce spider mite (*Oligonychus ununguis*)	Cygon 480 E	1B	1.5 L/ 1,000 L water	Overwintered eggs hatch in early May, when *Amelanchier laevis* and *Magnolia* x *soulangeana* are in full bloom. Mites prefer older needles as feeding sites. To monitor for mites, use a hand lens to check the undersides of twigs and needles for tiny reddish eggs or brown mites with black backs. Shake a branch over a white sheet of paper and look for crawling specks. Apply miticides when mites first appear. Kanemite is effective against mobile life stages but may also reduce egg viability. Use horticultural oil as a dormant treatment in early spring to target eggs and newly hatched nymphs. Do not use horticultural oil (including Landscape Oil) on white pine. Horticultural oil (including Landscape Oil) can be used when plants are dormant. Landscape Oil can be used in summer when leaves are fully expanded and hardened off. See product label. Permanent discolouration of foliage will occur to blue cultivars of both *Juniperus* and *Picea*. To prevent foliar discolouration on blue Colorado spruce, use only wettable powders and avoid horticultural oil. If populations are still significant, make 2 applications of other miticides at 10-day intervals when mites exist in spring. Do not exceed 2 applications of Nealta per season. Many predatory mites co-exist with pest mite populations. To conserve predatory mites, try miticides that are less toxic to these beneficials, such as Vendex and Floramite.
	Floramite SC	20D	625 mL/ 1,000 L water	
	Horticultural oil	UN	20 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	see label	
	Lagon 480 E	1B	1.5 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Nealta	25	1 L/ha	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pyrate 480 EC	1B	375–500 mL/ 1,000 L water	
	Vendex 50 W	12	50–100 g/ 100 L water	

ABIES — FIR				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *ABIES* (cont'd)				
Tarnished plant bug (*Lygus lineolaris*)	Actara 25 WG, Flagship 25 WG	4A	210–280 g/ha	These are small (5-mm) yellowish-brown insects. Adults have wings that are folded in an X pattern. Tarnished plant bugs feed by inserting their mouthparts inside leaf tissue and sucking out the contents, leaving the lower and upper epidermis behind. The resulting injury appears as small, clear "windows" on leaf tissue of broad-leaved plants. On conifers, feeding often causes terminal growth to yellow and become distorted and bushy. Treat in spring and early summer to manage populations of this insect.
	Ripcord 400 EC	3A	172 mL/ha	
White grubs: European chafer (*Rhizotrogus majalis*) June beetle (*Phyllophaga* sp.)	**Larval management:**			These beetle larvae are referred to as "white grubs." They chew fibrous roots and girdle underground stems of many woody ornamentals (including *Cornus* sp.). Before planting, cultivate infested fields to expose grubs to natural predators. Apply Intercept 60 WP once per year, during the mating period/egg-laying period and up to egg hatch (usually late June/early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering. Apply Acelepryn any time that larvae are present or during the mating period/egg-laying period to egg-hatch.
	Acelepryn, Acelepryn G	28	5.6–8.8 mL/100 m^2	
	Intercept 60 WP	4A	467 g/ha	
	Lorsban 4E, Lorsban NT (rescue treatment for shipping)	1B	4.5 L/1,000 L water	
	Adult management:			
	Imidan 50 WP	1B	1.25 kg/1,000 L water	
	Imidan WP	1B	0.89 kg/1,000 L water	
DISEASES AFFECTING *ABIES*				
Botrytis	Rovral WDG, Rovral WP	2	1 kg/1,100 L water	During very humid conditions (e.g., storage), a fuzzy, grey growth may develop on succulent plant parts. Treat twigs and buds in spring before leaves develop. Treat conifer seedlings at the onset of botrytis. Remove all fading and diseased plant parts promptly, especially when wet weather is predicted. Do not crowd plants. Maintain adequate sunlight and good air circulation.
Damping off, root rot and stem rot (*Phytophthora, Pythium*)	Heritage Maxx	11	0.4 L/1,000 L water	Stem rot and root rot cause rapid dieback and mortality and are often characterized by reddish-brown discolouration of the cambium. Subdue MAXX can be used as a drench or a pre-incorporated treatment for media to help protect conifer seedlings and transplants from *Pythium* and *Phytophthora*. Subdue MAXX can be used on conifer seedbeds, plugs and 2-0 transplants only. See product label.
	Presidio	43	60–119 mL/380 L water	
	Previcur N	28	see label	
	Subdue MAXX	4	1.2 L/ha in 200 L water (drench)	
	Torrent 400SC	21	see label	
Needlecast (various fungi)	Banner MAXX	3	350 mL/1,000 L water	This is principally a nursery disease. It is caused by several fungi with 2-yr life cycles. Symptoms develop early in the second season. Infected needles turn brown and drop. Badly infected plants have only current season needles. Spray after new growth begins and again 10 days later.
	Copper Spray	M 01	4 kg/1,000 L water	
	Daconil 2787 F	M 05	2.4–4.8 L/100–1,000 L water	
	Daconil 720	M 05	1.7–3.3 L/100–1,000 L water	
	Daconil Ultrex	M 05	1.45–2.9 kg/100–1,000 L water	

ACER — MAPLE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *ACER*				
Aphids (various)	Altus	4D	500–750 mL/ha	Treat when aphids first appear and repeat as required. Check leaves for honeydew and sooty mould. Aphids have many natural predators (e.g., ladybugs, hover flies, lacewings), so monitor for beneficial insects before making pesticide applications. Orthene may damage sugar maple leaves. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year. * Do not apply Kontos insecticide during bloom as this product is toxic to bee brood.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	*Kontos	23	see label	
	Malathion 500 EC	1B	1.4–3L/ 1,000 L water	
	Malathion 85E	1B	880 mL/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	375 mL/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks	
	Trounce	3A	50 L/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	
Asian long-horned beetle (*Anoplophora glabripennis*)	IMA-jet, IMA-jet 10	4A	see label	Asian long-horned beetle is a serious pest of deciduous trees; it bores into stems and trunks and weakens trees, leading to dieback and mortality. Make IMA-jet applications when the pest has been detected in your area (or within 24 km) and trees still appear healthy. This cerambycid borer is mostly found on maple species, especially *Acer negundo*, Manitoba maple. For trees that may be visited by pollinators, applications of IMA-jet must be made post-bloom, as this product is toxic to bees and bee brood.
Cottony maple scale (*Pulvinaria innumerabilis*)	Horticultural oil	UN	20 L/ 1,000 L water	The mature female scale with white egg sac resembles a partially popped corn kernel. This scale infests maple, linden, elm, beech, oak, and other trees and shrubs. It is found only on twigs. Use horticultural oil as an early-spring dormant treatment. Do not use horticultural oil on sugar or Japanese maples. Do not make more than 2 applications of Ference per year. Nymphs are active in late June/early July, about when *Philadelphus* and *Tilia cordata* are in bloom. Direct insecticidal spray to the lower leaf surface. Repeat application 10 days later. Do not use Malathion on Crimson King maple. Orthene may damage sugar maple leaves.
	Insecticidal soap	UN	see label	
	Ference	28	37.5–75 mL/ 100 L water	
	Malathion 500 EC	1B	1.4–3L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	
Fall cankerworm (*Alsophila pometaria*) Spring cankerworm (*Paleacrita vernata*)	Dipel 2X DF	11A	125 g/ 400 L water	Cankerworms are greenish-to-black loopers (inchworms) that appear early in the season and feed on the leaves of many deciduous hosts. Treat when larvae appear in mid-May, when *Acer platanoides* and *Magnolia* x *soulangeana* are blooming. To help reduce the next generation of fall cankerworm, place sticky bands around tree trunks, close to the ground, by late October. Bands will help to trap the flightless adult female moths as they emerge from the ground and crawl up the tree trunk.
	Imidan	1B	0.89 kg/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Malathion 500 EC	1B	2.5 L/ 1,000 L water	
	Thuricide 48 LV	11A	1–1.6 L/ha	

ACER — MAPLE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *ACER* (cont'd)				
Forest tent caterpillar (*Malacosoma disstria*)	Dipel	11A	see label	Forest tent caterpillar larvae are hairy with a series of keyhole-shaped white spots along their backs. Larvae are present early in the season. Larvae feed in colonies. Forest tent caterpillar larvae do not form a tent on their host. Larvae may completely defoliate broadleaf trees, particularly poplars. Treat foliage in mid-to-late May to reduce populations of larvae. Orthene may damage sugar maple leaves.
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pounce 384 EC	3A	90 mL/ha	
	Pyrate 480 EC	1B	500 mL/ 1,000 L water	
	ReVokBTK	11A	2.9–4.8 L/ha	
	Thuricide	11A	see label	
Greenstriped mapleworm (*Dryocampa rubicunda*)	There is no product registered at the time of this publication.			Larvae have a cherry-red head and yellowish body with seven dark lines running the entire body length. Preferred hosts are maple, oak and box elder. Insecticidal applications are usually not required. Eggs hatch over an extended period. If necessary, spray insecticides when larvae are present (from mid-June to late July).
Gypsy moth (*Lymantria dispar*)	AceCap 97	1B	773 mg/cartridge 1 cartridge/ 10.16 cm	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs, most notably basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. AceCap 97 applications must be made post-bloom as this product is toxic to bees and bee brood. Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow).
	Dipel	11A	see label	
	Dragnet	3A	230 mL/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide HPC	11A	7.14–12 L/ 1,000 L water	
	Thuricide 48LV	11A	see label	
Leafhopper (several species)	Altus	4D	500–750 mL/ha	Leafhoppers are tiny, yellowish-green to pale-coloured insects that jump quickly when disturbed. Wingless nymphs will often "side step" quickly to hide from potential predators. Leafhoppers have piercing-sucking mouthparts that cause yellowish flecks on the leaf surface. Check regularly for infestation of nursery crops when neighbouring farms are cutting alfalfa or hay. Hang yellow sticky traps in the canopy to monitor for leafhoppers. Check by disturbing plants or looking at the leaf bottoms for leafhopper nymphs or molted skins. Injury appears as leaf distortion with blackened leaf margins. Older leaves will appear bronze coloured or stippled. Treat as required.
	Tristar 70 WSP	4A	5 solupaks	

ACER — MAPLE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *ACER* (cont'd)				
Lecanium or European fruit lecanium scale (*Lecanium corni*)	Ference	28	37.5–75 mL/ 100 L water	When adults are mature in late spring/summer, they appear as a large, reddish-brown, spherical scale usually found on the underside of twigs. This scale infests many deciduous trees and shrubs. Use horticultural oil as an early-spring dormant treatment to reduce populations of overwintering nymphs. To suppress crawlers, spray insecticides when the *Sambucus canadensis* begins blooming. Do not make more than 2 applications of Ference per year. Do not use Malathion on Crimson King maple. Orthene may damage sugar maple leaves.
	Insecticidal soap	UN	see label	
	Horticultural oil	UN	20 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	
	Trounce	3A	50 L/ 1,000 L water	
Maple bladder gall mite (*Vasates quadripedes*) Maple spindle gall mite (*Vasates aceriscrumena*) Crimson erineum mite (*Eriophyes regulus*)	Horticultural oil	UN	20 L/ 1,000 L water	Maple bladder gall mite causes globular, wart-like galls on the upper surface of silver and red maple leaves. Heavy infestations may completely deform leaves but seldom injure trees seriously. Maple spindle gall mite produces slender fusiform galls 5 mm long on the upper surface of sugar and silver maple leaves. There are several generations per year. Crimson erineum mite causes red granular, velvety patches on both sides of sugar, silver and red maple leaves. Use horticultural oil as an early-spring dormant treatment. Do not use oil on sugar maple or Japanese maples. Apply Malathion in the spring when the temperature is 2°C or higher. Do not use Malathion on Crimson King maple.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
Maple petiole borer (*Caulocampis acericaulis*)	There is no product registered at the time of this publication.			The larvae bore inside leaf stems (petioles), causing petioles to turn black, shrivel and break near the blade, causing leaf drop. Collecting and destroying fallen leaves will not reduce the population of this pest. Larvae remain in petioles that are still attached to the tree, where they complete their life cycle. The adult is a tiny, amber-coloured sawfly that emerges as leaves are starting to emerge.
Maple spider mite (*Oligonychus aceris*)	Horticultural oil	UN	20 L/ 1,000 L water	These tiny mites look very similar to spruce spider mite: brown bodies and legs with black backs. Mites overwinter as reddish-brown eggs close to bud scars on the previous year's growth. Eggs hatch in spring, and mite numbers can build up by early summer. Mites feed on the undersides of leaves, causing stippling and bronzing. Maple spider mites are most common on silver-red hybrids.
Maple trumpet skeletonizer (*Epinotia aceriella*)	There is no product registered at the time of this publication.			This pest is normally a minor problem. It attacks sugar, red and silver maples. It spins a long trumpet-like tube of silk and frass on the underside of a leaf, which folds around it. The maple trumpet skeletonizer feeds from within this tube, skeletonizing the part of the leaf covered by the web. This causes the leaf to crumple. This pest may also attack hawthorn and beech. Larvae exist from late July to September.
Sugar maple borer (*Glycobius speciosus*)	There is no product registered at the time of this publication.			This borer is usually a landscape problem, especially on stressed trees. It is a robust, black, long-horned beetle with five yellow bands on the wing covers. The fleshy white larva cuts deep channels in the wood. Cracked, swollen areas resembling cankers indicate infestation. The borer has a 2-year life cycle. Females cut a slit into the bark and lay eggs in late July and into August. Keep trees healthy in order to help them withstand infestations.

ACER — MAPLE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *ACER* (cont'd)				
Western flower thrips (*Frankliniella occidentalis*)	Ference	28	37.5–75 mL/ 100 L water	Western flower thrips can feed openly on new leaves or from inside terminal vegetative buds and flower buds. They have piercing-sucking mouthparts that suck out plant juices of immature leaves and flowers, resulting in major distortion and colour flecking when flowers and foliage emerge. Injury may be confused with that of leafhoppers. Do not make more than 3 applications of Success 480 SC per year. Ference provides only suppression of thrips. Do not make more than 2 applications of Ference per year.
	Success	5	50 mL/ 1,000 L water	
Whitemarked tussock moth (*Orgyia leucostigma*)	Dragnet FT EC	3A	160 mL/ 1,000 L water	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). Apply Mimic to control early instar larvae; allow 3–7 days for larval mortality. A second application of Mimic may be required.
	Mimic 240 LV	18	290 mL/ha	
	Pounce 384 EC	3A	45– 90 mL/ha	
DISEASES AFFECTING *ACER*				
Anthracnose (*Gloeosporium apocrytum*)	Banner MAXX	3	28 mL/ 100 L water	Leaves are infected as they emerge in the spring. This disease causes irregular brown lesions, often in between veins. Leaves may be distorted. Collect and destroy fallen leaves in autumn, as they are a source of inoculum the following spring. Often, the second flush of growth will cover up this disease. Where disease pressure is high, protect newly emerging leaves with fungicides before leaf wetness periods.
	Banner 130 EC	3	34 mL/ 100 L water	
	Heritage Maxx	11	0.8–1.6 L/ 1,000 L water	
Tar spot (*Rhytisma acerinum*)	Banner MAXX	3	28 mL/ 100 L water	Emerged leaves are infected in spring during cool, wet weather. This disease causes irregular, black, tar-like spots on Norway and sugar maple by late summer. The tar spot fungus overwinters on fallen leaves. Apply fungicides before rain events to protect foliage during leaf emergence (during and after bloom). Compass 50 WG gives suppression of tar spot and can only be applied once per season. Banner MAXX can be applied up to 4 times per season. Collect fallen leaves in late summer and autumn and destroy. Removing fallen leaves from all infected neighbourhood trees may help reduce disease incidence the following year.
	Compass 50 WG	11	14–21 g/ 100 L water	
Verticillium wilt (*Verticillium dahliae*)	There is no product registered at the time of this publication.			This is a soil pathogen that enters trees via roots and travels systemically to the crown, resulting in crown wilt and dieback. Infection causes the sapwood to darken into a greenish black. This disease is often followed by frost cracks and associated cankers. Prune wilted branches back to healthy wood. Thin the remainder of the crown. Fertilize and water to promote vigour, especially root growth. Organic amendments to soil may help decrease soil *Verticillium* populations and improve tree growth.

ACER — MAPLE

Pest	Product	Group*	Rate	Notes
PHYSIOLOGICAL DISORDERS AFFECTING *ACER*				
Leaf scorch	A pesticide application would not be effective.			Physiological leaf scorch is a common symptom of desiccation on broadleaf decidous urban or roadside trees during hot, dry summers. Look for brown, dry leaf margins and areas in between leaf veins. It is often misdiagnosed as a foliar disease. Supplemental irrigation can help reduce stress on symptomatic trees.

AESCULUS — HORSECHESTNUT

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *AESCULUS*				
Anthracnose (*Glomerella cingulata*)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	Protect leaves with fungicides during cool, wet springs. Encourage good air circulation through the canopy. Do not crowd plants.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
Leaf blotch (*Guignardia aesculi*) (*Botryosphaeria aesculi*)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	Symptoms include large, blotchy, reddish-brown lesions surrounded by a yellow halo. Lesions appear on leaves by mid-summer. Leaves often curl and distort. A tree may show symptoms of leaf blotch, scorch and anthracnose. Protect leaves with fungicides during cool, wet springs. Encourage good air circulation through the canopy. Do not crowd plants.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
PHYSIOLOGICAL DISORDERS AFFECTING *AESCULUS*				
Leaf scorch (physiological)	Application of a pesticide will not be effective on this disorder.			Physiological leaf scorch is a common symptom of desiccation on broadleaf decidous urban or roadside trees during hot, dry summers. Look for brown, dry leaf margins and areas in between leaf veins. Leaf scorch is easily confused with the fungal disease anthracnose (see above). Supplemental irrigation can help reduce stress on symptomatic trees.

AMELANCHIER — SERVICEBERRY

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *AMELANCHIER*				
Western flower thrips (*Frankliniella occidentalis*)	Ference	28	37.5–75 mL/ 100 L water	Western flower thrips can feed openly on new leaves or from inside terminal vegetative buds and flower buds. They have piercing-sucking mouthparts that suck out plant juices of immature leaves and flowers, resulting in major distortion and colour flecking when flowers and foliage emerge. Injury may be confused with that of leafhoppers. Ference provides only suppression of thrips. Do not make more than 2 applications of Ference per year. Do not make more than 3 applications of Success per year.
	Success	5	50 mL/ 1,000 L water	
White-marked tussock moth *(Orgyia leucostigma)*	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.

AMELANCHIER — SERVICEBERRY

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *AMELANCHIER*				
Gymnosporangium rusts	Nova	3	250–340 g/ 1,000 L water	Spores from *Juniperus* hosts can infect rosaceous plants (*Malus*, *Crataegus*, *Amelanchier*, etc.).
	Pristine WG	7, 11	1–1.6 kg/ha	Treat when sporulation begins on the alternate host (*Juniperus*), in early-to-mid-spring when foliage is emerging and still tender. Repeat fungicidal application every 10–14 days if needed. Rotate registered fungicides with other chemical families to avoid resistance.
Powdery mildew (*Podosphaera amelanchieris*)	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	Fungal infection appears as white, powdery growth on the upper leaf surface.
	Nova	3	113 g/ 1,000 L water	Use Nova at the first sign of powdery mildew to manage this disease on Saskatoonberry. Use Nova no more than 3 times per season.
	Palladium WG	9, 12	see label	
	Senator 70WP	1	500–750 g/ 1,000 L water	For maximum effectiveness, apply Tivano prior to, or at the early stages of disease development.
	Tivano	Bio	20 L/ 1,000 L water	

BETULA — BIRCH

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *BETULA*				
Aphids (*Calaphis betulaecolens*), (*Euceraphis punctipennis*), (*Hamamelistes spinosus*)	Altus	4D	500–750 mL/ha	*Calaphis betulaecolens*, a large green aphid, feeds only on birch. *Euceraphis punctipennis*, a black-and-green aphid, leaves a cottony-white wax on birch and alder. *Hamamelistes spinosus* feeds on birch and on *Hamamelis* (witch hazel). Feeding nymphs cause corrugated swellings between veins on leaves.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	Treat when adults first appear and repeat as required. Check the underside of leaves for honeydew and sooty mould. Many natural predators feed on aphids (e.g., ladybugs, hoverflies, lacewings).
	Cygon 480 E	1B	500 mL/ 1,000 L water	
	Ference	28	37.5–75 mL/ 100 L water	Use up to 2 applications of Closer per crop cycle.
	Insecticidal soap	UN	see label	
	Tristar 70 WSP	4A	3 solupaks	Do not make more than 2 applications of Ference per year.
	Trounce	3A	50 L/ 1,000 L water	
Birch leafminer (*Fenusa pusilla* and many other species)	AceCap 97	1B	773 mg/cartridge 1 cartridge/ 10.16 cm	Larval mines look like a brown blotch sometimes covering half or more of each leaf. Foliage of heavily infested trees looks scorched. There are 2 generations of leafminer per year; the second flush of growth is also attacked. The adult is a small black sawfly that emerges from the soil when the first leaves are half grown. First mines appear when *Spiraea* x *vanhouttei* blooms.
	Cygon 480 E	1B	500 mL/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	When mines appear, use any listed control in mid-May and about 6 weeks later (when the second flush of leaves is attacked).
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Lagon 480	1B	500 mL/ 1,000 L water	AceCap 97 and Treeazin applications must be made post-bloom as these products are toxic to bees and/or bee brood.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	1.22 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Treeazin	UN	see label	

BETULA — BIRCH

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *BETULA* (cont'd)				
Birch skeletonizer (*Bucculatrix canadensisella*)	There is no product registered at the time of this publication.			This pest is generally not a significant problem. Small yellowish-green larvae attack birches and some alders. Larvae feed on the bottom of leaves from mid-to-late summer. Collect and destroy fallen leaves to remove overwintering pupae.
Bronze birch borer (*Agrilus anxius*)	Pyrate 480 EC	1B	500 mL/ 1,000 L water	This beetle attacks injured and weakened birch trees. The elongated white larvae make long, winding tunnels just under the bark. Tunnels show up as spiral ridges around the branches and trunk. Larvae develop over 2 years and emerge as adults from June to August, through a D-shaped hole. The adult is a slender, olive-bronze beetle. Remove and destroy weakened and dying branches before mid-May. Good tree health reduces infestation risks. Birch roots do not compete well with lawn grasses. Deeply water the root zone several times during the growing season. Manage birch leafminers to reduce stress. Apply Pyrate as a direct spray at the trunk and branches.
Gypsy moth (*Lymantria dispar*)	Dipel	11A	see label	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs but prefer basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide HPC	11A	7.14–12 L/ 1,000 L water	
Fall webworm (*Hyphantria cunea*)	Dipel	11A	See product(s) label	Caterpillars build large silk tents on the ends of branches starting in late June, spreading over several branches throughout the summer and becoming very noticeable by late August. Commonly found on walnut, cherry, crabapple, box-elder and ash. Open the tent to find pale yellow-green caterpillars with black spots and long hairs extending out from the body. There are black-headed and red-headed morphs of larvae. Adults emerge over a period of weeks, starting in June. Adults are white and lay eggs on lower leaf surfaces beginning in late June. Chemical control is rarely needed. Remove webs and caterpillars by hand and destroy. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pounce 384 EC	3A	45–90 mL/ha	
	Thuricide 48LV	11A	see label	

BUXUS — BOXWOOD				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *BUXUS*				
Box Tree Moth (*Cydalima perspectalis*)	Bioprotec Plus	11A	1.5–2.5 L/ha	Box tree moth is a new invasive species of moth, first detected in Toronto residential gardens in 2018. When monitoring for this pest, actively look inside canopy, pulling apart branches to uncover green larvae with black head and black spots down their backs feeding on foliage. Larvae often feed between the protection of multiple leaves that are webbed together. Actively search between leaves and twigs to find larvae feeding within canopy. Other signs of larval feeding include; webbed foliage, frass, empty head capsules or pupal cases, leaves that have been chewed shallowly on one side and leaves that have been consumed, leaving only the leaf margin behind. If left unmanaged, populations can build and larvae can defoliate boxwood plants. Irrigate defoliated plants and fertilize in fall and spring. Treat with insecticides when larvae are actively feeding on foliage since Dipel, Xentari and Bioprotec all need to be consumed in order to achieve larval mortality. Use sufficient spray volume to completely cover all leaf surfaces (upper and lower). If live larvae are found after 5 days of post-treatment, re-apply insecticidal spray. Larval activity is most prevalent 1) mid-May to late-June and 2) mid-July to mid-August. There is a third period of larval activity in early September, but it is brief as early instar larvae will construct a webby hibernarium and go dormant by September 15th.
	Dipel 2X DF	11A	560–1120 g/ha	
	Xentari WG	11A	750–1,000 g/ha	
Boxwood leafminers (*Monarthropalpus buxi, M. flavus*)	Avid 1.9% EC	6	600–1,200 mL/ha	Larvae overwinter in leaves and pupate in spring. The adult is a gnat-like fly that lays eggs into newly emerged foliage in spring. Newly hatched larvae mine new leaves in spring and throughout the summer. Treat newly emerged foliage when adult midges appear to reduce successful egg hatch and larval development. Citation is used as a foliar spray to target larvae. Citation interferes with the moulting process, resulting in failure of larvae to complete their life cycle.
	Citation 75WP	17	188 g/ha	
	Cygon 480 E	1B	1 L/ 1,000 L water	
	Lagon 480 E	1B	1 L/ 1,000 L water	
	Malathion	1B	see label	
Boxwood psyllid (*Psylla buxi*)	Avid 1.9% EC	6	600–1,200 mL/ha	Tiny, orange eggs overwinter in bud scales and are difficult to detect. Overwintering eggs hatch as buds begin to break in spring. Young nymphs are light green and develop a white, woolly protective mass as they get older. Nymphs feed on developing leaves. Leaves become cupped, enclosing the nymphs. Treat young psyllids after egg hatch, as leaves are emerging.
	Insecticidal soap	UN	see label	

BUXUS — BOXWOOD

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *BUXUS*				
Boxwood Blight *(Calonectria pseudonaviculata)* (a.k.a. *Cylindrocladium buxicola)*	Compass 50WG	11	150 g/ 1,000 L water	Look for light brown spots with dark borders, turning dark brown to black as lesions coalesce. Small, black, rod-shaped, discontinuous cankers can be found running longitudinally along older stems. Shoot dieback will occur on cankered stems. Most of the twig dieback will occur on the lower stems, resulting in significant leaf drop. Under high humidity (propagation, stem sample in plastic bag) white fuzzy masses of sticky spores may be observed on infected stems and leaves. Protect healthy tissues with fungicide applications where warm, humid conditions persist and there is a risk of *Calonectria* infection. Disease spread has been linked to the movement of infected plants, cuttings, and boxwood debris (especially fallen leaves). Another significant way this disease spreads is through contaminated tools and worker footwear/clothing. Sanitation and scouting are imperative to preventing the Introduction of *Calonectria* blight. Dip tools for 10 seconds in ≥70% isopropyl alcohol, 10% sodium hypochlorite or 0.5-1.5% quarternary ammonium and allow them to dry before use. To date, this disease is not known to occur in Ontario. Preventative fungicides are registered for use on nursery stock.
	Medallion	12	1.2 L/ 1,000 L water	
Volutella blight and canker *(Volutella buxi)*	-		-	Outer stem tissue becomes purplish-black between nodes, stems usually turn brown and die from the canker to the tip of the shoot. Under high humidity (propagation, plastic bag), orange-pink fungal fruiting bodies will form on cankered stems. This blight can be a problem in propagation areas where cuttings are being taken from infested, older stock plants. Always inspect cuttings and rooting beds for signs of canker and dieback. Remove and destroy infested cuttings immediately as a sanitation measure. Higher temperatures and well-drained media will accelerate rooting and decrease incidence of this disease in propagation (e.g., summer propagation). Remove and destroy infected leaves and stems in established plants (container, field).

CARAGANA — PEA SHRUB

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *CARAGANA*				
Leafhopper (several species)	Altus	4D	500–750 mL/ha	Leafhoppers are tiny, yellowish-green to pale-coloured insects that jump quickly when disturbed. Wingless nymphs will often “side step” quickly to hide from potential predators. Leafhoppers have piercing-sucking mouthparts that cause yellowish flecks on the leaf surface. Check regularly for infestation of nursery crops when neighbouring farms are cutting alfalfa or hay. Hang yellow sticky traps in the canopy to monitor for leafhoppers. Check by disturbing plants or looking at the leaf bottoms for leafhopper nymphs or molted skins. Treat as required.
	Tristar 70 WSP	4A	5 solupaks	

CARAGANA — PEA SHRUB

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *CARAGANA* (cont'd)				
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite WP	21A	284 g/ 1,000 L water (or 2 PVA bags in 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	

CARYA — HICKORY

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *CARYA*				
Hickory gall adelgid (*Phylloxera caryaecaulis*)	Malathion 500 EC	1B	1.25 L/ 1,000 L water	This pest produces nearly round galls on hickory twigs and leaf stems. Galls are about 16 mm in diameter. Girdled twigs die and break at the location of a gall. Overwintering eggs hatch as buds break. Apply insecticides at that time. Treatment is ineffective once galls appear. Infestations will not kill the tree.
	Pyrate 480 EC	1B	375 mL/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks	
Walnut caterpillar (*Datana integerrima*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Larvae are black with long grey hairs. This caterpillar feeds on walnut and hickory. Caterpillar colonies descend tree trunks and molt, leaving a conspicuous clump of grey cast skins on the trunk. Adult moths lay eggs in early July, and larvae feed until the end of August. Spray when larvae first appear, usually in July. Spray or remove larvae clustering on trunk.

CHAENOMELES — QUINCE

Disease	Product	Group*	Rate	Notes
DISEASES AFFECTING *CHAENOMELES*				
Fire blight (*Erwinia amylovora*)	Kasumin 2L	24	5 L/ 1,000 L water (see label)	Fire blight infects succulent vegetative growth. Dead, dry leaves persist on infected branches. Spray bactericidal products at early bloom, full bloom and petal fall when the weather is warm and humid and fire blight is a recurring problem. Avoid excessive pruning and nitrogen fertilization in spring. During dormancy, prune out infected branches about 30 cm below the cankered area when the tree is dry.
	Kasumin 4L	24	2.5 L/ 1,000 L water (see label)	
	Serenade Max	BM 02	2–3 kg/ha	

CLEMATIS — CLEMATIS

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *CLEMATIS*				
Two-spotted spider mite (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Do not exceed 2 applications of Nealta per year. Two spotted spider mites overwinter as adults near the surface of the soil.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	Nealta	25	1L/ha	
	SanMite WP	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water	
	Vendex 50 W	12	50–100 g/ 100 L water	

CLEMATIS — CLEMATIS

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *CLEMATIS* (cont'd)				
Western flower thrips (*Frankliniella occidentalis*)	Ference	28	37.5–75 mL/ 100 L water	Western flower thrips can feed openly on new leaves or from inside terminal vegetative buds and flower buds. They have piercing-sucking mouthparts that suck out plant juices of immature leaves and flowers, resulting in major distortion and colour flecking when flowers and foliage do emerge. Injury may be confused with that of leafhoppers. Ference provides only suppression of thrips. Do not make more than 2 applications of Ference per year. Do not make more than 3 applications of Success per year.
	Success	5	50 mL/ 1,000 L water	

CORNUS — DOGWOOD

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *CORNUS*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids appear as new growth emerges in the spring. Repeated applications of insecticidal soap will be required to reduce aphid populations. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year. *Do not apply Kontos insecticide during bloom, as this product is toxic to bee brood.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	*Kontos	23	see label	
	Trounce	3A	50 L/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	
White grubs: European chafer (*Rhizotrogus majalis*) June beetle (*Phyllophaga* sp.)	**Larval management:**			These beetle larvae are referred to as "white grubs." The larvae chew fibrous roots and girdle underground stems of many woody ornamentals (including *Cornus* sp.). To expose grubs to natural predators, cultivate infested fields before planting. Apply Intercept 60 WP once per year, during the mating period/ egg-laying period and up to egg hatch (usually late June/ early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application. Avoid overwatering. Apply Acelepryn any time that larvae are present or during the mating period/egg-laying period to egg-hatch.
	Acelepryn, Acelepryn G	28	5.6–8.8 mL/ 100 m^2	
	Intercept 60 WP	4A	see label	
	Lorsban NT	1B	4.5 L/ 1,000 L water (rescue treatment for shipping	
	Adult management:			
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
DISEASES AFFECTING *CORNUS*				
Anthracnose (*Glomerella cingulata*), (*Colletotrichum gloeosporioides*)	Banner MAXX	3	28 mL/ 100 L water	Leaves develop brown lesions in spring, often between veins. Leaves may become deformed and fall off. This fungus infects leaves as they are emerging in the spring. Where disease pressure is high, protect newly emerging leaves with fungicides before leaf wetness periods in spring.
	Banner EC 130	3	34 mL/ 100 L water	
	Heritage Maxx	11	0.8-1.6 L/ 1,000 L water	
	Palladium WG	9, 12	150–300mL/ 1,000 L water	
	Nova	3	340 g/ 1,000 L water	

CORNUS — DOGWOOD

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *CORNUS* (cont'd)				
Leaf spot	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	This disease is caused by several different fungi. Avoid overhead irrigation late in the day or at night. Do not crowd plants. Maintain adequate sunlight and good air circulation. Protect new leaves with fungicides at the first sign of disease.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Nova	3	340 g/ 1,000 L water	
Powdery mildew	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	This disease appears as a white, powdery fungal growth on the tops of leaves.
	MilStop	NC	2.8–5.6 kg/ 100 L water	MilStop will help suppress powdery mildew when applied preventively.
	Palladium WG	9, 12	see label	
Twig blight	There is no product registered at the time of this publication.			This disease is caused by several different fungi. Cankers appear at the base of dead twigs. Prune infected twigs and branches back to healthy wood. Improve cultural conditions by watering during dry conditions. Do not crowd plants. Maintain adequate sunlight and good air circulation.

CORYLUS — CORKSCREW HAZEL, FILBERT

Disease	Product	Group*	Rate	Notes
DISEASES AFFECTING *CORYLUS*				
Eastern filbert blight (*Anisogramma anomala*)	Copper Spray	M 01	3–9 kg/ 1,000 L water	Filbert blight causes branch dieback and small, crescent-shaped, black cankers on killed stems. Prune out cankered branches when the plant is dormant and dry. Protect new growth with fungicides from bud swell to leaf emergence.
	Flint, Flint 50WG	11	140–280 g/ha	

COTONEASTER — COTONEASTER

Disease	Product	Group*	Rate	Notes
DISEASES AFFECTING *COTONEASTER*				
Phytophthora root rot	Presidio	43	60–119 mL/ 380 L water	Infected roots become water-soaked and turn brown. Infected stems and leaves turn brown and die. Diseased leaves often persist on stems. Quite often the cambium turns from green to reddish-brown. This disease is often associated with overwatering or low aeration porosity of the media.
	Previcur N	28	see label	
	Torrent 400SC	21	see label	

CRATAEGUS — HAWTHORN				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *CRATAEGUS*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids are soft-bodied insects that suck plant sap. They can be found on soft, succulent plant tissue. Feeding causes distorted growth, honeydew and sooty mould. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year. Apply insecticides to reduce populations. Do not make more than 2 applications of Endeavor per year. Do not apply more than 386 g of Endeavor/ha/yr.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Endeavor 50WG	9B	10–20 g/ 100 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Tristar 70 WSP	4A	3 solupaks	
	Trounce	3A	50 L/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	
Eastern tent caterpillar (*Malacosoma americanum*)	Dipel	11A	see label	This caterpillar has one white stripe down its back. Colonies feed early in the season. Silken tents appear in the forks of branches, mainly of apple, cherry and hawthorn trees. Prune and destroy overwintering egg masses. These are silver in colour, about 1–2 cm long in a raised band circling a twig. They hatch when buds break in the spring. Treat then or at the first sign of webs. In light infestations, remove and destroy the tents (which contain larvae). Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dragnet	3A	230 mL/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	1.22 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pounce 384 EC	3A	90 mL/ 1,000 L water	
	Success	5	25 mL/ 1,000 L water	
Hawthorn leafminer (*Profensua canadensis*)	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	This leafminer forms a blotch mine covering half or more of each leaf. Foliage of heavily infested trees looks scorched. The adult is a small, black sawfly that emerges from the soil as the first leaves start to emerge and blossoms begin to open. Adults are active as the leaves begin to unfold. Treat foliage as it emerges in the spring to reduce larval populations.
	Malathion 85E	1B	1.22 L/ 1,000 L water	

CRATAEGUS — HAWTHORN

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *CRATAEGUS* (cont'd)				
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Do not exceed 2 applications of Nealta per year.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	Nealta	25	1L/ha	
	SanMite WP	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	
Western flower thrips (*Frankliniella occidentalis*)	Ference	28	37.5–75 mL/ 100 L water	Western flower thrips can feed openly on new leaves or from inside terminal vegetative buds and flower buds. They have piercing-sucking mouthparts that suck out plant juices of immature leaves and flowers, resulting in major distortion and colour flecking when flowers and foliage emerge. Injury may be confused with that caused by leafhoppers. Ference provides only suppression of thrips. Do not make more than 2 applications of Ference per year. Do not make more than 3 applications of Success 480 SC per year.
	Success	5	50 mL/ 1,000 L water	
DISEASES AFFECTING *CRATAEGUS*				
Fire blight (*Erwinia amylovora*)	Copper Spray	M 01	1.25 kg/ 1,000 L water	Fire blight affects succulent vegetative growth. Dead, dry leaves persist on infected branches. Spray bactericidal products at early bloom, full bloom and petal fall when weather is warm and humid and fire blight is a recurring problem. Avoid excessive pruning and nitrogen fertilization in spring. During dormancy, prune out infected branches about 30 cm below the cankered area when the tree is dry.
	Serenade Max	BM 02	2–3 kg/ha	

CRATAEGUS — HAWTHORN

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *CRATAEGUS* (cont'd)				
Hawthorn rust (*Gymnosporangium globosum*) Quince rust (*G. clavipes*)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	Symptoms appear as orange spots on leaf surfaces in late spring. In the case of *G. globosum*, finger-like structures appear on leaf undersides by mid-to-late summer. Infections of *G. clavipes* also appear on fruit and stems. Apply fungicide before bloom, when the fungus is sporulating on the alternate hosts (juniper). Remove alternate juniper hosts and/or separate alternate hosts as far away as possible from *Rosaceous* hosts (*Malus*, *Crataegus*, etc.).
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Nova	3	340 g/ 1,000 L water	
Leaf blight (*Diplocarpon* sp.)	Dithane DG 75, Dithane M-45, Dithane 80, Dithane Rainshield	M 03	2.75–3.5 kg/ 1,000 L water	Symptoms appear as small brown spots on leaves in mid-summer. Spray fungicides in spring to help protect leaves as they emerge. Do not crowd plants. Maintain adequate sunlight and good air circulation. Avoid summer pruning, which encourages susceptible soft growth.
	Manzate	M 03	see label	
Leaf spot (*Fabraea* sp.)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	Leaf spot appears as slightly depressed, angular, reddish-brown spots that join together. By mid-summer, dead areas have dark, raised bumps (fruiting structures). Collect and destroy fallen leaves. Spray protectant fungicides as flower buds open. Repeat applications if spots develop. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
Powdery mildew	Compass 50 WG	11	7.5–20 g/ 1,000 L water	This fungus appears as a white, powdery growth on the tops of leaves. Apply fungicides at the first sign of disease to reduce disease spread.
	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	
	Palladium WG	9, 12	see label	

EUONYMUS — EUONYMUS

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *EUONYMUS*				
Black vine weevil, Taxus weevil (*Otiorhynchus sulcatus*)	Demand CS	3A	360 mL/ 1,000 L water	Larvae are small, white, legless grubs that eat fibrous roots or strip bark off larger roots. Infested plants grow slowly or fail to grow. Plants look dry and off-colour. Transplants often die without becoming established. Larval control is difficult. Adults are black snout beetles that hide in soil litter during the day and cut crescent-shaped notches in needle margins at night. They also attack eastern white cedar, spruce, hemlock, azaleas, yews and rhododendrons. In container production, they are also significant pests of several hosts, including herbaceous perennials. Adult weevils have fused wing covers and cannot fly. To control adults, treat the foliage, trunk bark and branches during the last week of June and in early July. Spray in the evening, as adult activity increases about an hour after sunset. To test treatment safety, treat some conifer seedlings, especially pine, before treating a larger area. Entomopathogenic nematodes (e.g., *Heterorhabditis* sp.) are available to help suppress populations of larvae. Nematodes work very well in infested containers but with less success in the field. Nematodes can be applied in late summer/early autumn and in mid-spring to suppress larval populations. See the product label for complete directions. To monitor for adults, place a piece of plywood around infested plant bases. Adult weevils will hide under the wood during the day. Or place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Do not use Demand CS or Silencer in residential areas.
	Flagship 25WG	4A	10.5–14 g/ 100 L water	
	Heterorhabditis bacteriophora	NC	see label	
	Met52 G	UNF	see label	
	Silencer 120 EC	3A	300 mL/ 1,000 L water	

EUONYMUS — EUONYMUS

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *EUONYMUS* (cont'd)				
Euonymus scale (*Unaspis euonymi*)	Cygon 480 E	1B	2 L/ 1,000 L water	This greyish, pear-shaped scale also affects bittersweet (*Celastrus*) and *Pachysandra*. It produces 2 generations a year; the second generation appears about 6 weeks after the first. Examine plants during the dormant season, prune out highly infested regions and use dormant oil. Apply insecticides as nymphs emerge. *Catalpa speciosa* are beginning to bloom at this time; *Kolkwitzia* and *Philadelphus* are also blooming. Repeat the treatment after 7 days. Landscape Oil (horticultural oil) can be used when plants are dormant or in the summer when foliage is fully expanded and hardened off. See product label for rates and tolerant plants. Kontos insecticide can be used as a drench application. *Do not apply Kontos during bloom, as this product is toxic to bee brood.
	Horticultural oil	UN	20 L/ 1,000 L water	
	*Kontos	23	7 mL product/ 100 L of growing media	
	Lagon 480 E	1B	2 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
Euonymus webworm (*Yponomeuta cagnagella*)	Dragnet FT EC	3A	230 mL/ 1,000 L water	The larva is a pale yellow caterpillar with black spots along each side. Larvae feed on leaves in localized, webbed colonies. Severe defoliation can occur during June. Monitor deciduous euonymus for webbed colonies in May and June. Where possible, prune colonies out and destroy them. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Pounce 384 EC	3A	90 mL/ 1,000 L water	
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application/season of Apollo SC. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times/season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal.
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Dyno-Mite SC	21A	470 mL/ha	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite WP	21A	284 g/ 1,000 L water (or 2 PVA bags in 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	

EUONYMUS — EUONYMUS

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *EUONYMUS*				
Anthracnose (*Glomerella cingulata, Colletotrichum gloeosporioides*)	Daconil 2787	M 05	2.5 L/ 1,000 L water	Symptoms appear as a leaf spot and stem blight that is most prevalent on container-grown euonymus. Leaf spots are small, circular and dark brown with light brown centres about 0.5–3 mm in diameter. Infected foliage often drops (although extreme temperatures and humidity will also cause leaf drop). Stem lesions appear as brown-to-grey, raised, oval, scabby cankers that lead to dieback of stem and leaves above the canker. Variegated cultivars of *Euonymus fortunei* are the most susceptible to anthracnose. This fungus is a weak pathogen, and infection is usually facilitated by mechanical wounds (e.g., pruning) or low-temperature injury and freezing damage. This fungus infects and grows best during leaf wetness periods (June, July) with high temperatures and high humidity. To protect new growth, spray at bud break and through leaf emergence, especially during high temperatures and humidity. Maintain good air circulation. To limit leaf wetness periods, irrigate susceptible cultivars during mid-morning only. Prune out dead and dying twigs, especially in fall.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Heritage Maxx	11	0.8–1.6 L/ 1,000 L water	
	Palladium WG	9, 12	150–300mL/ 1,000 L water	
Crown gall (*Agrobacterium tumefaciens*)	Dygall	Bio	160 g/ 50 L water	This gall appears as large, abnormal growths on stems and roots. Susceptible plants (*Euonymus*, *Rosa*, *Salix*) must be treated before disease exposure or final field placement. Wounding (e.g., pruning) and damaging plants facilitate entry and infection by this pathogen. Remove and destroy infected plants and soil. This is a soil-borne bacteria. Avoid growing susceptible plants at sites with a history of this disease.

FAGUS — BEECH

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *FAGUS*				
Aphids (various) Beech blight aphid (*Fagiphagus imbricator*, *Grylloprociphilus imbricator*) Woolly beech leaf aphid (*Phyllaphis fagi*)	Altus	4D	500–750 mL/ha	Conspicuous white, cottony threads cover beech blight aphids and woolly beech leaf aphids. Beech blight aphid appears on twigs and small branches. The woolly beech leaf aphid feeds on leaf undersides. While unsightly, woolly beech aphids cause little tree damage unless very high populations exist. Treat aphids when they first appear, and repeat as needed. Excessive fertilization or pruning can cause undesirable succulent growth levels that attract these aphids. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	375 mL/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks	
	Trounce	3A	50 L/ 1,000 L water	

FAGUS — BEECH

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *FAGUS* (cont'd)				
Cankerworm (*Alsophila pometaria*), (*Paleacrita vernata*)	Dipel	11A	see label	Green and dark-grey inchworms (loopers, geometrids) can be found feeding on leaf undersides and edges in spring. Unchecked, cankerworm can cause significant defoliation to deciduous trees. Treat with insecticides when larvae are small.
	Orthene 75 SP	1B	see label	
Gypsy moth (*Lymantria dispar*)	Dipel	11A	see product(s) label	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs, most notably basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow). A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development.
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide HPC	11A	7.14–12 L/ 1,000 L water	
	Thuricide 48LV	11A	2–4 L/ha	
White-marked tussock moth (*Orgyia leucostigma*)	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.

FORSYTHIA — FORSYTHIA

Disease	Product	Group*	Rate	Notes
DISEASES AFFECTING *FORSYTHIA*				
Bacterial blight (*Pseudomonas syringae*)	Copper Spray	M 01	6 kg/ 1,000 L water	Young shoots or leaves turn black between early spring and early summer, especially during wet, cool weather. Apply copper spray once in October and again in January. In addition, during warm, humid blight conditions in April and May, apply 1 g/L of active ingredient (2 g 50% wettable powder). Repeat at 7–10-day intervals. Avoid overhead irrigation late in the day. Do not crowd plants. Maintain adequate sunlight and good air circulation. Excessive fertilization or pruning can cause undesirable succulent growth levels and reduce natural resistance to disease.

FRAXINUS — ASH				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *FRAXINUS*				
Ash flower gall mite (*Eriophyes fraxiniflora*)	Horticultural oil	UN	20 L/ 1,000 L water	This mite becomes active as male ash flower buds break in the spring. It feeds on the unfolding tissues, causing them to form irregular gall clusters of 12 mm diameter. Use horticultural oil as a dormant treatment. Use Malathion when the first blossoms begin to emerge. Landscape Oil (horticultural oil) can be used when the plant is dormant or in the summer when leaves are fully expanded and hardened off. See product label for rates and tolerant plants.
	Malathion	1B	see label	
Ash-lilac borer (*Podosesia syringae*)	Pyrate 480 EC	1B	500 mL/ 1,000 L water	Adults are dark brown, wasp-like moths, present from late May to late July (during *Syringa vulgaris* bloom). Larvae bore into trunks near the base. Lilac, mountain ash and privet are also hosts. Cut and destroy infested wood before May. Stressed trees are more susceptible to borers. Remove badly infested trees. Use pheromone traps to monitor adult activity. Treat trunk and large branches, especially around wounds, with insecticides when the *Syringa vulgaris* is in bloom. Repeat twice at 10-day intervals. Begin applications about 10 days after peak catch numbers.
Ash plant bug (*Tropidosteptes amoenus*)	There is no product registered at the time of this publication.			This plant bug feeds on *Fraxinus americana* and *F. pennsylvanica*. Young nymphs feed on leaf bottoms, causing leaf stippling. To monitor for plant bugs, tap a branch over a sheet of white paper or a tapping tray.
Emerald ash borer (*Agrilus planipennis*)	AceCap 97	1B	773 mg/cartridge 1 cartridge/ 10.16 cm	This exotic insect was first found in Essex County, Ontario, in 2002. Larvae bore into the phloem, making serpentine tunnels just under the bark. Small (8–14 mm), metallic-green, adult beetles emerge through tiny D-shaped holes in the bark from spring to summer. The larval tunnels in the cambium kill off sections of the tree, leading to dieback, epicormic (adventitious) branching at the base, and tree mortality. This borer is most commonly found on *Fraxinus pennsylvanica*. This is a regulated pest of quarantine significance to the Canadian Food Inspection Agency. It is difficult to detect infestations of emerald ash borer. Injectible insecticides are registered to combat this pest. However, trees with vascular damage due to boring larvae may not translocate insecticide as well as un-infested trees, so the efficacy may be lower. AceCap 97, IMA-jet and TreeAzin applications must be made post-bloom as these products are toxic to bees and bee brood.
	IMA-jet, IMA-jet 10	4A	see label	
	TreeAzin	UN	see label	
Fall webworm (*Hyphantria cunea*)	Dipel	11A	see label	Caterpillars build large silk tents on the ends of branches starting in late June, spreading over several branches throughout the summer and becoming very noticeable by late August. Commonly found on walnut, cherry, crabapple, box-elder and ash. Open the tent to find pale yellow-green caterpillars with black spots and long hairs extending out from body. There are black-headed and red-headed morphs of larvae. Adults emerge over a period of weeks, starting in June. Adults are white and lay eggs on lower leaf surfaces beginning in late June. Chemical control is rarely needed. Remove webs and caterpillars by hand and destroy. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pounce 384 EC	3A	45–90 mL/ha	

FRAXINUS — ASH				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *FRAXINUS* (cont'd)				
Gypsy moth (*Lymantria dispar*)	Dipel	11A	see label	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs, most notably basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow). A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development.
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide HPC	11A	7.14–12 L/ 1,000 L water	
	Thuricide 48LV	11A	2–4 L/ha	
Lecanium or European fruit lecanium scale (*Lecanium corni*)	Ference	28	37.5–75 mL/ 100 L water	When adults are mature in late spring/summer, they appear as a large, reddish-brown, spherical scale usually found on the underside of twigs. This scale insect infests many deciduous trees and shrubs. Use horticultural oil as an early-spring dormant treatment to reduce populations of overwintering nymphs. Do not make more than 2 applications of Ference per year. To suppress crawlers, spray insecticides when the *Sambucus canadensis* begins blooming. Do not use Malathion on Crimson King maple. Orthene may damage sugar maple leaves.
	Horticultural oil	UN	20 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	2.4–3 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	
	Trounce	3A	50 L/ 1,000 L water	
Leopard moth (*Zeuzera pyrina*)	There is no product registered at the time of this publication.			The larval stage of leopard moth bores into the branch tips and eventually into the heartwood of trees (as larvae grow larger), weakening the tree and causing dieback and tree mortality. Look for bore holes in branch tips and large bore holes with sawdust at the base of the trunk. Larvae are large (up to 50 mm) and cream-coloured with black spots. Control is difficult once the borer has become established in a tree. Remove infested trees and destroy. Insert a piece of flexible wire in and upwards via the bore hole to destroy larvae. Leopard moths are rarely found in large numbers.

FRAXINUS — ASH				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *FRAXINUS* (cont'd)				
Oystershell scale (*Lepidosaphes ulmi*)	Insecticidal soap	UN	see label	This scale insect attacks over 125 forest, shade, fruit and ornamental tree species. In heavy infestations, greyish scales completely encrust twigs and stems. This can cause branch and tree mortality. Mature females are 3 mm long and rounded at the rear, resembling oyster shells. Eggs overwinter under dead female shells, rendering them completely resistant to pesticides applied in fall or early spring. Use insecticides when crawlers are present in late May. Apply again 10 days later, about the time *Spiraea* x *vanhouttei* is blooming. Ensure good coverage of trunk, branches and leaf bottoms. Landscape Oil (horticultural oil) can be used in the summer when leaves are fully expanded and hardened off. See product label for rates and tolerant plants.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	0.61 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	
Sycamore lacebug (*Corythucha ciliata*)	Ference	28	37.5–75 mL/ 100 L water	Lacebugs are flat, rectangular insects, 4–6 mm long with broad, transparent, lace-like wing covers. Adults and nymphs feed on the underside of leaves. Leaves become pale and mottled, with white splotches. Lower leaf surfaces develop black and brownish dots. Heavily infested leaves may turn entirely brown and fall off. Most lacebug species produce 2 generations per year. Lacebugs usually occur on a single host, but sycamore lacebug can also be found on elm, hickory, linden, oak and walnut. Apply insecticides to leaf undersides when insects first appear.
	Malathion 500 EC	1B	1.25 L/ 1,000 L water	
	Malation 85E	1B	0.61–0.88 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
DISEASES AFFECTING *FRAXINUS*				
Anthracnose (*Gloeosporium aridum*)	Dithane DG 75, Dithane M-45, Dithane 80, Dithane Rainshield	M 03	2.75–3.5 kg/ 1,000 L water	Symptoms appear as leaf spots, marginal leaf browning and leaf deformation. Defoliation may occur in late spring and early summer. Apply treatments at 10–14-day intervals, beginning before bud burst and continuing while wet weather persists in spring. Collect and destroy fallen leaves. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Heritage Maxx	11	0.8–1.6 L/ 1,000 L water	
	Manzate	M 03	2.75–3.50 kg/ 1,000 L water (see label)	
	Palladium WG	9, 12	150–300mL/ 1,000 L water	
Leaf spot (*Mycosphaerella* sp.)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	Brown spots with yellowish borders appear by late summer. Apply fungicides at bud break. Collect and destroy fallen leaves to help reduce disease pressure. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	

GLEDITSIA — HONEYLOCUST

Pest	Product		Rate	Notes
INSECTS AFFECTING *GLEDITSIA*				
Cottony maple scale (*Pulvinaria innumerabilis*)	Ference	28	37.5–75 mL/ 100 L water	Mature female scale insects with white egg sacs resemble a partially popped corn kernel. This insect infests maple, linden, elm, beech, oak, and other trees and shrubs. It is found only on twigs. Use horticultural oil as an early-spring dormant treatment. Do not use horticultural oil on sugar or Japanese maples. Nymphs are active in late June/early July, about when *Philadelphus* and *Tilia cordata* bloom. Direct the insecticidal spray to the lower leaf surface. Repeat the application 10 days later. Do not make more than 2 applications of Ference per year. Do not use Malathion on Crimson King maple. Orthene may damage sugar maple leaves.
	Horticultural oil	UN	20 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	
Honeylocust plant bug (*Diaphnocoris chlorionis*)	Insecticidal soap	UN	see label	Plant bugs become active as new leaves begin to emerge. Plant bug feeding causes leaf yellowing, stippling, stunting and deforming early in the season. Shoot dieback may occur. To monitor for plant bugs, tap a branch over a sheet of paper or a tapping tray or use a sweep net. Apply insecticides when nymphs are active and numerous.
Honeylocust podgall midge (*Dasyneura gleditchiae*)	There is no product registered at the time of this publication.			The adult is a small insect similar to a fruit fly. It lays eggs on new leaflets, and larvae feed on the inner surface. This causes leaves to curl into a pod-like structure. There are several generations a year.
Honeylocust spider mite (*Eotetranychus multidigituli*)	Altus	4D	500–750 mL/ha	Adults overwinter on bark. Mites are light orange and very difficult to see with the naked eye. Feeding causes stippling, bronzing and discoloured foliage. Heavy infestation may cause defoliation. Treat when mites appear and again in 10 days. Repeat the procedure as needed. Landscape Oil (horticultural oil) can be used in the summer when leaves are fully expanded and hardened off. See product label for rates and tolerant plants.
	Horticultural oil	UN	see label	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	1 L/ 1,000 L water	
	Tristar 70 WSP	4A	5 solupaks	
Leafrollers (various)	There is no product registered at the time of this publication.			Leafrollers are caterpillars that feed while hidden in folded or rolled leaves. Fruit tree and redbanded leafrollers primarily affect fruit trees but also attack many shade trees and ornamentals.
Lecanium or European fruit lecanium scale (*Lecanium corni*)	Ference	28	37.5–75 mL/ 100 L water	When adults are mature in late spring/summer, they appear as a large, reddish-brown, spherical scale usually found on the underside of twigs. This scale insect infests many deciduous trees and shrubs. Use horticultural oil as an early-spring dormant treatment to reduce populations of overwintering nymphs. To suppress crawlers, spray insecticides when the *Sambucus canadensis* begins blooming. Do not make more than 2 applications of Ference per year.
	Horticultural oil	UN	20 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	
	Trounce	3A	50 L/ 1,000 L water	

HEDERA — IVY				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *HEDERA*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids become numerous as new growth emerges in the spring. Repeated applications of insecticidal soap will help smother aphids. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
Black vine weevil, Taxus weevil (*Otiorhynchus sulcatus*)	Demand CS	3A	360 mL/ 1,000 L water	Larvae are small, white, legless grubs that eat fibrous roots or strip bark off larger roots. Infested plants grow slowly or fail to grow. Plants look dry and off-colour. Transplants often die without becoming established. Larval control is difficult. Adults are black snout beetles that hide in soil litter during the day and cut crescent-shaped notches in needle margins at night. They also attack eastern white cedar, spruce, hemlock, azaleas, yews and rhododendrons. In container production, they are also significant pests of several hosts, including herbaceous perennials. Adult weevils have fused wing covers and cannot fly. To control adults, treat the foliage, trunk bark and branches during the last week of June and in early July. Spray in the evening, as adult activity increases about an hour after sunset. To test treatment safety, treat some conifer seedlings, especially pine, before treating a larger area. Entomopathogenic nematodes (e.g., *Heterorhabditis* sp.) are available to help suppress populations of larvae. Nematodes work very well in infested containers but with less success in the field. Nematodes can be applied in late summer/early autumn and in mid-spring to suppress larval populations. See the product label for complete directions. To monitor for adults, place a piece of plywood around infested plant bases. Adult weevils will hide under the wood during the day. Or place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Do not use Demand CS or Silencer in residential areas.
	Flagship 25WG	4A	10.5–14 g/ 100 L water	
	Heterorhabditis bacteriophora	NC	see label	
	Met52 G	UNF	see label	
	Silencer 120 EC	3A	300 mL/ 1,000 L water	

HEDERA — IVY

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *HEDERA* (cont'd)				
Two-spotted spider mite (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite WP	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	

HEMEROCALLIS — DAYLILY

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *HEMEROCALLIS*				
Western flower thrips (*Frankliniella occidentalis*)	Ference	28	37.5–75 mL/ 100 L water	Western flower thrips can feed openly on new leaves or from inside terminal vegetative buds and flower buds. They have piercing-sucking mouthparts that suck out plant juices of immature leaves and flowers, resulting in major distortion and colour flecking when flowers and foliage emerge. Injury may be confused with that of leafhoppers. Ference provides only suppression of thrips. Do not make more than 2 applications of Ference per year. Do not make more than 3 applications of Success per year.
	Success	5	50 mL/ 1,000 L water	

HEMEROCALLIS — DAYLILY

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *HEMEROCALLIS*				
Daylily rust (*Puccinia hemerocallidis*)	Heritage Maxx	11	0.8–1.6 L/ 1,000 L water	Daylily rust appears as orange, raised pustules in late summer and autumn. Yellow zones often encircle the pustules and leaves may be killed, especially on very susceptible cultivars. Orange, dusty spores arise from the pustules and spread by wind and rain to infect other plant foliage. See the OMAFRA Factsheet *Daylily Rust*, at ontario.ca/crops. Heritage fungicide is for use on daylilies to prevent the infection of daylily rust whenever spores may be present (usually starting in September in Ontario). Apply every 14–28 days. Do not make more than 2 applications per season.
Rhizoctonia stem blight (*Rhizoctonia* sp.)	Compass 50 WG	11	3.8 g/ 100 L water	Apply Compass as a drench at the time of propagation to help protect *Hemerocallis* from rhizoctonia stem blight.
	Heritage Maxx	11	0.4 L/ 1,000 L water	
	Medallion	12	300–600 mL/ 1,000 L water	
	Palladium WG	9, 12	150–300mL/ 1,000 L water	

HERBACEOUS PERENNIALS — VARIOUS

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING HERBACEOUS PERENNIALS				
Aphids (various)	Altus	4D	500–750 mL/ha	Various species of aphids feed on herbaceous ornamentals. Aphids are small, soft-bodied insects that have piercing-sucking mouthparts to suck plant sap. Feeding causes distortion and stunting of foliage. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year. *Do not apply Kontos insecticide during bloom as this product is toxic to bee brood. See Kontos label for host sensitivity.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Endeavor 50 WG	9B	10–20 g/ 100 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	*Kontos	23	see label	
	Tristar 70 WSP	4A	3 solupaks	
	Ventigra	9D	0.1 L/ha	

HERBACEOUS PERENNIALS — VARIOUS

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING HERBACEOUS PERENNIALS (cont'd)				
Black vine weevil, Taxus weevil (*Otiorhynchus sulcatus*)	Demand CS	3A	360 mL/ 1,000 L water	Larvae are small, white, legless grubs that eat fibrous roots or strip bark off larger roots. Infested plants grow slowly or fail to grow. Plants look dry and off-colour. Transplants often die without becoming established. Larval control is difficult. Adults are black snout beetles that hide in soil litter during the day and cut crescent-shaped notches in needle margins at night. They also attack eastern white cedar, spruce, hemlock, azaleas, yews and rhododendrons. In container production, they are also significant pests of several hosts, including herbaceous perennials. Adult weevils have fused wing covers and cannot fly. To control adults, treat the foliage, trunk bark and branches during the last week of June and in early July. Spray in the evening, as adult activity increases about an hour after sunset. To test treatment safety, treat some conifer seedlings, especially pine, before treating a larger area. Entomopathogenic nematodes (e.g., *Heterorhabditis* sp.) are available to help suppress populations of larvae. Nematodes work very well in infested containers but with less success in the field. Nematodes can be applied in late summer/early autumn and in mid-spring to suppress larval populations. See the product label for complete directions. To monitor for adults, place a piece of plywood around infested plant bases. Adult weevils will hide under the wood during the day. Or place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Do not use Demand CS or Silencer in residential areas.
	Flagship 25WG	4A	10.5–14 g/ 100 L water	
	Heterorhabditis bacteriophora	NC	see label	
	Met52 G	UNF	see label	
	Silencer 120 EC	3A	300 mL/ 1,000 L water	
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite WP	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	

HERBACEOUS PERENNIALS — VARIOUS

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING HERBACEOUS PERENNIALS (cont'd)				
Western flower thrips (*Frankliniella occidentalis*)	Ference	28	37.5–75 mL/ 100 L water	Western flower thrips can feed openly on new leaves or from inside terminal vegetative buds and flower buds. They have piercing-sucking mouthparts that suck out plant juices of immature leaves and flowers, resulting in major distortion and colour flecking when flowers and foliage do emerge. Injury may be confused with that of leafhoppers. Ference provides only suppression of thrips. Do not make more than 2 applications of Ference per year. Do not make more than 3 applications of Success per year.
	Success	5	50 mL/ 1,000 L water	
DISEASES AFFECTING HERBACEOUS PERENNIALS				
Botrytis flower blight (*Botrytis cinerea*)	Captan 80 WDG	M 04	see label	Botrytis blight appears as a grey, fuzzy mould on succulent plant tissues (e.g., flowers). Apply fungicides when disease first appears and repeat at 7–10-day intervals.
	Compass 50 WG	11	7.5–30 g/ 100 L water	
	Daconil 2787	M 05	2.5 L/ 1,000 L water	
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Rhapsody ASO	BM 02	1.0–2.0 L/ 100 L water	
	Rovral WP, Rovral WDG	2	5 g/ 10 L water	
Crown and root rots	Heritage Maxx	11	0.4 L/ 1,000 L water	Various fungi cause root and crown rots on ornamentals. Many are a function of unsuitable environmental conditions and media properties. Medallion and Palladium give suppression of Fusarium oxysporum. Apply Rootshield or Rhapsody as a preventive drench after cuttings are stuck, seeds are sown or young plants are transplanted. Rootshield can also be applied as pre-mix granules with media. Rootshield helps suppress soil-borne pathogens such as Pythium, Rhizoctonia and Fusarium. Rootshield is registered for greenhouse ornamentals only.
	Medallion	12	300–600 mL/ 1,000 L water	
	Palladium WG	9, 12	150–300mL/ 1,000 L water	
	Rhapsody ASO	BM 02	1–2 L/ 100 L water	
	Rootshield (*Trichoderma harzianum*)	BM 02	see label	
	Senator 70 WP	1	650–850 g/ 1,000 L water	
	Senator 50 SC	1	910–1,190 mL/ 1,000 L water	
	Torrent 400SC	21	see label	
Damping-off, bulb rots	Captan	M 04	see product(s) label	Use Captan as a bulb dip before storage of bulbs. Allow the fungicide to dry on the bulbs prior to storage.
Damping-off, root and stem diseases — pythium, phytophthora	Heritage Maxx	11	0.4 L/ 1,000 L water	Pythium and Phytophthora cause stem and root rots in many ornamentals, especially under saturated soil conditions where the media does not offer enough drainage (or aeration). Subdue MAXX can be used on a specific group of ornamentals (see product label). Apply Subdue MAXX to the media prior to potting or as a drench after seeding or transplanting. Irrigate within 1–2 days to ensure the product reaches the root zone. To avoid fungicide resistance, rotate Subdue MAXX with other families/groups of fungicides. Phostrol gives preventative suppression of Phytophthora root diseases only.
	Phostrol	P 07	see label	
	Presidio	43	60–119 mL/ 380 L water	
	Previcur N	28	see label	
	Subdue MAXX	4	see label	
	Torrent 400SC	21	see label	

HERBACEOUS PERENNIALS — VARIOUS

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING HERBACEOUS PERENNIALS (cont'd)				
Downy mildew (*Peronospora* spp.)	Acrobat 50 WP	40	48 g/ 100 L water	Downy mildew is a common disease on several species of herbaceous perennials, and symptoms can vary per host. Most often they appear as purplish zones on leaves. Downy mildew is most prevalent in warm, humid conditions. Fungicides must be applied preventatively, before disease symptoms are evident, to be effective. Make the first application when conditions are favourable for disease development. Regalia Maxx gives suppression of *Plasmopora* spp. and *Peronospora* spp. of downy mildew only.
	Heritage Maxx	11	0.4–0.8 L/ 1,000 L water	
	Micora	40	300–600 mL/ 1,000 L water	
	Presidio	43	60–119 mL/ 380 L water	
	Regalia Maxx	P 05	1 L/400 L water	
	Torrent 400SC	21	see label	
Leaf spot (various fungi)	Folpan 50 WP, Folpan 80 WDG	M 04	see label	Look for distinct, brown spots on herbaceous perennials. Protect new growth with fungicides at the first sign of disease. Apply Rhapsody prior to or at the early stages of disease and repeat every 7 days.
	Rhapsody ASO	BM 02	1–2 L/ 1,000 L water	
Powdery mildew	Compass 50 WG	11	15–20 g/ 100 L water	Powdery mildew appears as a white, powdery fungal growth on the tops of leaves. Early signs include small, circular whitish colonies. MilStop and Rhapsody can be used for the suppression of powdery mildew. Start applications at the first sign of disease. Regalia Maxx gives suppression of *Oidium* spp. powdery mildew only.
	Folpan 50 WP	M 04	2 kg/ 1,000 L water	
	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	
	MilStop	NC	2.8–5.6 kg/ 1,000 L water	
	Palladium WG	9, 12	see label	
	Regalia Maxx	P 05	500–1,000 mL/ 400 L water	
	Rhapsody ASO	BM 02	1.0–2.0 L/ 100 L water	
Rhizoctonia root and crown rot	Compass 50 WG	11	3.8 g/ 100 L water	*Rhizoctonia* causes crown and root rot of several ornamentals. Apply Compass as a drench at the time of propagation. Compass may cause injury to petunia, violet and New Guinea impatiens.
	Heritage Maxx	11	0.4 L/ 1,000 L water	
	Medallion	12	300–600 mL/ 1,000 L water	
	Rovral WP, Rovral WDG	2	10 kg/ha in 5 L water	
	Senator 50 SC	1	910–1,190 mL/ 1,000 L water	
	Senator 70 WP	1	650–850 g/ 1,000 L water	

HYDRANGEA — HYDRANGEA

Disease	Product	Group*	Rate	Notes
DISEASES AFFECTING *HYDRANGEA*				
Botrytis blight (*Botrytis cinerea*)	Phyton 27	M	see label	Infected plant parts develop a fuzzy, grey growth under very high humidity. Remove all fading and diseased plant parts promptly, especially when wet weather is predicted. Do not crowd plants. Maintain adequate sunlight and good air circulation.
Cercospora leaf spot (*Cercospora hydrangeae*)	Heritage Maxx	11	1.6 L/ 1,000 L water	Look for circular, distinct grey lesions encircled by purplish halos. Apply fungicides to protect leaves at the first sign of disease symptoms or preventively during periods of prolonged leaf wetness.
Powdery mildew (*Erysiphe polygoni*)	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	Powdery mildew appears as a white, powdery fungal growth on the tops of leaves. Early signs include small, circular, whitish colonies. MilStop can be used for the suppression of powdery mildew. Start application of MilStop at the first sign of disease.
	MilStop	NC	2.8–5.6 kg/ 1,000 L water	
	Palladium WG	9, 12	see label	
Rust (*Pucciniastrum hydrangeae* and others)	Heritage Maxx	11	0.8–1.6 L/ 1,000 L water	Look for small, orange pustules on the undersides of leaves in mid-to-late summer. Protect healthy foliage with fungicides where disease incidence is severe. Rust on hydrangea rarely impacts plant health.

JUGLANS — BUTTERNUT, WALNUT

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *JUGLANS*				
Walnut blister mite (*Eriophyes erinea, Aceria erinea*)	There is no product registered at the time of this publication.			This mite feeds on walnut and butternut leaves, causing yellow or brown felt-like galls. Overwintering mites become active as new spring growth begins.
Walnut caterpillar (*Datana integerrima*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Larvae are black with long grey hairs. Larvae feed on walnut and hickory foliage. Caterpillar colonies descend tree trunks and molt, leaving a conspicuous clump of grey cast skins on the trunk. Adult moths lay eggs in early July, and larvae feed until the end of August. Spray when larvae first appear, usually in July. Spray or remove larvae clustering on the trunk.
White-marked tussock moth (*Orgyia leucostigma*)	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.

JUGLANS — BUTTERNUT, WALNUT

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *JUGLANS* (cont'd)				
Fall webworm (*Hyphantria cunea*)	Dipel	11A	see label	Caterpillars build large silk tents on the ends of branches starting in late June, spreading over several branches throughout the summer and becoming very noticeable by late August. Commonly found on walnut, cherry, crabapple, box-elder and ash. Open the tent to find pale yellow-green caterpillars with black spots and long hairs extending out from body. There are black-headed and red-headed morphs of larvae. Adults emerge over a period of weeks, starting in June. Adults are white and lay eggs on lower leaf surfaces beginning in late June. Chemical control is rarely needed. Remove webs and caterpillars by hand and destroy. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pounce 384 EC	3A	45–90 mL/ha	
DISEASES AFFECTING *JUGLANS*				
Butternut canker (*Sirococcus clavigignenti-juglandacearum*)	There is no product registered at the time of this publication.			Dark brown-black cankers appear on branches and/or stems. Cankers are sunken, elongated and diamond-shaped. Dying branches can often be seen in the crown. Older cankers may show successive rings of callus loosely covered with bark. During spring, thin black fluid oozes from cracks in the bark and deposits a dried, sooty black stain. There is no known treatment for this disease.

JUNIPERUS — JUNIPER

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *JUNIPERUS*				
Juniper midge (*Contarinia juniperina*)	Cygon 480 E	1B	2 L/ 1,000 L water	This midge is a problem on eastern red cedar, *Juniperus virginiana*. Tips of injured plant shoots turn brown during June and July due to midge larvae feeding from the previous summer. Injury is rarely serious. Adult midges are active from late May to July. If needed, treat the foliage at 2–3-week intervals beginning in late June.
Juniper scale (*Carulaspis juniperi*)	Insecticidal soap	UN	see label	Adults appear as a small, circular, white scale with a yellow centre. Needles of juniper and arborvitae will turn yellow. This scale insect can infest all juniper species, especially *Pfitzer* and *Savin*. Juniper scale overwinters as eggs underneath the dead female shells, which makes dormant oil treatments ineffective. Sooty mould fungus sometimes develops. Treat crawlers about mid-June and repeat as needed, starting when *Philadelphus* is in full bloom and *Catalpa* are beginning to bloom. Do not use Malathion on Savin or *Canaertii* junipers.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	

JUNIPERUS — JUNIPER				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *JUNIPERUS* (cont'd)				
Juniper tip gall midge (*Oligotrophus apicis, O. betheli*)	There is no product registered at the time of this publication.			These midge larvae feed inside vegetative buds and cause galls to form on the ends of shoots. *Juniperus scopulorum* is particularly susceptible. *O. apices* causes an enlarged bud gall and *O. betheli* causes infested bud scales to reflex into star-shaped "flower" like structures. Prune out green galls and destroy them to reduce the number of next-generation adults that emerge.
DISEASES AFFECTING *JUNIPERUS*				
Blight (dieback) (*Kabatina juniperi*)	Copper Spray	M 01	4 kg/ 1,000 L water	This blight appears as a dieback of new shoots. Stressed plants and wounded shoots are more susceptible.
	Dithane M-45, Dithane 80, Dithane DG 75, Dithane Rainshield	M 03	2.75–3.5 kg/ 1,000 L water	Avoid overhead irrigation late in the day. Do not crowd plants. Maintain adequate sunlight and good air circulation. If possible, prune out infected twigs well below the site of the symptoms. Dip pruners in disinfectant as frequently as possible. Maintain healthy growth, but do not encourage soft, succulent growth through excessive pruning or over-fertilization. Shoot blight of juniper can also be caused by the fungus *Phomopsis*, but *Kabatina* is most commonly found in Ontario. Laboratory diagnosis is needed to distinguish between *Kabatina* and *Phomopsis*. Spray when spring growth starts. Repeat at 10-day intervals until growth stops.
Cedar-apple rust (*Gymnosporangium juniperi-virginianae*) Hawthorn rust (*G. globosum*) Quince rust (*G. clavipes*)	Nova	3	340 g/ 1,000 L water	Cedar-apple rust and hawthorn rust cause slimy, orange galls on juniper twigs in mid-spring. When dormant, cedar-apple rust galls and hawthorn rust galls can be located in juniper foliage by their orange horns. Quince rust causes cankers in the twigs. Starting in mid-summer, apply Nova every 10–14 days when infected alternate rosaceous hosts (Malus, Crataegus, Amelanchier, etc.) are sporulating. To avoid resistance, rotate Nova with registered fungicides from other chemical families where possible. Nova can also be tank-mixed with Dithane DG at the rate of 150 g/100 L (1.5 g/ L). Prune out dormant galls and cankers on infected branches before May. Separate rosaceous rust hosts from junipers. Plant resistant junipers where possible.

LARIX — LARCH

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *LARIX*				
Cutworms (various species)	Confirm 240 F	18	0.5 L/ha	Cutworms are moth larvae that hide in shallow soil burrows during the day and crawl up plant stems to harvest plant parts at night. Injury appears as chewed or girdled stems on woody species and clipped stems on herbaceous plants. Larvae are greyish-brown in colour, often with black spots along their sides and stripes along their body. They have three pairs of true legs, four pairs of fleshy prolegs and one pair of "claspers" at the end of their abdomen. They can be up to 3 cm long. Late instar larvae overwinter and pupate in spring. Use insecticides to reduce cutworm populations at the first sign of feeding injury. Treat plants with insecticides in the evening since the larvae feed at night. Applications of Confirm should be made with a high-volume spray and sprayed to run-off (for greenhouse use). Application of Pounce 384 EC should be made under warm, moist conditions when larvae are small.
	Pounce 384 EC	3A	180 mL/ 1,000 L water	
Larch casebearer (*Coleophora laricella*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Larvae feed from within papery cases that resemble a killed needle. These straw-coloured larval cases protect larvae while they migrate to new feeding sites. Larvae will migrate from overwintering sites and fasten their cases to newly emerging foliage in the spring. Larvae chew a hole into the green needle and mine the tissue within. Straw-coloured mined needles make the tree appear frost-damaged. Larvae feed in needles until late summer. Treat emerging needles with insecticides to reduce young larval populations in early spring.
Larch sawfly (*Pristiphora erichsonii*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Larvae are grey with black heads and can be up to 20 mm long. Larvae are active in mid-to-late summer. Monitor for shepherd's crooks, caused by egg-laying, in the new growth. Treat foliage in July when larvae are still young.
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
Tarnished plant bug (*Lygus lineolaris*)	Actara 25 WG, Flagship 25 WG	4A	210–280 g/ha	These are small (5 mm), yellowish-brown insects. Adults have wings that are folded in an X pattern. Tarnished plant bugs feed by inserting their mouthparts inside leaf tissue and sucking out the contents, leaving the lower and upper epidermis behind. The resulting injury appears as small, clear "windows" on leaf tissue of broad-leaved plants. On conifers, feeding often causes terminal growth to yellow and become distorted and bushy. Treat in spring and early summer to manage populations of this insect.
	Ripcord 400 EC	3A	172 mL/ha	
Woolly larch adelgid (*Adelges laricis*)	Malathion 500 EC	1B	1.25 L/ 1,000 L water	Adelgids feed on needles and are covered by waxy, woolly, cottony threads. Heavy infestations look like snow. Damaged leaves become bent or twisted. Treat foliage thoroughly when adelgids first appear.

LIGUSTRUM — PRIVET

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *LIGUSTRUM*				
Privet rust mite (*Aculus ligustri*)	There is no product registered at the time of this publication.			Mites become active as new leaves emerge, from May to November. Damage appears as leaf russetting. This insect is more active in cool weather.
Privet thrips (*Dendrothrips ornatus*)	Ference	28	37.5–75 mL/ 100 L water	These tiny, narrow insects suck plant sap from inside buds and newly emerging leaves. Injury appears as yellowish flecks on leaves. Leaves look greyish or dusty. Treat at the first sign of infestation and repeat as needed. Ference provides only suppression of thrips. Do not make more than 2 applications of Ference per year.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	500 mL/ 1,000 L water	
	Success 480 SC	5	50 mL/ 1,000 L water	
DISEASES AFFECTING *LIGUSTRUM*				
Anthracnose and twig blight (*Glomerella* sp.)	Nova	3	340 g/ 1,000 L water	Leaves turn brown and remain attached to twigs. Prune and destroy infected branches during dry weather. Spray fungicides to protect emerging shoots in spring. *Ligustrum amurense*, *L.* x *ibolium* and *L. obtusifolium regelianum* do not appear susceptible to this fungal disease.
Leaf spot (several fungi)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	Symptoms appear as brown spots on leaves, especially after a wet spring. Treat plants during prolonged wet conditions. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
Rhizoctonia root rot	Compass 50 WG	11	3.8 g/ 100 L water	Rhizoctonia is a fungus that causes crown and root rot on several ornamentals. Lab testing will be necessary to confirm diagnosis. Protect healthy plants with fungicides at the first sign of disease.
	Heritage Maxx	11	0.4 L/ 1,000 L water	
	Medallion	12	300–600 mL/ 1,000 L water	

LIRIODENDRON — TULIPTREE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *LIRIODENDRON*				
Tuliptree aphid (*Macrosiphum liriodendri*)	Altus	4D	500–750 mL/ha	This is a green aphid found on the underside of leaves from late June to late September. Treat when aphids first appear and repeat as needed. Excessive fertilization or pruning can cause excessive, susceptible succulent growth that is attractive to insects. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.25 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks	
	Trounce	3A	50 L/ 1,000 L water	

LIRIODENDRON — TULIPTREE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *LIRIODENDRON* (cont'd)				
Tuliptree scale (*Toumeyella liriodendri*)	Ference	28	37.5–75 mL/ 100 L water	This scale insect appears as a dark-brown, rounded scale. Tuliptree scale attacks several deciduous tree species.
	Horticultural oil	UN	20–30 L/ 1,000 L water	Use horticultural oil as a dormant treatment in early spring. Use any of the other materials when crawlers appear in August. Landscape Oil (horticultural oil) can be used when plants are dormant or in summer when new foliage is fully expanded and hardened off. See product label for rates and tolerant plants.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	Do not make more than 2 applications of Ference per year.

LONICERA — HONEYSUCKLE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *LONICERA*				
Honeysuckle aphid (*Hyadaphis tataricae*)	Altus	4D	500–750 mL/ha	Feeding injury from this aphid causes early-season curling and dwarfing of terminal shoots. Affected stems eventually die, causing a witches' broom appearance. Injury may completely disfigure heavily affected plants. Dead shoots may be visible the following spring. Prune out witches' brooms (15 cm below the broom) when plants are dormant, before buds begin to break in early spring.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	Use up to 2 applications of Closer per crop cycle.
	Ference	28	37.5–75 mL/ 100 L water	Do not make more than 2 applications of Ference per year.
	Horticultural oil	UN	see label	Apply horticultural oil after pruning to suppress overwintering eggs. Apply treatment when buds begin to break. Repeat at least once after a 3-week interval. Susceptible varieties include *Lonicera* x *bella* 'Dropmore,' *L. korolkowii* 'Zabelli,' *L. tatarica* 'Grandiflora,' 'Rosea,' 'Hack's Red,' and 'Red Giant.'
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks	
DISEASES AFFECTING *LONICERA*				
Honeysuckle blight (*Herpobasidium deformans*)	Dithane DG 75, Dithan Rainshield	M 03	2 kg/ 1,000 L water	Symptoms appear as new leaves expand in spring. Infected leaves curl and turn brown. The veins tend to remain green at first. Many species of honeysuckle are susceptible. Spray fungicides when the leaf buds show a green tip or up to 1.25 cm of green leaf. Repeat applications in 10–14-day intervals. Avoid overhead irrigation late in the day. Remove and destroy fallen, infected leaf material in autumn to reduce inoculum the following spring.
Powdery mildew	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	This fungus appears as a white, powdery growth on the tops of leaves. Treat at the first sign of disease and repeat applications to protect healthy tissue.
	Nova	3	340 g/ 1,000 L water	
	Palladium WG	9, 12	see label	

MAGNOLIA — MAGNOLIA

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *MAGNOLIA*				
Magnolia scale (*Neolecanium cornuparvum*)	Ference	28	37.5–75 mL/ 100 L water	Mature scales are large (up to 1 cm) and pinky-orange in colour. Feeding injury causes honeydew, sooty mould and twig dieback on *Magnolia acuminata*, *M.* x *soulangeana* and *M. stellata*. Nymphs are purple in mid-summer, turning white by late summer. They overwinter as tiny nymphs on the current season's wood. Do not make more than 2 applications of Ference per year. Dormant oil applications can suppress overwintering nymphs in fall and/or early spring. Landscape Oil (horticultural oil) can be used when plants are dormant or in summer when new leaves are fully expanded and hardened off. See product label for rates and tolerant plants.
	Horticultural oil	UN	20–30 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 WP, Orthene 97 SG	1B	see label	

MALUS — APPLE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *MALUS*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids are small, soft-bodied insects that feed by sucking on plant tissue. They produce honeydew that often attracts other insects (e.g., ants) and sooty mould growth. Treat when adults first appear, and repeat as required. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year. *Do not apply Kontos during bloom as this product is toxic to bee brood.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Endeavor 50 WG	9B	10–20 g/ 100 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	*Kontos	23	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	see label	
	Tristar 70 WSP	4A	3 solupaks	
	Trounce	3A	50 L/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	

MALUS — APPLE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *MALUS* (cont'd)				
Apple rust mite (*Aculus schlechtendali*)	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	Adult females overwinter in bark crevices or cracks in twigs. When leaves begin to emerge, the overwintered females move to feed on the new leaf tissue. Apple rust mites feed on both surfaces of host tree leaves, causing them to turn brown and dry. The first symptom of infestation is an upward curling of the leaf. Severe infestation can result in all the leaves turning brown. Dyno-Mite can be applied as soon as mites appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Landscape Oil (horticultural oil) can be used when plants are dormant to control overwintering females in bark and twig crevices. Bark injury may occur on Red Delicious, Empire and Mutsu apples. See product label for rates and tolerant plants. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal.
	Dyno-Mite SC	21A	470 mL/ha	
	Horticultural oil	UN	see label	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
Apple Clearwing Moth Borer *(Synanthedon myopaeformis)* Dogwood Borer *(Synanthedon scitula)*	Delegate	5	420 g/ha	Delegate is registered for the control of dogwood borer and to reduce the numbers of apple clearwing moth. Apply using a handgun or backpack sprayer only, direct the spray to cover the lower trunk of the tree, particularly the graft union and any pruning cuts. Thorough coverage is essential. Apply 1-2 applications at a 14 day interval targeting the 1st instar larval stage (in-season/summer). Apply Delegate a maximum of two applications per year. Rimon is registered as a direct application to the tree trunk. Apply 1-2 applications in the summer at a 14 day interval targeting 25-75% egg laying to prevent egg hatch and 1st instar larvae establishment. Maximum of 2 applications of Rimon per growing season.
	Rimon 10 EC	15	1.4 L/ 1,000 L water	
Brown marmorated stink bug *(Halyomorpha halys)*	Actara 25 WG	4A	385 g/ha	This brown stink bug is a new pest introduced into North America. This plant bug feeds openly on fruit, making them unmarketable. It also feeds on the foliage of over 60 plants (e.g., *Acer*, *Amelanchier*, *Buddleia*, *Catalpa*, *Cercis*, *Ilex*, *Juglans*, *Malus*, *Prunus*, *Pyrus*, *Rosa*, *Tilia*, *Viburnum*) and can cause serious economic losses in crops. Although it has not been detected in Ontario nurseries, it has been intercepted in residential neighbourhoods (inside homes) in southern Ontario. Malathion and Actara, as foliar treatments, provide suppression of brown marmorated stink bug.
	Malathion 85E	1B	1.22 L/ha	

MALUS — APPLE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *MALUS* (cont'd)				
Codling moth (*Cydia piononella*)	Confirm 240 F	18	1 L/ha	There is a pheromone lure available for this pest. Apply insecticides just after first sustained moth catch. Apply Confirm at larval hatch. Allow 3–7 days for larval mortality. Repeat the application of Confirm every 14–21 days, with a maximum of 4 applications per year. Apply Silencer at larval hatch. Repeat application every 14 days with a maximum of 3 applications per year. For the control of each generation, apply Delegate at first egg hatch based on pheromone trap catches and degree days after biofix dates. These pests must be controlled before the larvae penetrate the fruit so early timing is critical. Repeat at 14 day intervals to maintain control depending on pest pressure.
	Delegate	5	420 g/ha	
	Silencer 120 EC	3A	83 mL/ha	
Eastern tent caterpillar (*Malacosoma americanum*)	Dipel	11A	see product(s) label	This caterpillar has one white stripe down its back. Colonies feed early in the season. Silken tents appear in the forks of branches, mainly of apple, cherry and hawthorn trees. Prune and destroy overwintering egg masses. These are silver in colour, about 1–2 cm long, in a raised band circling a twig. They hatch when buds break in spring. Treat then or at the first sign of webs. Young larvae (< 2 cm) hide in tents during the day. Where infestations are light, remove and destroy them in early spring. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	see label	
	Pounce 384 EC	3A	90 mL/ 1,000 L water	
	Success	5	25 mL/ 1,000 L water	
European red mite (*Panonychus ulmi*)	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	These mites overwinter as tiny red eggs on twigs. Apply oil when plants show 1.25 cm of green tissue. Horticultural oil may cause bark injury on Red Delicious, Empire and Mutsu apples. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days apart. Landscape Oil (horticultural oil) can be applied when plants are dormant and in summer when new leaves are fully expanded and hardened off. Bark injury may occur on Red Delicious, Empire and Mutsu apples. See product label for rates and tolerant species. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal.
	Dyno-Mite SC	21A	470 mL/ha	
	Horticultural oil	UN	20–30 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	2.07 L/ha	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
Fall cankerworm (*Alsophila pometaria*) Spring cankerworm (*Paleacrita vernata*)	Dipel 2X DF	11A	125 g/400 L	Cankerworms are greenish-to-black loopers (inchworms) that appear early in the season and feed on the leaves of many deciduous hosts. Treat when larvae appear in mid-May, when *Acer platanoides* and *Magnolia* x *soulangeana* are blooming. To help reduce the next generation of fall cankerworm, place sticky bands around tree trunks, close to the ground, by late October. Bands will help to trap the flightless adult female moths as they emerge from the ground and crawl up the tree trunk.
	Imidan	1B	0.89 kg/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Malathion 500 EC	1B	2.5 L/ 1,000 L water	
	ReVokBTK	11A	2.9–4.8 L/ha	
	Thuricide 48 LV	11A	1–1.6 L/ha	

MALUS — APPLE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *MALUS* (cont'd)				
Fall webworm (*Hyphantria cunea*)	Dipel	11A	see label	Caterpillars build large silk tents on the ends of branches starting in late June, spreading over several branches throughout the summer and becoming very noticeable by late August. Commonly found on walnut, cherry, crabapple, box-elder and ash. Open the tent to find pale yellow-green caterpillars with black spots and long hairs extending out from body. There are black-headed and red-headed morphs of larvae. Adults emerge over a period of weeks, starting in June. Adults are white and lay eggs on lower leaf surfaces beginning in late June. Chemical control is rarely needed. Remove webs and caterpillars by hand and destroy. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pounce 384 EC	3A	45–90 mL/ha	
Gypsy moth (*lymantria dispar*)	Dragnet FT EC	3A	230 mL/ 1,000 L water	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs, most notably basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying ReVokBTK or Thuricide. A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. ReVokBKT and Thuricide are most effective when sprayed before larvae become mature (before the head capsule turns yellow).
	Imidan 50 WP	1B	3.75 kg/ha	
	Imidan WP	1B	2.68 kg/ha	
	Orthene 75 SP	1B	see label	
	ReVokBTK	11A	2.4–4 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide HPC	11A	7.14–12 L/ 1,000 L water	
	Thuricide 48LV	11A	2–4 L/ha	
Japanese beetle (*Popillia japonica*)	**Adult management:**			Japanese beetle adults are metallic green and copper in colour and about 13 mm long. They are easily recognized by the six tufts of white hair on each side of the abdomen. As the beetles feed, they consume and skeletonize foliage. Preferred hosts include members of the rosaceous family, maple, birch, linden and fruit trees. Spray adulticides when adults appear in early July, when the *Yucca filamentosa* is blooming. Larvae are C-shaped milky-white grubs about 25 mm long with brown heads and 3 pairs of legs. They can be distinguished from other white grubs by a V-shaped arrangement of spines on the underside of the abdomen. Larvae are most commonly found feeding on fibrous roots of turfgrass. Lorsban 4E is a rescue treatment to allow shipping from infested to uninfested regions. Apply to soil when grubs are young and actively feeding near the soil surface. Apply as a coarse spray and irrigate with 1–2 cm of water to wash the insecticide into the underlying soil. For containerized stock, submerge the root ball into a solution of Lorsban 4E (45 mL/10 L water) until all bubbling stops. Apply Intercept 60 WP once per year, during the mating period/ egg-laying period and up to egg hatch (usually late June/ early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering.
	Imidan 50 WP	1B	3.75 kg/ha	
	Imidan WP	1B	2.68 kg/ha	
	Larval management:			
	Acelepryn	28	0.50 L/ha	
	Altus	4D	500–750 mL/ha	
	Intercept 60 WP	4A	see label	
	Lorsban 4E, Lorsban NT	1B	4.5 L/ 1,000 L water (rescue treatment for shipping)	
	Tristar 70 WSP	4A	5 solupaks	

MALUS — APPLE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *MALUS* (cont'd)				
Leafrollers: Fruit tree leafroller (*Archips argyrospila*) Redbanded leafroller (*Argyrotaenia velutinana*)	Dipel	11A	see label	Leafrollers are caterpillars that feed while hidden in folded or rolled leaves. Fruit tree and redbanded leafrollers primarily affect fruit trees but also attack many shade trees and ornamentals. Apply the insecticide to foliage soon after leaves emerge in early June.
Oystershell scale (*Lepidosaphes ulmi*)	Insecticidal soap	UN	see label	This scale insect infests over 125 species of forest, shade, fruit and ornamental trees. In heavy infestations, greyish scales completely encrust twigs and stems and can kill branches and trees. Mature females are 3 mm long and rounded in the rear. Since this scale insect overwinters as eggs under dead female shells, dormant treatments in fall and early spring are ineffective. Use insecticides against crawlers in late May. Repeat in 10 days, when *Spiraea* x *vanhouttei* is blooming. Ensure good coverage of trunk, branches and leaf bottoms.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	see label	
Tentiform leafminer (*Phyllonorycter blancardella*)	Confirm 240 F	18	see label	Use insecticides to control the first generation during the prebloom or calyx stage. Early mines are only visible from lower leaf surfaces. Later stages are visible from upper leaf surfaces. There are 3 generations per year. Controlling the first generation is more effective than controlling subsequent generations.
	Tristar 70 WSP	4A	5 solupaks	
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Do not exceed more than 2 applications of Nealta per year.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	2.07 L/ha	
	Nealta	25	1L/ha	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	

MALUS — APPLE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *MALUS* (cont'd)				
Western flower thrips (*Frankliniella occidentalis*)	Ference	28	37.5–75 mL/ 100 mL water	Western flower thrips can feed openly on new leaves or from inside terminal vegetative buds and flower buds. They have piercing-sucking mouthparts that suck out plant juices of immature leaves and flowers, resulting in major distortion and colour flecking when flowers and foliage do emerge. Injury may be confused with that of leafhoppers. Ference provides only suppression of thrips. Do not make more than 2 applications of Ference per year. Do not make more than 3 applications of Success per year.
	Success	5	50 mL/ 1,000 L water	
White-marked tussock moth (*Orgyia leucostigma*)	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.
DISEASES AFFECTING *MALUS*				
Apple scab (*Venturia inaequalis*)	Aprovia, Aprovia Top	7, 3	375 L/ha (see label)	Scab infection causes purplish blotches on leaves and lesions on fruit. Start fungicide applications when leaf buds begin to break and show green tip. Repeat throughout bloom and leaf emergence, every 7–10 days during spring, especially before rainy weather. Rotate fungicides of different chemical families/groups and consider using adjuvents and stickers to increase efficacy. For more information, see OMAFRA Crop Protection Guide for Apples publication 360A, see table 3–5. Activity of Fungicides on Apple Diseases. Usually disease spread diminishes after new leaves harden off, cease fungicide treatment. Clean up and remove/destroy fallen leaves in autumn to help reduce winter carry-over. Prune to improve air circulation through the canopy. Try to use resistant cultivars (e.g., Sugar Tyme). Nova is a triazole fungicide and should be rotated with fungicides of other chemical families to manage resistance.
	Banner MAXX	3	14 mL/ 100 L water	
	Banner EC 130	3	17 mL/ 100 L water	
	Captan 50 WP	M 04	see label	
	Compass 50 WG	11	14–17.5 g/ 100 L water	
	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Dithane	M 03	see label	
	Equal 65 WP	U 12	1.08–2.25 kg/ha	
	Flint 50WG	11	140–175/ha	
	Inspire Super	3, 9	see label	
	Maestro 80 DF, Maestro WSP	M 04	see label	
	Manzate DF	M 03	see label	
	Microscopic Sulphur	M 02	6.5 kg/ 1,000 L water	
	Nova	3	340 g/ 1,000 L water	
	Serenade Max	BM 02	3–6 kg/ha	
	Supra Captan 80 WDG	M 04	see label	

MALUS — APPLE				
Pest	**Product**	**Group***	**Rate**	**Notes**
DISEASES AFFECTING *MALUS* (cont'd)				
Cedar-apple rust (*Gymnosporangium juniperi-virginianae*)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	Orange spots on leaf surface appear in early summer, followed by cream-coloured, finger-like structures on the underside of leaves by mid-to-late summer. Remove alternate hosts (junipers) where possible. Treat with fungicides when sporulation (slimy orange galls) begins on the alternate host (*Juniperus*), in mid-spring. Spores from juniper can infect alternate rosaceous hosts (*Malus*, *Crataegus*, *Amelanchier*, etc.). Repeat fungicidal applications every 10–14 days if needed.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Dithane DG, M-45, 80 WP	M 03	2 kg/ 1,000 L water	
	Ferbam 76 WDG	M 03	1.25–2 kg/ 1,000 L water	
	Manzate DF	M 03	6 kg/ha	
	Nova	3	340 g/ 1,000 L water	
	Pristine WG	43	1.0–1.6 kg/ha	
Fire blight (*Erwinia amylovora*)	BlightBan A506	Bio	370–530 g/ 1,000–2,000 L water	Fire blight affects succulent, vegetative growth. Dead, dry leaves persist on infected branches. Some cultivars are resistant to this disease. Spray bactericidal products at early bloom, full bloom and petal fall when the weather is warm and humid, and fire blight is a recurring problem. Avoid excessive pruning and nitrogen fertilization in spring. During dormancy, prune out infected branches about 30 cm below the cankered area when the tree is dry. Blightban and Bloomtime are biopesticides that may help suppress fire blight. For more information, see OMAFRA Crop Protection Guide for Apples, publication 360, Table 3-5, Activity of Fungicides on Apple Diseases.
	BlightBan C9-1	Bio	370–500 g/ 1,000–2,000 L water (see label)	
	Bloomtime Biological FD	Bio	375–500 g/ 1,000–2,000 L water	
	Copper Spray	M 01	see label	
	Kasumin 2L	24	5 L/ 1,000 L water (see label)	
	Kasumin 4L	24	2.5 L/ 1,000 L water	
	Serenade Max	BM 02	2–3 kg/ha	
	Streptomycin 17	25	600 g/ 1,000 L water	
Powdery mildew (*Podosphaera leucotricha*)	Compass 50 WG	11	14–21 g/ 100 L water	In this disease, a white, powdery substance develops on the tops of leaves in summer. Powdery mildew may lead to stunting and leaf drop. Treat with fungicides when symptoms first appear. Repeat every 10–14 days as needed. To avoid resistance to Nova, rotate with registered fungicides from other chemical families where possible.
	Funginex DC	3	2.5 L/ha	
	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	
	Microscopic Sulphur	M 02	6.5 kg/ 1,000 L water	
	Palladium WG	9, 12	100 g/ 100 L water	
	Pristine WG	7, 11	see label	
	Nova	3	340 g/ 1,000 L water	
	Serenade Max	BM 02	3–6 kg/ha	

ORNAMENTAL TREES AND SHRUBS — VARIOUS

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING ORNAMENTAL TREES AND SHRUBS				
Brown marmorated stink bug (*Halyomorpha halys*)	Actara 25 WG, Flagship 25 WG	4A	280 g/ha	This brown stink bug is a new pest introduced into North America. This plant bug feeds openly on fruit, making them unmarketable. It also feeds on the foliage of over 60 plants (e.g., *Acer*, *Amelanchier*, *Buddleia*, *Catalpa*, *Cercis*, *Ilex*, *Juglans*, *Malus*, *Prunus*, *Pyrus*, *Rosa*, *Tilia*, *Viburnum*) and can cause serious economic losses in crops. Although it has not been detected in Ontario nurseries, it has been intercepted in residential neighbourhoods (inside homes) in southern Ontario. Malathion, Actara and Flagship, as foliar treatments, provide suppression of brown marmorated stink bug.
	Malathion 85E	1B	see label	

PACHYSANDRA — PACHYSANDRA

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PACHYSANDRA*				
Euonymus scale (*Unaspis euonymi*)	Horticultural oil	UN	20 L/ 1,000 L water	This greyish, pear-shaped scale found commonly on euonymus also affects bittersweet (*Celastrus*) and *Pachysandra*. It produces 2 generations a year; the second generation appears about 6 weeks after the first. Examine plants during the dormant season, prune out highly infested regions and use dormant oil. Apply insecticides as nymphs emerge. *Catalpa speciosa* are beginning to bloom at this time; *Kolkwitzia* and *Philadelphus* are also blooming. Repeat treatment after 7 days. Landscape Oil (horticultural oil) can be used when plants are dormant or in the summer when foliage is fully expanded and hardened off. See product label for rates and tolerant plants.
	Insecticidal soap	UN	see label	
	Orthene 75 SP	1B	see label	

PHLOX — PHLOX

Disease	Product	Group*	Rate	Notes
DISEASES AFFECTING *PHLOX*				
Powdery mildew	Folpan 50 WP	M 04	2 kg/ 1,000 L water	Powdery mildew appears as a white, powdery fungal growth on the tops of leaves. Early signs include small, circular, whitish colonies. MilStop and Rhapsody can be used for the suppression of powdery mildew. Start application at the first sign of disease.
	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	
	MilStop	NC	2.8–5.6 kg/ 1,000 L water	
	Nova	3	340 g/ 1,000 L water	
	Palladium WG	9, 12	see label	
	Rhapsody ASO	BM 02	1.0–2.0 L/ 1,000 L water	
Rust (various)	Nova	3	250–340 g/ 1,000 L water	In this disease, orange-brown lesions form on leaves. Protect healthy tissue with fungicide applications, especially during warm, wet conditions.

PICEA — SPRUCE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PICEA*				
Bagworm (*Thyridopteryx ephemeraeformis*)	Lagon 480 E	1B	2 L/ 1,000 L water	This moth pest is a native of North America. It has a wide host range but is most commonly found on spruce. Look for masses of dead needles hanging like small bags from the tips of branches. Eggs overwinter inside the bags. Larvae feed on needles, partially enclosed in a small woven case. Larvae form bags on branch tips in late summer and pupate inside. Males emerge and fly to bags containing flightless females to mate. As many as 1,000 eggs are laid inside each bag. Remove and destoy bags by early spring. Insecticides may be effective on young larvae only.
	Orthene 75 SP	1B	see label	
Black vine weevil, Taxus weevil (*Otiorhynchus sulcatus*)	Demand CS	3A	360 mL/ 1,000 L water	Larvae are small, white, legless grubs that eat fibrous roots or strip bark off larger roots. Infested plants grow slowly or fail to grow. Plants look dry and off-colour. Transplants often die without becoming established. Larval control is difficult. Adults are black snout beetles that hide in soil litter during the day and cut crescent-shaped notches in needle margins at night. They also attack eastern white cedar, spruce, hemlock, azaleas, yews and rhododendrons. In container production, they are also significant pests of several hosts, including herbaceous perennials. Adult weevils have fused wing covers and cannot fly. To control adults, treat the foliage, trunk bark and branches during the last week of June and in early July. Spray in the evening, as adult activity increases about an hour after sunset. To test treatment safety, treat some conifer seedlings, especially pine, before treating a larger area. Entomopathogenic nematodes (e.g., *Heterorhabditis* sp.) are available to help suppress populations of larvae. Nematodes work very well in infested containers but with less success in the field. Nematodes can be applied in late summer/early autumn and in mid-spring to suppress larval populations. See the product label for complete directions. To monitor for adults, place a piece of plywood around infested plant bases. Adult weevils will hide under the wood during the day. Or place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Do not use Demand CS or Silencer in residential areas.
	Flagship 25WG	4A	10.5–14 g/ 100 L water	
	Heterorhabditis bacteriophora	NC	see label	
	Met52 G	UNF	see label	
	Silencer 120 EC	3A	300 mL/ 1,000 L water	
Cooley spruce gall adelgid (*Adelges cooleyi*)	Malathion 500 EC	1B	1.25 L/ 1,000 L water	Nymphs of this adelgid feed inside long, plump galls on the current year's shoots of blue Colorado spruce, Engelmann spruce and Sitka spruce. Douglas fir is an alternate host. Feeding injury causes needles to twist and turn yellow. This adelgid does not form a gall on Douglas fir. Treat in early spring before bud break or in early October. Thoroughly cover crevices in the bark of terminal twigs and the bases of buds. On blue spruce, use only wettable powders to prevent foliage discolouration. If possible, remove and destroy galls in June.

PICEA — SPRUCE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PICEA* (cont'd)				
Cutworms (various species)	Confirm 240 F	18	500 mL/ha	Cutworms are moth larvae that hide in shallow soil burrows during the day and crawl up plant stems to harvest plant parts at night. Injury appears as chewed or girdled stems on woody species (and clipped stems on herbaceous plants). Larvae are greyish-brownish in colour, often with black spots along their sides and stripes along their body. They have three pairs of true legs, four pairs of fleshy prolegs and one pair of "claspers" at the end of their abdomen. They can be up to 3 cm long. Late instar larvae overwinter and pupate in spring. Use insecticides to reduce cutworm populations at the first sign of feeding injury. Treat plants with insecticides in the evening since the larvae feed at night. Applications of Confirm should be made with a high-volume spray and sprayed to run-off (for greenhouse use). Applications of Pounce 384 EC should be made under warm, moist conditions when larvae are small.
	Pounce 384 EC	3A	180 mL/ 1,000 L water	
Eastern spruce gall adelgid (*Adelges abietis*)	Horticultural oil	UN	20 L/ 1,000 L water	Nymphs of these adelgids feed inside pineapple-shaped galls at the base of current-year shoots on Norway, white, red and black spruce. Old galls remain attached for long periods, turning black and making the tree look unsightly. With light infestations, remove and destroy galls before midsummer. Use horticultural oil as a dormant treatment. Use any of the other materials when adelgids migrate to new shoots in mid-May. On blue spruce, use only wettable powders to prevent foliage discolouration, and avoid horticultural oils because they remove the blue hue of blue spruce foliage.
	Malathion 500 EC	1B	1.25 L/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks	
Gypsy moth (*Lymantria dispar*)	Dipel	11A	see label	Gypsy moth larvae appear as dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs, most notably basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide 48LV	11A	2–4 L/ha	

PICEA — SPRUCE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PICEA* (cont'd)				
Pine needle scale (*Chionaspis pinifoliae*)	Cygon 480 E	1B	1.5 L/ 1,000 L water	Pine needle scale causes whitish flecks on pine and spruce needles. Reddish crawlers appear in late May, then turn yellowish. There are 2 generations per year. Infestations often start on lower branches. Prune out small infestations in late winter and early spring. Dormant treatments are ineffective because pine needle scale overwinter as eggs underneath the dead female shells. Crawlers are active when *Syringa vulgaris* and *Spiraea* x *vanhouttei* are blooming in late May. Treat at that time and again about 10 days later. Landscape Oil (horticultural oil) can be applied when plants are dormant and in summer when foliage is fully expanded and hardened off. Permanent discolouration of foliage will occur to *Pinus strobus* and blue cultivars of both *Juniperus* and *Picea*. See product label for rates and tolerant plants.
	Horticultural oil	UN	20–30 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Lagon 480	1B	1.5 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	2.445 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
Spruce bud scale (*Physokermes piceae, P. hemieryphus*)	Ference	28	37.5–75 mL/ 100 L water	This scale insect is a rounded, mahogany-brown scale that clusters on spruce. Lower branches become ragged, with some dieback. Monitor for honeydew and sooty mould. Spray to control the crawlers in mid-July. Repeat 10 days later. Do not make more than 2 applications of Ference per year. Landscape Oil (horticultural oil) can be applied when plants are dormant and in summer when new leaves are fully expanded and hardened off. Permanent discolouration of foliage will occur to blue cultivars of both *Juniperus* and *Picea*. See product label for rates and tolerant plants.
	Horticultural oil	UN	20–30 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Lagon 480 E	1B	1.5 L/ 1,000 L water	
	Malathion 500 EC	1B	2.5 L/ 1,000 L water	
Spruce budworm (*Choristoneura fumiferana*) Also see under *Abies*.	Cygon 480 E	1B	1.5 L/ 1,000 L water	This is a widespread and important defoliator of balsam fir and spruce. It is seldom a problem on landscape trees. Larvae begin to feed as buds break, and they continue to feed until mid-to-late June. They have a black head and brownish body with four light spots on the back of each segment. There is 1 generation per year. In mid-spring, apply general-coverage spray to control larvae. Use Mimic to control early instar larvae; allow 3–7 days for larval mortality. A second application of Mimic may be needed. On balsam fir, overwintering larvae become active about 2 weeks before bud break. Apply general-coverage spray to control larvae from mid-May to mid-June. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dipel	11A	see label	
	Dragnet FT EC	3A	160 mL/ 1,000 L water	
	Lagon 480	1B	1.5 L/ 1,000 L water	
	Lannate	1A	270–540g/ha	
	Malathion 500 EC	1B	2.5 L/ 1,000 L water	
	Mimic 240 LV	18	290 mL/ha	
	Pounce 384 EC	3A	45–90 mL/ha	
	ReVokBTK	11A	see label	
	Thuricide HPC	11A	see label	
	Thuricide 48LV	11A	see label	
Spruce needleminer (*Taniva albolineana, Endothenia albolineana*)	Lagon 480 E	1B	1.5 L/ 1,000 L water	Needleminer larvae bore into the bases of old needles. Young larvae feed in groups, while older larvae feed alone. Larvae build unsightly nests of dead needles and frass, held together by fine silk strands. Small grey moths appear throughout infested plants in late May and June. Apply insecticide to foliage about mid-June and repeat in late June. In the fall, or in spring before buds swell, dislodge nests with a strong stream of water.
	Malathion 500 EC	1B	2.5 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	

PICEA — SPRUCE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PICEA* (cont'd)				
Spruce spider mite (*Oligonychus ununguis*)	Cygon 480 E	1B	1.5 L/ 1,000 L water	Overwintered eggs hatch in early May, when *Amelanchier laevis* and *Magnolia* x *soulangeana* are in full bloom. Mites prefer older needles as feeding sites. To monitor for mites, use a hand lens to check the undersides of twigs and needles for tiny reddish eggs or brown mites with black backs. Shake a branch over a white sheet of paper and look for crawling specks. Apply miticides when mites first appear. Kanemite is effective against mobile life stages but may also reduce egg viability. Use horticultural oil as a dormant treatment in early spring to target eggs and newly hatched nymphs. Do not use horticultural oil on white pine or blue cultivars of Colorado spruce or juniper. Landscape Oil is a brand of horticultural oil that can be used on labelled plants in summer, when leaves are fully expanded and hardened off (see product label). If mite populations are still significant, make 2 applications of other miticides at 10-day intervals when mites exist in spring. Do not exceed 2 applications of Nealta per season. Many predatory mites co-exist with pest mite populations. To conserve predatory mites, try miticides that have less impact on these beneficials, such as Vendex and Floramite.
	Floramite SC	20D	625 mL/ 1,000 L water	
	Horticultural oil	UN	20–30 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	Lagon 480	1B	1.5 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Nealta	25	1 L/ha	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Vendex 50 W	12	50–100 g/ 100 L water	
Strawberry root weevil (*Otiorhynchus ovatus*)	Met52 G	UN	see label	Strawberry root weevil larvae are small, white, legless grubs that eat fibrous roots or strip bark from larger roots. The reddish-brown flightless adult is less than 6 mm long and is much smaller than the black vine weevil. Adults hide during the day and feed at night. Adults are active in late June and early July, when *Wiegela florida* and *Syringa reticulata* are blooming. Adults injure plants by puncturing or girdling the current season's shoots while feeding. Infested plants grow slowly or fail to grow. They look dry and off-colour. Transplants often die without becoming established. These pests have a large host range. Commonly injured plants include white cedar, spruce and juniper. To monitor for adults, wrap a sheet of burlap around infested plant bases. Adult weevils will hide in the burlap during the day. Place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Pounce 384 EC is registered for use on seedlings. To test treatment safety, treat some conifer seedlings before treating a larger area.
	Pounce 384 EC	3A	65 mL/ 1,000 L water	
Tarnished plant bug (*Lygus lineolaris*)	Actara 25 WG, Flagship 25 WG	4A	210–280 g/ha	Plant bugs are small (5 mm), yellowish-brown insects. Adults have wings that form an X pattern when folded closed. They feed by inserting their mouthparts inside leaf tissue and sucking out the contents, leaving the lower and upper epidermis behind. The resulting injury appears as small, clear "windows" on leaf tissue of broad-leaved plants. On conifers, feeding often causes terminal growth to yellow and become distorted and bushy. Treat in spring and early summer to manage populations of this insect.
	Ripcord 400 EC	3A	172 mL/ha	

PICEA — SPRUCE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PICEA* (cont'd)				
White grubs: European chafer (*Rhizotrogus majalis*) June beetle (*Phyllophaga* sp.)	**Larval management:**			These beetle larvae are referred to as "white grubs." They chew fibrous roots and girdle underground stems of many woody ornamentals (including *Cornus* sp.). To expose grubs to natural predators, cultivate infested fields before planting. Apply Intercept 60 WP once per year, during the mating period/egg-laying period and up to egg hatch (usually late June/early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application. Avoid overwatering. Apply Acelepryn any time that larvae are present or during the mating period/egg-laying period to egg-hatch.
	Acelepryn, Acelepryn G	28	5.6–8.8 mL/ 100 m^2	
	Intercept 60 WP	4A	see label	
	Lorsban 4E, Lorsban NT	1B	4.5 L/ 1,000 L water (rescue treatment for shipping)	
	Adult management:			
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
White pine weevil (*Pissoides strobi*)	There is no product registered at the time of this publication.			This is a small, brownish snout beetle that attacks only vertical terminals on pines and spruce. It kills at least 2 years' growth. Attacks cause crooked, forked or multiple-stemmed trees. Legless, white larvae are found in the terminal shoots. Remove and destroy infested, flagging leaders in June and July.
Yellow-headed spruce sawfly (*Pikonema alaskensis*)	Dragnet FT EC	3A	160 mL/ 1,000 L water	Sawfly larvae overwinter as late instar larvae in spun cocoons in the soil under the host tree. Adult sawflies are reddish brown and 8–10 mm long. Adults emerge in mid-late spring to mate and lay eggs in the branches at the base of needles. Larvae are green with lighter longitudinal stripes and yellow-brown heads. They feed on needles for 4–6 weeks. Target pesticide applications to young larvae where possible. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Pounce 384 EC	3A	45–90 mL/ha	
	Success 480 SC	5	25 mL/ 1,000 L water	
DISEASES AFFECTING *PICEA*				
Botrytis (*Botrytis cinerea*)	Rovral WP, Rovral WDG	2	1 kg/ 1,100 L water	This disease can be an issue on seedlings in cold storage. Look for grey, fuzzy mould on tissue. Treat with fungicides at the first sign of disease.
Canker, branch dieback (*Cytospora valsa*)	There is no product registered at the time of this publication.			This canker is often associated with the death of scattered lower branches. The first symptoms are browning and needle loss. Norway and Colorado spruce are very susceptible. Prune out diseased branches and twigs when the bark is dry. Maintain good growing conditions. Avoid damaging the trunk and branches.
Damping off, root rot and stem rot (*Phytophthora, Pythium*)	Heritage Maxx	11	0.4 L/ 1,000 L water	Stem rot and root rot cause rapid dieback and mortality and are often characterized by reddish-brown discolouration of the cambium. Subdue MAXX can be used as a drench or a pre-incorporated treatment for media to help protect conifer seedlings and transplants from *Pythium* and *Phytophthora*. Subdue MAXX is registered on conifer seedbeds, plugs and 2-0 transplants only. See product label for rates and application information.
	Presidio	43	60–119 mL/ 380 L water	
	Previcur N	28	see label	
	Subdue MAXX	4	1.2 L/200 L water (drench)	
	Torrent 400SC	21	see label	

PICEA — SPRUCE

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *PICEA* (cont'd)				
Needlecast (*Rhizosphaera kalkhoffii*) Stigmina needle cast *(Stigmina lautii)*	Banner MAXX	3	350 mL/ 1,000 L water	Symptoms of needlecast appear between early spring and early summer when needles infected the previous season turn purple or lavender and stomates turn from white to black. By mid-season, infected needles drop, leaving only current season growth. Blue Colorado spruce is very susceptible. Apply the first fungicide treatment in spring when new growth is 1–2 cm long. Repeat at 3–4-week intervals. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Copper Spray	M 01	4 kg/ 1,000 L water	
	Daconil 2787 F	M 05	2.4 L/ha in 1,000 water	
	Daconil 720	M 05	6.6 L/ha	
	Daconil Ultrex	M 05	5.7 kg/ha	
	Flint, Flint 50WG	11	210g/ha	
Needlecast (*Stigmina lautii*)	Banner MAXX	3	350 mL/ 1,000 L water	Needles infected with Stigmina often remain green, but stomates turn from white to black. Black fruiting structures emerging out of stomates have small dark appendages, similar to arms on a spider (visible with a hand lens). In contrast, fruiting structures emerging out of stomates of Rhizosphaera-infected needles are smooth and black. Banner MAXX gives preventive control of needlecast diseases when applied when shoot emergence is less than 5 cm.
Tip blight (*Sirococcus conigenus*)	Copper Spray	M 01	4 kg/ 1,000 L water	Apply the first treatment in spring when new growth is 1–2 cm long. Repeat at 3–4-week intervals. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Daconil 2787 F	M 05	3.6–6 L/ 1,000 L water	
	Daconil 720	M 05	2.5–4.2 L/ha	
	Daconil Ultrex	M 05	2.9–3.6 kg/ha	

PINUS — PINE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PINUS*				
Cutworms (various species)	Confirm 240 F	18	0.5 L/ha	Cutworms are moth larvae that hide in shallow soil burrows during the day and crawl up plant stems to harvest plant parts at night. Injury appears as chewed or girdled stems on woody species (and clipped stems on herbaceous plants). Larvae are greyish-brownish in colour, often with black spots along their sides and stripes along their body. They have three pairs of true legs, four pairs of fleshy prolegs and one pair of "claspers" at the end of their abdomen. They can be up to 3 cm long. Late instar larvae overwinter and pupate in spring. Use insecticides to reduce cutworm populations at the first sign of feeding injury. Treat plants with insecticides in the evening since the larvae feed at night. Applications of Confirm should be made with a high-volume spray and sprayed to run-off (for greenhouse use). Applications of Pounce 384 EC should be made under warm, moist conditions when larvae are small.
	Pounce 384 EC	3A	180 mL/ 1,000 L water	
European pine shoot moth (*Rhyacionia buoliana*)	Cygon 480 E	1B	2 L/ 1,000 L water	These larvae are brown with black heads. They feed inside emerging shoots in the spring. Feeding injury causes "hooking" of new candles and pitch proliferation. The adult is a small, orange-flecked moth, usually active in late June to early July. Egg hatch coincides with the bloom of *Catalpa speciosa*. There is 1 generation per year. In late April, apply spray to the area between buds on terminals and laterals when *Acer rubrum* and *Cornus mas* are blooming. Spray terminals about mid-July to prevent injury the following year. Delaying shearing until mid-July will destroy many eggs. Use pheromone traps to monitor for adult activity.
	Lagon 480 E	1B	2 L/ 1,000 L water	

PINUS — PINE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PINUS* (cont'd)				
Northern pine weevil (*Pissoides approximatus*)	There is no product registered at the time of this publication.			This weevil can be a problem on all pines, especially nursery production. It is often found on *Pinus sylvestris*. Damage includes flagging and browning of new shoots and seedlings. Adult feeding injury may result in small, circular wounds at the base of the damage that exude pitch resin. Remove freshly cut stumps and recently dead and dying trees by late spring to eliminate adult breeding grounds. Stressed trees are most susceptible. Monitor for adults as they are feeding on the tender bark of seedlings and young shoots of larger trees in April or late August.
Pales weevil (*Hylobius pales*)	There is no product registered at the time of this publication.			This is a small, brownish-black weevil that feeds on tender pine twig bark, causing branches to turn brown and die. This weevil is a common pest in nursery production. Larvae bore into stem tissue at the soil line, girdling the tree. The white, legless larvae have brown heads. Larvae feed in long underground tunnels along the wood grain and on the outside of major roots. Remove freshly cut stumps and recently dead and dying trees by late spring to eliminate adult breeding grounds. Stressed trees are most susceptible. Monitor for adults as they are feeding on the tender bark of seedlings and young shoots of larger trees in April or late August.
Pine bark adelgid (*Pineus strobi*)	Horticultural oil	UN	20 L/ 1,000 L water	This adelgid mainly affects white pine, although other pine species may be infested. Adelgids appear covered in white, woolly masses on trunks, stems and branches. In early spring, use horticultural oil on the trunk and branch bark as a dormant treatment. Horticultural oil may remove the waxy hue of white pine foliage. Avoid contacting white pine foliage with horticultural oil. Apply other insecticides to newly hatched nymphs in mid-late May. Repeat the application in 2–3 weeks. Ensure good coverage.
	Malathion 500 EC	1B	1.25 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Tristar 70 WSP	4A	3 solupaks	
Pine false webworm (*Acantholyda erythrocephala*)	There is no product registered at the time of this publication.			This insect is a web-spinning sawfly that feeds on pine. The larvae feed on clipped needles from the safety of their webbed and frass-covered masses on branches against the trunk (mainly white pine). Pine false webworms overwinter as late instar larvae and pupae in soil cocoons below the host. Adults emerge in early spring. Adults are large and black; the females have an orange head, while the males have a yellow face. Adults can be seen flying around foliage in May. Eggs are laid end-to-end along needles of white pine. Larvae are yellowish-brown with two dark longitudinal stripes on each side and obvious antennae. The short thoracic legs and absence of fleshy, abdominal prolegs gives this insect a very wobbly appearance when it moves around. Apply a strong stream of water with sufficient pressure to penetrate the webbing and knock out larvae. In light infestations, hand-pick or prune out nests.

PINUS — PINE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PINUS* (cont'd)				
Pine needle scale (*Chionaspis pinifoliae*)	Cygon 480 E	1B	1.5 L/ 1,000 L water	Reddish crawlers appear in late May, and then turn yellowish. Feeding injury causes yellow spots on pine and spruce needles. There are 2 generations per year. Infestations often start on lower branches. Prune out small infestations in late winter and early spring. Dormant treatments are ineffective, because pine needle scale overwinter as eggs underneath the dead female shells. Crawlers are active when *Syringa vulgaris* and *Spiraea* x *vanhouttei* are blooming in late May. Treat at that time and again about 10 days later. Landscape Oil (horticultural oil) can be applied when plants are dormant and in summer when foliage is fully expanded and hardened off. Discolouration of foliage will occur in *Pinus strobus* and blue cultivars of both *Juniperus* and *Picea*. See product label for rates and tolerant species.
	Horticultural oil	UN	20–30 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Lagon 480	1B	1.5 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	2.445 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
Pine pitch mass borer (*Vespamima pini, Synanthedon pini*)	There is no product registered at the time of this publication.			Pinkish-white borer larvae feed inside bark and can be found on established pine trees in the landscape. Large pitch resin masses appear on trunks. This moth has a 2–3-year life cycle. Stressed and wounded plants are most susceptible. Maintain good tree health, since no registered chemical controls exist. Larvae and pupae are found under the pitch masses. They can be removed and killed. Remove severely infested trees.
Pine root collar weevil (*Hylobius radicis*)	There is no product registered at the time of this publication.			This weevil feeds on many species of pine. White, Scots and Austrian are most susceptible. Infested trees often appear in isolated pockets or on sandy soils. The white, legless, grub-like larvae feed at the root collar, causing the trunk to swell. Pitch resin masses mixed with soil also appear. Prune off bottom branches. Pull away fallen needles and other organic matter to expose a circle of bare soil 60 cm across around the trunk. This increases light and temperature at the tree base, discouraging adult weevils.
Pine sawflies (open feeding): European pine sawfly (*Neodiprion sertifer*) Redheaded pine sawfly (*Neodiprion lecontei*)	Cygon 480 E	1B	1 L/ 1,000 L water	European pine sawfly has a dark-greenish body with dark longitudinal stripes and a black head. It appears in late May/June. Redheaded pine sawfly has a yellow body with six rows of black spots and a reddish head. It feeds on older foliage in July and August. Multiple generations can be present at one time and will attack all foliage. Initial feeding begins in small, easily removed colonies. Spot-treat foliage when small larvae are first observed feeding. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dragnet FT EC	3A	160 mL/ 1,000 L water	
	Lagon 480	1B	1 L/ 1,000 L water	
	Malathion 500 EC	1B	2.5 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pounce 384 EC	3A	45–90 mL/ha	
	Pyrate 480 EC	1B	500 mL/ 1,000 L water	
	Success	5	25 mL/ 1,000 L water	
	Tristar 70 WSP	4A	1 solupak/ 1,000 L water	

PINUS — PINE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PINUS* (cont'd)				
Pine shoot beetle (*Tomicus piniperda*)	There is no product registered at the time of this publication.			This introduced bark beetle was found in Ohio in 1992 and in Ontario in 1993. By 1994, it was regulated under the *Plant Protection Act*. Pines from many areas of the province are subject to quarantine. The primary host is Scots pine, *Pinus sylvestris*. The 3–mm-long adult beetles tunnel within the current season's growth, causing flagging and dropping of shoots. Adult beetles overwinter at the base of trees (within the first 30 cm above the soil), just inside the outer bark. The adults start to emerge in February–March, when temperatures reach 10°C. They bore into bark to lay their eggs, causing sap to flow out of these wounds. The larvae form galleries in the bark, thereby destroying the cambium and weakening or killing the tree. Maintain plant health, since no registered chemical controls exist. Do not plant nursery pines and Christmas trees near abandoned pine plantations. To discourage egg laying, remove stumps, pine debris, dying trees and pruned limbs from the area by February 1. Place uninfested "trap logs" (with a diameter greater than 6 cm) to attract mating adults, and destroy the logs by May 31. Contact the Canadian Food Inspection Agency for the Pest Alert Factsheet on pine shoot beetle.
Pine spittlebug (*Aphrophora cribrata*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Several different pines are susceptible hosts for pine spittlebug, with Scots pine often heavily infested. Young nymphs feed on sap from new growth and cover themselves with white, foam-like spittle. Several nymphs may be found in one spittle mass. This pest rarely causes serious damage. Treat when spittle masses first appear in mid-to-late May.
	Pyrate 480 EC	1B	88–150 mL/ 1,000 L water	
Pine tortoise scale (*Toumeyella numismaticum, T. parvicornis*)	Ference	28	37.5–75 mL/ 100 L water	This reddish-brown oval, convex scale, about 6 mm long, infests several kinds of pine. It removes plant sap and secretes large amounts of honeydew. Remove heavily infested limbs and trees in late winter and early spring. In late June, treat twigs to control nymphs. There are several natural predators. Do not make more than 2 applications of Ference per year. Landscape Oil (horticultural oil) can be applied when plants are dormant and in summer when foliage is fully expanded and hardened off. Permanent discolouration of foliage will occur to *Pinus strobus* and blue cultivars of both *Juniperus* and *Picea*. See product label for rates and tolerant plants.
	Horticultural oil	UN	20–30 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	

PINUS — PINE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PINUS* (cont'd)				
Spruce spider mite (*Oligonychus ununguis*)	Cygon 480 E	1B	1.5 L/ 1,000 L water	Overwintered eggs hatch in early May, when *Amelanchier laevis* and *Magnolia* x *soulangeana* are in full bloom. Mites prefer older needles as feeding sites. To monitor for mites, use a hand lens to check the undersides of twigs and needles for tiny reddish eggs or brown mites with black backs. Shake a branch over a white sheet of paper and look for crawling specks. Apply miticides when mites first appear. Kanemite is effective against mobile life stages but may also reduce egg viability. Use horticultural oil as a dormant treatment in early spring to target eggs and newly hatched nymphs. Horticultural oil (including Landscape Oil) will discolour foliage of white pine. Permanent discolouration of foliage will occur to blue cultivars of both *Juniperus* and *Picea*. To prevent foliar discolouration on blue Colorado spruce, use only wettable powders and avoid horticultural oil. Horticultural oil (including Landscape Oil) can be used on other species when plants are dormant. Landscape Oil can be used in summer when leaves are fully expanded and hardened off. See product label. Do not exceed 2 applications of Nealta per season. If populations are still significant, make 2 applications of other miticides at 10-day intervals when mites exist in spring. Many predatory mites co-exist with pest mite populations. To conserve predatory mites, try miticides that have less impact on these beneficials, such as Vendex and Floramite.
	Floramite SC	20D	625 mL/ 1,000 L water	
	Horticultural oil	UN	20 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	see label	
	Lagon 480	1B	1.5 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Nealta	25	1 L/ha	
	Orthene 75 SP	1B	see label	
	Vendex 50 W	12	50–100 g/ 100 L water	
Strawberry root weevil (*Otiorhynchus ovatus*)	Met52 G	UNF	see label	Strawberry root weevil larvae are small, white, legless grubs that eat fibrous roots or strip bark from larger roots. The reddish-brown flightless adult is less than 6 mm long and is much smaller than the black vine weevil. It hides during the day and feeds at night. Adults are active in late June and early July, when *Wiegela florida* and *Syringa reticulata* are blooming. Adults injure plants by puncturing or girdling the current season's shoots while feeding. Infested plants grow slowly or fail to grow. They look dry and off-colour. Transplants often die without becoming established. These pests have a large host range. Commonly injured plants include white cedar, spruce and juniper. To monitor for adults, wrap a sheet of burlap around infested plant bases. Adult weevils will hide in the burlap during the day. Place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Pounce 384 EC is registered for use on seedlings. To test product safety, treat some conifer seedlings, especially pine, before treating a larger area.
	Pounce 384 EC	3A	65 mL/ 100 L water	

PINUS — PINE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PINUS* (cont'd)				
Tarnished plant bug (*Lygus lineolaris*)	Actara 25WG, Flagship 25WG	4A	210–280 g/ha	These are small (5 mm), yellowish-brown insects. Adults have wings that are folded in an X pattern. Tarnished plant bugs feed by inserting their mouthparts inside leaf tissue and sucking out the contents, leaving the lower and upper epidermis behind. The resulting injury appears as small, clear "windows" on leaf tissue of broad-leaved plants. On conifers, feeding often causes terminal growth to turn yellow and become distorted and bushy. Treat in spring and early summer to manage populations of this insect.
	Ripcord 400 EC	3A	172 mL/ha	
White grubs: European chafer (*Rhizotrogus majalis*) June beetle (*Phyllophaga* sp.)	**Larval management:**			These beetle larvae are referred to as "white grubs." They chew fibrous roots and girdle underground stems of many woody ornamentals (including *Cornus* sp.). To expose grubs to natural predators, cultivate infested fields before planting. Apply Intercept 60 WP once per year, during the mating period/egg-laying period and up to egg hatch (usually late June/early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering. Apply Acelepryn any time that larvae are present or during the mating period/egg-laying period to egg-hatch.
	Acelepryn, Acelepryn G	28	5.6–8.8 mL/100 m^2	
	Intercept 60 WP	4A	see label	
	Lorsban 4E, Lorsban NT	1B	4.5 L/1,000 L water (curative treatment for larvae)	
	Adult management:			
	Imidan 50 WP	1B	1.25 kg/1,000 L water	
	Imidan WP	1B	0.89 kg/1,000 L water	
White pine aphid (*Cinara strobi*)	Closer	4C	200 mL/1,000 L water	These are black aphids that often cluster together on shoots. Look for honeydew and sooty mould on needles. Treat active stages in May. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year.
	Ference	28	37.5–75 mL/100 L water	
	Malathion 500 EC	1B	1.4–3 L/1,000 L water	
	Malathion 85E	1B	0.88 L/1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	375 mL/1,000 L water	
	Tristar 70 WSP	4A	3 solupaks/1,000 L water	
White pine weevil (*Pissoides strobi*)	There is no product registered at the time of this publication.			This is a small, brownish snout beetle that lays its eggs into the bark of vertical terminals of pine and spruce when the Forsythia blooms (late April). Legless, white larvae feed under the bark from May to July, killing last year's and this year's leader. Attacks cause wilting and dying of terminal. Remove and destroy infested, flagging leaders in June and early July.
Zimmerman pine moth (*Dioryctria zimmermani*)	Cygon 480 E	1B	2 L/1,000 L water	These grey-green larvae cause pitch resin to collect on pine trunks. Pitch masses appear at the branch whorls, on the trunk or on shoots near terminal branches. Individual branches may die back completely. Remove larvae from pitch masses in June and July. Prune damaged shoots and remove heavily infested trees. Chemical control is difficult. Spray bark thoroughly in late April to early May when overwintering larvae are breaking dormancy (when *Acer platanoides* is blooming). Treat again in mid-August when larvae hatch. Use pheromone traps to monitor adult activity.
	Lagon 480	1B	2 L/1,000 L water	

PINUS — PINE				
Disease	**Product**	**Group***	**Rate**	**Notes**
DISEASES AFFECTING *PINUS*				
Brown spot (*Scirrhia* or *Mycosphaerella*)	Daconil 2787 F	M 05	9.5 L/ 1,000 L water	Apply treatment in spring when new growth is 12 cm long. Repeat at 3–4-week intervals. Do not crowd plants. Maintain adequate sunlight and good air circulation.
Canker (*Ascocalyx abietina* or *Scleroderris abietina*)	Daconil 2787 F	M 05	2.4–4.8 L/ 1,000 L water	This canker may affect many pine species, especially Scots and red pine. Trees under 2 m are most susceptible. Symptoms appear in spring after infection. Bases of infected needles turn reddish brown by May or June. Needles may be bent. Cool, moist weather encourages infection. To reduce spread, prune out lower branches of pine windbreaks around nurseries. Apply treatment in spring when new growth reaches 1–5 cm. Repeat at 3–4-week intervals.
	Daconil 720	M 05	1.7–3.3 L/ha	
	Daconil Ultrex	M 05	1.45–2.9 kg/ha	
Damping off, root rot and stem rot (*Phytophthora, Pythium*)	Heritage Maxx	11	0.4 L/ 1,000 L water	Stem rot and root rot cause rapid dieback and mortality and are often characterized by reddish-brown discolouration of the cambium. Subdue MAXX can be used as a drench or a pre-incorporated treatment for media to help protect conifer seedlings and transplants from *Pythium* and *Phytophthora*. Subdue MAXX is registered for conifer seedbeds, plugs and 2-0 transplants only. See product label for rates and application information.
	Presidio	43	60–119 mL/ 380 L water	
	Previcur N	28	see label	
	Subdue MAXX	4	1.2 L/ha in 200 L water (drench)	
	Torrent 400SC	21	see label	
Diplodia tip blight (*Sphaeropsis sapinea* or *Diplodia pinea*)	Copper Spray	M 01	4 kg/ 1,000 L water	New shoots do not elongate in spring. They appear brown and stunted by June. Recent research suggests this fungus sporulates all year round. Maintain tree health, since infection is difficult to manage. Apply fungicides at bud break, using a maximum of 3 applications per year at 2-week intervals to help protect new shoots. Removing infected branches does not reduce infection, since spores are also produced on seed cones. Do not crowd plants. Maintain adequate sunlight and good air circulation.
Lophodermium needlecast (*Lophodermium seditiosum*)	Copper Spray	M 01	4 kg/ 1,000 L water	This fungus severely defoliates pines, especially Scots and Austrian pine. Only the current season's needles remain on the tree over winter. The previous season's needles turn red in late winter and early spring. Infected needles drop from late spring to early summer. Black, football-shaped fruiting bodies appear on cast needles in mid-summer. Apply treatment in mid-July to early August before infection occurs. Repeat at 3–4-week intervals as required. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Daconil 2787 F	M 05	2.4–4.8 L/ 1,000 L water	
	Daconil 720	M 05	1.7–3.3 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.45–2.9 kg/ha	
	Dithane DG 75, Dithane M-45, Dithane 80, Dithane Rainshield	M 03	2.5 kg/ 1,000 L water	
	Manzate	M 03	see label	
Sweetfern blister rust (*Cronartium comptoniae*)	There is no product registered at the time of this publication.			This rust disease affects hard two- and three-needle pines, especially jack pine (*Pinus banksiana*). It can cause serious losses in nurseries and young plantations. Cankers often appear on the trunk, less than 2 m above the ground. Trees with basal diameters of more than 8 cm seem resistant. Destroy diseased pines. Eliminate alternate hosts such as sweet fern (*Comptonia peregrina*) and sweet gale (*Myrica gale*) from plantations and from the immediate vicinity of pine nursery stock.

PINUS — PINE

Disease	Product	Group*	Rate	Notes
DISEASES AFFECTING *PINUS* (cont'd)				
Tip blight (*Sirococcus*)	Copper Spray	M 01	4 kg/ 1,000 L water	Apply treatment in spring when new growth is 12 cm long. Repeat at 3–4-week intervals. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Daconil 2787 F	M 05	3.6–6 L/ 1,000 L water	
	Daconil 720	M 05	2.5–4.2 L/ha	
	Daconil Ultrex	M 05	2.9–3.6 kg/ha	
White pine blister rust (*Cronartium ribicola*)	There is no product registered at the time of this publication.			This rust is a serious disease of five-needle pines, especially white pine, *Pinus strobus*. It infects the needles, eventually causing a perennial canker on branches and trunks. It can also cause an insignificant leaf spot. When plants are dormant, prune out girdled pine branches before the canker reaches the main stem. Prune infected, flagging branches 30 cm below the cankered area. Separate white pine nurseries and plantations from alternate host *Ribes* sp. by at least 600 m.

PLATANUS — LONDON PLANE, SYCAMORE

Disease	Product	Group*	Rate	Notes
DISEASES AFFECTING *PLATANUS*				
Anthracnose (*Apiognominia veneta*)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	As with frost damage, new leaves turn black-brown. Light-brown dead areas appear along the veins of mature leaves. Twigs that are 20–25 cm long may show signs of cankers and dieback. Treat up to 3 times, especially in cool, wet weather: as buds swell, at bud break and about 7 days after bud break. Prune out and destroy cankered twigs and branches. Collect and remove fallen, infected leaves. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Dithane DG 75, Dithane M-45, Dithane 80, Dithane Rainshield	M 03	2.75–3.5 kg/ 1,000 L water	
	Manzate	M 03	2.75–3.5 kg/ 1,000 L water	

POPULUS — POPLAR

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *POPULUS*				
Forest tent caterpillar (*Malacosoma disstria*)	Dipel	11A	see label	Forest tent caterpillar larvae are hairy with a series of keyhole- or footstep-shaped white spots along their backs. The larvae are present early in the season. They feed in colonies. Forest tent caterpillar larvae do not form a tent on their host. Larvae may completely defoliate broadleaf trees, particularly poplars. Treat foliage in mid-to-late May to reduce populations of larvae. Orthene may damage sugar maple leaves.
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pounce 384 EC	3A	90 mL/ 1,000 L water	
	ReVokBTK	11A	2.9–4.8 L/ha	
	Thuricide 48 LV	11A	1–1.6 L/ha	

POPULUS — POPLAR

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *POPULUS* (cont'd)				
Gypsy moth (*Lymantria dispar*)	Dipel	11A	see label	Gyspsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs but prefer basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	ReVokBTK	11A	7.14 –12 L/ha	
	Success	5	25 mL/ 1,000 L water	
Poplar and willow borer (*Cryptorhynchus lapathi*)	There is no product registered at the time of this publication.			This borer is a stout, black, rough-bodied snout beetle with pink outer wing covers. White, legless larvae honeycomb the trunks and larger branches of willows and poplars. Cut and destroy badly infected branches and trees before the end of June.
White-marked tussock moth (*Orgyia leucostigma*)	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.
DISEASES AFFECTING *POPULUS*				
Canker (several different fungi)	There is no product registered at the time of this publication.			Most poplar species are susceptible to canker, especially when stressed. Prune out and destroy infected branches during dry weather. Remove and destroy severely infected trees. Do not wound or injure trees. Do not crowd plants. Maintain adequate sunlight and good air circulation.
Leaf spot (several fungi)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	Brown spots appear on leaves, followed by defoliation. Collect and remove fallen, infected leaves. Treat at bud break, then twice more at 10–14-day intervals. Applications of Senator can be repeated every 10–14 days, with a maximum of 3 applications per year.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Senator 50 SC	1	1.54 L/ 1,000 L water	
	Senator 70 WP	1	1.1 kg/ 1,000 L water	

POTENTILLA — POTENTILLA

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *POTENTILLA*				
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	

PRUNUS — BLACK CHERRY, CHOKECHERRY, FLOWERING CHERRY, PIN CHERRY, PEACH, PLUM

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PRUNUS*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids are small, soft-bodied insects that suck plant sap from stems and leaves. Injury appears as distorted foliage, and plants may be severely weakened. Treat when aphids first appear, and repeat as required. Excessive fertilization or pruning can cause undesirable levels of succulent growth. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year. *Do not apply Kontos during bloom as this product is toxic to bee brood.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Endeavor 50WG	9B	10–20 g/ 100 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	*Kontos	23	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	see label	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pyrate 480 EC	1B	375 mL/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks/ 1,000 L water	
	Trounce	3A	50 L/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	
Apple Clearwing Moth Borer *(Synanthedon myopaeformis)* Dogwood Borer *(Synanthedon scitula)*	Delegate	5	420 g/ha	Delegate is registered for the control of dogwood borer and to reduce the numbers of apple clearwing moth. Apply using a handgun or backpack sprayer only, direct the spray to cover the lower trunk of the tree, particularly the graft union and any pruning cuts. Thorough coverage is essential. Apply 1–2 applications at a 14 day interval targeting the 1st instar larval stage (in-season/summer). Apply Delegate a maximum of 2 applications per year. Rimon is registered as a direct application to the tree trunk. Apply 1–2 applications in the summer at a 14 day interval targeting 25–75% egg laying to prevent egg hatch and 1st instar larvae establishment. Maximum of 2 applications of Rimon per growing season.
	Rimon 10 EC	15	1.4 L/ 1,000 L water	
Eastern tent caterpillar (*Malacosoma americanum*)	AceCap 97	1B	see label	This caterpillar has one white stripe down its back. Colonies feed early in the season. Silken tents appear in the forks of branches, mainly of apple, cherry and hawthorn trees. Prune and destroy overwintering egg masses. These are silver in colour, about 1–2 cm long, in a raised band circling a twig. They hatch when buds break in spring. Treat then or at the first sign of webs. Young larvae (< 2 cm) hide in tents during the day. Where infestations are light, remove and destroy the tents in early spring. AceCap 97 applications must be made post-bloom as this product is toxic to bees and bee brood. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dipel	11A	see label	
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	see label	
	Pounce 384 EC	3A	25 mL/ 1,000 L water	
	Success	5	1.5–2.0 L/ 1,000 L water	

PRUNUS — BLACK CHERRY, CHOKECHERRY, FLOWERING CHERRY, PIN CHERRY, PEACH, PLUM

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PRUNUS* (cont'd)				
European red mite (*Panonychus ulmi*)	Dyno-Mite SC, Dyno-Mite WP	21A	284 g/ha in 1,000 L water	These mites overwinter as tiny red eggs on twigs. Apply oil when plants are dormant or show 2.5 cm of green tissue and flowers are in a tight cluster. This can improve control of European red mite. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal.
	Horticultural oil	UN	20 L/ 1,000 L water	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
Gypsy moth (*Lymantria dispar*)	Dipel	11A	see label	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs, most notably basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide HPC	11A	7.4–12 L/ 1,000 L water	
	Thuricide 48LV	11A	2.4–4 L/ha	

PRUNUS — BLACK CHERRY, CHOKECHERRY, FLOWERING CHERRY, PIN CHERRY, PEACH, PLUM

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PRUNUS* (cont'd)				
Japanese beetle (*Popillia japonica*)	**Adult management:**			The adult beetles are metallic green and copper, about 13 mm long. They are easily recognized by six tufts of white hair on each side of the abdomen. As the beetles feed, they consume and skeletonize foliage. Preferred hosts include members of the rosaceous family, maple, birch, linden and fruit trees. Spray adulticides when adults appear in early July, when the *Yucca filamentosa* is blooming. Larvae are C-shaped, milky-white grubs (about 25 mm long) with brown heads and 3 pairs of legs. They are distinguishable from other white grubs by a V-shaped arrangement of spines on the underside of the abdomen. Larvae are most commonly found feeding on the fibrous roots of turfgrass. Lorsban 4E is a rescue treatment to allow shipping from infested to uninfested regions. Apply to soil when grubs are young and actively feeding near the soil surface. Apply as a coarse spray, and irrigate with 1–2 cm of water to wash the insecticide into underlying soil. For containerized stock, submerge the root ball into a solution of Lorsban 4E (45 mL/10 L water) until all bubbling stops. Apply Intercept 60 WP once per year, during the mating period/ egg-laying period and up to egg hatch (usually late June/ early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering.
	Imidan 50 WP, Imidan WP	1B	see label	
	Larval management:			
	Acelepryn	28	0.5 L/ha	
	Intercept 60 WP	4A	see label	
	Lorsban 4E, Lorsban NT	1B	4.5 L/ 1,000 L water (rescue treatment for shipping)	
Leafrollers: Fruit tree leafroller (*Archips argyrospila*) Redbanded leafroller (*Argyrotaenia velutinana*)	Dipel	11A	see label	Leafrollers are caterpillars that feed while hidden in folded or rolled leaves. Fruit tree and redbanded leafrollers primarily affect fruit trees but also attack many shade trees and ornamentals. Apply insecticides to foliage soon after leaves unfold in early June.
Peachtree borer (*Synanthedon exitiosa*) Lesser peachtree borer (*Synanthedon pictipes*)	Delegate	5	420 g/ha	Peachtree borers attack tree/shrub bases of *Prunus* (e.g., *Prunus* x *cistena*) at the soil line. Lesser peachtree borers attack higher limbs and are found mainly on fruit tree species of Prunus. Adults are clear-winged moths and resemble wasps when flying. Borers overwinter in bark or wood as partly grown larvae. Feeding resumes in spring, with gum and frass accumulating near the burrows. Treat in mid-to-late spring, when *Philadelphus* is blooming. Repeat twice at 3-week intervals. Spray with a gun, covering the trunk and scaffold limbs thoroughly. Use pheromone traps to monitor adult activity. Delegate is registered for the suppression of peachtree borer and lesser peachtree borer. Apply 420 grams of Delegate Insecticide per hectare. A spray volume of 1500–2000 L/ha is recommended. Using a handgun or back pack sprayer only, direct the spray to cover the tree trunk and any scaffold limbs from ground level to 1.5 m above ground, particularly the graft union and any pruning cuts. Thorough coverage is essential. Target the 1st instar larval stage, beginning 7–10 days after the first adult trap catch. Repeat applications at 14–21 day intervals. Apply a maximum of three applications per year. Rimon is registered as a direct application to the tree trunk and scaffold limbs. Maximum of 3 applications per growing season. Apply when economic thresholds are reached. Apply Rimon at 3 week intervals (21 days) starting 7–10 days after first trap catch.
	Rimon 10 EC	15	1.4 L/ha	

PRUNUS — BLACK CHERRY, CHOKECHERRY, FLOWERING CHERRY, PIN CHERRY, PEACH, PLUM

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PRUNUS* (cont'd)				
Pearslug (*Caliroa cerasi*)	Insecticidal soap	UN	see label	Small, dark, clear-bodied sawfly larvae feed from the undersides of leaves and cause significant defoliation. Treat with insecticides at the first sign of larval damage.
	Orthene 75 SP	1B	see label	
	Pounce 384 EC	3A	45–90 mL/ha	
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	2.07 L/ha	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	
Uglynest caterpillar (*Archips cerasivorana*)	There is no product at the time of this publication printing.			These caterpillar larvae are dark yellow-green with black heads. They favour low-growing shrubs as hosts. Larvae feed on choke, pin and black cherry. Webbed nests appear at branch ends between May and September. Prune out nests when found. Chemical control is seldom used because insects are so well protected inside the nest.

PRUNUS — BLACK CHERRY, CHOKECHERRY, FLOWERING CHERRY, PIN CHERRY, PEACH, PLUM

Disease	Product	Group*	Rate	Notes
DISEASES AFFECTING *PRUNUS*				
Bacterial blight (*Pseudomonas syringae*)	Copper Spray	M 01	6 kg/ 1,000 L water (dormant rate)	This disease often develops after plastic film is removed from cold frames (container production) and plants experience extreme shifts in temperature. Apply bactericidal products before autumn rains and again when most leaves have fallen. Do not crowd plants. Maintain adequate sunlight and good air circulation. Excessive fertilization or pruning can cause undesirable succulent growth that is susceptible to this disease.
Black knot (*Apiosporina morbosa* or *Dibotryon morbosa*)	Maestro 80 DF	M 04	3.75–4.5 kg/ 1,000 L water	Black knot causes large black swellings up to 10 cm long on branches and small twigs, eventually girdling and killing the branch. Spray fungicide at green tip, pre-bloom and blossom time. In late winter and early spring, prune and destroy infested twigs and branches 20–30 cm below knots. Eliminate wild or neglected *Prunus* species from the area.
	Maestro WSP	M 04	4 kg/ha	
Blossom and twig blight (*Monilina fructicola*)	Captan	M 04	see label	This disease causes blossoms and new shoots to suddenly collapse and turn brown. Shoot or twig blight appears in early spring. Fruit will turn brown, rot and hang on the tree. Spray just before blossom buds open. Repeat in 10 days if wet weather persists. Prune out and destroy infected twigs. Remove infected fruit from the tree and the adjacent ground.
	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Funginex DC	3	750 mL/ 1,000 L water (or 2.5 L/ha)	
Peach leaf-curl (*Taphrina deformans*)	Ferbam 76 WDG	M 03	1.75–3.5 kg/ 1,000 L water	Peach leaf-curl spores lodged in winter buds cause infections during spring. As leaves unfold in spring, they become puckered and curled. Thickened areas eventually turn pinkish. Infected leaves become weakened and drop. Apply fungicide in fall (preferred time) just after complete leaf drop or apply in early spring just before buds swell.
Powdery mildew (various)	Compass 50 WG	11	14–21 g/ 100 L water	This fungus appears as a white, powdery growth on the tops of leaves. Apply fungicides at the first sign of disease, and repeat applications to protect healthy foliage. Regalia Maxx gives suppression of *Oidium* sp. of powdery mildew only.
	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	
	Palladium WG	9, 12	see label	
	Regalia Maxx	P 05	0.5–1L/ 400 L water	
Shothole leaf spot (*Blumeriella jaapii*)	Captan	M 04	see label	In this disease, leaf spots appear as leaves expand to full size. New spots appear until late summer. Disease spots fall out with age, giving a shothole appearance. (Note that similar symptoms can be caused by insect pests.) Avoid overhead irrigation late in the day. Do not crowd plants. Maintain adequate sunlight and good air circulation.

PSEUDOTSUGA — DOUGLAS FIR				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PSEUDOTSUGA*				
Cooley spruce gall adelgid (*Adelges cooleyi*)	Malathion 500 EC	1B	1.25 L/ 1,000 L water	This pest causes galls on spruce. Douglas fir is an alternate host for this insect. Open-feeding, woolly nymphs cause new needles of Douglas fir to twist and turn yellow. Cooley spruce gall adelgid does not form a gall on this host. To catch newly hatched nymphs as they migrate to new foliage, treat in early spring as buds are breaking and new foliage is emerging.
Tarnished plant bug (*Lygus lineolaris*)	Actara 25WG, Flagship 25WG	4A	210–280 g/ha	These are small (5 mm), yellowish-brown insects. Adults have wings that are folded in an X pattern. Tarnished plant bugs feed by inserting their mouthparts inside leaf tissue and sucking out the contents, leaving the lower and upper epidermis behind. The resulting injury appears as small, clear "windows" on leaf tissue of broad-leaved plants. On conifers, feeding often causes terminal growth to yellow and become distorted and bushy. Treat in spring and early summer to manage populations of this insect.
	Ripcord 400 EC	3A	172 mL/ha	
DISEASES AFFECTING *PSEUDOTSUGA*				
Needlecast (various fungi)	Dithane DG, Dithane M-45, Dithane 80, Dithane Rainshield	M 03	2.75–3.5 kg/ 1,000 L water	Various pathogens cause needlecast diseases on this host. Protect emerging needles in spring with fungicide to reduce fungal infections.

PYRACANTHA — FIRETHORN

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *PYRACANTHA*				
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	
DISEASES AFFECTING *PYRACANTHA*				
Fire blight (*Erwinia amylovora*)	Copper Spray	M 01	1.25 kg/ 1,000 L water	Fire blight affects succulent vegetative growth. Dead, dry leaves persist on infected branches. Spray bactericidal products at early bloom, full bloom and petal fall when the weather is warm and humid and fire blight is a recurring problem. Avoid excessive pruning and nitrogen fertilization in spring. During dormancy, prune out infected branches about 30 cm below the cankered area when the tree is dry.
	Serenade Max	BM 02	2–3 kg/ha	
Scab (*Spilocaea pyracanthae*)	Banner MAXX	3	14 mL/ 100 L water	Scab infection causes dark zones on leaves that develop into yellow lesions. Infected leaves may drop, and dull scabs may appear on twigs and fruit. Plant scab-resistant cultivars. Clean up and destroy fallen leaves. Prune to improve air circulation through the canopy. Start fungicide applications when leaf buds begin to break. Repeat every 7–10 days during mid-spring, especially in rainy weather. Apply Banner MAXX every 14 days, beginning when leaf buds are at the green tip stage. Rotate Banner with fungicides from other chemical families to avoid resistance. Do not exceed 4 applications of Banner per year. Stop treatments if no infection exists when foliage is hardened off.
	Banner EC 130	3	17 mL/ 100 L water	
	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	

PYRUS — PEAR				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PYRUS*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids are small, soft-bodied insects that suck plant sap from stems and leaves. Injury appears as distorted foliage, and plants may be severely weakened. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year. Treat when aphids first appear, and repeat as required. Do not make more than 3 applications of Endeavor per year. Do not apply more than 3 kg/ha of Endeavor per year.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Endeavor 50WG	9B	10–20 g/ 100 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Tristar 70 WSP	4A	3 solupaks/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	
European red mite (*Panonychus ulmi*)	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	These mites overwinter as tiny red eggs on twigs. Apply horticultural oil when plants are dormant and continue applications until the plants reach the green tip stage and flower buds are in a tight cluster. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal.
	Dyno-Mite SC	21A	470 mL/ha	
	Horticultural oil	UN	20 L/ 1,000 L water	
	Kanemite 15 SC	20B	2.07 L/ha	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
Pear rust mite (*Epitrimerus pyri*)	Dyno-Mite SC	21A	470 mL/ha	Adult females overwinter in bark crevices or cracks in twigs. When leaves begin to emerge, the overwintered females move to feed on the bud scales. Pear rust mites feed on the leaves and fruit, causing browning of foliage and russeting on the skin of the fruit. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal.
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	

PYRUS — PEAR				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *PYRUS* (cont'd)				
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Do not exceed 2 applications of Nealta per year. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	2.07 L/ha	
	Nealta	25	1L/ha	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	
White-marked tussock moth (*Orgyia leucostigma*)	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.

PYRUS — PEAR				
Pest	**Product**	**Group***	**Rate**	**Notes**
DISEASES AFFECTING *PYRUS*				
Fire blight (*Erwinia amylovora*)	BlightBan A506	Bio	370–530 g/ 1,000–2,000 L water	Fire blight affects succulent vegetative growth. Dead, dry leaves persist on infected branches. Some cultivars are resistant to this disease. Spray bactericidal products at early bloom, full bloom and petal fall when the weather is warm and humid and fire blight is a recurring problem. Avoid excessive pruning and nitrogen fertilization in spring. During dormancy, prune out infected branches about 30 cm below the cankered area when the tree is dry. BlightBan and Bloomtime are biopesticides that may help to suppress fire blight.
	BlightBan C9-1	Bio	370–500 g/ 1,000–2,000 L water (see label)	
	Bloomtime Biological FD	Bio	370–530 g/ 1,000–2,000 L water	
	Copper Spray	M 01	2.2 kg/ 1,000 L water	
	Kasumin 2L	24	5 L/ 1,000 L water (see label)	
	Kasumin 4L	24	2.5 L/ 1,000 L water	
	Serenade Max	BM 02	2–3 kg/ha	
	Streptomycin 17	25	600 g/ 1,000 L water	
Pear trellis rust (*Gymnosporangium sabinae* [*G. fuscum*])	Nova	3	340 g/ 1,000 L water	Pear trellis rust affects all species of pear. It causes bright orange-red lesions on the leaves of pear trees that start to show around late spring–early summer. Over the summer months, the undersides of the leaf lesions develop swellings that later produce cream-coloured, lantern-shaped sporulating structures in early autumn. These spores travel to the alternate host, *Juniperus sabinae* (Savin juniper) and infect current season's growth, forming a perennial gall. The disease is carried over the winter in the juniper galls. These galls sporulate, producing orange, slimy projections during warm, wet conditions in early spring. The spores from the juniper galls can infect newly emerging leaves on pear trees, and the cycle begins again. This disease does not overwinter on pear and therefore cannot be carried on dormant pear nursery stock or on overwintering foliage. Pear trellis rust on pear requires annual infection by the juniper host galls each spring. Protect emerging foliage of pear trees before warm, wet conditions in early spring with fungicides. Where possible, flag sporulating galls on juniper and remove and destroy them when dormant. To reduce disease severity on established pear trees in the landscape, employ cultural methods that reduce soil compaction and increase soil moisture during drought periods.
	Pristine WG	7, 11	1–1.6 kg/ha	

QUERCUS — OAK

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *QUERCUS*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids are small, soft-bodied insects that suck plant sap from stems and leaves. Injury appears as distorted foliage, and plants may be severely weakened. Treat when aphids first appear, and repeat as required. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year. *Do not apply Kontos during bloom as this product is toxic to bee brood.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	*Kontos	23	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pyrate 480 EC	1B	375 mL/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	
Fall cankerworm (*Alsophila pometaria*) Spring cankerworm (*Paleacrita vernata*)	Dipel 2X DF	11A	125 g/ 400 L water	Cankerworms are greenish-to-black loopers (inchworms) that appear early in the season and feed on leaves of many deciduous hosts. Treat when larvae appear in mid-May, when *Acer platanoides* and *Magnolia* x *soulangeana* are blooming. To help reduce the next generation of fall cankerworm, place sticky bands around tree trunks, close to the ground, by late October. Bands will help to trap the flightless adult female moths as they emerge from the ground and crawl up the tree trunk.
	Imidan	1B	0.89 kg/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Malathion 500 EC	1B	2.5 L/ 1,000 L water	
	ReVokBTK	11A	2.9–4.8. L/ha	
	Thuricide 48 LV	11A	1–1.6 L/ha	
	Thuricide HPC	11A	2.9–4.8 L/ha	
Golden oak scale (*Asterolecanium variolosum*)	Cygon 480 E	1B	2 L/ 1,000 L water	Yellowish-golden scale feeds in small pits on white and English oak twigs, branches and trunks. Infestations can cause branch dieback. Use horticultural oil as a dormant treatment in early spring. Use any of the other materials against crawlers in late June. Crawlers can appear on first year and current season wood. Do not make more than 2 applications of Ference per year. Landscape Oil (horticultural oil) can be used when the plants are dormant or in the summer when foliage has fully expanded and hardened off. See product label for rates and tolerant plants.
	Ference	28	37.5–75 mL/ 100 L water	
	Horticultural oil	UN	20–30 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Lagon 480	1B	2 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	

QUERCUS — OAK

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *QUERCUS* (cont'd)				
Gypsy moth (*Lymantria dispar*)	AceCap 97	1B	773 mg/cartridge 1 cartridge per 10.16 cm	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs but prefer basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow). AceCap 97 applications must be made post-bloom, as this product is toxic to bees and bee brood.
	Dipel	11A	see label	
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide HPC	11A	7.14–12 L/ 1,000 L water	
	Thuricide 48LV	11A	2.4– 4 L/ha	
Lacebug (*Coruthuca arcuata*)	Ference	28	37.5–75 mL/ 100 L water	Lacebugs are flat, rectangular insects, 4–6 mm long with broad, transparent, lace-like wing covers. Adults and nymphs feed on the underside of leaves. The leaves become pale and mottled, with white splotches. Lower leaf surfaces develop black and brownish dots. Heavily infested leaves may turn entirely brown and fall off. Most species have 2 generations a year. Lacebugs usually occur on a single host. Other trees commonly attacked by lacebugs include elm, hickory, linden, sycamore and walnut. Apply insecticides to leaf undersides when insects first appear.
	Malathion 500 EC	1B	1.25 L/ 1,000 L water	
	Malathion 85E	1B	0.61–0.88 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
Lecanium or European fruit lecanium scale (*Lecanium corni*)	Ference	28	37.5–75 mL/ 100 L water	This scale infests many deciduous trees and shrubs. When adults are mature in late spring/summer, they appear as a large, reddish-brown, spherical scale usually found on the underside of twigs. Use horticultural oil as early-spring dormant treatment to reduce populations of overwintering nymphs. To suppress crawlers, spray insecticides when the *Sambucus canadensis* begins blooming. Do not use Malathion on Crimson King maple. Orthene may damage sugar maple leaves. Do not make more than 2 applications of Ference per year.
	Horticultural oil	UN	20 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	1 kg/ 1,000 L water	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	
	Trounce	3A	50 L/ 1,000 L water	

QUERCUS — OAK				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *QUERCUS* (cont'd)				
Oak leaf gall (several species)	There is no product registered at the time of this publication.			Many gall makers infest oak roots, bark, twigs, leaves, flowers and acorns. Each gall has a characteristic appearance. Many are conspicuous and interesting, but few cause serious damage.
Oak leafminer (*Profenusa lucifex*)	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	Oak leafminer larvae cause flat, blister-like mines from mid-June to July. Larvae are pale with stubby black legs and are found inside hollowed-out tissue within the leaf. Early treatment is most effective. Treat foliage to control larvae beginning the first week of June.
	Malathion 85E	1B	1.22 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
Oak leaftier (*Croesia semipurpurana*)	There is no product registered at the time of this publication.			Small, whitish larvae enter unopened buds in May. They feed on the young leaves, then tie the leaves together and shred the tissue.
Oak mite (*Oligonychus bicolor*)	Horticultural oil	UN	see label	Feeding from mites causes bronzing and bleaching of oak leaves. Treat upper leaf surfaces from mid-June to mid-July. These mites are closely related to spruce spider mites (same genus). Weather and predators often keep populations under control. Landscape Oil (horticultural oil) can be used when the plants are dormant or in the summer when foliage has fully expanded and is hardened off. See product label for rates and tolerant plants.
	Orthene 75 SP	1B	see label	
Oak skeletonizer (*Bucculatrix ainsliella*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Small yellowish-green larvae skeletonize the lower surface of oak leaves. There is 1 generation in June and a second in August/September. Treat foliage when damage first appears in mid-June. Repeat in August. Collect and destroy leaves in the autumn to reduce overwintering populations.
Oak twig pruner (*Elaphidionoides villosus*)	There is no product registered at the time of this publication.			This is a long-horned beetle that attacks oak and some other deciduous trees. Larvae tunnel inside the twigs. Foliage on infested branches begins to wilt in mid-summer, and damaged twigs fall to the ground. Collect and destroy fallen twigs before mid-May and in the autumn to remove pupae. Chemical control is difficult and impractical.
Orangestriped oakworm (*Anisota senatoria*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	The black larvae have orange or yellow stripes running lengthwise down the sides and back. Two stiff, black horns project from the top of the second body segment. There are small, sharp spines on the other body segments. If necessary, treat in August when larvae are young and concentrated on the lower branches.

QUERCUS — OAK				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *QUERCUS* (cont'd)				
Red oak clearwing moth (*Paranthrene simulans*)	There is no product registered at the time of this publication.			Larvae bore into the wood of red oak trees, causing dieback in the canopy and sometimes tree mortality. Look for large holes with sawdust on tree trunks. Bore holes and tunnels often ascend up into the trunk. Insert a piece of flexible wire in the bore hole to destroy larvae. Adults are clearwing moths and resemble wasps when they are flying. Monitor adult populations with clearwing moth pheromone traps in late spring. High densities of pheromone traps may interrupt mating in small stands of red oak.
White-marked tussock moth (*Orgyia leucostigma*)	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.
DISEASES AFFECTING *QUERCUS*				
Anthracnose (*Gnomonia quercina* or *Apiognomonia quercina*)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	This disease appears as irregular leaf-margin browning on red and white oak. Areas between veins also turn brown. Anthracnose often develops after a cool, wet spring. Collect and destroy fallen leaves in the fall. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Dithane DG, Dithane M-45, Dithane 80, Dithane Rainshield	M 03	2.75–3.5 kg/ 1,000 L water	
	Manzate	M 03	see label	
Leaf spot (several fungi)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	Well-defined brown or black spots appear on the leaves. Treat when plants are dormant or at bud swell. Do not crowd plants. Maintain adequate sunlight and good air circulation.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
PHYSIOLOGICAL DISORDERS AFFECTING *QUERCUS*				
Chlorosis or leaf yellowing	A pesticide application would not be effective.			This is a physiological problem for pin oak (*Quercus palustris*) and red oak (*Q. rubra*) on high-pH soils (pH > 6). Chlorosis is also caused by poor soil conditions such as water logging and compaction.
Leaf scorch (physiological)	A pesticide application would not be effective.			Irregular browning appears on leaf margins and between veins in response to hot, dry conditions. It occurs late in the season and during dry weather.

RHODODENDRON — RHODODENDRON, AZALEA

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *RHODODENDRON*				
Black vine weevil, Taxus weevil (*Otiorhynchus sulcatus*)	Demand CS	3A	360 mL/ 1,000 L water	Larvae are small, white, legless grubs that eat fibrous roots or strip bark off larger roots. Infested plants grow slowly or fail to grow. Plants look dry and off-colour. Transplants often die without becoming established. Larval control is difficult. Adults are black snout beetles that hide in soil litter during the day and cut crescent-shaped notches in needle margins at night. They also attack eastern white cedar, spruce, hemlock, azaleas, yews and rhododendrons. In container production, they are also significant pests of several hosts, including herbaceous perennials. Adult weevils have fused wing covers and cannot fly. To control adults, treat the foliage, trunk bark and branches during the last week of June and in early July. Spray in the evening, as adult activity increases about an hour after sunset. To test treatment safety, treat some conifer seedlings, especially pine, before treating a larger area. Entomopathogenic nematodes (e.g., *Heterorhabditis* sp.) are available to help suppress populations of larvae. Nematodes work very well in infested containers but with less success in the field. Nematodes can be applied in late summer/early autumn and in mid-spring to suppress larval populations. See the product label for complete directions. To monitor for adults, place a piece of plywood around infested plant bases. Adult weevils will hide under the wood during the day. Or place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Do not use Demand CS or Silencer in residential areas.
	Flagship 25WG	4A	10.5–14 g/ 100 L water	
	Heterorhabditis bacteriophora	NC	see label	
	Met52 G	UNF	see label	
	Silencer 120 EC	3A	300 mL/ 1,000 L water	
DISEASES AFFECTING *RHODODENDRON*				
Dieback, canker (*Phytophthora*)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	This canker is visible on the stem. Terminal buds and leaves turn brown, and leaves droop and curl. This pathogen may also affect the root and crown, resulting in water-soaked tissue that turns brown. Treat with Daconil as new leaves emerge. Repeat every 7–14 days during wet weather. Prune out infected branches, and avoid overhead irrigation late in the day. Do not crowd plants. Maintain adequate sunlight and good air circulation. Maintain media air porosity, and reduce watering where root rot exists. Do not grow near lilacs, a common host for this disease.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Presidio	43	60–119 mL/ 380 L water	
	Previcur N	28	see label	
	Torrent 400SC	21	see label	
	Truban 25% EC	14	see label	
	Truban 30% WP	14	see label	
Powdery mildew	Banner MAXX	3	35 mL/ 100 L water	Symptoms appear as white, powdery growth on the tops of leaves, especially during hot days and cool nights. Apply fungicides at the first sign of disease, and repeat every 10–14 days as required. Rotate fungicides with those from other chemical families to avoid resistance. Do not exceed a maximum of 4 applications per year.
	Banner 130 EC	3	14 mL/ 100 L water	
	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	
	Nova	3	340 g/ 1,000 L water	
	Palladium WG	9, 12	see label	
Stem rot of cuttings	Captan	M 04	see label	Various fungi will cause a stem rot on *Rhododendron*. Protect cuttings with fungicides during the propagation phase and any time high moisture and humidity is a problem. When using Captan, dip cuttings for 20–30 min and drain before planting.

RHODODENDRON — RHODODENDRON, AZALEA

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *RHODODENDRON* (cont'd)				
Sudden oak death (*Phytophthora ramorum*)	Acrobat 50 WP	40	48 g/ 100 L water	Sudden oak death is a foliar blight and stem canker found on Camellia, Rhododendron, Pieris, Kalmia, Viburnum and Syringa. The Canadian Food Inspection Agency has designated it a quarantinable, regulated pest. Apply preventive fungicides to protect growth during cool, wet conditions. For resistance management, rotate Subdue MAXX with other fungicides that belong to a different chemical group. Apply Acrobat 50 WP in at least 200 L of water/ha. Micora gives suppression of Phytophthora ramorum.
	Aliette WDG	P07	5 kg/ha	
	Aliette WP	P07	see label	
	CHIPCO Aliette	P07	see label	
	Micora	40	300–600 mL/ 1,000 L water	
	Presidio	43	60–119 mL/ 380 L water	
	Subdue MAXX	4	7.8–15.6 mL/ 100 L water	

RIBES — CURRANT

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *RIBES*				
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	

ROBINIA — LOCUST

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *ROBINIA*				
Locust borer (*Megacyllene robiniae*)	Pyrate 480 EC	1B	500 mL/ 1,000 L water	Locust borer larvae are fleshy, white grubs that tunnel in black locust stems. Weakened trees break in the wind. The black and yellow beetles feed on goldenrod pollen in late summer. Remove and destroy heavily infested trees. Maintain tree vigour, since chemical control is difficult. Treat the bark or trunk and larger branches to control adult beetles from mid-August to late September when goldenrod is blooming.
Locust leafminer (*Odontota dorsalis*)	Orthene 75 SP, Orthene 97 SG	1B	see label	In their adult and larval stages, leafminers feed on black locust leaves. Heavy infestations make trees unsightly. There are 2 generations a year. The adult is a small, wedge-shaped black beetle with bright orange wing covers. To control adult beetles, treat foliage in spring, when leaves open fully, and in early July.

ROSA — ROSE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *ROSA*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids are small, soft-bodied insects that feed by sucking plant sap from tissue. Feeding injury often causes distortion of growth. Aphids produce honeydew that attracts ants and sooty mould. Do not make more than 3 applications of Endeavor per year. Do not apply more than 3 kg of Endeavor/ha/yr. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year. *Do not apply Kontos during bloom as this product is toxic to bee brood.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Cygon 480 E	1B	1 L/ 1,000 L water	
	Endeavor 50WG	9B	10–20 g/ 100 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	*Kontos	23	see label	
	Lagon 480 E	1B	1 L/ 1,000 L water	
	Pyganic EC	3A	2.32–4.65 L/ha	
	Tristar 70 WSP	4A	see label	
	Trounce	3A	50 L/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	

ROSA — ROSE				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *ROSA* (cont'd)				
Japanese beetle (*Popillia japonica*)	**Adult management:**			The adult beetles are metallic green and copper, about 13 mm long. They are easily recognized by six tufts of white hair on each side of the abdomen. As the beetles feed, they consume and skeletonize foliage. Preferred hosts include members of the rosaceous family, maple, birch, linden and fruit trees. Spray adulticides when adults appear in early July, when the *Yucca filamentosa* is blooming. Larvae are C-shaped, milky-white grubs about 25 mm long with brown heads and 3 pairs of legs. Japanese beetle larvae are distinguishable from other white grub species by a V-shaped arrangement of spines on the underside of the abdomen. Larvae are most commonly found feeding on the fibrous roots of turfgrass. Lorsban 4E is a rescue treatment to allow shipping from infested to uninfested regions. Apply to the soil when grubs are young and actively feeding near the soil surface. Apply as a coarse spray, and irrigate with 1–2 cm of water to wash the insecticide into the underlying soil. For containerized stock, submerge the root ball into a solution of Lorsban 4E (45 mL/10 L water) until all bubbling stops. Apply Intercept 60 WP once per year, during the mating period/egg-laying period and up to egg hatch (usually late June/early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering.
	Imidan 50 WP	1B	1.25 kg/1,000 L water	
	Imidan WP	1B	0.89 kg/1,000 L water	
	Larval management:			
	Acelepryn	28	0.56–0.88 L/ha	
	Intercept 60 WP	4A	see label	
	Lorsban 4E, Lorsban NT	1B	4.5 L/1,000 L water (rescue treatment for shipping)	
Leafhopper (several species)	Altus	4D	500–750 mL/ha	Leafhoppers are tiny, yellowish-green to pale-coloured insects that jump quickly when disturbed. Wingless nymphs will often "side step" quickly to hide from potential predators. Leafhoppers have piercing-sucking mouthparts that cause yellowish flecks on the leaf surface. Check regularly for infestation of nursery crops when neighbouring farms are cutting alfalfa or hay. Hang yellow sticky traps in the canopy to monitor for leafhoppers. Check by disturbing plants or looking at the leaf bottoms for leafhopper nymphs or molted skins. Treat as required.
	Cygon 480	1B	10 mL/10 L water	
	Tristar 70 WSP	4A	5 solupaks/1,000 L water	
Rose chafer (*Macrodactylus subspinosus*)	There is no product registered at the time of this publication.			Rose chafer adults are slender, long-legged, tan beetles. They are densely covered with short, dull-yellow hairs. Beetles swarm in early June and feed on the opening buds of many hosts. They later attack the flowers, fruit and foliage. The larvae feed mostly on turfgrass roots but may attack the roots of woody ornamentals. Monitor for rose chafer in June. It is often a problem in sandy soils. With small infestations, pick off beetles by hand. Adult control is difficult.
Roseslug (*Endelomyia aethiops, Allantus cinctus*)	Insecticidal soap	UN	see label	These sawflies feed on the undersides of leaves from late May to mid-June. Treat both leaf surfaces with insecticides. *A. cinctus* may need a second treatment in mid-to-late August.
	Trounce	3A	50 L/1,000 L water	

ROSA — ROSE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *ROSA* (cont'd)				
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment.
	Cygon 480 E	1B	1 L/ 1,000 L water	
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21 L/ 500 L water	
	Lagon 480	1B	1 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Vendex 50 W	12	50–100 g/ 100 L water	
White-marked tussock moth (*Orgyia leucostigma*)	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.
DISEASES AFFECTING *ROSA*				
Bacterial canker (*Pseudomonas syringae*)	Copper Spray	M 01	6 kg/ 1,000 L water	Bacterial canker appears as a blackening of new tissue and is often associated with low-temperature events. Do not crowd plants. Maintain adequate sunlight and good air circulation. Excessive fertilization or pruning can cause undesirable levels of succulent growth. Treat with copper once in October and once in January. Treat during warm, humid blight conditions in April and May with 1 g/L of active ingredient (2 g 50% wettable powder). Repeat at 7–10-day intervals.

ROSA — ROSE				
Pest	**Product**	**Group***	**Rate**	**Notes**
DISEASES AFFECTING *ROSA* (cont'd)				
Black spot (*Diplocarpon rosae*)	Banner MAXX	3	33 mL/ 100 L water	Black spot is a common disease on rose. It appears on leaves and stems as purplish-black spots with yellow halos. Leaves may turn yellow and drop. Where possible, use resistant cultivars. Remove and destroy cankered canes. Where disease occurs, use fungicides every 7–10 days from mid-May (as leaves begin to emerge) until frost kills the foliage. Apply Senator every 10–14 days, and rotate with fungicides from other chemical families to avoid resistance. Reduce spray intervals in cool, wet weather. Avoid overhead irrigation, especially late in the day. A 6-hr period of wet foliage will permit infection to start. Do not crowd plants. Maintain adequate sunlight and good air circulation. Tivano fungicide provides suppression only.
	Banner EC 130	3	40 mL/ 100 L water	
	Captan	M 04	see label	
	Compass 50 WG	11	15–20 g/ 100 L water	
	Daconil 2787	M 05	1.8 L/ 1,000 L water	
	Daconil 720	M 05	1.3 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.1 kg/ 1,000 L water	
	Funginex DC	3	1 L/ 1,000 L water	
	Nova	3	340 g/ 1,000 L water	
	Rhapsody ASO	BM 02	1.0–2.0 L/ 100 L water	
	Senator 70 WP	1	500–750 g/ 1,000 L water	
	Senator 50 SC	1	700–1,050 mL/ 1,000 L water	
	Tivano	Bio	see label	
Botrytis (*Botrytis cinerea*)	Daconil 2787 F	M 05	1.8 L/ 1,000 L water	Botrytis can be an issue on roses in cold storage. Look for grey, velvety fungal growth on plants. Apply fungicide before lifting for storage. Repeat during storage. Apply fungicides at the first sign of disease, and repeat every 10–14 days if needed.
	Daconil 720	M 05	1.3 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.1 kg/ 1,000 L water	
	Senator 50 SC	1	700–1,050 mL/ 1,000 L water	
	Senator 70 WP	1	500–750 g/ 1,000 L water	
Botrytis flower blight (*Botrytis cinerea*)	Captan	M 04	see product(s) label	Botrytis is a grey, velvety fungus that may grow on succulent tissue (e.g., flowers). Apply fungicides when the disease first appears, and repeat at 7–10-day intervals.
	Daconil 2787	M 05	1.8 L/ 1,000 L water	
	Daconil 720	M 05	1.3 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.1 kg/ 1,000 L water	
Crown gall (*Agrobacterium tumefaciens*)	Dygall	Bio	160 g/ 50 L water	This gall appears as large, abnormal growths on stems and roots. Susceptible plants (*Euonymus, Rosa, Salix*) must be treated before disease exposure or final field placement. Wounding (e.g., pruning) and damaging plants facilitate entry and infection by this pathogen. Remove and destroy infected plants and soil. This is a soil-borne bacteria. Avoid planting susceptible species into soil with a history of this disease.

ROSA — ROSE				
Pest	**Product**	**Group***	**Rate**	**Notes**
DISEASES AFFECTING *ROSA* (cont'd)				
Downy mildew (*Peronospora sparsa*)	Acrobat 50 WP	40	48 g/ 100 L water	This fungus causes purplish to brownish blotches on the upper leaf surface. Under cool, moist conditions, slight symptoms of sporulation (fuzzy appearance) may be evident on the lower leaf surface below the lesion. These spores will disappear quickly once it warms up. Downy mildew infections often lead to premature leaf drop. Increase air circulation around susceptible plants, and reduce leaf wetness periods by watering only in the mid-morning. Regalia Maxx gives suppression of *Plasmopora* spp. and *Peronospora* spp. of downy mildew only.
	Heritage Maxx	11	400–800 mL/ 1,000 L water	
	Micora	40	300–600 mL/ 1,000 L water	
	Presidio	43	60–119 mL/ 380 L water	
	Regalia Maxx	P 05	1 L/ 400 L water	
	Torrent 400SC	21	see label	
Powdery mildew (*Sphaerotheca pannosa* var. *rosae*)	Banner MAXX	3	35 mL/ 100 L water	This fungus appears as a white, powdery growth on leaves and shoot ends. Leaves become stunted and curled. Treat when symptoms first appear. Apply fungicides every 10 days. Apply Nova every 10–14 days, and rotate with fungicides from other chemical families to avoid resistance. Senator can be applied every 10–14 days as needed. Do not apply sulphur when temperatures exceed 27°C. Do not crowd plants. Maintain adequate sunlight and good air circulation. Overhead watering during the day may reduce the spread and development of the disease, but avoid overhead irrigation late in the day. MilStop can be used for the suppression of powdery mildew. Start application of MilStop at the first sign of disease. Rhapsody is a biological fungicide that can help protect healthy tissues at the first sign of disease. Tivano fungicide provides disease suppression only.
	Banner EC 130	3	42 mL/ 100 L water	
	Copper 53 W	M 01	6 kg/ 1,000 L water	
	Folpan 50 WP	M 04	2 kg/ 1,000 L water	
	Funginex DC	3	1 L/ 1,000 L water	
	Heritage Maxx	11	0.4–1.6 L/ 1,000 L water	
	MilStop	NC	2.8–5.6 kg/ 1,000 L water	
	Nova	3	340 g/ 1,000 L water	
	Rhapsody ASO	BM 02	1.0–2.0 L/ 100 L water	
	Senator 70 WP	1	500–750 g/ 1,000 L water	
	Senator 50 SC	1	700–1,050 mL/ 1,000 L water	
	Sulphur	M 02	see label	
	Tivano	Bio	see label	

SALIX — WILLOW

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *SALIX*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids are small, soft-bodies insects that feed by sucking on plant sap. Feeding causes distortion and weakens the plant. Treat when aphids first appear, and repeat as needed. Do not make more than 3 applications of Endeavor per year. Do not apply more than 3 kg of Endeavor/ha/yr. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Endeavor 50WG	9B	10–20 g/ 100 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pyrate 480 EC	1B	375 mL/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks/ 1,000 L water	
	Trounce	3A	50 L/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	
Gypsy moth (*Lymantria dispar*)	Dipel	11A	see label	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs but prefer basswood, birch, hawthorn, oak, poplar and willow. Females lay eggs in brown, fuzzy masses July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide HPC	11A	7.14–12 L/ 1,000 L water	
	Thuricide 48LV	11A	2.4–4 L/ha	
Imported willow leaf beetle (*Plagiodera versicolora*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Adults are small, oval, metallic-blue beetles. Adults and larvae skeletonize willow and Lombardy poplar leaves. There are 2 or more generations per year. Larvae are black, slug-like grubs. Treat at the first sign of leaf feeding after leaves appear, in late May to early June. Repeat the application in early July if necessary. A pupal parasite exists, so avoid insecticide applications at the time of pupation.
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Success	5	25 mL/ 1,000 L water	

SALIX — WILLOW

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *SALIX* (cont'd)				
Poplar and willow borer (*Cryptorhynchus lapathi*)	Pyrate 480 EC	1B	500 mL/ 1,000 L water	This borer is a stout, black, rough-bodied snout beetle with pink outer wing covers. The white, legless larvae honeycomb the trunks and larger branches of willows and poplars. Cut and destroy badly infected branches and trees before the end of June. Treat trunk and branch bark in mid-August and September with insecticides.
Spiny elm caterpillar (*Nymphalis antiopa*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Adult moths are called the "mourning cloak butterfly." Larvae are black with scattered white dots and are covered with large, branched spines. They feed in groups on elm, willow and poplar. Treat when caterpillars first appear and are small.
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of twice per season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	
White-marked tussock moth (*Orgyia leucostigma*)	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on Malus and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.

SALIX — WILLOW

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *SALIX*				
Blight scab and black canker complex	There is no product registered at the time of this publication.			This fungal infection causes leaves to turn brown to black. Branches and twigs die back. Prune out infected wood. Do not crowd plants. Maintain adequate sunlight and good air circulation.

SORBUS — MOUNTAIN ASH

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *SORBUS*				
European red mite (*Panonychus ulmi*)	Horticultural oil	UN	20–30 L/ 1,000 L water	Use horticultural oil as a dormant spray in early spring when plants show 2.5 cm of green tissue and flower buds are a tight cluster. Use other materials about mid-spring. Landscape Oil (horticultural oil) can be used when the plants are dormant. See product label for rates and tolerant plants.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
Mountain ash sawfly (*Pristiphora geniculata*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Sawfly larvae are yellow with black spots on all body segments except the last one. There are four lines of spots along each side of the larvae. Two broken lines run down the back. Sawflies feed in colonies from June to early August. A second generation appears from late August to early September. Young larvae feed in colonies and are easily pruned out. Treat foliage to control larvae during late spring. Repeat the treatment in areas where the second generation appears in August.
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Pounce 384 EC	3A	45–90 mL/ha	
Pearleaf blister mite (*Eriophyes pyri* or *Phytoptus pyri*)	Horticultural oil	UN	see label	Feeding injury from this mite causes small blisters on the leaf undersides of pear, apple and mountain ash. There are several generations per year. Mites overwinter under the outer bud scales, resuming activity in the spring. Apply horticultural oil as a dormant treatment in the spring. Landscape Oil (horticultural oil) can be used when the plants are dormant and, in some cases, as a summer application. See product label.
DISEASES AFFECTING *SORBUS*				
Fire blight (*Erwinia amylovora*)	Copper Spray	M 01	1.25 kg/ 1,000 L water	Fire blight affects succulent vegetative growth. Dead, dry leaves persist on infected branches. Spray bactericidal products at early bloom, full bloom and petal fall when the weather is warm and humid and fire blight is a recurring problem. Avoid excessive pruning and nitrogen fertilization in spring. During dormancy, prune out infected branches about 30 cm below the cankered area when the tree is dry.

SYRINGA — LILAC

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *SYRINGA*				
Japanese beetle (*Popillia japonica*)	**Adult management:**			The adult beetles are metallic green and copper coloured, about 13 mm long. They are easily recognized by six tufts of white hair on each side of the abdomen. As the beetles feed, they consume and skeletonize foliage. Preferred hosts include members of the rosaceous family, maple, birch, linden and fruit trees. Spray adulticides when adults appear in early July, when the *Yucca filamentosa* is blooming. Larvae are C-shaped, milky-white grubs about 25 mm long with brown heads and 3 pairs of legs. Larvae are distinguishable from other white grub species by a V-shaped arrangement of spines on the underside of the abdomen. Larvae are most commonly found feeding on fibrous roots of turfgrass. Lorsban 4E is a rescue treatment to allow shipping from infested to uninfested regions. Apply to soil when the grubs are young and actively feeding near the soil surface. Apply as a coarse spray, and irrigate with 1–2 cm of water to wash the insecticide into the underlying soil. For containerized stock, submerge the root ball into a solution of Lorsban 4E (45 mL/10 L water) until all bubbling stops. Apply Intercept 60 WP once per year, during the mating period/egg-laying period and up to egg hatch (usually late June/early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering.
	Imidan 50 WP	1B	1.25 kg/1,000 L water	
	Imidan WP	1B	0.88 kg/1,000 L water	
	Larval management:			
	Acelepryn	28	0.56–0.88 L/ha	
	Intercept 60 WP	4A	see label	
	Lorsban 4E, Lorsban NT	1B	4.5 L/1,000 L water (rescue treatment for shipping)	
Lilac borer (*Podosesia syringae* var. *syringae*)	Pyrate 480 EC	1B	500 mL/1,000 L water	Lilac borer larvae bore into the trunk near the base. Stressed trees are most susceptible to borers. Cut and destroy infested wood before May. Prevent mechanical damage to wood and bark. The adults are dark-brown, wasp-like moths, present from late May to late July. They emerge through holes 1–1.5 cm in diameter. They are clearwing moths and resemble wasps when flying. Use pheromone traps to monitor adult activity. Begin treatment 10 days after peak catch numbers. Treat trunk and large branches, especially around wounds. Repeat twice at 10-day intervals.
Lilac leafminer (*Caloptilia syringella* or *Gracillaria syringella*)	Cygon 480 E	1B	1.25 L/1,000 L water	The adult is a small, dark-brown moth, active in late May to early June. Larvae are pale yellow and feed between leaf surfaces, causing brown blotches to form. For small infestations, pick and destroy affected leaves. Treat when pest activity first appears (immediately after flowering) and repeat 6 weeks later. Privet (*Ligustrum*) is an alternate host.
	Lagon 480	1B	1.25 L/1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/1,000 L water	
	Malathion 85E	1B	1.22 L/1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	

SYRINGA — LILAC

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *SYRINGA* (cont'd)				
Oystershell scale (*Lepidosaphes ulmi*)	Horticultural oil	UN	20–30 L/ 1,000 L water	Oystershell scale can be found on over 125 forest, shade, fruit and ornamental tree species. In heavy infestations, greyish scales completely encrust twigs and stems. This can cause branch and tree mortality. Mature females are 3 mm long and rounded at the rear, resembling oyster shells. Eggs overwinter under dead female shells, rendering them completely resistant to pesticides applied in fall or early spring (dormant applications of horticultural oil are ineffective). Use insecticides when crawlers are present in late May. Apply again 10 days later, about the time *Spiraea* x *vanhouttei* is blooming. Ensure good coverage of trunk, branches and leaf bottoms. Landscape Oil (horticultural oil) can be used in the summer when leaves are fully expanded and hardened off. See product label.
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	0.61 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	
White grubs: European chafer (*Rhizotrogus majalis*) June beetle (*Phyllophaga* sp.)	**Larval management:**			These beetle larvae are referred to as "white grubs." They chew fibrous roots and girdle underground stems of many woody ornamentals (including *Cornus* sp.). To expose grubs to natural predators, cultivate infested fields before planting. Apply Intercept 60 WP once per year, during the mating period/ egg-laying period and up to egg hatch (usually late June/ early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering. Apply Acelepryn any time that larvae are present or during the mating period/egg-laying period to egg-hatch.
	Acelepryn, Acelepryn G	28	5.6–8.8 mL/ 100 m^2	
	Intercept 60 WP	4A	see label	
	Lorsban NT, Lorsban 4E	1B	4.5 L/ 1,000 L water (rescue treatment for shipping)	
	Adult management:			
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
DISEASES AFFECTING *SYRINGA*				
Bacterial canker (*Pseudomonas syringae*)	Copper Spray	M 01	6 kg/ 1,000 L water (dormant rate)	In this disease, young shoots or leaves turn black between early spring and early summer, especially during wet, cool weather. Bacterial canker can kill young twigs during wet springs. It can be found on container-grown plants after plastic film has been removed from the cold frame in early spring. It is commonly found after low-temperature injury. Apply treatment once in October and again in January. During blight conditions in April and May, apply 1 g/L of active ingredient (2 g 50% wettable powder). Repeat at 7–10-day intervals. Avoid overhead irrigation late in the day. Prune out infected twigs. Do not crowd plants. Maintain adequate sunlight and good air circulation.
Powdery mildew (*Microsphaera alni*)	Nova	3	340 g/ 1,000 L water	This white-to-grey powdery mould appears on leaves in late summer and early autumn. It does not usually require chemical control. Do not crowd plants. Maintain adequate sunlight and good air circulation. Overhead watering during the day may reduce the spread and development of this disease, but avoid overhead irrigation late in the day. Apply fungicide when first symptoms appear in mid-to-late August. Repeat at 5–10-day intervals. Do not apply sulphur when temperatures exceed 27°C.
	Palladium WG	9, 12	see label	
	Sulphur	M 02	see label	

SYRINGA — LILAC

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *SYRINGA* (cont'd)				
Rhizoctonia root rot	Compass 50 WG	11	3.8 g/ 100 L water	Rhizoctonia causes a stem blight and root rot at or below the soil line. Lab testing is needed to confirm the identification of this disease. Protect healthy plants with fungicides at the first sign of disease.
	Heritage Maxx	11	0.4 L/ 1,000 L water	
	Medallion	12	300–600 mL/ 1,000 L water	

TAXUS — YEW

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *TAXUS*				
Black vine weevil, Taxus weevil (*Otiorhynchus sulcatus*)	Demand CS	3A	360 mL/ 1,000 L water	Larvae are small, white, legless grubs that eat fibrous roots or strip bark off larger roots. Infested plants grow slowly or fail to grow. Plants look dry and off-colour. Transplants often die without becoming established. Larval control is difficult. Adults are black snout beetles that hide in soil litter during the day and cut crescent-shaped notches in needle margins at night. They also attack eastern white cedar, spruce, hemlock, azaleas, yews and rhododendrons. In container production, they are also significant pests of several hosts, including herbaceous perennials. Adult weevils have fused wing covers and cannot fly. To control adults, treat the foliage, trunk bark and branches during the last week of June and in early July. Spray in the evening, as adult activity increases about an hour after sunset. To test treatment safety, treat some conifer seedlings, especially pine, before treating a larger area. Entomopathogenic nematodes (e.g., *Heterorhabditis* sp.) are available to help suppress populations of larvae. Nematodes work very well in infested containers but with less success in the field. Nematodes can be applied in late summer/early autumn and in mid-spring to suppress larval populations. See the product label for complete directions. To monitor for adults, place a piece of plywood around infested plant bases. Adult weevils will hide under the wood during the day. Or place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Do not use Demand CS or Silencer in residential areas.
	Flagship 25WG	4A	10.5–14 g/ 100 L water	
	Heterorhabditis bacteriophora	NC	see label	
	Met52 G	UNF	see label	
	Silencer 120 EC	3A	300 mL/ 1,000 L water	
Fletcher scale (*Lecanium fletcheri*)	Cygon 480 E	1B	2 L/ 1,000 L water	The adult is a reddish-brown sphere that appears on branches. Look for black honeydew and black sooty mould on the needles in mid-to-late spring. Heavily infested plants look off-colour. Treat newly emerged crawlers in early July when *Yucca filamentosa* is blooming, or in September when the nymphs migrate. Repeat the application in about 10 days to catch all nymphs. Do not make more than 2 applications of Ference per year. Apply horticultural oils, with caution of phytotoxicity, when plants are dormant. Apply Landscape Oil (horticultural oil) to target crawlers when new foliage is fully expanded and hardened off. See product label for rates and tolerant plants.
	Ference	28	37.5–75 mL/ 100 L water	
	Horticultural oil	UN	see label	
	Insecticidal soap	UN	see label	
	Lagon 480	1B	2 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	

TAXUS — YEW

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *TAXUS* (cont'd)				
Taxus mealybug (*Pseudococcus cuspidatae* or *Dysmicoccus wistariae*)	Cygon 480 E	1B	2 L/ 1,000 L water	Taxus mealybug is a slow-moving, white, woolly insect that can completely cover heavily infested branches and trunks with a waxy secretion. Feeding discolours needles and causes excessive needle cast. This mealybug attacks all yew species. Use insecticide on the bark of small branches and twigs to control nymphs when the *Aesculus hippocastanum* is blooming. See product label.
	Insecticidal soap	UN	see label	
	Lagon 480	1B	2 L/ 1,000 L water	
	Malathion 500 EC	1B	2.5 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Orthene 97 SG	1B	see label	
	Trounce	3A	50 L/ 1,000 L water	

THUJA — EASTERN WHITE CEDAR, ARBORVITAE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *THUJA*				
Black vine weevil, Taxus weevil (*Otiorhynchus sulcatus*)	Demand CS	3A	360 mL/ 1,000 L water	Larvae are small, white, legless grubs that eat fibrous roots or strip bark off larger roots. Infested plants grow slowly or fail to grow. Plants look dry and off-colour. Transplants often die without becoming established. Larval control is difficult. Adults are black snout beetles that hide in soil litter during the day and cut crescent-shaped notches in needle margins at night. They also attack eastern white cedar, spruce, hemlock, azaleas, yews and rhododendrons. In container production, they are also significant pests of several hosts, including herbaceous perennials. Adult weevils have fused wing covers and cannot fly. To control adults, treat the foliage, trunk bark and branches during the last week of June and in early July. Spray in the evening, as adult activity increases about an hour after sunset. To test treatment safety, treat some conifer seedlings, especially pine, before treating a larger area. Entomopathogenic nematodes (e.g., *Heterorhabditis* sp.) are available to help suppress populations of larvae. Nematodes work very well in infested containers but with less success in the field. Nematodes can be applied in late summer/early autumn and in mid-spring to suppress larval populations. See the product label for complete directions. To monitor for adults, place a piece of plywood around infested plant bases. Adult weevils will hide under the wood during the day. Or place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Do not use Demand CS or Silencer in residential areas.
	Flagship 25WG	4A	10.5–14 g/ 100 L water	
	Heterorhabditis bacteriophora	NC	see label	
	Met52 G	UNF	see label	
	Silencer 120 EC	3A	300 mL/ 1,000 L water	
Cedar leafminer, Arborvitae leafminer (*Argyresthia thuiella* and other species)	Cygon 480 E	1B	2 L/ 1,000 L water	Four caterpillar species mine cedar foliage, but *A. thuiella* is the most common. Feeding causes branch tips to turn brown. The adult is a small, light-grey moth that appears in late June to early July. Prune out infected tips before June to provide some suppression. To manage larvae, spray with Cygon in early May or late August. Use Malathion in June to suppress populations of adult moths.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	1.22 L/ 1,000 L water	

THUJA — EASTERN WHITE CEDAR, ARBORVITAE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *THUJA* (cont'd)				
Fletcher scale (*Lecanium fletcheri*)	Cygon 480 E	1B	2 L/ 1,000 L water	The adult is a reddish-brown sphere that appears on branches. Look for black honeydew and black sooty mould on the needles in mid-to-late spring. Heavily infested plants look off-colour. Treat newly emerged crawlers in early July when *Yucca filamentosa* is blooming, or in September when the nymphs migrate. Repeat the application in about 10 days to catch all nymphs. Do not make more than 2 applications of Ference per year. Apply horticultural oils, with caution of phytotoxicity, when plants are dormant. Apply Landscape Oil (horticultural oil) to target crawlers when new foliage is fully expanded and hardened off. See product label for rates and tolerant plants.
	Ference	28	37.5–75 mL/ 100 L water	
	Horticultural oil	UN	see label	
	Insecticidal soap	UN	see label	
	Lagon 480	1B	2 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
Juniper scale (*Carulaspis juniperi*)	Insecticidal soap	UN	see label	This small, circular, white scale with a yellow centre causes juniper and arborvitae needles to turn yellow. Treat crawlers in late June when *Philadelphus* is at full bloom and *Catalpa* are beginning to bloom. Repeat as needed about 10 days later.
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
Spruce spider mite (*Oligonychus ununguis*)	Cygon 480 E	1B	2 L/ 1,000 L water	Overwintered eggs hatch in early May, when *Amelanchier laevis* and *Magnolia* x *soulangeana* are in full bloom. Mites prefer older needles as feeding sites. To monitor for mites, use a hand lens to check the undersides of twigs and needles for tiny reddish eggs or brown mites with black backs. Shake a branch over a white sheet of paper and look for crawling specks. Apply miticides when mites first appear. Kanemite is effective against mobile life stages but may also reduce egg viability. Use horticultural oil as a dormant treatment in early spring to target eggs and newly hatched nymphs. Do not use horticultural oil on white pine or blue cultivars of Colorado spruce or juniper. Landscape Oil is a brand of horticultural oil that can be used on labelled plants in summer, when leaves are fully expanded and hardened off (see product label). If mite populations are still significant, make 2 applications of other miticides at 10-day intervals when mites exist in spring. Many predatory mites co-exist with pest mite populations. To conserve predatory mites, try miticides that have less impact on these beneficials, such as Vendex and Floramite.
	Floramite SC	20D	625 mL/ 1,000 L water	
	Horticultural oil	UN	20 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	Lagon 480	1B	2 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Nealta	25	1 L/ha	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pyrate 480 EC	1B	375–500 mL/ 1,000 L water	
	Vendex 50 W	12	50–100 g/ 100 L water	

THUJA — EASTERN WHITE CEDAR, ARBORVITAE

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *THUJA* (cont'd)				
Strawberry root weevil (*Otiorhynchus ovatus*)	Met52 G	UNF	see label	The weevil larvae are small, white, legless grubs that eat fibrous roots or strip bark from larger roots. The reddish-brown flightless adult is less than 6 mm long and is much smaller than the black vine weevil. Adults hide during the day and feed at night. Adults are active in late June and early July, when *Wiegela florida* and *Syringa reticulata* are blooming. Adults injure plants by puncturing and girdling the current season's shoots while feeding. These pests have a large host range. Commonly injured plants include white cedar, spruce and juniper. Infested plants grow slowly or fail to grow. They look dry and off-colour. Transplants often die without becoming established. To monitor for adults, wrap a sheet of burlap around infested plant bases. Adult weevils will hide in the burlap during the day. Place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Adults remain immobile during daylight hours and feed at night. Pounce 384 EC is registered for use on seedlings. To test treatment safety, treat some conifer seedlings before treating a larger area.
	Pounce 384 EC	3A	see label	
Tarnished plant bug (*Lygus lineolaris*)	Actara 25WG, Flagship 25WG	4A	210–280 g/ha	This plant bug is a small (5 mm), yellowish-brown insect. Adults have wings that form an X pattern when folded over their back. Tarnished plant bugs feed by inserting their mouthparts inside leaf tissue and sucking out the contents, leaving the lower and upper epidermis behind. The resulting injury appears as small, clear "windows" on leaf tissue of broad-leaved plants. On conifers, feeding often causes terminal growth to yellow and become distorted and bushy. Treat in spring and early summer to manage populations of this insect.
	Ripcord 400 EC	3A	172 mL/ha	
White grubs: European chafer (*Rhizotrogus majalis*) June beetle (*Phyllophaga* sp.) Japanese beetle (*Popillia japonica*)	**Larval management:**			These beetle larvae are referred to as "white grubs." They chew fibrous roots and girdle underground stems of many woody ornamentals (including *Cornus* sp.). To expose grubs to natural predators, cultivate infested fields before planting. Apply Intercept 60 WP once per year, during the mating period/egg-laying period and up to egg hatch (usually late June/early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering. Apply Acelepryn any time that larvae are present or during the mating period/egg-laying period to egg-hatch.
	Acelepryn, Acelepryn G	28	5.6–8.8 mL/100 m^2	
	Intercept 60 WP	4A	see label	
	Lorsban NT, Lorsban 4E	1B	4.5 L/1,000 L water (rescue treatment for shipping)	
	Adult management:			
	Imidan WP	4A	0.89 kg/1,000 L water	
	Imidan 50 WP	4A	1.25 kg/1,000 L water	

THUJA — EASTERN WHITE CEDAR, ARBORVITAE

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *THUJA*				
Botrytis (*Botrytis cinerea*)	Rovral WP, Rovral WDG	2	1 kg/ 1,100 L water	During very humid conditions, a fuzzy, grey growth develops on infected plant parts. Treat twigs and buds in spring before new leaves emerge. Treat conifer seedlings at the onset of botrytis. Remove all fading and diseased plant parts promptly, especially when wet weather is predicted. Do not crowd plants. Maintain adequate sunlight and good air circulation.
Damping off, root rot and stem rot (*Phytophthora, Pythium*)	Heritage Maxx	11	0.4 L/ 1,000 L water	*Pythium* and *Phytophthora* cause root and stem rots during conditions of high humidity and moisture (e.g., propagation). Protect healthy tissue with preventive fungicides or treat at the first sign of disease. Subdue MAXX can be used as a drench or a pre-incorporated treatment for media to help protect conifer seedlings and transplants from *Pythium* and *Phytophthora*. See product label.
	Presidio	43	60–119 mL/ 380 L water	
	Previcur N	28	see label	
	Subdue MAXX	4	1.2 L/ha in 200 L (drench)	
	Torrent 400SC	21	see label	
Leaf blight (*Didymascella thujina*)	Copper Spray	M 01	4 kg/ 1,000 L water	This leaf blight mainly attacks western red cedar (*Thuja plicata*). Apply fungicides at 10–14-day intervals starting at bud break to protect new growth.
	Dithane M-45, Dithane 80, Dithane DG 75, Dithane Rainshield	M 03	2.75–3.5 kg/ 1,000 L water	
	Manzate	M 03	see label	

TILIA — LINDEN, BASSWOOD

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *TILIA*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids are small, soft-bodied insects that suck plant sap. Feeding injury often causes distortion and weakens the plant. Apply insecticides at the first sign of aphids. Use up to 2 applications of Closer per crop cycle. Do not make more than 3 applications of Endeavor per year. Do not apply more than 3 kg of Endeavor/ha/yr. Do not make more than 2 applications of Ference per year. *Do not apply Kontos during bloom as this product is toxic to bee brood.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Endeavor 50WG	9B	10–20 g/ 100 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	*Kontos	23	see label	
	Tristar 70 WSP	4A	3 solupaks/ 1,000 L water	
	Trounce	3A	50 L/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	
Fall cankerworm (*Alsophila pometaria*) Spring cankerworm (*Paleacrita vernata*)	Dipel 2X DF	11A	125 g/400L	Green and dark-grey inchworms (loopers, geometrids) can be found feeding on leaf undersides and edges in spring. Cankerworm can cause significant defoliation to deciduous trees. Treat when larvae appear in mid-May, when *Acer platanoides* and *Magnolia* x *soulangeana* are blooming. To help reduce the next generation of fall cankerworm, place sticky bands around tree trunks, close to the ground, by late October. Bands will help to trap the flightless adult female moths as they emerge from the ground and crawl up the tree trunk. Treat with insecticides when larvae are small.
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	

TILIA — LINDEN, BASSWOOD

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *TILIA* (cont'd)				
Gypsy moth (*Lymantria dispar*)	Dipel	11A	see product(s) label	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs, most notably basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production). Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide 48LV	11A	2.4–4L /ha	
	Thuricide HPC	11A	7.14–12 L/ 1,000 L water	
Japanese beetle (*Popillia japonica*)	**Adult management:**			The adult beetles are metallic green and copper coloured, about 13 mm long. They are easily recognized by six tufts of white hair on each side of the abdomen. As the beetles feed, they consume and skeletonize foliage. Preferred hosts include members of the rosaceous family, maple, birch, linden and fruit trees. Spray adulticides when adults appear in early July, when the *Yucca filamentosa* is blooming. Larvae are C-shaped, milky-white grubs about 25 mm long with brown heads and 3 pairs of legs. Japanese beetle larvae are distinguishable from other white grubs by a V-shaped arrangement of spines on the underside of the abdomen. Larvae are most commonly found feeding on the fibrous roots of turfgrass. Lorsban 4E is a rescue treatment to allow shipping from infested to uninfested regions. Apply to soil when grubs are young and actively feeding near the soil surface. Apply as a coarse spray, and irrigate with 1–2 cm of water to wash the insecticide into the underlying soil. For containerized stock, submerge the root ball into a solution of Lorsban 4E (45 mL/10 L water) until all bubbling stops. Apply Intercept 60 WP once per year, during the mating period/ egg-laying period and up to egg hatch (usually late June/ early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering.
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Larval management:			
	Acelepryn	28	0.56–0.88 L/ha	
	Intercept 60 WP	4A	467 g/ha	
	Lorsban 4E, Lorsban NT	1B	4.5 L/ 1,000 L water (rescue treatment for shipping)	
Linden looper (*Erannis tiliaria*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Linden looper larvae are bright yellow with rusty-brown heads and 10 wavy black lines down the back. Larvae are present from early spring to early summer. This looper feeds on a wide variety of deciduous tree leaves. Band specimen trees with sticky trapping materials in late summer. This will trap wingless females as they climb up the trunk to lay their eggs. Treat foliage when larvae first appear.

TILIA — LINDEN, BASSWOOD

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *TILIA* (cont'd)				
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of 2 times per season at an interval of 28 days. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha in 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	
White-marked tussock moth (*Orgyia leucostigma*)	Pounce 384 EC	3A	45–90 mL/ha	Larvae are brightly colored, with four thick, white tufts of hairs on their backs. The head is bright red and the body has yellow or white stripes, with a black stripe along the middle of the back. Two gray-brown hair pencils can be found extending up and out on either side of the head, with one gray-brown hair pencil extending up and out from the hind end. Touching the hairs sets off an allergic reaction in many humans. Young larvae skeletonize the surface of the leaf, while older larvae eat everything except the larger veins. They grow to about 35 mm long. Fuzzy-covered egg masses can often be found overwintering on *Malus* and resemble Gypsy moth egg masses (a close relative). Spray when larvae are actively feeding. There are at least 2 generations of larvae per year.

TSUGA — HEMLOCK

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *TSUGA*				
Black vine weevil, Taxus weevil (*Otiorhynchus sulcatus*)	Demand CS	3A	360 mL/ 1,000 L water	Larvae are small, white, legless grubs that eat fibrous roots or strip bark off larger roots. Infested plants grow slowly or fail to grow. Plants look dry and off-colour. Transplants often die without becoming established. Larval control is difficult. Adults are black snout beetles that hide in soil litter during the day and cut crescent-shaped notches in needle margins at night. They also attack eastern white cedar, spruce, hemlock, azaleas, yews and rhododendrons. In container production, they are also significant pests of several hosts, including herbaceous perennials. Adult weevils have fused wing covers and cannot fly. To control adults, treat the foliage, trunk bark and branches during the last week of June and in early July. Spray in the evening, as adult activity increases about an hour after sunset. To test treatment safety, treat some conifer seedlings, especially pine, before treating a larger area. Entomopathogenic nematodes (e.g., *Heterorhabditis* sp.) are available to help suppress populations of larvae. Nematodes work very well in infested containers but with less success in the field. Nematodes can be applied in late summer/early autumn and in mid-spring to suppress larval populations. See the product label for complete directions. To monitor for adults, place a piece of plywood around infested plant bases. Adult weevils will hide under the wood during the day. Or place a white sheet under the plant, and shake the plant vigorously to dislodge any adults. Do not use Demand CS or Silencer in residential areas.
	Flagship 25WG	4A	10.5–14 g/ 100 L water	
	Heterorhabditis bacteriophora	NC	see label	
	Met52 G	UNF	see label	
	Silencer 120 EC	3A	300 mL/ 1,000 L water	
Eastern hemlock looper (*Lambdina fiscelleria*)	Mimic 240 LV	18	290 mL/ha	This looper is 3 cm long, greyish and flecked with black dots. It prefers hemlock, balsam fir and white spruce but will feed on several other coniferous and broadleaf hosts. Apply Mimic to control early instar larvae. Allow 3–7 days for larval mortality. A second application of Mimic may be required.
Hemlock woolly adelgid (*Adelges tsugae*)	IMA-jet, IMA-jet 10	4A	see label	This is a serious pest of eastern hemlock. Look for white egg sacs on the undersides of young twigs in early spring (April and May). It is the only adelgid species on hemlock with eggs sacs in early spring. Treat with multiple applications of contact insecticides when nymphs hatch, usually starting in early-mid May. Nymphs are tiny, blue, aphid-like insects that feed by sucking plant sap. Treat with injectable, systemic insecticides any time trees are actively transpiring.
	Landscape Oil	UNM	20 L/ 1,000 L water	
White grubs: European chafer (*Rhizotrogus majalis*) June beetle (*Phyllophaga* sp.)	**Larval management:**			These beetle larvae are referred to as "white grubs." They chew fibrous roots and girdle underground stems of many woody ornamentals (including *Cornus* sp.). To expose grubs to natural predators, cultivate infested fields before planting. Apply Intercept 60 WP once per year, during the mating period/ egg-laying period and up to egg hatch (usually late June/ early July in southern Ontario). In the field, sufficient irrigation (5–10 mm) should occur within 24 hr after application; avoid overwatering. Apply Acelepryn any time that larvae are present or during the mating period/egg-laying period to egg-hatch.
	Acelepryn G	28	5.6–8.8 mL/ 100 m^2	
	Intercept 60 WP	4A	467 g/ha	
	Lorsban NT, Lorsban 4E	1B	4.5 L/ 1,000 L water (rescue treatment for shipping)	
	Adult management:			
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	

ULMUS — ELM

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *ULMUS*				
Aphids (various)	Altus	4D	500–750 mL/ha	Aphids are small, soft-bodied insects that suck plant sap. Feeding injury often causes distortion and weakens the plant. Apply insecticides at the first sign of aphids. Do not make more than 3 applications of Endeavor per year. Do not apply more than 3 kg of Endeavor/ha/yr. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Endeavor 50WG	9B	10–20 g/ 100 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Tristar 70 WSP	4A	3 solupaks/ 1,000 L water	
	Trounce	3A	50 L/ 1,000 L water	
	Ventigra	9D	0.1 L/ha	
Elm bark beetle: European elm bark beetle (*Scolytus multistriatus*) Native elm bark beetle (*Hylurgopinus rufipes*)	Pyrate 480 EC	1B	see label	Elm bark beetles are vectors of the Dutch elm disease fungus. The smaller European elm bark beetle feeds in the crotches of small twigs. The native elm bark beetle attacks rough-barked branches and stems, causing distinct gallery formations. Both are small, brownish beetles about 3 mm long. Destroy elms infected with Dutch elm disease before overwintering adult beetles emerge and lay eggs. To control beetles, treat on suitable days in March and April, before leaves appear on the trees. Apply a second treatment in late July.
Elm casebearer (*Coleophora ulmifoliella*)	Malathion 500 EC	1B	2.5 L/ 1,000 L water	Overwintering casebearer larvae feed on emerging leaves. The larvae mine leaves. Heavy infestations cause leaf browning or scorching. All elms are potential hosts. Treat foliage in early June as mines begin to appear.
Elm flea weevil (*Orchetes alni*)	There is no product registered at the time of this publication.			Adult weevils overwinter in leaf litter and become active as leaves start to emerge in early spring. Adult flea weevils are very tiny (2–3 mm) and brown with black spots on their back. Adults feed on new leaves, and injury ranges from small holes to skeletonized leaves. Adults lay eggs in leaf veins, and larvae hatch to feed inside leaf tissue as leafminers do. Larvae are very tiny, white and legless. The preferred host is Siberian elm (*Ulmus pumila*).
Elm leaf beetle (*Pyrrhalta luteola*)	Orthene 75 SP, Orthene 97 SG	1B	see label	The adult beetle is olive green with a dark stripe on each wing cover. The beetles chew holes in developing leaves, while the black larvae skeletonize the underside. They may attack all elm species. Treat the upper and lower leaf surfaces when they are about three-quarters expanded. Do not apply Orthene on American elm.
	Success	5	25 mL/ 1,000 L water	
Elm leafminer (*Fenusa ulmi*)	Insecticidal soap	UN	see label	Treat foliage around late May to early June to control larvae as mines first become apparent. For small infestations, mined leaves can be picked off and destroyed. The adults are tiny, black sawflies that appear in early spring. Spray insecticides to target adults.
European elm scale (*Gossyparia spuria*)	Horticultural oil	UN	see label	Overwintering scale nymphs become active in early spring. Crawlers are covered in white, waxy, cottony strands. By June, females can easily be recognized by the white margins around the scale. Treat when young crawlers have emerged in early summer. Horticultural oils can be used when plants are dormant. See the product label for rates and tolerant plants.
	Insecticidal soap	UN	see label	

ULMUS — ELM				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *ULMUS* (cont'd)				
European red mite (*Panonychus ulmi*)	Dyno-Mite SC	21A	470 mL/ha	These mites overwinter as eggs. Apply horticultural oils when plants are dormant. See product label for rates and tolerant plants.
	Dyno-Mite WP	21A	284 g/ha	
	Horticultural oil	UN	20 L/ 1,000 L water	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
Fall webworm (*Hyphantria cunea*)	Dipel	11A	see label	Caterpillars build large silk tents on the ends of branches starting in late June, spreading over several branches throughout the summer and becoming very noticeable by late August. Commonly found on walnut, cherry, crabapple, box-elder and ash. Open the tent to find pale yellow-green caterpillars with black spots and long hairs extending out from body. There are black-headed and red-headed morphs of larvae. Adults emerge over a period of weeks, starting in June. Adults are white and lay eggs on lower leaf surfaces beginning in late June Chemical control is rarely needed. Remove webs and caterpillars by hand and destroy. Dragnet is registered in residential areas on ornamentals and fruit trees (it is not for use in commercial crop production).
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pounce 384 EC	3A	45–90 mL/ha	
Fall cankerworm (*Alsophila pometaria*) Spring cankerworm (*Paleacrita vernata*)	Dipel 2X DF	11A	125 g/ 400 L water	Green and dark-grey inchworms (loopers, geometrids) can be found feeding on leaf undersides and edges in spring. Cankerworm can cause significant defoliation to deciduous trees. Treat when larvae appear in mid-May, when *Acer platanoides* and *Magnolia* x *soulangeana* are blooming. To help reduce the next generation of fall cankerworm, place sticky bands around tree trunks, close to the ground, by late October. Bands will help to trap the flightless adult female moths as they emerge from the ground and crawl up the tree trunk. Treat with insecticides when larvae are small. Do not use Orthene on American elm.
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Orthene 75 SP	1B	see label	
Gypsy moth (*Lymantria dispar*)	Altus	4D	500–750 mL/ha	Gypsy moth larvae are dark, hairy caterpillars with five pairs of blue spots (tubercles) followed by six pairs of red spots along their backs. They feed in the spring and early summer, reaching about 6 cm long at maturity. They consume foliage of many trees and shrubs, most notably basswood, birch, hawthorn, oak, poplar and willow. Adult females lay eggs in brown, fuzzy masses in July and August. Remove and destroy egg masses before they hatch. Newly hatched larvae produce webs in order to disperse via wind to other hosts. Wait until larvae settle on hosts and begin feeding before applying Dipel. A folded burlap cloth wrapped around a tree provides a daytime shelter for larger larvae or pupae. Collect them from these shelters and destroy them. Dragnet is registered in residential areas on ornamnetals and fruit trees (it is not for use in commercial crop production). Orthene may damage sugar maple leaves. Success may be applied to larvae at any time during larval development. Dipel is most effective when sprayed before larvae become mature (before the head capsule turns yellow).
	Dipel	11A	see label	
	Dragnet FT EC	3A	230 mL/ 1,000 L water	
	Imidan 50 WP	1B	1.25 kg/ 1,000 L water	
	Imidan WP	1B	0.89 kg/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	ReVokBTK	11A	7.14–12 L/ha	
	Success	5	25 mL/ 1,000 L water	
	Thuricide 48LV	11A	2.4–4 L/ha	
	Thuricide HPC	11A	7.14–12 L/ 1,000 L water	
	Tristar 70 WSP	4A	5 solupaks/ 1,000 L water	

ULMUS — ELM				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *ULMUS* (cont'd)				
Lecanium or European fruit lecanium scale (*Lecanium corni*)	Ference	28	37.5–75 mL/ 100 L water	This scale insect infests many deciduous trees and shrubs. When adults are mature in late spring/summer they appear as a large, reddish-brown, spherical scale usually found on the underside of twigs. Do not make more than 2 applications of Ference per year. Use horticultural oil as an early-spring dormant treatment to reduce populations of overwintering nymphs. To reduce populations of crawlers, spray insecticides when the *Sambucus canadensis* begins blooming. Do not use Malathion on Crimson King maple. Orthene may damage sugar maple leaves.
	Horticultural oil	UN	20 L/ 1,000 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.4–3 L/ 1,000 L water	
	Orthene 75 SP	1B	see label	
	Pyrate 480 EC	1B	2 L/ 1,000 L water	
Two-spotted spider mite (TSSM) (*Tetranychus urticae*)	Apollo SC	10A	80 mL/ha	TSSM overwinters as adult mites in the soil or media around host plants. It becomes active during warm weather (late spring in the field). Attacked leaves become dull-coloured, stippled or bronzed. Check the undersides of leaves for mites and webs. These mites are very tiny. A hand lens will be needed to see the two faint black spots on their backs. Treat leaf undersides with miticides/insecticides when mites appear, and repeat as needed. Monitor for mites by examining lower leaf surfaces with a hand lens or vigorously shaking a branch over a sheet of white paper and looking for tiny, moving specks. Apollo SC acts primarily on mite eggs but has an effect on young mobile stages as well. It is not effective against adult mites. Apollo SC should be applied when mite populations are predominantly in the egg stage, with few young nymphs present. Do not make more than 1 application of Apollo SC per season. Apply Dyno-Mite when mites first appear. Apply Dyno-Mite a maximum of twice per season at an interval of 28 days. Apply SanMite in a sufficient water volume to ensure thorough coverage. Do not use more than 1,000 litres of spray solution per hectare. SanMite can only be used on plant growth stages for which thorough coverage can be achieved with a maximum spray volume of 1,000 L/ha. Do not use SanMite in successive miticide applications. Use SanMite in rotation with other miticides with different modes of action. A minimum re-application interval of 28 days is required between SanMite applications. Apply SanMite when mites first appear and before crop damage is evident since SanMite may require several days before mites exhibit symptoms. SanMite miticide/insecticide is not ovicidal. Apply Kanemite as mites appear. Kanemite may reduce the viability of eggs. Two-spotted spider mite does not overwinter on the plant, and populations are not reduced with a dormant horticultural oil treatment.
	Dyno-Mite SC	21A	470 mL/ha	
	Dyno-Mite WP	21A	284 g/ha 1,000 L water	
	Floramite SC	20D	333 mL/ 1,000 L water	
	Forbid 240 SC	23	30 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Kanemite 15 SC	20B	0.21–0.46 L/ 500 L water	
	SanMite	21A	284 g/ 1,000 L water (or 2 PVA bags/ 1,000 L water)	
	Vendex 50 W	12	50–100 g/ 100 L water	

ULMUS — ELM

Pest	Product	Group*	Rate	Notes
DISEASES AFFECTING *ULMUS*				
Dutch elm disease (*Ceratocystis ulmi*) (*Ophiostoma ulmi*)	Arbotect 20-S	1	see label	This disease often begins as the wilting of large branches, sometimes on one side of the tree. Leaves turn yellow and begin to flag or droop. Stripping away bark reveals stained wood. Control elm bark beetles that carry fungus from diseased trees to healthy ones. Remove diseased and dead materials to control the beetle populations that breed in them. Arbotect 20-S is a trunk-inject unit that introduces a fungicide into the plant system. Arbotect 20-S is registered for use by trained arborists or others trained in trunk injection techniques. This product may be effective when used where: • less than 30% of canopy is showing wilt symptoms • infested branches are removed at the first sign of wilt • leaves have fully expanded and the plant is actively transpiring (late May, June and early July)

VIBURNUM — VIBURNUM

Pest	Product	Group*	Rate	Notes
INSECTS AFFECTING *VIBURNUM*				
Snowball aphid (*Neoceruraphis viburnicola*)	Altus	4D	500–750 mL/ha	This aphid overwinters as eggs in *Viburnum opulus* buds. It does not seem to infest other species of *Viburnum*. Overwintering eggs hatch as buds begin to open in the spring. Feeding causes severe leaf distortion and twists young shoots. Treat foliage when aphids first appear (about mid-May) and repeat as needed. Use up to 2 applications of Closer per crop cycle. Do not make more than 2 applications of Ference per year.
	Beleaf 50 SG	29	0.12–0.16 kg/ha	
	Closer	4C	200 mL/ 1,000 L water	
	Ference	28	37.5–75 mL/ 100 L water	
	Insecticidal soap	UN	see label	
	Malathion 500 EC	1B	1.25 L/ 1,000 L water	
	Malathion 85E	1B	0.88 L/ 1,000 L water	
	Orthene 75 SP, Orthene 97 SG	1B	see label	
	Pyrate 480 EC	1B	375 mL/ 1,000 L water	
	Tristar 70 WSP	4A	3 solupaks/ 1,000 L water	
	Trounce	3A	50 L/ 1,000 L water	
Viburnum crown borer (*Synanthedon viburni, S. fatifera*)	Rimon 10 EC	15	1.4 L/ha	The larvae of this clearwing moth borer are cream coloured with a small brown head. They can be found boring in stems at the soil line (similar to peach tree borer). Signs of larval infestation include sawdust at the soil surface, disintegration of bark at the soil line, wilting and shrub dieback after it leafs out in spring. Rimon is registered as a direct application to the tree trunk and scaffold limbs. Maximum of 3 applications per growing season. Apply when economic thresholds are reached. Apply at 3 week intervals (21 days) starting 7-10 days after first adult moth trap catch. Remove and destroy infested plants before the larvae pupate (before mid-May). Pheromone traps are available to monitor for the adult stage of this pest.

VIBURNUM — VIBURNUM				
Pest	**Product**	**Group***	**Rate**	**Notes**
INSECTS AFFECTING *VIBURNUM* (cont'd)				
Viburnum leaf beetle (*Pyrrhalta viburni*)	Flagship 25WG	4A	280 g/ha	Adults and larvae of this beetle skeletonize foliage of *Viburnum opulus*, European cranberry and their cultivars. Eggs overwinter in twigs of last year's growth. Larvae hatch and begin feeding on leaf undersides as leaves emerge in the spring. Apply insecticides when larvae are newly hatched. Flagship 25WG is toxic to bees; avoid applications of Flagship when *Viburnum* is blooming. Prune out and destroy terminal shoots (containing eggs) before May 1.
DISEASES AFFECTING *VIBURNUM*				
Downy mildew (*Peronospora viburni*)	Acrobat 50 WP	40	48 g/ 100 L water	Symptoms of this disease appear as angular lesions between leaf veins. The undersides of leaves have a woolly appearance caused by fungal growth. Plants often defoliate in response to infection. Downy mildew needs moist conditions and cool or warm (not hot) temperatures. Do not crowd plants. Maintain adequate sunlight and good air circulation. Avoid overhead irrigation late in the day. Collect and destroy infected plant material. Regalia Maxx gives suppression of *Plasmopora* spp. and *Peronospora* spp. of downy mildew only.
	Heritage Maxx	11	400–800 mL/ 1,000 L water	
	Micora	40	300–600 mL/ 1,000 L water	
	Presidio	43	60–119 mL/ 380 L water	
	Regalia Maxx	P 05	1 L/ 400 L water	
	Torrent 400SC	21	see label	
Powdery mildew (*Microsphaera sparsa*)	Daconil 2787 F	M 05	2.5 L/ 1,000 L water	This fungus appears as a white, powdery growth on the tops of leaves. Apply fungicides at the first sign of disease. Do not crowd plants. Maintain adequate sunlight and good air circulation. Overhead watering during the day may reduce the spread and development of the disease. Avoid overhead irrigation late in the day. Apply fungicides when symptoms are first noticed, in mid-summer. Reapply at 5–10-day intervals.
	Daconil 720	M 05	1.7 L/ 1,000 L water	
	Daconil Ultrex	M 05	1.5 kg/ 1,000 L water	
	Palladium WG	9, 12	see label	

3. Crop Protection: Weeds

CHEMICAL WEED CONTROL

Herbicides may be used to control weeds. Selective herbicides control weeds in-crop. Non-selective herbicides control perennial weeds on premises, such as roadsides, fencerows and areas that are difficult to cultivate. A list of herbicides registered for weed management in nursery crops (Tables 3–1 and 3–2) and a list of herbicides registered for weed management specific to woody crops (Table 3–3) are provided later in this chapter.

Herbicide Licensing Requirements

As of May 1, 2020, Ontario's pesticides classes have been aligned with the federal government's pesticide categories to remove duplication and reduce complexity for the sale and use of pesticides in Ontario, while ensuring continued protection of human health and the environment. The PMRA classifies a pesticide into one of four classes – manufacturing, restricted, commercial and domestic. The MECP automatically classifies pesticides in Ontario as Class A, B, C or D based on the federal classification system plus one additional class (Class E) for regulating the sale and use of neonicotinoid-treated corn and soybean seed.

Farmers must be certified through the Grower Pesticide Safety Course (GPSC) in order to buy and use Class B and C pesticides on their farms. Certification is not required to buy and use Class D pesticides for agricultural purposes. Farmer assistants and supervised farmers using Class B or C pesticides must complete training and assist or be supervised by a certified farmer.

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

In Ontario, a licence is required for exterminators or technicians to apply herbicides for any other commercial use. For further information training and certification, visit the Ontario Pesticide Training and Certification website at www.ontariopesticide.com or call 1-888-620-9999.

Applying Chemical Herbicides

Weeds are successfully controlled when the target receives the correct dose, which is amount of active ingredient per surface area. The degree of spray coverage needed to achieve control depends on several factors, such as the temperature, time of day, wettability of the weed, weed stage of development, droplet size and the herbicide's mode of action. While small areas can be treated with a garden sprayer or even a watering can, power equipment will ensure consistent coverage and a high level of productivity over large areas.

When selecting a carrier volume, consider the following three criteria:

- Spray must reach the target.
- There must be enough droplets to sufficiently cover the target.
- Droplets must be in a form (size and pesticide concentration) that allows the pesticide to be efficiently taken up by the target.

Consider lower carrier volume (50-200 L/ha) for post-emergent herbicides. Consider higher volumes (150-300 L/ha) for pre-emergent herbicides. Always obey application directions on the herbicide label and consult the nozzle manufacturer's rate tables for volume, and pressure and spray quality settings.

Herbicide Drift

Herbicide drift can cause immediate or long-term damage to non-target plants. Maintain the lowest practical distance between nozzle and target, employing a Coarse spray quality. Consider drift-reducing technology such as shrouds and air-induction nozzles. Avoid spraying during hot, dry,

calm or windy conditions and avoid evening or night spraying when thermal inversions are forecast. For more information on the factors that influence drift potential, visit www.sprayers101.com and enter the word "drift" in the search engine.

When to Use Herbicides

Apply herbicides when both crop resistance and weed susceptibility are high. The timing depends on the herbicide, the weed species and the crop. Several different terms describe when herbicides may be applied. Unless otherwise stated, these terms refer to the crop's developmental stage. See Figure 3-1.

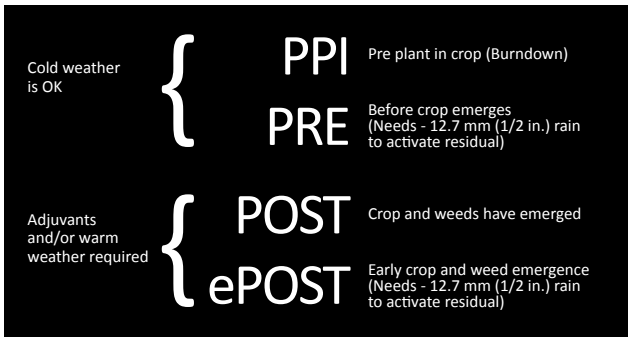

Figure 3–1: Classifying herbicides by crop and weed emergence. This infographic is not definitive but provides general guidance.

Application Technology

Herbicide application should be a precision operation. Pesticides applied incorrectly can result in wasted pesticide, reduced efficacy, crop damage (possibly the neighbour's) and environmental contamination. Every effort must be made to apply chemicals responsibly.

For detailed information on best practices in the safe, efficient and effective operation of agricultural sprayers, check www.Sprayers101.com. Sprayers 101 has practical information from industry professionals on sprayer settings, nozzles, coverage, maintenance, pesticide mixing, drift and more.

Sprayers for Small Areas

Compressed-air sprayers can be used on small areas. This type of sprayer is pressurized by a manual pump in the top of the spray tank. Compressed air forces spray mix through a hose to the nozzle. Hand-held (4–10 L capacity) or back-pack units (up to 25 L capacity). Preferred designs include pressure gauges to monitor and maintain the desired pressure. Consult the sprayer or nozzle manufacturer's rate tables to match operating pressure to flow and droplet size. For conventional nozzles (i.e., not air induction), lower pressure produces coarser droplets that are less prone to off-target drift. If the sprayer is to be used for herbicides, it should only be used for herbicides and not for other types of pesticides.

Know which pesticides can be used commercially and which can be used for cosmetic purposes in lawns and gardens. Pesticides can only be used for cosmetic purposes if the a) use is permitted under an exception to the ban, or b) active ingredient in the pesticide is included on the Allowable List. The Allowable List can be found at the Ministry of the Environment, Conservation and Parks' website at: ontario.ca/page/using-pesticides-ontario.

Horizontal Boom Sprayers

The most common type of sprayer used in herbicide application is the horizontal boom sprayer. Nozzles spaced evenly along the boom create an overlapping spray pattern called a swath. A successful application is most likely when:

- pressure is uniform along the boom
- nozzles are clean and calibrated to ensure they operate to manufactuer's specifications
- the boom travels at a constant height and speed in field conditions
- boom height maintains 100% overlap at target height

Not all sprayer designs are suitable for applying liquid fertilizer. An appropriate sprayer will feature additional agitation capacity and non-corrosize materials. Be sure to follow the manufacturer's instuctions for liquid fertilizer use and note any special mixing requirements on the liquid fertilizer label.

Directed Air-Assist or Mist Sprayers

This sprayer design employs a combination of air and liquid to deliver the pesticide. Spray mix is pumped through nozzles into a stream of air from a high-speed fan. The spray is vectored laterally and upward. These machines should **never** be used to apply herbicides.

Wiper Applicators for Selective Weed Control

Wiper applicators (rope-wick, roller applicator or similar devices) can sometimes be used when the target weeds are taller than the crop to avoid crop contact. Particular care must be taken to avoid sucker growth in orchards, vineyards and shelterbelts. Herbicides registered for use with the application method will have specific instructions on the label, but generally require:

- a high degree of contact with the target weed
- typical rates and application schedules that reflect the application to a more mature target weed

Employ travel speeds between 4–10 km/h and make passes in opposite directions to ensure complete coverage.

Care and Use of Equipment

Travel Speed

A constant travel speed will ensure a uniform application rate. Hills and surface structure impact the reliability of tractor speedometers. Onboard GPS or a smartphone speedometer app are the preferred means of confirming travel speed. Spray monitors and other electronic rate controllers will compensate for changes in travel speed by adjusting operating pressure to maintain the desired rate, but care must be taken to ensure nozzles are not operated outside their recommended pressure range. Do not operate air induction nozzles below 30 psi.

Water

Water quality plays a very important role in tank mixing. Begin with a qualified laboratory test to establish an accurate baseline for:

- pH
- total hardness
- bicarbonate HCO_3^-
- salinity (electrical conductivity) or Total Dissolved Salts (TDS)

Colorimetric test strips can be used to quickly check water quality before the addition of pesticides and for monitoring changes in water quality between laboratory tests. We prefer handheld digital monitors because they are more reliable (and readable) after pesticide additions.

Use only clean water that contains no debris, soil or organic matter. On your farm water supply, use a frost-free water hydrant located outside a building. An anti-backflow or anti-siphon valve should always be installed on any hydrant or water supply. Never allow the suction screen to rest on the bottom of a farm pond while filling a sprayer. The intake line near the screen must, by law, be equipped with a spring-loaded check valve or anti-backflow device to prevent contamination of the pond or stream when the pump is shut off. Tank-refilling nozzles, volume-booster nozzles or injection pumps should not be used to refill the sprayer tank from farm ponds or streams. These tank-refilling aids may cause pond or stream contamination.

Agitation

Sprayer agitation mixes products during loading, keeps them in suspension throughout the application and can resuspend them if the job is delayed or interrupted. There are two agitation methods, usually paired with a specific solution tank material.

- **Mechanical agitation:** A rotating shaft with paddles that is often associated with stainless steel solution tanks (and sometimes fiberglass). Steel tanks are durable and do not absorb chemistry. They are also heavy, expensive and cannot be moulded around pumps or sprayer parts.
- **Hydraulic agitation:** A sparge bar and/or a series of venturi jets that sweep the bottom of a plastic or fiberglass solution tank. These tanks are cheaper and moldable, but over time they photodegrade and adsorb chemistry. The spray liquid should be simmering; not calm and not a rolling boil. Problems arise when agitation is inadequate or aggressive.

If agititation is inadequate, emulsions can separate and suspensions can settle. Solids found at the bottom of the solution tank after an application mean the rate was lower than intended and was likely inconsistent. Adding insult to injury, the operator may have to deal with concentrated rinsate. The flow required for hydraulic agitation represents about 30% of the pump's total capacity.

If agitation is excessive, products can foam, thicken or separate. Overflows (aka foam-overs) are more likely to occur during filling. More subtly, foaming during spraying can break pump suction, or create a non uniform suspension that leads to an inconsistent application rate.

Loading and mixing order

The solution tank (vat, inductor, etc.) should be at least half full of water before adding the first product. The incomplete dissolution of products can leave hard-to-clean residues, plug fluid lines, and result in a non-uniform application that reduces efficacy.

Pesticide labels are always the first point of reference. They should be obeyed even if they contradict conventional practices. Booklet-style labels that come with the products are long, difficult to search and may not be up-to-date. It is often faster and easier to consult a trusted online source.

There are several acronyms to help you decide on the sequence when loading. The oldest and most recognizable is W.A.L.E.S. This stands for Wettable powders, Agitate, Liquid flowables, Emulsifiable concentrates, Surfactants.

1. Water-Soluble Bags (WSB): Allow them to fully dissolve and disperse.
2. Wettable Powders (WP)
3. Water Dispersible Granules (WDG, WG, SG)
4. Agitation to allow dry products to mix and disperse
5. Liquid Flowables (F, FL): Including, in order, Suspension Concentrates (SC), Suspo-emulsions (SE), Capsule Suspensions (CS/ZC), Dispersible Concentrates (DC), Emulsions in water (EW)
6. In order: Emulsifiable Concentrates (EC): Microemulsifiable Concentrates (MEC) and Oil Dispersions (OD)
7. In order: Solutions (SN), Soluble Liquids (SL), Liquid Fertilizers and Micronurients (when not already premixed with fertilizer).
8. NOTE: Compatibility agents and anti-foamers should be added before pesticides. Adjuvants like Non-Ionic Surfactants (NIS), Crop Oil Concentrates (COC), Drift Retardants (DR), and spreader/stickers should be added based on specific label direction or based on their formulation, just like pesticides.

With agitation on, add products in order. Top up the tank with carrier when all products have been added. While efficient sprayer loading is an excellent opportunity to improve your work rate, some dry products can require as long as five minutes to dissolve completely. Pace is especially important when the carrier or product is cold. Consider pre-hydrating dry products in a smaller tank (often called a slurry) or use an extra tank to pre-mix whole loads and simply transfer them over.

Pumps and flow control

The pump moves spray liquid from the solution tank to exit through the atomizers. It is important not to under-size the pump. Pump capacity must satisfy the highest possible demand (i.e., your highest-volume application), plus overcome back pressure and run any hydraulic agitation, if present. An extra 20% should be factored in to account for changes in performance (such as pump wear and slower travel speeds).

Pumps are either positive displacement (diaphragm, piston or peristaltic pumps) or non-positive displacement (centrifugal pumps). Positive displacement means that for every turn of the pump shaft, liquid is pumped regardless of pressure. Fluid is not compressible, so a relieve or bypass is required. Centrifugal pumps, on the other hand, can be “dead-headed” where the flow is turned off entirely while running, with no immediate damage.

Flow is typically controlled by a relief valve positioned between the pump and the nozzles. The valve is actuated by a spring-loaded piston or diaphragm, opening and closing in response to changes in pressure. The operator sets the desired operating pressure, and any additional pressure forces the valve open, diverting excess flow back to the solution tank via a bypass. This function can be handled by a rate controller, which automatically compensates for changing speed by adjusting flow. Flow is held constant for a more consistant application rate.

Filtration

The level of filtration required for any given spray operation depends on the materials sprayed and the "nuisance factor". That is, the balance between the effort required to remove and clean filters and the reduced work rate from plugged nozzles or pump damage. Filter casings with automatic shut-offs make cleaning easier. You can remove the filter without accidentally draining the tank.

There are positions for two filters on the suction side of the pump and for three on the pressure side. Few sprayers employ all five levels of filtration, but there are good reasons for each of them:

Filter Level	Purpose and Mesh Size
1. Basket strainer	Catches foreign objects during loading (e.g., frogs, insects, leaves, glasses, phones etc.)
2. Pump strainer	Catches undissolved soluble bags and chunks of dry formulations that could clog the pump intake. Use 6 mesh or coarser (never so fine as to clog and cavitate the pump).
3. Pre-manifold or "main" filter	The heavy lifter, this catches any chunks that could clog a nozzle. Default is 40 mesh, or at least as fine as the nozzle orifice.
4. In-line boom filter	May be redundant with the pre-manifold.
5. Nozzle (slotted strainer or mesh filter)	The last line of defense to ensure nozzle performance. Default is 50 mesh unless otherwise indicated by the nozzle manufacturer or in very high flow situations. It may also be required to create a tight fit between a hydraulic nozzle and the nozzle body.

Hydraulic Nozzles

Hydraulic nozzles rely on hydraulic energy in the form of pressure. Pressure forces spray liquid out through the nozzle orifice at a rate described by the inverse square law (i.e., Quadruple pressure gives double flow). Hydraulic nozzles produce a moderate range of flows and a wide range of droplet sizes. Nozzle size meters the flow while the orifice shape(s) define the spray geometry and median droplet size (i.e., spray quality).

On a horizontal boom, the spray from flat fan nozzles should overlap 100% at target height. This is a function of nozzle spacing, fan angle and the distance to the target. A single nozzle produces a range of droplet sizes. Volume Median Diameter (VMD) or DV0.5 is the droplet size where half the spray volume is composed of finer droplets and the other half is composed of coarser droplets. Pesticide labels may specify the spray quality. Generally, horizontal booms applying herbicides should employ coarser droplets.

Although coarser sprays are often thought to work less well, they offer certain advantages:

- Coarser droplets have a high survivability, resisting evaporation. This increases the opportunity for uptake and translocation within the plant.
- Coarser sprays produce less drift, enabling application under windier conditions and thus ensuring that the timing of the application with respect to the crop or disease stage can be optimized.

Nozzle tables are found on dealer and manufacturer websites as well as in their catalogs. Table layout varies slightly with brand, but they all relate a nozzle's flow to operating pressure. The better tables also provide the spray angle and spray quality. Operators can use tables to complete calibration calculations and when deciding how to distribute nozzle rates, angles and spray quality along a boom relative to the target canopy. The rates also serve as validation criteria when an operator is determining nozzle-wear.

Materials used for nozzle tips include brass, stainless steel, hardened stainless steel, as well as plastics/polymers and ceramics. All product formulations and carriers cause wear of the nozzle orifice. Wettable powders cause abrasive wear, more than other formulations.

Nozzle tips should be replaced when they deliver 5% more than the manufacturer's rated output specifications or when their distribution pattern becomes unacceptable.

Nozzle Types

The following nozzle types are categorized by their typical flow and spray geometry. In most cases, air induction options are available that require higher operating pressure (no less than 30 psi, idealy 50 psi) and produce a coarser spray quality. These droplets are ideal for herbicide applications, or positions in the highest nozzle bodies on vertical booms to reduce physical drift.

Flat-Fan nozzles

Maintain a full overlap spray pattern by using 110° flat-fan nozzle tips (instead of 80° tips). This reduces misses in the event the boom bounces while crossing rough ground. Special "even spray" fans are available for herbicide banded applications.

Flood nozzles

Flooding-fan nozzle tips have a wide spray angle. They can be used closer to the ground and at lower pressures than flat-fan tips.

Broadcast nozzles

Broadcast nozzles cover a very wide swath. Use broadcast nozzle tips for lanes and fencerows where a uniform spray pattern is not needed.

Full and Hollow Cone nozzles

Typically used with air-assist directed sprayers, they should not be used for herbicide applications. Hollow cones produce high flow and finer spray quality. Full cones produce the highest flow and coarser spray quality.

Sprayer sanitization

When sprayers are not cleaned as often or as thoroughly as they should be, it creates problems:

1. Unnecessary operator and environmental exposure.
2. Residue in (or on) the equipment can damage sprayer components.
3. Residue can cause physical or chemical incompatibility issues with future spray mixes.
4. Carry-over can deposit damaging or unlabelled residues on crops.

It helps to think of sprayer sanitation as two processes. Rinsing is a precursor to cleaning, and depending on your situation, you may not have to go all the way.

- **Rinsing:** The dilution of any remaining spray solution and exterior residue.
- **Cleaning:** Rinsing with additional steps to decontaminate sprayer components.

Rinsing:
Rinse as soon as possible. Don't let residue sit in (or on) the sprayer, even if you plan to use the same product the next day. Minimizing any remaining volume makes rinsing far more effective. Even an "empty" sprayer can still retain several litres of standing volume in the sump and lines. Operators should know this volume. Rinsing the system multiple times with low volumes (aka the Triple Rinse) is more effective at reducing pesticide concentration than a single, high-volume rinse. Once the sprayer is "empty", use clean water to fill the solution tank to 10% of its capacity (or add 10 parts water to one part standing volume) for the first rinse. Agitate and circulate it through the entire sprayer for a few minutes. Spray out the rinsate and repeat the process two more times.

Precautions must be taken to ensure rinsing is performed away from wells or open water. It is best to perform the triple rinse in the crop that was just sprayed. The dilute rinsate can be flushed through the lines and sprayed out through the nozzles onto the crop.

Cleaning:
A complete cleaning (sometimes called a decontamination) is required prior to long-term storage, or when residues from previous applications are known to cause physical or chemical antagonism with scheduled applications. Perform the following steps after a complete triple rinse:

1. Remove the suction and in-line screens. Remove nozzle strainers and nozzle tips. These will be inspected and cleaned shortly.

2. Fill the solution tank about 1/2 full of water and add an appropriate tank cleaning adjuvant. For example, ammonia at 3%/100 L (25 gal) water will raise the pH and helps remove those products whose solubility benefits from this. A detergent at 1.0 kg /150 L (1lb / 20 gal) water will remove the oily layer formed by EC formulations. Commercial cleaners conveniently combine these properties in one jug. Be aware that adding a surfactant or a commercial cleaner can generate a lot of foam, so have de-foamer handy.

Ammonia cleaner products do not neutralize all pesticides; they raise the pH, improving the solubility of some products. Do not use chlorine bleach. It is not as effective a cleaner as ammonia and can form chlorine gas when mixed with ammonia-containing liquids.

3. Collect a bucket-full of cleaner solution from the tank. Using a brush, clean the suction and in-line screens, and the nozzle strainers and tips.

4. Meanwhile, agitate and circulate the cleaner solution through the entire sprayer for five to 10 minutes. Open and close any lines or valves during this process to ensure everything is exposed to the rinse.

5. You can spray a small volume through the booms but drain the vast majority through the plumbing system. Collect some for cleaning the exterior of the sprayer.

6. Clean the exterior of the sprayer. High pressure washers and scrubbing with a push broom works well. Studies in Europe have shown the vast majority of residue is found on the sprayer head (i.e., fan outlet and boom area).

7. Rinse it all off. Replace all parts unless preparing for long-term storage.

Sprayer Calibration

Field Boom-Type Sprayer Calibration — Determining application rates in L/ha.

There are many ways of determining the rate of spray material that is being applied to 1 ha of land.

Instructions

1. Measure the time.
   - Place 2 stakes 50 m apart in the field.
   - Select the gear and throttle setting (rpm) at which you plan to spray. Half-fill the sprayer with water.
   - Drive the distance between the stakes 3 times, timing each pass. Each time, make sure the tractor is at the desired speed as you pass the first stake. Continue driving at this speed until you pass the second stake.
   - Note the average time of the 3 passes.

2. Measure the average nozzle output.
   - Park the sprayer with the PTO engaged and the throttle adjusted to reach the PTO speed set in the test run.
   - Adjust the pressure regulator to the desired working pressure with full flow to the boom.
   - Collect the output from each nozzle for the average length of time needed to travel the 50 m in the test run.
   - Enter the nozzle outputs into the equation below.
   - If any nozzle is more than 10% above or below the average output, it should be cleaned, re-tested and, if still 10% off, replaced.

3. Measure the nozzle spacing in metres.

4. Use the following formula to determine the sprayer output:

$$\text{Application rate (L/ha)} = \frac{(\text{mL of liquid per nozzle}) \times 0.2}{\text{nozzle spacing (m)}}$$

5. Calculate the area sprayed per full tank of spray solution. Re-check the sprayer calibration after each tank of spray is applied by dividing the volume sprayed by the area sprayed. The nature of some products may slightly alter the calibration from that of clean water.

6. Growers who are more comfortable with litres/acre or gallons/acre can use the following conversion guide.

   Litres/hectare × 0.4 = L/acre
   Litres/hectare × 0.09 = Imp. gal/acre
   Litres/hectare × 0.11 = U.S. gal/acre

Sample Calculation

Aver. time to travel 50 m (164 ft)	= 24.5 sec
Aver. amount of liquid collected per nozzle for 24.5 sec	= 525 mL
Nozzle spacing on the boom	= 0.5 m (~ 20 in.)
210 L/ha × 0.4	= 84 L/acre
210 L/ha × 0.09	= 18.9 imp. gal/acre
210 L/ha × 0.11	= 23 U.S. gal/acre

Band Spraying: The same formula can be used to calibrate when banding. Instead of using nozzle spacing in metres, use width of area sprayer per nozzle in metres.

NOTE 1: Sprayer-calibration bottles or kits are available from a number of suppliers. For further information contact your local office of the Ontario Ministry of Agriculture, Food and Rural Affairs or manufacturers of sprayers, sprayer parts or herbicides.

NOTE 2: For banded-spray applications, measure the width of the spray band (at the soil surface or surface of the crop canopy) and enter this value into the formula instead of the "nozzle spacing." Note that in band spraying, the acreage sprayed is NOT the same as the crop acreage (When broadcast spraying a row crop with 1-m rows, the whole field is treated. A band spray may only treat 30 cm over each row. Therefore, only about one-third of the field is actually treated.). The herbicide rates referred to in most herbicide publications and labels refer to the actual area sprayed unless otherwise stated.

Hand-Held/Backpack Sprayer Calibration

Many people use small hand-held or backpack sprayers for treating problem areas or spraying areas that were missed. Calibration of these sprayers is as important as calibrating your field sprayer.

Method I

1. Measure an area that is 100 m^2 — e.g., 10 m × 10 m or 25 m × 4 m
2. Fill the spray tank with water. Mark the level on a measuring stick. Pump to the pressure that will be used during the pesticide application.
3. Spray the water over the 100 m^2 area. Walk at a steady pace, taking care to apply it as evenly as possible, just as you would when applying pesticide.
4. Measure the amount of water needed to refill the spray tank to the mark on the measuring stick. This amount will be the sprayer output per 100 m^2.

Method II

1. Set 2 stakes 50 m apart in the field.
2. Half-fill the sprayer with water.
3. Walk the 50 m 3 times at a steady pace. Calculate your average time to travel the 50 m.
4. Measure the width of the band sprayed by the nozzle (in metres) at your walking pace.
5. Pump the sprayer for the same amount of time as calculated in step #3, collecting the liquid from the nozzle in a measuring device.
6. Use the following formula to determine the sprayer output:

$$\text{Application rate (L/ha)} = \frac{(\text{mL of liquid per nozzle}) \times 0.2}{\text{nozzle spacing (m)}}$$

Method III

1. Partially fill sprayer. Pump to the pressure you will use during the pesticide application.
2. Spray to determine width of swath (in metres).
3. Walk at a steady pace for 15 seconds. Measure the distance (in metres).
4. Multiply spray width times distance travelled to provide the area (in square metres) sprayed in 15 seconds.
5. Spray into a measuring device for 15 seconds – gives amount of solution sprayed in 15 seconds.
6. Use the following formula to determine the sprayer output:

$$\text{Application rate (L/ha)} = \frac{\text{amount sprayed}}{\text{area (length} \times \text{width)}} - \frac{\text{L} \times 10{,}000}{\text{m}^2}$$

To convert the application rate of any pesticide to the amount required for a small area, follow this guide:

- solids: 1 kg/ha = 10 grams/100 m^2
- liquids: 100 L/ha = 1 L/100 m^2

(*Source: Ontario Pesticide Education Program Manual 1995*).

Determining Amount of Herbicide Needed

Determining Amount of Product Required per Hectare

Most rates suggested in this publication are given in terms of both active ingredients per hectare and product (TRADE NAME) per hectare. However, where the amount of active ingredient in the formulations varies considerably (e.g., glyphosate is available in concentrations of 360 g/L, 480 g/L, 500 g/L and 540 g/L), the rate may be given in terms of active ingredient only.

NOTE: Throughout this publication, the active ingredient is printed in lowercase letters (e.g., atrazine, dicamba), whereas the product trade name (the name of the liquid or powder etc., inside the container as supplied by the manufacturer) is printed in capital letters (e.g., AATREX, BANVEL II), and its formulation is listed within brackets following the trade name.

Determining Amount of Product Required per Tankful

After determining how much commercial product is needed per hectare, calibrate the sprayer and determine the number of hectares each tank will cover. Determine the quantity of herbicide needed to add to the spray tank using the following formula:

Area covered per tankful
= sprayer tank size (L)/application rate (L/ha)
= hectares

Product required/tank
= hectares covered by tank × product rate/ha

Sample Calculations

(a) product/tank = 4.1 ha × 2.2 kg/ha
= 9.02 kg LOROX/tank

(b) product/tank = 4.1 ha × 2.1 L/ha
= 8.61 L AATREX/tank

A COMPENDIUM OF HERBICIDES WITH THEIR RECOMMENDED USES IN ONTARIO — AS OF DECEMBER 31, 2020

All listed products are registered for the listed purpose. The order in which products appear does not constitute a preference ranking. Information is presented as it appears on the product label.

Notes on Herbicides

These notes are listed below as a reference for applicators. Complete information on each herbicide is available on the product label located on the herbicide container. The federal Pest Management Regulatory Agency also provides pesticide labels under their "Search Pesticide Labels" section at www.pmra-arla.gc.ca. Many herbicide manufacturers also list product labels and/or material safety data sheets (MSDS) on their websites. For a list of herbicides registered on nursery crops in Ontario, see *Table 3–1. Herbicides Registered for Nursery Crops in Ontario (by Trade Name)* and *Table 3–2. Herbicides Registered for Nursery Crops in Ontario (by Active Ingredient)*. Lists of ratings of weed susceptibility to herbicides for broadleaf annuals, broadleaf perennials and annual grasses can be found later in this chapter.

Table 3–1. Herbicides Registered for Nursery Crops in Ontario (by Trade Name)

TRADE NAME	ACTIVE INGREDIENT
AIM	carfentrazone-ethyl
AMITROL	amitrole
BASAMID	dazomet
BONANZA	trifluralin
BROADSTAR	flumioxazin
CASORON	dichlobenil
DACTHAL	chlorthal dimethyl
DEVRINOL	napropamide
DUAL II MAGNUM	s-metolachlor
FRONTIER MAX	dimethenamid-p
GALLERY	isoxaben
GARLON	triclopyr
GOAL 2XL	oxyfluorfen
KATANA	flazasulfuron
KERB	propyzamide
PRINCEP NINE-T	simazine
RIVAL	trifluralin
PROWL H2O	pendimethalin
RONSTAR	oxadiazon
ROUNDUP	glyphosate
SIMADEX	simazine
SUREGUARD	flumioxazin
SPECTICLE	indaziflam
TREFLAN	trifluralin
VAPAM	metam sodium
VENTURE L	fluazifop-p-butyl

Table 3–2. Herbicides Registered for Nursery Crops in Ontario (by Active Ingredient)

ACTIVE INGREDIENT	TRADE NAME
amitrole	AMITROL
carfentrazone-ethyl	AIM
chlorthal dimethyl	DACTHAL
dazomet	BASAMID
dichobenil	CASORON
dimethenamid-p	FRONTIER MAX
flazasulfuron	KATANA
fluazifop-p-butyl	VENTURE L
flumioxazin	BROADSTAR, SUREGUARD
glyphosate	Various products (including ROUNDUP)
isoxaben	GALLERY
indaziflam	SPECTICLE
metam sodium	VAPAM
napropamide	DEVRINOL
oxadiazon	RONSTAR
oxyfluorfen	GOAL 2XL
propyzamide	KERB
pendimethalin	PROWL H2O
s-metolachlor	DUAL II MAGNUM
simazine	PRINCEP NINE-T, SIMADEX
triclopyr	GARLON
trifluralin	BONANZA, RIVAL, TREFLAN

Preplanting Treatments

Some preplant herbicides act on germinating seedlings, while others kill weed seeds in addition to seedlings. Apply preplant herbicide treatments before sowing or planting the crop. Incorporate preplanting herbicides (e.g., Treflan) into the soil soon after application. Incorporation instructions are provided on the label.

Soil Fumigants

Fumigants generally control nematodes and soil diseases. At higher application rates, they can also control weeds.

Before applying fumigants for nematode control, have the soil tested for nematode count. See *Appendix E, Diagnostic Services*, on page 172, for sampling instructions. Ensure that nematodes are the problem before using chemicals. Carefully follow the fumigant manufacturer's directions for dosage and methods of use. Wear a suitable respirator and full protective gear when using fumigants. Telone, Vapam, Vorlex and methyl bromide are extremely toxic to the applicator.

To use preplant fumigants effectively:

- Fumigate in the fall when soil temperatures are above 4°C. Fumigant dispersal improves at warmer soil temperatures (above 15°C).
- Remove trash and old root systems.
- Work the soil to a depth of 25–30 cm. Soil moisture is important for fumigant efficacy.
- Inject the fumigant about 30–40 cm deep.
- Pack or water immediately after injection to seal the soil surface.
- Ideally, leave the soil undisturbed until spring. If fall planting is necessary, delay it until at least 1 week after the fumigant injection.
- Work and aerate the soil for about a week before planting. Colder soils (below 15°C) require longer periods between injection and aeration. For fall planting, aerate the soil for at least 2 weeks after working.
- Fall ryegrass has been recently linked with high populations of root lesion nematodes. To avoid this problem, try using non-traditional types of annual cover crops such as pearl millet and sorghum. Italian ryegrass may also be an option because it is a poor host for root lesion nematode.

The following chemicals may be used as preplant treatments.

Active Ingredient: dazomet

Trade Name: BASAMID
Chemical Family: dithiocarbamate

Rates of Application

dazomet	500.0 kg/ha
BASAMID (98 Gr)	510.0 kg/ha

Sensitive Weeds

Most germinating weed seeds.

Uptake and Translocation

Breaks down on contact with soil moisture and releases toxic gases that control germinating weed seeds.

Basis of Selectivity

Non-selective. Chemical must dissipate completely from the seedbed before planting, otherwise, crop injury may occur.

Application Methods

Apply granular product to a well-worked seedbed and incorporate evenly. Seal soil immediately after incorporation by rolling and flooding or by covering with heavy polyethylene plastic and sealing the edges. After waiting 10–40 days, depending on soil temperature, aerate the soil. Conduct a safety germination test before using the treated soil. Do not use when soil temperature is below 6°C. See the manufacturer's directions for specific details on sealing soil, evacuating gases and performing the safety germination test.

Residual Activity

Depends on the rate applied, soil moisture and soil temperature. The gases are toxic to all growing plants. Perform a safety germination test before planting.

Unique Characteristics

Also controls unencysted nematodes and soil fungi.

Manufacturer: Mitsui & Co. (Canada) Ltd.

Active Ingredient: metam sodium

Trade Name: VAPAM
Chemical Family: thiocarbamate

Rates of Application

metam sodium	1,250.0 kg/ha
VAPAM (380 g/L)	3,287.5 L/ha

Remarks

Use on field replant sites of ornamentals and forest tree stock. For summer and fall treatment of seedbeds, plant beds, lawns, greenhouses and other limited areas.

Sensitive Weeds

Most scarified weed seeds and fleshy vegetative parts, including rhizomes and germinating seedlings. Vapam controls germinating weed seeds such as annual grasses, Bermuda grass, chickweed, dandelion, henbit, Johnson grass, lamb's-quarters, pigweed, purslane, ragweed and wild morning glory. It suppresses perennial weeds such as quackgrass. It also controls nematodes and symphylans (the garden centipede) as well as soil-borne fungus diseases, particularly damping-off and root rot, including diseases caused by species of *Rhizoctonia*, *Pythium*, *Fusarium*, *Phytophthora*, *Verticillium*, *Sclerotinia*, oak root fungus and clubroot of crucifers.

Basis of Selectivity

Most plant parts are sensitive. Do not plant crops until all fumigant dissipates from the soil. When moisture is present, Vapam releases methyl isothiocyanate gas. This kills most scarified seeds and fleshy vegetative parts (including rhizomes and germinating seedlings).

Application Methods

Apply as a drench to soil, wetting at least 8 cm deep. Apply uniformly using injectors, water or other incorporation tools that carry the product to the desired depth. It may be applied via the irrigation system. No gas-proof cover is needed unless the soil is very porous. Apply water via sprinklers to provide a surface water seal. Do not plant for 10–14 days (or longer if the weather is cool). To prevent crop injury, make sure all traces of toxic gas have dissipated from the treated soil before planting crops.

Residual Activity
Expect 10–40 days of residual activity, depending on soil temperature and the amount of organic matter in the soil. Vapam persists longer if temperatures are low or organic matter levels are high. Plant crop at least 12–16 days after treatment following a lettuce seedling bioassay that indicates no injury.

Unique Characteristics
Also controls nematodes, soil fungi and soil insects.

Manufacturer: Amvac Chemical Corp.

Active Ingredient: chlorthal dimethyl

Trade Name: **DACTHAL W-75**
Chemical Family: **phthalate**
Site of Action: **Group 3**

Rates of Application
Field applications

chlorthal dimethyl	5.02–16.88 kg/ha
DACTHAL	6.75–22.5 kg/ha

Remarks
Use on established nursery stock: abelia, alyssum, baby's breath, barberry, candytuft, deutzia, English ivy, euonymus, feverfew, forsythia, gladiolus, holly, juniper, locust, maple, marigold, oak, peony, petunia, salvia, spiraea, sycamore, tulip tree, walnut, weigela, willow and yew. Can also be used on established ornamental plantings (e.g., flower gardens).

Do not use on bugleweed, button pink, carnation, celosia, germander, geum, mesembryanthemum, pansy, phlox, snapdragon, sweet William, telanthera or *Vinca minor*.

Sensitive Weeds
Carpetweed, common chickweed, common lamb's-quarters, green foxtail, groundcherry, large crabgrass, lovegrass, purslane, redroot pigweed, smooth crabgrass, witch grass and yellow foxtail.

Uptake and Translocation
Absorbed by roots, not foliage. Not translocated through the plant.

Basis of Selectivity
Inhibits growth of germinating seeds.

Application Methods
Must be applied before weed seed germination. Rain or irrigation is needed for activation. Remove all existing weeds before application, as only germinating weeds will be controlled.

Residual Activity
Average half-life is 100 days in most soil types. Effective weed control can be maintained for as long as 2 months.

Manufacturer: AMVAC Chemical Corporation

Active Ingredient: dichlobenil

Trade Name: **CASORON G-4**
Chemical Family: **nitriles**
Site of Action: **Group 20**

Rates of Application
Field applications

dichlobenil	4.4–7 kg/ha
CASORON (4 Gr)	110–175 kg/ha

Container applications

dichlobenil	4.4 kg/ha
CASORON (4 Gr)	110 kg/ha

Container bed preparation

dichlobenil	4.4–7 kg/ha
CASORON (4 Gr)	110–175 kg/ha

Remarks
Use on field woody nursery stock: ash, birch (cutleaf weeping), boxwood, caragana, crabapple, eastern red cedar, eastern white cedar (arborvitae), elm, euonymus, forsythia, heather, holly (*Ilex* sp., except *I. crenata*, *I. rotunda*, *I. vomitoria*), honeysuckle, juniper, lilac, linden, locust, maple, mock orange, rhododendron, rose, spirea, willow and yew.

Use only on specific container woody nursery stock: *Juniperus chinensis*, *J. horizontalis* and *Thuja occidentalis* only.

Do not use on: ajuga, fir (*Abies* sp.), gladiolus, hemlock, *Ilex crenata*, *I. rotunda*, *I. vomitoria*, mugo pine or spruce.

Do not use on: herbaceous perennials (all plants that die down to the ground in the fall).

Use cautiously on: shallow-rooted ground covers (euonymus can be treated with this product).

Sensitive Weeds
Most weeds are susceptible to, or suppressed by, dichlobenil, including perennials, vetch and horsetail.

Uptake and Translocation
Absorbed by roots and rapidly translocated upward in the plant. Casoron inhibits cell growth at the growing points or meristematic tissues of the plant. Weed germination and growth initiation is strongly affected.

Basis of Selectivity
Selectivity is based on the physical separation between the dichlobenil vapour layer in the top 5 cm of soil and the established crop roots below this level.

Application Methods
Apply as a pre-emergence treatment to susceptible weeds, preferably in the fall or early spring. Apply to cool, moist soil.

Container nursery stock: Use only on containers growing outside. Apply at least 4 weeks after planting into containers with a weed-free surface. Do not use after September 15 or within 30 days of placing treated stock in overwintering structures.

Container bed preparation: Apply to bare soil before putting container pots onto the bed. For best results, apply to soils containing more than 2% organic matter. Dichlobenil provides inconsistent weed control on gravel or sandy soils. Apply in spring on a cool day and incorporate immediately using irrigation or mechanical methods. Do not cover polyhouses with plastic for 1 month after application. Do not apply in plastic-covered polyhouses or greenhouses. Do not transplant seedlings into treated soils until at least 1 year after application.

Residual Activity
May persist and provide weed control for 2–6 months. Higher rates and applications following use in previous years may cause soil residues to persist for more than 1 year.

Unique Characteristics
Although applied as a granular herbicide, it kills with a vapour layer in the topsoil profile. Weed roots take up the herbicide when entering this zone. Do not apply to very warm soils, since high temperatures volatilize the herbicide and prevent weed control.

Manufacturer: Arysta Lifescience Canada Inc.

Active Ingredient: dimethenamid-p

Trade Name: **FRONTIER MAX**
Chemical Family: **chloroacetamide**
Site of Action: **Group 15**

Rates of Application

dimethanamid-p	0.54–0.69 kg/ha
FRONTIER MAX	0.756–0.963 L/ha

Remarks
Frontier Max herbicide will control labelled annual grass weeds and certain broadleaf weeds in and around field, liner and container nurseries of commercial ornamental production. Frontier Max is used as pre-emergent or preplant incorporated herbicide. Frontier Max does not control weeds that have already emerged.

Established Container or Field-Grown Nursery Stock: Apply as a directed spray. Do not make over-the-top applications. Do not apply during bud swell, bud break or at time of first flush of new growth. If newly budded or grafted rootstock is to be sprayed, make an application using a shielded sprayer. Care must be taken to ensure there are no cracks in the soil where Frontier Max herbicide could come in contact with the roots.

Newly Transplanted Container or Field-Grown Nursery Stock: Apply as a directed spray. Do not make over-the-top applications. Use a shielded sprayer until plantings have been established for 1 year or more in the field. Do not apply until transplants have been watered and the soil has been thoroughly packed and settled around transplants. Care must be taken to ensure there are

no cracks in the soil where Frontier Max herbicide could come in contact with the roots. For container-grown ornamentals, delay the first application of the product to bareroot liners or young seedlings (e.g., plugs) for 2 weeks after transplanting. Do not apply during bud swell, bud break or the first flush of new growth. Direct sprays away from grafted or budded tissue on transplants at all times.

Applications can be made to ornamental plant species such as: *Abies fraseri*, *Acer rubrum*, *Buxus sempervirens*, *Fraxinus pennsylvanica*, *Hydrangea macrophylla*, *Ilex cornuta*, *Ilex crenata*, *Juniperus* sp., *Lagerstroemia indica*, *Magnolia grandiflora*, *Pseudotsuga menziesii*, *Rhododendron* sp., *Rosa* spp., *Spiraea vanhouttei*, *Taxus media*, *Thuja occidentalis*, *Thuja plicata.*

Do not apply Frontier Max herbicide during spring growth of conifers or injury to terminals may occur. Do not apply more than one application of Frontier Max herbicide per season. Before treating a large number of plants, spray a few plants and observe for 1–2 months for plant damage prior to full-scale application.

Sensitive Weeds
Barnyard grass, crabgrass (smooth, large), eastern black nightshade, fall panicum, foxtail (green, yellow, giant), old witchgrass and redroot pigweed. Use 963 mL/ha of Frontier Max herbicide for control of eastern nightshade and redroot pigweed.

Uptake and Translocation
Not readily translocated in the plant, so application placement and coverage are important.

Basis of Selectivity
Frontier Max inhibits the growth of seedling shoots (grasses) and roots (broadleaf). Susceptible grasses often fail to emerge from the soil. The mode of action is not well understood. This herbicide affects various biochemical processes in the plant and interferes with normal cell development.

Application Methods
Frontier Max is used as pre-emergent or preplant incorporated herbicide. Frontier Max herbicide will provide most effective weed control when applied and subsequently incorporated into soil by rainfall or mechanical tillage before weed seedlings emerge from the soil. Frontier Max herbicide treatments are most effective in controlling weeds when adequate rainfall or overhead irrigation is received. If Frontier Max herbicide is not activated by rainfall or irrigation within 30 days, erratic weed control may result.

Residual Activity
Provides season-long weed control. The length of residual activity depends upon soil and moisture factors, application rate and timing. Heavy rainfall following an incorporated treatment may reduce weed control.

Manufacturer: BASF Canada Inc.

Active Ingredient: flazasulfuron

Trade Name: **KATANA 25 WG**
Chemical Family: **sulfonylurea**
Site of Action: **Group 2**

Rates of Application

flazasulfuron	37.5 to 50 g/ha
KATANA (25WG)	150 to 200 g/ha

Remarks
Katana 25WG Herbicide is a selective herbicide for pre-emergence and post-emergence control of certain broadleaf weeds and grasses in conifer trees (ornamentals, Christmas trees, conifer release and forestry). Katana 25WG Herbicide may be applied to container and field grown Conifer Trees (ornamental production and Christmas trees) or for use in forestry for conifer release. Tolerant cultivars include: *Abies balsamea, A. concolor, A. fraseri, A. grandis, A. procera, A. nordmanniana, Cupressocyperis leylandii, Picea abies, P. pungens, Pinus resinosa, P. strobus, P. sylvestris and Pseudotsuga menziesii*.

Do not apply more than one application per year. Do not apply to conifer seedbeds. Do not apply to trees within 1 year of seeding. Directed sprays must not be made to conifers that have new growth or are not sufficiently hardened off.

Sensitive Weeds
Grasses, broadleaf weeds, yellow nutsedge.

Uptake and Translocation
Absorbed through the root and foliage of plants.

Basis of Selectivity
Best results are obtained when weeds are small and actively growing. Broadleaf weeds should be no larger than 5 to 10 cm and grasses should be no taller than 10 cm and prior to first tillering.

Application Methods
Weed growth stops within hours after the application, however progress from discoloration or chlorosis to necrosis generally requires from 2 to 4 weeks. Speed of control is generally a function of weather with faster action during warmer weather and actively growing weeds. The best control is obtained when Katana 25WG Herbicide is applied either to weeds just prior to germination or to young, actively growing weeds. For optimal herbicidal activity, prior to application, the bed or soil surface should be reasonably even and clear of crop and weed residue. Before herbicide application, crop and weed residue can be mixed into the soil through cultivation, or removed by blowing the area to be treated. Any practices that cause disturbance of the soil surface after herbicide treatment will decrease herbicidal activity.

Residual Activity
Length of control is a function of environmental factors such as soil type, soil moisture, temperature and amount of moisture after the application.

Unique Characteristics
For pre-emergence application, rainfall or irrigation is needed for herbicide activation. If rainfall does not occur within 2 weeks after a pre-emergence application, then 0.5 to 1.25 cm of irrigation water should be applied. Do not apply more than 2.5 cm of irrigation water.

Manufacturer: ISK Biosciences Corporation

Active Ingredient: flumioxazin

Trade Name: BROADSTAR G, SUREGUARD WDG

Chemical Family: N-phenylphthalimide

Site of Action: Group 14

Rates of Application

Field applications

flumioxazin	143–215 g/ha
SUREGUARD WDG	280–420 g/ha

Container applications

flumioxazin	0.21–0.42 kg/ha
BROADSTAR G	84–168 kg/ha

Remarks
Use BroadStar granular herbicide for pre-emergent weed control on outdoor, container-grown woody ornamentals. Apply BroadStar herbicide before target weeds germinate or immediately after disturbing the soil surface. BroadStar herbicide can be safely applied over the top of many species of woody ornamental shrubs and trees, providing the user follows the label directions. Apply to dry foliage only. Do not apply more than twice in a single year. See product label for more information. Use BroadStar on: *Acer ginnala*, *Acer palmatum*, *Buxus sempervirens*, *Juniperus horizontalis*, *Juniperus sabina*, *Picea glauca*, *Picea pungens*, *Quercus rubra*, *Taxus* x *media*, *Thuja occidentalis*.

Use SureGuard herbicide for pre-emergent weed control in field-grown ornamental deciduous and coniferous trees, including Christmas trees and trees produced for reforestation, and to maintain bare-ground non-crop areas in and around ornamental nurseries and field-grown ornamentals. SureGuard herbicide should be applied to tilled, weed-free and deciduous tree plantings. The deciduous trees species listed in the “Tolerant Deciduous Trees” section on the label have shown tolerance to applications of SureGuard herbicide only when applied to the soil and base of the plant. Tolerant ornamentals include: *Abies balsamea*, *Abies fraseri*, *Acer ginnala*, *Fraxinus pennsylvanica*, *Picea pungens*, *Pseudotsuga menzesii*, *Syringa reticulata*, *Thuja occidentalis*.

Do not use BroadStar on annual bedding plants and herbaceous perennials (e.g., hosta and daylily).

Do not use BroadStar on *Buddleia davidii*, *Clethra alnifolia*, *Deutzia gracilus* 'Nikko', *Hydrangea* spp., *Ilex verticillata*, *Myrica cerifera*, *Nandina domestica* 'Firepower', *Plumbago auriculata*, *Rhododendron* 'Delaware Valley', *Rosa* spp., *Spiraea japonica* or *Syringa* spp.

BroadStar herbicide can injure liners of several woody ornamental species that are tolerant when more mature.

Sensitive Weeds

Common lamb's-quarters (*Chenopodium album*), common ragweed (*Ambrosia artemisiifolia*), dandelion (*Taraxacum officinale*), eastern black nightshade (*Solanum ptycanthum*), green foxtail (*Setaria viridis*), green pigweed (*Amaranthus powellii*), hairy bittercress/snapweed (*Cardamine hirsuta*), hairy nightshade (*Solanum sarachoides*), liverwort (*Marchantia polymorpha*), redroot pigweed (*Amaranthus retroflexus*).

Suppression only: common chickweed (*Stellaria media*), common groundsel (*Senecio vulgaris*).

Uptake and Translocation

Root and shoot uptake.

Basis of Selectivity

BroadStar herbicide controls weeds by inhibiting protoporphyrinogen oxidase, an essential enzyme required by plants for chlorophyll biosynthesis. Seedling weeds are controlled when they start to emerge and are exposed to sunlight, following contact with the soil-applied herbicide. BroadStar herbicide is tightly bound to soil and does not inhibit or limit root growth under normal growing conditions.

Application Methods

Container-grown ornamentals: BroadStar herbicide can be safely applied over the top of many species of woody ornamental shrubs and trees, providing the user follows the label directions. BroadStar herbicide should be applied over dry foliage. Wait 7 days after treatment and apply 2.5 cm of irrigation before placing treated plants in an enclosed structure. See product label.

Field-grown coniferous trees: All over-the-top applications of SureGuard herbicide should be applied before bud swell in the spring or delayed until coniferous trees have sufficiently hardened off in the fall. For non-dormant coniferous ornamentals, applications may be made using a directed hooded or shielded spray.

Field-grown deciduous trees: For maximum safety of deciduous trees, directed applications of SureGuard herbicide should be made to the soil surface before bud swell in the spring or after dormancy has initiated in the fall. Direct the application of SureGuard herbicide to the soil surface and away from plant material.

Do not make more than 2 applications of SureGuard per season, and wait 8 weeks between applications.

Special Recommendations, Cautions or Restrictions

Apply BroadStar herbicide before weed seeds germinate. Disturbing the soil surface after application may reduce herbicide efficacy. Remove existing weeds, weed residues and trash before applying BroadStar herbicide. Apply to dry foliage only. To test for moisture, rub hands over plant foliage. Approximately 1–2 cm of rainfall, overhead sprinkler irrigation or hand irrigation is required to activate BroadStar herbicide. Irrigate plants within 1 hr after application with 1–2 cm of water to wash the particles off the plant foliage. Inadequate irrigation or rainfall following application may reduce the effectiveness of BroadStar herbicide. Drip irrigation cannot be relied on to activate BroadStar herbicide. If adequate soil moisture is maintained following application, BroadStar herbicide will provide residual control of the listed weeds, except under unusual environmental conditions (excessive rainfall, irrigation or temperature).

SureGuard herbicide may be applied to established field-grown deciduous trees. Pre-emergence applications of SureGuard herbicide should be made to tilled, weed-free deciduous tree plantings.

For maximum safety of deciduous trees, directed applications of SureGuard herbicide should be made to the soil surface before bud swell in the spring or after dormancy has begun in the fall. Direct the application of SureGuard herbicide to the soil surface and away from plant material.

Avoid direct spray onto plant surfaces, flowers, foliage and green bark. SureGuard herbicide applications made after bud swell may result in plant injury if the herbicide contacts the tree foliage. Splashing of herbicide-treated soil onto foliage can result in plant injury and should be avoided. Do not apply to trees that have been established for less than 1 year, unless they are protected from spray contact by non-porous wraps, grow tubes or waxed containers. Newly established or transplanted trees should be sufficiently watered-in before application to settle soil around the plant.

Moisture is necessary to activate SureGuard herbicide in the soil for residual weed control. Dry weather following applications of SureGuard herbicide may reduce its effectiveness. However, when adequate moisture is received after dry conditions, SureGuard herbicide will control susceptible germinating weeds. SureGuard herbicide may not control weeds that germinate after application but before an activating rainfall or irrigation or weeds that germinate through cracks resulting from dry soil.

Residual Activity

The length of residual control depends on the application rate as well as on rainfall and temperature conditions. Length of residual control will decrease as temperature and precipitation increase. It will also decrease when there are high levels of organic matter and/or clay in the soil.

Manufacturer: Valent Canada Inc.

Active Ingredient: indaziflam

Trade Name: SPECTICLE G
Chemical Family: Cellulose Biosynthesis Inhibitor (CBI)
Site of Action: Group 29

Container applications

indaziflam	0.075 kg/ha
SPECTICLE G	336 kg/ha

Remarks

SPECTICLE G is a granular herbicide for pre-emergent weed control on outdoor, container-grown ornamentals. To avoid injury to ornamentals, irrigate with a sufficient amount of water within one hour to wash granules from leaf surfaces. Application of SPECTICLE G after bud swell may cause injury if granules remain on foliage. Avoid application under environmental conditions that favour possible adherence of the granule to non-targeted areas. Deep cultivation reduces the effectiveness of SPECTICLE G and should be avoided.

Use SPECITCLE G on: a wide range of ornamentals. See “ORNAMENTALS AND THEIR CULTIVARS TOLERANT TO SPECTICLE G Herbicide” on the Specticle G pesticide label.

DO NOT USE SPECTICLE G on *Aquilegia canadensis, Astilbe chinensis, Berberis thumbergii, Calamagrostis x acutiflora, Ceanothus x pallidus, Codiaeum variegatum, Coreopsis auriculata, Dianthus sp, Duranta erecta, Echinacea purpurea, Euonymus japonicus, Festuca glauca, Hydrangea macrophylla, Ixora coccinea, Kerri japonica, Lavandula angustifolia, Ligustrum japonicum, Liriope sp., Mandevilla sp., Mentha sp., Muhlenbergia capillaries, Ophiopogon japonicus, Pennisetum alopecuroides, Pennisetum setaceum, Plumbago spp., Salvia spp., Sambucus nigra, Spirea japonica* or *Viburnum odoratissimum*. Foliar symptoms include stunted, yellowed new growth. Stem girdling and swelling at the soil line may occur in some sensitive species.

Uptake and Translocation

Root and shoot uptake.

Basis of Selectivity

The active ingredient in SPECTICLE G is indaziflam, which has a unique mode of action and is the only active ingredient in the Weed Science Society of America (WSSA) Group 29. Indaziflam prevents the emergence of seedlings by inhibiting crystalline cellulose deposition in the plant cell wall affecting cell wall formation, division and elongation. Indaziflam acts in plant cells and tissues where cellulose synthesis is actively taking place (germinating weed seeds and developing seedlings), for example, in actively growing meristematic tissues, dividing cells, expanding cells, as well as growing roots.

Application Methods

Container-grown ornamentals: SPECTICLE G Herbicide is a ready-to-use granular formulation and may be applied with a broadcast spreader or shaker can that is calibrated to deliver 336 kg/ha (3.36 kg/100 m^2 – 0.50 g/15 cm wide container). SPECTICLE G Herbicide is applied over-the-top to container-grown ornamentals using a clean, properly calibrated drop, rotary, hand-shaker or other spreader equipment according to manufacturer's directions. Check periodically to be certain that the equipment is working properly prior to each use. Uniform application is essential for satisfactory weed control.

Special Recommendations, Cautions or Restrictions

DO NOT USE SPECTICLE G on ornamentals where granules may become trapped in developing leaves or in meristematic areas (e.g., in whorls of grasses and perennials, such as hosta). Ornamentals should be established in the container for at least a week to allow the soil to settle and plants should be at least 12.7 cm (5 inches) tall prior to applying SPECTICLE G. Do not apply SPECTICLE G over-the-top of deciduous ornamentals at bud break. Do not apply SPECTICLE G to unhealed budded grafts or other types of grafts. Care must be taken that the granules are evenly distributed and applied to dry foliage. Any granules adhering to the foliage must be removed prior to irrigation to prevent localized damage. Within one hour of application it is recommended to irrigate or water treated containers with at least 6 mm of water. Do not use SPECTICLE G on nursery seedbeds, rooted cuttings or young plants in liners. Do not apply SPECTICLE G Herbicide to plant types not listed as tolerant on the label. SPECTICLE G will not prevent shoot emergence from deeper weeds.

Residual Activity

Four months of residual weed control is expected. Under some environmental conditions, longer residual may be observed. In field sites, residual may last more than 6 months. Spring applications may interfere with establishment of fall-seeded cover crops; annual ryegrass is especially sensitive to indaziflam residues.

Manufacturer: Bayer CropScience Inc.

Active Ingredient: isoxaben

Trade Name: GALLERY 75 DF
Chemical Family: benzamide
Site of Action: Group 21

Rates of Application

isoxaben	0.75 kg/ha
GALLERY 75 DF	1.0 kg/ha

Remarks

To be used on bareroot and container-grown nursery stock grown for silvicultural purposes and containerized ornamentals grown in nurseries. Use on the following nursery stock 4 weeks after germination or crop emergence: *Picea abies*, *Picea glauca*, *Picea mariana*, *Pinus banksiana*, *Pinus contorta*, *Pinus resinosa*, *Pinus strobus.* Do not use on cut flowers. Germination of some sensitive crop species may be reduced in the year following treatment. Gallery is labelled for use on several container-grown ornamentals: *Acer*, *Clematis*, *Cornus*, *Euonymus*, *Hemerocallis*, *Heuchera*, *Hosta*, *Juniperus*, *Picea*, *Potentilla*, *Prunus*, *Pseudotsuga*, *Rhododendron*, *Rosa*, *Spiraea*, *Taxus* and *Thuja*. Gallery is UV-sensitive.

Sensitive Weeds

Common lamb's-quarters, common purslane, low cudweed, pineappleweed, purslane speedwell, shepherd's-purse, St. John's wort.

Uptake and Translocation

Absorbed by roots and translocated to the shoots of germinating weeds.

Basis of Selectivity
Root selectivity.

Application Methods
Do not use more than once per season. Apply in late summer to early fall, early spring or any time before germination of target weeds or immediately after cultivation. A single rainfall or sprinkler irrigation of 1 cm after application is necessary to activate Gallery 75 DF within 21 days after application. Apply Gallery 75 DF in 100–400 L of water carrier per hectare. For outdoor use only.

Residual Activity
Provides season-long control. Germination of some sensitive crop species may be reduced in the year following treatment.

Manufacturer: Corteva AgriScience (Dow AgroSciences)

Active Ingredient: napropamide

Trade Name: **DEVRINOL 2-XT**
Chemical Family: **amide**
Site of Action: **Group 15**

Rates of Application

napropamide	4.5 kg/ha
DEVRINOL 2-XT	18.75 L/ha

Remarks
Use on newly transplanted or established ornamentals, woody nursery stock, forest tree stock and container-grown ornamentals. Do not apply to species right after direct seeding. Devrinol is UV-sensitive.

Use on any of the following field-grown nursery stock:

Deciduous and evergreen trees: maple (*Acer* spp.), ash (*Fraxinus* spp.), birch (*Betula* spp.), black walnut (*Juglans nigra*), cedar (*Juniperus* spp.), cypress (*Cupressus* spp.), dogwood (*Cornus florida*), Douglas fir (*Pseudotsuga menziesii*), fir (*Abies* spp.), hawthorn (*Crataegus* spp.), hemlock (*Tsuga* spp.), honey-locust (*Gleditsia tricanthos*), Japanese larch (*Larix kaempferi*), laburnum (*Laburnum* spp.), flowering crab apple tree (*Malus* spp.), spruce (*Picea* spp.), pin oak (*Quercus palustris*), pine (*Pinus* spp.), pittosporum (*Pittosporum tobira*), podocarpus (*Podocarpus macrophyllus*), poplar, cottonwood, aspen (*Populus* spp.), cherry, peach, plum, apricot (*Prunus* spp.) and pear (*Pyrus* spp.).

Deciduous and evergreen shrubs: asparagus (*Sprengeri*) (*Asparagus densiflorus* and *A. Sarmentosus*), aucuba (*Aucuba japonica*), azalea (*Rhododendron* spp.), bottlebrush (*Callistemon* spp.), boxwood (*Buxus microphylla* or *B. sempervirens*), camellia (*Camellia* spp.), cotoneaster (*Cotoneaster* spp.), crepe myrtle (*Lagerstroemia* spp.), dogwood (*Cornus florida*), euonymus (*Euonymus* spp.), forsythia (*Forsythia* spp.), hibiscus (*Hibiscus* spp.), honeysuckle (*Lonicera* spp.), St. John's-wort (*Hypericum* spp.), holly, yaupon (*Ilex* spp.), juniper (*Juniperus* spp.), leucothoe (*Leucothoe* spp.), privet (*Ligustrum* spp.), heavenly bamboo, (*Nandina domestica*), chokecherry (*Photinia* spp.), pittosporum (*Pittosporum tobira*), podocarpus (*Podocarpus* spp.), firethorn (*Pyrancantha* spp.), rhododendron (*Rhododendron* spp.), rose (*Rosa* spp.), yew (*Taxus* spp.) and viburnum (*Viburnum* spp.).

Fruit and nuts: filbert (*Corylus americana*), walnut (*Juglans nigra*) and grape (*Vitis* spp.).

Ground covers: Carpet bugleweed (*Ajuga* spp.), gazania (*Gazania* spp.), English ivy (*Hedera helix*), ivy (*Hedera* spp.), St. John's-wort (*Hypericum* spp.), lantana (*Lantana* spp.), liriope (*Liriope muscari* and *L. spicata*), pachysandra or spurge (*Pachysandra procumbens* and *P. Terminalis*), stonecrop (*Sedum* spp.), periwinkle (*Vinca major* or *V. minor*).

Flowers: Aster (*Aster* spp.), daisy (*Chrysanthemum* spp.), dahlia (*Dahlia* spp.), African daisy (*Dimorphotheca aurantiaca* and *D. sinuata*), geranium (*Geranium* spp.), plantain lily (hosta) (*Hosta* spp.), daffodils (*Narcissus* spp.), petunia (*Petunia hybrida*).

Use on the following container-grown nursery stock: Abelia (*Abelia* sp.), agapanthus (*Agapanthus* sp.), ageratum (*Ageratum houstonianum*), asparagus (*Asparagus* sp.), azalea (*Rhododendron* sp.), bottlebrush (*Callistemon* sp.), bougainvillea (Bougainvillea sp.), boxwood (*Buxus* sp.), camellia

(*Camellia* sp.), cotoneaster (*Cotoneaster* sp.), crape myrtle (*Lagerstroemia* sp.), cypress (*Cupressus* sp.), dogwood (*Cornus florida*), Douglas fir (*Pseudotsuga menziesii*), ivy (*Hedera* sp.), eucalyptus (*Eucalyptus* sp.), euonymus (*Euonymus* sp.), fir (*Abies* sp.), firethorn (*Pyracantha* sp.), forsythia (*Forsythia* sp.), gardenia (*Gardenia jasminoides*), geranium (*Geranium* sp.), heather (*Erica* sp.), hibiscus (*Hibiscus* sp.), holly (*Ilex* sp.), juniper (*Juniperus* sp.), leucothoe (*Leucothoe* sp.), privet (Ligustrum sp.), liriope (*Liriope muscari*, *L. spicata*), nandina (*Nandina domestica*), pachysandra (*Pachysandra procumbens*, *P. terminalis*), photinia (*Photinia* sp.), pine (*Pinus* sp.), podocarpus (Podocarpus sp.), raphoiolepis (*Raphiolopsis indica*), rhododendron (*Rhododendron* sp.), rose (*Rosa* sp.), sedum (*Sedum* sp.), star jasmine (*Trachelospermum asiaticum*), thuja (*Thuja occidentalis*) and vinca (*Vinca major* and *V. minor*).

Sensitive Weeds
Many annual weeds including annual bluegrass, barnyard grass, chickweed, crabgrass, foxtail, goose grass, groundsel, lamb's-quarters, pineappleweed, prickly lettuce, prostrate knotweed, purslane, redroot pigweed, sandbur and wild oats.

Uptake and Translocation
Absorbed through the roots of germinating weeds. Translocated upward through seedlings.

Basis of Selectivity
Metabolized by tolerant species. Inhibits root growth of germinating seedlings. Does not affect established plants due to placement selectivity.

Application Methods
Field nursery stock: Apply herbicide before planting, using water as the carrier. Incorporate uniformly to a depth of 2.5–5 cm, using irrigation or mechanical methods (e.g., tandem discs, field cultivator with sweep teeth). Follow with a levelling device.

Apply on established crops to a weed-free soil surface. Irrigate unless there is adequate rainfall within 7 days after spring/fall application or within 2 days after summer application. Soil must be wet to a depth of 5–10 cm.

Container nursery stock: Apply at any time of the year to a weed-free media surface. May be used on newly planted container stock once the potting media settles after the first watering. Incorporate by watering within 7 days after a spring or fall application. Water within 2 days after a summer application. Does not control bittercress.

Residual Activity
Provides season-long weed control if properly incorporated. Deep ploughing minimizes carry-over effects.

Unique Characteristics
Does not control germinated weeds. Resists leaching. To avoid crop injury, do not plant crops not registered for product use for 12 months after a napropamide application.

Manufacturer: United Phosphorus Inc.

Active Ingredient: oxadiazon

Trade Name: **RONSTAR 2 G**
Chemical Family: **oxadiazole**
Site of Action: **Group 14**

Rates of Application

oxadiazon	2–4.5 kg/ha
RONSTAR 2G (2 Gr)	100–225 kg/ha

Remarks
Use in container nursery stock on: alpine currant, Colorado spruce, dogwood, emerald and gold euonymus, golden elder, juniper, lilac, mugo pine, Nanking cherry, potentilla, Scotch pine, Serbian spruce and vine maple.

The following plants are sensitive to Ronstar 2 G: *Andromeda* 'Temple Bell' (snowdrift); *Calluna* 'Mediterranean pink' (heath); *Cotoneaster* 'Eichholz', 'Himalayan', 'Shangri-la'; *Hibiscus* 'Red Heart'; *Picea abies* 'Primila' (Primila Norway spruce); *Picea glauca* 'Densena' (Densena white spruce); *Rhododendron* 'Everest', 'Girard Roberta', 'Hershey', 'Himo-Crimson', 'John Hearrens', 'Leuchtenfuer', 'Memoire', 'Nova Zimbela' (azalea), 'Pink Champagne', 'White Grandeur'; *Tsuga canadensis* 'Pendula' (weeping hemlock); *Viburum davidii*.

Sensitive Weeds
Annual weeds including annual bluegrass, barnyard grass, bittercress, black nightshade, common groundsel, crabgrass, green foxtail, lamb's-quarters, pigweed, purslane, redroot pigweed, shepherd's-purse, stinkweed, tumble and yellow foxtail.

Uptake and Translocation
Primarily through emerging shoots when they penetrate through the layer of treated soil.

Basis of Selectivity
Greater physiological tolerance relative to susceptible species and lack of contact with sensitive crop tissue.

Application Methods
Use on newly transplanted and established ornamentals and trees. Apply uniformly to soil. Apply at any time of the year before weed seeds germinate. Remove existing weed growth for satisfactory weed control. Do not apply to wet foliage or when granules can collect on leaves. Apply the herbicide at least 4 weeks before covering polyhouses in the fall.

Residual Activity
60–120 days.

Unique Characteristics
Because moisture activates the chemical, rainfall or overhead irrigation after application improves weed control. When the product is applied to soil, it is rapidly and strongly fixed by soil colloids. This adsorption to soil, along with the product's limited water solubility, mean the product is not easily leached.

Manufacturer: Bayer CropScience Inc.

Active Ingredient: pendimethalin

Trade Name: **PROWL H2O**
Chemical Family: **dinitroaniline**
Site of Action: **Group 3**

Rates of Application

pendimethalin	1.68 kg/ha
PROWL H2O	3.7 L/ha

Remarks
Prowl H2O herbicide will control annual grasses and certain broadleaf weeds in and around field, liner and container outdoor ornamentals and conifers for field production, including Christmas trees. For use on established container or field grown ornamentals and conifers for field production, including Christmas trees. Plant only those plant species for which tolerance has been confirmed into soil treated the previous season with Prowl H2O herbicide, or injury may occur.

Tolerant species include: Fraser fir (*Abies fraseri*), common yarrow (*Achillea millefolium*), columbine (*Aquilegia* sp. 'McKana'), river birch (*Betula nigra*), shasta daisy (*Chrysanthemum maximum*), lanceleaf tickseed (*Coreopsis lanceolata*), Leyland cypress (*Cupressocyparis leylandii*), foxglove (*Digitalis purpurea*), purple coneflower (*Echinacea purpurea*), forsythia (*Forsythia intermedia*), green ash (*Fraxinus pennsylvanica*), blanket flower (*Gaillardia aristata, Gaillardia pulchella*), avens (*Geum quellyon*, *Geum chiloense*), baby's breath (*Gypsophila paniculata*), daylily (*Hemerocallis* spp.), Andorra juniper (*Juniperus horizontalis*), crepe myrtle (*Lagerstroemia indica*), statice (*Limonium latifolium*), peony (*Paeonia* sp.), loblolly pine (*Pinus taeda*), water oaks (*Quercus nigra*), blood stonecrop (*Sedium spurium*), Stokes aster (*Stokesia laevis*), spreading yew (*Taxus cuspidate*), globe cedar (*Thuja occidentalis*), Canadian hemlock (*Tsuga canadensis*).

Do not apply PROWL H2O on the following:
Japanese holly fern (*Cyrtomium falcatum*), golden balsam (*Impatiens* sp.), petunia (*Petunia* hybrid), false dragonhead (*Physostegia virginiana*), white pine (*Pinus strobus*), black-eyed Susan (*Rudbeckia hirta*) and lamb's ear (*Stachys byzantine*).

Sensitive Weeds
Broadleaf Weeds: Lamb's-quarters and redroot pigweed (suppression only).

Grasses: Barnyard grass, crabgrass (large and smooth), fall panicum and green foxtail.

Uptake and Translocation
Rapidly absorbed by primary roots of emerging/germinating seedlings as they penetrate through the layer of treated soil. Translocation with the plant is not significant and emerged weeds are not controlled.

Basis of Selectivity
Small-seeded grasses and broadleaf weeds. Weed seeds must germinate and grow within the treated soil layer to be affected.

Application Methods
Apply as a directed spray. Uniformly apply the recommended rate of Prowl H2O herbicide with properly calibrated ground equipment before weed emergence. PROWL H2O herbicide will not control emerged weeds. Do not make over-the-top applications. DO NOT apply during bud swell, bud break or at time of first flush of new growth. If newly budded or graphed rootstock, make an application using a shielded sprayer. Care must be taken to ensure there are no cracks in the soil where PROWL H2O herbicide could come in contact with the roots. Do not apply during bud swell, bud break or at time of first flush of new growth. Direct sprays away from graphed or budded tissue on transplants at all times. PROWL H2O herbicide treatments are most effective in controlling weeds when adequate rainfall or overhead irrigation is received. If PROWL H2O is not activated by rainfall or irrigation within 7 days, erratic weed control may result.

Residual Activity
Season-long control.

Manufacturer: BASF Canada Inc.

Active Ingredient: propyzamide

Trade Name: KERB 50 WSP
Chemical Family: amide
Site of Action: Group 15

Rates of Application

propyzamide	1.5 kg/ha
KERB (50WG)	3 kg/ha

Remarks
Use on established ornamentals such as coniferous trees and shrubs, ground covers, iris and peony. Do not use on *Vinca minor*.

Sensitive Weeds
Perennial grasses including annual grasses, common chickweed, quackgrass and volunteer cereals.

Uptake and Translocation
Taken up by plant roots and translocated to foliage. Little foliar absorption.

Basis of Selectivity
Faster degradation in tolerant species.

Application Methods
Use as a pre-emergence treatment for annual weeds, or apply it in the fall for post-emergence control of perennial grasses. Apply from late September to November when the soil temperature is low but above freezing and soil moisture is high.

Residual Activity
Persists 2–9 months, depending on soil type and climate. Decomposes slowly at temperatures below 1°C but accelerates at temperatures above this level. Persistence is greatest in sandy soils with low organic matter.

Unique Characteristics
Rainfall or irrigation is required after application. This moves the herbicide into the root zone for uptake by perennial grasses and germinating annual grasses.

Manufacturer: Corteva Agriscience (Dow AgroSciences)

Active Ingredient: s-metolachlor

Trade Name: DUAL II MAGNUM
Chemical Family: acetanilide
Site of Action: Group 15

Rates of Application

s-metolachlor (915 g/L)	0.14–1.6 kg/ha
DUAL II MAGNUM	1.25–1.75 L/ha

Remarks

Use on white spruce 2 years or older, black spruce, Norway spruce, jack pine, red pine and white pine transplant or seedling stock. Also, for use on poplar stoolbeds and second-year, non-bearing fruit trees. Use on outdoor ornamentals (woody and herbaceous): *Euonymus alata*, *Hemerocallis*, *Hosta*, *Juniperus*, *Rhododendron*, *Thuja*. May be used for field-grown conifers that are established: *Abies balsamea*, *Abies fraseri*, *Picea glauca*, *Pinus strobus*. Use on non-bearing stone fruit trees.

May be applied as a pre-emergent or early post-emergent application to weeds before they pass the two-leaf stage. For poplar stoolbeds, apply to dormant and flushing stoolbeds.

Apply to soil before bud break. Do not apply Dual II Magnum within 4 weeks after bud burst or until the needles have hardened. Do not use on sandy soils with less than 2% organic matter. Make only one ground application per year, banded over top of trees. Apply in a minimum of 300 L water/ha.

Sensitive Weeds

Annual broadleaf weeds and grasses such as American nightshade, barnyard grass, eastern black nightshade, fall panicum, giant foxtail, green foxtail, hairy crabgrass, redroot pigweed (suppression only), smooth crabgrass, witch grass, yellow foxtail, yellow nut sedge.

Uptake and Translocation

Absorbed by germinating grasses mainly through the shoot, just above the seed. Absorbed by germinating broadleaf weeds through roots and shoots.

Basis of Selectivity

Metabolized by tolerant species.

Application Methods

Early preplant, preplant incorporated or pre-emergence. Set incorporation equipment to work the soil 10 cm deep with a disc operating at 6–10 km/h or a vibrating shank cultivator at 10–13 km/h. One incorporation is sufficient and need not be immediate. Rainfall within 10 days is required for maximum activity of the pre-emergence application.

Residual Activity

Activity will normally last for 10–14 weeks.

Unique Characteristics

The rate required depends on weed pressure (use a higher rate for heavier weed pressure). Yellow nut sedge control requires a preplant, incorporated application. Winter cereals may be planted 4–5 months after s-metolachlor application. Many tank mix combinations are registered for various crops. Do not use on muck soils or coarse-textured soils low in organic matter.

Manufacturer: Syngenta Canada Inc.

Active Ingredient: simazine

Trade Name: PRINCEP NINE-T, SIMADEX
Chemical Family: S-triazine
Site of Action: Group 5

Rates of Application

Field applications

simazine	2.3–3.4 kg/ha
PRINCEP NINE-T (90 WG)	2.5–3.8 kg/ha
simazine	1.8–6.8 kg/ha
SIMADEX (500 g/L)	3.6–13.5 kg/ha

Container applications

simazine	2.3 kg/ha
PRINCEP NINE-T (90 WG)	2.5 kg/ha

Remarks

Use on new or established Christmas tree and woodland plantations (white pine 2 years or older and balsam fir). Use Princep Nine-T (only) for conifer site preparation before planting fir, pine or spruce.

Use on woody ornamentals and nursery stock established for at least 1 year: apple, barberry, black walnut, boxwood, cedar, chamaecyparis, cotoneaster, dogwood, flowering crabapple, hemlock, holly, juniper, mugo pine, multiflora rose, peony, rose, spruce, white ash and yew.

Use on container nursery stock: *Juniperus*, *Thuja* and *Taxus* only.

Sensitive Weeds

Annual broadleaf weeds such as clover (volunteer), groundsel, lady's-thumb, lamb's-quarters, pigweed, plantain, purslane, ragweed, smartweed and wild buckwheat. Annual grasses such as barnyard grass, crabgrass, wild oats and yellow foxtail. Most perennial species starting freshly from seed. Does not control triazine-resistant biotypes of foxtail, groundsel, lamb's-quarters or pigweed.

Uptake and Translocation

Absorbed by roots, but little or no foliar absorption. Translocated upwards in the xylem, accumulating in the apical meristem and leaves on new plantings of apples, apricots, cherries, peaches, pears and plums.

Basis of Selectivity

Some species, such as corn, metabolize simazine. In most crops, selectivity depends on crop-plant roots being deeper than the depth to which simazine leaches.

Application Methods

Remove any existing weeds from containers before application. Apply once per season: 1 month after planting, before weeds emerge.

Residual Activity

Persists longer than atrazine. Soil residues may persist for more than one season. Do not plant any crop but corn in the treated area for 1 year after a simazine application. If more than 2 kg/ha of product was applied, do not plant rotational crops the following year. If in any doubt, test the soil for excess residues.

Unique Characteristics

Apply only once per season. Needs sufficient moisture to activate. Rotate with non-triazine residual herbicides to avoid resistant weeds. Where rainfall causes erosion, soil containing simazine may wash to lower land and injure existing or subsequent crops.

Manufacturer: PRINCEP NINE-T: Syngenta Canada Inc.; SIMADEX: Bayer CropScience Inc.

Active Ingredient: trifluralin

Trade Name: BONANZA 480 EC, RIVAL EC, TREFLAN EC
Chemical Family: dinitroaniline
Site of Action: Group 3

Rates of Application

trifluralin	0.6–1.15 kg/ha
BONANZA 480 (480 g/L)	1.25–1.7 L/ha
RIVAL EC	1.2–2.3 L/ha
TREFLAN EC (480 g/L)	1.2–1.7 L/ha

Remarks

Use with field-grown nursery stock, perennials (except *Ajuga*, *Pachysandra* and *Vinca*) and established shelterbelts.

Sensitive Weeds

Effective on most annual grasses. Provides good control of pigweed and lamb's-quarters, including the triazine-tolerant biotypes of these weeds.

Uptake and Translocation
No significant absorption or translocation in crops. Controls susceptible weeds as they germinate. Does not control established weeds.

Basis of Selectivity
Physiological growth processes associated with seed germination.

Application Methods
Preplant incorporated. Apply in 100–300 L water/ha. Use a lower rate of the chemical on sandy soils and a greater rate for loam-to-clay soils. Do not use on soils with a high organic content (muck, peat or black sands with more than 15% organic matter). Incorporate twice in crosswise directions using a tandem disc (7–10 km/h) or tine cultivator (10–13 km/h) set 8–10 cm deep. Incorporate immediately after application if possible, although a delay of up to 24 hr is acceptable, as per label directions. Incorporate again any time before planting. Trifluralin is activated upon incorporation. Irrigation is not required.

Residual Activity
Recommended application rates provide season-long weed control. Trifluralin does not injure succeeding crops under normal conditions. Fall-seeded grain crops will grow in soil treated with trifluralin the preceding spring.

Unique Characteristics
Strongly absorbs to soil particles and shows negligible leaching. Organic matter and clay content influence the application rate. Does not control ragweed, annual nightshades or mustards. Lady's-thumb may escape.

Manufacturer: BONANZA: Loveland Products Canada Inc.; RIVAL: NuFarm Agriculture Inc.; TREFLAN: Gowan Company L.L.C.

Post-emergence Treatments

Post-emergence treatments are applied after crops and weeds emerge.

- Selective chemicals kill weeds with little damage to desirable plants.
- Many post-emergent treatments are non-selective and can damage desirable plants if used carelessly.
- The types of weeds controlled depend on weed susceptibility and crop tolerance to the chemical. Treatments must be applied at the correct stage of crop development. Since weed susceptibility is greatest when most weeds are young, early treatments need less herbicide and cause less crop damage.
- Some herbicides may be applied for pre-emergence weed action after the crop has emerged. For example, after a crop has been cultivated to ensure the soil is weed-free, a herbicide can be applied to control the weeds that subsequently germinate.

The following chemicals may be used as post-emergence treatments.

Active Ingredient: amitrole

Trade Name: **AMITROL 240**
Chemical Family: **triazole**
Site of Action: **Group 11**

Rates of Application

amitrole	0.39–0.69 kg/ha
AMITROL 240	1.7–3.0 L/ha

Remarks
To be applied only on spruce (*Picea* spp.).

Caution: Avoid application during the period of rapid shoot elongation in the spring. Applications can be made in the first year (1.7 L/ha), either in the seedbed or on transplants, but only after the seedlings have set bud. For actively growing seedlings or transplant bareroot spruce beyond the first year of growth, the rate may be increased to 3.0 L/ha. This product has activity against a wide range of plants (both evergreen and deciduous). Avoid spray drift into non-target areas.

Sensitive Weeds
Many annual and perennial broadleaf weeds and grasses, including ash, Canada thistle, cattail, dandelions, hoary cress, honeysuckle, horsetail, leafy spurge, locust, milkweed, poison-ivy, poison-oak, quack grass, sow-thistle, sumac and toadflax.

Uptake and Translocation
Absorbed by foliage and roots. Translocates well in the xylem and phloem. Accumulates in the growing regions of the plant.

Basis of Selectivity
Resistant plants metabolize amitrole more rapidly than sensitive plants and may have lower uptake as a result of leaf structure that reduces wetting and penetration.

Application Methods
Use foliar post-emergence application for actively growing plants. Good coverage is essential. If weeds are mature, it is advisable to cut them and then spray the regrowth. Do not disturb treated plants for at least 2 weeks after application. Do not make postharvest applications after October 1. For control of quackgrass and Canada thistle, apply in spring or fall to actively growing plants 15–20 cm tall, then wait 10–14 days to plough or disk. Poor results may occur if heavy rain falls within 6 hr after application.

Residual Activity
Approximately 2–4 weeks in moist, warm soil.

Manufacturer: Nufarm Agriculture Inc.

Active Ingredient: carfentrazone-ethyl

Trade Name: **AIM EC**
Chemical Family: **triazolinone**
Site of Action: **Group 14**

Rates of Application

carfentrazone-ethyl	36 g/ha
AIM EC	150 mL/ha

Remarks
To be applied on field-grown woody ornamental nurseries (genus such as *Malus*, *Prunus*, *Sorbus*). Aim EC herbicide can be applied a maximum of twice per growing season. Do not enter or allow workers to enter treated areas during the restricted entry interval (REI) of 12 hr.

Caution: This product contains aromatic petroleum distillates that are toxic to aquatic organisms.

Sensitive Weeds
Apply Aim EC to manage undesirable sucker growth from the base of vine or tree trunks or root sprouts. Treat when the tissue is young and not mature and/or hardened off.

Uptake and Translocation
Aim EC herbicide is a contact herbicide. Within a few hours following application, the foliage of susceptible weeds show signs of desiccation, and, in subsequent days, necrosis and death of the plant occur.

Basis of Selectivity
Aim EC herbicide is a selective, contact herbicide. It inhibits an enzyme of chlorophyll and heme biosynthesis.

Application Methods
Directed spray at the base of the tree for sucker control with special precaution not to get spray on fruit, foliage or tender growing parts. Use ground sprayers designed, calibrated and operated to deliver uniform spray droplets to the targeted plant or plant parts. Avoid using fine droplet nozzles that produce a droplet VMD of 300 microns or less (see the drift prevention section of the Aim label for more instructions). When using hooded sprayers or directed sprayer application:

use drift-reducing nozzles, splash screens or a full screen to prevent drift from reaching other parts of the vine or tree (at least one method is required). Direct the spray toward the sucker zone.

Weed control is optimized when the product is applied to actively growing weeds up to 10 cm in height, or as specified. For conventional boom and nozzle sprayers, use nozzles that produce minimal amounts of fine spray droplets. Do not exceed 210 kPa spray pressure, unless otherwise required for optimal drift-reduction nozzle performance. Apply with an adjuvant such as Agral 90 or Ag-Surf at 0.25% v/v (0.25 L/100 L of spray solution) or use Merge at 1% v/v (1 L/100 L of spray solution).

Residual Activity
None.

Manufacturer: FMC Corporation

Active Ingredient: clopyralid

Trade Name: **LONTREL XC**
Chemical Family: **pyridine carboxylic acid**
Site of Action: **Group 4**

Rates of Application

clopyralid	0.150–0.2 kg/ha
LONTREL XC (600 g/L)	0.25–0.35 L/ha

Remarks
Use for established, field-grown conifers including Christmas trees (*Abies balsamea*, *Abies fraseri*, *Picea abies*, *Pinus strobus*) and for bearing and non-bearing apple trees.

Sensitive Weeds
Vetch (post-emergent).

Uptake and Translocation
Most growth regulator herbicides are readily absorbed through both roots and foliage and are translocated in both the xylem and phloem.

Basis of Selectivity
Growth regulator herbicide. Weeds cannot grow due to disruption of plant cell growth.

Application Methods
Post-emergence.

Residual Activity
Half-life in soil is less than 30 days under conditions that are favourable for microbial degradation. Little to no residual activity.

Unique Characteristics
Clopyralid has little to no activity on woody vegetation, except woody species of the legume family.

Manufacturer: Corteva AgriScience (Dow AgroSciences)

Active Ingredient: fluazifop-p-butyl

Trade Name: **VENTURE L**
Chemical Family: **aryloxyphenoxy propionate**
Site of Action: **Group 1**

Rates of Application

fluazifop-p-butyl	0.075–0.25 kg/ha
VENTURE L (125 g/L)	0.6–2.00 L/ha

Remarks
Use for field and container application. Good on non-grassy ornamental plants, shrubs, trees, non-bearing forest and ornamental nursery field stock and container-grown nursery stock. See list of tolerant species on label. Over-the-top application can injure some blue junipers (e.g., *Juniperus horizontalis* 'Bar Harbour,' 'Blue Acres' and 'Blue Rug').

Cultivars differ in sensitivity to Venture L. For example, *J. horizontalis* 'Blue Acres' is sensitive, while *J. horizontalis* 'Plumosa Compacta' is tolerant. Consult the label for tolerant species. Test samples of each cultivar not specifically listed on the label before using this product. Also for non-bearing apples and pears.

Sensitive Weeds
Annual grass species, quackgrass and volunteer corn, wheat and barley.

Uptake and Translocation
Absorbed primarily by leaves. Translocated to roots and rhizomes.

Basis of Selectivity
Metabolism by tolerant species.

Application Methods
Post-emergence. Use a directed application in sensitive species to avoid contacting leaves and green tissue. Use higher application rates for quackgrass. Apply to actively growing grasses when annual grasses are in the 2–5-leaf stage and quackgrass is in the 3–5-leaf stage.

Residual Activity
Essentially none.

Unique Characteristics
Using preplant tillage to break up rhizomes improves quackgrass control. Do not cultivate for 5 days after application. Except as noted on the label, apply broadleaf herbicides separately at least 3 days after using this product. The product loses some effectiveness when used on stressed plants (e.g., when plants are suffering from lack of moisture, excessive humidity, low temperature or very low relative humidity). Weeds may regrow by tillering if the product is applied to stressed plants. A new flush of weeds may emerge after the first flush is controlled.

Manufacturer: Syngenta Canada Inc.

Active Ingredient: glyphosate

Trade Name: **various products**
(see OMAFRA Publication 75, *Guide to Weed Control*, or contact a local supplier)
Chemical Family: **amino acid**
Site of Action: **Group 9**

Rates of Application

Emerged annual weeds
glyphosate 0.8–1.25 kg/ha

Emerged perennial weeds
glyphosate 1.7–4.3 kg/ha

Quackgrass & other perennial grasses
glyphosate 0.9–2.5 kg/ha

Perennial weeds (Canada thistle, dogbane, sow thistle)
glyphosate 0.9–2.5 kg/ha

Other perennial weeds (field bindweed, common milkweed)
glyphosate 2.5–4.3 kg/ha

Remarks
Apply to actively growing weeds. Spray must not contact leaves or green bark of trees or shrubs.

CROP AND/OR NON-CROP REGISTRATIONS
See OMAFRA *Guide to Weed Control-Horticulture Crops*.

Sensitive Weeds
Annual grasses, perennial weeds (e.g., Canada thistle, cattails, field bindweed, milkweed, nut sedge, poison-ivy, quackgrass, sow thistle) and brush (e.g., alder, birch, maple, poplar, raspberry and willow).

Uptake and Translocation
Absorbed through foliage and translocated throughout the plant.

Basis of Selectivity
Non-selective for agricultural crops. Conifers may be tolerant at some stages for unknown reasons.

Application Methods
Use post-emergence for perennial weed control. Apply at the bud-bloom growth stage to most perennial weeds. For Canada thistle or sow thistle, wait until they are at least in early flower bud. Apply to milkweed at flower bud. Apply to bindweed at full flower. Treat quackgrass in the spring or fall while it is actively growing, with at least three or four new leaves on each emerged shoot.

Remove crop refuse in the fall, but do not till before application. Fall or spring tillage before spring application may reduce weed control. Wait at least 3–5 days after application before working the area. For maximum quack grass control, till before the quack grass turns completely brown.

Glyphosate can be applied with boom equipment, knapsack sprayers or high-volume spray equipment for agricultural and non-crop uses. Use backpack mist blowers only for silvicultural site preparation and roadside brush control. Use aerial applications only for silvicultural site preparation and conifer release.

Glyphosate may be applied with selective equipment to non-crop areas, tree plantings, grapes and orchards. (See *Wiper Applicators for Selective Weed Control*, on page 131.) Regardless of the application method, do not allow the herbicide to contact green foliage or the green bark of crops or other desirable plants. Remove all suckers from the trunks of desirable trees before spraying.

Residual Activity
Crops may be planted or seeded directly into treated areas following application. Use other herbicides to control weeds emerging after the application.

Unique Characteristics
Rainfall within 6 hr after application can reduce control, as can a heavy frost.

Manufacturers: Cheminova Canada; Corteva AgriScience (Dow Agrosciences); Interprovincial Cooperative Ltd.; Bayer CropScience Inc.; NuFarm Agriculture Inc.; Syngenta Canada Inc.

Active Ingredient: oxyfluorfen

Trade Name: GOAL 2XL, Basket 2XL
Chemical Family: diphenyl-ether
Site of Action: Group 14

Rates of Application

oxyfluorfen	0.12–0.24 kg/ha
GOAL 2XL (see label)	0.5 or 1 L/ha

Remarks
Goal 2XL has some pre-emergent effects but is used mainly as a post-emergent herbicide for broadleaf weeds in conifers (including Christmas trees). Goal 2XL has been tested on field-grown balsam fir, Fraser fir, white pine and white spruce. Goal 2XL may be applied to other non-listed conifer species, however, non-listed conifer species may vary in tolerance to herbicides, including Goal 2XL. Do not use handheld equipment to apply Goal 2XL to field-grown conifers. Goal 2XL applications should be made before bud break or after new foliage has hardened off (approximately 6 weeks after bud break). Some temporary needle burn may occur. Apply to healthy trees that are not under stress. Repeat applications as required to control late-germinating weeds. Do not apply more than 2 L of product per hectare per growing season.

For new and established plantings of *Populus* species (poplars and aspens) and their hybrids (including short-rotation intensive culture crops), Goal 2XL should only be applied to dormant, healthy plants. Make only 1 application per year, using a low-pressure sprayer with flat can nozzles. Do not apply more than 7 L per treated hectare per growing season.

Sensitive Weeds
Weed sensitivity depends on the rate used and application timing (see label). Sensitive weeds include: common purslane, cupped nightshade (potato weed), field pansy, lamb's-quarters, maple-leaved goosefoot, oak-leaved goosefoot, redroot pigweed, wild buckwheat, wood sorrel. (Dormant *Populus* tree crop: narrow-leaved hawk's beard, pale smartweed, shepherd's-purse, stinkweed.)

Uptake and Translocation
Goal 2XL is a contact herbicide with both foliar and soil activity. There is very little translocation within the plant.

Basis of Selectivity
Oxyfluorfen inhibits the production of a chlorophyll enzyme, which results in an accumulation of chemicals that disrupt cell membrane integrity in the presence of light.

Application Methods
To ensure effective post-emergence weed control, apply Goal 2XL when weeds are in the 2-4-leaf stage and actively growing. Heavy rainfall or heavy irrigation immediately following application to emerged weeds may reduce effectiveness. Apply in 200–500 L water/ha.

Do not apply to sandy soil. Goal 2XL enhances activity of glyphosate formulations and improves the weed spectrum and speed of kill.

Residual Activity
Can provide up to 6 months residual activity. Oxyfluorfen is not very soluble in water and can be expected to adhere strongly to all soil types.

Manufacturer: Nufarm Agriculture Inc.

Active Ingredient: triclopyr

Trade Name: **GARLON**
Chemical Family: **carboxylic acid**
Site of Action: **Group 4**

Rates of Application

triclopyr	0.48 kg/ha
GARLON (755 g/L)	0.635 L/ha

Remarks
For the control of labelled weeds (woody and broadleaf weeds), including smooth bedstraw, in Christmas tree plantations. For best results, applications of Garlon XRT herbicide should be made when woody plants and weeds are actively growing. Apply Garlon XRT herbicide to trees at least 1.2 m tall, after the buds of the trees have hardened off and no lammas growth is present. Do not apply in the year of planting. Apply only once per year.

Sensitive Weeds
Woody and broadleaf plants. Sensitive weeds include alder, ash, birch, chokecherry, maples (red maple), poplar and smooth bedstraw.

Uptake and Translocation
Selective herbicide that mimics the effects of plant hormones (auxins). Triclopyr causes the growing tips of plants to elongate uncontrollably, resulting in death of the plant.

Basis of Selectivity
It is most effective on broadleaf plants. It has little or no impact on grasses.

Application Methods
Post-emergence. Apply when target weeds are actively growing.

Residual Activity
Half-life in soil is approximately 30 days under conditions that are favourable for microbial decomposition.

Unique Characteristics
Apply only when there is little or no hazard from spray drift. Small quantities of spray drift may injure susceptible broadleaf plants.

Manufacturer: Corteva AgriScience (Dow AgroSciences)

CROP TOLERANCE AND EFFICACY OF HERBICIDES REGISTERED ON NURSERY CROPS

In this section:

Table 3–3. Herbicides Registered for Use on Woody Plants
Table 3–4. Weed Susceptibility and Herbicides — Broadleaf Annuals
Table 3–5. Weed Susceptibility and Herbicides — Broadleaf Perennials
Table 3–6. Weed Susceptibility and Herbicides — Annual Grasses

The following pages contain tables listing information about:

- herbicides registered in Ontario for use on nursery stock (agricultural use)
- the tolerance of specific nursery crops
- weed control ratings for herbicides registered on nursery stock

Table 3–3. Herbicides Registered for Use on Woody Plants

LEGEND: C = container D = directed spray only F = field S = seedbed T = transplant
Not = labelled restriction — = insufficient information available to make a rating

	Herbicide							
Botanical Name	**CASORON**	**DEVRINOL**	**DUAL II MAGNUM**	**KERB**	**PROWL**	**RONSTAR**	**SIMADEX, PRINCEP NINE-T**	**VENTURE L**
Abelia	—	—	—	—	—	—	—	—
Abies balsamea	Not	—	—	F	—	—	F	—
Abies *fraseri*	—	—	—	—	FC	—	—	—
Abies sp.	Not	—	—	F	—	—	—	TFC
Acer circinatum	—	—	—	—	—	C[2]	—	—
Acer sp.	T[1]F	TFC	—	—	—	—	—	TFC
Aesculus sp.	—	—	—	—	—	—	—	—
Aesculus *glabra*	—	—	—	—	—	—	—	—
Amelanchier canadensis	—	—	—	—	—	—	—	—
Aronia	—	—	—	—	—	—	—	—
Ajuga sp.	Not	—	—	—	—	—	—	—
Berberis	—	—	—	—	—	—	—	—
Berberis thumbergii	—	—	—	—	—	—	—	—
Betula	—	—	—	—	—	—	—	—
Betula pendula 'Gracilis'	T[1]F	—	—	—	—	—	—	—
Betula nigra	—	—	—	—	FC	—	—	—
Buddleia	—	—	—	—	—	—	—	—
Buxus sp.	T[1]F	TFC	—	—	—	—	F	TFC

[1] Apply 4 weeks after transplanting.
[2] Apply 30 days before covering polyhouses — no later than Sept. 30.
[3] Use directed spray from bud break to initial growth hardening.

Table 3–3. Herbicides Registered for Use on Woody Plants

LEGEND: C = container D = directed spray only F = field S = seedbed T = transplant
Not = labelled restriction — = insufficient information available to make a rating

	Herbicide							
Botanical Name	**CASORON**	**DEVRINOL**	**DUAL II MAGNUM**	**KERB**	**PROWL**	**RONSTAR**	**SIMADEX, PRINCEP NINE-T**	**VENTURE L**
Calluna sp.	T[1]F	—	—	—	—	—	—	TFC
Caragana sp.	T[1]F	—	—	—	—	—	F	TFC
Carpinus sp.	—	—	—	—	—	—	—	TFC
Carya sp.	—	—	—	—	—	—	—	—
Caryopteris	—	—	—	—	—	—	—	—
Castanea sp.	—	—	—	—	—	—	—	—
Catalpa	—	—	—	—	—	—	—	—
Cercis canadensis	—	—	—	—	—	—	—	—
Chaenomeles sp.	—	—	—	—	—	—	—	TFC
Chamaecyparis sp.	—	—	—	—	—	—	F	—
Cornus sp.	—	—	—	—	—	C[2]	F	TFCD
Cotinus coggygria	—	—	—	—	—	—	—	TFC
Cotoneaster sp.	—	—	—	—	—	—	F	TFC
Crataegus sp.	—	TFC	—	—	—	—	—	—
Cryptomeria japonica	—	—	—	—	—	—	—	—
Cupressus	—	—	—	—	—	—	—	—
Daphne	—	—	—	—	—	—	—	—
Deutzia	—	—	—	—	—	—	—	—
Erica sp.	T[1]F	—	—	—	—	—	—	—
Euonymus alatus	—	—	—	—	—	—	—	—
Euonymus fortunei 'Emerald & Gold'	—	—	—	—	—	C[2]	—	—
Euonymus sp.	T[1]F	TFC	—	—	—	—	—	TFC
Forsythia sp.	T[1]F	—	—	—	FC	—	—	TFC
Fothergilla gardenii	—	—	—	—	—	—	—	—
Fagus sp.	—	—	—	—	—	—	—	—
Fraxinus americana	—	—	—	—	—	—	F	—
Fraxinus sp.	T[1]F	—	—	—	FC	—	—	TFC
Ginkgo biloba	—	—	—	—	—	—	—	—
Gleditsia sp.	—	TF	—	—	—	—	—	TFC
Gleditsia triacanthos	—	—	—	—	—	—	—	T
Hedera sp.	—	C	—	—	—	—	—	TFC
Hibiscus sp.	—	TF	—	—	—	—	—	—
Hydrangea sp.	—	—	—	—	—	—	—	TFC
Hydrangea macrophylla	—	—	—	—	—	—	—	—
Hypericum sp.	—	TF	—	—	—	—	—	—
Ilex sp.	T[1]F	TFC	—	—	—	—	F	TFC[3]
Itea virginica	—	—	—	—	—	—	—	—

[1] Apply 4 weeks after transplanting.
[2] Apply 30 days before covering polyhouses — no later than Sept. 30.
[3] Use directed spray from bud break to initial growth hardening.

Table 3–3. Herbicides Registered for Use on Woody Plants

LEGEND: C = container D = directed spray only F = field S = seedbed T = transplant
Not = labelled restriction — = insufficient information available to make a rating

	Herbicide							
Botanical Name	**CASORON**	**DEVRINOL**	**DUAL II MAGNUM**	**KERB**	**PROWL**	**RONSTAR**	**SIMADEX, PRINCEP NINE-T**	**VENTURE L**
Juglans nigra	—	—	—	—	—	—	F	—
Juniperus chinensis 'Pfitzeriana'	T[1]FC[1,2]	—	—	F	—	—	—	TFCD
Juniperus horizontalis	—	—	—	—	FC	—	—	—
Juniperus sabina	T[1]FC[1,2]	—	—	F	—	—	—	—
Juniperus scopulorum	T[1]	—	—	F	—	—	—	—
Juniperus sp.	T[1]F	TFC	—	F	—	C[2]	FC	TFC[3]
Juniperus virginiana	T[1]F	—	—	F	—	—	—	—
Kerria japonica	—	—	—	—	—	—	—	—
Kolkwitzia amabilis	—	—	—	—	—	—	—	—
Laburnum sp.	—	TF	—	—	—	—	—	—
Lagerstroemia	—	—	—	—	—	—	—	—
Ligustrum sp.	—	TFC	—	—	—	—	—	TFC
Ligustrum japonicum	—	—	—	—	—	—	—	—
Lonicera sp.	T[1]F	—	—	—	—	—	—	TFC
Magnolia	—	—	—	—	—	—	—	—
Magnolia stellata	—	—	—	—	—	—	—	—
Malus sp.	T[1]F	TF	—	—	—	—	F	TFC
Malus sylvestris	—	TFC	—	—	—	F	—	—
Metasequoia glyptostroboides	—	—	—	—	—	—	—	—
Nyssa sylvatica	—	—	—	—	—	—	—	—
Parthenocissus quinquefolia	—	—	—	—	—	—	—	TFC
Philadelphus sp.	T[1]F	—	—	—	—	—	—	TFCD
Physocarpus opulifolius	—	—	—	—	—	—	—	—
Picea abies	Not	—	—	F	—	—	F	—
Picea abies 'Nidiformis'	Not	—	—	F	—	—	—	—
Picea glauca	Not	—	—	F	—	—	F	—
Picea glauca 'Conica'	Not	—	—	F	—	—	—	—
Picea marina	—	—	TF	—	—	—	—	—
Picea omorika	Not	—	—	—	—	C[2]	—	—
Picea pungens	Not	—	—	—	—	C[2]	—	—
Picea pungens 'Glauca'	Not	—	—	F	—	—	F	—
Picea pungens 'Glauca Globosa'	Not	—	—	F	—	—	F	—
Picea rubens	Not	—	—	F	—	—	F	—

[1] Apply 4 weeks after transplanting.
[2] Apply 30 days before covering polyhouses — no later than Sept. 30.
[3] Use directed spray from bud break to initial growth hardening.

Table 3–3. Herbicides Registered for Use on Woody Plants

LEGEND: C = container D = directed spray only F = field S = seedbed T = transplant
Not = labelled restriction — = insufficient information available to make a rating

	Herbicide							
Botanical Name	**CASORON**	**DEVRINOL**	**DUAL II MAGNUM**	**KERB**	**PROWL**	**RONSTAR**	**SIMADEX, PRINCEP NINE-T**	**VENTURE L**
Picea sp.	Not	TF	—	F	—	—	—	TFC[3]
Pieris sp.	—	—	—	—	—	—	—	TFC
Pinus banksiana	—	—	TF	—	—	—	—	—
Pinus mugo	Not	—	—	F	—	C[2]	F	—
Pinus nigra	—	—	—	F	—	—	—	—
Pinus resinosa	—	—	TF	—	—	—	—	—
Pinus sp.	—	TFC	—	F	—	—	—	TFC
Pinus strobus	—	—	TF	—	Not	F	—	F
Pinus sylvestris	—	—	—	—	—	C[2]	—	—
Pinus taeda	—	—	—	—	FC	—	—	—
Pittosporum sp.	—	TF	—	—	—	—	—	—
Platanus sp.	—	—	—	—	—	—	—	TFC
Podocarpus sp.	—	TFC	—	—	—	—	—	—
Populus sp.	—	TF	stoolbed	—	—	—	—	—
Populus deltoides	—	—	—	—	—	—	—	—
Populus tremuloides	—	—	—	—	—	—	—	—
Potentilla sp.	—	—	—	—	—	C[2]	—	TFC
Prunus sp.	—	TF	—	—	—	—	—	—
Prunus tomentosa	—	—	—	—	—	C[2]	—	—
Pseudotsuga menzeisii	—	—	—	F	—	—	—	TFC[3]
Pyracantha sp.	—	TFC	—	—	—	—	—	TFC
Pyrus sp.	—	F	F	—	—	—	—	F
Quercus	—	—	—	—	—	—	—	—
Rhododendron sp.	T[1]F	TFC	—	—	—	—	—	TFC
Ribes alpinum	—	—	—	—	—	C[2]	—	—
Ribes sp.	—	—	—	—	—	—	—	TFC
Robinia sp.	T[1]F	—	—	—	—	—	—	—
Rosa multiflora	—	—	—	—	—	—	F	—
Rosa sp.	T[1]F	TFC	—	—	—	—	F	TFC
Salix sp.	T[1]F	—	—	—	—	—	—	TFC
Sambucus canadensis 'Aurea'	—	—	—	—	—	C[2]	—	—
Sambucus sp.	—	—	—	—	—	—	—	TFC
Sambucus nigra	—	—	—	—	—	—	—	—
Spiraea sp.	T[1]F	—	—	—	—	—	—	TFC
Symphoricarpos rivularis	—	—	—	—	—	—	—	TFC
Syringa sp.	Not	—	—	—	—	C[2]	—	TFC

[1] Apply 4 weeks after transplanting.
[2] Apply 30 days before covering polyhouses — no later than Sept. 30.
[3] Use directed spray from bud break to initial growth hardening.

Table 3–3. Herbicides Registered for Use on Woody Plants

LEGEND: C = container D = directed spray only F = field S = seedbed T = transplant
Not = labelled restriction — = insufficient information available to make a rating

	Herbicide							
Botanical Name	**CASORON**	**DEVRINOL**	**DUAL II MAGNUM**	**KERB**	**PROWL**	**RONSTAR**	**SIMADEX, PRINCEP NINE-T**	**VENTURE L**
Taxodium	—	—	—	—	—	—	—	—
Taxus cuspidata	—	—	—	F	—	—	—	—
Taxus sp.	T[1]FC[1,2]	TF	—	F	—	—	FC	TFC[3]
Thuja occidentalis	T[1]FC[1,2]	—	—	F	—	—	—	—
Thuja sp.	T[1]F	C	—	F	—	—	FC	TFC
Tilia sp.	T[1]F	—	—	—	—	—	—	TFC
Tsuga sp.	Not	—	—	—	—	—	F	TFC[3]
Ulmus sp.	T[1]F	—	—	—	—	—	—	TFC
Viburnum sp.	—	—	—	—	—	—	—	TFC
Weigela sp.	—	—	—	—	—	—	—	TFC

[1] Apply 4 weeks after transplanting.
[2] Apply 30 days before covering polyhouses — no later than Sept. 30.
[3] Use directed spray from bud break to initial growth hardening.

Table 3–4. Weed Susceptibility and Herbicides — Broadleaf Annuals

LEGEND: S = susceptible MS = moderately susceptible — = insufficient information available to make a rating

Broadleaf Annuals	CASORON	DEVRINOL	DUAL II MAGNUM	KERB	PROWL	RONSTAR	SIMADEX, PRINCEP NINE-T	TREFLAN, RIVAL
bittercress	S	—	—	—	—	S	—	—
buckwheat, wild	S	—	—	—	—	—	S	MS
carpetweed	—	S	—	—	—	—	—	S
chickweed, common	S	S	—	S	—	—	—	S
clover, volunteer	—	—	—	—	—	—	S	—
groundsel, common	S	S	—	—	—	S	—	—
knotweed	S	—	—	—	—	—	—	—
knotweed, prostrate	—	S	—	—	—	—	—	S
kochia	S	—	—	—	—	—	—	—
lady's-thumb	—	—	—	—	—	—	S	—
lamb's-quarters	S	S	—	—	S	S	S	S
mustards	S	—	—	—	—	—	—	—
nightshade, black	—	—	MS	—	—	S	—	—
pigweed	S	S	—	—	—	S	—	S
pigweed, redroot	—	S	—	—	S	—	S	—
pineappleweed	—	S	—	—	—	—	—	—
plantain	S	—	—	—	—	—	—	—
prickly lettuce	—	S	—	—	—	—	—	—
purslane	S	S	—	—	—	S	S	S
ragweed, common	—	MS	—	—	—	—	S	—
Russian thistle	—	—	—	—	—	—	—	S
shepherd's-purse	S	—	—	—	—	S	—	—
smartweed	S	—	—	—	—	—	S	S
smartweed, green	—	—	—	—	—	—	S	—
sow thistle, annual	S	S	—	—	—	—	—	—
spurge	S	—	—	—	—	—	—	—
stinkweed	—	—	—	—	—	S	—	—
sweet clover, white	—	—	—	—	—	—	—	—

Table 3–5. Weed Susceptibility and Herbicides — Broadleaf Perennials

LEGEND: S = susceptible MS = moderately susceptible T = tolerant
— = insufficient information available to make a rating

Broadleaf Perennials	CASORON	DEVRINOL	DUAL II MAGNUM	KERB	PROWL	RONSTAR	ROUNDUP	SIMADEX	TREFLAN	VENTURE L
bindweed	T	—	—	—	—	—	S	—	T	—
chickweed, mouse eared	MS	—	—	—	—	—	S	—	MS	—
dandelion	MS	T	—	—	—	—	MS	—	—	—
grape, wild	T	—	—	—	—	—	MS	—	—	—
ground ivy (creeping Charlie)	MS	—	—	—	—	—	MS	—	—	—
horsetail	MS	—	—	—	—	—	MS	T	T	—
mallow	—	—	—	—	—	—	MS	—	—	—
milkweed	—	—	—	—	—	—	S	—	T	—
nut sedge	MS	MS	S	—	—	—	MS	T	T	T
plantain	MS	—	—	—	—	—	S	—	—	—
poison-ivy	—	—	—	—	—	—	—	—	—	S
quack grass	MS	T	—	MS	—	—	—	T	T	MS
sow thistle	MS	—	—	S	—	—	—	T	T	—
stinging nettle	—	—	—	—	—	—	—	—	—	S
thistle, Canada	MS	—	—	—	—	—	—	T	T	—
toadflax, yellow	—	—	—	S	—	—	S	—	—	S
vetches	MS	T	—	—	—	—	—	T	T	—

Table 3–6. Weed Susceptibility and Herbicides — Annual Grass

LEGEND: S = susceptible — = Insufficient information available to make a rating

Annual Grasses	CASORON	DEVRINOL	DUAL II MAGNUM	KERB	PROWL	RONSTAR	ROUNDUP	SIMADEX	TREFLAN	VENTURE L
barnyard grass	—	S	S	—	S	S	—	S	S	S
bluegrass, annual	S	S	—	—	—	S	S	—	S	—
brome grass	—	—	—	—	—	—	S	—	S	—
cheat grass	—	—	—	—	—	—	—	—	S	—
crabgrass	S	S	—	—	S	S	—	S	S	S
crabgrass, large	—	S	—	—	S	—	S	—	—	—
crabgrass, smooth	—	—	S	—	S	—	—	—	—	—
darnel, Persian	—	—	—	—	—	—	—	—	S	S
foxtail, giant	—	—	S	—	—	—	—	—	—	S
foxtail, green	S	S	S	—	S	S	S	—	S	S
foxtail, yellow	S	S	S	—	—	S	—	S	S	S
goose grass	—	S	—	—	—	—	—	—	S	—
grasses, annual	—	—	—	S	—	—	—	—	—	—
Johnson grass	—	—	—	—	—	—	—	—	—	S
love (stink) grass	—	—	—	—	—	—	—	—	S	—
oats, wild	—	S	—	S	—	—	S	S	S	S
panicum, fall	—	S	S	—	S	—	—	—	S	—
proso millet	—	—	—	—	—	—	—	—	—	S
ryegrass	—	S	—	—	—	—	—	—	—	—
witch grass	—	—	S	—	—	—	—	—	—	—

4. Appendices

APPENDIX A: Advisory Staff for Nursery and Landscape and Agricultural Information Contact Centre, Ontario Ministry of Agriculture, Food and Rural Affairs

Nursery and Landscape Specialist
Jennifer Llewellyn

Email: jennifer.llewellyn@ontario.ca

Tel: 519-835-5873

Agriculture Information Contact Centre

Providing province-wide, toll-free technical and business information to commercial farms, agri-businesses and rural businesses.

1 Stone Rd. West
Guelph, ON N1G 4Y2

Tel: 519-826-4047
Toll-free: 1-877-424-1300
Fax: 519-826-7610
Email: ag.info.omafra@ontario.ca

APPENDIX B: Additional Resources

Many factsheets, publications and other resources are available from the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA).

These can be ordered from Service Ontario:

- Online at ServiceOntario Publications: ontario.ca/publications
- Many can also be found online at ontario.ca/omafra
- For a complete list of publications from OMAFRA: ontario.ca/omafra

OMAFRA Publications

- *Agronomy Guide for Field Crops* – Publication 811
- *Growing Strawberries in Ontario*
- *Growing Red Raspberries in Ontario*
- *Fruit Crop Protection Guide*
- *Guide to Weed Control Hort Crops*
- *Integrated Pest Management for Ontario Apples*
- *Soil Fertility Handbook* – Publication 611
- *Vegetable Crop Protection Guide*

Websites

Websites for technical information on pests and production in Ontario fruit crops:

- Information on plant health issues and production with trees, shrubs and perennials: ONnurserycrops.com
- OMAFRA gateway to information on crops: ontario.ca/crops
- Spotted wing drosophila: ontario.ca/spottedwing
- Brown marmorated stink bug: ontario.ca/stinkbug
- Crop IPM (integrated pest management) modules: ontario.ca/cropipm
- Soil management, fertilizer use, crop nutrition and cover crops for fruit production: www.omafra.gov.on.ca/english/crops/hort/soil_fruit.htm
- Label Search Tool to find labels for pesticides and products registered for use in Canada: http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php
- Information on pesticide application technology: www.sprayers101.ca
- Specialty Cropportunities to find information on specialty berries and fruit: ontario.ca/crops (search on “cropportunities”)

Resources on Application Technology

- Ontario Pesticide Education Program: www.opep.ca

OMAFRA Factsheets:

- Plant Growth Regulators for Fruit
- Mating Disruption for Management of Insect Pests
- How Weather Conditions Affect Spray Applications
- Six Elements of Effective Spraying in Orchards and Vineyards
- Calibrating Airblast Sprayers
- Adjusting, Maintaining and Cleaning Airblast Sprayers
- Pesticide Drift from Ground Applications

Airblast 101 Course Materials: basic tools for applying pesticides and plant growth modifiers in an effective, economic and environmentally responsible manner. For more information, contact the ministry Application Technology Specialist.

Best Management Practices

The Best Management Practices series of publications presents a practical, affordable approach to conserving a farm’s soil and water resources while promoting productivity.

A sampling of titles appears below. For a complete list of books in the BMP series, see: ontario.ca/omafra.

- BMP01E *Farm Forestry and Habitat Management*
- BMP06E *Soil Management*
- BMP07E *Water Management*
- BMP08E *Irrigation Management*
- BMP09E *Integrated Pest Management*
- BMP13E *Pesticide Storage, Handling and Application*
- BMP15E *Buffer Strips*
- BMP16E *Manure Management*
- BMP20E *Managing Crop Nutrients*
- BMP28E *Best Management Practices and Self-Assessment - Water and Fertilizer Use for Outdoor Container Production*
- BMP29E *Self-Assessment and Best Management Practices for Water and Fertilizer Use in Greenhouse Vegetable Production*
- BMP30E *Water and Fertilizer Use for Greenhouse Floriculture Production*

APPENDIX C: Suppliers of Pest Monitoring Equipment and Biological Control Agents

This list includes sources of weather monitoring equipment, pest monitoring supplies and biological control agents. For a more extensive list of beneficial insects and mite suppliers, see the OMAFRA website at ontario.ca/crops. This is a partial list and does not imply endorsement or recommendation by the Ontario Ministry of Agriculture, Food and Rural Affairs of the companies listed.

Company	Address	Telephone/Fax/Email	Products
Anatis Bioprotection www.anatisbioprotection.com	278 rang Saint-André Saint-Jacques-le-Mineur, QC J0J 1Z0	Toll-free: 1-800-305-7714 Email: info@anatisbioprotection.com	• beneficial insects and mites
Biobest Canada Ltd. www.biobestgroup.com	2020 Foxrun Rd. R.R. #4 Leamington, ON N8H 3V7	Tel: 519-322-2178 Fax: 519-322-1271 Email: info@biobest.ca	• beneficial insects, mites, nematodes • pheromone lures and traps • bumblebee hives for pollination
Contech Enterprises Inc. (Formerly Pherotech)	7572 Progress Way Delta, BC V4G 1E9	Tel: 1-800-767-8658 Fax: 604-940-9433 Email: sales@contech-inc.com	• pheromone lures and traps
Cooper Mill Ltd. www.coopermill.com	31 Hastings Road R.R. #3 Madoc, ON K0K 2K0	Tel: 613-473-4847 Fax: 613-473-5080 Email: ipm@coopermill.com	• pheromone lures and traps
Distributions Solida Inc. www.solida.ca	480 rang St-Antoine St. Ferreol-les-Neiges, QC G0A 3R0	Tel: 418-826-0900 Fax: 418-826-0901 Email: info@solida.ca	• pheromone lures and traps • tangle traps, insect trap coating • hand lens magnifiers • tally counters
Gempler's www.gemplers.com	PO. Box 5175 Janesville, WI USA 53547	Toll-free: 1-800-382-8473 Fax: 1-800-551-1128 Email: customerservice@gempler.com	• weather monitoring equipment • pheromone lures and traps • tangle traps • hand lens magnifiers • tally counters
Great Lakes IPM, Inc. www.greatlakesipm.com	10220 Church Road NE Vestaburg, MI USA 48891	Tel: 989-268-5693 Toll-free: 1-800-235-0285 Fax: 989-268-5311 Email: glipm@greatlakesipm.com	• apple scab monitoring equipment • pheromone lures and traps • tangle traps • hand lens magnifiers • tally counters • insect sweep nets • field diagnostic equipment
Koppert Canada Ltd. www.koppert.ca	50 Ironside Cres. #2 Scarborough, ON M1X 1G4	Tel: 1-800-567-4195 Fax: 416-291-0902 Email: info@koppert.ca	• beneficial insects, mites • insect traps • BioWorks products

Company	Address	Telephone/Fax/Email	Products
Natural Insect Control www.naturalinsectcontrol.com	3737 Netherby Rd. Stevensville, ON L0S 1S0	Tel: 905-382-2904 Fax: 905-382-4418 Email: nic@niagara.com	· beneficial insects, mites and nematodes (Canadian strains) · pheromone lures and traps · mating disruption devices · bird houses
N.M. Bartlett Inc. www.bartlett.ca	4509 Bartlett Rd. Beamsville, ON L0R 1B1	Tel: 905-563-8261 Toll-free: 1-800-767-8658 Fax: 905-563-7882 Email: info@bartlett.ca	· pheromone lures and traps · mating disruption devices
Plant Products Inc. www.plantproducts.com	50 Hazelton Street Leamington, ON N8H 1B8	Tel: 519-326-9037 Toll-free: 1-800-387-2449 Fax: 519-326-9290 Email: info@plantproducts.com	· pheromone lures and traps · mating disruption devices · rodent traps · sticky tape and cards · tangle traps · beneficial insects
Warwick Orchards and Nursery	7056 Egremont Rd. R.R. #8 Watford, ON N0M 2S0	Tel: 519-849-6730 Fax: 519-849-6731 Email: warwickorchards@brktel.on.ca	· DeWitt leaf wetness sensor

APPENDIX D: Safety Supply Companies

This is a list of safety supply companies in Ontario providing protective clothing and personal protective equipment. Ask safety supply companies for help to select protective clothing and personal protective equipment. This is a partial list and does not imply endorsement or recommendation by the Ontario Ministry of Agriculture, Food and Rural Affairs of the companies listed.

Company	Address	Telephone/Fax/Email
3-M Canada Company www.3mcanada.ca	300 Tartan Drive London, ON N5V 4M9	Toll-free: 1-800-364-3577 Toll-free fax: 1-800-603-7758
Acklands Grainger www.acklandsgrainger.com	90 W. Beaver Creek Rd. Richmond Hill, ON L4B 1E7	Tel: 905-731-5516 Toll-free: 1-866-248-8801 Fax: 905-731-6053 Email: contact@agi.ca
Dupont Personal Protection Equipment www.personalprotection.dupont.ca	P.O. Box 2200 Streetsville Mississauga, ON L5M 2H3	Tel: 905-821-3300 Toll-free: 1-800-931-3456 Fax: 905-816-3059
Dutch Industries **"Protect-Air Cab Filter"** www.dutchopeners.com www.hurontractor.com	Huron Tractor 39995 Harvest Rd. Exeter, ON N0M 1S3	Tel: 519-235-1115 Fax: 519-235-1939
Hamisco Industrial Sales Inc. www.hamisco.com	3392 Wonderland Rd. S. London, ON N6L 1A8	Tel: 519-652-9800 Toll-free: 1-800-668-9800 Fax: 519-652-9661
Levitt-Safety (Eastern) Ltd. www.levitt-safety.com	2872 Bristol Circle Oakville, ON L6H 5T5	Tel: 905-829-3299 Toll-free: 1-888-453-8488 Fax: 905-829-2919 Email: csr@levitt-safety.com
The Mitt & Robe Company Ltd.	751 Norfolk St. N. Simcoe, ON N3Y 3R6	Tel: 519-428-4050 Toll-free: 1-877-893-6565 Fax: 519-428-5142 Email: sales@mittrobe.ca
MSA Canada www.msasafety.com	100 Westmore Dr., Unit 23 Toronto, ON M9V 5C3	Tel: 416-620-4225 Toll-free: 1-800-672-2222 Fax: 416-679-2875 Email: info@msasafety.com
Plant Products Inc. www.plantproducts.com	50 Hazelton St. Leamington, ON N8H 1B8	Tel: 519-326-9037 Toll-free: 1-800-387-2449 Fax: 519-326-9290 Email: info@plantproducts.com
Safety Express www.safetyexpress.com	4190 Sladeview Cres., Unit 1 & 2 Mississauga, ON L5L 0A1	Tel: 905-608-0111 Toll-free: 1-800-465-3898 Fax: 905-608-0091 Email: info@safetyexpress.com
The St. George Company Ltd. www.thestgeorgeco.com	20 Consolidated Dr. P.O. Box 430 Paris, ON N3L 3T5	Tel: 519-442-2046 Toll-free: 1-800-461-4299 Fax: 519-442-7191 Email: sales@thestgeorgeco.com

APPENDIX E: Diagnostic Services

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

Pest Diagnostic Clinic
Laboratory Services Division
University of Guelph
95 Stone Rd. W.
Guelph, ON N1H 8J7

Tel: 519-767-6299
Fax: 519-767-6240
Website: www.guelphlabservices.com
Email: aflinfo@uoguelph.ca

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

To obtain information on the fee schedule, visit www.guelphlabservices.com or phone the Pest Diagnostic Clinic.

How to Sample for Nematodes

Soil

When to sample

Soil and root samples can be taken at any time of the year that the soil is not frozen. In Ontario, nematode soil population levels are generally at their highest in May and June and again in September and October.

How to sample soil

Use a soil sampling tube, trowel or narrow-bladed shovel to take samples. Sample soil to a depth of 20–25 cm (8–10 in.). If the soil is bare, remove the top 2 cm (1 in.) prior to sampling. A sample should consist of 10 or more subsamples combined. Mix well, then take a sample of ½–1 L (1 pint–1 qt) from this. No single sample should represent more than 2.5 ha (6.25 acre). Mix subsamples in a clean pail or plastic bag.

Sampling pattern

If living crop plants are present in the sample area, take samples within the row and from the area of the feeder root zone (with trees, this is the drip line).

Number of subsamples

Based on the total area sampled:

500 m^2 (5,400 ft^2)	10 subsamples
500 m^2–0.5 ha (5,400 ft^2–1.25 acre)	25 subsamples
0.5 ha–2.5 ha (1.25–6.25 acre)	50 subsamples

Roots

From small plants, sample the entire root system plus adhering soil. For large plants, 10–20 g (½–1 oz.), dig fresh weight from the feeder root zone and submit.

Problem areas

Take soil and root samples from the margins of the problem area where the plants are still living. If possible, also take samples from healthy areas in the same field. If possible, take both soil and root samples from problem and healthy areas in the same field.

Sample handling

Soil samples

Place in plastic bags as soon as possible after collecting.

Root samples

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

Storage

Store samples at 5°–10°C (40°–50°F) and do not expose them to direct sunlight or extreme heat or cold (freezing). Only living nematodes can be counted. Accurate counts depend on proper handling of samples.

Submitting Plant for Disease Diagnosis or Identification

Sample submission forms

Sample submission forms can be found online at the University of Guelph Agriculture & Food Laboratory at: afl.uoguelph.ca/submitting-samples. Carefully fill in all 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 three 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 avoid drying out and contamination of the leaves by soil. Do not add moisture, as this encourages decay in transit. Cushion specimens and pack in a sturdy box to avoid damage during shipping. Avoid leaving specimens to bake or freeze in a vehicle or in a location where they could deteriorate.

Delivery

Deliver to the Pest Diagnostic Clinic as soon as possible by first class mail or by 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 rubbing alcohol. Do not use water, as this results in rot. Do not tape insects to paper or send them loose in an envelope.

Place live insects in a container with enough plant "food" to support them during transit. Be sure to write "live" on the outside of the container.

APPENDIX F: Ontario Ministry of the Environment, Conservation and Parks – Regional Contact Information

Please contact the Ministry's local District or Area office. The local District Office contact information can be found from the Government of Ontario Employee and Organization Directory at www.infogo.gov.on.ca/infogo/home.html#orgProfile/-270/en. After business hours, please contact the Pollution Hotline at 1-866-MOE-TIPS (1-866-663-8477).

Region/County	Address	Telephone/Fax
Central Region Toronto, Halton, Peel, York, Durham, Muskoka, Simcoe	5775 Yonge St., 8th Floor Toronto, ON M2M 4J1	Tel: 416-326-6700 Toll-free: 1-800-810-8048
West-Central Region Haldimand, Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	Ontario Government Building 119 King St. W., 9th Floor Hamilton, ON L8P 4Y7	Tel: 905-521-7640 Toll-free: 1-800-668-4557
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry, Haliburton, Peterborough, Kawartha Lakes, Northumberland, Renfrew, Ottawa, Lanark, District of Nipissing (Twp. of South Algonquin)	1259 Gardiners Rd., Unit 3 PO Box 22032 Kingston, ON K7M 8S5	Tel: 613-549-4000 Toll-free: 1-800-267-0974
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth	733 Exeter Rd. London, ON N6E 1L3	Tel: 519-873-5000 Toll-free: 1-800-265-7672
Northern Region (East) Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma (East), Timiskaming, Sault Ste. Marie	199 Larch St., Ste. 1201 Sudbury, ON P3E 5P9	Tel: 705-564-3237 Toll-free: 1-800-890-8516
Northern Region (West) Algoma (West), Cochrane, Kenora, Rainy River, Timmins, Thunder Bay	435 James St. S., Ste. 331 Thunder Bay, ON P7E 6S7	Tel: 807-475-1205 Toll-free: 1-800-875-7772
Standards Development Branch	Pesticides Section 40 St. Clair Ave. W. 7th Floor Toronto, ON M4V 1L5	Tel: 416-327-5519
Approvals Branch	Pesticides Licensing 2 St. Clair Ave. W. 12A Floor Toronto, ON M4V 1L5	Tel: 416-314-8001 Toll-free: 1-800-461-6290

AGRICULTURE AND AGRI-FOOD CANADA RESEARCH CENTRES

www.agr.gc.ca/index_e.php

Eastern Cereals and Oilseeds Research Centre
960 Carling Ave.
Ottawa, ON K1A 0C6
Tel: 613-759-1858

Greenhouse and Processing Crops Centre
2585 County Road 20
Harrow, ON N0R 1G0
Tel: 519-738-2251

Southern Crop Protection and Food Research Centre
1391 Sandford St.
London, ON N5V 4T3
Tel: 519-457-1470

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

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

CANADIAN FOOD INSPECTION AGENCY REGIONAL OFFICES (PLANT PROTECTION)

www.inspection.gc.ca

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

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

Hamilton
709 Main St. W., Ste. 101
Hamilton, ON L8S 1A2
Tel: 905-572-2201

London
19-100 Commissioners Rd. E.
London, ON N5Z 4R3
Tel: 519-691-1300

St. Catharines
395 Ontario St., PO Box 19
St. Catharines, ON L2N 7N6
Tel: 905-937-8232

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

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

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

UNIVERSITY OF GUELPH

Main Campus
Guelph, ON N1G 2W1
Tel: 519-824-4120
www.uoguelph.ca

Ridgetown Campus
Ridgetown, ON N0P 2C0
Tel: 519-674-1500
www.ridgetownc.uoguelph.ca

Department of Plant Agriculture
www.plant.uoguelph.ca

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

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

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

Lab Services Division
95 Stone Rd. W., PO Box 3650
Guelph, ON N1H 8J7
Tel: 519-767-6299
www.uoguelph.ca/labserv

Trace Organics and Pesticides
Tel: 519-767-6485

Pest Diagnostic Clinic
Tel: 519-767-6256

VINELAND RESEARCH AND INNOVATION CENTRE

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

APPENDIX H: The Metric System and Abbreviations

Metric Units

Linear Measures (length)
10 millimetres (mm) = 1 centimetre (cm)
100 centimetres (cm) = 1 metre (m)
1,000 metres = 1 kilometre (km)
Square Measures (area)
100 m × 100 m = 10,000 m^2 = 1 hectare (ha)
100 ha = 1 square kilometre (km^2)
Cubic Measures (volume)
Dry measure
1,000 cubic millimetres (mm^3)= 1 cubic centimetre (cm^3)
1,000,000 cm^3 = 1 cubic metre (m^3)
Liquid Measure
1,000 millilitres (mL) = 1 litre (L)
100 L = 1 hectolitre (hL)
Weight-Volume Equivalents (for water)
(1.00 kg) 1,000 grams = 1 litre (1.00 L)
(0.50 kg) 500 g = 500 mL (0.50 L)
(0.10 kg) 100 g = 100 mL (0.10 L)
(0.01 kg) 10 g = 10 mL (0.01 L)
(0.001 kg) 1 g = 1 mL (0.001 L)
Weight Measures
1,000 milligrams (mg) = 1 gram (g)
1,000 g = 1 kilogram (kg)
1,000 kg = 1 tonne (t)
1 mg/kg = 1 part per million (ppm)
Dry–Liquid Equivalents
1 cm^3 = 1 mL
1 m^3 = 1,000 L
Approximate Metric Conversions
5 mL = 1 tsp
15 mL = 1 tbsp
28.5 mL = 1 Imp. fl. oz.

Application Rate Conversions

Metric to Imperial or U.S. (approximate)
litres per hectare × 0.09 = Imp. gallons per acre
litres per hectare × 0.11 = U.S. gallons per acre
litres per hectare × 0.36 = Imp. quarts per acre
litres per hectare × 0.43 = U.S. quarts per acre
litres per hectare × 0.71 = Imp. pints per acre
litres per hectare × 0.86 = U.S. pints per acre
millilitres per hectare × 0.014 = U.S. fluid ounces per acre
grams per hectare × 0.015 = ounces per acre
kilograms per hectare × 0.89 = pounds per acre
tonnes per hectare × 0.45 = tons per acre
Imperial or U.S. to Metric (approximate)
Imp. gallons per acre × 11.23 = litres per hectare (L/ha)
U.S. gallons per acre × 9.35 = litres per hectare (L/ha)
Imp. quarts per acre × 2.8 = litres per hectare (L/ha)
U.S. quarts per acre × 2.34 = litres per hectare (L/ha)
Imp. pints per acre × 1.4 = litres per hectare (L/ha)
U.S. pints per acre × 1.17 = litres per hectare (L/ha)
Imp. fluid ounces per acre × 70 = millilitres per hectare (mL/ha)
U.S. fluid ounces per acre × 73 = millilitres per hectare (mL/ha)
tons per acre × 2.24 = tonnes per hectare (t/ha)
pounds per acre × 1.12 = kilograms per hectare (kg/ha)
pounds per acre × 0.45 = kilograms per acre (kg/acre)
ounces per acre × 70 = grams per hectare (g/ha)

Liquid Equivalents

Litres/Hectare	Approximate Gallons/Acre
Imperial Gallons	U.S. Gallons
50 = 4.45	5.35
100 = 8.9	10.7
150 = 13.53	16.05
200 = 17.8	21.4
250 = 22.25	26.75
300 = 26.7	32.1

Application Rate Conversions (cont'd)

Approximate Dry Weight Equivalents

Grams/Hectare	Ounces/Acre
100	1½
200	3
300	4¼
500	7
700	10

Kilograms/Hectare	Pounds/Acre
1.10	1
1.50	1¼
2.00	1¾
2.50	2¼
3.25	3
4.00	3½
5.00	4½
6.00	5¼
7.50	6¾
9.00	8
11.00	10
13.00	11½
15.00	13½

Conversion Tables – Metric to Imperial (approximate)

Handy Metric Conversion Factor

Litres per hectare × 0.4 = litres per acre

Kilograms per hectare × 0.4 = kilograms per acre

Length
1 millimetre (mm) = 0.04 inch
1 centimetre (cm) = 0.4 inch
1 metre (m) = 39.4 inches
1 metre (m) = 3.28 feet
1 metre (m) = 1.09 yards
1 kilometre (km) = 0.62 mile
Area
1 square centimetre (cm^2) = 0.16 square inch
1 square metre (m^2) = 10.77 square feet
1 square metre (m^2) = 1.2 square yards
1 square kilometre (km^2) = 0.39 square mile
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-foot
1 hectolitre (hL) = 2.8 bushels
Volume (liquid)
1 millilitre (mL) = 0.035 fluid ounce (Imp.)
1 litre (L) = 1.76 pints (Imp.)
1 litre (L) = 0.88 quart (Imp.)
1 litre (L) = 0.22 gallon (Imp.)
1 litre (L) = 0.26 gallon (U.S.)
Weight
1 gram (g) = 0.035 ounce
1 kilogram (kg) = 2.21 pounds
1 tonne (t) = 1.1 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 mile per hour
Temperature
°F = (°C × ⅘) + 32

Conversion Tables – Imperial to Metric (approximate)

Length
1 inch = 2.54 cm
1 foot = 0.3 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 = 0.4 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) × 5⁄9

Abbreviations

%	= percent (by weight)	kPa	= kilopascal
ai	= active ingredient	L	= litre
cm	= centimetre	m	= metre
cm^2	= square centimetre	m/s	= metres per second
e.g.	= for example	m^2	= square metre
g	= gram	mL	= millilitre
ha	= hectare	mm	= millimetre
kg	= kilogram	t	= tonne
km/h	= kilometres per hour		

APPENDIX I: Pest Monitoring Record Sheet					
DATE (MM/DD/YY)	**LOCATION (Farm, Block, Landmarks, Direction)**	**HOST (Include Species 'Cultivar', Growth phase, Container vs. Field)**	**PEST and/or SYMPTOMS (stage, population, % crop infestation)**	**GDD and/ or PLANT PHENOLOGY INDICATOR**	**ACTION TAKEN (Pesticide, Cultural measures)**

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.

To obtain a digital copy of this publication visit ontario.ca and search for the publication number and title.

To order a print copies of this or any other OMAFRA publication, visit ontario.ca/publications

Published by the Ministry of Agriculture, Food and Rural Affairs

Toronto, Canada

ISSN 2291-3386 (Print)

03-21

Cette publication est aussi disponible en français.

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