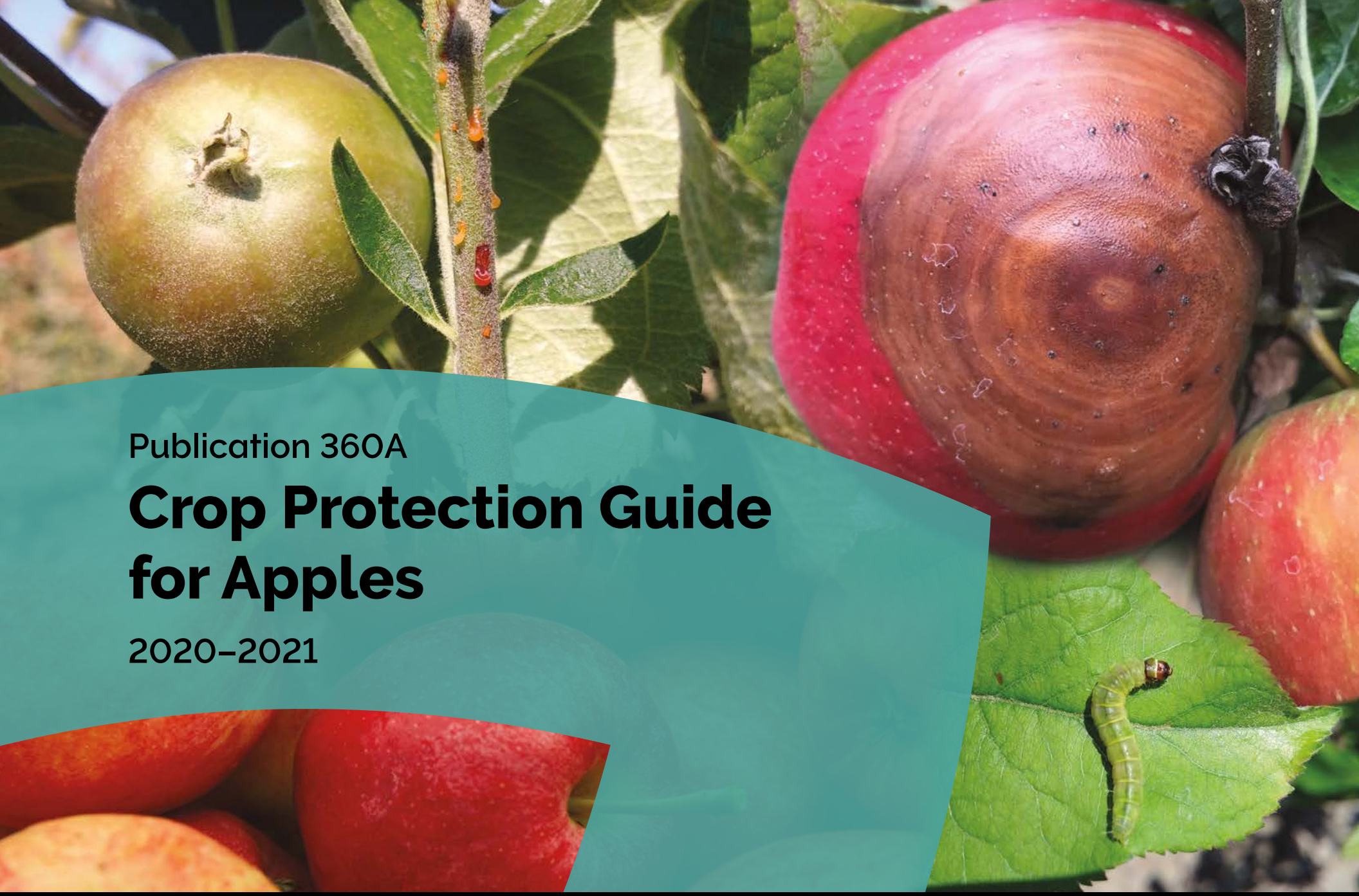


Publication 360A

Crop Protection Guide for Apples

2020–2021

Ministry of Agriculture,
Food and Rural Affairs

Ontario

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

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

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

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

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

THE PESTICIDE LABEL

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

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

REGISTRATION OF PESTICIDE PRODUCTS

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

1. Full Registration

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

2. Emergency Registration

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

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

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

MAXIMUM RESIDUE LIMITS

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

SUPPLEMENTAL/AMENDED LABELS

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

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

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

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

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

REGULATION OF PESTICIDES IN ONTARIO

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

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

CLASSIFICATION OF PESTICIDES

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

CERTIFICATION AND LICENSING

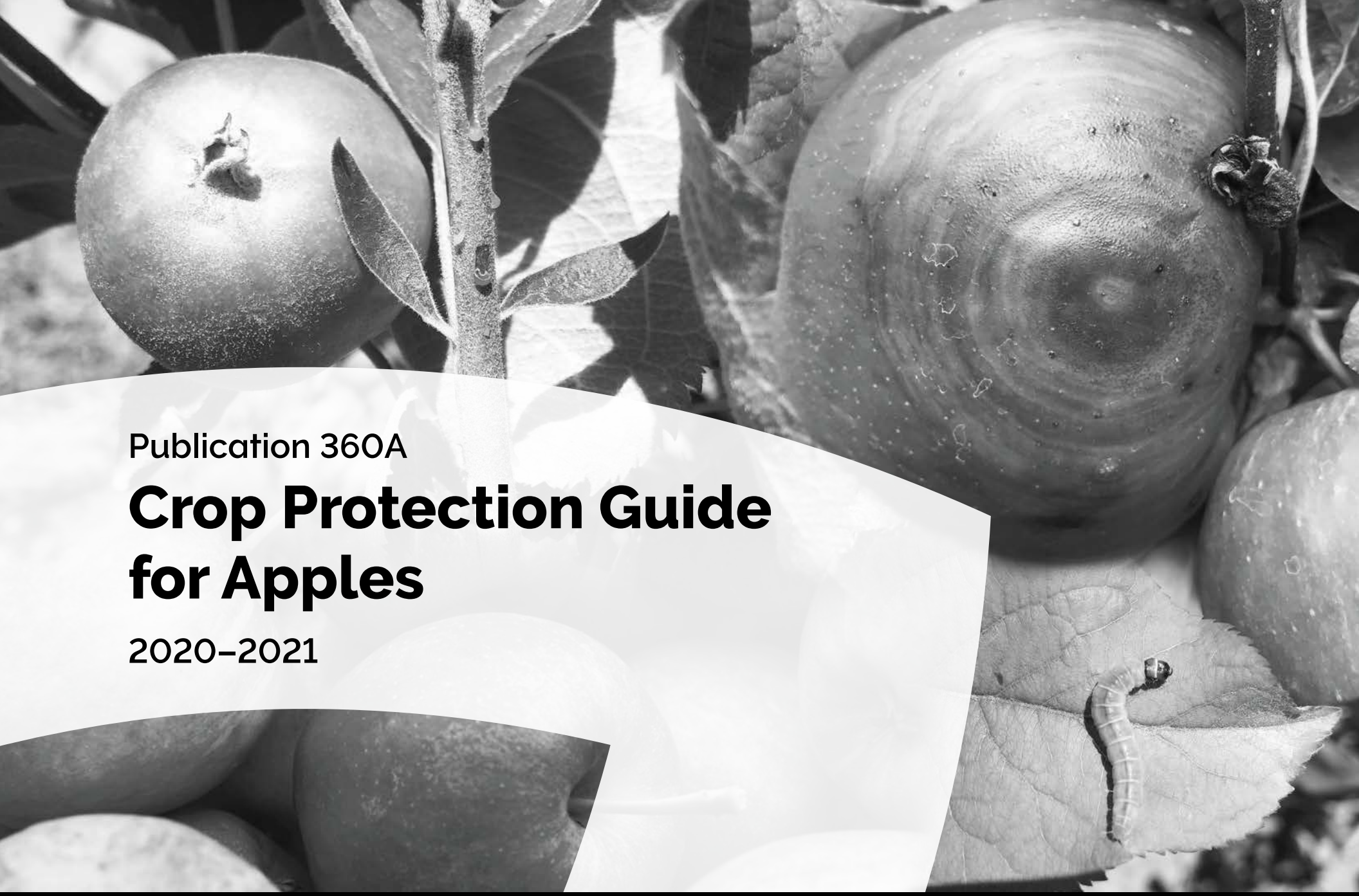
Growers and Their Assistants

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

Commercial Applicators (Exterminators) and Their Assisting Technicians

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

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



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Crop Protection Guide for Apples

2020–2021

Ministry of Agriculture,
Food and Rural Affairs

Ontario

Acknowledgements

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

If you need technical or business information

Contact the Agricultural Information Contact Centre at
1-877-424-1300
ag.info.omafra@ontario.ca

Looking for fruit production information on the Internet?

Check the OMAFRA website at ontario.ca/crops

This publication contains pesticide control products that have been registered as of October 31, 2019, on fruit crops. Any updates to this information will be posted on the OMAFRA website at ontario.ca/crops

Cover Images

Top left: fire blight ooze on infected Gala branch
Top right: black rot on Honeycrisp with mummified fruitlet (right)
Bottom right: obliquebanded leafroller larva
Bottom left: Gala apples (Source: Ontario Apple Growers)

Contents

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Introduction

Products Listed in This Publication

- Products listed in this publication are registered for use on apples in Ontario as of October 31, 2019. The information contained in this publication has been prepared in consultation with the product registrants and the Fruit Technical Working Group, comprised of representatives from provincial and federal governments, academia and industry.
- Products are organized by pest. Consult each product label before you use a pest control product. Labels for registered pest control products are available at the Pest Management Regulatory Agency (PMRA) website at http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php.

Levels of Control for Fungicides and Insecticides/Miticides

The value of all insecticides, miticides and fungicides is evaluated by the PMRA prior to registration, which includes an assessment of efficacy. Wording on the product label such as control, suppression or partial suppression is used to describe the level of pest management provided by these products. The definitions of "control" and "suppression" for insecticides have a somewhat different meaning than the same terms applied to fungicides, according to the PMRA's *Value Guidelines for New Plant Protection Products and Label Amendments.*

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

It is important to consider the level of control of a product and how it is incorporated into a pest management program. Together with cultural control, biological control or promoting natural enemies, products used for suppression might be enough to prevent significant crop damage. Products labelled for suppression may also play a role in resistance management. By alternating with products from different families, the risk of pest resistance to important products can be reduced. For more information on resistance management, refer to Chapter 2, *Managing Pesticide Resistance.* However, when using a new product for pest suppression, try to leave an untreated check and evaluate the benefits of using these products compared to the cost of application.

Fungicides

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

Suppression: A consistent level of disease management that is less than full control, as defined by commercial standards and expectations in the market, when compared to untreated control plots. In general, disease control ratings would be between 60%–100%. Suppression is defined as consistent disease reduction to a level that is not optimal but is still of commercial benefit.

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

Insecticides/Miticides

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

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

Source: Pest Management Regulatory Agency (PMRA), 2016.

1. Using Pesticides in Ontario

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

For the most up to date version of this chapter, visit ontario.ca/usingpesticides. Some of the information in this generic chapter may not apply to all crops.

Read the label before use. Product labels may change.

Review the Grower Pesticide Safety Course Manual.
www.opep.ca/certification/

Keep detailed spray records.

Federal Registration of Pesticides

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

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

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

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

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

Regulation of Pesticides in Ontario

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

Classification of Pesticides

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

Certification and Licensing

Certified Farmers and their Assistants

Growers must be certified through the Grower Pesticide Safety Course in order to buy and use Class 2 and 3 pesticides on their farms. They do not require this certification to buy and use Class 4, 5, 6 or 7 pesticides, however, a grower needs to provide his/her Farm Business Registration Number or a signed "Farmer Self Declaration to Enable Purchase of a Class 4 Pesticide" form to the vendor when buying Class 4 pesticides. For information about certification for growers and training for assistants to growers, visit the Ontario Pesticide Education Program website at www.opep.ca or call 1-800-652-8573.

Class 12 Requirements for Growers

There are regulatory requirements in place for growers who plan to purchase or plant neonicotinoid-treated corn (silage or grain) or soybean seed in Ontario. For more information on the training and reporting requirements for growers, visit the MECP website at ontario.ca/pesticides, then click on "Neonicotinoid regulations."

Commercial Applicators (Exterminators) and their Assisting Technicians

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

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

Exception Uses Under the Cosmetic Pesticide Ban

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

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

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

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

- Tree Care Specialists

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

- Inside front cover of this publication
- Pest Management Regulatory Agency (PMRA) website: www.healthcanada.gc.ca/pmra
- PMRA Pest Management Information Service: 1-800-267-6315 or TTY 1-800-465-7735 (from within Canada) or 1-613-736-3799 (from outside Canada)
- Ontario Ministry of the Environment, Conservation and Parks (MECP) website: ontario.ca/pesticides
- Regional MECP Pesticides Specialists Directory infogo.gov.on.ca/infogo/home.html#orgProfile/-270/en
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) website: www.opep.ca
- Ontario Pesticide Training & Certification website: www.ontariopesticide.com
- Pesticide Industry Council's Pesticide Technician Program website at www.horttrades.com/pesticide-technician
- IPM Council of Canada website: www.ontarioipm.com or www.ipmcouncilcanada.org
- Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca

Pesticide Application Information

When you decide to use a pesticide, choose the most appropriate formulation and application method for your situation. Use only properly calibrated sprayer equipment. Choose less toxic and less volatile alternatives when possible. Take all possible precautions to prevent the exposure of people and non-target organisms to the pesticide. Read the most current pesticide label thoroughly before application. The label provides important information, such as:

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

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

For more information on pesticide application, see:

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

Restricted Entry Intervals

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

An REI can range from 0 hours to several days. A pesticide label may state different REIs that are specific to a crop and post-application task (e.g., scouting, harvesting). If the REI is not stated on a label for agricultural crops, use a 12-hr REI. For golf courses and residential turf applications, the spray solution must be dry before re-entry can occur.

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

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

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

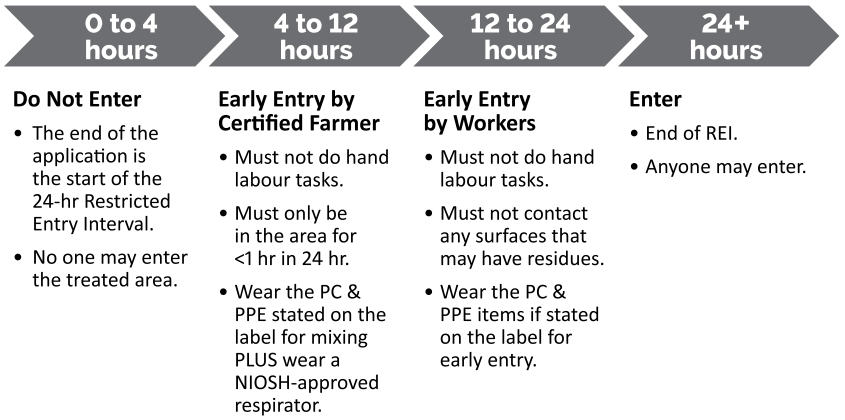

Figure 1–1. Example of a 24-hr REI on a pesticide label.

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

Days to Harvest Intervals for Food Crops (Preharvest, 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 preharvest interval (PHI) has ended, there may be pesticide residues in excess of the maximum residue limits (MRLs) set by PMRA.

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

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

Spray Buffer Zones

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

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

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

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

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

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

Vegetative Filter Strips

A vegetative filter strip is:

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

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

Protect the Environment

Protect Water Sources

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

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

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

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

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

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

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

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

Bee Poisoning

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

- Time insecticide applications to minimize bee exposure (e.g., apply post bloom). Daytime treatments, when bees are foraging, are most hazardous. Insecticide applications in the evening are the safest, unless there is evidence of a strong temperature inversion or high humidity. Under normal circumstances, spraying after 8 p.m. allows the spray to dry before the bees are exposed to it the next day. Spraying during early morning is the next best time, when fewer bees are foraging, but pesticide residues may still be present. Spraying should be completed well before 7 a.m. While honeybees and most other pollinating insects do not usually forage at temperatures below 13°C, bumblebees do. If you plan to spray in the morning, contact beekeepers who have bees within 5 km of your crop and spray site. The beekeepers may then have the option of taking any possible protective action.
- Do not apply insecticides while fruit trees are in bloom. The Bees Act makes it an offence to do so in Ontario. Do not spray any flowering crop on which bees are foraging.
- To prevent drift toward nearby hives, do not apply insecticides on windy days or when there is evidence of a strong temperature inversion.
- Bees and other pollinators may be poisoned by visiting flowering weeds, trees and cover crops that have come into contact with an insecticide via spray drift or drift of insecticide-contaminated dust during planting. Avoid spray drift to flowering weeds that are adjacent to or within the target field. Where possible, mow down flowering cover crops or flowering weeds in and bordering target fields prior to spraying to help safeguard the bees. Control dandelions and other flowering weeds within fields before spraying or planting seeds treated with an insecticide. Take measures to reduce movement of dust from insecticide seed treatments to flowering trees, weeds and water sources that are in or adjacent to the target field. For more information on reducing dust movement, search for “Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices” at www.canada.ca.
- Systemic insecticides may also pose a high risk to bees and other insect pollinators. Bees can be exposed to insecticide residues in or on flowers, leaves, pollen, nectar and/or surface water. Do not apply insecticide or allow it to drift onto blooming crops or off-site habitat if bees are foraging in or adjacent to the treatment area.
- In crop settings where pesticide use is highly likely, beekeepers should remove honeybee colonies as soon as pollination and bloom are complete in the crop and before any insecticides are applied post bloom. In emergency situations, if the colonies cannot be removed in time, beekeepers can place burlap or cloth soaked in water at the entrance of the hive to disrupt the flight of the bees for up to 12 hr and provide more time for spray to dry. To help prevent overheating of the hive during this time, keep an opening of 2.5 cm on each side of the hive entrance so bees can still get out and ventilate the hive. Also, the water on the burlap or cloth will help cool the colony.
- Not all pesticides are equally toxic to bees. If there is a risk of honeybee poisoning, try to choose an insecticide that is not highly toxic to bees. When there is a choice, choose a product formulation that is less hazardous to bees.
- Always read the most current pesticide label for guidance. Some pesticides cannot be used when bees are active in the crop.

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

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

Manage Drift

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

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

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

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

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

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

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

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

For more information about spray drift, see:

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

Waste Management (Container Disposal)

Empty Pesticide and Fertilizer containers up to 23 L

Never re-use empty pesticide containers.

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

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

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

Empty Seed And Pesticide Bags

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

Surplus Spray Mix

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

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

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

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

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

Surplus Pesticide Disposal

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

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

Storing Pesticides

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

Table 1–1. Requirements for Pesticide Storage Facilities

Storage requirements	Pesticide Classes		
	Class 2	Class 3	Class 4, 5, 6 & 7
No contact with food or drink	YES	YES	YES
Not an impairment to health and safety	YES	YES	YES
Clean and orderly	YES	YES	YES
Warning sign G posted*	YES	YES	YES
Emergency telephone numbers posted**	YES	YES	YES
Vented to outside	YES	YES	NO
Limited access (locked)	YES	YES	NO
No floor drain	YES	YES	NO
Respiratory protection and protective clothing kept readily available	YES	YES	NO
Area used primarily for pesticides	YES	NO	NO

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

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

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

For more information about storing pesticides, see:

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

Pesticide Spills

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

A spill is defined as a discharge of pollutant that is abnormal in quality or quantity, from or out of a structure, vehicle or other container into the environment. An incident such as an overturned pesticide sprayer that results in the loss of the spray solution to the environment is an example of a spill. A pesticide container that ruptures and leaks its contents is another example of a spill. The discharge or spraying of a pesticide in an unapproved area is also considered a spill.

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

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

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

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

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

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

For information on preventing spills, see:

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

For pesticide poisonings and pesticide injuries, call:

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

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

2. Pest Management

Integrated pest management (IPM) is an approach to managing pests that uses all available strategies to reduce pest populations below an economic injury level. IPM does not advocate a continuous pesticide spray program to eradicate pests. Instead, it promotes the integration of cultural, mechanical/physical, biological, behavioural and chemical control strategies. With IPM, adverse effects of pesticides are minimized and economic returns are maintained.

An IPM program makes management decisions based on:

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

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

- Publication 310, Integrated Pest Management for Apples
- Ontario Crop IPM, ontario.ca/cropIPM

Current information is also available on the OMAFRA website at ontario.ca/apples and ONfruit blog at onfruit.ca. Resources are also supplied via the OMAFRA Orchard Network Newsletter, meetings, field monitoring, demonstrations and pest management workshops.

Pest Management Tools

Cultural and Mechanical/Physical

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

- site selection
- resistant/tolerant cultivars
- crop rotation between orchard planting
- clean, certified nursery stock
- orchard sanitation
- elimination of alternative hosts
- inter-cropping
- encouraging natural enemies
- pruning
- water management
- nutrient management

Biological

Biological control uses beneficial organisms to help suppress pest populations. These biological control agents may be predatory insects, parasites, pathogens or nematodes. Many beneficials occur naturally in the environment; others may be introduced.

Beneficials will not completely eliminate damage by pests. However, once they are established, they can maintain pest populations at lower levels. They are also effective against indirect pests such as aphids, leafhoppers and mites, but less effective at keeping populations of direct pests, which attack the harvested product, at levels acceptable for commercial production. Important insects and mites for biological control include ground beetles, mullein bugs, minute pirate bugs, lacewings, lady bird beetles and phytoseiid mites.

Natural pathogens of insects and mites include bacteria, viruses, fungi and protozoa. Pathogens circulate naturally in insect populations. Under the right conditions, they can cause disease outbreaks in insects, which can significantly reduce insect populations. Aphids and caterpillars are routinely infected by cycles of viral or fungal disease, which thrive in a moist environment.

Follow these practices to conserve beneficial insects in fruit crops:

- Avoid use of pesticides that are toxic to beneficials in a cropping system. See Table 3–6. *Toxicity of Pesticides to Honeybees and Mite/Aphid Predators.*
- Encourage a diverse habitat within and/or around the perimeter of the orchard where beneficial insects can live. Small flowering plants are an important food source for parasitic wasps.
- Avoid ultra-clean cultivation. Crop residue, mulch or ground cover will encourage ground beetles and other important predators in the soil.

For additional information on predators and parasitoids, see Ontario Crop IPM at ontario.ca/cropIPM or OMAFRA Publication 208, *Predatory Insects in Fruit Orchards.*

Behavioural

Behavioural control uses a pest's natural behaviour to suppress the population. The most commonly used behavioural control in orchard systems is mating disruption, but also includes use of bait trap/crop or sterile insect release.

Managing insects using mating disruption is very different from using insecticides. Mating disruption products are highly specific, targeting a single or few very closely related insect pests. These products release large quantities of synthetically produced sex pheromone into the orchard, which confuses males and interferes with mate location. They do not kill the target pest, nor will they control immigration of mated females from untreated or poorly managed areas.

For more information on using mating disruption in tree fruit, see OMAFRA Factsheet 03–079, *Mating Disruption for Management of Insect Pests.* Refer to Chapter 3 of this publication for mating disruption products registered for use on apples in Ontario.

Chemical

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

Chemical controls are important tools for crop protection when used as part of an IPM program. Understand the pest's life cycle and apply chemicals at the stage when the pest is most vulnerable. Select the appropriate product for the target pests. To control insects and mites, monitor blocks closely. Spray according to action thresholds, degree-day timing (see *Degree-Day Modeling* below) or at critical stages of crop development. To control disease, apply fungicides prior to disease infection and development. Use factors such as weather conditions, crop stage and disease prediction models (where available) to assist in fungicide spray timing.

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

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

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

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

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

- more frequent applications needed to control pests
- slower acting than conventional pesticides
- may provide suppression rather than control of the pest
- more expensive than conventional pesticides
- fewer pests controlled

Degree-Day Modeling

Temperature, light and moisture affect the growth and development of plants and pests. Of these, temperature is the most important factor for insect and mite development. These pests need a certain amount of heat to move to the next development stage.

The amount of heat required for insect and mite development remains constant from year to year, but depending on weather conditions, the amount of actual time that it takes to complete development can vary.

Insects and mites have a minimum and maximum base temperature below or above which development does not occur. These base temperatures are different for each organism. For example, the minimum base temperature for codling moth, oriental fruit moth and obliquebanded leafroller (summer generation) is 10°C, 7.2°C and 6.1°C, respectively.

Degree-Days Celcius (DDC) are used to estimate the growth and development of pests in the growing season. Events such as egg-laying, egg hatch, movement of crawlers or the occurrence of disease infection can be predicted and used to schedule inspection and spray programs. For example, degree-day calculations can predict the first hatch of codling moth eggs or the percentage of apple scab ascospores that have matured in the orchard.

There are several methods used to calculate DDC, but the method commonly used with simple monitoring equipment is the averaging method or "max/min" method. DDC for a given organism are calculated as follows:

$$\text{DDC} = \frac{(\text{Daily max °C}) + (\text{Daily min °C})}{2} - \text{minimum base temperature}$$

Degree-Days Celcius are accumulated daily. The averaging method works well in most years. However, the actual DDC accumulations may be underestimated in extended periods of cool weather or overestimated in hot weather.

An example of the averaging method on a relatively cool spring day:

For a given pest:
Lower base temperature = 10°C
Upper base temperature = 35°C

On a given day:
Minimum temperature = 5°C
Maximum temperature = 15°C

Degree-Days Celcius (DDC) for that day is = (maximum + minimum temperature) / 2 – lower base temperature = (15+5) / 2 – 10 = 0 DDC

Note that the maximum temperature was higher than the base temperature for the insect, so growth and development were possible for at least part of the day. However, no DDC were accumulated. This illustrates how cool temperatures, especially over several days, could lead to an underestimation of insect development.

Degree-Days Celcius are either accumulated from a set start date, such as April 1, or from a specific event known as a biofix. A biofix is a biological event or indicator of a developmental event, that initiates the beginning of DDC calculations. A common biofix used for insects is the first sustained catch in pheromone traps. Using a biofix provides predictions that are more accurate and requires tracking temperatures over a shorter period.

There are several limitations to degree-days models:

- Factors such as humidity, light intensity and rainfall also affect pest development. As a result, DDC predictions are only estimates of pest development. Verify these predictions with field observations.
- Temperatures used to determine DDC must represent the environment where organisms develop. Use weather data collected from within a mile or less of the actual orchard or field being monitored. Site specific information can be obtained by using data loggers. Ventilated heat shields should be used with temperature sensors data loggers to ensure accurate air temperatures. Place data loggers at locations in the crop where the pest is normally active.
- DDC models have been developed and validated for only a few fruit pests in Ontario. Use precise temperature data measured on or very close to your farm for the best estimate of the development of these pests.

Managing Pesticide Resistance

Pest Resistance to Fungicides, Insecticides and Miticides

Pesticide resistance is the ability of a pest to survive exposure to a pesticide at a rate that previously controlled it. It can occur in any pest population, including fungi, insects and weeds, and can occur very quickly. Resistance to a pesticide develops after repeated exposure to the same pesticide or pesticide family. In any population, there are a few individuals with naturally occurring resistance to a particular chemical. When the pesticide is applied, those resistant individuals survive, while the susceptible portion of the population is killed. These resistant survivors multiply and gradually replace the susceptible ones. Eventually the resistant population dominates, and the pesticide loses efficacy. Modern pesticides often have very specific modes of action on pests, which makes the development of resistance more likely.

Resistance management is based on knowledge of a pest control product's mode of action. The mode of action refers to the way the product affects the pest — for example one mode of action may target a protein in an insect's gut which affects its ability to eat, while a different mode of action may target an insect's nervous system. A pesticide family is a group of products and active ingredients with the same mode of action. When a pest becomes resistant to one product in a pesticide family (or group), it is often resistant to all members of that family because they all work in the same way.

The development of resistance can be prevented or delayed by rotating pesticides with different modes of action. This is because, while there are always individuals in a pest population that are resistant to one mode of action, there are far fewer that are resistant to two modes of action. A pest individual that survives the first application is therefore much less likely to survive a second application if it has a different mode of action.

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

It is important to be aware that resistance is not the only cause of a pesticide failure. Before assuming a population is resistant to a product, consider the following factors, which may impact the effectiveness of pest control products:

- Product selection – Does the product actually have activity against the target pest? Was the product applied as directed on the label (foliar, trunk, soil drench, etc.)? How long does the product take to knockdown pests? How long does the knockdown effect last?

- Rate – Was the rate used that which was listed on the product label for the target pest?
- Weather conditions – Was the product applied under the right conditions specified on the product label (prior to rain, evening, etc.)? Could weather conditions during or after application have affected spray coverage or pesticide efficacy? Does the label specify the time required for the product to become rainfast?
- Timing – Was the product applied at the appropriate pest life stage?
- Water volume / quality – Was sufficient water volume used to ensure adequate coverage where the target pest is found (under leaf, on trunk, etc.)? Was the pH of the water higher or lower than what is listed on the product label? Was the sprayer properly calibrated?

Resistance Management Strategies

Resistance management strategies include rotating products from different groups and limiting the total number of applications from a single group within a growing season. Specific knowledge is required for growers to manage resistance effectively.

General Resistance Management Strategies

Follow an IPM program that makes use of a variety of different pest control strategies, including resistant varieties when available, monitoring, crop rotation and cultural, biological and chemical control options.

- Do not use pesticides at levels below label rates.
- Use adequate water volumes to deliver the pesticide to all tissues.
- Spray only when necessary. Use established thresholds where available.
- Spray at the best timing for the pest and the product you are using.
- Make each spray application count. Be sure the sprayer is calibrated, the correct rate is applied and spray coverage is complete.
- Read the product label. New products include resistance management recommendations on the label.
- Know the active ingredient of a pesticide. Many chemicals with the same active ingredients are marketed under different brand names. For example, the insecticide permethrin is marketed under the brand names Ambush, Perm-Up and Pounce.
- Know the product group. Choose products from different groups when possible in your spray rotation. For example, both Assail and Admire are in the same insecticide group (Group 4A). To use Assail after Admire is equivalent to using Assail after Assail, since resistance to both chemicals develops in the same way.

For a list of groups and their modes of action, see Table 2–1. *Fungicide/Bactericide Groups,* Table 2–2. *Insecticide/Miticide Groups* or Table 3–3. *Products Used on Apples.* In addition to these general resistance management strategies for all products, more specific strategies have been developed for fungicides, insecticides and miticides.

Managing Resistance to Fungicides

- Know the fungicide groups. Over a season, choose fungicides from different groups whenever possible.
- Limit the total number of applications, and the number of sequential applications, of a particular fungicide group per season. Look for specific resistance management strategies on the product label.
- Know which disease is targeted by which fungicide group. For combination products, know which fungicide component is controlling which disease.
- Apply fungicides before disease occurs. Applications of fungicides after the disease is established are more likely to select for resistant populations of the pathogen. Fungicide groups such as Group 9 and U12 should not be used after prebloom. Do not use Group 3, 7, 9 and 11 if apple scab or powdery mildew infection is present in the orchard.

- Where permitted, make use of Group M fungicides. These fungicides are known as multi-site inhibitors (Table 2–1. *Fungicide/Bactericide Groups*). They affect a wide range of metabolic processes in fungi and are less prone to the development of resistance. While there is no significant risk of resistance development, integrated resistance management should still be applied. For example, bacteria causing fire blight or blister spot can develop resistance to copper products.
- Tank-mix products from different groups. Where permitted, one of the tank-mix partners should be a fungicide from Group M, with a multi-site mode of action. This is an accepted resistance management strategy for fungicides, although not recommended for insecticides.

Two components of a resistance management strategy for a fungicide group are limiting the number of consecutive applications before rotating to a different group and observing a maximum number of applications per season. The following strategies reduce the risk for resistance development and may be more stringent than label guidelines:

- For high-risk pathogens with fungicide options from many groups, rotation to a different group is advisable after a single application of a resistance-prone fungicide, although this is not necessarily required by the label. For example, products in Groups 1, 3, 7, 9, 11 and U12 should be used once for apple scab before rotating to another group.
- For pathogens controlled by only a few registered fungicide groups, use no more than 2 consecutive applications of a resistance-prone fungicide and then alternate to a different fungicide group.
- When a product contains active ingredients from more than one group, each application counts as a use for each group. For example, one application of Pristine counts as a single use of boscalid (Group 7) and a single use of pyraclostrobin (Group 11).
- In some cases, a single fungicide group can control more than one pathogen. In this case, the maximum number of consecutive and total applications per season should be based on the pathogen with the highest risk of developing resistance. For example, Groups 3, 9 and 11 should not be used more than 2 times per season solo or as a tank-mix partner due to the high risk of apple scab resistance to these products.

Table 2–1. Fungicide/Bactericide Groups

Group	Chemical Group	Product Name	Active Ingredient	Resistance Risk[1]	Pests With Known Resistance to Chemical Group in Ontario
1	MBC (methyl benzimidazole carbamates)	Senator 50 SC	thiophanate-methyl	High	apple scab
3	DMI (demethylation inhibitors) Note: sometimes loosely known as sterol inhibitors (SI)	Aprovia Top 195 EC	difenoconazole * + benzovindiflupyr	Medium	apple scab
		Cevya	mefentrifluconazole	Medium	
		Fullback 125 SC	flutriafol	Medium	
		Inspire Super	difenoconazole * + cyprodinil	Medium	
		Nova	myclobutanil	Medium	
4	PA (phenylamides)	Ridomil Gold 480 SL	metalaxyl-M and S	High	—

M = Multi-site fungicides. NC = Not classified by FRAC, or group not indicated on product label. P = Plant extract. U = Mode of action has not been determined.
— = Information is not available. * Indicates active ingredient (a.i.) that puts it in this group.

[1] According to Fungicide Resistance Action Committee (FRAC) www.frac.info

Table 2–1. Fungicide/Bactericide Groups (cont'd)

Group	Chemical Group	Product Name	Active Ingredient	Resistance Risk[1]	Pests With Known Resistance to Chemical Group in Ontario
7	SDHI (succinate dehydrogenase inhibitors)	Aprovia Top 195 EC	difenoconazole + benzovindiflupyr *	Medium	—
		Fontelis	penthiopyrad	Medium–High	
		Kenja 400 SC	isofetamid	Medium–High	
		Luna Tranquility	fluopyram * + pyrimethanil	Medium	
		Pristine WG	boscalid * + pyraclostrobin	Medium	
		Sercadis	fluxapyroxad	Medium–High	
9	AP (anilinopyrimidines)	Inspire Super	difenoconazole + cyprodinil *	Medium	—
		Luna Tranquility	fluopyram + pyrimethanil *	Medium	
		Scala SC	pyrimethanil	Medium	
11	QoI (quinone outside inhibitors) Note: strobilurins belong in this group, but not all QoI are strobilurins	Flint	trifloxystrobin	High	apple scab
		Pristine WG	boscalid + pyraclostrobin *	Medium	
		Sovran	kresoxim-methyl	High	
12	PP (phenylpyrroles)	Scholar 230 SC	fludioxonil	Medium	—
19	Polyoxins	Diplomat 5 SC	polyoxin D zinc salt	Medium	—
24	Antibiotic	Kasumin 2L	kasugamycin	Medium	—
25	Antibiotic	Streptomycin 17	streptomycin	High	fire blight
29	2,6-dinitroaniline	Allegro 500 F	fluazinam	Low	—
33	Phosphonate	Aliette WDG	fosetyl al	Low	—
		Phostrol	mono- and dibasic sodium, potassium and ammonium phosphites	Low	
44	Microbial	Double Nickel LC	*Bacillus amyloliquefaciens* strain D-747	Low	—
		Serenade OPTI	*Bacillus subtilis* strain QST 713	Low	
M1	Inorganic	Copper 53 W	tri-basic copper sulphate	Low (except bacterial pathogens)	—
		Copper Spray	copper oxychloride	Low (except bacterial pathogens)	
		Cueva	copper octanoate	Low (except bacterial pathogens)	
		Parasol Flowable	copper hydroxide	Low (except bacterial pathogens)	
M2	Inorganic	Cosavet Edge DF	sulphur	Low	—
		Kumulus DF	sulphur	Low	
		Lime Sulphur	lime sulphur	Low	
		Microscopic Sulphur WP	sulphur	Low	
		Microthiol Disperss	sulphur	Low	

M = Multi-site fungicides. NC = Not classified by FRAC, or group not indicated on product label. P = Plant extract. U = Mode of action has not been determined.
— = Information is not available. * Indicates active ingredient (a.i.) that puts it in this group.

[1] According to Fungicide Resistance Action Committee (FRAC) www.frac.info

Table 2–1. Fungicide/Bactericide Groups (cont'd)

Group	Chemical Group	Product Name	Active Ingredient	Resistance Risk[1]	Pests With Known Resistance to Chemical Group in Ontario
M3	Dithiocarbamate	Dithane Rainshield	mancozeb	Low	—
		Ferbam 76 WDG	ferbam	Low	
		Granuflo T	thiram	Low	
		Manzate Pro-Stick	mancozeb	Low	
		Penncozeb 75 DF Raincoat	mancozeb	Low	
		Polyram DF	metiram	Low	
M4	Phthalimide	Folpan 80 WDG	folpet	Low	—
		Maestro 80 DF	captan	Low	
		Maestro 80 WSP	captan	Low	
		Supra Captan 80 WDG	captan	Low	
NC	Biological	Bio-Save 10 LP	*Pseudomonas syringae*	Low	—
		Blossom Protect	*Aureobasidium pullulans*	Low	
		Botector	*Aureobasidium pullulans*	Low	
NC	Oil	Purespray Green Spray Oil 13 E	mineral oil	Low	—
		Vegol Crop Oil	canola oil	Low	
NC	Not classified	Buran	garlic powder	Low	—
NC	Not classified	Oxidate 2.0	hydrogren peroxide + peroxyacetic acid	Low	—
P5	Plant extract	Regalia Maxx	*Reynoutria sachalinensis* extract	Unknown	—
U12	Guanidines	Syllit 400 FL	dodine	Low–Medium	apple scab

M = Multi-site fungicides. NC = Not classified by FRAC, or group not indicated on product label. P = Plant extract. U = Mode of action has not been determined.
— = Information is not available. * Indicates active ingredient (a.i.) that puts it in this group.

[1] According to Fungicide Resistance Action Committee (FRAC) www.frac.info

Managing Resistance to Insecticides and Miticides

- Know the insecticide groups. Rotate products from different groups. Avoid sequential applications of the same group or repeated use of any insecticide or group of insecticides.
- In some cases, insecticide groups have been divided into subgroups. For example, Group 1 has been divided into subgroups 1A and 1B, and Group 4 has been divided into subgroups 4A, 4C and 4D. Compounds from these subgroups are structurally distinct but share the same mode of action. The risk of cross-resistance between these subgroups is considered low. However, where alternatives are available, rotate with other groups. If only insecticides from these groups are registered against the pest but more than one subgroup is included, rotate between subgroups only if it is clear that cross-resistance does not exist in the target populations.
- For insects with multiple, discrete generations (e.g., oriental fruit moth, codling moth), manage each generation as separate units or "treatment windows". Use products from a single insecticide group to manage a given generation of a pest. If the pest emergence or activity of that generation is prolonged, apply a second application of the same product. This exposes each generation to only one group. Rotate to another insecticide group (or groups) for subsequent generations.
- For pests whose populations build quickly and with multiple, overlapping generations (e.g., aphids, mites), rotate between products in different insecticide groups for each spray.
- Avoid unnecessary or repeated applications of miticides and rotate among products in different groups. Many labels limit the number of applications of a product to one per season. Consider a multi-year rotation of miticides, so that mites are not exposed to products with a similar mode of action more frequently than once every few years.
- Consider annual delayed dormant oil or summer oils to suppress mite, aphid or scale populations and reduce the need for miticides when numbers exceed the treatment threshold(s).
- Time sprays to contact the most susceptible life stage of the pest. Consider the time of day when the pest is most active and location in the crop to maximize exposure with the treatment. For example, insecticides are only effective against San Jose scale when the susceptible crawler stage is present.
- Use mixtures with caution. Tank mixes and pre-formulated mixtures are pest management tools, not insecticide resistance management tools. Mixtures can provide a broader range of target pest control; however, their repeated use increases the probability that the target pest population(s) will develop multiple resistances. Alternating or rotating among products with one active ingredient, rather than mixing them, is the preferred strategy for insecticides and miticides in most situations.
- Consider the use of mating disruption where available and practical.
- Use regional or area-wide tactics rather than crop-by-pest management for cross-commodity pests, such as oriental fruit moth in stone and pome fruits.
- Encourage biological control by choosing pesticides less harmful to beneficial insects and by landscaping to provide flowering plants and unsprayed habitat for these natural enemies. This may reduce the need for insecticides or miticides, particularly those targeting indirect pests such as aphids and mites.
- Monitor problematic pests to detect shifts in sensitivity to a group of pesticides.

Table 2–2. Insecticide/Miticide Groups

Group	Type of Action	Chemical Sub-group or Exemplifying Active Ingredient	Product Name	Active Ingredient	Pests With Known Resistance to Chemical Group in Ontario
1	nerve	1A Carbamates	Lannate Toss-N-Go	methomyl	—
			Vydate L	oxamyl	
		1B Organophosphates	Imidan WP	phosmet	spotted tentiform leafminer codling moth obliquebanded leafroller oriental fruit moth
			Malathion 85 E	malathion	
3	nerve	3A Pyrethroids	Ambush 500 EC	permethrin	spotted tentiform leafminer obliquebanded leafroller
			Decis 5 EC	deltamethrin	
			Mako	cypermethrin	
			Matador 120 EC	lambda-cyhalothrin	
			Perm-Up EC	permethrin	
			Pounce 384 EC	permethrin	
			Silencer 120 EC	lambda-cyhalothrin	
			Up-Cyde 2.5 EC	cypermethrin	
4	nerve	4A Neonicotinoids	Actara 25 WG	thiamethoxam	codling moth
			Admire 240 Flowable	imidacloprid	
			Alias 240 SC	imidacloprid	
			Assail 70 WP	acetamiprid	
			Calypso 480 SC	thiacloprid	
			Clutch 50 WDG	clothianidin	
			Cormoran	acetamiprid * + novaluron	
		4C Sulfoxafimines	Closer	sulfoxaflor	—
			TwinGuard	sulfoxaflor * + spinetoram	
		4D Butenilides	Sivanto Prime	flupyradifurone	—
5	nerve	Spinosyns	Delegate	spinetoram	western flower thrips (greenhouse)
			Entrust	spinosad	
			GF-120 Fruit Fly Bait	spinosad	
			Success	spinosad	
			TwinGuard	sulfoxaflor + spinetoram *	
6	nerve and muscle	Avermectins	Agri-Mek SC	abamectin	—
			Minecto Pro	abamectin * + cyantraniliprole	
9	nerve	9D Pyropenes	Versys	afidopyropen	—

UN = Mode of action has not been determined. — = Information is not available. * Indicates active ingredient (a.i.) that puts it in this group.

Table 2–2. Insecticide/Miticide Groups (cont'd)

Group	Type of Action	Chemical Sub-group or Exemplifying Active Ingredient	Product Name	Active Ingredient	Pests With Known Resistance to Chemical Group in Ontario
10	growth regulation	10A Clofentezine	Apollo SC	clofentezine	mites
11	disrupt midgut membrane	11A B.t. microbial	Bioprotec CAF	*Bacillus thuringiensis var. kurstaki*	—
			Dipel 2X DF	*Bacillus thuringiensis var. kurstaki*	
			Foray 48 BA	*Bacillus thuringiensis var. kurstaki*	
			XenTari WG	*Bacillus thuringiensis var. kurstaki*	
15	growth regulation	Benzoylureas	Cormoran	acetamiprid + novaluron *	—
			Rimon 10 EC	novaluron	
18	growth regulation	Diacylhydrazine	Confirm 240 F	tebufenozide	obliquebanded leafroller codling moth
			Intrepid	methoxyfenozide	
20	energy metabolism	20B Acequinocyl	Kanemite 15 SC	acequinocyl	—
		20D Bifenazate	Acramite 50 WS	bifenazate	—
21	energy metabolism	21A Mitochondrial complex I electron transport inhibitors (METI)	Nexter SC	pyridaben	—
23	lipid synthesis, growth regulation	Tetronic and tetramic acid derivatives	Envidor 240 SC	spirodiclofen	—
			Movento 240 SC	spirotetramat	
25	energy metabolism	Beta-ketonitrile derivatives	Nealta	cyflumetofen	—
28	nerve and muscle	Diamides	Altacor	chlorantraniliprole	—
			Exirel	cyantraniliprole	
			Harvanta 50 SL	cyclaniliprole	
			Minecto Pro	abamectin + cyantraniliprole *	
29	nerve	Chordotonal organ modulators - undefined target site	Beleaf 50 SG	flonicamid	—
31	host-specific occluded pathogenic viruses	Granuloviruses	CYD-X	*Cydia pomonella* granulovirus	—
			Virosoft CP 4	*Cydia pomonella* granulovirus	
UN	unknown	—	Kopa	potassium salts of fatty acids	—
			Purespray Green Spray Oil 13E	mineral oil	
			Superior 70 Oil	minteral oil	
			Vegol Crop Oil	canola oil	

UN = Mode of action has not been determined. — = Information is not available. * Indicates active ingredient (a.i.) that puts it in this group.

Handling and Mixing Pesticides

Carrier Volume and Coverage

When the pesticide label does not prescribe a carrier volume or concentration, the sprayer operator must decide the appropriate volume. There should be sufficient carrier to disperse or dissolve the product and create enough spray to contact all target surface(s) with minimal runoff. The degree of contact is called coverage, which is a combination of the percent surface area covered and the droplet density on that surface. The operator must consider the following factors when choosing a volume:

- **The level of coverage required reflects the product's mode-of-action.** For example, a contact product generally requires a higher droplet density than a locally systemic product (which has limited translocation in plant tissues). A miticide intended to saturate bark is a dilute application that often incurs runoff. Plant growth regulators have very specific coverage requirements and should not be generalized.
- **The location and nature of the target.** For example, if the target is a mobile insect found predominately on the upper-side of the leaf, it may be controlled with less carrier than a disease found deep in the plant canopy. Further, the orientation and surface texture of the target will affect how spray is retained and how it spreads.
- **The impact of environmental conditions, sprayer design and the crop size, density and developmental stage.** For example, the more plant canopy to be protected per hectare, the more carrier volume will be required. More volume is required when sprayer air is poorly adjusted, the weather is dry and/or windy and the distance-to-target is long or convoluted (such as tree-tops or deep in unpruned canopies).

To understand the relationship between carrier volume and coverage, the sprayer operator requires a feedback mechanism. Visual inspection of foliar "wetness" or spray residue is subjective and transient, and therefore insufficient. Water-sensitive papers distributed within the target canopy provide a fast, repeatable and quantifiable means for evaluating coverage. Most conventional foliar products require minimal coverage of 10–15% with a droplet density of 85 droplets/cm^2.

Smartphone apps such as the GRDC's SnapCard (https://www.agric.wa.gov.au/grains/snapcard-spray-app) quickly calculate and record spray coverage for future consideration in light of the level of protection achieved. For more information on quantifying coverage, see the Sprayers101 website at www.sprayers101.com and use the keyword "coverage" in the search engine. Download a copy of *Airblast 101, A Handbook of Best Practices in Airblast Spraying* (https://sprayers101.com/airblast101/)

General Mixing Steps

1. **Read all product labels** — Know the product formulation (which affects mixing method and order). Look for information about the influence of carrier pH, hardness and any requirement for adjuvants. Defer to label instructions should they differ from these mixing steps.

2. **Shake any liquid products** — This ensures the active ingredient and inert ingredients are thoroughly mixed.

3. **Add carrier to the tank** — For water, fill the tank 50% with the required volume. For oil, fill the tank 75%.

4. **Agitate** — Agitation should continue through the mixing process. Excessive agitation may create foaming. If possible, reduce the level of agitation or use a defoamer adjuvant (50% of which should be added during step 3, and the remainder during step 7.)

5. **Add products in order** — The formulation type dictates the order in which tank mix partners should be added. Refer to *Product Order by Formulation* below. If using an inductor, flush with water between additions.

6. **Wait and check** — Dry products and water-soluble packets must fully disperse and/or dissolve before adding the next product. Several factors affect the duration, but 3–5 minutes is typical.

7. **Add remaining carrier.**

8. **Measure pH** — This is best done after all products are added to account for their impact on pH and buffering capacity. If required, pH adjusters can be added at the end of mixing to ensure the solution is in the range required by the label.

Product Order by Formulation

Pesticide labels usually provide directions for mixing different materials, which is the sequence for mixing. The order in which you add each product to the tank is critical.

1. **Dry Formulations** — This includes water dispersible granules (WDG or WG), wettable powders (WP) and soluble granules (SG). Allow more time for these products to dissolve and/or disperse completely. Best practice is to premix these products with water in a slurry before adding to the tank.

2. **Anti-drift adjuvants, compatibility agents or anti-foamers** — Consult labels as these products may require multiple additions or a different order than indicated here.

3. **Liquid Formulations** — Liquid pesticide formulations mix in water to form a solution. Some pesticides may be oil-based, such as emulsifiable concentrates (EC), and form an opaque (milky) emulsion that requires moderate agitation and may be prone to foaming.

Water Soluble Packaging

Water-soluble packaging (WSP) is often used for dry formulations. The PVA (polyvinyl alcohol) packaging should dissolve completely when added directly to the tank water (not the basket filter). Protect them from moisture by leaving them in outer packing until just before use and do not handle them with wet gloves. Reseal them to protect remainder.

Do not mix WSP with any product incompatible with the PVA packaging. which includes residues from prior applications of:

- Oils (e.g., Superior Oil)
- EC formulations containing mineral or vegetable oil
- Boron
- Chelated micronutrients
- Water-soluble fertilizers

Compatibility of Spray Materials

Tank-mixing is adding more than one formulated product in the tank at the same time for efficiency, resistance management and improved performance. However, the odds of incompatibility increase with the number of tank-mix partners.

Physical incompatibility can result in the solution thickening, foaming, separating or falling out of suspension, which in turn leads to poor coverage uniformity or plugged / damaged spray equipment. Chemical incompatibility (i.e. antagonism or synergy) can result in reduced pesticide efficacy or cause plant injury when sprayed on the crop.

For information on compatibility, check the product label, product manufacturer or distributor. Do not decide on tank-mixes during loading; instead, do so off-season. Users of commercial-class pest control products for crop protection or vegetation management are permitted to apply unlabeled tank-mixes as long as:

- each product is registered for use in Canada on the crop.
- each product is used according to the label.
- the tank-mix only includes an adjuvant when specifically required by one of the product labels.
- the application timing of each product is compatible with crop and pest staging.
- no product is specifically excluded on any other of the tank-mix product labels.

Registered product labels can be downloaded through Health Canada's label search webpage at http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php. Search for the following keywords:

- Do not mix
- Mix
- Hours
- Agitation
- The trade name of any intended tank-mix partner

Well-known incompatibilities include:

- Add Supra Captan or Maestro before EC formulations of pyrethroids. Apply immediately with constant agitation.
- Do not mix pesticides with lime sulphur or streptomycin.
- Although not technically a tank-mix incompatibility, do not use oil sprays within 14 days of Captan or Maestro, including the oil used with products such as Agri-Mek.

Jar Test for Pesticide Compatibility

If labels are silent on compatibility, or you are considering a new-tank mix, a *Jar Test* can be used to test physical incompatibility. Note, this will not reveal a chemical incompatibility. When performing a jar test, do so in a safe and ventilated area, away from sources of ignition, and always wear personal protective equipment (PPE).

1. Measure 500 mL of carrier into a 1 L glass jar. Be sure to use the same carrier at the same temperature used in the sprayer.
2. Add ingredients according to Table 2–3. *Tank-Mix Order for Pesticide Compatibility Test,* stirring after each addition.
3. Let the solution stand in a ventilated area for 15 minutes and observe the results. If the mixture is giving off heat, these ingredients are not compatible. If gel or scum forms or if solids settle to the bottom (except for the wettable powders) then the mixture is likely incompatible.
4. Keep records and retain the jars for the season. They may indicate products prone to settling or separating after prolonged rest (e.g., parking the sprayer overnight). They may also indicate potential problems during re-suspension or cleanout.

If you experience a physical incompatibility issue in the sprayer, do not immediately add water, ammonia, non-ionic surfactants or detergents to the tank. This may create further problems. First, contact the manufacturer or dealer for more information. Then, perform a *Reverse Jar Test* by sampling the solution and attempting to break down a small volume before doing so in the sprayer. If you succeed in re-suspending the solution, it may no longer be viable and must be safely discarded.

For more information on pesticide handling and operator safety, consult the Ontario Pesticide Education Program (OPEP) Grower Pesticide Safety course (www.opep.ca/resources).

Table 2–3. Tank-mix Order for Pesticide Compatibility Test

Order	Ingredient	Quantity for 500 mL or 500 g of Product Labeled for 1,000 L of Final Spray Volume
1	Compatibility agents	5 mL (1 teaspoon)
2	Water-soluble packets, wettable powders and dry flowables. Include a ~1cm^2 cutting of the PVA packaging.	15 g (1 tablespoon)
3	Liquid drift retardants	5 mL (1 teaspoon)
4	Liquid concentrates, micro-emulsions and suspension concentrates	5 mL (1 teaspoon)
5	Emulsifiable concentrates	5 mL (1 teaspoon)
6	Water-soluble concentrates or solutions	5 mL (1 teaspoon)
7	Remaining adjuvants and surfactants	5 mL (1 teaspoon)

Adjuvants Used in Fruit Crops

Spray adjuvants are tank-mix additives used to modify and enhance the effectiveness of the pesticide. They can improve pesticide performance by modifying the spray pattern, quality, uptake and penetration into the plant or insect exoskeleton. Other benefits to adjuvants may include:

- Keep pesticide from binding to minerals suspended in water.
- Adjust water pH so pesticide is less likely to break down.
- Manipulate droplet size to reduce on-target and off-site movement of pesticide.
- Improve odds that a spray droplet will stay on the target by reducing factors that cause droplets to bounce and roll off.
- Modify or reduce surface tension to enhance the ability of a droplet to be retained on or spread across the target surface.
- Minimize spray droplet evaporation.
- Prevent spray deposit from being washed off the leaf surface.
- Protect the droplet from degrading in sunlight.
- Improve pesticide's absorption and uptake by the plant or insect exoskeleton.

Unless the product label specifies an adjuvant be added to the tank, growers do not need to use them. However, if use of an adjuvant is stated on the product label, pesticide performance and efficacy can be significantly reduced if it is not included. There are many types of adjuvants which include:

- surfactants / wetter-spreaders (e.g., non-ionic surfactant, including organosilicones)
- stickers / spreader-sticker (e.g., kaolin clay)
- oil concentrates (e.g., petroleum-based crop oil, modified/methylated seed oils)
- water conditioning agents
- evaporation retardants
- anti-foaming agents
- pH adjusters (e.g., acidifiers, buffering agents)
- drift suppressing agents

A label may specify a particular name brand or generalize a category of adjuvant. In the latter case, the grower is free to use any adjuvant in that category, provided it is registered for use on the crop and in combination with the pesticide being applied. Always use adjuvants as directed on the product label. For specific adjuvants, consult your local input retailer or product registrant.

General cautions around the use of adjuvants include:

- Avoid the use of adjuvants that help with penetration into plant tissue with copper, sulphur or captan fungicides. This includes the use of oils. Penetrants should not be used with contact or surface pesticides.
- Avoid adjuvants with sticker activity that could impede movement of systemic pesticides in plant tissue.
- Avoid adjuvants with sticker activity early in the growing season when redistribution is important to protect newly emerging leaves. However, this may be a desirable characteristic during wet springs.

For more information on adjuvants, see the Sprayers 101 website at sprayers101.com.

3. Crop Protection

In this Section:

The information in this chapter is provided as a guideline only. Read the product label and follow all safety precautions. Labels for registered pest control products are available at the Pest Management Regulatory Agency (PMRA) website at http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php. Many products listed are under re-evaluation with the PMRA and may change within the lifetime of this publication. Consult the most recent label on the PMRA website and/or product registrant for complete information.

Products are listed in the crop protection tables by chemical group and are in alphabetical order within each group. The order does not reflect efficacy. Where a product in the calendar is followed by a "*", it is potentially acceptable for organic use based on Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec publication, *Bulletin D'Information No. 3, 3 juin 2019* or a letter of certification provided by the registrant. Check with your certifying body to verify the acceptability of any product prior to using it.

Information on the timing and rates of application for plant growth regulators and chemical thinners can be found in the crop protection tables. For additional information on plant growth regulators and thinning, visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops* and *Thinning of Tree Fruit.*

Unless specified on the product label, use enough water to ensure thorough spray coverage. Where the product rate is listed in amount per 1,000 L, or if a water volume is not provided on the label, use enough water to wet the foliage to the near drip point.

Crop nutrition is important for plant growth, fruit quality development and the acquisition of adequate cold hardiness by tree fruit. For fruit crops, soil testing, plant tissue analysis and visual deficiency symptoms all play an important role in assessing and monitoring the crop's nutritional status. For more information, visit ontario.ca/apples (click on *Soil Management, Fertilizer Use, Crop Nutrition and Cover Crops for Fruit Production*) and see OMAFRA Publication 611, *Soil Fertility Handbook*.

Resistance Management

To delay development of resistance to fungicides, insecticides and miticides, follow resistance management guidelines outlined in Chapter 2, *Resistance Management Strategies.* The chemical group is indicated in the column labelled "Group" before the "Product" column. Products belonging to the same chemical group are grouped together in the crop protection tables. Multi-site (M) fungicides are not prone to resistance and do not have to be rotated. Some products are not classified to mode of action (NC) and the mode of action has not been determined for others (U or UN).

Fungicide resistance management

Take the following steps to avoid rapid development of fungicide resistance:

- Do not reduce rates below those specified on the label.
- Do not use products containing the same chemical group in consecutive applications.
- Use products containing only one chemical family no more than twice per season.
- Use co-formulations or products that must be tank-mixed with another chemical group no more than 3 times per season.
- Use sufficient water to provide thorough coverage.
- Do not use Fullback, Nova, Inspire Super, Aprovia Top, Fontelis, Kenja, Sercadis, Luna Tranquility, Pristine, Scala, Sovran, or Flint when sporulating lesions of the target disease are present.

Insecticide Resistance Management

Take the following steps to avoid development of insecticide resistance:

- For pests with discrete generations (e.g., codling moth, oriental fruit moth), do not use insecticides from the same group for more than one generation. Within a generation, if more than one spray is required, use a product from the same chemical group.
- For pests with rapidly building and overlapping generations (e.g., mites, aphids), do not use products containing the same chemical group in consecutive applications.

Bee Toxicity

Some pesticides are toxic to bees and other pollinating insects. Use of pesticides on flowering crops requires careful management to avoid negative effects on pollinators. Insecticides should not be applied when tree fruit are in bloom or when bees are active. Before and after bloom, bees may be present on flowering cover crops and weeds—do not allow drift onto these or other flowering crops. Always follow label precautions to avoid impacts on bees. For more information, see *Bee Poisoning* in Chapter 1 and honeybee toxicity ratings in Table 3–6. *Toxicity of Pesticides to Honeybees and Mite/Aphid Predators*.

Apple (Bearing)

Table 3–1. Apple Crop Protection

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Dormant to bud swell						
Scale	**General Comments:** • May cause bark injury on Red Delicious, Empire, Mutsu/Crispin and Ambrosia. • Apply in a high-volume spray to ensure thorough coverage of trunk and limbs. • Do not apply within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain and to heat- or moisture-stressed trees. • Do not use within 14 days of Supra Captan, Maestro or Folpan.					
	NC	Purespray Green Spray Oil 13 E *	20 L/1,000 L water	12 hours	—	In addition to precautions in general comments, do not use within 14 days of Ambush, Perm-Up, Pounce or sulphur.
		Superior 70 Oil *	20 L/1,000 L water	12 hours	—	In addition to precautions in general comments, do not use within 30 days of sulphur.
		Vegol Crop Oil *	20 L/1,000 L water	12 hours	0 days	In addition to precautions in general comments, do not use within 14 days of copper and 30 days of sulphur. Do not apply to wet foliage.
Fire blight	M	Copper Spray *	3.2 kg/ha	48 hours	2 days	These products are contact fungicides only and do not have activity on the fire blight pathogen within the plant tissue. Apply when overwintering cankers begin to ooze as tree breaks dormancy. Apply up to 1/4-inch green. Phytotoxicity may occur with some copper formulations if applied at a later growth stage. Read label for more information. Thorough coverage of limbs and trunk is essential for good control. This spray does not eliminate the need for blossom blight management.
		Cueva *	1% v/v in 470–940 L water/ha	4 hours	1 day	
		Parasol Flowable	4.7 L/ha	48 hours	dormant	

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

— = Information is not applicable or not specified on label.
* Potentially organic. Check with certifying body.

Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Dormant to bud swell (cont'd)						
Tree growth modification	NC	Promalin SL	100–166 mL/ 500 mL latex paint	12 hours	28 days	Mix with latex paint and apply directly to buds with a brush or sponge uniformly covering bark surface. Apply to 1-year-old wood only. Apply when terminal buds have started to swell, but before bud break as this may result in injury to tender side shoot tips. Notching bark above the bud with a hacksaw blade prior to treatment will greatly increase efficacy. Do not use when temperatures are below freezing, above 30°C or if rain is forecast within 6 hours. Visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops*.
Green tip to half-inch green						
Scab	**General Comments:** • Apply fungicides before spore release as soon as green tissue is present and keep growing leaves covered if conditions are conducive to disease development. • Rainfall is needed for spore release and leaves/fruit must be wet for infection to occur. The length of the wetting period required for infection varies with temperature. See Table 3–10. *Relationship of Temperature and Moisture to Apple Scab Infection* and the Ontario Crop IPM website at ontario.ca/cropipm for information on infection periods. • In conditions of rapid growth or high disease pressure, use higher rate or shorter intervals between applications. • For resistance management, use a maximum of 2 applications of products per fungicide group from Group 3 and 7 per season.					
	M	Cueva *	1% v/v in 470–940 L water/ha	4 hours	1 day	May cause russeting of light-skinned cultivars. If concerned about sensitivity of fruit, test first on a small area.
		Dithane Rainshield or Manzate Pro-Stick or Penncozeb 75 Raincoat	2 kg/1,000 L water 6 kg/ha 2 kg/1,000 L water	12 hours 24 hours 24 hours	45 days	No product specific comments.
		Folpan 80 WDG	3.0–3.75 kg/ha	24 hours	—	May cause russeting to Delicious and other sensitive cultivars when used pink to 30 days after petal fall. Do not use within 14 days of oil.
		Granuflo-T	1.5–2.25 kg/ 1,000 L water	24 hours	28 days	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 DF or Supra Captan 80 WDG	3.75 kg/ha	48 hours	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. These product formulations are currently being phased-out. Last date of use is May 10, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

— = Information is not applicable or not specified on label.
* Potentially organic. Check with certifying body.

Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Green tip to half-inch green (cont'd)						
Scab (cont'd)	M (cont'd)	Maestro 80 WSP	3 kg/ha	High density[1]: 2 days[2]/ 6 days[3]/ 15 days[4,5] Standard[6]: 2 days[2]/ 4 days[3]/ 19 days[4]/ 24 days[5]	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. When restricted entry interval exceeds preharvest interval, follow restricted entry interval.
		Polyram DF	6 kg/ha	12 hours	45 days	Last date of use is June 21, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
	1	Senator 50 SC plus 1/2 to full rate Group M, where permitted	250 mL/1,000 L water See Group M	12 hours	1 day	Historically, Benlate-resistant forms of apple scab have been present in Ontario. Senator belongs to the same chemical group as Benlate. Use caution if Benlate was used in your orchard in the past. See label for more information on suggested tank-mix partners.
	3+7	Aprovia Top	386–643 mL/ha	12 hours	30 days	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. See labels for suggested tank-mix partners.
	7	Fontelis	1.0–1.5 L/ha	12 hours	28 days	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. See labels for suggested tank-mix partners. Fontelis contains mineral oil in the formulation. Tank-mixing or rotating with oil-sensitive products (e.g., captan, sulphur) may cause crop safety issues. See label for tank-mix restrictions. Use Sercadis with a non-ionic surfactant at a rate of 0.125% v/v (e.g., 1.25 L in 1,000 L water).
		Kenja 400 SC	913 mL/ha	12 hours	20 days	
		Sercadis	333 mL/ha	12 hours	0 days	
	7+9	Luna Tranquility plus 1/2 to full rate Group M, where permitted	800 mL/ha See Group M	12 hours[2]/ 24 hours[5]	14 days	No product specific comments.
	9	Scala SC	1 L/ha	12 hours[2]/ 24 hours[5]	14 days	This product does not control other diseases. Maximum of 2 applications per season, prebloom only.
	29	Allegro 500 F	0.5–1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	Apply at 7–14-day intervals. Do not make more than 3 sequential applications before rotating to another group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Green tip to half-inch green (cont'd)						
Scab (cont'd)	44	Serenade OPTI *	1.7–3.3 kg/ha	when dry	0 days	**Suppression only.** Apply preventatively at 7–10-day intervals. Use in conjunction with other cultural or chemical controls.
	NC	Buran *	1.8% v/v (i.e., 9 L in 500 L water/ha)	when dry	0 days	**Suppression only.** Do not use more than 18 L/ha per application. This product should only be used as a post-infection treatment, but before 350 degree-hours (base 0°C) after beginning of infection. Apply after rainfall or when conditions are conducive to disease development. Do not apply if rain is forecast within 48 hours.
		Oxidate 2.0 *	1% v/v	4 hours	0 days	**Partial suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
	U12	Syllit 400 FL plus 1/2 to full rate Group M, where permitted	1.75 L/ha See Group M	48 hours	7 days	Resistance is present in some Ontario orchards. Check the status of resistance to U12 fungicides in your orchard before using it. For resistance management, tank-mix with a compatible protectant scab fungicide from a different group. See label for more information on suggested tank-mix partners. Do not use after Tight cluster.
Powdery mildew	**General Comments:** • Apply fungicides beginning at Green tip and continue to First summer spray. Additional sprays beyond First summer spray may be needed on susceptible cultivars or if disease pressure is severe until terminal bud set. • For resistance management, use a maximum of 2 applications of products per fungicide group from Group 3, 7 and 11 per season.					
	M	Cosavet DF Edge * or Kumulus DF * or Microscopic Sulphur WP * or Microthiol Disperss *	22.5 kg/ha 22.5 kg/ha 6.5 kg/1,000 L water 22.5 kg/ha	24 hours	1 day	May cause an increase in red mite and scale populations. Do not use within 14 days of Purespray Green Spray Oil and 30 days of Vegol Crop Oil or Superior Oil.
	1	Senator 50 SC	250 mL/1,000 L water	12 hours	1 day	No product specific comments.
	3	Cevya	250–375 mL/ha	12 hours	0 days	**Suppression only.**
		Fullback 125 SC	585–877 mL/ha	12 hours	14 days	No product specific comments.
		Nova	340 g/ha	12 hours[2]/ 5 days[4]/ 12 days[5]	14 days	No product specific comments.
	3+7	Aprovia Top	643 mL/ha	12 hours	30 days	No product specific comments.
	3+9	Inspire Super	836 mL/ha	12 hours	14 days	**Suppression only.**

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Green tip to half-inch green (cont'd)						
Powdery mildew (cont'd)	7	Fontelis	1.0–1.5 L/ha	12 hours	28 days	Contains mineral oil in the formulation. Tank-mixing or rotating with oil-sensitive products (e.g., captan, sulphur) may cause crop safety issues. See label for tank-mix restrictions.
		Sercadis	167–333 mL/ha	12 hours	0 days	Use with a non-ionic surfactant at a rate of 0.125% v/v (1.25 L in 1,000 L water).
	7+9	Luna Tranquility	600 mL/ha	12 hours[2]/ 24 hours[5]	14 days	No product specific comments.
	7+11	Pristine WG	1.0–1.2 kg/ha	when dry[2]/ 5 days[4]/ 12 days[5]	5 days	Do not tank-mix or make sequential applications with Exirel.
	11	Flint	140–210 g/ha	12 hours[2]/ 4 days[5]	14 days	Do not tank-mix or make sequential applications with Exirel.
		Sovran	240 g/ha	48 hours	30 days	
	19	Diplomat 5 SC	259–926 mL/ha	when dry	0 days	**Suppression only.** Apply preventatively at 7–14-day intervals.
	44	Serenade OPTI *	1.7–3.3 kg/ha	when dry	0 days	**Suppression only.** Apply preventatively at 7–10-day intervals. Use in conjunction with other cultural or chemical controls.
	NC	Buran *	1.2–1.8% v/v (i.e., 9 L in 500–800 L water/ha)	when dry	0 days	Control can be achieved under low to moderate disease pressure with addition of a non-ionic surfactant at a rate of 0.1% v/v. Begin applications preventatively when conditions are conducive to disease development. Reapply every 7–10 days if needed. Do not apply if rain is forecast within 48 hours.
		Oxidate 2.0 *	1% v/v	4 hours	0 days	**Suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
		Purespray Green Spray Oil 13 E *	10 L/1,000 L water	12 hours	—	**Suppression only.** May cause bark injury on Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage. Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan, Ambush, Perm-Up, Pounce or sulphur.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Green tip to half-inch green (cont'd)						
Powdery mildew (cont'd)	NC (cont'd)	Vegol Crop Oil *	2% v/v	12 hours	0 days	**Suppression only.** May cause bark injury on Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage at a rate of 2% v/v (20 L/1,000 L water). Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan or copper and 30 days of sulphur. Do not apply to wet foliage.
Half-inch green to tight cluster						
European red mite	**General Comments:** • Oil may cause bark injury on Red Delicious, Empire, Mutsu/Crispin and Ambrosia. • Apply in a high-volume spray to ensure thorough coverage of trunk and limbs. • Apply before overwintering eggs hatch. • Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain and to heat- or moisture-stressed trees. • Do not use within 14 days of Supra Captan, Maestro or Folpan.					
	NC	Purespray Green Spray Oil 13 *	20 L/1,000 L water	12 hours	—	**Suppression only.** In addition to precautions in general comments, do not use within 14 days of Ambush, Perm-Up, Pounce or sulphur.
		Superior 70 Oil *	20 L/1,000 L water	12 hours	—	In addition to precautions in general comments, do not use within 30 days of sulphur.
		Vegol Crop Oil *	20 L/1,000 L water	12 hours	0 days	In addition to precautions in general comments, do not use within 14 days of copper and 30 days of sulphur. Do not apply to wet foliage.
Rosy apple aphid	**General Comments:** • Spray if 20 or more clusters in a 100-cluster sample are infested. • Unless stated otherwise in product specific comments, reapply, if necessary, after 14 days.					
	4A	Actara 25 WG	160 g/ha	12 hours	60 days	Maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks. Maximum 1 prebloom application of Actara. Last date of use for Actara is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Assail 70 WP	120 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	
		Calypso 480 SC	145–290 mL/ha	12 hours	30 days	
	4A+15	Cormoran	0.7–1.05 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C	Closer	100–200 mL/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.
	4C+5	TwinGuard	250 g/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Half-inch green to tight cluster (cont'd)						
Rosy apple aphid (cont'd)	4D	Sivanto Prime	500–750 mL/ha	12 hours	14 days	Where possible, rotate with products outside of Group 4.
	9D	Versys	100 mL/ha	12 hours	7 days	Apply in a minimum spray volume of 1,000 L/ha.
	28	Exirel	1.5 L/ha	12 hours	3 days	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
	29	Beleaf 50 SG	160 g/ha	12 hours[1]/ 48 hours[2]	21 days	Apply before populations reach economic threshold. Reapply 7 days later if monitoring indicates a need. Do not use with adjuvants.
	NC	Kopa *	2% v/v in 700–1,000 L water	12 hours	12 hours	Begin applications when populations are low and reapply every 1–3 weeks as needed. Test a small area of each variety prior to spraying the whole block. This product must coat the bodies of susceptible, soft-bodied insects to be effective. Good coverage is critical. Applying soaps more than 3 times may cause plant injury. Avoid application in direct sunlight or to trees under stress. Application within 3 days of sulphur may increase plant injury on sensitive varieties.
		Purespray Green Spray Oil 13 E *	10 L/1,000 L water	12 hours	—	**Suppression only.** May cause bark injury on Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage. Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of using Supra Captan, Maestro, Folpan, Ambush, Perm-Up, Pounce or sulphur.
		Vegol Crop Oil *	2% v/v	12 hours	0 days	May cause bark injury on Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage at a rate of 2% v/v (20 L/1,000 L water). Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan or copper and 30 days of sulphur. Do not apply to wet foliage.
Oriental fruit moth	NC	Isomate OFM TT *	125–250 dispensers/ha	—	—	Reduces mating of oriental fruit moth. Place dispensers in orchard in late April before flight begins. Use higher rate for high pressure areas or initial year of treatment. Dispensers are designed to last for the entire season. Supplemental control measures should be applied in orchards with high pest populations. Outbreaks of other pests may occur when insecticides are not used for oriental fruit moth. For information on mating disruption, see OMAFRA Factsheet 03–079, *Mating Disruption for Management of Insect Pests*.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Half-inch green to tight cluster (cont'd)						
Scab	**General Comments:** • Apply fungicides before spore release as soon as green tissue is present and keep growing leaves covered if conditions are conducive to disease development. • Rainfall is needed for spore release and leaves/fruit must be wet for infection to occur. The length of the wetting period required for infection varies with temperature. See Table 3–10. *Relationship of Temperature and Moisture to Apple Scab Infection* and the Ontario Crop IPM website at ontario.ca/cropipm for information on infection periods. • In conditions of rapid growth or high disease pressure, use higher rate and shorter intervals between applications. • For resistance management, use a maximum of 2 applications of products per fungicide group from Group 3, 7 and 11 per season.					
	M	Cueva *	1% v/v in 470–940 L water/ha	4 hours	1 day	May cause russeting of light-skinned cultivars. If concerned about sensitivity of fruit, test first on a small area.
		Dithane Rainshield or Manzate Pro-stick or Penncozeb 75 Raincoat	2 kg/1,000 L water 6 kg/ha 2 kg/1,000 L water	12 hours 24 hours 24 hours	45 days	No product specific comments.
		Folpan 80 WDG	3.0–3.75 kg/ha	24 hours	—	May cause russeting to Delicious or other sensitive cultivars when used pink to 30 days after petal fall. Do not use within 14 days of oil.
		Granuflo-T	1.5–2.25 kg/ 1,000 L water	24 hours	28 days	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 DF or Supra Captan 80 WDG	3.75 kg/ha	48 hours	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. These product formulations are currently being phased-out. Last date of use is May 10, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 WSP	3 kg/ha	High density[1]: 2 days[2]/ 6 days[3]/ 15 days[4,5] Standard[6]: 2 days[2]/ 4 days[3]/ 19 days[4]/ 24 days[5]	7 days	Do not use within 14 days of oil or as a tank-mix or sequential applications with products containing oil such as Fontelis or Exirel. When restricted entry interval exceeds preharvest interval, follow restricted entry interval.
		Polyram DF	6 kg/ha	12 hours	45 days	Last date of use is June 21, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Half-inch green to tight cluster (cont'd)						
Scab (cont'd)	1	Senator 50 SC plus 1/2 to full rate Group M, where permitted	250 mL/1,000 L water See Group M	12 hours	1 day	Historically, Benlate-resistant forms of apple scab have been present in Ontario. Senator belongs to the same chemical group as Benlate. Use caution if Benlate was used in your orchard in the past. See label for more information on suggested tank-mix partners.
	3	Cevya	250–375 mL/ha	12 hours	0 days	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. Resistance to some Group 3 fungicides has been confirmed in Ontario. Check the status of these products before using them in your orchard. Do not use earlier than Tight cluster. Residues last 5–8 days. Do not use if apple scab is present.
		Fullback 125 SC plus 1/2 to full rate Group M, where permitted	950 mL/ha See Group M	12 hours	14 days	
		Nova plus 1/2 to full rate Group M, where permitted	340 g/ha See Group M	12 hours[2]/ 5 days[4]/ 12 days[5]	14 days	
	3+7	Aprovia Top	386–643 mL/ha	12 hours	30 days	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. See labels for suggested tank-mix partners. Do not use if apple scab is present.
	3+9	Inspire Super plus 1/2 to full rate Group M, where permitted	560–836 mL/ha See Group M	12 hours	14 days	Do not use earlier than Tight cluster. Provides good scab control in cool weather. Residues last 5–8 days. Do not use if apple scab is present. May provide suppression of powdery mildew when applied at higher rate.
	7	Fontelis	1.0–1.5 L/ha	12 hours	28 days	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. See labels for suggested tank-mix partners. Do not use if apple scab is present. Fontelis contains mineral oil in the formulation. Tank-mixing or rotating with oil-sensitive products (e.g., captan, sulphur) may cause crop safety issues. See label for tank-mix restrictions. Use Sercadis with a non-ionic surfactant at a rate of 0.125% v/v (e.g., 1.25 L in 1,000 L water).
		Kenja 400 SC	913 mL/ha	12 hours	20 days	
		Sercadis	333 mL/ha	12 hours	0 days	
	7+9	Luna Tranquility plus 1/2 to full rate Group M, where permitted	800 mL/ha See Group M	12 hours[2]/ 24 hours[5]	14 days	Provides good scab control in cool weather. Do not use if apple scab is present.
	7+11	Pristine WG plus 1/2 to full rate Group M, where permitted	1.0–1.2 kg/ha See Group M	when dry[2]/ 5 days[4]/ 12 days[5]	5 days	Do not use earlier than Tight cluster. Residues last 5–8 days. Do not use if apple scab is present. Do not tank-mix or make sequential applications with Exirel.
	9	Scala SC	1 L/ha	12 hours[2]/ 24 hours[5]	14 days	Provides good scab control in cool weather. This product does not control other diseases. Maximum of 2 applications per season, prebloom only. Do not use if apple scab is present.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Half-inch green to tight cluster (cont'd)						
Scab (cont'd)	11	Flint plus 1/2 to full rate Group M, where permitted	140 g/ha See Group M	12 hours[2]/ 4 days[5]	14 days	Resistance to some Group 11 fungicides has been confirmed in Ontario. Check the status of these products before using them in your orchard. Do not use earlier than Tight cluster. Residues last 5–8 days. Do not use if apple scab is present. Do not tank-mix or make sequential applications with Exirel.
		Sovran plus 1/2 to full rate Group M, where permitted	240 g/ha See Group M	48 hours	30 days	
	29	Allegro 500 F	0.5–1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	Apply at 7–14-day intervals. Do not make more than 3 sequential applications before rotating to another group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.
	44	Serenade OPTI *	1.7–3.3 kg/ha	when dry	0 days	**Suppression only.** Apply preventatively at 7–10-day intervals. Use in conjunction with other cultural or chemical controls.
	NC	Buran *	1.8% v/v (i.e., 9L in 500 L water/ha)	when dry	0 days	**Suppression only.** Do not use more than 18 L/ha per application. This product should only be used as a post-infection treatment, but before 350 degree-hours (base 0°C) after beginning of infection. Apply after rainfall or when conditions are conducive to disease development. Do not apply if rain is forecast within 48 hours.
		Oxidate 2.0 *	1% v/v	4 hours	0 days	**Partial suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
	U12	Syllit 400 FL plus 1/2 to full rate Group M, where permitted	1.75 L/ha See Group M	48 hours	7 days	Resistance to some Group U12 fungicides has been confirmed in Ontario. Check the status of these products before using them in your orchard. See label for more information on suggested tank-mix partners. Do not use after Tight cluster.
Powdery mildew	Use one of the products listed for Powdery mildew at **Green tip to half-inch green.**					
Tight cluster to pink						
Rosy apple aphid	Use one of the products listed for Rosy apple aphid at **Half-inch green to tight cluster.**					

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Tight cluster to pink (cont'd)						
Woolly apple aphid	**General Comments:** • This is a special spray for orchards with a history of high woolly apple aphid damage. • Adults overwinter on the roots and in protected sites on the tree (i.e., loose bark, cankers). In the spring, young aphids crawl to new sites. • Apply in a high-volume spray to ensure thorough coverage of trunk and limbs.					
	4C	Closer	400 mL/ha	12 hours	7 days	No product specific comments.
	4C+5	Twinguard	500 g/ha	12 hours	7 days	No product specific comments.
Tentiform leafminer	**General Comments:** • Apply if there are 3 or more eggs per spur or 1 or more sap-feeders per leaf.					
	3	Ambush 500 EC or Perm-Up EC or Pounce 384 EC	400 mL/ha 520 mL/ha 520 mL/ha	when dry	7 days	Apply at first egg hatch. This group is highly toxic to beneficial insects and may lead to mite outbreaks. Maximum of 1 application per season.
		Decis 5 EC	250 mL/ha	12 hours	1 day	
		Mako or Up-Cyde 2.5 EC	400 mL/ha	12 hours	7 days	
		Matador 120 EC or Silencer 120 EC	83 mL/ha	24 hours	7 days	
	4A	Actara 25 WG	315 g/ha	12 hours	60 days	Apply when population is mainly in the sap-feeder stage. Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks. Last date of use for Actara is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Assail 70 WP	80 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	
		Calypso 480 SC	145 mL/ha	12 hours	30 days	
	4A+15	Cormoran	700 mL/ha	12 hours[2]/ 7 days[5]	14 days	Apply when population is mainly in the sap-feeder stage. Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	250–500 g/ha	12 hours	7 days	Apply at egg hatch or at first sign of sap-feeder stage. Where possible, rotate with products outside of Group 4 between generations.
	5	Delegate	420 g/ha	12 hours	7 days	Apply when population is mainly in the sap-feeder stage.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Tight cluster to pink (cont'd)						
Tentiform leafminer (cont'd)	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Apply at egg hatch or at first sign of sap-feeder stage. Apply with 0.25%–1% oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	18	Confirm 240 F	1 L/ha	12 hours	14 days	Apply at first egg hatch. Confirm provides **suppression only.**
		Intrepid	500 mL/ha	12 hours	14 days	
	28	Altacor	215 g/ha	12 hours	5 days	Apply when population is mainly in the sap-feeder stage. Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
		Exirel	500–750 mL/ha	12 hours	3 days	
Plant bugs	**General Comments:** • Targeted sprays for plant bug are not economical unless there is a perennial problem in the orchard. • Overwintering adults become active on warm days in early spring and attack floral buds and immature fruit. • While damage to bearing orchards is minimal after June, nurseries and newly planted blocks are susceptible throughout the summer. • Monitor for signs of feeding activity such as ooze near or on the flower buds. • Unless stated otherwise in product specific comments, reapply, if necessary, after 14 days.					
	3	Ambush 500 EC	400 mL/ha	when dry	7 days	These products are highly toxic to beneficial insects and may lead to mite outbreaks. Do not apply when bees are active in the orchard. Maximum of 1 application per season.
		Mako or Up-Cyde 2.5 EC	400 mL/ha 250 mL/ha	12 hours	7 days	
		Matador 120 EC or Silencer 120 EC	104 mL/ha	24 hours	7 days	
	4A+15	Cormoran	1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C	Closer	300 mL/ha	12 hours	7 days	No product specific comments.
	4C+5	Twinguard	360 g/ha	12 hours	7 days	No product specific comments.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Tight cluster to pink (cont'd)						
Codling moth, Oriental fruit moth	NC	Isomate-CM/OFM TT *	500 dispensers/ha	—	—	Reduces mating of codling moth and oriental fruit moth. Place pheromone traps for monitoring codling moth in orchard by bloom. Apply dispensers no later than petal fall, before first flight. Dispensers last up to 150 days for codling moth and up to 90 days for oriental fruit moth. For information on mating disruption, see OMAFRA Factsheet 03–079, *Mating Disruption for Management of Insect Pests*. Most orchards will require insecticides for one or both codling moth generations. Insecticides for oriental fruit moth may be needed in late cultivars where high populations exist.
Spring-feeding caterpillars	**General Comments:** • Species in this complex include, but are not limited to, redbanded leafroller, eye spotted bud moth, green pug moth, gypsy moth and green fruitworm. Not all products are registered for all species. Refer to the label for registered pests. • Apply if there are 12–15 larvae per 100 terminals. Reapply, if necessary, 10–14 days later according to product label.					
	1B	Imidan WP	2.68 kg/ha	7 days[2,8]/ 14 days[9]/ 30 days[5]	14 days	No product specific comments.
	4A+15	Cormoran	0.84–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	28	Altacor	145–285 g/ha	12 hours	5 days	Use higher rate when pest pressure is high. Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
		Exirel	0.5–1.0 L/ha	12 hours	3 days	
Scab	Use one of the products listed for Scab at **Half-inch green to tight cluster.**					
Powdery mildew	Use one of the products listed for Powdery mildew at **Green tip to half-inch green.**					
Phytophthora crown and root rot	33	Aliette	3–5 kg/ha	when dry	30 days	Apply as foliar spray only. Do not use a drench treatment on bearing trees. Do not use more than 1,000 L/ha. Apply from Tight cluster to pink and again 6 weeks later. Treat again after harvest. Do not tank-mix with copper, adjuvants/surfactants that enhance penetration or foliar fertilizers.
Rust	**General Comments:** • If the alternate host, Eastern red cedar, is nearby, include in sprays up to and including First summer spray.					
	M	Dithane Rainshield or Manzate Pro-stick or Penncozeb 75 Raincoat	2 kg/1,000 L water 6 kg/ha 2 kg/1,000 L water	12 hours 24 hours 24 hours	45 days	No product specific comments.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Tight cluster to pink (cont'd)						
Rust (cont'd)	M (cont'd)	Ferbam 76 WDG	1.25–2.0 kg/ 1,000 L water	12 hours	7 days	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use. May cause russeting on Golden Delicious and other sensitive cultivars.
		Granuflo-T	1.5–2.25 kg/ 1,000 L water	24 hours	28 days	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Polyram DF	6 kg/ha	12 hours	45 days	Last date of use is June 21, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
	3	Fullback 125 SC	585–877 mL/ha	12 hours	14 days	Weak on fruit scab and should be tank-mixed with a compatible protectant fungicide if used after Bloom. See options for apple scab control at **Half-inch green to tight cluster.**
		Nova	340 g/ha	12 hours[2]/ 5 days[4]/ 12 days[5]	14 days	
	3+7	Aprovia Top	643 mL/ha	12 hours	30 days	Weak on fruit scab and should be tank-mixed with a compatible protectant fungicide if used after Bloom. See options for apple scab control at **Half-inch green to tight cluster.**
	3+9	Inspire Super	836 mL/ha	12 hours	14 days	Weak on fruit scab and should be tank-mixed with a compatible protectant fungicide if used after Bloom. See options for apple scab control at **Half-inch green to tight cluster.**
	7	Fontelis	1.0–1.5 L/ha	12 hours	28 days	Contains mineral oil in the formulation. Tank-mixing or rotating with oil-sensitive products (e.g., captan, sulphur) may cause crop safety issues. See label for tank-mix restrictions. Weak on fruit scab and should be tank-mixed with a compatible protectant fungicide if used after Bloom. See options for apple scab control at **Half-inch green to tight cluster.**
	11	Flint	140 g/ha	12 hours[2]/ 4 days[5]	14 days	Weak on fruit scab and should be tank-mixed with a compatible protectant fungicide if used after Bloom. See options for apple scab control at **Half-inch green to tight cluster.** Do not tank-mix or make sequential applications with Exirel.
	29	Allegro 500 F	0.75–1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	Will provide suppression of Quince rust if used at higher rate. Apply at 7–14-day intervals. Do not make more than 3 sequential applications before rotating to another group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Pink						
Rosy apple aphid	Use one of the products listed for Rosy apple aphid at **Half-inch green to tight cluster.** Some products are toxic to bees. Do not apply during bloom or when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
Woolly apple aphid	**General Comments:** • This is a special spray for orchards with a history of high woolly apple aphid damage. • Adults overwinter on the roots and in protected sites on the tree (i.e., loose bark, cankers). In the spring, young aphids crawl to new sites. • Apply in a high-volume spray to ensure thorough coverage of trunk and limbs. • These products are toxic to bees. Do not apply during bloom or when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
	4C	Closer	400 mL/ha	12 hours	7 days	No product specific comments.
	4C+5	Twinguard	500 g/ha	12 hours	7 days	No product specific comments.
Tentiform leafminer	Use one of the products listed for Tentiform leafminer at **Tight cluster to pink.** Some products are toxic to bees. Do not apply during bloom or when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
Plant bug	Use one of the products listed for Plant bug at **Tight cluster to pink.** Some products are toxic to bees. Do not apply during bloom or when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
Spring-feeding caterpillar	Use one of the products listed for Spring-feeding caterpillar at **Tight cluster to pink.** Some products are toxic to bees. Do not apply during bloom or when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
European apple sawfly	**General Comments:** • Apply where there has been a history of damage. • Use 3-D white sticky traps to monitor for sawfly adults. Reapply at petal fall if monitoring indicates populations have reached economic thresholds. • Some products are toxic to bees. Do not apply during bloom or when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
	4A	Assail 70 WP	240 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	Maximum of 2 applications from this group per season. Repeated use may result in mite outbreaks.
		Calypso 480 SC	290 mL/ha	12 hours	30 days	
	4A+15	Cormoran	1.05–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	5	Delegate	420 g/ha	12 hours	7 days	No product specific comments.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Apply with 0.25%–1% oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Pink (cont'd)						
European apple sawfly (cont'd)	28	Exirel	1 L/ha	12 hours	3 days	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
Scab	Use one of the products listed for Scab at **Half-inch green to tight cluster.** Pink through to petal fall is a high-risk period for scab infection. See Table 3–10. *Relationship of Temperature and Moisture to Apple Scab Infection* and the Ontario Crop IPM website at ontario.ca/cropIPM for information on infection periods. Keep new growth covered.					
Powdery mildew	**General Comments:** • Apply fungicides beginning at Green tip and continue to First summer spray. Additional sprays beyond First summer spray may be needed on susceptible cultivars or if disease pressure is severe until terminal bud set. • For resistance management, use a maximum of 2 applications of products per fungicide group from Group 3, 7 and 11 per season.					
	M	Cosavet DF Edge * or Kumulus DF * or Microscopic Sulphur WP * or Microthiol Disperss *	22.5 kg/ha 22.5 kg/ha 6.5 kg/1,000 L water 22.5 kg/ha	24 hours	1 day	May cause an increase in red mite and scale populations. Do not use within 14 days of Purespray Green Spray Oil and 30 days of Vegol Crop Oil or Superior Oil.
	1	Senator 50 SC	250 mL/1,000 L water	12 hours	1 day	No product specific comments.
	3	Cevya	250-375 mL/ha	12 hours	0 days	**Suppression only.**
		Fullback 125 SC	585–877 mL/ha	12 hours	14 days	No product specific comments.
		Nova	340 g/ha	12 hours[2]/ 5 days[4]/ 12 days[5]	14 days	No product specific comments.
	3+7	Aprovia Top	643 mL/ha	12 hours	30 days	No product specific comments.
	3+9	Inspire Super	836 mL/ha	12 hours	14 days	**Suppression only.**
	7	Fontelis	1.0–1.5 L/ha	12 hours	28 days	Contains mineral oil in the formulation. Tank-mixing or rotating with oil-sensitive products (e.g., captan, sulphur) may cause crop safety issues. See label for tank-mix restrictions.
		Sercadis	167–333 mL/ha	12 hours	0 days	Use with a non-ionic surfactant at a rate of 0.125% v/v (e.g., 1.25 L in 1,000 L water).
	7+9	Luna Tranquility	600 mL/ha	12 hours[2]/ 24 hours[5]	14 days	No product specific comments.
	7+11	Pristine WG	1.0–1.2 kg/ha	when dry[2]/ 5 days[4]/ 12 days[5]	5 days	Do not tank-mix or make sequential applications with Exirel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Pink (cont'd)						
Powdery mildew (cont'd)	11	Flint	140–210 g/ha	12 hours[2]/ 4 days[5]	14 days	Do not tank-mix or make sequential applications with Exirel.
		Sovran	240 g/ha	48 hours	30 days	
	19	Diplomat 5 SC	259–926 mL/ha	when dry	0 days	**Suppression only.** Apply preventatively at 7–14-day intervals.
	44	Serenade OPTI *	1.7–3.3 kg/ha	when dry	0 days	**Suppression only.** Apply preventatively at 7–10-day intervals. Use in conjunction with other cultural or chemical controls.
	NC	Buran *	1.2–1.8% v/v (i.e., 9 L in 500–800 L water/ha)	when dry	0 days	Control can be achieved under low to moderate disease pressure with addition of a non-ionic surfactant at a rate of 0.1% v/v. Begin applications preventatively when conditions are conducive to disease development. Reapply every 7–10 days if needed. Do not apply if rain is forecast within 48 hours.
		Oxidate 2.0 *	1% v/v	4 hours	0 days	**Suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
		Purespray Green Spray Oil 13 E *	10 L/1,000 L water	12 hours	—	**Suppression only.** See comments for this product for Powdery mildew at **Green tip to half-inch green.**
		Vegol Crop Oil *	2% v/v	12 hours	0 days	**Suppression only.** See comments for this product for Powdery mildew at **Green tip to half-inch green.**
	P5	Regalia Maxx *	0.125% v/v in 1,000 L water/ha	when dry	0 days	**Suppression only.** Reapply every 7–10 days if conditions are conducive to disease development.
Phytophthora crown and root rot	Use one of the products listed for Phytophthora crown and root rot at **Tight cluster to pink.**					
Rust	Use one of the products listed for Rust at **Tight cluster to pink.**					
Black rot	**General Comments:** • Apply fungicides preventatively to susceptible cultivars in orchards with a history of black rot infections, particularly during wet weather.					
	M	Folpan 80 WDG	3.0–3.75 kg/ha	24 hours	—	May cause russeting to Delicious or other sensitive cultivars when used pink to 30 days after petal fall. Do not use within 14 days of oil.
		Granuflo-T	1.5–2.25 kg/ 1,000 L water	24 hours	28 days	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Pink (cont'd)						
Black rot (cont'd)	M (cont'd)	Maestro 80 DF or Supra Captan 80 WDG	3.75 kg/ha	48 hours	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. These product formulations are currently being phased-out. Last date of use is May 10, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 WSP	3 kg/ha	High density[1]: 2 days[2]/ 6 days[3]/ 15 days[4,5] Standard[6]: 2 days[2]/ 4 days[3]/ 19 days[4]/ 24 days[5]	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. When restricted entry interval exceeds preharvest interval, follow restricted entry interval.
	7+11	Pristine WG	1.0–1.2 kg/ha	when dry[2]/ 5 days[4]/ 12 days[5]	5 days	Do not tank-mix or make sequential applications with Exirel.
	29	Allegro 500 F	1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	**Suppression only.** Apply at 7–14-day intervals. Do not make more than 3 sequential applications before rotating to another group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.
	NC	Oxidate 2.0 *	1% v/v	4 hours	0 days	**Partial suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
Bloom						
DO NOT APPLY INSECTICIDES WHILE APPLE TREES ARE IN BLOOM. SEE *BEE POISONING* IN CHAPTER 1.						
Scab	**General Comments:** • Pink through to petal fall is a high risk period for scab infection. Keep new growth covered. • Rainfall is needed for spore release and leaves/fruit must be wet for infection to occur. The length of the wetting period required for infection varies with temperature. See Table 3–10. *Relationship of Temperature and Moisture to Apple Scab Infection* and the Ontario Crop IPM website at ontario.ca/cropIPM for information on infection periods. • In conditions of rapid growth or high disease pressure, use higher rate and shorter intervals between applications. • For resistance management, use a maximum of 2 applications of products per fungicide group from Group 3, 7 and 11 per season.					

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Bloom (cont'd)						
DO NOT APPLY INSECTICIDES WHILE APPLE TREES ARE IN BLOOM. SEE *BEE POISONING* in Chapter 1.						
Scab (cont'd)	M	Cueva *	1% v/v in 470–940 L water/ha	4 hours	1 day	May cause russeting of light coloured cultivars. If concerned about sensitivity of fruit, test first on a small area.
		Dithane Rainshield or Manzate Pro-stick or Penncozeb 75 Raincoat	2 kg/1,000 L water 6 kg/ha 2 kg/1,000 L water	12 hours	24 hours	No product specific comments.
		Folpan 80 WDG	3.0–3.75 kg /ha	24 hours	—	May cause russeting to Delicious or other sensitive cultivars when used pink to 30 days after petal fall. Do not use within 14 days of oil.
		Granuflo-T	1.5–2.25 kg/ 1,000 L water	24 hours	28 days	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 DF or Supra Captan 80 WDG	3.75 kg/ha	48 hours	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. These product formulations are currently being phased-out. Last date of use is May 10, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 WSP	3 kg/ha	High density[1]: 2 days[2]/ 6 days[3]/ 15 days[4,5] Standard[6]: 2 days[2]/ 4 days[3]/ 19 days[4]/ 24 days[5]	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. When restricted entry interval exceeds preharvest interval, follow restricted entry interval.
		Polyram DF	6 kg/ha	12 hours	45 days	Last date of use is June 21, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
	3	Cevya	250–375 mL/ha	12 hours	0 days	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. Resistance to some Group 3 fungicides has been confirmed in Ontario. Check the status of these products before using them in your orchard. Residues last 5–8 days. Do not use if apple scab is present. These products do not provide good control of fruit scab, so do not use for scab after Bloom.
		Fullback 125 SC plus 1/2 to full rate Group M, where permitted	950 mL/ha See Group M	12 hours	14 days	
		Nova plus 1/2 to full rate Group M, where permitted	340 g/ha See Group M	12 hours[2]/ 5 days[4]/ 12 days[5]	14 days	

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Bloom (cont'd)						
DO NOT APPLY INSECTICIDES WHILE APPLE TREES ARE IN BLOOM. SEE *BEE POISONING* in Chapter 1.						
Scab (cont'd)	3+7	Aprovia Top	386–643 mL/ha	12 hours	30 days	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. See labels for suggested tank-mix partners. Do not use if apple scab is present.
	3+9	Inspire Super plus 1/2 to full rate Group M, where permitted	560–836 mL/ha See Group M	12 hours	14 days	Residues last 5–8 days. Do not use if apple scab is present. These products do not provide good control of fruit scab, so do not use for scab after Bloom.
	7	Fontelis	1.0–1.5 L/ha	12 hours	28 days	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. See labels for suggested tank-mix products. Do not use if apple scab is present. Fontelis contains mineral oil in the formulation. Tank-mixing or rotating with oil-sensitive products (e.g., captan, sulphur) may cause crop safety issues. See label for tank-mix restrictions. Use Sercadis with a non-ionic surfactant at a rate of 0.125% v/v (e.g., 1.25 L in 1,000 L water).
		Kenja 400 SC	913 mL/ha	12 hours	20 days	
		Sercadis	333 mL/ha	12 hours	0 days	
	7+11	Pristine WG plus 1/2 to full rate Group M, where permitted	1.0–1.2 kg/ha See Group M	when dry[2]/ 5 days[4]/ 12 days[5]	5 days	Residues last 5–8 days. Do not use if apple scab is present. Do not tank-mix or make sequential applications with Exirel.
	11	Flint plus 1/2 to full rate Group M, where permitted	140 g/ha See Group M	12 hours[2]/ 4 days[5]	14 days	Resistance to some Group 11 fungicides has been confirmed in Ontario. Check the status of these products before using them in your orchard. Residues last 5–8 days. Do not use if apple scab is present. Do not tank-mix or make sequential applications with Exirel.
		Sovran plus 1/2 to full rate Group M, where permitted	240 g/ha See Group M	48 hours	30 days	
	29	Allegro 500 F	0.5–1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	Apply at 7–14-day intervals. Do not make more than 3 sequential applications before rotating to another group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.
	44	Serenade OPTI *	1.7–3.3 kg/ha	when dry	0 days	**Suppression only.** Apply preventatively at 7–10-day intervals. Use in conjunction with other cultural or chemical controls.
	NC	Buran *	1.8% v/v (i.e., 9 L in 500 L water/ha)	when dry	0 days	**Suppression only.** See comments for this product for Scab at **Half-inch green to tight cluster.**

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Bloom (cont'd)						
DO NOT APPLY INSECTICIDES WHILE APPLE TREES ARE IN BLOOM. SEE *BEE POISONING* in Chapter 1.						
Scab (cont'd)	NC (cont'd)	Oxidate 2.0 *	1% v/v	4 hours	0 days	**Partial suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
Fire blight	**General Comments:** • Models to time fire blight sprays (e.g., Maryblyt, Cougar Blight) are available. See the Ontario Crop IPM website at ontario.ca/cropIPM for more information. Ontario prediction maps are also available on ONfruit at onfruit.ca. • Otherwise, apply sprays if temperatures over 18°C are accompanied by high humidity (over 69%), heavy dews or rainfall. • Spray susceptible cultivars beginning at first bloom until petal fall including rat-tail bloom. • Products are most effective when applied prior to an infection period. Use alone for best results. • For resistance management, rotate between chemical groups.					
	M	Cueva *	1% v/v in 470–940 L water/ha	4 hours	1 day	May cause russeting of light coloured cultivars. If concerned about sensitivity of fruit, test first on a small area. Reapply every 3–7 days if conditions favour disease development.
	24	Kasumin 2L	5.0 L in 1,000 L water/ha	12 hours	90 days	Apply at 20–30% bloom, or when conditions favour disease development. Rotate with another chemical group after 2–3 days if warm, wet conditions (above 18°C) are forecast. If using lower water volumes, refer to the water volume chart on label for rate recommendations.
	25	Streptomycin 17	600 g/1,000 L water	24 hours[2]/ 7 days[7]/ 14 days[5]	50 days	Apply at 20–30% bloom, or when conditions favour disease development. Rotate to another chemical group after 2–3 days if warm, wet conditions (above 18°C) are forecast. Degrades rapidly in UV. May provide some curative or kick-back activity if applied within 24 hours following an infection event.
	44	Double Nickel LC *	5.0–7.5 L/ha	when dry	0 days	**Suppression only.** Apply at 1–5% bloom and reapply every 3–7 days if conditions favour disease development. Can be mixed with copper fungicides to improve control.
		Serenade OPTI *	1.1–1.7 kg/ha	when dry	0 days	**Suppression only.** Apply at 1–5% bloom and repeat as needed if conditions favour disease development. Under high pressure, follow with Streptomycin 2–3 days later.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Bloom (cont'd)						
DO NOT APPLY INSECTICIDES WHILE APPLE TREES ARE IN BLOOM. SEE *BEE POISONING* in Chapter 1.						
Fire blight (cont'd)	NC	Apogee or Kudos 27.5 WDG	450 g/1,000 L water	12 hours	45 days	Reduces vegetative growth, making trees less susceptible to fire blight shoot infection. Has no impact on blossom blight or fire blight bacteria but can slow spread to shoot should blossom infection occur. Apply in late bloom or king bloom petal fall when terminal shoots are 2.5–5.5 cm long. Must be applied at least 10 days before occurrence of conditions favourable to shoot infection. Accurate timing is critical. Reapply 14–21 days later. Uptake can be enhanced with the addition of 0.05% v/v non-ionic surfactant. In plantings with low vigour, a reduction in shoot growth caused by the high rate for fire blight suppression may be undesirable. Do not tank-mix with calcium. Severe cracking can occur on Empire and Stayman cultivars and decrease in yield in Cortland.
		Blossom Protect *	See comments	when dry	0 days	For every 1 m of tree height, dilute 5.25 kg Component A in 500 L/ha water and add dilution to 0.75 kg Component B. If a forecast system is available, apply 1–2 days before an infection date. Repeat after 2 days and up to 5 times if infection continues. If no forecast system is available, apply at 10, 40, 70 and 90% open blossoms. This product is sensitive to fungicides and may have reduced efficacy if tank-mixed or applied within 2 days of certain products. See label for further details. Russeting may occur on sensitive cultivars. Do not apply more than 2 times on Golden Delicious, Idared and Jonagold or to control rat-tail blossom.
		Oxidate 2.0 *	1% v/v	4 hours	0 days	**Partial suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
Russeting	NC	Promalin SL	250–500 mL/ha	12 hours	28 days	Apply at 7–12-day intervals, beginning at full bloom to petal fall. In long cold, wet or humid periods during bloom, use higher rate and shorten intervals between applications. Apply during periods of slow drying conditions to maximize efficacy. Do not use when temperatures are below freezing, above 30°C or if rain is forecast within 6 hours. Promalin cannot reduce russeting caused by frost damage, disease, herbicide drift or phytotoxicity. Visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops*.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Bloom (cont'd)						
DO NOT APPLY INSECTICIDES WHILE APPLE TREES ARE IN BLOOM. SEE *BEE POISONING* in Chapter 1.						
Fruit shape	**General Comments:** • Apply during slow drying conditions. • Spray first application or only application between full king bloom and early petal fall. • Do not use when temperatures are below freezing, above 30°C or if rain is forecast within 6 hours. • These products may increase the amount of thinning achieved with subsequent blossom thinning sprays. • Visit ontario.ca/apples and click on *Thinning in Tree Fruit* for more information.					
	NC	Perlan	1.2–2.3 L/ha	12 hours	28 days	For use on Red Delicious only. Apply between 40–80% king bloom and early petal fall. If a prolonged bloom occurs, apply 1.2 L/ha and reapply 5–7 days later.
		Promalin SL	0.6–2.3 L/ha	12 hours	28 days	Use on fruit that has a natural typiness like Red Delicious, Golden Delicious, Ambrosia and Gala to elongate fruit and develop more prominent calyx lobes. Apply a single application of 1.2–2.3 L/ha between early king bloom and early petal fall of side blooms. Alternatively, if a prolonged bloom occurs, apply two applications of 0.6–1.2 L/ha between early king bloom to early petal fall of side blooms and 3–21 days later (or when the rest of the canopy is in bloom).
Vegetative growth control	NC	Apogee or Kudos 27.5 WDG	270–450 g/ 1,000 L water	12 hours	45 days	Apply in late bloom or early petal fall when terminal and/or bourse shoots are 2.5–5 cm long. Accurate timing is critical. Use higher rate for medium to high vigour trees. See Table 3–13. *Suggested Apogee or Kudos 27.5 WDG Rates (g product per ha)*. Reapply at 14–21-day intervals if needed. Uptake can be enhanced with the addition of 0.05% v/v non-ionic surfactant. Do not tank-mix with calcium. Do not apply more than 2.7 kg/ha within 21 days of application. Severe cracking can occur on Empire and Stayman cultivars and decrease in yield in Cortland. Apogee may cause trees to retain more fruit. Consider a more aggressive thinning program if needed. Visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops*.
Petal fall (Calyx) when most petals have fallen Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests*.						
European red mite	**General Comments:** • Presence of beneficial insects should be considered before applying a spray. For more information on beneficial insects, see the Ontario Crop IPM website at ontario.ca/cropipm. • Thorough spray coverage is essential for good control. • Miticides are best applied alone. • For resistance management, do not use more than once per season. See Table 3–8. *Activity of Miticides Registered on Apple and/or Pear in Ontario*.					

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
European red mite (cont'd)	6	Agri-Mek SC	170 mL/ha	12 hours	28 days	Apply before a threshold of 5 mites per leaf is reached, no later than 21 days after petal fall. Apply with 10 L of oil and a minimum of 1,000 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not apply within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Apply before a threshold of 5 mites per leaf is reached, no later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	10	Apollo SC	300 mL/ha	12 hours[2]/ 48 hours[5]	21 days[10]	Apply when mites are mostly in the egg stage and before there are more than 3 active mites per leaf.
	20B	Kanemite 15 SC	2.07 L/ha	12 hours[2]/ 5 days[5]	14 days	Apply when there are 5–7 active mites per leaf.
	20D	Acramite 50 WS	851 g/ha (3.75 pouches/ha)	12 hours	7 days	Apply when there are 5–7 active mites per leaf.
	21	Nexter SC	500 mL/ha	24 hours	25 days	Apply when there are 5–7 active mites per leaf. Also controls apple rust mites.
	23	Envidor 240 SC	750 mL/ha	12 hours	7 days	Apply when there are 5–7 active mites per leaf. Control may not be apparent for up to 1 week. Also controls apple rust mites.
	25	Nealta	1 L/ha	12 hours	7 days	Apply as mite populations begin to build, before mite damage is observed. The use of a registered adjuvant may improve performance.
	29	Allegro 500 F	0.75–1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	When used to control listed diseases, may provide mite suppression. Do not mix with oil. This product is persistent. Where possible, do not use in consecutive years.
	NC	Kopa *	2% v/v in 700–1,000 L water	12 hours	12 hours	Begin applications when populations are low and reapply every 1–3 weeks as needed. Test a small area of each variety prior to spraying the whole block. These products must coat the bodies of susceptible, soft-bodied insects to be effective. Good coverage of all sides of plant parts is critical. Applying soaps more than 3 times may cause plant injury. Avoid application in direct sunlight or to trees under stress. Application within 3 days of sulphur may increase plant injury on sensitive varieties.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
European red mite (cont'd)	NC (cont'd)	Purespray Green Spray Oil 13 E *	10 L/1,000 L water	12 hours	—	**European red mite only. Suppression only.** See comments for this product for European red mite at **Half-inch green to tight cluster.**
		Vegol Crop Oil *	2% v/v	12 hours	0 days	See comments for this product for European red mite at **Half-inch green to tight cluster.**
Rosy apple aphid	**General Comments:** • Spray if 20 or more clusters in a 100-cluster sample are infested. • Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • Some of these products are toxic to bees. Do not apply when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
	4A	Actara 25 WG	160 g/ha	12 hours	60 days	Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks. Last date of use for Actara, Admire, Alias and Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Admire 240 Flowable or Alias 240 SC	230 mL/ha	24 hours	7 days	
		Assail 70 WP	120 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	
		Calypso 480 SC	145–290 mL/ha	12 hours	30 days	
		Clutch 50 WDG	140–210 g/ha	12 hours	7 days	
	4A+15	Cormoran	0.7–1.05 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C	Closer	100–200 mL/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.
	4C+5	TwinGuard	250 g/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.
	4D	Sivanto Prime	500–750 mL/ha	12 hours	14 days	Where possible, rotate with products outside of Group 4.
	9D	Versys	100 mL/ha	12 hours	7 days	Apply in a minimum of 1,000 L/ha water.
	23	Movento 240 SC	365 mL/ha	12 hours	7 days	Control may not be apparent for 2–3 weeks. Tank-mix with an adjuvant/ additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not tank-mix with sulphur.
	28	Exirel	1.5 L/ha	12 hours	3 days	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
	29	Beleaf 50 SG	160 g/ha	12 hours[2]/ 48 hours[5]	21 days	Apply before populations reach economic threshold. Reapply 7 days later if monitoring indicates a need. Do not use with adjuvants.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
Rosy apple aphid (cont'd)	NC	Kopa *	2% v/v in 700–1,000 L water	12 hours	12 hours	See comments for this product for Rosy apple aphid at **Half-inch green to tight cluster.**
		Purespray Green Spray Oil 13 E *	10 L/1,000 L water	12 hours	—	**Suppression only.** See comments for this product for Rosy apple aphid at **Half-inch green to tight cluster.**
		Vegol Crop Oil *	2% v/v	12 hours	0 days	See comments for this product for Rosy apple aphid at **Half-inch green to tight cluster.**
Tentiform leafminer	**General Comments:** • Some of these products are toxic to bees. Do not apply when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
	3	Ambush 500 EC or Perm-Up EC or Pounce 384 EC	400 mL/ha 520 mL/ha 520 mL/ha	when dry	7 days	If egg hatch is delayed, apply at Petal fall (calyx) when first sap-feeding miner is detected. These products are highly toxic to beneficial insects and may lead to mite outbreaks. Maximum of 1 application of product from this group per season.
		Decis 5 EC	250 mL/ha	12 hours	1 day	
		Mako or Up-Cyde 2.5 EC	250 mL/ha 400 mL/ha	12 hours	7 days	
		Matador 120 EC or Silencer 120 EC	83 mL/ha	24 hours	7 days	
	4A	Actara 25 WG	315 g/ha	12 hours	60 days	Apply when population is mainly in the sap-feeder stage. Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks. Last date of use for Actara, Admire, Alias and Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Admire 240 Flowable or Alias 240 SC	380 mL/ha	24 hours	7 days	
		Assail 70 WP	80 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	
		Calypso 480 SC	145 mL/ha	12 hours	30 days	
		Clutch 50 WDG	140–210 g/ha	12 hours	7 days	
	4A+15	Cormoran	700 mL/ha	12 hours[2]/ 7 days[5]	14 days	Apply when population is mainly in the sap-feeder stage. Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	250–500 g/ha	12 hours	7 days	Apply at egg hatch or at first sign of sap-feeder stage. Where possible, rotate with products outside of Group 4 between generations.
	5	Delegate	420 g/ha	12 hours	7 days	Apply when population is mainly in the sap-feeder stage.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
Tentiform leafminer (cont'd)	6	Agri-Mek SC	170 mL/ha	12 hours	28 days	Apply at egg hatch or at first sign of sap-feeder stage. Do not apply later than 21 days after petal fall. Apply with 10 L of oil and a minimum of 1,000 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Apply at egg hatch or at first sign of sap-feeder stage. Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	28	Altacor	215 g/ha	12 hours	5 days	Apply when population is mainly in the sap-feeder stage. Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
		Exirel	500–750 mL/ha	12 hours	3 days	
Leafcurling midge	**General Comments:** • This is a special spray for orchards where there is a history of damage. • Place pheromone traps in orchard at pink and begin monitoring for yellow eggs in the newest unfurled leaves. Apply an insecticide shortly after upswing in pheromone trap catches or when eggs have been found, which often coincides with petal fall. • See Table 3–4. *Activity of Insecticides and Miticides on Apple Pests* for efficacy of products.					
	3	Mako or Up-Cyde 2.5 EC	250 mL/ha 400 mL/ha	12 hours	7 days	Maximum of 1 application of product from this group per season. These products are highly toxic to beneficial insects and may lead to mite outbreaks. Do not apply when bees are active in the orchard.
	23	Movento 240 SC	365–585 mL/ha	12 hours	7 days	**Suppression only.** Control may not be apparent for 2–3 weeks. Under high pest pressure, use higher rate and reapply 2 weeks later. Tank-mix with an adjuvant/additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not tank-mix with sulphur.
Mullein bug	**General Comments:** • Monitor susceptible cultivars such as Red Delicious, Spartan, Northern Spy, Empire, Cortland, Gala, Jonagold and Golden Delicious. • Apply controls where 7–9 nymphs are caught per 25 tree taps. • Damage is not of concern once fruit is larger than dime- to quarter-sized. • Reapply, if necessary, in 10–14 days according to product label. • Some of these products are toxic to bees. Do not apply when bees are active in the orchard. Refer to label for specific bee toxicity statements.					

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
Mullein bug (cont'd)	4A	Actara 25 WG	315 g/ha	12 hours	60 days	Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks. Last date of use for Actara, Admire and Alias is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Admire 240 Flowable or Alias 240 SC	380 mL/ha	24 hours	7 days	
		Assail 70 WP	80–160 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	
		Calypso 480 SC	290 mL/ha	12 hours	30 days	
	4A+15	Cormoran	0.84–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C	Closer	400 mL/ha	12 hours	7 days	No product specific comments.
	4C+5	Twinguard	500 g/ha	12 hours	7 days	No product specific comments.
Plum curculio	**General Comments:** • Apply when monitoring indicates plum curculio is in the orchard or at first sign of feeding damage after bloom. Unless stated otherwise in the product specific comments, reapply, if necessary in 10–14 days according to the product label. • Some of these products are toxic to bees. Do not apply when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
	1B	Imidan WP	2.68 kg/ha	7 days[2,8]/ 14 days[9]/ 30 days[5]	14 days	Can be applied as a border spray if population is not resident in the orchard.
	4A	Actara 25 WG	385 g/ha	12 hours	60 days	Do not use as a border spray. Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks. Last date of use for Actara and Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Assail 70 WP	120–240 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	
		Calypso 480 SC	440 mL/ha	12 hours	30 days	
		Clutch 50 WDG	210 g/ha	12 hours	7 days	
	4A+15	Cormoran	1.05–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	**Suppression only.**
	28	Exirel	1.0–1.5 L/ha	12 hours	3 days	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
Plum curculio (cont'd)	28 (cont'd)	Harvanta 50 SL	1.2–1.6 L/ha	12 hours	7 days	**Suppression only.** This product is persistent. Where possible, do not use in consecutive years.
	NC	Surround WP *	50 kg/ha	12 hours	0 days	Must be applied before plum curculio is present. Make 2 initial applications at 50 kg/ha, 7 days apart, to establish a base layer. Continue at 7–14-day intervals, using a reduced rate of 25 kg/ha, to maintain even coverage of developing fruits. Do not use as a border spray. Light to moderate rain will help distribute product. Reapply after heavy rain, strong wind or overhead irrigation. White film will remain on fruit if applied near harvest unless crop will be washed and waxed. May delay sugar accumulation. Do not use with anti-foaming agents, spreader/stickers or summer oils.
European apple sawfly	**General Comments:** • Apply where there has been a history of damage. • Use 3-D white sticky traps to monitor for sawfly adults. If a prebloom insecticide has been applied, spray postbloom when 6 sawflies have been caught per trap. Where no prebloom insecticides have been applied, spray postbloom when 3 sawflies have been caught per trap. • Some of these products are toxic to bees. Do not apply when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
	4A	Assail 70 WP	240 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	Maximum of 2 applications from this group per season. Repeated use may result in mite outbreaks.
		Calypso 480 SC	290 mL/ha	12 hours	30 days	
	4A+15	Cormoran	1.05–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Do not reapply less than 12 days apart. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	5	Delegate	420 g/ha	12 hours	7 days	No product specific comments.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	28	Altacor	215 g/ha	12 hours	5 days	No product specific comments.
		Exirel	1 L/ha	12 hours	3 days	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
Obliquebanded leafroller	**General Comments:** • Spray overwintering obliquebanded leafroller in orchards with historical pest problems or high pest pressure (1–2% of the terminals or buds have larvae or damage). • Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • Place pheromone traps in orchards at petal fall to monitor emergence of summer-generation obliquebanded leafroller.					
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	No product specific comments.
	5	Delegate	420 g/ha	12 hours	7 days	No product specific comments.
		Entrust * or Success	364 mL/ha 182 mL/ha	when dry	7 days	No product specific comments.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	11	Bioprotec CAF * or Dipel 2X DF * or Foray 48 BA or XenTari WG *	4 L/ha 1.12 kg/ha 2.8 L/ha 0.5–1.6 kg/ha	12 hours	0 days	Product must be consumed to be effective. Spray when and where pests are actively feeding. Apply in a high-volume spray to ensure thorough coverage on both sides of the leaf. Apply to young larvae, early in infestation. Death of insect may take several days. Reapply at 5–7-day intervals if larvae activity is extended. Acidify spray mix to below pH 7.0 and apply on cloudy days or in the evening.
	18	Confirm 240 F	1 L/ha	12 hours	14 days	Cross-resistance to this group and pyrethroids may be possible in organophosphate-resistant populations.
		Intrepid	750 mL/ha	12 hours	14 days	
	28	Altacor	285 g/ha	12 hours	5 days	Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions. Harvanta is persistent. Where possible, do not use in consecutive years.
		Exirel	0.5–1.0 L/ha	12 hours	3 days	
		Harvanta 50 SL	1.2–1.6 L/ha	12 hours	7 days	
Oriental fruit moth	**General Comments:** • This is a special spray for orchards where there is a history of damage. • Adjust spray timing based on monitoring. Apply insecticides 6–10 days after upswing in pheromone trap captures, which often coincides with petal fall. Reapply, if necessary, in 10–14 days according to product label. • Alternatively, accumulate degree-days Celcius (DDC, base 7.2°C) at first sustained moth catch (biofix) and apply insecticides targeting first-generation larvae. For information on calculating degree days, see *Degree-Day Modeling* in Chapter 2. • If an insecticide is used at this time to manage oriental fruit moth, mating disruption may be delayed until mid-June. • Some of these products are toxic to bees. Do not apply when bees are active in the orchard. Refer to label for specific bee toxicity statements.					

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
Oriental fruit moth (cont'd)	3	Decis 5 EC	250 mL/ha	12 hours	1 day	Apply at 194–208 DDC or earlier if using as an ovi-larvicide. Highly toxic to beneficial insects and may lead to mite outbreaks. Maximum of 1 application per season. Apply in 3,000 L water.
	4A	Assail 70 WP	240 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	Apply at 139–153 DDC for eggs or larvae. Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks.
		Calypso 480 SC	440 mL/ha	12 hours	30 days	
	4A+15	Cormoran	1.05–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Apply at 111–139 DDC. Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	Apply at 194–208 DDC or earlier if using as an ovi-larvicide. Where possible, rotate with products outside of Group 4 between generations.
	5	Delegate	420 g/ha	12 hours	7 days	Apply at 194–208 DDC or earlier if using as an ovi-larvicide.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Apply at 194–208 DDC or earlier if using as an ovi-larvicide. Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	15	Rimon 10 EC	1.4 L/1,000 L water	12 hours	14 days	Apply at 111–139 DDC. Use for first generation only. See label for additional information on rates and volumes. Do not allow Rimon to drift onto grapes as leaf spotting may occur.
	18	Intrepid	1 L/ha	12 hours	14 days	Apply at 139–153 DDC for eggs or larvae.
	28	Altacor	215 g/ha	12 hours	5 days	Apply at 194–208 DDC or earlier if using as an ovi-larvicide. Do not tank-mix or make sequential applications of Exirel with strobilurin, copper or captan fungicides. See product label for other tank-mix restrictions. Harvanta is persistent. Where possible, do not use in consecutive years.
		Exirel	500–750 mL/ha	12 hours	3 days	
		Harvanta 50 SL	1.2–1.6 L/ha	12 hours	7 days	

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
Codling moth (eggs)	**General Comments:** • This is a targeted spray using insecticides with ovi-larvical activity which must be absorbed by eggs or ingested by larvae to interfere with regular insect growth or development. • Apply at petal fall and reapply 10–14 days later according to product label if monitoring indicates a need. • These products are toxic to bees and bee colonies. Do not apply when bees are active in the orchard. • Do not allow these products to drift onto grapes as leaf spotting may occur.					
	4A+15	Cormoran	1.05–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha.
	15	Rimon 10 EC	1.4 L/1,000 L water	12 hours	14 days	Use for first generation only. See label for additional information on rates and volumes.
Dogwood borer	NC	Isomate DWB	250–375 dispensers/ha	—	—	Apply before adult borer emergence (end of May). Use higher rate for high-pressure areas or initial year of treatment. For information on mating disruption, see OMAFRA Factsheet 03–079, *Mating Disruption for Management of Insect Pests.*
Scab	Use one of the products listed for Scab at **Bloom.** Cueva may cause russeting of light coloured cultivars. Use 0.8% solution if fruit is present. Do not use Sercadis after Petal fall (Calyx).					
Powdery mildew	Use one of the products listed for Powdery mildew at **Pink.** Do not use Sercadis after Petal fall (Calyx). Use caution with sulphur and oil during hot weather.					
Rust	Use one of the products listed for Rust at **Tight cluster to pink.**					
Black rot	Use one of the products listed for Black rot at **Pink.**					
Bitter rot	**General Comments:** • Apply fungicides preventatively to susceptible cultivars, such as Empire, Ambrosia, Honeycrisp and Golden Delicious, in orchards with a history of infections. • Warm, wet weather during fruit maturity favours disease development.					
	M	Granuflo-T	1.5–2.25 kg/ 1,000 L water	24 hours	28 days	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 DF or Supra Captan 80 WDG	3.75 kg/ha	48 hours	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. These product formulations are currently being phased-out. Last date of use is May 10, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
Bitter rot (cont'd)	M (cont'd)	Maestro 80 WSP	3 kg/ha	High density[1]: 2 days[2]/ 6 days[3]/ 15 days[4,5] Standard[6]: 2 days[2]/ 4 days[3]/ 19 days[4]/ 24 days[5]	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. When restricted entry interval exceeds preharvest interval, follow restricted entry interval.
	7+11	Pristine WG	1.0–1.2 kg/ha	when dry[2]/ 5 days[4]/ 12 days[5]	5 days	Do not tank-mix or make sequential applications with Exirel.
	29	Allegro 500 F	0.75–1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	Apply at 7–14-day intervals. Do not make more than 3 sequential applications before switching to another group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.
	P5	Regalia Maxx *	0.125% v/v in 1,000 L water/ha	when dry	0 days	**Suppression only.** Reapply every 7–10 days if conditions are conducive to disease development.
Alternaria blotch	**General Comments:** • This disease is not typically an economically damaging issue in Ontario. • Apply fungicides preventatively to susceptible cultivars such as Delicious strains in orchards with a history of Alternaria blotch.					
	M	Folpan 80 WDG	3.0–3.75 kg/ha	24 hours	—	May cause russeting to Delicious or other sensitive cultivars when used pink to 30 days after petal fall. Do not apply within 14 days of oil.
	3+7	Aprovia Top	643 mL/ha	12 hours	30 days	No product specific comments.
	29	Allegro 500 F	0.75–1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	Apply at 7–14-day intervals. Do not make more than 3 sequential applications before switching to another group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.
Fly speck, Sooty blotch	**General Comments:** • Begin fungicide coverage for these diseases at Petal fall (calyx) if fly speck and sooty blotch were a problem in the past. • While infection occurs shortly after petal fall, symptoms do not appear until mid- to late summer.					

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests.*						
Fly speck, Sooty blotch (cont'd)	M	Folpan 80 WDG	3.0–3.75 kg/ha	24 hours	—	May cause russeting to Delicious or other sensitive cultivars when used pink to 30 days after petal fall. Do not use within 14 days of oil.
		Granuflo-T	1.5–2.25 kg/ 1,000 L water	24 hours	28 days	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 DF or Supra Captan 80 WDG	3.75 kg/ha	48 hours	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. These product formulations are currently being phased-out. Last date of use is May 10, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 WSP	3 kg/ha	High density[1]: 2 days[2]/ 6 days[3]/ 15 days[4,5] Standard[6]: 2 days[2]/ 4 days[3]/ 19 days[4]/ 24 days[5]	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. When restricted entry interval exceeds preharvest interval, follow restricted entry interval.
	3+7	Aprovia Top	643 mL/ha	12 hours	30 days	Weak on fruit scab and should be tank-mixed with a protectant fungicide. See options for apple scab control at **Bloom.**
	3+9	Inspire Super	836 mL/ha	12 hours	14 days	Weak on fruit scab and should be tank-mixed with a protectant fungicide. See options for apple scab control at **Bloom.**
	7+11	Pristine WG	600–800 g/ha	when dry[2]/ 5 days[4]/ 12 days[5]	5 days	Weak on fruit scab and should be tank-mixed with a protectant fungicide. See options for apple scab control at **Bloom.** Do not tank-mix or make sequential applications with Exirel.
	11	Flint	140 g/ha	12 hours[2]/ 4 days[5]	14 days	Weak on fruit scab and should be tank-mixed with a protectant fungicide. See options for apple scab control at **Bloom.** Do not tank-mix or make sequential applications with Exirel.
	29	Allegro 500 F	0.5–1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	Apply at 7–14-day intervals. Do not make more than 3 sequential applications before rotating with another group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Petal fall (Calyx) when most petals have fallen (cont'd) Some products control more than one pest. See Table 3–7. *Activity of Petal Fall Insecticides Against Orchard Pests*.						
Fly speck, Sooty blotch (cont'd)	33	Phostrol	4.4 L/ha	12 hours	1 day	Reapply on a 7–14-day interval if conditions are conducive to disease development.
	P5	Regalia Maxx *	0.125% v/v in 1,000 L water/ha	when dry	0 days	**Suppression only.** Reapply every 7–10 days if conditions are conducive to disease development.
Blister spot	33	Aliette	2 kg/ha	when dry	30 days	Apply preventatively to susceptible cultivars such as Mutsu/Crispin, Jonagold and Golden Delicious. Begin applications at Petal fall (calyx) with 1–2 subsequent sprays at 7-day intervals. Do not mix with copper.
Russeting	Use one of the products listed for Russeting at **Bloom.**					
Fruit size	NC	Cilis Plus	0.5–2.5 L/ 1,000 L water	12 hours	28 days	Make 2–4 applications at 3–10-day intervals. May cause thinning in easy to thin cultivars. Use a high-volume spray to ensure thorough coverage. Apply when temperatures are greater than 20°C during and after application. Visit ontario.ca/apples and click on *Thinning of Tree Fruit* for more information.
		MaxCel	0.55–2.65 L/ 1,000 L water	12 hours	86 days	
Fruitlet thinning	**General Comments:** • Apply during warm, slow drying conditions to maximize absorption. • See Table 3–11. *Suggested Rates for Chemical Thinning of Mature Apple Trees*. • Visit ontario.ca/apples and click on *Thinning of Tree Fruit* for more information.					
	NC	Cilis Plus	3.75–10.1 L/ 1,000 L water	12 hours	28 days	See Table 3–12. *Suggested Rates of MaxCel or Cilis Plus to Use With or Without Sevin XLR*. Apply when fruitlets are 5–15 mm in diameter. Maximum 2 applications per season for thinning. Apply when temperatures are greater than 20°C during and after application.
		MaxCel	3.95–10.65 L/ 1,000 L water	12 hours	86 days	
		Fruitone -L	39–310 mL/ 1,000 L water	when dry	5 days	Apply between petal fall (3–7 mm fruit size) and early fruit set (8–10 mm fruit size) but most effective when the king fruitlets are 5–10 mm. Applying too soon can cause excessive thinning of Empire. Apply between 21°C and 24°C. Do not apply below 15.6°C or above 26.7°C.
Enhanced return bloom	NC	Maxcel	3.95–10.65 L/ 1,000 L water	12 hours	86 days	See Table 3–12. *Suggested Rates of MaxCel or Cilis Plus to Use With or Without Sevin XLR*. Apply when fruitlets are 5–15 mm in diameter. Maximum 2 applications per season. Apply when temperatures are greater than 20°C during and after application.
		Fruitone-L	39–310 mL/ 1,000 L water	when dry	5 days	Apply between petal fall (3–7 mm fruit size) and early fruit set (8–10 mm fruit size). Most effective when the king fruitlets are 5–10 mm. Applying too soon can cause excessive thinning of Empire. Apply between 21°C and 24°C. Do not apply below 15.6°C or above 26.7°C.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
First summer spray – 7–14 days after Petal fall (Calyx)						
European red mite, Two-spotted spider mite	**General Comments:** • Presence of beneficial insects should be considered before applying spray. For more information on beneficial insects, see the Ontario Crop IPM website at ontario.ca/cropipm. • Thorough spray coverage is essential for good control. • Miticides are best applied alone. • For resistance management, do not use more than once per season. See Table 3–8. *Activity of Miticides Registered on Apple and/or Pear in Ontario*.					
	6	Agri-Mek SC	170 mL/ha	12 hours	28 days	Apply before a threshold of 5 mites per leaf is reached, no later than 21 days after petal fall. Apply with 10 L of oil and a minimum of 1,000 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not apply within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Apply before a threshold of 5 mites per leaf is reached, no later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	10	Apollo SC	300 mL/ha	12 hours[2]/ 48 hours[5]	21 days[10]	Apply when mites are mostly in the egg stage and before there are more than 3 active mites per leaf.
	20B	Kanemite 15 SC	2.07 L/ha	12 hours[2]/ 5 days[5]	14 days	Apply when there are 5–7 active mites per leaf.
	20D	Acramite 50 WS	568 g/ha (2.5 pouches/ha) or 851 g/ha (3.75 pouches/ha)	12 hours	7 days	Apply when there are 5–7 active mites per leaf. Use lower rate for two-spotted spider mite and higher rate for European red mite.
	21	Nexter SC	0.5–1.0 L /ha	24 hours	25 days	Apply when there are 5–7 active mites per leaf. Use lower rate for European red mite and higher rate for two-spotted spider mite. Also controls apple rust mites.
	23	Envidor 240 SC	750 mL/ha	12 hours	7 days	Apply when there are 5–7 active mites per leaf. Control may not be apparent for up to 1 week. Also controls apple rust mites.
	25	Nealta	1 L/ha	12 hours	7 days	Apply as mite populations begin to build, before mite damage is observed. The use of a registered adjuvant may improve performance.
	29	Allegro 500 F	0.75–1.0 L/ha	24 hours[1]/ 72 hours[2]	28 days	When used to control listed diseases, may provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
First summer spray – 7–14 days after Petal fall (Calyx) (cont'd)						
European red mite, Two-spotted spider mite (cont'd)	NC	Kopa *	2% v/v in 700–1,000 L water	12 hours	12 hours	See comments for this product for European red mite at **Petal fall (Calyx).**
		Purespray Green Spray Oil 13 E *	10 L/1,000 L water	12 hours	—	**European red mite only. Suppression only.** See comments for this product for European red mite at **Half-inch green to tight cluster.**
		Vegol Crop Oil *	2% v/v	12 hours	0 days	See comments for this product for European red mite at **Half-inch green to tight cluster.**
Rosy apple aphid	Use one of the products listed for Rosy apple aphid at **Petal fall (calyx).** At this timing, Clutch 50 WDG applied at 210–420 g/ha provides suppression of oriental fruit moth and codling moth.					
Woolly apple aphid	**General Comments:** • Spray if aphid colonies are close to fruit clusters or on young trees and nursery stock. • Apply in a high-volume spray to ensure thorough coverage of trunk and limbs. • Reapply after 14 days if woolly apple aphid is still present.					
	1B	Malathion 85 E	610 mL/1,000 L water	12 hours[2]/ 48 hours[4]/ 72 hours[5]	3 days	May cause injury to McIntosh and Cortland if applied within 4 weeks of harvest.
	4C	Closer	400 mL/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.
	23	Movento 240 SC	365 mL/ha	12 hours	7 days	Control may not be apparent for 2–3 weeks. Tank-mix with an adjuvant/ additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not tank-mix with sulphur.
San Jose scale	**General Comments:** • Apply when the crawlers are active in orchards with a history of scale. In Ontario, first generation crawler activity typically begins mid- to late June and can continue for 4–6 weeks. Unless stated otherwise in product specific comments, reapply in 14 days. • Pheremone traps for adult flight and degree-days Celcius (DDC) can be used to determine optimal spray timing. Place traps in orchard at pink. Crawler activity should begin 222 DDC (base 10.5°C) after first adult catch. For information on calculating degree days, see *Degree-Day Modeling* in Chapter 2. • Thorough coverage of trunk and limbs is essential for good control. • These products are toxic to bees. Do not apply when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
	4C	Closer	400 mL/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4 between generations.
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4 between generations.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
First summer spray – 7–14 days after Petal fall (Calyx) (cont'd)						
San Jose scale (cont'd)	4D	Sivanto Prime	0.75–1.0 L/ha plus 0.25% v/v oil	12 hours	14 days	If using oil, may cause bark injury on some cultivars, such as Red Delicious, Empire and Mutsu/Crispin. Do not use oil within 14 days of Supra Captan, Maestro, Folpan or sulphur. Do not apply when temperatures exceed 30°C, to crops under moisture stress or just prior to rain. Where possible, rotate with products outside of Group 4 between generations.
	23	Movento 240 SC	365 mL/ha	12 hours	7 days	Control may not be apparent for 2–3 weeks. Apply 1–2 weeks before expected crawler emergence. Tank-mix with an adjuvant/additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not tank-mix with sulphur.
	NC	Kopa *	2% v/v in 700–1,000 L water	12 hours	12 hours	Begin applications when crawler activity begins and reapply every 1–3 weeks as needed. Test a small area of each variety prior to spraying the whole block. This product must coat the bodies of susceptible, soft-bodied insects to be effective. Good coverage is critical. Applying soaps more than 3 times may cause plant injury. Avoid application in direct sunlight or to trees under stress. Application within 3 days of sulphur may increase plant injury on sensitive varieties.
Plum curculio	Use one of the products listed for Plum curculio at **Petal fall (Calyx).**					
Codling moth (first generation larva)	**General Comments:** • Apply as a full cover spray. • Use pheromone traps to time sprays. Apply insecticides between the specified degree-days Celcius (DDC, base 10°C) after first sustained moth catch. For information on calculating degree days, see *Degree-Day Modeling* in Chapter 2. Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label.					
	1B	Imidan WP	2.68 kg/ha	7 days[2,8]/ 14 days[9]/ 30 days[5]	14 days	Apply at 138 DDC.
	4A	Assail 70 WP	170 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	Apply at 111–138 DDC. Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks.
		Calypso 480 SC	440 mL/ha	12 hours	30 days	
	4A+15	Cormoran	1.05–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Apply at 111–138 DDC. Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
First summer spray – 7–14 days after Petal fall (Calyx) (cont'd)						
Codling moth (first generation larva) (cont'd)	4C+5	TwinGuard	500 g/ha	12 hours	7 days	Apply at 138 DDC. Where possible, rotate with products outside of Group 4 between generations.
	5	Delegate	420 g/ha	12 hours	7 days	Apply at 138 DDC.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Apply at 83–111 DDC. Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	18	Confirm 240 F	1 L/ha	12 hours	14 days	Apply at 83–111 DDC.
		Intrepid	1 L/ha	12 hours	14 days	
	28	Altacor	215 g/ha	12 hours	5 days	Apply at 138 DDC.
		Exirel	500–750 mL/ha	12 hours	3 days	Apply at 83–111 DDC. Do not tank-mix or make sequential applications with strobilurin, copper or captan fungicides. See product label for other tank-mix restrictions.
		Harvanta 50 SL	1.2–1.6 L/ha	12 hours	7 days	Apply at 83–111 DDC. This product is persistent. Where possible, do not use in consecutive years.
	NC	CYD-X *	250 mL/ha	12 hours	0 days	May provide control of codling moth when used in conjunction with other active ingredients. Virus must be ingested to be effective. After death, larvae will disintegrate and release new viral bodies which may infect other codling moth larvae. Apply in late afternoon or on a cloudy day to avoid exposure to sunlight. Reapply every 7–14 days. Target early egg hatch.
		Virosoft CP-4 *	250 mL/ha	12 hours	—	
Scab	Use one of the products listed for scab at **Bloom.** An extra scab spray may be required between Petal fall (Calyx) and First summer spray. Cueva may cause russeting of light-skinned cultivars. Use a 0.8% solution if fruit is present. Do not use Sercadis after Petal fall (Calyx).					
Powdery mildew	Use one of the products listed for Powdery mildew at **Pink.** Do not use Sercadis after Petal fall (Calyx). Use caution with sulphur or oil sprays during hot weather.					
Black rot	Use one of the products listed for Black rot at **Pink.**					
Bitter rot	Use one of the products listed for Bitter rot at **Petal fall (Calyx).**					
Fly speck, sooty blotch	Use one of the products listed for Fly speck, sooty blotch at **Petal fall (Calyx).**					

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
First summer spray – 7–14 days after Petal fall (Calyx) (cont'd)						
Fire blight	**General Comments:** • Products do not have activity on infected shoots, but rather help prevent spread of bacteria to other susceptible tissue. • Prune out infected shoots where possible and apply preventative spray immediately after. • Apply within 24 hours of a trauma event such as hail, strong wind or heavy rain to control shoot blight, especially if blossom blight has occurred.					
	M	Cueva *	1% v/v in 470–940 L water/ha	4 hours	1 day	May cause russeting of light-skinned cultivars. Use a 0.8% solution if fruit is present. If concerned about sensitivity of fruit, test first on a small area. Reapply every 3–7 days if conditions favour disease development.
	25	Streptomycin 17	600 g/1,000 L water	24 hours[2]/ 7 days[7]/ 14 days[5]	50 days	Keep rat-tail bloom covered if not manually removing secondary blossoms.
	44	Double Nickel LC *	5.0–7.5 L/ha	when dry	0 days	**Suppression only.** Reapply every 3–7 days if conditions favour disease development. Can be mixed with copper fungicides to improve control.
	NC	Oxidate 2.0 *	1% v/v	when dry	0 days	**Partial suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
Blister spot	**General comments:** • Apply preventatively to Mutsu/Crispin, Golden Delicious and other susceptible cultivars.					
	4	Copper 53 W *	3 kg/ha	48 hours	30 days	Apply up to 3 sprays beginning 10 days after petal fall. To reduce the risk of phytotoxicity, use 6 kg of hydrated lime per 1 kg of Copper 53 W per 1,000 L of water. Do not tank-mix lime mixture with other insecticides and fungicides. See label for more information. Apply in 3,000 L water/ha.
	33	Aliette	2 kg/ha	when dry	30 days	Begin applications at petal fall and spray at 7-day intervals. Do not mix with copper.
Fruitlet thinning	**General Comments:** • Note the preharvest intervals for early maturing cultivars. • See Table 3–11. *Suggested Rates for Chemical Thinning of Mature Apple Trees*. • Visit ontario.ca/apples and click on *Thinning of Tree Fruit* for more information.					
	Use one of the products listed for Fruitlet thinning at **Petal fall (calyx)** and/or the following:					

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
First summer spray – 7–14 days after Petal fall (Calyx) (cont'd)						
Fruitlet thinning (cont'd)	NC	Sevin XLR	0.5–2.0 L/ 1,000 L water	Trellis[11]: 4 days[2]/ 14 days[4,5] Non-trellis[12]: 12 hours[2]/ 10 days[5]/ 17 days[4]	75 days	Apply 7–12 days after petal fall (7 days if warm and 12 days if cool). Can be applied up to 21 days after petal fall if conditions are less than ideal. There will be little to no increase in thinning effectiveness at concentrations higher than 2 L/1,000 L water. Apply as a dilute spray under slow drying conditions between 21–24°C. Chemical-resistant gloves are recommended when hand thinning following application.
		Sevin XLR plus Cilis Plus or MaxCel	1–2 L/1,000 L water plus 2.5–6.3 L/ 1,000 L water or 2.65–6.6 L/ 1.000 L water	Trellis[11]: 4 days[2]/ 14 days[4,5] Non-trellis[12]: 12 hours[2]/ 10 days[5]/ 17 days[4]	75 days/ 86 days[13]	Use for difficult-to-thin cultivars or for situations where aggressive thinning Is required to decrease crop load. See Table 3–12. *Suggested Rates of MaxCel or Cilis Plus to Use With or Without Sevin XLR*.
		Sevin XLR plus Fruitone-L	1 L/1,000 L water plus 5–10 ppm	Trellis[11]: 4 days[2]/ 14 days[4,5] Non-trellis[12]: 12 hours[2]/ 10 days[5]/ 17 days[4]	75 days	Use on hard-to-thin cultivars such as Paula Red, Golden Delicious, Fuji and Gala strains.
Enhanced return bloom	Use one of the products listed under Enhanced return bloom at **Petal fall (Calyx).**					
Subsequent summer sprays						
Codling moth (second generation larva)	**General Comments:** • Use pheromone traps to time sprays. Apply insecticides within specified degree-days Celcius (DDC, base 10° C) after first-generation sustained moth catch. For information on calculating degree days, see *Degree-Day Modeling* in Chapter 2. • Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • With the exception of Imidan, do not use these products as a border spray. Efficacy of this application method is unknown.					
	1B	Imidan WP	2.68 kg/ha	7 days[2,8]/ 14 days[9]/ 30 days[5]	14 days	Apply at 667–694 DDC. Residues last 18–21 days. At this timing, Imidan may be effective as a border spray if there is no resident population in the orchard.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Subsequent summer sprays (cont'd)						
Codling moth (second generation larva) (cont'd)	4A	Assail 70 WP	170 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	Apply at 639–667 DDC. Use a maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks.
		Calypso 480 SC	440 mL/ha	12 hours	30 days	
	4A+15	Cormoran	1.05–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	Apply at 667–694 DDC. Where possible, rotate with products outside of Group 4 between generations.
	5	Delegate	420 g/ha	12 hours	7 days	Apply at 667–694 DDC.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Apply at 667–694 DDC. Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	18	Confirm 240 F	1 L/ha	12 hours	14 days	Apply at 611–639 DDC.
		Intrepid	1 L/ha	12 hours	14 days	
	28	Altacor	215 g/ha	12 hours	5 days	Apply at 667–694 DDC. Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions. Harvanta is persistent. Where possible, do not use in consecutive years.
		Exirel	500–750 mL/ha	12 hours	3 days	
		Harvanta 50 SL	1.2–1.6 L/ha	12 hours	7 days	
	NC	CYD-X *	250 mL/ha	12 hours	0 days	May provide control of codling moth when used in conjunction with other active ingredients. Virus must be ingested to be effective. After death, larvae will disintegrate and release new viral bodies which may infect other codling moth larvae. Apply in late afternoon or on a cloudy day to avoid exposure to sunlight. Reapply every 7–14 days. Target early egg hatch.
		Virosoft CP 4 *	250 mL/ha	12 hours	—	

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Subsequent summer sprays (cont'd)						
Apple maggot	**General Comments:** • Apply 7 days after the first adult maggot is caught on a sticky board or immediately after first adult female maggot is caught on a red sphere. • Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • With the exception of Imidan, do not use these products as a border spray. Efficacy of this application method is unknown.					
	1B	Imidan WP	2.68 kg/ha	7 days[2,8]/ 14 days[9]/ 30 days[5]	14 days	Residues last 18–21 days. At this timing, Imidan may be effective as a border spray if there is no resident population in the orchard.
	4A	Assail 70 WP	120–240 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks.
		Calypso 480 SC	440 mL/ha	12 hours	30 days	
	4A+15	Cormoran	1.05–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	**Suppression only.**
	5	GF-120 Fruit Fly Bait *	1.5 L in 6 L water/ha	when dry	—	**Suppression only.** Reapply every 7 days, or sooner if rain or overhead irrigation washes off residue. Large droplet sizes optimize the attractiveness of the bait. Proper application techniques help ensure adequate coverage. Apply using an all-terrain vehicle fitted with an appropriate sprayer and nozzle for a large spray droplet size of 4–6 mm directed to underside of leaves and inside the canopy.
	28	Altacor	285 g/ha	12 hours	5 days	**Suppression only.**
		Exirel	1.5 L/ha	12 hours	3 days	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
		Harvanta 50 SL	1.2–1.6 L/ha	12 hours	12 hours	**Suppression only.** This product is persistent. Where possible, do not use in consecutive years.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Subsequent summer sprays (cont'd)						
Apple maggot (cont'd)	NC	Surround WP *	50 kg/ha	12 hours	0 days	Begin applications well before first maggot flies are trapped in commercial orchards. Use 50 kg/ha for the first 2 applications and continue at 7–14-day intervals using 25 kg/ha to maintain even coverage of fruit as long as flies continue to be captured. Light to moderate rain will help distribute product. Reapply after heavy rain, strong wind or overhead irrigation. White film will remain on fruit if applied near harvest unless crop will be washed and waxed. May delay sugar accumulation. Do not use with anti-foaming agents, white mineral particulate products, spreader/stickers or summer oils.
Scab	**General Comments:** • If scab is controlled in your orchard, use the lower rate given in brackets.					
	Until the end of the primary scab season, use one of the products listed for Scab at **Bloom.** For summer (secondary) scab control, use one of the following, particularly when conditions are conducive to disease development:					
	M	Cueva *	1% v/v in 470–940 L water/ha	4 hours	1 day	May cause russeting of light-skinned cultivars. Use a 0.8% solution if fruit is present. If concerned about sensitivity of fruit, test first on a small area.
		Dithane Rainshield or Manzate Pro-stick or Penncozeb 75 Raincoat	2 kg/1,000 L water (1.5) 6 kg/ha (5) 2 kg/1,000 L water (1.5)	12 hours 24 hours 24 hours	45 days	Check preharvest interval before spraying early maturing cultivars.
		Folpan 80 WDG	3.0–3.75 kg/ha	24 hours	—	May cause russeting to Delicious or other sensitive cultivars when used pink to 30 days after petal fall. Do not use within 14 days of oil.
		Granuflo-T	1.5–2.25 kg/ 1,000 L water (1.0–1.5)	24 hours	28 days	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 DF or Supra Captan 80 WDG	3.75 kg/ha (1.5)	48 hours	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. These product formulations are currently being phased-out. Last date of use is May 10, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Subsequent summer sprays (cont'd)						
Scab (cont'd)	M (cont'd)	Maestro 80 WSP	3 kg/ha	High density[1]: 2 days[2]/ 6 days[3]/ 15 days[4,5] Standard[6]: 2 days[2]/ 4 days[3]/ 19 days[4]/ 24 days[5]	7 days	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. When restricted entry interval exceeds preharvest interval, follow restricted entry interval.
		Polyram DF	6 kg/ha (4.5)	12 hours	45 days	Last date of use is June 21, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use. Check preharvest interval before spraying early maturing cultivars.
	29	Allegro 500 F	0.5–1.0 L/ha	24 hours[2]/ 72 hours[5]	28 days	Apply at 7–14-day intervals. Do not make more than 3 sequential applications before rotating to another group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.
Black rot	Use one of the products listed for Black rot at **Pink.**					
Bitter rot	Use one of the products listed for Bitter rot at **Petal fall (Calyx).**					
Fly speck, Sooty blotch	Use one of the products listed for Fly speck, sooty blotch at **Petal fall (Calyx).** In orchards that have not had a problem with fly speck and sooty blotch in the past, fruit can become infected typically 4–6 weeks after petal fall.					
Special summer sprays (when monitoring indicates the need)						
European red mite	**General Comments:** • Presence of beneficial insects should be considered before applying a spray. For more information on beneficial insects, see the Ontario Crop IPM website at ontario.ca/cropipm. • Thorough spray coverage is essential for good control. Use a minimum of 1,000 L/ha of water when applying summer miticides. See Table 3–8. *Activity of Miticides Registered on Apple and/or Pear in Ontario*. • Miticides are best applied alone. • For resistance management, do not use more than once per season.					
	20B	Kanemite 15 SC	2.07 L/ha	12 hours[2]/ 5 days[5]	14 days	Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August.
	20D	Acramite 50 WS	851 g/ha or 3.75 pouches/ha	12 hours	7 days	Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
European red mite (cont'd)	21	Nexter SC	500 mL/ha	24 hours	25 days	Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August. Also controls apple rust mite.
	23	Envidor 240 SC	750 mL/ha	12 hours	7 days	Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August. Control may not be apparent for up to 1 week. Also controls apple rust mite.
	25	Nealta	1 L/ha	12 hours	7 days	Apply as mite populations begin to build, before mite damage is observed. The use of a registered adjuvant may improve performance.
	NC	Kopa *	2% v/v in 700–1,000 L water	12 hours	12 hours	See comments for this product for European red mite at **Petal fall (Calyx).**
		Purespray Green Spray Oil 13 E *	10 L/1,000 L water	12 hours	—	**Suppression only.** See comments for this product for European red mite at **Half-inch green to tight cluster.**
		Vegol Crop Oil *	2% v/v	12 hours	0 days	See comments for this product for European red mite at **Half-inch green to tight cluster.**
Two-spotted spider mite	**General Comments:** • Presence of beneficial insects should be considered before applying a spray. For more information on beneficial insects, see the Ontario Crop IPM website at ontario.ca/cropipm. • Thorough spray coverage is essential for good control. Use a minimum of 1,000 L/ha of water when applying summer miticides. See Table 3–8. *Activity of Miticides Registered on Apple and/or Pear in Ontario*. • Miticides are best applied alone. • For resistance management, do not use more than once per season.					
	20B	Kanemite 15 SC	2.07 L/ha	12 hours[2]/ 5 days[5]	14 days	Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August.
	20D	Acramite 50 WS	568 g/ha or 2.5 pouches/ha	12 hours	7 days	Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August.
	21	Nexter SC	1 L/ha	24 hours	25 days	Controls only nymphs. Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August. Also controls apple rust mite.
	23	Envidor 240 SC	750 mL/ha	12 hours	7 days	Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August. Control may not be apparent for up to 1 week. Also controls apple rust mite.
	25	Nealta	1 L/ha	12 hours	7 days	Apply as mite populations begin to build, before mite damage is observed. The use of a registered adjuvant may improve performance.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
Two-spotted spider mite (cont'd)	NC	Kopa *	2% v/v in 700–1,000 L/ha	12 hours	12 hours	Begin applications when populations are low and reapply every 1–3 weeks as needed. Test a small area of each variety prior to spraying the whole block. This product must coat the bodies of susceptible, soft-bodied insects to be effective. Good coverage is critical. Applying soaps more than 3 times may cause plant injury. Avoid application in direct sunlight or to trees under stress. Application within 3 days of sulphur may increase plant injury on sensitive varieties.
Rosy apple aphid, Green apple aphid	**General Comments:** • For rosy apple aphid, spray if 20% of clusters are infested. • For green apple aphid, spray if 10% of terminals are infested. • Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • Sprays can be delayed or avoided if predators are present on more than 20% of infested terminals.					
	4A	Admire 240 Flowable or Alias 240 SC	230 mL/ha	24 hours	7 days	Maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks. Assail applied at this rate will also provide control of leafhoppers. Clutch applied at 210–420 g/ha provides suppression of oriental fruit moth and codling moth. Last date of use for Admire, Alias and Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Assail 70 WP	120 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	
		Calypso 480 SC	145–290 mL/ha	12 hours	30 days	
		Clutch 50 WDG	140–210 g/ha	12 hours	7 days	
	4A+15	Cormoran	0.7–1.05 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C	Closer	100–200 mL/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.
	4C+5	TwinGuard	250 g/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.
	4D	Sivanto Prime	500–750 mL/ha	12 hours	14 days	Where possible, rotate with products outside of Group 4.
	9D	Versys	100 mL/ha	12 hours	7 days	Apply in a minimum spray volume of 1,000 L/ha.
	23	Movento 240 SC	365 mL/ha	12 hours	7 days	Control may not be apparent for 2–3 weeks. Tank-mix with an adjuvant/additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not tank-mix with sulphur.
	28	Exirel	1.5 L/ha	12 hours	3 days	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
Rosy apple aphid, Green apple aphid (cont'd)	29	Beleaf 50 SG	160 g/ha	12 hours[2]/ 48 hours[5]	21 days	Apply before populations reach economic threshold. Reapply 7 days later if monitoring indicates a need. Do not use with adjuvants.
	NC	Kopa *	2% v/v in 700–1,000 L water	12 hours	12 hours	See comments for this product for Rosy apple aphid at **Half-inch green to tight cluster.**
		Purespray Green Spray Oil 13 E *	10 L/1,000 L water	12 hours	—	**Rosy apple aphid only. Suppression only.** See comments for this product for Rosy apple aphid at **Half-inch green to tight cluster.**
		Vegol Crop Oil *	2% v/v	12 hours	0 days	See comments for this product for Rosy apple aphid at **Half-inch green to tight cluster.**
Woolly apple aphid	**General Comments:** • Spray if aphid colonies are close to fruit clusters or on young trees and nursery stock. • Apply in a high-volume spray to ensure thorough coverage of trunk and limbs. • Reapply after 14 days if woolly apple aphid is still present.					
	1B	Malathion 85 E	610 mL/1,000 L water	12 hours[2]/ 48 hours[4]/ 72 hours[5]	3 days	May cause injury to McIntosh and Cortland if applied within 4 weeks of harvest.
	4C	Closer	400 mL/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4.
	23	Movento 240 SC	365 mL/ha	12 hours	7 days	Control may not be apparent for 2–3 weeks. Tank-mix with an adjuvant/ additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not tank-mix with sulphur.
Tentiform leafminer	**General Comments:** • From petal fall through to June, apply controls where there are 1 or more sap-feeding miners per leaf. • From mid to late June through July, apply where there are 2 miners per leaf (stressed trees) or 4 miners per leaf (healthy trees).					
	3	Ambush 500 EC or Perm-Up EC or Pounce 384 EC	400 mL/ha 520 mL/ha 520 mL/ha	when dry	7 days	Use is discouraged for summer generations of tentiform leafminer. Maximum of 1 application of product from this group per season. These products are highly toxic to beneficial insects and may lead to mite outbreaks.
		Decis 5 EC	250 mL/ha	12 hours	1 day	
		Mako or Up-Cyde 2.5 EC	250 mL/ha 400 mL/ha	12 hours	7 days	
		Matador 120 EC or Silencer 120 EC	83 mL/ha	24 hours	7 days	

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
Tentiform leafminer (cont'd)	4A	Admire 240 Flowable or Alias 240 SC	380 mL/ha	24 hours	7 days	Maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks. Note Calypso rate change from first to second generation. Clutch applied at 210–420 g/ha provides suppression of oriental fruit moth and codling moth. Last date of use for Admire, Alias and Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Assail 70 WP	80 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	
		Calypso 480 SC	290 mL/ha	12 hours	30 days	
		Clutch 50 WDG	140–210 g/ha	12 hours	7 days	
	4A+15	Cormoran	700 mL/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	250–500 g/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4 between generations.
	5	Delegate	420 g/ha	12 hours	7 days	No product specific comments.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	28	Altacor	215 g/ha	12 hours	5 days	No product specific comments.
		Exirel	500–750 mL/ha	12 hours	3 days	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
White apple leafhopper	**General Comments:** • Spray when 2–5 nymphs per leaf. Nymphs are active in mid-June and early August. Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • Control of adults is very difficult. • Best timing for control is after petal fall, if threshold is reached.					

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
White apple leafhopper (cont'd)	4A	Admire 240 Flowable or Alias 240 SC	200 mL/ha	24 hours	7 days	Maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks. Clutch applied at 210–420 g/ha provides suppression of oriental fruit moth and codling moth. Last date of use for Admire, Alias and Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Assail 70 WP	80 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	
		Calypso 480 SC	145 mL/ha	12 hours	30 days	
		Clutch 50 WDG	140–210 g/ha	12 hours	7 days	
	4A+15	Cormoran	700 mL/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4D	Sivanto Prime	500–750 mL/ha	12 hours	14 days	Where possible, rotate with products outside of Group 4.
	28	Altacor	285 g/ha	12 hours	5 days	**Suppression only.**
		Exirel	1 L/ha	12 hours	3 days	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
Potato leafhopper	**General Comments:** • Apply where monitoring indicates a potential problem, particularly on young trees or nursery stock. Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • Control of adults is very difficult.					
	4A	Assail 70 WP	80 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	Maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks. Clutch applied at 210–420 g/ha provides suppression of oriental fruit moth and codling moth. Last date of use for Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Calypso 480 SC	145 mL/ha	12 hours	30 days	
		Clutch 50 WDG	140–210 g/ha	12 hours	7 days	
	4A+15	Cormoran	700 mL/ha	12 hours[1]/ 7 days[2]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4D	Sivanto Prime	500–750 mL/ha	12 hours	14 days	Where possible, rotate with products outside of Group 4.
Leafcurling midge	Use one of the products listed for Leafcurling midge at **Petal fall (Calyx).** See Table 3–4. *Activity of Insecticides and Miticides on Apple Pests* for efficacy of products. Continue monitoring and apply an insecticide shortly after upswing in pheromone trap catches or when yellow eggs are found in newest unfurled leaves. Generations begin to overlap as season progresses, making control more difficult.					

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
Japanese beetle	**General Comments:** • This is a sporadic pest in Ontario that can cause economic damage, especially in young plantings of Honeycrisp. • Where trees are under stress (drought, heat, high crop load) and when skeletonization of leaves has become significant, special sprays may be required.					
	1B	Imidan WP	2.68 kg/ha	7 days[2,8]/ 14 days[9]/ 30 days[5]	14 days	No product specific comments.
	4A	Calypso 480 SC	145–290 mL/ha	12 hours	30 days	No product specific comments.
	4A+15	Cormoran	0.84–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	28	Altacor	285 g/ha	12 hours	5 days	**Suppression only.**
		Exirel	1.0–1.5 L/ha	12 hours	3 days	Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
San Jose scale	**General Comments:** • Apply when the crawlers are active in orchards with a history of scale. In Ontario, the second-generation crawler activity typically begins early August and can last 4–6 weeks. Unless stated otherwise in product specific comments, reapply in 14 days. • Pheromone traps for adult flight and degree-days Celcius (DDC) can be used to determine optimal spray timing. Crawler activity should begin 222 DDC (base 10.5°C) after first adult catch for the second generation. For more information, see *Degree-Day Modeling* in Chapter 2. • Thorough coverage of trunk and limbs is essential for good control. • These products are toxic to bees. Do not apply when bees are active in the orchard. Refer to label for specific bee toxicity statements.					
	4C	Closer	400 mL/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4 between generations.
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	Where possible, rotate with products outside of Group 4 between generations.
	4D	Sivanto Prime	0.75–1.0 L/ha plus 0.25% v/v oil	12 hours	14 days	If using oil, may cause bark injury on some cultivars, such as Red Delicious, Empire and Mutsu/Crispin. Do not use oil within 14 days of Supra Captan, Maestro, Folpan or sulphur. Do not apply when temperatures exceed 30°C, to crops under moisture stress or just prior to rain. Where possible, rotate with products outside of Group 4 between generations.
	23	Movento 240 SC	365 mL/ha	12 hours	7 days	Control may not be apparent for 2–3 weeks. Apply 1–2 weeks before expected crawler emergence. Tank-mix with an adjuvant/additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not tank-mix with sulphur.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
San Jose scale (cont'd)	NC	Kopa *	2% v/v in 700–1,000 L water	12 hours	12 hours	Begin applications once crawler activity begins and reapply every 1–3 weeks as needed. Test a small area of each variety prior to spraying the whole block. This product must coat the bodies of susceptible, soft-bodied insects to be effective. Good coverage is critical. Applying soaps more than 3 times may cause plant injury. Avoid application in direct sunlight or to trees under stress. Application within 3 days of sulphur may increase plant injury on sensitive varieties.
Obliquebanded leafroller	**General Comments:** • Place pheromone traps in orchards by June to monitor adult populations. • Insecticides for summer-generation larvae should be applied at 240–280 DDC after first sustained moth catch (base 6.1°C). For information on calculating degree days, see *Degree-Day Modeling* in Chapter 2. Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label.					
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	No product specific comments.
	5	Delegate	420 g/ha	12 hours	7 days	No product specific comments.
		Entrust * or Success	364 mL/ha 182 mL/ha	when dry	7 days	Reapply as necessary on a 7–10-day schedule.
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	11	Bioprotec CAF * or Dipel 2X DF * or Foray 48 BA or XenTari WG *	4 L/ha 1.12 kg/ha 2.8 L/ha 0.5–1.6 kg/ha	12 hours	0 days	Product must be consumed to be effective—spray when and where pests are actively feeding. Apply in a high-volume spray to ensure thorough coverage on both sides of the leaf. Apply to young larvae, early in infestation. Death of insect may take several days. Reapply at 5–7-day intervals if larvae activity is extended. Acidify spray mix to below pH 7.0 and apply on cloudy days or in the evening.
	18	Confirm 240 F	1 L/ha	12 hours	14 days	**Suppression only** at this timing.
		Intrepid	0.75 L/ha	12 hours	14 days	
	28	Altacor	285 g/ha	12 hours	5 days	Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions. Harvanta is persistent. Where possible, do not use in consecutive years.
		Exirel	0.5–1.0 L/ha	12 hours	3 days	
		Harvanta 50 SL	1.2–1.6 L/ha	12 hours	7 days	

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
Oriental fruit moth	**General Comments:** • This is a special spray for orchards where there is a history of damage. • Adjust spray timing based on monitoring. Apply insecticides 3–6 days after upswing in moth flight. Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • Alternatively, accumulate degree-days Celcius (DDC, base 7.2°C) after first sustained moth catch (biofix) of the first generation. For information on calculating degree days, see *Degree-Day Modeling* in Chapter 2.					
	3	Decis 5 EC	250 mL/ha	12 hours	1 day	For second generation, apply at 805–833 DDC. For third generation, apply at 1361–1389 DDC (1st spray) and 1611–1667 DDC (2nd spray). Highly toxic to beneficial insects and may lead to mite outbreaks. Use only as a last resort. Apply in 3,000 L water.
	4A	Assail 70 WP	240 g/ha	12 hours[2]/ 48 hours[7]/ 6 days[5]	7 days	For second generation, apply at 750–778 DDC. For third generation, apply at 1305–1333 DDC (1st spray) and 1556–1611 DDC (2nd spray).
		Calypso 480 SC	440 mL/ha	12 hours	30 days	
	4A+15	Cormoran	1.05–1.26 L/ha	12 hours[2]/ 7 days[5]	14 days	For second generation, apply at 750–778 DDC. For third generation, apply at 1305–1333 DDC (1st spray) and 1556–1611 DDC (2nd spray). Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	500 g/ha	12 hours	7 days	For second generation, apply at 805–833 DDC. For third generation, apply at 1361–1389 DDC (1st spray) and 1611–1667 DDC (2nd spray). Where possible, rotate with products outside of Group 4 between generations.
	5	Delegate	420 g/ha	12 hours	7 days	For second generation, apply at 805–833 DDC. For third generation, apply at 1361–1389 DDC (1st spray) and 1611–1667 DDC (2nd spray).
	6+28	Minecto Pro	496 mL/ha	12 hours	28 days	For second generation, apply at 805–833 DDC. For third generation, apply at 1361–1389 DDC (1st spray) and 1611–1667 DDC (2nd spray). Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	18	Intrepid	1 L/ha	12 hours	14 days	For second generation, apply at 750–778 DDC. For third generation, apply at 1305–1333 DDC (1st spray) and 1556–1611 DDC (2nd spray).

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
Oriental fruit moth (cont'd)	28	Altacor	215 g/ha	12 hours	5 days	For second generation, apply at 805–833 DDC. For third generation, apply at 1361–1389 DDC (1st spray) and 1611–1667 DDC (2nd spray). Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions. Harvanta is persistent. Where possible, do not use in consecutive years.
		Exirel	500–750 mL/ha	12 hours	3 days	
		Harvanta 50 SL	1.2–1.6 L/ha	12 hours	7 days	
Dogwood borer	**General Comments:** • In the orchards with a history of borer problems, place pheromone traps mid-June to monitor adult flight. • Make applications at 2-week intervals throughout the period of adult activity. • Direct the spray to the lower portion of the trunk, particularly the graft union and any pruning cuts.					
	3	Perm-Up EC plus oil or Pounce 384 EC plus oil	22 mL/100 L water plus 2 L oil	when dry	7 days	Apply at egg hatch or 7–14 days after peak flight of adult catch.
	4A+15	Cormoran	1.5 L/ha	12 hours[2]/ 7 days[5]	14 days	Apply between egg laying and hatch, or peak flight and 7–14 days after peak flight of adult catch. Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	5	Delegate	420 g/ha	12 hours	7 days	Apply at egg hatch, or 7–14 days after peak flight of adult catch.
	15	Rimon 10 EC	1.4 L/1,000 L water	12 hours	14 days	Apply at 25–75% egg laying, or peak flight. Do not exceed 2,000 L water/ha. May lead to mite outbreaks. Do not allow Rimon to drift onto grapes as leaf spotting may occur.
	28	Altacor	285 g/ha	12 hours	5 days	Apply at egg hatch, or 7–14 days after peak flight of adult catch.
Apple clearwing moth	**General Comments:** • This is not a common pest in Ontario. • Apply insecticides to tree trunk particularly on graft union and pruning cuts within 10 days of first adult emergence. • Repeat application at 7–14-day intervals throughout the period of adult activity.					
	5	Delegate	420 g/ha	12 hours	7 days	**Reduction in numbers only.**
	15	Rimon 10 EC	1.4 L/1,000 L water	12 hours	14 days	Do not exceed 2,000 L water/ha. May lead to mite outbreaks. Do not allow Rimon to drift onto grapes as leaf spotting may occur.

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Table 3–1. Apple Crop Protection (cont'd)

Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Special summer sprays (when monitoring indicates the need) (cont'd)						
Brown marmorated stink bug	**General Comments:** • This pest has been detected in orchards, but not at economically damaging levels. Check the OMAFRA website at ontario.ca/stinkbug for updates on pest development, registered products and management strategies. • There are currently no thresholds established. Apply when insects are first detected or early damage found. • Pheromone traps are commercially available. • These products are toxic to beneficial insects and should be used only when necessary.					
	4A	Actara 25 WG	385 g/ha	12 hours	60 days	**Suppression only.** Check preharvest interval before spraying Actara on early maturing cultivars. Last date of use for Actara and Clutch for brown marmorated stink bug has been extended to April 11, 2022. For all other registered pests, the last date of use is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Clutch 50 WDG	210–420 g/ha	12 hours	7 days	
Pinpoint and storage scab	Use one of the products listed for Scab in **subsequent summer sprays.** Do not use fungicides closer than the stated preharvest interval. See Table 3–3. *Products Used on Apples*.					
Fire blight	**General Comments:** • Products do not have activity on infected shoots but rather help prevent spread to other susceptible tissue. • Prune out infected shoots where possible and apply preventative spray after. • Apply within 24 hours of trauma event such as hail, strong winds or heavy rain.					
	M	Cueva *	1% v/v in 470–940 L water/ha	4 hours	1 day	May cause russeting of light-skinned cultivars. Use a 0.8% solution if fruit is present. If concerned about sensitivity of fruit, test first on a small area. Reapply every 3–7 days if conditions favour disease development.
	44	Double Nickel LC *	5.0–7.5 L/ha	when dry	0 days	**Suppression only.** Reapply every 3–7 days if conditions favour disease development. Can be mixed with copper fungicides to improve control.
	NC	Oxidate 2.0 *	1% v/v	4 hours	0 days	**Partial suppression only.** For increased coverage, use with a registered non-ionic surfactant. Reapply every 5–7 days if conditions favour disease development. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
Blister spot	Use one of the products listed for Blister spot in **First summer spray.**					
Preharvest sprays						
Botrytis grey mould, Penicillium storage diseases	9	Scala SC	2 L/ha	12 hours[2]/ 24 hours[5]	14 days	**Suppression only.** Apply 2 weeks before harvest. Summer applications of Supra Captan/Maestro may provide some protection against storage rots.

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Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Preharvest sprays (cont'd)						
Phytophthora crown or root rot	33	Aliette	3–5 kg/ha	when dry	30 days	Apply as foliar spray only. Do not use a drench treatment on bearing trees. Do not use more than 1,000 L/ha. Do not tank-mix with copper, adjuvants/ surfactants that enhance penetration or foliar fertilizers.
Fruit colour	**General Comments:** • Visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops* for more information.					
	NC	Ethrel	0.75–3.5 L/ha	2 days	—	Apply 2–3 weeks before the normal harvest date. Depending on the cultivar and air temperature, fruit will be ready to harvest 5–10 days after application. Check maturity daily. On early cultivars like Jerseymac and Paulared, use 0.75–1.5 L/ha. McIntosh requires 1.5–3.5 L/ha. Use higher rate early season on trees high in nitrogen or on poorly pruned trees. Fruit should be marketed immediately. Stimulates ripening and fruit drop. Tank-mix a stop-drop product like Fruitone L (NAA) with Ethrel and reapply NAA 5 days later.
		Blush	190–381 mL/ 100 L water	when dry	7 days	Make 1–2 applications 7–28 days before anticipated harvest. If applying twice, make first application 21–28 days before harvest and reapply 7–14 days later. Begin application once red colour starts to develop. Results may vary due to cultivar and environmental conditions. Do not apply to trees under stress. Avoid application during the hottest part of the day. Apply during slow drying conditions.
Preharvest drop	NC	Fruitone-L or Fruit Fix Concentrate	161–646 mL/ 1,000 L water 352 mL/1,000 L water	when dry	5 days	Apply 10 ppm (322 mL of Fruitone-L/1,000 L water or 176 mL of Fruit Fix/1,000 L water) as soon as the first undamaged apples begin to drop or after the first spot pick. Effective for 7–10 days. If needed, reapply 10 ppm 5–6 days later. Maximum absorption occurs at 21–24°C with high humidity. Use a non-ionic surfactant to improve absorption. Inhibits fruit abscission but fruit continues to mature at accelerated rate. Higher concentration and number of applications increase the ripening effect. One application of single strength (10 ppm) has little effect on direct ripening. Fruit will not keep well in long-term storage, especially McIntosh. Fruit treated twice should be sold immediately. Visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops*.
Harvest management	**General Comments:** • Delay maturity by reducing ethylene production. • For more information, visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops*.					

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Disease, Insect or Other	Group	Product	Rate	Restricted Entry Interval	Preharvest Interval	Product Specific Comments
Preharvest sprays (cont'd)						
Harvest management (cont'd)	NC	ReTain	333 g (1 pouch)/0.4 ha	12 hours	7 days	For single pick harvest, apply 3–4 weeks before the anticipated normal harvest date. This will delay harvest for up to 7–10 days. For multiple pick harvest, apply 1–2 weeks before the anticipated normal harvest date of first pick. This will not delay the first pick but will control the maturation rate for later picks. Reduces preharvest drop, helps to maintain fruit firmness, may reduce incidence and/or severity of watercore and stem bowl cracking and may enhance storage potential. Use with an organosilicone surfactant at a rate of 0.05–0.1% v/v. Do not tank-mix with sunburn protection products or apply a sun protectant product three days before or after application.
	NC	Harvista 1.3 SC	5.9–17.7 L/ha	4 hours	3 days	Harvest maturity can be delayed by 7–14 days and reduce preharvest drop, reduce fruit ethylene production, allow for additional time to develop colour and increase size, maintain fruit firmness, delay stach hydrolysis, delay onset or reduce incidence of watercore and enhance storage potential. An in-line chemical injector system, designed for use with this product, is required for application. Apply 3–21 days before estimated harvest. Ontario research has shown that applying as close as possible to the estimated harvest date has achieved better results. Use higher rate for fruit at a more advanced stage of maturity. Use low rate for bicoloured apples to prevent delay in red colour development. Use an organosilicone surfactant at a rate of 0.05% v/v. Do not apply when temperatures are above 35°C. Do not tank-mix or make sequential applications with copper.
Postharvest treatment						
Blue mould, Grey mould	1	Mertect SC	500 mL/500 L water	—	post-harvest	Continuous agitation is required. Does not control blue or grey mould that are resistant to benzimidazole fungicides.
	12	Scholar 230 SC	496 mL/378 L water	—	post-harvest	For use in dip tank or drencher. Treats up to 90,000 kg of fruit. For dip treatments, dip fruit for approximately 30 seconds, then allow fruit to drain.
	NC	Bio-Save 10 LP	500 g/300 L water	—	post-harvest	**Suppression only** of storage rots. For use in dip tank or drencher. Dip fruit for at least one minute.

[1] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [2] General re-entry. [3] Pruning and training. [4] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [5] Hand thinning. [6] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [7] Contact and scouting activities. [8] Personal protective equipment required for certain activities. See label. [9] Pick-your-own harvest. [10] Apply no later than 14 days after petal fall. [11] High density, trellised orchard. [12] Traditional low- to medium-density orchard. [13] Preharvest is 75 days for Sevin + Fruitone or Sevin + Cilis Plus, 86 days for Sevin + MaxCel.

— = Information is not applicable or not specified on label.
* Potentially organic. Check with certifying body.

Non-Bearing Apple (New Planting)

The following program is designed to offer limited protection when needed for newly planted trees. It is not intended for protection of bearing orchards.

To minimize pest pressure, remove neglected fruit trees in the area and control weeds. Alternative materials are available as shown in the calendar for bearing fruits.

Refer to Table 3–3. *Products Used on Apples* for restricted entry intervals.

Table 3–2. Non-Bearing Apple Crop Protection

Disease, Insect	Group	Product	Rate	Product Specific Comments
Early spring				
Phytophthora crown and root rot	4	Ridomil Gold 480 SL	1 mL/tree	Apply in 5 L of water per tree, using handgun to drench trunk and soil surrounding tree. Apply before new growth begins as a thorough drench to soil around base of tree. Do not apply as a foliar spray.
	33	Aliette	5–10 g/tree	Apply in 5 L of water per tree, using handgun to drench trunk and soil surrounding tree. Use higher rate for standard trees. Make first application in spring after bud break and again in early fall.
Tree growth modification	NC	Promalin SL	100–166 mL/ 500 mL latex paint	Mix with latex paint and apply directly to buds with a brush or sponge uniformly covering bark surface. Apply to 1-year-old wood only. Apply when terminal buds have started to swell, but before bud break as this may result in injury to tender side shoot tips. Notching bark above the bud with a hacksaw blade prior to treatment will greatly increase efficacy. Do not use when temperatures are below freezing, above 30°C or if rain is forecast within 6 hours. Visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops*.
First sprays				
Scab	**General Comments:** • Apply fungicides before spore release as soon as green tissue is present and keep growing leaves covered. • Rainfall is needed for spore release and leaves must be wet for infection to occur. The length of the wetting period required for infection varies with temperature. See Table 3–10. *Relationship of Temperature and Moisture to Apple Scab Infection* and the Ontario Crop IPM website at ontario.ca/cropipm for information on infection periods. • For resistance management, use a maximum of 2 applications of products per fungicide group from Group 3, 7 and 11 per season.			
	M	Cueva *	1% in 470–940 L water/ha	No product specific comments.
		Dithane Rainshield or Manzate Pro-stick or Penncozeb 75 Raincoat	2 kg/1.000 L water 6 kg/ha 2 kg/1,000 L water	No product specific comments.
		Folpan 80 WDG	3.0–3.75 kg/ha	Do not use within 14 days of oil.
		Granuflo T	1.5–2.25 kg/1,000 L water	Last date of use is December 14, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
First sprays (cont'd)				
Scab (cont'd)	M (cont'd)	Maestro 80 DF or Supra Captan 80 WDG	3.75 kg/ha	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel. These product formulations are currently being phased-out. Last date of use is May 10, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Maestro 80 WSP	3 kg/ha	Do not use within 14 days of oil or as a tank-mix or sequential application with products containing oil such as Fontelis or Exirel.
		Polyram DF	6 kg/ha	Last date of use is June 21, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
	3	Cevya	250–375 mL/ha	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. See labels for suggested tank-mix products.
		Fullback 125 SC plus 1/2 to full rate Group M, where permitted	950 mL/ha See Group M	
	3+7	Aprovia Top	386–643 mL/ha	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. See labels for suggested tank-mix products.
	3+9	Inspire Super plus 1/2 to full rate Group M, where permitted	560–836 mL/ha See Group M	Do not use earlier than tight cluster. Provides good scab control in cool weather. May provide suppression of powdery mildew when applied at higher rate.
	7	Fontelis	1.0–1.5 L/ha	For resistance management, tank-mix with a compatible protectant apple scab fungicide from a different group. See labels for suggested tank-mix products. Fontelis contains mineral oil in the formulation. Tank-mixing or rotating with oil-sensitive products (e.g., captan, sulphur) may cause crop safety issues. See label for tank-mix restrictions. Use Sercadis with a non-ionic surfactant at a rate of 0.125% v/v (e.g., 1.25 L in 1,000 L water).
		Kenja 400 SC	913 mL/ha	
		Sercadis	333 mL/ha	
	7+9	Luna Tranquility plus 1/2 to full rate Group M, where permitted	800 mL/ha See Group M	Provides good scab control in cool weather.
	7+11	Pristine WG plus 1/2 to full rate Group M, where permitted	1.0–1.2 kg/ha See Group M	Do not use earlier than tight cluster. Do not tank-mix or make sequential applications with Exirel.
	29	Allegro 500 F	0.5–1.0 L/ha	Apply at 7–14-day intervals. Do not make more than 3 sequential applications before rotating to includer group. Do not mix with oil. May provide mite suppression. This product is persistent. Where possible, do not use in consecutive years.
	44	Serenade OPTI *	1.7–3.3 kg/ha	**Suppression only.** Apply preventatively at 7–10-day intervals. Use in conjunction with other cultural or chemical controls.
	NC	Buran *	1.8% v/v (i.e., 9 L in 500 L water/ha)	**Suppression only.** Do not use more than 18 L/ha per application. This product should only be used as a post-infection treatment, but before 350 degree-hours (base 0°C) after beginning of infection. Apply after rainfall or when conditions are conducive to disease development. Do not apply if rain is forecast within 48 hours.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
First sprays (cont'd)				
Scab (cont'd)	NC (cont'd)	Oxidate 2.0 *	1% v/v	**Partial suppression only.** For increased coverage, use with a non-ionic surfactant. Apply at first sign of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
Powdery mildew	**General Comments:** • Begin application at green tip to half-inch green and continue to first summer spray. Additional sprays may be needed on susceptible cultivars or if disease pressure is severe. • Infection will continue until young susceptible tissue is no longer present. Infected shoots and buds — particularly on young trees — have reduced vigour and are more susceptible to cold injury. • For resistance management, apply a maximum of 2 applications of products per fungicide group from Groups 3, 7 and 11 per season.			
	M	Cosavet DF Edge * or Kumulus DF * or Microscopic Sulphur WP * or Microthiol Disperss *	22.5 kg/ha 22.5 kg/ha 6.5 kg/1,000 L water 22.5 kg/ha	May cause an increase in mite and scale populations at this rate. Do not use within 14 days of Purespray Green Spray Oil and 30 days of Vegol Crop Oil or Superior Oil.
	3	Cevya	250–375 mL/ha	**Suppression only.**
		Fullback 125 SC	585–877 mL/ha	No product specific comments.
		Nova	340 g/ha	No product specific comments.
	3+7	Aprovia Top	643 mL/ha	No product specific comments.
	3+9	Inspire Super	836 mL/ha	**Suppression only.**
	7	Fontelis	1.0–1.5 L/ha	Contains mineral oil in the formulation. Tank-mixing or rotating with oil-sensitive products (e.g., captan, sulphur) may cause crop safety issues. See label for tank-mix restrictions.
		Sercadis	167–333 mL/ha	Use with a non-ionic surfactant at a rate of 0.125 % v/v (e.g., 1.25 L in 1,000 L water).
	7+9	Luna Tranquility	600 mL/ha	No product specific comments.
	7+11	Pristine WG	1.0–1.2 kg/ha	Do not tank-mix or make sequential applications with Exirel.
	11	Flint	140–210 g/ha	Do not tank-mix or make sequential applications with Exirel.
		Sovran	240 g/ha	
	19	Diplomat 5 SC	259–926 mL/ha	**Suppression only.** Apply preventatively at 7–14-day intervals.
	44	Serenade OPTI *	1.7–3.3 kg/ha	**Suppression only.** Apply preventatively at 7–10-day intervals. Use in conjunction with other cultural or chemical controls.
	NC	Buran *	1.2–1.8% (i.e., 9 L in 500–800 L water/ha)	Control can be achieved under low to moderate disease pressure with addition of a non-ionic surfactant at a rate of 0.1% v/v. Begin applications preventatively when conditions are conducive to disease development. Reapply every 7–10 days if needed. Do not apply if rain is forecast within 48 hours.
		Oxidate 2.0 *	1% v/v	**Suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
First sprays (cont'd)				
Powdery mildew (cont'd)	NC (cont'd)	Purespray Green Spray Oil 13 E *	10 L/1,000 L water	**Suppression only.** May cause bark injury to Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage. Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of using Supra Captan, Maestro, Folpan, Ambush, Perm-Up, Pounce or sulphur.
		Vegol Crop Oil *	2% v/v	**Suppression only.** May cause bark injury to Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage at a rate of 2% v/v (20 L/1,000 L water). Do not apply within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan or copper and 30 days of sulphur. Do not apply to wet foliage.
	P5	Regalia Maxx *	0.125% v/v in 1,000 L water/ha	**Suppression only.** Do not apply until pink. Reapply every 7–10 days if conditions are conducive to disease development.
Prebloom				
Aphids	**General Comments:** • For rosy apple aphid, spray if 20% of clusters are infested. • For green apple aphid, spray if 10% of terminals are infested. • Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label.			
	4A	Actara 25 WG	160 g/ha	Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks. Last date of use for Actara is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Assail 70 WP	120 g/ha	
		Calypso 480 SC	145–290 mL/ha	
	4A+15	Cormoran	0.7–1.05 L/ha	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C	Closer	100–200 mL/ha	Where possible, rotate with products outside of Group 4.
	4C+5	TwinGuard	250 g/ha	Where possible, rotate with products outside of Group 4.
	4D	Sivanto Prime	500–750 mL/ha	Where possible, rotate with products outside of Group 4.
	9D	Versys	100 mL/ha	Apply in a minimum spray volume of 1,000 L/ha.
	28	Exirel	1.5 L/ha	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
	29	Beleaf	160 g/ha	Apply before populations reach economic threshold. Reapply 7 days later if monitoring indicates a need. Do not use with adjuvants.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Prebloom (cont'd)				
Aphids (cont'd)	NC	Kopa *	2% v/v in 700–1,000 L water	Begin applications when populations are low and reapply every 1–3 weeks as needed. Test a small area of each variety prior to spraying the whole block. This product must coat the bodies of susceptible, soft-bodied insects to be effective. Good coverage is critical. Applying soaps more than 3 times may cause plant injury. Avoid application in direct sunlight or to trees under stress. Application within 3 days of sulphur may increase plant injury on sensitive varieties.
		Purespray Green Spray Oil 13 E *	10 L/1,000 L water	**Rosy apple aphid only. Suppression only.** May cause bark injury to Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage. Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan, Ambush, Perm-Up, Pounce or sulphur.
		Vegol Crop Oil *	2% v/v	May cause bark injury to Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage at a rate of 2% v/v (20 L/1,000 L water). Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan or copper and 30 days of sulphur. Do not apply to wet foliage.
Tentiform leafminer	**General Comments:** • Monitor for tentiform leafminer and apply sprays when thresholds are reached. See comments for Tentiform leafminer at **Tight cluster to pink** in Table 3–1. *Apple Crop Protection*.			
	3	Ambush 500 EC or Perm-Up EC or Pounce 384 EC	400 mL/ha 520 mL/ha 520 mL/ha	Apply at first egg hatch. Highly toxic to beneficial insects and may lead to mite outbreaks. Maximum of 1 application of product from this group per season.
		Decis 5 EC	250 mL/ha	
		Mako or Up-Cyde 2.5 EC	250 mL/ha 400 mL/ha	
		Matador 120 EC or Silencer 120 EC	83 mL/ha	
	4A	Actara 25 WG	315 g/ha	Apply when population is mainly in sap-feeder stage. Maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks. Last date of use for Actara is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Assail 70 WP	80 g/ha	
		Calypso 480 SC	145 mL/ha	
	4A+15	Cormoran	700 mL/ha	Apply when population is mainly in the sap-feeder stage. Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	Twinguard	250–500 g/ha	Apply at egg hatch or at first sign of sap-feeder stage. Where possible, rotate with products outside of Group 4 between generations.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Prebloom (cont'd)				
Tentiform leafminer (cont'd)	5	Delegate	420 g/ha	Apply when population Is mainly in sap-feeder stage.
	6+28	Minecto Pro	496 mL/ha	Apply at egg hatch or at first sign of sap-feeder stage. Apply with 0.25%–1% oil and a minimum of 450 L water/ha. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	18	Confirm 240 F	1 L/ha	Apply at first egg hatch. Confirm provides **suppression only**.
		Intrepid	500 mL/ha	
	28	Altacor	215 g/ha	Apply when population Is mainly in sap-feeder stage. Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
		Exirel	500–750 mL/ha	
Leafcurling midge	**General Comments:** • This is a special spray for orchards where there is a history of damage. Young trees are particularly susceptible to this pest, which can reduce terminal growth. • Place pheromone traps in orchard at pink and begin monitoring for yellow eggs in the newest unfurled leaves. Apply an insecticide shortly after upswing in pheromone trap catches or when eggs have been found, which often coincides with petal fall. • See Table 3–4. *Activity of Insecticides and Miticides on Apple Pests* for efficacy of products.			
	3	Mako or Up-Cyde 2.5 EC	250 mL/ha 400 mL/ha	These products are highly toxic to beneficial insects and may lead to mite outbreaks. Maximum of 1 application of product from this group per season.
	23	Movento 240 SC	365–585 mL/ha	**Suppression only.** Control may not be apparent for 2–3 weeks. Under high pest pressure, use higher rate and reapply 2 weeks later. Tank-mix with an adjuvant/additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not tank-mix with sulphur.
Spring-feeding caterpillars	**General Comments:** • Species in this complex include, but are not limited to: obliquebanded leafroller, redbanded leafroller, eye spotted bud moth, green pug moth, gypsy moth and green fruitworm. Not all products are registered for all species. Refer to the label for registered pests. • Apply when caterpillars are small. Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • Not necessary if a pyrethroid (Group 3 insecticide) was used for tentiform leafminer.			
	1B	Imidan WP	2.68 kg/ha	No product specific comments.
	4A+15	Cormoran	0.84–1.26 L/ha	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	6+28	Minecto Pro	496 mL/ha	Apply with 0.25%–1% oil and a minimum of 450 L water/ha. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Prebloom (cont'd)				
Spring-feeding caterpillars (cont'd)	28	Altacor	145–285 g/ha	No product specific comments.
		Exirel	0.5–1.0 L/ha	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
		Harvanta 50 SL	1.2–1.6 L/ha	This product is persistent. Where possible, do not use in consecutive years.
Bloom				
Fire blight	**General Comments:** • Avoid overstimulating growth. • Hand-pick blossoms before they open to prevent blossom infection on non-bearing trees. • See comments for Fire blight at **Bloom** in Table 3–1, *Apple Crop Protection*.			
	M	Cueva *	1% v/v in 470–940 L water/ha	Reapply every 3–7 days if conditions favour disease development.
	24	Kasumin 2L	5.0 L in 1,000 L water/ha	Apply at 20–30% bloom, or when conditions favour disease development. Reapply after 2–3 days if warm, wet conditions (above 18°C) are forecast. For resistance management, rotate with a different chemical group. If using lower water volumes, refer to water volume chart on label for rate recommendations.
	25	Streptomycin 17	600 g/1,000 L water	Degrades rapidly in sunlight. Reapply after 2–3 days if warm, wet conditions (above 18°C) are forecast. May provide some kickback if applied within 24 hours of infection event. For resistance management, rotate with a different chemical group.
	44	Double Nickel LC *	5.0–7.5 L/ha	**Suppression only.** Apply at 1–5% bloom and reapply every 3–7 days if conditions favour disease development. Can be mixed with copper fungicides to improve control.
		Serenade OPTI *	1.1–1.7 kg/ha	**Suppression only.** Apply at 1–5% bloom and repeat as needed if conditions favour disease development.
	NC	Blossom Protect *	See comments	For every 1 m of tree height, dilute 5.25 kg Component A in 500 L/ha water and add dilution to 0.75 kg Component B. If a forecast system is available, apply 1–2 days before an infection date. Repeat after 2 days and up to 5 times if infection continues. If no forecast system is available, apply at 10, 40, 70 and 90% open blossoms. This product is sensitive to fungicides and may have reduced efficacy if tank-mixed or applied within 2 days of certain products. See label for further details.
		Oxidate 2.0 *	1% v/v	**Partial suppression only.** For increased coverage, use with a registered non-ionic surfactant. Apply at first signs of infection or when conditions favour disease development. Reapply every 5–7 days as needed. Do not apply when temperatures are high (above 30°C), prior to rain and to heat- or drought-stressed trees.
Tree growth modification	NC	Promalin SL	63–256 mL/10 L water	Stimulates lateral bud break and additional branch growth on young non-bearing trees, providing better tree structure for early cropping. Apply when new terminal growth is 2.5– 8 cm long (from approximately king bloom to 1 week after petal fall). Do not use when temperatures are below freezing or above 32°C. Visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops*.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Postbloom				
European red mite, Two-spotted spider mite	**General Comments:** • Presence of beneficial insects should be considered before applying a spray. For more information on beneficial insects, see the Ontario Crop IPM website at ontario.ca/cropipm. • Thorough spray coverage is essential for good control. See Table 3–8. *Activity of Miticides Registered on Apple and/or Pear in Ontario.* • Miticides are best applied alone. • For resistance management, do not use more than once per season.			
	6	Agri-Mek SC	170 mL/ha	Apply before a threshold of 5 mites per leaf is reached, no later than 21 days after petal fall. Apply with 10 L of oil and a minimum of 1,000 L water/ha. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur.
	6+28	Minecto Pro	496 mL/ha	Apply before a threshold of 5 mites per leaf is reached, no later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	20B	Kanemite 15 SC	2.07 L/ha	From petal fall to 21 days later, apply when there are 5–7 mites per leaf. Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August.
	20D	Acramite 50 WS	568 g/ha (2.5 pouches/ha) or 851 g/ha (3.75 pouches/ha)	From petal fall to 21 days later, apply when there are 5–7 mites per leaf. Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August. Use lower rate for two-spotted spider mite and higher rate for European red mite.
	21	Nexter SC	0.5–1.0 L/ha	Controls nymphs and adults of European red mite but nymphs only for two-spotted spider mite. From petal fall to 21 days later, apply when there are 5–7 mites per leaf. Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August. Use lower rate for European red mite and higher rate for two-spotted spider mite. Also controls rust mite.
	23	Envidor 240 SC	750 mL/ha	From petal fall to 21 days later, apply when there are 5–7 mites per leaf. Apply when there are 7–10 active mites per leaf in June to mid-July or 10–15 active mites per leaf in July and August. Control may not be apparent for up to one week. Also controls rust mite.
	25	Nealta	1 L/ha	Apply as mite populations begin to build, before mite damage is observed. The use of a registered adjuvant may improve performance.
	NC	Kopa *	2% v/v in 700–1,000 L/ha	Begin applications when populations are low and reapply every 1–3 weeks as needed. Test a small area of each variety prior to spraying the whole block. This product must coat the bodies of susceptible, soft-bodied insects to be effective. Good coverage is critical. Applying soaps more than 3 times may cause plant injury. Avoid application in direct sunlight or to trees under stress. Application within 3 days of sulphur may increase plant injury on sensitive varieties.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Postbloom (cont'd)				
European red mite, Two-spotted spider mite (cont'd)	NC (cont'd)	Purespray Green Spray Oil 13 E *	10 L/1,000 L water	**Suppression only.** May cause bark injury to Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage. Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan, Ambush, Perm-Up, Pounce or sulphur.
		Vegol Crop Oil *	2% v/v	May cause bark injury to Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage at a rate of 2% v/v (20 L/1,000 L water). Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan or copper and 30 days of sulphur. Do not apply to wet foliage.
Rosy apple aphid, Green apple aphid	**General Comments:** • For rosy apple aphid, spray if 20% of clusters are infested. • For green apple aphid, spray if 10% of terminals are infested. • Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label.			
	4A	Actara 25 WG	160 g/ha	Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks. Last date of use for Actara, Admire, Alias and Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Admire 240 Flowable or Alias 240 SC	230 mL/ha	
		Assail 70 WP	120 g/ha	
		Calypso 480 SC	145–290 mL/ha	
		Clutch 50 WDG	140–210 g/ha	
	4A+15	Cormoran	0.7–1.05 L/ha	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C	Closer	100–200 mL/ha	Where possible, rotate with products outside of Group 4.
	4C+5	TwinGuard	250 g/ha	Where possible, rotate with products outside of Group 4.
	4D	Sivanto Prime	500–750 mL/ha	Where possible, rotate with products outside of Group 4.
	9D	Versys	100 mL/ha	Apply in a minimum spray volume of 1,000 L/ha.
	23	Movento 240 SC	365 mL/ha	Control may not be apparent for 2–3 weeks. Tank-mix with an adjuvant/additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not mix with sulphur.
	28	Exirel	1.5 L/ha	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
	29	Beleaf	160 g/ha	Apply before populations reach economic threshold. Reapply 7 days later if monitoring indicates a need. Do not use with adjuvants.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Postbloom (cont'd)				
Rosy apple aphid, Green apple aphid (cont'd)	NC	Kopa *	2% v/v in 700–1,000 L water	Begin applications when populations are low and reapply every 1–3 weeks as needed. Test a small area of each variety prior to spraying the whole block. This product must coat the bodies of susceptible, soft-bodied insects to be effective. Good coverage is critical. Applying soaps more than 3 times may cause plant injury. Avoid application in direct sunlight or to trees under stress. Application within 3 days of sulphur may increase plant injury on sensitive varieties.
		Purespray Green Spray Oil 13 E *	10 L/1,000 L water	**Rosy apple aphid only. Suppression only.** May cause bark injury to Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage. Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan, Ambush, Perm-Up, Pounce or sulphur.
		Vegol Crop Oil *	2% v/v	May cause bark injury to Red Delicious, Empire, Mutsu/Crispin and Ambrosia. Apply in a high-volume spray to ensure thorough coverage at a rate of 2% v/v (20 L/1,000 L water). Do not apply oil within 48 hours of freezing temperatures, when temperatures are high (above 30°C), prior to rain or to heat- or moisture-stressed trees. Do not use within 14 days of Supra Captan, Maestro, Folpan or copper and 30 days of sulphur. Do not apply to wet foliage.
Woolly apple aphid	**General Comments:** • Spray if aphid colonies are close to fruit clusters or on young trees and nursery stock. • Apply in a high-volume spray to ensure thorough coverage of trunk and limbs. • Reapply after 14 days if woolly apple aphid is still present.			
	1B	Malathion 85 E	610 mL/1,000 L water	No product specific comments.
	4C	Closer	400 mL/ha	Where possible, rotate with products outside of Group 4.
	4C+5	TwinGuard	500 g/ha	Where possible, rotate with products outside of Group 4.
	23	Movento 240 SC	365 mL/ha	Control may not be apparent for 2–3 weeks. Tank-mix with an adjuvant/additive that has spreading and penetrating properties at a suggested rate of 0.2% v/v. Do not tank-mix with sulphur.
Tentiform leafminer	**General Comments:** • Monitor for tentiform leafminer and apply sprays when thresholds are reached. See comments for Tentiform leafminer under **Special summer sprays** in Table 3–1. *Apple Crop Protection*.			
	1A	Vydate L	1.5–3.0 L/1,000 L water	Very toxic to applicator.
	4A	Actara 25 WG	315 g/ha	Maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks. Last date of use for Actara, Admire, Alias and Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Admire 240 Flowable or Alias 240 SC	380 mL/ha	
		Assail 70 WP	80 g/ha	
		Calypso 480 SC	290 mL/ha	
		Clutch 50 WDG	140–210 g/ha	

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Postbloom (cont'd)				
Tentiform leafminer (cont'd)	4A+15	Cormoran	700 mL/ha	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	250–500 g/ha	Where possible, rotate with products outside of Group 4 between generations.
	5	Delegate	420 g/ha	No product specific comments.
	6+28	Minecto Pro	496 mL/ha	Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	28	Altacor	215 g/ha	No product specific comments.
		Exirel	500–750 mL/ha	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
Leafcurling midge	Use one of the products listed for Leafcurling midge at **Prebloom.** See Table 3–4. *Activity of Insecticides and Miticides on Apple Pests* for efficacy of products. Continue monitoring and apply an insecticide shortly after upswing in pheromone trap catches or when yellow eggs are found in newest unfurled leaves. Generations begin to overlap as season progresses, making control more difficult.			
Obliquebanded leafroller	**General Comments:** • Spray when larvae are small. Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • Place pheromone traps in the orchard at petal fall to monitor emergence of summer-generation adults.			
	4C+5	TwinGuard	500 g/ha	No product specific comments.
	5	Delegate	420 g/ha	No product specific comments.
		Entrust * or Success	364 mL/ha 182 mL/ha	No product specific comments.
	6+28	Minecto Pro	496 mL/ha	Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. May cause russeting on Golden Delicious and other light-skinned cultivars. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	11	Bioprotec CAF * or Dipel 2X DF * or Foray 48 BA or XenTari WG *	4 L/ha 1.12 kg/ha 2.8 L/ha 0.5–1.6 kg/ha	Product must be consumed to be effective. Spray when and where pests are actively feeding. Apply in a high-volume spray to ensure thorough coverage on both sides of the leaf. Apply to young larvae, early in infestation. Death of insect may take several days. Reapply at 5–7-day intervals if larvae activity is extended. Acidify spray mix to below pH 7.0 and apply on cloudy days or in the evening.
	18	Confirm 240 F	1 L/ha	Cross-resistance to this group and pyrethroids may be possible in organophosphate-resistant populations.
		Intrepid	750 mL/ha	

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Postbloom (cont'd)				
Obliquebanded leafroller (cont'd)	28	Altacor	285 g/ha	Do not tank-mix or make sequential applications of Exirel with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions. Harvanta is persistent. Where possible, do not use in consecutive years.
		Exirel	0.5–1.0 L/ha	
		Harvanta 50 SL	1.2–1.6 L/ha	
Oriental fruit moth	**General Comments:** • In early June until new shoots begin to harden, larvae can bore into the tips of terminal shoots causing die-back. • Place pheromone traps in the orchard in late April. Apply insecticides 6–10 days after upswing in catch, which often coincides with petal fall. Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label. • Alternatively, accumulate degree-days Celcius (DDC, base 7.2°C) at first sustained moth catch (biofix) and apply insecticides targeting first-generation larvae. For information on calculating degree days, see *Degree-Day Modeling* in Chapter 2.			
	3	Decis 5 EC	250 mL/ha	Apply at 194–208 DDC or earlier if using as an ovi-larvicide. Highly toxic to beneficial insects and may lead to mite outbreaks. Maximum of 1 application per season. Apply in 3,000 L water.
	4A	Assail 70 WP	240 g/ha	Apply at 139–153 DDC for eggs or larvae. Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks.
		Calypso 480 SC	440 mL/ha	
	4A+15	Cormoran	1.05–1.26 L/ha	Apply at 111–139 DDC. Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4C+5	TwinGuard	500 g/ha	Apply at 194–208 DDC or earlier if using as an ovi-larvicide. Where possible, rotate with products outside of Group 4 between generations.
	5	Delegate	420 g/ha	Apply at 194–208 DDC or earlier if using as an ovi-larvicide.
	6+28	Minecto Pro	496 mL/ha	Apply at 194–208 DDC or earlier if using as an ovi-larvicide. Do not apply later than 6 weeks after petal fall. Apply with 0.25%–1% v/v oil and a minimum of 450 L water/ha. Do not use within 14 days of Supra Captan, Maestro, Folpan or other products containing sulphur. Do not tank-mix or make sequential applications with strobilurins or copper fungicides. See product label for other tank-mix restrictions.
	15	Rimon 10 EC	1.4 L/1,000 L water	Apply at 111–139 DDC. Use for first generation only. See label for additional information on rates and volumes. Do not allow Rimon to drift onto grapes as leaf spotting may occur.
	18	Intrepid	1 L/ha	Apply at 139–153 DDC for eggs or larvae.
	28	Altacor	215 g/ha	Apply at 194–208 DDC or earlier if using as an ovi-larvicide. Do not tank-mix or make sequential applications of Exirel with strobilurin, copper or captan fungicides. See product label for other tank-mix restrictions. Harvanta is persistent. Where possible, do not use in consecutive years.
		Exirel	500–750 mL/ha	
		Harvanta 50 SL	1.2–1.6 L/ha	
Tree growth modification	Use one of the products listed under Tree growth modification at **Bloom**.			

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Postbloom (cont'd)				
Enhanced bloom	NC	Ethrel	2.0–4.25 L/1,000 L water	Apply 1–2 weeks after bloom to non-bearing trees (determined by bearing trees in the area). Use lower rate for spur type trees and higher rate for non-spur type trees. Concentrate sprays can be used at rate of 7 L/500 L water for spur type trees or 14 L/500 L water for non-spur type trees. This rate may completely remove any fruit from trees, especially if applied 4 weeks after full bloom. Visit ontario.ca/apples and click on *Thinning of Tree Fruit*. For young trees just beginning to initiate flowers, see comments for this product under Enhanced bloom at **Summer sprays.**
Summer sprays				
Aphids	Use one of the products listed for Aphids at **Postbloom.**			
Tentiform leafminer	Use one of the products listed for Tentiform leafminer at **Postbloom.**			
White apple leafhopper	**General Comments:** • Spray when 2–5 nymphs per leaf. Nymphs are active in mid-June and early August. • Best timing is after petal fall, if threshold is reached. • Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label.			
	4A	Admire 240 Flowable or Alias 240 SC	200 mL/ha	Maximum of 2 applications of product from this group per season. Repeated use may result in mite outbreaks. Last date of use for Admire, Alias and Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Assail 70 WP	80 g/ha	
		Calypso 480 SC	145 mL/ha	
		Clutch 50 WDG	140–210 g/ha	
	4A+15	Cormoran	700 mL/ha	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	4D	Sivanto Prime	500–750 mL/ha	Where possible, rotate with products outside of Group 4.
	28	Altacor	285 g/ha	**Suppression only.**
		Exirel	1 L/ha	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
Potato leafhopper	**General Comments:** • This pest can cause serious economic damage to young trees or nursery stock. • Unless stated otherwise in product specific comments, reapply, if necessary, in 10–14 days according to product label.			
	4A	Assail 70 WP	80 g/ha	Maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks. Last date of use for Clutch is April 11, 2021. Consult the most recent label on the PMRA website and/or the product registrant to verify dates of last sale and use.
		Calypso 480 SC	145 mL/ha	
		Clutch 50 WDG	140–210 g/ha	
	4A+15	Cormoran	700 mL/ha	Maximum of 2 applications of products from this group per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.

* Potentially organic. Check with certifying body.

Table 3–2. Non-Bearing Apple Crop Protection (cont'd)

Disease, Insect	Group	Product	Rate	Product Specific Comments
Summer sprays (cont'd)				
Potato leafhopper (cont'd)	4D	Sivanto Prime	500–750 mL/ha	Where possible, rotate with products outside of Group 4.
Japanese beetle	**General Comments:** • This is a sporadic pest in Ontario that can cause economic damage, especially in young plantings of Honeycrisp. • Apply when damage is first detected.			
	1B	Imidan WP	2.68 kg/ha	This may also provide some control of potato leafhopper.
	4A	Calypso 480 SC	145–290 mL/ha	No product specific comments.
	4A+15	Cormoran	0.84–1.26 L/ha	Maximum of 2 applications of products from Group 4A per season. Repeated use may result in mite outbreaks. Apply in a minimum spray volume of 1,000 L/ha. Do not allow Cormoran to drift onto grapes as leaf spotting may occur.
	28	Altacor	285 g/ha	**Suppression only.**
		Exirel	1.0–1.5 L/ha	Do not tank-mix or make sequential applications with strobilurins, copper or captan fungicides. See product label for other tank-mix restrictions.
Obliquebanded leafroller	Use one of the products listed for Obliquebanded leafroller at **Postbloom.** Insecticides for summer-generation larvae should be applied at 240–280 DDC after first sustained moth catch (base 6.1°C). For information on calculating degree days, see *Degree-Day Modeling* in Chapter 2.			
Oriental fruit moth	Use one of the products listed for Oriental fruit moth at **Postbloom.** This is a special spray timing if damage from first generation was observed in new planting. Adjust spray timing based on monitoring. Apply insecticides 3–6 days after upswing in moth flight using pheromone traps. Control is likely not needed for third generation in late summer as shoots have hardened off.			
Buffalo treehopper	Follow clean cultivation practices or remove legumes from cover crop.			
Enhanced bloom	Use one of the products listed under Enhanced bloom at **Postbloom.** For young trees just beginning to initiate flowers, apply 3–5 weeks after full bloom to avoid thinning and misshapen fruit.			
Fall				
Phytophthora crown and root rot	4	Ridomil Gold 480 SL	1 mL/tree	Apply in 5 L of water per tree in early fall, using handgun to drench trunk and soil surrounding tree. Do not apply as a foliar spray.
	33	Aliette	5–10 g/tree	Apply in 5 L of water per tree in early fall, using handgun to drench trunk and soil surrounding tree. Use higher rate for standard trees.
Root lesion nematode	See *Plant Parasitic Nematodes in Ontario* in Chapter 4 for more information.			

* Potentially organic. Check with certifying body.

Table 3–3. Products Used on Apples

Use this table as a guide but refer to product label for specific information.

The preharvest interval is the number of days between the last spray and first harvest.
The restricted entry interval is the minimum interval that must be observed between when you apply the pesticide and when you work in the treated crop without protective equipment.

The maximum applications is the labelled maximum number or product amount applied for the growing season and may be higher than what is recommended for resistance management or for the preservation of beneficial insects.

Products listed as potentially organic may be acceptable for organic use based on *Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec publication Bulletin D'Information No. 3, 3 juin 2019* or a letter of certification provided by the registrant. Check with certifying body to verify the acceptability of any product prior to using it.

Product Name	Registration Number	Common Name	Group	Preharvest Interval	Restricted Entry Interval	Maximum Applications	Potentially Organic
Products used for insect and mite control or suppression							
Acramite 50 WS	27925	bifenazate	20D	7 days	12 hours	1	—
Actara 25 WG ‡	28408	thiamethoxam	4A	60 days	12 hours	2	—
Admire 240 Flowable ‡	24094	imidacloprid	4A	7 days	24 hours	2	—
Agri-Mek SC	31607	abamectin	6	28 days	12 hours	1	—
Alias 240 SC ‡	28475	imidacloprid	4A	7 days	24 hours	2	—
Altacor	28981	chlorantraniliprole	28	5 days	12 hours	3 (max. 645 g/ha)	—
Ambush 500 EC	14882	permethrin	3	7 days	when dry	—	—
Apollo SC	21035	clofentezine	10	21 days[1]	12 hours[2]/48 hours[3]	1	—
Assail 70 WP	27128	acetamiprid	4A	7 days	12 hours[2]/48 hours[4]/ 6 days[3]	4	—
Beleaf 50 SG	29796	flonicamid	29	21 days	12 hours[2]/48 hours[3]	3 (max. 480 g/ha)	—
Bioprotec CAF	26854	*Bacillus thuringiensis*	11	0 days	12 hours	—	✓
Calypso 480 SC	28429	thiacloprid	4A	30 days	12 hours	3 (max. 875 mL/ha)	—
Closer	30826	sulfoxaflor	4C	7 days	12 hours	2	—
Clutch 50 WDG ‡	29382	clothianidin	4A	7 days	12 hours	2 (max. 420 g/ha)	—
Confirm 240 F	24503	tebufenozide	18	14 days	12 hours	4	—
Cormoran	33353	acetamiprid + novaluron	4A+15	14 days	12 hours[2]/7 days[3]	max. 6.9 L/ha	—
Cyd-X	30120	*Cydia pomonella* granulovirus	NC	0 days	12 hours	—	✓
Decis 5 EC	22478	deltamethrin	3	1 day	12 hours	3	—

‡ = New re-evaluation decision has been made for this active ingredient or formulation. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use.

M = Multi-site fungicides. NC = Not classified by FRAC/IRAC, or group not indicated on product label. P = Plant extract. U/UN = Mode of action has not been determined.
— = Information is not specified on the product label. ✓ = Potentially organic. Check with certifying body.

[1] Apply no later than 14 days after petal fall. [2] General re-entry. [3] Hand thinning. [4] Contact and scouting activities. [5] Maximum trunk applications per year for borer. [6] Personal protective equipment required for certain activities. See label. [7] Pick-your-own harvest. [8] Maximum of 3 consecutive applications to ensure plant injury does not occur. Additional applications may be possible if previous experience with repeat applications of the product under the same conditions have not produced plant injury. [9] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [10] Maximum dormant applications per year / maximum summer applications per year. [11] Maximum of 2 applications per codling moth generation. [12] Pruning and training. [13] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [14] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [15] Depends on tank-mix partner. See label for more information. [16] High density, trellised orchard. [17] Traditional low- to medium-density orchard.

Table 3–3. Products Used on Apples (cont'd)

Product Name	Registration Number	Common Name	Group	Preharvest Interval	Restricted Entry Interval	Maximum Applications	Potentially Organic
Products used for insect and mite control or suppression (cont'd)							
Delegate	28778	spinetoram	5	7 days	12 hours	2[5]/3	—
Dipel 2X DF	26508	*Bacillus thuringiensis*	11	0 days	12 hours	—	✓
Entrust	30382	spinosad	5	7 days	when dry	3	✓
Envidor 240 SC	28051	spirodiclofen	23	7 days	12 hours	1	—
Exirel	30895	cyantraniliprole	28	3 days	12 hours	4 (max. 4.5 L/ha)	—
Foray 48 BA	24978	*Bacillus thuringiensis*	11	0 days	12 hours	—	—
GF-120 Fruit Fly Bait	28336	spinosad bait	5	—	when dry	10	✓
Harvanta 50 SL	32889	cyclaniliprole	28	7 days	12 hours	5 (max. 6 L/ha)	—
Imidan WP	29064	phosmet	1B	14 days	7 days[2,6]/14 days[7]/ 30 days[3]	5	—
Intrepid	27786	methoxyfenozide	18	14 days	12 hours	2 (max. 2 L/ha)	—
Isomate CM/OFM TT	29352	pheromone, oriental fruit moth and codling moth	NC	—	—	—	✓
Isomate DWB	30589	pheromone, dogwood borer	NC	—	—	—	—
Isomate OFM TT	31419	pheromone, oriental fruit moth	NC	—	—	—	✓
Kanemite 15 SC	28641	acequinocyl	20B	14 days	12 hours	2 (max. 4.1 L/ha)	—
Kopa	31433	potassium salts of fatty acids	NC	12 hours	12 hours	3[8]	✓
Mako	30316	cypermethrin	3	7 days	12 hours	2	—
Malathion 85 E	8372	malathion	1B	3 days	12 hours[2]/48 hours[9]/ 72 hours[3]	2	—
Matador 120 EC	24984	lambda-cyhalothrin	3	7 days	24 hours	3	—
Minecto Pro	33023	abamectin + cyantraniliprole	6+28	28 days	12 hours	1	—
Movento 240 SC	28953	spirotetramat	23	7 days	12 hours	max. 1.83 L/ha	—
Nealta	31284	cyflumetofen	25	7 days	12 hours	2	—
Nexter SC	33433	pyridaben	21	25 days	24 hours	2	—

‡ = New re-evaluation decision has been made for this active ingredient or formulation. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use.

M = Multi-site fungicides. NC = Not classified by FRAC/IRAC, or group not indicated on product label. P = Plant extract. U/UN = Mode of action has not been determined.
— = Information is not specified on the product label. ✓ = Potentially organic. Check with certifying body.

[1] Apply no later than 14 days after petal fall. [2] General re-entry. [3] Hand thinning. [4] Contact and scouting activities. [5] Maximum trunk applications per year for borer. [6] Personal protective equipment required for certain activities. See label. [7] Pick-your-own harvest. [8] Maximum of 3 consecutive applications to ensure plant injury does not occur. Additional applications may be possible if previous experience with repeat applications of the product under the same conditions have not produced plant injury. [9] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [10] Maximum dormant applications per year / maximum summer applications per year. [11] Maximum of 2 applications per codling moth generation. [12] Pruning and training. [13] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [14] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [15] Depends on tank-mix partner. See label for more information. [16] High density, trellised orchard. [17] Traditional low- to medium-density orchard.

Table 3–3. Products Used on Apples (cont'd)

Product Name	Registration Number	Common Name	Group	Preharvest Interval	Restricted Entry Interval	Maximum Applications	Potentially Organic
Products used for insect and mite control or suppression (cont'd)							
Perm-Up EC	28877	permethrin	3	7 days	12 hours	—	—
Pounce 384 EC	16688	permethrin	3	7 days	when dry	—	—
Purespray Green Spray Oil 13 E	27666	mineral oil	NC	—	12 hours	2/8[10]	✓
Rimon 10 EC	28881	novaluron	15	14 days	12 hours	2[5]/4	—
Silencer 120 EC	29052	lambda-cyhalothrin	3	7 days	24 hours	3	—
Sivanto Prime	31452	flupyradifurone	4D	14 days	12 hours	2 L/ha	—
Success	26835	spinosad	5	7 days	when dry	3	—
Superior 70 Oil	9542 14981	mineral oil	NC	—	12 hours	1 (full rate)	✓
Surround WP	27469	kaolin	NC	0 days	12 hours	—	✓
TwinGuard	31442	sulfoxaflor + spinetoram	4C+5	7 days	12 hours	2	—
Up-Cyde 2.5 EC	28795	cypermethrin	3	7 days	12 hours	3	—
Vegol Crop Oil	32408	canola oil	NC	0 days	12 hours	2/4[10]	✓
Versys	33266	afidopyropen	9D	7 days	12 hours	4 (max. 400 mL/ha)	—
Virosoft CP 4	26533	*Cydia pomonella* granulovirus	NC	—	4 hours	4[11]	✓
Vydate L	17995	oxamyl	1A	non-bearing only	12 hours[2]/7 days[4,12]/ 30 days[3]	3	—
XenTari WG	31557	*Bacillus thuringiensis*	11	0 days	12 hours	—	✓
Products used for disease control or suppression							
Aliette	27688	fosetyl al	33	30 days	when dry	3	—
Allegro 500 F	27517	fluazinam	29	28 days	24 hours[2]/72 hours[3]	9	—
Apogee	28042	prohexadione calcium	NC	45 days	12 hours	4 (max. 5.4 kg/ha)	—
Aprovia Top	31526	difenoconazole + benzovindiflupyr	3+7	30 days	12 hours	max. 2.57 L/ha	—
Bio-Save 10 LP	29673	*Pseudomonas syringae*	NC	postharvest	—	1	—

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[1] Apply no later than 14 days after petal fall. [2] General re-entry. [3] Hand thinning. [4] Contact and scouting activities. [5] Maximum trunk applications per year for borer. [6] Personal protective equipment required for certain activities. See label. [7] Pick-your-own harvest. [8] Maximum of 3 consecutive applications to ensure plant injury does not occur. Additional applications may be possible if previous experience with repeat applications of the product under the same conditions have not produced plant injury. [9] Hand harvest. Where restricted entry interval exceeds preharvest interval, use longer interval. [10] Maximum dormant applications per year / maximum summer applications per year. [11] Maximum of 2 applications per codling moth generation. [12] Pruning and training. [13] High density orchard, where maximum canopy width per tree is less than 2 m (1 m from trunk to row alley). [14] Non-high density/standard orchard, where maximum canopy width per tree is greater than 2 m (1 m from trunk to row alley). [15] Depends on tank-mix partner. See label for more information. [16] High density, trellised orchard. [17] Traditional low- to medium-density orchard.

Table 3–3. Products Used on Apples (cont'd)

Product Name	Registration Number	Common Name	Group	Preharvest Interval	Restricted Entry Interval	Maximum Applications	Potentially Organic
Products used for disease control or suppression (cont'd)							
Blossom Protect	30552	*Aureobasidium pullulans*	44	0 days	when dry	5	✓
Buran	30601	garlic powder	NC	0 days	when dry	—	✓
Cevya	33405	mefentrifluconazole	3	0 days	12 hours	1.125 L/ha	—
Copper 53 W	9934	tri-basic copper sulphate	M	30 days	48 hours	3	✓
Copper Spray	19146	copper oxychloride	M	2 days	48 hours	2	✓
Cosavet DF Edge	31869	sulphur	M	1 day	24 hours	8	✓
Cueva	31825	copper octanoate	M	1 day	4 hours	10	✓
Diplomat 5 SC	32918	polyoxin D zinc salt	19	0 days	when dry	max. 2.77 L/ha	—
Dithane Rainshield	20553	mancozeb	M	45 days	12 hours	—	—
Double Nickel LC	31887	*Bacillus amyloliquefaciens*	44	0 days	when dry	—	✓
Ferbam 76 WDG ‡	20136	ferbam	M	7 days	12 hours	—	—
Flint	30619	trifloxystrobin	11	14 days	12 hours[2]/4 days[3]	4 (max. 840 g/ha)	—
Folpan 80 WDG	27733	folpet	M	—	24 hours	6	—
Fontelis	30331	penthiopyrad	7	28 days	12 hours	4 (max. 4.5 L/ha)	—
Fullback 125 SC	31679	flutriafol	3	14 days	12 hours	max. 2.05 L/ha	—
Granuflo T ‡	30548	thiram	M	28 days	24 hours	—	—
Inspire Super	30827	difenoconazole + cyprodinil	3+9	14 days	12 hours	4	—
Kasumin 2L	30591	kasugamycin	24	90 days	12 hours	4	—
Kenja 400 SC	31758	isofetamid	7	20 days	12 hours	6	—
Kudos 27.5 WDG	33010	prohexadione calcium	NC	45 days	12 hours	4 (max. 5.4 kg/ha	—
Kumulus DF	18836	sulphur	M	1 day	24 hours	8	✓
Luna Tranquility	30510	fluopyram + pyrimethanil	7+9	14 days	12 hours[2]/24 hours[3]	4 (max. 3.2 L/ha)	—
Maestro 80 DF ‡	26408	captan	M	7 days	48 hours	—	—

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Table 3–3. Products Used on Apples (cont'd)

Product Name	Registration Number	Common Name	Group	Preharvest Interval	Restricted Entry Interval	Maximum Applications	Potentially Organic
Products used for disease control or suppression (cont'd)							
Maestro 80 WSP	33488	captan	M	7 days	High density[13]: 2 days[2]/6 days[12]/ 15 days[2,9]	10[13]	—
					Standard[14]: 2 days[2]/4 days[12]/ 19 days[9]/24 days[3]	2[14]	
Manzate Pro-stick	28217	mancozeb	M	45 days	24 hours	—	—
Mertect SC	13975	thiabendazole	1	postharvest	—	—	—
Microscopic Sulphur WP	14653	sulphur	M	1 day	24 hours	8	✓
Microthiol Disperss	29487	sulphur	M	1 day	24 hours	8	✓
Nova	22399	myclobutanil	3	14 days	12 hours[2,4]/5 days[9]/ 12 days[3]	6	—
Oxidate 2.0	32907	hydrogen peroxide + peroxyacetic acid	NC	0 days	4 hours	8	✓
Parasol Flowable	25901	copper hydroxide	M	dormant	48 hours	1	—
Penncozeb 75 DF Raincoat	30241	mancozeb	M	45 days	24 hours	—	—
Phostrol	30449	mono- and dibasic sodium, potassium and ammonium phosphites	33	1 day	12 hours	6	—
Polyram DF ‡	20087	metiram	M	45 days	12 hours	—	—
Pristine WG	27985	boscalid + pyraclostrobin	7+11	5 days	when dry[2]/5 days[9]/ 12 days[3]	4	—
Regalia Maxx	30199	*Reynoutria sachalinensis*	P5	0 days	when dry	—	✓
Ridomil Gold 480 SL	28474	metalaxyl-M and S	4	non-bearing only	12 hours	2	—
Scala SC	28011	pyrimethanil	9	14 days	12 hours[2]/24 hours[3]	4	—
Scholar 230 SC	29528	fludioxonil	12	postharvest	—	1	—
Senator 50 SC	32096	thiophanate-methyl	1	1 day	12 hours	max. 0.875 L/ha or 1.75 L/ha[15]	—

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Table 3–3. Products Used on Apples (cont'd)

Product Name	Registration Number	Common Name	Group	Preharvest Interval	Restricted Entry Interval	Maximum Applications	Potentially Organic
Products used for disease control or suppression (cont'd)							
Sercadis	31697	fluxapyroxad	7	0 days	12 hours	4	—
Serenade OPTI	31666	*Bacillus subtilis*	44	0 days	when dry	—	✓
Sovran	26257	kresoxim-methyl	11	30 days	48 hours	4	—
Streptomycin 17	10305	streptomycin sulphate	25	50 days	24 hours[2]/7 days[4]/ 14 days[3]	3	—
Supra Captan 80 WDG ‡	24613	captan	M	7 days	48 hours	—	—
Syllit 400 FL	28351	dodine	U12	7 days	48 hours	2	—
Thinners and plant growth regulators							
Apogee	28042	prohexadione calcium	NC	45 days	12 hours	max. 5.4 kg/ha	—
Blush	32167	prohydrojasmon	NC	7 days	when dry	2	—
Cilis Plus	29210	6-benzylaminopurine	NC	28 days	12 hours	max. 21.3 L/ha	—
Ethrel	11580	ethephon	NC	—	48 hours	—	—
Fruit Fix Concentrate	16027	1-naphthaleneacetic acid	NC	5 days	when dry	2	—
Fruitone-L	31460	1-naphthaleneacetic acid	NC	5 days	when dry	2	—
Harvista 1.3 SC	32752	1-methylcyclopropene	NC	3 days	4 hours	max. 17.7 L/ha	—
Kudos 27.5 WDG	33010	prohexadione calcium	NC	45 days	12 hours	4 (max. 5.4 kg/ha)	—
MaxCel	28851	6-benzyladenine	NC	86 days	12 hours	max. 22.5 L/ha	—
Perlan	29187	6-benzylaminopurine + gibberellins A_4A_7	NC	28 days	12 hours	max. 2.4 L/ha	—
Promalin SL	16636	6-benzyladenine + gibberellins A_4A_7	NC	28 days	12 hours	4	—
ReTain	25609	aviglycine hydrochloride	NC	7 days	12 hours	—	—
Sevin XLR	27876	carbaryl	1A	75 days	Trellised[16]: 4 days[2]/14 days[3,9]	2 (max. 3.22 L/ha[16])	—
					Non-trellised[17]: 12 hours[2]/10 days[9]/ 17 days[3]	2 (max. 2.15 L/ha[17])	

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Notes on Apple Insects and Diseases

Use the information in the following tables to assist with choosing the best product for the pest complex present. Consider the life stage present, history of the pest, weather and resistance management strategies, as well as the activity of each product to pests and beneficial insects.

For more information on managing pesticide resistance, see Chapter 2, *Pest Resistance to Fungicides, Insecticides and Miticides*.

Table 3–4. Activity of Insecticides and Miticides on Apple Pests

Use products only for pests listed on the product label for the crop. The information provided in this table is intended to assist the grower in choosing the best insecticide for control of pests listed on the product label, while managing resistance and avoiding unnecessary sprays for non-target pests. Efficacy can be affected by rate of the product.

Insecticide	Apple maggot	Apple clearwing moth	Brown marmorated stink bug	Codling moth	Dogwood borer	European apple sawfly	Japanese beetle	Leafcurling midge	Mullein bug	Obliquebanded leafroller	Oriental fruit moth	Plum curculio	Potato leafhopper	San Jose scale	Spring-feeding caterpillar	Tarnished plant bug	Tentiform leafminer	White apple leafhopper	Aphids			Mites		
																			Green apple aphid	Rosy apple aphid	Woolly apple aphid	Apple rust mite	European red mite	Two-spotted spider mite
Acramite 50 WS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3*	4*
Actara 25 WG[1,2]	2	—	3*	1	—	2	1	—	3*	0	1	3*	4	0	—	3	3*	4	4	4*	—	0	0	0
Admire 240 Flowable[1,2]	2	—	2	—	—	—	1	—	3*	—	—	—	4*	2	—	2	4*	4*	4*	4*	2	0	0	0
Alias 240 SC[1,2]	2	—	2	—	—	—	1	—	3*	—	—	—	4*	2	—	2	4*	4*	4*	4*	2	0	0	0
Agri-Mek SC	0	0	1	0	0	0	0	—	0	0	0	0	3	—	0	0	4* ES	3	—	—	—	3 ES	4* ES	3* ES
Altacor	2*	—	1	4*	3*	4*	2*	—	—	4*	4*	1	—	1	4*	1	4*	2*	1	1	—	0	0	0
Ambush 500 EC[1]	3*	—	2	2*	3*	3	3	—	2*	2* R	3	2*	3	1	3*	4*	3*	3*	2	3	1	0	0	0
Apollo SC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1 ES	3* ES	2* ES

0 = Not effective. 1 = Reduction in damage or poor control. 2 = Suppression or fair control. 3 = Good control with some limitations. 4 = Excellent control.
ES = Early season applications only. R = Resistant. — = Information is unavailable. *(shaded area) = The pest is listed on the product label for control or suppression.

[1] May cause mite flare-ups.
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Ratings are based on moderate insect or mite pressure. Efficacy may be affected by rate of insecticide used, as well as coverage, timing and residual of the product. In some orchards, resistance may cause control failures when present. See *Pest Resistance to Fungicides, Insecticides and Miticides* in Chapter 2. Products must be applied at proper timings and label rates for each pest. Consult label or apple calendar for this information.
Source: Various extension publications (*Cornell Pest Management Guidelines for Tree Fruit, Michigan Fruit Management Guide, Penn State Tree Fruit Production Guide*), scientific journal articles and Ontario field trials.

Table 3–4. Activity of Insecticides and Miticides on Apple Pests (cont'd)

Insecticide	Apple maggot	Apple clearwing moth	Brown marmorated stink bug	Codling moth	Dogwood borer	European apple sawfly	Japanese beetle	Leafcurling midge	Mullein bug	Obliquebanded leafroller	Oriental fruit moth	Plum curculio	Potato leafhopper	San Jose scale	Spring-feeding caterpillar	Tarnished plant bug	Tentiform leafminer	White apple leafhopper	Aphids			Mites		
																			Green apple aphid	Rosy apple aphid	Woolly apple aphid	Apple rust mite	European red mite	Two-spotted spider mite
Assail 70 WP[1]	3–4*	—	3	3*	—	3*	4	2	3*	1	4*	3–4*	4*	2	3*	3	4*	4*	4*	4*	2	0	0	0
Beleaf 50 SG	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	3*	3*	2*	0	0	0
Bioprotec CAF	0	—	0	1	—	—	0	—	0	3*	1	0	0	0	3	0	0	0	0	0	0	0	0	0
Calypso 480 SC[1]	3*	—	2	3*	—	4*	4*	1–2	3*	1	4*	4*	4*	2	—	3	4*	4*	4*	4*	2	0	0	0
Closer[1]	0	0	2	0	0	0	0	3	3*	0	0	0	4	3*	0	2–3*	2	4	4*	4*	3–4*	0	0	0
Clutch 50 WDG[1,2]	—	—	3*	2*	—	—	2	—	—	1	3*	4*	4*	—	1	—	4*	4*	4*	4*	—	0	0	0
Confirm 240 F	0	—	1	3*	—	—	—	—	—	3* R	3 ES	0	0	0	3	0	3*	0	0	0	—	0	0	0
Cormoran	3–4*	—	—	3*	3*	3*	4*	—	3*	—	4*	3–4*	4*	—	3*	3*	4*	4*	4*	4*	—	0	0	0
Cyd-X	0	0	0	4*	0	0	0	0	0	—	3	0	0	0	—	0	—	0	0	0	0	0	0	0
Decis 5 EC[1]	3	—	—	3*	—	3	—	2*	1*	2* R	3*	2	4	1	3*	3	4*	4*	1*	3*	1	0	0	0
Delegate	2*	1*	1	4*	3*	—	—	2	—	4*	4*	2*	—	—	4*	—	4*	—	0	0	—	0	0	0
Dipel 2X DF	0	—	0	1	—	—	0	—	0	3*	1	0	0	0	3	0	0	0	0	0	0	0	0	0
Entrust	2	4	—	2*	—	—	—	—	—	4*	1	1	0	—	4*	0	3	0	0	0	—	0	0	0
Envidor 240 SC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4*	4*	4*
Exirel	3*	—	—	4*	—	3*	3*	2	0	4*	4*	2–3*	2	—	4*	3	4*	3*	3*	3*	—	0	0	0
Foray 48 BA	0	—	0	1	—	—	0	—	0	3*	1	0	0	0	3	0	0	0	0	0	0	0	0	0
Harvanta 50 SL	2*	—	—	4*	—	3	2	—	—	4*	4*	2*	—	—	4*	—	4	2	—	—	—	0	0	0

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ES = Early season applications only. R = Resistant. — = Information is unavailable. *(shaded area) = The pest is listed on the product label for control or suppression.

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Table 3–4. Activity of Insecticides and Miticides on Apple Pests (cont'd)

Insecticide	Apple maggot	Apple clearwing moth	Brown marmorated stink bug	Codling moth	Dogwood borer	European apple sawfly	Japanese beetle	Leafcurling midge	Mullein bug	Obliquebanded leafroller	Oriental fruit moth	Plum curculio	Potato leafhopper	San Jose scale	Spring-feeding caterpillar	Tarnished plant bug	Tentiform leafminer	White apple leafhopper	Aphids			Mites		
																			Green apple aphid	Rosy apple aphid	Woolly apple aphid	Apple rust mite	European red mite	Two-spotted spider mite
Imidan WP	3–4*	—	1	3* R	—	3	3*	1	—	2* R	3 R	4*	1	1*	3*	2*	1*	1	2*	2*	1	—	—*	—*
Intrepid	0	—	1	3*	—	—	—	—	—	3* R	3* ES	0	0	0	3	0	3*	0	0	0	—	0	0	0
Kanemite 15 SC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	4*	4*
Kopa	0	0	0	0	0	0	0	—	0	0	0	0	1	2*	0	0	0	1	3*	2*	—	2*	2*	2*
Mako[1]	2*	3*	1	2*	3*	3	—	2*	1*	1 R	3	3*	—	1	3*	3*	3*	1*	2	2	—	0	0	0
Malathion 85 E	2	—	2	3*	—	3	—	—	—	1	3	3*	1	—*	2	1	1	1	3*	2*	3*	—	—*	—*
Matador 120 EC[1]	3	—	2	3*	—	3	3	2*	—	2* R	3	2*	4	1	3*	4*	4*	4*	2–3*	2–3*	1*	0	0	0
Minecto Pro	3	—	—	4*	—	3*	—	—	—	4*	4*	2	2	—	4*	—	4*	3	3	3	—	3	4*	3*
Movento 240 SC	0	0	0	0	0	0	0	3*	0	0	0	0	—	4*	0	0	0	—	4*	3*	4*	0	0	0
Nealta	0	0	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	—	0	0	0	—	4*	4*
Nexter SC	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	3*	3*	2*
Perm-Up EC[1]	3*	—	2	2*	3*	3	3	—	2*	2* R	3	2*	3	1	3*	4*	3*	3*	2	3	1	0	0	0
Pounce 384 EC[1]	3*	—	2	2*	3*	3	3	—	2*	2* R	3	2*	3	1	3*	4*	3*	3*	2	3	1	0	0	0

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Table 3–4. Activity of Insecticides and Miticides on Apple Pests (cont'd)

Insecticide	Apple maggot	Apple clearwing moth	Brown marmorated stink bug	Codling moth	Dogwood borer	European apple sawfly	Japanese beetle	Leafcurling midge	Mullein bug	Obliquebanded leafroller	Oriental fruit moth	Plum curculio	Potato leafhopper	San Jose scale	Spring-feeding caterpillar	Tarnished plant bug	Tentiform leafminer	White apple leafhopper	Aphids			Mites		
																			Green apple aphid	Rosy apple aphid	Woolly apple aphid	Apple rust mite	European red mite	Two-spotted spider mite
Purespray Green Spray Oil 13 E (dormant)	0	0	0	0	0	0	0	—	0	0	0	0	0	4*	0	0	0	0	2	2*	—	—	4*	—
Purespray Green Spray Oil 13 E (summer)	—	—	—	1	—	—	—	1	—	—	1	—	—	2	—	—	1	—	2	2*	1	2	4*	2
Rimon 10 EC	—	3*	1	3*	3*	—	—	—	—	3	3*	—	2	—	4	3	4	2	—	—	—	0	0	0
Silencer 120 EC[1]	3	—	2	3*	—	3	3	2*	—	2* R	3	2*	4	1	3*	4*	4*	4*	2–3*	2–3*	1*	0	0	0
Sivanto Prime	—	—	—	—	—	—	—	—	—	—	—	—	4*	3*	—	—	4*	4*	4*	4*	1	0	0	0
Success	2	4*	—	2	—	—	—	—	—	4*	1	1	0	—	4*	0	3	0	0	0	—	0	0	0
Superior 70 Oil (dormant)	0	0	0	0	0	0	0	—	0	0	0	0	0	4*	0	0	0	0	2	2	—	—	4*	—
Surround WP	2*	—	2	2* ES	—	2*	1	—	—	1*	2*	2*	2*	2	1	1*	1	1*	1	1	—	0	2	0
TwinGuard	2*	1	1	3*	3	—	—	3	3*	4*	4*	2*	—	3*	3	2–3*	4*	4	3*	3*	3–4*	0	0	0
Up-Cyde 2.5 EC[1]	2*	—	—	2*	—	3	3	2*	1	1* R	3	3*	—	1	3*	3*	3*	1*	2	2	—	0	0	0
Vegol Crop Oil (dormant/summer)	—	—	—	—	—	—	—	—	—	—	—	—	—	2–4*	—	—	—	—	2*	2*	—	2*	4*	2*
Versys	0	0	0	0	0	0	0	—	0	0	0	0	—	—	0	0	—	—	4*	4*	—	0	0	0
Virosoft	0	0	0	4*	0	0	0	0	0	—	3	0	0	0	—	0	—	0	0	0	0	0	0	0

0 = Not effective. 1 = Reduction in damage or poor control. 2 = Suppression or fair control. 3 = Good control with some limitations. 4 = Excellent control.
ES = Early season applications only. R = Resistant. — = Information is unavailable. *(shaded area) = The pest is listed on the product label for control or suppression.

[1] May cause mite flare-ups.
[2] New re-evaluation decision has been made for this product. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use.

Ratings are based on moderate insect or mite pressure. Efficacy may be affected by rate of insecticide used, as well as coverage, timing and residual of the product. In some orchards, resistance may cause control failures when present. See *Pest Resistance to Fungicides, Insecticides and Miticides* in Chapter 2. Products must be applied at proper timings and label rates for each pest. Consult label or apple calendar for this information.
Source: Various extension publications (*Cornell Pest Management Guidelines for Tree Fruit, Michigan Fruit Management Guide, Penn State Tree Fruit Production Guide*), scientific journal articles and Ontario field trials.

Table 3–4. Activity of Insecticides and Miticides on Apple Pests (cont'd)

Insecticide	Apple maggot	Apple clearwing moth	Brown marmorated stink bug	Codling moth	Dogwood borer	European apple sawfly	Japanese beetle	Leafcurling midge	Mullein bug	Obliquebanded leafroller	Oriental fruit moth	Plum curculio	Potato leafhopper	San Jose scale	Spring-feeding caterpillar	Tarnished plant bug	Tentiform leafminer	White apple leafhopper	Aphids			Mites		
																			Green apple aphid	Rosy apple aphid	Woolly apple aphid	Apple rust mite	European red mite	Two-spotted spider mite
Vydate L	0	—	3	0	—	—	—	—	—	1*	0	0	3	1	—	2*	3*	3*	2*	3*	1*	3*	2*	3*
Xentari WG	0	—	0	1	—	—	0	—	0	3*	1	0	0	0	3	0	0	0	0	0	0	0	0	0

0 = Not effective. 1 = Reduction in damage or poor control. 2 = Suppression or fair control. 3 = Good control with some limitations. 4 = Excellent control.
ES = Early season applications only. R = Resistant. — = Information is unavailable. *(shaded area) = The pest is listed on the product label for control or suppression.

[1] May cause mite flare-ups.
[2] New re-evaluation decision has been made for this product. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use.

Ratings are based on moderate insect or mite pressure. Efficacy may be affected by rate of insecticide used, as well as coverage, timing and residual of the product. In some orchards, resistance may cause control failures when present. See *Pest Resistance to Fungicides, Insecticides and Miticides* in Chapter 2. Products must be applied at proper timings and label rates for each pest. Consult label or apple calendar for this information.
Source: Various extension publications (*Cornell Pest Management Guidelines for Tree Fruit, Michigan Fruit Management Guide, Penn State Tree Fruit Production Guide*), scientific journal articles and Ontario field trials.

Table 3–5. Activity of Fungicides on Apple Diseases

Use fungicides only for the disease listed on the product label for the crop. The information provided in this table is intended to assist the grower in choosing the best fungicide for control of pests listed on the product label, while managing resistance and avoiding unnecessary sprays for non-target pests. Efficacy can be affected by rate of the product or by the presence of resistant populations. See *Resistance management strategies by fungicide group and disease for Ontario fruit crops* in Chapter 2.

Group	Fungicide	Apple scab	Powdery mildew	Fire blight	Rust	Black rot	Bitter rot	Sooty blotch	Fly speck	Type of Activity
M	Copper 53 W[1]	2	1	2*	1	1	1	1	1	Contact
M	Copper Spray[1]	2	1	2*	1	1	1	1	1	Contact
M	Cosavet DF Edge	2*	2–3*	—	1	1	2	1–2	1–2	Contact
M	Cueva	2*	—	2*	—	—	—	—	—	Contact
M	Dithane Rainshield	3*	0	—	3*	3	3	2–3	2–3	Contact
M	Ferbam 76 WDG[1,2]	2*	0	—	2–3*	2*	1*	2*	2*	Contact
M	Folpan 80 WDG	2*	—	—	—	2*	—	2*	2*	Contact
M	Granuflo T[2]	2*	0	—	3*	2*	1*	2*	2*	Contact
M	Kumulus DF	2*	2–3*	—	1	1	2	1–2	1–2	Contact
M	Maestro 80 DF/WSP	3–4*	0	—	0	3–4*	3–4*	3*	2–3*	Contact
M	Manzate Pro-Stick	3*	0	—	3–4*	3	3	2–3	2–3	Contact
M	Microscopic Sulphur WP	2*	2–3*	—	1	1	2	1–2	1–2	Contact
M	Microthiol Disperss	2*	2–3*	—	1	1	2	1–2	1–2	Contact
M	Parasol Flowable	2	1	2*	1	1	1	1	1	Contact
M	Penncozeb 75 DF Raincoat	3*	0	—	3*	3	3	2–3	2–3	Contact
M	Polyram DF[2]	3*	0	—	4*	3	2–3	4	4	Contact
M	Supra Captan 80 WDG	3–4*	0	—	0	3–4*	3–4*	2–3*	2*	Contact
1	Senator 50 SC[3]	3*	3*	—	0	3	1	4	4	Locally systemic
3	Fullback 125 SC[3]	3–4*	4*	—	4*	0	0	0	0	Locally systemic
3	Nova[3]	3–4*	4*	—	4*	0	0	0	0	Locally systemic
3+7	Aprovia Top[3]	4*	3*	—	3*	—	—	3*	3*	Locally systemic
3+9	Inspire Super[3]	4*	3*	—	4*	1	1	3–4*	3–4*	Locally systemic
7	Fontelis[3]	4*	2–3*	—	3*	—	—	—	—	Locally systemic

0 = No control. 1 = Poor control. 2 = Fair control. 3 = Good control, some limitations. 4 = Excellent control, few if any limitations.
— = Not registered for this disease, or information is unavailable. *(shaded area) = The pest is listed on the label for control or suppression.

M = Multi-site fungicide. NC = Not classified by FRAC/IRAC, or group not indicated on product label. P = Plant extract. U = Mode of action has not been determined.
[1] May be phototoxic and cause russeting if used after early season. See label for more information.
[2] New re-evaluation decision has been made for this product. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use.
[3] Rankings assume no resistance in the pathogen population in an orchard.
Contact = Stays on the surface of plant. Locally systemic = Moves into plant but does not move to other plant parts. Systemic = Moves into plant and to unsprayed plant parts as they develop.

Not all products and formulations have not been evaluated (e.g., Cevya, Phostrol, Vegol Crop Oil). Contact manufacturer for more information.
Source: Various extension publications, scientific journal articles and Plant Disease Management Reports (APS).

Table 3–5. Activity of Fungicides on Apple Diseases (cont'd)

Group	Fungicide	Apple scab	Powdery mildew	Fire blight	Rust	Black rot	Bitter rot	Sooty blotch	Fly speck	Type of Activity
7	Kenja 400 SC[3]	4*	—	—	—	—	—	—	—	Locally systemic
7	Sercadis[3]	4*	3*	—	2	2	2	2–3	2–3	Locally systemic
7+9	Luna Tranquility[3]	4*	3–4*	—	1	2	2	2	2	locally systemic
7+11	Pristine WG[3]	3–4*	3–4*	—	2–3	3–4*	3–4*	4*	4*	Locally systemic
9	Scala SC[3]	2–3*	—	—	0	0	0	0	0	Locally systemic
11	Sovran[3]	4*	4*	—	2	2–3	2–3	4	3	Locally systemic
11	Flint[3]	4*	4*	—	2*	3	2–3	4*	3*	Locally systemic
19	Diplomat 5 SC	2	2*	—	—	2	2	3	3	Systemic
24	Kasumin 2L[3]	—	—	3*	—	—	—	—	—	Locally systemic
25	Streptomycin 17[3]	—	—	4*	—	—	—	—	—	Locally systemic
29	Allegro 500 F	2*	0	—	—*	1*	3*	3*	3*	Locally systemic
33	Phostrol	—	—	—	—	—	—	—*	—*	Systemic
44	Double Nickel LC	1–2	1–2	2*	—	—	—	—	—	Contact
44	Serenade OPTI	1–2*	1–2*	2*	2	—	2	2	2	Contact
NC	Blossom Protect	—	—	2–3*	—	—	—	—	—	Contact
NC	Buran	2–3*	2*	—	—	—	—	—	—	Contact
NC	Oxidate 2.0	1–2*	2*	1–2*	—	1–2*	—	—	—	Contact
NC	Purespray Green Spray Oil 13 E	0	1–2*	—	0	0	0	0	0	Contact
P5	Regalia Maxx	1–2*	1–2*	1–2*	2	2*	1–2*	1–2*	1–2*	Locally systemic
U12	Syllit 400 FL[3]	3–4*	1	—	2	0	0	1	1	Locally systemic

0 = No control. 1 = Poor control. 2 = Fair control. 3 = Good control, some limitations. 4 = Excellent control, few if any limitations.
— = Not registered for this disease, or information is unavailable. *(shaded area) = The pest is listed on the label for control or suppression.

M = Multi-site fungicide. NC = Not classified by FRAC/IRAC, or group not indicated on product label. P = Plant extract. U = Mode of action has not been determined.
[1] May be phototoxic and cause russeting if used after early season. See label for more information.
[2] New re-evaluation decision has been made for this product. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use.
[3] Rankings assume no resistance in the pathogen population in an orchard.
Contact = Stays on the surface of plant. Locally systemic = Moves into plant but does not move to other plant parts. Systemic = Moves into plant and to unsprayed plant parts as they develop.

Not all products and formulations have not been evaluated (e.g., Cevya, Phostrol, Vegol Crop Oil). Contact manufacturer for more information.
Source: Various extension publications, scientific journal articles and Plant Disease Management Reports (APS).

Table 3–6. Toxicity of Pesticides to Honeybees and Mite/Aphid Predators

Product	Honeybees[1]	*Stethorus* (spider mite destroyer)	Predatory mites			*Aphidoletes* (aphid midge)	Ladybugs	Minute pirate bugs	Lacewings	Fly and wasp parasitoids	Duration of impact to beneficial insects[2]
			Typhlodromus pyri	*Amblyselus fallacis*	*Zetzelia mali*						
Insecticides											
Actara 25 WG ‡	VT	VT	ST	ST	NT	MT	MT	MT	MT	VT	moderate
Admire 240 Flowable ‡	VT	MT	ST	ST	NT	ST	MT	MT	MT	MT	short to moderate
Alias 240 SC ‡	VT	MT	ST	ST	NT	ST	MT	MT	MT	MT	short to moderation
Altacor	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	short
Ambush 500 EC	VT	VT	VT	VT	MT	ST	MT	MT	MT	VT	short
Assail 70 WP	MT	MT	ST	MT	NT	MT	MT	MT	MT	VT	moderate
Beleaf 50 SG	NT	—	—	—	—	—	—	—	—	—	—
Bioprotec CAF	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Calypso 480 SC	NT	MT	NT	NT	NT	ST	MT	MT	MT	VT	moderate
Closer	VT	VT	ST	ST	NT	MT	MT	MT	MT	VT	short to moderate
Clutch 50 WDG ‡	VT	VT	ST	ST	NT	MT	MT	MT	MT	VT	long
Confirm 240 F	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Cormoran	VT	MT	ST	MT	NT	MT	VT	MT	VT	VT	moderate
CYD-X	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Decis 5 EC	VT	VT	VT	VT	VT	VT	VT	VT	VT	VT	short
Delegate	VT	ST	MT	MT	ST	ST	ST	ST	ST	MT	moderate
Dipel 2X DF	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Entrust	VT	ST	ST	ST	NT	ST	NT	NT	NT	ST	short to moderate
Exirel	VT	MT	ST	ST	ST	ST	MT	ST	ST	MT	short
Foray 48 BA	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
GF-120 Fruit Fly Bait	VT	NT	ST	ST	NT	NT	NT	NT	NT	ST	short to moderate
Harvanta 50 SL	VT	—	—	—	—	—	—	—	—	—	short
Imidan WP	VT	ST	NT	NT	NT	MT	MT	MT	MT	VT	moderate – long

NT = Non toxic. ST = Slightly toxic. MT = Moderately toxic. VT = Very toxic. I = Irritant. ‡ = New re-evaluation decision has been made for this active ingredient or formulation. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use. — = No information is available. Consult label or manufacturer for more information.

[1] Source: PMRA Environmental Assessment Division. For more detailed information on the toxicity of specific pesticides to honeybees, refer to the pesticide label.

[2] Duration: Short = hours to days. Moderate = days to 2 weeks. Long = many weeks or months.

[3] May be toxic to bee colonies exposed to direct treatment, drift or residues on flowering crops or weeds.

[4] White film barrier on plant tissue may act as a repellent to bees if used during bloom.

Adapted from various extension publications (*Cornell Pest Management Guidelines for Tree Fruit, Michigan Fruit Management Guide, Penn State Tree Fruit Production Guide, University of California Pest Management Guidelines*).

Table 3–6. Toxicity of Pesticides to Honeybees and Mite/Aphid Predators (cont'd)

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			Typhlodromus pyri	*Amblyselus fallacis*	*Zetzelia mali*						
Insecticides (cont'd)											
Intrepid	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Mako	VT	—	—	—	—	—	—	—	—	—	—
Malathion 85 E	VT	ST	NT	NT	NT	ST	MT	ST	ST	MT	moderate
Matador 120 EC	VT	VT	VT	VT	VT	VT	VT	VT	VT	VT	moderate
Minecto Pro	VT	MT	MT	MT	ST	ST	MT	ST	ST	MT	moderate
Movento 240 SC	VT[3]	ST	NT	NT	NT	ST	ST	ST	ST	—	short
Perm-Up EC	VT	VT	VT	VT	MT	ST	MT	MT	MT	VT	short
Pounce 384 EC	VT	VT	VT	VT	MT	ST	MT	MT	MT	VT	short
Rimon 10 EC	MT[3]	MT	NT	NT	NT	—	VT	MT	VT	VT	—
Silencer 120 EC	VT	VT	VT	VT	VT	VT	VT	VT	VT	VT	moderate
Sivanto Prime	MT	ST	NT	NT	NT	ST	—	—	—	—	short
Success	VT	ST	ST	ST	NT	ST	NT	NT	NT	ST	short to moderate
Surround WP	I[4]	MT	MT	MT	MT	MT	MT	—	ST	MT	long
Up-Cyde 2.5 EC	VT	—	—	—	—	—	—	—	—	—	—
Versys	MT	—	—	—	—	—	—	—	—	—	—
Virosoft CP 4	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Xentari WG	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Miticides											
Acramite 50 WS	MT	NT	MT	MT	MT	ST	NT	NT	NT	—	short
Agri-Mek SC	VT	MT	MT	MT	ST	ST	ST	ST	ST	—	moderate
Apollo SC	NT	NT	ST	ST	ST	NT	NT	NT	NT	—	short
Envidor SC	MT	MT	NT	NT	NT	—	—	—	—	—	—

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[1] Source: PMRA Environmental Assessment Division. For more detailed information on the toxicity of specific pesticides to honeybees, refer to the pesticide label.

[2] Duration: Short = hours to days. Moderate = days to 2 weeks. Long = many weeks or months.

[3] May be toxic to bee colonies exposed to direct treatment, drift or residues on flowering crops or weeds.

[4] White film barrier on plant tissue may act as a repellent to bees if used during bloom.

Adapted from various extension publications (*Cornell Pest Management Guidelines for Tree Fruit, Michigan Fruit Management Guide, Penn State Tree Fruit Production Guide, University of California Pest Management Guidelines*).

Table 3–6. Toxicity of Pesticides to Honeybees and Mite/Aphid Predators (cont'd)

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			Typhlodromus pyri	*Amblyselus fallacis*	*Zetzelia mali*						
Miticides (cont'd)											
Kanemite 15 SC	NT	ST	ST	ST	ST	—	—	—	—	—	—
Kopa	NT	ST	MT	MT	ST	ST	ST	ST	ST	—	short
Nealta	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	—
Nexter SC	VT	MT	VT	VT	MT	MT	MT	MT	MT	—	short
Purespray Green Spray Oil 13 E	NT	ST	MT	MT	ST	ST	ST	ST	ST	—	short
Superior 70 Oil	NT	ST	MT	MT	ST	ST	ST	ST	ST	—	short
Vegol Crop Oil	NT	ST	MT	MT	ST	ST	ST	ST	ST	—	short
Vydate L	VT	MT	VT	VT	VT	MT	MT	VT	VT	VT	long
Fungicides											
Aliette	NT	—	—	—	—	—	—	—	—	—	—
Allegro 500 F	NT	—	—	—	—	—	—	—	—	—	—
Aprovia Top	NT	—	—	—	—	—	—	—	—	—	—
Blossom Protect	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Buran	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Copper 53 W	NT	—	—	—	—	—	—	—	—	—	—
Copper Spray	NT	—	—	—	—	—	—	—	—	—	—
Cosavet DF Edge	ST	MT	ST	ST	ST	—	—	—	—	—	short
Cueva	NT	—	—	—	—	—	—	—	—	—	—
Diplomat 5 SC	NT	—	—	—	—	—	—	—	—	—	—
Dithane Rainshield	ST	ST	MT	MT	ST	—	—	—	—	—	—
Double Nickel LC	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Ferbam 76 WDG ‡	NT	—	—	—	—	—	—	—	—	—	—

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Table 3–6. Toxicity of Pesticides to Honeybees and Mite/Aphid Predators (cont'd)

Product	Honeybees[1]	*Stethorus* (spider mite destroyer)	Predatory mites			*Aphidoletes* (aphid midge)	Ladybugs	Minute pirate bugs	Lacewings	Fly and wasp parasitoids	Duration of impact to beneficial insects[2]
			Typhlodromus pyri	*Amblyselus fallacis*	*Zetzelia mali*						
Fungicides (cont'd)											
Flint	ST	ST	NT	NT	NT	—	—	—	—	—	—
Folpan 80 WDG	NT	—	—	—	—	—	—	—	—	—	—
Fontelis	NT	—	—	—	—	—	—	—	—	—	—
Fullback 125 SC	MT	ST	NT	NT	NT	—	—	—	—	—	—
Granuflo T ‡	ST	ST	ST	ST	—	—	—	—	—	—	—
Inspire Super	NT	ST	NT	NT	NT	—	—	—	—	—	—
Kasumin 2L	NT	—	—	—	—	—	—	—	—	—	—
Kenja 400 SC	NT	—	—	—	—	—	—	—	—	—	—
Kumulus DF	ST	MT	ST	ST	ST	—	—	—	—	—	short
Luna Tranquility	NT	—	—	—	—	—	—	—	—	—	—
Maestro 80 DF/WSP ‡	ST	ST	ST	ST	ST	ST	—	—	—	—	—
Manzate Pro-Stick	ST	ST	MT	MT	ST	—	—	—	—	—	—
Microscopic Sulphur WP	ST	MT	ST	ST	ST	—	—	—	—	—	short
Microthiol Disperss	ST	MT	ST	ST	ST	—	—	—	—	—	short
Nova	NT	ST	NT	NT	NT	—	—	—	—	—	—
Oxidate 2.0	MT[3]	—	—	—	—	—	—	—	—	—	—
Parasol Flowable	NT	—	—	—	—	—	—	—	—	—	—
Penncozeb 75 DF Raincoat	ST	ST	MT	MT	ST	—	—	—	—	—	—
Phostrol	NT	—	—	—	—	—	—	—	—	—	—
Polyram DF ‡	ST	ST	MT	MT	ST	—	—	—	—	—	—
Pristine WG	NT	ST	NT	NT	NT	—	—	—	—	—	—
Regalia Maxx	NT	—	—	—	—	—	—	—	—	—	—

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[2] Duration: Short = hours to days. Moderate = days to 2 weeks. Long = many weeks or months.

[3] May be toxic to bee colonies exposed to direct treatment, drift or residues on flowering crops or weeds.

[4] White film barrier on plant tissue may act as a repellent to bees if used during bloom.

Adapted from various extension publications (*Cornell Pest Management Guidelines for Tree Fruit, Michigan Fruit Management Guide, Penn State Tree Fruit Production Guide, University of California Pest Management Guidelines*).

Table 3–6. Toxicity of Pesticides to Honeybees and Mite/Aphid Predators (cont'd)

Product	Honeybees[1]	*Stethorus* (spider mite destroyer)	Predatory mites			*Aphidoletes* (aphid midge)	Ladybugs	Minute pirate bugs	Lacewings	Fly and wasp parasitoids	Duration of impact to beneficial insects[2]
			Typhlodromus pyri	*Amblyselus fallacis*	*Zetzelia mali*						
Fungicides (cont'd)											
Ridomil Gold 480 SL	NT	—	—	—	—	—	—	—	—	—	—
Scala SC	NT	—	—	—	—	—	—	—	—	—	—
Senator 50 SC	NT	—	—	—	—	—	—	—	—	—	—
Sercadis	NT	—	—	—	—	—	—	—	—	—	—
Serenade OPTI	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	none
Sovran	NT	NT	NT	NT	NT	—	—	—	—	—	—
Streptomycin 17	NT	—	—	—	—	—	—	—	—	—	—
Supra Captan 80 WDG ‡	ST	ST	ST	ST	ST	ST	—	—	—	—	—
Syllit 400 FL	MT	—	ST	ST	—	ST	—	—	—	—	—

NT = Non toxic. ST = Slightly toxic. MT = Moderately toxic. VT = Very toxic. I = Irritant. ‡ = New re-evaluation decision has been made for this active ingredient or formulation. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use. — = No information is available. Consult label or manufacturer for more information.

[1] Source: PMRA Environmental Assessment Division. For more detailed information on the toxicity of specific pesticides to honeybees, refer to the pesticide label.

[2] Duration: Short = hours to days. Moderate = days to 2 weeks. Long = many weeks or months.

[3] May be toxic to bee colonies exposed to direct treatment, drift or residues on flowering crops or weeds.

[4] White film barrier on plant tissue may act as a repellent to bees if used during bloom.

Adapted from various extension publications (*Cornell Pest Management Guidelines for Tree Fruit, Michigan Fruit Management Guide, Penn State Tree Fruit Production Guide, University of California Pest Management Guidelines*).

Table 3–7. Activity of Petal Fall Insecticides Against Orchard Pests

Use insecticides only for insects listed on the product label for the crop. Consult the label for more information. The information provided in this table is intended to assist the grower in choosing the best insecticide for control of pests listed on the product label, while managing resistance and avoiding unnecessary sprays for non-target pests. Efficacy can be affected by rate of the product.

Insecticide	Group	Obliquebanded leafroller	Oriental fruit moth	Codling moth (eggs)	Plum curculio	Mullein bug	Tentiform leafminer	Japanese beetle	European apple sawfly
Actara 25 WG ‡	4A	—	—	—	✓*	✓*	✓*	—	—
Admire 240 Flowable ‡	4A	—	—	—	—	✓*	✓*	—	—
Alias 240 SC ‡	4A	—	—	—	—	✓*	✓*	—	—
Assail 70 WP	4A	—	✓*	—	✓*	✓*	✓*	✓	✓*
Calypso 240 SC	4A	—	✓*	—	✓*	✓*	✓*	✓*	✓*
Cormoran	4A + 15	—	✓*	—	✓*	✓*	✓*	✓*	✓*
Closer	4C	—	—	—	—	✓*	—	—	—
TwinGuard	4C + 5	✓*	✓*	—	✓s*	✓*	✓*	—	—
Delegate	5	✓*	✓*	—	✓s*	—	✓*	—	✓*
Entrust	5	✓*	—	—	—	—	✓	—	—
Success	5	✓*	—	—	—	—	✓	—	—
Minecto Pro	6 + 28	✓*	✓*	—	—	—	✓*	—	✓*
Bioprotec CAF	11	✓*	—	—	—	—	—	—	—
Dipel 2X DF	11	✓*	—	—	—	—	—	—	—
Foray 48 BA	11	✓*	—	—	—	—	—	—	—
Xentari WG	11	✓*	—	—	—	—	—	—	—
Rimon 10 EC	15	✓	✓*	✓*	—	—	—	—	—
Intrepid	18	✓*	✓*	—	—	—	✓*	—	—
Altacor	28	✓*	✓*	—	—	—	✓*	✓s*	✓*
Exirel	28	✓*	✓*	—	✓*	—	✓*	✓*	✓*
Harvanta 50 SL	28	✓*	✓*	—	✓s*	—	—	—	—

‡ = New re-evaluation decision has been made for this active ingredient or formulation. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use.

✓ = Has activity on the pest. s = Suppression. * (shaded area) = The pest is listed on the product label for control or suppression.

— = Pest is not registered for this product, or product does not have activity at this timing.

Table 3–8. Activity of Miticides Registered on Apple and/or Pear in Ontario[1]

Product	Target Species	Life Stage(s) Affected	Preferred Timing	Comments on Knock-down
Acramite 50 WS	European red mite (apple) two-spotted spider mite (apple)	nymphs, adults	postbloom	rapid
Agri-Mek SC	European red mite two-spotted spider mite pear rust mite (pear)	nymphs	within 21 days of petal fall	rapid
Apollo SC	European red mite two-spotted spider mite	primarily eggs, newly hatched nymphs	egg stage, before >3 active mites per leaf, no later than 14 days after petal fall	slow
Envidor 240 SC	European red mite two-spotted spider mite apple rust mite (apple) pear rust mite (pear)	eggs, nymphs, adult females	postbloom	slow
Kanemite 15 SC	European red mite two-spotted spider mite	all life stages	postbloom	rapid
Kopa	European red mite two spotted spider mite apple rust mite (apple) pear rust mite (pear)	nymphs, adults	as mite population builds, before damage is observed	intermediate
Minecto Pro	European red mite two-spotted spider mite	nymphs	within 6 weeks of petal fall	rapid
Nealta	European red mite two-spotted spider mite	all life stages	as mite population builds, before damage is observed	intermediate[2]
Nexter	European red mite (ERM) apple rust mite (ARM) two-spotted spider mite (TSSM) pear rust mite (PRM) (pear)	nymphs and adults of ERM, ARM and PRM nymphs of TSSM no effect on eggs	summer	rapid
Purespray Green Spray Oil 13 E	European red mite	overwintering eggs, some nymphs	half-inch green to tight cluster prior to hatch	smothers eggs
Superior 70 Oil	European red mite	overwintering eggs, some nymphs	half-inch green to tight cluster prior to hatch	smothers eggs
Vegol Crop Oil	European red mite	overwintering eggs, some nymphs	half-inch green to tight cluster prior to hatch	smothers eggs

[1] Registered for use on apple or pear unless indicated otherwise. Use established thresholds to time applications. Miticides are most effective when applied alone, using recommended rates and water volumes. Apply each miticide once per season to delay the development of resistance.

[2] The knock-down may be enhanced by increased coverage using a registered adjuvant.

Table 3–9. Characteristics of Apple Scab Fungicides

Product	Protectant Activity (pre-infection)	Post-Infection Activity (hours)[1]	Post-Symptom Activity	Retention (50 mm rain)	Redistribution (12 mm rain)
Buran	N	350 degree hours (base 10°C)	VG	N	—
Copper 53 W	G	—	—	G	G
Copper Spray	G	—	—	G	G
Cosavet DF Edge	F	N	N	F–G	F–G
Cueva	G	—	—	G	G
Dithane Rainshield	VG	18–24	N	E[2]	G–VG
Ferbam WDG ‡	G	15–20	N	G	G
Flint	VG	48–72[3]	G	E	G
Fontelis	E	48	—	E	F–G
Granuflo T ‡	G	15–20	N	G	G
Inspire Super	VG	48[3]	E	VG	G
Kumulus DF	F	N	N	F–G	F–G
Luna Tranquility	E	48	—	E	F–G
Maestro 80 DF/WSP ‡	VG	18–24	N	VG	G
Manzate Pro-Stick	VG	18–24	N	E[2]	G–VG
Microscopic Sulphur WP	F	N	N	F–G	F–G
Microthiol Disperss	F	N	N	F–G	F-G
Nova	F	72–96[3]	G–VG	F[2]	F[2]
Parasol Flowable	G	—	—	G	G
Penncozeb 75 DF Raincoat	VG	18–24	N	E[2]	G–VG
Polyram DF ‡	VG	18–24	N	E[2]	G
Scala SC	G	48–72	N	G	—
Senator 50 SC	F	18–24	VG	G	F
Sercadis	VG	48	F	E	G
Sovran	VG	48–72[3]	G	E	F[2]
Supra Captan 80 WDG ‡	VG	18–24	N	VG	G
Syllit 400 FL	VG	18–24	VG	VG	G

E = Excellent. VG = Very good. G = Good. F = Fair. N = None. ‡ = New re-evaluation decision has been made for this active ingredient or formulation. Consult the most recent label on the PMRA website and/or product registrant for information on last date of sale and use. — = Indicates no information is available.

[1] Maximum post-infection activity is calculated from the start of the infection period.

[2] Values are based on field observations.

[3] Post-Infection activity of sterol inhibitor (Nova and Inspire Super) and strobilurin (Flint and Sovran) fungicides may be reduced in orchards where scab populations have shifted towards resistance.

Data is adapted from *Cornell Pest Management Recommendations for Commercial Tree Fruit Production* and work done by Szkolnik *et al.* (Geneva, NY) using conidia in greenhouse trials on Golden Delicious. The post-infection activity of these fungicides may not be adequate to control primary scab in commercial orchards. Do not rely solely on post-infection activity. Some products and formulations have not been evaluated (e.g., Allegro 500 F, Aprovia Top, Cevya, Cueva, Folpan 80 WDG, Fullback 125 SC, Kenja 400 SC, Oxidate 2.0, Pristine WG, Regalia Maxx and Serenade OPTI). Contact the manufacturer for more information.

Table 3–10. Relationship of Temperature and Moisture to Apple Scab Infection

Apple scab infections occur during wetting periods when moisture stimulates the spores to germinate and penetrate plant tissue. The scab prediction table given here can be used to determine whether conditions have been sufficient for infection so that appropriate spray decisions can be made.

Average Temperature (°C)[1]	Minimum Number of Hours of Leaf Wetness Required - Primary (Ascospore) Infection[2]			Minimum Number of Hours of Leaf Wetness Required - Secondary (Conidia) Infection[2]	Lesion appearance (days)[3]
	Light	Moderate	Heavy		
1	40	69	93	37	—
2	34	69	93	33	—
3	30	52	65	30	—
4	27	42	57	26	—
5	21	34	50	23	—
6	18	27	44	20	17
7	15	23	37	17	17
8	13	21	34	15	17
9	12	17	27	13	17
10	11	16	26	10	16
11	9	14	22	9.5	15
12–13	8	12	20	9	14
14–15	7	11	19	9	12–13
15.5	6.5	10	17	9	10–11
16–24	6	9	16	7.0–9.0	9–10
24–25	6.5	9	16	9–11	—
25	8	11	18	11	—
25.5	10	14	23	13	—

[1] Add lowest and highest temperatures during wet period and divide sum by 2 to get average temperature.

[2] Calculate hours of wetting by either (1) beginning the count at the time leaves first become wet and ending the count when the relative humidity drops below 90%, or (2) adding consecutive wet periods (hours) if the leaves are again wetted within 8 hours from the time relative humidity dropped below 90%.

[3] Number of days required for lesions to appear after infection has been initiated.

Adapted from Stensvand, A., Gadoury, D. M., Amundsen, T., Semb, L., and Seem, R. C. 1997. Ascospore release and infection of apple leaves by conidia and ascospores of *Venturia inaequalis* at low temperatures. Phytopathology 87:1046-1053 and Carisse, O. 2006. Apple Scab: Improving Understanding for Better Management. Agriculture & Agri-Food Canada, Publication 10203E.

Thinning and Plant Growth Regulators

Thinning of fruit is critical to improving average fruit size and finish, creating uniformity in the crop, and encouraging return bloom in tree fruit. Plant growth regulators (PGRs) are chemicals used to modify tree growth and structure, remove excess fruit, improve shape and appearance or alter fruit maturity. For additional information on plant growth regulators and thinning, visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops* and *Thinning of Tree Fruit*.

Suggested Rates for Chemical Thinning of Apples

Chemical thinning depends on the cultivar and stage of crop development. The rates in Table 3–11. *Suggested Rates for Chemical Thinning of Mature Apple Trees* are guidelines only. There is no substitute for personal experience. It is important to keep yearly records on weather conditions, rates, etc., and above all, leave some trees unsprayed to help assess the thinning response. Use only one of the suggested chemical treatments. For example, with Wealthy, apply NAA or Sevin, or the combination. Before you alter or modify a treatment that has proven to be effective, seek the advice of a crop consultant.

Factors Influencing Response to Thinning

Chemical thinning depends on the cultivar and stage of crop development. See Table 3–11. *Suggested Rates for Chemical Thinning of Mature Apple Trees* and Table 3–12. *Suggested Rates of MaxCel or Cilis Plus to Use With or Without Sevin XLR*. Response to thinning may vary due to environmental conditions (i.e., temperature, precipitation, humidity) before and after application, cultivar sensitivity, pollination and bee activity, tree age and vigour, density of foliage, spray coverage and timing of application. For more information, visit ontario.ca/apples and click on *Thinning of Tree Fruit*.

Table 3–11. Suggested Rates for Chemical Thinning of Mature Apple Trees[1]

Cultivar	Sevin XLR (L/1,000 L water)[2]	Fruitone (NAA) (ppm)[3]	Sevin XLR (/1,000 L water) + Fruitone (NAA) (ppm)[2,3]	MaxCel or Cilis Plus (g BA/ha)[4]	Sevin XLR (L/1,000 L water) + MaxCel or Cilis Plus (g BA/ha)[2,3,4]
Ambrosia	1–1.5	—	—	50	—
Aurora Golden Gala™	1–1.5	—	—	75	1 + 50
Braeburn	—	1.2–7.3	—	—	—
Cameo	1	2.4–9.7	—	—	—
Cortland	—	1.2–7.3	1–2 + 2.5–5	—	—
Creston	0.5–1	—	—	—	—
Crispin/Mutsu	0.5–1.5	2.4–9.7	—	—	—

— = Treatment information not available.

[1] These rates are suggested for trees with a settled cropping history. Chemically thinning a first crop tree or immature trees is considered very risky.
[2] Sevin XLR is 43% active ingredient and contains 480 g or approximately 0.5 kg of carbaryl per litre. 1 L of Sevin XLR is roughly equivalent to 1 kg of Sevin 50 W.
[3] Sufficient water volumes must be used to thoroughly wet trees. For actual amount of NAA, refer to the label.
[4] Consult Table 3–12. *Suggested Rates of MaxCel or Cilis Plus to Use With or Without Sevin XLR* to determine the actual ppm benzyladenine (BA) being applied. Concentration of BA should be no less than 50 ppm to be effective.
[5] At petal fall

Table 3–11. Suggested Rates for Chemical Thinning of Mature Apple Trees[1] (cont'd)

Cultivar	Sevin XLR (L/1,000 L water)[2]	Fruitone (NAA) (ppm)[3]	Sevin XLR (/1,000 L water) + Fruitone (NAA) (ppm)[2,3]	MaxCel or Cilis Plus (g BA/ha)[4]	Sevin XLR (L/1,000 L water) + MaxCel or Cilis Plus (g BA/ha)[2,3,4]
Empire	1–1.5	2.4–9.7	1 + 2.5–4	50–100	1 + 50
Fuji	—	—	1–1.5 + 10–12	100–150	1–2 + 50–75
Gala	—	2.4–9.7	1 + 5–10	75–100	1–2 + 50
Gingergold	1–1.5	2.4–9.7	1 + 2.5–5	75	1 + 50
Golden Delicious, Wealthy	1–2	3.6–9.7	1 + 5–10	75–100	1–2 + 50
Golden Supreme	1	2.4–9.7	—	—	—
Goldrush	—	—	1 + 10	—	—
Honeycrisp	1–1.5	2.4–9.7	1 + 2.5	—	—
Idared	—	1.2–7.3	—	50–75	—
Jerseymac	1–1.5	2.4–9.7	—	—	—
Jonagold	1–1.5	2.4–9.7	—	50–75	—
Jonamac	—	3.6–9.7	—	—	—
Lodi	—	3.6–9.7	1 + 10–15	—	—
Macoun	—	3.6–9.7	—	—	—
McIntosh, Early	—	3.6–9.7	1 + 5–105	50–75	—
McIntosh, Non-spur	1–2	1.2–7.3	—	50	—
McIntosh, Spur-type	—	1.2–7.3	1–2 + 2.5–5	50–75	1 + 50
Northern Spy	0.5–1.5	1.2–7.3	—	—	—
Paulared	1–1.5	3.6–9.7	1 + 10–15	75	1 + 50
Red Delicious	0.5–1.5	1.2–7.3	—	—	—
Red Delicious, Spur-type	—	1.2–7.3	1–2 + 5–10	—	—
Silken	1–1.5	—	—	—	—
Spartan, Russets	1–2	2.4–9.7	1 + 10–15	—	—

— = Treatment information not available.

[1] These rates are suggested for trees with a settled cropping history. Chemically thinning a first crop tree or immature trees is considered very risky.
[2] Sevin XLR is 43% active ingredient and contains 480 g or approximately 0.5 kg of carbaryl per litre. 1 L of Sevin XLR is roughly equivalent to 1 kg of Sevin 50 W.
[3] Sufficient water volumes must be used to thoroughly wet trees. For actual amount of NAA, refer to the label.
[4] Consult Table 3–12. *Suggested Rates of MaxCel or Cilis Plus to Use With or Without Sevin XLR* to determine the actual ppm benzyladenine (BA) being applied. Concentration of BA should be no less than 50 ppm to be effective.
[5] At petal fall

Table 3–12. Suggested Rates of MaxCel or Cilis Plus to Use With or Without Sevin XLR

Desired response[1]	Concentration of 6-BA (ppm)[2]	Concentration of Carbaryl (ppm)[2]	Number of Applications	Amount of MaxCel or Cilis Plus		Amount of Sevin XLR (L/1,000 L water/ha)
				MaxCel (L/1,000 L water/ha)	Cilis Plus (L/1,000 L water/ha)	
Enhance size only[3,4]	10–50	—	2 to 4	0.5–2.65	0.5–2.5	—
Mild thinning and sizing	50–75	—	1 to 2	2.65–3.95	2.5–3.75	—
Moderate thinning and sizing	75–100	—	1 to 2	3.95–5.3	3.75–5.05	—
	50–75	500	1 to 2	2.65–3.95	2.5–3.75	1
Aggressive thinning and sizing	100–150	—	1 to 2	5.3–7.95	5.05–7.55	—
	75–100	500–1,000	1 to 2	3.95–5.3	3.75–5.05	1–2
Very aggressive thinning and sizing	150–200	—	1 to 2	7.95–10.65	7.55–10.1	—
	100–125	1,000	1 to 2	5.3–6.6	5.05–6.3	2

— = Information is not available.

[1] There are several factors that influence the chemical thinning outcome. Rates are generally chosen on the degree of cultivar sensitivity to chemical thinners.
[2] 1 ppm is equivalent to 1 mg/L.
[3] Mild thinning may occur under some conditions (weak trees, young trees, sensitive cultivars, and environmental conditions that favour the thinning response).
[4] While 6-BA has the potential to increase cell division and enhance fruit size beyond the thinning (crop load) effect alone, this is not observed in all years because the response can be affected by spray concentration, coverage, cultivar, tree health, time of application, tree stress, and environmental conditions during and following spray application.

Calculating Parts per Million (ppm)

1 ppm = 1 g active ingredient per 1,000 L water

Precautions

Applying MaxCel or Cilis Plus in combination with the hormone thinner, NAA (naphthaleneacetic acid), either as a tank-mix or separate sprays during the same growing season may result in pygmy fruit in prone cultivars (i.e., Fuji, Red Delicious, Golden Delicious and Gala).

Bee Warning

When Sevin is used for fruit thinning, extensive bee kills can occur if weeds or legumes are blooming in the ground cover. To minimize bee kills, remove bees from the orchard prior to treatment. Do not spray when the wind will carry Sevin to adjacent weedy or crop areas in bloom. Advise local beekeepers of your spray activity.

Vegetative Growth Control in Apples

Patterns of terminal growth and fruit set differ among growing regions. Likewise, the response to Apogee or Kudos 27.5 WDG appears to differ between regions. Therefore, the rate and calendar date of application may vary between regions. For more information, visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops*.

See Table 3–13. *Suggested Apogee or Kudos 27.5 WDG Rates (g product per ha)* for rates. The application rate is determined primarily by tree size, vigour, and whether protection against shoot blight is an objective.

Follow the steps on the label to adjust rates for tree-row volume dilute applications. Table 3–13. *Suggested Apogee or Kudos 27.5 WDG Rates (g product per ha)* shows various rates for sprays applied at 1,000 L per ha (dilute). Apogee has been used effectively when applied in more concentrated sprays, provided thorough wetting of the canopy is achieved. Low-volume spraying of plant growth regulators and chemical thinners is not recommended.

Adjuvants and hard water

Include the spray adjuvant, Agral 90, with Apogee or Kudos 27.5 WDG to improve the uptake of the prohexadione-calcium molecule by the leaf. In addition, if the spray water source is hard water and contains high levels of calcium or magnesium, include an equal amount of ammonium sulphate (AMS) fertilizer by weight with Apogee or Kudos 27.5 WDG. Use a high-quality, greenhouse grade of AMS to avoid plugging of nozzles.

Table 3–13. Suggested Apogee or Kudos 27.5 WDG Rates (g product per ha)

Based on a tree-row volume dilute of 1,000 L/ha[1] (use this chart in conjunction with the product label).

Program Level	Tree Vigour[2]	# Sprays	1st Spray Petal Fall	2nd Spray Fruit Set	3rd Spray June Drop	4th Spray Growth	Season Total[3] (g/ha)
1	low	1 spray	450	—	—	—	450
2	low	2 sprays	270	270	—	—	540
3†	medium	2 sprays	450	450	—	—	900
4	medium/high	3 sprays	450	450	270	—	1170
5	high	3 sprays	450	450	450	—	1350
6	high	4 sprays	450	450	450	270	1620

— = No activity or activity unknown.

† Suggested base rate. Move to next higher level if there is a low crop load, for fire blight suppression, or if there was heavy pruning. Visit ontario.ca/apples and click on *Plant Growth Regulators for Fruit Crops*.

[1] Tree-row volume (see sprayers101.com and *Airblast 101: A Handbook of Best Practices in Airblast Spraying* for more details). Rates need to be increased when higher water volumes are required for adequate spray coverage.

[2] Vigour is defined as the total amount of shoot growth in a single season, not to be confused with tree-row volume.

[3] Maximum seasonal rate should not exceed a total of 5.4 kg of product per ha.

4. Replant Disorder

Apple trees that do not establish well or fail to establish when planted on a site previously grown with apples are often considered to be suffering from apple replant disorder. Although thought to occur in sites replanted after removing very old fruit trees, replant disorder has been documented to occur within three years of establishing an orchard on new ground.

The causes and symptoms of replant disorder vary from region to region and even from site to site. While not well understood, biological factors are thought to play a major role in this disorder including a complex of several fungal pathogens (*Cylindrocarpon, Phytophthora, Pythium* spp. and *Rhizoctonia*), bacteria and parasitic nematodes. In addition to biological factors, soil pH, moisture stress (too much and too little), soil compaction, toxins, soil structure, heavy metals and insufficient availability of nutrients (particularly phosphorous) are also implicated as contributing factors to replant disorder. However, research showing dramatic tree growth in response to soil pasteurization and fumigation to eliminate harmful microorganisms suggests this disorder is primarily a biological phenomenon.

Symptoms of replant disorder include:

- stunting of the tree with short internodes
- small and light green rosette leaves
- small root systems and decayed or discolored roots
- few new lateral or feeder roots

Vigorous young trees affected by apple replant disorder often stop growing in early summer. Affected trees leaf out in the spring but often produce little or no shoot growth. Severe replant disorder results in the death of young trees and entire orchards. Trees in orchards not killed by replant disorder have delayed fruit bearing and reduction in overall yield.

Prevention of replant problems is much easier and more successful than control. There is very little that can be done to correct replant problems once the trees are planted. The causes of apple replant disorder on different sites are highly variable. Not all soils respond in the same way to the various pre-plant treatments, and a treatment that is beneficial in one orchard may have no effect in another. Take a soil sample for nematodes and fungal pathogens at a site before establishing a new young orchard, particularly if the site was planted with apples or other fruit trees in the past.

The following cultural controls help avoid apple replant disorder:

- Avoid planting apples on the same ground where an old apple orchard has recently been removed. Rotating out of pome fruit for several years (two to eight years) is advised.
- Adjust soil pH if too high or low prior to planting with a lime or sulfur application.
- Plant as early as possible in the spring taking care not to skip important pre-plant operations.
- Provide adequate nutrition and irrigation as indicated by soil and tissue tests, and soil moisture monitoring equipment.
- Use rootstocks resistant to *Phytophthora* (e.g. CG.30, CG.6210 and CG.16) at sites where this pathogen is a contributing factor.
- Consider replant-resistant rootstock if available. Various Geneva rootstocks such as G.41, G214, G.935, G.202, G.30, G.210 and G.969 claim tolerance to the classic replant pathogens.
- Stagger planting rows to avoid planting directly in old tree sites.
- Grow nematode-suppressing cover crops in the years prior to orchard establishment.

Plant Parasitic Nematodes in Ontario

There are many beneficial nematodes in agricultural soil, however some nematodes are plant parasitic. When plant parasitic nematodes are present in high numbers in soil, they can cause significant yield losses to horticultural crops. The extent of loss depends on the crop, nematode species and soil populations.

The most destructive and common plant parasitic nematodes in Ontario fruit crops are root-lesion (*Pratylenchus penetrans*) and northern root-knot (*Meloidogyne hapla*). The northern root-knot nematode is becoming more prevalent. The pin (*Paratylenchus sp.*) and dagger (*Xiphinema sp.*) nematodes occasionally cause yield losses to some fruit crops in isolated fields. The dagger nematode is mainly a virus vector on grape, raspberry and apple.

Generally, symptoms of nematode injury include:

- uneven plant growth
- poor plant establishment
- plants weakening over time
- poor root growth
- knots or galls on roots
- excessive branching of roots, hairy root symptoms

Root-lesion nematodes can be a major cause of orchard replant failures. They can also cause a decline in vigour of existing peach and cherry orchards. These nematodes cause small brown lesions on the white lateral roots and kill the fine feeder roots. When lesions merge, the entire root system appears discoloured. Root lesions are frequently invaded by other pathogens which can cause root rot. Severely affected trees may lose all feeder roots. Young replant trees may die. Existing trees lack uniformity.

Thresholds

Nematode populations above economic thresholds can significantly reduce yields. The economic threshold for nematode populations refers to the population at planting. Planting a susceptible crop in soils with a population of nematodes near or above the economic threshold will result in crop losses over time. For economic thresholds, see Table 4–1. *Nematode Thresholds for Fruit Crops.*

Table 4–1. Nematode Thresholds for Fruit Crops

Type of Nematode	Economic Threshold (nematodes/kg soil)
Root-lesion	1,000 (exception: 500 on strawberries)
Root-knot	1,000
Pin	5,000
Dagger	100
Bulb and stem	100

- Nematode problems are most often found in sandy-loam and sandy soils. Always sample these soils for nematode populations before planting fruit crops.
- Root-lesion and root-knot nematode problems are not usually found in clay or clay-loam soils. Sample these soils for nematodes before planting in replant sites or where susceptible crops have been recently grown.
- Sample clay or clay-loam soils for dagger nematode before planting on virus-susceptible grape, raspberry or tree fruit.

For more information, see OMAFRA Factsheet, *Sampling Soil and Roots for Plant Parasitic Nematodes.* Information on how to sample soil for nematodes and where to send the samples can be found in Appendix B: *Diagnostic Services.*

Nematode Management

Nematode management starts a year before planting a susceptible crop like fruit trees. Try to reduce nematode populations so that clean stock can establish well before the nematodes rebound to damaging levels. Young plants tolerate much less nematode feeding than established plants. Use a combination of the following methods to manage nematodes:

- Start new fields with transplants free from nematodes and grown by an accredited plant propagator.
- Rotate susceptible crops with non-host crops for several years.
- Grow nematode-suppressing cover crops in the years prior to establishing fruit crops.
- Destroy residual crop roots.
- Plant resistant fruit cultivars where available.
- Control weeds, as they are good hosts of nematodes.
- Use soil fumigation before planting when nematode populations in soil reach or exceed thresholds (see Table 4–1. *Nematode Thresholds for Fruit Crops*).

Cover Crops for Nematode Suppression

Cover crops may reduce populations of plant parasitic nematodes when properly managed in the year before planting. In Ontario, these nematode-suppressing cover crops have been successful:

- oilseed radish
- certain white and oriental mustard cultivars like White Gold, Pacific Gold, Caliente, Cutlass or Forge
- specific sorghum × sudan-grass hybrids
- African marigold cultivars like Crackerjack or Creole
- Canadian Forage Pearl Millet 101 (root lesion nematode suppression)

Not all cultivars of the above cover crops reduce nematode populations. Choose the right variety. One or more years of nematode-suppressing cover crops may be required to reduce nematodes below economic thresholds.

Cover crops suppress nematodes in different ways:

- Canadian Forage Pearl Millet 101 is a poor host and inhibits the ability of root lesion nematodes to reproduce in its root-system.
- Certain cultivars of African marigolds produce a root exudate that is toxic to nematodes in the soil.
- Nematode-suppressing cover crop cultivars of brassica plants (e.g. oilseed radish, certain white and oriental mustards) produce glucosinolates and an enzyme in their leaves, stems and petioles. When the cover crop is cut and immediately incorporated into the soil, the glucosinolates are converted into isothiocyanates, which are toxic to nematodes.

Exclude cover crops such as clovers and buckwheat from orchard rotations. These are excellent hosts for root-lesion nematodes. Wheat or barley are the best cereal crops to grow before planting.

For more information, visit ontario.ca/crops and search the *Soil Management, Fertilizer Use, Crop Nutrition and Cover Crops for Fruit Production* webpage.

Other Cultural Practices to Reduce Nematodes

Nematode populations can build on many weed species. A good weed control program is essential the year before planting fruit crops. Plan an intensive weed management strategy for the cover crop where nematode-suppressing cover crops are grown.

Keep land fallow the year before planting to reduce nematode numbers. A disadvantage to fallow land is increased susceptibility to soil erosion.

In orchards, choose ground covers for planting between the rows that do not support nematodes, such as annual or perennial ryegrass, or creeping red fescue.

Nematode Suppression After Planting

Vydate will suppress nematodes after planting non-bearing apples. Vydate is less effective than pre-plant soil fumigation and does not control soil-borne disease. Refer to the product label for application methods, mixing instructions, rates and precautions.

- Vydate is highly toxic to bees. Do not apply during the pink or bloom period.
- Vydate is very toxic to humans. Follow application instructions closely.

Apple-specific strategies:

- Treat young whips and non-bearing fruit trees with 1 application of Vydate as a soil drench around the base of each tree when roots are actively growing and leaf growth begins in the spring. Follow this with a foliar application of Vydate.
- An alternative method is to make 3 foliar applications on a 2–3-week schedule for a total of 3 applications.
- Do not allow spray to drift onto trees in bloom.
- Do not apply to trees under water stress or not actively growing.
- Do not re-enter treated fields for 24 hours after application.

Soil Fumigation

Pre-plant soil fumigation is the most effective method of controlling fungal, weed and nematode problems. Fumigants can be broadcast over the whole field or applied only in bands where crop will be planted. Tree-row application, or the treatment of a 2.0–2.5 m strip centred on the row, is more economical, but requires good planning. However, broadcast fumigation will reduce the risk of re-contamination if non-fumigated soil is mixed into the fumigated strip.

For products, rates and other information on fumigants, refer to Table 4–2. *Products for Management of Nematodes and Other Soil-borne Pests.*

Application of Fumigants Before Planting

Most fumigants are applied by shank injection using specialized application equipment. Some formulations of metam sodium can be applied to the soil surface and watered in. See the product label for application instructions.

- Fumigate when soil temperatures are above 4°C at 20 cm depth. Warmer temperatures (15°C and over) are preferred for more rapid fumigant dispersal in the soil. Fumigation in the early fall before planting is best for fruit crops which are planted in early spring when soils are still cool.
- Land preparation is critical for effective fumigant application. Fumigants cannot easily penetrate large clumps of soil and organic matter. Remove trash and old root systems. One week prior to fumigation, work the soil to a depth of 25–30 cm and obtain good seedbed tilth and moisture. Keep soil moist and if necessary, irrigate the treated area during the week prior to fumigation. A light cultivation immediately before fumigation may be necessary if a soil crust has developed.
- Soil moisture in the top 15–20 cm must be at the level stipulated by the fumigant label prior to and during fumigation. If soil moisture is not sufficient, it must be adjusted before product application can occur. For best results, keep the soil surface moist during application and for 24 hours after application.
- Seal the soil surface immediately after injection of the fumigant. The best method for sealing the soil is covering it with tarps, however, rolling or cultipacking immediately behind the fumigant applicator can also be used. Some fumigants have specific requirements for sealing the soil-consult product labels to determine what is legally permissible for the fumigant and type of application. Light watering after application will further prevent the escape of fumigant from the soil.
- Leave soil undisturbed for at least 1 week after injection of the fumigant. Colder soils (below 15°C) require longer periods from injection to aeration.
- Work the soil and aerate for about a week before planting. For fall planting, work the soil and aerate for 2 weeks before planting. The time interval between fumigation and planting into fumigated soil depends upon the product used, the rate and the temperature following fumigation (consult product label).

- Use high-quality planting stock, preferably grown in fumigated soil. Nursery operators can provide information on how to manage nematodes.
- Always read the product label. All fumigant labels now contain detailed Good Agricultural Practices for soil conditions, sealing, application and re-entry. These are mandatory and must be followed for all fumigant applications.

Fumigating Single-Tree Sites Before Planting Replacement Trees

When trees are replanted within an existing orchard, nematodes and diseases can be controlled in the planting hole using Vapam or Busan before planting. Refer to the product label for application details, rates and safety precautions.

Table 4–2. Products for Management of Nematodes and Other Soil-borne Pests

CAUTION: These products are very toxic. Read the label and follow instructions for handling and application. Always follow manufacturer's directions carefully for dosage and methods of use. The applicator must wear suitable protective clothing, etc. These requirements vary between products and can be found on the label.

Product	Active Ingredient	Ontario Class	Pests Controlled[1]			Rates (shank injection or surface applied)	Rates (sprinkler application)
			Nematodes	Soil-borne Diseases	Weeds		
Busan 1020	metam sodium 33%	4	yes	yes	yes	375–935 L/ha (shank injection)	700–935 L/ha
Busan 1180	metam potassium 54%	3	yes	yes	yes	231–576 L/ha (shank injection)	431–576 L/ha
Busan 1236	metam sodium 42%	4	yes	yes	yes	274–683 L/ha (shank injection)	511–683 L/ha
Chloropicrin 100	chloropicrin 99%	2	yes	yes	no	93–140 L/ha (shank injection)	do not apply with sprinklers
Enfuse M 510	metam sodium 42%	4	yes	yes	yes	260 L/ha (surface applied)	do not apply with sprinklers
Pic Plus	chloropicrin 85.1%	2	yes	yes	no	108–162 L/ha (shank injection)	do not apply with sprinklers
MustGrow	oriental mustard seed meal 100%	3	yes[2]	yes[2]	no	1,121–2,240 kg/ha (surface applied)	do not apply with sprinklers
Vapam HL	metam sodium 42%	4	yes	yes	yes	279–696 L/ha (shank injection)	350–670 L/ha

[1] See label for exact registrations.
[2] Provides suppression rather than control.

Requirements for Fumigants

Health Canada's Pest Management Regulatory Agency (PMRA) label requirements for soil fumigant products containing chloropicrin, metam sodium and metam potassium are intended to further limit user exposure and increase protection of workers, bystanders and the environment. Growers and applicators should ensure they have the most current version of product labels before applying any fumigant. Detailed instructions can be found on product labels, but requirements include:

- A Fumigation Management Plan (FMP) must be completed prior to the start of any fumigant application. This is an organized, written description of the steps involved to ensure a safe and effective fumigation. The specific requirements for the FMP will be listed on the product label.
- Mandatory Good Agricultural Practices are now required. This standardizes many practices already on existing labels and helps improve the safety and efficacy of soil fumigations. These practices will vary with the product and application method but will include identifying optimal weather conditions, proper soil preparation, requirements for soil moisture and temperature, methods for soil sealing and use of proper application depths.
- DO NOT apply these products when a temperature inversion is occurring or is predicted to occur within 48 hours after application is complete, as fumigant vapours may drift. For more information on how inversions affect drift of pest control products, see www.sprayers101.com/surface-inversions/.
- DO NOT apply these products if light wind conditions (less than 3 km/h) are forecast to persist for more than 18 consecutive hours from the time the application starts until 48 hours after the application is complete. Calm conditions could indicate a temperature inversion, which could lead to spray drift. See www.sprayers101.com for more information on temperature inversions.
- Any person involved in the use of fumigants is considered a fumigant handler. All fumigant handlers must hold an appropriate pesticide applicator certificate or license recognized by the provincial pesticide regulatory agency where the pesticide application is to occur.
- Entry into fumigant application blocks by any person (other than fumigant handlers, emergency personnel and local, provincial or federal officials performing inspection, sampling or other official duties) is PROHIBITED during the Application Block Period.
- The Application Block Period begins at the start of application and expires at least 5 days after the application is complete. The length of the period will depend on application criteria (e.g., tarped or non-tarped, etc.). The applicator must verbally warn workers of the application.
- Fumigant application signs must be posted on all entrances to the application block. Signs must be posted prior to the start of the application (but no earlier than 24 hours prior to application) and remain posted for the duration of the Application Block Period. Signs must be removed within 3 days of the end of the Application Block Period.
- Only fumigant handlers with an appropriate pesticide applicator certificate or license recognized by the provincial regulatory agency may be in the application block from the start of the application until the Application Block Period expires, and in the buffer zone during the Buffer Zone Period.

Buffer Zones

- A buffer zone must be established for all fumigant applications. A buffer zone is an area around the perimeter of the fumigated area that extends equally in all directions. The size of the buffer zone area will depend on the product and application criteria.
- Only fumigant handlers with appropriate certification may enter the buffer zone during the Buffer Zone Period, the 48-hour period following application. All non-handlers, including field workers, residents and pedestrians must be excluded from the buffer zone during the Buffer Zone Period, except for transit (e.g., vehicular or bicycle traffic).
- The size of the buffer zone will vary with application method, rate and field size. Product labels will include tables to determine the required buffer zone distance.

- Buffer zones cannot include any residential area or occupied building, outdoor residential areas (e.g., lawns, gardens, play areas) or other areas that may be occupied during the 48-hour period following application.
- An emergency preparedness plan will be required when residences or businesses are located in close proximity to the outer edge of the buffer zone.

APPENDIX A: Additional Resources for Ontario Fruit Growers

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
- By phone through the ServiceOntario Contact Centre
  Monday–Friday, 8:30 a.m. - 5:00 p.m.
  416-326-5300
  416-325-3408 (TTY)
  1-800-668-9938 Toll-free across Canada
  1-800-268-7095 TTY Toll-free across Ontario
- In person at OMAFRA Resource Centres. Many can also be found online at ontario.ca/omafra
- For a complete list of publications from OMAFRA: ontario.ca/omafra

OMAFRA Publications

- *Growing Strawberries in Ontario* – Publication 513
- *Growing Red Raspberries in Ontario* – Publication 105
- *Fruit Crop Protection Guide* – Publication 360
- *Guides to Weed Control* – Publication 75A Field Crops & Publication 75B Hort Crops
- *Integrated Pest Management for Ontario Apples* – Publication 310
- *Predatory Insects in Fruit Orchards* – Publication 208
- *Soil Fertility Handbook* – Publication 611
- *Vegetable Crop Protection Guide* – Publication 838
- *Agronomy Guide for Field Crops* – Publication 811

Websites

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

- OMAFRA gateway to information on crops: ontario.ca/crops
- ONfruit blog: onfruit.ca
- ONspecialtycrops blog: onspecialtycrops.wordpress.com
- Spotted wing drosophila: ontario.ca/spottedwing
- Brown marmorated stink bug: ontario.ca/stinkbug
- Crop IPM (integrated pest management) modules: ontario.ca/cropipm
- Specialty Cropportunities to find information on specialty berries and fruit: ontario.ca/crops (search on “cropportunities”)
- Health Canada’s 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.com
- Ontario Pesticide Education Program: www.opep.ca

OMAFRA Factsheets

- *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*

Best Management Practices

The Best Management Practices series of publications presents a practical, affordable approach to conserving a farm’s soil and water resources without sacrificing productivity. For a complete list of books in the BMP series, see: ontario.ca/agbestpractices.

APPENDIX B: Diagnostic Services

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

Agriculture and Food Laboratory
Laboratory Services Division
University of Guelph
95 Stone Road West
Guelph, ON N1H 8J7
Tel: 519-767-6299
Fax: 519-767-6240
Website: www.afl.uoguelph.ca
Email: aflinfo@uoguelph.ca

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

To obtain information on the fee schedule, visit www.afl.uoguelph.ca 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

Forms can be obtained from on the Agriculture and Food Laboratory website at https://afl.uoguelph.ca/sites/default/files/pdf/general-submission-form.pdf. 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 Agriculture and Food Laboratory 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 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 C: Ontario Ministry of Agriculture, Food and Rural Affairs – Fruit Crop Advisory Staff

Agroforestry Specialist	Todd Leuty	Tel: 519-826-3215	todd.leuty@ontario.ca
Application Technology Specialist	Jason Deveau	Tel: 519-209-1883	jason.deveau@ontario.ca
Crop Protection Specialist	Denise Beaton	Tel: 519-400-3636	denise.beaton@ontario.ca
Entomology, Horticulture	Hannah Fraser	Tel: 905-708-8014	hannah.fraser@ontario.ca
Fresh Market Quality Specialist	Jennifer R. DeEll	Tel: 519-426-1408	jennifer.deell@ontario.ca
Fruit Crop Specialist (berry)	Erica Pate	Tel: 519-410-0624	erica.pate@ontario.ca
Fruit Crop Specialist (tender fruit, grape)	Kathryn Carter	Tel: 905-687-1280	kathryn.carter@ontario.ca
Horticulture IPM Specialist (pome fruit)	Kristy Grigg-McGuffin	Tel: 519-420-9422	kristy.grigg-mcguffin@ontario.ca
Horticulture IPM Specialist (specialty crops)	Melanie Filotas	Tel: 519-428-4340	melanie.filotas@ontario.ca
Horticulture IPM Specialist (tender fruit, grape)	Wendy McFadden-Smith	Tel: 905-932-8965	wendy.mcfadden-smith@ontario.ca
Industrial Crop Specialist	Jim Todd	Tel: 519-426-3823	jim.todd@ontario.ca
Minor Use Coordinator	Jim Chaput	Tel: 519-546-2482	jim.chaput@ontario.ca
New Crop Development Specialist	Evan Elford	Tel: 519-420-9343	evan.elford@ontario.ca
Soil Fertility Specialist, Horticulture	vacant	—	—
Pathologist, Horticulture	Katie Goldenhar	Tel: 519-824-4120 ext. 58910	katie.goldenhar@ontario.ca
Soil Management Specialist	Anne Verhallen	Tel: 519-359-6707	anne.verhallen@ontario.ca
Surveillance Coordinator	Cora Loucks	Tel: 519-546-8245	cora.loucks@ontario.ca
Soil Sustainability Specialist	vacant	—	—
Tree Fruit Specialist	Amanda Green	Tel: 226-931-4098	amanda.green@ontario.ca
Weed Management, Horticulture	Kristen Obeid	Tel: 519-738-1232	kristen.obeid@ontario.ca

A complete list of Ontario Ministry of Agriculture, Food and Rural Affairs crop advisory staff is available on the OMAFRA website at ontario.ca/crops.
In case of pesticide drift concern, please contact the Ministry of Environment, Conservation and Parks' local District or Area office. The local District Office contact information can be found from the Info Go website http://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).

APPENDIX D: The Metric System

Metric Units

Linear Measures (length)

10 millimetres (mm)	=	1 centimetre (cm)
100 centimetres (cm)	=	1 metre (m)
1,000 metres	=	1 kilometre (km)

Square Measures (area)

100 m × 100 m = 10,000 m^2 = 1 hectare (ha)

100 ha = 1 square kilometre (km^2)

Cubic Measures (volume)

DRY MEASURE

1,000 cubic millimetres (mm^3)	=	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)
(0.5 kg) 500 g	=	500 mL (0.5 L)
(0.1 kg) 100 g	=	100 mL (0.1 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 × 0.014	=	ounces per acre
kilograms per hectare × 0.89	=	pounds per acre
tonnes per hectare × 0.45	=	tons per acre

Imperial or U.S. to Metric (approximate)

Imp. gallons per acre × 11.23	=	litres per hectare (L/ha)
U.S. gallons per acre × 9.35	=	litres per hectare (L/ha)
Imp. quarts per acre × 2.8	=	litres per hectare (L/ha)
U.S. quarts per acre × 2.34	=	litres per hectare (L/ha)
Imp. pints per acre × 1.4	=	litres per hectare (L/ha)
U.S. pints per acre × 1.17	=	litres per hectare (L/ha)
Imp. fluid ounces per acre × 70	=	millilitres per hectare (mL/ha)
U.S. fluid ounces per acre × 73	=	millilitres per hectare (mL/ha)
tons per acre × 2.24	=	tonnes per hectare (t/ha)
pounds per acre × 1.12	=	kilograms per hectare (kg/ha)
pounds per acre × 0.45	=	kilograms per acre (kg/acre)
ounces per acre × 70	=	grams per hectare (g/ha)

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

Approximate Dry Weight Equivalents

GRAMS/HECTARE		OUNCES/ACRE
100	=	1 ½
200	=	3
300	=	4 ¼
500	=	7
700	=	10

KILOGRAMS/HECTARE		POUNDS/ACRE
1.10	=	1
1.50	=	1 ¼
2.00	=	1 ¾
2.50	=	2 ¼
3.25	=	3
4.00	=	3 ½
5.00	=	4 ½
6.00	=	5 ¼
7.50	=	6 ¾
9.00	=	8
11.00	=	10
13.00	=	11 ½
15.0	=	13 ½

Handy Metric Conversion Factor

litres per hectare × 0.4 = litres per acre

kilograms per hectare × 0.4 = kilograms per acre

Conversion Table – Metric to Imperial (approximate)

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 inch
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) × ⅝

Abbreviations

%	=	percent (by weight)
ai	=	active ingredient
cm	=	centimetre
cm^2	=	square centimetre
e.g.	=	for example
g	=	gram
ha	=	hectare
kg	=	kilogram
km/h	=	kilometres per hour
kPa	=	kilopascal
L	=	litre
m	=	metre
m/s	=	metres per second
m^2	=	square metre
mL	=	millilitre
mm	=	millimetre
t	=	tonne
v/v	=	volume/volume

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

PREVENT ACCIDENTS

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

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

IF AN ACCIDENT OR POISONING HAPPENS

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

FIRST AID

If a pesticide comes in contact with skin:

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

If pesticide comes in contact with eyes:

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

If pesticide was inhaled:

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

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

If a pesticide was swallowed:

- call the Ontario Poison Centre IMMEDIATELY.

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- online at ontario.ca/publications
- by phone through the ServiceOntario Contact Centre, Monday to Friday, 8:30 a.m. to 5:00 p.m. ET
  - 416-326-5300
  - 1-800-668-9938, toll-free across Canada
  - 1-800-268-7095 TTY, toll-free across Ontario

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Agricultural Information Contact Centre

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

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

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