PROTECTION GUIDE FOR TURFGRASS

Publication 384

Ministry of Agriculture and Food

Ministry of Rural Affairs

Ontario

Discard old editions of this publication. Each year the appropriate sub-committee of the Ontario Pest Management Research and Services Committee reviews the pesticides listed in this publication. To the best knowledge of the committee, at the time of printing, the pesticide products listed in this publication were:

- federally registered
- classified by the Ministry of the Environment (MOE)

The information in this publication is general information only. The Ontario Ministry of Agriculture and Food and the Ministry of Rural Affairs (OMAF and MRA) do not offer any warranty or guarantee, nor do they 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. It is against the law to use the product in any other way.

Federal Registration of Pesticide Products

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

1. **Full Registration**
   Pesticide registrations are normally granted for a period of five years, subject to renewal.
2. **Conditional Registration**
   Conditional registration may be granted for a specified, limited time period, where the registrant agrees to produce additional scientific or technical information, or the pesticide is used for emergency control of a serious pest outbreak.

Maximum Residue Limits

The PMRA has established maximum residue limits (MRLs) for pesticides. Processors or retailers may demand more restrictive limits. Growers should seek advice of their intended market to determine if more restrictive limitations apply. Keep accurate and up-to-date records on pesticide use in each crop.

Supplemental Labels

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

Examples of when you must use a supplemental label include:

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

You can obtain a copy of a supplemental label from the pesticide manufacturer or pesticide vendor, the grower association that sponsored the emergency registration or minor use, from OMAF and MRA 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 MOE 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 *www.ontario.ca/e-laws* or by calling the ServiceOntario Publications Toll-Free number: 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

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

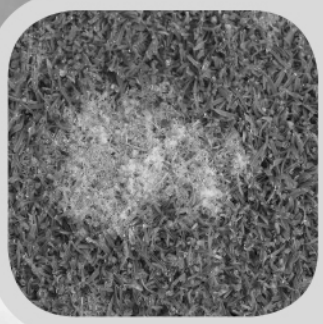
Certification and Licensing

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/index.cfm/home-page* or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council's Pesticide Technician Program website at *www.hort-trades.com* or call 1-800-265-5656 or e-mail pic@hort-trades.com
- the Pesticide Industry Regulatory Council (PIRC) at *www.oipma.ca.*

Cette publication est aussi disponible en français.



PROTECTION GUIDE FOR TURFGRASS

Publication 384

Ministry of Agriculture and Food

Ministry of Rural Affairs

Ontario

This publication lists crop protection products registered for turfgrass as of December 1, 2013. Products listed in this book have been reviewed by the registrants and the Turf Technical Working Group under the Ontario Pest Management Services Committee. Any supplements to this publication will be posted to the OMAF website at

www.ontario.ca/crops

Integrated pest management information for turfgrass can be found in OMAF Publication 816, *Turf IPM Manual*. Information on the biology of turfgrass diseases and insects can be found in OMAF Publication 162, *Diseases and Insects of Turfgrass in Ontario*.

All other turfgrass management information for Ontario can be found on the OMAF website at *www.ontario.ca/crops*.

Visit ONturf at *www.onturf.wordpress.com*. The ONturf blog provides timely information on turf management in Ontario.

Follow the OMAF and MRA Turfgrass Specialist on Twitter @ONturf.

Information in this book was contributed by:
• OMAF and MRA Agriculture Development Branch
• University of Guelph

Front cover:

Large: Sod field. Small Top: dollar spot mycelium, Middle: European chafer adult, Bottom: European chafer grub

Back cover:

Large: golf course green. Small Left: Japanese beetle adult, Middle: leatherjackets, Right: Helminthosporium leaf spot

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1. Using Pesticides in Ontario

The information in this chapter is updated regularly. For up-to-date information, visit *www.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.*
Keep detailed spray records.

Federal Registration of Pesticides

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

The PMRA re-evaluates registered pesticides to determine whether today's health and environmental protection standards are still met when the pesticide is used according to the label. Outcomes of a re-evaluation can be:

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

The pesticide label is a legal document. It prescribes how the pesticide can be legally used. 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.

Regulation of Pesticides in Ontario

The Ministry of the Environment (MOE) 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 *www.ontario.ca/e-laws* or by calling ServiceOntario at 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

Before a federally registered pesticide can be sold or used in Ontario, it must be classified under the provincial *Pesticides Act.* The Ontario pesticide classification system consists of 11 classes. Ontario's Pesticides Advisory Committee (OPAC) is responsible for assessing new pesticide products and recommending to the MOE 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 MOE, classified products are posted on the MOE website at *www.ontario.ca/pesticides*.

Certification and Licensing

Growers 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 use Class 4, 5, 6 or 7 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.

Commercial Applicators (Exterminators) and Their Assisting Technicians

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

- the Ontario Pesticide Training and Certification website at *www.ontariopesticide.com/index.cfm/home-page* or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council website at *www.hort-trades.com* or call 1-800-265-5656 or email *pic@hort-trades.com*
- the Pesticide Industry Regulatory Council (PIRC) at *www.oipma.ca*

Exception for Golf Courses and Specialty Turf

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, see *Pesticides and Golf Courses* at *www.ontario.ca/environment-and-energy/pesticides-and-golf-courses* and *Technical Guidance: Pesticides Act and Ontario Regulation 63/09 Specialty Turf and Specified Sports Fields* at *www.ontario.ca/environment-and-energy/technical-guidance-pesticides-act-and-ontario-regulation-6309-specialty-turf*.

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

- Inside front cover of this publication on page 2
- Pest Management Regulatory Agency (PMRA) website: *www.healthcanada.gc.ca/pmra*
- PMRA Pest Management Information Service: 1-800-267-6315 (from within Canada) or 1-613-736-3799 (from outside Canada)
- Ontario Ministry of the Environment (MOE) website: *www.ontario.ca/pesticides*
- Regional MOE Pesticides Specialist (See Appendix E. *Ministry of the Environment – Regional Contact Information,* on page 61.)
- Ministry of Agriculture and Food (OMAF) website: *www.ontario.ca/omaf*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) website: *www.opep.ca*
- Ontario Pesticide Training & Certification website: *www.ontariopesticide.com/index.cfm/home-page*
- Pesticide Industry Council website at *www.hort-trades.com*
- 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
- buffer zones
- precautionary statements
- steps to be taken in case of an accident
- disposal

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

For more information on pesticide application, see:

- OMAF Factsheet *Calibrating Airblast Sprayers*
- OMAF Factsheet *Adjusting, Maintaining and Cleaning Airblast Sprayers*
- OMAF Factsheet *How Weather Conditions Affect Spray Applications* (website only)
- OMAF Factsheet *Pesticide Drift from Ground Applications*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos at *www.opep.ca/index.cfm/learning-resources/videos/*
- OMAF Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application,* Order No. BMP13
- OMAF Factsheet *Pesticide Contamination of Farm Water Supplies — Recommendations on Avoidance, Cleanup and Responsibilities*

Restricted Entry Intervals

The restricted entry interval, also referred to as re-entry interval (REI), is the period of time following a pesticide application during which workers must not enter the treatment area. This allows any pesticide residue and vapours to dissipate from the treatment location (e.g., field), preventing the possibility of inadvertent pesticide exposure.

The PMRA reviews each pesticide to determine whether the label should include a specific restricted entry interval. If the restricted entry interval is not stated on the label for agricultural crops, assume that the REI is 12 hours. For golf courses and residential turf applications, the spray solution must be dry before entry can occur. Some pesticides have labels that carry a warning about working in treated crops and provide specific PPE requirements. Follow the label recommendations.

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

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

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

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

Buffer Zones

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

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

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

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

Health Canada's PMRA has an online spray drift calculator that allows applicators to modify the buffer zones specified on the product label based on weather conditions, the category of the spray equipment and the droplet size. For more information, see the Buffer Zone Calculator at *www.hc-sc.gc.ca/cps-spc/pest/agri-commerce/drift-derive/calculator-calculatrice-eng.php*.

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

Protect the Environment

Protect Water Sources

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

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

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

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

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

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

For more information on protecting water sources, see:
- OMAF Factsheet *Pesticide Contamination of Farm Water Supplies — Recommendations on Avoidance, Cleanup and Responsibilities*
- OMAF Factsheet *Groundwater — An Important Rural Resource: Protecting the Quality of Groundwater Supplies*
- OMAF Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application,* Order No. BMP13

Bee Poisoning

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

- Time insecticide applications to minimize bee exposure (e.g., apply post bloom). Daytime treatments, when bees are foraging, are most hazardous. Insecticide applications in the evening are the safest, unless there is evidence of a strong temperature inversion. Under normal circumstances, spraying after 8 pm allows the spray to dry before the bees are exposed to it the next day. Early morning is the next best time, but spraying should be completed well before 7 am. 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 in 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 it 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. See the "Field Crop News" blog at *fieldcropnews.com* for current information on ways to reduce dust movement.

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

- If there is a risk of honeybee poisoning, try to choose an insecticide that is not highly toxic to bees. When there is a choice, choose a product formulation that is less hazardous to bees.

- Always read the most current label for guidance.

- Before applying a pesticide or planting with insecticide-treated seed, advise local beekeepers so they can move colonies out of the danger area, if this is an option. Contact information for the local beekeepers' association in your area can be found on the Ontario Beekeepers' Association website at *www.ontariobee.com/community/local-beekeepers-associations*. Other ways to find your local beekeepers are to contact the Provincial Apiarist at 1-888-466-2372, ext. 63595 or see *www.ontario.ca/crops* and click "Apiculture" and then "Bee Inspectors" for a list of provincial bee inspectors who know the local beekeepers.

Manage Drift

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

- Do not spray when wind speeds are high or gusty. These conditions increase the potential for spray and vapour drift. Check pesticide labels for allowable wind speeds for spraying applications. However, not all labels provide this specific information.

- Constantly monitor wind conditions during spraying using a good-quality wind meter. Record the wind speed and direction. As wind conditions change, you may need to make adjustments to further reduce the drift potential, such as increasing water volume, minimizing nozzle-to-target distance, changing nozzle technology, changing fields because of surrounding influences or stopping spraying until conditions improve.

- Do not spray during periods of dead calm. Periods of dead calm may occur in early morning or late evening, at which time the temperature is usually cooler and the relative humidity is typically higher, which can result in the spray droplets remaining aloft, like fog. When the wind picks up, these spray droplets can move away from the target area, possibly causing injury to adjacent non-target areas. Off-target drift in calm conditions can occur hours after the spray event was completed.

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

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

Field air temperatures are often very different from local or regional forecasts, so the most reliable method of detecting inversion conditions is to measure temperatures at, and several metres above, the ground. Spray applicators can recognize a temperature inversion when:

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

Temperature inversions start to form 3 hours 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, then don't spray. Often, warnings for the risk of inversions are stated right on the product label.**

- Use the sprayer output specified on the pesticide label.

- Use a nozzle that will produce the droplet size specified on the pesticide label or delivers droplets appropriate for the job. Nozzles that produce fine droplets are rarely, if ever, required.

- Where practical, use air induction/venturi nozzles, which significantly reduce drift compared to conventional nozzles.

- Check the height of the boom to the target or distance from airblast boom to the target. Minimize the distance as much as possible while still maintaining spray uniformity.

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

- Use spray plume protection where practical or available (hoods, shrouds, screens or air curtains).

- Use drift-reducing adjuvants in the spray tank as directed on the label. Mechanical or hydraulic agitations have been shown to reduce the effectiveness of certain drift-reducing adjuvants. Be aware that certain combinations of anti-drift adjuvants and air-induction/venturi nozzles have been shown to increase the incidence of fine droplets that will drift.

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

For more information about spray drift, see:
- OMAF Factsheet *Pesticide Drift from Ground Applications*
- OMAF Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application,* Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos *How to Manage Spray Drift and Spray Drift Reduction Through Air Induction,* available at *www.opep.ca/index.cfm/learning-resources/videos/chapter-19-drift-of-pesticides/*

Pesticide Disposal

Empty Pesticide Containers Up to 23 L

Never re-use empty containers.

The Ontario Empty Pesticide Container Recycling Program, an industry-led program, is available free of charge to growers and commercial applicators.

Through this program, you can return triple-rinsed or pressure-rinsed plastic pesticide containers up to 23 L to container collection depots located throughout the province. Remove the cap and booklet from the pesticide container before recycling. To locate the closest container collection depot, visit *www.cleanfarms.ca,* call your local dealer, or contact CleanFARMS at 416-622-4460 (toll-free at 877-622-4460) or *info@cleanfarms.ca*.

Please note that starting in 2013 this program now includes liquid fertilizer containers up to 23 L in size.

Empty Pesticide Containers Greater Than 23 L

Growers and commercial applicators can return pesticide containers that are greater than 23 L in size. 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*.

Surplus Spray Mix

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

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

If you cannot find another allowable crop to spray, then dilute the remaining spray mix by adding 10 parts of water for each 1 part of spray mix. The diluted solution can be safely applied to the original treated area as long as you do not exceed the pesticide rate recommended on the label. Be sure to check the label for any restrictions about crop rotation, days to harvest or disposal of surplus spray mix.

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

Surplus Pesticide Disposal

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

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

Storing Pesticides

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

Table 1–1. Requirements for pesticide storage facilities

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

* Refer to MOE's website www.ontario.ca/pesticides for requirements for warning sign G. 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 MOE Spills Action Centre (1-800-268-6060) should also be readily available.

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

Pesticide Spills

If a pesticide spill causes, or is likely to cause, an adverse effect that is greater than that which would result from the proper use of the pesticide, you must notify the Ministry of the Environment Spills Action Centre at 1-800-268-6060 (24 hours 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 cleanup 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.

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

For pesticide poisonings and pesticide injuries, call:

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

For more information, see *Emergency and First Aid Procedures for Pesticide Poisoning* on page 65.

2. Safe Use of Pesticides

Pesticides cannot be used for cosmetic purposes in Ontario. Regulation 65/09 under the *Pesticides Act* sets out the exceptions for:

- golf courses, provided they are accredited for Integrated Pest Management by a Ministry of the Environment approved *Integrated Pest Management* body (currently The IPM Council of Canada)
- specialty turf used for lawn bowling, cricket, lawn tennis and croquet, provided they are accredited for Integrated Pest Management by a ministry-approved *Integrated Pest Management* body (currently The IPM Council of Canada)
- sports fields, for a short term to host national or international level sports competitions and with written permission from the Minister of the Environment

Lawns and gardens around the sports fields and specialty turf areas are subject to the ban.

Another exception for pesticide use is in the interest of public health or safety, to control plants that are poisonous to the touch, such as poison ivy; insects that bite, sting, are venomous or are disease carrying, like mosquitoes; and animals, insects or plants that may cause damage to a structure or infrastructure, such as termites.

For more information visit the Ministry of Environment website: *www.ontario.ca/pesticideban*.

Pesticide Use on Sod Farms, Golf Courses, Specialty Turf

Sod is an agricultural crop. Agricultural use is not restricted by the Cosmetic Pesticides Ban. Golf courses and specialty turf uses such as lawn bowling, cricket, lawn tennis and croquet are "excepted uses" under the *Pesticides Act* and Regulation 63/09. A large number of chemicals (and some micro-organisms) are registered as pesticides in Ontario for use on golf courses and sod farms.

In IPM programs, use pesticides only after careful assessment shows they are the best control for the situation. Apply pesticides only when monitoring shows that the threshold has been reached. This is economical and eliminates unnecessary pesticide use. Apply pesticides only with a properly calibrated sprayer.

See Chapter 1 for information on using pesticides safely.

For further information on the safe use of pesticides, refer to the *Grower Pesticide Safety Course Manual* found on the Ontario Pesticide Education Program's website at *www.opep.ca*.

Human Health

Risks of Pesticide Use

Each time a pesticide is handled, there is some risk. The amount of risk depends on two things — the toxicity of that pesticide and the degree of exposure to it.

Risk = Toxicity × Exposure

1. **Toxicity** is a measure of how harmful or poisonous the pesticide is. There are two types of toxicity:

   Acute toxicity is the toxic response that results from a single exposure to the pesticide. The symbols and words on the front panel of a pesticide label give information about the acute toxicity (See Table 2–1, *Label hazard symbols and words,* on page 16).

   Lethal dose 50% (LD_{50}) is a measure of acute toxicity. It is the number of milligrams of product per kilogram of body weight that will kill 50% of test animals (usually female rats) within a stated period of time (24 hours to 7 days). This is commonly measured as the acute oral LD_{50}, which refers to the chemical ingested through the mouth or nose. Dermal LD_{50} figures, which refer to penetration of the chemical through the skin, are also available.

   The lower the LD_{50} figure, the more toxic the product is to humans. No products registered for turfgrass have a high acute toxicity.

2. **Chronic toxicity** is the toxic response that results from repeated exposure to small doses of a pesticide over a longer period of time. These toxic effects may not appear for months or years after exposure to the pesticide. The symbols on the label do not give information about the chronic toxicity of the product. Use protective clothing and equipment to help reduce exposure and risk of chronic effects.

Exposure is a measure of the contact with the pesticide. Workers can be exposed to the pesticide in three ways:

1. **Dermal exposure** occurs through the skin or eyes. The amount and rate of pesticide that may be absorbed depends on several things, including:

   - Skin condition at time of exposure: If the skin is moist, or if a rash, broken skin or scratches are present, pesticides will be absorbed more easily.

   - Part of the body that is exposed: Eyes, genital area, scalp and ear canals absorb pesticides at a higher rate than hands or arms. Eyes absorb 100% of the pesticides they are exposed to.

2. **Respiratory exposure (inhalation)** occurs when small spray particles, dust, gases or vapours are inhaled.

3. **Oral exposure** occurs when a pesticide enters the mouth or is swallowed.

Cholinesterase Blood Tests

Organophosphorus and carbamate pesticides can affect the human nervous system. These pesticides can reduce the levels of the enzyme acetyl cholinesterase in the serum and red blood cells. The body uses this enzyme to transmit messages through the nervous system. If cholinesterase levels fall, individuals experience symptoms such as trembling, twitching, blurred vision, and breathing and heart difficulties.

People who use any organophosphorus or carbamate pesticides on a routine basis should have regular cholinesterase blood tests. A family doctor can arrange these tests, which are covered by the Ontario Health Insurance Plan (OHIP). Workers should have their first test before beginning to handle these pesticides to assess their normal (baseline) cholinesterase level.

During the spray season, workers who spray organophosphorus or carbamate insecticides regularly for several weeks should have a cholinesterase blood test every 7 to 10 days. If the worker's cholinesterase level drops to less than half of the baseline level, the worker is showing signs of pesticide poisoning and should not be exposed to these pesticides until cholinesterase levels return to normal.

Read and Follow Pesticide Label Information

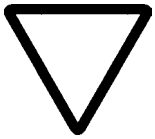
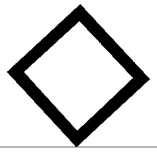
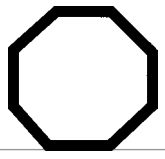
Know the Hazard Symbols and Words

Four important symbols and words show the potential hazards of pesticides.

Table 2–1. Label hazard symbols and words

Hazard Symbol	Signal Word
	Poison
	Corrosive
	Flammable
	Explosive

The hazard symbol always appears inside one of the shapes shown on page 11. The shape and its signal word together indicate the degree of hazard of the pesticide. The greater the number of sides of the shape, the more hazardous the product.

Degree of Hazard	Warning Symbol	Signal Word
Triangular shape (3 sides) means low hazard		Caution
Diamond shape (4 sides) means moderate hazard		Warning
Octagonal shape (8 sides) means high hazard		Danger

Learn these symbols and words — they could save your life!

Check the label for special warnings about eye hazards and skin hazards. **In addition,** the front panel of the pesticide label may contain warnings that indicate whether the product is corrosive to eyes or is a skin or eye irritant.

First Aid

If a serious accident occurs, call 911.

1. Rescuers should always protect themselves from injury. Protective clothing and equipment should always be worn before entering a contaminated area or handling a contaminated victim.

Symptoms of Pesticide Poisoning

Mild Symptoms
Headache, fatigue (feeling tired), loss of appetite, dizziness, weakness, nervousness, nausea, perspiration, diarrhoea, loss of weight, thirst, moodiness, irritation of the skin, eyes, nose or throat.

Moderate Symptoms
Nausea, trembling, loss of muscular co-ordination, excessive saliva, blurred vision, constricted throat or chest, laboured breathing, flushed or yellow skin, abdominal cramps, vomiting, diarrhoea, thirst, mental confusion, perspiration, rapid pulse, cough.

Severe Symptoms
Vomiting, loss of reflexes, inability to breathe or increased breathing rate, muscle twitching, tiny pupils, convulsions, unconsciousness, thirst, fever.

(Source: *Grower Pesticide Safety Course Manual,* University of Guelph Ridgetown Campus. Available online at *www.opep.ca*.)

If symptoms occur during or shortly after handling a pesticide, go to a hospital. Take the pesticide label, Material Safety Data Sheet (MSDS) or pesticide container. Do not transport the container in the passenger compartment. See the Emergency Procedures for Pesticide Poisoning on the inside back cover.

2. Check to see if the victim is breathing.

   If the victim is not breathing:

   - Straighten the victim's airway and check for breaths.
   - If the victim does not begin to breathe, perform artificial respiration until the victim begins to breathe independently.
   - Avoid becoming contaminated, especially if the victim has pesticide or vomit around the face or mouth. Use a face shield airway with a one-way valve. Do not breathe the exhaled air from the victim.
   - If the victim's pulse disappears, perform CPR if qualified to do so.

   If the victim is breathing, but unconscious:

   - Place the victim in the recovery position (on the side with the head turned slightly down). If the victim vomits, try to keep the airway clear.

3. Stop the exposure to the pesticide. Move the victim away from the contaminated area. Remove all contaminated clothing. Use soap and water to wash any skin exposed to the pesticide.

4. Check the four basic facts:

   - What? Identify the pesticide. Look for the label, container or leftover pesticide.
   - How much? How much product was the victim exposed to?
   - Where? How did the pesticide enter the body? Did it enter through the mouth, skin, eyes or lungs?
   - When? How much time has passed since the victim was exposed to the pesticide, and how long was the exposure? Were the symptoms immediate or did the poisoning occur as a result of using the pesticide over a longer period of time?

Don't waste time.
If you can't answer these questions quickly, be ready to tell emergency personnel whatever you can.

5. Call an ambulance or the poison information centre.

6. Start the first aid treatment appropriate for the contaminant and route of entry. First aid instructions can be found on most pesticide labels.

7. Make sure the patient gets medical attention. First aid is not a substitute for professional medical help.

General Precautions When Using Pesticides

Always read the label:

- before buying a pesticide
- before using a pesticide
- before storing or disposing of a pesticide

Always keep records of pesticide use.

Learn about the health hazards and toxic properties of the pesticide being used. Consult the product label, Material Safety Data Sheet (MSDS) or manufacturer for this information. Check the company's website for MSDS information.

Protection When Using Pesticides

Tell someone where the work is taking place, what pesticides are being handled and how long the job is expected to take.

Post emergency numbers, including the numbers for the Poison Information Centre and Spills Action Centre, near all telephones.

Keep a list of the names and the Pest Control Products (PCP) Act Registration Numbers of all the pesticides handled. It's a good idea to keep a file of the pesticide label booklets for all the products used. Ensure that co-workers and family members know where to find this list or file in case of an accident.

Have plenty of clean water, soap and paper towels — and an extra set of gloves and coveralls — nearby at all times in case a pesticide contaminates clothing or skin.

Wear the correct protective clothing and equipment and be sure that all items are clean and in good repair before wearing or using them.

Never smoke, chew tobacco, eat or drink when handling pesticides. Never carry tobacco or food in clothes, and never leave tobacco, food or beverages in areas where pesticides are handled or stored.

Change clothes and wash hands and face before eating, drinking or smoking.

Wash hands before using the toilet, as well as after. The skin in the groin area absorbs pesticides very easily.

Protective Clothing and Equipment

Choose and wear the appropriate protective clothing and equipment. Make sure protective clothing and equipment fit properly and are clean and in good repair. The protective clothing and equipment workers should wear depends on:

- **The pesticide being used —** read the precautions section of the label to find out what is required.
- **The job being done —** for example, use more protection when handling concentrated pesticide or when mixing and loading a sprayer.
- **The type of application —** enclosed space or air-blast sprayer applications made with open tractors require more protective equipment.

All persons who work with pesticides need their own set of protective clothing and equipment. Consult the product label to find out what protective clothing is required.

For all pesticides, always wear:

- a water-repellent hat, such as a hard hat or waterproof rain hat
  - Sometimes the entire head and neck must be protected: for example, if applying pesticides in a greenhouse, applying dusty formulations or using an air-blast sprayer. In these situations, wear a hood or hat that protects the ear canals. Do not wear baseball-style or other cloth hats, which absorb pesticides and are not safe.
- long pants and a long-sleeved shirt or coveralls
  - Coveralls can be reusable or disposable.
  - If the reusable coveralls are cotton or polyester, they should be tightly woven. However, water-resistant coveralls are preferred because cotton, denim and cotton/polyester pants cling to the skin if they get wet, which increases the risk of dermal exposure.
  - Disposable coveralls should be designated for pesticide use.
- chemical-resistant gloves (unlined)
  - Use neoprene or nitrile PVC gloves, unless the label states otherwise. Do not wear rubber gloves, because many pesticides can break down the rubber material. Fold up the cuffs of the gloves and wear the gloves tucked under the shirt or jacket sleeves.

- chemical-resistant boots (unlined)
  - Wear pant legs over boots to prevent pesticide from running down inside the boots.

Read the label. It will describe what extra protective clothing and equipment to wear.

For some pesticides, workers should also wear:

- goggles
  - Use safety goggles with indirect vents so that splashes do not enter the eye. Regular eyeglasses do not provide complete protection. Never wear contact lenses when handling pesticides.

- face shield
- chemical-resistant apron

- respirator
  - A respirator is a unit that covers the mouth and nose to prevent spray droplets, small particles and vapours from entering the lungs. A dust mask is not a substitute for a pesticide respirator. Respirators and replacement cartridges should be NIOSH/MSHA-approved. Use cartridges and pre-filters that protect against organic vapours. For more information about respirators, see the *Grower Pesticide Safety Course Manual,* Ridgetown College, University of Guelph.

For fumigants:

- When handling methyl bromide, do not wear gloves because they will trap gas next to the skin. Wear a full-face respirator with organic vapour canister or positive-pressure breathing apparatus. Check the label. When using certain methyl bromide products, a self-contained breathing apparatus must be worn at all times while using the product.

- When handling aluminum phosphide, use cotton gloves and wear a NIOSH/MSHA-approved full-face mask respirator with an acid-gas canister. Always check the label to find the appropriate safety equipment requirements.

When Working in Enclosed Areas

Canister Respirators

Canister gas masks offer effective protection against certain harmful gases, vapours and particulate matter. They are generally suitable for ventilated areas where conditions don't change rapidly. They should never be used in confined spaces where low oxygen levels or high gas concentrations may occur.

Other Protective Clothing

Wear other protective clothing listed on the pesticide label.

Working Conditions

Always check and follow the label for appropriate safety equipment requirements. Use the recommendations below as a guide only.

- Use canister respirators when the surrounding air contains low concentrations of toxic gases, vapours or particulate matter derived from soil-drench, granular, dust or foliar spray applications. Pesticides applied in this manner usually have moderate to low toxicity.

- Use a self-contained breathing apparatus when applying highly toxic pesticides. Pesticides can produce high concentrations of toxic gases, vapours or particulate matter, as well as reduce oxygen levels, especially in an enclosed space (e.g., when fumigating grain).

- Read the product label for recommendations and legal requirements. A list of safety supply companies can be found in Table 2–2, *Ontario Suppliers of Protective Clothing and Equipment,* on page 20.

Safety Equipment Suppliers

Read the label for safety equipment recommendations and requirements. Protective clothing and equipment can be purchased from the suppliers listed in Table 2–2.

Table 2–2. Ontario suppliers of protective clothing and equipment

Business Name	Address/Website	Telephone/Email
3-M Canada Inc.	Occupational Health and Environmental Safety P.O. Box 5757 London, ON N6A 4T1 *www.3m.ca/safety*	Tel: 519-451-2500 Toll-free: 1-800-364-3577 Fax: 1-800-603-7758 Orders: 809-263-3489 OHS: 1-800-267-4414
Acklands Grainger	90 West Beaver Creek Road Richmond Hill, ON L4B 1E7 *www.acklandsgrainger.com*	Tel: 905-731-5516 Fax: 905-731-6053 Email: *contact@agi.ca*
Aearo Canada	6889 Rexwood Road Mississauga, ON L4V 1R2 *www.aearo.com*	Toll-free: 1-877-327-4332
DuPont Personal Protection	P.O. Box 2200 Streetsville, Mississagua, ON L5M 2H3 *www.personalprotection.dupont.ca*	Toll-free: 1-800-387-9326 Fax: 1-866-765-5357
HAMISCO	3392 Wonderland Road South London, ON N6L 1A8 *www.hamisco.com*	Tel: 519-652-9800 Toll-free: 1-800-668-9800 Fax: 519-652-9661
Huron Tractor	39995 Harvest Road Exeter, ON N0M 1S3 *www.hurontractor.com*	Tel: 519-235-1115 Fax: 519-235-1939
Levitt-Safety (Eastern) Limited	2872 Bristol Circle Oakville, ON L6H 5T5 *www.levitt-safety.com*	Tel: 905-829-3299 Toll-free: 1-888-453-8488 Fax: 905-829-2919
MGS Horticultural Inc.	50 Hazelton Street Leamington, ON N8H 1B8 *www.mgshort.com*	Tel: 519-326-9037 Fax: 519-326-5861 Email: *info@mgshort.com*
Mitt & Robe Co.	751 Norfolk Street North Simcoe, ON N3Y 3R6 *www.mittrobe.ca*	Tel: 519-428-4050 Toll-free: 1-877-893-6565 Fax: 519-428-5142
MSA Canada Inc.	5535 Eglinton Avenue West Unit 222 Toronto, ON M9C 5K5 *www.msasafety.com*	Tel: 416-620-4225 Toll-free: 1-800-267-0672 Fax: 416-620-9697
Plant Products Co. Ltd.	314 Orenda Road East Brampton, ON L6T 1G1 *www.plantprod.com*	Tel: 905-793-7000 Toll-free: 1-800-387-2449 Fax: 905-793-9157
Safety Express	4190 Sladeview Crescent Units 1 and 2 Mississauga, ON L5L 0A1 *www.safetyexpress.com*	Tel: 905-608-0111 Toll-free: 1-800-465-3898 Fax: 905-608-0091 Email: *info@safetyexpress.com*
The St. George Company (Suppliers of Kasco Helmets)	P.O. Box 430 20 Consolidated Drive Paris, ON N3L 3T5 *www.thestgeorgeco.com*	Tel: 519-442-2046 Toll-free: 1-800-461-4299 Fax: 519-442-7191 Email: *sales@thestgeorgeco.com*

Care of Protective Clothing and Equipment

After completing the spray operation, clean all protective clothing and equipment.

Never let children, pets or livestock come in contact with contaminated clothing or equipment. Also ensure that they cannot come into contact with the puddles of water created when cleaning equipment.

Wash gloves with soap and water and keep them on while removing other protective clothing and equipment and washing equipment.

Always remove protective clothing and equipment outdoors. If a granular pesticide was used, shake the clothing outdoors in a safe place. Be sure to empty pockets and cuffs.

Dispose of clothing that has been contaminated by spills of highly toxic or concentrated pesticide. Place contaminated clothing in a plastic bag and take it to a landfill site.

Continue to wear gloves while washing protective equipment. It is best to wash equipment outdoors. If the work area does not have a cleanup area outside, designate specific buckets just for equipment cleanup. Mark them and keep them in a designated place. Wash the inside and outside of goggles, hats, boots and any water-repellent clothing in warm soapy water, then rinse them well and let them air-dry.

Respirators

Record the date the cartridge is first used.

Remove the cartridges and prefilters from the respirator.

After each use, remove cartridges and filter pads from the face piece and store them in clean, sealed plastic bags.

Wash the face piece in warm soapy water, rinse it thoroughly and dry it in a well-ventilated area. Air-drying prevents damage to the inlet and outlet valves.

Never use alcohol or other solvents for cleaning because they will damage the rubber and plastic.

Discard cartridges, canisters and filter pads at the interval set by the manufacturer. Discard them earlier if breathing becomes difficult or a pesticide taste or odour is noticed.

Rubber, Vinyl or Plastic Boots and Gloves

To avoid contact with pesticides, wash the outside of boots and gloves with detergent and water before taking them off.

After removing boots and gloves, wash them inside and out with detergent and water, rinse them thoroughly and dry them in a well-ventilated area.

How to Wash Clothes Used for Spraying

Never mix spray clothing with household laundry. All clothing used for spraying must be stored and washed separately from other clothing. Wash spray clothing after each use. Remember to use chemical-resistant gloves to handle pesticide-contaminated clothing.

Presoak clothing before washing. Use one of the following methods:

- hose off garments outdoors
- soak in separate tub or pail
- use the prewash cycle in an automatic washer

Use hot water, a heavy-duty detergent and the highest water level and the longest cycle the washing machine offers. Follow the instructions that came with the machine for washing heavily soiled clothing.

Wash clothing twice.

After washing it, hang it outside (preferably in bright sunlight) until it is completely dry. Do not use a clothes dryer.

Clean the washing machine. Run the washing machine through one complete cycle using only detergent and hot water (no clothing).

When spray clothing is dry, place it in a plastic bag and keep it separate from other clothing.

Personal Hygiene

Always wash hands before eating, drinking or smoking.

When finished for the day, take a bath or shower as soon as possible. The longer a pesticide remains on the skin, the greater the risk that it will be absorbed into the body.

Wash hair and scrub under fingernails. Shower with a lot of soap and water.

Always change into clean clothes.

Wear clean work clothes every day. A small spill on the previous day's clothes may not seem important, but wearing the same clothing again without washing it prolongs exposure and increases risk.

Pesticide Application Procedures

Sprayers

Sprayers that can deliver sufficient volume for adequate coverage are satisfactory for applying emulsion-type insecticides.

If using 2,4-D or related herbicides, clean the sprayers thoroughly with detergent containing ammonia to prevent plant damage, or use a separate sprayer.

Adequate agitation is essential when applying wettable powder formulations.

Pumps should be capable of delivering the flow and pressure required and be compatible with materials sprayed.

Keep in mind that the higher the pressure, the greater the danger of drift.

Calibrate your sprayer at least twice during the season with each set of nozzles used. The wear on nozzles and other parts will alter the amount of spray delivered.

Check all nozzles for flow rate at least once a year. Replace nozzles when their output is 10% greater than rated output.

Sprayer Calibration

Sprayer calibration is an important part of integrated pest management. Sprayer calibration:

- ensures that the proper amount of pesticide is applied
- ensures uniform pesticide application and coverage
- minimizes leftover tank mixtures, which can be difficult to dispose of

Field boom-type sprayer calibration (Determining application rates in L/ha)

This is one way to determine the number of litres of spray material being applied to 1 ha of land.

Step 1. Measure the time.

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

Step 2. Measure the average nozzle output.

- Park the sprayer with the power take off (PTO) engaged and the throttle adjusted to reach the PTO speed set in the test run.
- Adjust the pressure regulator to the desired working pressure with full flow to the boom.
- Collect the output from each nozzle for the average length of time needed to travel the 50 m in the test run.
- Enter the nozzle outputs into the equation below.
- If any nozzle is more than 5% above or below the average output, clean or replace it.

Step 3. Measure the nozzle spacing in metres.

Step 4. Use this formula to determine the sprayer output:

$$\text{sprayer output (L/ha)} = \frac{\text{average nozzle output (mL)}}{\text{nozzle spacing (m)}} \times 0.2$$

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

Use the following conversion guide to measure in litres/acre or gallons/acre.

litres/ha × 0.4 = L/acre
litres/ha × 0.09 = Imp. gal/acre
litres/ha × 0.11 = U.S. gal/acre

Sample calculation

Average time to travel 50 m	= 24.5 sec
Average amount of liquid collected per nozzle for 24.5 sec	= 525 mL
Nozzle spacing on the boom	= 0.5 m
Application rate = 525 mL × 0.2 ÷ 0.5 m	= 210 L/ha
210 L/ha × 0.4	= 84 L/ac
210 L/ha × 0.09	= 18.9 Imp. gal/ac
210 L/ha × 0.11	= 23 U.S. gal/ac

Sprayer-calibration bottles or kits are available from a number of suppliers. For more information on calibration, see OMAF Publication 75, *Guide to Weed Control*. There is also a calibration calculator on the

OMAF website at *www.ontario.ca/crops* or contact the manufacturers of sprayers, sprayer parts or pesticides.

Handheld or backpack sprayer calibration

Many people use small, handheld spray guns or backpack sprayers for treating problem areas or spraying areas that were missed. Calibrating these sprayers is as important as calibrating your field sprayer.

Method 1

- Measure an area that is 100 m², e.g., 10 m × 10 m, or 25 m × 4 m.
- Fill the spray tank with water. Mark the level on a measuring stick. Pump to the pressure you will use during the pesticide application.
- Spray the water over the 100 m² area. Walk at a steady pace, taking care to apply it as evenly as possible, just as you would when applying pesticide.
- Measure the amount of water needed to refill the spray tank to the mark on the measuring stick. This amount will be the sprayer output per 100 m².

Method 2

- Set two stakes 50 m apart in the field.
- Half-fill the sprayer with water.
- Walk the 50 m three times at a steady pace. Calculate your average time.
- Measure the width of the band sprayed by the nozzle (in metres) at your walking pace.
- Pump the sprayer for the average time as calculated, collecting the liquid from the nozzle in a measuring device.

$$\text{application rate (L/ha)} = \frac{\text{mL liquid/nozzle}}{\text{band width (m)}} \times 0.2$$

Method 3

- Partially fill sprayer. Pump to the pressure you will use during the pesticide application.
- Spray to determine width of swath (in metres).
- Walk at a steady pace for 15 sec. Measure the distance (in metres).
- Multiply spray width times distance travelled to provide the area (in square metres) sprayed in 15 sec.
- Spray into a measuring device for 15 sec to determine the amount of solution.

$$\text{application rate (L/ha)} = \frac{\text{amount sprayed}}{\text{area (length} \times \text{width)}} = \frac{\text{L} \times 10{,}000}{\text{square metres}}$$

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

dry measure:	1 kg/ha	=	10 gm/100 m²
liquid measure:	100 L/ha	=	1 L/100 m²

For more information on calibration, see OMAF Publication 75, *Guide to Weed Control.* There is also a calibration calculator on the OMAF website at *www.ontario.ca/crops*.

Drop spreader

Method 1: Weigh before and weigh after

- Set the gate opening on the drop spreader using the product label directions or set it slightly larger than the granule size and record the gate opening setting.
- Measure the width of the bottom of the hopper between the wheels and record the swath width in metres.
- Measure a test area that is 100 m² (hopper width × distance travelled = 100 m²) (i.e. 1 m × 100 m = 100 m² or 2 m × 50 m = 100 m²)
- Weigh out more than enough product to cover the 100 m² area and record the weight in kg.
- Run the spreader over the 100m² area.
- Weigh the product remaining in the spreader and record the weight.

$$\frac{\text{application rate}}{100\ \text{m}^2} = \text{weight of product put in spreader} - \text{weight of product remaining}$$

Sample calculation

Weight of product in spreader = 2.0 kg
Weight of product in spreader after test run = 1.5 kg
Application rate/100 m² is 2.0 kg – 1.5 kg = 0.5 kg/100 m²

Method 2: Catch can

- Apply a catch can or a small section of gutter with end caps under the spreader opening to capture all granules.
- Repeat the first three steps for the weigh before and weigh after method.
- Fill the hopper half full with product
- Run the spreader over the 100 m² test area collecting the product in the catch can.
- Weigh the amount of product in the catch can.

$$\frac{\text{application rate}}{100\ \text{m}^2} = \text{weight of product collected in the catch can}$$

Rotary spreader

Calibration of a rotary spreader is a two part process:

1. Measurement of swath width.

2. Determination of the application rate

Measurement of swath width

- Place shallow cake pans or boxes (at least 2.5–5 cm high) in the centre of a test area and space the remaining boxes on 50 cm centres to either side of the centre box (7–9 boxes will work well). Mark the boxes or pans with numbers from 1–7 or 1–9.

- Fill the spreader about one-half full with the product and use the recommended spreader setting on the product label for the desired application rate. Make 3 passes over the boxes or pans always in the same direction.

- Record the weight of the granules collected from each box or pan or pour granules into clear jars marked with the box number. Line up the jars in the same order as the collection boxes to see the distribution pattern. The centre jar should have the most product and it should taper off evenly on each side.

- Find the jars to each side of centre that have half the amount of product as the centre jar. The distances between these boxes or pans is the effective swath width. If the two outermost jars have more than half of the amount of product contained in the centre jar, the above procedure will have to be repeated using a larger number of boxes or pans.

Example

Depth of granules in the centre jar = 5 cm
Depth of granules in the 1st and 9th jar = 2.5 cm
Distance between the centre of each pan is 0.5 m × 8 pans = 4 m effective swath width

Table 2–3. Distance and effective swath width for rotary spreader to equal 100 m²

Effective swath width (m)	Distance (m)
2	50
4	25
6	16.66
8	12.5
10	10

Determination of application rate

Because the distribution pattern of a rotary spreader is rarely uniform, it is best to make two passes to apply a pesticide product. The calibration should be based on applying half the label rate and making two passes perpendicular to one another. Select a test setting to deliver one-half the label rate. This may take some experimenting with the spreader.

- Weigh out more than enough product to load the spreader for an area of 100 m² (see Table above for example distances). Record the weight of product.

- Select a test setting to deliver **one-half** the label rate. Record the spreader setting.

- Apply the material over the measured distance and weight the amount left in the spreader and record.

- The weight of product put in the spreader minus the weight of product left in the spreader (the difference in kg should be within 10% of half the pesticide label rate) is the application rate of product per 100 m².

$$\frac{\text{application rate}}{100\ \text{m}^2} = \text{weight of product in spreader before} - \text{weight of product in spreader after}$$

Table 2–4. Determination of application rate example

Pass #	Half Label rate	Swath width	Distance	Spreader setting	Weight of product before	Weight of product after	Difference	10% of half label rate range
1	280 g/100 m²	4 m	25 m	M	1000 g	600 g	400 g	252–308 g
2	280 g/100 m²	4 m	25 m	N	600 g	300 g	300 g	252–308 g
3	280 g/100 m²	4 m	25 m	O	300 g	100 g	200 g	252–308 g

Pass 2, with the spreader wet at "N" delivered a rate of 300 g of product per 100 m² which is within 10% of half of the label rate (252–308 g).

Pesticide Resistance

Many of the recommended pesticides have specific mechanisms of action. They act on a single system or site in the organism. Do not use materials with the same mechanism of action repeatedly in a season. This increases the chances of pest resistance developing.

Pests are resistant when they are able to survive exposure to rates of pesticides that previously controlled them. Generally, resistance to a pesticide develops after repeated exposure to a specific chemical. Resistance occurs because a few naturally occurring resistant individual pests survive after each spray, while the susceptible portion of the population is killed. These resistant survivors multiply and gradually replace the susceptible ones. Eventually only a resistant population remains.

The development of resistance to pesticides can occur very quickly. Do not use the same chemical or chemicals from the same family repeatedly. Alternate chemical families or use them in combination with others that have a different mode of action. This practice reduces the likelihood of resistance developing.

Several pesticides may act similarly because they come from the same chemical family (such as myclobutanil and propiconazole, or trifloxystrobin and azoxystrobin). Thus, alternating chemicals within a family does not work. Use pesticides with different modes of actions. For example, alternate thiophanate-methyl, iprodione and propiconazole. See Table 3-1 on page 27 for the chemical families.

Pesticide Injury to Crops

Although insecticides and fungicides are selected and formulated to avoid plant injury, damage can still occur under some conditions. In addition to the precautions mentioned in this publication, you should also:

- Apply sprays when the drying condition is fast (i.e., low relative humidity). Some chemicals break down to components that injure plant tissues if they stay wet.
- Apply sprays when the temperature is below 27°C.
- Be particularly careful when plants have been under growth stress, such as prolonged periods of drought, excessive cloud cover, or extremely low or high temperatures.
- Apply sprays soon after mixing. Some pesticides may undergo a chemical change if the sprays remain in the tank for a long time, like overnight. In other cases, the pesticide may settle out and clog the lines.

3. Crop Protection: Diseases, Insects and Other Pests

Fungicides and insecticides are only two of the many tools that can be used to control diseases and insects in turf. These products should be used as part of an integrated pest management (IPM) program. For more information on IPM refer to OMAF Publication 816, *Turf IPM Manual*.

Diseases

Fungicides registered for use on sod farms, golf courses and other excepted used are listed in Table 3-1.

Table 3-1. Fungicides registered for use on sod farms, golf courses and other excepted uses

Trade name (alphabetically in each group)	Classification	Common name	LD_{50} (mg ai/kg)[1]	Chemical family*
Banner MAXX	3	propiconazole	1,310	sterol inhibitor
Banol	4	propamocarb hydrochloride	2,000–2,900	N/A
Cadence 70 WDG	2	boscolid	5,000	anilid
Chipco Aliette Signature	3	fosetyl-al	2,860	aluminum salt
Chipco Triton	3	triticonazole	>2,000	sterol inhibitor
Civitas	4	mineral oil	>5,000	unique
Compass 50WG	3	trifloxystrobin	5,000	strobilurin
Daconil Ultrex	4	chlorothalonil	5,000	aromatic hydrocarbon
Eagle WSP	4	myclobutanil	2,090	sterol inhibitor
Heritage MAXX	3	azoxystrobin	>5,000	strobilurin
Insignia EG	3	pyraclostrobin	>2,000	strobilurin
Instrata	3	chlorothalonil/ propiconazole/ fludioxonil	>1,750 and <5,000	aromatic hydrocarbon/sterol inhibitor/phenylpyrrole
Phostrol	4	mono- and dibasic sodium, potassium, and ammonium phosphites	>5,000	phosphite
Premis 200F	3	triticonazole	>2,000	sterol inhibitor
ProTurf DSB Turf Fertilizer Plus Fungicide	4	thiophanate-methyl	>7,000	benzimidazole
ProTurf Granular Systemic Fungicide	4	thiophanate-methyl	>7,000	benzimidazole
ProTurf Granular Fungicide X	4	iprodione	3,500	dicarboximide
Quali-Propiconazole 14.3	3	propiconazole	1,310	sterol inhibitor
Quali-Pro Iprodione 240 SE	4	iprodione	>5,000	dicarboximide
Rhapsody ASO	4	Bacillus subtilis strain QST 713	>5,000	bacterium
Rovral Green GT	4	iprodione	3,500	dicarboximide
Senator 70WP WSB	4	thiophanate-methyl	>7,000	benzimidazole
Subdue MAXX	3	metalaxyl	3,436	phenylamide
Supra Captan	3	captan	9,000	phthalimide
Tourney™ Fungicide	3	metconazole	1,750	sterol inhibitor
Trilogy	3	iprodione/ triticonazole/ trifloxystrobin	5,000	dicarboximide/ sterol inhibitor/ strobilurin
Velista	4	penthiopyrad	>5,000	pyrazole carboxamide

[1.] ai = active ingredient. The relative toxicity may be referred to as its LD_{50}. The higher the LD_{50} figure, the less toxic the product is to humans. Products with low LD_{50} ratings are highly toxic. No products registered for turf have a high acute toxicity.

* Alternate or tank-mix with another product with different fungicide classification to minimize risk of fungicide resistance developing.

Class 11 pesticides are ingredients in products for cosmetic uses under the ban (*Pesticide Act* and Regulation 63/09). See Table 3-2 *Class 11 biopesticide or lower risk pesticide active ingredients allowed for cosmetic uses on turfgrass (fungicides, insecticides and goose repellent)* for a list of biopesticides or lower risk pesticides allowed for cosmetic uses on turfgrass. Licensed exterminators and those who perform land exterminations in non-residential areas that use Class 11 pesticides must post a green sign to notify the public of the use of these pesticides.

Check MOE website at *www.ontario.ca/pesticideban* for the list of pesticides for cosmetic uses.

Table 3-2. Class 11 biopesticide or lower risk pesticide active ingredients allowed for cosmetic uses on turfgrass (fungicides, insecticides and goose repellent)

Active Ingredient	Classification	Uses
Bacillus subtilis strain QST 713	4	Check label for specific uses and follow the label directions
ferric phosphate	4	
Metarhizium anisopliae strain F52	3	
methyl-anthranilate	4	
mineral oil	4	
phosphite	4	

Disease control products registered for use on sold farms, golf courses and other excepted uses are listed in Table 3-3.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m^2	Interval (days)	Comments from the product label See label for complete information.
algae Improve fertility and drainage. Alleviate compaction.	no chemical control available			
anthracnose *(Colletotrichum graminicola)* Occurs June to September under humid and warm conditions. Avoid nitrogen deficiency, drought stress, soil compaction, poor drainage and excessive thatch, especially on annual bluegrass.	Rhapsody ASO*	125 –250 mL	7–10	Begin when conditions favour disease development. Continue applications as needed on 7–10 day intervals. Apply in enough water to provide thorough coverage. Under moderate-to-severe disease pressure, use higher rates and minimum spray intervals, and use in a program with other registered fungicides.
	Heritage MAXX	32–63 mL	14–28	Begin when conditions favour infection, before symptoms develop.
	Daconil Ultrex	103–115 mL	7–10	Apply when conditions favour disease development but before symptoms develop and repeat applications as long as conditions persist.
	Velista	9–15 g	14	Begin application at the early stage of disease development. Use high rates for high disease pressure. May be applied as a tank mix with other fungicides registered for the same disease such as Daconil Ultrex and Heritage fungicide.
	Premis 200 F*	16–32 mL	14–21	Apply at the first signs or when environmental conditions (cool and wet conditions or hot and humid conditions) favour disease development. Use the higher rate and shorter interval when pressure is high. Under low disease conditions, the spray interval may be increased up to 21 days. Do not apply more than 3 times a season.

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m^2	Interval (days)	Comments from the product label See label for complete information.
anthracnose *(Colletotrichum graminicola)* (cont'd)	Chipco Triton	16–32 mL	14–21	Apply at the first signs or when conditions favour disease development. Use the higher rate when disease pressure is high. Under low disease conditions, the spray interval may be increased up to 21 days. Do not apply more than 3 times a season.
	Tourney™ Fungicide	8.4 g	Once	Use preventatively when conditions favour disease development. Apply in 8 L of water per 100 m^2 for foliar blight.
	Banner MAXX	26–51 mL	21	Apply when warm, humid weather conditions occur. Do not apply more than 3 times a season.
	Qualipro Propiconazole 14.3 ME*	26–51 mL	21	Apply when conditions favour disease development. Do not apply more than 3 times a season.
anthracnose foliar blight *(Colletotrichum graminicola)*	Chipco Aliette® Signature	120 g	14	Apply 2–4 applications 14 days apart as a preventive treatment in spring or summer to areas with a history. Begin when conditions favour disease development. Should be used with a fertility program that avoids excess yet provides adequate nitrogen through light, more frequent applications over the entire growing season. Under extreme prolonged infection pressure, should be used as a part of a season-long spray program with other fungicides.
	Compass 50WG*	3.8 g	14	Apply when conditions are favourable for disease development. Rotate with different mode-of-action fungicides. Do not use more than 2 sequential applications. Do not apply more than 2.4 kg/ha a year.
anthracnose basal rot *(Colletotrichum graminicola)*	Chipco Aliette® Signature	120 g	14	Apply 2–4 applications 14 days apart as a preventive treatment in spring or summer to areas with a history. Begin when conditions favour disease development. Should be used with a fertility program that avoids excess yet provides adequate nitrogen through light, more frequent applications over the entire growing season. Under extreme prolonged infection pressure, should be used as a part of a season-long spray program with other fungicides.
	Trilogy SC*	65 mL	14	Apply at the first sign of anthracnose disease break out or apply preventatively when stressful environmental conditions (cool and wet conditions or hot and humid conditions) favour anthracnose development. Maximum of 2 applications during basal rot anthracnose infection period. Every application must be alternated with at least one application of a non-strobilurin fungicide.
	Insignia	15.4–28 g	14–28	Apply when conditions are favourable for disease development.
	Tourney™ Fungicide	8.4	Once	Use preventatively when conditions favour disease development. Apply 8–16 L of water per 100 m^2 for basal rot.
bentgrass dead spot *(Ophiosphaerella agrostis)* Occurs on newly seeded greens and tees in summer.	Chipco Aliette® Signature	120 g	14	Apply 2–4 times 14 days apart as a preventive in spring or summer to areas with a history of the disease. Begin when conditions favour disease development. Under extreme prolonged infection pressure should be used as part of a season-long program with other fungicides.

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m^2	Interval (days)	Comments from the product label See label for complete information.
brown patch, Rhizoctonia blight *(Rhizoctonia solani)* Occurs under humid, warm conditions and extended periods of leaf wetness in June to September. Avoid excess nitrogen and night watering.	Quali-Pro Iprodione	125–250 mL	14–21	Under severe disease pressure, use the higher rate and the shorter interval. To assist in disease management, alternate this product with other fungicides with different modes of action to reduce the possible development of disease resistance.
	Rhapsody ASO*	125–250 mL	7–10	Begin when conditions favour disease development. Continue as needed on 7–10 day intervals. Apply in enough water to provide thorough coverage. Under moderate-to-severe disease pressure, use high rates and minimum spray intervals and use in a program with other registered fungicides.
	Velista	9–15 g	14	Begin application at the early stage of disease development. Use the high rate for moderate to high disease pressure and/or for curative situations.
	ProTurf DSB with thiophanate-methyl	0.86 kg	14–21	Apply to moist or dry foliage.
	Senator 70 WP WSB*	30–60 g	5–7	Apply after mowing or avoid mowing for 12 hours after application. Begin ground applications when diseases first appear. When disease pressure is severe, apply at the higher rate.
	ProTurf Granular Systemic Fungicide	0.66–1.32 kg	14–21	For prevention apply to moist or dry foliage at normal rate when disease activity is noted or suspected. May require more frequent treatments under conditions that favour the disease. To arrest the disease, apply at higher rate.
	Heritage MAXX	32 mL	14–28	Begin before disease is present (usually late May to June) when conditions favour disease development. During prolonged periods of favourable conditions, apply on the shorter interval.
	Compass 50 WG*	4.6–6.1 g	14–21	Apply when conditions favour disease development. Apply 4.6 g/100 m^2 at 21-day intervals under low disease pressure and 6.1 g/100 m^2 at a 14-day interval under high disease pressure. Do not use more than 2 sequential applications. Do not apply more than 2.4 kg/ha a year.
	Daconil Ultrex	58–115 g (preventive)	7–14	Apply when conditions favour disease development and repeat as long as conditions persist.
		115–212 g (curative)	7–14	Under severe disease conditions, use the curative rates and apply on a 7-day schedule.
	Insignia EG*	14–25 g	14–21	Apply when conditions favour disease development.
	ProTurf Granular Fungicide X	2.34–3.52 kg	14	To prevent disease, apply at the normal-to-heavy rate to moist or dry turf when disease activity is anticipated and repeat at 2-week intervals. If disease pressures are heavy, apply at the heavy rate to moist or dry foliage. To control disease, apply to moist or dry foliage at the heavy rate as soon as disease activity is noticed. Repeat bi-weekly until disease is under control, then revert to the normal or heavy rate applications bi-weekly.
	Rovral Green GT	125–250 mL	14–21	Apply at the first signs of disease. Repeat applications may be used at a 14–21 day interval throughout the season, or as needed. Rotate with other fungicides.
	Eagle WSP*	18 g	14	Apply a maximum of 4 times a year.

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m^2	Interval (days)	Comments from the product label See label for complete information.
brown patch, Rhizoctonia blight *(Rhizoctonia solani)* (cont'd)	Premis 200 F*	32 mL	14–21	Apply at the first sign of disease or when conditions favour disease development. Repeat every 14 days when conditions exist. Do not apply more than 3 times a season.
	Chipco Triton	32 mL	14–21	Apply at the first sign of disease or when conditions favour disease development. Shorten spray interval when disease pressure is high. Under low disease conditions, the spray interval may be increased up to 21 days. Do not apply more than 3 times a season.
	Tourney™ Fungicide	8.4–11.2 g	once	Apply in 8 L of water per 100 m^2. Use preventatively when conditions favour disease development.
	Banner MAXX	51–103 mL	14	Apply when conditions favour disease development. Use the higher rate under severe disease pressure. Do not apply if disease symptoms are present. Do not apply more than 6 times a season.
	Qualipro Propiconazole 14.3 ME*	51–103 mL	14	Apply when conditions favour disease development. Use the higher rate under severe disease pressure. Do not apply if disease symptoms are present. Do not apply more than 6 times a season.
cool season brown patch, yellow patch *(Rhizoctonia cerealis)* Occurs April to May and September to November during cool, wet weather.	Banner MAXX	77–103 mL	once	Apply once in late fall before snow cover. Do not apply on top of snow. Do not apply more than once a season.
	Qualipro Propiconazole 14.3 ME*	77–103 mL	once	Apply once in late fall before snow cover. Do not apply on top of snow. Do not apply more than once a season.
dollar spot *(Sclerotinia homoeocarpa)* Occurs June to September under humid and warm conditions. Begins when iris and peony are in full bloom. Avoid nitrogen deficiency, drought stress, soil compaction and excessive thatch, especially on annual bluegrass. Light frequent application of foliar-applied nitrogen will decrease the severity.	ProTurf Granular Systemic Fungicide	0.66–1.32 kg	14–21	For prevention, apply to moist or dry foliage at normal rate when disease activity is noted or suspected.
	Senator 70 WP WSB*	25–30 g	10–14	Apply after mowing or avoid mowing for 12 hours after application. Begin when disease first appears. When pressure is severe, apply at higher rates.
	Civitas	250–500 mL	14	Apply as a preventive treatment or when conditions are favourable for disease development. The addition of a compatible spray indicator, such as a dye, is suggested. Test this product on a small area of fairways, greens, roughs and tees prior to broad application, as short-cut turf may be more susceptible to disease and phytotoxicty.
	Velista	9–15 g	14–21	Begin application at the early stage of disease development. Use the high rate for moderate to high disease pressure and/or for curative situations. The interval for golf greens and tees is 14 days. The interval for golf fairways and other turf is 14–21 days.
	Quali-Pro Iprodione	62 mL	Repeat applications as required	The minimum control period is 21 days. Alternate with other fungicides with different modes of action in a dollar spot control program to reduce the possible development of disease resistance.
	Rhapsody ASO*	125–250 mL	7–10	Begin when conditions favour disease development. Continue as necessary on a 7–10 day Intervals. Apply in enough water to provide thorough coverage. Under moderate-to-severe disease pressure, use higher rates and minimum spray intervals and use in a program with other registered fungicides.

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m²	Interval (days)	Comments from the product label See label for complete information.
dollar spot *(Sclerotinia homoeocarpa)* (cont'd)	Cadence 70 WDG*	3.2–4.0 g	14	Should be applied prior to or in the early stages of disease development. Apply in 5–15 L of water/100 m². Do not exceed 2 consecutive applications before using another mode of action for at least one application. Do not apply more than 6 times a season. Do not apply more than 24 g/100 m² a year.
	Daconil Ultrex	29–58 g (fairways preventive)	7–14	Apply preventive rates when conditions favour disease development and repeat as long as conditions persist. Under severe conditions, use the curative rates and spray on a 7-day schedule. Daconil Ultrex can be tank-mixed at 115 g/100 m² with Banner MAXX at a rate of 300 mL/100 m².
		58–115 g (greens, tees, ornamental preventive)	7–14	
		115–212 g (greens, tees, ornamental curative)	7–14	
	ProTurf Granular Fungicide X	2.34–3.52 kg	14	To prevent disease, apply at the normal-to-heavy rate to moist or dry turf when disease activity is anticipated and repeat at 2-week intervals. If disease pressure is heavy, apply at the heavy rate to moist or dry foliage. When disease is under control, revert to bi-weekly normal rate applications. To control disease, apply to moist or dry foliage at the heavy rate as soon as disease activity is noticed. Repeat bi-weekly until disease is under control, then revert to the normal or heavy-rate applications bi-weekly.
	Rovral Green GT	62 mL	21	Apply at the first signs. Repeat as required. Alternate with other fungicides.
	Eagle 40 WSP*	15–20 g	14–21	Start applications before or immediately after the first signs. Do not apply more than 4 times a year. Under conditions optimum for severe disease development, use the shortest interval and highest rate.
	Trilogy SC*	65 mL	21	Apply at the first sign of dollar spot or when environmental conditions favour dollar spot development. Maximum of 2 applications during dollar spot infection period. DO NOT apply more than 2 sequential applications of TRILOGY SC or other strobilurin (Group 11) fungicides before alternating to a non-strobilurin fungicide for at least 2 applications.
	Chipco Triton	16 mL	14–21	Apply at the first sign of disease or when conditions favour its development. Repeat every 14–21 days to maintain control. Do not apply more than 3 times season.
	Insignia EG* (suppression only)	15.4–28 g	14–28	Apply when conditions are favourable for the disease.
	Premis 200 F*	16 mL	14–21	Apply at the first sign of disease or when conditions favour its development. Repeat every 14–21 days to maintain control. Do not apply more than 3 times a season.

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m^2	Interval (days)	Comments from the product label See label for complete information.
dollar spot *(Sclerotinia homoeocarpa)* (cont'd)	Tourney™ Fungicide	8.4–11.2 g	once	Use higher rates when the turf is under high dollar spot pressure. Apply in 8 L of water per 100 m^2.
	Banner MAXX	26–51 mL	21–28	Apply when conditions favour disease development. Rotate with fungicides that have a different mode of action. Banner MAXX Fungicide can be tank-mixed with Daconil 2787 Flowable Fungicide or Heritage Fungicide. Do not apply more than 6 times a season.
	Qualipro propiconazole 14.3 ME*	26–51 mL	21–28	Apply when conditions favour disease development. Can be tank-mixed (see Daconil 2787 or Heritage Fungicide). Rotate with fungicides that have a different mode of action. Do not apply more than 6 times a season.
fairy ring	Heritage MAXX	63 mL	28	Apply as soon as symptoms develop. May take 2–3 weeks to disappear. Severely damaged turf may need reseeding.
fusarium patch *(Microdochium nivale)* Occurs in cool, wet conditions in spring, fall and early winter. Avoid excess nitrogen and remove dew.	Heritage MAXX	32–63 mL	14–28	Apply when conditions are favourable for disease development, i.e., extended period of cool (<15.5°C) and wet weather in spring and fall.
	Quali-Pro Iprodine	185 mL	21–28	Apply in the fall or spring on a preventive basis when cool and wet conditions are favourable for disease development.
	Compass 50 WG*	3.8 g	14	Apply when conditions favour disease development or when disease is present after snow melt. For curative applications apply on a 14-day interval, 2–3 times. Do not apply more than twice in a row. Do not apply more than 2.5 kg/ha a year.
	Rovral Green GT	185 mL	21–28	Apply in spring and fall for prevention when conditions favour disease development.
	Premis 200 F*	32 mL	21	Apply in fall or early winter for suppression. If disease persists, apply again. Mix Premis with 185 mL of Rovral Green GT. If high disease pressure is anticipated in the spring, apply fungicide twice before snow fall.
	Chipco Triton	32 mL	21	Apply in the fall or early winter when conditions favour disease development. Repeat when disease pressure persists. Can be tank-mixed with 185 mL of Rovral Green GT. Do not apply more than 3 times a season.
	Banner MAXX	51–103 mL	30	Apply in the fall or early spring during cool, wet weather. Use the high rate only under high disease pressure. Do not apply more than twice a season.
	Qualipro Propiconazole 14.3 ME*	51–103 mL	30	Apply in the fall or early spring during cool, wet weather. Use the high rate only under high disease pressure. Do not apply more than twice a season.

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m²	Interval (days)	Comments from the product label See label for complete information.
grey snow mould, Typhula blight (*Typhula* spp.) Avoid succulent turf growth in late fall. Keep turf mowed until leaf growth ceases. Use snow fencing or other methods to prevent excessive snow accumulation. Minimize thatch as this is a perfect environment for dormant sclerotia. Control with a single application late in fall before permanent snow cover, early to late November in southern Ontario, mid to late October in northern Ontario.	Instrata	300 mL	once	Make 1 application in the late fall before snow cover. Do not apply on top of snow or when the temperature is below 0°C. Do not apply more than 1 application per season.
	Civitas (may reduce symptoms of grey snow mould)	Single application rate: 600–930 mL	once	Make a single high rate or 2 or more applications at the low rate, spaced 14 days apart, in late fall before snow cover Test this product on a small area of fairways, greens, roughs and tees prior to broad application, because short-cut turf may be more susceptible to disease and phytotoxicity.
		Multiple application rate: 330–460 mL	14	
	Heritage MAXX (*Typhula incarnata* control only)	95–126 mL	once 14	Apply in late fall before snow cover. Do not apply on top of snow. Use the higher rate if there is a history of severe infection.
	Quali-Pro Iprodione	375 mL	once	Apply as a preventive in late fall or early winter just before the ground freezes or before first snowfall.
	Trilogy	100–177 mL	once	Apply in late fall before permanent snow cover. In regions with a history of heavy snow mould disease pressure, use the highest labelled rate. Do not apply on top of snow or when temperature is below 0°C.
	Compass 50 WG*	6.1 g tank-mixed with 271–345 mL of Rovral Green GT	once	Apply preventive tank-mix in a minimum of 500 L spray solution (610–700 L/ha recommended) before permanent snow cover or tarping. A lower rate of Rovral Green GT (minimum 271 mL/100 m²) mixed with 6.1 g/100 m² should be used in regions that do not experience high disease pressure and a higher rate of Rovral Green GT (maximum of 345 mL/100 m²) with 6.1 g/100 m² of Compass 50 WG Fungicide in regions that typically show high disease pressure . If area has a history of heavy pressure or a heavy or long snow cover, use a mid-to-later application of a DMI product or other fungicide as part of an overall strategy.
	Daconil Ultrex	145–303 g	once	Apply in late fall before snow cover.
	ProTurf Granular Fungicide X	1.17–2.34 kg; (prevention)	14–21	To prevent the disease apply the prevention rate to dry foliage when disease activity is anticipated. Repeat at 2–3 week intervals.
		2.34–3.52 kg (control)		To control the disease apply to dry foliage at the higher rate. Repeat In mid-winter when turf is free of snow and again immediately after the final snow melt in the spring.
	Rovral Green GT	375 g	once	Apply as a preventive just before ground freezes or before the first snow fall.
	Eagle WSP*	30 g	once	Apply in late fall before snow cover.
	Insignia EG*	17 g	once	Make single application of 17 g or two applications at 8.5 g in late fall just prior to snow cover.
		8.5 g	14–28	

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m²	Interval (days)	Comments from the product label See label for complete information.
grey snow mould, Typhula blight (*Typhula* spp.) (cont'd)	Premis 200 F*	32 mL	21	When conditions favour heavy disease pressure or if there is history of the disease, apply at 21-day intervals in late fall or early winter before snow fall. Do not apply more than 3 times a season. To increase control, mix with 375 mL/100 m² of Rovral Green for the last application.
	Chipco Triton	32 mL	21	When conditions favour heavy disease pressure or if there is history of the disease, apply at 21-day intervals in late fall or early winter before snow fall. Do not apply more than 3 times a season. To increase control, mix with 375 mL/100 m² of Rovral Green for the last application.
	Tourney™ Fungicide	11.2 g + 250 g a.i. of Daconil 2787 Flowable Fungicide or Daconil Ultrex Fungicide	once	Apply in late fall before snow cover. Make the application before the turfgrass enters dormancy (usually after the last mowing of the season) and before the first snow fall. Apply in 8 L of water per 100 m².
	Banner MAXX	206 mL	once	Apply before snow cover. Do not apply on top of snow or when the temperature is below 0˚C.
	Qualipro Propiconazole 14.3 ME*	206 mL	once	Apply before snow cover. Do not apply on top of snow or when the temperature is below 0˚C.
Helminthosporium Leaf spot Melting Out (*Drechslera* spp.) Occurs in spring under cold wet conditions. If leaf spot is severe, with warm weather infection spreads to the crown, causing the Melting Out phase. Avoid early spring applications of nitrogen. Raise mowing height.	Civitas (suppression only)	250–500 mL	14	Apply as preventive treatment or when conditions are favourable for disease development. The addition of a compatible spray indicator such as a dye is suggested. Test this product on a small area of fairways, greens, roughs, and tees prior to broad application, because short-cut turf may be more susceptible to disease and phytotoxicity.
	Heritage MAXX*	32–63 mL	14–28	Apply when conditions favour disease development. Apply lower rate at 14-day intervals or higher rates at 28-day intervals.
	Quali-Pro Iprodione	125 mL	14–21	Apply at the first sign of leaf spot, melting out. Repeat applications 2 or 3 times in the early spring at a 14–21 day spray interval or as needed. Under severe disease pressure use the shorter spray interval. To assist in disease management, it is recommended that this product be alternated with other fungicides with different modes of action in a leaf spot control program to reduce the possibility of the development of disease resistance.
	Compass 50 WG*	3.1 g	14–21	Apply when conditions favour disease development. Use short interval under high disease pressure. Do not apply more than twice in a row. Do not apply more than 2.5 kg/ha a year.
	Daconil Ultrex	58–115 g (preventive greens, tees)	7–14	Apply when conditions favour disease and repeat as long as the conditions persist.
		115–212 g (curative greens, tees)	7–14	Under severe disease conditions, use the curative rates and spray on a 7-day schedule.

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m²	Interval (days)	Comments from the product label See label for complete information.
Helminthosporium Leaf spot Melting Out (*Drechslera* spp.) (cont'd)	ProTurf Granular Fungicide X	1.17 kg 2.34–3.52 kg	14–28	Apply to moist or dry turf at the light rate to prevent disease. Repeat if needed. Apply to moist or dry foliage at the higher rate when disease activity is first noticed. Repeat as needed at intervals not closer than 2 weeks.
	Rovral Green GT	125 mL	14–21	Apply at the first sign of leaf spot. Repeat 2–3 times in early spring. Under severe disease pressure use the shorter spray interval. Alternate with other fungicides.
	Insignia EG*	15.4 g	14	Apply when conditions favour disease development.
	Banner MAXX	51–103 mL	14	Under light-to-moderate disease pressure, apply to reduce severity. Do not apply more than 3 times a season.
	Qualipro Propiconazole 14.3 ME*	51–103 mL	14	Under light-to-moderate disease pressure, apply to reduce severity. Do not apply more than 3 times a season.
pink snow mould *(Microdochium nivale)* Avoid succulent turf growth in late fall. Keep turf mowed until leaf growth ceases. Use snow fencing or other methods to prevent excessive snow accumulation. Minimize thatch.	ProTurf DSB with thiophanate-methyl	860 g	once	Apply in late fall after ground has frozen but before snowfall.
	Senator 70WP WSB*	125–175 g	once	Apply in late fall after ground has frozen but before snowfall.
	Civitas (may reduce symptoms of pink snow mould)	Single application rate: 660-930 mL	once	Make a single high rate or 2 or more applications at the low rate, spaced 14 days apart, in late fall before snow cover. Test this product on a small area of fairways, greens, roughs and tees prior to broad application, because short-cut turf may be more susceptible to disease and phytotoxicity.
		Multiple application rate: 330–460 mL	14	
	Heritage MAXX	95–126 mL	once	Apply in late fall before snow cover. Do not apply on top of snow. Use higher rate if there is a history of severe Infection.
	Quali-Pro Iprodione	250–375 mL	once	Use the higher rate where severe disease pressure is anticipated or if disease is present at the time of application.
	Trilogy	100–177 mL	once	Apply in late fall before permanent snow cover, in regions with a history of heavy snow or when the temperature is below 0°C. Do not apply more than 1 application per season.
	Compass 50 WG*	6.1 g tank-mixed with 271–354 mL of Rovral Green GT	once	Apply preventive tank-mix in a minimum of 500 L spray solution (610–700 L/ha recommended) in late fall before permanent snow cover or tarping. A lower rate of Rovral Green GT (minimum 271 mL/100 m²) mixed with 6.1 g/100 m² should be used in regions that do not have high disease pressure, and a higher rate of Rovral Green GT (maximum 354 mL/100 m²) with 6.1 g/100 m² in regions that typically show high disease pressure.
	Daconil Ultrex	145–303 g	once	Apply in late fall after ground has frozen but before snowfall.
	ProTurf Granular Fungicide X	1.17–2.34 kg (prevention)	14–21	To prevent disease apply prevention rate to dry foliage when disease activity is anticipated. Repeat at 2–3 week intervals.
		2.34–3.52 kg (control)		For control, apply to dry foliage at the higher rate. Repeat In mid-winter when turf is free or snow and immediately after the final snow melt.

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m²	Interval (days)	Comments from the product label See label for complete information.
pink snow mould *(Microdochium nivale)* (cont'd)	Rovral Green GT	250–375 mL	once	Apply as a preventive in late fall or early winter just before the ground freezes or before first snowfall. Use higher rates where severe disease pressure is anticipated of if disease is present at the time of application.
	Chipco Triton	32 mL	21	Apply in a tank-mix with Rovral Green GT at a rate of 250 mL and apply once in late fall or early winter before snowfall. If high disease pressure is anticipated in the spring, apply twice before snowfall at a 21-day interval. Do not apply more than 3 times a season.
	Insignia	300 mL	once	Apply in the late fall before snow cover. Do not apply on top of snow or when the temperature is below 0°C.
	Insignia EG*	25 g	once	Apply in the late fall just prior to snow cover.
	Premis 200 F*	32 mL	21	Mix with 250 mL/100 m² of Rovral Green. If high disease pressure is anticipated in the spring, apply fungicide twice before snow fall at 21-day intervals. Do not apply more than 3 times a season.
	Tourney™ Fungicide	11.2 g + 250 g a.i. of Daconil 2787 Flowable Fungicide or Daconil Ultrex Fungicide	once	Apply in late fall before snow cover. Make the application before the turfgrass enters dormancy (usually after the last mowing of the season) and before the first snow fall. Apply in 8 L of water per 100 m².
	Banner MAXX	206 mL	once	Apply once in late fall before snow cover. Do not apply on top of snow or when the temperature is below 0°C.
	Qualipro Propiconazole 14.3 ME*	206 mL	once	Apply once before snow cover. Do not apply on top of snow or when the temperature is below 0°C.
powdery mildew *(Erysiphe graminis)* Avoid excess nitrogen and shade. Increase air circulation.	Senator 70 WP WSB*	125–250 g	14–21	Apply in a minimum of 24 L and wash into root zone with 2.5 cm of water immediately. Apply after mowing or avoid mowing for 12 hours after application. Begin when diseases first appear. When disease pressure is severe, apply at the higher rate.
pythium blight, cottony blight, greasy spot *(Pythium aphanidermatum)* Avoid excess nitrogen and watering. Occurs when humidity is greater than 90% for at least 9 hours, maximum daily temperature is 27.7˚C and low temperature is 20˚C.	Heritage MAXX	63 mL	10–14	Begin before disease is present (usually late May or June) when conditions favour disease development.
	Phostrol (suppression only)	130–260 mL	14	For preventive suppression of pythium blight, begin foliar applications when conditions favouring disease development exist and continue on a 14-day interval, if needed. Use 4–20 L water/100 m². Do not mow or water the treated area until sprays have dried. Under moderate to heavy disease pressure, use the higher rate. Do not make more than 4 applications during the growing season.
	Subdue MAXX	16–32 mL	7–21	Apply as a preventative treatment at a rate of 16–32 mL in 10–20 L of water per 100 m². Re-treat at 10–21 day intervals if required. During periods of prolonged conditions favourable for disease development use 16–32 mL on a 7–14-day schedule.
	Chipco Aliette® Signature	200 g	once	Apply only once when symptoms appear. Use as part of a season-long spray program.

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m^2	Interval (days)	Comments from the product label See label for complete information.
pythium blight, cottony blight, greasy spot *(Pythium aphanidermatum)* (cont'd)	Banol (preventive)	64 mL	7–21	Apply as a preventive treatment to established turf during high temperature or humidity favourable to the development of the disease. Repeat if conditions remain favourable. Do not apply more than 2 applications before alternating with a fungicide of a different group with a different mode of action. Do not apply more than 3 applications per growing season.
	Banol (preventive on overseeded turf for the control of pythium damping-off)	64 mL	7–21	For overseeded areas, apply immediately after germination to control pythium damping-off. Repeat if conditions remain cool and wet.
	Banol (curative)	64 mL	7–21	For a curative treatment on established turf, apply immediately after pythium blight outbreak has occurred. Curative control will only be achieved if a preventive application has previously been made. Repeat if conditions remain favourable for disease. Do not apply more than 2 applications before alternating with a fungicide of a different group with a different mode of action. Do not apply more than 3 applications per growing season.
	Insignia EG*	22.5 g	14	Begin preventive application when conditions favour disease development.
pythium crown and root rot (many *Pythium* spp.) Wet soil favours the disease. Little is known about weather conditions that favour the disease.	Supra Captan WDG*	60 g		Use as a preventive. Do not apply more than 120 g/100 m^2 per year. Apply in enough water for thorough coverage.
	ProTurf Fungicide X	1.49 kg	7–10	Apply at first sign of disease. Apply to moist foliage of newly seeded grass and repeat if disease persists.
	Subdue MAXX	16–32 mL	once	Apply as a drench when disease symptoms first occur.
	Chipco Aliette ® Signature	200 g	once	Apply when symptoms appear. Use as part of season-long spray program with other registered pesticides.
	Truban	142 g	7–10	Apply when symptoms first appear. Do not apply more than 4.26 kg/ha a year. Do not apply more than 2 times a year
necrotic ring spot *(Leptosphaeria korrae)* "Frog-eye" symptoms all year. Reduce excess thatch. Attacks Kentucky bluegrass and fine fescues. Turf-type perennial ryegrasses and some Kentucky bluegrass varieties are resistant. Provide balanced fertility. Avoid drought stress.	no chemical control available			
red thread *(Laetisaria fuciformis)* Avoid nitrogen deficiency, especially on perennial ryegrass and fine fescues.	Banner MAXX	51 mL	14	Apply when cool, wet conditions occur. Prolonged periods of high humidity favour disease development. Do not apply more than 3 times a season.
	Qualipro Propiconazole 14.3 ME*	51 mL	14	

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Table 3-3. Disease control products registered for use on sod farms, golf courses and other excepted uses (cont'd)

Disease, conditions, cultural control	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100m²	Interval (days)	Comments from the product label See label for complete information.
rust *(Puccinia spp.)* Use resistant varieties of Kentucky bluegrass and perennial ryegrass. Provide adequate levels of fertility. Mow frequently.	Insignia EG*	12.5 g	14	Apply when conditions favour disease development, in mid-summer to fall when wet conditions are followed by a dry period.
slime moulds Remove spore masses by raking or hosing off the turf.	no chemical control available			
summer patch *(Magnaporthe poae)* Symptoms usually occur during July to August. Attacks annual bluegrass and Kentucky bluegrass. Avoid nitrogen deficiency. Apply light frequent watering during dry periods to reduce heat stress.	Heritage MAXX	32–63 mL	14–28	Apply when conditions favour disease development. Apply the lower rate at 14–day intervals or higher rate at 28-day intervals.
	Eagle WSP*	18 g	30	Will control only low-to-moderate disease severity.
	Tourney™ Fungicide	11.2 g	once	Use preventatively when conditions favour disease development in the spring and fall. Apply in 16 L of water per 100 m².
	Banner MAXX	103 mL	30	Apply as a preventive when soil temperature greater than 16°C at a 5 cm depth for 4 consecutive days, with a second application 30 days later. A third application may be required if hot, humid weather occurs. Apply with 13–21 L of water per 100 m². Do not apply more than 3 times a season.
	Qualipro Propiconazole 14.3 ME*	103 mL	30	
take-all patch *(Gaeummannomyces graminis)* Attacks bentgrasses. Use acidifying (ammonium) fertilizers to reduce thatch pH. Avoid drought stress.	Insignia (suppression only)	28 g	28	Apply when conditions are favourable for the disease. Make 1 application in the fall and 1 application in the spring.
	Banner MAXX	32–63 mL	14–28	Make 1–2 fall applications in September and October or when night temperatures drop to 13°C, and 1–2 spring applications in April and May. Apply preventively when conditions favour disease development (high surface moisture or humidity and warm night temperatures). DO NOT exceed more than 4 applications per year. DO NOT add surfactants or wetting agents as this may result in phytotoxicity.
waitea patch *(Waitea circinata* var. *circinata)*	Heritage MAXX	32–63 mL	14–28	Apply when conditions are favourable for disease development, i.e., warmer temperatures between 20°C and 30°C and during periods of high humidity and extended leaf wetness. During prolonged periods of favourable conditions, apply on the shorter application interval. DO NOT apply more than 2 sequential applications of Heritage MAXX before alternating with a fungicide of a different group with a different mode of action.
	Tourney™ Fungicide	11.2 g	once	Use preventatively when conditions favour disease development. Apply in 8 L of water per 100 m².

* Fungicide formulation abbreviations: ASO: aqueous suspension organic; EG: water dispersible granular; F: flowable; FF: flowable fungicide; ME: microemulsion; SP: soluble pack; W: wettable; WDG: water dispersible granule; WG: wettable granule; WP WSB: wettable powder water soluble bag; WSP: water soluble pouch.

Insects

Insecticides registered for use on sod farms, golf courses and other excepted uses are listed in Table 3-4.

Table 3-4. Insecticides registered for use on sod farms, golf courses and other excepted uses

Trade name (alphabetically in each group)	Classification	Common name	LD_{50} (mg ai/kg)[1]	Chemical family
Acelepryn Suspension	2	chlorantraniliprole	>5,000	anthranilic diamide
Arena	2	clothianidin	>5,000	neonicotinoids
Chipco Sevin T&O	3	carbaryl	400–850	carbamate
Deltagard SC	3	deltamethrin	700	synthetic pyrethroid
Dursban, Pyrate	3	chlorpyrifos	135	organophosphate
Merit 0.5G, Merit Solupak	4	imidacloprid	424–475	chloronicotinyl
MET52 EC BioInsecticide	3, 11	*Metarhizium anisopliae* Strain F52	>5,000	biological
Quali-Pro Imidacloprid 75 WSP, Quali-Pro Imidacloprid 0.5 Granular	4	imidacloprid	424–475	chloronicotinyl
Scimitar CS	3	lambda-cyhalothrin	632-696	synthetic pyrethroid
Success 480SC	4	spinosad	75,000	naturalyte

1. ai = active ingredient. The relative toxicity may be referred to as its LD_{50}. The higher the LD_{50} figure, the less toxic the product is to humans. Products with low LD_{50} ratings are highly toxic. No products registered for turf have a high acute toxicity.

Insect control products are listed in Table 3-5.

Table 3-5. Insect control products

Pest	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100 m^2	Comments from the product label See label for complete information.
annual bluegrass weevil, *(Listronotus maculicollis)* A problem on closely mowed turf composed mainly of annual bluegrass. Monitor for adults returning to turf when forsythia are in full bloom.	Acelepryn	8.8–11.25 mL	Apply when over-wintered adult annual bluegrass weevils are observed in late April or early May to prevent damage from larvae in late-May and June. Higher rate may be required for applications made after mid-May.
	Arena	5.5–7.0 g	Apply when populations reach damaging thresholds. For optimal control, target 2nd and 3rd instar larvae. Early-season to overwintered adults may provide suppression only. Do not make more than 1 application per season. Avoid mowing grass until after irrigation or rainfall has occurred.
	Dursban 2E* Dursban T* Pyrate 480 EC*	45 mL 22.5 mL 22.5 mL	Spray suspected problem areas in mid-April and again in mid-May.
ant *(Lasius neoniger)*	Chipco Sevin T&O*	210–290 mL	Mow turf and apply spray. Do not water for 2 days after treatment. Repeat in 2–3 weeks if needed.
	Deltagard SC*	12 mL	Apply when insects are present or signs of insect feeding are visible. A second application may be necessary in 2–3 weeks where heavy infestations occur. For dense turfgrass canopies or turf maintained under high mowing heights, minimum water volumes of 10 L per 100 m^2 are recommended. Delay irrigation or mowing for 24 hours after application. Do not apply more than 2 times a year.
	Scimitar CS*	3.7 mL	Apply in 8–10 L/100 m^2 of water in spring and late summer. Re-apply after a minimum of 7 days if needed. Do not apply more than 4 times a year

* Insecticide formulation abbreviations: CS: capsule suspension; E: emulsion; EC: emulsifiable concentrate; F: flowable; G: granules; T: turf; SC: suspension concentrate; T&O: turf and ornamental; WG or WDG: water dispersible granule; WP WSB: wettable powder water soluble bag.

Table 3-5. Insect control products (cont'd)

Pest	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100 m^2	Comments from the product label See label for complete information.
ant *(Lasius neoniger)* (cont'd)	Dursban 2E* Dursban T*	45 mL 22.5 mL	Spray when pests first appear; repeat as needed.
	Pyrate 480 EC*	22.5 mL	Spray when pests first appear; repeat as needed. Maximum applications are 2 per season.
black turfgrass ataenius *(Ataenius spretulus)* Monitor for adults in clipping baskets or with a soap flush when Van Houtte spirea and horse chestnut are in bloom.	Merit Solupak Merit 0.5 G*	1 packet/1,200 m^2 560 g	Apply prior to egg hatch. Irrigation or rainfall should occur within 24 hours to move the active ingredient through the thatch. On golf courses, irrigate treated areas following application. Avoid mowing until after irrigation or rainfall. Apply only once a year.
	Quali-Pro Imidacloprid 75 WSP* Quali-Pro Imidacloprid 0.5 G*	1 packet/1,200 m^2 560 g	Apply prior to egg hatch. Irrigation or rainfall should occur within 24 hours. On golf courses, irrigate treated areas following application. Avoid mowing until after irrigation or rainfall has occurred. Apply only once a year.
bluegrass billbug *(Sphenophorus parvulus)*	Arena	4.5 g	When adults are first identified in the spring. Do not make more than 1 application per season. Avoid mowing grass until after irrigation or rainfall has occurred.
cutworm (various species) Monitor using a soap flush.	Acelepryn	1.45–2.9 mL	Delay watering or mowing for 24 hours after application. If the area being treated is maintained at a mowing height of greater than 2.5 cm, then the higher rate may be required during periods of high pest pressure.
	Deltagard SC*	12 mL	Apply when insects are present or signs of insect feeding are visible. A second application may be necessary in 2–3 weeks where heavy infestations occur. For dense turfgrass canopies or turf maintained under high mowing heights, minimum water volumes of 10 L per 100 m^2 are recommended. Delay irrigation or mowing for 24 hours following application. Do not apply more than 2 times a year.
	Chipco Sevin T&O*	210–290 mL	Mow and apply spray. Do not water for 2 days after treatment. Repeat in 2–3 weeks if needed.
	Dursban 2E* Dursban T*	45 mL 22.5 mL	Spray when pests first appear. Repeat as needed.
	Pyrate 480 EC*	22.5 mL	Spray when pests first appear. Repeat as needed. Maximum applications are 2 per season.
European chafer/ Japanese beetle *(Rhizotrogus majalis)*/ *(Popillia japonica)*	Acelepryn	5.6–8.8 mL	Apply from early April to late August for preventive and early curative control. Base need on historical monitoring, previous records or experiences, current season adult trapping or other methods. The higher rates may be required for early season (April and May) applications where a long residual is required, or in late August when less sensitive mid-instar grubs are present. Do not apply when the soil is saturated with water. Irrigate immediately after application.

* Insecticide formulation abbreviations: CS: capsule suspension; E: emulsion; EC: emulsifiable concentrate; F: flowable; G: granules; T: turf; SC: suspension concentrate; T&O: turf and ornamental; WG or WDG: water dispersible granule; WP WSB: wettable powder water soluble bag.

Table 3-5. Insect control products (cont'd)

Pest	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100 m^2	Comments from the product label See label for complete information.
European chafer/ Japanese beetle *(Rhizotrogus majalis)/ (Popillia japonica)* (cont'd)	Arena	2.5–5.0 g	**Preventative applications –** Make applications through peak egg hatch of target species, beginning as early as the first adults appear. **Curative applications –** Curative applications are considered applications after egg hatch of the target species of when obvious turf damage from current generation has occurred. Use the upper end of the rate range when making applications post egg hatch. Late season applications (late summer or early fall) may provide suppression only. Ensure each application is followed by sufficient irrigation or rainfall to move active ingredient through the thatch. The need for an application can be determined by a number of methods, including historical monitoring of the site, previous records or experiences, and current season adult trapping. Do not make more than 1 application per season. Avoid mowing grass until after irrigation or rainfall has occurred.
	Merit Solupak Merit 0.5 G*	1 packet/1,200 m^2 560 g	Apply prior to egg hatch. Irrigation or rainfall should occur within 24 hours. On golf courses, irrigate treated areas following application. Avoid mowing turf areas until after irrigation or rainfall has occurred. Apply only once a year.
	Quali-Pro Imidacloprid 75 WSP* Quali-Pro Imidacloprid 0.5 G*	1 packet/1,200 m^2 560 g	Apply prior to egg hatch. Irrigation or rainfall should occur within 24 hours. On golf courses, irrigate treated areas following application. Avoid mowing turf areas until after irrigation or rainfall has occurred. Apply only once a year.
	Chipco Sevin T&O*	210–290 mL	Apply to the early instar stage. Irrigate after application. If soil is dry remove excessive thatch and irrigate 24 hours before treatment.
June beetle grubs (*Phyllophaga* spp.)	no insecticides registered		
hairy chinch bug *(Blissus leucopterus hirtus)* The smaller stages of chinch bug nymphs are easiest to control.	MET52 BioInsecticide (suppression only)	64–96 mL	Use the higher application rate when pest pressure is high. Re-apply as required. The need for and timing of re-application should be determined by monitoring. The application interval is 4 weeks for hairy chinch bug.
	Arena	3.5-5.0 g	Apply when insect populations reach damaging thresholds. Use the upper end of the rate range when pest pressure is high or when treating areas with very low damage thresholds (e.g. golf greens, sod farms). Do not make more than 1 application per season. Avoid mowing grass until after irrigation or rainfall has occurred.
	Deltagard SC*	12 mL	Apply when insects are present or signs of insect feeding are visible. A second application may be necessary in 2–3 weeks where heavy infestations occur. For dense turfgrass canopies or turf maintained under high mowing heights, minimum water volumes of 10 L per 100 m^2 are recommended. Delay irrigation or mowing for 24 hours following application. Do not apply more than 2 times a year.
	Chipco Sevin T&O*	210–290 mL	Mow turf and apply spray. Do not water for 2 days after treatment. Repeat in 2–3 weeks if needed.
	Dursban 2E* Dursban Turf*	45 mL 22.5 mL	Spray when pests first appear. Repeat as needed.

* Insecticide formulation abbreviations: CS: capsule suspension; E: emulsion; EC: emulsifiable concentrate; F: flowable; G: granules; T: turf; SC: suspension concentrate; T&O: turf and ornamental; WG or WDG: water dispersible granule; WP WSB: wettable powder water soluble bag.

Table 3-5. Insect control products (cont'd)

Pest	Control (in order by highest LD_{50}, i.e. least toxic)	Rate/100 m^2	Comments from the product label See label for complete information.
hairy chinch bug *(Blissus leucopterus hirtus)* (cont'd)	Pyrate 480 EC*	22.5 mL	Spray when pests first appear. Repeat as needed. Do not apply more than 2 times a season.
Japanese beetle *(Popilla japonica)*	Acelepryn	5.6–8.8 mL	Apply from early April to late August for preventive and early curative control. Base need on historical monitoring, previous records or experiences, current season adult trapping or other methods. The higher rates may be required for early season (April and May) applications where a long residual is required or in late August when less sensitive mid-instar grubs are present. Do not apply when the soil is saturated with water. Irrigate immediately after application.
	Merit Solupak Merit 0.5 G*	1 packet/1,200 m^2 560 g	Apply prior to egg hatch. Irrigation or rainfall should occur within 24 hours. On golf courses, irrigate treated areas following application. Avoid mowing until after irrigation or rainfall has occurred. Apply only once a year.
	Quali-Pro Imidacloprid 75 WSP* Quali-Pro Imidacloprid 0.5 G*	1 packet/1,200 m^2 560 g	Apply prior to egg hatch. Irrigation or rainfall should occur within 24 hours. On golf courses, irrigate treated areas following application. Avoid mowing until after irrigation or rainfall has occurred. Apply only once a year.
leatherjackets (larvae of European crane fly *Tipula paludosa*)	Arena	5.5 g	Apply in the spring, when larvae are mature but prior to pupation. In the fall, apply prior to egg hatch. Only apply when populations of leather jackets (European crane fly) reach damaging thresholds. Do not make more than 1 application per season. Avoid mowing grass until after irrigation or rainfall has occurred.
	Merit Solupak Merti 0.5 G* (suppression only)	1 packet/1,200 m^2 560 g	Apply when adult crane flies take flight in August and September and begin laying eggs.
	Chipco Sevin T & O*	200 mL	Apply in 150–200 L/100 m^2 or for small areas 1.5–3 L/100 m^2 and irrigate. Apply only once a year. Consider treatment at or above 270 larvae per m^2.
	Dursban T* Pyrate 480 EC*	20–25 mL 20–25 mL	Apply as drenching spray in water in late fall after the flight of adult crane flies has ceased.
sod webworm, cranberry girdler and lawn moths (various species)	Success 480 S*	0.5–1.0 mL	Treat in early morning or early evening. Do not re-apply within less than 7 days. Do not water for 2 days after application. Do not mow turf for 1–3 days after treatment. Do not exceed 4 applications a year.
	Deltagard SC*	12 mL	Apply when insects are present or signs of insect feeding are visible. A second application may be necessary in 2–3 weeks where heavy infestations occur. For dense turfgrass canopies or turf maintained under high mowing heights, minimum water volumes of 10 L per 100 m^2 should be used. Delay irrigation or mowing for 24 hours. Do not apply more than 2 times a year.
	Chipco Sevin T&O*	210–290 mL	Mow turf and apply spray. Do not water for 2 days after treatment. Repeat in 2–3 weeks if needed.
	Dursban 2E*	45 mL	Delay watering or mowing the treated area for 12–24 hours after treatment.
	Dursban Turf Pyrate 480 EC*	22.5 mL 22.5 mL	Delay watering or mowing the treated area for 12–24 hours after treatment.

* Insecticide formulation abbreviations: CS: capsule suspension; E: emulsion; EC: emulsifiable concentrate; F: flowable; G: granules; T: turf; SC: suspension concentrate; T&O: turf and ornamental; WG or WDG: water dispersible granule; WP WSB: wettable powder water soluble bag.

Insect Parasitic Nematodes

Insect parasitic nematodes are microscopic worm-like creatures that move through the soil and attack insects. There are two types of behaviour exibited by nematodes: "sit and wait or ambusher" and "cruiser". The sit-and-wait or ambusher nematodes stand on their tails in an upright position near the soil surface and attach to passing hosts. The cruiser does not attach well to passing hosts, but is highly mobile, can travel a fair distance and is able to seek out its host. One nematode species exhibits a behavior which is intermediate to the "sit and wait" and "the cruiser". Each nematode species has a preferred host. Depending on the species of nematode, they may be used to control leatherjackets, white grub species, and caterpillars (cutworms and sod webworm). Nematodes are sold in a dormant stage, which are mixed with water then applied to the soil. They can also be applied through irrigation systems or conventional sprayers. Nematodes are living organisms and as such are not regulated by the Pesticides Act and Reg. 63/09. Table 3-6 lists the insect parasitic nematode species. Many different products are available. For specific rates of application, consult the product label. For more information on nematodes refer to OMAF Publication 816, *Turf IPM Manual*.

Best Management Practices for Nematodes Use

- Keep nematodes refrigerated until used
- Keep out of direct sunlight – they are sensitive to sunlight, drying out and extremes in temperature
- Water the turf until moist and then apply nematodes
- Water immediately after nematode application
- Keep turf wet for 2 days after application
- Apply when soil temperature is greater than 12ºC and less than 30º
- Remove any screens or filters from sprayer applicator
- Keep agitated and do not store diluted mixture for more than 6 hours.

Table 3-6. Insect parasitic nematode species

Target pest	Insect parasitic nematode species	Optimum temperature range	Nematode behaviour
Caterpillars (cutworm, sod webworm), hairy chinch bug and leatherjackets (European crane fly larvae)	*Steinernema carpocapse*	Work best when temperatures range from 22–28°C	Sit and wait behavior
White grub species	*Steinernema glaseri*	Especially effective against grubs Largest nematode species	Cruiser
Fly larvae and leatherjackets	*Steinernema feltiae*	Continue to work when soil temperatures are as low as 10°C	Between ambusher and cruiser
White grub species and leatherjackets (European crane fly larvae)	*Heterorhabditis bacteriophora*	Work best when soil temperatures are above 20°C	Cruiser

Other Pests

Slugs

Slug control and snail bait registered for use on sod farms, golf courses, other excepted uses and cosmetic uses are listed in Table 3-7.

Table 3-7. Slug control and snail bait registered for use on sod farms, golf courses, other excepted uses and cosmetic uses

Trade name	Classification	Common name	LD_{50} (mg ai/kg)[1]	Chemical family
Sluggo® Slug and Snail Bait for Gardens	6	ferric phosphate	>5,000	inorganic
Sluggo® Professional Slug and Snail Bait	4	ferric phosphate	>5,000	inorganic

[1] The relative toxicity may be referred to as its LD_{50}. The higher the LD_{50} figure, the less toxic the product is to humans. Products with low LD_{50} ratings are highly toxic. No products registered for turf have a high acute toxicity.

Snail and slug control products are listed in Table 3-8.

Table 3-8. Snail and slug control products

Product	Control	Rate/100m²	Interval (days)	Comments
Sluggo® Sluggo® Professional Slug and Snail Bait	Snails and slugs on lawns and grass grown for seed production	2.5–5 g/m²	14	Apply at higher rate if infestation is severe, if the area is heavily watered or after long periods of heavy rain. When slugs or snails are detected, scatter product by hand or with a granular spreader where the slugs or snails are observed. Do not place in piles. If the ground is dry, wet it before applying bait. The soil should be moist but with little or no standing water.

Canada Geese

Goose repellent registered for use on sod farms, golf courses, other excepted uses and cosmetic use are listed in Table 3-9.

Table 3-9. Goose repellent registered for use on sod farms, golf courses, other excepted uses and cosmetic use.

Trade Name	Classification	Common name	LD_{50} (mg ai/kg)[1]	Chemical family
Avigon	4	methyl-anthranilate	10,000	n/a

[1] The relative toxicity may be referred to as its LD_{50}. The higher the LD_{50} figure, the less toxic the product is to humans. Products with low LD_{50} ratings are highly toxic. No products registered for turf have a high acute toxicity.

Avigon 14.5 can be used as a repellent for Canada geese. For turfgrass of about 2.5 cm in height, apply 13 L/ha of undiluted Avigon 14.5. Dilute Avigon 14.5 according to the directions before application to turf. Spray evenly on area to be protected to provide thorough coverage and allow material to dry before permitting human activity. Do not mow treated area for as long as possible after treatment. Repeat after three days if needed.

Dilution instructions

Make sure spray equipment is clean before mixing. Shake or stir Avigon 14.5 container well. Mix Avigon 14.5 with water at a ratio of 1 part product to 19 parts water. For example, mix 1 litre of product with 19 litres of water to make 20 litres of spray mixture. Mix product outside or in a ventilated area.

Use restrictions

This product may be used to repel Canada geese from golf courses and municipal parks. Do not apply to residential lawns or recreational areas of parks. Do not apply when grass is wet or rain is expected or when temperatures are below freezing. Avoid direct exposure to honey bees. Do not apply in the vicinity of hives.

4. Crop Protection: Weeds

The major species of broadleaf weeds infesting turfgrass in Ontario are dandelion, plantain, black medick, chickweed, prostrate knotweed, mallow, henbit, ground ivy and white clover. The major grassy weeds are crabgrass, annual bluegrass, quackgrass, orchard grass and bentgrass. Herbicides are only one of the many tools that can be used to control weeds in turf. These products should be used as part of an integrated pest management (IPM) program. For more information on IPM for weed control, refer to OMAF Publication 816, *Turf IPM Manual*.

Weed Control

This herbicide information is for use on sod farms, golf courses, turf used for lawn bowling, cricket, lawn tennis and croquet, and for sports fields hosting national or international tournaments.

Herbicides are often the easiest, most effective and cheapest way to control annual and perennial weeds when populations are very high.

Information on specific products can be found in Table 4-1. Herbicides, soil fumigant and growth regulators registered for use on sod farms, golf courses and other excepted uses. Herbicides registered for use on home lawns, parks, sports fields and other cosmetic uses can be found in Table 4-2. *Class 11 herbicide active ingredients allowed for cosmetic uses on turfgrass*. All herbicides registered for use on turf can be found in Table 4-3. *Herbicides registered for use on sold farms, golf courses and other excepted uses*.

New Turf

After seeding new turf, many annual weeds may emerge before the grass seedlings do. If these young weeds are not controlled, they will shade and eventually crowd out much of the grass population. Mowing at a height of 6–8 cm will eliminate many such weeds. If they are extremely thick, 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L water/ha) on Kentucky bluegrass, fine fescues and perennial ryegrass or mecoprop (0.4–0.6 kg in 400 L water/ha) on bentgrass can be used — but not before the grass has been up for at least 4 weeks.

Established Turf

Applications of 2,4-D are most effective in the spring or in September when the weeds are growing well. This treatment generally thins clover. Weeds not normally controlled by 2,4-D may be controlled by mecoprop or dicamba, or with combinations of one of these with 2,4-D. Mecoprop and dicamba are also sold in commercial mixtures with 2,4-D.

Do not use mixtures containing dicamba close to shrubs or other susceptible ornamentals at rates above 0.425 kg/ha (active). Prepared mixtures of this chemical and 2,4-D are effective on a wide range of turf weed species, including knotweed, which is not controlled by most other herbicides except when very young.

Broadleaf Herbicides

2,4-D controls many broadleaf weeds including dandelion, plantains, shepherd's purse, smartweeds and vetch.

Mecoprop controls many 2,4-D and MCPA-tolerant weeds such as chickweeds, clovers, ground ivy and black medick and is generally safer to use on bentgrass than 2,4-D.

Dicamba controls broadleaf weeds including 2,4-D-tolerant weeds such as chickweeds, clover and young knotweed but does not adequately control plantains.

MCPA controls dandelion, plantains, and shepherd's purse. Weeds tolerant to MCPA include chickweeds, clovers and black medick. Two and three-way mixes of these herbicides extend the spectrum of weeds that are controlled by using only one of these herbicides.

Grass Herbicides

Betasan, Dimension and corn gluten meal-based products can be applied before crabgrass emerges in the spring, and Acclaim Super and Dimension can be applied after emergence. Corn gluten meal-based products can also be applied in the fall.

Herbicide Drift

Broadleaf herbicide spray drift can damage crops a great distance from the sprayer. Grapes for wine are particularly susceptible. For information, see the OMAF/Agriculture and Agri-Food Canada booklet *Best Management Practices—Pesticide Storage, Handling and Application* and the Ontario Pesticide Education Program (Ridgetown College) videos *How to Manage Spray Drift and Spray Drift Reduction Through Air Induction*.

Table 4-1. Herbicides, soil fumigant and growth regulators registered for use on sod farms, golf courses and other excepted uses.

Trade name (alphabetically in each group)	Classification	Common name	LD_{50} (mg ai/kg)[1]	Chemical family
Acclaim Super	3	fenoxaprop-ethyl	335	aryloxyphenoxyproprionate
Basagran	4	bentazon	1,100	benzothiadiazine
Basamid	3	dazomet	519	thiadiazine
Betasan	4	bensulide	770	benzene sulfonamide
Callisto	3	mesotrione	>5,000	benzoylcyclohexanedione
Corn gluten meal (many manufacturers)	4	corn gluten meal	–	corn gluten
Compitox, Mecoprop	4	mecoprop	930	phenoxy
Dimension	3	dithopyr	3,600	pyridine
2,4-D (many manufacturers)	3, 4	2,4-D (2,4-dichlorophenoxyacetic acid) 2,4-D/dicamba 2,4-D/mecoprop 2,4-D/mecoprop/dicamba	650 650/1,040 650/930 650/930/1,040	phenoxy phenoxy/benzoic acid phenoxy/phenoxy phenoxy/phenoxy/benzoic acid
Fiesta	4	Iron (present as FeHEDTA)	>5,000	metal salt of polyamino carboxylic acid
Gramoxone	3	paraquat	157–207	bipyridylium
Kona	4	citric acid/lactic acid	Not stated. Listed as "no known acute effects from swallowing"	lacto-fermented dairy products
MCPA amines	4	MCPA	700–1,000	phenoxy
Munger Horticultural Vinegar Plus	4	acetic acid	>5,000	Inorganic acid
Primo MAXX	4	trinexapac-ethyl	5,050	cycloproply derivative of cyclohexenone
Quali-Pro® Trinexapac 11.3	4	trinexapac-ethyl	5,050	cylcopropyl derivative of cyclohexenone
Quicksilver T&O Herbicide	4	carfentrazone-ethyl	>4,000	triazolinones
Roundup	4	glyphosate	4,320	N-(phosphonomethyl) glycine
Royal MH-60 SG	4	maleic hydrazide	75,000	unique
Vanquish	3	dicamba	1,040	benzoic acid
Velocity SP	4	bispyribac (sodium)	2,635	pyrimidinyl carboxy

[1] ai=active ingredient. The relative toxicity may be referred to as its LD_{50}. The higher the LD_{50} figure, the less toxic the product is to humans. Products with low LD_{50} ratings are highly toxic. No products registered for turf have a high acute toxicity.

Table 4-2. Class 11 herbicide active ingredients allowed for cosmetic uses on turfgrass

Active Ingredient	Classification	Uses
acetic acid	4, 5	Check label for specific uses and follow the label directions
citric acid/lactic acid	4	
corn gluten meal	4, 5	
fatty acid	5, 6	
horticultural vinegar	4	
iron (present as FeHEDTA)	4	

Licensed exterminators and those who perform land exterminations in non-residential areas that use Class 11 pesticides must post a green sign to notify the public of the use of these pesticides.

Check MOE website at *www.ontario.ca/pesticideban* for the list of pesticides for cosmetic uses.

Table 4-3a. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Site preparation before turfgrass establishment**

Active ingredient (alphabetical) Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
glyphosate* glyphosate (360)	0.27–4.32 kg 0.75–12 L	0.3–4.8 L	Apply in 200–300 L/ha (80–120 L/ac) water. Non-selective herbicide will kill turf that is sprayed. For actively growing weeds in the fall, or spring prior to planting. Allow 5–7 days translocation time before doing any tillage when conditions are good. If cool temperatures follow application, allow more time. Only weeds emerged at application time will be controlled. Repeat application may be necessary. For annual weeds, use 0.75–3.5 L product/ha (0.3–1.4 L/acre). Use 50–100 L/ha water (20–40 L/acre) for the low rate or use a surfactant with larger water volumes. Water volumes of 100–300 L/ha (40–120 L/acre) can be used with the 3.5 L/ha rate. For dandelions and quackgrass, use 2.5–7 L product /ha (1–2.8 L/acre). Apply when plants have at least 3–4 new leaves. Repeat treatments may be needed. The low rate (2.5 L/ha [1 L/acre]) provides a minimum of one season control. Higher rates (4.75–7L/ha [1.9–2.8 L/acre]) provide longer control. For dandelions, apply 2.5 L/ha (1 L/acre) if 15 cm or less in diameter and 3.5–5 L/ha (1.4–2 L/acre) if larger. For perennial broadleaf weeds, use 7–12 L product/ha (2.8–4.8 L/acre). Canada thistle and sow-thistle should be at least in early bud, milkweed at bud, bindweed at full flower, and dogbane past full bloom for best results. For undisturbed perennials such as sod in non-crop areas, use the highest rate and repeat it when plants regrow to optimum stage.

* various concentrations available

Table 4-3b. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Pre-emergence grass herbicides**

Active ingredient (alphabetical) Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
bensulide Betasan (480 g/L) Betasan (GR*) (12.5 Gr)	11–14.4 kg 23–30 L 125 kg	 9.2–12 L 50 kg	Apply in 800–1,000 L/ha (320–400 L/acre) water unless otherwise stated. Apply to established turf before crabgrass emergence in early spring or in fall. Use the low rate for crabgrass and the high rate for annual bluegrass. Do not reseed for 1 year. Do not apply peat moss to lawn before application. Use only on mineral soils.
chlorthal dimethyl Dacthal W-75 (75 WP*)	11.625 kg 15.5 kg	 6.2 kg	Apply early in spring before weed seed germination. Apply in 450–1,100 L/ha (180–440 L/acre) water. Do not apply to Cohansey and Toronto bent. Do not reseed for 60 days.
corn gluten meal (many manufacturers)	970–980 kg/ha (see label)	388–392 kg (see label)	To inhibit dandelion and smooth crabgrass seed germination. Apply to established Kentucky bluegrass turf in early spring before smooth crabgrass and dandelion seed germinate or in late summer and early fall after heat stress has passed. Apply when soil is moist and when rain is forecasted within two days of treatment. If rainfall does not occur within 2 days, irrigation is required. Excessive moisture at time of treatment may reduce effectiveness. Apply twice a year for best results. Do not apply to newly seeded grass. Wait until after first mowing. Do not apply if allergic to corn. If over-seeding or re-sodding in the spring, do not apply in the spring. If over-seeding or re-sodding in the fall, do not apply in the fall.
dithiopyr Dimension (120 g/L)	0.42 kg 3.5 L	 1.4 L	Apply to established turf before crabgrass emergence. Apply in 200–800 L/ha (80–160 L/acre) water. Allow turf to recover from aeration or other stresses before application. Do not apply to putting greens during the first year. Check label for sensitive varieties, including Colonial bentgrasses. Do not irrigate within 2 hours or reseed for 3 months. May be tank-mixed with Killex or other broadleaf herbicides. Do not tank-mix with other products for greens.

* various concentrations available

Table 4-3c. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Post-emergence grass herbicides**

Active ingredient (alphabetical) Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
bispyribac Velocity (SP*) (761 g/L)			Apply in 400–800 L/ha (160–320 L/acre) water. Do not use before June 1 or after September 15, unless high temperature reaches 21°C, more than 185 g/ha within 28 days, or more than 370.8 g/ha per season. Do not re-treat if turf shows undesirable chlorosis.
	31 g 41 mL	 16 mL	Program 1: Creeping bentgrass and perennial ryegrass (fairways and tees mowed at 0.9 to 1.9 cm. Sod mowed at 1.3 to 1.9 cm) Apply on a 7-day interval. Continue until the desired level of control is achieved. This program should be considered where complete removal of annual bluegrass during a single season could result in an unacceptable stand of turf. Application to control weeds will also suppress infection of creeping bentgrass by dollar spot *(Sclerotinia homoeocarpa)*. Suppression of dollar spot will be greatest when a weed control program Is initiated in the late spring or early summer before the appearance of significant dollar spot infection. Early-season application may delay the initiation of a dollar spot control program with fungicides and may reduce overall fungicide application on creeping bentgrass.

* various concentrations available

Table 4-3c. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Post-emergence grass herbicides** (cont'd)

Active ingredient (alphabetical) Trade name (formulation)	**Active rate/ha Product rate/ha**	**Product rate/acre**	**Comments from product label See label for complete information.**
bispyribac Velocity (SP*) (761 g/L) (cont'd)	93 g 122.2 mL	49 mL	Program 2: Creeping bentgrass and perennial ryegrass (fairways and tees mowed at 0.9–1.9 cm. Sod mowed at 1.3–1.9 cm.) Apply up to four times on a 14-day interval. This program should be considered for turf with light infestation of annual bluegrass, where removal of these weeds would not result in an unacceptable stand of turf. Application to control annual bluegrass will also suppress dandelion and white clover populations. To maximize suppression apply a minimum of 2 applications when weeds are actively growing. When used for weed control it can suppress infection of creeping bentgrass by dollar spot *(Sclerotinia homoeocarpa)*. Suppression of dollar spot will be greatest when a weed control program is initiated in the late spring or early summer before the appearance of significant dollar spot infection. Early-season application may delay the initiation of a dollar spot control program with fungicides and may reduce overall fungicide application on creeping bentgrass.
	31 g 41 mL	16 mL	Kentucky bluegrass and tall fescue (sod and golf courses) Apply on a 7- to 14-day interval. Begin early in June and continue until the desired level of annual bluegrass control is achieved. A shorter mowing height will increase the tolerance of the Kentucky bluegrass and fescue to the herbicide.
dithiopyr Dimension (120 g/L)	0.42–0.54 kg 3.5–4.5 L	1.4–1.8 L	For established turf until crabgrass reaches the 1–3 leaf stage before tillering. Use higher rate for larger plants or when area is heavily infested. Apply in 200–800 L/ha (80–160 L/acre) water. Allow turf to recover from aeration or other stresses before application. Do not apply to greens during the first year. Check label for sensitive varieties, including Colonial bentgrasses. Do not irrigate within 2 hours of application. Do not reseed for 3 months. May be tank-mixed with Killex or other broadleaf herbicides. Do not tank-mix with other products for greens.
fenoxaprop-p-ethyl Acclaim Super (80.5 g/L)	0.092 kg 1.14 L	0.46 L	Apply in 400–800 L/ha (160–320 L/acre) water. To control crabgrass at the 1–4 leaf up to the multi-tiller stage. Good coverage is essential to control multi-tillered or grassy weeds in the reproductive phase. Make a second application on mature monostands 21 days after first. Do not apply to bentgrass or seedling Kentucky bluegrass. Do not tank-mix with any other herbicide or pesticide. Do not apply broadleaf herbicides 7 days before or after Acclaim Super. Do not apply during periods of drought. Do not mow for 4 days before or after application. Do not irrigate for 3 hours.

* various concentrations available

Table 4-3d. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Pre-emergence broadleaf weed control sod (production only) up to 2-leaf weed stage**

Active ingredient Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
mesotrione Callisto 480 SC* Weeds controlled; Lamb's-quarters, redroot pigweed, velvet leaf, wild mustard, common ragweed (suppression only)	0.144 kg 0.3 L	0.12 L	Make only 1 application per year. Apply pre-emergence to weeds: • in established sod, or • prior to or post-seeding and prior to emergence of weeds, or • post-emergence to weeds (regardless of whether prior to or post-seeding)

* various concentrations available

Table 4-3e. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Post-emergence broadleaf weed control sod (production only) 3-8 leaf stage**

Active ingredient Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
mesotrione Callisto 480 SC* Weeds controlled; Eastern black nightshade, redroot pigweed, velvet leaf, wild mustard, common ragweed (suppression only)	0.118 kg 0.21 L	0.084 L	Apply in 250 L/ha of water. Do not apply to creeping bentgrass. Cool-season turf species and varieties may vary in their tolerance to this product. Since not all cool-season turf varieties have been tested for tolerance, limit first use to a small area of each variety or mixture to confirm tolerance prior to adoption as a general field practice. Additionally, consult your seed supplier for information on the tolerance of specific cool-season turf varieties to this product. Make applications close to anticipated weed seed germination. Apply at grass seeding or close to seeding for best performance. Weed control is most effective on young, actively growing weeds. Avoid spraying on newly germinated turfgrass plants. Efficacy will be reduced under moisture stress or from applications to mature weeds. May reduce density of fine fescue seedlings. It can be used on grass seed blends that contain less than 20% by weight of fine fescue. Wait until the newly germinated turf has been mowed 2 times, or 4 weeks after emergence, (whichever is longer) before making a post-emergence application. Use only ground boom equipment when applying this product. Do not apply through any type of irrigation equipment. Do not apply directly to water or areas where surface water is present. Do not spray to runoff.

* various concentrations available

Table 4-3f. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Non-selective soil fumigant for the control of soil-borne nematodes, soil fungi and germinating weed seeds. It is suitable for the fumigation on turf seedbeds.**

Active ingredient Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
dazomet Basamid (Granular)	315.25–485 kg 325–500 kg	130–200 kg	Soil preparation before treatment: Soil should be well prepared, in seedbed condition, having a fine tilth and free from clods. It should be free from un-decomposed root and plant residues. Soil moisture level must be suitable for seed germination for a 5–7 day period prior to treatment. Water the soil as necessary to achieve and maintain this level. Incorporation: Must be thoroughly and evenly incorporated into the soil to a depth of 15–23 cm immediately after application. This is best achieved using a rotary cultivator or a rototiller equipped with L-shaped tines. The rotor speed should be high and the forward speed low. Sealing of treated soil: As soon as possible after incorporation, seal the soil to retain the maximum concentration of gases in the soil. This can be done by: • compacting the surface with a roller. The surface should be firm and free from cracks and remain so for the duration of fumigation. To avoid surface cracks in hot weather, water the soil as required. • flooding the soil surface with water to obtain a surface crust with 10–20 L of water/m^2. Surface compaction, as described above and flooding can be combined. • covering the treated area with a polyethylene sheet and sealing the edges with soil. This method will allow the effective gases to act more efficiently on a disease agent and weed seeds immediately below the soil surface and increase the effectiveness of the product. Aeration of soil: All traces of toxic gases must disappear from the treated soil before planting or sowing, otherwise plant damage or death may result. At warm soil temperatures (above 18°C at 10–15 cm), the soil may be opened 5–7 days after the application. This can be done with a rototiller, disc harrow or hand tools. Work the soil to the depth of incorporation but no deeper. At the next step, about 2 days later, the safety germination test must be carried out. (See product label for safety germination test). At cooler temperatures (below 8°C–12°C), do not work the soil for 2–4 weeks after application; wait 10–15 days after opening the soil. When temperatures are below 6°C, do not use this product. Waiting period: The interval between treatment and planting depends on the temperature, moisture and structure of the soil. See waiting period chart on product label.

Table 4-3g. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Non-selective vegetation control in and around gardens, established trees and shrubs, sidewalks, driveways, patios, non-crop areas, right-of way, greenhouses and industrial land sites.**

Active ingredient Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
acetic acid (many manufacturers)	**Dilution rate:** Early-season annual weed control: 1 L of product for 3 L of water Larger annual weeds and top growth reduction (suppression) of perennial weeds: 1 L of product for 2.25 L of water.	Spray until vegetation is thoroughly wet	For large weeds, spot treatment is best. Re-treatment is required for re-growth of perennial weeds.

Table 4-3h. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Selective post-emergence broadleaf herbicides**

Active ingredient (alphabetical) Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
2,4-D 2,4-D (470 g/L) (many manufacturers and formulations)	0.8–1.4 kg 1.7–3 L	 0.68–1.2 L	Damage may occur when applied to bentgrass. If used on bentgrass apply at 0.28 kg/ha.
2,4-D 2,4-D (470 g/L) plus mecoprop Mecoprop (150 g/L) or Mecoprop/ 2,4-D Mecoturf Plus 2,4-D ([1:1] 400 g/L) or mecoprop/ 2,4-D Premium 2-Way Turf Herbicide ([1:1] 400 g/L) or Turf-Rite 2+2 ([1:1] 400 g/L (many manufacturers and formulations)	0.8–1.1 kg 1.8–2.3 L 5.7–7.3 L 1.7–2.2 kg 4.25–5.5 L 2 kg 5 L 4.25–5.5 L	 0.7–0.9 L 2.3–2.9 L 1.7–2.2 L 2 L 1.7–2.2 L	May be combined with Vanquish (0.21 L/ha (0.08 L/acre)) for control of young knotweed. Damage may occur when applied to bentgrass. For newly established turf at least 4 weeks old, use 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L water/ha) or mecoprop (0.4–0.6 kg in 400 L water/ha) for annual weeds.
2,4-D/ dicamba/ mecoprop Killex (308 g/L) or Premium 3-Way Turf Herbicide (308 g/L) or Par III (308 g/L) or Tri-Kill (308 g/L) or Trillion (308 g/L) (many manufacturers and formulations)	1.7 kg 5.5 L 5.5 L 5.5 L 5.5 L 5.5 L	 2.2 L 2.2 L 2.2 L 2.2 L 2.2 L	In closely mowed bentgrass (greens) apply at half doses (30 mL/100 m^2). Temporary yellowing may occur. Recovery from injury will occur 1 week after application. Do not use close to shrubs or other susceptible ornamentals at rates above 0.425 kg/ha (active). Do not mow grass 3–5 days before and after application. Do not treat until turf is well established.
bentazon Basagran (480 g/L) plus oil concentrate Assist	0.84 kg 1.75 L 2 L	 0.7 L 0.8 L	To control top growth of yellow nut sedge. Apply when nut sedge is young and actively growing. Make 2 applications 10 days apart. Do not mow grass 3–5 days before and after application. Do not treat until turf is well established.

Table 4-3h. Herbicides registered for use on sod farms, golf courses and other excepted uses – **Selective post-emergence broadleaf herbicides** (cont'd)

Active ingredient (alphabetical) Trade name (formulation)	**Active rate/ha Product rate/ha**	**Product rate/acre**	**Comments from product label See label for complete information.**
citric acid/lactic acid Kona	**Dilution rate**: *Broadcast applications*: Mix 25% product with 3% surfactant and 72% water. *Spot treatment*: Mix 50% product with 3% surfactant and 47% water.	**Application rate**: 200 mL/m^2	Start applications in May or later. To provide consistent partial suppression of the weeds, repeat the application every 14 days for a total of at least 5 applications in a season. Turfgrass species may vary in their tolerance to this product. Not all turfgrass species have been tested. Limit first use of this product as a broadcast treatment to a small area to confirm tolerance of the target lawn prior to adoption as general practice. Chlorosis to turf may be observed following application, but turf normally recovers in 3 weeks. Targeted weeds: birds-foot treefoil, white clover, red clover, black medick and yellow wood-sorrel.
dicamba Vanquish (480 g/L)	0.6 kg 1.25 L	0.5 L	Apply alone or as a tank-mix in at least 110 litres of water per hectare as a foliar spray to actively growing weeds. Best results will be obtained if application is made in early spring or fall, 2 weeks prior to first frost. Apply with caution near trees or shrubs. Do not apply closer than the drip line of trees and shrubs. Do not apply to bentgrass. Do not rake, mow or water lawn within 24 hours after application. For control of a broader range of weeds, the recommended rate may be tank-mixed with 2.2 litres of 2,4-D amine (500 g/L) or 2 litres of 2,4-D ester (600 g/L) herbicide.
iron (present as FeHEDTA) Fiesta	**Dilution rate:** 40 mL of product to 960 mL of water	**Application rate:** Easy-to-control weeds: 100 mL/m^2 Moderately difficult-to-control weeds: 200 mL/m^2 Tough-to-control perennial weeds: 400 mL/m^2	Uniform coverage is important. Repeat treatment every 3–4 weeks, if necessary, up to a maximum of 4 applications per area per year. For spot treatment, spray weeds until foliage is thoroughly wetted, just to the point of runoff. Visible signs of control may be seen within several hours of applications. Susceptible weeds, moss and algae will turn brown or black. Occasionally, a darkening of the leaf blades can occur after treatment, however the grass will recover within a few days to several weeks. Do not apply to drought-stressed turf. Do not apply when the daytime temperature will exceed 30°C. Do not apply to bentgrass. If unsure of grass sensitivity, test spray a small area. Do not apply to newly seeded areas until 4 or more weeks after grass seedlings have emerged. Avoid spraying desirable plants. Rinse any desirable plants or structures accidentally contacted immediately with water. Do not apply if rainfall is expected within 3 hr of application. Do not irrigate within 3 hr of application. Easy-to-control weeds: black medick, slender speedwell, wild geranium, moss, and weed seedlings of false dandelions, English daisy, dandelion or white clover. A second application at this rate may be required to achieve control of these weeds. Moderately difficult-to-control weeds: dandelion, English daisy, false dandelion, white clover, bull thistle, common chickweed, narrow-leaved plantain, dove's foot geranium, lawn burweed and algae. Tough-to-control perennial weeds: broad-leaved plantain, creeping buttercup and Canada thistle. For Canada thistle, best results are obtained when weeds are less than 15 cm tall. Two applications may be required for control.
MCPA MCPA Amine (500 g/L)	1.1–1.4 kg 2.2–2.8 L	0.88–1.12L	To control field horsetail, dandelion, plantains, and shepherd's purse. Do not apply to bentgrass unless necessary, and then only at 0.28 kg/ha. Some yellowing may occur. Use as a substitute for 2,4-D. At slightly higher doses than 2,4-D it will usually provide as good weed control. Reduced control of dandelion and plantains may occur during dry, hot weather.
mecoprop Compitox (150 g/L) Mecoprop (150 g/L)	0.83–1.28 kg 5.5–8.5 L 5.5–8.5 L	 2.2–3.4 L 2.2–3.4 L	To control 2,4-D and MCPA-tolerant weeds such as chickweed, clover, ground ivy and black medick, as well as many broadleaf weeds. May be applied to bentgrass. Apply before flower to dandelion. Repeated applications may be needed for dandelion and black medick.

Table 4-4. Selective post-emergence silvery thread moss control on golf course greens and tees only

Active ingredient Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
carfentrazone QuickSilver	0.109 kg 0.490 L	As a stand-alone product: 0.198 L	For golf course greens and tees only. Start applications when turfgrass is actively growing and first sign of silvery thread moss is present. The minimum retreatment interval for sequential broadcast applications is two weeks. Do not exceed 440 g/ha per year. Use a non-ionic surfactant such Agral 90 or Ag-Surf in the spray mix at a rate of 25 mL of surfactant per 100 L of water. Do not tank-mix with other herbicides for silvery thread moss control. Applications to bentgrass turf that is under stress due to extreme high (>32°C) or below-freezing temperatures, disease infection, insect infestation or extreme high or low moisture conditions may cause transitory yellowing. Poa annua may be damaged at rates greater than 1.5 mL per 100 m^2. Most creeping bentgrass varieties are tolerant to applications; however, not all varieties of creeping bentgrass have been fully evaluated. First confirm tolerance by making an application to small test area when applying to creeping bentgrass varieties other than Penncross or Crenshaw. Cultural practices that favour the establishment of healthy bentgrass will also help displace moss that is suppressed by QuickSilver treatment.
	0.033–0.109 kg 0.146–0.490 L	Control over longer periods: 0.058-0.198 L	

* Herbicide formulation abbreviations: GR: granules ; SC: soluble concentrate; SP: soluble packet; WP: wettable powder

Turfgrass Renovation

Mow and thoroughly rake the turf to be renovated to remove all dead and cut vegetation. Herbicides registered for turfgrass renovation are listed in Table 4-5.

Turfgrass Retardation

Treatment with maleic hydrazide (Royal MH 60 SG, 6.5–8 kg/ha [2.6–3.2 kg/acre] product) may reduce growth. Follow manufacturer's directions carefully. This chemical is intended for use in areas where mowing and trimming are difficult and where a lawn-like appearance is not necessary.

Table 4-5. Herbicides registered for turfgrass renovation

Active ingredient Trade name (formulation)	Active rate/ha Product rate/ha	Product rate/acre	Comments from product label See label for complete information.
paraquat Gramoxone (200 g/L)	2.4 kg 12 L	4.8 L	Apply in 1,000 L/ha (400 L/acre) water. Will "burn off" all emerged vegetation. When old turf is dead, rotovate top 5 cm to cover dead grass, rake the surface to prepare seedbed and reseed.
glyphosate* glyphosate (360 g/L)	1.7–2.5 kg 4.75–7 L	1.9–2.8 L	Apply in 200–300 L/ha (80–120 L/acre) water after omitting at least 1 regular mowing. Ideally delay tillage for 7 days to allow for proper translocation. Direct seeding into the killed turf (no tillage) may be carried out.

* Various manufacturers.

Growth Regulation

Primo MAXX reduces the frequency of mowing and the amount of grass clippings by regulating the growth of turfgrass. Full growth regulation begins about 3–5 days after application. It can be applied to well-maintained turf on golf courses and sod farms and to difficult-to-mow areas along curbs, parking lots, cart paths and bunkers and around trees, shrubs and flower beds.

Primo MAXX reaches the growing point by foliar uptake. Primo MAXX may not be rainfast soon after application. Application should be completed at least three hours before irrigation or rain. Treated areas should continue to receive regular maintenance practices, including irrigation, fertilization, weed, disease and insect control when needed.

Primo MAXX may cause temporary yellowing. This usually disappears in about one week. To minimize yellowing and enhance colour, apply readily available nitrogen at 0.1–0.25 kg of nitrogen per 100 m^2.

Primo MAXX can be applied every 4 weeks or later as required to actively growing turf at the rates shown in Table 4-6. *Primo MAXX application rates* on page 58. It may be applied at one-half rate shown in Table 4-6 when applied every two weeks or later as needed during the summer when turf growth begins to slow or where yellowing of annual bluegrass is a concern.

A reduction in turf quality may occur. The turf should recover within 2–4 weeks.

Turf treated with Primo MAXX may grow more rapidly than untreated turf for several weeks following a period of suppressed growth.

Do not make more than 7 applications a year at the rates in Table 4-6 or 14 applications at the half-rate.

Do not overlap or apply to turf that is stressed by low fertility, high temperatures, drought, frost or to turf that is diseased or insect damaged.

Do not apply Primo MAXX for 2 weeks after aeration or vertical mowing.

Tank Mixtures – Pesticides

Primo MAXX can be tank-mixed with only one of the following:

- Heritage Fungicide
- Daconil 2787
- Banner MAXX fungicide
- Subdue MAXX fungicide

Read all the labels and follow the precautions, directions for use, and other restrictions.

Apply Primo MAXX only to the turf species or mixtures on sites for which a rate is shown in Table 4-6. Rates shown should provide 50% suppression of turf growth under good growing conditions for a minimum of 4 weeks with minimal yellowing. Growth suppression may be less with the use of rates that are one half less than those shown.

Where yellowing of annual bluegrass is a concern, use half the rate and apply every 2 weeks or later as required. Where temporary discolouration of annual bluegrass can be tolerated, use the rate shown in Table 4-6 and apply every 4 weeks or later as needed. For more information on turf herbicides, mode of action and precautions, see OMAF Publication 75, *Guide to Weed Control*.

Table 4-6. Primo MAXX application rates

Turf type	Sod and golf courses, including rough areas*	Sod and fairways (cut at 1.0–1.9 cm)	Greens**
	mL/100m²		
creeping bentgrass *(Agrostis stolonifera, palustris)*	–	8.0	4.0
tall fescue *(Festuca arundinacae)*	24	–	–
Kentucky bluegrass *(Poa pratensis)*	19	8.0†	–
perennial ryegrass *(Lolium perenne)*	32	16†	–
mixture – creeping bentgrass, annual bluegrass *(Poa annua)*	–	8.0	4.0
mixture – Kentucky bluegrass, tall fescue, perennial ryegrass	24	–	–
mixture – Kentucky bluegrass, perennial ryegrass, annual bluegrass	–	16	–
mixture – Kentucky bluegrass, annual bluegrass	–	8.0	–

– Not for use on the turf species or mixture on this site.
* Includes edging and banding applications along curbs, parking lots, cart paths, bunkers and around trees, shrubs and flower beds. Apply in a 20–30 cm band with a single nozzle sprayer. Canopy height should be at least 3.8 cm for Kentucky bluegrass and perennial ryegrass and at least 5 cm for tall fescue.
† About one third suppression of turf growth can be expected.
**Primo MAXX has not been tested at the rate of 2.0 mL/100m². Results may be unsatisfactory.

5. Appendices

APPENDIX A: Accredited Soil Testing Laboratories in Ontario

These labs are accredited to perform soil tests for pH, buffer pH, P, K and Mg Ontario soils.

Laboratory Name	Address	Telephone/Fax/E-mail	Contact
A & L Canada Laboratories Inc. *www.alcanada.com*	2136 Jetstream Rd. London, ON N5V 3P5	Tel: 519-457-2575 Fax: 519-457-2664 E-mail: *alcanadalabs@alcanada.com*	Greg Patterson Ian McLachlin
Activation Laboratories *www.actlabsag.com*	9-1480 Sandhill Dr. Ancaster, ON L9G 4V5	Tel: 289-204-0515, Ext. 102/104 Fax: 289-204-0514 E-mail: *Laboratory@ActLabsAg.com*	Rob Deakin Dr. Steve Jenkins
Agri-Food Laboratories *www.agtest.com*	503 Imperial Rd. Unit #1 Guelph, ON N1H 6T9	Tel: 519-837-1600 1-800-265-7175 Fax: 519-837-1242 E-mail: *ca.agri.guelph.lab@sgs.com*	Jack Legg Papken Bedirian
Brookside Laboratories, Inc. *www.blinc.com*	200 White Mountain Dr. New Bremen, OH 45869	Tel: 419-753-2448 Fax: 419-753-2949 E-mail: *mflock@blinc.com*	Mark Flock
Exova Accutest Laboratory Exova Canada Inc. *www.exova.com*	8-146 Colonnade Rd. Ottawa, ON K2E 7Y1	Tel: 613-727-5692, ext. 317 Fax: 613-727-5222 E-mail: *lorna.wilson@exova.com*	Lorna Wilson
FoReST Laboratory *lucas.lakeheadu.ca/forest*	955 Oliver Rd. BB1005D Thunder Bay, ON P7B 5E1	Tel: 807-343-8639 Fax: 807-343-8116 E-mail: *soilslab@lakeheadu.ca*	Breanne Neufield Joel Symonds
University of Guelph Laboratory Services *www.guelphlabservices.com*	University of Guelph P.O. Box 3650 95 Stone Rd. W. Guelph, ON N1H 8J7	Tel: 519-767-6299 Fax: 519-767-6240 E-mail: *aflinfo@uoguelph.ca*	Nick Schrier
Stratford Agri Analysis *www.stratfordagri.ca*	1131 Erie St. Box 760 Stratford, ON N5A 6W1	Tel: 519-273-4411 1-800-323-9089 Fax: 519-273-2163 E-mail: *info@stratfordagri.ca*	Keith Lemp Mark Aikman

There is no official accreditation in Ontario for tissue analysis, but all the accredited soil-testing labs are monitored for proficiency on tissue analyses.

APPENDIX B: Diagnostic Services

Weed identification

Pest Diagnostic Clinic
Laboratory Services Division
University of Guelph
95 Stone Rd. West
Guelph, ON N1H 8J7
519-767-6256
519-767-6240 fax
www.guelphlabservices.com

Turf disease and insect diagnosis and nematode counts

GTI Diagnostics
The Guelph Turfgrass Institute
328 Victoria Rd. South
Guelph, ON N1H 6H8
519-824-4120 × 58873
519-766-1704 fax
diagnostics@guelphturfgrass.ca
www.guelphturfgrass.ca

Sample submission forms can be obtained at
www.guelphturfgrass.ca

APPENDIX C: Collecting and Submitting Samples for Disease, Weed or Plant Identification

Disease diagnosis

Choose a 10–15 cm square piece of turfgrass (a cup changer plug works well) including thatch and 5 cm of soil.

Take a sample from the outside edge of a ring or patch and include healthy and unhealthy turf as well as the interface between. If symptoms are general, collect the sample from an area where they are of intermediate severity.

Plant identification

The entire plant (including root) is preferable. It should include lateral buds, leaves, and flowers or fruits.

Please specify where the plant came from, i.e. cultivated field, waste area, yard, etc. Also include the county of origin, if available.

Shipping plant material

Do not add moisture when packing turf samples, plants or plant parts. Wrap in newspaper, tying roots and soil off separately to reduce contamination, and put in a plastic container. Avoid shipping over the weekend.

Insect specimens

Send dead, hard-bodied insects cushioned in a sturdy container. Preserve soft-bodied insects such as caterpillars in alcohol.

Hints for shipping insects

- Do not send insects in water.
- Do not tape insects to paper or send them loose in an envelope.
- Live insects should have enough food to survive until arrival. Clearly label the package with "live insects."

Sampling for nematodes

Only living nematodes can be counted. Accurate counts depend on proper handling of samples.

When to sample

Take soil and root samples at any time when the soil is not frozen. In Ontario nematode soil population levels are generally highest in May-June and again in September-October.

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 dripline).

Problem areas

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

Sampling soil

Take samples using a soil-sampling tube, trowel or narrow-bladed shovel. Sample soil to a depth of 20–25 cm. If the soil is bare, remove the top 2 cm before sampling. Combine 10 or more subsamples in a clean pail or plastic bag. Mix them well. Take 0.5–1 L from this to create a sample. No one sample should represent more than 2.5 ha (6.5 acre).

Number of subsamples

The number of subsamples is based on the total area samples:

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

Sampling roots

From small plants, take the entire root system plus adhering soil. For large plants, dig 10–20 g fresh weight from the feeder root zone and submit it.

Handling soil samples

Place in plastic bags as soon as possible after collecting.

Handling root samples

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

Storage

Store samples at 5–10°C and do not expose them to direct sun or extreme heat or cold.

APPENDIX D: Ontario Ministry of Agriculture and Food and the Ministry of Rural Affairs Turfgrass Specialist

Pam Charbonneau
OMAF and MRA Turfgrass Specialist
328 Victoria Rd. South
Guelph, ON N1L 0H2
Tel: 519-824-4120 × 52597
Fax: 519-766-1704
pamela.charbonneau@ontario.ca
www.ontario.ca/crops
www.onturf.wordpress.com
@ONturf

Other Ontario Ministry of Agriculture and Food and the Ministry of Rural Affairs contacts

Agricultural Information Contact Centre
Tel: 1-877-424-1300 or 519-826-4047
Fax: 519-826-7610
ag.info.omaf@ontario.ca
1 Stone Road West, Guelph ON N1G 4Y2

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

A complete list of Ontario Ministry of Agriculture and Food and the Ministry of Rural Affairs Agriculture Development Branch Staff is available on the OMAF website at *www.ontario.ca/crops*

APPENDIX E: Ontario Ministry of Environment — Regional Contact Information

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

APPENDIX F: The Metric System

Metric units

Linear measures (length)

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

Square measures (area)

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

Cubic measures (volume)

Dry measure

1,000 cubic millimetres (mm^3)	=	1 cubic centimetre (cm^3)
1,000,000 cm^3	=	1 cubic metre (m^3)

Liquid measure

1,000 millilitres (mL)	=	1 litre (L)
100 L	=	1 hectolitre (hL)

Weight-volume equivalents (for water)

(1.00 kg) 1,000 grams	=	1 litre (1.00 L)
(0.50 kg) 500 g	=	500 mL (0.50 L)
(0.10 kg) 100 g	=	100 mL (0.10 L)
(0.01 kg) 10 g	=	10 mL (0.01 L)
(0.001 kg) 1 g	=	1 mL (0.001 L)

Weight measures

1,000 milligrams (mg)	=	1 gram (g)
1,000 g	=	1 kilogram (kg)
1,000 kg	=	1 tonne (t)
1 mg/kg	=	1 part per million (ppm)

Dry liquid equivalents

1 cm^3	=	1 mL
1 m^3	=	1000 L

Metric conversions (Approximate)

5 mL	=	1 tsp
15 mL	=	1 tbsp
28.5 mL	=	1 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. pins 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**
50	=	5
100	=	10
150	=	15
200	=	20
250	=	25
300	=	30

Dry weight conversions (Approximate)

grams/hectare		**ounces/acre**
100 grams	=	1 ½ ounces
200 grams	=	3 ounces
300 grams	=	4 ¼ ounces
500 grams	=	7 ounces
700 grams	=	10 ounces
kilograms/hectare		**pounds/acre**
1.10 kilograms	=	1 pound
1.50 kilograms	=	1 ¼ pounds
2.00 kilograms	=	1 ¾ pounds
2.50 kilograms	=	2 ¼ pounds
3.25 kilograms	=	3 pounds
4.00 kilograms	=	3 ½ pounds
5.00 kilograms	=	4 ½ pounds
6.00 kilograms	=	5 ¼ pounds
7.50 kilograms	=	6 ¾ pounds
9.00 kilograms	=	8 pounds
11.00 kilograms	=	10 pounds
13.00 kilograms	=	11 ½ pounds
15.00 kilograms	=	13 ½ pounds

Conversion Tables — Metric to Imperial (Approximate)

Length

1 millimetre (mm)	=	0.04 inch
1 centimetre (cm)	=	0.40 inch
1 metre (m)	=	39.40 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)	=	1.20 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
1 litre (L)	=	1.76 pints
1 litre (L)	=	0.88 quart
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)	=	1.10 short tons
1 tonne (t)	=	2,205 pounds

Pressure

1 kilopascal (kPa)	=	0.15 pounds/in^2

Speed

1 metre per second	=	3.28 feet per second
1 metre per second	=	2.24 miles per hour
1 kilometre per hour	=	0.62 mile per hour

Temperature

°F	=	(°C × 9/5) + 32

Conversion Tables — Imperial to Metric (Approximate)

Length

1 inch	=	2.54 cm
1 foot	=	0.30 m
1 yard	=	0.91 m
1 mile	=	1.61 km

Area

1 square foot	=	0.09 m^2
1 square yard	=	0.84 m^2
1 acre	=	0.40 ha

Volume (dry)

1 cubic yard	=	0.76 m^3
1 bushel	=	36.37 L

Volume (liquid)

1 fluid ounce (Imp.)	=	28.41 mL
1 pint (Imp.)	=	0.57 L
1 gallon (Imp.)	=	4.55 L
1 gallon (U.S.)	=	3.79 L

Weight

1 ounce	=	28.35 g
1 pound	=	453.6 g
1 ton	=	0.91 tonne

Pressure

1 pound per square inch	=	6.90 kPa

Temperature

°C	=	(°F – 32) × 5/9

Abbreviations

% = per cent (by weight)
ai = active ingredient
AP = agricultural powder
cm = centimetre
cm^2 = square centimetre
DG = dispersible granular
DP = dispersible powder
E = emulsifiable
e.g. = for example
EC = emulsifiable concentrate
F = flowable
g = gram
Gr = granules, granular
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
SC = sprayable concentrate
SP = soluble powder
t = tonne
W = wettable (powder)
WDG = water dispersible granular
WP = wettable powder
km/h = kilometres per hour

Emergency and First-Aid Procedures for Pesticide Poisoning

For a major spill, a theft or a fire involving a pesticide call the Ministry of the Environment at **1-800-268-6060.**

For pesticide poisonings and pesticide injuries call the Poison Information Centre:

Toronto 1-800-268-9017
1-877-750-2233 (TTY)

PREVENT ACCIDENTS

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

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

IF AN ACCIDENT OR POISONING HAPPENS

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

FIRST AID

If a pesticide comes in contact with skin:

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

If pesticide comes in contact with eyes:

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

If pesticide was inhaled:

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

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

If a pesticide was swallowed:

- **call the Poison Information Centre IMMEDIATELY.**

Emergency numbers are listed at the front of each Bell telephone directory.

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