



PROTECTION GUIDE FOR TURFGRASS

2017

Publication 384

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

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

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

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

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

The Pesticide Label

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

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

Registration of Pesticide Products

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

1. Full Registration

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

2. Conditional Registration

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

3. Emergency Registration

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

Maximum Residue Limits

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

Supplemental Labels

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

Examples of when you must use a supplemental label include:

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

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

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

Regulation of Pesticides in Ontario

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

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

Classification of Pesticides

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

Certification and Licensing

Growers and Their Assistants

For information about certification for growers and training for assistants, check the Ontario Pesticide Education Program website: www.o pep.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.

3. Crop Protection: Weeds

Herbicides, soil fumigant and growth regulators registered for use on sod farms, golf courses and other excepted uses are listed in Table 3-1.

Class 11 herbicide active ingredients allowed for cosmetic uses on turfgrass are listed in Table 3-2.

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

Selective post-emergence silvery thread moss, moss and algae control recommendations are listed in Table 3-4.

Herbicides registered for turfgrass renovation are listed in Table 3-5.

Primo MAXX application rates are listed in Table 3-6.

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, see OMAFRA Publication 845, *Integrated Pest Management for Turf*.

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.

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 OMAFRA/Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application* and the Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos *How to Manage Spray Drift* and *Spray Drift Reduction Through Air Induction*.

Table 3–1. Herbicides, soil fumigant and growth regulators registered for use on sod farms, golf courses and other excepted uses

LEGEND:		ai: active ingredient	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	
Trade name (alphabetically in each group)	Classification	Common name	LD₅₀ (mg ai/kg)¹	Chemical family	
Acclaim Super	3	fenoxaprop-ethyl	335	aryloxyphenoxypropionate	
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)	650	phenoxy	
		2,4-D/dicamba	650/1,040	phenoxy/benzoic acid	
		2,4-D/mecoprop	650/930	phenoxy/phenoxy	
		2,4-D/mecoprop/dicamba	650/930/1,040	phenoxy/phenoxy/benzoic acid	
Etho SC Herbicide	3	ethofumesate	>2,100	benzofuran	
Fiesta	4	iron (present as FeHEDTA)	>5,000	metal salt of polyamino carboxylic acid	
Gramoxone	3	paraquat	157–207	bipyridylum	
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	
Moss-Aside Moss Killer	4	potassium salts of fatty acids	>5,000	salts of carboxylic acids	
Primo MAXX	4	trinexapac-ethyl	5,050	cyclopropyl derivative of cyclohexenone	
Quali-Pro Trinexapac 11.3	4	trinexapac-ethyl	5,050	cyclopropyl 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	
WeedOut Ultra Professional	3	4-chloroindole-3-acetic acid, present as potassium salt	>5,000	plant hormone	
ZeroTol	3	hydrogen peroxide	1,410	not classified	

¹ The relative toxicity may be referred to as its LD₅₀. The higher the LD₅₀ figure, the less toxic the product is to humans. Products with low LD₅₀ ratings are highly toxic. No products registered for turf have a high acute toxicity.

Table 3-2. Class 11 herbicide active ingredients allowed for cosmetic uses on turfgrass

Active Ingredient	Classification	Uses
4-chloroindole-3-acetic acid, present as potassium salt	3	Check label for specific uses and follow the label directions.
acetic acid	4, 5	
citric acid/lactic acid	4	
corn gluten meal	4, 5	
fatty acid	5, 6	
horticultural vinegar	4	
iron (present as FeHEDTA)	4	
hydrogen peroxide	3	
potassium salts of fatty acids	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 the MOECC website at ontario.ca/pesticideban for the list of pesticides for cosmetic uses.

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

LEGEND: GR: granules SC: soluble concentrate SP: soluble packet WP: wettable powder			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label. See label for complete information.
Site preparation before turfgrass establishment			
glyphosate (0.27–4.32 kg/ha)	glyphosate (360 g/L) (many manufacturers)	0.75–12 L/ha (0.3–4.8 L/acre)	<p>Apply in 200–300 L/ha (80–120 L/acre) water.</p> <p>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.</p> <p>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.</p> <p>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 (4.75–7 L/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.</p> <p>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.</p>

Table 3–3. Herbicides registered for use on sod farms, golf courses and other excepted uses

LEGEND: GR: granules SC: soluble concentrate SP: soluble packet WP: wettable powder			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label. See label for complete information.
Pre-emergence grass herbicides			
bensulide (11–14.4 kg/ha)	Betasan (480 g/L)	23–30 L/ha (9.2–12 L/acre)	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 (11.625 kg/ha)	Dacthal W-75 (75 WP)	15.5 kg/ha (6.2 kg/acre)	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 (see label)	many manufacturers	970–980 kg/ha (388–392 kg/acre)	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 2 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 (0.42 kg/ha)	Dimension (120 g/L)	3.5 L/ha (1.4 L/acre)	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 hr or reseed for 3 months. May be tank-mixed with Killex or other broadleaf herbicides. Do not tank-mix with other products for greens.
ethofumesate (1.5–4.0 kg)	Etho SC Herbicide (480 g/L)	3.2–8.25 L/ha (1.3–3.34 L/acre)	Residual control of annual bluegrass is dependent on soil moisture conditions and soil texture. The activity in the soil is reduced as the soil texture becomes finer and soil organic matter content increases. Apply in 110–560 L/ha (44–224 L/acre) water. Apply to soil using low-pressure ground spray equipment. Do not use smaller than 50-mesh strainer and never less than an 8002E nozzle orifice. To obtain consistent annual bluegrass control, 2 applications may be required, with the first application made prior to seeding and the second made 6 weeks after seeding. Kentucky bluegrass, perennial ryegrass and Italian ryegrass have been shown to be tolerant to this herbicide. Other turfgrass species may vary in their tolerance to herbicides, including this herbicide. Since not all turfgrass species have been tested for tolerance to Etho SC Herbicide, first use should be limited to a small area of each species to confirm their tolerance prior to adoption as a general field practice. Consult your seed supplier for information on the tolerance of specific species of turfgrass to this herbicide.

Table 3–3. Herbicides registered for use on sod farms, golf courses and other excepted uses

LEGEND: GR: granules SC: soluble concentrate SP: soluble packet WP: wettable powder			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label. See label for complete information.
Post-emergence grass herbicides			
bispyribac (See below for rates for individual programs.)	Velocity (SP) 76.1% (water soluble packets of 56.7 g)	See below for coverage per packet.	Programs 1–4, Kentucky bluegrass and tall fescue: Do not use before May 15 or after October 15. Do not apply unless daily high temperature reaches 21°C. Do not apply if freezing air temperatures are predicted within 3 days of application. Do not apply more than 185 g/ha (74 g/acre) within 28 days, or more than 370.8 g/ha/season (148.3 g/acre). Do not apply more than 140 g/ha (92.3 g/acre) per application. Do not re-treat if turf shows undesirable chlorosis. Will suppress dandelion and white clover populations. Can substantially suppress the development and severity of dollar spot on bentgrass fairways and tees.
bispyribac (16–31 g/ha)		1 packet/ 0.915–1.83 ha (2.25–4.5 acres)	Program 1: Creeping bentgrass and perennial ryegrass (fairways and tees mowed at 0.9–1.9 cm. Sod mowed at 1.3–1.9 cm.). Apply on a 21–28-day interval. This management program should be considered as a long-term and slow removal of annual bluegrass. Make applications during times of active turfgrass growth. Use the lower rate and wider application interval for the slowest conversion.
bispyribac (16–31 g/ha)		1 packet/ 0.915–1.83 ha (2.25–4.5 acres)	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 2 applications in late spring or early summer on a 14-day interval after annual bluegrass germination has begun. Apply 2 additional applications in the late summer or early fall (October 15) on a 14-day interval when turf is aggressively growing.
bispyribac (31 g/ha)		1 packet/1.83 ha (4.5 acres)	Program 3: Creeping bentgrass and perennial ryegrass. Apply on a 5–10-day interval. Continue until the desired level of control of annual bluegrass is achieved. This program should be considered for turf where complete removal of annual bluegrass is acceptable.
bispyribac (93 g/ha)		1 packet/0.61 ha (1.5 acres)	Program 4: 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 infestations of annual bluegrass, where removal of these weeds would not result in an unacceptable stand of turf.
bispyribac (16–31 g/ha)		1 packet/ 0.915–1.83 ha (2.25–4.5 acres)	Kentucky bluegrass and tall fescue (sod farms and golf courses) Apply on a 7–14-day interval. Begin applications early in the recommended use season 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 (0.42–0.54 kg/ha)	Dimension (120 g/L)	3.5–4.5 L/ha (1.4–1.8 L/acre)	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 (80–320 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 hr of application. Do not reseed for 3 months. May be tank-mixed with Killlex or other broadleaf herbicides. Do not tank-mix with other products for greens.
fenoxaprop-p-ethyl (0.092 kg/ha)	Acclaim Super (80.5 g/L)	1.14 L/ha (0.46 L/acre)	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 hr.

Table 3–3. Herbicides registered for use on sod farms, golf courses and other excepted uses

LEGEND: GR: granules SC: soluble concentrate SP: soluble packet WP: wettable powder			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label. See label for complete information.
Pre-emergence broadleaf weed control sod (production only) up to 2-leaf weed stage			
mesotrione (0.144 kg/ha)	Callisto 480 SC	0.3 L/ha (0.12 L/acre)	<p>Weeds controlled: Lamb's-quarters, redroot pigweed, velvet leaf, wild mustard, common ragweed (suppression only)</p> <p>Make only 1 application per year.</p> <p>Apply pre-emergence to weeds:</p> <ul style="list-style-type: none"> • in established sod • prior to or post-seeding and prior to emergence of weeds • post-emergence to weeds (regardless of whether prior to or post-seeding)
Post-emergence broadleaf weed control sod (production only) 3-8 leaf stage			
mesotrione (0.118 kg/ha)	Callisto 480 SC	0.21 L/ha (0.084 L/acre)	<p>Weeds controlled: Eastern black nightshade, redroot pigweed, velvet leaf, wild mustard, common ragweed (suppression only).</p> <p>Apply in 250 L/ha (100 L/acre) of water.</p> <p>Do not apply to creeping bentgrass.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>

Table 3–3. Herbicides registered for use on sod farms, golf courses and other excepted uses

LEGEND: GR: granules SC: soluble concentrate SP: soluble packet WP: wettable powder			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label. See label for complete information.
Non-selective soil fumigant for the control of soil-borne nematodes, soil fungi and germinating weed seeds, suitable for fumigation on turf seedbeds			
dazomet (315.25–485 kg/ha)	Basamid (Granular)	325–500 kg/ha (130–200 kg/acre)	<p>Soil preparation before treatment:</p> <p>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.</p> <p>Incorporation:</p> <p>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.</p> <p>Sealing of treated soil:</p> <p>As soon as possible after incorporation, seal the soil to retain the maximum concentration of gases in the soil. This can be done by:</p> <ul style="list-style-type: none"> • 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 100,000 L/ha (40,000 L/acre). 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. <p>Aeration of soil:</p> <p>All traces of toxic gases must disappear from the treated soil before planting or sowing, otherwise plant damage or death may result.</p> <p>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).</p> <p>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.</p> <p>When temperatures are below 6°C, do not use this product.</p> <p>Waiting period:</p> <p>The interval between treatment and planting depends on the temperature, moisture and structure of the soil. See waiting period chart on product label.</p>

Table 3–3. Herbicides registered for use on sod farms, golf courses and other excepted uses

LEGEND: GR: granules SC: soluble concentrate SP: soluble packet WP: wettable powder			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label. See label for complete information.
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			
acetic acid	(many manufacturers)	Dilution rate: <i>Early-season annual weed control:</i> 1 L of product for 3 L of water <i>Larger annual weeds and top growth reduction (suppression) of perennial weeds:</i> 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.
Selective post-emergence broadleaf herbicides			
2,4-D (0.8–1.4 kg/ha)	2,4-D (470 g/L) (many manufacturers and formulations)	1.7–3 L/ha (0.68–1.2 L/acre)	Damage may occur when applied to bentgrass. If used on bentgrass, apply at 0.28 kg/ha (0.11 kg/acre).
2,4-D (0.8–1.1 kg/ha) + Mecoprop (150 g/L)	2,4-D (470 g/L) plus Mecoprop (150 g/L)	1.8–2.3 L/ha (0.7–0.9 L/acre) plus 5.7–7.3 L/ha (2.3–2.9 L/acre)	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 (0.16–0.24 kg in 320 L water/acre)) or mecoprop (0.4–0.6 kg in 400 L water/ha (0.16–0.24 kg in 160 L water/acre)) for annual weeds.
2,4-D/mecoprop (2 kg/ha)	2,4-D/mecoprop ([1:1]) 400 g/L (many manufacturers)	4.25–5.5 L/ha (1.7–2.2 L/acre)	
2,4-D/dicamba/mecoprop (1.7 kg/ha)	Killex (308 g/L) Premium 3-Way Turf Herbicide (308 g/L) Par III (308 g/L) Tri-Kill (308 g/L) Trillion (308 g/L) (many manufacturers)	5.5 L/ha (2.2 L/acre)	In closely mowed bentgrass (greens), apply at half doses (3 L/ha (1.2 L/acre)). 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 (0.17 kg/acre) (active). Do not mow grass 3–5 days before and after application. Do not treat until turf is well established.
4-chloroindole-3-acetic acid, present as a potassium salt	WeedOut Ultra Professional (45 g/L)	Dilution rate: Mix 1 part product with 9 parts water.	For spot treatment only. Treat broadleaf weeds in lawns and turf (on right-of-ways, non-crop areas, golf courses, sod production, parks, cemeteries and athletic fields) when weeds are actively growing. Avoid over-applying to the point of runoff. Do not apply to drought-stressed turf or newly seeded grass. Do not apply in very hot or rainy weather, or if rainfall is forecast within the next 2–4 hr. Do not water for 2 hr after application. For more resistant weeds, re-apply after 4–6 weeks. Grass that is accidentally treated may temporarily become brown but will recover.

Table 3–3. Herbicides registered for use on sod farms, golf courses and other excepted uses

LEGEND: GR: granules SC: soluble concentrate SP: soluble packet WP: wettable powder			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label. See label for complete information.
Selective post-emergence broadleaf herbicides — continued			
bentazon (0.84 kg/ha)	Basagran (480 g/L)	1.75 L/ha (0.7 L/acre)	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.
	plus oil concentrate Assist	2 L/ha (0.8 L/acre)	
citric acid/ lactic acid	Kona	Dilution rate: <i>Broadcast applications:</i> Mix 25% product with 3% surfactant and 72% water. <i>Spot treatment:</i> Mix 50% product with 3% surfactant and 47% water. Application rate: 200 mL/m ²	Targeted weeds: birds-foot treefoil, white clover, red clover, black medick and yellow wood-sorrel. 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.
dicamba (0.6 kg/ha)	Vanquish (480 g/L)	1.25 L/ha (0.5 L/acre)	Apply alone or as a tank-mix in at least 110 L of water/ha (44 L of water/acre) 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 hr after application. For control of a broader range of weeds, the recommended rate may be tank-mixed with 2.2 L/ha (0.88 L/acre) of 2,4-D amine (500 g/L) or 2 L/ha (0.8 L/acre) of 2,4-D ester (600 g/L) herbicide.
iron (present as FeHEDTA (4.43%))	Fiesta	Dilution rate: 40 mL of product to 960 mL of water Application rate: <i>Easy-to-control weeds:</i> 100 mL/m ² <i>Moderately difficult-to-control weeds:</i> 200 mL/m ² <i>Tough-to-control perennial weeds:</i> 400 mL/m ²	Uniform coverage is important. Repeat treatment every 3–4 weeks, if necessary, up to a maximum of 4 applications/area/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, 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.

Table 3–3. Herbicides registered for use on sod farms, golf courses and other excepted uses

LEGEND: GR: granules SC: soluble concentrate SP: soluble packet WP: wettable powder			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label. See label for complete information.
Selective post-emergence broadleaf herbicides — continued			
MCPA (1.1–1.4 kg/ha)	MCPA Amine (500 g/L)	2.2–2.8 L/ha (0.88–1.12 L/acre)	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 (0.1 kg/acre). 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 0.83–1.28 kg/ha	Compitox (150 g/L)	5.5–8.5 L/ha (2.2–3.4 L/acre)	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.
	Mecoprop (150 g/L)		

Table 3–4. Selective post-emergence silvery thread moss, moss and algae control

LEGEND: GR: granules SC: soluble concentrate SP: soluble packet WP: wettable powder			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label. See label for complete information.
carfentrazone (0.109 kg/ha)	QuickSilver	As a stand-alone product: 0.490 L/ha (0.198 L/acre)	<p>For control of silvery thread moss on 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 2 weeks. Do not exceed 440 g/ha (176 g/acre) per year. Use a non-ionic surfactant such as 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.</p> <p>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. <i>Poa annua</i> may be damaged at rates greater than 0.15 L/ha.</p> <p>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.</p> <p>Cultural practices that favour the establishment of healthy bentgrass will also help displace moss that is suppressed by QuickSilver treatment.</p>
carfentrazone (0.033–0.109 kg/ha)		Control over longer periods: 0.146–0.490 L/ha (0.058–0.198 L/acre)	
potassium salts of fatty acids	Moss-Aside Moss Killer	<p>Dilution rate: 5%–10% solution</p> <p>Dilute concentrate by mixing one part concentrate with 19 parts water (50 mL/L water)</p> <p>Application rate ai: Apply at 50–100 L/100 m²</p> <p>Application rate diluted product: 500–1,000 mL/m² (5,000–10,000 L/ha)</p>	<p>For control of moss and algae on golf courses, lawn turf and cultivated areas.</p> <p>Lawns, Turf and Cultivated Areas: Thoroughly soak moss with dilute solution. For thick moss (greater than 2.5 cm), use up to 2 L/m².</p> <p>Golf Courses: For putting greens, fairways and other areas, apply 500–1,000 mL/m² (5,000–10,000 L/ha).</p> <p>A contact product. For best results, good coverage is essential. Avoid overlapping spray to eliminate risk of damage to turf grasses and ornamentals. If moss is dry, thoroughly wet moss with water before treating. Rinse turf with 5 L/100 m² of water 15–30 minutes after application. Do not irrigate at least 6 hr after treatment. Do not apply to turf if temperature will exceed 30°C. Re-apply every 2 weeks or as required.</p>
hydrogen peroxide	ZeroTol	<p>Application rate: 200 mL in 11–19 L clean water/100 m².</p>	<p>For use on all turf types such as commercial turf, lawns, athletic fields and golf course fairways, greens and tees.</p> <p>Broad spectrum treatment for control of algae and fungi on turf.</p> <p>Drench the soil to saturate the root systems in areas affected. Up to 5 consecutive applications may be used. Optimum treatment time is early morning or late afternoon. For best results, apply immediately after grass has been cut. Applications can be made during wet or rainy weather. Use spray solution the same day it is prepared, do not store and reuse mixed spray solution.</p>

Table 3–5. Herbicides registered for turfgrass renovation

LEGEND: * Various manufacturers			
Active ingredient (rate)	Trade name (formulation)	Product rate	Comments from product label See label for complete information.
paraquat (2.4 kg/ha)	Gramoxone (200 g/L)	12 L/ha (4.8 L/acre)	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* 1.7–2.5 kg/ha	glyphosate (360 g/L)	4.75–7 L/ha (1.9–2.8 L/acre)	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.

Turfgrass Renovation

Mow and thoroughly rake the turf to be renovated to remove all dead and cut vegetation.

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.

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 3 hr 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 1 week. To minimize yellowing and enhance colour, apply readily available nitrogen at 0.1–0.25 kg nitrogen/100 m².

Primo MAXX can be applied every 4 weeks or later as required to actively growing turf at the rates shown in Table 3–6. *Primo MAXX application rates*. It may be applied at one-half rate shown in Table 3–6 when applied every 2 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 3–6 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.

Table 3–6. Primo MAXX application rates**LEGEND:** — Not for use on the turf species or mixture on this site.

Turf type	Sod and golf courses, including rough areas*	Sod and fairways (cut at 1.0–1.9 cm)	Greens**
Creeping bentgrass (<i>Agrostis stolonifera</i> , <i>Agrostis palustris</i>)	—	8.0 mL/100 m ²	4.0 mL/100 m ²
Tall fescue (<i>Festuca arundinacea</i>)	24 mL/100 m ²	—	—
Kentucky bluegrass (<i>Poa pratensis</i>)	19 mL/100 m ²	8.0 mL/100 m ² †	—
Perennial ryegrass (<i>Lolium perenne</i>)	32 mL/100 m ²	16 mL/100 m ² †	—
Mixture – creeping bentgrass, annual bluegrass (<i>Poa annua</i>)	—	8.0 mL/100 m ²	4.0 mL/100 m ²
Mixture – Kentucky bluegrass, tall fescue, perennial ryegrass	24 mL/100 m ²	—	—
Mixture – Kentucky bluegrass, perennial ryegrass, annual bluegrass	—	16 mL/100 m ²	—
Mixture – Kentucky bluegrass, annual bluegrass	—	8.0 mL/100 m ²	—

* 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.

**Primo MAXX has not been tested at the rate of 2.0 mL/100 m². Results may be unsatisfactory.

† About one-third suppression of turf growth can be expected.

Apply Primo MAXX only to the turf species or mixtures on sites for which a rate is shown in Table 3–6. 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 3–6 and apply every 4 weeks or later as needed. For more information on turf herbicides, mode of action and precautions, see OMAFRA Publication 75, *Guide to Weed Control*.