

## Western Committee on Crop Pests Guide to Integrated Control of Insect Pests of Crops

## Insect Management In Turf in Western Canada

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Recommendations for lawns and recreational areas not grazed by livestock.

**Recommendations include both domestic and commercial registered products. Commercial products are available only to agricultural operations (sod farms) or certified applicators. Products listed are representative of currently registered products for turf pests, but are not a comprehensive list. Check with local and provincial regulations on use restrictions or certification requirements before using domestic or commercial products.**

<b>Ants</b>	Hymenoptera: Formicidae
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**Important: Mow the lawn before treatment. Keep off treated lawns until dry.**

**Cultural Control** - Flood ant nests repeatedly to discourage colonization. Maintain adequate irrigation on turf to avoid dry spots that encourage ant nest development.

**Chemical Control** -

Control Product*	Active Ingredient	Rate (g AI/100 m <sup>2</sup> )
Wilson Ant Stakes (Domestic)	borax	Solid bait
Dursban Water Soluble (Commercial), Lorsban 4E, Lorsban NT (Commercial), MPower Chlorpyrifos (Commercial) Pyrate (Commercial), Sharphos (Commercial)	chlorpyrifos	10.8
Deltagard SC (Commercial)	deltamethrin	0.6
Scimitar CS (Commercial) Demand CS (Commercial)	lambda-cyhalothrin	0.37
Doktor Doom House & Garden (Domestic) Wilson Ant Out (Domestic) Prelude 240 (Commercial)	permethrin	0.25% formulation (domestic) - 0.5% solution (commercial)
Trounce Lawn and Turf (Domestic)	potassium salts of fatty acids & pyrethrins	fatty acids – 48-142% pyrethrins – 0.48-1.42%
Ortho Ant-B-Gon Granules (Domestic)	pyrethrins	0.175%
Raid Ant, Roach & Earwig Bug Killer	pyrethrins, piperonyl	pyrethrins 0.1-0.2G%

(Domestic)	butoxide, permethrin	piperonyl butoxide 0.25-0.48% permethrin 0.2%
Blaze Pro Ant Destroyer (Domestic) Doktor Doom Ant Next & Ant Killer (Domestic) Ortho Ant-B-Gon Foam (Domestic)	pyrethrins, N-octyl bicycloheptene dicarboximide, permethrins	pyrethrins 0.05% N-octyl bicycloheptene dicarboximide 0.25% permethrins 0.2%
Insectigone Ant Killer (Domestic) Wilson Ant Killer Dust (Domestic)	silicon dioxide	80-90% powder

**\*Check product label carefully to ensure product can be used on ant hills/nests, lawns or turf. Not all ant control products are approved for use on turf. Many domestic ant control products are registered for use indoors or on exterior surfaces, but are not registered or suitable for use on turf.**

**Control Timing -** Most damage to turf occurs from the adult ants building mounds on lawns. Treat in mid to late summer.

#### **Restrictions -**

- borax: Keep out of reach of children and pets. Place bait in areas not accessible to children or pets. Do not open bait containers.
- chlorpyrifos: Commercial products – Registration of chlorpyrifos has been cancelled. Existing stocks in Canada are being phased-out. The last date of sale by retailers is December 10, 2022. All use of chlorpyrifos must cease by December 10, 2023. Dursban WS and Pyrate only approved for use on sod farms, golf courses, industrial sites and highway medians. Other listed products only approved for use on sod farms. Not for use around residential areas, parks, school grounds or playing areas.
- deltamethrin: Commercial products. Delay irrigation or mowing for 24 hours following application. Do not apply more than 2 times per year. Observe buffer zones listed on product label. Do not allow people or pets to re-enter treated area until product has dried. For sod farms, do not allow worker entry during the 12-hour re-entry interval (REI).
- lambda-cyhalothrin: Commercial product. Maximum of 4 applications per year - spring and late summer. Do not apply when turf is water logged. Delay irrigation or mowing for 2 days after application. Keep children and pets off treated areas until spray has dried. Observe buffer zone distance (up to 120 m) between sensitive freshwater/marine habitats and sprayed areas. Highly toxic to bees.
- permethrin: Domestic products: Apply as spot treatment to ant nests and ant trails. Commercial product: For use only on home or residential lawns. Ant mounds: apply 4-7.5 L of solution to each mound and treat a 1 m diameter circle around mound. Apply in cool conditions (early morning or late evening) for best results.
- potassium salts of fatty acids/pyrethrins: Domestic products. Spray to wet. Repeat 10-14 days later if necessary
- pyrethrins: Domestic product. Apply granules directly to ant nests/mounds dry or dissolved in water.
- pyrethrins, N-octyl bicycloheptene dicarboximide, permethrin: Domestic product. Apply directly to ant hills/nests.
- pyrethrins, piperonyl butoxide, permethrin: Domestic products. Apply directly to ant hills/nests.

silicon dioxide: Domestic products. Apply to ant hills

**Aphodius Beetles (dung beetles)**      *Aphodius* sp.      (Coleoptera: Scarabaeidae)

**Cultural Control -** Regular aeration in conjunction with limited topdressing using manure composts will reduce habitat (thatch) and food for the beetles.

**Chemical Control -** No registered compounds

**Control Timing -** *Aphodius* beetle adults emerge in mid-June, laying eggs which hatch shortly afterwards to grubs. Grubs feed through the summer, pupate in August, and overwinter as adults.

**Black Turfgrass Ataenius**      *Ataenius spretulus*      (Coleoptera: Scarabaeidae)

**Chemical Control -**

Control Product	Active Ingredient	Rate (g AI/100 m <sup>2</sup> )
Scotts Grub-B-Gon Granules (Domestic) grubGONE G (Commercial)	<i>Bacillus thuringiensis</i> <i>ssp galleriae</i>	1.12-1.68 kg of product
Merit (Commercial)	imidacloprid	2.8
Acelepryn (Commercial)	chlorantraniliprole	1.12-1.76

**Control Timing -** Black Turfgrass Ataenius has the same life cycle as *Aphodius* beetles, with adults depositing eggs in May to June. Applications should be made prior to egg hatch of the target pests, followed by sufficient irrigation or rainfall (5 -10 mm) to move the active ingredient through the thatch. Avoid over watering (more than 20 mm).

**Restrictions -**

*Bacillus thuringiensis* *ssp galleriae*: Domestic and commercial products. Avoid applications on steep slopes. Avoid application when heavy rain is forecast. Do not allow re-entry to treated area for four hours or until dusts have settled. Do not apply within 7 days of previous treatment. Do not exceed annual maximum rate of 3.36 kg per 100 m<sup>2</sup>.

imidacloprid: Commercial. Turf and lawn uses of imidacloprid have been cancelled. Existing stocks in Canada are being phased-out. The last date of sale by retailers is May 19, 2023. All use of imidacloprid must cease by May 19, 2024. Avoid mowing until

after irrigation or rainfall has occurred. Do not graze treated areas or use clippings from treated areas for feed or forage. Do not plant any food crop within a year of applying imidacloprid. Do not apply more than once per year. Do not apply within 30m of sensitive aquatic systems or where soils are highly permeable and there is risk for groundwater contamination. Toxic to bees – avoid applications when bees are foraging or during periods when weeds are blooming.

chlorantraniliprole: Commercial. Apply from early April to late September. Do not exceed a total of 2.25 g A.I. per season. Do not retreat within 7 days of initial application. Do not apply within 1 metre of aquatic habitats when using field sprayers.

<b>Chinch Bugs</b>	<i>Blissus leucopterus</i>	Hemiptera: Blissidae
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**Cultural Control -** Minimize drought stressed areas - chinch bugs like dry lawns. Reduce thatch, and do not over fertilize lawns with high nitrogen fertilizers. Remove plant debris in fall to reduce overwintering sites.

**Biological Control -** Chinch bugs are susceptible to predatory bugs, spiders and parasitic wasps.

**Chemical Control -**

<b>Control Products</b>	<b>Active Ingredient</b>	<b>Rate (g AI/100 m<sup>2</sup>)</b>
Bioceres D (Domestic) Wilson Grub Out Chinch Bug and Grub Killer (Domestic) Biotitan GR (Commercial)	<i>Beauvaria bassiana</i> strain ANT-03	1-2 kg of product
Acelypryn (Commercial)	chlorantraniliprole	1.16-2.25
Dursban Water Soluble (Commercial), Lorsban 4E, Lorsban NT (Commercial), MPower Chlorpyrifos (Commercial), Pyrate (Commercial), Sharphos (Commercial)	chlorpyrifos	10.8
Arena (Commercial)	clothianidin	1.75-2.5
Ference (Commercial)	cyantraniliprole	1.17-2.33
Deltagard SC (Commercial)	deltamethrin	0.6
Met52 EC Bioinsecticide (Commercial)	<i>Metarhizium anisopliae</i> Strain F52	7-10.6
Trounce Lawn & Turf	potassium salts of fatty acids &	fatty acids – 48-142%

Insecticide (Domestic)	pyrethrins	pyrethrins – 0.48-1.42%
Tetrino (Commercial)	tetraniliprole	0.5-1.0

**Control Timing -** Adults overwinter and lay eggs in the spring. Nymphs and adults suck on sap from grass blades throughout the summer, when control efforts should be undertaken.

**Restrictions -**

- Beauveria bassiana* strain ANT-03: Domestic and Commercial products. Provides reduction of populations. Do not apply in hot weather or during mid-day. Avoid application to moderate or steep slopes, areas with compacted soil or clay. Avoid application when heavy rain is forecast. Do not contaminate irrigation or drinking water supplies, or aquatic habitats. May be harmful to beneficial insects and bees – avoid applications to blooming plants or weeds. If application must be made during blooming weeds, apply in evening when activity of most bees is reduced.
- chlorantraniliprole: Commercial product – suppression only. Apply before egg hatch. Do not apply directly to water bodies, or contaminate irrigation or drinking water supplies or aquatic habitats.
- chlorpyrifos: Commercial products – Registration of chlorpyrifos has been cancelled. Existing stocks in Canada are being phased-out. The last date of sale by retailers is December 10, 2022. All use of chlorpyrifos must cease by December 10, 2023. Dursban WS and Pyrate only registered for use on sod farms, golf courses, industrial sites and highway medians. Other listed products only registered for use on sod farms. Not for use around residential areas, parks or playing areas.
- clothianidin: Commercial products. Observe buffer zones on label for sensitive terrestrial, freshwater and marine habitats. Do not make more than one application per season. Apply when insect populations reach damaging thresholds.
- cyantraniliprole: Commercial product – suppression only. Apply before egg hatch. Avoid application to moderate or steep slopes, areas with compacted soil or clay. Avoid application when heavy rain is forecast. Observe buffer zones listed on product label. Toxic to bees – avoid applications when bees are foraging or during periods when weeds are blooming.
- deltamethrin: Commercial products. Delay irrigation or mowing for 24 hours following application. Do not apply more than 2 times per year. Observe buffer zones listed on product label. Do not allow people or pets to re-enter treated area until product has dried. For sod farms, do not allow worker entry during the 12-hour re-entry interval (REI).
- Metarhizium anisopliae* Strain F52: Commercial products. Spray to wet foliage but avoid runoff. Reapply at four-week intervals if necessary.
- potassium salts of fatty acids/pyrethrins: Domestic products. Spray to wet. Repeat 10-14 days if necessary
- tetraniliprole: Commercial. Apply when chinch bugs first observed. Toxic to bees – manage flowering weeds for 10 days following treatment by mowing or herbicide

treatment. Do not reapply within 4 weeks of initial treatment. Maximum annual application rate of 2 g AI/100 m<sup>2</sup>.

<b>Crane Fly Larvae (Leatherjackets)</b>	<i>Tipula paludosa</i>	Diptera: Tipulidae
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**Cultural Control -** Reduce thatch layer, reduce irrigation in early fall when larvae are more susceptible to drought. Avoid overwatering and ensure irrigation systems are not leaking and creating continually moist soil conditions favourable for crane flies.

**Chemical Control -**

Control Product	Active Ingredient	Rate (g AI/100 m <sup>2</sup> )
Acelepryn (Commercial)	chlorantraniliprole	1.12-2.25
Dursban Water Soluble (Commercial), Lorsban 4E, Lorsban NT (Commercial) MPower Chlorpyrifos (Commercial), Sharphos (Commercial) Pyrate (Commercial)	chlorpyrifos	9.6 – 12
Arena (Commercial)	clothianidin	2.75
Ference (Commercial)	cyantraniliprole	1.17-2.34
Merit (Commercial)	imidacloprid	2.8

**Control Timing -** Adults emerge during the summer and lay eggs. Larvae hatch from the eggs in late summer and overwinter as larvae. Most turf damage occurs in late fall and early spring. Control is most effective in late fall.

**Restrictions -**

chlorantraniliprole: Commercial products. Apply from early April to late September. Do not exceed 2.25 g ai/100 m<sup>2</sup> per season. Do not apply within one metre of aquatic habitats when using field sprayers. Chlorantraniliprole is persistent, may carryover, and may result in contamination of groundwater.

chlorpyrifos: Commercial products. Registration of chlorpyrifos has been cancelled. Existing stocks in Canada are being phased-out. The last date of sale by retailers is December 10, 2022. All use of chlorpyrifos must cease by December 10, 2023. Dursban WS and Pyrate approved for use on sod farms, golf courses, industrial sites and highway medians. Other listed products only registered for use on sod farms. Not for use around residential areas, parks or playing areas. Apply as drenching spray in water in late fall after the flight of adult crane flies has ceased

- for the year.
- clothianidin Commercial products. Apply in the spring, when larvae are mature but prior to pupation or in the fall prior to egg hatch. Only apply when populations reach damaging thresholds. Clothianidin is persistent, may carryover, and may contaminate groundwater. For use only on golf courses and sod farms. Observe re-entry periods for golf courses (after spray has dried) or sod farms (12 hours). Toxic to bees – avoid applications when bees are foraging or during periods when weeds are blooming.
- cyantraniliprole: Commercial product. Apply when overwintered adult crane flies are first observed and in mid-summer/fall to control the fall generation. Only registered for golf course and sod farm sites, not residential lawns, playing fields or cemeteries. Avoid application to moderate or steep slopes, areas with compacted soil or clay. Avoid application when heavy rain is forecast. Observe buffer zones listed on product label. Toxic to bees – avoid applications when bees are foraging or during periods when weeds are blooming. Do not exceed 4.5 g ai/100 m<sup>2</sup> year.
- imidacloprid: Commercial products. Turf and lawn uses of imidacloprid have been cancelled. Existing stocks in Canada are being phased-out. The last date of sale by retailers is May 19, 2023. All use of imidacloprid must cease by May 19, 2024. Suppression only. Application timing should commence when adults take flight and begin laying eggs in August and September. Do not graze treated areas or use clippings from treated areas for feed or forage. Do not plant any food crop within a year of applying imidacloprid. Do not apply more than once per year. Do not apply within 30m of sensitive aquatic systems or where soils are highly permeable and there is risk for groundwater contamination. Toxic to bees – avoid applications when bees are foraging or during periods when weeds are blooming.

<b>Glassy Cutworm</b>	<i>Apamea devastator</i>	Lepidoptera: Noctuidae
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**Biological Control -** Numerous predators (ground beetles) and parasites (wasps and flies) can affect populations of glassy cutworm, but the level of control can vary from year to year and location to location.

**Chemical Control -**

Control Product	Active Ingredient	Rate (g AI/100 m <sup>2</sup> )
Dursban Water Soluble (Commercial) Lorsban 4E, Lorsban NT (Commercial), MPower Chlorpyrifos (Commercial), Sharphos (Commercial), Pyrate (Commercial)	chlorpyrifos	10.8
Deltagard SC (Commercial)	deltamethrin	0.6

**Control Timing -** Adults lay eggs in August, hatching shortly after, with the larvae feeding on host plants throughout the fall, overwintering and resuming feeding in the spring. Pupation occurs in mid-summer. Control efforts should be focused during the fall and early spring.

**Restrictions -**

chlorpyrifos: Commercial products – Registration of chlorpyrifos has been cancelled. Existing stocks in Canada are being phased-out. The last date of sale by retailers is December 10, 2022. All use of chlorpyrifos must cease by December 10, 2023. Dursban WS and Pyrate only registered for use on sod farms, golf courses, industrial sites and highway medians. Other listed products only registered for use on sod farms. Not for use around residential areas, parks or playing areas. Do not water or mow for 12-24 hours after treatment. Maximum of two applications per season.

deltamethrin: Commercial products. Delay irrigation or mowing for 24 hours following application. Do not apply more than 2 times per year. Observe buffer zones listed on product label. Do not allow people or pets to re-enter treated area until product has dried. For sod farms, do not allow worker entry during the 12 hour re-entry interval (REI).

<b>Slugs, Snails</b>	Mollusca: Gastropoda
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**Cultural Control -** Hand picking is effective on small populations. Placing a wooden board adjacent to the lawn will provide a shelter for slugs on the underside of the board to protect themselves from the sun. Check boards daily.

**Biological Control -** Slugs and snails have numerous natural enemies such as toads, snakes, ground beetles, wild birds and ducks.

**Chemical Control -**

Control Product	Active Ingredient	Rate (g AI/100 m <sup>2</sup> )
Safer's Slug & Snail Bait (Commercial)	ferric sodium EDTA	12
Sluggo Professional Slug & Snail Bait (Commercial) Ferramol (Commercial)	ferric phosphate	0.34-1.25

**Control Timing -** Slugs and snails have various life cycles depending on the species, and overwinter in all life stages. Control efforts should be focused when most plant damage occurs - when plant growth is tender and there is adequate moisture in the



surrounding soil and vegetation for the slugs and snails to successfully propagate and survive. Apply in evening when slugs are active.

**Restrictions -**

- ferric sodium EDTA: Commercial product. Do not contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.
- ferric phosphate: Commercial product. Do not contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes. This product may be toxic to fish and other aquatic organisms. Avoid contamination of fish-bearing waters. Avoid applications to areas with moderate or steep slopes, compacted soil or clay. Avoid application when heavy rain is forecast.

**Note:** While there are several domestic products approved for use against slugs and snails for flower and vegetable gardens, none are registered for use directly on turf. Some labels specifically state: “Application is permitted only to non-turf areas”.

<b>Sod Webworm</b>	<i>Parapediasia sp &amp; Pediasia sp.</i>	Lepidoptera: Crambidae
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**Cultural Control -** Fertilize and water. Damage can be outgrown by a healthy, vigorous stand of turf. Considerable damage may occur if irrigation is not applied during periods of drought, or close mowing is used.

**Biological Control -** No commercial products are available for biological control of sod webworm, but predaceous birds, ground beetles and rove beetles can have an influence on sod webworm populations. Parasites such as parasitic wasps, microsporidia and fungal diseases can also impact populations.

**Chemical Control -**

Control Product	Active Ingredient	Rate (g AI/100 m <sup>2</sup> )
Dursban Water Soluble (Commercial) Lorsban 4E, Lorsban NT (Commercial) MPOWER Chlorpyrifos (Commercial) Pyrate (Commercial) Sharphos (Commercial)	chlorpyrifos	10.8
Deltagard SC (Commercial)	deltamethrin	0.6
Conserve 120 SC (Commercial) Conserve 480 SC (Commercial)	spinosad	0.12 - 0.24 0.24-0.48
Conserve 120 SC Naturalyte (Domestic)	spinosad	0.24-0.48

**Control Timing -** Sod webworms have four life stages, with the pupal stage being the overwintering stage. Adults emerge in early spring, laying eggs which hatch

about a week later. Control efforts should focus on the early larval stages (about 2-3 weeks after peak adult flight), which is the stage most vulnerable to insecticides.

### Restrictions –

- chlorpyrifos: Commercial product. Registration of chlorpyrifos has been cancelled. Existing stocks in Canada are being phased-out. The last date of sale by retailers is December 10, 2022. All uses of chlorpyrifos must cease by December 10, 2023. Dursban WS and Pyrate registered for use on sod farms, golf courses, industrial sites and highway medians. Other listed products only registered for use on sod farms. Not for use around residential areas, parks or playing areas. Do not water or mow for 12-24 hours after treatment.
- deltamethrin: Commercial products. Delay irrigation or mowing for 24 hours following application. Do not apply more than 2 times per year. Toxic to aquatic organisms. Observe buffer zones listed on product label. Avoid applications to areas with moderate or steep slopes, compacted soil or clay. Avoid application when heavy rain is forecast. Do not allow people or pets to re-enter treated area until product has dried. For sod farms, do not allow worker entry during the 12-hour re-entry interval (REI).
- spinosad: Domestic and commercial products. Do not water or mow for 12-24 hours after application. Do not reapply within less than 7 days. Do not apply more than 4 times/year. Do not apply immediately after a rainfall or if rain is forecast within 48 hours. Highly toxic to bees and aquatic invertebrates. Avoid applications when bees are foraging or during periods when weeds are blooming. Do not contaminate aquatic habitats.

<b>Ticks</b>	<b>Acari: Ixodida</b>
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Ticks (including blacklegged ticks – *Ixodes scapularis*, western blacklegged tick – *Ixodes pacificus* and Rocky Mountain wood tick – *Dermacentor andersoni*)

**Cultural Control** – Reduce tick habitat by clearing leaves, brush, tall grasses, woodpiles, and stone fences from around the house and the edges of yards or gardens. This may help reduce ticks and the rodents that the ticks depend on. Avoid tick attachment by wearing long sleeved shirts and long pants in areas where ticks may be present. Check outdoor pets (dogs and cats) regularly for ticks after they have been outside.

**Biological Control** – Some birds and parasitic wasps are known to feed on or attack ticks. Research has been conducted on nematodes, bacterial and fungal biocontrol agents but limitations on product application and their uptake by ticks has not yet been resolved that would support commercial purposes.

### Chemical Control -

Control Product	Active Ingredient	Rate (g AI/100 m <sup>2</sup> )
Deltagard SC (Commercial)	deltamethrin	0.6

**Control timing** Ticks have four life stages: egg, larva, nymph and adult. The larval and nymph stages occur in the spring and summer when they are host seeking small and medium mammals and ground dwelling birds. The adult stage occurs in the fall and seeks large mammals for hosts. Control efforts on turf areas should focus on the larval and nymphal stages in the spring and summer when the ticks are more susceptible.

**Restrictions –**

deltamethrin: Commercial products. Delay irrigation or mowing for 24 hours following application. Do not apply more than 2 times per year. Observe buffer zones listed on product label. Do not allow people or pets to re-enter treated area until product has dried. For sod farms, do not allow worker entry during the 12-hour re-entry interval (REI).

<b>White Grub</b>	Coleoptera: Scarabaeidae
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White grub (including Japanese Beetle and European Chafer) (*Popillia japonica* & *Amphimallon majalis*)

**Cultural Control -** Maintaining a healthy lawn by proper cutting, fertilization, and irrigation makes the lawn less attractive to egg-laying females, who are attracted to bare spots and thin areas of the lawn. It also makes the lawn less susceptible to the damage caused by grub feeding activities.

**Biological Control -** White grubs are susceptible to numerous agents, including viruses, bacteria, fungi, parasitic nematodes, mites, wasps and flies, and vertebrate predators such as birds and skunks. Vertebrate predators can cause extensive damage to turf while rooting for the grubs. Nematodes can be purchased to help manage white grubs in lawns. Lawn Guardian is a product consisting of two native species of nematodes, purchased as a nematode paste that is mixed with water and sprayed onto the lawn to manage grubs.

**Chemical Control -**

Control Product	Active Ingredient	Rate (g AI/100 m <sup>2</sup> )
Grubhalt G (Domestic) Scotts Grub-B-Gon (Domestic)	<i>Bacillus thuringiensis ssp galleriae</i>	1.12-1.68 kg of product
Acelepryn (Commercial)	chlorantraniliprole	1.12 - 1.76
Arena (Commercial)	clothianidin	1.25-2.5
Ference (Commercial)	cyantraniliprole	1.17-2.34

Merit (Commercial)	imidacloprid	2.8
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**Control Timing -** European Chafer has a one-year life cycle, with eggs being laid in August. Larvae (grubs) hatch and feed through the fall and spring. Pupation occurs in late spring, with adults emerging in late May. Control efforts should be focused during active feeding periods in late fall and early spring.

Japanese beetles have a one-year life cycle. In the lower mainland of BC, the optimal application time is mid-July to mid-August when the early larval instars are present.

**Restrictions -**

*Bacillus thuringiensis ssp galleriae*: Domestic products. Avoid applications on steep slopes. Avoid application when heavy rain is forecast. Do not allow re-entry to treated area for four hours or until dusts have settled. Do not apply within 7 days of previous treatment. Do not exceed annual maximum rate of 3.36 kg per 100 m<sup>2</sup>.

chlorantraniliprole: Commercial products. Do not exceed 2.25 g ai/100 m<sup>2</sup> per season. Buffer zones of 1 m must be maintained for the protection of all freshwater and shallow (<1m) marine habitats when using field sprayers. Chlorantraniliprole is persistent, may carryover, and may result in contamination of groundwater.

clothianidin: Commercial products. Preventative – make applications during peak egg hatch. Curative – make applications after egg hatch or when turf damage is evident. Do not make more than one application per season. Clothianidin is persistent, may carryover, and may contaminate groundwater. For use only on golf courses and sod farms. Observe re-entry periods for golf courses (after spray has dried) or sod farms (12 hours). Toxic to bees – avoid applications when bees are foraging or during periods when weeds are blooming. Toxic to aquatic organisms – observe buffer zones on label when using field sprayer.

cyantraniliprole: Commercial product. Treat from peak adult flight through peak egg hatch. For use only on golf course and sod farm sites, not residential lawns, playing fields or cemeteries. Avoid application to moderate or steep slopes, areas with compacted soil or clay. Avoid application when heavy rain is forecast. Observe buffer zones listed on product label. Toxic to bees – avoid applications when bees are foraging or during periods when weeds are blooming. Do not exceed 4.5 g ai/100 m<sup>2</sup> per year.

imidacloprid: Commercial products. Turf and lawn uses of imidacloprid have been cancelled. Existing stocks in Canada are being phased-out. The last date of sale by retailers is May 19, 2023. All use of imidacloprid must cease by May 19, 2024. Applications should be made prior to egg hatch of the target pests, followed by sufficient irrigation or rainfall (5 -10 mm) to move the active ingredient through the thatch. Avoid over watering (more than 20 mm). Do not apply through any irrigation system. Avoid mowing until after irrigation or rainfall has occurred. Do not graze treated areas or use clippings from treated areas for feed or forage. Do not plant any food crop within a year of applying imidacloprid. Do not apply more than once per year. Do not apply within 30m of sensitive aquatic systems or where soils are highly permeable and there is risk for groundwater contamination. Toxic to bees – avoid applications when bees are foraging or during periods when weeds are blooming.