

1. Corn (Field and Seed)

Bee kill incidences in Ontario have been found to be associated with the planting of corn and soybean seed treated with neonicotinoid. Growers are encouraged to follow best management practices to protect pollinators at planting. See Health Canada's pollinator protection web page: www.healthcanada.gc.ca/pollinators and *Chapter 10. Neonicotinoid Regulatory Requirements in Ontario*, as well as ontario.ca/neonics for the latest information.

CORN INSECTS

Table 1-1. Chemical Control Options for Insects in Field and Seed Corn — Corn Rootworm

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)
CORN ROOTWORM (<i>Diabrotica virgifera</i> and <i>Diabrotica barberi</i>)				
Soil-Applied at Planting Only				
<p>Avoid planting corn following corn. Crop rotation is the best strategy for control. Risk factors include heavier soil (clay), high beetle populations in corn of previous season and being the latest field planted in the previous season.</p> <p>If there is less than 1 beetle per corn plant on average throughout the month of August, then no insecticide is necessary in the following corn crop.</p> <p>In-furrow application is safer to the applicator and non-target mammals than T-band application.</p> <p>Granular insecticides are toxic to birds and small wild mammals. Any spilled or exposed granules must be incorporated into the soil or otherwise cleaned-up from the soil surface.</p>	tefluthrin	Force 3.0G	37.5 g/ 100-m (328-ft) row	May be applied in a T-band or in-furrow. For banded applications, place directly over the furrow in a 15-cm band ahead of the press wheel. For in-furrow applications, place all material directly in the open seed furrow, behind the planter disc openers.
	chlorpyrifos	Lorsban 15 G	75 g/ 100-m (328-ft) row	Suppression only. Must be applied in a 10–15-cm band over the row behind the planter shoe, in front of the press wheel. Do not place in direct contact with seed. 24-hr re-entry period.
		Pyrifos 15 G	75 g/ 100-m (328-ft) row	

CORN INSECTS

Table 1–1. Chemical Control Options for Insects in Field and Seed Corn — Corn Rootworm

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)
CORN ROOTWORM (<i>Diabrotica virgifera</i> and <i>Diabrotica barberi</i>) (cont'd)				
Seed Treatment				
<p>In Ontario, the use of neonicotinoid seed treatments on corn and soybean seed is restricted. See Chapter 10 for further information on the requirements to use these products. Seed treatments are best suited for those fields at high risk of rootworm infestations, especially if planting corn after corn.</p> <p>NOTE: The planting of neonicotinoid-treated corn and soybean seed can pose a risk to pollinators. This includes all clothianidin, imidacloprid and thiamethoxam products. The contaminated insecticide dust emitted from pneumatic planters can drift onto flower and water sources and expose bees to these insecticides. Growers are encouraged to follow best management practices (BMPs) to protect pollinators at planting. To help minimize the dust generated during planting, refer to <i>Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices</i> on the Health Canada website at www.healthcanada.gc.ca/pollinators.</p> <p>If treated seeds are spilled outdoors or in areas accessible to birds, promptly clean up or bury to prevent ingestion.</p>	clothianidin (See NOTE.)	Poncho 1250 NipsIt Inside 600	166.7 mL/ 80,000 kernels	<p>For use in commercial seed treatment facilities only. For low-to-moderate rootworm populations. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy. A 30-day plantback interval for cereal grains, grasses, soybeans and dry beans is required.</p>
	thiamethoxam (See NOTE.)	Cruiser 5 FS	166.7 mL/ 80,000 kernels	
Transgenic				
<p>There are cases of western corn rootworm developing resistance to Bt. To reduce the risk of resistance, growers are encouraged to control rootworm through crop rotation and plant-appropriate refuge when using Bt corn traits. For more information regarding Bt corn and/or refuge options, see the Canadian Corn Pest Coalition website at www.cornpest.ca.</p>	Bt corn	Agrisure 3000GT Agrisure 3122 Agrisure Viptera 3111 Genuity SmartStax Genuity VT Triple Pro Herculex XTRA Optimum AcreMax Xtra Optimum AcreMax XTreme Optimum Intrasect Xtra SmartStax YieldGard VT Triple	See Table 9–7. <i>Bt Corn Products/Traits Currently Available in Canada (as of April 2015)</i> , on page 176, for Bt corn options.	Use Bt hybrids in fields of continuous corn with moderate-to-high populations of rootworm. Keep careful and accurate records as to where Bt and non-Bt hybrids are planted or note if refuge in a bag was used.

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Table 1–2. Chemical Control Options for Insects in Field and Seed Corn — Wireworms, Millipedes

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)
WIREWORMS (<i>Limoni</i> spp. and others)				
Seed Treatment				
<p>In Ontario, the use of neonicotinoid seed treatments on corn and soybean seed is restricted. See Chapter 10 for further information on the requirements to use these products.</p> <p>The risk factors for wireworm infestations include fields with a history of cereal/corn/grassy weeds, sandy soils, history of wireworm problems and fields that are coming out of sod.</p> <p>NOTE: The planting of neonicotinoid-treated corn and soybean seed can pose a risk to pollinators. This includes all clothianidin, imidacloprid and thiamethoxam products. The contaminated insecticide dust emitted from pneumatic planters can drift onto flower and water sources and expose bees to these insecticides. Growers are encouraged to follow best management practices (BMPs) to protect pollinators at planting. To help minimize the dust generated during planting, refer to <i>Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices</i> on the Health Canada website at www.healthcanada.gc.ca/pollinators.</p> <p>If treated seeds are spilled outdoors or in areas accessible to birds, promptly clean up or bury to prevent ingestion.</p>	clothianidin (See NOTE.)	Poncho 250 NipsIt Inside 600	33.3 mL/ 80,000 kernels	<p>For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. A 30-day plantback interval for cereal grains, grasses, soybeans and dry beans is required.</p> <p>For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy.</p> <p>For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy. Do not graze or feed livestock on treated areas for 45 days after planting.</p> <p>For use in commercial seed treatment facilities only. Apply Fortenza as a water-based slurry utilizing standard slurry seed treatment equipment that provides uniform seed coverage. This product contains no colourant. An appropriate colourant must be added when this product is applied. Follow resistance management instructions as stated on label. Do not apply subsequent applications of a Group 28 insecticide (e.g., Coragen) following Fortenza seed treatment.</p>
	imidacloprid (See NOTE.)	Gaucho 480 FL Sombrero 600 FS	27 mL/ 80,000 kernels 21.3 mL/ 80,000 kernels	
	thiamethoxam (See NOTE.)	Cruiser 5 FS	16.7 mL/ 80,000 kernels	
	cyantraniliprole	Fortenza	167 mL/ 100 kg seed	
Soil Applied at Planting Only				
In-furrow application is safer to the applicator and non-target animals than T-band application. Granular insecticides are toxic to birds and small wild mammals. Any spilled or exposed granules must be incorporated into the soil or otherwise cleaned-up from the soil surface.	tefluthrin	Force 3.0G	37.5 g/ 100-m (328-ft) row	In-furrow application only. Place directly in the seed furrow behind the planter disc openers.
MILLIPEDES (Various species)				
Millipedes can be a pest in cool, wet springs in fields with heavy residue or high organic matter. They can be misidentified as wireworms. Ensure that proper identification has been made. No registered products available at this time.				

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Table 1–3. Chemical Control Options for Insects in Field and Seed Corn — Black Cutworm

LEGEND: PHI = Pre-Harvest Interval (days)

N/A = not applicable

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
BLACK CUTWORM (<i>Agrotis ipsilon</i>)					
Seed Treatment					
<p>In Ontario, the use of neonicotinoid seed treatments on corn and soybean seed is restricted. See Chapter 10 for further information on the requirements to use these products.</p> <p>Clothianidin may not be used as a corn seed treatment solely for protection from black cutworm.</p> <p>However, seed treatments used for the control of other soil insect pests may provide early-season protection from young black cutworm larvae.</p> <p>Black cutworm is a sporadic pest. Using seed treatments specifically for black cutworm control is not needed unless the field has had a continuous history of cutworm injury.</p> <p>NOTE: The planting of neonicotinoid-treated corn and soybean seed can pose a risk to pollinators. This includes all clothianidin, imidacloprid and thiamethoxam products. The contaminated insecticide dust emitted from pneumatic planters can drift onto flower and water sources and expose bees to these insecticides. Growers are encouraged to follow best management practices (BMPs) to protect pollinators at planting. To help minimize the dust generated during planting, refer to <i>Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices</i> on the Health Canada website at www.healthcanada.gc.ca/pollinators.</p> <p>If treated seeds are spilled outdoors or in areas accessible to birds, promptly clean up or bury to prevent ingestion.</p>	clothianidin (See NOTE.)	Poncho 250 NipsIt Inside 600	33.3 mL/ 80,000 kernels	N/A	<p>For seed corn only. The use of neonicotinoid seed treatments for black cutworm control is not permitted on field corn. For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy. A 30-day plant-back interval for cereal grains, grasses, soybeans and dry beans is required.</p>
	cyantraniliprole	Fortenza	167 mL/ 100 kg seed	N/A	

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Table 1–3. Chemical Control Options for Insects in Field and Seed Corn — Black Cutworm

LEGEND: PHI = Pre-Harvest Interval (days)

N/A = not applicable

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
BLACK CUTWORM (<i>Agrotis ipsilon</i>) (cont'd)					
Soil-Applied at Planting Only					
<p>Risk factors for black cutworm infestations include fields with winter annual weeds and volunteer wheat before planting, no-till fields or heavy soybean residue. Control annual weeds at least 3 weeks prior to planting to reduce attraction by adult moths flying in from the south.</p> <p>Granular insecticides are toxic to birds and small wild mammals. Any spilled or exposed granules must be incorporated into the soil or otherwise cleaned up from the soil surface.</p>	tefluthrin	Force 3.0G	37.5 g/ 100-m (328-ft) row	N/A	Soil-applied control is not as good as a well-timed rescue treatment. May be applied as a banded or in-furrow application. For banded applications, place directly in a 15-cm band ahead of the press wheel. For in-furrow application, place all material directly in the open seed furrow, behind the planter disc openers.
Transgenic Corn					
<p>Use transgenic corn specifically for black cutworm control only in those fields with a history of cutworm infestations, as this pest is sporadic and may only require foliar control when thresholds are reached.</p>	Bt corn	Agrisure 3122 Agrisure Viptera 3110 Agrisure Viptera 3111 Agrisure Viptera 3220 Genuity SmartStax Herculex I Herculex XTRA Optimum AcreMax Optimum AcreMax Xtra Optimum AcreMax XTreme Optimum Intrasect Optimum Intrasect Xtra SmartStax	<p>See Table 9–7. <i>Bt Corn Products/Traits Currently Available in Canada (as of April 2015)</i>, on page 176, for Bt corn options.</p>	N/A	<p>Use Bt hybrids containing Cry1F or Vip3A only. May only control young larvae.</p> <p>Keep careful and accurate records as to where Bt and non-Bt hybrids are planted or note if refuge in a bag is used.</p>

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Table 1–3. Chemical Control Options for Insects in Field and Seed Corn — Black Cutworm

LEGEND: PHI = Pre-Harvest Interval (days)

N/A = not applicable

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
BLACK CUTWORM (<i>Agrotis ipsilon</i>) (cont'd)					
Rescue Treatments					
Scout early. Black cutworms are easier to control when larvae are small. Look for leaf-feeding (pinholes) by young climbing larvae as the first sign of damage. If more than 10% of plants show leaf feeding, or 3% of the plants are cut at the base and larvae are smaller than 2.5 cm, treating at this time will provide nearly 100% control.	permethrin	Ambush 500 EC	140 mL/ha (60 mL/acre)	1	Apply at seedling stage only. Apply under warm, moist conditions in evening or night when cutworms are most active. Do not disturb the soil for 5 days after application. Toxic to bees. Avoid spraying when bees are foraging. Spray deposit should be dry before bees commence foraging in treated crop.
		Pounce 384 EC	180 mL/ha (73 mL/acre)	1	
	cypermethrin	Mako	175 mL/ha (70 mL/acre)	21	Apply at seedling stage only. Apply under warm, moist conditions in evening or night when cutworms are most active. Do not disturb soil for 5 days after application. Toxic to bees and other beneficial insects. Avoid spraying when bees are foraging.
	chlorpyrifos	Lorsban 4E	1.2–2.4 L/ha (480–960 mL/acre)	70	Apply at seedling stage only. For best results, apply in the evening. Maximum 1 application/yr. 24-hr re-entry period. Toxic to bees exposed to direct treatment, drift or residues on blooming plants. DO NOT use on flowering crops or weeds. DO NOT apply this product or allow it to drift to flowering crops or weeds if bees are visiting the treatment area. Applicators should inform local beekeepers prior to application if hives are in adjacent fields.
		Pyrinex 480 EC	1.2–2.4 L/ha (480–960 mL/acre)	70	
	lambda-cyhalothrin	Matador 120 EC	83 mL/ha (34 mL/acre)	silage: 14 field and seed: 21	Apply at seedling stage only. Apply under warm, moist conditions in evening or night when cutworms are most active. Do not disturb soil for 5 days after application. 24-hr re-entry period. This product is toxic to bees when exposed to direct treatment, drift or residues on flowering crops or weeds. DO NOT apply this product to flowering crops or weeds if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.
		Silencer 120 EC			
	chlorantraniliprole	Coragen	250 mL/ha (101 mL/acre)	field corn: 14 seed corn: 1	Apply to foliage when rain is not expected in the next 24 hr. Use a minimum of 100 L/ha of water. Maximum 4 applications/yr. 12-hr re-entry period.

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Table 1-4. Chemical Control Options for Insects in Field and Seed Corn — Seedcorn Maggot, Seedcorn Beetle

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)
SEEDCORN MAGGOT (<i>Delia platura</i>)				
Seed Treatment				
For all seed treatments, use full rate and ensure good coverage of seed.				
<p>In Ontario, the use of neonicotinoid seed treatments on corn and soybean seed is restricted. See Chapter 10 for further information on the requirements to use these products.</p> <p>Seedcorn maggot problems in corn are rare in Ontario. Use seed treatments in high-risk fields where large amounts of manure, green manure or residue have been recently incorporated, in fields that are freshly tilled or when cool, unfavourable emergence conditions exist.</p> <p>NOTE: The planting of neonicotinoid-treated corn and soybean seed can pose a risk to pollinators. This includes all clothianidin, imidacloprid and thiamethoxam products. The contaminated insecticide dust emitted from pneumatic planters can drift onto flower and water sources and expose bees to these insecticides. Growers are encouraged to follow best management practices (BMPs) to protect pollinators at planting. To help minimize the dust generated during planting, refer to <i>Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices</i> on the Health Canada website at www.healthcanada.gc.ca/pollinators.</p>	clothianidin (See NOTE.)	Poncho 250 NipsIt Inside 600	33.3 mL/ 80,000 kernels	<p>For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy. A 30-day plantback interval for cereal grains, grasses, soybeans and dry beans is required.</p> <p>For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy. Do not graze or feed livestock on treated areas for 45 days after planting.</p>
	thiamethoxam (See NOTE.)	Cruiser 5 FS	16.7–33.3 mL/ 80,000 kernels	
Soil-Applied at Planting Only				
In-furrow application is safer to the applicator and non-target animals than T-band application.	tefluthrin	Force 3.0G	37.5 g/ 100-m (328-ft) row	In-furrow application only. Place directly in the seed furrow behind the planter disc openers.
SEEDCORN BEETLE (<i>Agonoderus lecontei</i> and <i>Clivina impressifrons</i>)				
Risk factors for seedcorn beetle infestations include no-till, cool, wet spring and slow crop emergence conditions.				
No registered products available at this time.				

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Table 1–5. Chemical Control Options for Insects in Field and Seed Corn — European Chafer, Corn Flea Beetle

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)
GRUB — EUROPEAN CHAFER (<i>Rhizotrogus majalis</i>)				
Seed Treatment				
<p>In Ontario, the use of neonicotinoid seed treatments on corn and soybean seed is restricted. See Chapter 10 for further information on the requirements to use these products. Avoid planting corn if the grub population is extreme — plant soybeans instead.</p> <p>See OMAFRA Publication 811, <i>Agronomy Guide for Field Crops</i>, for further information on insect biology and management options.</p> <hr/> <p>NOTE: The planting of neonicotinoid-treated corn and soybean seed can pose a risk to pollinators. This includes all clothianidin, imidacloprid and thiamethoxam products. The contaminated insecticide dust emitted from pneumatic planters can drift onto flower and water sources and expose bees to these insecticides. Growers are encouraged to follow best management practices (BMPs) to protect pollinators at planting. To help minimize the dust generated during planting, refer to <i>Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices</i> on the Health Canada website at www.healthcanada.gc.ca/pollinators.</p> <p>If treated seeds are spilled outdoors or in areas accessible to birds, promptly clean up or bury to prevent ingestion.</p>	clothianidin (See NOTE.)	Poncho 250 NipsIt Inside 600	33.3 mL/ 80,000 kernels	For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy. A 30-day plantback interval for cereal grains, grasses, soybeans and dry beans is required.
	thiamethoxam (See NOTE.)	Cruiser 5 FS	16.7 mL/ 80,000 kernels	For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy. Do not graze or feed livestock on treated areas for 45 days after planting.
	cyantraniliprole	Fortenza	167 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Apply Fortenza as a water-based slurry utilizing standard slurry seed treatment equipment that provides uniform seed coverage. This product contains no colourant. An appropriate colourant must be added when this product is applied. Follow resistance management instructions as stated on label. Do not apply subsequent applications of a Group 28 insecticide (e.g., Coragen) following Fortenza seed treatment.

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Table 1–5. Chemical Control Options for Insects in Field and Seed Corn — European Chafer, Corn Flea Beetle

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)	
CORN FLEA BEETLE (<i>Chaetocnema pulicaria</i>)					
Seed Treatment					
<p>In Ontario, the use of neonicotinoid seed treatments on corn and soybean seed is restricted. See Chapter 10 for further information on the requirements to use these products.</p> <p>Flea beetles are a vector of Stewart's bacterial wilt. It is uneconomical to spray corn with insecticides to protect against Stewart's wilt except in seed corn with highly susceptible inbreds.</p> <p>NOTE: The planting of neonicotinoid-treated corn and soybean seed can pose a risk to pollinators. This includes all clothianidin, imidacloprid and thiamethoxam products. The contaminated insecticide dust emitted from pneumatic planters can drift onto flower and water sources and expose bees to these insecticides. Growers are encouraged to follow best management practices (BMPs) to protect pollinators at planting. To help minimize the dust generated during planting, refer to <i>Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices</i> on the Health Canada website at www.healthcanada.gc.ca/pollinators.</p> <p>If treated seeds are spilled outdoors or in areas accessible to birds, promptly clean up or bury to prevent ingestion.</p>	clothianidin (See NOTE.)	Poncho 250	33.3 mL/ 80,000 kernels	For seed corn only. The use of neonicotinoid seed treatments solely for protection against flea beetles is not permitted on field corn. For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy. A 30-day plantback interval for cereal grains, grasses, soybeans and dry beans is required.	
		NipsIt Inside 600			imidacloprid (See NOTE.)
	thiamethoxam (See NOTE.)	Sombrero 600 FS	21.3 mL/ 80,000 kernels		
		Cruiser 5 FS	16.7–33.3 mL/ 80,000 kernels		For seed corn only. The use of neonicotinoid seed treatments solely for protection against flea beetles is not permitted on field corn. For use in commercial seed treatment facilities only. Seed-applied insecticides can affect seed drop and final plant stands. Use approved lubricant as required to minimize dust and ensure planting accuracy. Do not graze or feed livestock on treated areas for 45 days after planting.

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Table 1–6. Chemical Control Options for Insects in Field and Seed Corn — European Corn Borer

LEGEND: PHI = Pre-Harvest Interval (days) N/A = not applicable					
Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
EUROPEAN CORN BORER (ECB) (<i>Ostrinia nubilalis</i>)					
Transgenic Corn					
To manage potential corn borer resistance, plant the appropriate refuge for the Bt corn trait used and follow all insect resistance management strategies mandated by the Canadian Food Inspection Agency. For more information regarding Bt corn and/or refuge options, see the Canadian Corn Pest Coalition website, found at www.cornpest.ca .	Bt corn	Agrisure 3000GT Agrisure 3122 Agrisure CB/LL Agrisure GT/CB/LL Agrisure Viptera 3110 Agrisure Viptera 3111 Agrisure Viptera 3220 Genuity SmartStax Genuity VT Double Pro Genuity VT Triple Pro Herculex I Herculex XTRA Optimum AcreMax Optimum AcreMax Xtra Optimum AcreMax XTreme Optimum Intrasect Optimum Intrasect Xtra SmartStax YieldGard CB YieldGard VT Triple	See <i>Table 9–7. Bt Corn Products/Traits Currently Available in Canada (as of April 2015)</i> , on page 176, for Bt corn options.	N/A	Insecticides have generally not provided economic control of ECB in field corn. Bt corn provides much better control. Use corn hybrids that express the Bt toxin in the ear as well as the stalk to help avoid stalk and ear rot. Keep careful and accurate records as to where Bt and non-Bt hybrids are planted or note if refuge in a bag is used.

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Table 1–6. Chemical Control Options for Insects in Field and Seed Corn — European Corn Borer

Integrated Pest Management Options		Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
EUROPEAN CORN BORER (ECB) (<i>Ostrinia nubilalis</i>) (cont'd)						
Foliar Treatment						
See OMAFRA Publication 811, <i>Agronomy Guide for Field Crops</i> , to calculate economic thresholds.	deltamethrin	Decis 5 EC	250–300 mL/ha (100–120 mL/acre)	1	Ground application only. Apply when egg masses begin to hatch but no later than when 1st pinhole feeding occurs on foliage. For 2nd brood in late planting, apply before tassels show. Repeat in 5–8-day intervals. Use at least 240 L water/ha. Maximum 3 applications/yr. Do not feed silage or stubble to dairy cattle. 12-hr re-entry period. Toxic to bees for 1 day after application. DO NOT apply when crop or weeds are in bloom.	
	cypermethrin	Mako	175 mL/ha (70 mL/acre)	5	Ground and aerial application. Apply when egg masses begin to hatch but no later than when 1st feeding occurs on foliage. For 2nd brood in late planting, apply before tassels show. Use a minimum 300–500 L water/ha for ground application and 11–22 L/ha for aerial application. Maximum 3 applications/yr. Do not apply more than 2 applications by air. Re-entry period when foliage dries. Toxic to bees and other beneficial insects. Avoid spraying when bees are foraging.	
	chlorantraniliprole	Coragen	250–375 mL/ha (101–151 mL/acre)	field corn: 14 seed corn: 1	Ground and aerial application. Apply to foliage when rain is not expected in the next 24 hr. Time application to coincide with peak egg hatch. Use a minimum of 100 L/ha of water. Maximum 4 applications/yr. 12-hr re-entry period.	
	lambda-cyhalothrin	Matador 120 E Silencer 120 EC	187 mL/ha (76 mL/acre) 83–187 mL/ha (34–76 mL/acre)	silage: 14 field and seed: 21	Ground and aerial application. For best results, apply in the early morning, before temperatures rise, or during the evening, past the heat of the day. Use 100–200 L water/ha for ground application, 10–40 L water/ha for aerial application. Spray no later than 10 days after egg hatch. Maximum 3 applications/yr. Do not apply more than 2 applications of 83 mL/ha by air. 24-hr re-entry period. This product is toxic to bees when exposed to direct treatment, drift or residues on flowering crops or weeds. DO NOT apply this product to flowering crops or weeds if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.	

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Table 1–6. Chemical Control Options for Insects in Field and Seed Corn — European Corn Borer

LEGEND: PHI = Pre-Harvest Interval (days) N/A = not applicable					
Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
EUROPEAN CORN BORER (ECB) (<i>Ostrinia nubilalis</i>) (cont'd)					
Foliar Treatment (cont'd)					
See OMAFRA Publication 811, <i>Agronomy Guide for Field Crops</i> , to calculate economic thresholds.	<i>Bacillus thuringiensis</i>	Bioprotec CAF	2.8–4.0 L/ha (1.1–1.6 L/acre)	1	Ground application only. This product is a good option for organically grown corn. Apply at first signs of infestation when larvae are small. Repeat applications, according to economic threshold, as necessary to maintain control. Use a minimum of 300 L/ha of water. This product is more effective when no rain occurs within 24–48 hr after application. Maximum 6 applications/yr.
		Dipel 2X DF	0.56–1.12 kg/ha (0.22–0.45 kg/acre)	1	This product is a good option for organically grown corn. Apply when pinhole feeding is observed in at least 5% of the plants. Repeat at 7-day intervals. Only effective against small larvae and must be applied before larvae begin stalk boring.
	carbaryl	Sevin XLR Plus	2.5–4.0 L/ha (1.0–1.6 L/acre)	1	For larvae in whorls and foliage, treat entire plant. Repeat as necessary. For silks and ears, apply in 2–4-day intervals when silks first appear. This product is highly toxic to honeybees exposed to direct treatment on blooming crops or weeds. Apply Sevin XLR Plus from late evening to early morning or when bees are not foraging.
	lambda-cyhalothrin + chlorantraniliprole	Voliam Xpress	500 mL/ha (200 mL/acre)	silage: 14 field and seed: 21	Apply no later than when the first feeding is seen on foliage. Re-apply after 7 days, depending on the presence of significant populations as determined by local monitoring. This treatment will not prevent internal cob damage if the insect has penetrated the ear. Allow a 7-day interval between treatments. For ground application, apply in a minimum of 150 L of water/ha. For aerial application, apply in a minimum of 40 L of water/ha. This product is toxic to bees when exposed to direct treatment, drift or residues on flowering crops or weeds. DO NOT apply this product to flowering crops or weeds if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.
	methoxyfenozide	Intrepid	300–600 mL/ha (120–240 mL/acre)	21	Apply at the first signs of feeding damage before the insect enters the ear. Monitoring of insect populations is key to controlling this pest. Direct application at the whorl for early-season (first-generation) infestations. Repeat applications after 5–10 days if required, based on population monitoring. Use the higher rate for heavy infestations or larger crop canopies.

CORN INSECTS

Table 1–7. Chemical Control Options for Insects in Field and Seed Corn — Western Bean Cutworm

LEGEND: PHI = Pre-Harvest Interval (days) — = no information was provided on the product label N/A = not applicable					
Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
WESTERN BEAN CUTWORM (<i>Striacosta albicosta</i>)					
Transgenic Corn					
Plant the appropriate refuge for the Bt corn trait used and follow all insect resistance management strategies mandated by the Canadian Food Inspection Agency. For more information regarding Bt corn and/or refuge options, see the Canadian Corn Pest Coalition website, at www.cornpest.ca .	Bt corn	Agrisure 3122 Agrisure Viptera 3110 Agrisure Viptera 3111 Agrisure Viptera 3220 Genuity SmartStax Herculex I Herculex XTRA Optimum AcreMax Optimum AcreMax Xtra Optimum AcreMax XTreme Optimum Intrasect Optimum Intrasect Xtra SmartStax	See <i>Table 9–7. Bt Corn Products/Traits Currently Available in Canada (as of April 2015)</i> , on page 176, for Bt corn options.	N/A	Bt corn hybrids containing Vip3A provide full control. Bt corn hybrids containing Cry1F provide some control. Some ear feeding may still occur on Cry1F hybrids and could result in ear rot (mycotoxin) development. YieldGard Bt corn varieties (Cry 1Ab) do not control western bean cutworm. Keep careful and accurate records as to where Bt and non-Bt hybrids are planted or note if refuge in a bag is used.

CORN INSECTS

Table 1–7. Chemical Control Options for Insects in Field and Seed Corn — Western Bean Cutworm

LEGEND: PHI = Pre-Harvest Interval (days) — = no information was provided on the product label N/A = not applicable					
Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
WESTERN BEAN CUTWORM (<i>Striacosta albicosta</i>) (cont'd)					
Foliar Treatment					
<p>Use pheromone traps to monitor for pest presence and peak flight. Focus scouting efforts on the top three-to-four leaves of the plant. Look for egg masses and young larvae. Eggs hatch 1 or 2 days after turning purple. Spray is warranted if 5% of the plants have eggs or small larvae. Spray is only effective on small larvae, prior to them entering the ear. Additional impact on quality can be expected from ear rots and secondary pests that may enter and feed on the damaged ears.</p> <p>Additional information on pest status and management recommendations is provided at the Ontario WBC Trap Network: www.cornpest.ca.</p>	lambda-cyhalothrin	Matador 120 E	83–187 mL/ha (34–76 mL/acre)	silage: 14 field and seed: 21	<p>Ground and aerial application. For best results, apply in the early morning, before temperatures rise, or during the evening. Use 100–200 L water/ha for ground application, 10–40 L water/ha for aerial application. Spray no later than 10 days after egg hatch. Maximum 3 applications/yr. Do not apply more than 2 applications of 83 mL/ha by air. 24-hr re-entry period.</p> <p>This product is toxic to bees when exposed to direct treatment, drift or residues on flowering crops or weeds. DO NOT apply this product to flowering crops or weeds if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.</p>
	deltamethrin	Decis 5.0 EC	250–300 mL/ha (100–120 mL/acre)	1	<p>Ground application only. Apply when egg masses begin to hatch. Use at least 240 L water/ha. Maximum 3 applications/yr. Do not feed silage or stubble to dairy cattle. 12-hr re-entry period.</p> <p>Toxic to bees for 1 day after application. DO NOT apply when crop or weeds are in bloom.</p>
	lambda-cyhalothrin + chlorantraniliprole	Voliam Xpress	500 mL/ha (200 mL/acre)	silage: 14 field and seed: 21	<p>Apply no later than when the first feeding is seen. Re-apply after 7 days, depending on the presence of significant populations as determined by local monitoring. This treatment will not prevent internal cob damage if the insect has penetrated the ear. Allow a 7-day interval between treatments. For ground application — apply in a minimum of 150 L of water/ha. For aerial application — apply in a minimum of 40 L of water/ha.</p> <p>This product is toxic to bees when exposed to direct treatment, drift or residues on flowering crops or weeds. DO NOT apply this product to flowering crops or weeds if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.</p>
	chlorantraniliprole	Coragen	250–375 mL/ha (101–151 mL/acre)	seed corn: 1 field corn: 14	<p>For ground application, use a minimum water volume of 100 L/ha and 50 L/ha for aerial. Thorough coverage is required to obtain optimum control. Use high rate of Coragen under heavy pest pressure. Minimum of 3 days between applications. Maximum 4 applications/yr. 12-hr re-entry period. Do not exceed a total of 1.125 L of Coragen/ha/season.</p>

CORN INSECTS

Table 1–8. Chemical Control Options for Insects in Field and Seed Corn — Armyworm, Corn Leaf Aphid, Brown Marmorated Stink Bug, Potato Stem Borer, Slugs, Sap Beetles

LEGEND: PHI = Pre-Harvest Interval (days)

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
ARMYWORM (TRUE – <i>Pseudaletia unipuncta</i>, FALL – <i>Spodoptera frugiperda</i>)					
Foliar Treatment					
<p>Late-planted corn is most susceptible to leaf and whorl feeding by armyworm.</p> <p>True armyworm: Insecticide may be warranted in seedling corn if there are two or more unparasitized larvae per seedling, and feeding damage exceeds 10%. In corn past the 6-leaf stage, if 50% of the plants are showing damage and are infested with larvae smaller than 2.5 cm, insecticide treatment may be warranted.</p> <p>Fall armyworm: Insecticide may be warranted if 50% of the plants are infested with unparasitized larvae smaller than 2.5 cm. However, damage is usually not economically significant unless infestations are high, and feeding is concentrated on the undeveloped tassels.</p> <p>If larvae have white eggs attached to them, they are parasitized and may not need treatment. If larvae are 2.0 cm or larger, chemical control will not work well. Once the larvae are in the corn ear, insecticides cannot provide control.</p>	chlorantraniliprole	Coragen	250–375 mL/ha (101–151 mL/acre)	field corn: 14 seed corn: 1	Ground and aerial application. Apply to foliage when rain is not expected in the next 24 hr. Use a minimum of 100 L/ha of water. Maximum 4 applications/yr. 12-hr re-entry period.
	carbaryl	Sevin XLR Plus	2.5–4.0 L/ha (1.0–1.6 L/acre)	1	For larvae in whorls and foliage, treat entire plant. Repeat as necessary. Follow label precautions regarding honeybees.
	lambda-cyhalothrin	Matador 120 E	83–208 mL/ha (34–84 mL/acre)	silage: 14 field and seed: 21	Ground and aerial application. For best results, apply in the early morning, before temperatures rise, or during the evening. Use 100–200 L water/ha for ground application, 10–40 L water/ha for aerial application. Spray no later than 10 days after egg hatch. Maximum 3 applications/yr. Do not apply more than 2 applications of 83 mL/ha by air. 24-hr re-entry period.
	Silencer 120 EC	83 mL/ha (34 mL/acre)	This product is toxic to bees when exposed to direct treatment, drift or residues on flowering crops or weeds. DO NOT apply this product to flowering crops or weeds if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.		
CORN LEAF APHID (<i>Rhopalosiphum maidis</i>)					
If 50% of all plants during the late-whorl-to-early-tassel stage have 400 aphids per plant, or if honeydew accumulation is impeding pollination and plants are under moisture stress, control is required. Control is not recommended once pollination has occurred.	flupyradifurone	Sivanto Prime	500–750 mL/ha (202–303 mL/acre)	21	The maximum amount of Sivanto Prime allowed per crop season is 2,000 mL/ha. Apply as a foliar application ensuring thorough coverage. Do not make any application of Sivanto Prime following soil, in-furrow or seed treatment applications of a Group 4D insecticide.
					Toxic to adult bees in laboratory studies via oral exposure, however, not toxic to bees through contact exposure, and field studies conducted with this product have shown no effects on honeybee colony development. Minimize spray drift to reduce exposure to bees in habitats close to the application site. Application during the crop blooming period, and when flowering weeds are present, may only be made in the early morning and the evening when most bees are not foraging.

CORN INSECTS

Table 1–8. Chemical Control Options for Insects in Field and Seed Corn — Armyworm, Corn Leaf Aphid, Brown Marmorated Stink Bug, Potato Stem Borer, Slugs, Sap Beetles

LEGEND: PHI = Pre-Harvest Interval (days)

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
BROWN MARMORATED STINK BUG (<i>Halyomorpha halys</i>)					
This is a new invasive species in Ontario and is established in many urban areas of Ontario, though infestations have not been detected in crops in Ontario as of 2015. Brown marmorated stink bugs (BMSBs) are most likely to enter corn and soybean fields once the crop has an ear developing or a pod forming. Scout fields once a week, inspecting 5 areas within the first 12 m of the field's edge. No thresholds have been established for corn or soybeans in Ontario yet, though BMSB has been found to cause serious injury to host crops in the mid-Atlantic U.S. If this pest is found in corn or soybeans, please contact the OMAFRA Agricultural Information Contact Centre at: 1-877-424-1300 or ag.info.omafra@ontario.ca . Management strategies are under development. Up-to-date information is available at ontario.ca/stinkbug .	malathion	Malathion 85E	1.345 L/ha (544 mL/acre)	5	Ground application only. Use a minimum of 500 L water/ha. Toxic to bees exposed to direct treatment, drift or residues on flowering crops and weeds. DO NOT apply this product to flowering crops or weeds if bees are visiting the treatment area.
POTATO STEM BORER (<i>Hydraecia micacea</i>)					
No insecticides are registered.					
SLUGS (Various species)					
Usually not an economic pest because growing point is not affected.					
SAP BEETLES (<i>Glischrochilus quadrisignatus</i>)					
Not an economic pest but can carry <i>Fusarium</i> .					

CORN INSECTS

Table 1–9. Chemical Control Options for Insects in Field and Seed Corn — Corn Earworm, Two-Spotted Spidermites

LEGEND: PHI = Pre-Harvest Interval (days)

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
CORN EARWORM (CEW) (<i>Helicoverpa zea</i>)					
<p>Insecticides have generally not provided economic control of CEW in field corn. There may be some value in treating seed corn to maintain kernel quality.</p> <p>For best results, apply at or shortly after egg hatch. Target insecticides to cover the corn ear and silks.</p>	lambda-cyhalothrin	Matador 120 E	83–187 mL/ha (34–76 mL/acre)	silage: 14	<p>Ground and aerial application. For best results, apply in the early morning, before temperatures rise, or during the evening. Use 100–200 L water/ha for ground application, 10–40 L water/ha for aerial application. Spray no later than 10 days after egg hatch. Maximum 3 applications/yr. Do not apply more than 2 applications of 83 mL/ha by air. 24-hr re-entry period. This product is toxic to bees when exposed to direct treatment, drift or residues on flowering crops or weeds. DO NOT apply this product to flowering crops or weeds if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.</p>
		Silencer 120 EC	83 mL/ha (34 mL/acre)	field and seed: 21	
	cypermethrin	Mako	175 mL/ha (70 mL/acre)	5	
	chlorantraniliprole	Coragen	250–375 mL/ha (101–151 mL/acre)	field corn: 14 seed corn: 1	
	lambda-cyhalothrin + chlorantraniliprole	Voliam Xpress	500 mL/ha (200 mL/acre)	silage: 14 field and seed: 21	<p>Apply no later than when the first feeding is seen. Re-apply after 7 days, depending on the presence of significant populations as determined by local monitoring. This treatment will not prevent internal cob damage if the insect has penetrated the ear. Allow a 7-day interval between treatments. For ground application — apply in a minimum of 150 L of water/ha. For aerial application — apply in a minimum of 40 L of water/ha. This product is toxic to bees when exposed to direct treatment, drift or residues on flowering crops or weeds. DO NOT apply this product to flowering crops or weeds if bees are visiting the treatment area. Minimize spray drift to reduce harmful effects on bees in habitats close to the application site.</p>
TWO-SPOTTED SPIDERMITES (<i>Tetranychus urticae</i>)					
<p>Spidermites can be an economic pest in seed corn, particularly in hot, dry years. Populations can flare up shortly after applications of pyrethroid insecticides, as these insecticides control the natural enemies but have no activity on the pest.</p>	spiromesifen	Oberon	400–600 mL/ha (160–240 mL/acre)	field and seed: 30 silage: 5	<p>For use in field, seed and silage corn. Ground and aerial application. An adjuvant may be used to improve coverage and control. For best results, treat when mite populations begin to build and before a damaging population becomes established. This product is effective against the egg and nymph stages of whiteflies and mites. Use a minimum of 100 L/ha of water for ground application, 50 L/ha of water for aerial application. Maximum 2 applications/yr. 12-hr re-entry period. May be toxic to bee brood. Bee brood may be exposed to residues on pollen and nectar brought back to the hive by bees foraging on flowering crops and weeds.</p>

Seed Corn

All seed corn should be treated with a fungicide seed treatment to prevent early-season preemergence and postemergent damping-off disease. This will help reduce seed decay and seedling blights. Corn seedling diseases are prevalent under cool wet conditions that keep the soil temperatures below 13°C. Low-lying or poorly drained areas of the field are often the first to show disease problems. Seed rots and seedling blights are more severe in no-till or reduced-tillage fields since heavy residue will keep soil cooler and wetter longer than in conventional fields. Damping-off will occur in conventional fields when the crop is planted early in conditions that favour disease development or when environmental conditions cause slow germination. Other factors that delay germination and emergence, such as compaction, crusting, deep planting, etc., can also result in a poor stand. Plant vigour is often reduced in those plants that do survive. Consult with your seed company and the Ontario Corn Committee Hybrid Performance Trials at www.gocorn.net for hybrid selection.

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Table 1–10. Chemical Control Options for Diseases in Seed Corn — Pythium Damping-Off

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)
PYTHIUM DAMPING-OFF (<i>Pythium</i> spp.)				
Seed Treatment				
<p>This disease can occur on all soil types but losses are greatest in cold, wet clay soils. Minimize soil compaction and remove excess moisture through increased drainage. Plant when soil temperatures are above 13°C. There is no known resistance but some degree of tolerance is available in some hybrids. Crop rotation has limited effect.</p> <p>Consult with your seed company for hybrid selection.</p>	metalaxyl-M	Apron XL LS	20–40 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or cut for forage within 4 weeks after planting. Read label for information regarding resistant strains of fungus.
	metalaxyl	Allegiance FL	46–110 mL/ 100 kg seed	For commercial and on-farm treating facilities. Do not graze or feed livestock on seeded area for 4 weeks after planting.
		Apron FL		
	azoxystrobin	Dynasty 100 FS	10 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Must be used in combination with Maxim XL for control of other corn diseases.
	thiabendazole + fludioxonil + metalaxyl-M + azoxystrobin	Maxim Quattro	67 mL/ 100 kg seed	For use in commercial seed-treating facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at, or immediately before, planting. Do not graze corn or cut for forage within 30 days of planting. This product contains no colourant. An appropriate colourant must be added when this product is applied to seed.
	penflufen + prothioconazole + metalaxyl	EverGol Energy	65 mL/ 100 kg seed	For commercial and on-farm treating. Uniform application is necessary for optimum product performance. This product contains no dye. An appropriate seed colourant must be applied.
ethaboxam	INTEGO Solo Fungicide	13–19.6 mL/100 kg (5–7.5 g ai/100 kg)	For commercial and on-farm treating. Regulations under the <i>Seeds Act</i> require that an appropriate colourant must be added when this product is applied to seed. A red colourant must be added when this product is applied to grain. For best results, use INTEGO Solo Fungicide combined with other oomycete-active seed treatment fungicides, such as metalaxyl, to broaden the spectrum of activity. INTEGO Solo Fungicide can also be used in combination with a broad-spectrum registered seed treatment fungicide having activity against <i>Rhizoctonia solani</i> and other fungal pathogens responsible for seed and seedling diseases.	

CORN DISEASES

Table 1–11. Chemical Control Options for Diseases in Seed Corn — Rhizoctonia

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)
RHIZOCTONIA (<i>Rhizoctonia solani</i>)				
Seed Treatment				
This disease can occur on all soil types. There are no known resistant or tolerant hybrids available. Remove excess soil moisture through improved drainage. Plant seed when soil temperatures are above 13°C.	fludioxonil	Maxim 480 FS	5.2–10.4 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or cut for forage within 4 weeks after planting.
	carbathiin + thiram	Vitaflo 280	280 mL/ 100 kg seed	For commercial and on-farm treating facilities. Do not graze or feed livestock on treated areas for 4 weeks after planting.
	azoxystrobin	Dynasty 100 FS	10 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Must be used in combination with Maxim XL for control of other corn diseases.
	ipconazole	Vortex FL	5.6 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Use only in treating equipment that can accurately control application rates and provide good distribution of chemical onto seed in the mixing chamber. Not for use in hopper-box, planter-box, slurry-box or similar seed treatment applications. This product contains no dye. An appropriate seed colourant must be applied.
	thiabendazole + fludioxonil + metalaxyl-M + azoxystrobin	Maxim Quattro	67 mL/ 100 kg seed	For use in commercial seed-treating facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at, or immediately before, planting. Do not graze corn or cut for forage within 30 days of planting. This product contains no colourant. An appropriate colourant must be added when this product is applied to seed.
	penflufen + prothioconazole + metalaxyl	EverGol Energy	65 mL/ 100 kg seed	For commercial and on-farm treating facilities. Uniform application is necessary for optimum product performance. This product contains no dye. An appropriate seed colourant must be applied.

CORN DISEASES

Table 1–12. Chemical Control Options for Diseases in Seed Corn — Fusarium Seedling Blight

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)
FUSARIUM SEEDLING BLIGHT (<i>F. culmorum</i>, <i>F. graminearum</i> and <i>F. avenaceum</i>)				
Seed Treatment				
Some level of resistance or tolerance to this disease is available in some hybrids. Rotate with other crops. Tillage has little effect. Treat seed with fungicide and reduce early-season stresses. Plant when soil temperatures are above 13°C.	fludioxonil	Maxim 480 FS	5.2–10.4 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or cut for forage within 4 weeks after planting.
	carbathiin + thiram	Vitaflo 280	280 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Do not graze or feed livestock on treated areas for 4 weeks after planting.
	captan	Agrox FL	120 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Mix with the amount of water required for the slurry treater equipment to be used.
	trifloxystrobin	Trilex FS	21 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Apply using standard commercial seed treatment equipment. Not for use in hopper-box, planter-box, slurry-box or similar seed treatment applications. Uniform application on seed is necessary to ensure seed safety and best disease protection.
	ipconazole	Vortex FL	5.6 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Use only in treating equipment that can accurately control application rates and provide good distribution of chemical onto seed in the mixing chamber. Not for use in hopper-box, planter-box, slurry-box or similar seed treatment applications. This product contains no dye. An appropriate seed colourant must be applied.
	thiabendazole + fludioxonil + metalaxyl-M + azoxystrobin	Maxim Quattro	67 mL/ 100 kg seed	For use in commercial seed-treating facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at, or immediately before, planting. Do not graze corn or cut for forage within 30 days of planting. This product contains no colourant. An appropriate colourant must be added when this product is applied to seed.
	penflufen + prothioconazole + metalaxyl	EverGol Energy	65 mL/ 100 kg seed	For commercial and on-farm treating. Uniform application is necessary for optimum product performance. This product contains no dye. An appropriate seed colourant must be applied.

CORN DISEASES

Table 1–13. Chemical Control Options for Diseases in Seed Corn — Aspergillus Seed Rot, Penicillium Seed Rot

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	Comments (label precautions, re-entry periods, etc.)
ASPERGILLUS (<i>Aspergillus</i> spp.) SEED ROT				
Seed Treatment				
Aspergillus seed rot is occasionally a problem in Ontario.	fludioxonil	Maxim 480 FS	5.2–10.4 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or cut for forage within 4 weeks after planting.
	ipconazole	Vortex FL	5.6 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Use only in treating equipment that can accurately control application rates and provide good distribution of chemical onto seed in the mixing chamber. Not for use in hopper-box, planter-box, slurry-box or similar seed treatment applications. This product contains no dye. An appropriate seed colourant must be applied.
	thiabendazole + fludioxonil + metalaxyl-M + azoxystrobin	Maxim Quattro	67 mL/ 100 kg seed	For use in commercial seed-treating facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at, or immediately before, planting. Do not graze corn or cut for forage within 30 days of planting. This product contains no colourant. An appropriate colourant must be added when this product is applied to seed.
	penflufen + prothioconazole + metalaxyl	EverGol Energy	65 mL/ 100 kg seed	For commercial and on-farm treating. Uniform application is necessary for optimum product performance. This product contains no dye. An appropriate seed colourant must be applied.
PENICILLIUM (<i>Penicillium oxalicum</i>) SEED ROT				
Seed Treatment				
This disease prefers high temperatures and is found only until the nodal roots develop. Infected roots may appear blue-green.	fludioxonil	Maxim 480 FS	5.2–10.4 mL/ 100 kg seed	For use in commercial seed treatment facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at or immediately before planting. Do not graze or cut for forage within 4 weeks after planting.
	ipconazole	Vortex FL	5.6 mL/ 100 kg seed	Provides suppression only. For use in commercial seed treatment facilities only. Use only in treating equipment that can accurately control application rates and provide good distribution of chemical onto seed in the mixing chamber. Not for use in hopper-box, planter-box, slurry-box or similar seed treatment applications. This product contains no dye. An appropriate seed colourant must be applied.
	thiabendazole + fludioxonil + metalaxyl-M + azoxystrobin	Maxim Quattro	67 mL/ 100 kg seed	For use in commercial seed-treating facilities only. Do not use in hopper-box, planter-box, slurry-box or other non-commercial seed treatment applications at, or immediately before, planting. Do not graze corn or cut for forage within 30 days of planting. This product contains no colourant. An appropriate colourant must be added when this product is applied to seed.
	penflufen + prothioconazole + metalaxyl	EverGol Energy	65 mL/ 100 kg seed	Provides suppression only. For commercial and on-farm treating. Uniform application is necessary for optimum product performance. This product contains no dye. An appropriate seed colourant must be applied.

CORN DISEASES

Table 1–14. Chemical Control Options for Diseases in Field and Seed Corn — Common Rust

LEGEND: PHI = Pre-Harvest Interval (in days)

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
COMMON RUST (<i>Puccinia sorghi</i> and <i>Puccinia polysora</i>)					
Rust is generally not a problem in Ontario except when infection begins early in the season. Field corn has good resistance compared to seed corn, sweet corn and specialty corn hybrids. As a result, foliar fungicides in field corn are not needed unless significant disease appears before corn tassels. Humid, cool conditions favour this disease.	azoxystrobin + propiconazole	Quilt	0.75–1.0 L/ha (305–406 mL/acre)	30	Ground and aerial application. Apply when disease first appears, followed by a second application 14 days after, if environmental conditions are favourable for disease development. Do not apply to field corn or field corn grown for seed after brown silk. Maximum 2 applications/yr. 12-hr re-entry period.
	azoxystrobin	Quadris	453 mL/ha (183 mL/acre)	7	Ground and aerial application. Apply prior to disease development. Second application may be made 7–14 days later. Maximum 2 applications/yr. Do not re-enter treated area until residues have dried.
	pyraclostrobin	Headline EC	400–600 mL/ha (160–240 mL/acre)	7	Ground and aerial application. For optimal disease control, begin applications prior to disease development. Use a minimum water volume of 100 L/ha. Do not graze treated crop within 6 days of last application. Maximum 2 applications/yr. 12-hr re-entry period.
	propiconazole	Tilt 250 E	500 mL/ha (200 mL/acre)	14	Ground and aerial application. Apply when rust pustules first appear. Under severe disease pressure, a second application 14 days later may be necessary. Only in seed corn, under severe disease pressure, can a third application be made 14 days later. Can be tank-mixed with Mako or Matador for insect control.
		Bumper 418 EC	300 mL/ha (121 mL/acre)		
	pyraclostrobin + fluxapyroxad	Priaxor	300 mL/ha (120 mL/acre)	21	Ground and aerial application. For optimal disease control, begin applications prior to disease development. Use a minimum water volume of 100 L/ha for ground application. Maximum 2 applications/yr. 12-hr re-entry period.
	prothioconazole	Proline 480 SC	315–420 mL/ha (127–170 mL/acre)	24 hr OR 20 days for hand- detasselling seed corn	Ground and aerial application. Maximum 1 application per year. 24-hr re-entry period. EXCEPTION: 20 days for hand-harvesting sweet corn and hand-detasselling seed corn. Apply Proline 480 SC Foliar Fungicide as a preventive foliar spray when the earliest disease symptoms appear on the leaves and stems. Observe fields closely for early disease symptoms, particularly under prolonged conditions favourable for disease development. Under high disease pressure, use a non-ionic surfactant with Proline 480 SC Foliar Fungicide (do not apply a non-ionic surfactant prior to tassel emergence, as crop injury may occur).
	penthiopyrad	Vertisan	1–1.75 L/ha (0.4–0.7 L/acre)	7	Ground and aerial application. Begin applications prior to disease development and continue on a 7–14-day interval. Use higher rate and shorter interval when disease pressure is high. Do not apply more than 2 sequential applications before switching to a fungicide with a different mode of action. Maximum 3.5 L/ha/yr. 12-hr re-entry period, 3 days if detasselling.
	propiconazole + tebuconazole	Stratego 250 EC	730–880 mL/ha (295–356 mL/acre)	14	Ground and aerial application. Use the higher rate when disease pressure is severe. Do not apply more than 2 applications of Stratego 250 EC per season. Do not apply to sweet corn within 14 days of harvest.

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Table 1–15. Chemical Control Options for Diseases in Field and Seed Corn — Northern Corn Blight, Helminthosporium Leaf Spot

LEGEND: PHI = Pre-Harvest Interval (in days)

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
NORTHERN CORN LEAF BLIGHT (<i>Setospaeria turcica</i>)					
Risk of this disease is on the rise in Ontario. Consult with your seed company for hybrid selection. Seed corn may need protection. Crop rotation and tillage will reduce inoculum levels in surface residues. In reduced tillage systems, rotation and resistance are necessary. Chemical control is not usually economical in field corn.	azoxystrobin + propiconazole	Quilt	0.75–1.0 L/ha (305–406 mL/acre)	30	Ground and aerial application. Apply when disease first appears, followed by a second application 14 days after, if environmental conditions are favourable for disease development. Do not apply to field corn or field corn grown for seed after brown silk. Maximum 2 applications/yr.
	propiconazole	Tilt 250 E	250–500 mL/ha (100–200 mL/acre)	14	Ground and aerial application. Apply when rust pustules first appear. Under severe disease pressure, a second application 14 days later may be necessary. Only in seed corn, under severe disease pressure, can a third application be made 14 days later. Can be tank-mixed with Mako or Matador for insect control.
		Bumper 418 EC	150–300 mL/ha (60–121 mL/acre)		
	pyraclostrobin + fluxapyroxad	Priaxor	300 mL/ha (120 mL/acre)	21	Ground and aerial application. For optimal disease control, begin applications prior to disease development. Use a minimum water volume of 100 L/ha for ground application. Maximum 2 applications/yr. 12-hr re-entry period.
	prothioconazole	Proline 480 SC	315–420 mL/ha (127–170 mL/acre)	24 hr OR 20 days for hand- detasselling seed corn	Ground and aerial application. Maximum 1 application/yr. 24-hr re-entry period. EXCEPTION: 20 days for hand-harvesting sweet corn and hand-detasselling seed corn. Apply Proline 480 SC foliar fungicide as a preventive foliar spray when the earliest disease symptoms appear on the leaves and stems. Fields should be observed closely for early disease symptoms, particularly under prolonged conditions favourable for disease development.
	picoxystrobin	Acapela	0.53–0.8 L/ha (0.21–0.32 L/acre)	7	Ground and aerial application. Apply prior to disease development and continue on a 7–14-day interval. Use high rate and shorter interval when disease pressure is high. Apply no more than 2 sequential applications before switching to a fungicide with a different mode of action. Maximum 2.64 L/ha/season. 12-hr re-entry period.
propiconazole + tebuconazole	Stratego 250 EC	730–880 mL/ha (295–356 mL/acre)	14	Ground and aerial application. Use the higher rate when disease pressure is severe. Do not apply more than 2 applications of Stratego 250 EC per season. Do not apply to sweet corn within 14 days of harvest.	
HELMINTHOSPORIUM LEAF SPOT (<i>Cochliobolus carbonum</i>)					
This disease is not generally a problem in Ontario, since hybrids with resistance are available. Consult with your seed company for hybrid selection. Crop rotation and tillage will reduce inoculum levels in surface residues. In reduced tillage systems, rotation and resistance are necessary. Chemical control is usually not economical in field corn but may be necessary if a very susceptible seed corn inbred is used.	propiconazole	Tilt 250 E	250–500 mL/ha (100–200 mL/acre)	14	Ground and aerial application. Apply when rust pustules first appear. Under severe disease pressure, a second application 14 days later may be necessary. Only in seed corn, under severe disease pressure, can a third application be made 14 days later. Can be tank-mixed with Mako or Matador for insect control.
		Bumper 418 EC	150–300 mL/ha (60–121 mL/acre)		

CORN DISEASES

Table 1–16. Chemical Control Options for Diseases in Field Corn — Eye Spot, Southern Corn Leaf Blight

LEGEND: PHI = Pre-Harvest Interval (in days)

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
EYE SPOT (<i>Aureobasidium zeae</i> or <i>Kabatiella zeae</i>)					
Many resistant or tolerant commercial hybrids are available. Consult with your seed company for hybrid selection. Crop rotation and tillage will reduce inoculum levels in surface residues. In reduced tillage systems, rotation and resistance are necessary. Chemical control is usually not economical in field corn but may be necessary if a very susceptible seed corn inbred is used.	pyraclostrobin	Headline EC	400–600 mL/ha (160–240 mL/acre)	7	Ground and aerial application. Use a minimum water volume of 100 L/ha. For optimal disease control, begin applications prior to disease development. Do not graze treated crop within 6 days of last application. Maximum 2 applications/yr. 12-hr re-entry period.
	azoxystrobin + propiconazole	Quilt	0.75–1.0 L/ha (305–406 mL/acre)	30	Ground and aerial application. Apply when disease first appears, followed by a second application 14 days after, if environmental conditions are favourable for disease development. Do not apply to field corn or field corn grown for seed after brown silk. Maximum 2 applications/yr.
	propiconazole	Tilt 250 E	500 mL/ha (200 mL/acre)	14	Ground and aerial application. Apply when rust pustules first appear. Under severe disease pressure, a second application 14 days later may be necessary. Only in seed corn, under severe disease pressure, can a third application be made 14 days later. Can be tank-mixed with Mako or Matador for insect control.
		Bumper 418 EC	300 mL/ha (121 mL/acre)		
	pyraclostrobin + fluxapyroxad	Priaxor	300 mL/ha (120 mL/acre)	21	Suppression only. For optimal disease control, begin applications prior to disease development. Use a minimum water volume of 100 L/ha for ground application. Maximum 2 applications/yr. 12-hr re-entry period.
	prothioconazole	Proline 480 SC	315–420 mL/ha (127–170 mL/acre)	24 hr OR 20 days for hand- detasselling seed corn	Ground and aerial application. Maximum 1 application/yr. 24-hr re-entry period. EXCEPTION: 20 days for hand-harvesting sweet corn and hand-detasselling seed corn. Apply Proline 480 SC foliar fungicide as a preventive foliar spray when the earliest disease symptoms appear on the leaves and stems. Observe fields closely for early disease symptoms, particularly under prolonged conditions favourable for disease development. Under high disease pressure, use a non-ionic surfactant with Proline 480 SC foliar fungicide (do not apply a non-ionic surfactant prior to tassel emergence, as crop injury may occur).
propiconazole + tebuconazole	Stratego 250 EC	730–880 mL/ha (295–356 mL/acre)	14	Ground and aerial application. Use the higher rate when disease pressure is severe. Do not apply more than 2 applications of Stratego 250 EC per season. Do not apply to sweet corn within 14 days of harvest.	
SOUTHERN CORN LEAF BLIGHT (<i>Cochliobolus heterostrophus</i>)					
Was a major concern in the 1970s, but with the switch from cytoplasm male sterile T to normal cytoplasm corn, the disease is not considered to be a threat.	azoxystrobin + propiconazole	Quilt	0.75–1.0 L/ha (305–406 mL/acre)	30	Ground and aerial application. Apply when disease first appears, followed by a second application 14 days after, if environmental conditions are favourable for disease development. Do not apply to field corn or field corn grown for seed after brown silk. Maximum 2 applications/yr.
	propiconazole	Tilt 250 E	250–500 mL/ha (100–200 mL/acre)	14	Ground and aerial application. Apply when disease first appears. Can be tank-mixed with Mako or Matador for insect control. Under severe disease pressure, a second application 14 days later may be necessary. Only in seed corn, under severe disease pressure can a third application be made 14 days later.
Bumper 418 EC		150–300 mL/ha (60–121 mL/acre)			

CORN DISEASES

Table 1–17. Chemical Control Options for Diseases in Field and Seed Corn — Grey Leaf Spot, Nematodes

LEGEND: PHI = Pre-Harvest Interval (in days)

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
GREY LEAF SPOT (<i>Cercospora zeae-maydis</i>)					
This disease is becoming more common in Southwestern Ontario. Some hybrids are tolerant/resistant to the disease. Consult with your seed company for hybrid selection. Crop rotation and tillage will reduce inoculum levels in surface residues. In reduced tillage systems, rotation and resistance are necessary. Chemical control is usually not economical in field corn.	pyraclostrobin	Headline EC	400–600 mL/ha (160–240 mL/acre)	7	Ground and aerial application. Use a minimum water volume of 100 L/ha. For optimal disease control, begin applications prior to disease development. Do not graze treated crop within 6 days of last application. Maximum 2 applications/yr. 12-hr re-entry period.
	azoxystrobin + propiconazole	Quilt	0.75–1.0 L/ha (305–406 mL/acre)	30	Ground and aerial application. Apply when disease first appears, followed by a second application 14 days after, if environmental conditions are favourable for disease development. Do not apply to field corn or field corn grown for seed after brown silk. Maximum 2 applications/yr.
	pyraclostrobin + fluxapyroxad	Priaxor	300 mL/ha (120 mL/acre)	21	Ground and aerial application. For optimal disease control, begin applications prior to disease development. Use a minimum water volume of 100 L/ha for ground application. Maximum 2 applications/yr. 12-hr re-entry period.
	prothioconazole	Proline 480 SC	315–420 mL/ha (127–170 mL/acre)	24 hr OR 20 days for hand- detasselling seed corn	Ground and aerial application. Maximum 1 application per year. 24-hr re-entry period. EXCEPTION: 20 days for hand-harvesting sweet corn and hand-detasselling seed corn. Apply Proline 480 SC foliar fungicide as a preventive foliar spray when the earliest disease symptoms appear on the leaves and stems. Observe fields closely for early disease symptoms, particularly under prolonged conditions favourable for disease development. Under high disease pressure, use a non-ionic surfactant with Proline 480 SC foliar fungicide (do not apply a non-ionic surfactant prior to tassel emergence, as crop injury may occur).
	penthiopyrad	Vertisan	1–1.75 L/ha (0.4–0.7 L/acre)	7	Ground and aerial application. Begin applications prior to disease development and continue on a 7–14-day interval. Use higher rate and shorter interval when disease pressure is high. Do not apply more than 2 sequential applications before switching to a fungicide with a different mode of action. Maximum 3.5 L/ha/yr. 12-hr re-entry period, 3 days if detasselling.
	propiconazole	Tilt 250 E Bumper 418 EC	500 mL/ha (200 mL/acre) 300 mL/ha (121 mL/acre)	14	Ground and aerial application. Apply when rust pustules first appear. Under severe disease pressure, a second application 14 days later may be necessary. Only in seed corn, under severe disease pressure, can a third application be made 14 days later. Can be tank-mixed with Mako or Matador for insect control.
NEMATODES: NEEDLE (<i>Longidorus</i> spp.), ROOT LESION (<i>Pratylenchus</i> spp.), ROOT KNOT (<i>Meloidogyne</i> spp.)					
Corn nematodes are difficult to diagnose in the field without a lab test. Unfortunately symptoms are misdiagnosed for other problems. Above-ground symptoms typically include stunting, yellowing and uneven stands while root symptoms may include lesions, discolouration, lack of root hairs and/or stunted root growth.	<i>Bacillus firmus</i> strain I-1582	Votivo 240 FS	0.042–0.42 mL/ 1,000 seeds	N/A	Check with your seed corn dealer for availability and co-pack formulations.

CORN DISEASES

Table 1–18. Chemical Control Options for Diseases in Field Corn — Stalk Rot, Fusarium and Gibberella Ear Rots

LEGEND: PHI = Pre-Harvest Interval (in days)

Integrated Pest Management Options	Active Ingredient	Trade Name	Rate	PHI	Comments (label precautions, re-entry periods, etc.)
STALK ROT suppression only (<i>Fusarium</i>, <i>Gibberella</i> and <i>Colletotrichum</i>)					
Foliar Treatment					
<p>The distribution and prevalence of stalk and ear rot diseases vary from year to year. However, the diseases are present in most years even though at low levels. The majority of stalk rot damage in Ontario is caused by three fungi, namely <i>Anthraco</i>se, <i>Gibberella</i> and <i>Fusarium</i>. However, <i>Diplodia</i> and <i>Pythium</i> have also been observed in Ontario.</p> <p>Management begins by reducing crop stresses through planting hybrids that have good resistance or tolerance to leaf diseases and stalk rots, managing insects, good weed control, appropriate plant populations, a balanced N and K fertility program, crop rotation and tillage.</p>	prothioconazole	Proline 480 SC	420 mL/ha (170 mL/acre)	14	Ground and aerial application. Maximum 1 application/yr. 24-hr re-entry period.
FUSARIUM (<i>Fusarium</i> spp.) and GIBBERELLA (<i>Gibberella</i> spp.) EAR ROTS					
<p>Any of the <i>Fusarium</i> or <i>Gibberella</i> rots can establish after pollination in wounds created by insects or birds. Warm rainy weather or long dews any time after pollination may lead to ear rots in these wounded cobs. The most common and important ear mould in Ontario is <i>Gibberella zeae</i>, which is the sexual reproductive stage of <i>Fusarium graminearum</i>. Many plant pathologists believe that in years with a high occurrence of fusarium head blight in wheat, the potential exists for increased gibberella ear rot in corn. These ear rots are especially important to swine and other livestock producers since they produce mycotoxins that can have a detrimental effect on the animals. Preventing ear rots is difficult since weather conditions are critical to disease development. Although some tolerant hybrids are available, none have complete resistance. Consult with your seed company for hybrid selection. Harvest fields as soon as possible if 10% of the ears have some ear rot to limit further disease development and potential mycotoxins production.</p> <p>See OMAFRA Publication 811, <i>Agronomy Guide for Field Crops</i>, for more information.</p>	prothioconazole	Proline 480 SC	420 mL/ha (170 mL/acre)	24 hr OR 20 days for hand- detasselling seed corn	<p>Provides suppression only. Ground and aerial application. Timing of application is critical. Apply from development stage of corn between the tip of stigmata visible (silking BBCH 63) to the stigmata drying (silk browning BBCH 67). This product will reduce both disease symptoms and levels of mycotoxin in the grain. Maximum 1 application/yr. 24-hr re-entry period.</p> <p>EXCEPTION: 20 days for hand-harvesting sweet corn and hand-detasselling seed corn. Under high disease pressure, use a non-ionic surfactant with Proline 480 SC foliar fungicide (do not apply a non-ionic surfactant prior to tassel emergence, as crop injury may occur).</p>
	metconazole	Caramba	1.0 L (400 mL)	20	<p>Provides suppression only. Ground and aerial application. Apply to corn when the crop is between silking (GS 63) and silk browning (GS 67). It is important to have good spray coverage on the silks to ensure optimum efficacy. Maximum 1 application/yr. Re-entry interval is 12 hr.</p> <p>EXCEPTION: 18 days for hand harvesting. Pre-harvest interval is 20 days for field corn grain and popcorn grain. Pre-harvest interval for sweet corn cobs is 7 days for mechanical harvesting and 18 days for hand harvesting.</p>