

# SUPPLEMENT

to Protecting pollinators  
from pesticides

## APPLES



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# HOW TO USE THIS DOCUMENT

This supplement to *Protecting Pollinators From Pesticides Apples* contains information on the pesticide regulatory process of the Pest Management Regulatory Agency (PMRA) and precautionary levels for pesticide products used in apples in Canada. It is meant to help stakeholders make more informed decisions when using pesticide products that may impact pollinators.

**Use Table 1: Formulated products and their active ingredients** to identify the active ingredient(s) in a given product.

**Use Table 2: Active ingredient pollinator precaution levels** to see the PMRA restriction levels (most, moderately, and least restrictive) for active ingredients.

**Use Table 3: Pollinator precaution levels** to learn how the PMRA determines precaution levels used in Table 2.

# UNDERSTANDING POLLINATOR TOXICITY, EXPOSURE, AND RISK



**Toxicity** + **Exposure** = **Risk**

While the terms, risk and toxicity, are sometimes used interchangeably, they mean different things and should not be confused. **Toxicity** (sometimes referred to as 'hazard') of an active ingredient to bees refers to how much it will harm a bee if there is exposure. Toxicity can occur orally (ingestion) or from topical exposure, and is tested in both these ways, at different life stages, and with both single and repeated exposure on bees. **Exposure** refers to the likelihood of a pesticide coming into contact with a pollinator and the levels at which exposure may occur. Exposure considerations incorporate crop-specific information such as the attractiveness of the flowers to pollinators, time of bloom, whether managed pollinators are brought to the crop, and whether the crop is harvested before bloom. Exposure levels are estimated for different pesticide application types and rates, and may use models or actual residue levels in pollen and nectar if they are available.

It is the combination of toxicity and exposure that determine **risk** of a pesticide on a particular crop or crop group. Risk considers whether exposure is likely to occur at levels that will result in toxicity to pollinators. Risk also considers the residual toxicity, meaning how long the residues present may pose a risk to pollinators.



# PMRA RISK CHARACTERIZATION FOR POLLINATORS

The Pest Management Regulatory Agency (PMRA), a part of Health Canada, is the branch of the Canadian federal government responsible for regulating pest control products under the authority of the Pest Control Products Act, including insecticides, herbicides, fungicides, and other products. The PMRA's primary mandate is to prevent unacceptable risks to Canadians and the environment from the use of these products. PMRA applies modern, evidence-based scientific approaches to assess whether the health and environmental risks of pesticides are acceptable. When there is potential exposure of bees to a crop protection product, the PMRA requires information to assess the risk to bees.

The PMRA characterizes the risk of a product (specific to formulation and application method) by using a tiered approach that assesses the information on toxicity and exposure. This tiered approach first establishes toxicity and exposure risks for honey bees at various life stages, and progresses to colony, semi-field, and field studies depending on the level of risk found in the first tier. The risk characterization also considers the risk to other bee species such as solitary bees and bumble bees. Honey bee information may be used as a surrogate for considering risk to other bee species, with information on toxicity and exposure for other bee species considered as available. Additionally, the attractiveness of crops to honey bees and other bees, and other agronomic considerations such as whether the crop is harvested before bloom, are considered. For more information, see *Guidance for Assessing Pesticides Risks to Bees*<sup>1</sup>.

The risk characterization is used by the PMRA to determine **precaution levels** and the mitigation measures required to reduce harm to bees. Precaution levels in this document are categorized as

most restrictive, moderately restrictive, and least restrictive.

When used according to the label, the PMRA considers the risk to bees and other pollinators acceptable for pesticides registered for use in Canada. The PMRA reassesses risk as new scientific information becomes available and label precautions and registrations can change. **It is critical that users read and understand the current registrations and product label prior to use to minimize exposure and risk to pollinators.**

## ASSESSING RISKS TO WILD BEES

Currently, PMRA pesticide toxicity testing requires testing only on honey bees, however studies on bumble bees, mason bees, and other species are increasingly received, reviewed, and incorporated into pollinator risk assessments for pesticides. Wild bees may be exposed to pesticides in ways different from honey bees (such as through nesting in the ground), and the toxicity effect of a pesticide can vary from one bee species to another (depending on life cycles, body size, nesting habits, etc.)<sup>2</sup>. The PMRA takes into account new information on pesticide toxicity and exposure to pollinators other than honey bees as it emerges, however, it is important to note that at this time there are many unknowns around exposure and toxicity beyond honey bees.

<sup>1</sup> USEPA, PMRA. 2014. Guidance for assessing pesticide risks to bees. Office of Chemical Safety and Pollution Prevention Office of Pesticide Programs Environmental Fate and Effects Division, Environmental Protection Agency, Washington DC; Environmental Assessment Directorate, Pest Management Regulatory Agency, Health Canada, Ottawa, ON; California Department of Pesticide Regulation.

<sup>2</sup> Boyle, N. K., T. L. Pitts-Singer, J. Abbott, A. Alix, D. L. Cox-Foster, S. Hinarejos, D. M. Lehmann, L. Moradin, B. O'Neill, N. E. Raine, R. Singh, H. M. Thompson, N. M. Williams, and T. Steeger. 2019. Workshop on Pesticide Exposure Assessment Paradigm for Non-Apis Bees: Foundation and Summaries. *Environmental Entomology*. 48(1):4–11.

# TABLE 1.

## PESTICIDE PRODUCTS AND THEIR ACTIVE INGREDIENTS

Use Table 1 to look up specific products registered for use on apples and determine their active ingredient(s). Then go to Table 2 to check the precaution level for that active ingredient. These products were registered for use in Canada in apples in January 2021. For the most current product registration, use the PMRA's label search.

Product Name	Active Name
<b>Insecticide</b>	
ACETA 70 WP	ACETAMIPRID
ACETAMIPRID RTU INSECTICIDE	ACETAMIPRID
ACRAMITE 50WS MITICIDE	BIFENAZATE
ACTARA 25WG	THIAMETHOXAM
AGRI-MEK SC	ABAMECTIN
AGRI-MEK 1.9% EC INSECTICIDE/MITICIDE	ABAMECTIN
AMBUSH 500EC	PERMETHRIN
APOLLO SC OVICIDAL MITICIDE	CLOFENTEZINE
ASSAIL 70 WP INSECTICIDE	ACETAMIPRID
BARTLETT SUPERIOR 70 OIL EMULSIFIABLE INSECTICIDE	MINERAL OIL
BELEAF 50SG INSECTICIDE	FLONICAMID
BIOPROTEC 3P DRY FLOWABLE BIOLOGICAL INSECTICIDE	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
BIOPROTEC CAF	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
BIOPROTEC ECO	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
BIOPROTEC PLUS	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
BRIMSTONE DF	SULPHUR
BTK - BIOINSECTICIDE	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
BYI 02960 200SL INSECTICIDE	FLUPYRADIFURONE
CALYPSO 480 SC INSECTICIDE	THIACLOPRID
CHLOROPICRIN 100 LIQUID SOIL FUMIGANT	CHLOROPICRIN
CLOSER INSECTICIDE	SULFOXAFLOX
CLOTHIANIDIN INSECTICIDE	CLOTHIANIDIN
CLUTCH 50 WDG INSECTICIDE	CLOTHIANIDIN
CONFIDOR 200 SL SYSTEMIC INSECTICIDE	IMIDACLOPRID
CONFIRM 240F AGRICULTURAL INSECTICIDE	TEBUFENOZIDE

<b>Product Name</b>	<b>Active Name</b>
CORMORAN	NOVALURON ACETAMIPRID
COSAVET DF EDGE	SULPHUR
CYCLANILIPROLE 50SL INSECTICIDE	CYCLANILIPROLE
CYD-X	CYDIA POMONELLA GRANULOVIRUS (STRAIN M)
DANITOL INSECTICIDE	FENPROPATHRIN
DECIS 5 EC INSECTICIDE (EASTERN CANADA & BRITISH COLUMBIA)	DELTAMETHRIN
DECIS 100 EC INSECTICIDE	DELTAMETHRIN
DECIS FLOWABLE INSECTICIDE	DELTAMETHRIN
DELEGATE INSECTICIDE	SPINETORAM
DIPEL 2X DF BIOLOGICAL INSECTICIDE	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
DOKTOR DOOM GO GREEN PREMIUM QUALITY HORTICULTURE OIL INSECT SPRAY	MINERAL OIL
DOKTOR DOOM FORMULA 420 3-IN-1 CROP & PLANT RESCUE CONCENTRATE	CANOLA OIL
DOKTOR DOOM FORMULA 420 3-IN-1 CROP & PLANT RESCUE READY-TO-SPRAY	CANOLA OIL
DOKTOR DOOM FORMULA 420 FLOWER POWER INSECT KILLER CONCENTRATE	PYRETHRINS
DOKTOR DOOM FORMULA 420 FLOWER POWER INSECT KILLER READY-TO-USE	PYRETHRINS
DOKTOR DOOM FORMULA 420 PROFESSIONAL USE 3-IN-1 CROP & PLANT RESCUE CONCENTRATE	CANOLA OIL
DOKTOR DOOM PREMIUM 3 IN 1 CROP & PLANT RESCUE CONCENTRATE	CANOLA OIL
DOKTOR DOOM THRIP KILLER	PERMETHRIN
DOUBLE DOWN SPRAY OIL	MINERAL OIL
DRAGNET FT EMULSIFIABLE CONCENTRATE INSECTICIDE	PERMETHRIN
DUPONT ALTACOR INSECTICIDE	CHLORANTRANILIPROLE
ENTRUST INSECTICIDE	SPINOSAD
ENTRUST 80 INSECTICIDE	SPINOSAD
ENVIDOR 240 SC MITICIDE	SPIRODICLOFEN
EXIREL INSECTICIDE	CYANTRANILIPROLE
FORAY 48BA BIOLOGICAL INSECTICIDE AQUEOUS SUSPENSION	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
FPY 500	FLUOPYRAM
FYFANON 50% EC EMULSIFIABLE CONCENTRATE INSECTICIDE	MALATHION
GENERAL HYDROPONICS EXILE	POTASSIUM SALTS OF FATTY ACIDS
GENERAL HYDROPONICS SUFFOCOAT	CANOLA OIL
GF-120 FRUIT FLY BAIT	SPINOSAD

Product Name	Active Name
GREEN EARTH GARDEN SULPHUR FUNGICIDE MITICIDE	SULPHUR
GREEN EARTH LIME SULPHUR CONCENTRATE	LIME SULPHUR OR CALCIUM POLYSULPHIDE
GUARDSMAN DORMANT SPRAY OIL	MINERAL OIL
HARVANTA 50SL INSECTICIDE	CYCLANILIPROLE
HYDROWORXX INSECTICIDE/MITICIDE CONCENTRATE	PYRETHRINS
IMIDAN 50-WP INSTAPAK AGRICULTURAL INSECTICIDE WETTABLE POWDER	PHOSMET
IMIDAN WP INSECTICIDE	PHOSMET
INTREPID INSECTICIDE	METHOXYFENOZIDE
IPCO SYNCRO	PERMETHRIN
ISOMATE OFM TT	E-8-DODECEN-1-YL ACETATE OR E-8-DODECENYL ACETATE Z-8-DODECEN-1-OL OR Z-8-DODECENOL Z-8-DODECEN-1-YL ACETATE OR Z-8-DODECENYL ACETATE
ISOMATE CM FLEX	1-TETRADECANOL 1-DODECANOL CODLELURE
ISOMATE DWB	(E,Z)-2,13-OCTADECADIEN-1-YL ACETATE (E,Z)-2,13-OCTADECADIEN-1-OL (Z,Z)-3,13-OCTADECADIEN-1-YL ACETATE (Z,Z)-3,13-OCTADECADIEN-1-OL
ISOMATE-CM/LR TT	(Z)-11-TETRADECENAL (Z)-11-TETRADECEN-1-OL (Z)-9-TETRADECEN-1-YL ACETATE 1-TETRADECANOL 1-DODECANOL CODLELURE (Z)-11-TETRADECENYL ACETATE
ISOMATE-CM/OFM TT	E-8-DODECEN-1-YL ACETATE OR E-8-DODECENYL ACETATE 1-TETRADECANOL 1-DODECANOL CODLELURE Z-8-DODECEN-1-OL OR Z-8-DODECENOL Z-8-DODECEN-1-YL ACETATE OR Z-8-DODECENYL ACETATE
ISOMATE-P PHEROMONE	(E,Z)-3,13-OCTADECADIEN-1-YL ACETATE (Z,Z)-3,13-OCTADECADIEN-1-YL ACETATE
KANEMITE 15 SC MITICIDE	ACEQUINOCYL
KING ECO-WAY FRUIT TREE & GARDEN FUNGICIDE SPRAY OR DUST	SULPHUR
KLENZE 11 INSECTICIDE	PERMETHRIN
KLENZE 18 INSECTICIDE	PERMETHRIN
KLENZE 2 INSECTICIDE	PERMETHRIN
KOPA INSECTICIDAL SOAP	POTASSIUM SALTS OF FATTY ACIDS

<b>Product Name</b>	<b>Active Name</b>
KUMULUS DF WATER DISPERSIBLE GRANULAR FUNGICIDE AND ACARICIDE	SULPHUR
LABAMBA INSECTICIDE	LAMBDA-CYHALOTHRIN
LANDSCAPE OIL SPRAY EMULSIFIABLE INSECTICIDE	MINERAL OIL
LIME SULPHUR INSECTICIDE MITICIDE FUNGICIDE	LIME SULPHUR OR CALCIUM POLYSULPHIDE
MAKO INSECTICIDE	CYPERMETHRIN
MALATHION 85E	MALATHION
MATADOR 120 EC Emulsifiable Concentrate Insecticide	LAMBDA-CYHALOTHRIN
MICROSCOPIC SULPHUR WETTABLE POWDER FUNGICIDE	SULPHUR
MINECTO PRO	ABAMECTIN CYANTRANILIPROLE
MOHAWK DORMANT SPRAY OIL	MINERAL OIL
MOVENTO 150 OD INSECTICIDE	SPIROTETRAMAT
MOVENTO 240 SC INSECTICIDE	SPIROTETRAMAT
MUSTGROW CROP BIOFUMIGANT	ORIENTAL MUSTARD SEED MEAL
NEALTA MITICIDE	CYFLUMETOFEN
NEU1161I RTU INSECTICIDE/MITICIDE	PYRETHRINS
NEU1161I RTU WITH PULLN SPRAY APPLICATOR INSECTICIDE / MITICIDE	PYRETHRINS
NEU1161I RTU WITH QUICK CONNECT SPRAYER INSECTICIDE / MITICIDE	PYRETHRINS
NEU1161I WITH APPLICATOR	PYRETHRINS
NEUDORFF ANT AND INSECT BAIT	SPINOSAD
NEUDOSAN COMMERCIAL	POTASSIUM SALTS OF FATTY ACIDS
NEXTER SC MITICIDE/INSECTICIDE	PYRIDABEN
NEXTER WP MITICIDE/INSECTICIDE	PYRIDABEN
OPAL INSECTICIDAL SOAP	POTASSIUM SALTS OF FATTY ACIDS
PERM-UP EMULSIFIABLE CONCENTRATE INSECTICIDE	PERMETHRIN
PIC PLUS FUMIGANT	CHLOROPICRIN
POLECI 2.5 EC EASTERN INSECTICIDE	DELTAMETHRIN
POUNCE 384 EC INSECTICIDE	PERMETHRIN
PURESPRAY GREEN SPRAY OIL 13E	MINERAL OIL
PURESPRAY GREEN CONCENTRATE	MINERAL OIL
RADIANT SC	SPINETORAM
RIMON 10 EC	NOVALURON
RIMON 10 EC NOVALURON INSECTICIDE	NOVALURON
RIPCORD 400 EC	CYPERMETHRIN
SAFER'S BTK BIOLOGICAL INSECTICIDE	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
SAFER'S END-ALL INSECTICIDE/MITICIDE	PYRETHRINS
SAFER'S END-ALL INSECTICIDE/MITICIDE CONCENTRATE	PYRETHRINS

<b>Product Name</b>	<b>Active Name</b>
SCORPIO ANT AND INSECT BAIT	SPINOSAD
SEMIOS CM ECO	CODLELURE
SEMIOS CM PLUS	CODLELURE
SEMIOS OFM ECO	E-8-DODECEN-1-YL ACETATE OR E-8-DODECENYL ACETATE Z-8-DODECEN-1-OL OR Z-8-DODECENOL Z-8-DODECEN-1-YL ACETATE OR Z-8-DODECENYL ACETATE
SEMIOS OFM PLUS	E-8-DODECEN-1-YL ACETATE OR E-8-DODECENYL ACETATE Z-8-DODECEN-1-OL OR Z-8-DODECENOL Z-8-DODECEN-1-YL ACETATE OR Z-8-DODECENYL ACETATE
SEVIN XLR CARBARYL INSECTICIDE LIQUID SUSPENSION	CARBARYL
SHIP 250 EC INSECTICIDE	CYPERMETHRIN
SILENCER 120 EC EMULSIFIABLE CONCENTRATE INSECTICIDE	LAMBDA-CYHALOTHRIN
SILENCER 120 EC LOW VOC	LAMBDA-CYHALOTHRIN
SIVANTO PRIME INSECTICIDE	FLUPYRADIFURONE
SPINOSAD INSECTICIDE	SPINOSAD
SUCCESS INSECTICIDE	SPINOSAD
SUFFOIL-X	MINERAL OIL
SUNSPRAY ULTRA-FINE	MINERAL OIL
SUPERIOR 70 OIL	MINERAL OIL
SUPERIOR LIME SULPHUR	LIME SULPHUR OR CALCIUM POLYSULPHIDE
SUPERIOR MALATHION LIQUID INSECTICIDE-MITICIDE CONCENTRATE	MALATHION
SURE SPRAY INSECTICIDE VB-5	PERMETHRIN
SURROUND. WP CROP PROTECTANT	KAOLIN
TENGARD EMULSIFIABLE CONCENTRATE INSECTICIDE	PERMETHRIN
THE PROTECTOR HOUSE AND GARDEN	PERMETHRIN
TWINGUARD INSECTICIDE	SULFOXAFLO SPINETORAM
UNIVAR DORMANT SPRAY OIL	MINERAL OIL
UP-CYDE 2.5 EC	CYPERMETHRIN
VAYEGO 200 SC INSECTICIDE	TETRANILIPROLE
VEGOL CROP OIL	CANOLA OIL
VEGOL INSECTICIDAL OIL	CANOLA OIL
VEGOL READY-TO-SPRAY	CANOLA OIL
VEGOL SINGLE DOSE INSECTICIDAL OIL	CANOLA OIL

<b>Product Name / Insecticide Products</b>	<b>Active Name</b>
VELUM PRIME	FLUOPYRAM
VERSYS INSECTICIDE	AFIDOPYROPEN
VIROSOFT CP4 BIO-INSECTICIDE FOR CODLING MOTH ON APPLE TREES	CYDIA POMONELLA GRANULOSIS VIRUS (STRAIN CMGV4)
VYDATE INSECTICIDE/NEMATICIDE	OXAMYL
WARRIOR INSECTICIDE	LAMBDA-CYHALOTHRIN
WILSON AMBUSH TREE & GARDEN INSECT KILLER	PERMETHRIN
WILSON FRUIT GUARD INSECT KILLER	PERMETHRIN
XENTARI WG	BACILLUS THURINGIENSIS SSP. AIZAWAI
<b>Fungicides</b>	
A15457 FUNGICIDE	BENZOVINDIFLUPYR
A20259 FUNGICIDE	"DIFENOCONAZOLE
PYDIFLUMETOFEN"	FOSETYL-AL
AGROSOLAN LIQUID FUNGICIDE	MANCOZEB
ALIETTE WETTABLE POWDER SYSTEMIC FUNGICIDE	FOSETYL-AL
ALIETTE SYSTEMIC FUNGICIDE	FOSETYL-AL
ALIETTE WDG SYSTEMIC FUNGICIDE	FOSETYL-AL
ALLEGRO 500F AGRICULTURAL FUNGICIDE	FLUAZINAM
APROVIA FUNGICIDE	BENZOVINDIFLUPYR
APROVIA TOP	"BENZOVINDIFLUPYR
DIFENOCONAZOLE"	CHLOROTHALONIL
BAD747 LC	BACILLUS AMYLOLIQUEFACIENS, STRAIN D747
BAD747 WG	BACILLUS AMYLOLIQUEFACIENS, STRAIN D747
BARTLETT MICROSCOPIC WETTABLE SULPHUR	SULPHUR
BIOPROTEC FRUIT TREE FUNGICIDE CONCENTRATE	GARLIC POWDER
BIOPROTEC FRUIT TREE FUNGICIDE READY TO USE	GARLIC POWDER
BLIGHTBAN A506	PSEUDOMONAS FLUORESCENS A506
BLOOMTIME BIOLOGICAL FD BIOPESTICIDE FAST DIS-SOLVING POWDER	PANTOEA AGGLOMERANS STRAIN E325 (NRRL B-21856)
BLOSSOM PROTECT	AUREOBASIDIUM PULLULANS DSM 14940 AND DSM 14941
BMJ WG	BACILLUS MYCOIDES ISOLATE J
BRIMSTONE DF	SULPHUR
BURAN	GARLIC POWDER
CAPTAN 4 FLOWABLE AGRICULTURAL FUNGICIDE	CAPTAN
CAPTAN 50 WP FUNGICIDE	CAPTAN
CAPTAN 80 DF FUNGICIDE	CAPTAN
CAPTAN 80 WSP FUNGICIDE	CAPTAN
CEVYA	MEFENTRIFLUCONAZOLE
CGA279202 50WG FUNGICIDE	TRIFLOXYSTROBIN
CHLOROPICRIN 100 LIQUID SOIL FUMIGANT	CHLOROPICRIN

<b>Product Name</b>	<b>Active Name</b>
COPPER 53W	COPPER, PRESENT AS BASIC COPPER SULFATE
COPPER SPRAY FUNGICIDE	COPPER (PRESENT AS COPPER OXYCHLORIDE)
COSAVET DF EDGE	SULPHUR
CUEVA RTU WITH QUICK CONNECT SPRAYER	COPPER (PRESENT AS COPPER OCTANOATE)
CUEVA COMMERCIAL	COPPER (PRESENT AS COPPER OCTANOATE)
CUEVA READY-TO-SPRAY	COPPER (PRESENT AS COPPER OCTANOATE)
CUEVA RTU	COPPER (PRESENT AS COPPER OCTANOATE)
CUEVA RTU WITH PULLN SPRAY APPLICATOR	COPPER (PRESENT AS COPPER OCTANOATE)
CUEVA RTU WITH QUICKPUMP APPLICATOR	COPPER (PRESENT AS COPPER OCTANOATE)
CUEVA RTU WITH WAND APPLICATOR	COPPER (PRESENT AS COPPER OCTANOATE)
DIPLOMAT 5SC FUNGICIDE	POLYOXIN D ZINC SALT
DITHANE RAINSHIELD FUNGICIDE	MANCOZEB
DOKTOR DOOM FORMULA 420 3-IN-1 CROP & PLANT RESCUE CONCENTRATE	CANOLA OIL
DOKTOR DOOM FORMULA 420 3-IN-1 CROP & PLANT RESCUE READY-TO-SPRAY	CANOLA OIL
DOKTOR DOOM FORMULA 420 FUNGICIDE CONCENTRATE	COPPER (PRESENT AS COPPER OCTANOATE)
DOKTOR DOOM FORMULA 420 FUNGICIDE READY-TO-USE (RTU)	COPPER (PRESENT AS COPPER OCTANOATE)
DOKTOR DOOM FORMULA 420 PROFESSIONAL USE 3-IN-1 CROP & PLANT RESCUE CONCENTRATE	CANOLA OIL
DOKTOR DOOM PREMIUM 3 IN 1 CROP & PLANT RESCUE CONCENTRATE	CANOLA OIL
DOUBLE DOWN SPRAY OIL	MINERAL OIL
EXCALIA FUNGICIDE	INPYRFLUXAM
FLINT FUNGICIDE	TRIFLOXYSTROBIN
FLINT 50WG FUNGICIDE	TRIFLOXYSTROBIN
FOLPAN 80 WDG FUNGICIDE	FOLPET
FONTELIS FUNGICIDE	PENTHIOPYRAD
FPY 500	FLUOPYRAM
FULLBACK 125 SC FUNGICIDE	FLUTRIAFOL
FUNGINEX DC FUNGICIDE	TRIFORINE
GENERAL HYDROPONICS SUFFOCOAT	CANOLA OIL
GREEN EARTH BORDO COPPER SPRAY	COPPER, PRESENT AS BASIC COPPER SULFATE
GREEN EARTH GARDEN SULPHUR FUNGICIDE MITICIDE	SULPHUR
GREEN EARTH LIME SULPHUR CONCENTRATE	LIME SULPHUR OR CALCIUM POLYSULPHIDE
HOLLYSUL MICRO-SULPHUR	SULPHUR
HYDROWORXX DISEASE CONTROL CONCENTRATE	COPPER (PRESENT AS COPPER OCTANOATE)
INSPIRE FUNGICIDE	DIFENOCONAZOLE

<b>Product Name</b>	<b>Active Name</b>
INSPIRE SUPER FUNGICIDE	CYPRODINIL DIFENOCONAZOLE
ISOFETAMID 400SC FUNGICIDE	ISOFETAMID
KASUMIN	KASUGAMYCIN (PRESENT AS HYDROCHLORIDE HYDRATE)
KENJA 400SC FUNGICIDE	ISOFETAMID
KING ECO-WAY PTV POTATO, TOMATO & VEGETABLE FUNGICIDE SPRAY	COPPER, PRESENT AS BASIC COPPER SULFATE
KING ECO-WAY FRUIT TREE & GARDEN FUNGICIDE SPRAY OR DUST	SULPHUR
KUMULUS DF WATER DISPERSIBLE GRANULAR FUNGICIDE AND ACARICIDE	SULPHUR
LIME SULPHUR INSECTICIDE MITICIDE FUNGICIDE	LIME SULPHUR OR CALCIUM POLYSULPHIDE
LUNA PRIVILEGE	FLUOPYRAM
LUNA TRANQUILITY FUNGICIDE	FLUOPYRAM PYRIMETHANIL
MAESTRO 80 WSP FUNGICIDE	CAPTAN
MANZATE DISPERSS	MANCOZEB
MANZATE PRO-STICK FUNGICIDE	MANCOZEB
MANZATE MAX	MANCOZEB
MICROSCOPIC SULPHUR WETTABLE POWDER FUNGICIDE	SULPHUR
MICROTHIOL DISPERSS	SULPHUR
MIRACLE-GRO GARDEN DEFENSE GARDEN DISEASE CONTROL CONCENTRATE	COPPER (PRESENT AS COPPER OCTANOATE)
MIRACLE-GRO GARDEN DEFENSE GARDEN DISEASE CONTROL READY-TO-SPRAY	COPPER (PRESENT AS COPPER OCTANOATE)
MIRACLE-GRO GARDEN DEFENSE GARDEN DISEASE CONTROL READY-TO-USE	COPPER (PRESENT AS COPPER OCTANOATE)
MIRACLE-GRO GARDEN DEFENSE GARDEN DISEASE CONTROL READY-TO-USE WITH WAND APPLICATOR	COPPER (PRESENT AS COPPER OCTANOATE)
MUSTGROW CROP BIOFUMIGANT	ORIENTAL MUSTARD SEED MEAL
NOVA FUNGICIDE	MYCLOBUTANIL
NUFARM BLIGHTBAN C9-1	PANTOEA AGGLOMERANS C9-1
OXIDATE	HYDROGEN PEROXIDE PEROXYACETIC ACID
OXIDATE 2.0	HYDROGEN PEROXIDE PEROXYACETIC ACID
OXIDATE FC	HYDROGEN PEROXIDE PEROXYACETIC ACID
PARASOL FLOWABLE FUNGICIDE	COPPER (PRESENT AS COPPER HYDROXIDE)
PENNZOZEB 75DF FUNGICIDE	MANCOZEB
PENNZOZEB 75DF RAINCOAT FUNGICIDE	MANCOZEB

<b>Product Name</b>	<b>Active Name</b>
PHOSTROL FUNGICIDE	MONO- AND DIBASIC SODIUM, POTASSIUM, AND AMMONIUM PHOSPHITES
PIC PLUS FUMIGANT	CHLOROPICRIN
POLYOXIN D ZINC SALT 5SC FUNGICIDE	POLYOXIN D ZINC SALT
POTASSIUM BICARBONATE	POTASSIUM BICARBONATE
PRISTINE WG FUNGICIDE	"BOSCALID
PYRACLOSTROBIN"	EXTRACT OF REYNOUTRIA SACHALINENSIS
PURESPRAY GREEN SPRAY OIL 13E	MINERAL OIL
QST713 LIQUID	BACILLUS SUBTILIS (STRAIN QST 713)
REGALIA LIQUID FUNGICIDE CONCENTRATE	EXTRACT OF REYNOUTRIA SACHALINENSIS
REGALIA LIQUID FUNGICIDE READY-TO-SPRAY	EXTRACT OF REYNOUTRIA SACHALINENSIS
REGALIA MAXX BIOFUNGICIDE LIQUID CONCENTRATE	EXTRACT OF REYNOUTRIA SACHALINENSIS
SAFER'S SULPHUR DUST FUNGICIDE MITICIDE	SULPHUR
SCALA SC FUNGICIDE	PYRIMETHANIL
SENATOR 50 SC FUNGICIDE	THIOPHANATE-METHYL
SENATOR 70WP	THIOPHANATE-METHYL
SENATOR 70WP 1	THIOPHANATE-METHYL
SENATOR 70WP WSB1	THIOPHANATE-METHYL
SERCADI FUNGICIDE	FLUXAPYROXAD
SERENADE OPTI	BACILLUS SUBTILIS (STRAIN QST 713)
SERENADE MAX	BACILLUS SUBTILIS (STRAIN QST 713)
SHARDA CAPTAN 48 SC	CAPTAN
SHARDA CAPTAN 80 WSP	CAPTAN
SOVRAN FUNGICIDE	KRESOXIM-METHYL
STREPTOMYCIN 17	STREPTOMYCIN
SUFFOIL-X	MINERAL OIL
SUPERIOR LIME SULPHUR	LIME SULPHUR OR CALCIUM POLYSULPHIDE
SUPRA CAPTAN 80 WSP FUNGICIDE	CAPTAN
SYLLIT 400 FL	DODINE
THIOPHANATE-METHYL 500 SC FUNGICIDE	THIOPHANATE-METHYL
VANGARD 75WG FUNGICIDE AGRICULTURAL	CYPRODINIL
VEGOL CROP OIL	CANOLA OIL
VEGOL INSECTICIDAL OIL	CANOLA OIL
VEGOL READY-TO-SPRAY	CANOLA OIL
VEGOL SINGLE DOSE INSECTICIDAL OIL	CANOLA OIL
VELUM PRIME	FLUOPYRAM
XEMIUM EC FUNGICIDE	FLUXAPYROXAD
XEMIUM SC FOLIAR FUNGICIDE	FLUXAPYROXAD

# TABLE 2.

## ACTIVE INGREDIENT POLLINATOR PRECAUTION LEVELS

Table 2 lists active ingredients registered for use in apples (as of January 2021) in Canada and their corresponding pollinator precaution levels based on the PMRA risk characterization framework: 'Most restrictive pollinator precaution', 'Moderately restrictive pollinator precaution', and 'Least restrictive pollinator precaution' (see Table 3). Pesticide active ingredients are listed alphabetically under the insecticide and fungicide sections of the table.

Active ingredient registrations frequently change and new information may change their precaution level.

In addition to formulation and application method, rate and timing, the actual risk to bees may be affected by other factors, as discussed in this guide. Further information, including special precautions for wild and native bee species, and pertinent research are included in the column titled "Additional Information (where available)". Also note that the pesticide mode of action (MoA) needs to be considered as part of an overall crop protection plan in order to avoid products becoming ineffective due to pest resistance. Information for MoA can be found at: <http://www.irac-online.org/modes-of-action/>

### LABEL SEARCH

In addition to using this table to look up pollinator precaution levels, the PMRA has a tool called the 'Pesticide Label Search' which allows the user to either download an app to access product labels from their mobile device or to use the online [label search tool](#).

### PRE-MIXES

Many pre-mixed products have entered the market containing multiple active ingredients. Refer to the pesticide label for pollinator precautions or use Table 1 to look up each active ingredient separately.

### Disclaimer

The Pest Management Regulatory Agency and Pollinator Partnership Canada neither endorse these products nor intend to discriminate against products not mentioned. Some of the pesticides listed may not be registered for use in your province. It is the user's responsibility to check the registration status of any material and any provincial restrictions before use.

### KEY TO ABBREVIATIONS USED IN TABLE 2

**RT** Residual Time. The length of time the residues of the product remain toxic to bees after application.

**ERT** Extended Residual Toxicity. Residues are expected to cause at least 25% mortality for longer than 8 hours after application.

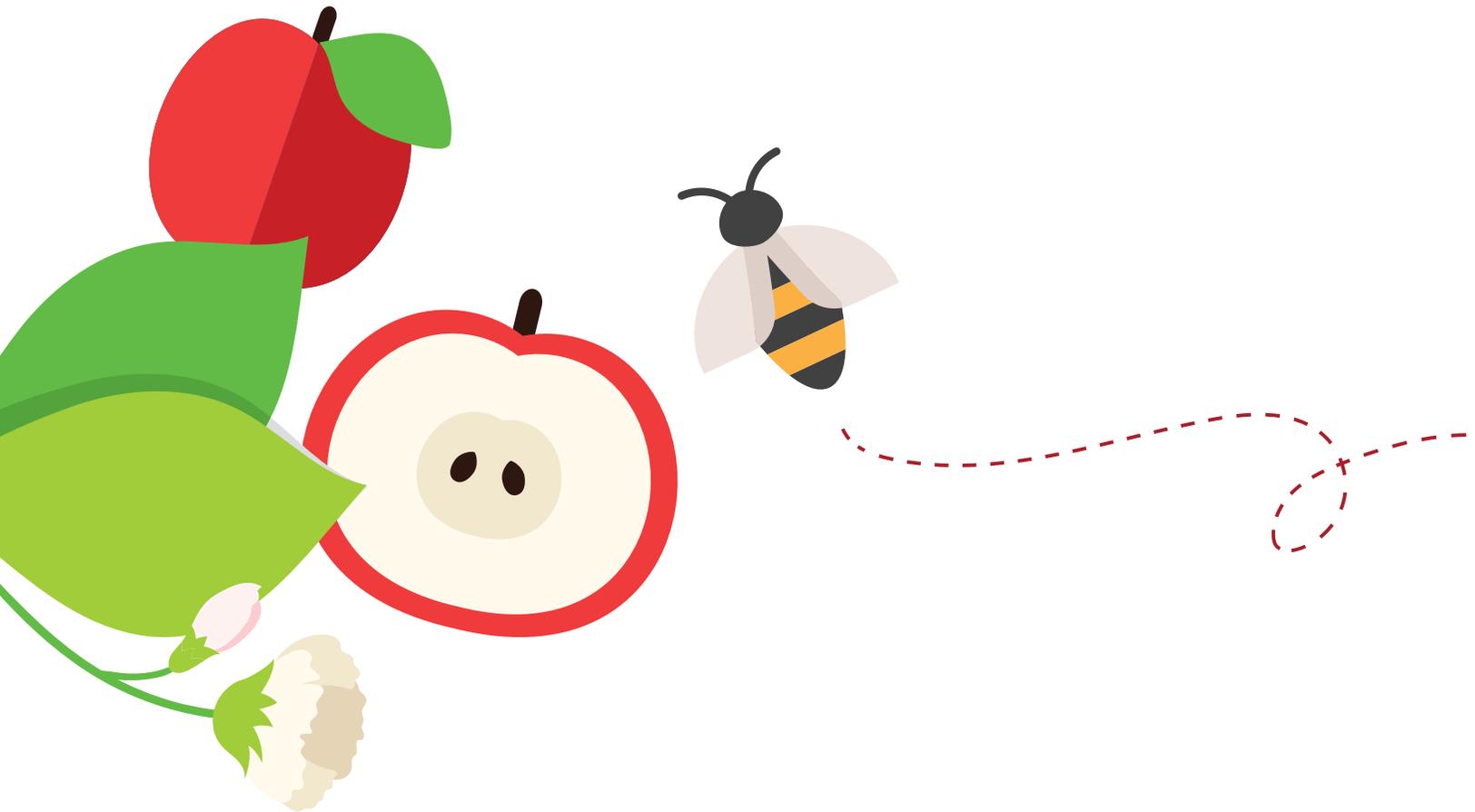
Active Ingredient	Most Restrictive	Moderately Restrictive	Least Restrictive	Additional Information (Where Available)
<b>Insecticides/Miticides</b>				
ABAMECTIN	x			
ACEQUINOCYL			x	
ACETAMIPRID		x		Cyano group neonicotinoids exhibit lower toxicity to bees than nitro group neonicotinoids <sup>1</sup> .
AFIDOPYROPEN		x		
BACILLUS THURINGIENSIS SSP. AIZAWAI		x		
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)			x	
BIFENAZATE			x	
CANOLA OIL			x	Harmful effects are caused by smothering and suffocation making risks greatest for small arthropods. Larger size of some bees is thought to mitigate negative impacts <sup>2</sup> .
CARBARYL	x			
CHLORANTRANILIPROLE			x	
CHLOROPICRIN			x	
CLOFENTEZINE			x	
CLOTHIANIDIN	x			
CODLELURE			x	
CYANTRANILIPROLE		x		
CYCLANILIPROLE	x			
CYDIA POMONELLA GRANULOSIS VIRUS (STRAINS CMGV4, M)			x	
CYFLUMETOFEN			x	
CYPERMETHRIN	x			
DELTAMETHRIN		x		>8 hours RT for alfalfa leafcutting bees <sup>3</sup> . Formulated products may have a repellent effect lasting 2-3 hours <sup>4</sup> .
FENPROPATHRIN	x			
FLONICAMID			x	
FLUOPYRAM			x	
FLUPYRADIFURONE		x		
IMIDACLOPRID	x			Bumble bees may be more sensitive to imidacloprid than honey bees <sup>5</sup> .
KAOLIN			x	
LAMBDA-CYHALOTHRIN		x		May be more toxic to bees when mixed with propiconazole. > 1 day ERT for alfalfa leafcutting bees <sup>3</sup> .

Active Ingredient	Most Restrictive	Moderately Restrictive	Least Restrictive	Additional Information (Where Available)
LIME SULPHUR OR CALCIUM POLYSULPHIDE			x	Can repel bees if applied during bloom season <sup>6</sup> .
MALATHION	x			Up to 7 days ERT for alfalfa leafcutting bees <sup>3</sup> .
MATING DISRUPTORS INCLUDING: (E,Z)-2,13-OCTADECADIEN-1-OL, (E,Z)-2,13-OCTADECADIEN-1-YL ACETATE, (E,Z)-3,13-OCTADECADIEN-1-YL ACETATE, (Z)-11-TETRADECEN-1-OL, (Z)-11-TETRADECENAL, (Z)-11-TETRADECENYL ACETATE, (Z)-9-TETRADECEN-1-YL ACETATE, (Z,Z)-3,13-OCTADECADIEN-1-OL, (Z,Z)-3,13-OCTADECADIEN-1-YL ACETATE, 1-DODECANOL, 1-TETRADECANOL, E-8-DODECEN-1-YL ACETATE, E-8-DODECENYL ACETATE, Z-8-DODECEN-1-OL, Z-8-DODECENOL, Z-8-DODECEN-1-YL ACETATE, Z-8-DODECENYL ACETATE			x	
METHOXYFENOZIDE			x	
MINERAL OIL			x	Harmful effects are caused by smothering and suffocation.
NOVALURON		x		Effects on egg hatch and larval development in alfalfa leafcutting bees <sup>7</sup> . Effects on brood development and colony strength in honey bees <sup>8</sup> .
ORIENTAL MUSTARD SEED MEAL			x	
OXAMYL		x		
PERMETHRIN	x			Up to 3 days ERT for alfalfa leafcutting bees. May be repellent in arid conditions <sup>3</sup> .
PHOSMET	x			Up to 5 days ERT for alfalfa leafcutting bees <sup>3</sup> .
POTASSIUM SALTS OF FATTY ACIDS			x	Non-target insects in flightless stage are vulnerable <sup>9</sup> .
PYRETHRINS	x			Commonly mixed with piperonyl butoxide (PBO) which acts as a synergist <sup>3</sup> .
PYRIDABEN	x			> 8 hours ERT for alfalfa leafcutting bees <sup>3</sup> .
SPINETORAM	x			

Active Ingredient	Most Restrictive	Moderately Restrictive	Least Restrictive	Additional Information (Where Available)
SPINOSAD	x			>1 day ERT for alfalfa leafcutting bees <sup>3</sup> .
SPIRODICLOFEN	x			Toxic to bee brood <sup>10</sup> .
SPIROTETRAMAT	x			Toxic to bee brood <sup>10</sup> .
SULFOXAFLOX	x			
SULPHUR			x	While most sources say sulphur poses little risk for bees, other sources suggest sulphur may repel bees and impact pollination <sup>11</sup> .
TEBUFENOZIDE			x	Honey bee learning and behavior can be affected <sup>12</sup> .
TETRANILIPROLE	x			Less toxic to bees than most other neonicotinoids <sup>1</sup> .
THIACLOPRID		x		
<b>Fungicides</b>				
AUREOBASIDIUM PULLULANS DSM 14940 AND DSM 14941			x	
BACILLUS AMYLOLIQUEFACIENS, STRAIN D747			x	
BACILLUS MYCOIDES ISOLATE J		x		Laboratory tests suggest potential effects on bumble bees <sup>13</sup> .
BACILLUS SUBTILIS (STRAIN QST 713)			x	
BENZOVINDIFLUPYR			x	
BOSCALID			x	Boscalid will also increase the toxicity of insecticide seed treatments to honey bees <sup>14</sup> .
CANOLA OIL			x	Harmful effects are caused by smothering and suffocation making risks greatest for small arthropods.
CAPTAN			x	ERT lasting up to 7 days for mason bees <sup>3</sup> . Negative effects on honey bee brood observed in lab but not in field <sup>15</sup> .
CHLOROPICRIN			x	
COPPER (PRESENT AS COPPER HYDROXIDE)			x	
COPPER (PRESENT AS COPPER OCTANOATE)			x	
COPPER (PRESENT AS COPPER OXYCHLORIDE)			x	
COPPER, PRESENT AS BASIC COPPER SULFATE			x	
CYPRODINIL			x	

Active Ingredient	Most Restrictive	Moderately Restrictive	Least Restrictive	Additional Information (Where Available)
DIFENOCONAZOLE			x	Can synergize with cyprodinil to cause learning difficulties in honey bees <sup>3</sup> .
DODINE			x	
EXTRACT OF REYNOUTRIA SACHALINENSIS			x	
FLUAZINAM			x	
FLUOPYRAM			x	
FLUTRIAFOL			x	
FLUXAPYROXAD			x	
FOLPET			x	
FOSETYL-AL			x	
GARLIC POWDER			x	
HYDROGEN PEROXID		x		
INPYRFLUXAM			x	
ISOFETAMID			x	
KASUGAMYCIN (PRESENT AS HYDROCHLORIDE HYDRATE)			x	
KRESOXIM-METHYL			x	
LIME SULPHUR OR CALCIUM POLYSULPHIDE			x	Can repel bees if applied during bloom season <sup>6</sup> .
MANCOZEB			x	
MEFENTRIFLUCONAZOLE			x	
MINERAL OIL			x	
MONO- AND DIBASIC SODIUM, POTASSIUM, AND AMMONIUM PHOSPHITES			x	
MYCLOBUTANIL			x	
ORIENTAL MUSTARD SEED MEAL			x	
PANTOEA AGGLOMERANS C9-1			x	
PANTOEA AGGLOMERANS STRAIN E325 (NRRL B-21856)			x	
PENTHIOPYRAD			x	
PEROXYACETIC ACID		x		
POLYOXIN D ZINC SALT			x	
POTASSIUM BICARBONATE			x	
PSEUDOMONAS FLUORESCENS A506			x	
PYDIFLUMETOFEN			x	
PYRACLOSTROBIN			x	
PYRIMETHANIL			x	
STREPTOMYCIN			x	

Active Ingredient	Most Restrictive	Moderately Restrictive	Least Restrictive	Additional Information (Where Available)
SULPHUR			x	While most sources say sulphur poses little risk for bees, other sources suggest sulfur may repel bees and impact pollination <sup>11</sup> .
THIOPHANATE-METHYL			x	
TRIFLOXYSTROBIN			x	
TRIFORINE			x	



# TABLE 3. POLLINATOR PRECAUTION LEVELS

Table 3 provides some of the considerations used by the PMRA to define the pollinator precaution levels.

This table is not specific to apples but rather shows how pesticide risk to pollinators is characterized for any active ingredient.

Three pollinator precaution levels are described here and correspond to the categories in Table 2 of this document. Always refer to label directions when applying pesticides as restrictions are specific to products and crops and are essential for minimizing harm to bees.

	<b>MOST RESTRICTIVE</b>	<b>MODERATELY RESTRICTIVE</b>	<b>LEAST RESTRICTIVE</b>
	Typically requires the most restrictive precautions, with greater restrictions for applications to highly bee-attractive crops	Typically requires some restrictions on application to bee-attractive crops	Typically requires minimal or no restrictions
<b>Acute adult contact/oral toxicity</b>	Typically highly toxic with an acute toxicity LD50 of < 2 µg/bee. Some pesticides may be highly toxic but have moderately restrictive labels due to short residual toxicity.	Typically moderately toxic with an acute toxicity LD50 of > 2 µg/bee to < 10.9 µg/bee. Note that some pesticides may be highly toxic but have moderately restrictive labels due to short residual toxicity.	Typically practically non-toxic with an acute toxicity LD50 of ≥ 11 µg/bee.
<b>Larval toxicity</b>	May have larval toxicity.	May have larval toxicity.	Typically none.
<b>Chronic toxicity</b>	May have chronic toxicity.	May have chronic toxicity.	Typically none.
<b>Residual toxicity</b>	Typically greater than 8 hours.	Typically 2 to 8 hours.	Typically no residual toxicity.

<b>Higher tier studies</b>	Available higher tier studies may indicate longer residual toxicity and a potential for effects even when exposure to residues occurs well after application (typically one to several days after application).	Available higher tier studies may indicate shorter residual toxicity and a potential for effects only when exposure to residues occurs shortly after application.	Higher tier studies are not typically required for low toxicity compounds; however, in some cases information may be available. Available higher tier studies would indicate a negligible potential for effects.
<b>Crop pollinator attractiveness</b>	Highly attractive crops require the most restrictive precautions, whereas crops with low or moderate attractiveness may require less restrictive statements.	Restrictions are similar for crops with high, moderate, and low crop attractiveness, and greater restrictions for highly attractive crops are not typically required.	No/minimal restrictions for crops with high, moderate, and low crop attractiveness.
<b>Bloom in relation to harvest</b>	Crops harvested after bloom would have restrictive statements.	Crops harvested after bloom may have restrictive statements.	Minimal or no restrictions whether crops harvested before or after bloom.
<b>Examples of restrictions</b>	<p>For highly bee-attractive crops, may not allow application during bloom.</p> <p>For moderately/low bee-attractive crops, avoid application during bloom but if necessary evening application may be allowed.</p> <p>May restrict pre-bloom application timing (i.e., certain systemic products; foliar or soil application methods).</p> <p>May be required to remove flowering weeds or groundcover prior to application (for example in orchards, or in turf lawns).</p> <p>Minimize spray drift.</p>	<p>For highly and moderately/low bee-attractive crops, avoid application during bloom but if necessary evening application may be allowed.</p> <p>Minimize spray drift.</p>	Typically requires minimal or no restrictions.

# REFERENCES

1. Blacquièrre, T., G. Smaghe, C. A. M. Van Gestel, and V. Mommaerts. 2012. Neonicotinoids in bees: A review on concentrations, side-effects and risk assessment. *Ecotoxicology* 21:973–992.
2. Pest Management Regulatory Agency. 2016. Registration Decision RD2016-35, Canola Oil. <https://www.canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/decisions-updates/registration-decision/2016/canola-oil-rd2016-35.html>.
3. Riedl, H., E. Johansen, L. Brewer, and J. Barbour. 2006. How to Reduce Bee Poisoning from Pesticides, PNW 591. Oregon State University Agricultural Experiment Station. 24p.
4. National Pesticide Information Centre. 2010. Deltamethrin General Fact Sheet. <http://npic.orst.edu/factsheets/DeltaGen.pdf>. 3p
5. Cresswell, J. E., C. J. Page, M. B. Uygun, M. Holmbergh, Y. Li, J. G. Wheeler, I. Laycock, C. J. Pook, N. H. de Ibarra, N. Smirnov, and C. R. Tyler. 2012. Differential sensitivity of honey bees and bumble bees to a dietary insecticide (imidacloprid). *Zoology* 115:365–371.
6. Biddinger, D. J., J. L. Robertson, C. Mullin, J. Frazier, S. A. Ashcraft, E. G. Rajotte, N. K. Joshi, and M. Vaughn. 2013. Comparative Toxicities and Synergism of Apple Orchard Pesticides to *Apis mellifera* (L.) and *Osmia cornifrons* (Radoszkowski). *PLoS ONE* 8.
7. Hodgson, E. W., T. L. Pitts-Singer, and J. Barbour. 2011. Effects of the insect growth regulator, novaluron on immature alfalfa leafcutting bees, *Megachile rotundata*. *Journal of Insect Science* 11:43.
8. Cutler, G. C., and C. D. Scott-Dupree. 2007. Novaluron: prospects and limitations in insect pest management. *Pest Technology* 1:38–46.
9. National Pesticide Information Center. 2001. Potassium Salts of Fatty Acids (Technical Fact Sheet). <http://npic.orst.edu/factsheets/achive/psfatech.pdf>.
10. Health Canada. Pest Management Regulatory Agency. Pesticidelabels. <http://pr-rp.hc-sc.gc.ca/ls-re/index-eng.php>
11. Mader, E., 2009. Invertebrate Conservation Fact Sheet. Organic-Approved Pesticides: Minimizing Risks to Pollinators, The Xerces Society for Invertebrate Conservation: Portland, OR.
12. Dyke, M. Van, E. Mullen, D. Wixted, and S. McArt. 2018. A Pesticide Decision-Making Guide to Protect Pollinators in Tree Fruit Orchards. College of Agriculture and Life Sciences, Cornell.
13. Mommaerts, V., G. Sterk, and G. Smaghe. 2009. A laboratory evaluation to determine the compatibility of microbiological control agents with the pollinator *Bombus terrestris*. *Pest Management Science* 65:949–955.
14. Tsvetkov, N., O. Samson-Robert, K. Sood, H. S. Patel, D. A. Malena, P. H. Gajiwala, and P. Maciukiewicz. 2017. Chronic exposure to neonicotinoids reduces honey bee health near corn crops. *Science* 356.
15. Everich, R., C. Schiller, J. Whitehead, M. Beavers, and K. Barrett. 2009. Effects of Captan on *Apis mellifera* brood development under field-conditions in California almond orchards. *Journal of Economic Entomology* 102:20–29.

A close-up photograph of several white flowers with prominent yellow stamens. The flowers are in various stages of bloom, with some petals fully open and others partially visible. The background is a soft, out-of-focus green, suggesting foliage.

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