



SUPPLEMENT

to Protecting pollinators
from pesticides

WILD BLUEBERRY

This guide is a joint project between Pollinator Partnership Canada and the Atlantic Tech Transfer Team for Apiculture. This supplement was authored by Samantha J. Medeiros, Lora Morandin, Ph.D., and Kathleen Law, M.A., Pollinator Partnership Canada.

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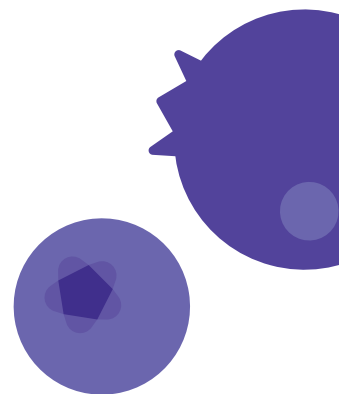
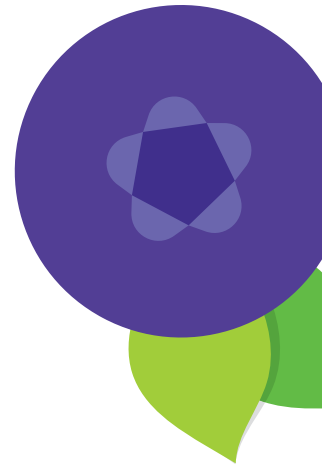
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HOW TO USE THIS DOCUMENT

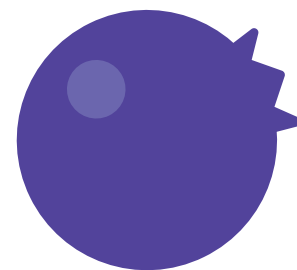
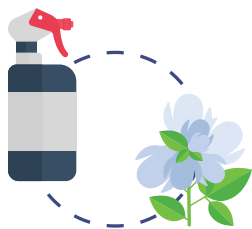
This supplement to *Protecting Pollinators From Pesticides Wild Blueberry* contains information on the pesticide regulatory process of the Pest Management Regulatory Agency (PMRA) and precautionary levels for pesticide products used in wild blueberry production in Canada. It is meant to help stakeholders 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.

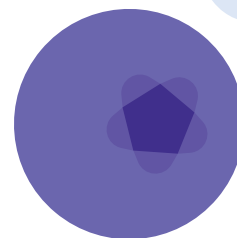
UNDERSTANDING POLLINATOR TOXICITY, EXPOSURE, AND RISK



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**.

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.)**. 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 to species beyond honey bees.

*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.

**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 wild blueberry 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 wild blueberry in January 2023. For the most current product registration, use the [PMRA's label search](#).

Product Name	Active Name
Insecticide	
ACETA 70 WP	ACETAMIPRID
ACTARA 25WG	THIAMETHOXAM
ADMIRE 240 FLOWABLE SYSTEMIC INSECTICIDE	IMIDACLOPRID
ALTACOR INSECTICIDE	CHLORANTRANILIPROLE
AMBUSH 500EC	PERMETHRIN
ASSAIL 30 SC INSECTICIDE	ACETAMIPRID
ASSAIL 70 WP INSECTICIDE	ACETAMIPRID
AXCELA	METALDEHYDE
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)
BYI 02960 200SL INSECTICIDE	FLUPYRADIFURONE
CLOSER INSECTICIDE	SULFOXAFLOL
CONCEPT LIQUID INSECTICIDE	DELTAMETHRIN IMIDACLOPRID
CONFIRM 240F AGRICULTURAL INSECTICIDE	TEBUFENOZIDE
CORMORAN	NOVALURON ACETAMIPRID
CYCLANILIPROLE 50SL INSECTICIDE	CYCLANILIPROLE
CYGON 480 SYSTEMIC INSECTICIDE	DIMETHOATE
CYGON 480-AG SYSTEMIC INSECTICIDE	DIMETHOATE

Product Name	Active Name
DANITOL INSECTICIDE	FENPROPATHRIN
DEADLINE M-PS	METALDEHYDE
DECIS 100 EC INSECTICIDE	DELTAMETHRIN
DECIS 5 EC INSECTICIDE (EASTERN CANADA & BRITISH COLUMBIA)	DELTAMETHRIN
DECIS FLOWABLE INSECTICIDE	DELTAMETHRIN
DELEGATE INSECTICIDE	SPINETORAM
DIAMANTE 4	DIMETHOATE
DIPEL 2X DF BIOLOGICAL INSECTICIDE	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
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 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
ENTRUST INSECTICIDE	SPINOSAD
ENTRUST 80 INSECTICIDE	SPINOSAD
ENVIDOR 240 SC MITICIDE	SPIRODICLOFEN
ESCAR-GO 3	METALDEHYDE
ESCAR-GO 5	METALDEHYDE
EXIREL INSECTICIDE	CYANTRANILIPROLE
FERRAMOL SLUG AND SNAIL BAIT	FERRIC PHOSPHATE
FORAY 48BA BIOLOGICAL INSECTICIDE AQUEOUS SUSPENSION	BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)
FPY 500	FLUOPYRAM
GENERAL HYDROPONICS EXILE	POTASSIUM SALTS OF FATTY ACIDS
GENERAL HYDROPONICS SUFFOCOAT	CANOLA OIL
GF-120 FRUIT FLY BAIT	SPINOSAD
HARVANTA 50SL INSECTICIDE	CYCLANILIPROLE
IMIDAN 50-WP INSTAPAK AGRICULTURAL INSECTICIDE WETTABLE POWDER	PHOSMET
IMIDAN WP INSECTICIDE	PHOSMET
INTREPID INSECTICIDE	METHOXYFENOZIDE
IPCO SYNCRO	PERMETHRIN
KOPA INSECTICIDAL SOAP	POTASSIUM SALTS OF FATTY ACIDS
LAGON 480 E INSECTICIDE	DIMETHOATE
LIME SULPHUR INSECTICIDE MITICIDE FUNGICIDE	LIME SULPHUR OR CALCIUM POLYSULPHIDE

Product Name	Active Name
MAKO INSECTICIDE	CYPERMETHRIN
MALATHION 85E	MALATHION
MOVENTO 240 SC INSECTICIDE	SPIROTETRAMAT
MUSTGROW CROP BIOFUMIGANT	ORIENTAL MUSTARD SEED MEAL
NEUDORFF ANT AND INSECT BAIT	SPINOSAD
NEUDOSAN COMMERCIAL	POTASSIUM SALTS OF FATTY ACIDS
OBERON FLOWABLE INSECTICIDE-MITICIDE	SPIROMESIFEN
OLEGROW INSECTICIDAL SOAP DOMESTIC	POTASSIUM SALTS OF FATTY ACIDS
OLEGROW INSECTICIDE SOAP COMMERCIAL	POTASSIUM SALTS OF FATTY ACIDS
OPAL INSECTICIDAL SOAP	POTASSIUM SALTS OF FATTY ACIDS
PERM-UP EMULSIFIABLE CONCENTRATE INSECTICIDE	PERMETHRIN
POLECI 2.5 EC INSECTICIDE	DELTAMETHRIN
POUNCE 384 EC INSECTICIDE	PERMETHRIN
PURESPRAY GREEN SPRAY OIL 13E	MINERAL OIL
PYGANIC CROP PROTECTION EC 1.4 II	PYRETHRINS
QST713 LIQUID	BACILLUS SUBTILIS (STRAIN QST 713)
RADIANT SC	SPINETORAM
RIMON 10 EC	NOVALURON
RIMON 10 EC NOVALURON INSECTICIDE	NOVALURON
RIPCORD 400 EC AGRICULTURAL INSECTICIDE	CYPERMETHRIN
SCORPIO ANT AND INSECT BAIT	SPINOSAD
SEVIN XLR CARBARYL INSECTICIDE LIQUID SUSPENSION	CARBARYL
SIVANTO PRIME INSECTICIDE	FLUPYRADIFURONE
SLUGGO PROFESSIONAL SLUG AND SNAIL BAIT	FERRIC PHOSPHATE
SPIRO SC MITICIDE	SPIRODICLOFEN
SUCCESS INSECTICIDE	SPINOSAD
SUFFOIL-X	MINERAL OIL
SUPERIOR 70 OIL	MINERAL OIL
SUPERIOR MALATHION LIQUID INSECTICIDE-MITICIDE CONCENTRATE	MALATHION
UP-CYDE 2.5 EC	CYPERMETHRIN
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
WILSON SLUGOUT PELLETS	METALDEHYDE
XIREN	METALDEHYDE

Product Name	Active Name
Fungicides	
A15457 FUNGICIDE	BENZOVINDIFLUPYR
A20560 FUNGICIDE	FLUDIOXONIL PYDIFLUMETOFEN
A21461 FUNGICIDE	AZOXYSTROBIN PYDIFLUMETOFEN PROPICONAZOLE
ACTINOVATE AG FUNGICIDE	STREPTOMYCES LYDICUS STRAIN WYEC108
ACTINOVATE SP FUNGICIDE	STREPTOMYCES LYDICUS STRAIN WYEC108
ALLEGRO 500F AGRICULTURAL FUNGICIDE	FLUAZINAM
APROVIA FUNGICIDE	BENZOVINDIFLUPYR
BOTECTOR	AUREOBASIDIUM PULLULANS DSM 14940 AND DSM 14941
BRAVO 720	CHLOROTHALONIL
BRAVO WEATHERSTIK	CHLOROTHALONIL
BRAVO ZN AGRICULTURAL FUNGICIDE	CHLOROTHALONIL
BRAVO ZNC	CHLOROTHALONIL
BUMPER 418 EC	PROPICONAZOLE
BUMPER 432 EC	PROPICONAZOLE
BUTTON FUNGICIDE	CYPRODINIL FLUDIOXONIL
CABRIO EG FUNGICIDE	PYRACLOSTROBIN
CANTUS WDG FUNGICIDE	BOSCALID
CAPTAN 480 SC	CAPTAN
CAPTAN 50 WP FUNGICIDE	CAPTAN
CAPTAN 80 DF FUNGICIDE	CAPTAN
CAPTAN 80 WSP FUNGICIDE	CAPTAN
CONFINE EXTRA FUNGICIDE	MONO- AND DI-POTASSIUM SALT OF PHOSPHOROUS ACID
CO-OP PIVOT	PROPICONAZOLE
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 PULL'N SPRAY APPLICATOR	COPPER (PRESENT AS COPPER OCTANOATE)
CUEVA RTU WITH QUICK CONNECT SPRAYER	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)
CYPROFLU FUNGICIDE	CYPRODINIL FLUDIOXONIL
DIPLOMAT 5SC FUNGICIDE	POLYOXIN D ZINC SALT

Product Name	Active Name
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
DOKTOR DOOM PREMIUM FUNGICIDE CONCENTRATE	COPPER (PRESENT AS COPPER OCTANOATE)
DOUBLE DOWN SPRAY OIL	MINERAL OIL
DOUBLE NICKEL 55	BACILLUS AMYLOLIQUEFACIENS, STRAIN D747
DYGALL	AGROBACTERIUM RADIOBACTER
ECHO 720 AGRICULTURAL FUNGICIDE	CHLOROTHALONIL
ECHO 90WSP AGRICULTURAL FUNGICIDE	CHLOROTHALONIL
ECHO NP FUNGICIDE	CHLOROTHALONIL
ELEVATE 50 WDG FUNGICIDE	FENHEXAMID
FITNESS FUNGICIDE	PROPICONAZOLE
FONTELIS FUNGICIDE	PENTHIOPYRAD
FPY 500	FLUOPYRAM
FPY/PTZ FUNGICIDE	FLUOPYRAM PROTHIOCONAZOLE
FUNGINEX DC FUNGICIDE	TRIFORINE
GENERAL HYDROPONICS SUFFOCOAT	CANOLA OIL
HYDROWORXX DISEASE CONTROL CONCENTRATE	COPPER (PRESENT AS COPPER OCTANOATE)
INSPIRE SUPER FUNGICIDE	CYPRODINIL DIFENOCONAZOLE
INTUITY FUNGICIDE	MANDESTROBIN
IPCO PIVOT 418 EC	PROPICONAZOLE
ISOFETAMID 400SC FUNGICIDE	ISOFETAMID
KENJA 400SC FUNGICIDE	ISOFETAMID
LIME SULPHUR INSECTICIDE MITICIDE FUNGICIDE	LIME SULPHUR OR CALCIUM POLYSULPHIDE
LUNA PRIVILEGE	FLUOPYRAM
LUNA SENSATION	FLUOPYRAM TRIFLOXYSTROBIN
LUNA TRANQUILITY FUNGICIDE	FLUOPYRAM PYRIMETHANIL

Product Name	Active Name
MAESTRO 80 WSP FUNGICIDE	CAPTAN
MERIVON FUNGICIDE	FLUXAPYROXAD PYRACLOSTROBIN
METCONAZOLE 50 WDG FUNGICIDE	METCONAZOLE
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)
MIRAVIS NEO 300SE	AZOXYSTROBIN PYDIFLUMETOFEN PROPICONAZOLE
MIRAVIS PRIME FUNGICIDE	FLUDIOXONIL PYDIFLUMETOFEN
MISSION 418 EC	PROPICONAZOLE
MODO FUNGICIDE	PROPICONAZOLE
MUSTGROW CROP BIOFUMIGANT	ORIENTAL MUSTARD SEED MEAL
NOVA FUNGICIDE	MYCLOBUTANIL
ORONDIS GOLD FUNGICIDE	METALAXYL-M AND S-ISOMER OXATHIPIPROLIN
OXIDATE	HYDROGEN PEROXIDE PEROXYACETIC ACID
OXIDATE 2.0	HYDROGEN PEROXIDE PEROXYACETIC ACID
OXIDATE FC	HYDROGEN PEROXIDE PEROXYACETIC ACID
PHOSTROL FUNGICIDE	MONO- AND DIBASIC SODIUM, POTASSIUM, AND AMMONIUM PHOSPHITES
POLYOXIN D ZINC SALT 5SC FUNGICIDE	POLYOXIN D ZINC SALT
PRINCETON FUNGICIDE	PROPICONAZOLE
PRISTINE WG FUNGICIDE	BOSCALID PYRACLOSTROBIN
PROBLAD	BLAD POLYPEPTIDE
PROBLAD BIOFUNGICIDE	BLAD POLYPEPTIDE
PROLINE 480 SC FOLIAR FUNGICIDE	PROTHIOCONAZOLE
PROLINE GOLD	FLUOPYRAM PROTHIOCONAZOLE
PROPI SUPER 25 EC	PROPICONAZOLE
PROPICONAZOLE 250E FUNGICIDE	PROPICONAZOLE

Product Name	Active Name
PROPULSE	FLUOPYRAM PROTHIOCONAZOLE
PURESPRAY GREEN SPRAY OIL 13E	MINERAL OIL
QST713 LIQUID	BACILLUS SUBTILIS (STRAIN QST 713)
QUASH FUNGICIDE	METCONAZOLE
QUASH SC FUNGICIDE	METCONAZOLE
QUILT FUNGICIDE	AZOXYSTROBIN PROPICONAZOLE
ROOTSHIELD HC - BIOLOGICAL FUNGICIDE WETTABLE POWDER	TRICHODERMA HARZIANUM RIFAI STRAIN KRL-AG2
ROOTSHIELD PLUS WP - BIOLOGICAL FUNGICIDE	TRICHODERMA HARZIANUM RIFAI STRAIN KRL-AG2 TRICHODERMA VIRENS STRAIN G-41
S-2200 4 SC FUNGICIDE	MANDESTROBIN
SCALA SC FUNGICIDE	PYRIMETHANIL
SENATOR 50 SC FUNGICIDE	THIOPHANATE-METHYL
SENATOR 70WP	THIOPHANATE-METHYL
SENATOR 70WP 1	THIOPHANATE-METHYL
SENATOR 70WP WSB1	THIOPHANATE-METHYL
SERCADIS FUNGICIDE	FLUXAPYROXAD
SERENADE MAX	BACILLUS SUBTILIS (STRAIN QST 713)
SERENADE OPTI	BACILLUS SUBTILIS (STRAIN QST 713)
SERIFEL	BACILLUS AMYLOLIQUEFACIENS STRAIN MBI600
SHARDA CAPTAN 80 WSP	CAPTAN
SHARDA FUNGTION SC	AZOXYSTROBIN PROPICONAZOLE
SUFFOIL-X	MINERAL OIL
SUPRA CAPTAN 80 WSP FUNGICIDE	CAPTAN
SWITCH 62.5 WG FUNGICIDE	CYPRODINIL FLUDIOXONIL
TAEGRO 2 BIOFUNGICIDE	BACILLUS SUBTILIS VAR. AMYLOLIQUEFACIENS STRAIN FZB24
THIEF 50 SC	THIOPHANATE-METHYL
THIOPHANATE-METHYL 500 SC FUNGICIDE	THIOPHANATE-METHYL
TILT 250E	PROPICONAZOLE
TIMOREX GOLD BIOFUNGICIDE	TEA TREE OIL
VEGOL CROP OIL	CANOLA OIL
VEGOL INSECTICIDAL OIL	CANOLA OIL
VEGOL READY-TO-SPRAY	CANOLA OIL

Product Name	Active Name
VEGOL SINGLE DOSE INSECTICIDAL OIL	CANOLA OIL
VELUM PRIME	FLUOPYRAM
WEED AWAY PIVOT 418 EC	PROPICONAZOLE
WINFIELD PHOSPHITE EXTRA FUNGICIDE	MONO- AND DI-POTASSIUM SALT OF PHOSPHOROUS ACID
XEMIUM SC FOLIAR FUNGICIDE	FLUXAPYROXAD

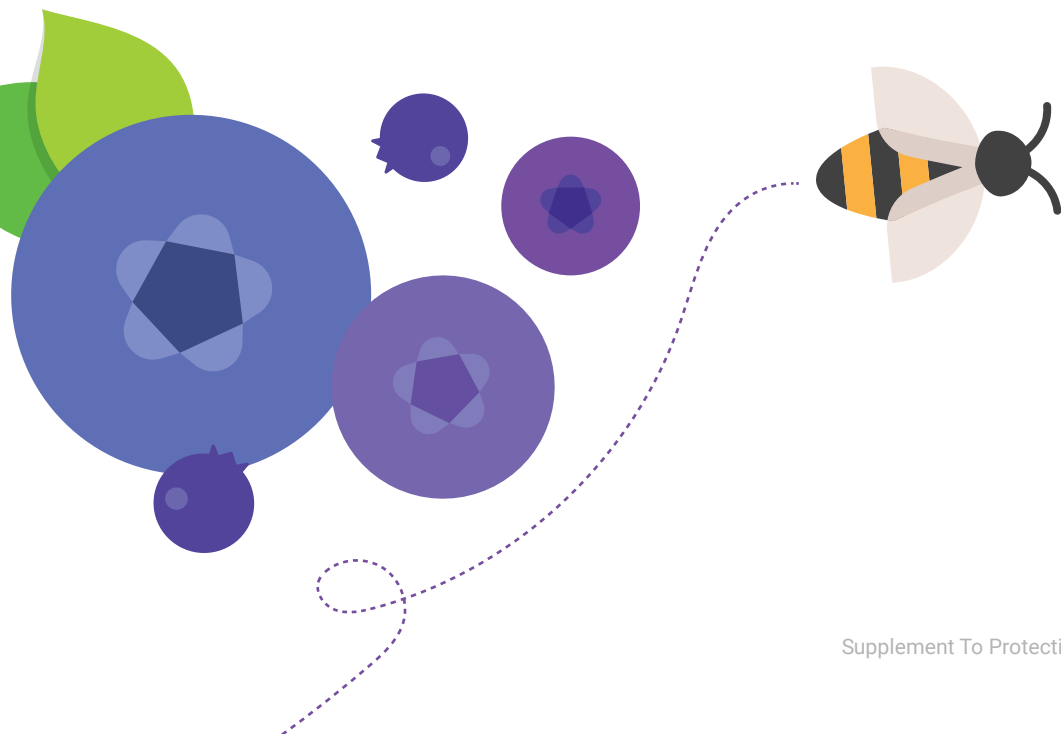


TABLE 2.

ACTIVE INGREDIENT POLLINATOR PRECAUTION LEVELS

Table 2 lists active ingredients registered for use in wild blueberry (as of January 2023) 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.

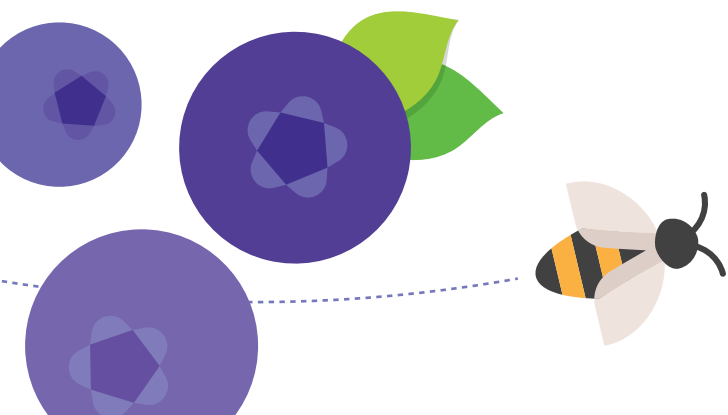
KEY TO ABBREVIATIONS USED IN TABLE 2

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)
Insecticides/Miticides				
ACETAMIPRID		X		2 day ERT to bumble bees ¹ . Cyano group neonicotinoids exhibit lower toxicity to bees than nitro group neonicotinoids ² .
BACILLUS SUBTILIS (STRAIN QST 713)			X	Laboratory tests suggest potential effects on bumble bees ³ .
BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS)			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 ⁴ .
CARBARYL	X			Carbaryl has ERT to all bees including the alfalfa leafcutting bees ⁵ and bumble bees ¹ .
CHLORANTRANILIPROLE			X	
CYANTRANILIPROLE		X		
CYCLANILIPROLE	X			
CYPERMETHRIN	X			
DELTAMETHRIN		X		>8 hours RT for alfalfa leafcutting bees ⁵ . Formulated products may have a repellent effect lasting 2-3 hours ⁶ . 2 days ERT for bumble bees ¹ .
DIMETHOATE	X			ERT to alfalfa leafcutting bees ⁵ . Do not place alfalfa leafcutting bee nest shelters into fields until at least 1 week after treatment ¹ .
FENPROPATHRIN	X			
FERRIC PHOSPHATE			X	
FLONICAMID			X	
FLUOPYRAM			X	
FLUPYRADIFURONE		X		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 ⁷ .
IMIDACLOPRID	X			Bumble bees may be more sensitive to imidacloprid than honey bees ⁸ .
IRON (PRESENT AS FERRIC PHOSPHATE)			X	
LIME SULPHUR OR CALCIUM POLYSULPHIDE			X	Can repel bees if applied during bloom season ⁹ .
MALATHION	X			Up to 7 days ERT for alfalfa leafcutting bees ⁵ .

Active Ingredient	Most Restrictive	Moderately Restrictive	Least Restrictive	Additional Information (Where Available)
METALDEHYDE			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 ⁷ . Effects on brood development and colony strength in honey bees ¹⁰ .
ORIENTAL MUSTARD SEED MEAL			X	
PERMETHRIN	X			Up to 3 days ERT for alfalfa leafcutting bees. May be repellent in arid conditions ⁵ .
PHOSMET	X			Up to 5 days ERT for alfalfa leafcutting bees ⁵ .
POTASSIUM SALTS OF FATTY ACIDS			X	Non-target insects in flightless stage are vulnerable ¹¹ .
PYRETHRINS	X			Commonly mixed with piperonyl butoxide (PBO) which acts as a synergist ⁵ .
SPINETORAM	X			
SPINOSAD	X			>1 day ERT for alfalfa leafcutting bees ⁵ .
SPIRODICLOFEN	X			Toxic to bee brood ¹² .
SPIROMESIFEN		X		May be toxic to bee brood ⁷ .
SPIROTETRAMAT	X			Toxic to bee brood ⁷ . 1 day ERT for bumble bees ¹ .
SULFOXAFLOX	X			
TEBUFENOZIDE			X	Honey bee learning and behavior can be affected ¹³ .
THIAMETHOXAM	X			Thiamethoxam is often used as a systemic insecticide, and has been found in pollen and nectar of plants ^{2,14} . Documented incidents have demonstrated some degree of hazard with these treatments ^{14,15} . Bumble bees may be more sensitive to neonicotinoids than honey bees ⁸ .



Active Ingredient	Most Restrictive	Moderately Restrictive	Least Restrictive	Additional Information (Where Available)
Fungicides				
AGROBACTERIUM RADIO-BACTER			X	
AUREOBASIDIUM PULLULANS DSM 14940 AND DSM 14941			X	
AZOXYSTROBIN			X	
BACILLUS AMYLOLIQUEFACIENS STRAIN MBI600			X	
BACILLUS AMYLOLIQUEFACIENS, STRAIN D747			X	
BACILLUS SUBTILIS (STRAIN QST 713)			X	Laboratory tests suggest potential effects on bumble bees ³ .
BACILLUS SUBTILIS VAR. AMYLOLIQUEFACIENS STRAIN FZB24			X	
BENZOVINDIFLUPYR			X	
BLAD POLYPEPTIDE			X	
BOSCALID			X	Boscalid will also increase the toxicity of insecticide seed treatments to honey bees ¹⁶ .
CANOLA OIL			X	Harmful effects are caused by smothering and suffocation making risks greatest for small arthropods ⁴ .
CAPTAN			X	ERT lasting up to 7 days for mason bees ⁵ . Negative effects on honey bee brood observed in lab but not in field ¹⁷ .
CHLOROTHALONIL			X	Common contaminant of beeswax ¹⁸ .
COPPER (PRESENT AS COPPER OCTANOATE)			X	
CYPRODINIL			X	
DIFENOCONAZOLE			X	Can synergize with cyprodinil to cause learning difficulties in honey bees ⁵ .
FENHEXAMID			X	
FLUAZINAM			X	
FLUDIOXONIL			X	
FLUOPYRAM			X	
FLUXAPYROXAD			X	
HYDROGEN PEROXIDE		X		
ISOFETAMID			X	
LIME SULPHUR OR CALCIUM POLYSULPHIDE			X	

Active Ingredient	Most Restrictive	Moderately Restrictive	Least Restrictive	Additional Information (Where Available)
MANDESTROBIN			X	
METALAXYL-M AND S-ISOMER			X	
METCONAZOLE			X	
MINERAL OIL			X	Harmful effects are caused by smothering and suffocation.
MONO- AND DI-POTASSIUM SALT OF PHOSPHOROUS ACID			X	
MONO- AND DIBASIC SODIUM, POTASSIUM, AND AMMONIUM PHOSPHITES			X	
MYCLOBUTANIL			X	
ORIENTAL MUSTARD SEED MEAL			X	
OXATHIPIPROLIN			X	
PENTHIOPYRAD			X	
PEROXYACETIC ACID		X		No information for bees. Very toxic to aquatic life. Low bioaccumulation potential ¹⁹ .
POLYOXIN D ZINC SALT			X	
PROPICONAZOLE			X	Mason bees more sensitive than honey bees ²⁰ . If mixed with lambda-cyhalothrin, may increase toxicity ²¹ .
PROTHIOCONAZOLE			X	
PYDIFLUMETOFEN			X	
PYRACLOSTROBIN			X	
PYRIMETHANIL			X	
STREPTOMYCES LYDICUS STRAIN WYEC108			X	
TEA TREE OIL			X	
THIOPHANATE-METHYL			X	
TRICHODERMA HARZIANUM RIFAI STRAIN KRL-AG2			X	
TRICHODERMA VIRENS STRAIN G-41			X	
TRIFLOXYSTROBIN			X	
TRIFORINE			X	

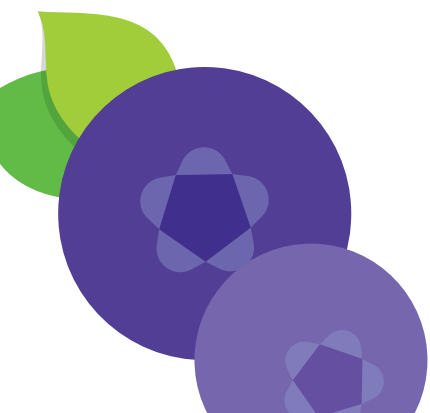


TABLE 3. POLLINATOR PRECAUTION LEVELS

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

This table is not specific to wild blueberry 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.

	MOST RESTRICTIVE	MODERATELY RESTRICTIVE	LEAST RESTRICTIVE
	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
Acute adult contact/oral toxicity	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.
Larval toxicity	May have larval toxicity.	May have larval toxicity.	Typically none.
Chronic toxicity	May have chronic toxicity.	May have chronic toxicity.	Typically none.
Residual toxicity	Typically greater than 8 hours.	Typically 2 to 8 hours.	Typically no residual toxicity.

Higher tier studies	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.
Crop pollinator attractiveness	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 or minimal restrictions for crops with high, moderate, and low crop attractiveness.
Bloom in relation to harvest	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.
Examples of restrictions	<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. Koppert Biological Systems, Koppert Side Effects Database: <https://sideeffects.koppert.com/side-effects>
2. Blacquière, 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.
3. 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.
4. 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>.
5. 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.
6. National Pesticide Information Centre. 2010. Deltamethrin General Fact Sheet. <http://npic.orst.edu/factsheets/DeltaGen.pdf>. 3p
7. Health Canada. Pest Management Regulatory Agency. Pesticide labels. <http://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php>
8. 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.
9. 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.
10. Cutler, G. C., and C. D. Scott-Dupree. 2007. Novaluron: prospects and limitations in insect pest management. *Pest Technology* 1:38–46.
11. National Pesticide Information Center. 2001. Potassium Salts of Fatty Acids (Technical Fact Sheet). <http://npic.orst.edu/factsheets/archive/psfatech.pdf>.
12. Bayer Crop Science. 2013. Spirotetramat Technical Insecticide (pesticide label). https://pr-rp.hc-sc.gc.ca/1_1/view_label?p_ukid=189692886
13. 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.
14. Stoner, K.A., and B.D. Eitzer, 2012. Movement of Soil-Applied Imidacloprid and Thiamethoxam into Nectar and Pollen of Squash (*Cucurbitapepo*). *Plos One*, 7(6).
15. Sagili, R., unpublished work: Oregon State University
16. 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.
17. 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.
18. Mullin, C. A., M. Frazier, J. L. Frazier, S. Ashcraft, R. Simonds, D. VanEngelsdorp, and J. S. Pettis. 2010. High levels of miticides and agrochemicals in North American apiaries: implications for honey bee health. *Plos One* 5:9754.
19. The European Parliament and Council of the European Union. 2014. Regulation (EU) No 528/2012 concerning the making available on the market and use of biocidal products. https://www.echa.europa.eu/documents/10162/17158507/consolidated_bpr_en.pdf
20. Ladurner, E., J. Bosch, W. P. Kemp, and S. Maini. 2005. Assessing delayed and acute toxicity of five formulated fungicides to *Osmia lignaria* Say and *Apis mellifera*. *Apidologie*
21. Pilling, E.D., and P.C. Jepson, 1993. Synergism between EBI fungicides and a pyrethroid insecticide in the honeybee (*Apis mellifera*). *Pesticide Science*, 39(4): p. 293-297.

* 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.

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