SUPPLEMENT to Protecting pollinators from pesticides **WILD BLUEBERRY**

POLLINATOR PARTNERSHIP C A N A D A 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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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



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 THEIRACTIVE 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 <u>PMRA's label search</u>.

| Product Name | Active Name |
|---|--|
| Insecticide | |
| ACETA 70 WP | ACETAMIPRID |
| ACTARA 25WG | ТНІАМЕТНОХАМ |
| 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 | SULFOXAFLOR |
| 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 SUS- PENSION | 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 |
| VEGUL SINGLE DOSE INSECTICIDAL OIL | |
| | |
| XIREN | |
| | |

| 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 OXATHIAPIPROLIN |
| 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 POLLINATORPRECAUTION 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.

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 <u>label search tool.</u> 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/

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.

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.

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 | | х | | 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) | | | Х | Laboratory tests suggest potential effects on bumble bees ³ . |
| BACILLUS THURINGIENSIS SUBSPECIES KURSTAKI (ALL STRAINS) | | | Х | |
| CANOLA OIL | | | Х | 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 | Х | | | Carbaryl has ERT to all bees includ- ing the alfalfa leafcutting bees ⁵ and bumble bees ¹ . |
| CHLORANTRANILIPROLE | | | Х | |
| CYANTRANILIPROLE | | Х | | |
| CYCLANILIPROLE | Х | | | |
| CYPERMETHRIN | Х | | | |
| DELTAMETHRIN | | х | | >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 | х | | | 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 | Х | | | |
| FERRIC PHOSPHATE | | | х | |
| FLONICAMID | | | Х | |
| FLUOPYRAM | | | Х | |
| FLUPYRADIFURONE | | х | | 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 | х | | | Bumble bees may be more sensitive to imidacloprid than honey bees ⁸ . |
| IRON (PRESENT AS FERRIC PHOSPHATE | | | Х | |
| LIME SULPHUR OR CALCIUM POLYSULPHIDE | | | Х | Can repel bees if applied during bloom season ⁹ . |
| MALATHION | Х | | | Up to 7 days ERT for alfalfa leafcutting bees⁵. |

| Active Ingredient | Most Restrictive | Moderately Restrictive | Least Restrictive | Additional Information (Where Available) |
|-----------------------------------|---------------------|---------------------------|----------------------|---|
| METALDEHYDE | | | Х | |
| METHOXYFENOZIDE | | | X | |
| MINERAL OIL | | | х | 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 | | | х | |
| PERMETHRIN | х | | | Up to 3 days ERT for alfalfa leafcutting bees. May be repellent in arid conditions ⁵ . |
| PHOSMET | х | | | Up to 5 days ERT for alfalfa leafcutting bees⁵. |
| POTASSIUM SALTS OF FATTY ACIDS | | | х | Non-target insects in flightless stage are vulnerable ¹¹ . |
| PYRETHRINS | x | | | Commonly mixed with piperonyl butoxide (PBO) which acts as a synergist ⁵ . |
| SPINETORAM | Х | | | |
| SPINOSAD | х | | | >1 day ERT for alfalfa leafcutting bees ⁵ . |
| SPIRODICLOFEN | Х | | | Toxic to bee brood ¹² . |
| SPIROMESIFEN | | Х | | May be toxic to bee brood ⁷ . |
| SPIROTETRAMAT | х | | | Toxic to bee brood ⁷ . 1 day ERT for bumble bees ¹ . |
| SULFOXAFLOR | х | | | |
| TEBUFENOZIDE | | | х | Honey bee learning and behavior can be affected ¹³ . |
| THIAMETHOXAM | Х | | | 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 | | | х | |
| AUREOBASIDIUM PULLU- LANS DSM 14940 AND DSM 14941 | | | Х | |
| AZOXYSTROBIN | | | Х | |
| BACILLUS AMYLOLIQUEFA- CIENS STRAIN MBI600 | | | Х | |
| BACILLUS AMYLOLIQUEFA- CIENS, STRAIN D747 | | | Х | |
| BACILLUS SUBTILIS (STRAIN QST 713) | | | Х | Laboratory tests suggest potential effects on bumble bees ³ . |
| BACILLUS SUBTILIS VAR. AMYLOLIQUEFACIENS STRAIN FZB24 | | | Х | |
| BENZOVINDIFLUPYR | | | Х | |
| BLAD POLYPEPTIDE | | | Х | |
| BOSCALID | | | х | Boscalid will also increase the toxicity of insecticide seed treatments to honey bees ¹⁶ . |
| CANOLA OIL | | | Х | Harmful effects are caused by smothering and suffocation making risks greatest for small arthropods ⁴ . |
| CAPTAN | | | х | 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 | | | х | Common contaminant of beeswax ¹⁸ . |
| COPPER (PRESENT AS COP- PER OCTANOATE) | | | х | |
| CYPRODINIL | | | Х | |
| DIFENOCONAZOLE | | | х | Can synergize with cyprodinil to cause learning difficulties in honey bees ⁵ . |
| FENHEXAMID | | | Х | |
| FLUAZINAM | | | X | |
| FLUDIOXONIL | | | Х | |
| FLUOPYRAM | | | X | |
| FLUXAPYROXAD | | | X | |
| HYDROGEN PEROXIDE | | X | | |
| ISOFETAMID | | | Х | |
| LIME SULPHUR OR CALCIUM POLYSULPHIDE | | | X | |

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

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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 Typically requires the most restrictive precautions, with greater restrictions for applications to highly bee-attractive crops | MODERATELY RESTRICTIVE Typically requires some restrictions on application to bee- attractive crops | LEAST RESTRICTIVE 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 | For highly bee-attractive crops, may not allow application during bloom. For moderately/low bee- attractive crops, avoid application during bloom but if necessary evening application may be allowed. May restrict pre-bloom application timing (i.e., certain systemic products; foliar or soil application methods). May be required to remove flowering weeds or groundcover prior to application (for example in orchards, or in turf lawns). Minimize spray drift. | For highly and moderately/low bee- attractive crops, avoid application during bloom but if necessary evening application may be allowed. Minimize spray drift. | Typically requires minimal or no restrictions. |

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