HAZARDS AND SAFEGUARDS IN APPLYING INSECTICIDES TO CROPS IN BLOOM

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CAUSES OF BEE POISONING

Most bee poisoning occurs when honey bees, leafcutting bees and wild bees come into contact with insecticides that are applied to crops during the blooming period. Other causes of bee poisoning are:

- drift of toxic sprays or dusts onto adjoining crops that are in bloom.
- bees coming into contact with insecticide residues on plants.
- bees drinking or touching contaminated water on foliage, flowers or empty pesticide containers.
- bees collecting contaminated pollen or nectar.
- bees collecting unused pesticide in a dry dust, liquid foliar or aerosol formulation.

REDUCTION OF BEE POISONING

Honey Beekeeper-Grower Cooperation

A major consideration for the reduction of honey bee poisoning is beekeeper-grower co-operation. The beekeeper often depends on the grower for bee forage and the grower depends on the honey bees provided by the beekeeper for pollination. Co-operation and understanding of each other's management issues are essential.

What The Pesticide Applicator Can Do:

(l) Do not apply insecticides that are toxic to bees on crops or weeds in bloom. Avoid pesticide drift – do not spray in windy conditions; use low drift spray nozzles.

(2) Apply insecticides in late evening when bees are not actively foraging. Honey bees do not usually forage at temperatures lower than about 13°C. Do not apply insecticides when temperatures are expected to be unusually low after application, as residues remain toxic to bees for a longer time under such conditions.

(3) Ground application of insecticides is generally less hazardous than aerial application because there is less product drift and smaller crop areas are treated at any given time.

(4) Do not discard unused insecticides where they might become a bee-poisoning hazard. Sometimes bees collect dry insecticide formulations when pollen is not readily available because the dust particles are similar in size to pollen grains. If this occurs, the bees will carry the dust particles back to the colony and feed them to developing brood and adults, resulting in potential death of the hive.

(5) Use reduced-risk insecticides or formulations with reduced toxicity to bees whenever such choices are consistent with integrated pest management (IPM) programs for specific crops and insect pests. Dusts and encapsulated insecticides are usually more hazardous to bees than sprays of the same material. Wettable powders often have a longer residual period than emulsifiable concentrates. Ultra-low volume formulations of some pesticides may be much more hazardous to bees than regular sprays, while granular formulations are usually the safest method of insecticide treatment near honey bee colonies. Use the lowest effective rate of an insecticide, and if recommended pesticides are equally toxic, use the one with the shortest residual period. Be sure to read the pesticide label for information on the toxicity of specific pesticides and formulations to bees.

(6) Notify beekeepers with apiaries in the area in which insecticides will be applied at least 48 hours before their application. Contact with beekeepers can often be made through the Provincial Apiarist's office.

What The Grower Can Do:

(1) Use insecticides only when needed, and use all pesticides according to label directions. When insect pests damage a crop annually, initiate an IPM program that will include pest monitoring so that insecticides can be applied when economic threshold levels have been reached. This will ensure that the insecticide will be most efficient in killing the pest and minimize non-target impacts.

(2) Learn the pollination requirements of the crops you are growing. Application of insecticides during the day and/or when crops are in bloom can potentially cause bee/colony death, and subsequently result in poor crop yield.

(3) Be aware that blooming weeds such as narrow-leaved hawk's beard in alfalfa seed fields, even if the alfalfa is not blooming, may harbour honey bees that could be killed with the application of insecticide.

(3) Learn about the beekeeper's management issues concerning insecticide-honey bee interactions and the potential negative impacts. Develop a mutually beneficial understanding to ensure proper bee pollination of crops.

What The Honey Beekeeper Can Do:

(1) Be aware of the crops that will be grown in the vicinity of your apiaries and familiarize yourself with bee toxicity of the insecticides that may be applied to those crops.

(2) If possible, choose apiary sites which are relatively isolated from intensive insecticide applications and which are not normally subjected to drift of chemicals.

(3) Provide a map of apiary locations to your municipality office, extension agrologist, local aerial applicators and the provincial apiculturist.

(4) Post a sign in all apiaries with your name, address and phone number in printing large enough to be read at some distance so that you can be contacted to move colonies when insecticides are going to be applied.

(5) If insecticides are going to be applied, move colonies out of the area. If this is not feasible, cover colonies with a tarp, staking the edges like a tent and providing a centre support. An internal source of fresh water is essential so that the bees can remain cool during confinement and to prevent losses from exposure to contaminated water when the tarps are removed.

Safeguarding Other Bee Pollinators

In general there is limited information available on the impact of pesticides on bee pollinators other than honey bees. However, pesticides toxic to honey bees will likely be toxic to other bee pollinators, but the level of toxicity may vary based on the size and behavior of the specific pollinator.

Leafcutter Bees. If an insecticide has been applied to a crop to control pest insects and leafcutting bees are ready but have not been released, the incubator temperatures can be lowered to about l0^{o}C and the bees held until the poisonous residue has disappeared from the crop (see following table). Shelters can be covered or closed during application of short-residual insecticides to prevent drift of insecticides into shelters. In extreme northern areas bees may not get back to the shelters at night so evening application of insecticides is not advisable. If application of insecticides is necessary during bloom, apply only after foraging has ceased in the evenings, allowing good flight conditions for the bees to return to their shelters unharmed.

Bumblebees. As indicated for leafcutter bees, insecticides should only be applied during bloom after foraging has ceased in the evening. Bumblebee nest in hedgerows and uncultivated land

adjacent to crop fields. Nesting habitat should be conserved and application of insecticides and herbicides in these areas should be avoided. Bumble bees can forage at temperatures lower than honey bees, that is, earlier in the morning and later in the evening.

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Table 1. The hazard ratings of insecticides and acaricides currently registered in Canada to bees and typical duration of toxicity.

		Field Application Hazards of Insecticides[a] to Bees			
		Hazard rating[b]			
Insecticide active ingredient	Common trade name	Honey bee	Leafcutting bee	Bumble bee	Residue hazard (days)[c]
abamectin	Agri-Mek, Avid	1-3	2	2	<1-3
acephate	Orthene	1	1	1	2.5->3
acequinocyl	Kanemite	3	-[d]	-	none
acetamiprid	Assail	1-2	-	-	<1
allethrin	Raid Max	1-2	-	-	-
amitraz	Mitac, Avipar	3	-	-	none
azadirachtin	Neemix	2-3	2	-	<1
azinphos-methyl	Sniper, Guthion	1	1	1	2.5-5
Bacillus thuringiensis	Dipel, Foray	3	3	3	none
Beauveria bassiana	Balence	3	3	3	none
bendiocarb	Ficam	1	-	1	>1
bifenazate	Acramite	1-2	-	3	<1
carbaryl	Sevin, Sevin XLR	1-2	1-2	1	<1-7
carbofuran	Furadan	1	1	1	3-14
chlorantraniliprole	Altacore, Coragen	3	-	3	-
chlorpyrifos	Lorsban, Dursban	1	1	1	2-6
clofentezine	Apollo	3	-	-	none
clothianidin foliar	Prosper, Titan	1	1	1	>3
Cydia pomonella granulovirus	Virosoft	3	-	-	none
cypermethrin	Ripcord	1	1	1	<1->3
cyromazine	Governor, Citation	2-3	-	-	<1
deltamethrin	Decis	1-2	1-2	1-2	<1-1
diazinon	Diazinon	1	1	1	1-7
dichlorvos	Vapona	1	1	-	-
dicofol	Kelthane	3	3	3	<1
diflubenzuron	Dimilin	3	1	-	-
d-limonene	Procitra-DL	3	-	-	-
dimethoate	Cygon, Lagon	1	1	1	3-7
dinocap	Dikar	3	-	-	-
d-phenothrin	Bedlam	3	-	-	-
endosulfan	Thiodan	1-2	1	-	<1-3
esfenvalerate	Asana	1	2	-	<1-1
fenbutaton oxide	Vendex	3	-	-	-
flonicamid	Beleaf	3	-	-	<1

fluvalinate	Apistan	2-3	-	-	none
formetanate hydrochloride	Carzol	1-2	2	2	<1
horticultural oils		2	-	-	<1
imidacloprid	Admire, Gaucho	1	1-2	1	<1->1
insecticidal soaps		3	-	-	<1
kaolin clay	Surround	3	-	-	-
lambda cyhalothrin	Matador, Silencer	1	1	1	>1
malathion	Malathion	1-2	1	1-2	<1-7
MCH	MCH Bubble Cap	3	3	3	none
metaflumizone	Alverde	3	-	3	-
Metarhizium anisopliae	Met52	3	-	-	-
methamidophos	Monitor	1	1	1	1
methomyl	Lannate	1-2	1-2	2	<1-1.5
methoprene	Altosid	3	-	-	-
methoxyfenozide	Intrepid	3	-	-	<1
naled	Dibrom	1-2	1-2	2	<1-4.5
Nosema locustae	Nolo Bait	3	3	3	none
novaluron	Rimon	1-2	2	-	1
oxamyl	Vydate	1-2	1-2	-	<1->1
permethrin	Ambush, Pounce	1	1	1	<1-5
phosmet	Imidan	1	1	-	1-5
propoxur	Baygon	1	1	1	1
pymetrozine	Endeavour, Fulfill	2-3	2	2	<1
pyrethrins	Pyrenone	2-3	2	2	<1
pyridaben	Nexter, Dino-Mite	2	1-2	-	<1
pyriproxifen	Distance	3	-	3	<1
resmethrin	Croc-Bloc, Konk	1	-	-	-
rotenone	Rotenone, Deritox	2-3	-	-	<1
spinetoram	Delegate	1-2	1	-	-
spinosad	Entrust, Success	1-2	1	2	<1->1
spirodiclofen	Envidor	1	-	1	1
spiromesifen	Forbid, Oberon	1-2	1	-	-
spirotetramet	Kontos, Movento	1	-	2	-
tebufenozide	Confirm	2	-	-	<1
tetrachlovinphos	Gardona	1-2	1	-	<1-1
tetramethrin	Raid Outdoor Barrier	1	-	-	-
thiacloprid	Calypso	2-3	-	-	none
thiamethoxam	Actara	1	-	1	5-14
thymol	Thymovar	3	-	-	-

tralomethrin	tralomethrin	2	-	-	<1
trichlorfon	Dylox	2-3	2	2	<1

Notes:

[a] Not including pesticides used in seed treatments or granular formulations. Most of the pesticides listed here have not been tested for bee toxicity under Western Canadian conditions; the data are for a general guideline only.

[b] Hazard ratings for field application where bees are, or will be, foraging (may vary with formulation):

l. Very poisonous to bees; do not apply to crops or weeds in bloom unless bees are kept off for the period that residue on the crop is a hazard.

2. Moderately poisonous to bees; avoid direct application to bees, but may be applied with minimum hazard in late evening when bees are not foraging.

3. Not very poisonous to bees; may be applied with minimum hazard to bees.

[c] Residue hazard represents the average time in days that residue poisonous to honey bees will remain on the foliage (may vary with formulation and weather).

[d] No data available.

Caution: Bee poisoning hazards can be drastically modified by abnormal weather conditions. Unusually low temperatures following spray application may cause residues to remain toxic up to 20 times as long as under warmer conditions. On the other hand, if abnormally high temperatures occur late in the evening or early in the morning, bees may be actively foraging on the treated crop during these times. Morning dew can also make residues more toxic to foraging bees.

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