

reaching the economic injury level. Note that factors such as moisture, temperature conditions and stage of crop growth, can increase or decrease the impact of insects on crop production. In some instances, nominal thresholds are presented; these decision guidelines are based on experience rather than research quantifying the impact of the insects on the crop.

Estimating Percent Defoliation

Many economic thresholds for insects are based on percent defoliation of the plants they are feeding on. The following figure may assist in determining the percent defoliation. Although the following photo is of sunflower leaves, this figure can be used to estimate % defoliation for many crops.

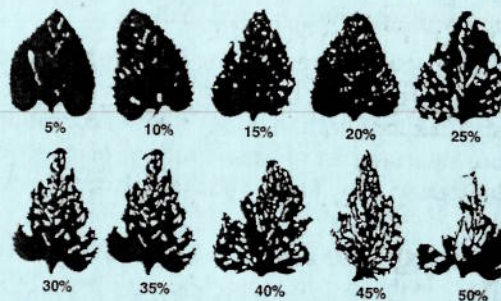


Photo courtesy of North Dakota State University Extension

Hazard Ratings of Insecticides to Bees

The following table indicates the maximum time required for the insecticides listed in the Guide to be degraded by weather to a low hazard level for bees. **These times are to be used as general guidelines only.** Most of these insecticides have not been tested for bee toxicity under Western Canadian conditions, and environmental conditions influence the rate at which pesticides degrade.

INSECTICIDE	HAZARD RATING ^a		RESIDUE HAZARD (DAYS) ^b
	HONEY BEE	LEAFCUTTER BEE	
Least Hazardous Insecticides to Bees			
Dipel	3	3	none
Nolo Bait	3	3	none
Eco bran	3	3	N/A
Coragen	3	-	-
Beleaf	3	-	<1
Moderately to Highly Hazardous to Bees			
Fulfill	2-3	2	<1
Assail	1-2	-	<1
Decis/Poleci	1-2	1-2	<1 - 1
Rimon	1-2	2	1
Lannate	1-2	1-2	<1 - 1.5
Success/Entrust	1-2	1	<1 - >1
Admire/Alias/Grapple	1	1-2	<1 - >1
Matador/Silencer	1	1	>1
Oberon	1-2	1	-
Delegate	1-2	1	-
Movento	1	-	-
Agri-mek	1-3	2	<1 - 3
Orthene	1	1	2.5 - 3
Mako/UP-Cyde	1	1	<1 - >3
Dibrom	1-2	1-2	<1 - 4.5
Ambush/Pounce/Perm-UP	1	1	<1 - 5
Imidan	1	1	1 - 5
Malathion	1-2	1	2 (Honey Bee), 6 (Leafcutter Bee)
Lorsban/Pyrinex/Nufos/Citadel/ Warhawk/MPOWER Krypton	1	1	2-6
Cygon/Lagon	1	1	3 - 7

^a **HAZARD RATING 1** = 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.

^b Residue hazard represents the average time in days that residues poisonous to honey bees will remain on foliage (may vary with formulation and weather). Unusually low temperatures following spray application may cause residues to remain toxic longer than under warmer conditions. Morning dew can also make residues more toxic to foraging bees. A more extensive list of hazard ratings of insecticides to bees and duration of toxicity can be found at the Western Committee on Crop Pests website at: <http://www.westernforum.org/WCCP%20Guidelines.html>.

Reducing Bee Losses from Insecticides

Careless use of insecticides can kill bees and other beneficial insects such as pollinators, predatory and parasitic biological control insects. Help to reduce insecticide poisoning of bees by:

- 1. Avoid applying insecticides that are toxic to bees on crops in bloom.** Any field with even a small amount of bloom, whether it is the main crop, cover crop, or weeds will probably have foraging bees visiting the flowers. If at all possible, apply insecticides before or after the crop has gone into bloom. Control all flowering weeds prior to insecticide application.
- 2. Apply insecticides when bees are least active.** The highest level of bee activity occurs during the day. Apply insecticides in late evening or early morning when the bees are not foraging. As a general rule, evening applications are less hazardous to bees than morning applications. Do not apply insecticides if unusually low temperatures or heavy dew are forecast following application, because residuals typically remain toxic to bees longer under these conditions.
- 3. Minimize insecticide drift.** To avoid insecticides drifting into non-target locations, do not apply insecticides during windy conditions. Choose nozzles with a low drift rating. As a general rule, ground applications of insecticide are less prone to drift than aerial applications. When planting insecticide treated seeds, reduce the movement of dust from the seeding equipment to flowering crops, weeds and water sources that are in or adjacent to the field being seeded. If seeding equipment may potentially generate dust, controlling flowering weeds in the field prior to seeding may reduce pollinators being attracted to the field.
- 4. Contact the beekeeper before spraying.** Communication and cooperation between the insecticide applicator and the beekeeper can usually prevent bee losses. Notifying the beekeeper in advance (i.e. 48 hours) of applying insecticides will allow the beekeeper to move or protect the colonies from insecticide damage.
- 5. If possible, use insecticides and/or insecticide formulations which are the least hazardous to bees.** The following table "Hazard Ratings of Insecticides to Bees" will help in selecting the least hazardous insecticide. In general, dusts are more hazardous to bees than sprays. Wettable powders are more hazardous than emulsifiable concentrates (EC) or water-soluble formulations. Granular insecticides and spreadable bran bait insecticides are generally the least hazardous to bees.

Insecticide Poisoning in Humans

Organophosphate (OP) and carbamate insecticides (identified on the Insecticide Groups chart page 624) can pose a serious risk to unprotected persons. Poisonings can occur while mixing, loading and/or during the application of these products without the appropriate protective equipment or measures. These pesticides are readily absorbed through the skin or the lungs, and can act as nervous system toxins. Overexposure can produce symptoms such as headache, nausea, pupil dilation and excessive sweating and salivation. Higher doses may cause breathing difficulties, muscle twitching, weakness and spasms. Very high doses have caused respiratory failure and death.

Both OP and carbamate pesticides inhibit an enzyme called cholinesterase. Measurements of cholinesterase in the blood before and during the application season can indicate harmful exposures to OPs and carbamates. **Persons who intend to mix, load and/or apply these types of pesticides repeatedly during a season, need a baseline and repeat measurements. Consult your doctor before the spraying season to arrange for these measurements.**

Degree of Risk and Hazard Rating:

(see page 4 for full description)

Res

Repe
giver
insec

1.

2.

3.

4.

Insect
mode
insect
progr