

# Organic Pesticides: Minimizing Risks to Pollinators

Although in general, organic pesticides are less toxic and do break down more quickly than conventional chemicals, it should be noted that **not all organic pesticides are safe for bees**. Often precautions must be taken to minimize negative effects to bees and other beneficial insects. Toxic effects may occur immediately or, depending on the pesticide, days and even months after an application when toxic residues persist.

Routes of exposure may be 1) direct to adult bees through direct contact through contaminated nectar, pollen or water, or 2) indirect to the brood through contaminated pollen brought into the hive or nest. Soil drench is of particular concern as 70% of native bees are ground nesters.

Although solitary insects are most vulnerable to pesticides, bumble bees, honey bees, social wasps and other beneficial insects are also at risk. Effects may be lethal or sub-lethal. Effects are disproportionately greater to native bees compared to honey bees. Testing and labeling do not differentiate.

The degree to which organic pesticides are harmful to bees and beneficial insects depends on the toxicity of the compound and the length of exposure. Thus a less toxic pesticide with longer exposure may be equal to a more toxic pesticide with less time exposure.

## Testing and Limitations

Many organic pesticides have never been tested for effects on bees. Whatever testing has been done on bees usually is done on adult honey bees only (not on native bees).

Also, testing of multiple pesticides which may be encountered in near-by sites has not been done.

## Prevention is the Key

An Integrated Pesticide Management (IPM) approach which utilizes other non-chemical techniques is best. This requires that chemical choices should be made **only after all alternative strategies have been evaluated and rejected**. If pesticides are to be used, steps should be taken to reduce both the degree of toxicity and the level of exposure, including things like choice of application method, drift protection, timing, buffers, etc.

## SPECIFIC ORGANIC PESTICIDES

**Azadirachtin and Neem Oil** – Moderately toxic to bees and parasitoid wasps. Toxicity to bees increases when mixed with soap.

***Bacillus thuringiensis* (Bt)** – Most subspecies have little or no toxicity to bees but *ssp. Aizawai* was found to be highly toxic to honey bees. *Ssp kurstaki* is safe for bees but can be harmful to butterflies and moths.

**Boric Acid/borax** – low toxicity to adult bees and beneficial insects. However, some boron fertilizers can be harmful to bees if applied when plants are in bloom.

**Cedar Oil** – derived from various species of cedar and juniper. Commonly used as mosquito and tick repellent but not very effective at killing ticks or mosquitoes. May have some contact toxicity to bees and other beneficial insects. Should not be sprayed on flowering shrubs or flowers on butterfly host plants.

**Cinnamaldehyde (Cinnamon oil)** – Toxic to some soft-bodied insects, mites, and nematodes, but low toxicity to honey bees.

**Diatomaceous Earth (DE)** – A universal insecticide that can kill pollinators and beneficial insects if they crawl on leaf or stem surfaces with recently applied DE. Avoid creating clouds of DE dust during application which could be harmful to humans.

**Garlic, cottonseed or clove oil** – Used as deterrents. Some evidence that garlic oil can be toxic to honey bee workers and larvae.

**Horticultural oil/narrow range oil** – Harmful to bees upon direct contact. Apply at night to minimize risk to bees.

**Insecticidal soap** – Mortality may occur if directly applied to foraging bees and other beneficial insects. Apply at night to minimize risk to bees.

**Kaolin/kaolin clay** – Low toxicity to bees but may affect some beneficial insects. Kaolin application can disrupt bee foraging; apply at night to minimize exposure.

**Limonene/d-limonene** – Applied at recommended doses is low in toxicity to bees, but should not be used as a fumigant to honey bees in hives.

**Pyrethrins** – Broad spectrum insecticides derived from chrysanthemums. Highly toxic to bees. Pyrethrins degrade rapidly when exposed to sunlight and air. Applying at night can minimize risk to bees.

**Spinosad** – Highly toxic to bees and other beneficial insects. Much less toxic after residues have dried. Applying at night can minimize risks to bees.

NOTE: The above information is not meant to be recommendations, but is provided as a guide for those who wish to make appropriate management decisions only after all other options have been considered.

For more detailed information please see Xerces publication *Organic Pesticides: Minimizing Risks to Pollinators and Beneficial Insects* at <https://xerces.org/guidelines-organic-pesticides>.

