Protecting Bees and Beneficial Insects from Systemic Insecticides Applied in Landscapes

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Why are bees in decline?

Honey bees and native bees, such as bumble bees, pollinate 30% of the plants that produce the vegetables, fruits, and nuts that we consume. More than 100 crops in North America require pollinators. Pollination by bees contributes over $18 billion worth of additional crop yields. In addition, bees pollinate native plants that require seed to sustain future populations. These seeds and fruits from native plants are fed on by many animals, from birds to bears. Both native bees and managed honey bees are in decline due to habitat loss, loss of high quality pollen (protein), loss of nectar plants, pathogens, and pesticide use.

Honey bee colonies in Europe and North America have faced some difficult problems for a long time. Beekeepers have been battling the devastating effects of a parasite of bees called the Varroa mite, which was introduced into Europe in the 1970's and in the US in 1980's and is very difficult to control. Honey bees are also faced with a number of diseases and viruses that compromise their immune systems and health in general. Since WWII, with the increase in monocultures and herbicide use, there has been a serious decrease in flowering plants that bees depend on for food.

Beginning in 2006 a yearly die-off of honey bee colonies occurred throughout the US. The cause of this mortality is still unknown but was coined, colony collapse disorder. Most researchers now agree that honey bee decline is due to multiple, interacting causes, including the effects of bee specific diseases and parasites, lack of floral resources that provide good bee nutrition, and lethal and sub-lethal effects of pesticides. It is known that insecticide use in general can take a toll on honey bees and native bees when the bees are exposed to high enough concentrations.

However, it is unclear how much the neonicotinyl insecticides contribute to honey bee poor health or even mortality. Recent research indicates that bees exposed to relatively low doses of neonicotinyl insecticides (10 ppb) may have suppressed immune systems, which makes them more susceptible to some bee diseases. Research also shows that neonicotinoids can have multiple sublethal effects on bees, including disorientation, effects on learning and a reduction in pollen collection and storage. More research needs to be conducted to determine actual residue levels that bees are exposed to in agricultural and urban environments.

Do systemic, neonicotinyl insecticides contribute to bee decline?

Neonicotinyl, systemic insecticides are the most widely used insecticide in the world, due to their low mammalian toxicity and the ability of the insecticide to move systemically, from soil into the entire plant. Application methods include seed treatments, foliar sprays, soil and trunk drenches, and trunk-injections. There are few systemic insecticides, while there are many systemic herbicides and fungicides.

There are six neonicotinyl active ingredients, imidacloprid, dinotefuran, thiamethoxam, and clothianidin, of which acetamiprid and thiacloprid are the least toxic to bees. There is another systemic insecticide, fipronil. You will find these active ingredients listed on the insecticide label in small print. The neonicotinyl class of insecticides is highly toxic to bees and kills bees at around 180 ppb in flower nectar or pollen. However, sublethal doses of neonicotinyl insecticide starting around 10 ppb, causes bees to lose navigation and foraging skills. The amount of the neonicotinoid compound in the pollen and nectar will depend on the mode of application and the concentration applied to the plant or soil. How long the compound lasts within the plant also depends on application method, concentration applied, and binding capacity of the soil.

The use of neonicotinyl insecticides as trunk injections and soil drenches for ash trees is important to slow the spread of the exotic, invasive Emerald Ash Borer. As bees do not collect ash pollen in quantities, the risk to bee pollinators is low. In contrast, the use of neonicotinyl insecticides on flowering garden plants, shrubs and trees, including linden and basswood trees can kill bees and beneficial insects that utilize the flowers for pollen and nectar. It is wise to avoid using systemic neonicotinyl insecticides on flowering plants that bees visit regularly.

What are bee-friendly flowers?

Retrofit you garden to include many species of flowers that bloom from May to September to provide pollen and nectar to bees and beneficial insects. Avoid treating flowering plants that bees utilize, with any insecticides, especially systemic, neonicotinoids.

There are numerous lists identifying these plants:

1. Pollinator Conservation, plants for bees and other pollinators https://ncipmhort.cfans.umn.edu/ www.entomology.umn.edu/cues/pollinators/plants.html
2. The University of MN Bee Lab, Bulletin, Plants for Minnesota https://beelab.umn.edu/

Protect bees from insecticides

The conservation of beneficial insects is an essential part of Integrated Pest management (IPM) programs. When scouting plants for pest insects, check for populations of both pest and beneficial insects, such as lady beetles and bees. If beneficial insects are present, wait to spray insecticides to see if the beneficial insects control the pest insects. Do not apply insecticides while plants are in full bloom. If possible avoid beneficial insects by spraying leaves in the evening when bees and lady beetles are not foraging.

Use spot treatments of contact insecticides, not systemic insecticides.

Only spot spray the patch of pest insects, never spray flowers or buds. Flowers that open after spraying with contact insecticides do not contain insecticide residue. Use contact insecticides, such as bifenthrin, cyfluthrin, azadirachtin, and spinosad. Toxicity lasts 1-3 weeks. However, flowers that open after systemic insecticides are sprayed can contain the insecticide residue for months.

See *Understanding Pesticide Toxicity to Pollinators* fact sheet for more information.

2020.Understanding pesticide Toxicity to Pollinators, https://ncipmhort.cfans.umn.edu/sites/ncipmhort.cfans.umn.edu/files/2022-06/Understanding_pesticide_toxicity_to_pollinators_2020.pdf.

Alternatives to systemic insecticides are contact Insecticides. For the last 10 years the EPA has been registering selective insecticides that conserve beneficial insects and pollinators.

- Stops mouthparts from feeding/working; pymetrozine, Endeavor
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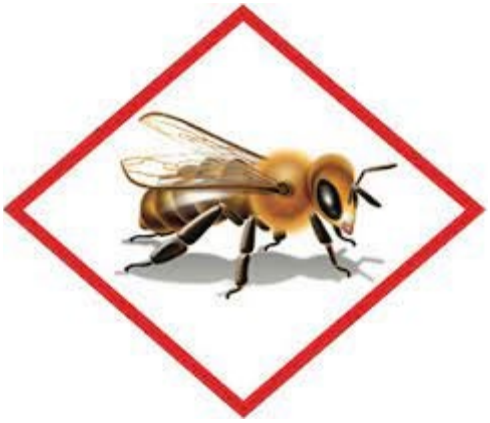
- IGR, insect growth regulator, stops larval growth: pyriproxifen (Distance), diflubenzuron (Adept or Dimilin), Novaluron (Pedestal)
- juvenile hormone mimic; kinoprene (Enstar II)
- Microbial: *Beauveria bassiana* (BotaniGard), spinosad (Conserve, Entrust), bee friendly when dried
- Bee friendly, but at low dose kills butterfly larvae and adults: chlorantraniliprole (Acelpryn, GrubEc)
- Kills mites only; Akari, Floramite, Hexygon, Judo, Forbid

The new bee icon helps signal the pesticide's potential hazard to bees.



EPA has added new language to foliar neonicotinyl insecticide products (imidacloprid, dinotefuran, thiamethoxam, and clothianidin) to protect bees and other insect pollinators. The bee icon above signals that the pesticide has potential to harm bees. The language in the new bee advisory box explains application restrictions to protect bees. https://www.epa.gov/sites/default/files/2013-11/documents/bee-label-info-graphic.pdf

Bee and other insect pollinators can be exposed to the product from:

1. Direct contact during foliar application or contact with residues on plant surfaces after foliar application.
2. Ingestion of residues in nectar and pollen when the pesticide is applied as a seed treatment, soil, tree injection, as well as foliar application.

When using this product take steps to:

1. Minimize exposure when bees are foraging on pollinator attractive plants around the application site.
2. Minimize drift of this product onto beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives can result in bee kills.

Pesticide incidents (for example, bee kills) should be reported to Minnesota Department of Agriculture. Also, pesticide incidents can be reported to the National Pesticide Information Center at www.ipm.orst.edu or the EPA at https://www.epa.gov/pollinator-protection/report-bee-kills

Gardeners beware, 2016.

Bee-toxic pesticides found in bee-friendly plants sold at garden centers nationwide, Friends of the Earth https://foe.org/wp-content/uploads/2017/legacy/GardenersBewareFollowupReport_4.pdf. A 2014 review paper from the Friends of the Earth focused national attention on the use of neonicotinyl insecticides in plants sold at garden centers, https://foe.org/resources/gardeners-beware-2014/. There are 3 FOE reports that links neonicotinyl use in plant propagation in nurseries and greenhouses to residue in nectar and pollen and potential effects on foraging bees.

It is not necessary to remove plants from your garden that may have been treated with systemic neonicotinyl insecticides when you purchased them. You do not know if they were treated with neonicotinyl insecticides and residue in plants decreases with time. In addition, many bedding plants are bred to produce sterile flowers that do not produce pollen and nectar. Flowers that are double, such as marigolds and geraniums, are not attractive to bees.

In your landscape you should not treat flowering plants that are attractive to bees and beneficial insects with systemic insecticides.

Read more on honey bee diseases and disorders at http://npic.orst.edu/envir/ccd.html

For results of yearly USDA Honey Bee Surveys and Reports go to: https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Bee_and_Honey/

UMN Pollinator Conservation, plants for bees and other pollinators, https://ncipmhort.cfans.umn.edu/

Xerces Society Pollinator Friendly Parks, https://xerces.org/pollinator-conservation/parks

UMN Conservation Guide: Pollinators, Pants, Pesticides, https://ncipmhort.cfans.umn.edu/sites/ncipmhort.cfans.umn.edu/files/2022-03/2020-Pollinator-Conservation-Guide.pdf

UMN A Guide to IPM in landscapes, https://ncipmhort.cfans.umn.edu/sites/ncipmhort.cfans.umn.edu/files/2022-03/2020-Guide-to-Integrated-Pest-Management.pdf

Xerces Society Pollinator Conservation, https://xerces.org/pollinator-conservation

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