

Protecting bees and beneficial insects from systemic insecticides applied in landscapes

Vera Krischik, Department of Entomology, University of Minnesota, April 25 2014

Why are bees in decline?

Honey bees and native bees, such as bumblebees, 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 massive 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 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.

What are systemic, neonicotinyl insecticides?

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 active ingredients, imidacloprid, dinotefuran, thiamethoxam, clothianidin, acetamiprid, and thiacloprid, of which acetamiprid and thiacloprid are the least toxic to bees. 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 20 ppb, cause 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 new EPA bee icon and bee advisory box on insecticide labels



EPA has added new language to 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.

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 beekill@epa.gov.

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 your garden to include many plant species 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. The University of MN Bee Lab "Plants for Minnesota Bees"
www.beelab.umn.edu/prod/groups/cfans/@pub/@cfans/@bees/documents/article/cfans_article_451478.pdf
2. CUES: Pollinator Conservation, plants for bees and other pollinators www.entomology.umn.edu/cues/pollinators/plants.html
3. CUES: plants that provide pollen and nectar for beneficial insects www.entomology.umn.edu/cues/gervais/keytable.htm
4. CUES: plants for butterfly gardening www.extension.umn.edu/garden/yard-garden/landscaping/butterfly-gardening/

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 spray leaves in the evening when bees are not foraging.

Use spot treatments of contact 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.

For discussion with nursery and greenhouse growers: Alternatives to systemic insecticides are contact insecticides, which are available to professional applicators.

Thrips: Aria, Aza-Direct, AzaGuard, Azatin XL, Mesuro, Orthene, Overture, Pedestal, Pylon, Sanmite

Aphids: Aria, Azatin, Benefit, BotaniGard, Distance, Endeavor, Enstar II, Ornazin, Orthene, Precision

Whiteflies: Aria, Azatin, BotaniGard, Distance, Endeavor, Enstar, Ornazin, Orthene, Pedestal (not on poinsettias), Precision, Sanmite, Talus, Judo

Mites: Akari, Avid, Floramite, Hexygon, Judo, Ovation, ProMite, Pylon, Sanmite, Shuttle-O, Tetrasan, Ultiflora

Fungus gnats: soil drenches of Azatin XL, Adept or Distance

Mealybugs: Aria, Enstar, Orthene, and Talus

Gardeners beware: Bee-toxic pesticides found in bee-friendly plants sold at garden centers nationwide, Friends of the Earth www.foe.org/news/archives/gardeners-beware

A 2013 review paper from the Friends of the Earth focused national attention on the use of neonicotinyl insecticides in plants sold at garden centers

Garden center plants were purchased at three locations around the country and a mixture of ground flowers, stems, and leaves were analyzed for the presence of the neonicotinyl insecticides.

Imidacloprid residue was found in 6 out of 13 purchased plants and residue was at levels that may kill bees in two samples. This is the first report that links imidacloprid 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.

Much more research is necessary to understand the amount of neonicotinyl residue in purchased plants and landscape plants and the potential effects of these residues on bees and beneficial insects.

The information given in this fact sheet is for educational purposes only. References to commercial products or trade names are made with the understanding that no discrimination is intended and no product endorsement by the University of Minnesota Extension is implied. Pesticide products should always be used in accordance with all label directions. Pesticide label directions can and do change over time. Therefore, when a pesticide product is purchased, it is the responsibility of the user to read and follow the label directions attached to the product container. The plant or site of the intended application must be listed on the label. Any use inconsistent with the label is a violation of Federal law.