Growing Flowering Plants That are Safe for Pollinators in the Yard and Garden

David Smitley, September 30, 2014
Michigan State University

A type of sweat bee, one of 4,000 spp. of native bees in the USA
**What are neonicotinoid insecticides?** Neonicotinoids are a group of insecticides with a chemical structure that is similar to nicotine.

[Chemical structures of Imidacloprid and Nicotine]

They are more selective (e.g. they have greater toxicity to insects than to mammals), and are less harmful than most older classes of insecticides. The most widely used neonicotinoid insecticide, imidaclorpid, is less toxic to people than caffeine, and about twice as toxic as ibuprofen.
## Neonicotinoid Insecticides Used for Pest Control on Ornamentals

<table>
<thead>
<tr>
<th>Neonic insecticides given to bees orally</th>
<th>Honey bees</th>
<th>Honey bees</th>
<th>Bumble bees</th>
<th>Bumble bees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lowest lethal concentration</td>
<td>lowest sublethal concentration</td>
<td>Lowest lethal concentration</td>
<td>lowest sublethal concentration</td>
</tr>
<tr>
<td></td>
<td>Acute (ppb)</td>
<td>Chronic (ppb)</td>
<td>Acute (ppb)</td>
<td>Chronic (ppb)</td>
</tr>
<tr>
<td>Acetamiprid</td>
<td>442,000</td>
<td>ND</td>
<td>5,000</td>
<td>ND</td>
</tr>
<tr>
<td>Clothianidin</td>
<td>&gt;190</td>
<td>ND</td>
<td>24</td>
<td>ND</td>
</tr>
<tr>
<td>Dinotefuran</td>
<td>&gt;380</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>&gt;185</td>
<td>0.10</td>
<td>ND</td>
<td>24</td>
</tr>
<tr>
<td>Thiomethoxam</td>
<td>&gt;250</td>
<td>ND</td>
<td>ND</td>
<td>50</td>
</tr>
</tbody>
</table>

1From the 2012 Xerces Society Report: ‘Are Neonicotinoids Killing Bees?’
How Neonicotinoids and Bees Became a Crisis for Greenhouse and Nursery Growers: the Last 16 Months

Start: June 20, 2013

Buzzkill: Huge bee die-off in Oregon parking lot blamed on insecticide spraying

Grist.org, Oregon Public Broadcasting

- 25,000 dead bumble bees and honey bees found in the parking lot of the Wilsonville Target Store

- Linden trees in full bloom had been sprayed with Safari (dinitotefuran)

- Scott Hoffman Black, executive director of the Xerces Society, said he has confirmed the bees died from pesticide poisoning. “Evidently they didn’t follow the label instructions. This should not have been applied to the trees while they’re in bloom.”
Bee Science Articles
02/11/14 - GMO Soybeans Are Bad for Mexico's Beekeepers
02/20/12 - Study Says Insecticide Used with GM Corn Toxic to Bees
01/21/11 - Call to Ban Pesticides Linked to Bee Deaths
12/24/08 - Bee Learning Affected by Eating Toxin from GE Corn
08/26/08 - New Research Finds Higher-Than-Expected Levels of Pesticides in Hives
05/08/08 - Honeybee Hives in U.S. Seeing Continued Decline
05/05/08 - Air Pollution Impedes Bees' Ability to Find Flowers
09/07/07 - Study Points to Virus in Collapse of Honeybee Colonies
05/04/07 - What's The Buzz? Scientists Explore Pesticide Poisoning of Bees
04/26/07 - Requiem for the Honeybee
February 7, 2014

Join One of these Five Home Depot ‘Swarms’ to Help Save the Bees! Organic Consumers Association

For related articles and more information, please visit OCA's Honey Bee Health page and our Millions Against Monsanto page.

If you live in Eugene, Ore., the Bay Area (Calif.), Minneapolis, Minn., Washington D.C., or Chicago, Ill., you’re in luck. You can join activists from the OCA and other bee-friendly groups to help deliver valentines to local Home Depot store managers with this message: “Give Bees Some Love! Stop Selling Bee-Killing Plants!”

You can download your valentine, and add your own personal message. We even have leaflets you can print and hand out.
Feb 12, 2014: Organic Consumers Association Protest in Chicago

[IM] Organic Consumers Association part of the national action to protest Home Depot and Lowes
Organic Consumers Association Protest in Chicago at a Home Depot
March 2014

Buyers from Home Depot and Lowes contact nursery and greenhouse growers to announce that they may NOT be accepting plants treated with neonicotinoid insecticides, or that treated plants will need to be labeled.

**How can they do that?**

The large retail stores control the lion-size of the flower and nursery market. Contracts with these buyers are highly competitive and may involve millions of dollars in sales per year.
May 2, 2014

A New Documentary Film Exploring "Colony Collapse Disorder" and the Fate of Agriculture

![Vanishing of the Bees](image-url)

[Organic Consumers](https://organicconsumers.org)
The Case of The Vanishing Bees
Pesticides & The Perfect Crime: In the widespread bee die-offs, bees often just vanish. One beekeeper calls it the Perfect Crime—no bodies, no murder weapon, no bees. What’s happening to the bees?
Study strengthens link between neonicotinoids and collapse of honey bee colonies (by Dr. Lu)

For immediate release: May 9, 2014
Boston, MA — Two widely used neonicotinoids—a class of insecticide—appear to significantly harm honey bee colonies over the winter, particularly during colder winters, according to a new study from Harvard School of Public Health (HSPH). The study replicated a 2012 finding from the same research group that found a link between low doses of imidacloprid and Colony Collapse Disorder (CCD), in which bees abandon their hives over the winter and eventually die.
May 2014. 2nd Lu paper receives a lot of attention in the media


Discussion of Lu papers
In a recent review, Cresswell suggests that “the field-realistic range of imidaclorpid concentrations is assumed to be 0.7–10 μg L⁻¹ (ppb). Dosages in first Lu paper: 20, 40, 200, or 400 ppb fed constantly to bees in sugar water. Also, symptoms of affected colonies may not match CCD. Dosage in second Lu paper: 136 ppb fed constantly to bees in sugar water.

Concentration of imidaclorpid or clothianidin in sugar water fed to bees continuously for 13 weeks is much higher than what is expected in the pollen of seed-treated field crops. But overall, these results are consistent with other papers where bees are fed neonicotinoid-tainted sugar water.
Gardeners Beware 2014: Bee-Toxic Pesticides Found in “Bee-Friendly” Plants Sold at Garden Centers Across the U.S. and Canada

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Report Summary (of a 60 page report):
• Plants were purchased from retail nurseries, including Home Depot, Lowe's, Walmart, and Orchard Supply Hardware in 18 cities across the U.S., as well as three provinces in Canada.
• They then sent the plants off to a laboratory to measure the presence and concentration of pesticides in the greenery.
• Testing showed that 51 percent of store-bought plants had levels of a group of harmful pesticides known as neonicotinoids that were high enough to kill honey bees, bumble bees, and other pollinators "outright."
Gardeners Beware Report

Oral LD50
- 180 ppb, acute
- 50 ppb, chronic
Determination of Imidacloprid Residue Concentrations in Seedless Watermelon Flowers

Galen P. Dively, Mike Embrey, Terry Patton, and Amy Miller
Department of Entomology, University of Maryland

Table 2. Summary of imidacloprid concentrations detected in flowers collected three weeks after peak bloom in treated replicate plots of seedless watermelon.

<table>
<thead>
<tr>
<th>Flower type</th>
<th>Treatment regime</th>
<th>Type of sample</th>
<th>Mean ppb of imidacloprid</th>
<th>SEM</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staminate/pistillate</td>
<td>Single transplant drench at planting (7 oz/acre)</td>
<td>F</td>
<td>4.1</td>
<td>0.52</td>
<td>3.1</td>
<td>4.8</td>
</tr>
<tr>
<td>(six replicate plots)</td>
<td>Split treatments (3.5 oz/acre at planting; 3.5 oz/acre 3 weeks later)</td>
<td>F</td>
<td>3.3</td>
<td>0.37</td>
<td>2.8</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R</td>
<td>0.0</td>
<td>0.00</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S/C</td>
<td>2.3</td>
<td>1.20</td>
<td>0.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

1 F = flower tissue (sepals, receptacle) excluding the male and female parts; S = Stamens (male parts of flower); P = Carpels (female parts of flower); and R = water rinsate obtained by washing the reproductive parts of the flowers.
Pesticides found in plants purchased at Home Depot or Walmart can prove deadly for bees. By Marina Koren  Follow on Twitter

Neonicotinoids have previously been linked to the country's shrinking bee population. Last June, more than 50,000 bumblebees, or about 300 colonies, were found dead or dying in a Target parking lot in Oregon.

http://www.salon.com/2014/06/26/bee_friendly_plants
September 2014 Home Depot Decision: Impact on Greenhouse and Nursery Growers

- In 2015 Home Depot is requiring a label in each pot of plants treated with a neonicotinoid insecticide.

- Two other retail store buyers have requested that no neonics be used but have not yet made a firm requirement.

![Image of a greenhouse with colorful flowers]
Questions Raised

• Is the widespread use of imidacloprid and other neonics causing the decline of managed honey bees? Impact on butterflies?

• Are flowering plants sold in garden centers harmful to bees because of the use of pesticides during production?
Growing evidence for declines in bee populations has caused great concern because of the valuable ecosystem services they provide. Neonicotinoid insecticides have been implicated in these declines because they occur at trace levels in the nectar and pollen of crop plants. We exposed colonies of the bumble bee *Bombus terrestris* in the laboratory to field-realistic levels of the neonicotinoid imidacloprid, then allowed them to develop naturally under field conditions. Treated colonies had a significantly reduced growth rate and suffered an 85% reduction in production of new queens compared with control colonies. Given the scale of use of neonicotinoids, we suggest that they may be having a considerable negative impact on wild bumble bee populations across the developed world.
Most of the 92 million acres of corn planted across the U.S. this year will have been treated with either clothianidin or thiamethoxam as a seed treatment.

Plants visited by foraging bees (dandelions) growing near these fields were found to contain neonicotinoids.

Dead bees collected near hive entrances during the spring sampling period were found to contain clothianidin.

We also detected clothianidin in pollen collected by bees and stored in the hive.

Maize pollen from treated seed was found to contain clothianidin (3.5 ppb) and other pesticides; and honey bees in our study readily collected maize pollen.
Insecticidal Seed Treatments can Harm Honey Bees
Erin Hodgson, Department of Entomology (ISU) and Christian Krupke, Department of Entomology (Purdue)
http://www.extension.iastate.edu/CropNews/2012/0406hodgson.htm

Figure 1. Bees exhibit neurotoxic symptoms when dosed with neonicotinoids. Dying bees have trouble flying, collecting food and getting back into the hive. *Photo by John Obermeyer, Purdue Extension Entomology.*
Imidacloprid
Use by Year and Crop

- Other
- Pasture and hay
- Orchards and grapes
- Rice
- Vegetables and fruit
- Cotton
- Wheat
- Soybeans
- Corn

Estimated use in million pounds


Clothioanidin
However, honey bee decline appears to have started before the widespread use of neonics.
As the use of neonics increased by 0.8 million pounds from 1995 to 2009, the use of carbamates and organophosphates decreased by 20 million pounds. Randy Oliver
Varroa mite found in 12 states

Imidacloprid starts here

Randy Oliver, Scientific Beekeeping
Dietary traces of neonicotinoid pesticides as a cause of population declines in honey bees: an evaluation by Hill's epidemiological criteria

James E Cresswell\textsuperscript{1,*},
Nicolas Desneux\textsuperscript{2} and
Dennis vanEngelsdorp\textsuperscript{3}

\textit{Pest Management Science}

* 72 papers cited. Most of them are journal articles report the results of experiments with bees that relate to the neonic pesticide issue directly or indirectly.
<table>
<thead>
<tr>
<th>Criterion</th>
<th>Brief description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Experimental evidence</td>
<td>Fails to contradict established knowledge</td>
<td>−1 Mixed results</td>
</tr>
<tr>
<td>2. Coherence</td>
<td>Fails to contradict established knowledge</td>
<td>+3</td>
</tr>
<tr>
<td>3. Plausibility</td>
<td>Probable given established knowledge</td>
<td>+2 Yes</td>
</tr>
<tr>
<td>4. Analogy</td>
<td>Similar examples known</td>
<td>+3 Yes</td>
</tr>
<tr>
<td>5. Temporality</td>
<td>Cause precedes effect</td>
<td>−4 Years do not match</td>
</tr>
<tr>
<td>6. Consistency</td>
<td>Cause is widely associated with effect</td>
<td>−4 Poor geographic match</td>
</tr>
<tr>
<td>7. Specificity</td>
<td>Cause is uniquely associated with effect</td>
<td>−5 No</td>
</tr>
<tr>
<td>8. Biological gradient</td>
<td>Monotonic dose–response relationship</td>
<td>−4</td>
</tr>
<tr>
<td>9. Strength</td>
<td>Cause is associated with a substantive effect</td>
<td>−2 Weak</td>
</tr>
</tbody>
</table>

**CONCLUSION:** Dietary neonicotinoids cannot be implicated in honey bee declines, but this position is provisional because important gaps remain in current knowledge.
The United Kingdom Report
An assessment of key evidence about Neonicotinoids and bees
March 2013
• Three recent studies with neonicotinoids showed sub-lethal effects on bees
• These results contrast with a growing body of evidence from field studies that fail to show an effect of neonicotinoids when bees are allowed to forage naturally in the presence treated crops.

The Australia Report
Overview report on bee health and the use of neonicotinoids in Australia
February 2014
• The introduction of the neonicotinoids has led to an overall reduction in the risks to the agricultural environment from the application of insecticides.
• Australian honeybee populations are not in decline, despite the increased use of neonicotinoids in agriculture and horticulture since the mid-1990s.
Extensive research on Colony Collapse Disorder suggests that there are many causes of this syndrome, with the most important causes being the interaction of several bee diseases with other stressors (USDA ARS 2014). At this time neonicotinoids are NOT considered to be a primary cause of Colony Collapse Disorder. However, recent research indicates that bees exposed to neonicotinoid insecticides may have suppressed immune systems, which could make them more susceptible to some bee diseases (Di Prisco et al. 2013).

Bee Lab Objectives:
1) diagnosing and mitigating disease, 2) reducing the impacts on bees of pesticides and other environmental chemicals, and 3) improving bee health through better nutrition
What do the Beekeepers Think?

http://scientificbeekeeping.com
Randy Oliver

As Dr. Eva Crane...has pointed out “the best that beekeepers can hope for, in the light of the great need to kill pest insects, is an acceptable level of mortality among their bees.”

Beekeepers realize that in order to get locations, that they need to get along with the landowners, who are often farmers (or friends of the farmers). If the beekeeper raises a stink, he may lose his welcome. So in general, commercial beekeepers accept the occasional bee kill as a normal cost of doing business.
Is there a geographic correlation to neonic use as a seed treatment and bee decline? Iowa as a test case.

Figure 2. If you add up all the blue dots (each representing 10,000 acres treated with insecticides), it’s easy to see why in some areas it’s hard for beekeepers to find “safe” places for their hives. Source USDA.  
[http://scientificbeekeeping.com](http://scientificbeekeeping.com) Randy Oliver
Honey yield per hive in Iowa, where GM crops are most intensively used, 1974 – 2010. Randy Oliver
Figure 4. A bee kill in an almond orchard this spring. Surprisingly, no insecticides were involved! These bees were killed by a tank mix of herbicides, spray oil, and liquid fertilizer. A number of colonies were killed outright and others were weakened. http://scientificbeekeeping.com  Randy Oliver
Investigation of honey bee winter mortality in Ontario

Figure 1: Estimated mortality of honey bees in Ontario. The light colored horizontal bar represents the normal level of mortality derived from a literature review.
Based on research from the University of Guelph (Guzman et al., 2010) and reports and field observation from other provinces (Currie et al., 2010), **varroa is still the main factor** in colony mortality. The overall virulence of *Nosema ceranae* in honey bees is somewhat unclear and there are many other pathogens such as viruses that have a further impact on honey bees.

Paul Kozak
Provincial Apiarist
Ontario Ministry of Agriculture, Food and Rural Affairs
Email: Paul.Kozak@ontario.ca
Overall: How much do trace amounts of neonics in the pollen and nectar of crops planted with treated seed impact bees? Unresolved. An equivalent concentration in sugar water fed to bees causes problems, Purdue study found clothianidin in bee pollen, but field data showing decline of colonies due to seed-treated field crops is still lacking.

What about planter box dust during planting? Definitely a problem if bees visit weed flowers along the edge of field at planting time or shortly after.
<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Fungicide pretreatment</th>
<th>LD50 (µg/bee)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetamiprid</td>
<td>None</td>
<td>7.07</td>
</tr>
<tr>
<td>Acetamiprid</td>
<td>Propiconazole</td>
<td>0.07</td>
</tr>
<tr>
<td>Thiacloprid</td>
<td>None</td>
<td>14.6</td>
</tr>
<tr>
<td>Thiacloprid</td>
<td>Propiconazole</td>
<td>0.03</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>None</td>
<td>0.018</td>
</tr>
<tr>
<td>Imidacloprid</td>
<td>Propiconazole</td>
<td>0.012</td>
</tr>
</tbody>
</table>

- DMI pretreatment makes Acetamiprid and Thiacloprid as toxic to bees as imidacloprid (otherwise they are 200-fold less toxic).
- Little effect on imidacloprid

What about endangered species of butterflies?
Example: The Poweshiek Skipper
Percent of Sites with Positive Detections in Iowa, Minnesota, North Dakota and South Dakota

Poweshiek skipperling for survey years $n_{sites} > 1$
So, the role of neonics in causing bee decline is being intensely debated and researched without a clear answer at this point.

But it doesn’t matter- the public eye has been focused on garden center plants, and we need to grow plants that are safe for bees and other pollinators.

**Note:** Greenhouses in Europe are exempt from the temporary ban on neonicotinoids.
What Do We Know About the Safety of Neonics Used on Greenhouse and Nursery Plants?

- Two studies with ladybird beetles and butterflies on soil drenched nursery plants by Vera Krischik

- Two studies with clover in turf by JL Larson, CT Redmond, DA Potter

- Two experiments with greenhouse-grown flowers for garden centers by Smitley
From Krischik, UMinn: Nursery plants treated with Marathon soil app.

### 2011 Imidacloprid residue plants

<table>
<thead>
<tr>
<th>Dose in mg/soil</th>
<th>Dead bees on Agastache</th>
<th>Agastache spp. nectar ppb</th>
<th>Asclepias spp. nectar ppb</th>
<th>Esperanza spp. nectar ppb</th>
<th>Rosa spp. pollen ppb</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.6b</td>
<td>6b</td>
<td>3c</td>
<td>0c</td>
<td>26b</td>
</tr>
<tr>
<td>25</td>
<td>0.6b</td>
<td>52b</td>
<td>80c</td>
<td>8c</td>
<td>36b</td>
</tr>
<tr>
<td>50</td>
<td>0.5b</td>
<td>133b</td>
<td>175bc</td>
<td>21c</td>
<td>30b</td>
</tr>
<tr>
<td>300 1X</td>
<td>1.1ab</td>
<td>1973b</td>
<td>1568bc</td>
<td>106c</td>
<td>95b</td>
</tr>
<tr>
<td>3 gal pot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>600 2X</td>
<td>2.4a</td>
<td>5265ab</td>
<td>2950b</td>
<td>276b</td>
<td>332b</td>
</tr>
<tr>
<td>3 gal pot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td>2.4a</td>
<td>9335a</td>
<td>8337a</td>
<td>9162a</td>
<td>720a</td>
</tr>
</tbody>
</table>

F values: F=3.2, 0.01 for Dead bees on Agastache, F=3.7, 0.017 for Agastache spp. nectar ppb, F=25.8, 0.0001 for Asclepias spp. nectar ppb, F=166, 0.0001 for Esperanza spp. nectar ppb, F=5.7, 0.0025 for Rosa spp. pollen ppb.
Landscape rates of soil-applied imidacloprid translocated to flowers reduces survival of *Coleomegilla, Hippodameia*, and *Cocinella* ladybeetles, but not *Harmonia* ladybeetles, *Danaus plexippus*, and *Vanessa cardui*, butterflies

Vera A. Krischik, Mary Rogers, Garima Gupta, and Aruna Varshey

- Survival and fecundity of both butterfly species was not reduced in free-ranging or force-fed experiments (0 ppb (C), 15 ppb (1X), or 30 ppb (2X) imidacloprid) experiments.
- However, butterfly larval survival was significantly reduced on 1X and 2X imidacloprid treatments.
- Three (*Coleomegilla maculata*, *Harmonia axyridis*, and *Hippodamia convergens*) of the four lady beetle species had significantly reduced survival at day 12 from both 1X and 2X treatments.
Pollinator assemblages on dandelions and white clover in urban and suburban lawns

Jonathan L. Larson · Adam J. Kesheimer · Daniel A. Potter

More than 50 spp. of pollinators found on dandelions and white clover in lawns

Published Sept. 2014
Objectives of Potter Study

- Evaluate hazards of lawn insecticides to bees in the field
- Find ways to reduce the risks of harm
Assessing Insecticide Hazard to Bumble Bees Foraging on Flowering Weeds in Treated Lawns

Jonathan L. Larson, Carl T. Redmond, Daniel A. Potter*
Department of Entomology, University of Kentucky

Results of Kentucky Study

When bumble colonies were caged 24 h after turfgrass with clover was sprayed, and kept their for 2 weeks:

• For Clothianidin- the number of foraging bees was reduced by 75% and no new queens produced (compared with 35 queens in control plots)
• For chlorantraniliprole (Acelepryn)- No difference from control treatment
• For lawns mowed before spraying- No effect on the bees
What are the biggest potential problems for bees if neonicotinoids are used?

- Spraying open flowers during the last few weeks before shipping (with any insecticide).
- Soil drenches in greenhouses with imidacloprid, primarily used in hanging baskets.
- Soil drenches of flowering trees (*Tilia*) in nurseries or in yards for Japanese beetle, etc.
Three Experiments With Greenhouse and Nursery Plants
Smitley, MSU

1. Evaluate the impact of an imidacloprid soil drench applied to 12” diameter hanging baskets

2. Determine the amount of dislodgable residue of imidacloprid on flowers purchased in a garden if the flowers received a foliar spray of imidacloprid at 1, 2 and 4 weeks prior to the shipping date.

3. Determine the impact of an imidacloprid soil drench applied around the base of Tilia trees after petal-fall on bumble bees the following year.
Experiment I:
Imidacloprid applied to hanging baskets as a soil drench
Methods:
• Hanging baskets were drenched at 4 weeks before shipping
• 5 weeks after the drench plants were put in screen cages with colonies of bumble bees
• Bumble bees remained in screen cages for 3 weeks
• Colonies were counted three times, at 1, 3 and 6 weeks after being put in screen cages
The only way to count bumble bees is to paint each one when it is counted!

Photo by Cristi Palmer, IR4
Counting bumble bees in the cold room with a red light

Photo by Cristi Palmer
# Bumble Bees Per Colony After Soil Drench With Imidacloprid or Water (Control)

<table>
<thead>
<tr>
<th>Date</th>
<th>Treatment</th>
<th>Number of Bees Counted Per Colony</th>
<th>New Queens Produced Per Colony</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 14</td>
<td>Imidacloprid</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>July 14</td>
<td>Control</td>
<td>133</td>
<td></td>
</tr>
<tr>
<td>July 28</td>
<td>Imidacloprid</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>July 28</td>
<td>Control</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>August 18</td>
<td>Imidacloprid</td>
<td>22</td>
<td>0.6</td>
</tr>
<tr>
<td>August 18</td>
<td>Control</td>
<td>18</td>
<td>1.0</td>
</tr>
</tbody>
</table>
Results:
• No significant differences in the total number of bees counted on any sample date
• No differences in number of queens produced at the end of the summer

Problems:
• Poor survival of all colonies after being put into the field

Questions:
• Are there any sublethal effects?
• How important is nutrition (flowers available)
Experiment II

• Determine the last time that foliar sprays can be applied to open flowers, and still be safe for bees
• Flowers were sprayed with imidacloprid at 4, 2 and 1 week before shipping.
• Flowers were sampled 1 week after the shipping date
<table>
<thead>
<tr>
<th>Weeks Before Shipping</th>
<th>Plant Type</th>
<th>Olefin (ppb)</th>
<th>Imidacloprid (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Portulaca</td>
<td>70</td>
<td>110*</td>
</tr>
<tr>
<td>1</td>
<td>Verbena</td>
<td>0</td>
<td>70</td>
</tr>
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<tr>
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*Data are means of 10 replications*
Results of Experiment II

• Dislodgable residues were measured on 4 types of flowers
• > 20 ppb were only found on dislodgable residue samples from flowers sprayed 1 or 2 weeks before shipping.

❖ Conclusion- Avoid spraying open flowers the last 2 weeks before shipping.

Note: Samples were also collected for whole-flower tissue analysis pending funding of the Specialty Crop Block Grant.
Can we make guidelines that if followed can be used to label plants as bee-friendly?

Yes, guidelines will be based on the first year of on-going research, and they will include:

- Do not spray flowers in the last 2 – 3 weeks before shipping.
- Do not apply soil drenches of imidacloprid to hanging baskets any later than 5 weeks before shipping. Do not exceed the label rate.
- Do not use imidacloprid soil drenches on flowering trees and shrubs attractive to bees.
- Read bee warning information on pesticide labels and avoid practices that are harmful to bees.
We’re glad you care about bees. We do too.

A brief timeline:
• Honey bee decline began in the early 1950s.
• A sharp decline was noted when parasitic mites were introduced to the U.S. around 1987.
• The decline has continued since 1995, when the neonicotinoid class of insecticides was put into use, but the rate of decline did not change.
• Up to 50,000 bees were accidentally killed in an Oregon parking lot near the Xerces Society headquarters in 2013. This became the rallying point for anti-pesticide activists.
• A 2014 study by Harvard School of Public Health linked low doses of neonicotinoids to Colony Collapse Disorder, which was widely spread by media.
• Additional studies show mixed results with the conclusion that pesticides, including neonics, may have an impact on bee decline, but the primary causes are the varroa mite, lack of food, and other factors.
• Michigan State University conducted specific research* in 2014 and then made recommendations for greenhouse growers that produce flowering annuals.

*Research compiled by Dr. David Smitley (MSU) is located here: http://www.ent.msu.edu/directory/david_smitley

What are neonicotinoids? Neonicotinoids are a class of insecticides that are similar in structure to nicotine and a significant improvement over earlier insecticides because they are more targeted and less harmful to humans and non-targeted insects, including bees. This class of insecticide is used to protect crops from whitefly, Japanese beetle, emerald ash borer, and other insects.
In response, WenkeSunbelt Greenhouses has devised a proactive plan of action:
- Reduce or eliminate the use of neonicotinoids. Hanging baskets and poinsettias are our only crops that could potentially need them.
- Follow the MSU recommendations:
  - Avoid spraying open flowers during the last 2-3 weeks of production, prior to shipping
  - Avoid drenching during the last 5 weeks of production, prior to shipping
- Follow the new EPA Bee Advisory Guidelines
- Fund research with MSU and AmericanHort
- Preventative scouting and maintaining weed-free facilities

Remember... This research has also shown that bees and other pollinators benefit from having flowers as a food source. **Our plants are truly Bee Friendly!**
**PROTECTION OF POLLINATORS**

**APPLICATION RESTRICTIONS** EXIST FOR THIS PRODUCT BECAUSE OF RISK TO BEES AND OTHER INSECT POLLINATORS. FOLLOW APPLICATION RESTRICTIONS FOUND IN THE DIRECTIONS FOR USE TO PROTECT POLLINATORS.

Alerts users to separate restrictions on the label. These prohibit certain pesticide use when bees are present.

Look for the bee hazard icon in the Directions for Use for each application site for specific use restrictions and instructions to protect bees and other insect pollinators.

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

**This product can kill bees and other insect pollinators.**

Bees and other insect pollinators will forage on plants when they flower, shed pollen, or produce nectar.

Makes clear that pesticide products can kill bees and pollinators.

Bees and other insect pollinators can be exposed to this pesticide from:

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

Bees are often present and foraging when plants and trees flower. EPA's new label makes it clear that pesticides cannot be applied until all petals have fallen.

When Using This Product Take Steps To:

- Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.
- Minimize drift of this product onto beeshives or to off-site pollinator attractive habitat. Drift of this product onto beeshives can result in bee kills.

 Warns users that direct contact and ingestion could harm pollinators. EPA is working with beekeepers, growers, pesticide companies, and others to advance pesticide management practices.

Information on protecting bees and other insect pollinators may be found at the Pesticide Environmental Stewardship website at: [http://pesticidestewardship.org/pollinatorprotection/Pages/default.aspx](http://pesticidestewardship.org/pollinatorprotection/Pages/default.aspx)

Highlights the importance of avoiding drift. Sometimes, wind can cause pesticides to drift to new areas and can cause bee kills.

Pesticide incidents (for example, bee kills) should immediately be reported to the state/tribal lead agency. For contact information for your state/tribe, go to: [www.aaapo.org](http://www.aaapo.org). Pesticide incidents can also be reported to the National Pesticide Information Center at: [www.npic.orst.edu](http://www.npic.orst.edu) or directly to EPA at: beekeeper@epa.gov

The science says that there are many causes for a decline in pollinator health, including pesticide exposure. EPA's new label will help protect pollinators.

Read EPA's new and strengthened label requirements: [http://go.usa.gov/jHHH4](http://go.usa.gov/jHHH4)
From the new ‘bee box’ on EPA pesticide labels:

“The science says that there are many causes for a decline in pollinator health, including pesticide exposure. EPA’s new label will help protect pollinators”.

If bee-friendly management strategies are followed then-

Planting annual flowers, perennial flowers, and flowering trees and shrubs should help bees by providing more food for them. Encouraging wildflowers and flowering weeds is also good for bees.
Media Attention to Bee Issues Also Has Some Benefits:

- People are more aware of the role of pollinators and their diversity
- Where flowers are present, bees are indicators of the health of the insect community. Protecting bees protects all beneficial insects and biological control.
This Power Point file can be downloaded at:

http://www.ent.msu.edu/directory/david_smitley