VERMONT AGENCY OF AGRICULTURE

NEONICOTINOID PESTICIDES; SAFETY AND USE

The Secretary of Agriculture Food, and Markets shall evaluate whether the use or application of the pesticides imidacloprid, clothianidin, thiamethoxam, dinotefuran, or any other member of the nitro group of neonicotinoid pesticides is safe and not harmful to human health or the health of bees and other pollinators in the State.

January 27, 2015

Pollinator health and neonicotinoid pesticides: summary & recommendations

Introduction

Successful agriculture and healthy pollinator populations are intrinsically linked. In Vermont, crops such as apples, blueberries and other fruits & vegetables require pollinators for successful crop production. Agricultural commodities such as honey and other bee-related products are essential to our diverse agricultural system and economy. The presence and activities of pollinators also maintains and improves Vermont's biodiversity, an essential component of a healthy ecosystem. As such, the Vermont Agency of Agriculture has been proactively involved in establishing pollinator health protection policy at the federal level, as well as actively investigating and researching potential pesticide exposures and impacts to honey bees (*Apis mellifera*) in Vermont. Active working collaborations include multi-year pollen studies, case investigations of potential pesticide impacts to locally-managed hives, and policy work with US EPA for strengthened pollinator protection for pesticide labels and the development of national guidance for managed pollinator protection plans. The details of these activities will be outlined in this report. This report will summarize the current status of both federal and state pollinator health, neonicotinoid pesticides, and address ongoing and possible future work to decrease pollinator exposure to pesticides in Vermont. Other concerns such as sub-lethal effects, impacts to solitary pollinators, metabolites, degradants, synergistic effects and accumulation in biota are still undergoing significant research and continue to be monitored at the state and federal levels.

Pollinator health status

Within the last decade multiple sources have noted declines in certain pollinators, both in North America and throughout Europe. Honey bee colonies, the most widely used managed agricultural pollinator in the United States, have declined from a high in 1947 of about 6 million colonies to about 2.5 million managed hives in 2012. Other pollinator populations have been recorded declines as well.

Since the mid-1980's, parasitic mites (*Varroa destructor*) and other widespread parasites (*Nosema* spp) have reportedly resulted in a 15-21% mortality in overwintering honey bee colonies. Nationally in 2006 losses increased significantly in overwintering hives. These losses were characterized by the disappearance of adult workers leaving the colony for no obvious reason and were collectively termed Colony Collapse Disorder (CCD). The widespread losses related to CCD received a lot of media attention and prompted increased scientific scrutiny of honey bee health.

To date, no one single factor has been identified as the cause of CCD or other pollinator health decreases. Many researchers have hypothesized that it is an interaction of multiple stressors/factors that are causing these declines and increased mortalities in managed hives.

The following factors, in some combination, are suspected to be influencing the decline of pollinators:

- Pollinator pests (*e.g.*, mites) and diseases
- Nutrition issues
- Loss of habitat (agricultural practices, urbanization)
- Management practices of bee keepers
- Pesticide exposure
- Change in methodology of counting of colonies in the US

Pollinators in Vermont, honey bees or others, face these issues. To date Vermont has not had confirmed cases of widespread honey bee colony losses.

Pollinators & pesticide exposure

Pesticides, although they have not been shown to be directly related to CCD or other health declines, are of concern to pollinator health due to the nature of pollinator activities (foraging in treated areas, collection of pollen and nectar that contain residues) and new classes of registered pesticides.

Pollinators may be exposed to pesticides intentionally or incidentally (contact with treated plants, soil, nectar, pollen). For instance honey bee hives are intentionally treated with pesticides such as coumaphos and fluvalinate to kill parasitic mites. Pollinators may also be directly exposed to pesticides if they are present when pesticide applications are actively occurring, as may be case for contracted pollination services. Incidental exposure may occur when pesticides migrate off treated application sites in the form of application drift, or as has been investigated, by dust from seed planter lubricant having direct contact with treated seed, or particles of windblown soil or run-off from fields planted with treated seeds.

Incidental exposures to pollinators may also be from pesticide residual on or in a blooming crop visited by foraging pollinators, ingestion of contaminated nectar, pollen or other environmental exposures (drinking water, nesting locations).

Neonicotinoid pesticides

There has been substantial attention regarding the possible effects on pollinator health of a relatively new class of insecticides, the neonicotinoids. The mode of action of neonicotinoid pesticides is modeled after the natural insecticide, nicotine. They act on the central nervous system of insects. Their action causes excitation of the nerves and eventual paralysis, which leads to death. Because they bind at a specific site they are not cross-resistant to the carbamate, organophosphate, or synthetic pyrethroid insecticides, which was an impetus for their development.

In the US, neonicotinoid pesticides were first registered by the US EPA in the 1990s. Currently registered neonicotinoids active ingredients include imidacloprid, thiamethoxam, clothianidin, dinotefuran, acetamiprid, thiacloprid, nitenpyrem.

Toxicity of neonicotinoids

Neonicotinoids are less toxic to mammals and birds and were developed to replace organophosphates and other more toxic chemistries of insecticides.

As the neonicotinoids block a specific neuron pathway that is more abundant in insects than warm-blooded animals, these insecticides are more selectively toxic to insects than mammals. As such, the neonicotinoids are classified by the EPA as both toxicity class II and class III agents and are labeled with the signal word “Warning” or “Caution.”

The most available of mammalian toxicity data of the neonicotinoids is with imidacloprid. These data indicate that it is less toxic when absorbed by the skin or when inhaled compared to ingestion. It causes minor eye reddening, but is non-irritating to the skin.

A chronic toxicity study showed that rats fed up to 1,800 ppm resulted in a No Observable Effect Level (NOEL) of 100 ppm. The EPA categorizes imidacloprid as a “Group E” (no evidence of carcinogenicity). In animals and humans, imidacloprid is quickly and almost completely absorbed from the gastrointestinal tract, and eliminated via urine and feces within 48 hours.

Table 1. Common neonicotinoid pesticide mammalian toxicities (mg/kg of body weight).

Common name	**Rat oral LD_{50}**	**Rabbit dermal LD_{50}**
Acetamiprid	450	> 2,000 (Tristar®)
Clothianidin	> 5,000	> 2,000 (Acceleron®)
Dinotefuran	2,000	> 2,000
Imidacloprid	4,870 (Gaucho®)	> 2,000 (Admire®)
Thiamethoxam	> 5,000	> 2,000
> means "greater than"		

Imidacloprid, clothianidin, dinotefuran, thiamethoxam are considered by the US EPA to be highly toxic to honey bees. Many acute toxicity tests for imidacloprid have been done on honey bees. General ranges for imidacloprid honey bee toxicity are $LD_{50contact}$: 0.06 to 0.243 micrograms per bee; LD_{50oral}: 0.0037 to 0.0409 micrograms per bee. The thiamethoxam, clothianidin, and dinotefuran all have LD_{50s} that also fall in the highly toxic to honey bee category (less than 2 micrograms per bee).

Neonicotinoid application

One thing that makes neonicotinoids different is that they are systemic in the plant. This means that after they are applied, they enter the plant and can be moved throughout it. These pesticides may remain in varying concentrations throughout the plant after its application. Roots, leaves, tissues, and other plant parts will contain the pesticide. This attribute makes it a particularly effective against sucking insects. Insects feed on the plant and ingest the pesticide.

Neonicotinoids can also be found in pollen and nectar of plants or as a residue on the outside of the plant. They also may persist in the soil.

Neonicotinoids may be applied foliarly, through soil applications (drench/amendment), as a seed coating and tree trunk direct injections/applications. The method and timing of application of neonicotinoids can significantly impact the potential exposure of pollinators, mammals and birds to direct contact with them. Incidental exposure can occur through contact with wind-blown soil or dust particles that land on pollinator forage or in other environmental media.

Vermont neonicotinoid use

In Vermont, neonicotinoid containing products can be purchased and used in a wide variety of settings. Homeowners can purchase tree, lawn and garden care products at most hardware, or similar type stores. Other general use neonicotinoid-containing products available to the general public include spot-on flea and tick control products and bug-bomb home fogger products.

A particular concern with homeowner products is that, despite having a lower concentration of pesticide, the rate of application per acre may actually be significantly higher than rates labeled for agricultural or commercial use for many ornamental applications. This may result in more concentrated areas of neonicotinoid pesticides being applied in an area, by a person who may not have formal training in pesticide application or understand how the product may affect pollinators. There is no data available on how much neonicotinoid pesticides are used by the general public in Vermont.

A significant quantity of neonicotinoid pesticide enters Vermont on treated seed. Seeds may be treated with both a fungicide and a neonicotinoid insecticide to protect seeds and young seedlings from pests. Although corn is wind pollinated there are concerns about incidental exposure through pollen from foraging bees, corn pollen that leaves the treated field, dusts during seed planting, and any accumulation in the soil or field run-off that may result in an exposure from water.

The vast majority of field corn seed (all conventional) enters the state as a “treated article”. As the ‘use’ of the pesticide technically occurs outside of Vermont, it is exempt from state pesticide regulations. Lacking regulatory authority over the treated seeds, there is no mechanism to track the amount of neonicotinoid treated seeds used in the state, however a rough approximation can be made based on acreage in corn and average seeding rates: 1.25 mg active ingredient (ai) per seed * 30,000 seeds per acre *100,000 acres ≈ 8,270 pounds of ai per year in Vermont.

Neonicotinoid data that is reported in Vermont is the use by commercial applicators (those certified by the Agency of Agriculture and includes government and non-commercial applicators). These applicators may buy and use varying types and concentrations of these products for use as insecticides. They may be used indoors or outdoors. These data are presented in the next section.

Private applicators, as certified by the Agency of Agriculture, may apply pesticides on their own property but do not report their individual usage. These usages may be captured in sales of restricted use products.

Vermont commercial neonicotinoid usage[1]

Commercial use of neonicotinoids began in Vermont when imidacloprid was first registered in 1994. In the past two decades, about 60 different neonicotinoid products have been used by commercial applicators. Most products have been used in the turf and ornamental industry. In these treatments many of the products used are fertilizers that also contain insecticides. Of note, currently the neonicotinoid class of active ingredients represent the only available grub control products for turf. Foliar-applied, soil drenches, and direct tree injections have also been reported in the ornamental and lawn care industries. In indoor industries many gels, baits, and sprays containing neonicotinoids are used.

Table 2. Total pounds of neonicotinoids reported by commercial applicators 1994-2013

Treatment Use Type	**Pounds of neonicotinoids used commercially in Vermont (1994-2013)**				
	Imidacloprid	Clothianidin	Dinotefuran	Thiacloprid	Thiamethoxam
Ornamental & shade trees	27,011	*NR*	7	*NR*	0.031
Golf course	5,899	61	*NR*	*NR*	23
Lawn care	2,748	180	*NR*	*NR*	19
Structural pest control	238	*NR*	0.036	*NR*	2.5
Greenhouse/Christmas trees	4.3	*NR*	*NR*	*NR*	0.028
Small fruits & vegetables	3.6	*NR*	*NR*	*NR*	*NR*
Tree fruits	0.9	*NR*	*NR*	2.7	*NR*
Electrical utility	0.8	*NR*	*NR*	*NR*	*NR*
Forestry	0.5	*NR*	*NR*	*NR*	*NR*
Wood treatment	0.2	*NR*	*NR*	*NR*	*NR*
Mosquitos	0.05	*NR*	*NR*	*NR*	*NR*

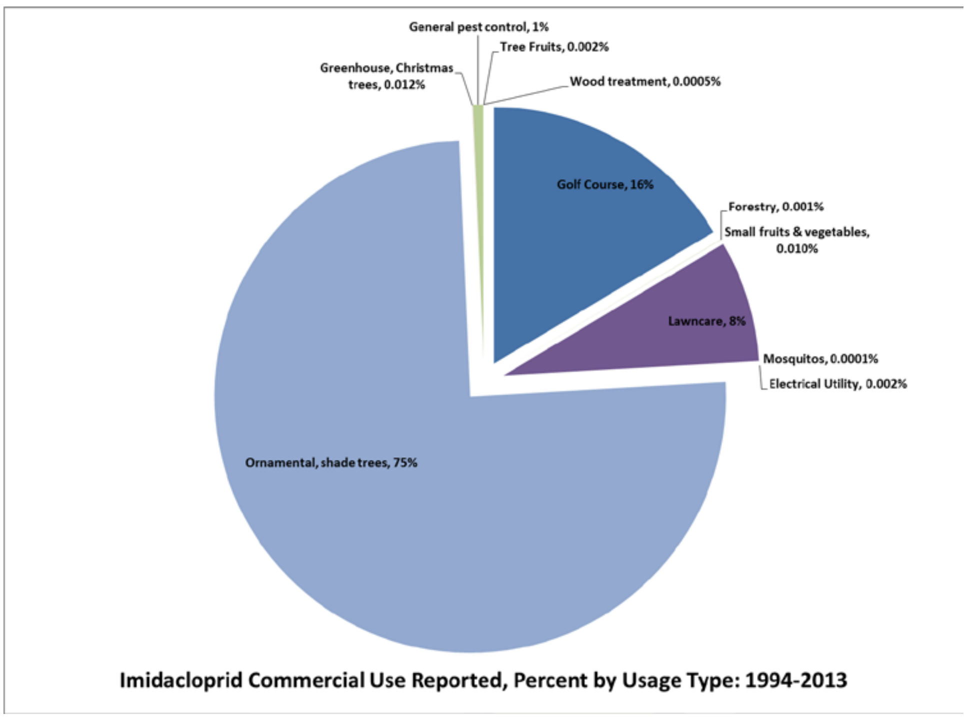
NR = none reported

[1] Note that the data presented in this section does not reflect homeowner use, seed treatment applications or applications by private applicators.

Although several neonicotinoid active ingredients are registered in the state, imidacloprid is by far the most used commercially. Imidacloprid accounts for effectively (99.2%) all of commercial usage in the state (Table 2). By comparison, clothianidin is the second most commercially used neonicotinoid pesticide accounts for only 0.67% of the total. Again, note that this does not account for seed treatment where clothianidin is favored.

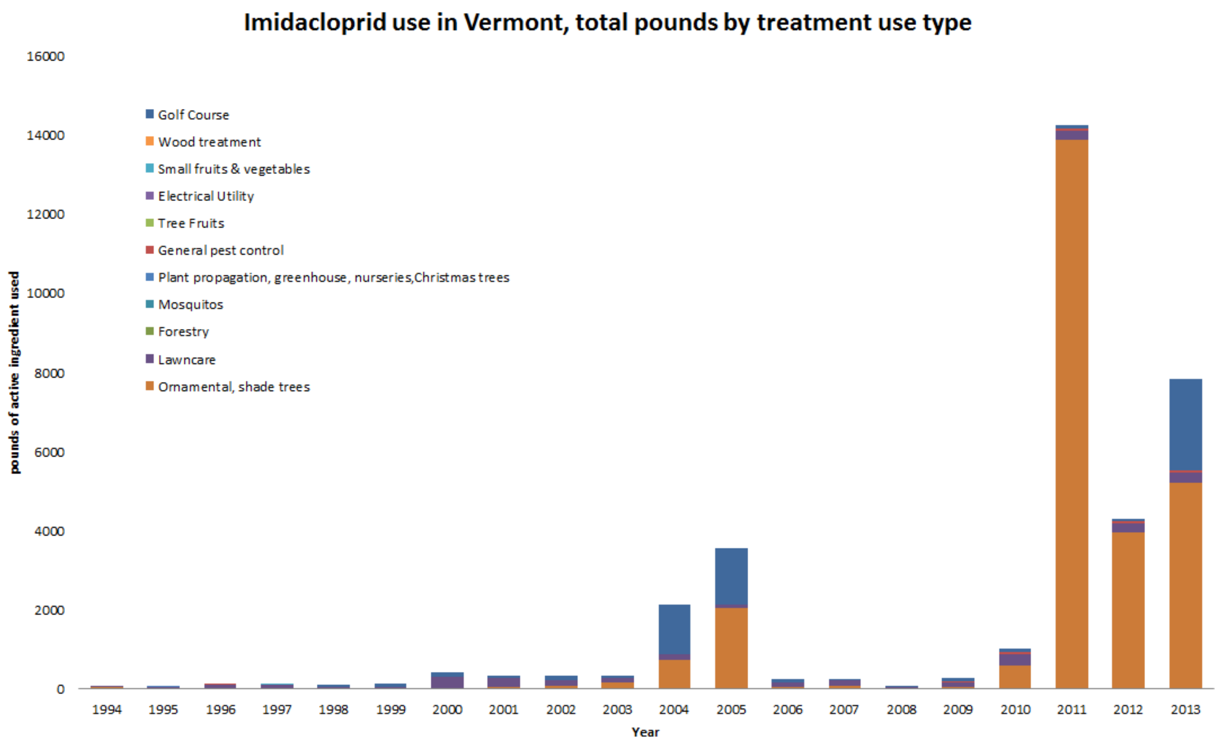
The commercial use of imidacloprid is classified by use treatment types. Since 1994, ornamental and shade trees use have accounted for 75% of imidacloprid use, followed by golf course (16%) and lawn care (8%) treatments. (Figure 1)

Figure 1. Imidacloprid commercial use reported as a percent of usage type in VT: 1994-2013



The use of imidacloprid has varied over time, but has become more prevalent in the past few years (Figure 2). In 2011, an increase was seen as a result of targeted treatments for gypsy moth. In 2011, the highest reported use year to date for all neonicotinoid pesticides (≈14000 pounds), this class of pesticides was 2.5% of the total commercial use in the state.

Figure 2. Imidacloprid use in Vermont total pounds by treatment use type 1994-2013

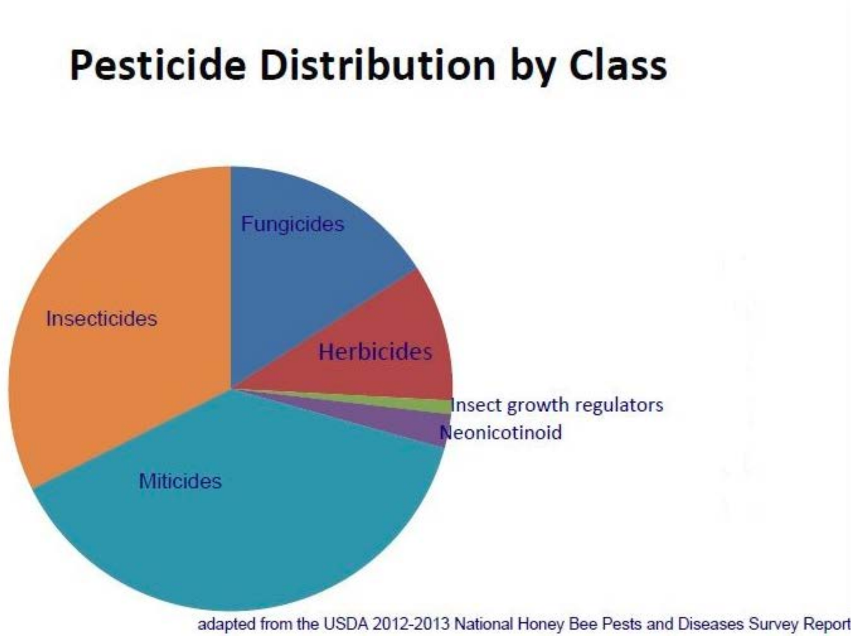


National prevalence of neonicotinoids and other pesticides in pollen

A major concern for pollinator exposure to pesticides, including neonicotinoids, is their presence in pollen. For honey bees, this pollen is collected and brought back to the hive. Pesticides measured in hive pollen can be used as a surrogate for pollinator exposure. Nationally, pesticides are routinely found in honey bee pollen. A USDA survey conducted in 2012-2013 found the most prevalent pesticides in hive pollen were miticides used to treat parasitic mites: coumaphos, fluvalinate, thymol, and 2, 4-dimethylphenyl (an amitraz derivative).

However, pesticides from other classes were also found in the pollen samples. Many times more than one pesticide was found in each pollen sample. The pesticides most often found in pollen were the miticides, non-neonicotinoid insecticides, fungicides, herbicides and neonicotinoid insecticides (Figure 3)

Figure 3. Pesticide class distribution in pollen samples collected nationally 2012-2013.



The Vermont Agency of Agriculture has also been collecting and testing pollen for pesticide residues to better understand potential pesticide exposures and impacts on Vermont pollinators.

Vermont pesticide pollen studies

In 2012 and 2013 pollen was collected on a weekly basis from managed honey bee hives. All hives are located in Addison County. Hive location #1 is located in a prevalent hay/pasture land use area. Hive locations #2 and #3 are located in the same bee yard, which is in in close proximity to corn fields.

The Agency of Agriculture laboratory tested for were herbicides (H), fungicides (F), neonicotinoid insecticides (N). Miticides were not tested. The pesticides analyzed are associated with corn treatments, either as field applications or seed treatments. Analytes tested for in 2012 were:

- atrazine (H)
- metolachlor (H)
- imidacloprid (N),
- thiamethoxam (N)
- clothianidin (N)
- metalaxyl (F)
- trifloxystrobin (F)

Table 3. Results of pesticides in Vermont pollen from Hive #1 in 2012.

2012 Hive #1 (hay/pasture) Pesticide Concentration in Pollen in parts per billion (ppb)				
Sample week	Atrazine	Metalochlor	Imidacloprid	Trifloxystrobin
5/6/12 – 5/12/12	ND	ND	ND	ND
5/13/12 – 5/19/12	**2.6**	ND	ND	ND
5/20/12 – 5/26/12	**1.0**	ND	ND	ND
5/27/12 – 6/2/12	**6.1**	ND	ND	ND
6/3/12 – 6/9/12	**1.2**	ND	ND	ND
6/10/12 – 6/16/12	**1.8**	ND	ND	ND
6/17/12 – 6/23/12	**3.8**	ND	ND	ND
7/15/12 – 7/21/12	ND	ND	ND	ND
7/22/12 – 7/28/12	ND	ND	ND	ND
7/29/12 – 8/4/12	ND	ND	ND	ND
8/5/12 – 8/11/12	ND	ND	ND	ND
8/12/12 – 8/18/12	ND	ND	ND	ND
8/19/12 – 8/25/12	ND	ND	ND	ND
8/26/12 – 9/1/12	ND	ND	ND	ND
9/2/12 – 9/7/12	ND	ND	ND	ND
ND = None detected. Metalaxyl, thiamethoxam, clothianidin were not detected in 2012 samples				

Table 4. Results of pesticides in Vermont pollen from Hive #2 in 2012.

2012 Hive #2 (field corn) Pesticide Concentration in Pollen in parts per billion (ppb)				
Sample week	Atrazine	Metalochlor	Imidacloprid	Trifloxystrobin
6/11/12 – 6/15/12	**68**	**25**	**0.7**	**5.5**
6/18/12 – 6/22/12	**75**	**4.4**	ND	**0.64**
6/25/12 – 7/2/12	**18**	**4.2**	ND	ND
7/9/12 – 7/13/12	**19**	**1.1**	ND	ND
7/16/12 – 7/20/12	**24**	**1.1**	ND	ND
7/25/12 – 8/1/12*	**2.2**	ND	ND	ND
8/2/12 – 8/9/12*	**0.5**	ND	ND	ND
ND = None detected. Metalaxyl, thiamethoxam, clothianidin were not detected in 2012 samples * corn tasseled in area				

Hive location #1 had lower levels of the pesticides than Hive location #2. At least one pesticide was detected in 59% of the samples collected in 2012 (13/22). Thiamethoxam, metalaxyl, and clothianidin were not detected in any samples. Atrazine was the most common pesticide detected, and at the highest concentrations.

Highest concentrations of pesticides were observed in early to mid-June, while corn was not tasseling. In 2012 of the neonicotinoids, imidacloprid was detected only once and was in the same sample that had comparatively high concentrations of 3 other pesticides. All pesticide concentrations detected were much lower than the national study.

The presence of all four pesticides; atrazine, metolachlor, imidacloprid and trifloxystrobin in Hive location #2 early in the week of June 11th indicate that these pesticides were not from that year's corn pollen, but may be from the windblown soil particles, foliar residue contact, treated dusts that drifted onto other pollinating plants or from other environmental media. Even with this limited data set, the overall levels and prevalence of most pesticides tested for are much lower than the national study. For instance, atrazine detected in the national samples ranged from 7.4 to 996 parts per billion, with an average of 65.4 parts per billion. Vermont's average in hives near corn fields (worst case scenario) was 22 parts per billion. Vermont's analytical method was also much more sensitive for atrazine (being able to detect lower concentrations).

In 2013, Hive location #1 was again sampled, but hive #2 was replaced with another hive located near corn fields (Hive location #3). Hive location #3 is located in the same bee yard as hive #2. Also, metalaxyl was eliminated from the analyte list and an additional three fungicides were tested for in 2013: azoxystrobin, thiabendazole, and pyraclostrobin. Corn herbicides were again the most commonly detected active ingredients (Table 5). Early in 2013, neonicotinoids clothianidin and thiamethoxam were detected before the corn was in bloom, indicating other sources of exposure. It is important to note that thiamethoxam may be converted to clothianidin in plants. Again, levels and prevalence were lower than national results.

Table 5. 2013 Vermont pollen data, hive locations #1 and #3

2013 Hive #1 (hay/pasture) Pesticide Concentration in Pollen in parts per billion (ppb)									
Sample week	Atrazine	Metalochlor	Imidacloprid	Thiamethoxam	Azoxystrobin	Trifloxystrobin	Thiabendazole	Clothianidin	Pyraclostrobin
5/5/13- 5/11/13	ND	**1.0**	ND	ND	ND	ND	ND	ND	ND
5/12/13 - 5/18/13	**13**	**9.4**	ND	ND	ND	ND	ND	ND	ND
5/19/13 -5/25/13	**5.7**	**11**	ND	ND	ND	ND	ND	ND	ND
5/26/13 - 6/1/13	**0.7**	**2.1**	ND	ND	ND	ND	ND	ND	ND
6/2/13 - 6/8/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
6/9/13 - 6/15/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
6/16/13 - 6/22/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
6/23/13 - 6/29/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
7/7/13- 7/13/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
7/14/13 -7/20/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
7/21/13 - 7/27/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
7/28/13 - 8/3/13	ND	ND	ND	ND	ND	**0.5**	ND	ND	ND
8/4/13 - 8/10/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
8/11/13 - 8/17/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
8/18/13 - 8/24/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
2013 Hive #3 (field corn) Pesticide Concentration in Pollen in parts per billion (ppb)									
Sample week	Atrazine	Metalochlor	Imidacloprid	Thiamethoxam	Azoxystrobin	Trifloxystrobin	Thiabendazole	Clothianidin	Pyraclostrobin
5/11/13 - 5/14/13	**5.3**	**7.7**	ND	**0.8**	ND	ND	ND	**6.2**	ND
5/15/13 - 5/18/13	**49.5**	**32**	ND	**1.2**	ND	**0.7**	ND	ND	ND
5/19/13 - 5/23/13	**12**	**19**	ND	ND	ND	ND	ND	ND	ND
5/24/13 - 6/3/13	**4.5**	**9.4**	ND	ND	ND	ND	ND	ND	ND
6/4/13 - 6/5/13	**2.9**	**6.6**	ND	ND	ND	ND	ND	ND	ND
6/6/13 - 6/19/13	ND	**1.9**	ND	ND	ND	ND	ND	ND	ND
6/20/13 - 7/3/13	**2.1**	**1.2**	ND	ND	ND	ND	ND	ND	ND
7/4/13 - 7/7/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
7/8/13 - 7/18/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
7/24/13 - 7/31/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
8/1/13 - 8/7/13	ND	ND	ND	ND	ND	ND	ND	ND	ND
ND = None detected. Detection limits range from 0.5 - 0.8 parts per billion (ppb)									

Pollinator mortality directly associated with neonicotinoid pesticide use

There have been reported instances of potential pollinator mortalities linked to the use, or potential misuse, of neonicotinoid pesticides. In Vermont, we have investigated several instances of managed pollinator declines and no link to *any* type of pesticide was found to be the cause.

However, in 2013 in Oregon, there were 4 separate incidents of bumble bee kills related to application of dinotefuran and imidacloprid to linden (*Tilia spp.*) trees. Pesticide levels were measured over two years. In some instances, levels in the year after application showed higher levels of pesticide.

Table 6. Linden Tree Samples Associated with 2013 Bumble Bee Kill (June 15), Foliar or Soil Drench Applications of Dinotefuran (parts per million = ppm)

Dinotefuran application method	Sample: 6/21/2013		Sample: 6/18/2014	
Tree – Foliar Application	Tree #1	Tree #2	Tree #1	Tree #2
Flowers tested	11.0 ppm	7.4 ppm	Non-detect	Non-detect
Leaves tested	3.8 ppm	5.4 ppm	Non-detect	Non-detect
Tree –Soil Drench	Tree #3	Tree #4	Tree #3	Tree #4
Flowers tested	0.012 ppm	0.12 ppm	0.024 ppm	0.076 ppm
Leaves tested	0.97 ppm	0.39 ppm	0.63 ppm	0.65 ppm

As a result of the subsequent investigation by the Oregon Department of Agriculture, on December 12, 2014, a new state-wide rule was proposed to ban the application of any product containing dinotefuran, imidacloprid, thiamethoxam, or clothianidin, regardless of application method, to linden trees, basswood trees or other *Tilia* species.

European Union use restrictions

The European Union has restricted the use of some neonicotinoid insecticides. With the exception of seed treatments, the restrictions are similar to those that have been implemented by the US EPA (*i.e.*, prohibition of pesticide application when crops are in bloom). These restrictions have often been referred to as a “ban”, however it is more appropriately described as an elaborate process for determining which uses are discontinued and which uses are still allowed but with management provisions.

The main elements of the EU process include:

- Restricting the use of 3 neonicotinoids (clothianidin, imidacloprid and thiamethoxam) for some seed treatments, soil applications (granules) and foliar treatments on bee attractive plants and cereals. Seed treatment uses are prohibited but some may be allowed by professional users. The exemptions are specified by crop and by time of year of a planting.

- Other exceptions include limiting applications to bee-attractive crops in greenhouses and to open-air fields only after flowering.

- A plan to review the conditions of approval of the 3 neonicotinoids to account for relevant scientific and technical developments is also built into the regulation.

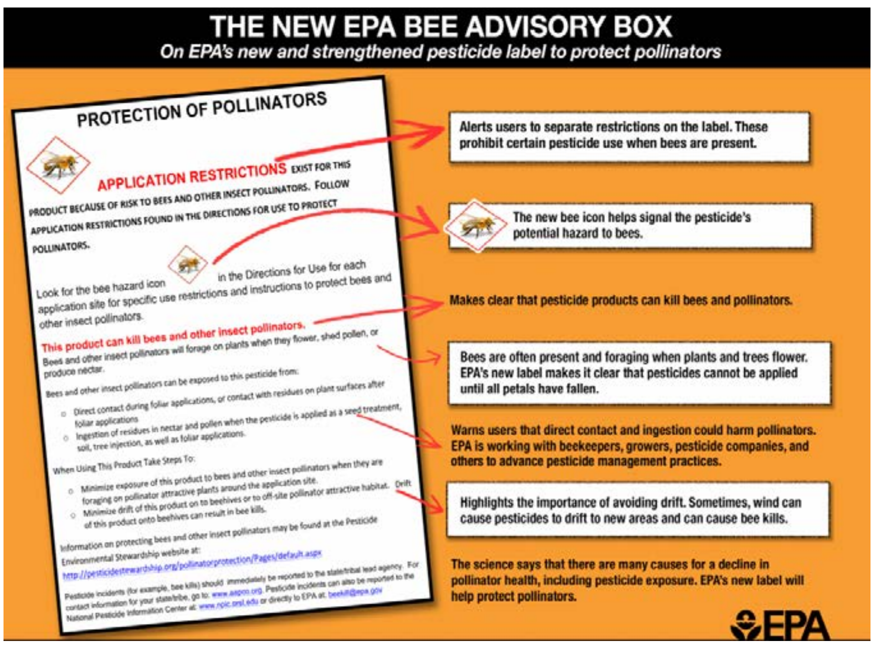
Europe, the United States and Canada are all in the process of implementing additional protections or practices to protect both native and managed pollinators. To date, all of the actions taken have been very prescriptive and individualized as a response to observable harm.

Federal actions to mitigate exposure of pollinators to pesticides

At the federal level, actions are being taken to protect pollinators. In June 2014, President Obama directed federal agencies to increase efforts to protect pollinator health in the United States. One focus of the directive was specific to reduce pesticide exposures.

The EPA has already required new labeling in the form of a "bee box", (Figure 4) on all neonicotinoids pesticides, alerting the applicator to the potential risks from the pesticides. This may be particularly helpful in increasing the general public's awareness, as they may actually be applying at rates significantly higher than agricultural or commercial applicators. Increased pesticide label restrictions for contracted pollinator services will also occur.

Figure 4. Example of new required labeling for neonicotinoid pesticides.



Additionally, the EPA with input from state and federal agencies is developing a guidance policy for states to create their own "Managed Pollinator Protection Plan". See the draft guidance in appendix 1. Using this guidance each state will be responsible for developing a managed pollinator protection plan that reflects the state's usage pattern (pesticide type, treatment types) for pesticides as well as the types of managed pollinator activities in the state.

Status in Vermont

In Vermont homeowners, farmers and commercial pesticide applicators use neonicotinoid-containing pesticides. The commercial use of neonicotinoids is tracked by the Agency. Most of the commercial use is for turf and ornamentals. The amount of use by the general public and the amount of treated seeds planted is unknown and of concern.

Pollen data collected in 2012 and 2013 in Vermont show the presence of pesticides, with a small number of detections of neonicotinoids only detected early in the growing season. The prevalence and concentration of pesticides in the Vermont pollen data is less than the national data, but we do know pollinators are being exposed to a variety of pesticides. The current Vermont data set is limited.

In the few instances of honey bee decline that were reported to the Agency of Agriculture, in those cases, no correlation was identified between *any* type of pesticide and the decline.

Senior staff members at the Agency of Agriculture, through national pesticide control associations, have actively been working with the federal agencies to develop policies and guidance for managed pollinator protection plans and supporting other federal actions to Vermont staff members are currently conducting targeted outreach on reducing pesticide exposure to pollinators and identifying stakeholders for a Vermont Managed Pollinator Protection Plan. See Appendix 2.

The Agency believes that current actions by the federal government, such as the implementation of “bee boxes” and further label restrictions on federal pesticide labels for contracted pollinators will improve pollinator health

However, as neonicotinoids are a unique class of pesticides that present a different exposure potential for both humans and pollinators. Gaps, in exposure assessments and data exist at both the state and federal level. Although it does not currently appear to be a significant factor in honey bee mortality in Vermont, more information on environmental accumulation, sub-lethal effects, metabolite toxicity, pollinator risk assessments and concentrations in other media in Vermont such as water and soil are needed. As information is gathered, specific state regulatory actions may need to be taken by the Agency of Agriculture.

The Agency of Agriculture may currently restrict product use, similar to steps taken by Oregon Department of Agriculture when a labeled product needed more stringent use restriction to protect pollinators. This mechanism may be used to control use of neonicotinoid pesticides by the general public and certified pesticide applicators. However, the current regulatory structure only allows the Agency of Agriculture to regulate pesticide uses that occur in Vermont. Under FIFRA, the treated corn seeds are a treated article and therefore currently exempt from Vermont pesticide regulation. This use pattern for neonicotinoid pesticides is particularly concerning, as drift onto pollinator attractive plants and accumulation in other pollinator-contacted environmental media has been demonstrated. A prescriptive state response may be necessary.

Vermont should be prepared to exert regulatory oversight to take corrective actions when treated articles present unacceptable risks to the environment, pollinators or human health. As such, authority over treated articles is needed.

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Appendix 1. Draft Federal Managed Pollinator Protection Plan Guidance

Guidance for State Lead Agencies for the Development and Implementation of Managed Pollinator Protection Plans

Pollinator health is a high priority national issue due to significant colony losses experienced by U.S. beekeepers over the past decade. In his memo, "Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators" in June of 2014, the President called attention to the issue of pollinator health and directed federal efforts to reverse pollinator losses and help restore populations to healthy levels. In particular, the memo directed the U.S. Environmental Protection Agency (EPA) to engage state agencies in developing state pollinator protection plans as a means of mitigating the risk of pesticides to bees and other managed pollinators.

The purpose of a state Managed Pollinator Protection Plan is to establish a framework for open communication and coordination among key stakeholders, including beekeepers, growers, pesticide applicators, and landowners. Open communication will not only help build relationships and increase mutual understanding, but also ensure peaceful co-existence and allow all parties to operate successfully. It is the intent that such open communication will lead to practices that both mitigate potential pesticide exposure to bees and allow for crop production.MP3's are intended to reduce pesticide exposure to bees that are adjacent to, or nearby a pesticide treatment site where bees can receive exposure via drift, or by flying to and foraging in the treatment site.

The purpose of this guidance document is to identify the critical elements of an EPA-accepted state MP3 which are believed to help increase communication and collaboration that will reduce potential risk from pesticides. A number of pesticide SLAs have developed MP3's in recent years to encourage communication and cooperation among stakeholders. These proactive approaches have demonstrated success in reducing unacceptable losses to bee production while allowing crop producers to use the tools needed for crop protection.

Critical Elements of State Managed Pollinator Protection Plans

1. Public stakeholder participation process

Public participation is essential to gain buy-in from stakeholders, build relationships and trust, and identify key issues affecting pollinator health at the state level. Existing state pollinator plans originated from stakeholder meetings initiated and facilitated by the SLA, providing opportunities for stakeholders to offer input and recommendations.

2. A method for growers/applicators to know if there are managed pollinators near treatment sites

An important element of an MP3 is the ability for an applicator to contact beekeepers with colonies near a treatment area to alert them of a pending treatment. In order to adequately coordinate and communicate with beekeepers, growers and applicators need accurate and timely information on the location of nearby colonies that could affect application decisions.

3. A method for growers/applicators to identify and contact beekeepers prior to application.

Once growers and applicators identify managed hives in the pollinator awareness zone, there needs to be a means for growers and applicators to contact those beekeepers to notify them that a pesticide application needs to be made .Beekeepers, in turn, need a reasonable period in order to take action to protect their colonies if necessary. This is often done by moving colonies temporarily to a protected location. Growers or applicators should notify beekeepers in advance of treatment so that parties can discuss and decide upon steps to protect the managed bees in the defined area, while still allowing management of the pest(s).Plans should identify a minimum time prior to an anticipated pesticide application in which all beekeepers of managed colonies in the defined action zone should be contacted. The minimum time frame used by several states is 48 hours prior to the anticipated application.

4. Recommendations on how to minimize risk of pesticides to bees

The intended goal of the MP3 is to be the framework for communication needed to encourage growers and pesticide applicators to mitigate risk of pesticides to bees while adequately managing pests. State MP3's that have been developed to date include other BMPs to minimize risk of pesticides to bees. Examples of BMPs include controlling flowering weeds in a crop, making applications when bees are less active (such as after dusk or before dawn), using application methods that are more targeted (such as drip irrigation), using products less toxic to bees when possible, minimizing or reducing pesticide drift, utilizing Integrated Pest Management (IPM), and other approaches. These recommendations may be developed with the assistance of university researchers and extension specialists, as well as input from crop producers and bee keepers. These sorts of BMPs can be effective in mitigating risk of pesticides to managed bees and should be included in state plans.

5. A clear defined plan for public outreach

State MP3's will only be successful if there is robust adoption of the plan. One way to accomplish this is through adequate outreach to publicize the MP3 and its recommendations/requirements not only to key stakeholders, but to the general public as well. This typically involves meetings with organized stakeholder groups, such as trade associations, commodity groups, and beekeeping organizations. States should clearly describe how they will provide outreach to the public on their MP3.

6. Mechanism to measure effectiveness of an MP3 and a process to periodically review and modify each plan

As stated above, the objective of an MP3 is reduced exposure to bees through enhanced communication and collaboration among stakeholders. An MP3 should include measures that can be used to determine whether the objective is being met. Specifically, an MP3 should include measure(s) that indicate whether communication/cooperation has increased and whether exposure to bees has decreased.

Optional/Recommended Elements of State Managed Pollinator Protection Plans

1. A strategy to deal with colonies without identified owners

The placement of colonies by a beekeeper without a formal agreement with the landowner is a concern in some areas. Even after a state has developed a plan to allow applicators to identify *beekeepers in the area and obtain beekeeper contact information, there may be instances in which an applicator or landowner encounters a colony with an unknown owner. States are encouraged to develop strategies to address these types of situations in a way that does not penalize the landowner or pesticide applicator. Strategies will likely depend on a state's laws and regulatory authority. States are encouraged to explore their authority to seize or remove unidentified colonies, and to seek stakeholder input on reasonable approaches that can be taken when unidentified colonies are found.*

2. Communication with crop advisors and agricultural extension service

Many landowners utilize crop advisors and agricultural extension specialists for input on cropping and pest management decisions. These individuals are often aware of local pest pressures and crop protection needs not only at the field level, but also at a landscape level. Crop advisors and agricultural extension are important partners in integrating crop protection and pollinator protection beyond just the individual field. States are encouraged to engage in regular communication to explore and develop strategies on how the expertise and input of crop advisors and agricultural extension services can be utilized in pollinator protection efforts.

4. Clear information as to the applicability of the MP3

Because different crops have different crop protection needs and different pollinator risk mitigation strategies, separate or modified MP3's may be developed for specific cropping systems. Managed pollinators are primarily honey bees, but could include some species of bumble bees, mason bees, and alfalfa leafcutting bees. States are encouraged to clearly define the agricultural production/beekeeping system to which their MP3 applies, including timeframes of applicability. States are also encouraged to develop crop-specific approaches if they see a need to do so.

5. Addressing urban beekeeping and pesticide use in non-agricultural settings

Urban beekeeping is significant in some states. In addition, there have been significant bee kills in some parts of the country involving non-agricultural pesticide applications. States are encouraged to include provisions addressing urban beekeeping and non-agricultural pesticide applications if managed bees are found in close proximity to urban and residential areas.

6. Recommendations for more formalized agreements between beekeepers, crop producers, and property owners, especially in situations with a financial agreement.

In some situations, beekeepers place hives on private property without contractual agreement or landowner compensation. However, there are other cases, even when managed bees are not present for pollination services, in which there is a financial agreement between the beekeeper and landowner (e.g., the beekeeper compensates the landowner for use of their property).

Appendix 2. Vermont's Managed Pollinator Protection Plan Outreach

Background

In June 2014, President Obama directed federal agencies to increase efforts to protect pollinator health in the United States. One focus of the directive was to reduce pollinator pesticide exposures. The EPA has already implemented increased pesticide label restrictions on neonicotinoid insecticides. The addition of a "bee box" on pesticide labels increase awareness of these pollinator-based restrictions.

Managed Pollinator Protection Plans

Additionally, the EPA with input from state and federal agencies has developed a guidance policy for states to create their own "Managed Pollinator Protection Plan". Each state plan should reflect the State's managed pollinator activities, agriculture and other pesticide-related industries.

The Vermont Managed Pollinator Protection Plan Will Focus on

- Ensuring effective communication between beekeepers, crop producers and other pesticide applicators.
- A method for growers/applicators to know if there are managed pollinators near treatment sites.
- A method for growers/applicators to identify and contact beekeepers prior to application
- Recommendations on how to minimize risk of pesticides to bees
- A clear defined plan for public outreach
- A mechanism to measure effectiveness of the plan and a process to periodically review and modify each plan.

To develop a Vermont Managed Pollinator Protection Plan, the Agency of Agriculture will need your input.

Next Steps for Vermont

The Vermont Agency of Agriculture is currently identifying potential stakeholders for Vermont's Managed Pollinator Protection Plan. If you would like to participate in the process, please email Jenn.LaValley@state.vt.us or call (802) 828-2431 and you will be notified of stakeholder meetings and be able to participate in the process from the beginning to help design a framework that works for Vermont.

Changes to the Apiary law as of 2014

The VT legislature amended the Apiary Law in 2014 (6 VSA § 3021) requiring the owners of both migratory & non-migratory honey bee hives to register with Agency. The registration period will be from July 1-June 30 annually.

If you have honey bee hives and have *not* received a pre-registration letter that was sent out in December, please email Steve.parise@state.vt.us with your contact information: name, phone number, mailing address & preferred email address, so that you may be included in this year's registration mailing.

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