



Nursery Stock Report

Nursery stock labeled as beneficial to pollinators



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Pursuant to Minn. Stat. § 3.197, the cost of preparing this report was approximately \$ 6,840.

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Executive Summary

This report is submitted pursuant to 2019 1st special Session Minnesota Laws Chap. 88 Art.2, Sec. 22.

By March 1, 2020, the commissioner of agriculture must report recommendations to the members of the legislative committees or divisions with jurisdiction over agricultural policy regarding the regulatory oversight of nursery stock labeled as beneficial to pollinators. The report must include a summary of the Minnesota Department of Agriculture's technical ability to test for insecticides on different parts of plants that comprise nursery stock, including minimum detectable concentrations for various insecticides, and the cost per test.

Over the past five years, 209 samples advertised as beneficial to pollinators were collected and analyzed for the presence of systemic insecticides. Of the 209 samples, 24 individual or 11.4% tested positive at or above the "No Observed Adverse Effect Level" (NOAEL). Of those sites with positive results, follow-up tests in the subsequent year resulted in no new positive results or no plants advertised as beneficial to pollinators. All plants remaining from lots testing positive for pesticides were held off-sale pending relabeling or redaction of any specific claims to the benefit to pollinators, and official Notice of Violations were issued from the Minnesota Department of Agriculture (MDA).

The MDA Laboratory Services Division worked to verify the quantitative method for detecting five neonicotinoid insecticides (acetamiprid, clothianidin, dinotefuran, imidacloprid and thiamethoxam) on flowers. Using the same analytical method for each of the five chemicals, the MDA Lab was able to verify that the analysis detected each chemical at the level of one part per billion (ppb) as anticipated.

As part of this report, the MDA Lab determined a cost per test to analyze flowers and plant parts for presence of systemic insecticides. While calculating the incremental cost for an individual sample is straightforward, the MDA Lab lacks the needed number of analysts during the peak pesticide residue testing season to process nursery samples along with other required analysis. Due to the complex nature of the analysis, competition for equipment, and analysts performing their primary program activities, an investment in base infrastructure would be needed to have the nursery flower sample analyses performed routinely by the MDA Lab. The Lab has estimated that one analyst could test approximately 260 samples if they were dedicated to the program. Factors such as salary, supplies, equipment repair/maintenance, and indirect costs were factored into this estimate. In order to run 260 samples per year, the MDA Lab estimates it would need \$155,400 annually, or roughly \$600.00 per sample. Due to these cost and workflow concerns, the MDA began using a third party lab to provide these analyses in 2017. The third party lab charges \$375.00 per sample and has the capacity to process about 200 samples in a calendar year. The third party lab is able to provide a similar level of accuracy in detecting these chemicals. Based on these considerations, the current practice of having nursery flower samples analyzed by a third party lab seems to be the most economical and practical option going forward.

This report will show that the percentage of samples that have been found in violation has decreased over the past four years. This decrease has occurred even though the reporting levels for samples in violation has also decreased as new information has become available from the U.S Environmental Protection Agency (EPA). The experience of the Minnesota Department of Agriculture in enforcing this law is that plants that are in violation typically have concentrations well above the EPA NOAEL for honey bees which would indicate that the current thresholds in place for reporting are adequate.

Background

In 2014, the Minnesota Nursery Law was amended to include language to protect pollinators from systemic insecticides:

18H.14 LABELING AND ADVERTISING OF NURSERY STOCK

(e) A person may not label or advertise an annual plant, bedding plant, or other plant, plant material, or nursery stock as beneficial to pollinators if the annual plant, bedding plant, plant material, or nursery stock has been treated with and has a detectable level of systemic insecticide that:

(1) has a pollinator protection box on the label; or

(2) has a pollinator, bee, or honeybee precautionary statement in the environmental hazards section of the insecticide product label. The commissioner shall enforce this paragraph as provided in chapter 183.

In response to the new law, the Minnesota Department of Agriculture (MDA) Plant Protection Division, the Lab Services Division, and the Pesticide and Fertilizer Management Division worked to develop standard operating procedures for sampling, lab analysis, and educational outreach materials. MDA Nursery Program inspectors began educating clientele and distributing a fact sheet on the law as part of their standard operating procedure when the law went into effect on July 1, 2014.

Based on the Environmental Protection Agency's (EPA) review of neonicotinoids and MDA Pesticide and Fertilizer Management Division information on widely used systemic insecticides, five systemic neonicotinoids were selected for analysis: acetamiprid, clothianidin, dinotefuran, imidacloprid, and thiamethoxam. These five insecticides were chosen because they are among the most commonly used neonicotinoids in Minnesota and methods for analysis are available. In the fall of 2014, the MDA Laboratory Services Division began verifying a quantitative method for detecting these five neonicotinoid insecticides.

During the 2015 Legislative Session, the Minnesota Legislature amended Chapter 18H.14 to read as follows:

18H.14 LABELING AND ADVERTISING OF NURSERY STOCK

e) A person selling at retail or providing to an end user may not label or advertise an annual plant, bedding plant, or other plant, plant material, or nursery stock as beneficial to pollinators if the annual plant, bedding plant, plant material, or nursery stock has:

(1) been treated with a systemic insecticide that:

(i) has a pollinator protection box on the label; or

(ii) has a pollinator, bee, or honey bee precautionary statement in the environmental hazards section of the insecticide product label; and

(2) a concentration in its flowers greater than the no observed adverse effect level of a systemic insecticide.

The commissioner shall enforce this paragraph as provided in chapter 18J.

(f) For the purposes of paragraph (e):

(1) "systemic insecticide" means an insecticide that is both absorbed by the plant and translocated through the plant's vascular system; and

(2) "no observed adverse effect level" means the level established by the United States Environmental Protection Agency for acute oral toxicity for adult honeybees.

The MDA revised fact sheets and web information per the new statute and the Lab Services Division completed development of specific residue tests for floral material for the five systemic insecticides. Nineteen samples of plant material were collected during the 2015 nursery inspection season to support the methods development. The samples were prepared using AOAC (Association of Official Analytical Chemists) International Official Method 2007.1, and the analysis was performed using a High Resolution/Accurate Mass Liquid Chromatography-Mass Spectrometry (HR/AM LC-MS) instrument. This method was also used in the Friends of the Earth publication {Gardeners Beware 2014: Bee-Toxic Pesticides Found in “Bee-Friendly” Plants Sold at Garden Centers Across the U.S. and Canada} from 2014. The method was originally developed for pesticide analysis in fruits and vegetables, so it needed to be verified for use in flowers. The MDA Lab successfully verified the method at the Method Limit of Quantitation of five parts per billion (ppb) and was determined to be adequate based on the EPA’s established oral “No Observed Adverse Effect Level” for the five pesticides.

The EPA defines “No Observed Adverse Effect Level” as, “the highest exposure level at which there are no biologically significant increases in the frequency or severity of adverse effect between the exposed population and its appropriate control; some effects may be produced at this level, but they are not considered adverse or precursors of adverse effects.”

During the 2016 nursery inspection season, 55 flower samples were collected and submitted for analysis by the MDA’s Lab Services Division. However, due to the high volume of pesticide analysis that occurs during the growing season, the nursery sample analyses were not completed until fall. Positive samples were found at three locations, but all plants were gone by the time the results were available. Still, those sites were notified of the violations which had occurred.

Because of the delay experienced during 2016, the MDA identified a third party lab, Legend Technical Services, Inc. in St. Paul, who could provide the same analysis, and samples were taken there in 2017. Legend Technical Services was able to provide a sample analysis turnaround of less than two weeks throughout the nursery inspection season which is quick enough for labeling to be changed when a positive sample is found.

In 2015, some companies expressed interest in making special claims (grown without insecticides, pesticide-free etc.) regarding some of the plants they wanted to sell. It was determined that labeling statutes allowed such claims provided the company submitted a plan to the Commissioner of Agriculture describing plant production, handling, and labeling and the plan was approved by the Commissioner. To formalize this process, a Compliance Agreement template was developed. Upon request a company interested in making special claims for their plant material received a Compliance Agreement template to review. On a case-by-case basis, programs were reviewed by the department and, if acceptable, a formal Compliance Agreement was drafted, and signed by the company and department. Several firms requested and entered into these agreements with the department starting in 2016.

Sample Analysis Results

2015

MDA Nursery Program inspectors collected 19 samples for systemic insecticide analysis by the MDA Laboratory Services Division during 2015. An official sample consisted of 20-50 grams of flowers collected from the same species of plant from the same supplier at one retail sales location. Each sample was tested for acetamiprid, clothianidin, dinotefuran, imidacloprid, and thiamethoxam adapting a laboratory procedure that yielded a result consistent with the “No Observed Adverse Effect Level” (NOAEL). No samples taken in 2015 tested at or above the NOAEL for honeybees as those values were defined at that time by EPA for acute oral toxicity (Table 1).

Samples were taken from plants advertised (labeled, signed, etc.) as pollinator friendly. Examples of advertising includes pictures or symbols of butterflies, hummingbirds, and bees as well as claims that the plants are attractive to pollinators, bee friendly, and safe for honeybees (Figure 1).

Table 1. Analytical results for plant samples collected during 2015. No samples were found with concentrations greater than the levels indicated.

County	Processing Lab	Product Sampled <i>Genus / Common Name</i>	Acetamiprid ppb	Clothianidin ppb	Dinotefuran ppb	Imidacloprid ppb	Thiamethoxam ppb
Anoka	MDA	<i>Rudbeckia / Black-Eyed-Susan</i>	< 5	< 9	< 30	< 15	< 20
Anoka	MDA	<i>Monarda / Bee Balm</i>	< 5	< 9	< 30	< 15	< 20
Carver	MDA	<i>Rudbeckia / Black-Eyed Susan</i>	< 5	< 9	< 30	< 15	< 20
Dakota	MDA	<i>Rudbeckia / Black-Eyed Susan</i>	< 5	< 9	< 30	< 15	< 20
Dakota	MDA	<i>Monarda / Bee Balm</i>	< 5	< 9	< 30	< 15	< 20
Dakota	MDA	<i>Delphinium / Larkspur</i>	< 5	< 9	< 30	< 15	< 20
Dakota	MDA	<i>Leucanthemum / Shasta Daisy</i>	< 5	< 9	< 30	< 15	< 20
Hennepin	MDA	<i>Liatris / Blazing Star</i>	< 5	< 9	< 30	< 15	< 20
Hennepin	MDA	<i>Sedum / Stonecrop</i>	< 5	< 9	< 30	< 15	< 20
Hennepin	MDA	<i>Sedum / Stonecrop</i>	< 5	< 9	< 30	< 15	< 20
Hennepin	MDA	<i>Agastache / Giant Hyssop</i>	< 5	< 9	< 30	< 15	< 20
Hennepin	MDA	<i>Azalea / Azalea</i>	< 5	< 9	< 30	< 15	< 20
Rice	MDA	<i>Monarda / Bee Balm</i>	< 5	< 9	< 30	< 15	< 20
Rice	MDA	<i>Eupatorium / Joe Pye Weed</i>	< 5	< 9	< 30	< 15	< 20
Rice	MDA	<i>Buddleia / Butterfly Bush</i>	< 5	< 9	< 30	< 15	< 20
Washington	MDA	<i>Platycondon / Balloon flower</i>	< 5	< 9	< 30	< 15	< 20
Washington	MDA	<i>Echinacea / Coneflower</i>	< 5	< 9	< 30	< 15	< 20
Washington	MDA	<i>Veronica / Speedwell</i>	< 5	< 9	< 30	< 15	< 20
Wright	MDA	<i>Weigela / Weigela</i>	Not analyzed	< 9	< 30	< 15	< 20



Figure 1. Examples of labeling that was considered pollinator friendly. Plants with labeling such as this were subject to sampling.

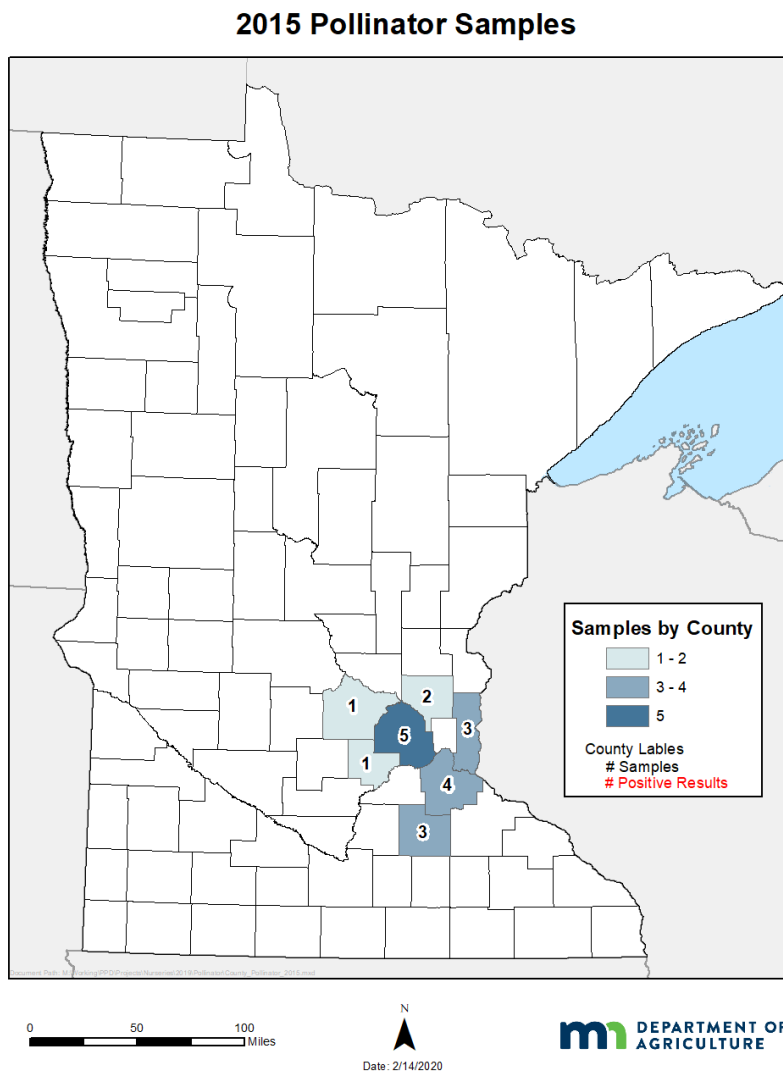


Figure 2. Distribution of samples collected during 2015.

2016

A total of 55 flower samples were collected between April 6 and August 31, 2016. The samples came from 20 sales locations statewide. The plants sampled were all labeled or advertised as pollinator-friendly. Samples were collected from annual and perennial plants, and dependent on what plants were in bloom and advertised as pollinator friendly at the time of inspection.

Each sample was tested for acetamiprid, clothianidin, dinotefuran, imidacloprid, and thiamethoxam adapting a laboratory procedure that yielded a result consistent with the “No Observed Adverse Effect Level.” Positive results were found for two of the five chemicals: acetamiprid and imidacloprid. Imidacloprid was found in six samples from three locations. The levels found ranged from 38.4 parts per billion (ppb) to 497 ppb (Table 2). Acetamiprid was detected in six samples collected from one location. Of the 55 samples collected, 21.8% tested over the NOAEL for a systemic insecticide. Of the 20 locations where samples were collected, 15% had plants advertised as pollinator friendly that contained systemic insecticides above the NOAEL.

During this season, the capacity of the MDA Lab Services Division to perform these analyses became an issue. The MDA has responsibility for a high volume of pesticide analysis during the growing season that required priority over these samples. Samples that were collected very early in the nursery inspection season were quickly analyzed by the lab; however, when other pesticide testing demands grew too large, the rest of the plant samples collected from nursery settings were frozen and stored until they could be analyzed later in the year. This meant that samples which were found to be in violation of law were not identified until the growing season was over and all plant sales were completed. Although no action could be taken to correct the violation at this point, a Notice of Violation was issued to each of the four firms.

Due to the complex nature of flowers as a matrix, the MDA Lab did not report results for acetamiprid in several samples due to unpredictable co-extracts such as color pigments that interfered with the analysis.

Table 2. Analytical results for plant samples collected during 2016. Sample exceeding the threshold for each chemical are shown in **bold**.

County	Processing Lab	Product Sampled <i>Genus / Common Name</i>	Acetamiprid ppb	Clothianidin ppb	Dinotefuran ppb	Imidacloprid ppb	Thiamethoxam ppb
Blue Earth	MDA	<i>Petunia / Petunia</i>	< 5	< 9	< 30	< 15	< 20
Blue Earth	MDA	<i>Echinacea / Coneflower</i>	< 5	< 9	< 30	< 15	< 20
Blue Earth	MDA	<i>Monarda / Bee Balm, Raspberry Wine'</i>	< 5	< 9	< 30	< 15	< 20
Blue Earth	MDA	<i>Buddleia / Butterfly Bush</i>	< 5	< 9	< 30	< 15	< 20
Blue Earth	MDA	<i>Monarda/ Bee Balm, 'Pardon My Pink'</i>	< 5	< 9	< 30	< 15	< 20
Blue Earth	MDA	<i>Salvia / Sage</i>	< 5	< 9	< 30	38.4	< 20
Crow Wing	MDA	<i>Gillardia / Blanketflower</i>	Not analyzed	< 9	< 30	< 15	< 20
Crow Wing	MDA	<i>Leucanthemum / Shasta Daisy</i>	Not analyzed	< 9	< 30	< 15	< 20
Crow Wing	MDA	<i>Giaillardia / Blanket Flower</i>	26.4	< 9	< 30	< 15	< 20
Crow Wing	MDA	<i>Digitalis / Foxglove</i>	17.6	< 9	< 30	< 15	< 20
Crow Wing	MDA	<i>Monarda / Bee Balm</i>	6610	< 9	< 30	< 15	< 20
Crow Wing	MDA	<i>Veronica / Speedwell</i>	661	< 9	< 30	< 15	< 20
Crow Wing	MDA	<i>Astilbe / Astilbe</i>	305	< 9	< 30	< 15	< 20
Crow Wing	MDA	<i>Phlox / Phlox</i>	403	< 9	< 30	< 15	< 20
Dakota	MDA	<i>Torenia / Wishbone flower</i>	< 5	< 9	< 30	< 15	< 20

County	Processing Lab	Product Sampled <i>Genus / Common Name</i>	Acetamiprid ppb	Clothianidin ppb	Dinotefuran ppb	Imidacloprid ppb	Thiamethoxam ppb
Dakota	MDA	<i>Fuchsia / Fuchsia</i>	< 5	< 9	< 30	< 15	< 20
Dakota	MDA	<i>Salvia / Sage</i>	< 5	< 9	< 30	< 15	< 20
Dakota	MDA	<i>Coreopsis / Tickseed</i>	< 5	< 9	< 30	< 15	< 20
Dakota	MDA	<i>Geranium / Geranium</i>	< 5	< 9	< 30	61.8	< 20
Dakota	MDA	<i>Begonia / Begonia</i>	< 5	< 9	< 30	135	< 20
Dakota	MDA	<i>Coreopsis / Tickseed</i>	< 5	< 9	< 30	497	< 20
Dakota	MDA	<i>Begonia / Begonia</i>	< 5	< 9	< 30	135	< 20
Dakota	MDA	<i>Geranium, Petunia, Thunbergia / Flower combo mix</i>	< 5	< 9	< 30	61.8	< 20
Hennepin	MDA	<i>Osteospermum / African Daisy</i>	< 5	< 9	< 30	< 15	< 20
Hubbard	MDA	<i>Kniphofia / Torch Lily</i>	< 5	< 9	< 30	< 15	< 20
Hubbard	MDA	<i>Coreopsis / Tickseed</i>	< 5	< 9	< 30	< 15	< 20
Hubbard	MDA	<i>Hemerocallis / Daylily</i>	< 5	< 9	< 30	< 15	< 20
Hubbard	MDA	<i>Rudbeckia / Black-Eyed Susan</i>	< 5	< 9	< 30	< 15	< 20
Hubbard	MDA	<i>Platycondon / Balloon Flower</i>	< 5	< 9	< 30	< 15	< 20
Itasca	MDA	<i>Petunia / Petunia</i>	< 5	< 9	< 30	< 15	< 20
Itasca	MDA	<i>Coreopsis / Tickseed</i>	< 5	< 9	< 30	< 15	< 20
Itasca	MDA	<i>Echinacea / Coneflower</i>	< 5	< 9	< 30	< 15	< 20
Itasca	MDA	<i>Achillea / Yarrow</i>	Not analyzed	< 9	< 30	< 15	< 20
Itasca	MDA	<i>Nepeta / Cat Nipp</i>	< 5	< 9	< 30	< 15	< 20
Itasca	MDA	<i>Heliopsis / Oxeye</i>	< 5	< 9	< 30	< 15	< 20
Itasca	MDA	<i>Liatris / Blazing Star</i>	< 5	< 9	< 30	< 15	< 20
McLeod	MDA	<i>Asclepias / Milkweed</i>	Not analyzed	< 9	< 30	< 15	< 20
McLeod	MDA	<i>Agastache / Anise Hyssop</i>	< 5	< 9	< 30	< 15	< 20
McLeod	MDA	<i>Liatris / Blazing Star</i>	< 5	< 9	< 30	< 15	< 20
Olmsted	MDA	<i>Aquilegia / Columbine</i>	< 5	< 9	< 30	< 15	< 20
Olmsted	MDA	<i>Coreopsis / Tickseed</i>	< 5	< 9	< 30	< 15	< 20
Olmsted	MDA	<i>Petunia / Petunia</i>	< 5	< 9	< 30	< 15	< 20
Olmsted	MDA	<i>Buddleja / Butterfly Bush</i>	< 5	< 9	< 30	< 15	< 20
Ramsey	MDA	<i>Argyranthemum / Marguerite Daisy</i>	< 5	< 9	< 30	< 15	< 20
Ramsey	MDA	<i>Pentas / Pentas</i>	< 5	< 9	< 30	< 15	< 20
Scott	MDA	<i>Petunia / Petunia</i>	< 5	< 9	< 30	< 15	< 20
Scott	MDA	<i>Alyssum / Alyssum</i>	< 5	< 9	< 30	< 15	< 20
Scott	MDA	<i>Geranium / Geranium</i>	< 5	< 9	< 30	< 15	< 20
Scott	MDA	<i>Osteospermum / African Daisy</i>	< 5	< 9	< 30	< 15	< 20
Scott	MDA	<i>Petunia / Petunia</i>	< 5	< 9	< 30	< 15	< 20
Steele	MDA	<i>Hemerocallis / Day Lily</i>	< 5	< 9	< 30	< 15	< 20
Steele	MDA	<i>Veronica / Speedwell</i>	< 5	< 9	< 30	< 15	< 20
Washington	MDA	<i>Leucanthemum / Shasta Daisy</i>	Not analyzed	< 9	< 30	< 15	< 20
Washington	MDA	<i>Monarda / Bee Balm</i>	< 5	< 9	< 30	< 15	< 20
Washington	MDA	<i>Coreopsis / Tickseed</i>	< 5	< 9	< 30	< 15	< 20

2016 Pollinator Samples

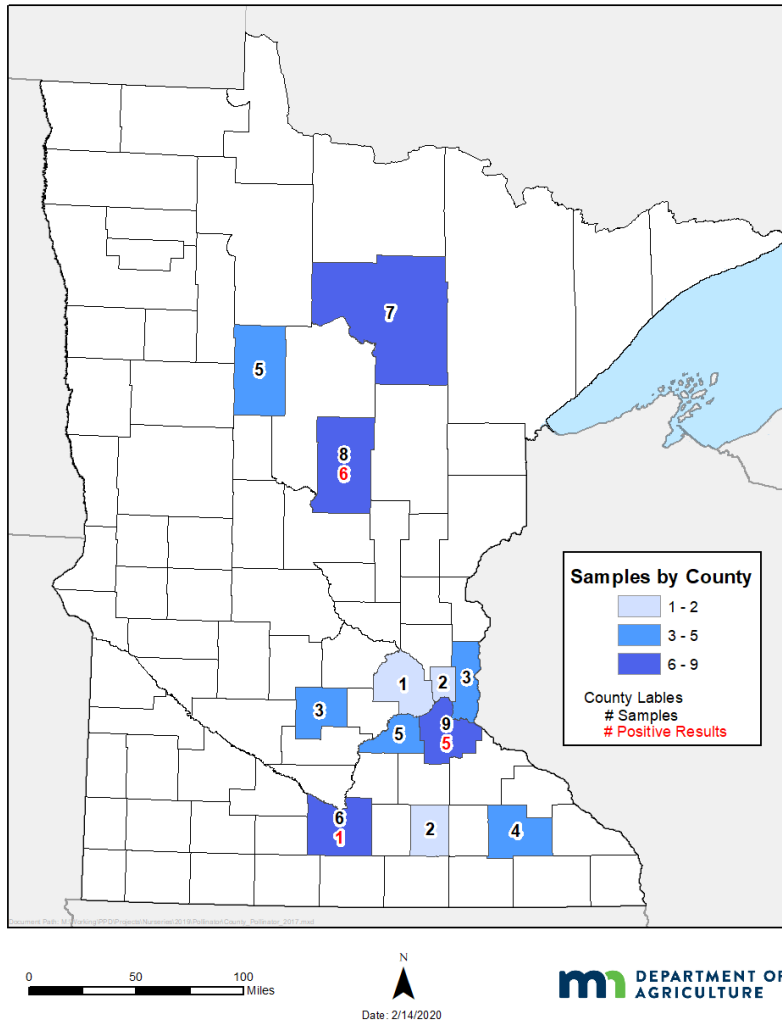


Figure 2. Distribution of samples collected during 2016.

2017

During 2017, 47 samples were collected for analysis. Eleven samples were analyzed by the MDA Lab Services Division prior to the beginning of their busy season. The rest of the samples collected were analyzed by Legend Technical Services, Inc. under contract with the MDA. This allowed for a quick turnaround on sample results throughout the growing season and the ability to require corrective actions for sites that had violations.

MDA Nursery Program inspectors reported that it was difficult to find enough volume of flowering plants advertised as pollinator-friendly in 2017. Forty-seven samples were analyzed, down from 55 the year prior. That difficulty was reflected in the reduced number of entities sampled in 2017. Fourteen entities were sampled compared to 20 the year prior. At least two entities sampled in 2016 contacted the MDA during winter 2016-17 to discuss their options. As a result, these entities had no advertising posted in 2017 which precluded repeat sampling. Other entities removed pollinators from their advertising and were also not sampled.

Each sample was tested for levels of acetamiprid, clothianidin, dinotefuran, imidacloprid, and thiamethoxam exceeding the “No Observed Adverse Effect Level.” During 2017, the EPA released values for chronic toxicity to honey bees for these chemicals. These values were lower than the values for acute toxicity that had been previously used. In response, the MDA lowered the thresholds so that lower concentrations of the chemicals would be reported (Table 3).

Levels exceeding the NOAEL were found in six samples. One sample contained clothianidin, imidacloprid, and thiamethoxam. One sample contained clothianidin and imidacloprid. One sample contained dinotefuran and imidacloprid. Three samples contained imidacloprid alone.

Of the 47 samples collected, 12.7% were positive for at least one of the five neonicotinoid insecticides included in the analysis. This was a decrease from the 21% in 2016. Twenty-eight percent of the sites sampled had plants labeled as pollinator friendly but containing systemic insecticides. The positive samples were obtained from four sites: two independent nurseries and two sites from a large retail chain. None of these sites has violations in 2016. As a result of the timely results, Notices of Violation were issued to the three entities (2 locations were for the same retailer) and follow-up inspections confirmed that pollinator advertising was removed from the remaining inventory.

Table 3. Analytical results for plant samples collected during 2017. Sample exceeding the threshold for each chemical are shown in **bold**.

County	Processing Lab	Product Sampled <i>Genus / Common Name</i>	Acetamiprid ppb	Clothianidin ppb	Dinotefuran ppb	Imidacloprid ppb	Thiamethoxam ppb
Anoka	Legend	<i>Echinacea / Coneflower</i>	< 4.0	7.9	< 5.0	66	5.7
Anoka	Legend	<i>Ligulistylis / Meadow Blazing Star</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Eryngium / Rattlesnake Master</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Lobelia / Cardinal flower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Veronia / Ironweed</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Tradescantia / Spiderwort</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Achillea / Yarrow</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Phlox / Phlox</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Coreopsis / Tickseed</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5

County	Processing Lab	Product Sampled <i>Genus / Common Name</i>	Acetamiprid ppb	Clothianidin ppb	Dinotefuran ppb	Imidacloprid ppb	Thiamethoxam ppb
Benton	Legend	<i>Penstemon / Smooth Beardtongue</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Carlton	Legend	<i>Coreopsis / Tickseed</i>	< 4.0	< 6.0	< 5.0	69	< 5.5
Carlton	Legend	<i>Leucanthemum / Shasta</i>	< 4.0	< 6.0	< 5.0	84	< 5.5
Carlton	Legend	<i>Salvia / Sage</i>	< 4.0	< 6.0	< 5.0	41	< 5.5
Carlton	Legend	<i>Aquilegia / Columbine</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Carver	Legend	<i>Heliopsis / Oxeye</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Carver	Legend	<i>Liatris / Blazing Star</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Carver	Legend	<i>Phlox / Phlox</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Clay	Legend	<i>Osteospermum / African Daisy</i>	< 4.0	6.7	< 5.0	94	< 5.5
Clay	Legend	<i>Ranunculus / Buttercups</i>	< 4.0	< 6.0	20	230	< 5.5
Clay	Legend	<i>Gerbera / Gerber Daisy</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Dakota	Legend	<i>Scabiosa / Pincushion</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Goodhue	Legend	<i>Agastache / Hyssop</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Goodhue	Legend	<i>Echinacea / Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Kalimeris / Kalimeris</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Echinacea / Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Eupatroidium / Boneset</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Monarda / Bee Balm</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Phlox / Phlox</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Lobelia / Cardinal flower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Allium / Flowering Onion</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Achillea / Yarrow</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Achillea / Yarrow</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Heliopsis / Oxeye</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Centaurea / Cornflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Ramsey	Legend	<i>Pentas / Pentas</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Ramsey	Legend	<i>Pentas / Pentas</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Ramsey	Legend	<i>Pentas / Pentas</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Ramsey	Legend	<i>Salvia / Sage</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Ramsey	Legend	<i>Tagetes / Marigold</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Ramsey	Legend	<i>Petunia / Petunia</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Washington	Legend	<i>Echinacea / Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Winona	Legend	<i>Rudbeckia / Black-Eyed Susan</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Winona	Legend	<i>Liatris / Blazing Star</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Winona	Legend	<i>Senna / Senna</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Winona	Legend	<i>Zephyranthes / Zephyr lily</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Winona	Legend	<i>Asclepias / Milkweed</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Winona	Legend	<i>Desmodium / Tick-trefoil</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5

2017 Pollinator Samples

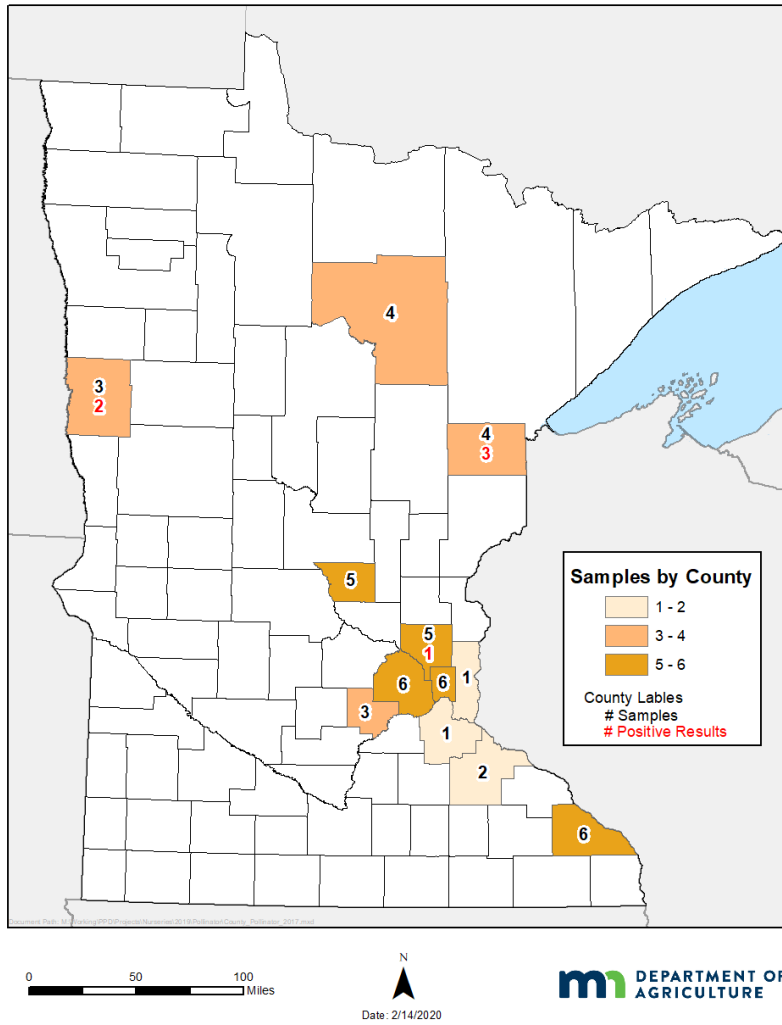


Figure 3. Distribution of samples collected during 2017.

2018

During 2018, MDA Nursery Program inspectors submitted 39 flowers samples for analysis to Legends Technical Services. Retail locations such as box-stores and garden centers were sampled across the state, with the bulk of the samples coming from the Twin Cities metro area. Thirty-nine samples were analyzed, down from 47 the year prior. As awareness of the law has grown, fewer sellers are advertising plants as pollinator friendly and the number of entities where samples could be taken fell to 10 from 14 the year prior.

Two samples contained levels of insecticides above the NOAEL, with the average turnaround time for analytical results at 12 days. Notices of Violation were issued to the two entities selling the plants. These entities used out of state suppliers as well as their own stock and willingly removed the pollinator advertising.

Each sample was tested for acetamiprid, clothianidin, dinotefuran, imidacloprid, and thiamethoxam adapting a laboratory procedure that yielded a result consistent with the NOAEL. Positive results were found for two of the five chemicals: clothianidin and imidacloprid. Imidacloprid was found in one sample from one location at 5.1 ppb. Clothianidin was detected in one sample collected from one location. The level found was 12 ppb. Only 5% of samples were found to be in violation. Twenty percent of sites with samples collected were in violation.

Table 4. Analytical results for plant samples collected during 2018. Sample exceeding the threshold for each chemical are shown in **bold**.

County	Processing Lab	Product Sampled Genus / Common Name	Acetamiprid ppb	Clothianidin ppb	Dinotefuran ppb	Imidacloprid ppb	Thiamethoxam ppb
Anoka	Legend	<i>Buddleia</i> / Butterfly Bush	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Osteospermum</i> / African Daisy	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Verbena</i> / Common Vervain	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Leucanthemum</i> / Shasta Daisy	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Angelonia</i> / Angelonia	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Gazania</i> / Traling Gazania	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Echinacea</i> / Coneflower	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Scabiosa</i> / Pincushion Flower	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Phlox</i> / Phlox	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Penstemon</i> / Smooth Beardtongues	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Penstemon</i> / Slender Beardtongues	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Achillea</i> / Yarrow	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Echinacea</i> / Coneflower	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Rudbeckia</i> / Black-Eyed Susan	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Zinnia</i> / Yellow Zinnia	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Zinnia</i> / Red Zinnia	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Coreopsis</i> / Tickseed	< 4.0	< 6.0	< 5.0	5.1	< 5.5
Hennepin	Legend	<i>Dahlia</i> / Dahlia	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Salvia</i> / Sage	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Pentas</i> / Pentas	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Dahlia</i> / Dahlia	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Heliotropeium</i> / Heliotrope	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Asclepias</i> / Butterfly Weed	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Buddleia</i> / Butterfly Bush	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Phlox</i> / Phlox	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5

County	Processing Lab	Product Sampled <i>Genus / Common Name</i>	Acetamiprid ppb	Clothianidin ppb	Dinotefuran ppb	Imidacloprid ppb	Thiamethoxam ppb
Hennepin	Legend	<i>Monarda / Bee Balm</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Hemerocallis / Daylily</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Salvia / Sage</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Achillea / Yarrow</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Gillardia / Blanket Flower</i>	< 4.0	12.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Monarda / Bee Balm</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Veronica / Speedwell</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Salvia / Sage</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Achillea / Yarrow</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Asclepias / Butterfly Weed</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Heliopsis / Oxeye</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Liatris / Blazing Star</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
McLeod	Legend	<i>Echinacea / Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
McLeod	Legend	<i>Buddleia / Butterfly Bush</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5

2018 Pollinator Samples

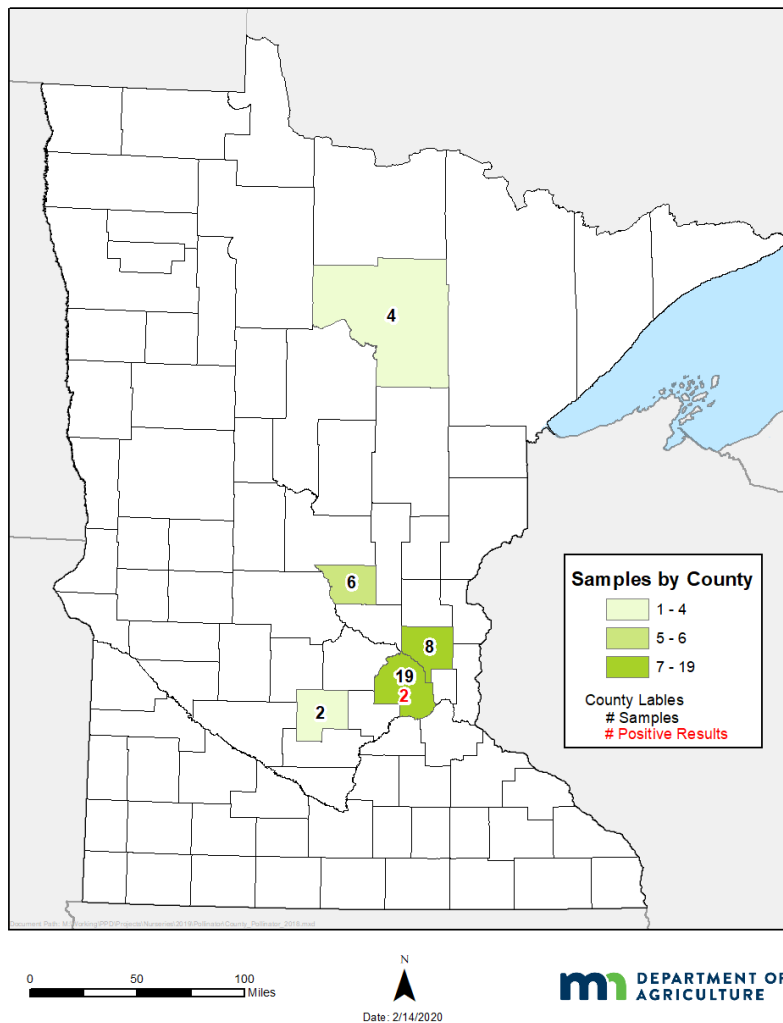


Figure 4. Distribution of samples collected during 2018.

2019

In 2019, MDA Nursery Program inspectors collected 50 flowers samples for analysis by Legends Technical Services. Retail locations such as box-stores and garden centers were sampled across the state and in each nursery inspector territory. The bulk of the samples came from the Twin Cities metro area. Four samples resulted in levels of insecticides above NOAEL, with the average turnaround time for these positive sample at 14 days.

The number of entities that requested pollinator Compliance Agreements remained the same at six. Two types of Compliance Agreements were written this year, one for entities intending to advertise plants as beneficial to pollinators and the other claiming freedom from certain chemicals or systemic insecticides.

Fifty samples were analyzed, up from 39 the year prior. That was a slight increase reflected in the increased number of entities sampled in 2018, 14 compared to 10 the year prior.

Each sample was tested for acetamiprid, clothianidin, dinotefuran, imidacloprid, and thiamethoxam adapting a laboratory procedure that yielded a result consistent with the NOAEL. Positive results were found for one of the five chemicals: imidacloprid. Imidacloprid was found in four samples from two locations. The levels found ranged from 6 ppb to 3500 ppb.

Sample analysis will be reviewed for 2020 as well as any potential additions to the list of systemic insecticides the MDA is analyzing for.

Table 5. Analytical results for plant samples collected during 2019. Sample exceeding the threshold for each chemical are shown in **bold**.

County	Processing Lab	Product Sampled <i>Genus / Common Name</i>	Acetamiprid ppb	Clothianidin ppb	Dinotefuran ppb	Imidacloprid ppb	Thiamethoxam ppb
Anoka	Legend	<i>Veronica / Speedwell</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Anoka	Legend	<i>Agastache / Hyssop</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Eupatorium / Snakeroot</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Allium / Flowering Onion</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Eutrochium / Joe Pye Weed</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Benton	Legend	<i>Rudbeckia / Black-Eyed Susan</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Carlton	Legend	<i>Hieracium / Hawkweed</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Carlton	Legend	<i>Salvia / Sage</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Dakota	Legend	<i>Silphium / Compass Plant</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Dakota	Legend	<i>Verbena / Vervain</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Dakota	Legend	<i>Rudbeckia / Black-Eyed Susan</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Dakota	Legend	<i>Agastache / Hyssop</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Dakota	Legend	<i>Lobelia / Cardinal Flower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Heuchera / Coral Bells</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Salvia / Sage</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Coreopsis / Tickseed</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Achillea / Yarrow</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Nepeta / Catnip</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Salvia / Sage</i>	< 4.0	< 6.0	< 5.0	3500	< 5.5
Hennepin	Legend	<i>Gillardia / Blanket Flower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Achillea / Yarrow</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Dianthus / Dianthus</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Delphinium / Larkspur</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Aquilegia / Columbine</i>	< 4.0	< 6.0	< 5.0	11	< 5.5

County	Processing Lab	Product Sampled <i>Genus / Common Name</i>	Acetamiprid ppb	Clothianidin ppb	Dinotefuran ppb	Imidacloprid ppb	Thiamethoxam ppb
Hennepin	Legend	Aquilegia / Columbine	< 4.0	< 6.0	< 5.0	6	< 5.5
Hennepin	Legend	Salvia / Sage	< 4.0	< 6.0	< 5.0	16	< 5.5
Hennepin	Legend	<i>Duranta / Duranta</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Canna / Canna Lily</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Leucanthemum / Shasta Daisy</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Hennepin	Legend	<i>Scaevola / Half flower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Achillea / Yarrow</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Sedum / Stonecrop</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Echinacea / Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Perovskia / Russian Sage</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Rudbeckia / Black-Eyed Susan</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Itasca	Legend	<i>Echinacea / Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
McLeod	Legend	<i>Echinacea / Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
McLeod	Legend	<i>Coreopsis / Tickseed</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
McLeod	Legend	<i>Lobelia / Cardinal Flower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
McLeod	Legend	<i>Leucanthemum / Shasta Daisy</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Norman	Legend	<i>Echinacea / Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Norman	Legend	<i>Achillea / Yarrow</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Norman	Legend	<i>Phlox / Phlox</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Olmsted	Legend	<i>Echinacea / Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Olmsted	Legend	<i>Rudbeckia / Black-Eyed Susan</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Pope	Legend	<i>Eupatorium / Snakeroot</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Pope	Legend	<i>Allium / Flowering Onion</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Pope	Legend	<i>Helenium / Sneezeweed</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Pope	Legend	<i>Rudbeckia / Black-Eyed Susan</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5
Pope	Legend	<i>Ratibida / Upright Prairie Coneflower</i>	< 4.0	< 6.0	< 5.0	< 4.5	< 5.5

2019 Pollinator Samples

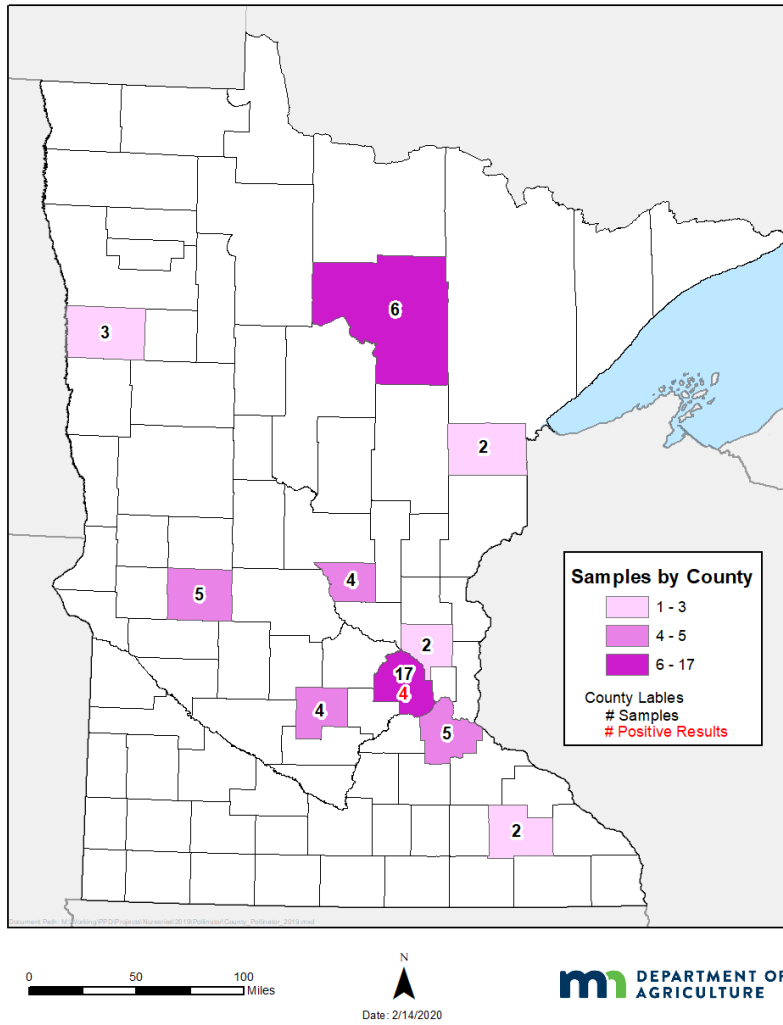


Figure 4. Distribution of samples collected during 2018.

Summary

Table 6 provides a summary of the number of locations sampled and number of samples collected during each year since this law was passed. As awareness of this law has increased, the percentage of samples that have been found in violation has decreased. This decrease has occurred even though the reporting levels for samples in violation has also decreased as information has become available from the EPA.

Table 7 provides a listing of all samples that have been found in violation and the concentration in parts per billion (ppb) of the target chemical. The experience of the Minnesota Department of Agriculture in enforcing this law is that plants that are in violation typically have concentrations well above the EPA NOAEL for honey bees which would indicate that the current thresholds in place for reporting are adequate.

Table 6. Summary of locations visited, samples taken, and violations found, 2015-2019.

	2015	2016	2017	2018	2019
# samples	19	55	47	39	50
% samples with violations	0%	22%	13%	5%	8%
# locations	7	20	14	10	14
% locations with violations	0%	20%	29%	20%	14%

Table 7. A listing of all samples found to be in violation and the concentration of the chemical found (ppb), 2015-2019.

Chemical	2015	2016	2017	2018	2019
Acetamiprid		17.6			
Acetamiprid		26.4			
Acetamiprid		305.0			
Acetamiprid		403.0			
Acetamiprid		661.0			
Acetamiprid		6610.0			
Clothianidin			6.7	12.0	
Clothianidin			7.9		
Dinotefuran			20.0		
Imidacloprid		38.4	41.0	5.1	6.0
Imidacloprid		61.8	66.0		11.0
Imidacloprid		61.8	69.0		16.0
Imidacloprid		135.0	84.0		3500.0
Imidacloprid		135.0	94.0		
Imidacloprid		497.0	230.0		
Thiamethoxam			5.7		