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The Impact of Neonicotinoids on Honey Bees

Briefing Paper – November 2015

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1. LWV Minnesota Position on Natural Resources

The League of Women Voters Minnesota position on natural resources is to "promote an environment beneficial to life through the protection and wise management of natural resources in the public interest by recognizing the interrelationships of air quality, energy, land use, waste management and water resources.

- Resource Management: Promote resource conservation, stewardship and long-range planning with the responsibility for managing natural resources shared by all levels of government.
- Environmental Protection and Pollution Control: Preserve the physical, chemical and biological integrity of the ecosystem, with the maximum protection of the public health and environment.
- Public Participation: Promote public understanding and participation in decision making as essential elements of responsible and responsive management of our natural resources.
- Agricultural Policy: Promote adequate supplies of food and fiber at reasonable prices to consumers and support economically viable farms, environmentally sound farm practices and increased reliance on the free market."[1]

2. Introduction

Neonicotinoid insecticides (neonics) and their links to bee declines and environmental contamination are continually in the news, with articles and reports coming out seemingly every day. A consortium of scientists first gathered in Europe in 2009 to examine the catastrophic decline of arthropods (notably seen by the scarcity of insects splattered on windshields, the decline of butterflies, and the global disorders among honey bees). [2] The meetings of these scientists led to a moratorium on three neonics in the European Union. In the U.S., massive die-offs of bees have prompted beekeepers and environmental groups to aggressively lobby for stronger regulations on neonics. This paper explains what neonics are, how they are impacting honey bees, the alternatives to neonics, and what is presently being done to reduce their use.

3. Bees

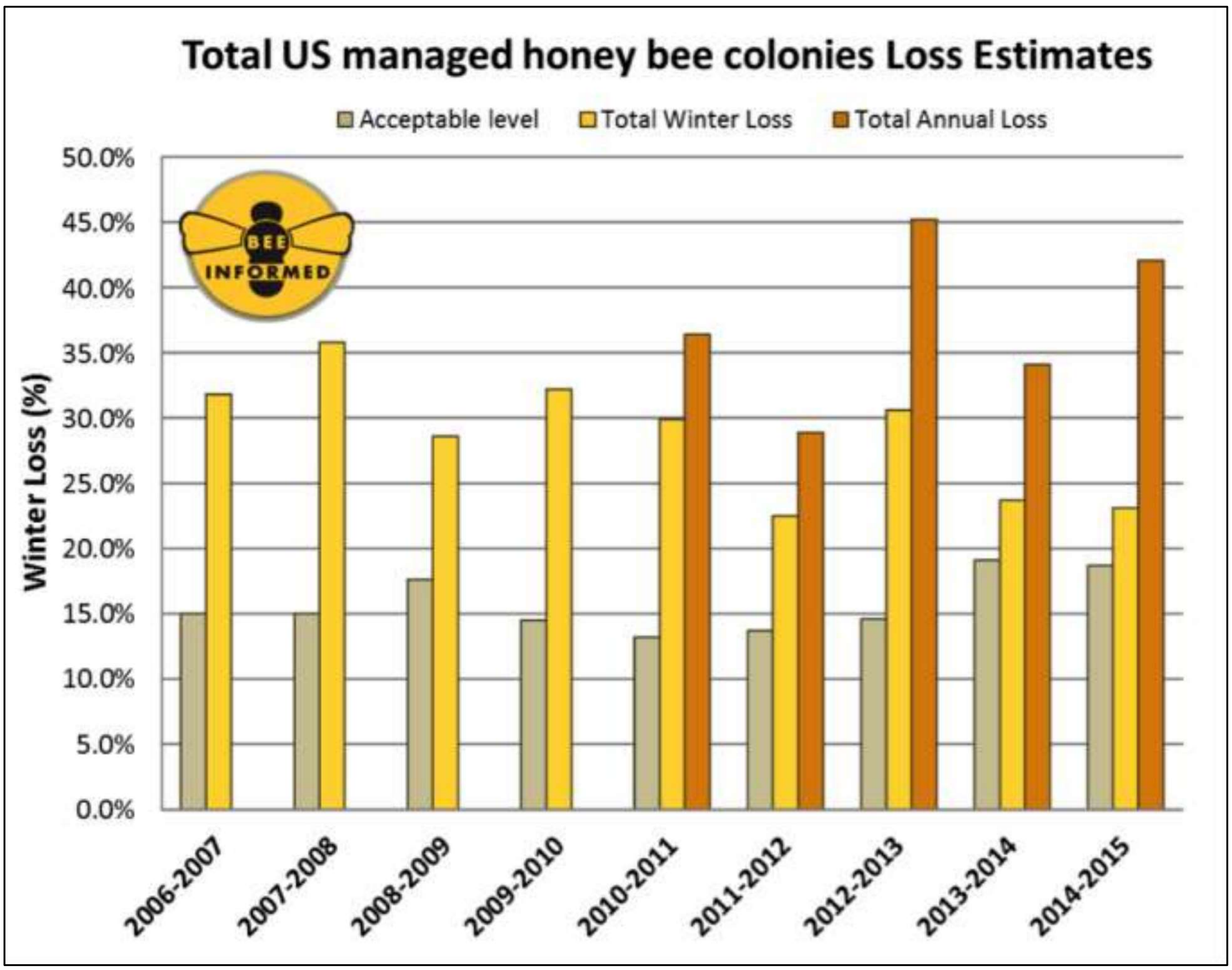
Bees and other pollinators (any animal that transfers pollen from flowering plants, including insects, birds, and bats) are responsible for the reproduction of about 90% of all flowering plants on earth. Honey bees alone enable the production of at least 90 commercially grown crops in North America.[3] Globally, pollinators are responsible for every third bite of food we eat, for many of our plant-based medicines, and for the majority of wildlife habitats.

Financially, pollinators contribute over 24 billion dollars to the U.S. economy. Honey bees contribute more than 15 billion dollars while native wild pollinators contribute more than 9 billion dollars through their "vital role in keeping fruits, nuts, and vegetables in our diets."[4] California's 4.8 billion dollar almond industry relies almost exclusively on honey bees, and requires the pollination services of approximately 1.4 million beehives annually—60% of all U.S. beehives—most of which are trucked in from around the country.[5]

3.1. Bee Decline

In 2006 beekeepers reported massive bee losses. While some losses are expected, these rates far exceeded acceptable levels (see Table 1).[6] Severe honey bee declines have been noted on every continent, and hundreds of species of pollinators are near extinction.[7] Bee decline is generally attributed to multiple and interrelated factors including habitat loss, pesticides, pathogens (viruses, bacteria, etc.), parasites (e.g. Varroa destructor, Nosema ceranae), poor nutrition (monocultures reduce variety and quantity of food sources), and climate change. While bees have been facing nutrition problems since WWII when monocropping and herbicide use became prominent, evidence suggests that the widespread use of neonics around the globe has become a driving factor in bee decline.

Table 1: Bee Colony Losses



3.2. Links to Neonicotinoids

Neonicotinoid insecticides have harmful, if not deadly, effects on honey bees and other pollinators.[8] Even though pesticide industry giants such as Bayer CropScience and Syngenta continue to point to causes other than pesticides as the culprit for this catastrophic bee and pollinator loss, the EPA acknowledges exposure to pesticides as a factor.[9] Moreover, independent, peer-reviewed scientific data continues to increase. The most comprehensive report to date is the “Worldwide Integrated Assessment of the Impact of Systemic Pesticides on Biodiversity and Ecosystems,” prepared by The Task Force on Systemic Pesticides. [10] Other studies showing the effects of neonics on pollinators are listed in Table 2.

Table 2: Partial List of Key Studies Demonstrating the Impacts of Neonicotinoids and Other Pesticides on Pollinators[11]

Species	Authors/Date	Pesticides	Significance
Honey bee	Zhu, et al., 2014	Fluvalinate, coumaphos, chlorothalonil, chloropyrifos	Combination of the four most common pesticides found in pollen/wax synergize, increase bee larvae mortality.
	Doublet, et al., 2014	Thiacloprid	Sublethal doses of a neonicotinoid pesticide interact with parasite *Nosema cernae* and black queen cell virus to elevate honey bee mortality.
	Carillo, et al., 2014	Fipronil, imidacloprid	Learning, as evaluated through proboscis (e.g. mouthparts used for feeding) extension, is diminished.
	Di Prisco, et al., 2013	Clothianidin	Altered immune response allowed replication of viral pathogens in exposed bees.
	Williamson & Wright, 2013	Clothianidin, coumaphos	Long term memory, short-term memory, and odor differentiation all decrease.
	Palmer, et al., 2013	Imidacloprid, clothianidin, organophosphate miticides	Cognitive damage from exposure causes “epileptic type” hyperactivity with implications for survival.
	Matsumoto, 2013	Clothianidin, dinotefuran, etofenprox, fenitrothion	Demonstrates behavioral changes and declines in homing success.
	Derecka, et al., 2013	Imidacloprid	Metabolizing genes for honeybee larvae reduce at low levels of exposure.
	Hatjina, et al., 2013	Imidacloprid	Of the few physiological studies, this finds sublethal doses decrease phyopharyngeal glands and respiratory rhythm.
Africanized honey bees	Sandrock, et al., 2013	Thiamethoxam, clothianidin	Sublethal exposure to neonicotinoids is expressed in complex fitness related ways, including a 50% reduction in offspring.
Solitary bee	Bryden, et al., 2013	Imidacloprid	Chronic sublethal stress causes bee colony failure according to models.
Bumblebee	Gill, et al., 2012	Imidacloprid, lambda-cyhalothrin	Combination of two pesticides impairs foraging, increases worker mortality, and reduces colony success.
	Whitehorn, et al., 2012	Imidacloprid	Field realistic levels drastically reduce queen production and growth rates.
Wildlife	Goulson, 2013	Clothianidin, thiamethoxam, imidacloprid	Reviews the environmental risks of these chemicals to bees, birds, and beneficials.

4. Neonicotinoids

The systemic insecticides known as neonicotinoids (neonics) are powerful neurotoxins that were developed in the 1980s and introduced in the mid-to-late 1990s, the first new class of insecticide in over 50 years. (The other classes are: organophosphates, carbamates, phenyl-pyrazoles, and pyrethroids.) Over the past two decades neonics have become the most widely used pesticide, with over a quarter of the global market by 2009 worth $2.63 billion (See Table 3).[12] Neonics are used primarily as a seed coating for commodity crops--around 94% of corn and at least 30% of soybeans in the U.S. are treated with neonics. They are also widely used in horticulture (fruits, vegetables, flowers, and ornamental plants), lawn care and urban forestry (e.g., in trunk injections or soil drenching to temporarily prevent pests such as the emerald ash borer).

Table 3: Growth in Global Sales of Neonicotinoid Pesticides[13, 14, 15]

Product	Application	Crop uses	Company	Global Sales (US $ millions)			
				2003	2005	2007	2009
imidacloprid	Seed treatment for soybeans; sprayed on tomatoes, leafy greens	140	Bayer CropScience	665	830	840	1,091
thiamethoxam	Seed treatment for corn and soybeans; applied to soil for other vegetables and fruits	115	Syngenta	215	359	455	627
clothianidin	Seed treatment for canola, corn, sugar beets; soil application for potatoes	40	Sumitomo/ Bayer CropScience	<30	162	365	439
acetamiprid	Sprayed on fruit and leafy vegetables	60	Nippon Soda	60	95	130	276
thiacloprid	Soil treatment or spray for cotton and fruit	50	Bayer CropScience	<30	55	80	112
dinotefuran	Soil treatment or sprayed on leafy greens, potatoes, cucumbers	35	Mitsui Chemicals	<30	40	60	79
nitenpyram	Oral medication for parasites on pets; soil treatment or spray for rice, fruit, vegetables, tea	12	Sumitomo	45	<10	<10	8

4.1. Prevalence in Water and Food

Neonic seed coatings are one of the major causes of water contamination. About 5% of the coating actually enters the growing plant, and 95% is left to be scraped, blown, sloughed off, or otherwise dispersed into the air, soil, or water.[16] A recent U.S. Geological Survey study found neonics in about half of the streams sampled nationwide, and in up to 75% of those tested in the Midwest.[17] The high water solubility of neonics eases their transport into both surface and groundwater. Runoff has been found far beyond agricultural fields and other areas where they were first applied. A report published in September of 2015 found such widespread contamination of waters across the United States that it led them to suggest that we are now "approaching an ecological crisis—a second Silent Spring."[18] The contamination of aquifers and other drinking water sources for millions of people is a serious, yet understudied, potential health concern.[19]

Neonic residues are present in much of the food we consume daily. [20] (See Appendix 1). Since neonics are systemic, that is, part of the plant tissue, they cannot be washed off. In Washington, D.C., the House and Senate cafeterias are run by a food company with an organic food emphasis. Yet testing of the food served in these cafeterias, conducted by the Harvard T.H. Chan School of Public Health, uncovered neonicotinoids in nearly every food item sampled.[21]

Neonics are applied on more than 150 million acres annually—about one-twelfth of the area of the contiguous United States.[22] Field testing (as opposed to lab testing) on the effectiveness and environmental safety of neonics has been slow to occur. However, a recent analysis of peer-reviewed literature reported that: neonics did not provide yield benefits; they were less cost-effective than alternative methods; and efficacy was unpredictable for target pests. The report concluded that neonics are "massively overused."[23] Still, the market for systemic insecticide seed treatments continues to grow rapidly. DuPont Pioneer, Bayer CropScience, and Syngenta are all currently expanding seed coating operations in Minnesota and Iowa.[24]

4.2. Effects on Honey Bees

LWV Minnesota members are interested in learning about the effect of neonics on honey bees, and the consequences of declining honey bee and other pollinator populations. Both neonics and fipronil (a similar insecticide) are systemic and neurotoxic to insects. "Systemic" means the insecticide is absorbed through the plant's vascular system, so that roots, stems, leaves, even the pollen, nectar, and moisture exuded by the plant (guttation droplets) become poisonous to insects. "Neurotoxic" means that the poison affects the insect's neural functioning. In honey bees, neonics interfere with learning, foraging, memory, navigation, reproduction, and immune system functioning which makes them more susceptible to infections.[25]

Bees are exposed to neonics when they collect pollen and nectar of contaminated crops, plants and trees, when they drink water containing neonics, or when they are exposed to dust emitted when neonic-treated seeds are planted in the spring. Because neonics persist in soil and water, bees are continually exposed to them throughout the growing season. And because neonics are often used in conjunction with other agrochemicals, the combined effects are too often lethal.[26] For example, in the presence of some fungicides, neonics become 1,000 times more toxic to honey bees.[27] However, chemicals do not have to kill the bee to have an effect. A sublethal dose causes the bee to lose navigation and foraging skills.[28] If a honey bee cannot return to its hive, it dies. If enough bees cannot forage as a consequence of sublethal neonic poisoning, the hive is greatly weakened, more susceptible to other stressors, and will eventually die. And sadly, because they are chemically similar to nicotine, plants laced with neonics are actually preferred by foraging honey bees and bumblebees who will seek them out.[29]

5. Alternatives

5.1. Integrated Pest Management

As noted earlier, most corn and about a third of U.S. soybean seeds are currently being treated with neonic insecticides. However, this has been the case for only the last 15 years. In 2000, less than 30% of corn and less than 5% of soybeans were treated with any insecticide.[30] The widespread adoption of neonics as seed dressings has led to a move away from integrated pest management.[31] The Integrated Pest Management (IPM) approach relies "to the greatest possible extent on biological rather than chemical measures, and emphasizes the prevention of pest problems with crop rotation, the reintroduction of natural, disease-fighting microbes into plants/soil, and release of beneficial organisms that prey on the pests."[32] Once a particular pest problem is identified, responses may include the introduction of ladybugs (to control aphids), the use of sterile male pests (to control numbers), or the placement of barriers or traps (to physically remove them). Chemical pesticides are used only as a last resort.

IPM is an integral part of organic food production which may use pesticides derived from natural sources alone. IPM permits the judicious use of some synthetics as well as bio-pesticides, which may include microorganisms such as bacteria or fungi, or biochemicals such as insect sex pheromones. While considered "safer" than synthetics, organic pesticides can be just as deadly to pollinators if not applied correctly.

IPM remains a viable option in industrial farming, so long as farmers have the freedom to choose their own seeds. However, in the U.S. it is nearly impossible to purchase corn seeds without some type of neonic coating.[33] Since the introduction of neonics and genetically modified corn in the 1990s, close relationships formed between seed companies and insecticide manufacturers, so that today only a few large companies control the seed market. The concentrated market power in the seed industry has allowed these few multi-billion dollar companies to significantly limit U.S. farmers' choice around seeds in general, including seed coatings.[34]

5.2. Crop Rotation and Alternative Growing Techniques

Non-chemical alternatives to neonics include the practice of crop rotation. Rather than planting the same crop over and over, depleting nutrients and thus requiring the use of chemical fertilizers, rotating in other crops improves soil health and disrupts host-specific pests. Other types of alternative farming systems that would be more sustainable than the current model, such as agroforestry, silviculture, and permaculture, have been employed for centuries around the world. New techniques are discovered each day by organic farmers to fit their specific conditions while limiting chemicals. Farmers who employ non-chemical techniques have good reason for doing so: agrochemicals often kill off more than the targeted pests, putting at risk the biodiversity that supports the entire system.

5.3. Agroecology

As the name agroecology implies, the emphasis is on preserving natural ecosystems, including supporting bees and all pollinators. Agroecology takes into account changing global weather patterns and declining natural resources, and recognizes the importance of biodiversity and healthy ecosystems. The United Nations, after a thorough assessment, concluded that, "business as usual is not an option" for world agriculture, and that agroecological practices are most likely to sustain the world's population.[35]

5.4. Home Use

Although most neonics are used in agricultural treatments, they are also available in many retail products and plants. Home use of pesticides on private property is the only allowable usage that is unregulated by the state and where the applicator is not required to obtain a license.[36] Because many of these products contain higher concentrations of neonics, it is imperative that the user apply the product exactly as instructed on the label, or avoid them altogether. See Appendix 2 for a list of common home and garden products containing neonics to avoid.

Lawns, the third largest monocrop in the U.S. after corn and soybeans, require a tremendous amount of water and inputs to maintain. As more and more homeowners become conscious of the need to conserve both water and bees, they are creating a new paradigm for the ideal lawn. They're committing to protect bees from systemic pesticides by refusing to purchase any systemic pesticides or plants containing them. They're working to implement IPM practices in their home gardens and are willing to purchase plants with some pest damage, because "picture perfect" plants and a landscape hospitable to bees are not always simultaneously attainable. There is also a growing movement to replace monoculture lawns with native plants which are more appealing to native pollinators. Such native plants often have the added benefit of requiring less water and maintenance than lawns. See Appendix 3 for links to two organizations whose focus is native plants.

6. Actions

Realizing the dangers of neonics to pollinators and their pervasiveness in our food and water, many are now calling for tighter regulations or outright bans on neonics and systemic pesticides. Farmers, bee keepers, consumers, environmental groups, researchers, and scientists worldwide have all been making their voices heard. Table 4 is a summary of some of the ways governments have been taking action.

Table 4: Recent Actions Regarding Neonicotinoids

	Date	Action
Worldwide		
European Union	December, 2013	Temporary ban on three neonicotinoids that were found to be harmful to honey bees (*clothianidin, imidacloprid and thiamethoxam*). However, the UK recently suspended the ban, allowing its farmers to use two of the pesticides for 120 days to ward off the cabbage stem flea beetle. The ban is to be reviewed at the end of 2015.[37]
Canada	2014	In Canada, Ontario recently became the first jurisdiction in North America to cut the use of neonics on corn and soybeans, with the goal of an 80% reduction in acres planted with coated seeds by 2017. Farmers will be allowed to plant only half of their corn and soybeans next year with neonic-coated seeds unless they can provide evidence of pest problems. After that, all farmers wanting to use coated seeds will need to prove they have pests. The move was largely in response to the staggering loss of 58% of the province's honey bees in the winter of 2013-14.[38]
United States		
U.S. EPA	2015, 2016	Complete review of 4 major neonicotinoids (*imidacloprid* by the end of 2015; *clothianidin, thiamethoxam acetamiprid* in 2016) which will then be followed by a 6-9 month period to develop an action plan based on the review results.
U.S. EPA	2015	Moratorium on approving *new uses* of neonic applications in outdoor settings until EPA completes its review of the chemicals. It has also proposed a rule to create temporary pesticide-free zones to protect hives contracted for pollination, but this does not apply to seed coatings. [39]
U.S. Appeals Court	September, 2015	The court said the EPA used "flawed and limited data" to approve the unconditional registration of sulfoxaflor, a neonicotinoid, and rescinded the EPA's approval saying studies have shown it highly toxic to honey bees.[40]
Obama Administration	June, 2014	Presidential memorandum calling for Strategy to Promote the Health of Honey Bees and other Pollinators.[41]
Obama Administration	May, 2015	The Pollinator Health Task Force released a report focusing on increasing pollinator habitat, but neglected to limit use of known bee-harming pesticides. They encourage the public to "think carefully before applying any pesticides and always follow the label instructions" and then it is up to the state and tribal governments to make their own pollinator plans.[42] The Administration also banned use of neonics on grounds of federal facilities and in the national wildlife refuges.[43]
U.S. Legislation	None	Saving the Pollinators Act introduced in 2013, not enacted. Reintroduced in 2015 as H.R. 1284 - Saving America's Pollinators Act. Currently in subcommittee.
State & Local		
Minnesota	2014	Minnesota legislature passed two bee/pollinator bills which were signed into law: (1) a nursery labeling law stating that plants containing pollinator lethal insecticides can't be labeled "bee friendly," and (2) a beekeeper compensation law ensuring that beekeepers who lose their bees due to a pesticide kill can be compensated.

Minnesota	2015	Weakened the previous year's nursery labeling law by allowing plants to be labeled 'bee friendly' as long as the pollinator-lethal insecticides are below the acutely toxic level, ignoring the sublethal effects on bees. Passed (1) a law requiring a license for online purchase of "restricted use pesticide," (2) a law saying that any entity getting state funding for new conservation land is (not required but) encouraged to plant habitat for monarch butterflies and minimize pesticide use, and (3) a new law that will create buffer zones around waterways in the state, creating important pollinator habitat.
Minnesota City Action	2014	Rather than treat ash trees infested with emerald ash borer, Minneapolis has chosen to remove and replace 40,000 trees on city boulevards, parks, and golf courses over the next eight years, citing public pressure regarding the use of neonicotinoids.[44]
Minnesota City Action	July, 2014	Shorewood became the first city in the state of Minnesota to work toward becoming bee-safe by passing a resolution prohibiting systemic pesticides (including neonicotinoids) on city property, planting clover in three city parks, and spreading the word to its citizens about needs of bees.
Minnesota Cities' Actions	July-August, 2015	Lake Elmo, St. Louis Park, Stillwater, and Minneapolis all pass bee safe/pollinator friendly resolutions.
Other Cities' Actions	2014-2015	Eugene, OR, Spokane, WA and Seattle, WA have also banned use of neonicotinoids on city-owned land.

7. Appeal to Governments

Unless further action is taken, despite moratoriums in Europe, the use of neonics and other systemic pesticides may well continue to grow. Factors include: the increase in acreage of crops where they are heavily used; the development of combined formulations; the rise of generic sales as patents expire; and the possible development of molecules with properties of multiple pest classes (insecticides combined with herbicides or fungicides, for example).[45]

In the concluding remarks of its "Worldwide Integrated Assessment," the scientists of the Task Force on Systemic Pesticides made an appeal to governmental regulatory agencies across the globe:

- to reduce the use of and tighten regulations on neonics and fipronil on a global scale;
- to educate farmers and other practitioners regarding alternatives such as Integrated Pest Management (IPM) and organic growing practices;
- to replace neonics and fipronil with the principles of prevention and precaution; and
- to research why pesticides (neonics, fipronil, and others) have replaced proven sustainable agricultural practices.[46]

8. Conclusion

Expressing opposition to any environmental pollutant is no easy task. Similar to the petroleum industry, agrochemical companies have money for congressional lobbying, suppressing research, discounting editorials, and establishing research institutions to support the safety of their products.[47] But the growing public outcry over the loss of bees–coupled with the movement towards more local, sustainable foods and healthy communities–gives hope that U.S. consumers have been paying attention, and will take action to avoid the further spread of neonics. Bees, as indicator species, are sounding the alarm through their demise. Not only are the many benefits we receive from these pollinators at risk, so are the very ecosystems we depend upon to sustain life on this planet.

LWV Minnesota can play an important role in this issue. Our members truly understand that small actions can lead to widespread results. We can help educate our communities on the importance of a pollinator safe environment. Agricultural policies at the state level can be affected by educating our legislators on the perils of systemic neonic exposure to us as well as to our honey bees. At the national level, we can urge our representatives to support Saving America's Pollinators Act of 2015 (H.R.1284). This bill specifies clear policy recommendations on the use of neonics. The LWV Minnesota position on natural resources promotes "protection and wise management of natural resources." The seriousness of this issue compels us to act.

APPENDIX 1: NEONICOTINOID RESIDUES ON FOOD

Food	Neonicotinoid	Food	Neonicotinoid
Apple Juice	acetamiprid, thiacloprid	***Lettuce***	acetamiprid, imidacloprid
Apple Sauce	acetamiprid, thiacloprid	***Papaya***	thiamethoxam
Apples	acetamiprid, thiacloprid	***Peaches***	acetamiprid, clothianidin
Baby Food, Applesauce	acetamiprid, thiacloprid	***Pears***	acetamiprid, clothianidin, thiacloprid
Baby Food, Peaches	acetamiprid	***Plums***	acetamiprid, clothianidin
Baby Food - Pears	acetamiprid, thiacloprid	***Potatoes***	clothianidin, imidacloprid, thiamethoxam
Blueberries	acetamiprid, dinotefuran	***Potatoes, Frozen***	clothianidin
Broccoli	acetamiprid, dinotefuran	***Raisins***	acetamiprid
Cabbage	acetamiprid, thiacloprid	***Snap Peas***	acetamiprid, thiacloprid
Cantaloupe	acetamiprid, dinotefuran, thiamethoxam	***Spinach***	acetamiprid, clothianidin, dinotefuran, imidacloprid
Cauliflower	acetamiprid, dinotefuran	***Spinach, Canned***	clothianidin
Celery	acetamiprid, dinotefuran	***Spinach, Frozen***	acetamiprid, imidacloprid
Cherries	clothianidin, imidacloprid, thiamethoxam	***Strawberries***	acetamiprid, thiamethoxam
Cherry Tomatoes	acetamiprid, clothianidin, dinotefuran, imidacloprid, thiamethoxam	***Summer Squash***	acetamiprid, clothianidin, dinotefuran, imidacloprid, thiamethoxam
Cilantro	acetamiprid, dinotefuran, imidacloprid	***Sweet Bell Peppers***	acetamiprid, clothianidin, dinotefuran, imidacloprid, thiamethoxam
Cucumbers	acetamiprid, clothianidin, dinotefuran, thiamethoxam	***Tangerines***	acetamiprid, thiamethoxam
Grape Juice	acetamiprid, dinotefuran	***Tomatoes***	acetamiprid, clothianidin, thiamethoxam
Grapes	acetamiprid, clothianidin, dinotefuran, thiacloprid, thiamethoxam	***Water, Finished***	clothianidin
Green Beans	acetamiprid, dinotefuran	***Water, Untreated***	clothianidin, dinotefuran
Greens, Collard	acetamiprid, dinotefuran, imidacloprid	***Watermelon***	clothianidin, dinotefuran, thiamethoxam
Greens, Kale	acetamiprid, clothianidin, dinotefuran, imidacloprid	***Winter Squash***	acetamiprid, dinotefuran, imidacloprid, thiamethoxam
Hot Peppers	acetamiprid, clothianidin, dinotefuran, imidacloprid, thiacloprid, thiamethoxam		

Source: www.whatsonmyfood.org

Note: This site tests organic, conventional, domestic and imported foods, and looks at four levels of toxicity: carcinogenicity, neurotoxicity, developmental or reproductive toxicity, endocrine disruption, and honey bee toxicity.

APPENDIX 2: NEONICOTINOIDS IN HOME AND GARDEN PRODUCTS

BEE Protective

A Project Of:
Beyond Pesticides &
Center for Food Safety

APRIL 2013

HELP THE HONEY BEES!

LOOKING TO HELP honey bees and other important pollinators? One of the best ways to support healthy hives and pollinator protection is to provide ample foraging. Keeping a garden that provides not just nectar, pollen, and habitats, but also refrains from using toxic pesticides will go a long way towards helping bees and other pollinators. The most widely used garden insecticides are a class of chemicals called neonicotinoids. Below is a list of common home and garden products containing neonicotinoids. To keep your lawn and garden happy, healthy, and teeming with life for pollinators, you should avoid the following products:

PRODUCT	MANUFACTURER	ACTIVE INGREDIENT (AI)	% AI
12 Month Tree & Shrub Insect Control Landscape Formula	Bayer Advanced	Imidacloprid	2.940
12 Month Tree & Shrub Protect & Feed (Concentrate)	Bayer Advanced	Imidacloprid	1.470
12 Month Tree & Shrub Protect & Feed (Granules)	Bayer Advanced	Imidacloprid	1.100
12 Month Tree & Shrub Protect & Feed II (Granules)	Bayer Advanced	Imidacloprid Clothianidin	0.550 0.275
12 Month Tree & Shrub Protect & Feed II (Granules)	Bayer Advanced	Imidacloprid Clothianidin	0.740 0.370
2-In-1 Insect Control Plus Fertilizer Plant Spikes	Bayer Advanced	Imidacloprid	2.500
2-In-1 Systemic Rose & Flower Care	Bayer Advanced	Imidacloprid	0.220
3-In-1 Insect, Disease & Mite Control (Ready-to-Spray)	Bayer Advanced	Imidacloprid	0.012
3-In-1 Insect, Disease & Mite Control (Ready-to-Use and Concentrate)	Bayer Advanced	Imidacloprid	0.470
All-In-One Rose & Flower Care	Bayer Advanced	Imidacloprid	0.150
All-In-One Rose & Flower Care Granules	Bayer Advanced	Clothianidin Imidacloprid	0.050 0.110
ALOFT® Gc Sc Insecticide	Arysta LifeScience	Clothianidin	24.700
ALOFT® Lc G Insecticide	Arysta LifeScience	Clothianidin	0.250
ALOFT® Lc Sc Insecticide	Arysta LifeScience	Clothianidin	24.700
ARENA® .25 G Insecticide	Valent U.S.A. Corporation	Clothianidin	25.000
ARENA® 50 WDG Insecticide	Valent U.S.A. Corporation	Clothianidin	50.000
Complete Brand Insect Killer For Soil & Turf (Granules)	Bayer Advanced	Imidacloprid	0.150
Complete Brand Insect Killer For Soil & Turf (Ready-to-Spray and Concentrate)	Bayer Advanced	Imidacloprid	0.720
Criterion™ 0.5 G	Bayer Environmental Science	Imidacloprid	0.500
Criterion™ 2F Insecticide	Bayer Environmental Science	Imidacloprid	21.400
Criterion™ 75 WSP Systemic Insecticide	Bayer Environmental Science	Imidacloprid	75.000
DIY Tree Care Products Multi-Insect Killer	ArborSystems	Imidacloprid	5.000
Dual Action Rose & Flower Insect Killer	Bayer Advanced	Imidacloprid	0.012
Ferti-lome® 2-N-1 Systemic	Voluntary Purchasing Groups, Inc.	Imidacloprid	0.150
Flagship™ 0.22 G	Syngenta Crop Protection, LLC	Thiamethoxam	0.220
Flagship™ 25 WG	Syngenta Crop Protection, LLC	Thiamethoxam	25.000
Fruit, Citrus & Vegetable Insect Control	Bayer Advanced	Imidacloprid	0.235
Green Light® Grub Control with Arena® Insecticide	The Scotts Company	Clothianidin	0.250
Green Light® Tree & Shrub Insect Control with Safari® 2 G Insecticide	The Scotts Company	Dinotefuran	2.000

PRODUCT	MANUFACTURER	ACTIVE INGREDIENT (AI)	% AI
Hi-Yield® Systemic Insect Spray	Voluntary Purchasing Groups, Inc.	Imidacloprid	1.470
Hunter .5 G Insecticide	Bayer Corporation	Imidacloprid	0.500
Hunter 75 WSP Insecticide	Bayer Corporation	Imidacloprid	75.000
Knockout Ready-to-Use Grub Killer Granules	Gro Tec, Inc.	Imidacloprid	0.200
Lesco Bandit 2F Insecticide	Bayer Environmental Science	Imidacloprid	21.400
Lesco Bandit Insecticide 0.5 G	Bayer Environmental Science	Imidacloprid	0.500
Lesco Bandit Insecticide 75 WSP	Bayer Environmental Science	Imidacloprid	75.000
Mallet® 0.5 G Insecticide	Nufarm Americas Inc.	Imidacloprid	0.500
Mallet® 2 F T&O Insecticide	Nufarm Americas Inc.	Imidacloprid	21.400
Mallet® 75 WSP Insecticide	Nufarm Americas Inc.	Imidacloprid	75.000
Marathon® 1% Granular	OHP, Inc.	Imidacloprid	1.000
Marathon® 60 WP	OHP, Inc.	Imidacloprid	60.000
Marathon® II	OHP, Inc.	Imidacloprid	21.400
Maxide® Dual Action Insect Killer Concentrate	Gulfstream Home and Garden	Thiamethoxam	0.400
Maxide® Dual Action Insect Killer Granules	Gulfstream Home and Garden	Thiamethoxam	0.200
Meridian® 0.33 G	Syngenta Crop Protection, LLC	Thiamethoxam	0.330
Meridian® 25 WG	Syngenta Crop Protection, LLC	Thiamethoxam	25.000
Merit® 0.5 G	Bayer Corporation	Imidacloprid	0.500
Merit® 2 F	Bayer Corporation	Imidacloprid	21.400
Merit® 75 WP Insecticide	Bayer Corporation	Imidacloprid	75.000
Merit® 75 WSP Insecticide	Bayer Corporation	Imidacloprid	75.000
Merit® Tree Injection	Bayer Environmental Science	Imidacloprid	17.100
Monterey Once A Year Insect Control	Lawn and Garden Products, Inc.	Imidacloprid	1.470
Monterey Once A Year Insect Control II	Lawn and Garden Products, Inc.	Imidacloprid	1.470
Ortho® Bug B Gon® Year-Long Tree & Shrub Insect Control	The Scotts Company	Imidacloprid	1.470
Ortho® Flower, Fruit & Vegetable Insect Killer	The Scotts Company	Acetamiprid	0.006
Ortho® MAX® Tree & Shrub Insect Control Ready-to-Spray	The Scotts Company	Imidacloprid	1.470
Ortho® Rose & Flower Insect Killer	The Scotts Company	Acetamiprid	0.006
Safari 2 G Insecticide	Valent U.S.A. Corporation	Dinotefuran	2.000
Safari 20 SG Insecticide	Valent U.S.A. Corporation	Dinotefuran	20.000
Season Long Grub Control Plus Turf Revitalizer	Bayer Advanced	Imidacloprid	0.250
Season-Long Grub Control	Bayer Advanced	Imidacloprid	1.470
Surrender® GrubZ Out	Control Solutions, Inc.	Imidacloprid	0.500
Termite Killer Granules	Bayer Advanced	Imidacloprid	0.370
Transtect™ 70WSP Insecticide	Rainbow Treecare Scientific Advancements	Dinotefuran	70.000
Xytect™ 2F Insecticide	Rainbow Treecare Scientific Advancements	Imidacloprid	21.400
Xytect™ 75WSP Insecticide	Rainbow Treecare Scientific Advancements	Imidacloprid	75.000
Xytect™ Infusible	Rainbow Treecare Scientific Advancements	Imidacloprid	5.000
Zylam® 20 SG Systemic Turf Insecticide	PBI/Gordon Corporation	Dinotefuran	20.000

LIST MAY NOT INCLUDE ALL HOME AND GARDEN PRODUCTS CONTAINING NEONICOTINOIDS

NATIONAL OFFICE: 660 Pennsylvania Avenue, SE, Suite 302, Washington, DC 20003 CALIFORNIA OFFICE: 303 Sacramento St., 2nd Floor, San Francisco, CA 94111
NORTHWEST OFFICE: 917 SW Oak Street, Suite 300 Portland, OR 97205

For more information visit www.centerforfoodsafety.org

CENTER FOR FOOD SAFETY

APPENDIX 3: MINNESOTA GROUPS WORKING TO PROTECT POLLINATORS

Bee Lab
https://www.beelab.umn.edu/
219 Hodson Hall, 1980 Folwell Ave., St. Paul, MN 55108
612-624-4798

BeezKneez
www.thebeezkneezdelivery.com/
2204 Minnehaha Ave, Minneapolis, MN 55404
(612) 990-9770

Humming for Bees
http://www.hummingforbees.org/
PO Box 712, Excelsior, MN 55331
(952) 470-0132

Pollinate Minnesota
www.pollinatemn.org/
Minneapolis, MN 55413
(612) 245-6384

Pesticide Action Network, North America (PAN or **PANNA)**
http://www.panna.org/
Midwest Office: 3438 Snelling Ave (Upper Level), Minneapolis, MN 55406
(612) 254-9222

Pollinator Friendly Alliance
www.pollinatorfriendly.org/
PO Box 351, Stillwater, MN 55082
(651) 351-1100

Pollinators of Native Plants (Heather Holm)
http://www.pollinatorsnativeplants.com/
Minnetonka, MN

Pollinator Revival
http://pollinatorrevival.org/
Minneapolis, MN

Organizations Focusing on Native Plants & Natural Landscaping

Prairie Restoration (focus on using native plants and a return to natural landscaping)
http://www.prairieresto.com/fire_management.shtml
Six 6 MN locations: Princeton, Scandia, Northfield, Watertown, Moorhead, Duluth
Head Quarters: 31646 128th Street, Princeton, MN 55371
(763) 389-4342

Wild Ones (focus on using native plants and a return to natural landscaping)
http://www.wildones.org/connect/chapters/minnesota-chapters/
Seven MN chapters: Arrowhead, Brainerd, Northfield, Prairie Edge (western suburbs of Minneapolis), St. Cloud, St. Croix, Twin Cities). Each city has their own phone number and address.

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Patricia Hauser, LWV South Tonka, co-chair
Amy Wenner, LWV South Tonka, co-chair
Deb Brinkman, LWV St. Louis Park
Sue Hnastchenko, LWV South Tonka
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