September 8, 2026
Maine Board of Pesticide Control Members
90 Blossom Lane, AMHI Campus, Deering Bldg.
Augusta, ME 04333
207-287-2731

Re: American Seed Trade Association Comments on L.D. 1323, Resolve, Directing the Board of Pesticides Control to Evaluate the Impact of Neonicotinoids on Pollinators, Humans, and the Environment

Dear Maine Board of Pesticide Control Members:

On behalf of American Seed Trade Association (ASTA), thank you for the opportunity to submit comments on the Maine Board of Pesticide Control's (BPC) Interim Report to Evaluate the Impact of Neonicotinoids on Pollinators, Humans, and the Environment (the "Interim Report"). We appreciate BPC's thoughtful engagement on this issue and look forward to continuing our collaborative dialogue moving forward.

1. Introduction of ASTA and Its Members. Founded in 1883, ASTA is one of the oldest trade organizations in the United States. Its membership consists of nearly 700 companies involved in seed production and distribution, plant breeding, and related industries in North America. ASTA member companies research, develop, produce, and distribute all varieties of seeds—including grasses, forages, flowers, vegetables, row crops, and cereals. Approximately 85 percent of all private U.S. seed companies operating in the United States are ASTA members, and an estimated 95 percent of ASTA's active members are small businesses that report annual sales of less than $15 million. ASTA members represent the full spectrum of plant breeding and seed development, from conventional breeding to advanced biotechnology and genome editing applications. ASTA and its members support agricultural producers of food products and farm commodities in the United States and around the world.

ASTA members have a long history of operating in accordance with applicable federal and state seed and pesticide laws, including the Federal Insecticide, Fungicide and Rodenticide Act ("FIFRA") and corresponding state pesticide laws. Of the $16–17 billion in annual seed sales by ASTA's members, more than 75% cover seeds that are treated with pesticides. These seed treatments are often applied to seeds by ASTA's members, in accordance with the seed treatments' FIFRA labels. Moreover, ASTA, working together with other stakeholders, has developed stewardship programs to educate farmers and pesticide applicators on best practices for handling and managing treated seed.

ASTA's members similarly invest substantial funds in research, development, and production of new seed varieties/cultivars and seed-treatment products. Relying on the seed treatment registrations issued by EPA and state regulators, and the continued marketability of their treated seed, ASTA's members have also invested millions of dollars in research and development of seed treatment equipment and improvements to the seed treatment application process and made additional capital investments in employee and customer training, marketing materials, and packaging. ASTA has a substantial interest in the issues raised in the Interim Report.

2. Importance of Neonicotinoid Seed Treatments to U.S. Agriculture. Seed treatments and treated seed offer many important benefits to U.S. agriculture. Seed treatments provide a precise mode of applying pesticides, protecting the seed during its most vulnerable developmental stages and before emergence from the soil. This method of protection helps to suppress and control pathogens, insects, or other pests that threaten seed viability and health before the seed enters the soil through its development. Indeed, the pests these pesticides are designed to mitigate can damage both seed and developing seedling at or below the soil surface, and treated seeds are often the only tool that growers have to protect this vulnerable stage of plant growth. Seed treatments help to ensure that the plant has a greater opportunity to grow a strong root system, which is the foundation of a healthy, productive plant. Seed treatments help safeguard expensive, high-value, high-quality seed and, thus, growers' seed investments.

Since their introduction decades ago, seed treatments have been rapidly adopted by growers for numerous reasons. In addition to their effectiveness, seed treatments are easy for growers to handle and use, permit earlier and faster planting, allow for precise and low dose applications of pesticides, and provide an economical alternative to traditional soil or broadcast applications. Over decades of use, the agriculture industry has developed and advanced new technologies to improve the treated seed process, reducing overall pesticide load to only milligrams of active ingredient per individual seed. Seed treatments therefore may reduce the environmental impact by decreasing the number and dose of spray applications of agrichemical products and lessening exposures to off-target species, including pollinators and other beneficial insects. Seed treatments are also crucial components in modern integrated pest management (IPM), enabling growers to control some of their most challenging pests and reduce the likelihood of resistance.

Clothianidin, thiamethoxam, and imidacloprid, in particular, are critically important neonicotinoid insecticides that help control a wide range of harmful insect pests. These pesticides are used as a seed treatment on numerous types of crop seeds planted in the United States, including soybeans, grain, cotton, corn, beets, peanuts, onions, leafy vegetables, rice, and more. Seed treatments have proven remarkably successful in controlling pests and improving plant populations and crop yields. Seed treatments permit more seeds to reach crop maturity, and produce healthier, more abundant crops on the same acreage than those same seeds would without treatment. For example, an analysis of 1,550 field studies conducted over twenty years shows that neonicotinoid seed treatments provide average yield increases between 3.6 and 71.3 percent in eight major North American crops.[1]

In sum, growers' adoption of seed treatment products reflects the efficacy and quality of these products, their importance to the agricultural economy, and their value in meeting growers' needs to better protect their investment.

3. Market Availability. The Interim Report referenced the market availability of neonicotinoid-treated seeds compared to untreated seeds. Across U.S. agriculture, growers, seed companies, breeder/producers, and seed retailers can choose from a wide variety of untreated seed, or seed treated with specific pesticides and pesticide combinations. Seed treatment applications are made by seed companies, breeder/producers, and retailers, as well as by seed treatment technology providers that add value by conditioning, priming, pelleting, encrusting, or film coating seeds. Treated seed reaches the market either by "downstream" to retailers, or back "upstream" to the seed companies for direct sales to growers.

Thus, the seed treatment process, including when, where, and how seeds are treated, is not a one-size-fits-all approach and can vary widely based on farmer needs and pest pressures to meet the specific demands for an upcoming planting season. For some crops, such as corn, customer treatment demands and projected cultivation volumes require seed treatment in advance of customer order and based on demand projections. But that is not the approach for all crops or all farms. For crops that do not face consistent pest or disease pressure and require minimal processing in preparation for cultivation, it is common to apply desired treating pesticides "just in time", i.e., within a few days of transporting to the grower customer, or for the farmer to apply seed treatments on-farm. In these cases, seed is treated by customer order to tailor the application to local needs. Thus, the availability of treated seed in U.S. agriculture is calibrated to and reflective of farmer demand in a particular growing season.

4. Comparative Risk and Use Patterns. We urge that, as the Maine Board of Pesticides Control reviews its neonicotinoid program, it consider the comparative risk and use patterns of seed treatments as compared to other application methods. It has been well documented that seed treatment applications of neonicotinoids represent a lower-risk use

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[1] *See* AgInfomatics, LLC, *The Value of Neonicotinoids in North American Agriculture*, Executive Summary, at vi (2015), https://aginfomatics.com/uploads/3/4/2/2/34223974/executive_summary_neonicotinoids.pdf.

pattern compared to foliar and soil applications of the same compounds.[2] Because seed treatments deliver a targeted and precise application of active ingredient directly to the seed at very low per-unit rates, the amount of pesticide that ultimately translocates to pollen and nectar is substantially less than the concentrations resulting from broadcast foliar sprays or soil drench techniques applied at comparable rates.[3] As a result, EPA's risk assessments have made low-risk conclusions for on-field exposures associated with virtually all neonicotinoid seed treatment uses, finding that residues were all below the no-observed-adverse-effect concentration ("NOAEC"), indicating low risk of colony-level effects.[4]

EPA has reached similar conclusions regarding off-field exposure, further underscoring the environmental protectiveness of seed treatments. EPA has found that seed treatments—which deliver the active ingredient in a contained manner at or before planting—virtually eliminates risk from spray drift and presents the "lowest overall aquatic risk profile."[5]

For example, EPA recently issued Biological Evaluations ("BEs") for these active ingredients pursuant to the Endangered Species Act, which evaluated effects on over 1,700 listed species and over 800 designated critical habitats. EPA found that estimated environmental concentrations ("EECs") from foliar and soil treatments "are orders of magnitude greater than aquatic EECs from seed treatments."[6] Based on this finding, EPA concluded that "exposures and associated risks from flowable uses are assumed to be protective of seed treatment uses"—meaning that the environmental exposures modeled for spray applications encompass and exceed those attributable to seed treatments. Indeed, EPA's consideration of seed treatment uses in the BEs did not result in any additional "likely to adversely affect" determinations beyond those already triggered by the higher-exposure spray applications, and EPA characterized the limited additional

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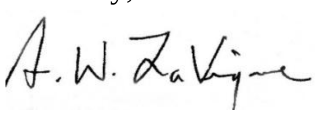
[2] *See* EPA, *Final Bee Risk Assessment to Support the Registration Review of Clothianidin and Thiamethoxam* at 16, 213 (Jan. 14, 2020) [hereinafter "TMX Assessment"], § 1.2, § 5.3; EPA, *Preliminary Bee Risk Assessment to Support the Registration Review of Imidacloprid* at 257 (Jan. 4, 2016) [hereinafter "IMD Assessment"], § 6).
[3] S*ee* TMX Assessment at 36–42, § 2.4, Tables 2-1, 2-3 & 2-4; IMD Assessment at 40–42, 44–46, §§ 3.1.1, 3.1.3, Tables 3-1 and 3-3.
[4] TMX Assessment at 16–17, 64, 125–127, § 1.2, § 5.2.2, Tables 5-14 & 5-15; IMD Assessment at 253–257, 289, § 6, Table 7-1.
[5] TMX Assessment at 19, 55–56, §§ 2.8.2–2.8.3; IMD Assessment at 19, 55–56, §§ 2.8.2–2.8.3; EPA, *Preliminary Aquatic Risk Assessment to Support the Registration Review of Imidacloprid* (Dec. 22, 2016), at 8.
[6] EPA, Biological Evaluation for Imidacloprid, Appendix 4-5 at 1 (June 2022) [hereinafter "IMD BE"]; EPA, Biological Evaluation for Clothianidin, Appendix 4-5 at 2 (June 2022) [hereinafter "Clothianidin BE"].

determinations made for seed-eating species as supported by only the "weakest evidence."[7]

Taken together, EPA's findings confirm that seed treatments use less active ingredient per acre, produce lower residue concentrations in bee-relevant matrices, and present a more contained exposure profile than alternative application methods, making them a more environmentally protective means of deploying neonicotinoid crop protection.[8] As the Board considers its regulatory framework regarding neonicotinoids, and particularly neonicotinoid-treated seeds, the Board should consider that seed treatments represent a fundamentally lower-exposure, lower-risk use pattern relative to alternative applications.

Conclusion. Thank you for your consideration of these comments. ASTA and its members support the continued availability and use of treated seeds for Maine growers. Treated seeds are a proven, effective, and environmentally responsible tool. ASTA urges the Board to ensure any policy recommendations preserve access to these critical inputs. We welcome the opportunity to continue this important dialogue.

Sincerely,



Andy LaVigne
CEO and President
American Seed Trade Association

[7] IMD BE, Appendix 4-5 at 1–3; Clothianidin BE, Appendix 4-5 at 3–4.
[8] *See generally* TMX Assessment at 16–19, 213–215, §§ 1.2, 5.3; IMD Assessment at 16–19, 213–215, §§ 1.2, 5.3.

July 7, 2026

Alexander Peacock, Executive Director
Maine Board of Pesticides Control
Alexander.R.Peacock@maine.gov

Dear Mr. Peacock and Members of the Board:

On behalf of the Wild Blueberry Commission of Maine, thank you for the opportunity to provide input in response to the Board's Request for Information, pursuant to the Chapter 69 Resolve passed into law and originating from LD 1323 in June of 2025.

Maine's wild blueberry agroecosystem is an inherently low-input crop. These wild plants have existed in the region for thousands of years, first managed by alternate year burning by the Wabanaki. Today, the natural diversity and an alternate year stewardship cycle help maintain natural resilience to pest pressure. While some plants are more susceptible to certain pests and diseases, the neighboring individual may carry some level of resistance – this is not true of other agricultural systems where genetically identical individual plants are planted out by the millions. We manage our wild fields on a prune year-harvest year cycle, breaking the life cycle of many pests when fruit is not produced in each alternate year. These wild attributes make the wild blueberry system inherently low-input, helping our producers to maintain and even build healthy populations of pollinators—as documented by research.[1, 2, 3] Continued and safe delivery of one of the world's healthiest wild foods, does require some management, especially as new and invasive pests continue to appear in the landscape. Our low level of management ensures that our products continue to exceed the standards of consumers and buyers and allows us to manage invasive pests and diseases.

The Maine wild blueberry industry depends on healthy populations of native pollinators. Wild blueberry flowers require multiple bee visits to produce fruit, making pollinator conservation not simply an environmental objective, but an economic necessity for our growers. Over the past four decades, University of Maine research and Cooperative Extension programs have helped producers adopt management practices that minimize risks to pollinators while maintaining effective pest management. Today, it is standard practice for growers to employ not just Integrated Pest Management, but Integrated Pest and Pollinator Management (IPPM). In accordance with IPPM, it is also standard practice not to make neonicotinoid applications during bloom because growers recognize that protecting pollinators is essential to producing a crop.

As the Board evaluates the available information, we encourage it to place weight on Maine-specific scientific evidence. A statewide University of Maine study that sampled wild bumble bees from agricultural and non-agricultural landscapes throughout Maine found no detectable neonicotinoid residues in pollen collected from 176 bees.[1] More recent University of Maine research has found no evidence that wild bee diversity or species richness in Maine wild blueberry fields declined in 2021-2023 relative to surveys conducted approximately a decade earlier (2010-2012).[2] In addition, Maine landscape-scale research has shown that, particularly in Downeast Maine, the presence of wild blueberry fields in a landscape is associated with greater native bee diversity in the surrounding landscape,[3] suggesting that current IPPM management of this crop is compatible with maintaining healthy wild bee communities.

We also encourage the Board to consider the rapidly evolving federal regulatory landscape. The U.S. Environmental Protection Agency is implementing the most significant modernization of pesticide risk mitigation in decades through its Endangered Species Act workplan and associated mitigation strategies. Under this framework, pesticide labels increasingly require applicators to implement site-specific measures to reduce runoff, erosion, spray drift, and other pathways of environmental exposure before applications may be made – all to minimize impacts to threatened and endangered species. These requirements continue to expand as products undergo registration review and are specifically intended to address environmental risks through scientifically informed, product-specific mitigation measures.[4]

As the Board considers whether additional state action is warranted, it is also important to recognize that the EPA's mitigation strategies were designed to provide nationally consistent protections through enforceable federal labeling requirements. Unless Maine-specific evidence demonstrates that additional measures are necessary, more restrictive state requirements would place Maine producers at a competitive disadvantage with producers in other growing regions, without producing commensurate environmental benefits.

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[1] Butler, R.G. et al. 2021. Maine's bumble bees (Hymenoptera : Apidae)—part 2 : comparisons of a common (Bombus ternarius) and a rare (Bombus terricola) species. *Environmental Entomology, 50*(6), 1358-1369

[2] Fanning, P., and S. Bushmann. (unpublished data). Resampling of wild bee populations in Maine wild blueberry: determining status and developing long-term trends in pollinator communities. Unpublished.

[3] Du Clos, B., F. A. Drummond, C. S. Loftin. 2022. Effects of an early mass-flowering crop on wild bee communities and traits in power line corridors vary with blooming plants and landscape context. *Landscape Ecology, 37*(10), 2619-2634.

[4] Environmental Protection Agency (EPA). 2024. Implementing EPA's Workplan to Protect Endangered and Threatened Species from Pesticides. Updated November 22, 2024. https://www.epa.gov/endangered-species/implementing-epas-workplan-protect-endangered-and-threatened-species-pesticides. Accessed on April 15, 2025.

The Wild Blueberry Commission appreciates the Board's careful consideration of this issue and respectfully encourages decisions that are grounded in Maine-specific science, recognize the industry's reliance on and careful stewardship of healthy pollinator populations, and account for the substantial changes already occurring within the federal pesticide regulatory system.

Thank you for your consideration. We would be pleased to provide any additional information that may assist the Board in its review.

Sincerely,

Eric Venturini
Executive Director
Wild Blueberry Commission of Maine

August 25st, 2026

Alexander Peacock, Executive Director
Maine Board of Pesticides Control
Alexander.R.Peacock@maine.gov

Dear Mr. Peacock and Members of the Board:

On August 21, 2026, I provided testimony on behalf of Maine's wild blueberry industry in response to the Board's Request for Information, pursuant to the Chapter 69 Resolve passed that originated from LD 1323 in June of 2025. Following my comments, Mr. Curtis Bohlen requested more information on use of neonicotinoids in Maine's wild blueberry industry.

The short answer to Mr. Bohlen's question is, judiciously and in close adherence to the time-tested and scientifically backed guidance provided to our farmers by University of Maine research and Extension specialists. Wild blueberry farmers have had the benefit of the advice and guidance of one of the world's most prominent wild and honey bee researchers since the 1980's, Dr. Frank Drummond. During his tenure, he led extensive research on the health and management of wild and domestic pollinators of Maine's wild blueberry system. He educated our growers about responsible use of crop protectants, including neonicotinoids, and effective application of Integrated Pest and Pollinator Management. I personally had the honor of serving as one of Dr. Drummond's advisee's during my own graduate career at the University of Maine. Today, Dr. Drummond's work is carried on by his replacement, Dr. Phil Fanning – an equally talented entomologist who is dedicated to carrying on this body of work.

This long partnership between Maine's wild blueberry producers and Dr. Drummond (now Dr. Fanning), is one of great trust. Our farming community closely follows not only pollinator restrictions on labels, but the trusted Maine research-based guidance that Dr. Fanning issues annually on how to employ neonicotinoids and other tools as part of an effective Integrated Pest and Pollinator Management strategy in wild blueberries.

Please find below a table that lists the neonicotinoids in Extension's recommended crop protectants,[1] along with pollinator guidance for each product. These recommendations are

[1] Fanning, P. 2026. 2026 Pest Management Guide: Insect, Cultural Insect Management. Are you sure you need to act? The University of Maine Cooperative Extension, Orono, ME 04469, January 2026.

consistent with use in our industry. I would point your attention to the "use" column, describing that these products are used for Blueberry Maggot Fly (BMF), Spotted Wing Drosophila (SWD), and thrips. Both BMF and SWD are not managed until well after bloom. Pollinators are in wild blueberry fields turning flowers into fruit mid-May to mid-June, whereas SWD does not appear in fields until July 1 (absolute earliest), and more often not until in mid-July.[2] The Blueberry Maggot Fly can emerge as early as mid-June, but does not reach threshold management levels until 971 degree days[3] (typically late July or early August). My point is that management timing of BMF and SWD does not align with bloom timing, and therefore the impact of BMF and SWD Integrated Pest and Pollinator Management (IPPM) on pollinators is negligible.

Thrips, similarly, are controlled in the prune year of the wild blueberry system, not during the crop year when flowers would be present. Again, due to timing, any impact of neonicotinoid applications for thrips control would be negligible on pollinators. For all three pests, producers rely on University of Maine recommendations for monitoring, thresholds, cultural, and protectant management strategies.[4]

Sincerely,

Eric Venturini
Executive Director
Wild Blueberry Commission of Maine

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[2]Drummond, F., E. Ballman, J. Collins. 2019. Population Dynamics of Spotted Wing Drosophila (*Drosophila suzukii* (Matsumura)) in Maine Wild Blueberry (*Vaccinium angustifolium* Aiton). *Insects* 2019, *10*(7): 205. https://doi.org/10.3390/insects10070205

[3]Dill, J., F. Drummond, and D. Yarborough. 2001. 201-Monitoring for the Blueberry Maggot Fly (*Rhogoletis mendax* Curran). Fact Sheet No. 201, University of Maine Cooperative Extension No. 5030.

[4] Drummond, F. 2012. 202-Blueberry Thrips. Fact Sheet No. 202, University of Maine Cooperative Extension No. 2373.

2026 PEST MANAGEMENT GUIDE: INSECT

THE UNIVERSITY OF MAINE
Cooperative Extension

Cultural Insect Management

Are you sure you need to act?

It is critical that we make sure an insect pest is present at damaging levels in a field before taking management action. Managing an insect is expensive in labor, equipment, and products, so make sure you have a problem before taking action.

Scouting and adopting action thresholds to inform management decisions is key to reducing unnecessary or untimely applications of pesticides. Comprehensive guides and information on how to scout and trap insects, and recommended action thresholds for insect pests can be found here:

https://extension.umaine.edu/blueberries/factsheets/insects

CULTURAL INSECT MANAGEMENT IN WILD BLUEBERRY

INSECTS	METHOD	COMMENTS
Blueberry Maggot	Harvesting	Harvesting techniques that reduce fruit loss can minimize the number of infested fruits left on the plants and on the ground.
	Management	Keep isolated fields in the same cycle.
	Winnower cleanup	Compost, burn or dispose of winnower refuse.
Flea Beetle, Sawfly, Spanworm	Fire pruning	Blueberry litter must be ignited.
Thrips	Fire pruning	Burn curled stems as soon as extensive curling occurs in early spring, but not later than July 1 in a nonbearing crop or reduction in next year's fruit buds will occur.
Spotted wing drosophila	Early harvest	Monitor adult and larval populations; Refer to Cooperative Extension Bulletin No. 210, *Spotted Wing Drosophila: Pest Biology and IPM Recommendations for Wild Blueberries* for additional information.

Chemical Insect Management

THIS CHART IS NOT A SUBSTITUTE FOR READING AND FOLLOWING THE LABEL. It is unlawful to use any pesticide for other than the registered use. Read and follow the label on the product container. The user assumes all responsibility for use inconsistent with the label. Trade names are used for identification. No product endorsement is implied, nor is discrimination intended against similar materials. Cooperative Extension makes no warranty or guarantee of any kind concerning the use of these products. **Check with your processor regarding PHI restrictions or MRL restrictions for export sales. For organic growers, check with your certifier that the product is approved by them and that the product has current OMRI certification.**

Extremely toxic to fish
Moderately toxic to fish
Can be aerially applied
Extremely toxic to bees
Moderately toxic to bees
Extremely toxic to birds
Moderately toxic to birds
Extremely toxic to people
Moderately toxic to people

Spotted Wing Drosophila Control **0=Not Effective** **1=Slightly Effective** **2=Moderately Effective** **3=Effective** **4=Very Effective**

INSECTICIDES WITH ENVIRONMENTAL PERSISTENCE

GROUP[a] USE[b] & TOXICITY		AERIAL APPLICATION	INSECTICIDE	ACTIVE INGREDIENT & SIGNAL		RATE: PER/ACRE & MAX/ACRE/YR	PHI DAYS	REI HRS.	NOTES
BMF THRIPS			Admire Pro Systemic Protectant	imidacloprid	CAUTION	Foliar 2.1 to 2.8 oz **Max:** Foliar: 5 app; 14 oz (0.5 lb ai) for all	foliar 3	12	Do not use prior to or during bloom. Highly toxic to bees if used as a foliar spray during bloom. **Foliar**: For sprout application during emergence of thrips and tip midge. Apply at least 7 days apart. <u>Human & Environment:</u> **S, 7 day persistence**
BMF FB SWD	2		Assail 30 SG	acetamiprid	CAUTION	4.5 to 5.3 oz (SWD – 5.3 oz) **Max:** 5 app; 26.7 oz (0.5 lb ai)	1	12	Do not apply more than once every 7 days. Add 1 lb/a sugar to spray tank to enhance performance for SWD ONLY. Toxic to bees exposed to direct treatment; do not apply while bees are actively visiting treatment area. <u>Human & Environment:</u> **S, 7 day persistence**
			Assail 70 WP			1.7-3.0 oz **Max:** 2 App; 6 oz (0.26 lb ai)			
BMF SWD THRIPS	2		Montana 2F	imidacloprid	CAUTION	Foliar 4.8 to 6.4 oz **Max:** Foliar 5 app; 32 oz (0.5 lb ai) for all	3	12	**Foliar**: Apply at least 7 days apart. Rotate to another mode of action after 3 applications. Do not apply foliar after applying a soil application of any Group 4A product. Avoid use prior to and during bloom. Highly toxic to bees. Sprout application during emergence for thrips; make 1st application when sprouts are 0.25-0.5 inch, 2nd application when sprouts are 0.5-1 inch. <u>Human & Environment:</u> **S, 7 day persistence**
			Montana 4F			Foliar 2.4 to 3.2 oz **Max:** Foliar 5 app;16 oz (0.5 lb ai)			

September 8, 2026

Submitted via email to: pesticides@maine.gov

Maine Board of Pesticides Control
c/o: Mr. Alexander Peacock
28 State House Station
Augusta, ME 04333

Re: Comments on the Maine Board of Pesticides Control Neonicotinoid Study Pursuant to L.D. 1323

Dear Members of the Board,

CropLife America (CLA) appreciates the opportunity to provide comments to the Maine Board of Pesticides Control regarding the Board's study of neonicotinoid insecticides and neonicotinoid-treated seed. CLA represents the developers, manufacturers, formulators, and distributors of pesticide products used by farmers, foresters, public health officials, and consumers across the United States. CLA member companies are committed to protecting human health, supporting agricultural productivity, and advancing science-based environmental stewardship.

CropLife America supports the Board's effort to evaluate the available information regarding neonicotinoids and recognizes the importance of human health, pollinator health, environmental protection, and public confidence in pesticide regulation. As the Board conducts its review, we encourage adoption of a risk-based framework consistent with EPA's registration process, which considers exposure, use patterns, the effectiveness of mitigation measures, and comparative risk in addition to hazard. EPA has already completed extensive pollinator risk assessments for neonicotinoids and incorporated mitigation measures into registered product labels[1,2,3]. These existing assessments should be considered alongside any state review, together with the benefits of neonicotinoid uses and the practical implications of alternative pest management approaches.

I. **Pollinator Impacts**

CLA recognizes the importance of insect pollinators to agricultural productivity and food production. Protection of pollinator health is a shared goal among growers, beekeepers, regulators, researchers, and pesticide manufacturers. As the Board evaluates available information on neonicotinoid insecticides, it is important to consider the full range of factors recognized by scientists as affecting pollinator populations and honey bee health. Honey bees and other pollinators are exposed to a variety of biological, environmental, nutritional, and management-related stressors throughout their lifecycle. Scientific assessments conducted by government agencies and researchers have consistently recognized that honey bee health cannot be attributed to any single factor. Rather, observed declines and episodic colony losses are generally understood to result from the interaction of multiple stressors acting simultaneously.[4,5,6,7,8,9]

Among the factors identified by researchers as influencing honey bee health are:

- Parasites such as varroa mites, *Varroa destructor* .
- Viral, bacterial, and fungal diseases affecting honey bee colonies.
- Nutritional stress resulting from poor forage quality or limited forage diversity.
- Habitat loss and habitat fragmentation.
- Climatic and weather-related stressors.
- Transportation-related stress associated with commercial pollination services.
- Beekeeping and colony management practices.
- Exposure to environmental contaminants, including pesticides.

The Board's evaluation should therefore consider pesticide exposure within the broader context of pollinator health rather than evaluating any single factor in isolation.

i. Real-World Versus Laboratory Findings

Neonicotinoid insecticides have been used globally for more than two decades and have been reviewed by regulatory authorities in numerous jurisdictions. As a result, an extensive body of laboratory and field research has been generated examining potential effects on pollinators. [10,11]

Distinguishing between laboratory observations on individual bees and demonstrable effects on honey bee colonies is particularly important because colony-level outcomes represent the biologically relevant endpoint for evaluating long-term pollinator sustainability.

ii. Recommended Framework for the Board

CLA encourages the Board to evaluate pollinator impacts using a comprehensive, science-based framework that:

- Recognizes the multifactorial nature of honey bee health.
- Distinguishes between hazard and actual risk.
- Considers colony-level outcomes alongside laboratory observations.
- Evaluates the influence of disease, parasites, nutrition, habitat availability, and management practices.
- Evaluates potential recommendations within a comparative risk framework.

Such an approach is most likely to identify the factors that meaningfully influence pollinator health while supporting informed, science and risk-based policy decisions to protect agriculture and other green spaces.[12]

II. Environmental Impacts

Environmental protection is a central component of pesticide regulation in the United States. Before registration, pesticides undergo extensive environmental reviews addressing ecological effects, environmental fate, transport, persistence, and potential exposure to non-target organisms. These evaluations continue throughout EPA's registration review process and are regularly updated as new scientific information becomes available.

Treated seeds represent a targeted pest management approach that places protection directly on or near the seed during the earliest and most vulnerable stages of crop establishment. This delivery system differs substantially from many conventional application methods because treatment occurs prior to planting and protection is concentrated where pest pressure is most likely to occur. Restricting access to treated seed would provide no clear environmental benefits but would force growers to take the risk that the seed and seedling will be attacked by pests below ground and that the young plant will die before foliar insecticide applications can be made. Treated seeds help protect developing crops while reducing the need for later-season rescue applications.

The Board should also consider environmental tradeoffs associated with alternative pest management strategies. Evaluating only the potential risks associated with pesticide-treated seed may provide an incomplete picture of environmental outcomes. Alternative approaches may involve additional field operations, greater reliance on foliar applications, increased fuel consumption, increased worker activity in treated fields, or substitution with products that present different environmental profiles. Any assessment should therefore consider both direct and indirect consequences associated with potential changes in pest management practices.

CLA encourages the Board to evaluate environmental impacts within a comparative framework that considers both the risks and benefits of available pest management options.

III. Human Health Considerations

The protection of human health is a foundational objective of pesticide regulation. EPA conducts comprehensive human health risk assessments addressing dietary exposure, occupational exposure, residential exposure, drinking water considerations, and aggregate risk.[13,14,15,16] Products are registered only after EPA determines they can be used safely in accordance with approved labeling requirements.

As with environmental and pollinator assessments, human health evaluations are based on both hazard and anticipated exposure. This distinction is important when evaluating neonicotinoids and treated seeds because use patterns can significantly influence the likelihood and magnitude of human exposure. Seed treatment technologies may offer certain exposure-related advantages because treatment occurs before seed reaches the grower and protects crops during early development without the field exposure associated with foliar application.

CLA encourages the Board to rely upon established human health risk assessments and actual exposure considerations when evaluating potential human health impacts associated with neonicotinoid products.

IV. Market Availability

The Board's evaluation should consider not only whether alternatives to neonicotinoid-treated seed exist in theory, but whether those alternatives are available, practical, and capable of providing comparable protection under real-world farming conditions.

Agricultural production decisions are inherently made in the face of uncertainty. Growers must routinely balance risk, cost, and expected benefit when selecting seed, crop protection products, and other production practices. These decisions are often made months before planting and long before pest pressure for a given growing season can be accurately predicted.

For many crops, seed purchasing decisions are made well in advance of the planting season. Growers frequently place seed orders months before fields are planted and before they have sufficient information to determine whether economically significant populations of soil-borne or early-season insect pests will be present. As a result, decisions regarding treated seed cannot be evaluated solely in hindsight based on whether pest pressure ultimately materialized in a particular year. Rather, these decisions represent a proactive risk-management strategy intended to protect yield potential and preserve crop establishment during the most vulnerable stages of development.

This consideration is particularly important because many pests targeted by seed treatments can cause significant economic damage before they are detected or before corrective actions can be implemented. Unlike certain foliar pests that can be monitored and managed after plant emergence, many soil insects and seedling pests are difficult or impractical to scout effectively prior to planting. Once damage becomes evident, opportunities for intervention, such as replanting of the crop, may be limited or unavailable, particularly in Maine's short growing season.

The Board should also recognize that market availability extends beyond the physical availability of untreated seed. Seed production, treatment, distribution, and sales systems are planned well in advance of each growing season. Seed is grown, not manufactured, and its production cannot be as easily altered or diverted as can goods produced in a factory. Significant changes in demand for treated or untreated seed can require adjustments to the variety of seed crops grown generations before in the seed supply chain, impacting seed production decisions made one or more seasons before planting. Accordingly, assessments of alternative availability should consider logistical, agronomic, and timing constraints that may affect a grower's ability to access suitable alternatives.

Evaluations of market availability should therefore account for:

- Timing of seed production and purchasing decisions.
- Availability of untreated seed in commercially meaningful quantities.
- Crop-specific and regional differences in pest pressure.
- The ability of alternative practices to provide comparable protection during early crop establishment.
- Supply chain considerations affecting seed availability and grower access.
- The role of treated seed as a risk-management tool in situations where pest pressure cannot be accurately predicted prior to planting.

Ultimately, growers are tasked with making management decisions that maximize the likelihood of a successful crop while balancing environmental stewardship, economic sustainability, and operational risk. Any evaluation of neonicotinoid-treated seed should recognize the inherent uncertainty under which these decisions are made and the importance of maintaining practical tools that allow growers to manage risk before losses occur.

IV. Additional Considerations

i. Costs and Benefits

The Board's study should consider both risks and benefits associated with neonicotinoid uses. Available information indicates that these products can contribute to crop establishment, pest management, yield protection, and economic sustainability for growers. Evaluating risks without considering benefits may result in an incomplete understanding of their overall role in agricultural production. Any analysis should be grounded in the real-world agronomic and economic benefits of treated seed — including avoided crop loss, reduced replanting, reduced pesticide and equipment costs, and minimizing pesticide exposure.[17, 18] The Board must fully account for the costs and risks any proposed regulations would impose on agriculture and rural communities, consistent with the statutory standard of “unreasonable adverse effects on the environment.”

ii. Alternatives and Comparative Risk

The appropriate policy question is not whether alternatives to neonicotinoid seed treatments exist, but whether those alternatives provide comparable efficacy, availability, environmental performance, and human health outcomes. Any evaluation should compare the likely outcomes associated with alternative pest management approaches, including differences in application methods, worker handling, number of applications, operational complexity, and overall pest control effectiveness, rather than considering neonicotinoid seed treatments in isolation.

This comparative approach is consistent with the U.S. Department of Agriculture’s National Integrated Pest Management Roadmap, which defines Integrated Pest Management (IPM) as a sustainable, science-based decision-making process that combines biological, cultural, physical, and chemical tools to identify, manage, and reduce pest risks while minimizing overall economic, health, and environmental impacts. Insecticide seed treatments are an important component of many growers' IPM programs because they provide targeted protection against damaging pests during critical stages of crop establishment, often reducing the need for broader insecticide applications. Growers incorporate treated seed into comprehensive IPM strategies and implement stewardship best management practices (BMPs) related to seed handling, planter-dust reduction, proper disposal, pollinator protection, buffer practices, and environmental stewardship.[19] When paired with these BMPs, treated seed allows growers to target insect pests while helping protect beneficial insects and maintain a diverse pest management toolbox. Real-world examples from growers regarding how treated seeds are incorporated into their IPM programs would provide valuable context for understanding the practical role these technologies play in supporting crop production, environmental stewardship, and pollinator protection.

V. Conclusion

CLA appreciates the Board's efforts to evaluate available information regarding neonicotinoids and treated seeds. As the Board develops findings and recommendations, we respectfully encourage reliance on established scientific risk assessment principles, consideration of existing federal regulatory reviews, evaluation of comparative risks and benefits, and recognition of the diverse use patterns and pest management needs that exist within Maine agriculture.
A science-based, exposure-focused, and comparative risk approach will provide the most effective framework for evaluating neonicotinoid insecticides and treated seed technologies while supporting the Board's shared goals of protecting pollinators, safeguarding environmental resources, preserving human health, and maintaining resilient agricultural systems.

Sincerely,

Dillon Gabbert
Director, State Regulatory Affairs
CropLife America
4201 Wilson Blvd.
Arlington, VA 22203

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September 8, 2026

Maine Board of Pesticide Control Members
90 Blossom Lane, AMHI Campus, Deering Bldg.
Augusta, ME 04333

July 20, 2026

Amanda Albers
State Regulatory Engagement Lead

Bayer Crop Science LLC
Regulatory Science

800 N Lindbergh Blvd
St. Louis, Missouri 63167
United States

amanda.albers@bayer.com

www.bayer.com

RE: ***Neonicotinoid Stakeholder Input from Bayer Crop Science under LD 1323***

Bayer Crop Science (Bayer) is submitting this information for your consideration as you evaluate the potential impacts and benefits of neonicotinoid use in Maine as requested under LD1323.

Thank you for considering these comments. We would be pleased to discuss any questions or provide additional information as needed. Please feel free to reach out to me by phone at 314-343-6014 or email at amanda.albers@bayer.com.

Sincerely,

Amanda Albers

Amanda Albers
State Regulatory Engagement Lead

Bayer Crop Science Input on L.D. 1323, Resolve, Directing the Board of Pesticides Control to Evaluate the Impact of Neonicotinoids on Pollinators, Humans, and the Environment

There are many studies that have been conducted with the major neonicotinoid insecticides, primarily consisting of those that have been published in scientific journals and those in the grey literature such as industry-funded studies conducted to support registration of these compounds. These studies conducted by Bayer and other registrants are often conducted using US EPA as well as other international guidelines and under the strict Good Laboratory Practices rules and system. Both types of studies should be evaluated for scientific quality and applicability in any assessment of these compounds. The US EPA has integrated these studies as appropriate into several ecological risk assessments covering aquatic and terrestrial systems, pollinators and endangered species. These assessments should serve as the starting basis for any review of these compounds.

The US EPA conducted an ecological risk assessment for the registration review of imidacloprid and released these in three parts: an aquatic-specific assessment in 2017 (US EPA 2017a), a non-pollinator terrestrial assessment in 2017 (US EPA 2017B) and a pollinator-specific assessment that was finalized in 2020 (US EPA 2020). These assessments were conducted jointly with the PMRA in Canada (now PRD) and California Department of Pesticide Regulation. In 2022, the Agency finalized a national-level Biological Evaluation (US EPA 2022) for imidacloprid assessing the risks to federally threatened and endangered species. These assessments are based on methods and approaches developed and refined by the EPA over decades of conducting pesticide risk assessments using quantitative methods for evaluating hazard and exposure then integrated them into estimates of risk. Published journal studies as well as unpublished industry studies conducted under good laboratory practices as defined by the EPA were reviewed and evaluated for quality for inclusion in these assessments.

As imidacloprid is an insecticide, two broad areas of particular interest are the risk to aquatic and terrestrial invertebrates (or more specifically, arthropods). The examples below demonstrate the comprehensiveness of the EPA's assessments as well as the wealth and breadth of scientific data used in these assessments.

In the Effects Characterization, chapter 2 of the Biological Evaluation for imidacloprid (US EPA 2022), a total of 65 acute freshwater aquatic invertebrate studies were used to construct a species sensitivity distribution that covered 41 distinct species. It is remarkably rare that this many freshwater invertebrate species and studies are available for a given pesticide. As described in the Insecticide Strategy Case Studies (US EPA 2024), the EPA further divided the acute aquatic invertebrate data into three taxonomic groups: mollusks, crustaceans and insects. Notably, there was sufficient representation of species, that the EPA constructed species sensitivity distributions separately for both crustaceans and insects. Ultimately the Agency derived acute toxicity endpoints based on the highest 5th percentile of sensitive species in each group with values of 26.1 and 1.1 µg/L for crustaceans in insects respectively. These endpoints are used to characterize risk to individuals of threatened and endangered species. In addition, the EPA developed a population-level acute endpoint (20.7 µg/L) to evaluate the risk of a threatened or endangered species that generally rely on aquatic invertebrates that would be impacted by habitat or prey loss due to imidacloprid exposure.

The pollinator-specific assessment (US EPA 2020) conducted by the EPA for the registration review of imidacloprid was based on a relatively recent substantial update to their risk assessment methodology for pollinators released in 2014 (US EPA 2014). This methodology was developed jointly with the PMRA of Canada and California Department of Pesticide Regulation and was reviewed by an independent Scientific Advisory Panel of outside experts before being implemented. The overall structure of the pollinator assessment is a tiered approach, with the lowest tier being represented by laboratory toxicity studies integrated with modeled exposure estimates. As one moves up the tiers, greater environmental realism is incorporated at the cost of greater complexity.

The first tier of the pollinator assessment uses laboratory studies to characterize toxicity (hazard), while conservative models or default assumptions are used as exposure estimates. Not surprisingly, as insecticides are designed and applied to control insects, most uses of insecticides exceed EPA's level of concern at this tier. Consequently, the risk assessment is refined by using studies with greater environmental realism than those conducted in laboratories.

In the second tier, exposure is based on residue trials in the specific crops for a pesticide's label. As imidacloprid has a wide range of use patterns, Bayer conducted and submitted to the EPA sixty-six pollen and nectar residue studies, some conducted over multiple years, to support imidacloprid's registration. The EPA evaluated and used these trials along with relevant literature studies from the published literature of sufficient quality to characterize exposure to pollinators in their assessment. This analysis is also supported by using residue trials results from clothianidin and thiamethoxam as additional lines of evidence for the exposure characterization. Toxicity was also refined in the second tier using a large scale colony feeding study in which 96 colonies spread over 12 separate apiaries were force-fed treated sucrose solution over a six week period. The data evaluation report (DER) for this specific study, in which the EPA reviews and independently conducts statistical analysis of the study data, is 166 pages in length and is available online (US EPA 2016).

The final, third tier of pollinator risk assessment is the full field study. For these studies, honey bee colonies are placed in the middle of large fields (e.g., ~ 40 acres) for the full flowering period of the target crop. While they are rarely conducted for most pesticides, multiple full field studies were conducted for imidacloprid, and, while not used quantitatively in EPA's review, they were used to support the overall conclusions of the risk assessment.

The Final Bee Risk Assessment (US EPA 2020) completed in 2020 is comprised of 327 pages in the main document. In addition, there are 294 pages of appendices and a further 334 pages of attachments. This assessment was conducted with use patterns for which imidacloprid was labeled for at that time. In other words, some use patterns were mitigated or removed based upon the outcome of the risk assessment. However, for the use patterns at that time, EPA placed them into four categories with respect to risk: 1) low risk, 2) weakest evidence of risk, 3) moderate evidence of risk and 4) strongest evidence of risk. Generally, foliar and soil use patterns had higher risks than seed treatments. All use patterns in the 4) strongest evidence of risk were foliar or soil uses and conversely seed treatments were either in the 2) weakest evidence of risk (i.e., soybean) or 1) low risk (i.e., corn).

In addition to the risk evaluated by EPA, the benefits of the use of imidacloprid products in both agricultural and non-agricultural sectors are considered when developing mitigations or restrictions at the end of registration review. An example of this is documented for the use imidacloprid in berry crops (US EPA 2019). In particular the use in blueberries, a crop important for Maine agriculture, was assessed for typical usage at a national level, the benefits of different application methods, and subsequent outcomes of mitigations to reduce the risk identified in the pollinator risk assessment.

In summary, there is a substantial body of work that has been done to characterize the toxicity, exposure and subsequent risk of the major neonicotinoids such as imidacloprid to ecological receptors. These studies have already been evaluated by the EPA for scientific merit and applicability and then integrated into comprehensive ecological risk assessments. These assessments should be used as the basis or starting point for the effort being conducted in Maine.

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September 8th , 2026

Board of Pesticide Control
90 Blossom Ln
Augusta, ME 04330

Good morning Board Directors Bohlan, Grey, and members of the BPC

My name is Adam Nordell, and I am a conservation advocate with Environment Maine, a policy and action group with one mission: to restore and protect the natural world. Our staff works for clean air, clean water, clean energy, wildlife, open spaces and a livable climate. Our members across the state put grassroots support behind our research and advocacy. We support carefully regulating the commercial use of neonicotinoid pesticides because we recognize the vital role that pollinators play in sustaining ecosystems and food production. I should also note that I ran a diversified commercial farm for twelve years and grew solanaceous crops including tomatoes, peppers, eggplant and potatoes as well as grain crops such as grain crops including corn and wheat. Like many other farmers in Maine, I was successfully able to produce healthy crops and supply our many customers without the use of neonicotinoids.

Bees and other pollinators are essential to Maine's agriculture and biodiversity, yet they face alarming declines due to habitat loss, climate change and toxic pesticides. Research shows that neonics contribute to bee die-offs through lethal and sublethal[1] effects by impairing reproduction, navigation and immune function. Without urgent action, these declines threaten biodiversity, food security and Maine's natural heritage.

As you are well aware, neonicotinoids are systematic pesticides which are uptaken by the crop and expressed in all of the crop tissues including the roots, stalk, flower, pollen and fruit. This systematic expression extends the pesticide's impact beyond the target pest species to any other invertebrate or vertebrate who interact with the crop. While we've heard that neonicotinoids are frequently applied to non-pollinator dependent potatoes in Maine, potato flowers are in fact visited by pollinators including wild bumble bees. And while the potato crop may not hinge on the health of the local bee population, the broader ecosystem and food system does. A 2017 study of bees in a commercial potato farm in Michigan identified an astounding 58 species of bees present within the production field and its headlands and grassy borders. The same study noted the presence of the species *Bombus impatiens* on the flowers of neonicotinoid treated potato plants[2].

While my focus is on pollinators for the critical role they play in our ecosystem and food production, Environment America is also invested in a safe and healthy food system. It's worth noting that FDA's 2012 total diet study found that neonics were among the pesticides found most frequently in toddler foods. USDA's 2014 pesticide monitoring report found neonics present in 12 of 19 sampled fruits and vegetables[3].

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Research has found neonicotinoids and their potent metabolites in human cerebrospinal fluid. While the human health impacts of neonics are generally understudied, research has identified links between neonic exposure and neurological impacts including memory loss and hand tremors.

A quick survey of commercial seed suppliers including Albert Lea Seed, Viking Seed, Blue River Seed, Johnny's Selected Seeds, FEDCO Seeds, and other sources reveals a great abundance and diversity of non-neonicotinoid treated seed appropriate for Maine farmers engaged in the production of dairy products, vegetables, forage crops and grains. Farmers in Quebec have successfully navigated the regulatory transition that mandated a move away from nicotinoid treated seeds. Testimony from a group of conventional dairy farmers from that province suggests that, despite claims to the contrary, the commercial seed market is able to quickly adapt to an evolving regulatory landscape[4]. That successful experience suggests that if there are indeed gaps in seed market availability here in Maine, shifting market incentives here and nearby northeastern states will quickly lead to the development and production of an even wider array of regulation-compliant seeds.

I hope that the board strongly considers the ecological and human risks associated with exposure to these chemicals as you write the report.

Sincerely,

Adam Nordell
Conservation Advocate
Environment Maine

[4] UVM Extension NW Crops & Soils, 2024 Quebec Farmer Panel on Transitioning Away From Neonic Treated Seeds https://www.youtube.com/watch?v=N9OWx9XWIaE [accessed 9/8/2026]

September 8th, 2026

Board of Pesticide Control
90 Blossom Ln
Augusta, ME 04330

Dear Board of Pesticide Control Directors Bohlen, Gray, and members of the BPC,

Research shows that 95% of the neonicotinoids used in seed coatings don't stay on the crop. Pesticide residue from the seeds ends up in the air, water, and soil, impacting the surrounding ecosystem. What little pesticide is absorbed by the plant makes the flowers, pollen and fruit poisonous for bees. When our default is to use toxic chemicals - even if there is little or no positive impact on the crop yield - bees, birds and other wildlife are killed. Please limit the use of neonicotinoids on Maine farms.

Sincerely,

Susanna	Adams	Portland	ME
Lynn	Bailets	Cape Elizabeth	ME
Susan	Bernat	Portland	ME
Ron	Beyna	Cumberland Center	ME
Lucinda	Blackwell	Falmouth	ME
Andy	Blanchard	Winthrop	ME
Susan	Bradbury	Buxton	ME
Ellen	Brouillet	Berwick	ME
Rhonda	Cobb	Saco	ME
Nathan	Currier	Kittery	ME
Shirley	Davis	Orono	ME
Geoffrey	Day	Berwick	ME
Elizabeth	Della Valle	Portland	ME
Peter	Demos	Camden	ME
Jacqui	Deveneau	Portland	ME
Ellen	Dohmen	Bar Harbor	ME
Emmah	Doucette	Fryeburg	ME
Eduardo	Duarte	Portland	ME
Deborah	Dunn	Saco	ME
Timothy	Floyd	Augusta	ME

Mark	Follansbee	Scarborough	ME
Rona	Fried	Casco	ME
Elizabeth	Grobe	Brunswick	ME
Mary C	Harrington	Topsham	ME
Claire	Holman	South Portland	ME
Elizabeth	Holman-perry	South Portland	ME
Dwight	Junkins	Ashland	ME
Jennifer	Kastelic	Ellsworth	ME
Jan	Kernis	Brunswick	ME
Kerry	Kohnert	Bremen	ME
Alex	Lawrence	Yarmouth	ME
Steven	Linnell	Portland	ME
Jill	Linzee	New Harbor	ME
Sandra	Lucore	New Harbor	ME
Laurel	M	Portland	ME
Suzanne	Malis-Andersen	Veazie	ME
Doug	McCown	Portland	ME
Ellen	Nelson	South China	ME
Caroline	Nickerson	Auburn	ME
Kevin	O'Carroll	Harpswell	ME
Rebecca	Obenhaus	Cape Elizabeth	ME
Suzanne	Patrakis	Kittery	ME
Leya	Pearce	Yarmouth	ME
Melissa	Plattner	Kittery	ME
Petra	Remsen	Camden	ME
Leslie	Rothman	Portland	ME
Ann	Schaer	Waldoboro	ME
Laura	Sholtz	Exeter	ME
Tia	Simon	Gorham	ME
Trish	Stevens	Troy	ME
Sonya	Theriault	Portland	ME
Lytfi	Volksmyth	Old Town	ME
George	Voyzey	Harpswell	ME
Jon	Wearn	South Portland	ME
Curtis	White	Bath	ME

Jennifer	Williams	Cape Elizabeth	ME
Deb	Williams	Westbrook	ME
Peggy	York	Portland	ME
Anne	Young	Hallowell	ME
Virginia	Zavacky	South Berwick	ME
Jay	Alexander	Belchertown	MA
Natalie	Alexander	Bellingham	WA
Susan	Boudreau	West Roxbury	MA
Lorraine	Brabham	Hoboken	NJ
Maure	Briggs	Vernon Rockville	CT
Susanna	Chivian	Cambridge	MA
Owanza	di Mdina	Lakewood Ranch	FL
Hartson	Doak	Kapolei	HI
Peter	Fallon	Marblehead	MA
Patricia	Frederick	Ashburnham	MA
Michael	Gavin	West Roxbury	MA
Patricia	Gilbert	Cromwell	CT
Abigail	Gindele	Portsmouth	NH
Leslie	Grenier	Boylston	MA
Amanda	Grondin	Port Townsend	WA
Steve	Gross	La Mesa	CA
Melinda	Hall	Falmouth	MA
Shelley	Hartz	Littleton	MA
Richard	Hassinger	Newton	MA
Rosemary	Hewett	South Hamilton	MA
Ryan	Houlette	Cambridge	MA
Kate	Kenner	Guilford	VT
Diane	Kent	Scottsdale	AZ
Caroline	Korte	Arvada	CO
Ann Marie	Lahaie	Lynn	MA
Gloria	Lansin	Amery	WI
Kathleen	Lewis	Quincy	MA

Kyle	McAdam	Gilmanton	NH
Virginia	Mendez	Hollywood	FL
Dogan	Ozkan	Fresno	AK
Alan	Papscun	Stockbridge	MA
Phill	Patzer	Cadillac	MI
Le	R	Mokena	IL
Christine	Roane	Springfield	MA
Daniela	Rossi	Aberdeen	ID
Victoria	Shih	Plano	TX
Doug	Shohan	Lee	MA
Bridget	Spann	Williamstown	MA
Sarah	Stewart	Watertown	MA
Michael	Stuart	Wilton Manors	FL
Karen	Tauchman	Cambridge	MA

September 8, 2026

Submitted via email to: alexander.r.peacock@maine.gov

Maine Board of Pesticides Control
c/o: Mr. Alexander Peacock
28 State House Station
Augusta, ME 04333

Subject: Stakeholder Submission: Comprehensive Review of Neonicotinoids under LD 1323 (Document #1)

Dear Members of the Maine Board of Pesticides Control,

Growing Matters (www.growingmatters.org) is writing to provide information regarding the use, benefits, and regulation of neonicotinoids (neonics) for your consideration as you evaluate these products as part of your legislative mandate stated by LD1323. Growing Matters is a coalition of organizations and individuals committed to scientific discourse on the stewardship, benefits, and alternatives of neonicotinoid insecticides in North America. The coalition includes Bayer CropScience, Syngenta, LLC, Valent U.S.A. LLC, BASF Agricultural Solutions and Mitsui Chemicals Crop & Life Solutions, Inc.

This is the first of three documents Growing Matters is submitting. Two additional documents from third party sources will also be submitted to address specific data categories requested by the Board. The second addresses the cost benefits of neonicotinoids section and was prepared by Dr. Paul Mitchell, Ag Infomatics, University of Wisconsin. The third addresses the pollinator, non-pollinator and human health sections of the review and were prepared by Dr. Dwayne Moore, Stone Environmental. Growing Matters is also supportive of comments submitted by CropLife America.

This document will provide a high-level overview of current use patterns, target pests, Integrated Pest Management (IPM) and Insect Resistance Management (IRM), benefits, stewardship actions, and regulatory status at the U.S. Environmental Protection Agency (EPA).

Growing Matters is committed to pesticide safety and the stewardship of neonicotinoid products and appreciates the opportunity to comment om the Board's pending analysis of neonicotinoid use and safety in Maine. We will address the categories of concern listed in the legislation, or reference supporting addendums submitted along with these comments. Growing Matters encourages the Board to consider these addendums along with the information provided here for a more balanced approach in your analysis. Please reach out to Growing Matters if you require additional information.

Sincerely,
Growing Matters

General Overview

Neonicotinoids (neonics) are a widely used class of synthetic insecticides introduced in the 1990s as "reduced risk" alternatives to existing insecticides. They currently account for roughly 20- 30% of the global insecticide market with the most common being the nitroguanidine neonics imidacloprid, clothianidin, thiamethoxam, and dinotefuran.[1] In general, neonic treated seeds provide control of below ground pests such as wireworm, seedcorn maggot, and corn rootworm while providing foliar control of aphids, whiteflies, leafhoppers, Colorado potato & flea beetles, mealybugs and other sap-feeding and chewing pests. As a chemical class, they are a critical component of Insect Resistant Management (IRM) programs. In Maine, neonics are used primarily by grain and dairy farmers as seed treatments and as soil and foliar treatments in apples, blueberries, and potatoes. Residential use by consumers has been banned. Nationwide, increased adoption of these products has brought scrutiny from the environmental community. However, these products have undergone extensive evaluation by the EPA and are safe when used in accordance with approved label directions, which include specific risk mitigation measures. In addition, they are currently undergoing the EPA's registration review process, a legally mandated assessment conducted every 15 years. This review will result in further label updates and additional mitigation measures where warranted.

Benefits of Neonicotinoids

Neonics Applied Seed Treatments

Precision Technology that Reduces Pesticide Load/Acre: Seed treatments are a precision application technology that reduces overall pesticide load per acre by as much as five times, while minimizing direct exposure to pollinators compared to foliar sprays (AgInfomatics, 2017). This low dose application method protects the seed itself and emerging seedlings from pests while reducing exposure to non-target organisms. Seed treatment applications are considered an early season use pattern, helping to preserve the late-season activity of insect parasitoids and predators that contribute to insect management within an Integrated Pest Management (IPM) program.

Seed Treatments Maximize Stand & Yields: Neonic seed treatment helps ensure early season stand establishment for corn and soybean. Stand establishment is critical in short-season environments like Maine, where replanting a failed stand will lead to reduced yield for three primary reasons: 1) Studies have shown that planting corn late usually results in a loss of 1 to 2 bushels per acre per day once you slip past the ideal window. By June, corn yield potential can plummet by more than 1% each day; [1, 2, 3] 2) late planting pushes the critical pollination and grain-fill stages into the late summer, meaning shorter days and less solar radiation; [1] and 3) late-planted corn and soybean matures closer to Maine's early fall freeze. This increases the risk of frost damage before black-layer (maturity) is achieved and leads to high grain moisture, spiking artificial drying costs at harvest. [1, 2, 3, 4]

EPA noted the benefits of neonicotinoid-treated seeds in the Neonicotinoid Benefits assessment completed by the Biological and Economic Effects Division as part of registration review.

Neonicotinoid-treated seeds offer a highly cost-effective, insurance-based safeguard for Maine growers against early-season soil pests. As noted in the EPA Neonicotinoid Benefit Assessments, these chemistries are critical for managing devastating, invasive pests where alternatives are severely limited. Eliminating this tool would significantly increase operational costs by requiring multiple subsequent applications of costlier, less efficient pesticide alternatives.

Neonics Applied as Foliar Treatments

Foliar neonicotinoid applications provide vital, targeted crop protection for Maine's high-value agriculture, balanced by strict label mitigations designed to protect pollinators from chemical exposure. While seed treatments protect seeds during early germination, foliar sprays are applied later in the season to protect emerged crops from insects that threaten yields. Here are other important uses in Maine:

- **Preserving Wild Blueberry Yields:** Commercial growers of wild blueberries utilize foliar neonicotinoids to control devastating mid-to-late season pests like the blueberry maggot fly and flea beetles.
- **Protecting Apple Orchards:** Foliar applications provide rapid knockdown control against sap-sucking pests like aphids and destructive plum curculio beetles, which directly blemish and ruin commercial fruit crops.
- **Blight and Vector Interruption in Potato**: In northern Maine's potato-growing regions, foliar sprays suppress aphid populations, which acts as a critical line of defense to stop the transmission of destructive potato viruses.

Control of Invasive Species

Neonics are often one of the few options for controlling invasive insect species in agronomic crops in Maine such as Brown Marmorated Stinkbug and the ever-threatening Spotted Lanternfly. For trees and forests, neonics are used to control Emerald Ash Borer, Hemlock Woolly Adelgid, and Asian Longhorned Beetle.

Summary Points:

- Neonics are broad spectrum pesticides that are reduced risk alternatives to older chemistry.
- Neonics may be used as seed, soil, or foliar treatments in Maine agriculture and are critical for insect resistant management programs.
- The use of neonic treated seeds can reduce the total amount of pesticide used per acre by five times.
- Neonics not only control pests that reduce yields in Maine blueberry, apple, and potato production, they are essential tools in controlling invasive insects.
- See Growing Matters document #2 submitted with comments from Dr. Paul Mitchell on the cost and benefits of neonics.

Pollinator and Non-Pollinator Environmental Overview

EPA conducted pollinator and non-pollinator risk assessments for each neonic prior to registration and again recently as part of registration review. For pollinators, EPA has implemented a Tiered pollinator risk assessment approach that was created in collaboration with Pest Management Regulatory Agency (PMRA) in Canada. This robust data driven approach starts with a Tier 1 ultra-conservative screening level evaluation then moves to a Tier 2 semi-field and then a Tier 3 field study if risks are identified along the way. The non-pollinator risk assessment evaluates risks to all other non-pollinator organisms including aquatic and terrestrial invertebrates. Risks identified in these assessments were mitigated prior to registration. Pollinator risks and non-pollinator risks from neonics are managed via the following label mitigations:

1. All neonicotinoid labels feature a distinct bee hazard icon to alert applicators of risks to pollinators. This section outlines risks via spray drift, how long it persists, ways to reduce exposure, and language encouraging communication between applicators and beekeepers.

2. Labels require that planted seed treated with neonics be planted to a certain depth and that spilled seed be cleaned up or covered to reduce impact to local wildlife through ingestion.
3. Neonic applications are prohibited when a crop is flowering, blooming, or when bees (pollinators) may be actively foraging.
4. If a foliar application is needed, it is recommended that applications occur toward late evening/night or when temperatures drop below 55°F because pollinators are inactive during these windows.

The Board should also consider that neonics are currently going through registration review by the EPA. This process is required under FIFRA to occur every 15 years. However, the registration review of neonics has been delayed over the years with the implementation of new pollinator data requirements and their 2022 workplan to protect endangered species. However, this process is nearing completion with an amended Proposed Interim Decision (PID) expected in 2027. Additional mitigations and label changes to protect pollinators and other species will be included in the PID then added to labels following the release of an Interim Decision (ID). Based on the initial PID, the following additional mitigations are likely to be added to labels:

1. Measures intended to reduce off-target transport and environmental contamination, including practices to reduce runoff, erosion, and spray drift to protect non-target plants and wildlife (EPA, 2020).
2. Improved label language and stewardship requirements to enhance compliance and risk reduction, including clearer directions intended to reduce environmental exposure, improve user compliance, and support resistance management (EPA, 2020).

3. Additional protections aimed at reducing ecological risks to sensitive non-target organisms, particularly aquatic invertebrates, including rate reductions, runoff, and spray-drift mitigations, and use cancellations (EPA, 2020)

Given the likelihood of significant label changes to neonic products over the next two years, Growing Matters recommends that the Board consider monitoring registration review actions and comment on proposed changes when the amended PID is published rather than taking immediate steps to restrict or ban uses that may be inconsistent with Federal actions.

In addition to the existing and pending label restrictions outlined above, Growing Matters would like to remind the Board that Maine has already taken actions to reduce risks to pollinators in the non-Ag space with the passage of LD155, which makes all neonicotinoids “restricted-use” pesticides. These products may only be used by certified applicators and are no longer available for purchase in retail stores by homeowners.

The Environmental Fate and Effects Division of EPA (EFED) completed pollinator risk assessments for the neonics as part of registration review. In reference to seed treatment risk for clothianidin and thiamethoxam, EFED stated: “*For crops where clothianidin or thiamethoxam are applied as seed treatment, there is a low risk from exposures of clothianidin and thiamethoxam to honey bees*” (EPA, 2020). As it relates to foliar uses, EFED determined low risk when clothianidin and thiamethoxam were applied to the following crops (or groups) found in Maine:

- Foliar applications of clothianidin and thiamethoxam to soybeans;
- Foliar, post-bloom applications of clothianidin and thiamethoxam to orchard crops;
- Foliar and soil, post-bloom applications of clothianidin and thiamethoxam to berries.

Summary Points:

- EPA already requires substantial data from registrants on neonic impacts to pollinators.
- Neonic labels have language that alerts the applicator to risks to pollinators and how to mitigate those risks.
- Neonics are currently undergoing registration review at EPA; additional mitigations to protect pollinators, other non-target organisms, and endangered species will be added to labels in the next two years.

Stewardship of Neonics

Prevention of Impacts to Non-Target Organisms: The seed industry takes a proactive approach towards stewardship of neonic treated seed. The American Seed Trade Association (ASTA) approach to reducing "dust-off" emphasizes a combination of advanced technological manufacturing and strict on-farm planter management. "Dust-off" occurs when the chemical pesticide coatings on seeds rub off due to mechanical friction, creating toxic dust that may be emitted by vacuum/pneumatic planters and drifts onto non-target areas like flowering weeds and honeybee hives.

To combat this, ASTA partnered with other agricultural stakeholders to create comprehensive educational platforms like the Guide to Seed Treatment Stewardship, establishing standard industry benchmarks to suppress dust emissions. This guide provides farmers and seed companies with up-to-date guidelines on how to comply with all pesticide registrations and how to safely use and dispose of treated seeds to minimize environmental impacts. The American Farm Bureau Federation, National Corn Growers Association, and American Soybean Associations endorse the guide, and both EPA and U.S. Department of Agriculture recognize this guide in their comments on treated seeds.

The Guide to Seed Treatment Stewardship outlines how the seed industry has fundamentally redesigned how treatments are applied to keep active chemical ingredients securely adhered to the seed:

- **Enhanced Coating Polymers**: Specialized chemical binders and polymers are blended into the seed treatment recipe to create a more durable, scratch-resistant outer shell that dramatically lowers dust abrasion.
- **Rigorous Testing Standards**: Seed companies use standardized "dust-off testing methods" (such as the Heubach test) to aggressively shake and measure seed samples, ensuring they maintain low dust properties throughout transit and handling.
- **Advanced Seed Flow Lubricants**: Farmers are instructed to replace older lubricants with specialized, innovative seed flow lubricants (such as fluency agents) specifically engineered to reduce friction and minimize dust generation during planting.
- **Planter Exhaust Redirection**: For pneumatic or vacuum-style planters, ASTA recommends directing the air exhaust downward toward the soil surface rather than out into the open air. This effectively redirects any potential dust directly in the furrow.
- **Avoid Mechanical Abrasion**: Farmers should handle seed bags and bulk containers with care, avoiding rough mechanical handling that causes abrasion and damage to the treated seeds.

BeSure!: Growing Matters is focused on ensuring proper use of neonics to protect the environment while maintaining product viability for maximum economic benefit. An example is our support of the BeSure! Campaign over the last 8 years. BeSure! is a grower focused National communications campaign that promotes Best Management Practices (BMPs) when using neonics to protect bees and other wildlife (BeSure! Link). This was done through interviews, social media, and promotion through local outlets throughout the U.S. including Maine. Each year the campaign begins prior to planting season to remind growers to follow all label instructions and BMPs when using neonics. Here are the national statics, which include Maine:

- 216M total campaign impressions (across paid digital, earned media, paid radio/broadcast media and organic social media).
    - 154.5M total traditional media impressions.
    - 5.2M total paid radio and broadcast impressions.
    - 40M total paid digital impressions.
    - 11.1M total organic social media impressions.

- 83.9k total paid digital campaign engagements.
- 112 potential radio affiliate stations reached.
- Eleven earned media stories published by agriculture and other trade media outlets.
- 6 BeSure! campaign partnerships with key industry stakeholders.

For neonic treated seed, it is important to note that seed tag language specifically addresses the proper handling, storage, and disposal of treated seeds, as well as use restrictions.

Summary Points:

- Neonic registrants are committed to effectively stewarding their products regardless of application method.
- BeSure! promotes education and outreach through multiple media outlets to promote BMPs, and communication between applicators and beekeepers.
- The industry has also reduced exposure to non-target organisms by reducing seed abrasion leading to "dust-off" during planting.

Neonic Benefits to IPM & IRM Programs

Neonicotinoid seed treatments are valuable tools within an Integrated Pest Management (IPM) program when used as part of a comprehensive, risk-based approach to pest management. They provide targeted early-season protection during crop establishment, helping protect stand establishment and yield potential in situations where pest pressure is anticipated. For soil-dwelling insect pests, established economic thresholds are limited or unavailable, and practical in-season scouting can be difficult. As a result, growers must often make preventive management decisions based on field history, crop rotation, soil characteristics, environmental conditions, planting practices, and local pest experience, all of which are important IPM considerations for assessing pest risk.

The decision to use seed treatments are made well in advance of planting, with treated seed purchases often occurring in the year prior to the growing season. Consequently, growers rely on historical pest pressure, agronomic factors, and anticipated pest risk when selecting seed treatment options. Within an IPM framework, neonicotinoid seed treatments represent one management tool among many and should be integrated with complementary practices such as crop rotation, resistant varieties where available, cultural controls that promote plant vigor, conservation of beneficial insects, and in-season scouting and economic thresholds where practical. This integrated approach helps ensure that pest management decisions are tailored to field-specific conditions while supporting both crop productivity and long-term sustainability.

Insect Resistance Management (IRM) is a key component of the stewardship framework for neonicotinoid insecticides. Neonicotinoid product labels contain resistance management requirements developed in collaboration with the Insecticide Resistance Action Committee (IRAC) to help preserve the long-term effectiveness of these tools. Neonicotinoids are classified as Group 4A insecticides and the product labels have recommendations to preserve pest susceptibility, and aligns insecticide use with crop growth stage and pest biology. Effective IRM is further strengthened through the implementation of Integrated Pest Management (IPM) practices. Labels encourage growers to assess pest risk, use economic thresholds where available, incorporate cultural and biological control measures, and regularly monitor pest populations for changes in field performance.

Summary Points:

- Neonics play a vital role in IPM programs due to their increased selectivity and reduced impacts to beneficial impacts.
- Neonic treated seeds are critical in preventing early-season stand loss from pests that are difficult to predict prior to planting.
- Early-season injury can lead to re-planting of the crop which leads to yield loss for Maine growers.

Market Availability of Treated Seeds

Seed companies determine production decisions for certified crop seeds, such as corn, approximately two years in advance of a planting season. Seed companies provide growers with choices of hybrids or varieties with certain traits that enable the crop to exhibit characteristics, for example, to increase yield or have tolerance against pests or drought. Seed treatments are commonly applied to commercially sold seeds to protect against adverse planting conditions and early pest pressure. By reducing the risk of stand loss and replanting, these treatments help protect the grower’s investment and support the crop’s ability to reach its genetic yield potential.

Seed companies must clean, size, treat, package, and distribute seed within a brief period between fall harvest and spring planting while managing numerous varieties, seed sizes, and treatment combinations. Growers requesting a different package or untreated seed must therefore place special orders well in advance so the seed can be set aside, treated as needed, and managed separately. Without timely clarity in the consideration of the seed production decisions timeline, seed companies could stop producing and selling specific hybrids and varieties including the choices of short-season and high-yielding untreated varieties. Growers would have limited choices of quality crop seeds at planting time, putting their revenue at risk.

Summary Points:

- Production, treating, and packaging of seeds is complex and done well in advance of the planting season.
- Lack of clarity, bans, or restrictions on neonic treated seeds will impact seed availability of Maine growers including access to high-yielding hybrids and varieties.
- Lack of seed availability best suited for Maine's climate could lead to reduced yield.

Human Health Considerations

Neonicotinoids were registered as "Reduced Risk" pesticides under EPA criteria because they possess a favorable mammalian and human safety profile, significantly reducing acute exposure risks for applicators and farm workers. As part of this registration, EPA completed full human health risk assessment for each neonicotinoid which can be found here in the dockets of each active (clothianidin, dinotefuran, imidacloprid, thiamethoxam). In each case, the EPA found that risks to human health were low when used according to the label. In its EPA Updated Occupational Exposure Assessments, the EPA notes that human health risks are tied primarily to extremely high, unmitigated exposure scenarios. Occupational risks are managed effectively through proper personal protective equipment (PPE) mandates rather than product elimination.

Summary Points:

- Neonics pose negligible risks to human health when used according to the label.
- See Growing Matters document #3 with comments from Dr. Dwayne Moore for additional information.

September 8, 2026

Submitted via email to: alexander.r.peacock@maine.gov

Maine Board of Pesticides Control
c/o: Mr. Alexander Peacock
28 State House Station
Augusta, ME 04333

Subject: Stakeholder Submission: Comprehensive Review of Neonicotinoids under LD 1323 (Document #2)

Dear Members of the Maine Board of Pesticides Control:

This is the second of three documents Growing Matters is submitting in support of data requested by the Board and will address the "Benefits of Neonicotinoid Treated Seeds".

Growing Matters is a coalition of organizations and individuals committed to scientific discourse on the stewardship, benefits and alternatives of neonicotinoid insecticides in North America. The joint effort is led by Bayer CropScience, Syngenta, Valent U.S.A. LLC, BASF Agricultural Solutions and Mitsui Chemicals Crop & Life Solutions, Inc

The member companies of Growing Matters jointly commissioned a comprehensive evaluation of the economic and societal benefits of neonicotinoid insecticides to North American agriculture, as well as trees, turf and landscape and production ornamentals. AgInfomatics, LLC, an independent agricultural consulting firm established in 1995 by professors from the University of Wisconsin-Madison and Washington State University, conducted the research and published a series of reports, resource materials and peer-reviewed articles. The Growing Matters Coalition information and data can be found at https://growingmatters.org/research-reports/.

The Growing Matters coalition is committed to pesticide safety and the stewardship of neonicotinoid products and appreciates the opportunity to comment om the Board's pending analysis of neonicotinoid use and safety in Maine. We will address the categories of concern listed in the legislation, or reference supporting addendums submitted along with these comments. Growing Matters encourages the Board to consider these addendums along with the information provided here for a more balanced approach in your analysis.

Sincerely,
Growing Matters

Comments on the Benefits of Neonicotinoid Treated Seeds: Dr. Paul Mitchell

Dr. Paul Mitchell provided a summary of the work that AgInfomatics conducted on behalf of Growing Matters. Paul Mitchell is a professor in the department of Agricultural and Applied Economics at the University of Wisconsin-Madison (UW) and an Extension-funded faculty in cropping systems management. He has been at UW since 2004, where he continues to maintain an active research and extension program broadly focused on the economics of pest management, and agricultural policy.

Growing Matters is submitting these comments in response to the Maine Board of Pesticide Control's request for public comment on the use, benefits, and potential impacts of neonicotinoid-treated seeds. Below is a summary of AgInfomatics research on the benefits of neonicotinoid treated seeds for the Maine Board of Pesticide Control to consider when making its regulatory decisions. AgInfomatics conducted a research and outreach project team from 2013 to 2015 with funding by the registrants, while Paul Mitchell was on the faculty at the University of Wisconsin in Madison. The resulting reports were originally posted on my the AgInfomatics website, and since the webpage has been discontinued, the reports are on the Growing Matters page: https://growingmatters.org/research-reports/. This work was completed in 2015. Other work on the benefits of neonicotinoid treated crop seeds has been published since then and will be included in this summary.

The AgInfomatics research was a comprehensive, data-driven economic analysis of the value of neonicotinoid insecticide seed treatments in North American agriculture. That research used multiple independent methodologies — including economic modeling, meta-analysis of field trial data, farmer surveys, multi-market equilibrium analysis, and regional grower listening sessions — to estimate the economic and societal benefits of neonicotinoid insecticides across major U.S. and Canadian crops, with a particular focus on the use of neonicotinoid-treated seeds.

The AgInfomatics research was submitted to the U.S. Environmental Protection Agency during the registration review proceedings for imidacloprid, clothianidin, and thiamethoxam. EPA reviewed the AgInfomatics research and included it in the registration review dockets. In January 2020, EPA issued its Proposed Interim Registration Review Decisions for clothianidin and thiamethoxam, which proposed specific mitigation measures and concluded the overall risks from these neonicotinoids are reasonable under FIFRA given the benefits of their continued use, including seed treatment uses.[1] Since the completion of this AgInfomatics research, Paul Mitchell has continued to publish peer-reviewed research on the value of insecticide seed treatments and pest management economics.

Here, the summary of the evidence showing that neonicotinoid-treated seeds provide substantial economic and non-economic value to corn and soybean growers nationally and that restrictions on the use of neonicotinoid treated seed could potentially produce worse environmental outcomes because farmers would change their pest management practices to use alternative insecticides with different risk profiles.

[1]U.S. Environmental Protection Agency, Clothianidin and Thiamethoxam Proposed Interim Registration Review Decision, Case Numbers 7620 and 7614 (January 2020), pp. 50–51.

Overview of the AgInfomatics Research Program

The AgInfomatics research was a comprehensive, multi-method analysis of the economic and societal benefits of neonicotinoid insecticides (clothianidin, dinotefuran, imidacloprid, and thiamethoxam) in North American agriculture. The research analyzed pest management strategies used across more than 133 million acres of neonicotinoid-treated crops in the United States (corn, soybean, wheat, cotton, and sorghum, potato, and tomato) and Canada (canola, corn, and soybean).[2]

The research methodology, analytics, and documentation for each study were designed to meet the standards of peer-reviewed publications. In brief, the research employed the following methodologies:

1. Econometric modeling of insecticide use, crop yield data, and market impacts, using GfK Kynetec proprietary market data, USDA National Agricultural Statistics Service data, and state extension publications as primary data sources.
2. A meta-analysis assembling data from more than 1,550 field studies conducted in many locations across several states over multiple years, generating 3,359 paired yield observations comparing neonicotinoid-treated plots to untreated controls, plus approximately 1,000 additional studies generating 1,611 observations comparing neonicotinoid-treated plots to plots treated with non-neonicotinoid insecticides. The crops include corn, soybean, wheat, cotton, sorghum, canola, potato, and tomato.[3]
3. A telephone survey of 622 U.S. and Canadian corn farmers, 621 U.S. and Canadian soybean farmers, and 500 Canadian canola farmers. Data from this survey was analyzed using stated-preference methods to estimate the total value farmers derive from insect pest management practices, including both monetary and non-monetary benefits.
4. A multi-market equilibrium analysis that used the AGSIM model for U.S. commodity crops and partial equilibrium analysis for specialty crops and Canadian crops, to estimate the aggregate economic value of neonicotinoids that accounted for effects on market prices and total crop production.[5]
5. Eight regional grower listening sessions across the United States and Canada, conducted in Chicago, IL; Davenport, IA; Memphis, TN; Lake Alfred, FL; Prosser, WA; San Diego, CA; Regina, SK; and London, ON.[6]
6. In-depth case studies of Florida citrus and Mid-South cotton production.

These reports are currently available on the Growing Matters page: https://growingmatters.org/research-reports/. Relevant to this regulatory decision, we encourage you to begin with the Executive Summary that overviews the entire body of work, which is listed first on the web page.

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[2]P.D. Mitchell, Estimated Impact of Neonicotinoid Insecticides on Pest Management Practices and Costs for U.S. Corn, Soybean, Wheat, Cotton and Sorghum Farmers, AgInfomatics (2014), p. 1.

[3]P.D. Mitchell, A Meta-Analysis Approach to Estimating the Yield Effects of Neonicotinoids, AgInfomatics (2014), pp. 5-6.

[4]T.M. Hurley and P.D. Mitchell, Value of Insect Pest Management to U.S. and Canadian Corn, Soybean and Canola Farmers, AgInfomatics (2014), pp. 4-5.

[5]P.D. Mitchell and F. Dong, An Economic Assessment of the Benefits of Nitroguanidine Neonicotinoid Insecticides in the United States and Canada, AgInfomatics (2015).

[6]B. Shaw and K. Genskow, A Summary of Grower and Agri-Professional Perspectives From Regional Listening Sessions in the United States and Canada, AgInfomatics (2014), p. 2, Table 1.

Based on the AgInfomatics research and Paul Mitchell's experience as an extension crop production economist, the primary benefits of neonicotinoids from a farmer's perspective are increased crop yields, reduced pest management costs, and improved risk management. Several other benefits are also generated, including improved insecticide resistance management, human health and worker safety, operational efficiency, and improved environmental stewardship benefits. From a broader societal perspective, neonicotinoids generate aggregate economics benefits due to their impact on crop yields and prices, as well as environmental benefits. These findings were documented in the AgInfomatics research reports, with is the overview here (noting specific pages to help navigate the documents), and corroborated in subsequent papers published by Paul Mitchell and others.

Yield Benefits of Neonicotinoid-Treated Seed

The AgInfomatics meta-analysis provides one of the most comprehensive assessments of neonicotinoid yield effects available based on field studies conducted from the mid-1990s to about 2012. For each crop, a consistent series of tables and figures were created to report results systematically for each crop.[7] The yield benefits vary tremendously across years, sites and states for neonicotinoid seed treatments relative to either no control or to non-neonicotinoid alternatives (Corn and Soybean Figures 1 and 3 are included at the end of this document). This variation occurs because observed benefits for a site-year depend on many factors, especially the realized pest pressure from the many target pests and the early-season soil and weather conditions, all of which vary. This uncertainty in the realized yield benefit is why many farmers evaluate the use of neonicotinoid seed treatments through a risk management lens, which is discussed further in the discussion of risk management benefit of neonicotinoids.

The average yield benefits provide some indication of the value of neonicotinoid seed treatments. For corn, the average yield benefit of neonicotinoid-treated seed relative to untreated controls was 17.4% (N=774, $p < 0.0001$) and the average yield benefit relative to non-neonicotinoid insecticide treatments was 4.4% (N=429, $p < 0.0001$).[8] For soybeans, the average yield benefit relative to untreated controls was 3.6% (N=718, $p < 0.0001$) and the average yield benefit relative to non-neonicotinoid insecticide treatments was 0.2% (N=216), which was not statistically significant ($p = 0.3735$).[9] Importantly, the meta-analysis found no systematic difference in results between published studies and registrant-funded studies — evidence that the funding source did not bias the outcomes.[10]

These averages show the typical yield benefits of neonicotinoid seed treatments, but the histograms (pasted at the end of this document) show the tremendous variation is the actual yield benefits observed across the research plots. As expected, the observed yield benefits generally cluster around the averages, but they also

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[7] P.D. Mitchell, A Meta-Analysis Approach to Estimating the Yield Effects of Neonicotinoids, AgInfomatics (2014), Section 6.0 Appendix of Results, p. 19 and following.

[8] P.D. Mitchell, A Meta-Analysis Approach to Estimating the Yield Effects of Neonicotinoids, AgInfomatics (2014), Tables 2 and 3; Corn Figure 1, Corn Figure 3.

[9] P.D. Mitchell, A Meta-Analysis Approach to Estimating the Yield Effects of Neonicotinoids, AgInfomatics (2014), Tables 2 and 3; Soybean Figure 1, Soybean Figure 3).

[10] P.D. Mitchell, A Meta-Analysis Approach to Estimating the Yield Effects of Neonicotinoids, AgInfomatics (2014), pp. 12–13.

show a wide range, from negative outcomes when the untreated or alternate treatment plot yielded more to large positive yield benefits. *This variation is at the heart of the farmer's decision problem.* They must decide at the time of seed purchase months before planting whether to pay for the seed treatment without knowing the pest pressure from the target pests or the early-season soil and weather conditions that drive these observed yield benefits. Farmers are not only choosing the average yield benefit, but also the distribution of yield benefits – which histogram for yield benefits they want. They are likely to get a yield benefit outcome somewhere around the average, but the histograms show that they can also get outcomes that are substantially larger or smaller than these averages. Choosing the distribution of yield outcomes is what makes the decision whether to use a neonicotinoid seed treatment is also a risk management decision for farmers.

Risk Benefits of Neonicotinoid-Treated Seed

Farmers make many crop decisions that involve uncertainty in the outcomes and managing risk, not just insect management. Understanding expected or average outcomes is often the first step in making such decisions, and then farmers often want some sense of the variability in the outcomes. Multiple measures of variability or risk are available; a point made in Mitchell and Hutchison (2008). One measure is the probability of a key outcome, such as the likelihood of a positive yield benefit, the approach used in Gaspar et al. (2015), a paper published independent of the AgInfomatics studies. Using data from small plot studies, the effect of neonicotinoid seed treatments and soybean seeding density on soybean yield was estimated. Importantly, the analysis extended beyond reporting average yield impacts to evaluate the likelihood that a farmer would achieve a positive net return. This distinction is particularly relevant when assessing the risk management value of pest management tools. Unlike traditional statistical analyses that often emphasize a 95% confidence threshold, farmers routinely make decisions under conditions of uncertainty and do not require 95% certainty of a positive outcome before taking action. Instead, many growers are willing to accept a degree of risk when the probability of achieving an economic benefit is favorable, making the likelihood of positive returns an important consideration in evaluating pest management practices.

People vary in their willingness to bear risk; a point made in Mitchell and Hutchison (2008). Thus, a decision that generates some average outcome and some probability of a positive outcome may be acceptable risk to one person, but the same average and probability may not be acceptable to another person. As a result, it is difficult to make blanket statements about acceptable risks in specific contexts such as insect management in crop production. Hence, the usefulness of reporting the averages and other measures of risk and letting individuals make their own decision.

Simple examples of this practice are insurance deductible options or investment recommendations for retirement. Firms offer multiple deductible options and lower or higher risk portfolio options and let individuals choose the option they are most comfortable with. This was the logic in Gaspar et al. (2015) and the related extension publication[11] for reporting the average return for using a neonicotinoid seed treatment in soybean production and the likelihood of earning a positive return. The information is reported to help individuals choose the option they are comfortable with.

[11]Gaspar, A. S. Conley, J. Gaska, P. Mitchell. 2014. Economic Risk and Profitability of Soybean Seed Treatments at Reduced Seeding Rates, UW Extension, Madison, WI. https://soybeanresearchinfo.com/wp-content/uploads/2019/03/SoybeanTreatmentRisk_2014_FINAL.pdf.

Based on the histograms, the likelihood is 83.9% that the corn yield benefit is positive relative to no treatment and 69.5% relative to non-neonicotinoid insecticide treatments. For soybeans, the likelihood is 80.5% that the yield benefit is positive relative to no control and 53.2% relative to relative to non-neonicotinoid insecticide treatments. The average yield benefits and these probabilities represent aggregates across many site-years. Actual yields vary considerably based on weather, soil conditions, and insect pressure in any given year and location. This variability is precisely why neonicotinoid seed treatments function as a critical risk mitigation tool for growers – their value lies in protecting against the downside risk of unexpectedly low yields from unpredictable pest pressure. In some site-years, treated seed produces large yield gains; in others, when pest pressure for that year ends up being low, the gain may be minimal. But because soil-dwelling pests such as wireworm, seedcorn maggot, and white grub appear erratically and are extremely difficult to scout before planting — and because damage occurs underground before any rescue treatment can be applied — growers choose seed treatments to manage this risk.[12] As a result, many famers find seed treatments valuable as a risk-mitigation strategy.

This risk-mitigation dynamic is especially important in Maine, where the short growing season makes stand establishment and timely emergence critical. If soil pests damage seeds or seedlings, replanting may not be feasible given Maine's compressed planting window and short growing season. The risk of stand loss without seed treatment protection is thus an acute concern for Maine growers.

The risk management benefit of neonicotinoid seed treatments is part of their value to farmers. Hurley and Mitchell (2020) conducted a telephone survey like that used for the AgInfomatics study but added questions about farmer's risk tolerance and the importance of a variety of concerns when making their pest manger decisions. The technical details are reported in Tables 5 and 6 for corn and soybeans, and Tables S17a-c and S18a-c in the supporting information, but to quote from the Abstract, we found that

> *In addition to yield and cost, farmers showed significant concern for economic risk and human and environmental safety when making pest management decisions. These non-monetary concerns significantly affected the likelihood farmers used these practices and their perceived value. … [S]eed-based insecticides dominate farmer insecticide use and the value they derive from insecticides. Because seed purchase is months before planting, farmers rely on risk-based integrated pest management to make pest management decisions, weighing both monetary and non-monetary factors when deciding whether the risks are sufficient to justify the use of insecticides.*

[12] P.D. Mitchell, A Meta-Analysis Approach to Estimating the Yield Effects of Neonicotinoids, AgInfomatics (2014), p. 15.

Cost Benefits of Neonicotinoid Seed Treatments

The AgInfomatics research constructed a detailed non-neonicotinoid counterfactual scenario that projected how farmer pest management practices and costs would change if neonicotinoid insecticides were no longer available. Acres using neonicotinoids were reallocated to alternative non-neonicotinoid insecticides and practices based on typical target pests, registered targets for alternative insecticides, and insecticide market shares.[13] The changes in pest management practices and costs were then calculated and summarized by crop,[14] and then summarized succinctly by crop in Table 2 of the Economic Assessment and Benefits.[15]

> *The estimated average cost increase when switching from the use of neonicotinoids to non-neonicotinoid alternatives for the 2012-2014 base period across all US acres was $8.32 per treated acre for corn and $3.30 for soybeans. For corn, on a treated acre basis, costs for soil-applied active ingredients to replace neonicotinoids increase $7.42/acre and costs for soil applications increase $2.84/acre, or 89% of the total $8.32 cost increase, with the remaining costs increase from foliar active ingredients, additional application costs, and increased scouting. For soybeans, soil active ingredient costs decrease $7.33/acre, while cost increases for foliar application and foliar active ingredients and additional scouting increase costs by $8.55/acre, with an additional cost increase of $2.07 in higher seeding densities, to give a net cost change of $3.30 per treated acre.*

It is worth highlighting that a significant portion of these added costs come from increased application costs, especially for soybeans. Seed treatments are essentially costless to apply, since the treatment is already on the seed at planting. Switching to soil-applied or foliar insecticides require separate equipment passes, substantially increasing fuel, labor, and machinery costs, all of which come at added cost and inconvenience for growers.

Value of Neonicotinoid Seed Treatments

The value of neonicotinoid seed treatments is further supported by the simple observation that farmers continue to buy them. Farmers have continued to use seed treatments over millions of acres and many years, even in times of tight and negative margins when they are under tremendous pressure to be cost efficient. The yield benefits for corn seem clear based on the yield benefit histograms. The value for soybean growers is somewhat lower based on the histograms – the average benefit is not as large as for corn and the likelihood of a positive benefit is smaller – yet farmers continue to buy seed treatments for

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[13] P.D. Mitchell, Methods and Assumptions Methods and Assumptions for Estimating the Impact of Neonicotinoid Insecticides on Pest Management Practices and Costs for U.S. Corn, Soybean, Wheat, Cotton and Sorghum Farmers, AgInfomatics (2014).

[14] P.D. Mitchell, Estimated Impact of Neonicotinoid Insecticides on Pest Management Practices and Costs for
U.S. Corn, Soybean, Wheat, Cotton and Sorghum Farmers, AgInfomatics (2014), Table 11.

[15] P.D. Mitchell, An Economic Assessment of the Benefits of Nitroguanidine Neonicotinoid Insecticides in the United States and Canada, AgInfomatics (2015), Table 2.

soybeans. For a social scientist, this simple fact suggests that farmers find value, and so Paul Mitchell and his colleagues developed a survey tool to better understand the size of this value and the factors that determine it.

AgInfomatics conducted a telephone survey of growers to estimate the value of neonicotinoid seed treatments for farmers. The survey included 1,743 respondents: 622 U.S. and Canadian corn farmers across 12 states and 3 provinces, 621 U.S. soybean farmers across 14 states and 3 provinces, and 500 Canadian canola farmers across 3 provinces.[16] The analysis and results for corn, soybeans and canola in the US and Canada were summarized in the AgInfomatics report, and then the US soybean data were published as a journal article (Hurley and Mitchell 2016).

Using stated-preference methods, the AgInfomatics survey estimated that the value of insecticide seed treatments for the 2013 crop year was $13.38 per treated acre for U.S. corn farmers and $11.93 per treated acre for U.S. soybean farmers net of seed treatment costs.[17] After further polishing and methodological revisions in response to reviewer comments, the published findings in Hurley and Mitchell (2016) for the value of insecticide seed treatments for U.S. soybean farmers was $11.35 per treated acre. They conducted a similar study a few years later to estimate the value of different types of insect management including seed treatments to US corn, soybean, and cotton farmers in the 2016 crop year, which was published as Hurley and Mitchell (2020). The estimated value of seed treatments was $18.83 per treated acre for corn and $14.47 per treated acre for soybeans.[18]

The total farmer value of neonicotinoid seed treatments across North America was estimated at $1.43 billion in 2013 ($1.13 billion in the U.S. and $301 million in Canada), making neonicotinoid seed treatments the single most valued insect management practice for North American corn, soybean, and canola farmers — surpassing even Bt corn ($1.3 billion).[19] Updating these estimates for current conditions is not simple, but the total farmer value of neonicotinoid seed treatments is likely higher today due to factors such as increased input costs and commodity prices.

A critical survey finding is that when farmers were asked whether they would still plant with an insecticidal seed treatment if the same crop varieties were available without it, 75.6% of U.S. corn farmers and 79.9% of U.S. soybean farmers answered "yes."[20] The subsequent survey of U.S. corn, soybean, and cotton farmers published by Hurley and Mitchell (2020) found that 75.0-76.5% would continue using seed treatments even with untreated alternatives available.[21] This evidence suggests that any purported lack of available untreated alternatives is not why growers continue to demand treated seed. Farmers operate in an environment of tight margins and high input costs, and they make careful, economically rational

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[16] T. Hurley and P. Mitchell, Value of Insect Pest Management to U.S. and Canadian Corn, Soybean and Canola Farmers, AgInfomatics (2014), Table 1.

[17] T. Hurley and P. Mitchell, Value of Insect Pest Management to U.S. and Canadian Corn, Soybean and Canola Farmers, AgInfomatics (2014), Table ES1.

[18] T. Hurley and P. Mitchell, Value of Insect Pest Management to U.S. and Canadian Corn, Soybean and Canola Farmers, AgInfomatics (2014), Tables S14a and S15 in the Supplemental Information.

[19] T. Hurley and P. Mitchell, Value of Insect Pest Management to U.S. and Canadian Corn, Soybean and Canola Farmers, AgInfomatics (2014), pp. 38-39, Table 31.

[20] T. Hurley and P. Mitchell, Value of Insect Pest Management to U.S. and Canadian Corn, Soybean and Canola Farmers, AgInfomatics (2014), p. 107.

[21] Hurley and Mitchell (2020), p. 9.

decisions about their input spending. The consistent willingness of three-quarters or more of corn and soybean farmers to purchase treated seeds even when they could obtain the varieties without the added seed treatment cost — is evidence that these growers perceive genuine value in the protection treated seed provides. Farmers choose treated seed because it delivers direct yield benefits when needed, reduces input costs, and provides risk management benefits that growers value. Beyond these benefits, farmers note a few other important benefits that I want to highlight.

Resistance Management and IPM Integration

If neonicotinoids were restricted, farmers would respond by putting far greater reliance on other remaining insecticide classes, including pyrethroids and organophosphates, and their modes of action. This concentration of selection pressure on other, older classes would increase the probability of resistance developing in target pest populations.[22] This finding has been confirmed by additional research. Perry and Moschini (2020) used different data and different methods and arrived at the same projection – if neonicotinoids were restricted, pyrethroids and organophosphates remain the primary substitutes for neonicotinoid seed treatments in U.S. maize. Using actual farmer responses to the EU ban on neonicotinoids, Kathage et al. (2018) documented the same pattern — pyrethroids are the dominant alternative in every case study examined.[23]

Since the AgInfomatics study, soybean aphid resistance to pyrethroids has become widespread, which puts more pressure on farmers to use neonicotinoids (both seed treatments and foliar applications) in order to rotate modes of action as a recommended practice to reduce the likelihood of resistance developing to remaining modes of action.

From the perspective of farmers (based on listening sessions), they include neonicotinoid seed treatments as integral parts of their Integrated Pest Management (IPM) programs.

> Seed treatments precisely target pests, preserve populations of beneficial insects critical to IPM, and reduce the disruption that broad-spectrum foliar applications cause to biological control.[24] They also see neonicotinoid seed treatments as important to manage insect resistance. Without neonicotinoids, growers would rely more heavily on pyrethroids (IRAC Group 3A) and organophosphates (IRAC Group 1B), concentrating selection pressure on fewer modes of action and accelerating the development of resistant pest populations. This concern was consistently raised by growers at the AgInfomatics regional listening sessions, where panelists noted that the loss of neonicotinoids would increase resistance of pests to other chemistries and, therefore, reduce the effectiveness of other insect controls at their disposal."[25]

[22]AgInfomatics, Executive Summary (2015), at pp.10, 28.

[23]See Perry and Moschini (2020), pp. 3, 9 for substitution patterns); Kathage et al. (2018), Tables 2-3 for pyrethroid substitution across all case studies; also see U.S. EPA, Clothianidin and Thiamethoxam PID (2020), p. 48 for note that pyrethroids, organophosphates, and carbamates are the registered alternatives for seed treatment uses.

[24]B. Shaw and K. Genskow, A Summary of Grower and Agri-Professional Perspectives From Regional Listening Sessions in the United States and Canada, AgInfomatics (2014), pp. 3-4.

[25]B. Shaw and K. Genskow, A Summary of Grower and Agri-Professional Perspectives From Regional Listening Sessions in the United States and Canada, AgInfomatics (2014), p. 3; see also AgInfomatics, Executive Summary (2015), p. 10.

Human Health and Worker Safety

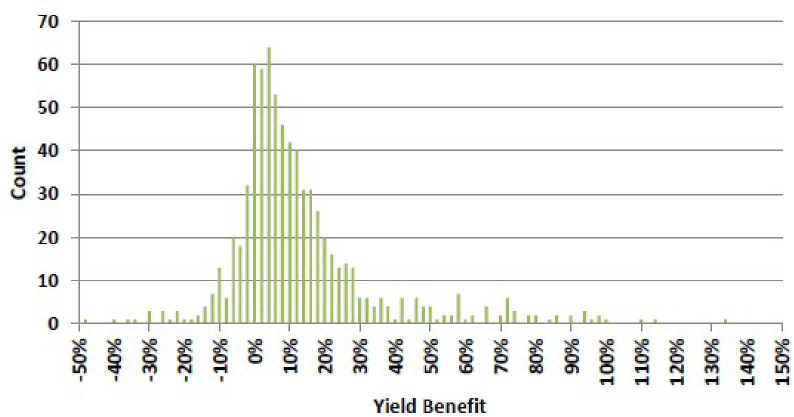
Neonicotinoid seed treatments are delivered directly on the seed before planting, eliminating the need for workers to handle, mix, and apply other foliar or soil-applied insecticides with higher human and mammalian toxicity during the growing season. At regional listening sessions, growers consistently emphasized the improved safety of neonicotinoid seed treatments compared to the alternatives they would be forced to use without neonicotinoids.[26] EPA classified several neonicotinoids as conventional reduced-risk or organophosphate-alternative insecticides since 2001, reflecting their favorable human safety profile.[27]

Our survey of farmers in 2016 (Hurley and Mitchell 2020) found not only a strong concern with the yield and cost effects of seed treatments, but also with risk and environmental safety. From the Abstract:

> *Aggregating over treated areas, the largest total values for each crop were for seed-based technologies. In addition to yield and cost, farmers showed significant concern for economic risk and human and environmental safety when making pest management decisions. These non-monetary concerns significantly affected the likelihood farmers used these practices and their perceived value.*

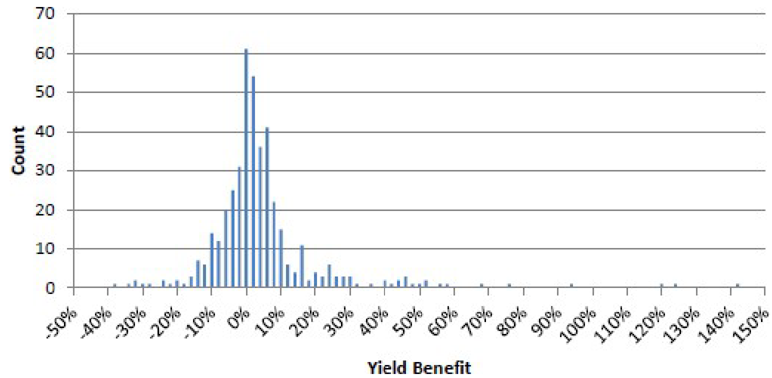
Select figures from P.D. Mitchell, A Meta-Analysis Approach to Estimating the Yield Effects of Neonicotinoids, AgInfomatics (2014).

Corn Figure 1. Histogram of corn yield benefits for neonicotinoid treatments relative to untreated control treatment, truncated at −50% and +150% (N = 774, minimum = −89.73%, maximum = 329.98%, average = 17.38%, standard deviation = 41.60%, t = 11.619, p = <0.0001).

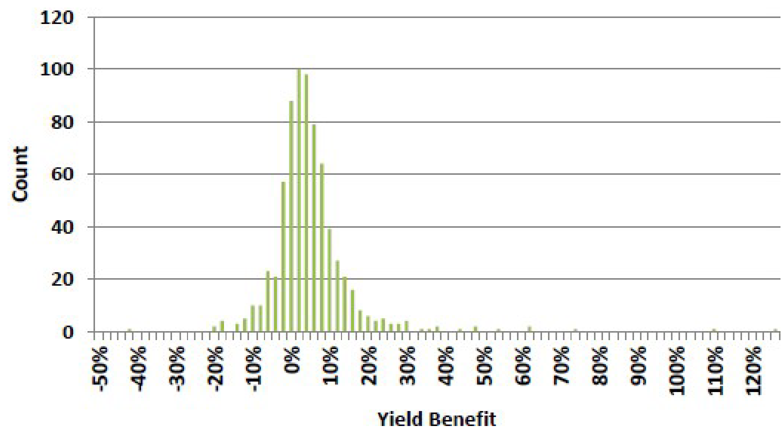


[26]B. Shaw and K. Genskow, A Summary of Grower and Agri-Professional Perspectives From Regional Listening Sessions in the United States and Canada, AgInfomatics (2014), pp. 14-15.
[27]Hurley and Mitchell, (2016), p. 102.

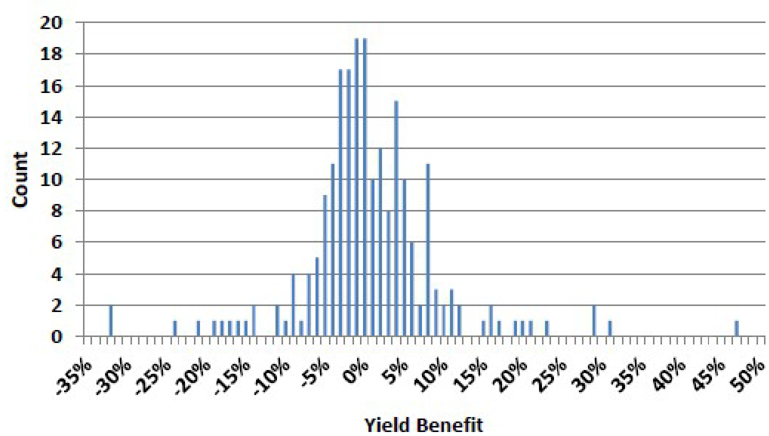
Corn Figure 3. Histogram of corn yield benefits for neonicotinoid treatments relative to non-neonicotinoid insecticide treatments, truncated at −50% and +150% (N = 429, minimum = −55.75%, maximum = 171.43%, average = 4.40%, standard deviation = 21.04%, t = 4.327, p = <0.0001).



Soybean Figure 1. Histogram of soybean yield benefits for neonicotinoid treatments relative to untreated control treatment, truncated at −50% and +125% (N = 718, minimum = −77.50%, maximum = 125.00%, average = 3.62%, standard deviation = 12.38%, t = 7.833, p = <0.0001).



Soybean Figure 3. Histogram of soybean yield benefits for neonicotinoid treatments relative to non-neonicotinoid insecticide treatments (N = 216, minimum = −32.87%, maximum = 46.83%, average = 0.19%, standard deviation = 8.86%, t = 0.3231, p = 0.3735).



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September 8, 2026

Submitted via email to: alexander.r.peacock@maine.gov

Maine Board of Pesticides Control

c/o: Mr. Alexander Peacock
28 State House Station
Augusta, ME 04333

Subject: Stakeholder Submission: Comprehensive Review of Neonicotinoids under LD 1323 (Document #3)

Dear Members of the Maine Board of Pesticides Control:

This is the last of three documents Growing Matters is submitting to the Board; this one provides information regarding the environmental and human health requests. This information was comprised by Dr. Dwayne Moore, Senior Scientist, Stone Environmental Inc., at the request of Growing Matters and addresses inaccurate claims against neonicotinoids across the country that would be pertinent to Maine.

Growing Matters is a coalition of organizations and individuals committed to scientific discourse on the stewardship, benefits and alternatives of neonicotinoid insecticides in North America. The joint effort is led by Bayer CropScience, Syngenta, Valent U.S.A. LLC, BASF Agricultural Solutions and Mitsui Chemicals Crop & Life Solutions, Inc

The Growing Matters coalition is committed to pesticide safety and the stewardship of neonicotinoid products and appreciates the opportunity to comment om the Board's pending analysis of neonicotinoid use and safety in Maine. We will address the categories of concern listed in the legislation, or reference supporting addendums submitted along with these comments. Growing Matters encourages the Board to consider these addendums along with the information provided here for a more balanced approach in your analysis.

Sincerely,

Growing Matters

BACKGROUND

Despite the widespread adoption of neonicotinoid-treated seeds due to their high efficacy and reduced risk profiles, several U.S. states are considering restrictions on neonicotinoid-treated seeds either via either regulatory or legislative means, following prior legislative actions in states such as New York, Vermont, and Washington.

Activists and other non-governmental groups have claimed various environmental harms arising from the use of neonicotinoid-treated seeds since their introduction in the mid-2000s, including the following:

- Mass declines in pollinator populations including the monarch butterfly and the federally threatened or endangered species,
- Harmful effects on aquatic ecosystems due to impacts on aquatic invertebrates,
- Mass declines in birds, and
- Developmental and neurological effects in infants and children.

Growing Matters, an industry coalition dedicated to the scientific stewardship, benefits, and management of neonicotinoid insecticides in North America, requested that I independently review these claims and prepare responses to them. In this report, I briefly discuss my expertise and then address each of the above claims. I also briefly discuss issues that could arise should use of neonicotinoid-treated seeds be limited in the future.

Overall, I found that the claims of widespread effects of neonicotinoid seed treatments to honey bees and wild pollinators, including threatened and endangered species, aquatic insects including mayflies, deer, birds, and human health are without merit and lack credible supporting scientific evidence.

RELEVANT EXPERIENCE AND EXPERTISE

I have served as an ecological risk assessor for the past 37 years, the first 7 years with Environment Canada (the Canadian analogue to the United States Environmental Protection Agency (EPA)), the next 7 years as a Senior Associate with The Cadmus Group, 19 years as a Senior Vice President and Senior Scientist with Intrinsik Ltd., and the past 3 years as Senior Ecotoxicologist and Modeler at Stone Environmental, Inc. During my career, I have led and conducted numerous screening-level and refined risk assessments on the effects of industrial chemicals and pesticides on aquatic life and wildlife. I hold a Bachelor of Science degree in Plant Sciences from the University of Western Ontario, and Master of Science and Doctor of Philosophy degrees in community ecology from the University of Ottawa.

While at Environment Canada, I developed guidance for conducting ecological risk assessments of priority industrial substances, led and participated in priority substance assessments, and developed water quality guidelines for toxic chemicals to ensure protection of aquatic life. For the last 30 years, I have served as a consultant ecological risk assessor to a variety of stakeholders, including private companies, non-government organizations, and government agencies in Canada, the United States, Europe, and Australia. The government agencies have included Environment Canada, Health Canada, Canadian Nuclear Safety Commission, Canadian Department of Fisheries and Oceans, Provinces of British Columbia and Ontario, Canadian Council of Ministers of the Environment, US Environmental Protection Agency (EPA), US Army Corps of Engineers, US Department of Energy, Australian Pesticides and Veterinary Medicines Authority, and Department for Environment in the United Kingdom. My current curriculum vitae is included in Appendix A.

My scholarly activities have included authoring over 65 peer-reviewed publications, 12 book chapters, and editing a book. I have been selected to and served on numerous Scientific Advisory Panels and Boards for the US government, been a member of editorial boards for three major journals in the area of ecological risk assessment and toxicology and helped organize many Society of Environmental Toxicology and Chemistry (SETAC) Pellston workshops on specialized topics in risk assessment. These workshops are collaborative efforts involving prominent experts from academia, government, and industry.

I am an expert in, among other areas, ecological risk assessments for pesticides and industrial chemicals, wildlife exposure modeling, development of water quality guidelines and criteria for protection of aquatic life, community ecology, statistics, uncertainty analysis, and analysis of toxicity data. Since becoming a consultant in 1996, I have developed probabilistic exposure and risk models for birds and mammals exposed to bait, granular, seed treatment, and flowable pesticides. I have also led and participated in many refined aquatic and wildlife risk assessments for pesticides including the neonicotinoids, imidacloprid, clothianidin, and thiamethoxam. I have led and participated in assessments conducted for threatened and endangered species in the United States for a wide variety of pesticides.

1. Introduction to Neonicotinoids

Neonicotinoids ("neonics") are most often applied to seeds prior to planting to control early season insect pests, leading to reduced yields and destroyed crops (Tomizawa and Casida, 2005). These pesticides are also applied to soil and foliage and are widely used in row crops (e.g., corn, cotton, potatoes, soybeans), greenhouse vegetables, forestry, vine crops, citrus, stone fruit and pome orchards, bush berries, and tree nuts. Neonics control crop pests including aphids, Japanese beetles, lacebugs, leaf beetles, leafhoppers, leafminers, thrips, white flies, and many others (Elbert et al., 2008). Neonicotinoid seed treatments have replaced many at-planting applications of flowable and granular insecticides (Casida, 2018). Neonicotinoids have very low toxicity to mammals compared to many other pesticide classes (Casida, 2018). As a result, neonicotinoid products have been widely adopted in the United States because of their efficacy, ease of use, and reduced risks for pesticide handlers.

During registration review, the United States Environmental Protection Agency (EPA) evaluated the potential effects of neonicotinoids on honey bees and other pollinators, as well as aquatic invertebrates, birds, mammals, terrestrial invertebrates, plants, and federally threatened and endangered (i.e., "listed") species. EPA's evaluations included, but were not limited to, potential effects from use of neonicotinoids in seed treatments. The Agency relied on a structured, tiered assessment framework, extensive data requirements, peer review, public consultation, and the integration of multiple lines of evidence to ensure that regulatory decisions were scientifically defensible and protective of ecological resources (EPA, PMRA, and CalDPR, 2014; EPA, 2016, 2017a,b,c,d, 2020a,b,c, 2022a,b,c).

Pollinator Assessments

For pollinators, EPA relied on a harmonized risk assessment framework developed in collaboration with Health Canada's Pest Management Regulatory Agency (PMRA) and the California Department of Pesticide Regulation (EPA, PMRA, and CalDPR, 2014). The framework was designed to move beyond reliance on single laboratory studies and incorporated increasingly realistic exposure scenarios and toxicity data as assessments progressed through successive tiers.

EPA's Tier 1 evaluations included acute and chronic laboratory toxicity studies on adult and larval honey bees (EPA, 2020a,b,c). These studies are intentionally conservative and provide screening-level estimates of potential risk under worst-case exposure assumptions. When potential concerns were identified, EPA required additional information. Higher-tier assessments incorporated measured pollen and nectar residues, semi-field tunnel studies and feeding studies, and full field colony studies that evaluated colony strength, brood production, foraging behavior, overwinter survival, and recovery potential following exposure to neonicotinoids (EPA, 2020a,b,c).

A major strength of the EPA pollinator assessments was their explicit use of multiple lines of evidence. Toxicity data, environmental residue measurements, exposure studies, colony-level studies, and ecological field observations were considered to determine whether effects observed in laboratory studies translated into risks under real-world conditions (EPA, 2020a,b,c).

Non-pollinator Assessments

The Agency conducted separate aquatic and terrestrial ecological risk assessments for non-pollinators and released these assessments for public review as part of the registration review process (EPA, 2016, 2017a,b,c,d, 2020d). For imidacloprid, EPA completed an aquatic ecological assessment and subsequently conducted a terrestrial ecological assessment (EPA, 2016, 2017a). Similar aquatic and terrestrial risk assessments were completed for clothianidin, thiamethoxam, and dinotefuran (EPA, 2017b,c,d, 2020d).

For aquatic ecosystems, EPA evaluated toxicity to aquatic insects and other invertebrates, which are among the most sensitive groups affected by neonicotinoids. The Agency integrated laboratory toxicity data, environmental fate information, water exposure estimates, monitoring data, and ecological effects information to characterize potential risks. The resulting analyses identified specific circumstances in which aquatic invertebrates could face elevated risks and contributed substantially to the overall regulatory conclusions for the neonicotinoid class and required mitigations on neonicotinoid labels (EPA, 2016, 2017b,c,d, 2020d,e,f,g).

For terrestrial wildlife, EPA assessed risks to birds, mammals, and non-pollinating terrestrial invertebrates through quantitative exposure and effects analyses. The Agency considered multiple exposure routes, including dietary exposure from treated seeds, contaminated vegetation, and insect prey. Toxicity endpoints were combined with environmental exposure estimates to evaluate both acute and chronic risks. Where screening-level concerns were identified, EPA conducted refined assessments using additional information and exposure assumptions, consistent with its tiered risk assessment framework (EPA, 2017a,b,c,d, 2020d).

EPA also examined broader ecological effects by evaluating environmental fate and transport, persistence, movement into surface waters, and potential impacts on listed species under the Endangered Species Act. Following completion of the registration review assessments, EPA prepared biological evaluations and subsequent jeopardy and adverse-modification analyses for federally listed species (EPA, 2022a,b,c).

MITIGATION MEASURES

Based on the collective evidence from the pollinator and non-pollinator assessments, EPA developed a suite of mitigation measures intended to reduce environmental exposure and risk while providing the tools that farmers need to control insect pests (EPA, 2020e,f,g). These measures included:

- Restrictions on applications to blooming crops to reduce bee exposure. For bee-attractive crops such as fruiting vegetables, cucurbits, berries, tree fruit, and tree nuts, EPA evaluated whether applications could occur during bloom, pre-bloom, or post-bloom and proposed timing restrictions where risks were identified (EPA, 2020e,f,g).
- Crop-stage restrictions and application-rate reductions for certain agricultural uses. The imidacloprid and dinotefuran Proposed Interim Decisions (PIDs) included application rate reductions and crop-stage restrictions. The clothianidin/thiamethoxam PID included application rate reductions as part of its proposed mitigation package (EPA, 2020e,f,g).
- Measures intended to reduce off-target transport and environmental contamination, including practices to reduce runoff, erosion, and spray drift to protect non-target plants and wildlife (EPA, 2020e,f,g).
- Improved label language and stewardship requirements to enhance compliance and risk reduction, including clearer directions intended to reduce environmental exposure, improve user compliance, and support resistance management (EPA, 2020e,f,g).
- Many of the labels for neonicotinoid seed treatments (e.g., Poncho/Votivo, Cruiser 5FS), as ultimately approved by EPA, require that treated seeds be buried to a depth of greater than one half inch. This mitigation substantially reduces wildlife access to treated seeds.
- Additional protections aimed at reducing ecological risks to sensitive non-target organisms, particularly aquatic invertebrates, including rate reductions, runoff and spray-drift mitigations, and use cancellations (EPA, 2020e,f,g).

In summary, there are many good reasons why State regulatory agencies have relied on and continue to rely on EPA assessments and regulatory requirements for neonicotinoid seed treatment uses. As I will show below, activist claims regarding widespread effects of neonicotinoid seed treatments on the environment are greatly exaggerated and based on selective, often flawed, evidence.

Simply put, the mitigations currently required by the EPA on neonicotinoid seed treatment labels are effective and ensure environmental protection in the United States.

2. MASS DECLINES IN POLLINATOR POPULATIONS

CLAIM: The evidence typically presented by activists to support their claim of mass declines in pollinator populations due to use of neonic seed treatments is weak due to reliance on flawed studies and failure to consider more realistic field studies and the overall weight of evidence. In the section that follows, I describe the evidence typically cited by activists. In my response to claims, I use a weight of evidence approach that relies on more refined and realistic studies to determine if there have been mass pollinator declines and, if so, whether neonicotinoid seed treatments are a significant contributing factor.

Evidence Cited To Support Claim:[1] Many flowering plants depend on animal pollination including crops such as blueberries, pumpkins, apples, cherries, and watermelons. Reilly et al. (2020) found that crop production in the United States is frequently limited by inadequate pollinator visitation. Turo et al. (2024) similarly concluded that insufficient pollinator visitation often limits crop yields globally. Smith et al. (2022) estimated that worldwide pollinator losses have caused 3-5% production declines in fruit, vegetable, and nut crops.

Activists also cite evidence of recent bee declines. According to the Apiary Inspectors of America's 2023-2024 U.S. Beekeeping Survey, U.S. beekeepers lost a record 55% of honey bee colonies during the 2023-2024 beekeeping year. The U.S. Fish and Wildlife Service (2017) found that the endangered rusty patched bumble bee had disappeared from nearly 90% of its native range since the mid-1990s.

Pollinator declines are often attributed to clothianidin, imidacloprid, and thiamethoxam, the active ingredients for neonicotinoid insecticides commonly used as seed treatments in US crops. Several peer-reviewed studies often cited by activists identify neonicotinoid use as a potential driver of wild pollinator declines. Guzman et al. (2024) concluded that neonicotinoid use was "a major driver of changes in occupancy across hundreds of wild bee species" in the United States from 1995 to 2015. Van Deynze et al. (2024) claimed that neonicotinoid-treated seed use was strongly correlated with declines in butterfly species richness from 1998 to 2014 and that neonicotinoids were the most significant factor affecting relative local monarch abundance. Woodcock et al. (2016) found evidence of increased wild bee population extinction rates associated with neonicotinoid seed treatment use on oilseed rape in the United Kingdom.

My Response: The number of honey-producing bee colonies declined dramatically (i.e., 61%) in the United States from 1947 to 2008 (vanEngelsdorp and Meixner, 2010). This decline began well before the introduction of neonicotinoid seed treatment products. Since the introduction of neonicotinoids in the mid to late 1990s, the number of honey-producing bee colonies has remained remarkably steady (Figure 1). The situation is similar in Maine and other states despite some variability over time (Figure 2). In recent years, the number of honey-producing bee colonies in Maine has been increasing despite the increased use of neonicotinoids during that timeframe (Figure 3).

[1] Throughout this Comment, I endeavor to provide a fair summary of activist claims and the evidence activists rely on to support their claims. My summaries should not be construed as an endorsement that these claims are correct (they are not) or that the data and studies they cite reach or support scientifically reliable, methodologically sound conclusions regarding the risks and effects of neonicotinoid use on vulnerable species.

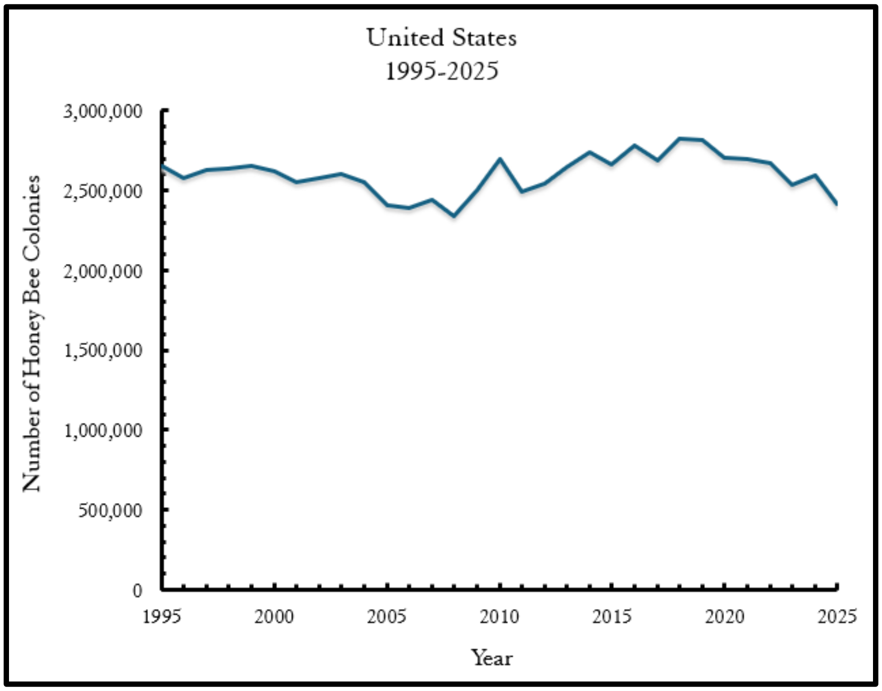

Figure 1. Number of honey producing colonies in the United States from 1995-2025. Data were obtained from the US Department of

Agriculture Natural Agricultural Statistics Service (https://quickstats.nass.usda.gov/).

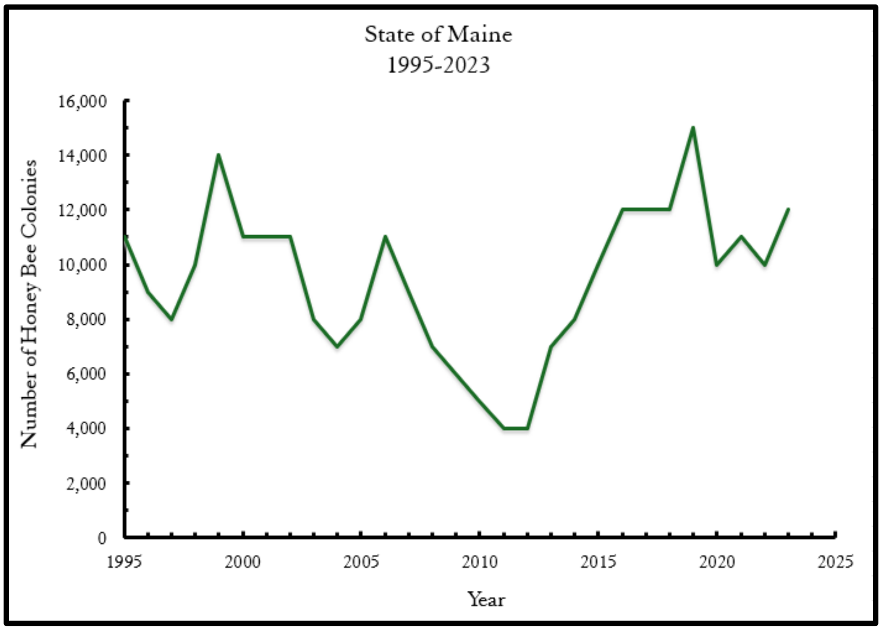

Figure 2. Number of honey producing colonies in Maine from 1995-2023. Data were obtained from the US Department of Agriculture Natural Agricultural Statistics Service (https://quickstats.nass.usda.gov/).

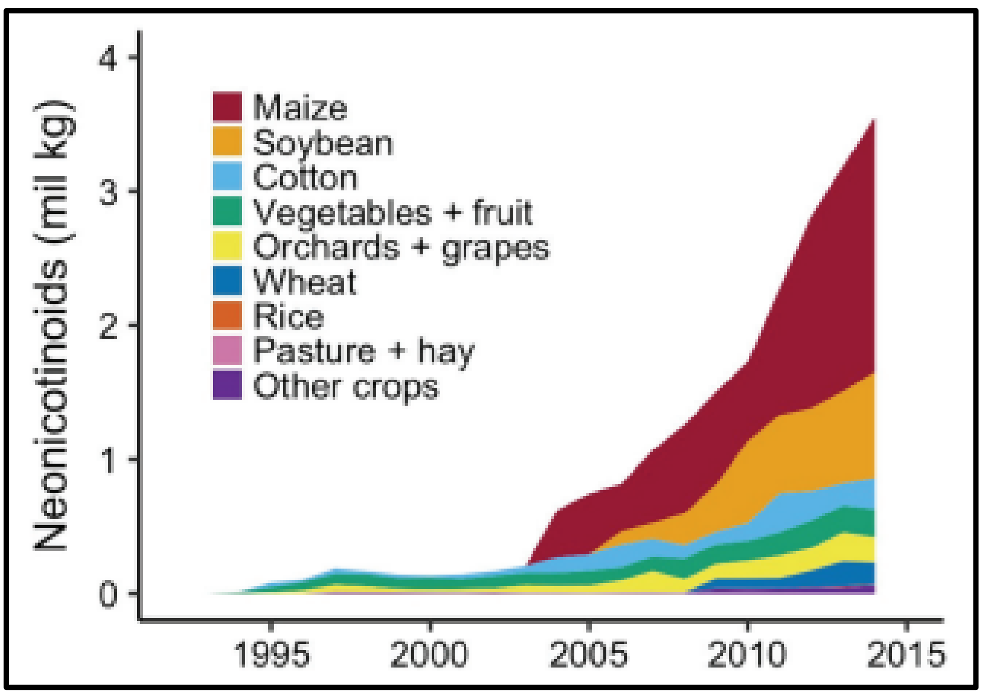

Figure 3. Neonicotinoid use in the United States by crop from 1992 to 2014 (from Tooker et al., 2017). In this figure, maize and corn are synonymous.

These data reflect that the number of honey bee colonies has been stable since the advent of neonicotinoid use. Annual colony losses in the United States continue to be an issue with losses varying between 29 and 45% of honey bee colonies from 2010-11 to 2015-16 (Hellerstein et al., 2017). However, it is well established that losses of honey bee colonies are attributable to numerous factors including pests and diseases, bee keeping practices and in-breeding, climate change, agricultural practices, and the use of various herbicides and insecticides (Neumann and Carreck, 2010; Staveley et al., 2014; Hristov et al., 2020). The ectoparasitic mite, *Varroa destructor*, has been a major factor in colony losses as has the microsporidium fungi, *Nosema ceranae* and *Nosema apis* (Neumann and Carreck, 2010; Staveley et al., 2014). A descriptive epizootiological study conducted by vanEngelsdorp et al. (2009) compared risk factors between bee colonies afflicted and not afflicted by colony collapse disorder (CCD), an issue that has plagued honey bees since at least 2006 (Hristov et al., 2020). Their study included 61 quantified variables (e.g., adult bee physiology, pathogen loads, pesticide levels). No single variable emerged as a most likely cause of CCD. Bees in CCD colonies had higher pathogen loads and were co-infected with a greater number of pathogens than control populations, indicating either an increased exposure to pathogens or a reduced resistance of bees to pathogens. Levels of the synthetic acaricide coumaphos (a pesticide used by beekeepers to control *Varroa destructor*) were higher in control colonies than CCD-affected colonies. Pesticides were not a significant CCD risk factor even though 171 pesticides and related metabolites, including neonicotinoids (see Mullin et al., 2010 for details), were measured in wax samples, bees, and bee-collected pollen.

The US Department of Agriculture (USDA) and other researchers have extensively studied the various threats to bee health for many years (see https://www.ars.usda.gov/oc/br/ccd/index/#research). One of the key threats is CCD. The term CCD has been used in a variety of ways, but the USDA currently defines CCD as a syndrome involving a dead colony with no adult bees and with no dead bee bodies, but with a live queen and usually honey and immature bees still present. According to the USDA, no scientific cause for CCD has been proven, and most research has pointed to a complex of factors being involved that can vary on a case by case basis (see also Hristov et al., 2020).

CCD is far from the only pervasive threat to honey bee health and productivity. According to the USDA, reports of CCD began to wane in 2010, yet commercial beekeepers continued (and still continue) to report high percentages of colony loss each year due to other causes. For example, the USDA reports that bee keepers continue to struggle with parasites and pests (particularly *Varroa destructor*), pathogens, and poor nutrition (including nutrition deficiencies from placing bees in mono-crop environments for honey production and/or pollination), along with use of various pesticides. Recent USDA reports show that *Varroa* mites were the number one stressor in all quarters surveyed in 2023 and 2024 (USDA, 2024, 2025).

The US Department of Agriculture's (USDA) assessment of threats to honey bee health is consistent with what commercial beekeepers themselves report. According to the Bee Informed Partnership's (BIP) 2022-2023 Annual Bee Colony Loss Survey (https://beeinformed.org/wp-content/uploads/2023/06/BIP-2022-23-Loss-Abstract.pdf), commercial bee keepers continue to experience high levels of annual colony losses. The most prominent cause of colony losses reported by commercial beekeepers was *Varroa* mites, followed by queen issues, and adverse weather. Commercial bee keepers, to a lesser extent, also attributed losses to use of pesticides (including in-hive uses), nutritional stress, predators, unknown causes, brood diseases, apicultural treatments, shipping stress, equipment failure, and scavenger pests.

The gold standard for assessing bee colony issues is the field hive study (Entine, 2018). Field hive studies of honey bees and bumble bees foraging in neonic pesticide-treated crops, as well as areas with natural sources of pollen and nectar, provide the highest degree of realism regarding possible effects on bees. The science media tends to report on studies, no matter how weak, that found problems rather than those demonstrating that current practices are safe. This bias has been true in the debate over neonicotinoids. While the media continues to produce stories suggesting that a pesticide-fueled "bee-pocalypse" is unfolding, numerous field hive and solitary bee studies found that neonicotinoids have caused little to no observable adverse effects on bees at the hive level from field-realistic exposures. For example, canola/oilseed rape field studies found that honey bee colonies exposed under realistic agricultural conditions to neonicotinoid-treated seed crops showed little or no measurable colony-level impairment. In Canadian canola, there were no long-term differences in bee mortality, worker longevity, brood development, colony weight gain, honey yield, or overwintering outcomes after colonies foraged in clothianidin seed-treated canola fields (Cutler and Scott-Dupree, 2007). A large-scale Canadian field study similarly reported vigorous colonies during and after exposure to clothianidin-treated canola, with no treatment-related effects on colony weight gain, honey production, pest incidence, adult bee numbers, sealed brood, mortality, or overwintering success, despite detectable low-level clothianidin residues in pollen (Cutler et al., 2014a). A broader review of canola seed treatments concluded that neonicotinoid seed treatments have been widely used in Western Canadian canola production but have not caused adverse colony-level effects on managed honey bees under those production systems (Sekulic and Rempel, 2016). Oilseed rape/canola flowers are highly attractive to bees, much more so than corn (which does not produce nectar and is wind pollinated), soybean flowers, and many other crop flowers (USDA, 2016). Thus, bees are more likely to be exposed to neonicotinoids from oilseed rape/canola seed treatments than most other crop seed treatments. The data from field studies involving oilseed rape and canola flowers thus strongly support the conclusion that bees face minimal risks of harmful exposure from neonicotinoids used in seed treatments in the United States.

Other higher-tier field and weight-of-evidence studies confirm the findings from the canola field studies conducted in Canada. Pilling et al. (2013) reported that honey bee colony mortality, foraging behavior, colony strength, weight, brood development, food storage, and overwintering performance were unaffected following four years of repeated exposure to flowering maize and oilseed rape grown from thiamethoxam-treated seed in France. Osterman et al. (2019) found no detectable negative effects of clothianidin-treated oilseed rape grown in Sweden on honey bee colony development or pathogen dynamics in a landscape-scale study. Schmuck and Lewis (2016) reviewed large-scale monitoring studies conducted in Europe and concluded that clothianidin-treated oilseed rape seeds did not cause any detrimental effects on honey bees, bumble bees, or red mason bees. And the list goes on. For honey bees, see field studies by Henry et al. (2015), Meikle et al. (2016), Rolke et al. (2016), and Thompson et al. (2016a). For bumble bees, see field studies by Thompson (2013), Cutler et al. (2014b), Stanley et al. (2016), Sterk et al. (2016), and Thompson et al. (2016b). For solitary bees, see field study by Peters et al. (2016).

Weight-of-evidence reviews of field studies by Solomon and Stephenson (2017a,b,c) and Stephenson and Solomon (2017a,b) concluded that imidacloprid, clothianidin, and thiamethoxam seed treatments used according to good agricultural practice posed minimal or no significant colony-level risk to honey bees.

Field studies offer a reality check to laboratory studies, i.e., "caged bee" studies, which almost always overdose the bees because:

- Bees in the field have access to a wider variety of forage than neonic-treated crops, whereas lab studies commonly feed the bees only neonic-spiked food.
- Exposure of bees in the field is limited by the short duration of crop flowering, whereas chronic lab studies expose bees to continuous diets spiked with neonic pesticides for weeks.
- Lab studies are unable to capture the self-detoxification capacities of honey bee and bumble bee hives (e.g., Leska et al., 2022).
- Many lab studies simply feed bees doses of neonic pesticides at levels far above field-realistic exposures. Such lab studies prove little more than that one can definitely kill bees if you feed them enough insecticide.

Large-scale losses are not new to the beekeeping industry. Since 1869, there have been at least 18 different episodes of unusually high colony mortality documented internationally (Underwood and vanEngelsdorp, 2007). For example, a condition called "May Disease" occurred in Colorado in 1891 and 1896, where large clusters of bees completely disappeared or significantly declined over a short period of time (Aikin, 1897, as cited in vanEngelsdorp et al., 2009). The overall takeaways from the literature regarding honey bee losses is that CCD or CCD-like large scale losses have been occurring for over 150 years, the causes of CCD are complex with the most important being *Varroa* mites and pathogens, and that the numbers of honey bee hives in the United States have been stable since the advent of neonicotinoid use, including seed treatments. The evidence that neonicotinoid seed treatments have somehow caused a "bee-pocalypse" is very weak indeed (Miller, 2019a). EPA's rigorous pollinator assessments, in contrast, found that most neonicotinoid uses, including seed treatments, do not pose significant risks to bee colonies (EPA 2020a,b,c). Canada's Pest Management Regulatory Agency (PMRA) has issued similar findings (Health Canada, 2019, 2023a,b).

Activist claims that wild bee species are also undergoing drastic declines is not supported by the best available scientific evidence (Miller, 2019b; Entine, 2019). To begin, the vast majority of wild bee species in North America are found in habitats (e.g., deserts) where they do not come in contact with agricultural crops. Kleijn et al. (2015) found that crop-visiting wild bee communities are dominated by a small number of common species, and threatened species are rarely observed on crops. Those dominant crop pollinators, which represent only 2% of wild bee species, account for 80% of all crop visits by wild bees. They are also thriving. Bartomeus et al. (2013) conducted a long-term study of relative rates of change for the entire regional bee fauna in the northeastern United States using >30,000 museum records representing 438 species. Over a 140-year period, steep declines were observed for only three species of bumble bees. The declines observed in individual wild bumble bee species were likely due to disease, habitat loss, and climate change, not neonicotinoid seed treatments. Studies have shown that there is spread, or "spillover," of viral diseases from managed honey bees to wild bee populations (Manley et al., 2015). Researchers at the University of Vermont demonstrated that exposure to viral diseases arises from bumble bees foraging on flowers previously visited by infected honey bees (Alger et al., 2019). Kerr et al. (2015) found that climate change is contributing to bumble bee losses in North America. The authors further stated that the "effects are independent of changing land uses or pesticide applications." Urbanization and other human development may also contribute to the loss of wild bee habitat.

SUMMARY:

- Since the introduction of neonicotinoids in the mid to late 1990s, the number of honey-producing bee colonies in the United States has remained remarkably steady. There is no temporal correlation between increasing use of neonicotinoid seed treatments and number of honey bee colonies.

- Field studies of bees foraging in neonic pesticide-treated crops, as well as areas with natural sources of pollen and nectar, provide the highest degree of realism regarding possible effects on bees. Numerous field studies involving honey bees, bumble bees, and solitary bees have shown that exposure to crops planted with neonicotinoid-treated seeds had negligible effects on bees.

- The vast majority of wild bee species are not in contact with agriculture. The small percentage of wild bee species that pollinate agricultural crops are thriving. Yields of agricultural crops in the United States and elsewhere that depend on wild pollinators are not declining.

3. IMPACTS ON AQUATIC INVERTEBRATES

CLAIM: Activists have frequently claimed that aquatic invertebrates, including mayflies and other aquatic insects, are being harmed by exposure to neonicotinoids in areas where there is high usage, with the primary source of those neonics being seed treatments. To support their claim, they rely on water monitoring data collected by the United States Geological Survey (USGS), various States, and other sources.

EVIDENCE CITED TO SUPPORT CLAIM: Activists claim that water monitoring data show that neonicotinoids are regularly found in surface waters, particularly during planting and the month following planting of various crops that rely on neonic seed treatments (e.g., corn, soybean). Observed concentrations can sometimes exceed acute and chronic benchmarks that have been established by the EPA as protective of aquatic invertebrates. To support their claim that neonics are harming whole ecosystems, a study in Japan that attributed collapse of a fishery to the decimation of aquatic invertebrate populations because of neonic use in nearby agriculture is often cited (Yamamuro et al., 2019).

MY RESPONSE: Various States, particularly in the Midwest where neonics have high usage, confirmed that their surface water monitoring programs have regularly detected neonics at concentrations above EPA's chronic benchmarks for aquatic invertebrates. The EPA's chronic aquatic life benchmarks (ALBs) are 10 ng/L for imidacloprid, 50 ng/L for clothianidin, and 740 ng/L for thiamethoxam. These ALBs are screening criteria used to interpret surface water monitoring data (EPA, 2025) and exceedance of an ALB is not proof of ecological harm. Rather, exceedance of an ALB identifies a potential concern and typically warrants refined, site-specific, or higher-tier analysis before inferring adverse community-level effects (Clark et al., 1999). For aquatic invertebrates, possible higher tier tools include using additional toxicity data, species sensitivity distributions (SSDs), mesocosms, field evidence, and/or community-level assessments (EPA, 2007). ALBs reflect conservative toxicity thresholds, derived from sensitive lab studies and safety factors, below which harmful effects are not expected for nearly all species (EPA, 2025). These chronic benchmarks presume constant 21-day exposures at the ALB concentrations.

There are many reasons why the neonic concentrations observed by various States do not establish adverse effects on aquatic communities:

- *Sampling plan design, temporal trends, and chronic effects.* Detections are typically confined to the immediate post-planting window and are not pervasive year-round. Further, concentrations exceeding chronic ALBs are nearly always the result of grab samples or one-time sampling events triggered by either the regularly scheduled site sampling timing or by a storm event. Therefore, they do not represent appropriate concentrations for comparison to chronic ALBs which are intended as 21-day average concentrations. Comparing the maximum detected values to the acute ALBs for is a more scientifically defensible approach. Maximum neonic concentrations in US surface waters rarely exceed the EPA's acute ALBs. Clearly, duration of exposure is an important consideration for the monitoring data evaluations.

- *Thresholds not indicative of chronic effects.* Aquatic toxicity studies conducted in limn corrals, mesocosms and microcosms (i.e., constructed artificial aquatic ecosystems) offer a level of environmental realism not found in the laboratory studies that are the basis of EPA's ALBs (OECD, 2006; de Jong et al., 2008). Cosm studies account for natural abiotic and biotic interactions and are conducted under environmentally relevant exposure conditions. Laboratory studies are typically performed under constant environmental conditions using a single species. Ratte and Memmert (2003) found a no observed adverse effect concentration (NOAEC) of 9,400 ng/L for emerging insects and macrozoobenthos exposed to imidacloprid. Moring et al. (1992) derived a NOAEC of 6,000 ng/L for macroinvertebrates exposed to imidacloprid. The concentrations of imidacloprid detected in State monitoring programs are much lower than the cosm NOAECs (also see Whitfield-Aslund et al., 2017; Finnegan et al., 2018). Cosm and field studies have also demonstrated that aquatic invertebrate communities can recover from effects that occur early in the growing season (e.g., Hartgers and Roessink, 2015; Lobson et al., 2018). Growing and mature crops tend to stabilize soil in the field, reducing runoff and erosion (Ma et al., 2014; Davidová et al., 2015), thus giving aquatic invertebrates time to recover.

- *Refined assessments demonstrate low concern for aquatic invertebrates.* An example of a refined approach was published by Whitfield-Aslund et al. (2017). The authors conducted a probabilistic ecological risk assessment to determine the potential effects of exposure of aquatic invertebrate communities to imidacloprid arising from labeled agricultural and non-agricultural uses in the United States. Aquatic exposure estimates were derived using a higher-tier refined modeling approach that accounted for realistic variability in environmental and agronomic factors. Toxicity was assessed using refined acute and chronic community-level toxicity endpoints for aquatic invertebrates (i.e., species or taxon sensitivity distributions) developed using the best available data. Overall, the Whitfield-Aslund et al. (2017) assessment found that aquatic invertebrate communities in the United

States are unlikely to be adversely affected by acute or chronic exposure to imidacloprid arising from currently registered uses.

- *Neonic mixtures in surface water are not a concern.* The weight of evidence indicates pesticide mixture effects are generally additive or sub-additive at environmentally relevant levels (e.g., Rodney et al., 2013; Jeninga et al., 2023). A recent U.S. Geological Survey (USGS) study (Schmidt et al., 2022) did observe synergy in a controlled mesocosm study, but only at high concentrations (1,000 to 5,000 ng/L), far above neonic concentrations observed in US surface waters. Synergism arising from the occurrence of neonic mixtures in US surface waters should not be a concern based on the available scientific evidence.

- *Response to claim that EPA's acute neonic benchmarks are too high.* Activists contend that EPA's acute aquatic life benchmarks for imidacloprid (385 ng/L), clothianidin (11,000 ng/L), and thiamethoxam (17,500 ng/L) are markedly less protective than the corresponding European Union benchmarks (57-65 ng/L, 340 ng/L, and 550-770 ng/L, respectively). Further, a global review by Morrissey et al. (2015) suggested a 200 ng/L threshold for potential short-term harm. Even considering the more protective proposed total neonic criterion by Morrissey et al. (2015), US surface waters rarely, if ever, have total neonicotinoid concentrations exceeding 200 ng/L (e.g., Berens et al., 2021; MDA, 2024a,b).

- *Response to claims of declines in mayfly populations.* The only study supporting the claim that increasing use of neonicotinoid seed treatments have adversely affected mayflies was a study by Stepanian et al. (2020). That study used radar observations of mayfly emergence flights to quantify long-term changes in annual biomass transport along the Upper Mississippi River and Western Lake Erie Basin. Their results indicated that mayfly production across both waterways declined by over 50% from the early 2000s to 2019. The authors noted that an even worse decline was observed in western Lake Erie, and the Illinois, Ohio and Mississippi Rivers from about 1970 to 1990 due to a combination of increasing eutrophication from agricultural runoff, chronic hypoxia, hydrologic engineering, and environmental toxicity. Importantly, the authors had no data to link recent mayfly declines with use of neonicotinoid seed treatments. As the authors stated, recent declines are likely due to multiple stressors including climate change causing warming waters and chronic hypoxia, and nutrient runoff causing hypoxia and algal blooms that release toxins such as microcystin to which mayflies are highly sensitive. They speculate that pesticides, including neonicotinoids, could be compounding the effects of climate change, nutrient runoff, and other anthropogenic stressors. However, this speculation is nothing more than just that because the study was not designed to identify causes of mayfly declines.

- *Response to claims of harm to a Japanese fishery.* The methods used by Yamamuro et al. (2019) to link a perceived fishery collapse in Lake Shinji, Japan with the use of neonicotinoids and effects on invertebrate prey are dubious at best. Miller (2019c) reviewed the Yamamuro et al. (2019) study, pointing out its many shortcomings and lack of quantifiable evidence for the decrease in smelt and eel abundance. The key points are as follows:

    - Estimates of neonicotinoid exposure over time were based on neonicotinoid sales near Lake Shinji and not actual water concentration measurements over time.

- Water concentrations of neonicotinoids were only measured in 2018 and only one quantifiable concentration was found. Additionally, the reported measurement was for total neonicotinoids and was lower than the limit of quantification for several of the neonicotinoids measured. Therefore, the measurement itself is unreliable.
- Biomass of zooplankton was declining long before and plateaued around the time neonicotinoids were introduced in Japan (see third figure in Miller, 2019c).
- Other possible causes of decline include extensive shoreline industrial development, significant heavy metal contamination and eutrophication issues, habitat changes, and the construction of an artificial wall.
- Japan's Ministry of the Environment had touted Lake Shinji's rich biodiversity of fish, clams, and birds, despite decades of pollution.

SUMMARY:

- Chronic ALBs should only be compared with 21-day average concentrations, not maximum detected values.
- Reported exceedances reflect episodic storm-driven exposures and are not indicative of chronic risk at the maximum concentrations detected.
- Exceedance of acute and chronic ALBs does not equate to ecological harm and should be interpreted within a higher-tier risk assessment framework.
- Observed neonic concentrations remain well below levels associated with chronic community-level impacts.
- Available evidence indicates the potential for recovery following material exposure events with many community-level effects diminishing over time.
- There is no evidence that greater-than-additive effects from exposure to neonic mixtures are occurring in US surface waters.
- Although EPA's acute benchmarks are higher than corresponding European benchmarks and the acute total neonic acute benchmark proposed by Morrissey et al. (2015), exceedances of the more sensitive neonic benchmarks are infrequent and transient in US surface waters.
- There is no evidence demonstrating a link between observed mayfly declines from the early 2000s to 2019 in Lake Erie and the Mississippi River and the use of neonicotinoid seed treatments.
- Yamamuro et al. (2019) failed to explain the steep decreasing trend in macrofaunal abundance occurring long before the introduction of neonicotinoids in Japan, used neonicotinoid sales data rather than actual measured concentrations, and did not account for the confounding factors affecting the natural habitats of Lake Shinji.

4. MASS DECLINES IN BIRDS

CLAIM: Activists have claimed that the increase in neonicotinoid use led to statistically significant reductions in bird biodiversity between 2008 and 2014, particularly for grassland and insectivorous birds. The claim centers around the assertion that when farmers plant field crops, neonic-treated seeds are often left on the surface or the seeds are planted shallow enough for birds to eat.

EVIDENCE CITED TO SUPPORT CLAIM: Several studies have been cited to support claims regarding the effects of neonicotinoid-treated seeds on birds. These studies are described herein. Li et al. (2020) suggested that the increase in neonicotinoid use between 2008 and 2014 led to statistically significant reductions in bird biodiversity relative to a scenario without neonicotinoid use. The reductions were particularly evident for grassland and insectivorous birds, with average annual rates of reduction of 4% and 3%, respectively.

Activists also cite a review produced for the American Bird Conservancy by Mineau and Palmer (2013). The authors of this study claimed that neonicotinoids debilitate birds and have high chronic and reproductive risks. Mineau and Palmer (2013) blame the high chronic risk of neonicotinoids to birds on the persistent and systemic nature of seed treatments, leading to the chemicals being present in the environment for extended periods. They further state, "Regardless of the exact label directions and requirements, seed-treatment chemicals are widely available to birds (see also Roy et al., 2019). Seeds are never fully covered with soil, making them easy to find by foraging birds. Spills are commonplace with current machinery. And many species have the ability to scrape and dig for planted seed." Mineau and Palmer (2013) also state that 1/10 of a seed consumed per day would lead to critical reproductive effects in sensitive bird species.

Frequently cited by activists are two studies by Eng et al. which claimed that white-crowned sparrows exposed to imidacloprid experienced impacts on their migration behavior. In the first study, Eng et al. (2017) found that white-crowned sparrows consuming the equivalent of just four imidacloprid-treated canola seeds per day over three days suffered impaired condition (e.g., body weight loss, declines in fat stores), migration delays, and improper migratory direction, which could lead to increased risk of mortality or lost breeding opportunity. A subsequent study by Eng et al. (2019) found that a high imidacloprid dose caused migrating white-crowned sparrows to stay a median of 3.5 days longer at the site of capture after exposure compared with controls.

Also commonly cited is a study by Lopez-Antia et al. (2015) which exposed red-legged partridges to imidacloprid-treated seeds at 20% of the recommended application rate. The study authors observed no effects on survival, but reduced levels of plasma biochemistry parameters (glucose, magnesium and lactate dehydrogenase), increased blood superoxide dismutase activity, changes in carotenoid-based integument coloration, reduced clutch size, delayed first egg laying date, increased egg yolk vitamins and carotenoids, and depressed T-cell immune response in chicks.

MY RESPONSE: Although Li et al. (2020) claimed that bird population declines are correlated with increased neonicotinoid use, other studies have not observed such a relationship. One such study was conducted by Belden et al. (2018). This study involved a route-level, spatially explicit comparison of bird abundance trends and agricultural land cover across the central United States. Belden et al. (2018) paired North American Breeding Bird Survey (BBS) counts from 1995-2016 for 31 bird species across 13 high-cropland states, including Minnesota, with USDA-NASS Cropland

Data Layer classifications around each survey route, primarily using a 2 km buffer to characterize local land cover. Routes were categorized by dominant land cover, e.g., >50% cropland versus >50% grassland, and by increasing proportions of total cropland and combined corn/soybean cover. The authors then used Poisson regression to estimate species-specific changes in bird counts over time and compared slopes among land-cover categories. Their central test was whether bird populations declined more strongly in areas of higher agricultural intensity, which would be expected if current row crop practices and/or associated pesticide use (e.g., increasing use of neonic seed treatments) were broadly driving population declines. Their results did not show a broad, consistent pattern of greater bird declines in crop-intensive landscapes including corn and soybean areas with high usage of neonicotinoid seed treatments. Nearly all species showed some statistically significant response to land cover differences, but the direction of response varied. For example, in cropland versus grassland comparisons, 16 species exhibited negative trends in cropland whereas 11 exhibited positive trends, and similar mixed patterns appeared across increasing cropland and corn/soybean categories. Median differences in annual percent change were small, generally around 0.5 to 0.7% per year, and species with positive or negative responses did not cluster by feeding guild. Belden et al. (2018) concluded that while agriculture-related effects, particularly localized or species-specific pesticide exposure, cannot be ruled out, their large-scale analysis does not indicate that current agricultural intensification and associated pesticide use is causing widespread bird population declines across most species studied. Instead, habitat-related factors, including habitat loss, degradation, and species-specific landscape requirements, are more likely to explain many of the observed declines. Of particular note, Belden et al. (2018) suggested that pesticides may have caused bird population declines from 1966 to 1995. Use of organochlorine insecticides such as DDT, aldrin, and dieldrin, which were recognized as significant contributors to bird population declines, were prohibited in the United States by the early 1970s. Further, another class of insecticides have been found to be toxic to birds if sufficiently exposed (Hill and Fleming 1982; EPA 2017e,f), and there has been a general decrease in the usage of that chemical class since the advent of neonicotinoid usage in the late 1990s. The Belden et al. (2018) paper is consistent with others showing that large-scale bird declines in agricultural regions are not explained by a single, uniform “cropland intensity” effect, and habitat availability and quality may be more important than broad pesticide-intensity proxies. For example, Hill et al. (2014) conducted an analysis of grassland-bird Breeding Bird Survey data and concluded that models based on habitat availability were better supported than models based on acute insecticide toxicity. Walk et al. (2010) found that small grassland patches surrounded by cropland in Illinois did not reduce nesting success for dickcissels and eastern meadowlarks, emphasizing the importance of retaining small habitat patches within farmed landscapes. Stanton et al. (2018) found that 77 bird species associated with farmlands and grasslands in North America were declining well before the advent of neonicotinoids (Figure 6). These bird populations have since stabilized (aerial insectivores and shrub species) or are increasing in abundance (grassland species) (see also Sauer et al., 2014). Finally, it is worth remembering that correlation does not equal causation.

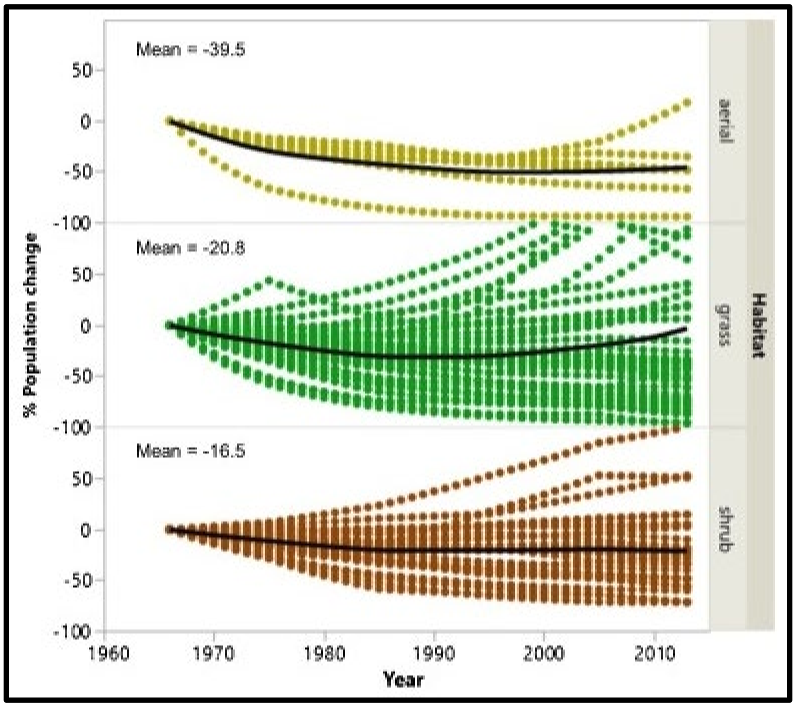

Figure 6. Population trends of 77 North American farmland bird species based on data collected by the North American Breeding Bird Survey, 1966-2013 (Sauer et al., 2014). Dotted lines represent % change in individual species populations based on the average annual counts (from Stanton et al., 2018).

The Li et al. (2020) study had several distinct weaknesses including:

- *County-level aggregation may have obscured local exposure and habitat relationships.* The authors aggregated Breeding Bird Survey route data to the county level to match pesticide use data. However, bird exposure to neonicotinoids from seed treatments is likely much more localized than a county-wide average. A county may contain both heavily treated cropland and large areas of habitat with little exposure. Thus, county-level pesticide estimates can misclassify actual exposure experienced by birds along specific survey routes.

- *The time window for the study was short: 2008-2014.* The Li et al. (2020) study was limited to seven years because national Cropland Data Layer data began in 2008 and US Geological Survey neonicotinoid seed-treatment reporting was discontinued after 2014. This short period makes it difficult to distinguish long-term bird population trends from short-term fluctuations caused by weather, migration conditions, disease, habitat management, and other ecological changes.

- *Important habitat and management variables were only partially captured.* The models included cropland acreage, developed land, climate variables, human population density, county fixed effects, and pesticide use, but did not account for fine-scale habitat quality or management practices. Variables such as availability of field margins and hedgerows, grassland patch size, wetland presence, mowing timing, tillage system, crop rotation, cover crops, Conservation Reserve Program enrollment, insect abundance, and local vegetation structure all affect bird populations. The authors themselves noted that unobserved factors such as vegetation types, land management practices, and plant-insect interactions could confound pesticide and land-use effects.

- *BBS data have known limitations for abundance estimation.* Breeding Bird Survey counts depend on volunteer observers recording birds seen or heard along road-based routes. Detection probability can vary by observer, habitat, weather, noise, species behavior, and landscape openness. The paper uses BBS data because they are extensive and standardized, but route-based counts are imperfect proxies for true abundance, especially when aggregated to counties.

- *Neonicotinoid use is compared by mass, which may not fully represent biological risk.* The authors recognized that neonicotinoids vary in toxicity and included a toxicity-weighted measure as a robustness check. However, pesticide risk depends not only on kilograms applied or LD50 values, but also on application method, timing, environmental persistence, treated seed availability to birds, uptake into plants, movement into water, effects on insect prey, and species-specific sensitivity. These factors were not represented in the Li et al. (2020) models.

Overall, the evidence that neonic seed treatments are causing large declines in bird populations is uncertain at best.

Mineau and Palmer (2013) conducted dubious analyses and ignored critical information in arriving at their conclusions regarding risks of neonicotinoids to birds. First, Mineau and Palmer (2013) greatly exaggerated the availability of treated seeds to birds following application. The labels for seeds treated with neonicotinoids (e.g., Poncho/Votivo and Poncho 600 for clothianidin) often require the use of precision drilling for planting. Precision drilling involves using a metered machine to release evenly spaced seeds in a furrow and closing the furrow after planting. The speed of the drill can be altered for seed size, type, and spacing. Precision drilling ensures that seeds are sown underground, increases the speed and efficiency of planting, and reduces wasted seeds. A Dutch study demonstrated that precision drilling for winter wheat, onion, sugar beet, corn, alfalfa, flax, pea, and spring wheat had an overall incorporation efficiency of 99.5% (DeSnoo and Luttik, 2004). For corn, only 0.18% of drilled seeds remained on the soil surface (DeSnoo and Luttik, 2004), which translates to approximately 61 seeds on the soil surface per acre assuming typical corn seeding rates for field corn.[2] More recent data from DEFRA (2010), McGee et al. (2018), Lennon et al. (2020), EFSA (2023), and Hahne et al. (2024) indicate that seed counts from De Snoo and Luttik (2004) are outdated, and overestimate seed availability after drilling with current agronomic practices. Therefore, the current use of precision drilling ensures that few treated seeds are present on the soil surface. Additionally, the directions on the product label for clothianidin-treated corn-seeds (e.g., Poncho® 600 label) mandate that spilled or exposed seeds must be incorporated into the soil or otherwise removed from the soil surface. Lack of seeds on the soil

[2] According to the University of Minnesota Extension, planting rates of 34,000 to 36,000 corn seeds per acre maximize net return in most fields (https://extension.umn.edu/corn-planting/optimal-corn-plant-populations-minnesota). 35,000 seeds/acre × 0.18% = 63 seeds/acre. Sweet corn seeding rates are typically lower, i.e., 20,000 to 25,000 seeds/acre.

surface decreases the overall attractiveness of a crop field to foraging animals such as birds (Galle et al., 2009).

Second, Mineau and Palmer (2013) failed to note that treated seeds for some crops are not attractive to birds or cannot be consumed in sufficient quantities to cause toxicity because of their large size. For example, soybeans are fairly large and are not attractive to birds because they have digestion inhibitors that decrease a bird's appetite and result in weight loss (Kendeigh and West, 1965; Warner et al., 1989; Diaz, 1990; Dabbert and Martin, 1994).

The US Geological Survey (USGS) performed a controlled laboratory study where Japanese quail ingested wheat seeds coated with imidacloprid for 1 to 10 days (Bean et al., 2019). A maximum dose of 2.7 mg/kg bw could be administered based on the maximum number of coated seeds that could be ingested at one time by the birds. This dose is well below the median lethal dose for Japanese quail. Imidacloprid was rapidly absorbed by the blood and cleared from the birds to below detectable limits within 24 hours. No signs of toxicity, including enhanced gene expression, oxidative DNA damage, or alterations in corticosterone and thyroid hormones, were observed. The limiting size of a bird's stomach reduces the potential for risk by restricting the number of treated seeds that can be eaten at any one time. This limitation is particularly evident for treated soybeans, which are too large for most passerines (i.e., songbirds) to consume.

Third, the majority of corn and soybean fields in the United States are not tilled or only partially tilled prior to planting of treated seeds. Untilled and partially tilled fields have far greater quantities of waste grains from the previous harvest and weed seeds than treated seeds on the soil surface (Warner et al., 1985, 1989). Waste grains and weed seeds have far lower levels of neonicotinoids than treated seeds. The presence of large quantities of waste grains and weed seeds ensures that the probability of birds consuming one or more treated seeds is greatly reduced (Moore and Priest, 2022). In 2005, 71.2% of corn fields and 88.4% of soybean fields used no till or partial till practices in the United States. A US Department of Agriculture report concluded that no till practices are expected to steadily increase in use in the future (Horowitz et al., 2010). A recent USDA survey confirms this trend for corn, soybean, wheat, and cotton crops (Figure 7).

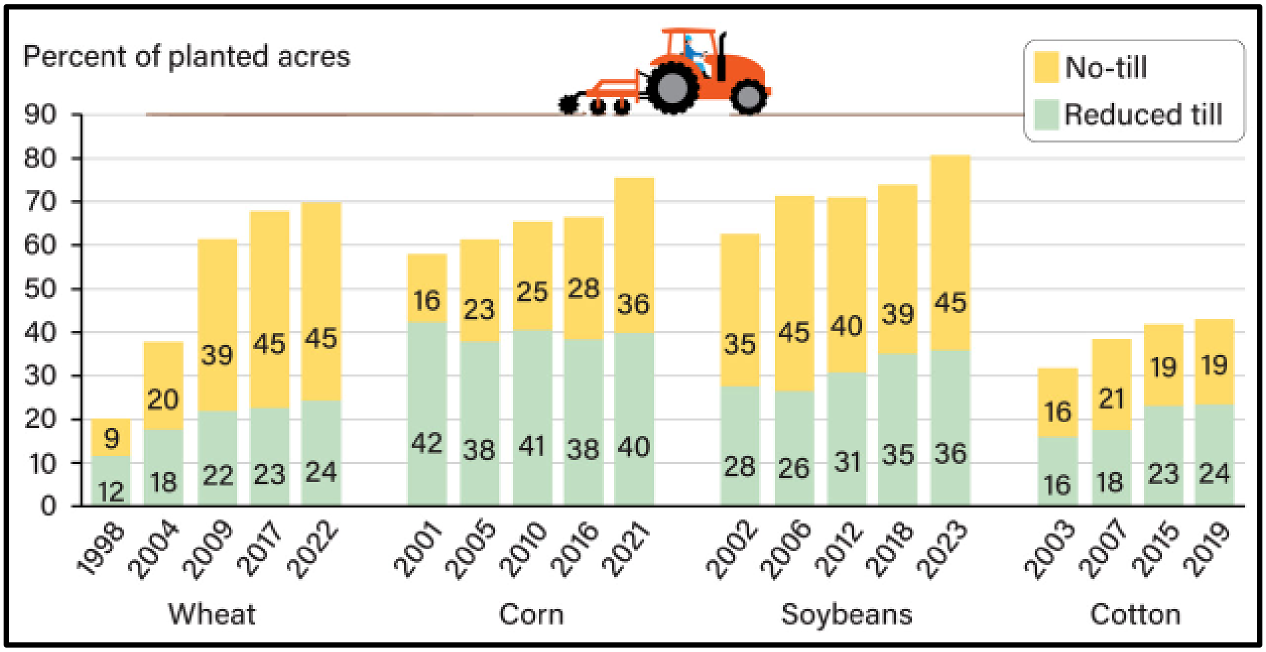

Figure 7. Percent of no-till and reduced till acreage for wheat, corn, soybean, and cotton crops in the United States, from 1998 to 2023. Source: USDA, Economic Research Service (ERS) using USDA, National Agricultural Statistics Service Agricultural Resource Management Survey data.

Fourth, some of the toxicity endpoints determined by Mineau and Palmer (2013) have limited scientific credibility and are inconsistent with the approaches used by regulatory agencies including EPA. For example, they used a conservative threshold range for dietary exposure of 2.5 to 8.8 mg/kg body weight (bw) for acute, sub-lethal effects of clothianidin to birds. This range is well below the acute toxicity threshold of 42.3 mg/kg body weight (bw) derived by EPA. Using EPA's standard approach, Mineau and Palmer's dose range is well below the dose of 37.2 mg/kg bw estimated to result in 1-in-one million mortality to the most sensitive bird species that has been tested. The 1-in-one million mortality dose is a highly conservative threshold and is considered to be protective for threatened and endangered species by EPA, US Fish and Wildlife Service and National Marine Fisheries Service in their national endangered species assessments for pesticides. The upper bound of the range derived by Mineau and Palmer (2013) would cause less than 1 mortality per trillion individuals exposed at that level. There is no scientific or regulatory basis for such a conservative threshold range.

If the dire predictions of Mineau and Palmer (2013) regarding the risks posed by neonicotinoids to birds were true, one would expect that populations of granivorous (seed-eating) and omnivorous birds would have declined sharply in the American Midwest where neonicotinoid seed treatment usage has been highest. In fact, many of the types of bird species predicted to be at significant risk from neonicotinoids exposure by Mineau and Palmer (2013) have experienced strong and sustained population increases in the American Midwest (Hill et al., 2014; Belden et al., 2018; Pardieck et al., 2019).

The results of the laboratory-based study performed by Eng et al. (2017) wherein white-crowned sparrows were unable to orient correctly following a high dose exposure to imidacloprid were later discounted by their follow-up study using free-living birds. In the field study, Eng et al. (2019)

found no evidence that imidacloprid exposure impaired migratory orientation or navigation. Rather, birds exposed to the higher dose delayed migration for several days, apparently due to transient reductions in food consumption, body mass, and fat reserves. Once birds resumed feeding and restored energy reserves, they migrated normally, with no differences in flight speed or migration distance among treatment groups (Eng et al., 2019). Therefore, the migratory disorientation observed under laboratory conditions in Eng et al. (2017) was not replicated in free-living birds tracked during migration (Eng et al., 2019).

Although Eng et al. (2019) found longer stopover durations when birds were exposed to imidacloprid, the authors did not establish a link between these effects and adverse long-term consequences for individual birds or populations. In fact, delayed departure may represent a compensatory response that allows birds to regain sufficient body mass and fat reserves before continuing migration. The study found that exposed birds eventually resumed migration and subsequently traveled at rates similar to untreated birds (Eng et al., 2019). The study did not evaluate subsequent survival, reproduction, or population growth rates, and therefore did not establish population-level impacts resulting from the observed migratory delays (Eng et al., 2019).

The relevance of the exposure scenarios used by Eng et al. (2019) is uncertain. Exposure estimates based on whole-seed consumption may overestimate pesticide intake for many granivorous passerines such as white-crowned sparrows because these species often remove and discard seed coats before ingestion. Avery et al. (1997) demonstrated that several granivorous bird species dehusk treated seeds and consumed only 15-40% of the applied imidacloprid residue, indicating that actual pesticide intake may be substantially lower than estimates based on complete consumption of treated seeds (Avery et al., 1997). In addition, studies examining bird responses to treated seeds have shown that imidacloprid can reduce subsequent feeding through post-ingestive aversion. Avery et al. (1993, 1994) reported reduced consumption of imidacloprid-treated seeds by granivorous birds, suggesting that treated seeds may deter continued feeding before large quantities are consumed.

Previous biomonitoring work also suggests that free-living songbirds are generally exposed to much lower concentrations than those administered experimentally. Hao et al. (2018) detected neonicotinoid residues in plasma of free-living, white-crowned sparrows at part-per-trillion concentrations, indicating environmental exposure but at levels substantially lower than those measured following experimental dosing in the migration studies by Eng et al. (2017, 2019).

Despite widespread use of neonicotinoids in recent decades, population data for the white-crowned sparrow from the Breeding Bird Survey do not show a significant long-term decline in abundance attributable to neonicotinoid use (Pardieck et al., 2019). The Breeding Bird Survey shows a mix of increasing and decreasing population sizes over time depending on location (Figure 8). Sharp decreases in population size occurred before the introduction of neonicotinoids (Figure 9).

The white-crowned sparrows monitored by Eng et al. (2019) appeared to be traveling in a northeastern direction from the capture areas (see Figure 4 of Eng et al., 2019). There is information available on Canadian populations of white-crowned sparrows in Newfoundland that follow a similar migratory trajectory. Abundances of white-crowned sparrows in Canadian locations have generally increased since the 1970s and continued to increase following the introduction of neonicotinoid seed treatments in the mid-1990s (Figure 10).

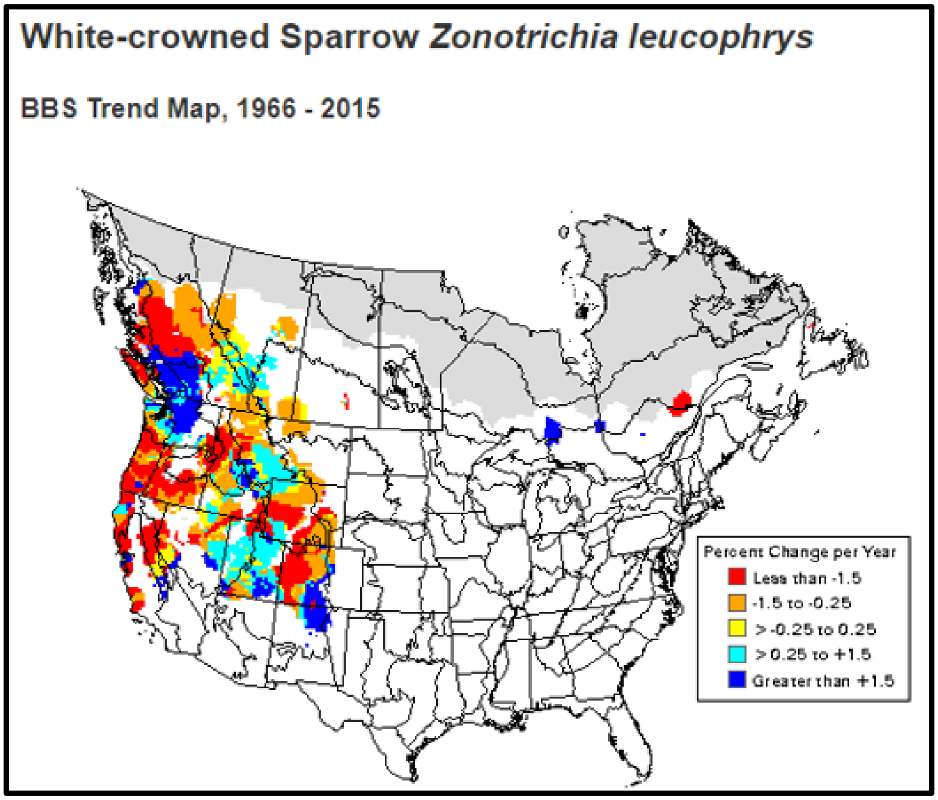

Figure 8. Breeding Bird Survey trend map for 1966 to 2015 (Pardieck et al., 2019).

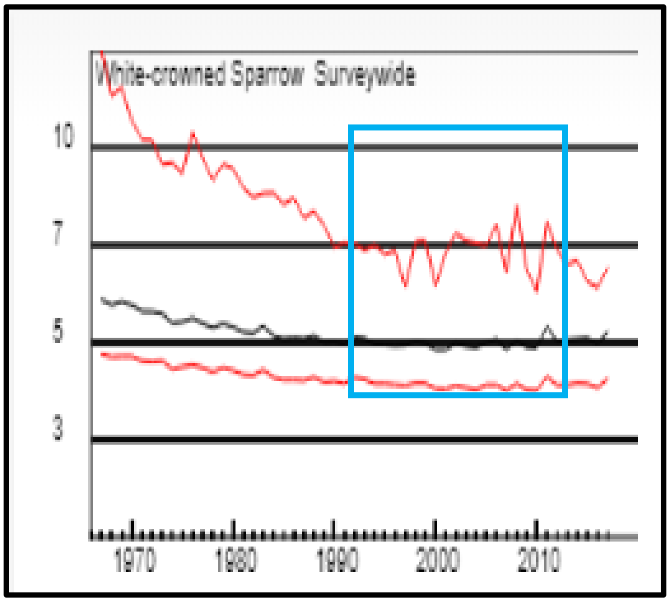

Figure 9. Results of Breeding Bird Survey (Pardieck et al., 2019) for the white-crowned sparrow. Boxed area represents time period of neonicotinoid use. The lower red line is the 2.5% percentile and the upper red line is the 97.5% percentile. The black line is the mean estimate of relative abundance. See Sauer and Link (2011) for a precise definition of the relative abundance index.

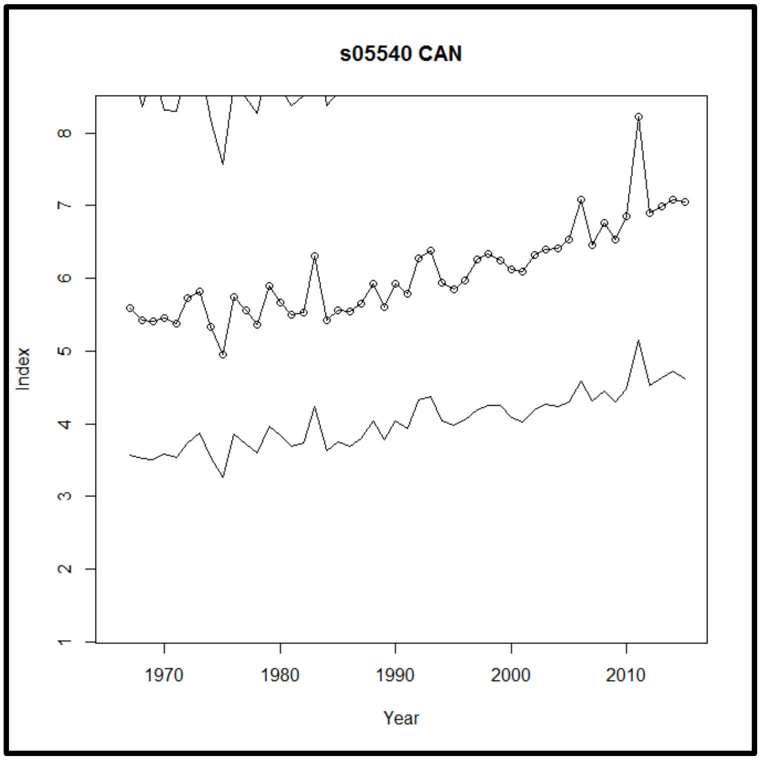

Figure 10. Population trend for white-crowned sparrow in Canada (Pardieck et al., 2019). The center black line is the mean estimate of relative abundance. The lower and upper lines are the 2.5% and 97.5% percentiles. See Sauer and Link (2011) for a precise definition of the relative abundance index.

The Lopez-Antia et al. (2015) study found that continuous exposure of red-legged partridges to imidacloprid-treated seeds at 20% of the maximum application rate caused various biochemical effects and reduced reproduction. However, the study involved an unrealistic exposure scenario where birds were fed exclusively imidacloprid-treated wheat ad libitum for up to 25 days, with no opportunity to select alternative foods. In agricultural fields, red-legged partridges generally consume a mixed diet and have access to untreated seeds, green vegetation, and invertebrates. Consequently, feeding birds exclusively treated seed for prolonged periods overestimated exposure relative to typical field situations. The study was entirely a captive experiment. A field study by McGee et al. (2018) demonstrated just how unlikely it is that birds would ingest nothing but neonic-treated seeds for extended durations. In their study, McGee et al. (2018) monitored individual birds using 24-hr remote video surveillance for three consecutive days after planting clothianidin-treated seeds in 21 corn fields in Ontario, Canada. Spotting scopes were used to monitor the full duration of the field visits of 596 individual birds during morning hours. Only two birds were observed consuming treated seeds (one seed each) and three birds consumed seeds for which the treatment status could not be visually confirmed. Similarly, in >1,380 hours of continuous video monitoring of field locations with the highest likelihood of avian exposure (where multiple treated seeds remained clustered on the soil surface), no birds were observed eating treated seed. This study verified that standard sowing practices in Ontario are effective at burying treated seeds such that the count of seeds on the soil surface after planting was low, and foraging birds consumed very few of the clothianidin-treated corn seeds remaining on the soil surface after planting.

SUMMARY:

- The Li et al. (2020) conclusion that bird populations are declining because of increasing usage of neonicotinoids is based on weak evidence. So too is Mineau and Palmer's (2013) predictions of high exposure and mass mortality of birds resulting from seed application of neonicotinoids. Other far more methodologically sound studies did not observe any relationship between bird populations from different feeding guilds and increasing neonicotinoid usage since the late 1990s (e.g., Hill et al., 2014; Belden et al., 2018; Pardieck et al., 2019).

- The use of precision drilling for planting seeds greatly reduces the availability of treated seeds on the soil surface. Pesticide labels require burying or removing spilled seeds.

- The size and chemical composition of some crops seeds makes them too big, toxic, or unattractive for consumption by birds.

- Current tilling practices increase the availability of waste grain and weed seeds on the soil surface, which reduces the probability of a bird consuming a treated seed.

- The toxicity endpoints used by Mineau and Palmer (2013) were overly conservative and did not follow standard EPA guidance.

- The exposure scenarios in the Eng et al. (2017, 2019) and Lopez-Antia (2015) studies were not environmentally realistic as demonstrated by Hao et al. (2018) and McGee et al. (2018).

6. DEVELOPMENTAL AND NEUROLOGICAL EFFECTS IN INFANTS AND CHILDREN

CLAIM: The Centers for Disease Control and Prevention detected traces of neonicotinoids in about half the US population indicating recent exposure through food and drinking water. Using this information, activists allege that epidemiologic studies have linked neonic exposures during pregnancy or early life development to an elevated risk of developmental or neurological effects to infants and children.

EVIDENCE CITED TO SUPPORT CLAIM: Several studies have shown that neonics have been detected in fruits, vegetables, processed food, and drinking water (Klarich et al., 2017; Naidenko et al., 2023). For example, clothianidin, imidacloprid, and thiamethoxam were ubiquitously detected in finished tap water samples collected from the University of Iowa and Iowa City treatment plants following maize and soybean planting at concentrations ranging from 0.24 to 57.3 ng/L (Klarich et al., 2017).

Given the presence of neonicotinoids in our diet and drinking water, it is not surprising that studies demonstrating the presence of neonics in nearly half the general population of the United States (Ospina et al., 2019), 95% of pregnant women (Buckley et al., 2022), and in the urine of newborn babies (Ichikawa et al., 2019). Such exposure is potentially concerning because neonic exposures have been linked to adverse developmental and neurological effects in infants and children (Cimino et al., 2017; Sass et al., 2024), and ovarian cells (Mourikes et al., 2023a,b). Sass et al. (2024) reviewed Data Evaluation Records (DERs) prepared by EPA for developmental neurotoxicity (DNT) studies conducted with female rats during pregnancy and lactation. These DNT studies were conducted on behalf of neonicotinoid registrants and submitted to the Agency. Sass et al. (2024) identified nicotine-like effects such as reduced brain size, indicative of neuronal cell loss. Statistically significant shrinkage of brain tissue was observed in high-dose offspring for five neonicotinoids: acetamiprid, clothianidin, imidacloprid, thiacloprid, and thiamethoxam. Two brain regions reduced in the rodent studies, the corpus callosum and caudate-putamen, tend to be smaller in people diagnosed with attention-deficit hyperactivity disorder (ADHD). Thus, Sass et al. (2024) suggested a possible link between perinatal neonicotinoid exposure and ADHD.

MY RESPONSE: All pesticides in the United States are registered by EPA through a rigorous process that evaluates both human health and environmental effects. This process includes assessments of potential exposure to pesticide residues in food and drinking water, as well as to people who apply pesticides (Figure 11). The Federal Food, Drug, and Cosmetic Act (FFDCA) sets a high bar for health and food safety, especially for infants and children. For each pesticide, EPA determines safe levels and sets “tolerances” to ensure that any foods with residues are safe to eat. As enforcement tools, tolerances represent the highest amounts of pesticides allowed in food, and those levels are not expected to be exceeded when pesticides are applied according to their labels. Tolerances are also called “maximum residue levels” (MRLs) and are only established after EPA has determined that foods containing these residue levels meet stringent regulatory safety standards.

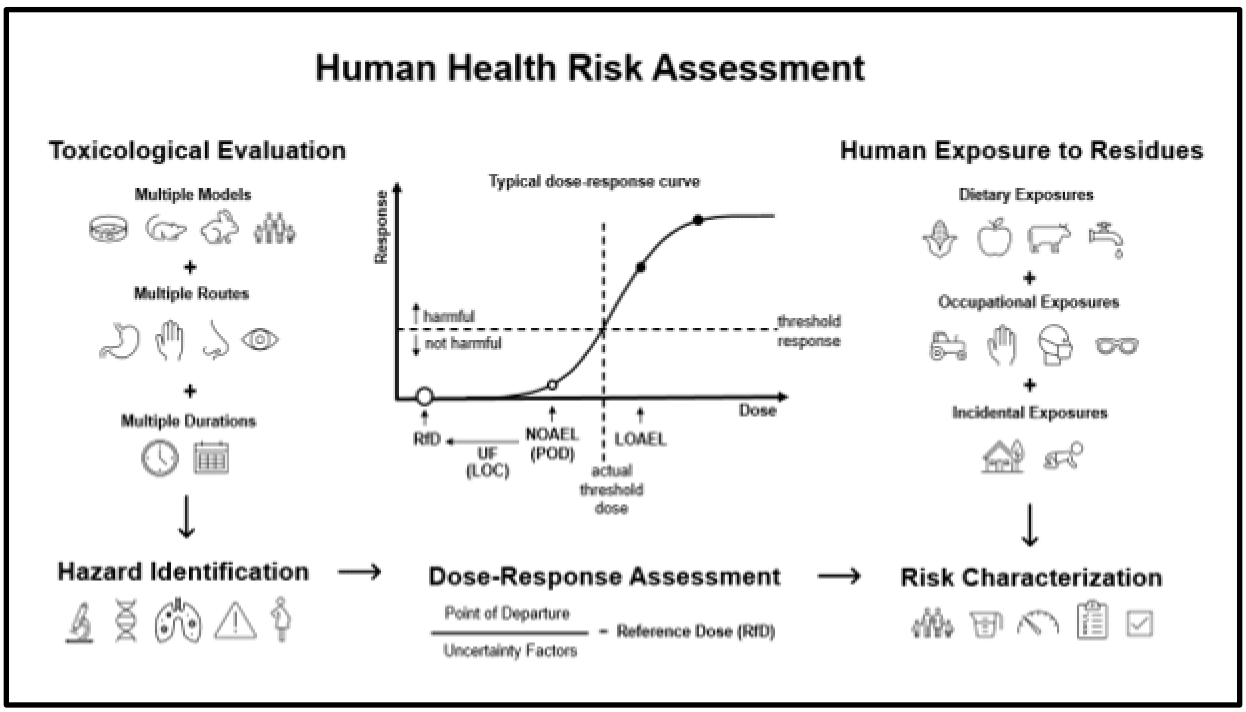

Figure 11. Key steps in the human health risk assessment process in the United States (from Avanasi et al., 2022).

According to the US Department of Agriculture, neonicotinoids were detected in a wide variety of fruits and vegetables in 2023 (USDA, 2023). For example, acetamiprid was detected in 781 of 9,655 (8.1%) fruit and vegetable samples. Clothianidin, dinotefuran, imidacloprid, and thiamethoxam were detected in 1.7%, 1.3%, 3.4%, and 2.5% of fruit and vegetable samples, respectively (sample size = 9,654 or 9,655). The average detection frequency across neonicotinoids during the period, 1999-2015, was similar at 4.5% (Craddock et al., 2019). From 1999-2015, imidacloprid was the neonicotinoid with the highest overall detection frequency at 12.0%. Higher detection frequencies were observed for specific food commodity-neonicotinoid combinations such as cherries (45.9%), apples (29.5%), pears (24.1%) and strawberries (21.3%) for acetamiprid; and cauliflower (57.5%), celery (20.9%), cherries (26.3%), cilantro (30.6%), grapes (28.9%), collard greens (24.9%), kale (31.4%), lettuce (45.6%), potatoes (31.2%) and spinach (38.7%) for imidacloprid (Craddock et al., 2019). However, it is a virtual certainty that the neonicotinoids in these fruits and vegetables came from sources other than seed treatments (e.g., foliar applications) because neonic-treated seeds are not approved for these commodities.

Although neonicotinoids were detected in a small percentage of fruits and vegetables sold in the United States in 2023, it was quite rare for those detections to occur at levels exceeding the MRLs established by EPA, i.e., 9 of 9,655 samples or 0.09% (USDA, 2023). Six of the MRL exceedances were for acetamiprid in grapes and three were for imidacloprid in grapes. All exceedances were minor, i.e., <2-fold, and all but one were for grapes imported from other countries (Chile and Peru). Together, these results indicate that the neonicotinoid pesticide labels are being followed in Minnesota and rest of the United States and are protective of human health. Because of the many safety factors and conservative assumptions used to derive MRLs, MRL exceedances do not necessarily indicate that there is a health risk. Conversely, there is a very low likelihood of health risks when MRLs are not exceeded. Finally, none of the MRL exceedances were due to use of neonic-treated seeds because treated seeds are not used for grapes.

EPA has determined that exposure to neonicotinoids through acute and chronic dietary and drinking water exposure is not a health concern for the US population, including the most vulnerable population, i.e., children 1-2 years old. Risk estimates ranged from 2% to 38% of the reference dose (aRfD for acute exposure, cRfD for chronic exposure) for the general population in the Agency's most recent neonicotinoid risk assessments (EPA, 2017g,h,i,j, 2018a). A chronic RfD is the amount of a chemical that a person can be exposed to daily over a lifetime without suffering adverse health effects. cRfDs are lower than No Observed Adverse Effect Level (NOAEL) values for the most sensitive test species because they include safety factors to account for variations in population sensitivity and uncertainty in extrapolation from animal data (e.g., rats) to humans. EPA considers exposure a concern when risk estimates exceed 100% of the cRfD. EPA's risk assessments also determined that neonicotinoids do not pose a health concern for residential and occupational handlers, adults and children exposed via inhalation and dermal exposure following nearby applications, and bystanders exposed to spray drift (EPA, 2017g,h,i,j, 2018a).

As is typical for EPA's human health assessments for pesticides, there were many conservative assumptions and safety factors incorporated in the neonicotinoid assessments:

- The acute and chronic dietary exposure assessments were deliberately conservative. The analyses assumed that neonicotinoid residues in food groups were equal to the corresponding MRLs even though it is quite rare for neonicotinoid concentrations to approach or exceed those levels (USDA, 2023). For example, 99.4% and 99.7% of acetamiprid and imidacloprid concentrations were below the corresponding MRLs for fruits and vegetables in 2023. The observed exceedances were for imported commodities. For clothianidin, dinotefuran, and thiamethoxam, 100% of fruit and vegetable samples had concentrations below the corresponding MRLs.

- Each neonicotinoid assessment assumed that 100% of the crop was treated for those crops with MRLs.
- For drinking water, the Agency assumed the maximum 1-in-10-year average annual concentration estimated from all use scenarios and drinking water sources (i.e., surface water, groundwater).
- The assessments assumed that pesticide residues ingested by consumers are absorbed systemically and that none are excreted, i.e., there is no metabolism and/or excretion (Avanasi et al., 2022). Neonicotinoids are rapidly metabolized and excreted (Ford and Casida, 2006a,b; Harada et al., 2016). Thus, EPA very conservatively assumed longer term exposure at higher levels than is the case in reality.
- Conservative assumptions regarding dermal absorption, inhalation exposure, and extrapolation from partial daily monitoring overestimate occupational and bystander exposure to pesticides by up to two orders of magnitude (Ross et al., 2000). Despite EPA considerably overestimating exposure to workers and bystanders, the Agency still found no health concerns. Thus, we have high confidence in their no risk conclusions.
- The standard combined uncertainty or safety factors of 100X (based on 10X for intraspecies variability and 10X for interspecies extrapolation) were applied to estimate RfDs. The safety factor of 100X was applied to the most sensitive endpoint (NOAEL) for the most sensitive mammalian species tested. The endpoints considered included effects on survival, growth, reproduction, development, locomotor activity, startle response, immune response, behavior, organ histopathology, and many others. The Agency's use of safety factors, many conservative assumptions, and a broad array of toxicity endpoints leads to high confidence in their conclusion of no human health concerns for neonics.

The above and many other conservative assumptions collectively ensure that the potential for risk was overestimated in the neonicotinoid assessments. Despite the EPA's use of these conservative assumptions and safety factors, no risk concerns were identified for any population in the United States potentially exposed to neonicotinoids.

Chang et al. (2018) estimated risk to human health arising from simultaneous exposure to six neonicotinoids in the diet of US consumers: acetamiprid, clothianidin, dinotefuran, imidacloprid, thiacloprid, and thiamethoxam. In their study, Chang et al. (2018) used the relative potency factor (RPF) approach to aggregate individual neonicotinoids into a single metric (IMI_{RPF}) representing the intakes of total neonicotinoids in relation to imidacloprid for each food item. The authors then estimated the average daily intake of neonicotinoids using fruit and vegetable residue data collected from US Congressional Cafeteria study (USCC) and US Department of Agriculture (USDA) Pesticide Data Program (PDP), and food consumption data from National Health and Nutrition Examination Survey (NHANES) in 2011-2012. The estimated combined exposure to neonicotinoids was below the current chronic reference dose (cRfD) for imidacloprid, thus indicating no health concerns for US consumers simultaneously exposed to neonicotinoids in their diet.

A peer-reviewed publication by the National Toxicology Program in the United States indicated that there were only a few epidemiological studies that have investigated the association between pre-natal and early childhood exposure to neonicotinoids and developmental neurotoxicity effects

(Boyd et al., 2020). These epidemiological studies had notable shortcomings. For example, the only available study linking early developmental neonicotinoid exposure (via imidacloprid used for flea and tick control in pets) to autism spectrum disorder(ASD) (Keil et al, 2014) relied on maternal-reported exposure categories (never/ever during childhood; and never/ever/consistent/occasional for pre-natal exposure). The authors further indicated that the relationship between these rudimentary exposure estimates and ASD was weak and could have resulted from exposure misclassification alone. Epidemiological studies linking neonicotinoid exposure in agriculture to ASD are lacking. The epidemiological studies investigating incidence of birth defects (e.g., anencephaly, congenital heart defects) used proximity to agricultural fields as a surrogate for exposure to neonicotinoids and/or rudimentary exposure categories (i.e., none or any) (Carmichael et al., 2014; Shaw et al., 2014; Yang et al., 2014). Proximity to agricultural fields is a poor indicator of potential neonicotinoid exposure from seed treatments given that many other pesticides and chemicals are used in agricultural areas. The Boyd et al. (2020) findings regarding the weak link between pre-natal and early childhood exposure to neonicotinoids and developmental effects echo the findings of an earlier review by Cimino et al. (2017). Cimino et al. (2017) investigated four general population studies that had reported associations between chronic neonicotinoid exposure and adverse developmental or neurological outcomes, including tetralogy of Fallot (a congenital heart defect at birth that causes low oxygenation of blood; Carmichael et al., 2014), anencephaly (Yang et al., 2014), autism spectrum disorder (Keil et al., 2014), and a symptom cluster including memory loss and finger tremor (Marfo et al., 2015). As found by Boyd et al. (2020), Cimino et al. (2017) concluded that the epidemiological studies conducted to date were limited in number with suggestive but methodologically weak findings related to chronic exposure to neonicotinoids. To my knowledge, there have not been any more recent epidemiological studies investigating the link between pre-natal and early childhood neonicotinoid exposure and developmental effects in the United States or elsewhere.

A critical review of in vitro, in vivo, and epidemiology studies by Sheets et al. (2016) found no evidence of effects consistent with developmental neurotoxicity even at unrealistically high doses well above those predicted by EPA for children (EPA, 2017g,h,i,j, 2018a). Neonicotinoids have limited toxicity to mammals, including humans, because they have a low binding affinity for nicotinic acetylcholine receptors (nAChRs) (Casida, 2018; Thompson et al., 2020). In addition, neonicotinoids are rapidly metabolized and/or eliminated by mammals (Ford and Casida, 2006a,b; Harada et al., 2016). A recent critical review by Thompson et al. (2020), concluded that, "The results from subchronic studies performed following EPA guidelines indicate that sustained dietary exposure to neonicotinoids … causes little-to-no neurotoxicity." Sheets et al. (2016) reviewed the collective evidence from developmental neurotoxicity (DNT) studies conducted at Bayer and JRF laboratories that complied with U.S. EPA and OECD test guidelines. Their review of the DNT studies and the published literature indicated that "imidacloprid is not a developmental neurotoxicant, as it does not disrupt neurodevelopment in mammals." DNT study methods have been extensively validated, provide reliable, relevant and reproducible data, and represent the best available science for assessing developmental neurotoxicity potential in humans (Makris et al., 2009).

In their draft registration review document for imidacloprid, EPA (2017h) stated, "The concern for neurotoxicity is low, however, since the selected endpoints are protective of these effects." As neurotoxicity effects only occurred at medium and high dose levels in laboratory studies, EPA (2017h) also stated that their hazard assessment is protective of developing and young animals. For thiamethoxam, EPA (2017i) determined that developing animals are no more sensitive than adults.

Moreover, EPA (2017g,h,i,j, 2018a) determined that acetamiprid, clothianidin, dinotefuran imidacloprid, and thiamethoxam are rapidly absorbed, excreted within 24 hours, and do not bioaccumulate.

SUMMARY:

- Pesticide residues in foods, including those for neonicotinoids, are strictly regulated in the United States. Monitoring data for neonicotinoids show that fruits and vegetables available to US consumers are safe and healthy. The neonicotinoids that have been detected in fruits and vegetables in the United States are unlikely to have arisen from neonic-treated seeds.

- Despite being highly conservative, EPA's draft human health risk assessments demonstrated that neonicotinoids do not pose a concern for human health in the United States for consumers, bystanders, and residential and occupational handlers.

- Simultaneous exposure to neonicotinoids registered in the United States also does not pose a risk to consumers.

- The epidemiological studies conducted to date on the association between neonicotinoid exposure and developmental effects had numerous deficiencies and were methodologically weak.

- Because neonicotinoids have low binding affinity for nAChRs in mammals, have limited capacity to cross the blood brain barrier in humans, and are rapidly metabolized or eliminated, the weight of evidence indicates that developmental neurotoxicity effects due to pre-natal and early childhood exposure are unlikely.

6. RISK OF WITHDRAWAL OF NEONICOTINOID SEED TREATMENTS OPTIONS

Should the use of neonicotinoid seed treatments be curbed in individual States or nationally, many of the replacement pesticides would be broad spectrum products. Those products have higher application rates than is the case for the most important use patterns of clothianidin, imidacloprid, and thiamethoxam. Because the other products are more likely to be applied via ground and aerial spray, there would be increased potential for greater quantities of pesticide migrating to surrounding habitats than for neonic seed treatments. Crop seeds and seedlings would also be at greater risk to damage from below ground pests because these pests are very hard to scout. Many of the replacement pesticides also have other less favorable properties (e.g., pests have developed resistance to them). I delve into some of these potential outcomes in the following sections.

POTENTIAL FOR OFF-FIELD TRANSPORT WOULD INCREASE

Because seeds are typically pre-treated with a coating containing neonicotinoids then sold to farmers, spray drift from application is negligible, because application of the pesticide occurs at the seed treatment facility and not in the field. Off-field transport of neonicotinoids from seed treatments only arises from drift of abraded seed dust and runoff. Significant efforts have been undertaken to develop newer formulations and planting practices to minimize abraded seed dust and off-target movement. Abraded seed dust can be created during sowing of seeds involving pneumatic machines that vent through mechanical outflow air fans. At present, the abraded seed dust issue is carefully managed through stewardship programs to avoid potential exposure, including to honey bees and other pollinators. Examples of best management practices include: (1) using high quality seed that is free from excessive dust, (2) using an appropriate coating system that keeps abrasion of coated pesticide to a minimum, (3) following planter manufacturer recommendations for use of talc, graphite, or other flow agents, (4) avoiding releasing dust when opening seed containers and during filling, emptying, or cleaning of the planting equipment, (5) avoiding sowing of treated seeds when wind speeds are high or in the direction of sensitive habitats or those attractive to pollinators, and (6) removal of blooming weeds that are attractive to pollinators prior to planting by tillage or herbicides (see, for example, https://seed-treatment-guide.com/wp-content/uploads/2025/08/Guide-to-Seed-Treatment-Stewarship-2025.pdf). Health Canada (2021) noted that dust-mitigation measures implemented for treated seed have been successful at ensuring protection of honey bees.

The overall potential for off-field transport is far lower for seed treatments than for ground or foliar applications. Seeds are planted below ground and the maximum quantities that may be applied on a per acre basis are much reduced compared to other formulations. A commonly used aerially applied insecticide has a maximum seasonal application rate of 1 lb a.i./A for corn, approximately 10 times higher than the rate allowed for clothianidin and imidacloprid, and approximately 5 times higher than the rate allowed for thiamethoxam. Further, two foliar or ground applications of that insecticide are permitted per season for corn, which increases the potential for additional occupational exposure versus the one application permitted per season for clothianidin and thiamethoxam seed treatments. Of course, none of this is to say that labeled uses of alternative products are unreasonable. These products have also passed EPA's risk assessments required for registration. Restricting access to treated seed would thus push growers into potentially using different insecticides that could lead to increased exposure to vulnerable species. EPA carefully considers these risks when determining whether to approve specific products or labeled uses of products, including use of neonicotinoids in seed treatments. The Agency is uniquely positioned with respect to having the in-house experts, data requirements, and resources necessary to perform risk-benefit assessments. Relying on studies or analyses that focus only on the alleged risks of particular products in isolation without evaluating the consequences of restricting access to those products leads to distorted risk-benefits assessments.

Replacement Pesticides Target a Broader Range of Organisms Than Neonicotinoids

According to EPA's benefits assessments, the likely replacements for neonicotinoid seed treatments would vary by crop were their use in Minnesota to be severely curbed. There would likely be a shift toward foliar or at-plant applications of other, broad spectrum insecticides, in addition to foliar applications of neonics (EPA, 2014, 2018b). For soybeans, EPA stated that increased foliar applications of organophosphates (e.g., acephate, chlorpyrifos, though the latter is in registration review and may have only limited uses going forward; EPA, 2026), pyrethroids (e.g., bifenthrin, cyfluthrin, gamma- and lambda-cyhalothrin, deltamethrin, esfenvalerate, zeta-cypermethrin, permethrin), foliar sprays of neonicotinoids (e.g., clothianidin, imidacloprid, thiamethoxam), and sulfoxaflor are likely (EPA, 2014). For corn, there would be a shift towards at-plant soil insecticides and early-season foliar applications of broad spectrum insecticides, and possibly other registered systemic/foliar alternatives, depending on the pest complex and label availability (EPA, 2018b, 2020e,f). Similar shifts to at-plant and early-season foliar application of these options would also likely occur for small grains (e.g., wheat), sugar beets, vegetable crops, and canola (EPA, 2018b). EPA (2018b) cautioned that these replacements may increase monetary cost, labor, and management effort and compromise pest control in some crops because alternatives often lack the systemic seedling protection of neonicotinoid seed treatments.

Replacement of Neonicotinoid Seed Treatment Products Could Increase Development of Insecticide Resistance

Pesticide resistance has become more widespread and problematic for growers and must be managed carefully. Only one insecticide-resistant arthropod was documented in the United States in 1908, but that number increased to 574 by 2012 (Sparks, 2013). As resistance develops in a given insect pest population, growers must apply pesticides at higher rates or more frequently to obtain the same level of pest control. Once resistance to a particular class of chemistry is established, the preferred option for controlling that pest is no longer available, potentially forcing growers to resort to a broad-spectrum insecticide.

The development of pesticide resistance can be caused by various pest control practices, including the lengthy and frequent use of a single class of pesticides and the use of broad spectrum products (FAO, 2012). The Food and Agriculture Organization of the United Nations (FAO) recommends use of as many different classes of pesticides as possible to reduce resistance pressure on an individual class of pesticide. To prevent or delay insecticide resistance, EPA and FAO recommend rotating use of insecticides with differing modes of action. The Insecticide Resistance Action Committee (IRAC) has developed a classification system for insecticides based on mode of action (www.irac-online.org). Neonicotinoids are nicotinic acetylcholine receptor competitive modulators and fall under Group 4A for insecticide resistance. Organophosphates are in Category 1, acetylcholinesterase inhibitors, pyrethroids are in Category 3, sodium channel modulators, and sulfoxaflor is in Group 4C, nicotinic acetylcholine receptor competitive modulators (but has a unique metabolism and interaction with receptors compared to neonics). Reducing or eliminating use of neonic seed treatments would thus promote development of pesticide resistance.

7. Concluding Thoughts

The environmental and human health risks posed by neonicotinoid-treated seeds have been greatly exaggerated by activists, including activist scientists, non-governmental organizations, and, quite often, by the media. A critical examination of the weight of evidence indicates that neonicotinoid-treated seeds provide many benefits with little risk to the environment and human health.

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APPENDIX A

Curriculum Vitae for Dr. Dwayne R.J. Moore

Dr. Dwayne Moore / Senior Modeler

Dwayne is a highly experienced ecotoxicologist with more than three decades of experience in pesticide risk assessment and ecological exposure and risk modeling. He has managed projects for government and industry clients, including screening-level and refined aquatic and wildlife risk assessments for pesticides in Canada, the U.S., European Union, Latin America, and beyond. Dwayne led the development of probabilistic exposure and risk models for birds exposed to granular, seed treatment, and flowable pesticides. He also created the refined screening-level and probabilistic species-specific models for many threatened and endangered terrestrial species potentially exposed to

Years of Experience / 35

Years of Experience at Stone / 3

Education

Ph.D., Wetland Community Ecology, 1990, University of Ottawa

Master of Science, Wetland Community Ecology, 1985, University of Ottawa

Bachelor of Science, Plant Sciences, 1983, University of Western Ontario

Skills

Ecological Risk Assessment

Endangered Species Risk Assessment

Pollinator Risk Assessment

Probabilistic Risk Assessment

Wildlife Risk Assessment

Crop Protection Product Registration

Litigation Support

Exposure Modeling, Ecotoxicology, Uncertainty Analysis, and Statistics

Professional and Community Activities

Member, CropLife America Ecotoxicology Work Group (2009–Present)

Editorial Board, Integrated Environmental Assessment and Management (2018–Present)

Member, Society of Environmental

Employment History

Stone Environmental, Inc. / Poland, Maine
Senior Ecotoxicologist / July 2023–Present

Project management; lead and participate in ecological risk assessments on potential impacts of pesticides on aquatic and terrestrial ecosystems; develop exposure and risk models; ecotoxicology; statistics; field study support; teach courses; litigation support.

Intrinsik Ltd. / New Gloucester, Maine
Senior Vice President and Senior Scientist / 2004–2023

Company and project management; led and participated in ecological risk assessments that predicted or evaluated the potential impacts of industrial chemicals and pesticides on aquatic and terrestrial ecosystems; ecotoxicology; statistics; developed environmental quality guidelines and criteria; taught courses; litigation support.

The Cadmus Group, Inc. / Ottawa, Ontario
Senior Associate / 1996–2003

Company and project management; led and participated in ecological risk assessments that predicted or evaluated the potential impacts of industrial chemicals on aquatic and terrestrial ecosystems; developed environmental quality guidelines and criteria; ecotoxicology; statistics; taught courses.

Environment Canada / Gatineau, Quebec
Senior Evaluator, Commercial Chemicals Evaluation Branch / 1991–1996

Conducted ecological risk assessments for priority substances in Canada.

Environment Canada / Gatineau, Quebec
Evaluator, Water Quality Branch / 1989–1991

Developed environmental quality guidelines for industrial chemicals.

Related Project Experience

Study Design and Statistical Analyses for Spray Drift-Non-target Terrestrial Plant Studies / Confidential Clients / 2017–current / Kansas, Maryland, Missouri, and Texas

Developed statistically-optimized study designs for field studies that determined effects of various herbicides on downwind sensitive non-target terrestrial plant species. Conducted subsequent statistical analyses on biological endpoints and contributed to preparation of field study reports.

Pollinator Risk Assessments for Insecticides / Confidential Clients / 2020-current

Led and conducted Tier I and II pollinator risk assessments for various insecticides including conducting statistical analyses for Tier I larval and adult toxicity studies and Tier II tunnel and colony feeding studies, determining downwind safe buffer distances, and proposing risk mitigation measures as necessary.

Litigation Support / Confidential Clients / 2009-current

Provided litigation support for various pesticides and other products including preparing expert reports, declarations and rebuttals, and participating in deposition hearings.

Ecological Risk Assessment for an RNAi Product to Control Varroa Mites in Honeybee Hive / Confidential Client / 2023.

Led an assessment to determine the risks of an RNAi product added to honeybee hives as a sugar solution for control of varroa mites. The project included assessing risks to honeybee larvae and adults in the hive and to potentially exposed biota outside the hive.

Development of a Level of Concern for Atrazine / Confidential Client / 2016-current

Developed a level of concern for aquatic plants exposed to atrazine using several lines of evidence including the results of community-level mesocosm and field studies, ecosystem models, and single species studies. Have continued to support the client on this issue as the US Environmental Protection Agency continues to refine its aquatic risk assessment for this crop protection product.

Ecological Risk Assessment Support for Crop Protection Products / CropLife America / 2009-current

Provided support for CropLife America on a variety of topics including assessing risks of pesticide mixtures, development of tools for assessing pesticide risks to endangered species and commenting on assessments and methods developed by the US Environmental Protection Agency. Served on the Ecological Risk Assessment Committee from 2010-2016 and on the Ecotox Working Group from 2010 to the present.

Pesticide Risk Assessment Course / 2010, 2014 and 2023 / Orlando, Florida

Designed and lectured at Pesticide Ecological Risk Assessment courses offered by Intrinsik Corp. and Stone Environmental Inc. in Orlando, Florida (Feb 10-12, 2010; Feb 19-21, 2014; February 15-17, 2023).

Courses on Statistics and Probabilistic Methods / US Environmental Protection Agency, Environment Canada, Ontario Ministry of the Environment, Department of Fisheries and Oceans Canada, Canadian Pest Management Regulatory Agency, Pesticide Registrants / 1996-current

Organized and led numerous courses on statistics, including sampling design, hypothesis testing, regression analysis and multivariate techniques, and probabilistic methods, including first and second-order Monte Carlo analysis, probability bounds analysis, and other methods. The courses have involved various government and industry clients and have ranged from one-day to two weeks in duration.

Field Bioaccumulation Study for a Pyrethroid / Confidential Client / 2018-2020

Designed and led a 2-year field study that involved exposing piscivorous and benthic fish species to a pyrethroid added directly to the water column in ponds. The study determined changes in pyrethroid concentrations over time in water, sediment and fish tissues at two study locations. The results were used to determine whether the pyrethroid was a bioaccumulation concern as defined by the Pest Management Regulatory Agency in Canada.

Developments of Species Sensitivity Distribution Model / Environment Canada / 2009-2012

Co-led the development of SSDMaster, a software package that enabled the fitting of five species sensitivity distribution models to datasets ranging in size from 6 to 99 taxa. The package included graphical and statistical tests for determining goodness-of-fit for each model.

FIFRA National Ecological Risk Assessments / Pesticide Registrants / 2006-current

Led and participated in the development of screening-level and refined FIFRA Ecological Risk Assessments for numerous crop protection products (herbicides, insecticides, fungicides and others) for many clients. The assessments addressed aquatic life, wildlife, and terrestrial plants and invertebrates.

National Endangered Species Risk Assessments / Pesticide Registrants / 2006-current

Conducted screening-level and refined National Endangered Species Assessments for crop protection products for various clients. Developed species-specific exposure and risk models for flowable and granular pesticides for all currently listed bird, mammal, herptile, terrestrial invertebrate and terrestrial plant species.

Granular Pesticide Risk Assessment Model for Avian Species / Confidential Client / 2009

Led and co-developed the probabilistic exposure model Granular Pesticide Risk Assessment Model (GranParam) for avian receptors exposed to granular pesticides. The model has been used for refined avian risk assessments for several insecticides.

Liquid Pesticide Risk Assessment Model for Avian Species / Confidential Client / 2009

Led and co-developed probabilistic exposure model Liquid Pesticide Risk Assessment Model (LiquidPARAM) for avian receptors exposed to flowable pesticide formulations. The model has been used for refined avian risk assessments for insecticides and fungicides in Canada, South America, and the U.S.

Led or co-led Superfund Ecological Risk Assessments / US Environmental Protection Agency / 2003-2007

Led or co-led ecological risk assessments for the Housatonic River, Massachusetts; Calcasieu Estuary, Louisiana; and Anniston, Georgia. The projects involved leading and conducting refined ecological risk assessments for large contaminated sites for aquatic biota and wildlife. Contaminants included PCBs, dioxins, furans, phthalates, lead, mercury, PAHs and many others.

Publications and Presentations

Books

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PRESENTATIONS

Moore, D.R.J. 2025. Current state of the practice for pesticide risk assessments involving non-target arthropods. 46th Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Moore, D.R.J. and R. Layton. 2025. A terrestrial predator-prey model for potentially bioaccumulative pesticides and rodenticides. American Chemical Society Fall 2025 Meeting, Washington, DC.

Moore, D.R.J. 2024. Accounting for uncertainty in pesticide risk assessments for wildlife: Approaches at different tiers. 45th Annual Society of Environmental Toxicology and Chemistry Conference, Fort Worth, TX.

Moore, D.R.J., M. Frugis and L. Mezin. 2024. A biological option for control of Varroa mites in honeybee hives. 45th Annual Society of Environmental Toxicology and Chemistry Conference, Fort Worth, TX.

Moore, D.R.J., R. Brain, J. Mitchell, R. Lightfoot, B. Brayden and J. Hanzas. 2024. A higher-tier field spray drift bioassay concept to evaluate herbicidal effects to non-target plants. 45th Annual Society of Environmental Toxicology and Chemistry Conference, Fort Worth, TX.

Moore, D.R.J., A.R. Cabrera, J.P. Hanzas, P. Jensen and D.R. Schmehl. 2024. Common eastern bumble bee (Bombus impatiens) colony health following exposure to an insecticide in a semi-field colony feeding study: Test design and lessons learned. American Chemical Society Fall 2024 Meeting, Denver, CO.

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Priest, C. and **D.R.J. Moore**. 2023. The importance of accurate field metabolic rate estimates in the Endangered Species Assessment process. 44th Annual Society of Environmental Toxicology and Chemistry Conference, Louisville, KY.

Moore, D.R.J., C. Priest and J. Wisk. 2023. Risk assessment for threatened and endangered bird species in the United States potentially exposed to clothianidin seed treatments. American Chemical Society Fall 2023 Meeting, San Francisco, CA.

Moore, D.R.J., R.S. Teed, H. Rathjens, M.F. Winchell, T.M. Blickley and P. Havens. 2023. Incorporating the US EPA's PAT Assessment Tool into the TERESA modeling suite for determining pesticide risks to threatened and endangered species in the United States. American Chemical Society Spring 2023 Meeting, Indianapolis, IN.

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Moore, D.R.J., R.S. Teed, C. Priest, H. Rathjens, M.F. Winchell, T.M Blickley and P. Havens. 2021. Developing refined pesticide risk assessment models for endangered species: A case study for the Cape Sable Seaside Sparrow. 42nd Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Moore, D.R.J., R.S. Teed, C. Priest, R.P. Bergin, C. McCarroll-Butler, H. Rathjens, M.F. Winchell, M. Kern, N. Green and T.M. Blickley. 2020. Assessing the risk of pesticides to terrestrial threatened and endangered species: An overview of the TERESA modeling suite. 41st Annual Society of Environmental Toxicology and Chemistry Conference, San Francisco, CA.

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Moore, D.R.J. 2018. Weight-of-evidence pesticide assessments for threatened and endangered species to inform management decisions. 256th American Chemical Society National Meeting, Boston, MA.

Moore, D.R.J., R.S. Teed, C.D. Priest, T.B. Fredricks and L.J. Schuler. 2018. A probabilistic model for assessing risk to bird species potentially exposed to seed treatment pesticides. 256th American Chemical Society National Meeting, Boston, MA.

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Breton, R.L., G.H. Manning, Y. Clemow, M.F. Winchell, L. Padilla, S.I. Rodney, J.P. Hanzas, T.L. Estes, B. Toth, K. Budreski, **D.R.J. Moore** and P. Whatling. 2016. A refined aquatic ecological risk assessment for the California tiger salamander potentially exposed to malathion. 37th Annual Society of Environmental Toxicology and Chemistry Conference, Orlando, FL.

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Moore, D.R.J., R.S. Teed, C.D. Greer, T.B. Fredricks and L.J. Schuler. 2015. A probabilistic risk assessment model for bird species foraging in corn and soybean fields with different tillage practices. 36th Annual Society of Environmental Toxicology and Chemistry Conference, Salt Lake City, UT.

Whitfield-Aslund, M., **D.R.J. Moore**, L. Ortego and S. McGee. 2015. Ecological risk assessment for aquatic invertebrates exposed to imidacloprid Part B: Effects metrics and risk characterization. 36th Annual Society of Environmental Toxicology and Chemistry Conference, Salt Lake City, UT.

Feken, M., T.M. Blickley, T. Carro, M. Christ, P. Edwards, T.B. Fredricks, K. Henry, M. Kern, S. McGee, **D.R.J. Moore**, S. Mortensen, S. Plautz, J. Staveley and F. Womack. 2015. Passerine dietary (LC50) test: Challenges and utility in deriving an acute endpoint for pesticide registration in the U.S. 36th Annual Society of Environmental Toxicology and Chemistry Conference, Salt Lake City, UT.

Moore, D.R.J., R.S. Teed and N. Poletika. 2015. Terrestrial endangered species assessment for chlorpyrifos: Initial analyses and results. 250th American Chemical Society National Meeting, Boston, MA.

Moore, D.R.J., R.S. Teed and N. Poletika. 2015. Endangered species assessment for chlorpyrifos co-occurrence and proximity analyses: Initial results. 250th American Chemical Society National Meeting, Boston, MA.

Teed, R.S., **D.R.J. Moore** and M. Winchell. 2015. Ecological risk assessment framework for endangered species assessments. 250th American Chemical Society National Meeting, Boston, MA.

Whitfield-Aslund, M., R.L. Breton, L. Padilla, R. Reiss, P. Whatling, M. Winchell, K. Wooding and **D.R.J. Moore**. 2015. Ecological risk assessment for Pacific salmon exposed to dimethoate in California. 250th American Chemical Society National Meeting, Boston, MA.

Knopper, L.D., R.L. Breton, **D.R.J. Moore**, A.T. Hall and L.M. Bowers. 2015. Effects characterization for aquatic invertebrates exposed to imidacloprid-Part A: A novel evaluation rubric to assess aquatic toxicity studies. SETAC Europe 25th Annual Meeting, Barcelona, Spain.

Moore, D.R.J., L.D. Knopper, R.L. Breton, C.D. Greer, M. Whitfield-Aslund, A.T. Hall and L.M. Bowers. 2015. Effects characterization for aquatic invertebrates exposed to imidacloprid-Part B: Higher tier approaches. SETAC Europe 25th Annual Meeting, Barcelona, Spain.

Moore, D.R.J. 2015. A framework for endangered species assessments: Recommendations from a CropLife America workshop. Crop Life/Informa Workshop held April 23-24. Washington, D.C.

Moore, D.R.J. 2014. Uncertainty analysis methods for assessing risks of pesticides to endangered species. 35th Annual Society of Environmental Toxicology and Chemistry Conference, Vancouver, BC.

Pastorok, R.A., **D.R.J. Moore**, A.B. Parks, D.V. Preziosi and R.S. Teed. 2014. Using probabilistic population modeling to inform pesticide risk assessments and jeopardy determinations for endangered species. 35th Annual Society of Environmental Toxicology and Chemistry Conference, Vancouver, BC.

Knopper, L.D., R.L. Breton, **D.R.J. Moore**, A.T. Hall and L.M. Bowers. 2014. Use of a novel evaluation rubric to assess micro- and mesocosm ("cosm") studies for ecological risk assessments. 35th Annual Society of Environmental Toxicology and Chemistry Conference, Vancouver, BC.

Fredricks, T.B., T.M. Blickley, K. Brugger, T. Carro, M. Christ, P.J. Edwards, K.S. Henry, W.E. Hillwalker, S. McGee, M.E. Kern, **D.R.J. Moore**, S.R. Mortensen and J.P. Staveley. 2014. Passerine acute oral dose study update. 35th Annual Society of Environmental Toxicology and Chemistry Conference, Vancouver, BC.

Breton, R.L., **D.R.J. Moore**, Y. Clemow, G. Manning, P. Whatling and M. Winchell. 2014. A refined effects determination for Delta smelt potentially exposed to malathion. 35th Annual Society of Environmental Toxicology and Chemistry Conference, Vancouver, BC.

Moore, D.R.J. 2014. Are mixtures of pesticides in the aquatic environment as serious an issue as implied by monitoring studies? 245th American Chemical Society National Meeting, San Francisco, CA.

Breton, R.L., Y. Kara, S. Rodney, M. Winchell, T.L. Estes, J. Hanzas, R.S. Teed, **D.R.J. Moore** and P. Whatling. 2014. A refined effects determination for the California red-legged frog potentially exposed to malathion. 245th American Chemical Society National Meeting, San Francisco, CA.

Breton, R.L., Y. Kara, S. Rodney, T.L. Estes, J. Hanzas, R.S. Teed, **D.R.J. Moore** and P. Whatling. 2014. A refined effects determination for the California red-legged frog potentially exposed to dimethoate. 245th American Chemical Society National Meeting, San Francisco, CA.

Moore, D.R.J. 2014. Population modeling in ecological risk assessments of pesticides. CropLife America Science Forum: Population Modeling of Endangered Species, Washington, DC.

Moore, D.R.J. and M.F. Leggett. 2013. No more excuses: It is time to incorporate uncertainty analyses in pesticide risk assessments. 34th Annual Society of Environmental Toxicology and Chemistry Conference, Nashville, TN.

Giesy, J.P., C. Cutler, J.M. Giddings, D. Mackay, **D.R.J. Moore**, W. Williams, J. Purdy and K.R. Soloman. Ecological risk assessment for chlorpyrifos in terrestrial and aquatic systems in North America: Overview and conclusions. 244th American Chemical Society National Meeting, Indianapolis, IN.

Moore, D.R.J., R.S. Teed, C.D. Greer, K.R. Solomon and J.P. Giesy. 2013. A refined avian risk assessment for agricultural uses of flowable chlorpyrifos in the United States. 244th American Chemical Society National Meeting, Indianapolis, IN.

Moore, D.R.J., R.S. Teed, C.D. Greer, K.R. Solomon and J.P. Giesy. 2013. A refined avian risk assessment for agricultural uses of granular chlorpyrifos in the United States. 244th American Chemical Society National Meeting, Indianapolis, IN.

Poletika, N.N., **D.R.J. Moore** and J.M. Giddings. 2013. Chlorpyrifos agricultural use and the Endangered Species Act: Do refinements in ecological risk assessment address uncertainty? 244th American Chemical Society National Meeting, Indianapolis, IN.

Moore, D.R.J. and W.G. Landis. 2012. Just say no to NOELs. 33rd Annual Society of Environmental Toxicology and Chemistry Conference, Long Beach, CA.

Landis, W.G. and **D.R.J. Moore**. 2012. The curve is the measure of toxicity. 33rd Annual Society of Environmental Toxicology and Chemistry Conference, Long Beach, CA.

Moore, D.R.J. 2012. Uncertainty analysis in ecological risk assessments of pesticides. CropLife America Science Forum: The Uncertainty of Capturing Uncertainty, Washington, DC.

Moore, D.R.J., K.J. Beckett and R.S. Teed. Risks of granular and flowable carbofuran to birds in Colombia. 2011. 32nd Annual Society of Environmental Toxicology and Chemistry Conference, Boston, MA.

Rodney, S., R.L. Breton, T.M. Wolf, P. Whatling, **D.R.J. Moore**, T.L. Estes and J. Hanzas. 2011. Development of models to predict pesticide spray drift deposition from aerial, airblast and groundspray applications. 32nd Annual Society of Environmental Toxicology and Chemistry Conference, Boston, MA.

Moore, D.R.J. and R.S. Teed. 2011. Risks of pesticide mixtures to salmon in the Pacific Northwest. 242nd American Chemical Society National Meeting, Denver, CO.

Teed, R.S., **D.R.J. Moore**, T. Hall, G. Sabbagh and R.L. Breton. 2011. An approach for the assessment of indirect effects to threatened and endangered terrestrial species exposed to herbicides: Glufosinate case study. 242nd American Chemical Society National Meeting, Denver, CO.

Moore, D.R.J. 2011. Do mixtures of pesticides pose a risk to salmonids in the Pacific Northwest? Crop Life/Informa Workshop held April 7-8. Washington, D.C.

Moore, D.R.J. 2010. Risks of pesticide mixtures to salmon in the Pacific Northwest. 31st Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Teed, R.S., **D.R.J. Moore**, T. Hall and R.L. Breton. 2010. An approach for assessment of indirect effects to threatened and endangered aquatic and terrestrial species exposed to herbicides: Glufosinate case study. 31st Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Estes, T.L., R.L. Breton, T.M. Wolf, P. Whatling, J. Schupner, J. Hanzas and **D.R.J. Moore**. 2010. Development of empirically-derived drift distributions to predict deposition of pesticides from ground spray applications. 31st Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Estes, T.L., R.L. Breton, T.M. Wolf, P. Whatling, J. Schupner, J. Hanzas and **D.R.J. Moore**. 2010. Development of empirically-derived drift distributions to predict deposition of pesticides from orchard airblast applications. 31st Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Estes, T.L., R.L. Breton, T.M. Wolf, P. Whatling, J. Schupner, J. Hanzas and **D.R.J. Moore**. 2010. Development of empirically-derived drift distributions to predict deposition of pesticides from aerial applications. 31st Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Teed, R.S. and **D.R.J. Moore**. 2010. Occurrence and toxicity of pesticide mixtures in California's Central Valley. 31st Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Breton, R.L., **D.R.J. Moore**, R.S. Teed, P. Whatling and J. Schupner. 2010. A refined effects determination for the California red-legged frog potentially exposed to dimethoate. 31st Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Schuler, L.J., J.P. Wright, J.L. Honegger, J. Hanzas and **D.R.J. Moore**. 2010. Le Sueur River watershed aquatic plant assessment. 31st Annual Society of Environmental Toxicology and Chemistry Conference, Portland, OR.

Moore, D.R.J. 2010. Assessing risks from pesticide mixtures in surface waters. Crop Life/Informa Workshop held April 15-16. Washington, D.C.

Moore, D.R.J., N.N. Poletika and R.L. Breton. 2009. Policy, process and technical issues facing the development of benchmarks in Canada and the United States. 30th Annual Society of Environmental Toxicology and Chemistry Conference, New Orleans, LA.

Moore, D.R.J. 2009. Use of advanced tools in assessment of risk. Crop Life/Informa Workshop held April 28-29. Washington, D.C.

Moore, D.R.J., R.S. Teed and T.M. Delongchamp. 2008. A probabilistic exposure model for birds exposed to flowable pesticides. 29th Annual Society of Environmental Toxicology and Chemistry Conference, Tampa, FL.

Moore, D.R.J., R.S. Teed, T.M. Delongchamp, R.L. Breton, L.B. Best, L.W. Brewer, K.R. Solomon, D. Carlson, M. Maynard, M. Morelli and S. Nissen-Meyer. 2008. Estimating risk for birds exposed to flowable carbofuran in the United States. 29th Annual Society of Environmental Toxicology and Chemistry Conference, Tampa, FL.

Brewer, L.W., J.M. Stafford, C.A. Redmond, L.B. Best, **D.R.J. Moore**, K.R. Soloman, D. Carlson, M. Maynard, M. Morelli and S. Nissen-Meyer. 2008. Mallard (*Anas platyrhynchos*) avoidance of flowable carbofuran relative to risk projections in avian pesticide risk assessment. 29th Annual Society of Environmental Toxicology and Chemistry Conference, Tampa, FL.

Solomon, K.R., L.W. Brewer, J.M. Stafford, C.A. Redmond, L.B. Best, **D.R.J. Moore**, D. Carlson, M. Maynard, M. Morelli and S. Nissen-Meyer. 2008. Recovery rate of carbofuran-inhibited brain acetylcholinesterase in birds: A risk assessment issue. 29th Annual Society of Environmental Toxicology and Chemistry Conference, Tampa, FL.

Stafford, J.M., L.W. Brewer, C.A. Redmond, L.B. Best, **D.R.J. Moore**, K.R. Soloman, D. Carlson, M. Maynard, M. Morelli and S. Nissen-Meyer. 2008. Further evaluation of the use of the median lethal dose (LD50) as the lethality threshold in avian pesticide risk assessment. 29th Annual Society of Environmental Toxicology and Chemistry Conference, Tampa, FL.

Rodney, S.I., **D.R.J. Moore**, R.S. Teed, and M.J. Demers. 2008. An Excel-based tool for fitting and evaluating species sensitivity distributions. 29th Annual Society of Environmental Toxicology and Chemistry Conference, Tampa, FL.

Hall, T., C. Thomas, J. Honegger, J. Giddings and **D.R.J. Moore**. 2008. Endangered species indirect effects: Screening level assessments and refined ecological assessments. 29th Annual Society of Environmental Toxicology and Chemistry Conference, Tampa, FL.

Moore, D.R.J. 2008. Ecological risk assessment: Protection goals. Crop Life/Informa Workshop held April 8-9. Washington, D.C.

Moore, D.R.J. 2008. LiquidPARAM: A refined probabilistic model for estimating risk to birds exposed to flowable pesticides. Invited speaker to March 19 SETAC Laurentian Meeting, Ottawa, ON.

Moore, D.R.J. 2008. LiquidPARAM: A model developed in support of the avian risk assessment for liquid carbofuran. Presented at the U.S. EPA Scientific Advisory Panel Meeting to Consider the Scientific Issues Associated With EPA's Notice of Intent to Cancel Carbofuran, February 5-8, 2008. Washington, D.C.

Moore, D.R.J., D.L. Fischer, T.S. Ramanarayanan, R.P. Thompson and S.I. Rodney. 2006. Estimating risk for aquatic life exposed to aldicarb in the United States. 27th Annual Society of Environmental Toxicology and Chemistry Conference, Montreal, QC.

Moore, D.R.J., D.L. Fischer, R.S. Teed, R.P. Thompson and S.I. Rodney. 2006. Estimating risk for birds exposed to aldicarb in the United States. 27th Annual Society of Environmental Toxicology and Chemistry Conference, Montreal, QC.

Moore, D.R.J., D.L. Fischer, R.S. Teed and S.I. Rodney. 2006. Estimating risk for birds exposed to granular pesticides: A probabilistic exposure model. 27th Annual Society of Environmental Toxicology and Chemistry Conference, Montreal, QC.

Moore, D.R.J., D.L. Fischer, R.S. Teed and S.I. Rodney. 2006. A probabilistic exposure model for estimating risk of birds exposed to granular pesticides: Sensitivity analysis and model performance. 27th Annual Society of Environmental Toxicology and Chemistry Conference, Montreal, QC.

Moore, D.R.J., D.L. Fischer, R.S. Teed and S.I. Rodney. 2006. A probabilistic exposure model for birds exposed to granular pesticides. 27th Annual Society of Environmental Toxicology and Chemistry Conference, Montreal, QC.

Moore, D.R.J., L.B. Best, L.W. Brewer, D.L. Fischer, A.T. Hall, I.D. Kelly, S.J. Klaine, T.S. Ramanarayanan and K.R. Solomon,. 2006. Establishing "Bright Lines" in probabilistic risk assessments of pesticides and contaminated sites. 27th Annual Society of Environmental Toxicology and Chemistry Conference, Montreal, QC.

Breton, R.L., R.P. Thompson, **D.R.J. Moore**, R.S. Teed, S. Mortensen and S.B. Wall. 2006. An endangered species assessment for wildlife potentially exposed to brodifacoum. 27th Annual Society of Environmental Toxicology and Chemistry Conference, Montreal, QC.

Jiapizian, P., P.-Y. Caux, E. Sabo, M. Demers, **D.R.J. Moore**, R.S. Teed, R.L. Breton, R. Roshon and G. Stephenson. 2006. Derivation of Ideal Performance Standards for 10 pesticides in Canadian surface waters. 27th Annual Society of Environmental Toxicology and Chemistry Conference, Montreal, QC.

Moore, D.R.J. 2006. A probabilistic model for estimating exposure of birds to granular pesticides. Invited speaker to April 26 SETAC Laurentian Meeting, Ottawa, ON.

Moore, D.R.J., R.S. Teed, R.L. Breton, R.P. Thompson, R. Willis, P.B. Jiapizian, P.-Y. Caux, M. Bauder and P. Bacchus. 2005. A methodology for derivation of Ideal Performance Standards for pesticides in Canada. 26th Annual Society of Environmental Toxicology and Chemistry Conference, Baltimore, MD.

Goldacker, S., J. Archbold, J. Shapiro, P.B. Jiapizian, P.-Y. Caux R.S. Teed and **D.R.J. Moore**. 2005. Introducing a method to derive Achievable Performance Standards at the sub-watershed level for pesticides. 26th Annual Society of Environmental Toxicology and Chemistry Conference, Baltimore, MD.

Moore, D.R.J., R.L. Breton, R.P. Thompson, R.S. Teed and S.C Svirsky. 2005. Risk to birds and mammals in the PCB-contaminated watershed of the Housatonic River, Massachusetts. Third International Conference on Remediation of Contaminated Sediments, New Orleans, LA.

Moore, D.R.J. 2004. A probabilistic site-specific approach for developing Ambient Water *Qua*lity Criteria for mercury. WEFTEC Workshop: Looking to the Future by Reevaluating Water *Qua*lity Criteria Now, New Orleans, LA.

Moore, D.R.J. 2004. Estimating and presenting uncertainties in empirical data and modeling results. Addressing and Managing Uncertainty at Contaminated Sites – USACE/USEPA/SMWG Joint Sediment Conference, St. Louis, MO.

Lortie, J.P., **Moore, D.R.J.** and Svirsky, S.C. 2003. Ecological risk assessment overview: PCB contamination in the Housatonic River, Pittsfield, Lenox, and Lee, MA. 10th Annual Conference of the Wildlife Society, Burlington, VT.

Pawlisz, A.V., **D.R.J. Moore**, R.P. Thompson, R.L. Breton, R.S. Teed and D.B. MacDonald. 2003. A probabilistic risk assessment for sediment-probing, carnivorous-wading, and piscivorous birds exposed to tPCBs, mercury, TE*Q,* lead and selenium in the Calcasieu Estuary, LA. 24th Annual Society of Environmental Toxicology and Chemistry Conference, Austin, TX.

Teed, R.S., **D.R.J. Moore**, D.L. MacDonald, D.B. MacDonald, R.L. Breton, A.V. Pawlisz and R.P. Thompson. 2003. Assessing the risks to carnivorous fish in the Calcasieu Estuary, Louisiana: A probabilistic risk assessment. 24th Annual Society of Environmental Toxicology and Chemistry Conference, Austin, TX.

Moore, D.R.J., R.L. Breton, D.B. MacDonald, A.V. Pawlisz, R.S. Teed and R.P. Thompson. 2003. Assessing risks to wildlife in the Calcasieu Estuary, Louisiana: An overview of the probabilistic approach used. 24th Annual Society of Environmental Toxicology and Chemistry Conference, Austin, TX.

Breton, R.L., D.B. MacDonald, **D.R.J. Moore**, R.S. Teed, A.V. Pawlisz and R.P. Thompson. 2003. Assessing the risks to piscivorous and omnivorous mammals in the Calcasieu Estuary contaminated site, Louisiana: A probabilistic risk assessment. 24th Annual Society of Environmental Toxicology and Chemistry Conference, Austin, TX.

Moore, D.R.J., S. Ferson, J.P. Lortie and C. Werner. 2002. Probabilistic risk assessment approach for threatened and endangered species exposed to PCBs along the Housatonic River. 23rd Annual Society of Environmental Toxicology and Chemistry Conference, Salt Lake, UT.

Moore, D.R.J., R.S. Teed and M. Richardson. 2002. Derivation of an ambient water quality criterion for mercury: Taking account of site-specific conditions. 23rd Annual Society of Environmental Toxicology and Chemistry Conference, Salt Lake, UT.

Moore, D.R.J. 2002. SETAC Pellston workshop on uncertainty analysis: Wildlife exposure assessment case study. 23rd Annual Society of Environmental Toxicology and Chemistry Conference, Salt Lake, UT.

Pawlisz, A.V., J. Steevens, M. Reiss and **D.R.J. Moore**. 2002. Development of tissue residue benchmarks for estimating risk associated with contaminated sediments. 23rd Annual Society of Environmental Toxicology and Chemistry Conference, Salt Lake, UT.

Teed, R.S., Thompson, R.P., **Moore, D.R.J.** and Tillitt, D. 2002. Analytical co-elution and the development of toxic equivalency factors (TEF). 22nd Annual Society of Environmental Toxicology and Chemistry Conference, Salt Lake, UT.

Teed, R.S., **D.R.J. Moore**, G.M. Richardson, A.V. Pawlisz, H.E. Allen, S. Thakali, J. Little, G. Holdsworth and R.P. Thompson. 2002. Assessment of existing methods and data development for revising water quality criteria for protection of aquatic life and wildlife for mercury. WEFTEC 2002 Conference, Chicago, IL.

Moore, D.R.J., S. Svirsky, T. DeLong, R. Dexter, S. Ferson and J. Lortie. 2001. Ecological risk assessment approach for the Housatonic River. 22nd Annual Society of Environmental Toxicology and Chemistry Conference, Baltimore, MD.

Svirsky, S., R., Beach, J. Lortie, **D.R.J. Moore**, C. Wallen and J. Walsh. 2001. Assessing risk, fate, transport and bioaccumulation of PCBs in the Housatonic River. 22nd Annual Society of Environmental Toxicology and Chemistry Conference, Baltimore, MD.

Warren-Hicks, W.A., M. Santoro, D. Bacon, B.R. Parkhurst and **D.R.J. Moore**. 2001. Ecological risk assessment of PFOS. 22nd Annual Society of Environmental Toxicology and Chemistry Conference, Baltimore, MD.

Cureton, P.M., A. Atkinson, M. Bonnell, R.S. Teed and **D.R.J. Moore**. 2001. Proposed framework for screening level ecological risk assessments of substances in Canada. 22nd Annual Society of Environmental Toxicology and Chemistry Conference, Baltimore, MD.

Moore, D.R.J. 2001. Introduction to probabilistic methods. EUPRA European Workshop on Probabilistic Risk Assessment for Environmental Impacts of Pesticides, Leeuwenhorst, The Netherlands.

Moore, D.R.J., A.V. Pawlisz, A.D.M. Hart and W.A. Warren-Hicks. 2001. Probabilistic techniques to determine risk to birds exposed to chlorpyrifos in apple orchards. EUPRA European Workshop on Probabilistic Risk Assessment for Environmental Impacts of Pesticides, Leeuwenhorst, The Netherlands.

Hart A., **D.R.J. Moore**, W.A. Warren-Hicks, A.V. Pawlisz, and R.S. Teed. 2001. Simple probabilistic techniques to determine risk to birds exposed to chlorpyrifos in apple orchards. 11th Annual Meeting of Society of Environmental Toxicology and Chemistry Europe Conference, Madrid, Spain.

Moore, D.R.J., A. Hart, W.A. Warren-Hicks, A.V. Pawlisz and R.S. Teed. 2001. Application of second order Monte Carlo analysis and probability bounds analysis to estimate risk to birds exposed to chlorpyrifos in apple orchards. 11th Annual Meeting of Society of Environmental Toxicology and Chemistry Europe Conference, Madrid, Spain.

Moore, D.R.J. 2001. New developments in quantifying uncertainty in ecological risk assessment. English Nature Workshop: Risk Assessment, Peterborough, UK.

Moore, D.R.J. 2000. Use of hierarchical Monte Carlo methods to propagate uncertainties in ecological risk assessments of pesticides. 21st Annual Society of Environmental Toxicology and Chemistry Conference, Nashville, TN.

Ferson, S. and **D.R.J. Moore**. 2000. Bounding uncertainty analyses: Marrying probability and worst case arguments in risk assessments. 21st Annual Society of Environmental Toxicology and Chemistry Conference, Nashville, TN.

Moore, D.R.J., A.V. Pawlisz and R.S. Teed. 2000. Utility of the spatially-explicit PATCH model for estimating risks of anthropogenic stressors to wildlife. 21st Annual Society of Environmental Toxicology and Chemistry Conference, Nashville, TN.

Pasternak, J.P., **D.R.J. Moore** and R.S. Teed. 2000. A probabilistic risk assessment for aquatic biota exposed to inorganic chloramines in Canada. 21st Annual Society of Environmental Toxicology and Chemistry Conference, Nashville, TN.

Karalis, E., D.J. Porter, M.A. Bonnell, **D.R.J. Moore**, A.J. Atkinson and R.S. Teed. 2000. A framework for the ecological risk assessment of new substances in Canada. 21st Annual Society of Environmental Toxicology and Chemistry Conference, Nashville, TN.

Karalis, E., D.J. Porter, M.A. Bonnell, **D.R.J. Moore** and A.J. Atkinson. 2000. A framework for the ecological risk assessment of new substances in Canada. 27th Annual Aquatic Toxicity Workshop, St. John's, NL.

Moore, D.R.J. and W.J Warren-Hicks. 2000. New and not so new statistical methods for use in ecological risk assessment. 10th Annual Meeting of Society of Environmental Toxicology and Chemistry Europe Conference, Brighton, U.K.

Sutcliffe, R., R.L. Breton, D. MacDonald, **D.R.J. Moore**, J.D. Walker, M. Bonnell, and R Purdy. 2000. Results of an international *QSA*R workshop on estimating persistence, bioaccumulation and ecotoxicity of substances. 10th Annual Meeting of Society of Environmental Toxicology and Chemistry Europe Conference, Brighton, U.K.

Moore, D.R.J., R.L. Breton, D. MacDonald, P. Harris, R. Chenier, R. Sutcliffe, J. Sanderson, S. Bradbury, C. Russom and P.C. Jurs. 1999. Ability of ECOSAR, TOPKAT, Neural Networks and ASTER to predict toxicity of chemicals to aquatic biota. 20th Annual Society of Environmental Toxicology and Chemistry Conference, Philadelphia, PA.

Warren-Hicks, W.J. and **D.R.J. Moore**. 1999. Beyond Monte Carlo. 20th Annual Society of Environmental Toxicology and Chemistry Conference, Philadelphia, PA.

Warren-Hicks, W.J. B.R. Parkhurst, **D.R.J. Moore**, R.B. Berger, J.J. Pletl, D.L. Denton and R.B. Baird. 1999. Whole effluent toxicity test variability: A variance components analysis. 20th Annual Society of Environmental Toxicology and Chemistry Conference, Philadelphia, PA.

Moore, D.R.J., R.S. Teed, W.J. Warren-Hicks, B.R. Parkhurst, R.B. Berger, J.J. Pletl, D.L. Denton and R.B. Baird. 1999. Intra- and Inter-treatment variance in reference toxicant tests. 20th Annual Society of Environmental Toxicology and Chemistry Conference, Philadelphia, PA.

Parkhurst, B.R., W.J. Warren-Hicks, **D.R.J. Moore**, R.B. Berger, J.J. Pletl, D.L. Denton and R.B. Baird. 1999. WET test variability: Demonstration of effects on compliance with WET. 20th Annual Society of Environmental Toxicology and Chemistry Conference, Philadelphia, PA.

Teed, R.S., S.S. Qian, W.J. Warren-Hicks, **D.R.J. Moore**, F.J. Keating and L.S. Steeves. 1999. Examination of the spatial relationship and interaction of selected environmental parameters to mercury concentrations in fish tissue in the north-eastern United States. 20th Annual Society of Environmental Toxicology and Chemistry Conference, Philadelphia, PA.

Jensen, F.A., G.R. Craig, **D.R.J. Moore** and M.B. Constable. 1999. The risks of ammonia to aquatic biota in Canada: Results of a priority substances assessment. 20th Annual Society of Environmental Toxicology and Chemistry Conference, Philadelphia, PA.

Parkhurst, B.R., **D.R.J. Moore** and J. Kennedy. 1999. How well do EPA's water quality criteria for ammonia predict effects to aquatic communities? 20th Annual Society of Environmental Toxicology and Chemistry Conference, Philadelphia, PA.

Moore, D.R.J. 1998. Ecological risk assessment. 19th Annual Society of Environmental Toxicology and Chemistry Conference, Charlotte, NC.

Moore, D.R.J. and P.Y. Caux. 1998. Hockey stick and Generalized Linear Models (GLiMs): How useful are they for estimating thresholds? 19th Annual Society of Environmental Toxicology and Chemistry Conference, Charlotte, NC.

Moore, D.R.J. 1998. Ethics in ecological risk assessment. 19th Annual Society of Environmental Toxicology and Chemistry Conference, Charlotte, NC.

Moore, D.R.J., R.S. Teed, B.E. Sample, G.W. Suter and B.R. Parkhurst. 1998. A probabilistic risk assessment of the effects of methylmercury and PCBs on mink and kingfishers along East Fork Poplar Creek, Oak Ridge, Tennessee. 19th Annual Society of Environmental Toxicology and Chemistry Conference, Charlotte, NC.

Moore, D.R.J., R.S. Teed, B.E. Sample, G.W. Suter and B.R. Parkhurst. 1998. Risk-based decision making: The East Fork Poplar Creek case study. 19th Annual Society of Environmental Toxicology and Chemistry Conference, Charlotte, NC.

Keating, F.J., P.A. Cocca, R.S. Teed, L. Steeves and **D.R.J. Moore**. 1998. Comparison of air deposition of mercury with concentrations in fish. 19th Annual Society of Environmental Toxicology and Chemistry Conference, Charlotte, NC.

deFur, P., S. Ferenc, M. Dobbs, C. Grue, S. Marcy, **D.R.J. Moore**, R. Rolland and R. Wentsel. 1998. Risk characterization in ecological assessments for multiple stressors. 19th Annual Society of Environmental Toxicology and Chemistry Conference, Charlotte, NC.

Moore, D.R.J. 1998. Probabilistic ecological risk assessment. U.S. Army Corps of Engineers Workshop on Environmental Risk Assessment and Dredged Material Management: Issues and Applications, San Diego, CA.

Moore, D.R.J., R.S. Teed, A. Fairbrother, L.A. Kapustka and R.S. Bennett. 1997. A searchable database for population, community and ecosystem-level endpoints used in ecological risk assessment. 18th Annual Society of Environmental Toxicology and Chemistry Conference, San Francisco, CA.

Moore, D.R.J. and P.Y. Caux. 1997. Incorporating sediment bioavailability in a probabilistic risk assessment of CCA-treated bulkhead effects to marine biota. 18th Annual Society of Environmental Toxicology and Chemistry Conference, San Francisco, CA.

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Additional Professional and Community Activities

Invited Panel Member and Guest Speaker at CropLife America Science Forum on Population Modeling (2014)

Invited Panel Member and Guest Speaker at CropLife America Science Forum on Uncertainty Analysis (2013)

Member, CropLife America Ecological Risk Assessment Committee (2009–2018)

US EPA Science Advisory Board Member (2006, 2008)

Invited Speaker, U.S. ACE/U.S. EPA/SMWG Joint Sediment Conference (2004)

Steering Committee Member for SETAC Pellston Workshop on Probabilistic Risk Assessments of Pesticides (2002)

Invited Participant, SETAC Pellston Workshops on Wildlife Risk Assessment (Current), Problem Formulation in Ecological Risk Assessment (2010), Re-evaluating Water Quality Criteria (1998), Ecological Risk Assessments Involving Multiple Stressors (1997)

Peer Reviewer, Ecological Risk Assessment for the Hudson River (2000)

Editorial Board, Environmental Toxicology and Chemistry (2000–2003)

US EPA FIFRA Scientific Advisory Panel Member (1999, 2000, 2004)

Editorial Board, Human and Ecological Risk Assessment (1995–2004)

Co-editor, "Uncertainty Analysis in Ecological Risk Assessment" (1998, SETAC Press)

Steering Committee Member for SETAC Pellston Workshop on Designing a Decision Support System for Ecological Risk Assessment (1994)

Director Alex Peacock
Board of Pesticides Control
28 State House Station
Augusta, ME 04333

August 14, 2026

RE: Stakeholder Input required by LD 1323 (132nd Maine Legislature)

Dear Director Peacock and members of the Board of Pesticides Control:

Thank you for the opportunity to submit input regarding the seven research topics outlined in Section 1 of LD 1323, *Resolve, Directing the Board of Pesticides Control to Evaluate the Impact of Neonicotinoids on Pollinators, Humans and the Environment*.[1]

Since 1843, Maine Audubon has worked to conserve Maine wildlife and wildlife habitat by engaging people in education, conservation, and advocacy. The oldest and largest Maine-based conservation organization, Maine Audubon has eight public centers and sanctuaries across the state; seven chapters; 30,000 members, volunteers, and supporters; and connects with more than 250,000 people annually.

Though effective at managing pests, neonicotinoid insecticides – also called "neonics" – pose threats to Maine wildlife, pollinators, and farmers due to their indiscriminate nature and pervasiveness in the environment. In 2021, the 130th Maine Legislature directed the Board of Pesticides Control (BPC) to prohibit the use of some of the most prevalent neonics (dinotefuran, clothianidin, imidacloprid, and thiamethoxam) in most residential uses with the passage of LD 155.[2] And last year, LD 1323 directed the BPC to further investigate the impacts of these insecticides through both stakeholder input sessions and a report prepared by the BPC, which must include findings and recommendations on impacts of neonics and neonic-treated seeds on pollinators, toxicity of neonics to humans, alternatives to the insecticides, among other topics.

Maine Audubon participated in the first stakeholder session and intends to participate throughout the entirety of the process. The following information provides an abbreviated compilation of our organization's input on four of the seven study areas assigned to the BPC under LD 1323:

[1] LD 1323, Resolve, Directing the Board of Pesticides Control to Evaluate the Impact of Neonicotinoids on Pollinators, Humans and the Environment (RESLV Chapter 69) https://legislature.maine.gov/legis/bills/getPDF.asp?paper=HP0858&item=5&snum=132
[2] LD 155, Resolve, Directing the Board of Pesticides Control To Prohibit the Use of Certain Neonicotinoids for Outdoor Residential Use (RESLV Chapter 33) www.mainelegislature.org/legis/bills/getPDF.asp?paper=HP0111&item=5&snum=130

1. The impacts of neonicotinoids, including neonicotinoid-treated seeds, on pollinators.

Beyond their lethal effects on pollinators, neonics can cause a range of significant sublethal impacts that should be investigated thoroughly in the Board of Pesticide's final report. The following examples illustrate some of the documented sublethal impacts of neonicotinoids:

- Imidacloprid, thiamethoxam, and clothianidin induce flight muscle paralysis in honeybees, resulting in the cessation of wing movements (Girolami et al. 2009).
- There is growing evidence that sublethal exposure can affect learning, memory, and orientation in honeybees (Pisa et al. 2015).
- Sublethal effects on honeybee reproduction have been correlated with neonicotinoid exposure, including honeybee hatching and development delays when food was contaminated with imidacloprid (Decourtye et al. 2005) and drastically reduced brood production of worker Bumble Bees as a result of simulated contact with imidacloprid (Laycock et al. 2012).
- Recent research indicates that neonicotinoid exposure increased worker bee mortality and has been linked to declines in social immunity and increased queenlessness (Tsvetkov et al. 2017).

In addition to mortality concerns, Maine Audubon urges the BPC to investigate the sublethal effects of neonicotinoids which can often be cumulative. Addressing sublethal effects is key to reducing stress across pollinator species. Another alarming aspect of neonicotinoid use is its ability to persist in soils across multiple growing seasons — the final report should detail how repeated exposure impacts pollinators over time.

2. The costs and benefits of neonicotinoid-treated seeds compared to untreated seeds, including the market availability of neonicotinoid-treated seeds compared to untreated seeds.

In many agricultural systems, the economic benefits of neonicotinoid use are often limited and may not outweigh their costs. Peer-reviewed research demonstrates that neonicotinoid seed treatments for corn, soybean, and other cereal crops offer little to no economic advantage for farmers.

- A recent Cornell University assessment concluded that "neonicotinoid-treated seeds do not consistently increase yield compared to untreated controls, fungicide-only controls, or other insecticide treatments (Grout et al., 2020).
- A 2015 study showed that using neonic-coated soybean seeds actually decreased yield because they reduced beneficial predators (Douglas et al., 2015).
- In the context of soybean production, the Environmental Protection Agency (EPA) concluded that neonic-treated soybean seeds offer "no overall net income benefit" (U.S. Environmental Protection Agency, 2026).

- Walmart has committed to sourcing 100% of its fresh produce and flora from suppliers that adopt integrated pest management practices while also encouraging suppliers to phase out neonicotinoids. These decisions were made “to help improve pollinator health and biodiversity in the regions in which [Walmart operates]” (Mundo, 2021).

3. The impact of neonicotinoids on the environment, including, but not limited to, soil, water and plant tissues.

Unlike other pesticides, neonics are systemic, meaning that they are taken up by plants from the soil and become present in all parts of the plant as well as in pollen. Neonics can also enter groundwater and can remain in the soil for decades. Neonic effectiveness is indiscriminate, killing not only pest insects, but beneficial pollinators, other insects, and wildlife that eat affected plants or insects. It is essential that the Board investigate the impacts not only on soil, water and plant tissues, but also on birds, mammals, and aquatic species.

<u>Soil</u> – The persistence and prevalence of neonicotinoids in soil is a concern for both animal health and human health. Understanding how these insecticides interact with soil will be helpful for the Board’s final report.

- A study in Wisconsin found that neonicotinoids can leach through soil and into irrigation systems, resulting in the insecticide being reapplied to the same soil or areas that were not intended to be treated with neonicotinoids (Huseth & Groves, 2014).
- Neonicotinoid residues in soils can accumulate over years (Sánchez-Bayo et al., 2016).
- The half lives of neonicotinoids in soil can be between 50 and 600 days (Bonmatin et al., 2015).
- Research has shown that neonicotinoid exposure in soils can impact the reproduction of earthworms and disrupt the epidermal and midgut tissues of earthworms (Wang et al., 2015).

<u>Aquatic Ecosystems</u> – Neonicotinoids can leach into surface and groundwater (Berens et al., 2021), where they have been detected across a wide range of water bodies and may persist for extended periods, contributing to ongoing environmental contamination.

- Exposure to neonics can be lethal to invertebrate species and drive sublethal effects, including immobility and reduced feeding, reproduction, and growth (Hoyle & Code, 2021). Over time, these impacts can harm entire populations and alter food webs, multiplying existing threats on invertebrate species that are already contending with a myriad of stressors (Tooker & Pearsons, 2021).

- Recent studies have shown that neonic exposure in amphibians can lead to abnormal behaviors, disruption of developmental processes, increased predation, neurological issues, and heightened mortality (Oliveria et al., 2025).
- A 2022 study observed a 10% decrease in larval survival to metamorphosis when tadpoles were exposed to imidacloprid. Additionally, 15.7% of individuals developed undifferentiated or hermaphroditic gonads—indicating endocrine disruption (Thompson et al., 2022).
- Imidacloprid exposure has been correlated with declines in macro-invertebrate abundance among the orders Amphipoda, Basommatophora, Diptera, Ephemeroptera, and Isopoda (Van Dijk et al., 2013).

Birds – In addition to exploring the impact of neonicotinoids on soil, water, and plant tissues, the report should also highlight the dangers neonicotinoids pose to wildlife, including birds. Birds are primarily exposed to neonicotinoids through consumption of treated insects, seeds, or plants. Like other organisms that come into contact with neonics, exposure can lead to sublethal complications or even death.

- A study in Spain found that imidacloprid exposure in partridges caused sublethal effects including altered biochemical parameters, oxidative stress, and reduced carotenoid-based coloration. That same study found that imidacloprid reduced chick survival, reduced the size of eggs, and reduced fertilization rates (Lopez-Antia et al., 2013).
- A subsequent study found that higher doses of imidacloprid led to partridge mortalities with evidence of imidacloprid accumulation. While lower doses were correlated with reduced clutch size, delays in first egg lay rate, and depressed T-cell immune response of chicks (Lopez-Antia et al., 2015).
- Sparrows exposed to imidacloprid showed declines in fat stores, body mass, and failed to orient correctly (Eng et al., 2017).
- A 2024 report found evidence that neonicotinoids harm bird health, behavior, reproduction, and survival (Molenaar et al., 2024).
- Neonicotinoid presence has also been detected in Wild Turkeys. One study found that 22.5% of tested Wild Turkeys in Ontario were positive for neonicotinoid residues (Macdonald et al., 2018).

Mammals – A growing body of evidence suggests that neonicotinoids can cause serious sublethal impacts on mammals. We respectfully urge the Board to thoroughly investigate these impacts for their report.

- A study in Minnesota found that higher concentrations of imidacloprid in the spleens of White-Tailed Deer led to lethargy, smaller organ sizes, and likely lower reproductive success (Beer, 2021).
- Another 2019 study found that as imidacloprid increased in the spleen, White-Tailed Deer fawn survival, thyroxine levels, jawbone lengths, body weight, and organ weights decreased. Presence of imidacloprid in the genitals of adult female deer correlated with decreased genital organ weight, and imidacloprid levels in their spleens were correlated with decreased activity levels in adult females and their fawns. Alarmingly, this study also found that control deer had detectable levels of imidacloprid in their bodies, likely due to the food that they were given, highlighting how prevalent neonicotinoid exposure can be (Berheim et al., 2019).
- Several studies have demonstrated that there is widespread exposure to neonicotinoids in mesopredators. A study in North Dakota detected imidacloprid in 13% of bobcats, 15% Fishers, and 35% of river otters. Mean imidacloprid concentrations found in the spleens of mesopredators were greater than the mean level of imidacloprid in spleens of captive White-Tailed Deer fawns and free-ranging deer. This study illustrates how neonic exposure can occur in animals that are less likely to come into contact with treated grain crops (Michel et al., 2026).

<u>Endangered Species</u> – According to a recent EPA review, three commonly used neonics pose considerable threats to endangered species: Clothianidin may adversely affect 67% of listed species and 56% of critical habitats; Imidacloprid may adversely affect 70% of listed species and 83% of critical habitats; and Thiamethoxam may adversely affect 77% of listed species and 81% of critical habitats (U.S. Environmental Protection Agency, 2026).

From soil to endangered species, neonicotinoid exposure can lead to serious environmental consequences. It is important for the Board's report to fully feature all of these impacts. Even if morality is not the end result, the sublethal impacts of neonicotinoids can be detrimental to the health of ecosystems. It is also important to recognize that environmental exposure to neonicotinoids does not happen in a silo as ecosystems are constantly being exposed to other pollutants and other stressors that can exacerbate the impact of neonicotinoids.

5. Alternatives to neonicotinoid seed treatments for the protection of crops from damaging pests and disease.

To effectively consider the alternatives to neonicotinoid seed treatments, it would be helpful for the Board to analyze progress that other states and countries have made in restricting the use of neonicotinoids. For example, Quebec has achieved great success in regulating pesticide-treated seeds. Former agronomist with the Canadian Ministry of Agriculture Louis Robert proudly shared in 2024: *"The most reliable proof is that it's not even a matter of discussion anymore. Today, as we speak in 2024 in*

Quebec, over half of the corn and soy acreage doesn't carry any insecticide, and we're going to have a fantastic year in terms of yield (Held, 2024)."

The Xerces Society for Invertebrate Conservation reviewed market responses to neonicotinoid restrictions in Quebec and reported that "[i]n spite of vigorous opposition from seed companies and the pesticide industry, they were able to adjust quickly to the new market conditions" (Mafi, 2024). Furthermore, Quebec growers are reportedly spending less by buying untreated seeds (Mafi, 2024). Quebec's leadership in restricting neonicotinoid use provides a valuable model, and Maine would benefit from examining the approaches that have contributed to its success.

Conclusion

Maine Audubon respectfully submits the above information and hopes it will serve as a helpful resource for staff and members of the Board of Pesticides Control as they undertake the important work of compiling the final report. A fully informed report will shed light on the prevalence of neonicotinoids in Maine and their impacts on wildlife, the environment, and people. Importantly, it will provide insights for the State, organizations like Maine Audubon, and the broader community. Notably, 22 public health, environmental, and conservation organizations supported LD 1323 and nearly 1,000 Maine people from all 16 counties signed a petition in favor of the original, more restrictive proposal that was presented to the 132nd Maine Legislature. This broad statewide support demonstrates that the impacts of neonicotinoids on humans and wildlife are a salient and important issue for people all across Maine..

Please find citations for the provided information on the following pages. Thank you for your consideration and we welcome questions or follow-up conversation.

Sincerely,

Anthony Erwin
Policy Advocate

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September 8, 2026

Comments Regarding L.D. 1323, Resolve, Directing the Board of Pesticides Control to Evaluate the Impact of Neonicotinoids on Pollinators, Humans, and the Environment

A Maine dairy farmer begins planning next year's feed supply long before the ground is ready for planting. Cows must be fed every day of the year, and feed is one of the largest expenses of producing milk. Maine dairy guidance estimates that feed accounts for roughly 46 to 50 percent of the cost of producing milk. That makes the farm's ability to grow its own high-quality forage one of the most important tools it has for controlling production costs.

A dairy farm can purchase forage and grain from other farms, but buying feed means paying the market value for someone else to grow, harvest and store the crop, and often paying to transport a heavy, bulky product into Maine. It also leaves the farm vulnerable to regional feed shortages and price increases when drought, flooding or poor harvests reduce supply.

For a dairy farm with suitable acreage and equipment, growing feed on the farm can therefore be substantially more economical than replacing that feed on the open market. Northeast dairy cost data illustrate the difference. In one analysis of 100 dairy farms, home-raised corn silage averaged approximately $23 per ton to produce, while its average market value during the same period was approximately $48 per ton. The exact cost on an individual Maine farm will vary with seed, fertilizer, fuel, labor, machinery, land and yield, but the underlying economic relationship is important: the farm may be able to produce forage for considerably less than it would cost to purchase an equivalent quantity at market value.

Current market values also demonstrate why replacement feed can become expensive quickly. Recent Northeast estimates have placed corn silage at roughly $60 to $63 per ton. That should not be directly compared with the older $23 production-cost figure as though both represent the same year, but it shows the current scale of purchased forage prices. When a dairy needs hundreds or thousands of tons of forage during a year, even a relatively small reduction in homegrown production can translate into a significant new cash expense.

Maine dairy farms grow corn for exactly this reason. State dairy cost-of-production data show that corn silage is a common and substantial part of Maine dairy production, with participating farms growing hundreds of acres on average. Homegrown forage allows the dairy to convert its land, equipment and labor into feed rather than purchasing all of that feed at market price.

Corn silage is particularly important because nearly the entire corn plant—stalk, leaves, cob and grain—is harvested, chopped and stored under conditions that allow it to ferment. The result is a relatively energy-dense forage that can be stored and fed throughout the year. The farmer is not simply trying to produce the largest possible pile of green material. Yield matters, but so do grain development, starch content, digestibility, moisture and maturity at harvest.

If the farm harvests less silage than expected, or the crop does not develop enough grain to provide the anticipated feed value, the cows' nutritional requirements do not decline. The farmer has to purchase something else to make up the difference.

That is why choosing corn seed is not a routine purchase. It is one of the first decisions in producing next year's feed supply.

Choosing Corn Means Making Decisions Months Before the Risks Are Known

The farmer begins by estimating how much forage the herd will consume, how much feed remains from the previous harvest, how many acres are available and how much corn the farm can reasonably expect to produce per acre. Then the farmer and seed dealer begin selecting hybrids.

Commercial field corn is not one interchangeable product. Individual hybrids differ in expected silage yield, grain and starch production, fiber digestibility, root and stalk strength, disease resistance, insect-protection traits and adaptation to specific soils and growing conditions. A farmer may select several hybrids because the farm's fields themselves are different. A well-drained field may warm early and be ready to plant in May, while a heavier field on the same farm may remain cold and wet for weeks longer.

In Maine, relative maturity is particularly important. Different corn hybrids require different amounts of growing time and accumulated heat to develop. A farmer expecting to plant a well-drained field in early May may choose a longer-season hybrid because the crop should have enough time to mature and because that hybrid may offer desirable yield or feed-quality characteristics. A wetter field normally planted later may receive a shorter-season hybrid. Farms often plant several maturity groups both to spread weather risk and to avoid having every field ready to harvest simultaneously.

The farmer makes all of these decisions before knowing what the following spring will bring. The seed may be ordered months before anyone knows whether the soil will warm early, whether May will bring weeks of rain, whether a field will have to be replanted or whether early-season insects will become economically significant.

That uncertainty is not theoretical. Maine farmers experienced it in 2025.

The Wet Spring of 2025 Changed the Seed Maine Farmers Needed

Persistent rainfall in the spring of 2025 left fields saturated and delayed corn planting across Maine. Heavy planting equipment cannot simply be driven onto saturated soil without risking compaction, rutting and damage that can affect crop performance for the rest of the season. Farmers had to wait for fields to become workable.

As days of delay became weeks, the bags of seed already sitting on the farm did not change, but the amount of growing season remaining did. A hybrid selected for planting in early or mid-May may no longer be an appropriate choice if the field cannot be planted until June. The later the planting date, the greater the risk that a longer-maturity hybrid will fail to accumulate enough heat and development before Maine's growing season ends. For a dairy farmer, that can mean lower silage yield, inadequate grain development and poorer feed quality.

In 2025, farmers responded by exchanging seed they had already purchased for shorter-season hybrids. Some acreage was shifted to different crops because it had become too late to plant the corn originally planned for those fields. That adaptation was possible because Maine dealers could search beyond the seed originally ordered for Maine. Short-season hybrids are also grown in northern and upper-Midwestern states, and in a difficult planting year seed can be moved between regions.

Under the current conventionally treated-seed system, that exchange can often be made without an additional seed cost to the farmer. A dealer can take back one bag of conventionally treated seed and replace it with another available bag of conventionally treated seed that has a more appropriate relative maturity or hybrid package. Because conventional treatment packages are widely used across the national corn market, dealers can draw from a much larger inventory when weather suddenly changes what a Maine farmer needs.

Two important neonicotinoid active ingredients used in commercial corn seed treatment are clothianidin and thiamethoxam. Both are Group 4A neonicotinoid insecticides.

That flexibility changes if Maine requires seed without those insecticidal active ingredients. What the seed industry commonly calls fungicide-only seed is a separate treatment configuration: the insecticidal component is removed while fungicidal protection remains. The fungicide active ingredients themselves vary by company, hybrid and commercial treatment package, so "fungicide-only" should not be understood as a single standardized chemical treatment.

Seed companies must determine well in advance which hybrids will be offered without clothianidin, thiamethoxam or another insecticidal seed treatment, how many bags to produce, where to position those bags and whether sufficient demand exists to justify maintaining that separate inventory.

The fungicide-only package can also carry an additional cost. A farmer who can currently exchange one conventionally treated hybrid for another without paying an additional seed charge may instead face an added cost for a specialized treatment package. Even if a replacement is available, therefore, the farmer may no longer be able to make a simple no-cost exchange when weather changes the planting plan.

The distinction matters because the treatment decision has already been made before the farmer knows that replacement seed will be needed. If a warehouse in Minnesota contains exactly the short-season hybrid a Maine farmer needs but the seed was treated with clothianidin **or** thiamethoxam, that inventory could no longer be used if Maine prohibited those treatments. The insecticide cannot simply be removed from a bag of finished seed, and the seed company cannot respond to a June shortage by growing another crop of seed.

The farmer may instead face a narrower inventory, an added charge for fungicide-only seed, a hybrid that does not have the preferred agronomic characteristics, the longer-season seed already purchased, another crop, fewer acres of corn, or no suitable replacement at all.

For a dairy farmer, that is significant because the cost is not limited to the price difference between two seed bags. A restriction can affect both the cost of the seed and the flexibility to exchange it when weather changes the planting plan. If that leads to a less suitable hybrid, a later planting date, lower yield or fewer acres of corn, the consequences can show up again months later as purchased feed.

Seed Producers Have to Make Their Decisions Even Earlier

The seed producer faces the same problem from the opposite end of the supply chain. Corn seed is itself an agricultural crop before it becomes a product in a bag. Seed companies must determine which hybrids to produce, plant the parent lines, grow and harvest the seed crop, condition and test the seed, determine whether the finished seed will receive an insecticidal treatment such as clothianidin or thiamethoxam, apply the treatment package, package the seed and distribute inventory throughout the country.

Information from the seed industry indicates that planning for seed intended to be planted in 2027 may begin as early as December 2025. In practical terms, decisions affecting a Maine farmer’s future seed supply may be made more than a year before that farmer puts a planter into the field.

Maine is also an extremely small part of the national market. Current industry estimates put Maine corn-seed sales at approximately 12,000 bags annually, representing roughly 30,000 acres and about $3.5 million in sales. By comparison, U.S. farmers planted approximately 95.3 million acres of corn in 2026. Maine therefore represents only about 0.03 percent of U.S. corn acreage, or approximately one Maine corn acre for every 3,177 acres planted nationally.

At comparable seeding rates, the national market is on the order of 38 million bags of corn seed, compared with approximately 12,000 in Maine. But Maine’s 12,000 bags are not 12,000 identical bags. They are divided among seed companies, hybrids, maturity groups, genetic packages and traits. The industry also needs extra inventory for replanting, late planting and unexpected changes in demand.

The current treated-seed market allows dealers to move and exchange much of that inventory relatively freely among regions. A Maine-only requirement excluding clothianidin, thiamethoxam or other regulated neonicotinoid active ingredients would divide that inventory into separate treatment categories, reducing interchangeability and potentially adding both cost and delay for the farmer.

Requiring a separate treatment package for Maine therefore means predicting, far in advance, how many bags will be needed across all of those combinations for a market representing roughly three one-hundredths of one percent of national corn acreage. The concern is not that fungicide-only seed is physically impossible to produce. The concern is whether Maine farmers will retain access to the specific seed they need, when they need it, and at the same cost, including the seed they cannot know they will need until weather changes the planting plan.

Neonicotinoid Seed Treatment Protects a Crop Before the Farmer Can See the Problem

Seed availability is only part of the issue. Neonicotinoid active ingredients such as clothianidin and thiamethoxam are applied to corn seed because the period between planting and successful crop establishment exposes corn to pests that can cause damage before there is an established plant to protect.

Seedcorn maggot and wireworm are two examples. Both can attack seed below the soil surface. If an insect population develops later on an established crop, the farmer may be able to scout the field, determine whether the pest has reached an economic threshold and apply a treatment. When an insect destroys a seed underground, the situation is different.

Once a seed has been destroyed before emergence, that plant is permanently lost. A later foliar insecticide cannot restore the stand. The farmer must either accept fewer plants per acre and the associated yield risk or, if stand loss is severe enough, replant all or part of the field. Replanting means another seed purchase, another pass with the planter, additional labor, fuel and machinery costs, and a later planting date that may itself require changing to a shorter-season hybrid.

Research led by Heather Darby at the University of Vermont illustrates how significant that difference can become under meaningful early-season pest pressure. In a 2024 controlled trial, untreated corn averaged approximately 17,500 plants per acre, compared with roughly 28,500 plants per acre when seed treatment was used—a difference of approximately 11,000 established plants per acre.

The probability of seedcorn maggot or wireworm damage was approximately 83.1 percent in untreated controls. Fungicide-only seed reduced damage to about 43.2 percent, while insecticide-treated seed had damage of approximately 23.5 percent.

The same research demonstrates an important nuance. The insecticide treatments included a neonicotinoid, spinosad, and a diamide treatment, and there were no significant population differences among those insecticide treatments under the conditions tested. That tells us other chemistries may provide useful early-season protection. It does not tell us whether the same commercial hybrids are offered with those treatments, whether sufficient quantities are produced, whether farmers must special-order them months in advance, whether they cost more, or whether emergency replacement inventory will exist when planting plans change.

The research also demonstrates why farmers cannot know at ordering time whether treatment will matter on their particular acreage. Seedcorn maggot and wireworm pressure changes with temperature, field history, planting date and other conditions.

That variability is precisely the farmer's dilemma. The farmer has to buy the seed before knowing whether the next field will be the low-pressure field or the field where early-season protection makes a substantial difference.

A Potato Farmer Uses Neonics for a Different Reason

A Maine potato farmer begins with an entirely different crop and production system. Before planting begins, the grower has already made a series of decisions about which varieties to grow, where those varieties will be planted, what the intended market requires and how the crop will be protected. The farmer has purchased seed potatoes, prepared fields, planned fertility, scheduled equipment and labor, and developed a pest- and disease-management program for a crop that will remain in the ground for months before it produces revenue.

Potatoes are planted from seed tubers or cut seed pieces rather than the small botanical seeds familiar to consumers. Each viable seed piece is planted into a hill and expected to establish a plant above ground while developing multiple new tubers below ground. The farmer therefore needs to protect both the developing plant and the underground crop throughout the growing season.

Neonicotinoids are directly part of that production system. Two important active ingredients are imidacloprid and thiamethoxam. Both are Group 4A systemic neonicotinoid insecticides and have been used as seed-piece or in-furrow treatments at planting. As the potato plant develops, the active ingredient is taken up systemically by the plant, providing protection against insects including aphids, Colorado potato beetle, flea beetles and leafhoppers.

That is fundamentally different from waiting until insects are visible on foliage and then spraying the crop. Imidacloprid or thiamethoxam is present as the plant emerges. A farmer who instead depends on a later foliar treatment must detect the pest, determine that treatment is warranted and successfully get a sprayer onto the field during an appropriate application window.

Colorado potato beetle illustrates why that protection matters. Adult beetles emerge and feed on potato foliage and lay eggs that develop into larvae capable of consuming large amounts of leaf tissue. Heavy defoliation reduces the plant's ability to capture sunlight and produce the carbohydrates needed to develop tubers underground. The result can be fewer or smaller potatoes at harvest.

In 2024, approximately 13,250 acres of Maine potatoes were monitored through an integrated pest-management program, and about 35 percent of those acres exceeded the economic threshold for Colorado potato beetle. Uncontrolled Colorado potato beetle can substantially reduce potato yields, making effective control economically significant.

A field that looks healthy at harvest does not demonstrate that the pest never posed a threat. It may demonstrate that the grower's pest-management program worked. This is an important distinction in evaluating pesticides because successful control often removes the visible evidence of the damage the pesticide prevented.

For a seed-potato farmer, however, insect management becomes even more complicated because the farmer is not simply protecting this year's crop.

A Seed-Potato Farmer Is Protecting the Next Generation of Potatoes

Maine's seed-potato farms produce potatoes intended to become planting stock for future crops. Disease therefore affects not only yield and appearance at harvest but whether the crop retains its value as certified seed.

Potato Virus Y, or PVY, is a particularly important threat. The virus can reduce yield and tuber quality and can result in seed lots being downgraded or rejected. It can spread through infected seed, mechanically through farm operations and through aphids moving among plants.

An aphid does not need to consume enough of a potato plant to cause economically significant feeding damage to create a serious problem. An aphid can acquire PVY while feeding on an infected plant and transmit the virus as it moves through the field. In seed production, the concern therefore extends beyond controlling insects that physically damage the crop. The grower is also managing insects capable of moving disease into planting stock that will produce another generation of potatoes.

Maine seed-potato growers use multiple tools together to manage that risk. They begin with certified seed and varieties selected in part for disease characteristics. Fields are inspected, infected plants may be removed, equipment sanitation is important, and horticultural mineral oil is used to reduce virus transmission. Systemic insecticides applied at planting—particularly imidacloprid and thiamethoxam—are another component of the program because they suppress potato-colonizing aphids and reduce their ability to reproduce and spread within the crop.

Systemic insecticides do not prevent every case of PVY. Transient aphids can acquire and transmit the virus rapidly, sometimes before imidacloprid or thiamethoxam can kill them. That does not mean systemic aphid control has no value. It means PVY cannot be controlled with a single intervention. Farmers layer different management practices because each addresses a different portion of the transmission cycle.

The issue can extend beyond the potato field itself. Rotation crops and surrounding vegetation can support aphid populations, and aphids move through the agricultural landscape. Restrictions on neonicotinoid use not only on potatoes but also on crops grown in rotation with or near seed-potato acreage could therefore complicate the management of aphid populations associated with PVY transmission.

What Would Replace Imidacloprid or Thiamethoxam?

The replacement is not simply "use another spray."

Maine guidance for managing PVY already describes the disease as requiring a layered control program. Growers are advised to begin with certified seed, use varieties with improved tolerance or resistance where possible, disinfect cutting and planting equipment, use a systemic insecticide at planting, begin mineral-oil applications around emergence, add an appropriate knockdown insecticide to oil sprays, and use additional cultural practices such as nurse cropping.

That distinction matters because imidacloprid or thiamethoxam, mineral oil, and later foliar insecticides do not control exactly the same aphids in the same way. The at-plant systemic treatment helps control potato-colonizing aphids—aphids that establish and reproduce in the crop—and thereby reduces their ability to spread PVY within the field. It does not fully control transient, non-colonizing aphids that may briefly probe a potato plant, acquire or transmit PVY and move on before a systemic insecticide can kill them.

Those transient aphids are one reason the recommended program already includes mineral oil. Research summarized in Maine potato guidance reports that oil applications can materially reduce PVY spread and that adding knockdown insecticides can provide additional suppression.

In other words, mineral oil plus foliar insecticide is not simply the replacement for an at-plant systemic neonicotinoid. Those tools are already components of intensive PVY-management programs used alongside systemic protection.

Removing the systemic imidacloprid or thiamethoxam component therefore removes one layer from an existing integrated program rather than merely exchanging one pesticide for another.

Maine potato insecticide guidance includes foliar active ingredients such as bifenthrin, zeta-cypermethrin, dimethoate, malathion and methomyl among the tools available for particular insect pests and uses. Which active ingredient is appropriate depends on current registration, the label, pest pressure, resistance-management requirements and the grower's overall program.

There is also a fundamental biological limitation. No insecticide program completely prevents PVY transmission from transient aphids because PVY is a non-persistent virus. An aphid can acquire and transmit the virus during very brief probing. That is why the recommended program uses several overlapping practices rather than relying on one active ingredient.

The Certification Consequence Is Real

For a Maine seed-potato grower, failure to control PVY can have consequences far beyond modest yield loss. It can determine whether the crop retains its value as certified seed.

Maine requires post-harvest virus testing as part of seed-potato certification. For the Certified Seed Class, the post-harvest tolerance is 5 percent or less PVY, with total virus also limited to 5 percent. A lot exceeding that tolerance may lose eligibility to be sold in the certified class, subject to the testing and retesting provisions in Maine's certification rules.

The standard is substantially tighter for higher-value Foundation Seed. Foundation seed generally must remain at approximately 0.5 percent or less PVY and 0.5 percent or less total virus in post-harvest testing. A lot that misses the Foundation tolerance but remains within the Certified Seed limits can be downgraded rather than retaining the higher certification class.

That means a relatively small increase in virus incidence can have a large commercial effect. A seed lot can move from a higher-value certification class to a lower one, or exceed the tolerance required to remain certified seed.

Recent Maine post-harvest testing illustrates that this is not an abstract concern. In the 2025 testing cycle, approximately 7,977 acres of seed potatoes were included in post-harvest testing. Roughly 56.8 percent of tested acreage fell within the Foundation-level virus range, approximately 40.2 percent fell within the Certified range, and about 3.04 percent exceeded the 5-percent certification threshold.

The percentage exceeding the threshold has been substantially higher in some recent years. Approximately 9.36 percent of tested acreage exceeded 5 percent virus in the previous testing year, while the figure was about 15.1 percent in 2022–23.

For a seed grower, therefore, the question is not simply whether another active ingredient kills aphids. The relevant question is whether the complete replacement program keeps virus incidence below the certification threshold on a crop whose commercial value depends on remaining below that threshold.

Maine does not presently have evidence of a simple one-for-one substitute for systemic imidacloprid or thiamethoxam in seed-potato PVY management. The current program already combines systemic insecticide protection with repeated mineral-oil and foliar treatments because those tools address different aphid populations and different stages of virus transmission.

The cost implications also extend beyond the price of another pesticide. Additional foliar treatments mean more pesticide product, more trips across the field, more fuel, more machinery use, more employee time and more dependence on suitable spray weather. If the replacement program fails to maintain virus levels within certification standards, the financial consequence can include loss of certification class and loss of seed value.

The exact per-acre cost of that replacement program should be quantified with Maine growers and crop advisers before BPC concludes that another insecticide program is economically equivalent.

Maine Weather Makes Later Applications a Very Different Tool

The difference between an at-plant systemic active ingredient such as imidacloprid or thiamethoxam and a later foliar treatment is especially significant in Maine because the later treatment must actually be applied when it is needed.

The 2023 growing season in Aroostook County provides a concrete example. Daniel Corey Farms in Monticello began planting approximately 1,000 acres of certified seed potatoes on April 29. Repeated rainfall delayed completion of planting until roughly June 14. The same rain made it difficult to get sprayers into fields later to manage insects and diseases.

A grower can have the appropriate active ingredient, functioning equipment and trained employees and still be unable to make a foliar application when saturated soil cannot support the sprayer. Wind or rainfall can further reduce suitable application windows. Meanwhile, the pest population or disease cycle continues.

If an at-plant application of imidacloprid or thiamethoxam is replaced with one foliar treatment, the farmer needs one additional successful application window. If equivalent protection requires multiple applications—or repeated mineral-oil and insecticide applications throughout a virus-management program—the farm needs multiple additional windows and incurs the product, labor, equipment and fuel costs associated with each.

That is why identifying another registered active ingredient does not establish that the alternative is agronomically equivalent to the tool it replaces.

Other Maine Crops Face Their Own Production Decisions

Maine's agricultural diversity makes broad conclusions about neonicotinoids particularly difficult. Vegetable growers, fruit producers, grain farmers, dairy farmers and other specialty-crop growers are not managing the same crops, pests or production systems.

Consider a grower preparing to plant squash, pumpkins, cucumbers or melons. Before planting, the farmer has selected varieties based on yield, disease resistance, fruit quality and the market window when the crop needs to be ready. Some production may be destined for wholesale buyers, some for direct sale and some for seasonal markets where being several weeks late can dramatically reduce the value of the crop.

Young cucurbit plants can be particularly vulnerable to striped cucumber beetles. Beetles feed on seedlings and can transmit bacterial wilt. Severe feeding shortly after emergence can kill plants or leave a poor stand before the crop has had an opportunity to become established. The economic consequence is not merely a damaged leaf. It can be an empty section of the field that produces nothing during the market period the farmer planned for months earlier.

Systemic active ingredients used in cucurbit production can include thiamethoxam and imidacloprid, depending on crop, application method, current registration and label. Non-neonic options can include active ingredients such as methomyl, gamma-cyhalothrin, lambda-cyhalothrin, permethrin, zeta-cypermethrin, cyclaniliprole and cyantraniliprole, again depending on the particular crop and label.

That chemical comparison matters. Replacing an at-plant systemic treatment with later foliar applications changes when and where pesticide enters the production system. It may also change the number of applications, acreage sprayed and potential exposure of non-target organisms.

Growers also have nonchemical management tools, but those are not automatically interchangeable with an insecticidal seed or soil treatment. Physical exclusion with row covers or insect netting can prevent beetles from reaching young plants, but commercial-scale use requires purchasing the material, installing and securing it over acreage, maintaining it through wind and weather and removing it at the appropriate time for pollination. Transplants can shorten the period when plants are most vulnerable, but they require greenhouse space, containers, growing media, labor and another trip across the field to transplant the crop.

The same analysis should be performed for each agricultural production system affected by a proposed restriction. A substitute that works economically and agronomically for one crop should not be assumed to provide the same result for another.

Horticulture Is Agriculture Too

The discussion cannot stop with field crops.

Horticulture is agriculture, and in Maine it is a significant agricultural sector. USDA's 2024 Census of Horticultural Specialties counted 280 Maine horticultural specialty operations with approximately $93.2 million in sales. Of that total, approximately $64.4 million was reported through wholesale channels and approximately $28.9 million through retail channels. USDA defines horticultural specialty products broadly to include annual bedding and garden plants, potted flowering plants, cut flowers, greenhouse-grown food crops, commercial vegetable transplants, nursery stock, trees, shrubs, vines, Christmas trees, propagation material and other greenhouse and nursery products.

These businesses are agricultural producers. They grow living crops for sale. They invest in structures, growing media, heating, irrigation, labor, plant material and months or years of production before receiving revenue from the finished plant. Maine's agricultural support system itself treats commercial greenhouses, nurseries, florists and related plant producers as part of commercial horticulture.

The pest-management problem is also different from the one faced by a corn or potato farmer.

For an ornamental grower, appearance itself is part of the crop's value. A plant does not have to die for the grower to suffer an economic loss. Aphids can curl and distort foliage and new growth. Whiteflies remove plant sap and discolor foliage. Mealybugs and scale can stunt plants and contaminate their appearance. Thrips can scar, distort and discolor flowers and leaves. A plant that remains biologically alive may nevertheless become commercially unsalable if customers reject it at the garden center or a wholesale buyer refuses the crop.

That creates a particularly unforgiving pest threshold. A field crop may tolerate some insect feeding without losing market value if yield and quality remain acceptable. A flowering plant, hanging basket, foliage plant, perennial, shrub or nursery tree may lose much of its retail value because the damage is visible.

Neonicotinoids have a role in this production system as well. Northeastern greenhouse guidance identifies imidacloprid, thiamethoxam, acetamiprid and dinotefuran as Group 4A neonicotinoid active ingredients used in greenhouse ornamental production. Maine guidance likewise identifies the systemic active ingredient imidacloprid as a tool for insects such as aphids, mealybugs and whiteflies on ornamental plants.

Systemic use is particularly relevant in horticulture because the pesticide can be taken up through the root system and moved into plant tissue where sucking insects feed. That differs from a contact treatment that must physically reach the insect. In a greenhouse filled with dense foliage, hanging baskets, multi-layered canopies and plants containing hundreds of leaves, achieving complete contact coverage can be difficult.

There are alternatives, including biological controls and non-neonic pesticide active ingredients. But, just as in field agriculture, the word “alternative” can conceal substantial differences in how those tools work.

Regional greenhouse guidance identifies pymetrozine for aphids; spinosad for thrips, leafminers and caterpillars; pyriproxyfen for immature whiteflies, scale and mealybugs; horticultural mineral oils; insecticidal soaps; and beneficial insects and parasitoids for various pests. These are valuable IPM tools. They are not automatically one-for-one substitutes for a systemic treatment. Some require thorough contact coverage. Some target particular life stages rather than the entire pest population. Oil applications can injure some flowers or sensitive plants. Contact products may require repeated applications because they have limited residual activity. Biological controls require correct pest identification, timing, environmental conditions and compatibility with other pesticides.

Whitefly management demonstrates the problem. Greenhouse guidance notes that contact insecticides may have to be repeated over a two- to three-week period depending on the population and residual activity, while systemic insecticides are taken up by actively growing plants and can provide a different form of control. Whitefly populations can also develop resistance to multiple active ingredients, making preservation of different modes of action an important component of resistance management.

The same resistance-management principle applies more broadly. A horticultural grower cannot simply use the same replacement chemistry repeatedly every time a neonicotinoid would otherwise have been used. Repeated dependence on a smaller number of modes of action can increase selection pressure for resistance, potentially shortening the useful life of the remaining products.

There is also an important distinction between greenhouse exposure and outdoor agricultural exposure. A pesticide applied inside an enclosed greenhouse does not necessarily create the same exposure pathway as a foliar insecticide sprayed across an outdoor flowering crop. Conversely, a finished ornamental plant may eventually be sold and placed outdoors, where flowering plants can be visited by pollinators. Both facts matter.

BPC therefore should not treat "horticultural use" as though it presents one uniform exposure scenario. The Board should examine the particular active ingredient, application method, plant species, production stage, whether the plant is flowering when treated, whether the plant remains under protection or is moved outdoors, the persistence of residues and the likelihood that pollinators will actually encounter those residues. Northeastern greenhouse guidance itself recognizes both the systemic movement of neonicotinoids into plant tissue and the need to manage potential pollinator exposure carefully. (UMass Amherst)

That is the same risk-based analysis Maine should conduct throughout this review: What is the actual agricultural use? What is the actual exposure pathway? What evidence shows harm from that use under Maine conditions? And what does the grower have to do instead?

For Maine horticulture, the replacement analysis should include more than the price of another pesticide. It should consider additional applications, employee time, greenhouse labor, compatibility with beneficial insects, crop injury, resistance management, the ability to achieve adequate coverage, the possibility of crop rejection because of visible pest damage, and the value of plants that may have been in production for months or years before they are sold.

A $93 million Maine agricultural sector should not disappear from the analysis simply because many of its crops are grown under glass or are sold for landscapes rather than for food.

Maine Farmers Have a Direct Economic Interest in Protecting Pollinators

Pollinators are essential to Maine agriculture. Fruits, vegetables, berries and other crops depend to varying degrees on native bees, managed honeybees and other insects to move pollen between flowers. Successful pollination affects fruit set, crop quality, yield and ultimately the amount of marketable product a farmer can harvest and sell.

Farmers do not simply assume that adequate pollination will occur. They manage habitat to support native pollinators and, for crops requiring additional pollination, may contract with commercial beekeepers to bring managed honeybee colonies onto agricultural land during bloom. Nationally, agricultural producers paid more than $400 million for pollination services on approximately 1.73 million acres in 2024.

This is an important part of the discussion surrounding agricultural pesticides. Farmers who grow pollinator-dependent crops have a direct economic interest in maintaining healthy pollinator populations. They have already invested in land preparation, seed or plants, fertilizer, labor, equipment and other production costs before the crop flowers. If inadequate pollination reduces fruit set, much of that investment has already been made and cannot be recovered.

Protecting pollinators and protecting crops from damaging insects are therefore not competing objectives for these farmers. Both are necessary to successfully produce the crop.

Horticultural growers have the same interest where they produce flowering plants. Nursery and greenhouse businesses sell many of the very plants that eventually provide pollen and nectar in home landscapes, commercial landscapes and public spaces. A sustainable horticultural industry therefore has an interest both in producing healthy, pest-free plants and in using pest-management practices that protect pollinators when exposure is reasonably expected.

That is why pesticide exposure matters as much as pesticide toxicity. An insecticidal active ingredient may be toxic to a bee at a sufficient dose, but the risk created by an agricultural use also depends on whether and how the bee encounters it. Application method, rate, timing, persistence, crop growth stage and the presence of flowers all affect potential exposure.

A seed treatment containing clothianidin or thiamethoxam creates a different exposure pathway than a foliar application over an established crop. A greenhouse soil treatment on a nonflowering ornamental creates another exposure scenario. A foliar treatment applied to an outdoor flowering plant creates another.

Those distinctions are exactly what a meaningful risk assessment is supposed to evaluate.

Substituting one active ingredient for another therefore cannot be assumed to improve pollinator protection merely because the replacement is not a neonicotinoid. The Board needs to compare the actual current production practice with the actual replacement practice.

Commercial Beekeepers Also Depend on Those Colonies Surviving

The farmer is only one side of a commercial pollination arrangement. On the other side is a beekeeper whose business depends on keeping those colonies alive, healthy and productive. The bees placed on a farm for pollination are not disposable. They remain valuable biological and economic assets that the beekeeper expects to use again after the pollination contract ends.

A commercial beekeeper has invested in queens, bees, hive equipment, feeding, parasite and disease management, labor and transportation. Colonies used for one agricultural crop may subsequently be moved to another crop, returned to a home apiary, used for honey production, divided to produce additional colonies or prepared for overwintering and the following year's pollination season.

Losing a colony therefore can mean much more than losing income from a single pollination contract. The beekeeper can also lose future pollination revenue, honey production, the value of the colony itself and the time and expense required to rebuild or replace it.

The economics of that system give beekeepers a direct incentive to protect their colonies from harmful pesticide exposure. A beekeeper whose livelihood depends on those colonies has no financial interest in repeatedly placing them on agricultural properties where the beekeeper expects them to be poisoned. Likewise, a farmer paying for pollination has no financial interest in killing the colonies needed to pollinate the crop.

Pollination agreements can specifically address pesticide use and the protection provided to managed colonies. Farmers and beekeepers may coordinate colony placement and timing, pesticide applications, bloom periods, bee activity and the eventual removal of the hives. Those precautions exist because both parties have valuable economic interests at risk.

The fact that professional beekeepers continue to place valuable colonies on agricultural land does not prove that exposure to clothianidin, thiamethoxam, imidacloprid or any other pesticide active ingredient can never occur or that every pesticide use is risk-free. It does provide important real-world context.

Maine's Own Pollinator Evidence Should Drive the Analysis

Maine has something more useful than assumptions about what might be occurring: the state has collected evidence from bees and hives here.

BPC's interim review of neonicotinoids reports that the Maine Apiary Program's pesticide-monitoring data from 2018 through 2024 contained only one detection of a neonicotinoid. That detection occurred in bee bread collected from a Washington County hive in 2022. The concentration was 7 parts per billion, only 2 parts per billion above the analytical detection limit. No other neonicotinoid was detected in the Apiary Program samples reported for that seven-year period.

Maine-specific research examining pollen collected by honeybees provides another measure of actual exposure. Researchers analyzed pollen from 32 honeybee colonies at locations around Maine. Neonicotinoids were detected at only two sites. Only one location had an insecticide risk quotient above the study's level of concern, and the active ingredient responsible for that result was phosmet, an organophosphate insecticide—not a neonicotinoid.

That point should be stated chemically rather than generically. The pesticide that exceeded the study's insecticide level of concern was phosmet, not the neonicotinoid active ingredients clothianidin, thiamethoxam or imidacloprid.

None of this establishes that a Maine bee can never be exposed to a neonicotinoid or that every agricultural or horticultural use presents zero risk. What the Maine evidence does not currently demonstrate is widespread neonicotinoid exposure in monitored hives or a pattern showing that agricultural neonicotinoid use is causing significant pollinator harm in Maine.

That distinction should matter enormously in determining whether farmer and grower access should be restricted. If the purpose of restricting a use is to improve pollinator health, the Board should first identify the active ingredient and exposure pathway it intends to reduce and the Maine evidence demonstrating that the pathway is causing meaningful harm.

The analysis cannot stop there. BPC must determine what active ingredient or management system farmers and horticultural growers will use instead and compare the environmental consequences of that replacement program with the anticipated benefit of removing the neonicotinoid.

Canada Did Not Simply "Ban Treated Seed"

During the discussion of neonicotinoids in Maine, Canada—and Quebec in particular—has been presented as evidence that farmers can transition away from neonicotinoid-treated seed without significant consequences. That experience is relevant, but it needs to be described accurately.

Quebec did not eliminate farmer access to neonicotinoid-treated seed.

Quebec instead established a system requiring an agronomic prescription before a farmer can purchase and plant specified insecticide-coated seed or use specified active ingredients. The Quebec system has specifically regulated neonicotinoids including clothianidin, thiamethoxam and imidacloprid.

The distinction is critical. Quebec substantially reduced routine use of neonicotinoid-treated seed, but farmers did not lose access when agronomic conditions justified treatment. Consequently, evidence that Quebec reduced treated acreage without experiencing widespread average yield losses does not demonstrate what would happen if Maine farmers lost access entirely.

Quebec's Prescription System Depends on a Professional Infrastructure Maine Does Not Have

Quebec placed its prescription requirement within an existing, highly developed system of professional agronomy.

Agronomy is a regulated profession in Quebec. Agronomists are licensed and governed through an established professional system, and the province's pesticide-prescription program relies on those professionals to evaluate the crop, field conditions, pest risk and agronomic need before issuing a prescription.

As of March 31, 2026, Quebec had approximately 3,203 licensed agronomists.

Maine has nothing comparable.

Maine does not maintain a professional licensing system for agronomists equivalent to Quebec's, so there is no exact Maine number that can be compared directly with Quebec's 3,203 licensed professionals. The closest broad federal occupational measure illustrates the scale of the difference. The U.S. Bureau of Labor Statistics has estimated that Maine employs only about 60 soil and plant scientists in total.

That category is considerably broader than commercial crop agronomy. It can include professionals working in soil science, plant research and other areas who do not provide crop consulting, do not visit commercial farms and would not necessarily be qualified or available to perform individualized pesticide-prescription assessments.

Even if every one of those approximately 60 people were treated as potentially available—which they plainly are not—Quebec would have roughly 53 licensed agronomists for every one Maine worker classified as a soil or plant scientist.

BPC does not presently provide the missing capacity. Its current staff structure is designed to administer pesticide registration, licensing, enforcement, inspection, toxicology, water-quality work, policy, education, compliance and administration across the state. It does not maintain a statewide corps of field agronomists available to perform individualized crop and pest evaluations.

And adding Maine horticulture makes the capacity question larger, not smaller. If a prescription system extended beyond corn and potatoes to affected nursery, greenhouse, vegetable and other horticultural uses, the state would need enough qualified professionals not merely to respond during field-crop planting but also to understand greenhouse production, ornamental crops, nursery systems and their pests.

The need for expertise would therefore span very different production systems.

Consider again the wet spring of 2025. A dairy farmer who had already purchased corn seed might discover in late May or June that planting had been delayed enough to require a shorter-season hybrid. The seed dealer might locate an appropriate replacement in another state, but under a Quebec-style system the farmer could also need professional approval before purchasing and planting replacement seed treated with clothianidin or thiamethoxam.

At that point, time matters. The field may finally be dry enough to plant. Rain may be forecast again in two days. Every additional day removes growing time from Maine’s already short season.

Maine therefore could not simply adopt Quebec’s prescription requirement without first creating the professional capacity necessary to administer it.

If the state expected BPC to conduct or oversee individual agronomic evaluations, it could require new professional staff positions, regional coverage, salaries, benefits, travel budgets, vehicles, training, administrative support and a system for processing prescriptions quickly enough to meet agricultural timelines.

Alternatively, Maine could rely on private crop advisers or contracted professionals. That would not eliminate the capacity problem. The state would still have to determine what qualifications those professionals must possess, whether sufficient crop- and horticulture-specific expertise exists, how they would be approved, whether enough are available throughout Maine and who would pay for each evaluation.

Quebec's experience may demonstrate that a prescription-based system can operate where a large, regulated agronomy profession already exists. It does **not** demonstrate that Maine can reproduce that model without substantial new staffing, expense and administrative infrastructure.

Canada's Experience Also Shows the Importance of Addressing the Actual Exposure Pathway

Canada's experience with pollinator incidents provides another useful lesson. Regulators identified honeybee mortality associated with insecticidal dust generated during planting of corn and soybean seed treated with neonicotinoids including clothianidin and thiamethoxam. The response focused on that specific exposure pathway: planting practices and dust-reduction measures were changed rather than simply eliminating treated seed.

Reported incidents subsequently declined substantially while treated-seed uses remained available.

That experience illustrates an important principle for Maine. When evidence identifies a particular active ingredient, application method or exposure pathway that is causing harm, regulators can target that pathway rather than assuming that eliminating farmer access to an entire category of agricultural tools is the only solution.

The same principle is especially important in horticulture, where an application inside an enclosed greenhouse, a systemic treatment to a nursery plant, and a foliar treatment to an outdoor flowering crop may create very different exposure pathways. Those uses should not be treated as environmentally identical simply because the same chemical class is involved.

Removing a Neonicotinoid Does Not Remove the Pest

A regulatory decision can prohibit clothianidin, thiamethoxam, imidacloprid, acetamiprid or dinotefuran. It cannot change the biology of the pest.

Wireworms remain in the soil. Seedcorn maggots continue to attack germinating seed. Colorado potato beetles continue to feed on potato foliage. Aphids continue to colonize fields and greenhouses. Whiteflies, mealybugs, scale and thrips continue to damage horticultural crops. Striped cucumber beetles continue to attack young plants.

If another corn seed-treatment chemistry can provide equivalent protection, that may be a useful alternative. But BPC needs to determine whether seed companies actually offer that active ingredient on the hybrids Maine farmers use, whether enough will be produced for Maine, whether farmers must order it earlier, whether emergency replacement inventory will exist and what it costs.

For a horticultural grower, the same test applies. It is not enough to identify insecticidal soap, horticultural oil, spinosad, pymetrozine, pyriproxyfen, a biological-control organism or another active ingredient somewhere in a pest-management guide. BPC should determine whether that tool controls the same pest on the same plant, whether it works at the same pest stage, whether it is compatible with the grower's beneficial-insect program, whether it requires repeated treatment, whether it creates phytotoxicity or visible residue on the crop, what additional labor it requires, and whether the finished plant remains marketable.

The environmental analysis should therefore include the entire replacement program: the specific active ingredient or biological practice, amount applied, number and timing of applications, toxicity to beneficial organisms and pollinators, aquatic toxicity where relevant, drift and runoff potential, applicator exposure, labor, fuel, machinery operation and the consequences when treatment fails.

A chemical or management practice should be called an alternative only when a farmer or horticultural grower can actually obtain it and use it successfully.

International Markets Can Narrow the Farmer's Choices Further

An agronomically effective active ingredient may also create a market problem.

Maine agricultural commodities move through domestic and international markets, and destination countries establish maximum residue limits that do not necessarily correspond with U.S. registrations.

The European Union illustrates why the chemical name matters. European rules have imposed particularly stringent restrictions on outdoor uses of the neonicotinoid active ingredients clothianidin, thiamethoxam and imidacloprid. But it would be equally inaccurate to conclude that every non-neonic replacement is prohibited in Europe. For example, spinosad remains an approved active ingredient in the European regulatory system.

The correct comparison therefore must be crop- and chemical-specific. An active ingredient may be legally registered and agronomically effective in Maine while its residue tolerance or a buyer's specifications affect whether the resulting commodity can enter a particular export market.

For Maine farmers, a chemical that controls the pest but prevents the resulting crop from meeting a buyer's requirements is not a practical alternative.

The Economic Consequence Does Not Stop at the Field Edge—or the Greenhouse Door

The economic impact of losing a crop-protection tool cannot be measured solely by comparing the price of two pesticides.

For the corn grower, the added cost can begin before the seed ever enters the ground. A farmer who can currently exchange conventionally treated seed without an additional charge may instead have to pay more for a specialized treatment package, if the appropriate hybrid is available at all.

A poor stand can then mean fewer productive plants per acre, lower silage yield or a decision to replant. Replanting requires additional seed, labor, fuel and machinery use and consumes days from an already short Maine growing season.

For the dairy farmer, lost corn production becomes a feed problem months later. The cows still require the same amount of nutrition. If the farm produces less forage, replacement feed has to come from somewhere.

That distinction has significant economic consequences because a ton of silage produced on the farm and a ton purchased on the market do not necessarily have the same cost. Northeast dairy cost data have historically shown home-raised corn silage costing substantially less to produce than its market value. One analysis found an average home-production cost of approximately $23 per ton, compared with an average market value of approximately $48 per ton during the same period.

Recent Northeast estimates placing corn-silage market value at approximately $60 to $63 per ton illustrate how quickly that replacement cost can accumulate. A dairy replacing 100 tons of lost silage at $60 per ton is purchasing approximately $6,000 of feed. Replacing 500 tons represents approximately $30,000 at that market value, before considering transportation or differences in feed quality.

For potatoes, the economic calculation is different. Removing imidacloprid or thiamethoxam may mean greater reliance on mineral oil and foliar insecticides, with associated product, machinery, labor and application costs. For seed potatoes, failure to control PVY can additionally affect certification and seed value.

For horticulture, the economic consequence can occur before the plant ever reaches a customer. A grower may have already paid for propagation material, pots, growing media, fertilizer, heating, greenhouse space, irrigation and weeks or months of employee labor. If aphids distort the new growth, whiteflies damage the foliage, mealybugs contaminate the crop or thrips scar the flowers immediately before sale, that accumulated investment may be tied up in plants buyers will not purchase.

That is a different kind of yield loss, but it is still agricultural loss.

And because some horticultural crops require months or years to reach saleable size, the economic value at risk cannot always be measured simply as one season’s pesticide expense.

The correct economic analysis therefore follows the consequence through the entire agricultural business.

Maine Cannot Afford to Add Another Pressure to an Already Shrinking Dairy Sector

The economic consequences of agricultural regulation also have to be considered in the context of what is already happening to Maine dairy farms. This is not a sector with a large cushion of farms available to absorb additional costs, production risk or feed shortages.

Maine had 665 dairy farms in 1989. By 2000, only 466 remained. The number fell to 304 in 2010, 195 in 2020, 145 in 2023, and 141 in 2024.

In just 35 years, Maine lost 524 dairy farms. Since 2000 alone, the state has lost 325.

The dairy decline matters to the neonicotinoid discussion because corn production is part of the basic economic system of many dairy farms. For those farms, corn silage is feed for the herd, and feed represents roughly half of the cost of producing milk.

Anything that increases the cost or uncertainty of producing that feed ultimately becomes a dairy-farm cost.

A restriction on clothianidin- or thiamethoxam-treated corn seed could affect that cost in several ways. A farmer who can currently exchange treated seed at no additional cost may instead have to pay more for a specialized seed-treatment package. The farmer may have fewer hybrids available, may have difficulty obtaining shorter-season replacement seed after a delayed spring, may face greater stand-loss or replanting risk in fields with early-season insect pressure, or may have to substitute a different treatment if it is commercially available.

If those changes reduce silage yield or quality, the financial effect does not end in the cornfield. The dairy still has to feed the cows.

This does not mean that restricting neonicotinoids would automatically cause a particular dairy farm to close. Dairy-farm closures rarely result from one expense or one bad year. They are more often the result of cumulative pressure: several years of thin margins, rising input costs, weather losses, labor shortages, debt, family-transition challenges and another production problem added on top.

That is precisely why this policy matters.

When Maine has already gone from 665 dairy farms to 141, the relevant policy question should not be whether any single regulation can be proven to close a farm by itself. The question should be whether the state is adding another measurable cost or production risk to a sector that has already lost nearly four out of every five farms it had in 1989.

Maine should be extraordinarily cautious about adopting agricultural policies that make it harder or more expensive for the remaining dairy farms to produce their own feed.

The Evidence Does Not Support Either Extreme

The available evidence does not support the proposition that every Maine acre—or every greenhouse crop—needs a neonicotinoid every year.

Under low pest pressure, the economic benefit of an insecticidal treatment can be small. Horticultural growers can and do use scouting, sanitation, biological control, oils, soaps, cultural controls and non-neonic pesticides successfully in many circumstances. Integrated pest management should continue to reduce unnecessary pesticide use.

But the evidence does not support the opposite proposition either: that these active ingredients never provide meaningful protection or that removing them imposes no consequence.

Pest pressure varies from farm to farm, field to field, greenhouse to greenhouse and year to year. Soil temperature and moisture vary. Incoming horticultural plant material can arrive with pests. Weather changes after corn seed has already been ordered. Greenhouse pest populations can expand rapidly under warm protected conditions. Individual operations have different crops, markets, facilities, biological-control programs and economic tolerances for damage.

That variation describes agriculture.

The relevant question is what happens when the protection matters—and whether the farmer or horticultural grower retains an effective, practical and environmentally responsible tool for managing that risk.

What the Next Draft Needs From Maine Agriculture

Research can tell us whether an active ingredient controls an insect under trial conditions. It cannot answer every question about whether a particular treatment works in the commercial agricultural system that supplies a Maine farmer or horticultural producer.

The next stage of this work should therefore document what happens at the farm, greenhouse, nursery and dealer level.

Seed companies and dealers can identify which active ingredients are actually available on Maine corn hybrids; which fungicide-only packages are offered; how far in advance alternatives must be ordered; whether minimum orders apply; how pricing differs; whether unused seed can be returned; whether treated seed can be exchanged without an additional cost; what premium applies to fungicide-only seed; and what happens when a farmer suddenly needs a shorter-maturity hybrid after a wet spring.

Corn and dairy farmers can document actual experiences changing hybrids after delayed planting, replanting poor stands and purchasing replacement feed when forage production falls short. They can also provide current Maine-specific figures for the cost per ton of growing corn silage compared with purchasing replacement forage.

Potato and seed-potato growers can answer the replacement question in equally specific chemical terms. If imidacloprid or thiamethoxam is removed from the at-plant program, what active ingredient will replace it? How many additional applications will be required? What will they cost? And will the resulting program maintain PVY below certification thresholds?

Maine horticultural growers need to be part of the record as well. Greenhouse, nursery, floriculture, vegetable-transplant and other commercial horticultural operations can identify which neonicotinoid active ingredients they actually use; on which crops; against which pests; whether the application is foliar, soil, drench or another method; whether the plants are flowering; whether they remain indoors or are later sold for outdoor use; what non-neonic or biological tools are currently used alongside them; and what the complete replacement program would cost.

For horticulture, BPC should also quantify something field-crop yield statistics may not capture: the value of cosmetic marketability. Growers should document what happens when a pest does not kill the plant but makes it unsalable, the labor and materials already invested in that crop, the additional applications required by alternatives, phytotoxicity concerns, biological-control compatibility and the consequences of reducing the number of insecticide modes of action available for resistance management.

Commercial beekeepers can describe how pollination contracts address pesticide applications, what information they require from farms before placing colonies, how colonies are monitored during agricultural pollination, what an actual pesticide-related colony loss looks like and how significant such a loss would be to a beekeeping business.

The same specificity is needed on the environmental side. BPC should not analyze "neonicotinoids" and "alternatives" as abstractions. It should compare specific active ingredients, specific application methods, specific crops and specific exposure pathways.

Before Maine Removes a Tool, Follow What Happens Next

The analysis should begin with the dairy farmer calculating how much forage will be needed to feed the herd next winter. It should follow that calculation to the corn acreage, the hybrids and maturity groups selected months before planting, and the seed company's production decisions made even earlier.

Then it should follow seed treated with clothianidin or thiamethoxam into a wet Maine spring when planting slips several weeks and the farmer suddenly needs a different maturity.

It should follow the economics of that seed exchange. Today, a dealer may be able to exchange one conventionally treated hybrid for another at no additional seed cost to the farmer. Under a system requiring a separate fungicide-only treatment package, the same farmer may face a narrower inventory, a premium for the replacement seed, or no appropriate hybrid at all.

It should follow that seed underground, where seedcorn maggot or wireworm can destroy it before a plant emerges.

And then the analysis should continue past harvest. If that dairy farmer produces fewer tons of silage, the cows do not eat less. The farm may have to buy replacement feed. Historically, homegrown corn silage has cost dairy farms substantially less than the corresponding market value of purchased silage.

The analysis should follow a potato seed piece treated with imidacloprid or thiamethoxam into an Aroostook County field. It should follow an aphid through a seed-potato crop and understand that the concern is not simply feeding damage but movement of PVY into planting stock intended to produce another generation of potatoes.

It should follow the proposed replacement chemistry through repeated foliar applications, Maine weather, additional labor and machinery, and then through post-harvest testing to determine whether the seed lot retains its certification and value.

It should follow a vegetable grower trying to protect seedlings from striped cucumber beetles while still producing a marketable crop on schedule.

And it should walk into a Maine greenhouse.

There, the crop may be thousands of potted annuals, perennials, flowering plants, vegetable transplants or nursery plants growing close together in a protected environment. An aphid, whitefly or mealybug outbreak does not have to kill those plants to create economic damage. Distorted new growth, insects visible on foliage or damaged flowers may be enough to make the crop unsalable.

If the grower currently uses imidacloprid, thiamethoxam, acetamiprid or dinotefuran, BPC should identify exactly how that active ingredient is being used and what exposure it creates. Then it should follow the alternative. If the replacement is insecticidal soap, how often must the crop be treated and can adequate coverage be achieved? If it is horticultural oil, is the crop sensitive to injury? If it is spinosad, pymetrozine, pyriproxyfen or another active ingredient, does it control the same pest stages? If it is biological control, will it work under that grower's crop, temperature, pest-density and pesticide program?

And if several replacement tools must be combined to accomplish what one systemic treatment previously provided, the complete cost and environmental effect of that system should be compared—not merely the price of one pesticide container.

The analysis should also follow that plant when it leaves the greenhouse. If it is a flowering ornamental that will be placed outdoors, potential pollinator exposure deserves consideration. If it is a nonflowering crop during treatment or remains in an enclosed production environment, that exposure scenario may be very different. Use-specific risk cannot be replaced by assumptions based only on chemical class.

It should follow farmers producing pollinator-dependent crops who need healthy pollinators and effective pest management at the same time. And it should follow the commercial beekeeper who places valuable colonies on agricultural land knowing that the survival and productivity of those colonies determines future pollination income, honey production and the viability of the beekeeping business.

If the proposed solution is instead a Quebec-style agronomic prescription, the analysis must follow that process too. Who evaluates the farm or greenhouse? How quickly can the grower obtain the evaluation? Who pays the professional? Does Maine have professionals with expertise not only in corn and potatoes but also in commercial greenhouse and nursery production?

Quebec operates its prescription system with more than 3,200 licensed agronomists. Maine has no comparable regulated agronomy profession, and even the entire broad federal occupational category of soil and plant scientists in Maine numbers only about 60.

BPC should apply the same discipline to the claimed environmental benefit. Maine's monitoring from 2018 through 2024 found only one low-level neonicotinoid detection in the Apiary Program samples reported by the Board. Maine pollen research detected neonics at only two of 32 sites, and the active ingredient responsible for the one site exceeding the study's insecticide level of concern was phosmet, not a neonicotinoid.

Those findings do not establish zero risk. But neither do they support assuming widespread pollinator harm from every Maine agricultural or horticultural use of clothianidin, thiamethoxam, imidacloprid, acetamiprid, dinotefuran or another neonicotinoid active ingredient.

Maine's dairy sector deserves consideration because the state has already lost more than 500 dairy farms since 1989. Maine horticulture deserves consideration because USDA now reports 280 horticultural operations producing more than $93 million in annual sales. Potato growers, seed-potato producers, vegetable growers, commercial beekeepers and the rest of Maine agriculture deserve the same use-specific analysis.

The relevant policy question is therefore not whether neonicotinoids possess hazards. They do. The same is true of other insecticidal active ingredients.

The question is whether a particular active ingredient, used in a particular way on a particular crop, is creating a demonstrated level of harm under Maine conditions that warrants restricting farmer or grower access; what active ingredient or management practice Maine agriculture will actually use instead; and whether the complete replacement program provides an agronomically effective, commercially available, economically practical and environmentally preferable result.

Before Maine takes away farmer or grower access to a crop-protection tool, those questions should be answered with Maine evidence, specific chemistry, and real Maine agricultural and horticultural experience.

The Maine Farmers Coalition believes farmer and grower access to neonicotinoids should be preserved unless and until a particular use is shown to create a meaningful risk under Maine conditions and an effective, available, economically practical and environmentally preferable replacement—not merely another pesticide active ingredient or theoretical management practice—has been demonstrated for the agricultural producers who rely on that use.

Respectfully,

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Quebec and Canada

Gouvernement du Québec. *Understanding agronomic prescription.* Explains Quebec's requirement for agronomic justification and prescriptions for specified pesticides and treated seeds, including the role of professional agronomists. (Gouvernement du Québec)

Gouvernement du Québec. (2021). *Publication de l'édition 2019 du Bilan des ventes de pesticides au Québec.* Reports that neonicotinoid-treated corn declined from nearly 100 percent of acreage to **less than 2 percent**, while treated soybean acreage declined from approximately 50 percent to **less than 1 percent**, after implementation of agronomic justification and prescription requirements. (Gouvernement du Québec)

Ordre des agronomes du Québec. (2026). *Éditorial du président: Une gouvernance en évolution, une profession mobilisée.* Reports **3,203 registered agronomists as of March 31, 2026**. (OAQ)

U.S. Bureau of Labor Statistics. (2023). *Maine Occupational Employment and Wage Estimates.* Reports approximately **60 workers classified as Soil and Plant Scientists (SOC 19-1013)** in Maine. This is the broad occupational comparison used in the draft; it should not be characterized as 60 available agronomists. (Bureau of Labor Statistics)

Maine Board of Pesticides Control. *Contact Us / Staff Directory.* Used to document BPC's existing staffing structure and the absence of a statewide field corps performing individual agronomic-prescription evaluations. (Maine)

Health Canada, Pest Management Regulatory Agency. *Neonicotinoid Insecticides.* Current federal status of **imidacloprid, clothianidin and thiamethoxam** and Canadian regulatory decisions concerning agricultural and seed-treatment uses. (Canada)

Health Canada, Pest Management Regulatory Agency. *Protecting Pollinators When Using Treated Seed—Best Management Practices.* Source for Canadian measures addressing dust generated during planting of neonicotinoid-treated seed and pollinator-risk mitigation. (Canada)

International markets and European pesticide regulation

U.S. Department of Agriculture, Foreign Agricultural Service. *Maximum Residue Limits (MRL) Database.* Database covering pesticide and veterinary-drug residue tolerances in the United States, European Union and major export markets. Supports the draft's point that a

U.S.-registered pesticide alternative is not automatically compatible with every export market. (FAS)

European Commission. (2013). *Commission Implementing Regulation (EU) No. 485/2013*. Addresses conditions of approval for **clothianidin, thiamethoxam and imidacloprid** and restrictions on seed treated with those substances. (EUR-Lex)

European Commission. (2023). *Commission Regulation (EU) 2023/334.* Changes maximum residue limits for **clothianidin and thiamethoxam**, including consideration of pollinator impacts associated with outdoor uses. (EUR-Lex)

European Commission. (2026). *Commission Implementing Regulation (EU) 2026/351 renewing the approval of the active substance spinosad.* Confirms that **spinosad remains an approved active ingredient in the European Union through April 1, 2041**, subject to applicable conditions. (EUR-Lex)

MAINE POTATOES

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August 31, 2026

RE: LD 1323 Stakeholder Input Gathering

Neonicotinoid insecticides (neonics) are an extremely important part of the integrated pest management (IPM) programs used by agriculture and the potato industry in Maine. The vast majority of our growers use IPM to protect their potatoes as well as some of their rotational crops by keeping pests below the economic thresholds where crop damage can occur. A major component of IPM is the ability to rotate chemistries with different modes of action to help delay the development of resistance that can result from repeated reliance on a single crop protectant. Therefore, the loss of one chemistry, such as neonicotinoids, would have a negative impact on resistance-management options.

Maine should make regulatory decisions based on the best available evidence, product-specific risk assessments, documented agricultural benefits, and a rigorous comparison with alternatives.

The approval and regulation of pesticides must be based on science. The Environmental Protection Agency (EPA) completes rigorous risk assessments for neonicotinoids and pursues risk mitigation as appropriate. These products are strictly regulated, tested, and reviewed to ensure compliance with state and federal standards. EPA's risk assessments have found relatively low risk to honeybee colonies from certain neonicotinoid seed-treatment uses under specified use conditions.

Neonicotinoids are used in agriculture to protect crops from damaging insect pests and the diseases they can transmit. Certain neonicotinoid seed-treatment and in-furrow uses can provide effective pest control while presenting relatively low risk to honeybee colonies under specified use conditions. The risk of crop failure due to pests, combined with the inability to replant during Maine's short growing season, can have a significant impact on a farmer's growing season and yield. Restricting the use of neonicotinoid insecticides without an equally effective alternative could affect the success of our state's potato production, whether those insecticides are applied directly to potato crops or to rotational crops utilized throughout potato production, such as small grains, soybeans, and corn. Potential impacts include decreased yields, decreased quality, decreased marketability, increased reliance on imported seed and the concomitant risk of quarantine pest introduction, and increased costs of production.

Neonicotinoid use as seed treatments or in-furrow applications can target Colorado potato beetles and aphids; two of the major potato pests in Maine. These methods utilize the systemic properties of neonicotinoids and can reduce the need for some foliar insecticide applications and associated worker exposure. Because the active ingredient is targeted through the seed or soil rather than applied directly to foliage, these uses may also reduce direct exposure to some beneficial insects.

Maine potato growers are committed to implementing proven IPM programs, which involve the sound application of approved and regulated crop protectants. Targeted, systemic pest management can support climate-smart practices by reducing the need for some foliar applications and associated field passes. At the same time, a growing number of producers have transitioned to three- and four-year crop rotations, resulting in several thousand acres of cover crops, such as red and white clovers and multi-species mixes, which are untreated and provide habitat for bees and other pollinators. Maine's beekeeper surveys [1,2] identify Varroa mites and associated viruses as a major cause of hive losses. Therefore, Maine policy should address all aspects affecting bee health; parasites, disease pressure, and pesticide exposure, rather than treating them as mutually exclusive explanations.

In 2021, the Maine Legislature passed a law directing the Maine Board of Pesticides Control to prohibit the use of certain neonics for outdoor residential use. This law prohibits the use of pesticides containing dinotefuran, clothianidin, imidacloprid, or thiamethoxam in outdoor residential areas. The restriction was appropriately focused on outdoor residential uses while maintaining agricultural uses subject to existing state and federal pesticide requirements.

If important tools like these are removed, alternative pest-management methods, mid-season rescue treatments, and potential yield reductions could raise farmer costs and lower production, with impacts that may extend downstream to food costs and consumers. This could lead to more frequent applications of alternative insecticides, particularly where those products have lower efficacy or shorter residual activity, potentially increasing the total amount of active ingredient applied to some crops. These alternative insecticides will also have their own biological and environmental impacts that need to be comparatively assessed.

If there were alternatives that could provide the same effectiveness, commercial agriculture in Maine would have strong incentives to adopt those practices. However, until other crop protectants with comparable efficacy are available, removing these tools could force farmers to rely more heavily on less effective or older pest-control options and could undermine some of the industry's climate-smart practices.

Loss of neonicotinoids would also reduce the number of effective modes of action available to growers for resistance management. This could increase reliance on remaining chemistries and, depending on how those products are used, increase selection pressure leading to insecticide resistance of the targeted pests. There needs to be extensive research to identify effective control alternatives and to determine whether those alternatives can provide comparable control across the full range of labeled neonicotinoid uses, including aphids, Colorado potato beetles, flea beetles, leafhoppers, cereal leaf beetles, psyllids, wireworms, and seed maggots. That research should evaluate not only efficacy, but also application rates, number and timing of applications, resistance-management implications, environmental fate, non-target effects, worker exposure, and overall economic impacts.

We support science-based evaluation and appropriate mitigation, but regulation should evaluate the actual use, exposure pathway, agricultural benefit, alternatives, and comparative environmental consequences rather than treating all neonicotinoid uses as equivalent. The appropriate comparison should not be between neonicotinoid use and no pest-control intervention, but between the risks and benefits of the available pest-management strategies needed to achieve effective crop protection.

Thank you for your consideration of this written testimony. If you have any questions or if I can be of assistance, please feel free to contact me at (207) 769-5061 or jtapley@mainepotatoes.com.

Sincerely,

Jeannie Tapley

Jeannie Tapley
Executive Director

[1] 2016-2023 Beekeeper Survey Summary
https://www.maine.gov/dacf/php/apiary/documents/2016-2023-beekeeper-survey-summary.pdf?utm_source=chatgpt.com

[2] 2023/2024 Maine Honeybee Survey Results
https://www.maine.gov/dacf/php/apiary/documents/2023-2024-bee-survey-summary.pdf?utm_source=chatgpt.com

2016-2023 Beekeeper Survey Summary

For the past seven seasons, beekeepers have reported their losses and management practices via an online survey administered by the Maine Apiary Program. This data has been important for identifying trends, recognizing when and how losses occur, and determining where to focus education/outreach activities. A summary of the yearly surveys can be found on the Maine State Apiary webpage and have been reported in past issues of the MSBA Bee Line. This report is a more in depth look at trends in hive losses, Varroa monitoring, and Varroa control.

Between 172 and 388 beekeepers (representing 1,122 and 2,688 hives, respectively) responded to the online beekeeper management survey over the past seven years. Average yearly losses ranged from a low of 33.7% during the 2021/2022 season to a high of 45.2% during the 2018/2019 beekeeping season (Table 1).

Table 1: Number of beekeeper responses, the number of hives managed by beekeepers who responded, and the overall percent hive loss by beekeeping season.

	Number of Responses	Number of Hives	Overall Loss (%)
2016/2017	172	1,122	45.0
2017/2018	212	1,156	43.4
2018/2019	360	1,915	45.2
2019/2020	312	1,875	35.8
2020/2021	388	2,688	43.9
2021/2022	329	2,129	33.7
2022/2023	304	1,957	37.4

The counties with the average highest losses from 2016-2023 were Aroostook (61.5%), Washington (59.7%), Oxford (49.6%), and Androscoggin (47.4%). The counties with the lowest average losses between 2016-2023 were Hancock (25.0%), Piscataquis (30.4%), Lincoln (32.4%), and Somerset (35.0%) (Table 2).

Table 2: Hive losses by county.

County	2016/2017		2017/2018		2018/2019		2019/2020		2020/2021		2021/2022		2022/2023		2016-2023		
	N	Loss (%)	N	Loss (%)	N	Loss (%)	N	Loss (%)	N	Loss (%)	N	Loss (%)	N	Loss (%)	Summer Loss (%)	Winter Loss (%)	Total Loss (%)
Androscoggin	7	52.7	9	26.4	13	88.7	11	23.7	12	64.9	14	21.6	8	35.7	3.8	43.6	47.4
Aroostook	1	100	5	72.7	7	77.6	4	62.1	9	40.5	3	25.0	4	75.0	15.4	46.2	61.5
Cumberland	57	47.8	57	40.9	94	54.6	72	37.5	86	57.7	87	37.1	80	43.9	9.0	37.0	46.0
Franklin	4	43.5	3	16	4	71.4	6	39.4	6	29.2	6	50.0	5	53.8	9.5	30.0	39.5
Hancock	9	50.1	9	24.6	16	25.9	19	32.8	21	16.7	17	21.8	7	31.9	3.1	22.0	25.0
Kennebec	13	53.9	19	43.8	26	30.4	31	38.6	39	41.6	27	32.7	33	36.9	6.9	30.8	37.7
Knox	3	3.0	12	38.9	20	38.2	20	50.0	25	53.6	16	35.6	14	29.0	10.4	31.2	41.5
Lincoln	2	75	11	46.2	34	26.2	22	23.0	36	46.4	28	27.2	17	29.8	5.9	26.5	32.4
Oxford	7	69	11	48.7	21	52.2	19	30.1	15	52.6	11	58.2	7	72.4	6.7	42.8	49.6
Penobscot	22	63.8	22	53.4	36	31	29	33.9	33	32.4	23	48.6	32	32.2	8.6	28.7	37.3
Piscataquis	1	50	1	0	4	44.4	4	19.0	10	32.6	1	50.0	0	ND	4.3	26.1	30.4
Sagadahoc	6	62.5	9	50	10	27.7	10	35.6	16	50.8	17	21.0	7	31.0	9.0	26.5	35.5
Somerset	5	85	2	100	13	36.4	9	46.7	12	35.7	16	27.7	15	32.6	4.0	31.0	35.0
Waldo	8	65.2	9	21.9	15	23.9	17	41.5	18	46.3	16	69.9	15	22.5	11.5	29.4	40.9
Washington	1	94.1	5	89.7	9	60	3	22.2	9	36.2	3	33.3	3	64.0	12.3	47.4	59.7
York	26	64.7	28	47.9	38	38.6	36	54.2	40	52.6	41	39.3	50	37.1	8.5	35.9	44.4

Varroa mites and their associated viruses was the number one reported cause of winter hive mortality every year except in the 2017/2018 survey where environmental factors were reported as the top cause of losses. While queen issues/loss is the number one reported cause of summer hive mortality, Varroa mites and their associated viruses has been cited as the second most common cause of summer hive losses for the past five seasons.

On average, those beekeepers monitoring for Varroa experienced lower average losses than those that did not monitor (33.5-44.6 vs 43.7-59.9%). Beekeepers using alcohol washes as a monitoring method experienced lower losses than those using other methods of monitoring (28.0-39.0% vs 33.4-51.8%). Other monitoring methods include counting bottom board drops, sugar shake, drone brood inspection, visual inspection, etc. (Table 3).

Table 3: Average losses experienced by beekeepers using different methods to monitor for Varroa mites.

	Average		No Varroa Monitoring		Varroa Monitoring		Alcohol Wash		Other Monitoring Method	
Year	n	%	n	%	n	%	n	%	n	%
2016/2017	172	45.0	77	45.8	95	44.6	19	39.0	76	49.7
2017/2018	212	43.4	74	59.9	136	38.8	40	28.0	96	47.5
2018/2019	360	45.2	119	47.1	236	44.6	112	38.0	124	51.0
2019/2020	312	35.8	83	43.7	230	33.5	111	32.7	201	39.1
2020/2021	388	43.9	85	57.0	303	42.3	179	38.7	124	51.8
2021/2022	326	33.7	61	50.5	263	34.9	176	31.2	87	33.4
2022/2023	297	37.4	53	52.2	244	35.5	157	36.1	87	33.8

Strategies to control varroa mites are often broken up into two categories: prevention and intervention. Prevention measures primarily rely on disrupting the mite lifecycle which slows mite population growth. These methods are not intended to eliminate all mites in a hive but can maintain mite populations at low levels. Prevention methods include drone brood sacrifice, brood interruption, using screened bottom boards, etc. Intervention methods are used when mite infestations have reached treatment level/threshold and include all registered miticide treatments.

Those beekeepers that treated for Varroa mites experienced lower losses (31.5-43.9%) than those that did not treat (61.3-77.6%). Beekeepers that used both preventative and intervention control methods (aka Integrated Pest Management) experienced lower losses (28.5-40.6%) than those using only preventative (36.4-86.7%) or intervention methods (31.6-47.0%) (Table 4).

Table 4: Losses experienced by beekeepers using different Varroa management strategies.

	Treated for Varroa		Did not Treat for Varroa		Prevention Only		Intervention Only		Integrated Pest Management	
Year	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
2016/2017	137	40.3	30	76.2	5	81.5	99	39.1	38	40.6
2017/2018	187	41.6	25	77.6	3	83.3	140	42.3	44	38.9
2018/2019	314	43.9	35	76.3	7	86.7	227	47.0	87	37.5
2019/2020	291	34.7	21	71.9	11	41.2	189	35.5	90	32.3
2020/2021	346	42.6	42	74.0	6	54.5	247	43.8	90	38.4
2021/2022	284	31.5	38	77.8	7	36.4	198	31.6	79	31.2
2022/2023	272	36.3	24	61.3	3	87.5	188	39.6	81	28.5

2023/2024 Maine Honeybee Survey Results

Demographics

293 beekeepers, representing 2,150 hives responded to the survey. Most (97.3%) identified as backyard/hobby beekeepers (<30hives) and 95.6% have their apiaries registered with the state of Maine. Most (74.4%) are also members of a beekeeping organization (MSBA, local MSBA chapters, EAS). The average number of years of beekeeping experience was 8.1 years (range 1-50).

Table 1: Beekeeping experience.

Years Beekeeping	N
1 to 3	87
4 to 6	82
7 to 9	42
10 to 20	63
21 to 30	10
31 to 40	2
41+	7

Practices

Participants started colonies by splitting already existing hives (41.6%), buying packages (40.3%) and/or nucs (39.6%). Just under 15% reported collecting swarms to start new colonies.

Most beekeepers (88.4%) provided supplemental food to their hives during the 2023/2024 beekeeping season. Half (50.0%) used sugar syrup to boost food stores and encourage comb building. More than half (65.5%) of beekeepers used either fondant, candy boards or dry sugar for supplemental winter feeding. Twenty three percent of respondents reported using pollen patties or pollen substitute. Around 17% of respondents use Honey Bee Healthy, Hive Alive, essential oils or other feeding stimulants in their hives and 2.1% reported using probiotic supplements in their hives.

Less than 1% of respondents rented hives for agricultural pollination services. Participants reported harvesting approximately 31,044 pounds of honey (n= 280, average 111 pounds per beekeeper, 17.0 pounds per hive). Participants reported approximately 31,453 pounds of honey (n= 294, average 107 pounds per beekeeper, 20.6 pounds per hive) harvested in 2022/2023 and approximately 26,611 pounds of honey (average 81.9 pounds per beekeeper, 13.7 pounds per hive) harvested in the 2021/2022 survey.

Hive losses

State wide hive loss was 24.3% (summer: 5.2%, winter: 19.1%) between April 2023 and April 2024. This was a 13.1% drop from the previous season where respondents reported a state wide loss of 37.4% (summer: 8.1%, winter: 29.4%) between April 2022 and April 2023.

Table 2: Average losses by county from April 2023-April 2024.

County	N	Summer Loss (%)	Winter Loss (%)	Total Loss (%)
Androscoggin	4	30.8	38.5	69.2
Aroostook	8	0.0	31.6	31.6
Cumberland	97	5.3	19.9	25.2
Franklin	8	1.7	13.3	15.0
Hancock	19	1.5	10.2	11.7
Kennebec	16	13.8	25.9	39.7
Knox	8	9.4	18.8	28.1
Lincoln	10	2.6	20.5	23.1
Oxford	13	0.0	20.9	20.9
Penobscot	24	4.9	13.8	18.7
Piscataquis	5	0.0	53.8	53.8
Sagadahoc	8	4.1	26.5	30.6
Somerset	12	2.3	27.3	29.5
Waldo	7	12.5	18.8	31.3
Washington	7	11.1	63.0	74.1
York	39	11.3	19.0	30.3

For those beekeepers reporting losses, the most commonly reported causes of summer loss were queen loss/failure (47.8%), varroa mites/viruses (26.9%), unknown (23.9%), environmental factors (16.4%), and robbing (6.0%). Two hundred eighteen (76.5%) respondents reported no summer losses.

For those beekeepers reporting losses, the most commonly reported causes of winter loss were varroa mites/viruses (33.5%), unknown (30.4%), environmental factors (29.1%), starvation (23.4%), and queen loss/failure (22.2%). One hundred twenty-seven (44.6%) respondents reported no winter losses.

Pest and Diseases

Varroa mites/ viruses: Over eighty percent (81.1%) of respondents monitored for Varroa mites. Of those that monitor for mites, 71.4% did so using alcohol rolls, 44.6% using screen bottom boards, 20.3% using visual survey and 12.1% using drone brood survey. Just over 43% of beekeepers monitor for varroa, report using more than one method.

Beekeepers report using screen bottom boards (17.5%), brood disruption (6.7%) and drone brood removal (2.8%) as part of their varroa mite management strategy. The most common miticides used were Formic Pro (formic acid, 52.3%), Apiboxal vaporization (oxalic acid, 42.4%), Apiguard (thymol, 19.3%) and Apivar (amitraz, 15.8%). Twenty-eight beekeepers (9.8%) reported no varroa mite management.

Other Pests/Diseases: Most respondents (97.5%) report using no antibiotic treatments in their hives, 2.5% used Fumadil-B and 0.4% used Terramycin.

Director Peacock, Chairman Adams and members of the Maine Board of Pesticide Control, I am Tom Stevenson, I live in Wayne with my family and am the owner of Stevenson Strawberry Farm. I also serve as the president of the Maine Vegetable and Small Fruit Growers Association.

I first would like to thank the board ‘s effort to continue to engage stakeholders in the process.

As a grower I’d like to reiterate what was said in previous board meetings: Neonicotinoid treated seed is an incredibly important tool for Maine agriculture. It provides targeted protection against early-season pests and helps farmers like me keep soil-health practices such as cover crops and reduced tillage. These treated seeds also are economically beneficial to small growers because of reduced need for repeated application: saving time is saving labor and saving money. As you all know many growers face a serious economic burden right now due to the cost of diesel and energy.

Banning the use of neonicotinoids would be hugely determinantal to Maine’s vegetable and fruit growers who put food on the plates of communities across the state. Our members grow more than 100 different crops and rely on this technology to protect their crops. Without it, by the time a crop sprouts, the damage is already done, and the crop is destroyed.

Opponents of noenicitinoids and treated seed claim there are alternatives. However, utilizing alternatives depending on the crop might mean a larger area of treatment, more applications, and a less safe alternative.

Please don’t put farmers in a position where we are falling behind other northeastern states. We’ve already have piles challenges unique to our state. We have a safe option with neonicotinoids and treated seed that has already passed regulatory review at the state and federal level.

Climate change is real and it is happening now. We will continue to see new pest infest our state. Neonictinoids will become an even more important tool in the future. Along with pest new crops will become profitable to grown in Maine as long as we have to tools to protect it.

What are your goals for Maine agriculture and where do you see agriculture in Maine in 10 years?

I appreciate the boards time and attention and I'd be happy to try and answer any questions.

Best Regards,

Tom Stevenson

Good morning, members of the Board.

My name is **Alvin Winslow**, and I appreciate the opportunity to provide input as you conduct the study required by **L.D. 1323**.

I would ask you to make sure **three things** are fully considered.

First, start with the extensive science we already have.

When Colony Collapse Disorder emerged, the United States launched one of the largest collaborative investigations of honeybee health ever undertaken.

By USDA's 2011 report, it involved scientists from **8 federal agencies, 2 state departments of agriculture, 22 universities, and private research organizations**. Another USDA project involved **21 collaborators at 17 institutions**.

They specifically investigated pesticides and **neonicotinoids**, along with Varroa mites, viruses, Nosema, nutrition, genetics, queen health, habitat and management practices. They tested bees, pollen and wax. In one phase, more than **180 analyses were performed on the same colonies by seven different laboratories**.

After years of research, **neonicotinoids were not identified as the cause of Colony Collapse Disorder.**

The conclusion was that bee mortality is a **complex, multifactorial problem**, with Varroa mites and the viruses they transmit emerging as particularly important factors.

I attended Maine's **2014 Pollinator Health and Safety Conference**, and I remember Maine State Apiarist **Tony Jadczak** warning us:

"Banning one class of insecticides will not fix this problem."

Let me repeat that. The Maine state Apiarist declared, "Banning one class of insecticides will not fix this problem."

Second, please look at what has happened in Europe since then.

In 2018, the European Union essentially eliminated outdoor agricultural uses of three major neonics.

If neonics were the principal cause of colony mortality, we should have seen a substantial and sustained improvement.

We didn't.

Immediately before the restrictions, the COLOSS survey reported European winter colony losses of approximately **16.8%**, two years later the EU countries reported **17.9%** losses and substantial year-to-year and country-to-country losses have continued at or above pre-ban levels.

The Netherlands and Great Britian reported c**olony mortality during the winter of 2025–26 exceeding 20%**, with losses exceeding 40% in some regions.

That doesn't mean neonics cannot harm bees. They can.

But Europe's experience strongly reinforces Tony's point: **removing one insecticide class did not solve the bee-mortality problem.**

Finally, and most importantly for Maine agriculture, please evaluate seed treatments separately from broadcast spraying.

Seed treatment is a precision use. The insecticide is placed directly on the seed to protect the developing crop.

I spend considerable time **calibrating potato and corn planters**. In my experience, I simply don't see insecticide dust or drift coming out of modern planters in the manner sometimes described.

And I have never observed honeybees foraging in a potato or cornfield during spring planting. Corn isn't flowering then. Bees become interested in corn later, when it tassels and produces pollen. And bees rarely forage potato blossoms, because the Maine country side is filled with better food sources as many wild flowers are also in bloom at that time.

So, I would ask the Board to examine **actual exposure under Maine field conditions**: Where are the bees when we're planting? What exposure actually occurs? And what residues are present when the crop eventually produces pollen? If we look at other University and government research conducted in 2014 the answer is **close to zero, well below bee toxicity levels** when we use neonics for seed treatment.

The same principle applies to potatoes. These at-plant products are important tools against **Colorado potato beetles, aphids, flea beetles and leafhoppers**.

If we take away targeted protection, **the insects don't disappear.** Farmers have to control them another way, potentially with additional foliar insecticide applications. I hope you will consider the risk of these alternatives to bees, which may pose greater risk to bees.

So please don't compare **neonics with nothing**.

Compare targeted seed and at-plant treatments with **what farmers will actually have to use in their place**.

Every pesticide has risks. Our responsibility is to understand those risks using **actual exposure, actual field conditions and good science**.

Protect our pollinators. Absolutely. But also protect the ability of Maine farmers to use precise, science-based tools when the evidence shows they can be used responsibly. We have a long history of good stewardship by our Maine Farmers. If we ban neonics we will have a significant negative impact on our farms in Maine, and we won't help the bees.

We already have a library of an extensive body of research addressing these questions—from major universities, USDA scientists, independent third-party researchers, industry, growers, and other stakeholders.

At some point, I think we also have to ask: **How much more are we actually going to discover by continuing to spend Maine taxpayers' dollars investigating the same questions over and over again?**

It reminds me a little of that old song refrain: *I'm doing the same thing all over again. (where is Nora Jones when you need her).*

Thank you. Do you have any questions.

Alvin Winslow

More Detailed Letter

August 21, 2026

To the Maine Board of Pesticides Control:

RE: L.D. 1323 — Evaluation of the Impact of Neonicotinoids on Pollinators, Humans and the Environment

Thank you for the opportunity to provide stakeholder input as the Board conducts the evaluation required by L.D. 1323.

As an agricultural professional working with Maine farmers, I am particularly concerned that this study accurately evaluate **seed-treatment and targeted at-plant uses of neonicotinoids in crops such as potatoes and corn**, and that these uses not be evaluated as though they create the same exposure and risk as broadcast applications.

I respectfully ask the Board to consider several important points as it completes this study.

1. Begin With the Extensive Scientific Work Already Completed

When Colony Collapse Disorder became a major concern beginning around 2006 and 2007, the United States undertook an extraordinary scientific effort to determine what was happening to honeybees.

This was not the work of one university or one government agency. By USDA's 2011 report, the research involved scientists from **8 federal agencies, 2 state departments of agriculture, 22 universities, and private research organizations**. USDA also funded a major Managed Pollinator project involving **21 collaborators at 17 institutions**, including 14 land-grant universities and USDA research laboratories.

The investigation was exceptionally thorough.

Researchers investigated **Varroa mites, viruses, Nosema and other diseases, nutrition, genetics, queen health, habitat, migratory stress, agricultural practices and pesticides—including neonicotinoids.** They followed colonies over time, tested bees, pollen and wax for pesticide residues, and studied interactions between pesticides and disease. In one phase alone, more than **180 different analyses were performed on the same colonies by more than seven laboratories.**

After years of research, these scientists **did not identify neonicotinoids as the cause of Colony Collapse Disorder.**

Pesticides were recognized as one potential stressor, but the broader conclusion was that bee mortality involved multiple interacting factors. **Varroa mites and the viruses associated with them emerged as particularly important factors in colony survival.**

I believe this extensive body of research should be an important part of the Board's evaluation.

2. Maine Has Already Examined Much of This Science

I personally attended Maine's **2014 Pollinator Health and Safety Conference**.

The Maine Board of Pesticides Control brought together experts representing **USDA, EPA, Penn State, the University of Tennessee, the University of Maine, the Maine Board of Pesticides Control and the Maine Department of Agriculture.**

The presentations examined bee mortality, native pollinators, pesticide risks, neonicotinoid use in Maine, pollinator best-management practices and EPA's research and regulatory efforts.

Maine State Apiarist **Tony Jadczak** cautioned against looking for a single explanation for a complicated biological problem. His message was summarized by an important warning:

"Banning one class of insecticides will not fix this problem."

I encourage the Board to revisit its own scientific record from that conference as part of the L.D. 1323 review and compare what was known then with what has been learned since.

3. Examine Europe's Experience Since 2018

Europe provides an important real-world experience that should be included in this study.

In **2018, the European Union essentially ended outdoor agricultural uses of imidacloprid, clothianidin and thiamethoxam**, three neonics at the center of the pollinator controversy.

If those insecticides were the dominant cause of widespread honeybee colony mortality, it would be reasonable to expect a substantial and sustained improvement following their removal.

Eight years later, that sustained decline has not occurred.

Immediately before the restrictions, the COLOSS survey reported European winter colony losses of approximately **16.8%**, two years later the EU countries reported **17.9%** and substantial year-to-year and country-to-country losses have continued at or above pre-ban levels.

The Netherlands and Great Britian reported **colony mortality during the winter of 2025–26 exceeding 20%**, with losses exceeding 40% in some regions.

This does **not** establish that neonicotinoids are harmless to bees. They are insecticides and can harm bees when exposure is sufficient.

But it does demonstrate that **removing the major neonicotinoids did not solve Europe's honeybee mortality problem.**

That experience is remarkably consistent with the warning Maine heard from Tony Jadczak in 2014 and deserves consideration in the Board's evaluation.

4. Evaluate Seed Treatments Separately

This may be the most important recommendation I can offer from an agricultural perspective.

A neonicotinoid used as a **seed treatment or targeted at-plant application is fundamentally different from broadcasting an insecticide across an established crop.**

The purpose of seed treatment is precision: a relatively small and carefully controlled amount of insecticide is placed directly on the seed so that the developing plant receives protection during its most vulnerable establishment period.

As the Board evaluates this practice, I believe it is important to examine **actual field exposure under modern Maine farming conditions**, rather than assuming that every potential exposure pathway identified under other conditions necessarily represents what is occurring here.

I have personally spent considerable time **calibrating corn seed and working around corn planters**. In my experience, I do not see insecticide dust coming out of these planters in the manner sometimes portrayed in discussions of treated corn seed.

I also have not observed honeybees foraging in cornfields during spring planting. Corn is not flowering at that time. Honeybees become interested in corn later in the season when it tassels and produces pollen, which they can collect as a protein source for the colony.

That timing deserves careful consideration when evaluating actual pollinator exposure from treated corn seed: **Where are the bees when the seed is planted, what exposure actually occurs, and what residues—if any—remain in pollen when bees later forage on the crop?**

Published research identifying potential exposure pathways should certainly be considered. But those pathways should also be compared with measurements from **modern planting equipment, modern seed coatings and actual agricultural conditions**.

The Board's evaluation should therefore be based upon **measured exposure and real-world risk**, not simply the fact that an insecticide is present on the seed.

Risk depends upon toxicity and exposure. Application method matters. Crop matters. Rate matters. Timing matters. And the presence or absence of pollinators at the time of application matters.

5. Consider the Importance to Maine Potato Production

Systemic neonicotinoids such as **imidacloprid and thiamethoxam** have historically been important tools in potato production against **Colorado potato beetle, aphids, flea beetles and leafhoppers**.

Colorado potato beetle has an extraordinary ability to develop insecticide resistance. Maintaining effective modes of action and using them responsibly in rotation is therefore extremely important.

If an effective at-plant treatment is removed, **the insects do not disappear.**

Growers must control them another way.

In some circumstances that can mean replacing targeted systemic protection with additional foliar insecticide applications later in the season.

Therefore, the scientifically meaningful comparison is not:

Neonicotinoid versus no pesticide.

It is:

Neonicotinoid seed or at-plant treatment versus the actual pest-control program that would replace it.

6. Apply the Same Risk-Based Approach to Corn

Neonic-treated corn seed can protect seedlings against early-season insects during the critical period of stand establishment.

The benefit is not identical on every acre. Research has demonstrated meaningful yield and economic benefits under some pest-pressure conditions and little benefit under others.

That is an argument for **responsible, targeted use based upon agronomic need and sound IPM—not for treating every use as though its benefits and risks are identical.**

Agriculture should be moving toward greater precision—not away from it.

7. Evaluate the Alternatives

As part of the L.D. 1323 study, I strongly encourage the Board to ask:

What happens if this particular use is removed?

If eliminating a targeted seed or at-plant treatment results in additional broadcast applications of another insecticide, environmental risk has not disappeared. **We have changed the chemical, timing and route of exposure.**

A complete environmental assessment should therefore consider:

amount of active ingredient used → actual environmental exposure → pest control achieved → foliar applications avoided → resistance management → environmental and human-health risks of the practical alternatives.

Conclusion

I am not arguing that neonicotinoids are harmless. **No effective insecticide should be described that way.**

I am asking that the study required by L.D. 1323 distinguish **hazard from actual field risk,** distinguish among application methods, and compare the complete agricultural systems involved.

I respectfully ask the Board's final evaluation to examine the extensive existing pollinator-health research; evaluate the post-2018 European experience; distinguish seed and at-plant treatments from broadcast applications; examine actual Maine crop uses and exposure pathways; evaluate agricultural benefits and resistance-management consequences; and compare each use with the environmental and human-health risks of the alternatives that would actually replace it.

The question should not simply be:

"Can a neonicotinoid cause harm?"

The more useful scientific question is:

"For this crop, this pest, this rate and this application method, what is the actual exposure and risk, what agricultural benefit does it provide, and how does that risk compare with the practical alternatives?"

We already have an extensive body of research addressing these questions—from major universities, USDA scientists, independent third-party researchers, industry, growers, and other stakeholders.

At some point, I think we also have to ask: **How much more are we actually going to discover by continuing to spend Maine taxpayers' dollars investigating the same questions over and over again?**

It reminds me a little of that old song refrain: *doing the same thing all over again.*

Thank you for considering my comments.

Respectfully submitted,

Alvin Winslow

Peacock, Alexander R

From: Pesticides
Sent: Tuesday, August 18, 2026 7:53 AM
To: Peacock, Alexander R; Boyd, Karla
Subject: FW: Neonicitinoids Use

Follow Up Flag: Follow up
Flag Status: Flagged

-----Original Message-----
From: Val Libby <val.libby@gmail.com>
Sent: Tuesday, August 18, 2026 6:07 AM
To: Pesticides <Pesticides@maine.gov>
Subject: Neonicitinoids Use

From 2009-2014 I worked at Surry Gardens nursery in Surry. The outdoor display of potted perennials were sprayed with a pesticide containing neonicitinoids in 2013. The area was at least 20' by 40' of flowering plants. The next day the ground was covered with dead bees.
This was my post-retirement job.
I am a retired professor of horticulture, Temple University, Philadelphia.
I live in Blue Hill & still teach.
Valencia Libby
207-412-3662

Sent from my iPhone

Peacock, Alexander R

From: Pesticides
Sent: Monday, August 24, 2026 7:11 AM
To: Peacock, Alexander R; Boyd, Karla
Subject: FW: Vote to ban neonicotinoids

Follow Up Flag: Follow up
Flag Status: Flagged

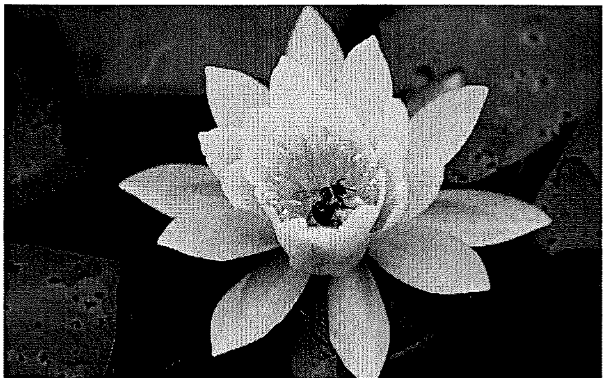
From: Claudia Griffiths
Sent: Sunday, August 23, 2026 1:40 PM
To: Pesticides
Subject: Vote to ban neonicotinoids

Thank you for the opportunity for Maine resident input. From my reading, neonicotinoids are a poisonous dangerous chemical we should ban. My readings vary but are well summarized by this Conservation Law Foundation summary:

" Neonicotinoids, often called neonics, are a noxious, dangerous variety of pesticide wreaking havoc on New England's ecosystems. When applied to crop seeds, these hazardous chemicals can poison pollinators, sicken and kill birds, and spread through our soil and water.

"Also, they often don't work. Scientists have found that neonics don't help staples like corn, soy, and wheat. In fact, neonics' tendency to wipe out pollinators and other beneficial insects can actually hurt farmers' crop yields.

"CLF is working to shut down the widespread, needless use of this toxic chemical. This legislative session, we're advocating for three bills in New England to take on neonics. Bills in Massachusetts and New Hampshire would sharply limit the use of neonicotinoid-treated seeds. Another bill in Connecticut would gather data on neonic use to lay the groundwork for stronger, smarter regulations. There are enough threats to pollinators and pollution in our soil and water. We don't have to senselessly and recklessly add more dangers."



Protecting Pollinators and Ourselves from Toxic Neonicotinoid Pesticides
clf.org

Respectfully submitted,

C.N.Griffiths

Camden, Maine