# Agricultural Innovation Board (AIB) Recommendations Regarding BMPs for Neonicotinoid Treated Seeds

January 12, 2024 - Vermont Senate Committee on Agriculture

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# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1) ((G) criteria for a system of approval of neonicotinoid treated article seeds***

- Ontario regulations require IPM certification (one time, no expiration date) and Pest Assessment Report (formalized scouting report, one time, no expiration) used to gain access to neonicotinoid treated seeds on entire farm property
  - Requirements placed on farmers and technical service providers by provincial regulations were too burdensome to administer the program and therefore were scaled back
  - Transitioned to diamide treated seed
- Quebec requires farmers to obtain agronomic justification and prescription from certified agronomist following an agronomic assessment (valid for 1 year).
  - Requirements are burdensome and have high impact on resources
  - Transitioned to diamide treated seed

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# What Are Diamides? How Are They Different From Neonics?

- Neonicotinoid insecticides are systemic insecticides that target insect nicotinic acetylcholine receptors that play a key role in nerve signaling
- Anthranilic diamides are systemic insecticides that target insect ryanodine receptors and disrupt the functioning of calcium channels which are an essential step in muscle contraction.
    - Control insect pests by directly killing individuals and inhibiting their feeding, development and reproduction
- Diamide insecticides are significantly more expensive than neonicotinoids
- Alternative seed treatment insecticide to neonicotinoids
    - Chlorantraniliprole, cyantraniliprole
- Broflanilide (sprayed in planting furrow) is classified as a meta-diamide that targets a different receptor
    - Nurizma Insecticide, registered for use in VT

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# AIB Key Takeaways - Diamide Insecticide Discussions

- Alternative insecticides to neonicotinoid treated seeds
  - Chlorantraniliprole, cyantraniliprole (seed treatments)
  - Broflanilide (sprayed in furrow)
- Currently offered in combination with neonicotinoids on treated seeds
  - Pioneer Seeds offers Chlorantraniliprole + clothianidin treated seeds
  - Limited seed reporting data from 2022 indicates that only Chlorantraniliprole + neonicotinoid treated seeds were sold by dealers in the state*
    - No diamide-only insecticide treated seeds were reported
- Broflanilide: Comparison of Hazard and Chemical/Fate Properties for Several Alternative Insecticides (EPA-HQ-OPP-2018-0053-0009)

*Vermont seed sales data to date has multiple limitations and chemical data provided in seed reporting likely does not encompass all active ingredients used as seed treatments on treated seeds in Vermont. Limited reporting from seed distributors means that available brands and active ingredients in the state may not be represented in reported data.

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**Table 1. Comparison of the Toxicity of Broflanilide to Alternative Insecticides**

| **Pesticide:** | | **Broflanilide** | **Imidacloprid** | **Thiamethoxam** | **Clothianidin** |
|---|---|---|---|---|---|
| **PC Code:** | | **283200** | **129099** | **060109** | **044309** |
| **Class:** | | **Diamide** | **Neonicotinoid** | **Neonicotinoid** | **Neonicotinoid** |
| **Crops** | | **wheat, corn, potato** | **potato** | **wheat, corn, potato** | **wheat, corn** |
| Taxa | | | | | |
| Birds | Acute Oral $LD_{50}$ (mg/kg-bw) | > 2000 | 17 | 576 | 423 |
| | Dietary $LC_{50}$ (mg/kg-diet) | > 5000 | 1536 | >5200 | >5,040 |
| | Repro. NOAEC (mg/kg-diet) | 29.7 | 125 | 300 | 205 |
| Mammals | Acute Oral $LD_{50}$ (mg/kg-bw) | > 5000 | 424 | 1563 | 389 |
| | Repro. NOAEC (mg/kg-diet) | 26 | 250 | 1000 | 150 |
| | | | | | |
| Honey Bees | Acute Contact $LD_{50}$ (ug/bee) | 0.0088 | 0.043 | 0.021 | 0.0275 |
| | Acute Oral $LD_{50}$ (ug/bee) | 0.0149 | 0.0039 | 0.0038 | 0.0037 |
| | Chronic Adult NOAEC (ug/bee) | 0.00062 | 0.00016 | No Data | 0.00036 |
| | Acute Larval $LD_{50}$ (ug/bee) | > 0.029 | No Data | No Data | >15 |
| | Chronic Larval NOAEC (ug/bee) | 0.00008 | 0.0018 | No Data | 0.680 |
| | | | | | |
| Fish | Acute $LD_{50}$ (ug/L) | 251 | 163 | >111,000 | >101,500 |
| | Chronic NOAEC (ug/L) | 11 | 6.42 | 1700 | 9,700 |
| | | | | | |
| Aquatic Invertebrates | Acute Water Column $EC_{50}$ (ug/L) | 0.0215 | 0.77 | 35 | 22 |
| | Chronic Water Column NOAEC (ug/L) | < 0.0018 | 0.01 | 0.74 | <0.05 |
| | 10-d Benthic NOAEC in µg ai/kg (ug/L-pore water) | 14 (0.079) | (0.3) | (35) | (1.1) |
| | Chronic Benthic NOAEC in µg ai/kg (ug/L -pore water) | 1.5 (0.024) | (0.03) | (>1 [sediment dosed]; 10 [water dosed]) | (<0.05) |
| | | | | | |
| Terrestrial Plants | Monocot $IC_{25}$ | >0.091 | >0.51 | >0.28 | >0.19 |
| | Dicot $IC_{25}$ | >0.091 | >0.51 | 0.28 | >0.19 |
| Aquatic Vascular Plants | $IC/EC_{50}$ | >630 | NA | >90,000 | >280,000 |
| Aquatic Non-Vascular Plants | $IC/EC_{50}$ | 570 | NA | >99,000 | 17,600 |

**Key**

| |
|---|
| Alternative is less toxic than broflanilide. |
| Alternative has similar toxicity to broflanilide. |
| Alternative is more toxic than broflanilide. |

**Table 2. Comparison of the Toxicity of Broflanilide to other Diamides**

| | Pesticide: | Broflanilide | Flubendiamide | Cyantraniliprole | Chlorantraniliprole |
|---|---|---|---|---|---|
| | PC Code: | 283200 | 027602 | 090098 | 090100 |
| | Class: | Diamide | Diamide | Diamide | Diamide |
| Taxa | | | | | |
| Birds | Acute Oral $LD_{50}$ (mg/kg-bw) | > 2000 | >2000 | >2250 | >2250 |
| | Dietary $LC_{50}$ (mg/kg-diet) | > 5000 | >4535 | >5620 | >5620 |
| | Repro. NOAEC (mg/kg-diet) | 29.7 | 98 | 1000 | 120 |
| Mammals | Acute Oral $LD_{50}$ (mg/kg-bw) | > 5000 | >5000 | >5000 | >5000 |
| | Repro. NOAEC (mg/kg-diet) | 26 | 50 | 200 | 20,000 |
| | | | | | |
| Honey Bees | Acute Contact $LD_{50}$, (ug/bee) | 0.0088 | >200 | 1.45 | No Data |
| | Acute Oral $LD_{50}$, (ug/bee) | 0.0149 | >200 | 0.491 | No Data |
| | Chronic Adult NOAEC (ug/bee) | 0.00062 | No Data | 0.10 | No Data |
| | Acute Larval $LD_{50}$ (ug/bee) | > 0.029 | No Data | 0.0374 | No Data |
| | Chronic Larval NOAEC (ug/bee) | 0.00008 | No Data | No Data | No Data |
| | | | | | |
| Fish | Acute $LD_{50}$ (ug/L) | 251 | >65.7 | >10000 | >12,000 |
| | Chronic NOAEC (ug/L) | 11 | 60.5 | <750 | 110 |
| | | | | | |
| Aquatic | Acute Water Column $EC_{50}$ (ug/L) | 0.0215 | 1.5 | 20.4 | 11.6 |
| | Chronic Water Column NOAEC (ug/L) | < 0.0018 | 0.38 | 6.56 | 4.4 |
| | 10-d Benthic NOAEC in µg ai/kg (ug/L-pore water) | 14 (0.079) | (130) | (719) | No Data |
| | Chronic Benthic NOAEC in µg ai/kg (ug/L-pore water) | 1.5 (0.024) | 1.9 (0.28) | 10 | No Data |
| | | | | | |
| Terrestrial Plants | Monocot $IC_{25}$ | >0.091 | >0.158 | 3.56 | 0.172 |
| | Dicot $IC_{25}$ | >0.091 | >0.158 | 2.28 | >0.267 |
| Aquatic Vascular Plants | $IC/EC_{50}$ | >630 | >54.6 | >12100 | >2000 |
| Aquatic Non-Vascular Plants | $IC/EC_{50}$ | 570 | >69.3 | >10000 | >1780 |

**Key**

| |
|---|
| Alternative is less toxic than broflanilide. |
| Alternative has similar toxicity to broflanilide. |
| Alternative is more toxic than broflanilide. |

# AIB Key Takeaways - Diamide Insecticide Discussions

- To illustrate the range of toxicity, a difference of 10x was selected to designate whether an alternative is less (shaded in green) or more toxic (shaded in pink)
- Diamides are similarly to less toxic than neonics to birds
- Diamides are less toxic than neonics on an acute basis to mammals
  - Chronic toxicity endpoints to mammals indicate a mixed pattern of toxicity
    - Chlorantraniliprole is less toxic than all 3 neonics and thiamethoxam is less toxic than diamides on a chronic basis to mammals
- Fish acute and chronic data suggest that diamides are more toxic than the neonics, with broflanilide being the most toxic
- Aquatic invertebrate data indicate that broflanilide is generally more toxic than the other chemicals
  - chlorantraniliprole and cyantraniliprole have similar toxicity on an acute basis to neonics and are slightly less toxic than neonics on a chronic basis where data are available.
- Data suggest generally similar toxicity to aquatic and terrestrial plants among the chemicals

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# AIB Key Takeaways - Diamide Insecticide Discussions

- Honeybee data is limited across the chemicals (no data for chlorantraniliprole)
  - Cyantraniliprole has lower acute and chronic adult toxicity than neonics and broflanilide
  - Broflanilide has similar toxicity on an acute and chronic adult basis, but is more toxic than neonics when comparing chronic and acute larval toxic endpoint concentrations

Residual Time to 25% Bee Mortality (RT25) Data | US EPA

- Chlorantraniliprole and cyantraniliprole have similar RT25 to imidacloprid, and shorter RT25 than thiamethoxam and clothianidin

**Table 3. Comparison of the Environmental Fate Properties of Broflanilide and Alternative Insecticides**

| Pesticide: | PC Code: | Class: | Half-lives (days) | | | | | | Mobility |
|---|---|---|---|---|---|---|---|---|---|
| | | | Hydrolysis @ PH 7.0 | Aquatic Photolysis | Aerobic Soil Metabolism | Anaerobic Soil Metabolism | Aerobic Aquatic Metabolism | Anaerobic Aquatic Metabolism | $K_F$ ( $K_D$) or $K_{FOC}$ or $K_{OC}$ (L/kg) |
| Broflanilide | 283200 | Diamide | Stable | 80 | 829-5742 | 157-2354 | 945-1430 | 871-1411 | *113-248*[A] 3596-20204 |
| Flubendiamide | 027602 | Diamide | Stable | | Stable | Stable | Stable | 289 | 1076-3318 |
| Cyantraniliprole | 090098 | Diamide | 31 | 0.33 | 16.2-89.4 | 4.3 | 3.9-25.1 | 2.4-12 | 157-376 |
| Chlorantraniliprole | 090100 | Diamide | Stable | 33 | 228-924 | Not Measured | 125-231 | 208 | 152-535 |
| Imidacloprid | 129099 | Neonicotinoid | Stable | 0.2 | 139-608 | Not Measured | 30-159 | 33 | 98-487 |
| Thiamethoxam | 060109 | Neonicotinoid | Stable | 3.6-3.9 | 34.3-464 | 45.6-118.0 | 16.3-35.1 | 20.7-28.6 | 33.1-176.7 |
| Clothianidin | 044309 | Neonicotinoid | Stable | 0.6 | 148-1155 | Not Measured | 177.7-182.4 | 27 | 84-345 |

- Persistence and mobility within the environment
  - Broflanilide is less mobile and more persistent than other diamides and neonics
  - Chlorantraniliprole has similar mobility and persistence as clothianidin

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# AIB Key Takeaways - Diamide Insecticide Discussions

- Tracey Baute, Ontario Ministry of Agriculture, Food and Rural Affairs, 6/26/23 AIB presentation
  - Smith, Baute, Schaafsma, 2020 Ontario study compared neonicotinoid treated seed to diamide treated seed and fungicide-only treated seed
    - Diamide treated seed results were inconsistent, no clear yield advantage to the diamide treatment over fungicide-only or neonic treatments
  - Diamide detections in water monitoring studies
  - More studies continue relevant to the potential risk of both neonics and diamides to non-target organisms
- Diamides are potential future AIB topic to address
  - Toxicity, environmental persistence, use, and effectiveness of diamide treated seeds
    - Cornell University / New York State Integrated Pest Management has initiated a research project looking at the efficacy of diamide treated seed against corn seed maggot compared to neonic, fungicide, and spinosad treated seed and untreated seed

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# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1) ((G) criteria for a system of approval of neonicotinoid treated article seeds***

- Amendments to Article 37 of the New York Conservation Law (S. 1856-A and A. 7640) – Birds and Bees Act
  - Passed by Senate and Assembly in June 2023
- Approved by Governor in December 2023
  - Changes to be ratified by Legislature
- Creates Title 11 – Regulation of Treated Article Seeds
  - Prohibits use of neonicotinoid treated seeds by Jan. 1 2029
  - Provides for waiver process to allow NTS seeds if:
    - grower receives IPM training
    - Pest risk assessment is conducted, and report generated
- NYDEC will adopt rules to implement, in consultation with Commissioner of Agriculture

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# Next Steps

- Work with UVM to extend and expand research to address recommendations
  - Identification and mitigation of potential impacts from use of NTS during planting
  - Continued sampling of soil and water for NTS residues
- Participate with UVM in outreach and education to growers
  - UVM webinar series December 12-21: Managing Neonicotinoids in Row Crops
- Participate with stakeholders in identifying opportunities for increasing pollinator habitat without impacting agricultural production
- AIB will continue to discuss this issue

# Thank you

January 12, 2024 - Vermont Senate Committee on Agriculture

Steve Dwinell, Director, Public Health & Agricultural Resource Management Division, Agency of Agriculture, Food and Markets

Morgan Griffith, Agrichemical Program Manager, Agency of Agriculture, Food and Markets

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# AIB Members

- **Wendy Sue Harper** - Ph.D. Soil Biologist, Associate Faculty, Prescott College [AIB Role Fulfillment: Soil Biologist]
- **Clara Ayer** - Dairy Farmer, Fairmont Farm [AIB Role Fulfillment: an active farmer who is a member of an organization representing the conventional dairy industry in Vermont]
  - Appointment concluded April 11, 2023
- **Amanda St. Pierre** - Dairy Farmer, Pleasant Valley Farms [AIB Role Fulfillment: an active farmer who is a member of an organization representing the conventional dairy industry in Vermont]
  - Appointment commenced April 11, 2023
- **Fitzroy Beckford, Ph.D.** - Associate Dean and Director of UVM Extension in the College of Agriculture and Life Sciences [AIB Role Fulfillment: a member from the University of Vermont Center for Sustainable Agriculture]
- **Terence Bradshaw, Ph.D.** - Assistant Professor, Department of Plant and Soil Science / Director, Horticultural Research and Education Center, UVM [AIB Role Fulfillment: an active farmer who is a member of an organization representing fruit and vegetable farmers in Vermont]
  - Appointment concluded July 1, 2023
- **Ann Hazelrigg, Ph.D. -** Extension Associate Professor, Department of Plant and Soil Science / Director, Plant Diagnostic Clinic, UVM [AIB Role Fulfillment: an active farmer who is a member of an organization representing fruit and vegetable farmers in Vermont]
  - Appointment commenced July 1, 2023
- **Jonathan Chamberlin** - Ag Retail/Crop Consultant, Bourdeau Brothers [AIB Role Fulfillment: a certified crop consultant]
- **Clarice Cutler** - Environmental Analyst, Department of Environmental Conservation, Agency of Natural Resources [AIB Role Fulfillment: the Secretary of Natural Resources or designee]
  - Appointment concluded October 11, 2023
- **Abbi Pajak** - Environmental Analyst, Department of Environmental Conservation, Agency of Natural Resources [AIB Role Fulfillment: the Secretary of Natural Resources or designee]
  - Appointment commenced November 6, 2023

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# AIB Members, contd.

- **Earl Ransom** - Organic Dairy Farmer, Rockbottom Farm [AIB Role Fulfillment: an active farmer who is a member of an organization representing the organic farming community]
- **Ryan Rebozo, Ph.D.** - Director of Conservation Science, Vermont Center for Ecostudies [AIB Role Fulfillment: a member of an environmental organization that advocates for policy regarding the management or reduction of toxic substances in the State]
- **Steven Schubart** - Grass-fed beef operation owner, Grass Cattle Company [AIB Role Fulfillment: an active farmer who is a member of an organization representing grass-based, non-dairy livestock farming in Vermont]
- **Sarah Owen, Ph.D.** - State Toxicologist, Department of Health, Agency of Human Services [AIB Role Fulfillment: the Commissioner of Health or a designee with expertise in the effects of pesticides on human health]
- **Laura DiPietro** - Director, Water Quality Division, Agency of Agriculture, Food & Markets [AIB Role Fulfillment: the Director of the Agency of Agriculture, Food and Markets, Water Quality Program or designee]
- **Morgan Griffith** - Agrichemical Program Manager, Public Health and Agricultural Resource Management Division, Agency of Agriculture, Food & Markets [AIB Role Fulfillment: the Director of the Agency of Agriculture, Food and Markets, Agrichemical Program or designee]
- **Steven Dwinell** - Director, Public Health and Agricultural Resource Management Division, Agency of Agriculture, Food & Markets [AIB Role Fulfillment: the Secretary of the Agency of Agriculture, Food and Markets or designee]

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# AIB Activities

- 17 public meetings 2022-2023
- Review of literature and resources
- Expert witnesses and public comment
- Publicly accessible Meeting information
- 2022 Annual Report to Legislature
  - 2023 annual report in final review
- Report regarding BMPs for non-neonicotinoid treated article seeds (2/15/23)
- AIB Recommendations Regarding Best Management Practices (BMPs) For Neonicotinoid Treated Article Seeds - Final Report (1/2/24)

# Neonicotinoid Treated Seed (NTS) Legislative Charge

**6 V.S.A. § 1105a**

(c)(1) Under subsection (a) of this section, the Secretary of Agriculture, Food and Markets, after consultation with the Agricultural Innovation Board, shall adopt by rule BMPs for the use in the State of neonicotinoid treated article seeds. In developing the rules with the Agricultural Innovation Board, the Secretary shall address:

(A) establishment of threshold levels of pest pressure required prior to use of neonicotinoid treated article seeds;

(B) availability of nontreated article seeds that are not neonicotinoid treated article seeds;

(C) economic impact from crop loss as compared to crop yield when neonicotinoid treated article seeds are used;

(D) relative toxicities of different neonicotinoid treated article seeds and the effects of neonicotinoid treated article seeds on human health and the environment;

(E) surveillance and monitoring techniques for in-field pest pressure;

(F) ways to reduce pest harborage from conservation tillage practices; and

(G) criteria for a system of approval of neonicotinoid treated article seeds.

(2) In implementing the rules required under this subsection, the Secretary of Agriculture, Food and Markets shall work with farmers, seed companies, and other relevant parties to ensure that farmers have access to appropriate varieties and amounts of untreated seed or treated seed that are not neonicotinoid treated article seeds.

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# To address (A) – (G), AIB went to the experts…

## AIB heard presentations from 14 external subject matter experts

- **Alexander Sereno**, Regional Director USDA Risk Management Agency
- **Dr. Heather Darby**, UVM Extension
- **Dr. Scott McArt**, Associate Professor of pollinator health, Department of Entomology, Cornell University
- **Dr. John Tooker**, Professor of Entomology/State IPM Coordinator, Penn State College of Agricultural Sciences
- **Louis Robert**, Agronomist Emeritus, Ministry of Agriculture, Fisheries, Aquaculture, and Food of Quebec
- **Emilie Bergeron**, Vice President Chemistry, CropLife Canada
- **Christine Hazel**, Global Regulatory Leader, Corteva Agriscience
- **Tracey Baute**, Ontario Ministry of Agriculture, Food and Rural Affairs
- **Elson Shields**, Professor of Entomology Emeritus, Cornell University
- **Lucas Rhoads**, Natural Resources Defense Council
- **Gene Harrington**, Biotechnology Innovation Organization
- **Andrew Munkres**, Vermont Beekeepers Association
- **Paul Hoekstra**, Grain Farmers of Ontario
- **Brad Van Kooten**, US Category Lead, Seed Applied Technologies, Pioneer® Corteva Agriscience
- **David Kosztyo**, District Sales Leader, Pioneer® Corteva Agriscience

# To address (A) – (G), AIB went to the experts…

## AIB heard presentations from State employees and AIB members

- **Dr. Terence Bradshaw**, Associate Professor and Chair, Department of Plant and Soil Science, UVM
- **Dr. Sarah Owen**, State Toxicologist, Vermont Department of Health
- **Jill Goss**, Feed, Seed & Fertilizer Specialist, AAFM
- **Stephanie Smith**, Deputy Director, AAFM
- **Morgan Griffith**, Agrichemical Program Manager, AAFM

# What did AIB learn?

- Recommendations are based on the following understandings by AIB members:
  - Toxicity of neonicotinoids to non-target insects and risk for exposure to small mammals and birds from the use of neonicotinoid treated seeds (NTS)
  - Previous research evaluating corn yields with NTS vs non-NTS shows inconsistent or no significant differences in yield
  - Possible impact of past use of NTS on present pest pressures (halo effect)
  - In the current seed market NTS is low-cost protection against potential pest loss from corn seed maggot and wireworms
  - Non-NTS purchasing options are very limited. This lack of availability does not allow for flexibility of variety selection or seed exchange when adjusting to planting conditions closer to planting time

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# Overall, what does AIB recommend?

- Further understand the issues within Vermont
- Educate growers about practices to limit pest pressure or reduce potential non-target exposure
- Promote ongoing and future research
- Unanimous member support for efforts to increase pollinator habitat without impacting agricultural production
- Some support for monetary programs to mitigate any potential losses from use of non-NTS

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# What does AIB recommend?

1. Support additional research:
   a) Study the impact of halo or legacy effect on pest populations from the almost universal use of neonic treated seeds since 1990
   b) Non-target dust movement with new seed treatment technology that reduces abrasion of seed treatment during handling and planting
   c) Effectiveness, unknown limitations, and market availability of seed lubricant alternatives to talc and graphite
   d) Impact of managing/mowing buffers at planting time of treated seeds
      i. Reducing pollinator habitat in areas at risk of exposure from planting treated seeds may conflict with other conservation programs or not feasible for farms
2. Education and training
   a) Develop IPM guidance for growers for how to reduce environmental impact of NTS
      i. Develop information (in collaboration with UVM) on toxicity and potential risk to pollinators, decision making, scouting, types of pests, & management practices
      ii. Develop regional monitoring reports that track the prevalence of the pests
   b) Ensure growers receive updates on relevant research
      i. Seed treatment technology innovations to reduce dust/abrasion
      ii. Seed lubricant alternatives
      iii. Impact of past use of NTS on present pest populations
      iv. Local data on feasibility of VT corn crops without neonicotinoid seed treatment (plant stand, yield, economic impact, cultural pest management practices)
   c) Educate growers about seed label language and how to follow the label

# What does AIB recommend?

3. Support and promote efforts to increase pollinator habitat without impacting agricultural production
4. Important to build in a mechanism for review and reevaluation of recommendations, so guidelines can adjust as we learn
   a) Revisit policy recommendations after a defined period of time and evaluate based on measurable metrics

# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1)(A) establishment of threshold levels of pest pressure required prior to use of neonicotinoid treated article seeds;***

***(E) surveillance and monitoring techniques for in-field pest pressure;***

- Seed purchasing occurs months ahead of the season (September – November prior to April/May planting).
- Scouting the field for pests in the in the spring before planting unlikely to influence what type of seeds to purchase and plant.
- Scouting the field in the fall before seed purchase does not provide a clear indicator of pest levels in the next spring.
- Few methods are available for scouting for corn seed maggot and no economic thresholds are established for this pest.

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# AIB Considerations

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***(c)(1)(A) establishment of threshold levels of pest pressure required prior to use of neonicotinoid treated article seeds;***

***(E) surveillance and monitoring techniques for in-field pest pressure;***

- Monitoring the emergence of corn seed maggot flies through in-field scouting and growing degree day calculators offers growers an option to time planting between emerging fly generations to reduce risk of injury.
    - There can be multiple generations of corn seed maggot in VT, but the first generation causes the most significant damage, especially when the corn is slow to germinate.
- Corn seed maggot is unpredictable.  It can appear before or after planting.  Corn is vulnerable to corn seed maggot injury 7-30 days from planting.
- There is no insecticide rescue treatment. Re-planting is the only option.

# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1)(A) establishment of threshold levels of pest pressure required prior to use of neonicotinoid treated article seeds;***

***(E) surveillance and monitoring techniques for in-field pest pressure;***

- Prior to introduction of seed treatments, protection was afforded by insecticides applied to soil during planting at much higher rates
- Use of treated seed has been widespread, potentially resulting in a "halo" effect, where treatment has reduced population to extent that untreated seed plantings are protected to some extent

*Conclusion – Research is needed on predicting occurrence so decisions can be made on types of protection.*

# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1) (B) availability of nontreated article seeds that are not neonicotinoid treated article seeds;***

- Limited availability of untreated corn seed varieties and maturities
- Producers who order untreated seed cannot exchange for different maturities/varieties closer to planting time, if conditions change.
- Completely untreated corn is available
- Fungicide-only treatments are difficult to purchase
- Limiting seed options for VT farmers would put them at a disadvantage in terms of having options and flexibility in seed performance, seed choices, and makes it more difficult for farmers to adapt to climate change.
- VT is a small market and it is difficult to influence the seed production industry

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# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1) (C) economic impact from crop loss as compared to crop yield when neonicotinoid treated article seeds are used***

- Research comparing fungicide-only treated seed to neonicotinoid and fungicide treated seed shows inconsistent yield differences, if any.
- No clear trend for increased yield with neonicotinoid treated seeds compared to untreated or fungicide-only treated seed.
- Most studies showed no yield difference between treated vs. non-treated
- May be influenced by halo effect of past NTS
- Some studies did show an increase in yield

*Conclusion – Research needed under VT conditions.*

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# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1)(D) relative toxicities of different neonicotinoid treated article seeds and the effects of neonicotinoid treated article seeds on human health and the environment;***

- Review of EPA human health risk assessment for imidacloprid
  - Residue on food crop from seed treatment use is negligible
  - Very little risk for exposure to the farmer when seed is purchased already treated
  - The amount of active ingredient per seed is considerably less than the amount of active ingredient applied during in-furrow treatments
  - Neonicotinoids have favorable human health profile compared to the organophosphate insecticides they replaced
  - Neonicotinoids other than imidacloprid would have similar human health risk assessment if they have similar use profile

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# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1) (D) relative toxicities of different neonicotinoid treated article seeds and the effects of neonicotinoid treated article seeds on human health and the environment;***

- Imidacloprid, clothianidin and thiamethoxam are classified as highly toxic to honeybees (acute and chronic toxicities)
  Neonicotinoids can have sublethal impacts on honeybee physiology, reproduction and behavior
- Canada's PMRA investigated honeybee mortalities and found that exposure to neonicotinoids in dust generated during planting of treated corn or soybean seed with vacuum planters contributed to the mortalities observed.
- Corn Dust Research Consortium conducted research from 2013-2017 on impacts of dust generation during planting and impacts on pollinators.
  - Bee mortality results associated with planting activities varied between the replicates, with some showing increased mortality with planting activities (Iowa and Ohio) and some showing no difference in mortality (Nebraska).

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# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1) (D) relative toxicities of different neonicotinoid treated article seeds and the effects of neonicotinoid treated article seeds on human health and the environment;***

- Sources of neonicotinoid exposures to non-target species come from:
  - Exhausted dust from vacuum planters
  - Soil dust carried over from previous season moved by any activity in the field and by also contributing to abrasion of seed
  - Surface water after rain event within fields and adjacent to fields from fugitive dust
  - Residues blown onto flowering resources including weeds and tree blossoms
- 98% of abrasion comes from soil through the intake of vacuum planters – the solution is to pre-filter followed by post-filter BUT planter modification is not a viable option for VT growers at this time.
- Dust exhausted from vacuum planters that is directed back towards the soil is harmful to ground-dwelling beneficial invertebrates.
  - Dust contains protein and therefore can be attractive to pollinators

# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1) (D) relative toxicities of different neonicotinoid treated article seeds and the effects of neonicotinoid treated article seeds on human health and the environment;***

- Canadian PMRA regulation prohibits the use of talc and graphite as seed lubricants in vacuum planters. Recommend using a dust-reducing fluency agent.
- UVM evaluated seed lubricants available in VT, most growers use talc and graphite, but a dust-reducing fluency agent was available at the local dealer.
- Improvements in polymer coatings for treated seed are reported by the industry to reduce dust generation during seed handling and planting

*Conclusion – research on dust generation and impact under VT conditions is needed, outreach and education to growers about reducing impacts from planting operations*

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# AIB Considerations

***6 V.S.A. § 1105a***

***(c)(1) (F) ways to reduce pest harborage from conservation tillage practices***

- There is a relationship between type of tillage practice and resulting pest pressures
  - Situation is complex in VT because manure and cover crop incorporation are common and recommended practices
- Conservation tillage practices can reduce corn seed maggot populations because plant residues occur mainly on surface of the soil rather than being incorporated into the soil where decomposition occurs.
  - No-till is less attractive to corn seed maggot because organic matter isn't exposed
  - No-till practices provide habitat for beneficial organisms and increased predator populations
- There is opportunity to learn economic impacts of using untreated seed and planting later in the season to avoid peak pest pressures

*Conclusion – Research under VT conditions regarding practices to reduce pest pressures*