Surface Water Monitoring for Neonicotinoids 2017-2021

Methods

Surface Water Collection Sites (Routine Sampling and Post-Rainfall Event Sampling), 2017-2021

Northwest	North/Central
Hungerford Brook (Highgate)	Otter Creek (Middlebury)
Jewett Brook - 01 (Lower Newton Road St. Albans)[a]	Middlebury River (Middlebury)
Jewett Brook - 02 (Lower Newton Road St. Albans)	Winooski River (Middlesex)
Mill River Tributary (Georgia)	Lamoille River (Morristown)
Alburgh Center Lake Champlain (Alburgh)	Little Otter Creek (Ferrisburgh) [ab]
Missisquoi Bay Lake Champlain (Highgate)	White River, 2nd Branch (Brookfield)
Missisquoi Bay Central Lake Champlain (Quebec)	Diamond Island Lake Champlain (Ferrisburgh)
Lake Champlain (Burlington)	Calendar Brook (Sutton)
Pike River (Quebec) [a]	King George Road Stream (Sutton)
Missisquoi River (St. Albans) [a]	Station Road Stream (Sutton)
Rock River (Highgate) [a]	Sheffield Road Culvert (Sutton)
St. Albans Bay Lake Champlain (St. Albans)	Burke Road Culvert (Sutton)
Northeast	**Southwest**
Black River (Coventry)	Battenkill River (Arlington)
Mississquoi River (Troy)	Mettawee River (Pawlet)
Passumpsic River (St. Johnsbury)	
East/Southeast	
Connecticut River (Newbury)	
Williams River (Chester)	
West River (Brattleboro)	

[a] indicates post rain-fall event sample site

[ab] indicates post rain-fall event sample site and routine sampling site

U.S. EPA Aquatic Life Benchmarks

[Aquatic Life Benchmarks and Ecological Risk Assessments for Registered Pesticides | US EPA]

U.S. EPA Aquatic Life Benchmarks (ppb)

Pesticide	Year Updated	CAS number	Fish		Invertebrates			Nonvascular Plants	Vascular Plants
			Acute[a]	Chronic[b]	Acute[c]	Chronic NOAEC[d]	Chronic LOAEC[e]	Acute[f]	Acute[g]
Clothianidin	2016	210880-92-5	> 50750	9700	11	0.05	3.4	64000	> 280000
Imidacloprid	2017	138261-41-3	114500	9000	0.385	0.01	0.03		
Thiamethoxam	2017	153719-23-4	> 57000	20000	17.5	0.74	2.23	> 99000	> 90200

[a]For acute fish, toxicity value is generally the lowest 96-hour LC_{50} in a standardized test (usually with rainbow trout, fathead minnow, or bluegill)

[b]For chronic fish, toxicity value is usually the lowest NOEAC from the life-cycle or early life stage test (usually with rainbow trout or fathead minnow)

[c]For acute invertebrate, toxicity value is usually the lowest 48- or 96-hour EC_{50} or LC_{50} in a standardized test (usually with midge, scud, or daphnids)

[d]For chronic invertebrates, toxicity value is usually the lowest NOAEC from a life-cycle test with invertebrates (usually with midge, scud, or daphnids)

[e]For chronic invertebrates, the LOAEC from a life-cycle test with invertebrates (midge or mayfly)

[f]For acute nonvascular plants, toxicity value is usually a short-term (<10 days) EC_{50} (usually with green algae or diatoms)

[g]For acute vascular plants, toxicity value is usually short-term (<10 days) EC_{50} (usually with duckweed)

Findings

Clothianidin detections by year and site (routine and post-rainfall event sampling), 2017-2021

	Samples	Detections	Detections above benchmark[a]	Site of detection	Date of detection
2017	43	7	7	Rock River[b] Jewett Brook - 01[b] Pike River[b]	6/7/2017, 6/20/2017, 6/30/2017 6/7/2017, 6/20/2017, 6/30/2017 6/20/2017
2018	116	2	2	Hungerford Brook Hungerford Brook (Woods Hill Rd)	6/13/2018 6/26/2018
2019	180	7	7	Jewett Brook - 01[b] Mill River Tributary Hungerford Brook	6/21/2019, 10/2/2019, 10/18/2019, 11/1/2019 9/10/2019, 10/2/2019 10/2/2019
2020	156	6	6	Jewett Brook - 01[b] Hungerford Brook Jewett Brook - 02	8/5/2020 6/1/2020, 8/6/2020, 10/6/2020 7/14/2020, 8/6/2020
2021	143	1	1	Little Otter Creek	7/6/2021

[a] most conservative aquatic life benchmark (USEPA Chronic Invertebrate, 0.05 ppb) is equivalent to reporting limit

[b] indicates post rain-fall event sample

No detections exceeded the invertebrate chronic LOAEC

Findings

Imidacloprid detections by year and site (routine and post-rainfall event sampling), 2017-2021

	Samples	Detections	Detections above benchmark[a]	Site of detection	Date of detection
2017	43	1	1	Jewett Brook - 01[b]	6/7/2017
2018	116	0	0		
2019	180	0	0		
2020	156	1	1	Jewett Brook - 02	8/6/2020
2021	143	0	0		

[a] most conservative aquatic life benchmark (USEPA Chronic Invertebrate, 0.01 ppb) is lower than reporting limit (0.05 ppb)

[b] indicates post rain-fall event sample

Both detections also exceeded the invertebrate chronic LOAEC

Findings

Thiamethoxam detections by year and site (routine and post-rainfall event sampling), 2017-2021

	Samples	Detections	Detections above benchmark[a]	Site of detection	Date of detection
2017	43	9	0	Mill River Tributary Pike River[b] Rock River[b] Jewett Brook - 01[b]	9/14/2017 6/7/2017, 6/20/2017, 6/30/2017 6/7/2017, 6/20/2017 6/7/2017, 6/20/2017, 6/30/2017
2018	116	2	0	Hungerford Brook Hungerford Brook (Woods Hill Rd)	6/13/2018 6/26/2018
2019	180	3	0	Jewett Brook - 01[b] Little Otter Creek	6/21/2019, 10/2/2019 6/21/2019
2020	156	1	0	Jewett Brook - 02	8/6/2020
2021	143	0	0		

[a] most conservative aquatic life benchmark (USEPA Chronic Invertebrate, 0.74 ppb)

[b] indicates post rain-fall event sample

No detections exceeded the invertebrate chronic LOAEC

Findings & Next Steps

VT Neonicotinoid Pesticide Usage, 2017-2020

Year	Total Pounds Active Ingredient Applied		
	Clothianidin	Imidacloprid	Thiamethoxam
2017	9	1130	7
2018	9	982	8
2019	26	972	6
2020	19	1028	10

VT Seed Sales, 2020

Seed Type	Treated (tons)	Untreated (tons)
Cereal Grain	0.3	7.8
Corn	848.5	68.2
Cover Crops	0.2	0
Flower and Vegetable	0	11.8
Forage-not otherwise specified	0.1	5.3
grass, forage and pasture	1.3	7.1
Hemp	0	0.00002
oil seed-no soybean	0	0
soybean	149.6	222.9
Turf	0	0.7

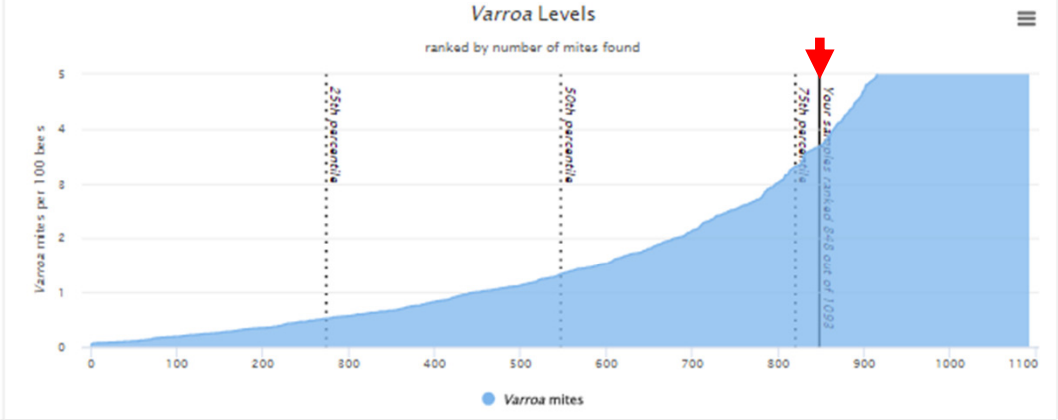
Next Steps

- Increased monitoring and expanded biota testing if we see more than occasional detections in specific water ways
  - ANR Watershed Management Division Fall 2022 bioassessment planned at Jewett Brook
- Survey neonicotinoid treated seeds planted in Vermont and identify available alternatives
- Lower reporting limit of imidacloprid detection testing so our monitoring data can more accurately be compared to benchmarks.

Glimpse Into The Hives

Snapshot of USDA APHIS National Honey Bee Survey – 2021 Health Assessment from 2 VT Beekeepers

Figure 1: Your *Varroa* load results compared to national averages



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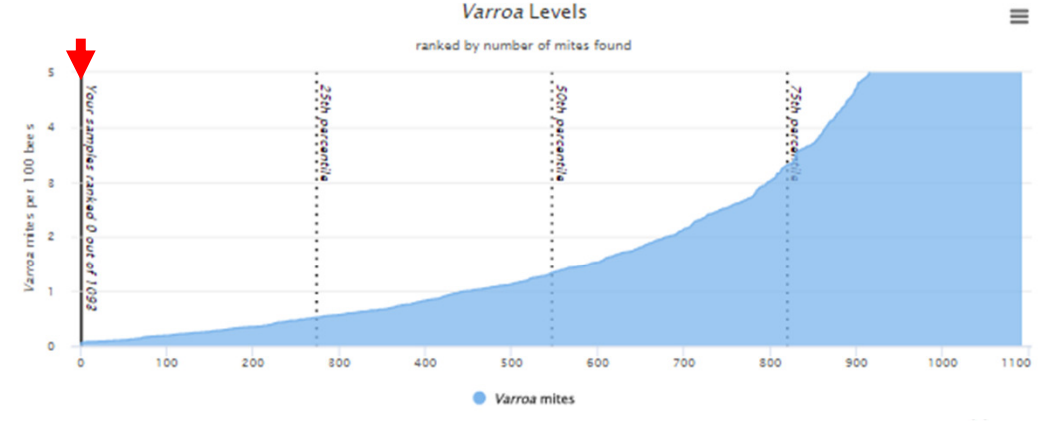
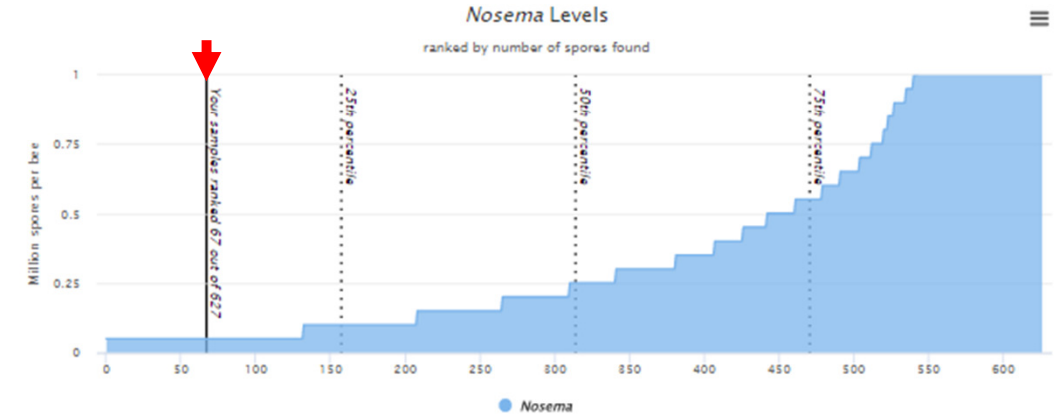


Figure 2: Your *Nosema* load results compared to national averages



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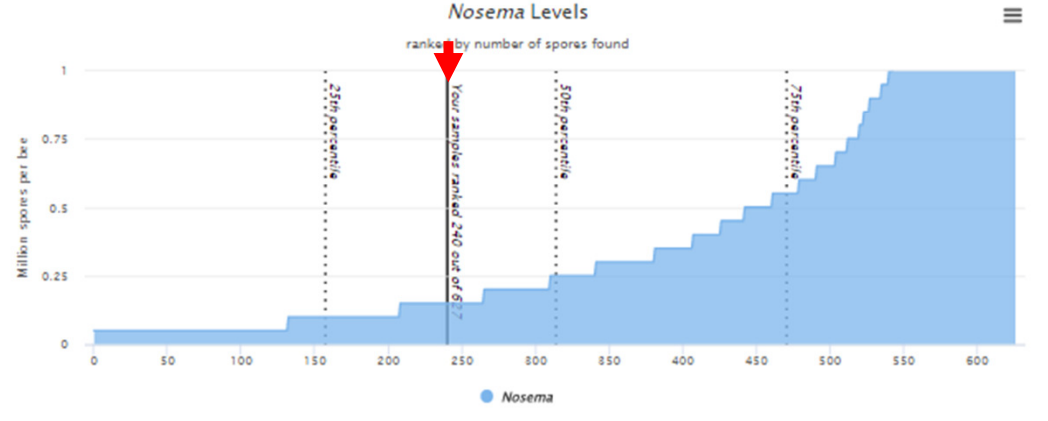

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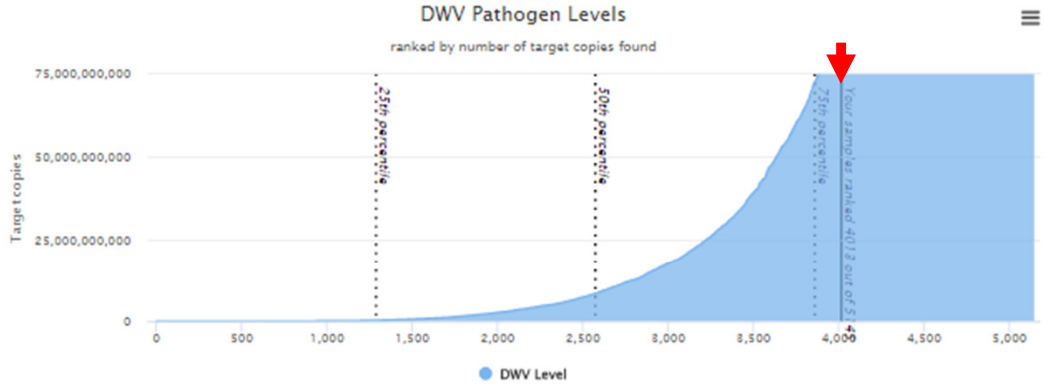

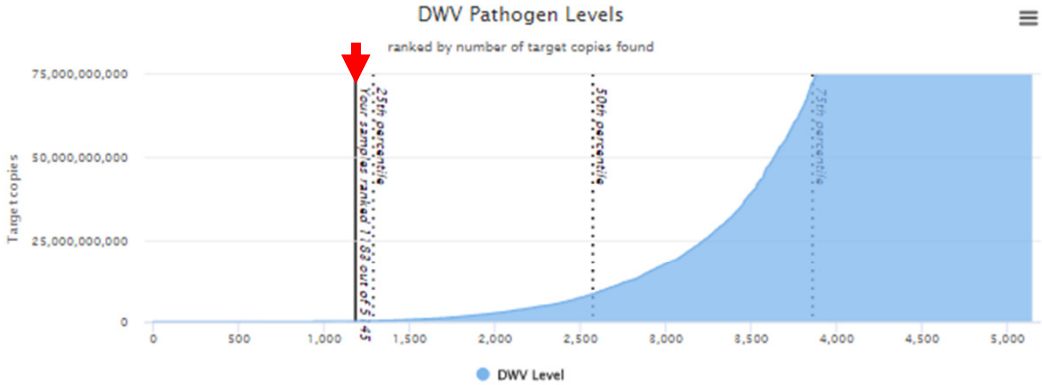

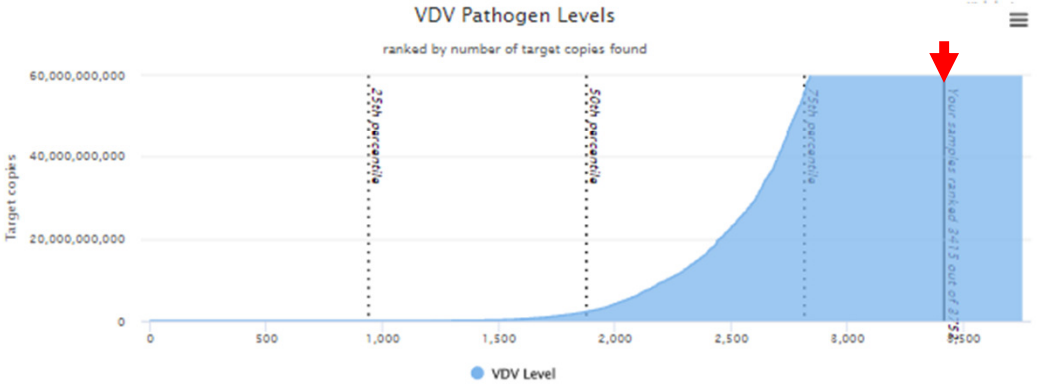

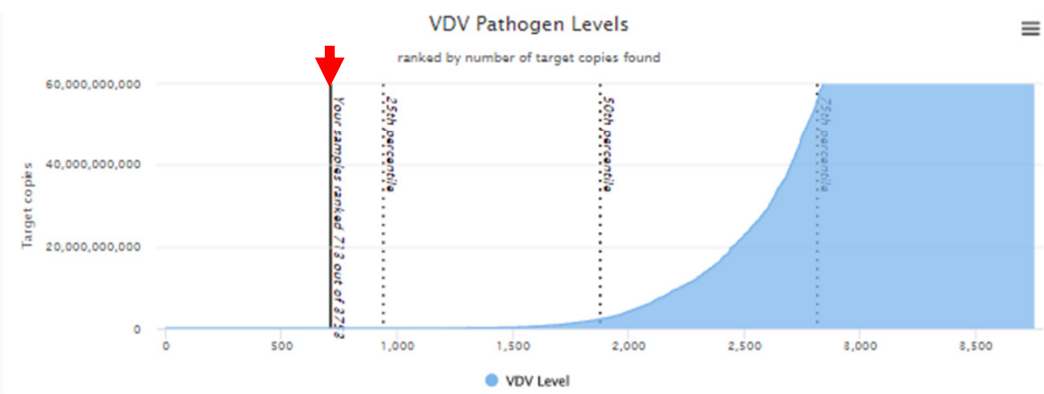

Glimpse Into The Hives

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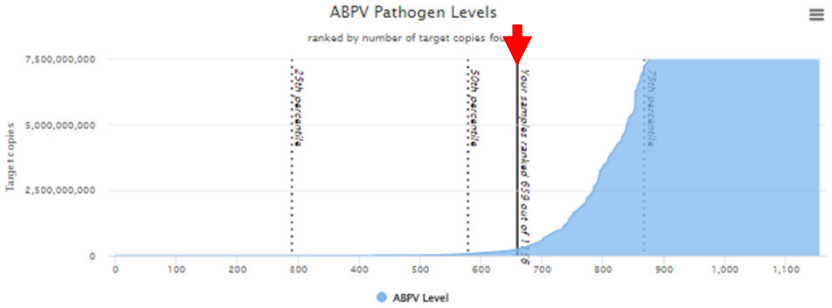
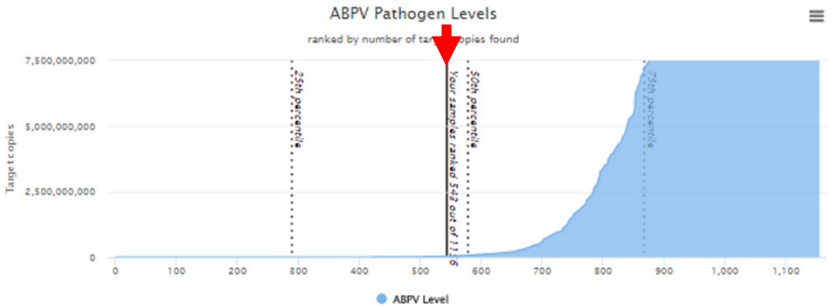
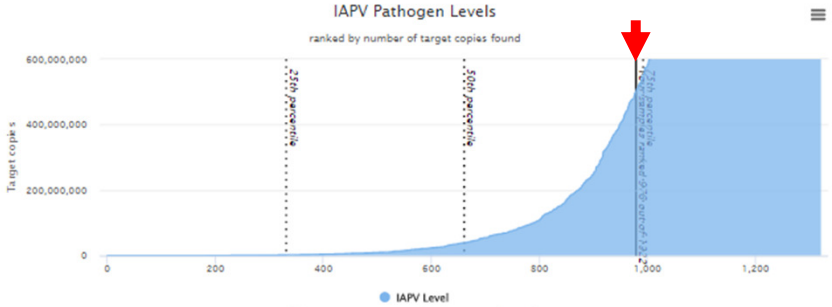
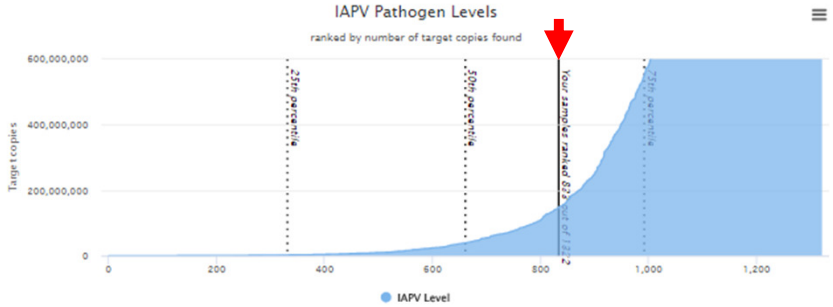
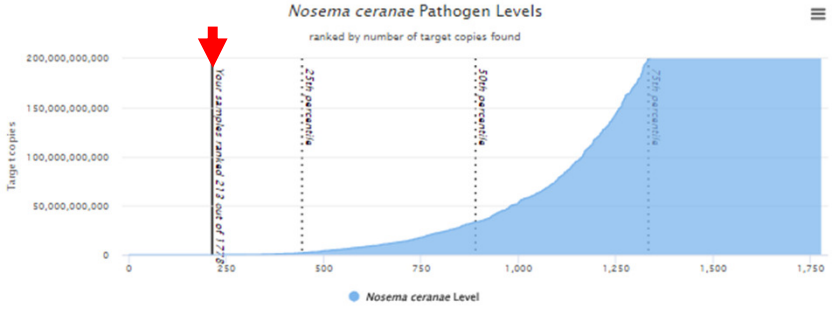










Glimpse Into The Hives

USDA APHIS National Honey Bee Survey – Pesticide Results from VT Beekeepers

USDA APHIS National Honey Bee Survey, Vermont pesticide Results 2016 – 2020

	2016	2017	2018	2019	2020
Pesticide Active Ingredients Detected (maximum detected concentration)	2,4-DMPF	2,4-DMPF	2,4-DMPF	2,4-DMPF	2,4-DMPF (240 ppb)
	Acetamiprid	Acetochlor	Acetochlor	Acetochlor	4-OH-Chlorothalonil
	Carbendazim (MBC)	Atrazine	Atrazine	Atrazine	Acetamiprid
	Prothioconazole	Carbaryl	Boscalid	Captan	Atrazine
	Thymol (1990 ppb)	Carbendazim	Carbendazim	Carbaryl	Boscalid
		Chlorpyrifos	Chlorothalonil	Carbendazim	Captan
		Chlorthal-dimethyl (DCPA)	Chlorpyrifos	Coumaphos	Carbaryl
		Coumaphos	Chlorthal-dimethyl	Coumaphos oxon	Chlorantraniliprole
		Coumaphos oxon	Coumaphos	Diphenylamine	Coumaphos
		Cyprodinil	Coumaphos oxon	Diuron	Coumaphos oxon
		Difenoconazole	DDE p,p'	Fenpyroximate	Cyprodinil
		Diphenylamine	DEET	Hexythiazox	Fluvalinate
		Diuron	Diphenylamine	Metolachlor	Fluxapyroxad
		Fenamidone	Diuron	Piperonyl Butoxide	Indoxacarb
		Fenpyroximate	Fenamidone	Propargite	Metolachlor
		Fluvalinate	Fenpyroximate	Thymol (4290 ppb)	Novaluron
		Hexythiazox	Flumeturon		Piperonyl Butoxide
		Indoxacarb	Fluopyram		Pyraclostrobin
		Iprodione	Fluvalinate		
		Metalaxyl	Hexythiazox		
		Metolachlor	Metolachlor		
		Penthiopyrad	Piperonyl Butoxide		
		Permethrin	Propargite		
		Piperonyl butoxide	Thymol (15200 ppb)		
		Propargite	Trifluralin		
		Tebufenozide			
		Thymol (7750 ppb)			
		Trifloxystrobin			
		Trifluralin			

Glimpse Into The Hives

Snapshot of USDA APHIS National Honey Bee Survey – 2020 Pesticide Results from 7 VT Beekeepers

USDA APHIS National Honey Bee Survey, 2020 Vermont pesticide Results (ppb)

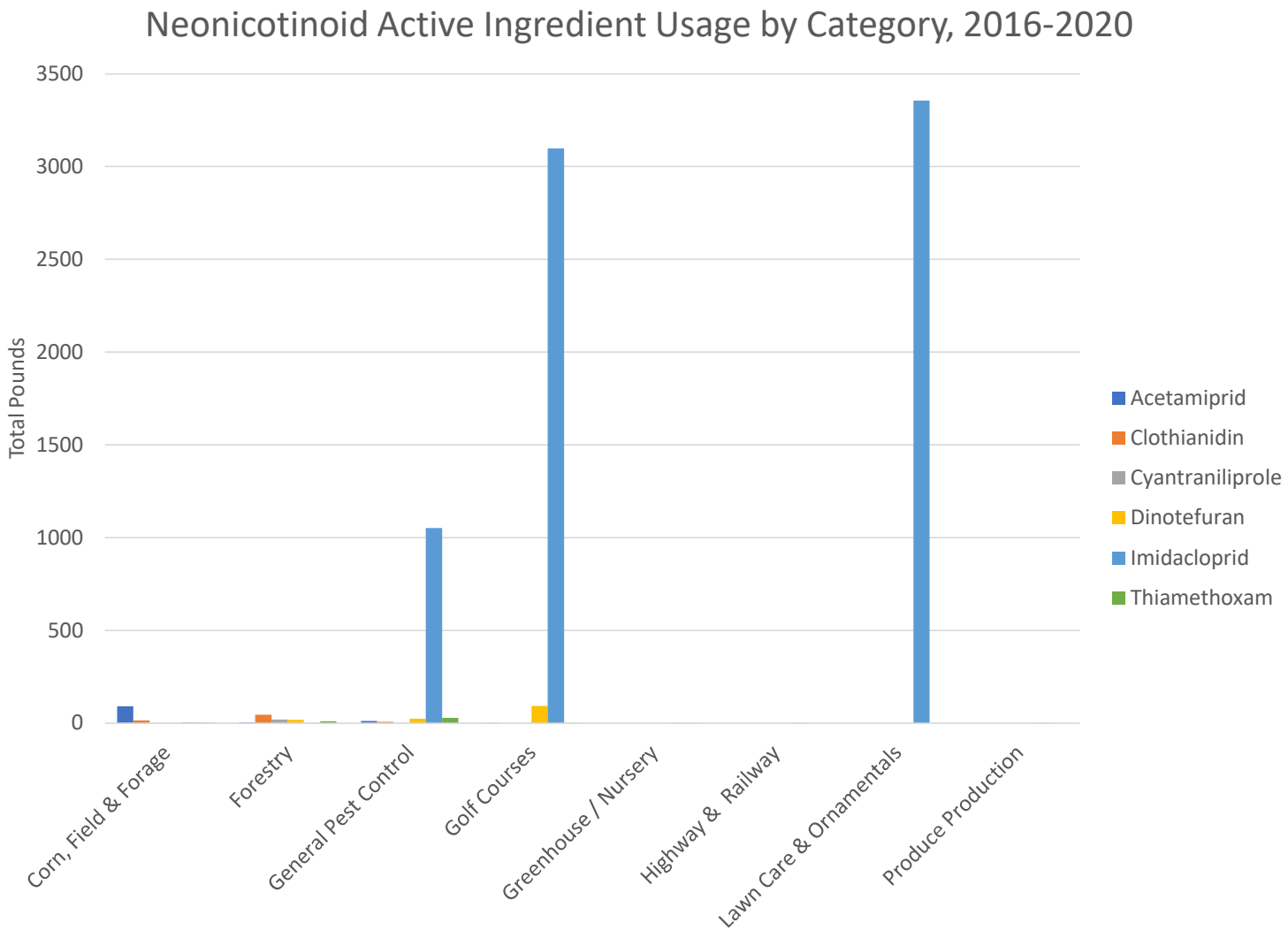
Pesticide	Beekeeper A	Beekeeper B	Beekeeper C	Beekeeper D	Beekeeper E	Beekeeper F	Beekeeper G
2,4-DMPF	29				240	199	34
4-OH-Chlorothalonil		Trace					
Atrazine	Trace	Trace					3
Boscalid				Trace			
Carbaryl		Trace			Trace		Trace
Coumaphos	Trace		21				
Coumaphos oxon			2				
Fluvalinate	Trace				81	Trace	26
Metolachlor	Trace						Trace
Novaluron		Trace					
Pyraclostrobin				Trace			

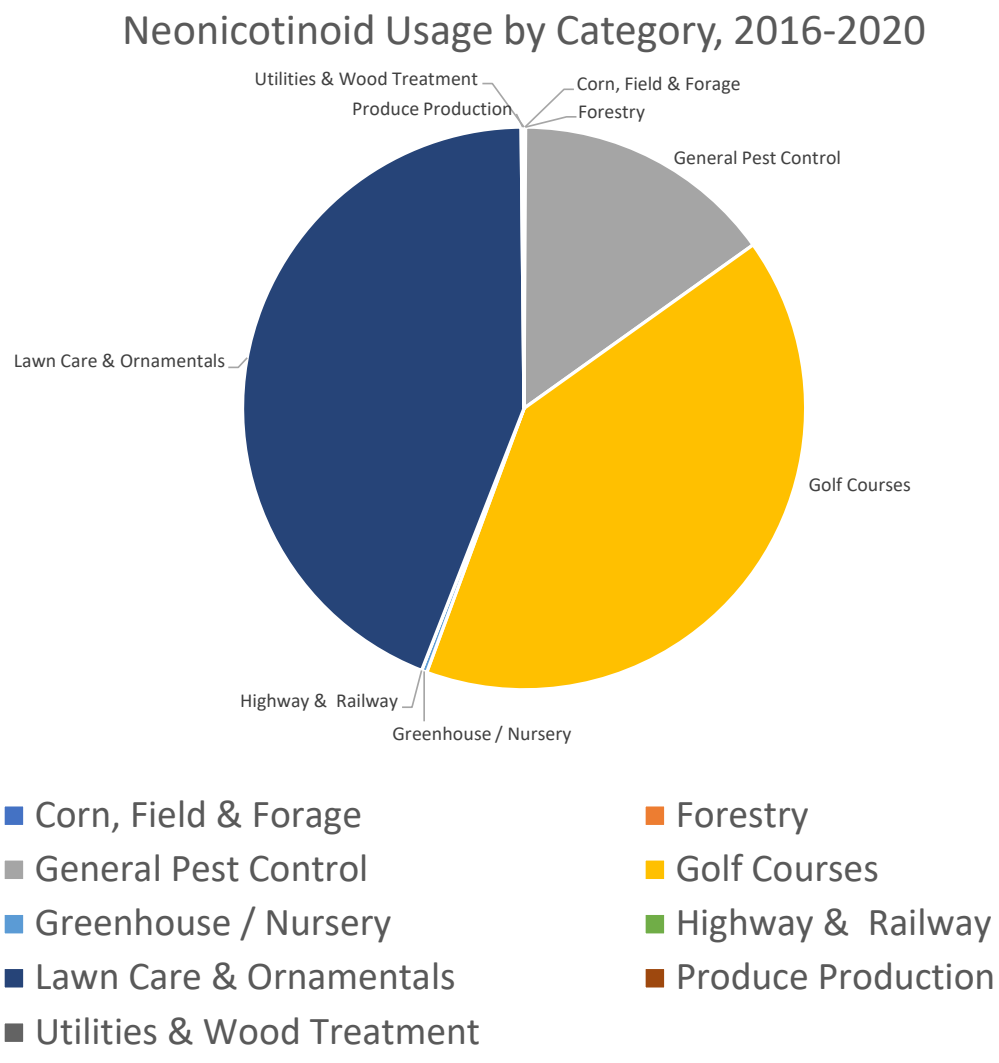
Glimpse Into The Hives Next Steps

- Cornell Review of literature finds the majority of laboratory and semi-field research demonstrate neonicotinoids can be harmful to honey bees, however the majority of field studies find only limited or no effects on honey bees
  - The impact of neonicotinoids on bumble bees is more in agreement between lab and field research studies

VT Field Observations & Next Steps

- Little to no investigations involving honey bee health impacted by neonicotinoids in the state
- Pollen monitoring for pesticides (through VAAFM) planned for Summer 2022
- National Honey Bee Survey (administered through UVM) will continue for 2022


Neonicotinoid Active Ingredient Usage by Category, 2016-2020
Total Pounds
3500
3000
2500
2000
1500
1000
500
0
Corn, Field & Forage
Forestry
General Pest Control
Golf Courses
Greenhouse / Nursery
Highway & Railway
Lawn Care & Ornamentals
Produce Production
Acetamiprid
Clothianidin
Cyantraniliprole
Dinotefuran
Imidacloprid
Thiamethoxam


Neonicotinoid Usage by Category, 2016-2020
Utilities & Wood Treatment
Produce Production
Corn, Field & Forage
Forestry
General Pest Control
Lawn Care & Ornamentals
Golf Courses
Highway & Railway
Greenhouse / Nursery
Corn, Field & Forage
Forestry
General Pest Control
Golf Courses
Greenhouse / Nursery
Highway & Railway
Lawn Care & Ornamentals
Produce Production
Utilities & Wood Treatment