April 7, 2020

Dear US Environmental Protection Agency,

Current research and interactions with the farming community on the topic of systemic insecticides like neonicotinoids have led to the clear conclusion that ***neonicotinoids hurt farmers and society far more than they help us***. There are three central drivers of this conclusion. First, neonicotinoids inflict cost but seldom provide any benefits to farmers in most farming systems. Second, regenerative food systems are more competitive and superior in managing pests profitably. And finally, neonicotinoid contamination prohibits farmers from experiencing pest management benefits of agroecological approaches. For these reasons, these chemicals are hurting society, and EPA's restrictions on neonicotinoids should accompany a massive education program into non-chemical alternatives to these toxins.

Most farm systems show no benefit of neonicotinoids relative to untreated fields. There really is no debate on this topic: in most cropping systems, insecticidal seed treatments provide no benefits to farmers, and this is supported by a litany of scientific studies. When applied as seed treatments (the primary mode of application for neonicotinoids), these products seldom improve yields (*1-8*), and often they do not reduce pest populations (*1-3, 9*) on the majority of acres on which they are used in the United States. This is true for soybeans, sunflowers, corn, barley, and oats throughout much of their production range. Farmers are charged for a product that does not help them. Indeed, neonicotinoids can reduce yields by reducing pollination and enhancing pest abundance in some of these cropping systems (*10-12*), leaving farmers worse that when they began. Nevertheless, in many crops, farmers have little option but to buy seed with them, and pay the associated costs. Neonicotinoids thus represent a drain on the profitability of farming on most acres in the U.S. and a substantial risk to society.

Regenerative food systems are superior to neonicotinoid use. For those few food systems where neonicotinoids have perceived benefits for farmers, agroecological approaches are more effective based on profitability and promotion of natural resources. Farmers around the world are upending the notion that pests are inevitable, and that pesticides are an effective management tool (*3, 13*). Regenerative agriculture—which has roots in conservation agriculture and adaptive management (*14-17*)—relies on four central principles to achieve pest-free crops and livestock. These are: 1) eliminate tillage, 2) never leave bare soil (always have living roots on the ground), 3) some plant diversity is better than none, and more is better than less, and 4) integration of plants and animals on farms. These four underlying principles are achieved through myriad practices that are adapted to the local or regional environment to attain a functioning farm system. Regenerative is organic, but organic isn't necessarily regenerative. The end result is that by focusing on soil health and promoting biodiversity on farms, regenerative farms produce healthy food profitably.

The effect of regenerative principles on pest populations are well founded in ecology. Pest outbreaks are caused by monoculture cropping conditions, and by removing diversity and network connectivity from an agroecosystem (*14, 18*). Regenerative principles fundamentally restore diversity and reduce disturbance to an agroecosystem within a functioning farm operation. Soil disturbance (e.g., tillage) removes life from the soil, and disrupts the balance among organisms that remain in the soil,

Ecdysis Foundation
46958 188th Street
Estelline, South Dakota, 57234
www.ecdysis.bio
Jonathan.Lundgren@ecdysis.bio
Ph: 605-695-9878

reducing their ability to function (*19-21*). These functions of soil life that are related to pest management include making the crop able to resist pest pressure (e.g., increasing the immune function of the plant and the vigor of the resulting crop plant), and increasing the biotic resistance to pest proliferation (e.g., entomopathogens, predators, parasitoids, and competitors). Plant cover and a healthy rhizosphere are essential to maintaining life in the soil year-round (*22-25*). Most pests are early successional organisms and take advantage of stressed crops grown in monocultures that are devoid of biotic resistance to the pest (*26*). Practices that eliminate life give a platform for continual pest resurgence. The diversity of most other organisms is directly tied to plant diversity, abundance, and biomass within a habitat (*27, 28*). Thus, practices that encourage plant diversity on a farm provide clear benefits to pest management (*29-32*). Animals (livestock) are essential to a healthy biological community on the land, especially a healthy plant community (*33*). Their dung recycles nutrients and feeds the next generation of plants (*34*). Livestock, through stimulation of plant growth, direct consumption of plants, and trampling action, are an effective management tool for many pests when crop plants are directly grazed. In the end, pest management is not the prime motivation for these principles; producers are enacting regenerative systems because it makes them more resilient and profitable.

Neonicotinoids reduce or remove alternative approaches for farmers. There is strong evidence that the pest management benefits of regenerative principles are reduced by neonicotinoids. The EPA regulated Bt crops because inappropriate use of the transgene would result in Bt-resistance that eliminates the utility of other forms of Bt for other sectors of the agricultural community. Because they are widespread, systemic in nature, and highly toxic, neonicotinoids are eliminating the ability of farmers to use conservation approaches to fight pests. Thus, farmers that don't want to use neonicotinoids become ensnared in depending on these chemicals.

Regenerative farms have higher yield and profit because natural enemies effectively reduce pest pressure on the crop; pollinators increase yields that overcome crop damage, and strong insect communities effectively suppress pests in unpredictable ways. Natural enemies (*1, 2*), pollinators (*1, 5*), and insect community diversity (*35, 36*) are frequently reduced by neonicotinoid seed treatments in cropland. Soil communities in particular (Principle 1: stop tillage to improve soil life) are adversely affected by neonicotinoids (*10, 37, 38*). Furthermore, efforts to increase beneficial insects in cropland through promoting plant diversity (Principles 2 & 3; always have living roots on the ground and increase plant diversity on farms) are also counteracted by neonicotinoids. For example, wildflower plantings designed to promote pollinators, predators, and other beneficial insects are typically contaminated with neonicotinoids (*39-41*). This was true even in flowering conservation strips deployed on organic farms, and honey bee nutritional status declined as the toxin found in their bee bread increased. Similarly, when farmers attempt to interseed cover crops in between their corn rows to increase insect diversity, these untreated plants become contaminated with neonicotinoid seed treatments present in the soil (*42*). Finally, mammals are adversely affected by neonicotinoids (Principle 4: integrate livestock and crops), and thus neonicotinoid contamination of forage can harm livestock designed to promote pest management in cropland. The quantity of imidacloprid found in the spleens of white-tailed deer was correlated with reduced fawn survival, weight, hormone levels, and increased morphological abnormalities (*43*).

Ecdysis Foundation
46958 188th Street
Estelline, South Dakota, 57234
www.ecdysis.bio
Jonathan.Lundgren@ecdysis.bio
Ph: 605-695-9878

Give the years of experience in this system, it is clear that the benefits of systemic insecticides like neonicotinoids do not outweigh the risks of this technology. Neonicotinoids seldom help farmers, but by contaminating regenerative food systems, reduce alternative tools needed by progressive farmers. Farmers are being charged- often unknowingly or without alternatives- for using a technology that hurts the life on their farm and fails to provide any benefit. This is bad for farmers, and the EPA has an obligation to protect the nation's pollinators and environment from this unnecessary cost.

Sincerely,

Dr. Jonathan Lundgren, PhD
Director, Ecdysis Foundation
46958 188th Street
Estelline, SD, 57234
www.ecdysis.bio
jonathan.lundgren@ecdysis.bio

American Honey Producers Association
PO Box 435
Mendon, UT 84325
281-900-9740
www.ahpanet.com

American Beekeeping Federation
Molly Sausaman
Executive Director
500 Discovery Parkway, Suite 125

Superior, CO 80027
Phone: 720-616-4145
Email: msausaman@abfnet.org
Web: www.abfnet.org

Colorado State Beekeepers Association
Ed Colby, CSBA President
6765 County Road 214
New Castle, CO 81647
president@coloradobeekeepers.org
970-984-0419

Georgia Beekeepers Association
President Linda Tillman
gabeepresident@gmail.com
1210 Box Springs Road
Box Springs, GA
404-447-1943

Minnesota Hobby Beekeepers Association
Susan Bornstein MHBA President
president@mnbeekeepers.com
11 Lost Rock Lane
St. Paul, MN 55127
651-481-8012

Pollinate Minnesota
Erin Rupp
erin@pollinatemn.org, 612.245.6384
512 2nd Street NE, Mpls, MN 55413

Zen Honeycutt, Founding Executive Director
Mission Viejo, CA. 92691
M. 949-307-6695

Jeff Dinsmore
Humming for Bees
jeff@hummingforbees.org
612-720-9084

Jennifer Kraft Leavey, Ph.D.
Principal Academic Professional
Georgia Tech College of Sciences
404-385-7229 jennifer.leavey@cos.gatech.edu

Metro Atlanta Beekeepers Association
President Gail Dean
president@metroatlantabeekeepers.org
770-444-2335
562 Rue Montaigne
Stone Mountain, GA 30083

Tri-state Beekeepers Association, Trenton, GA
Eddie Gwaltney, President
407 Moore Road
Lookout Mountain, GA 30750
423-298-7557

Atlanta Natural Beekeeping Meetup
Julia Mahood and Linda Tillman, Founders
4790 Huntley Drive
Atlanta, GA 30342
678-448-2576

The Good Acre
Rhys Williams
Executive Director
612-889-1544
rhys@thegoodacre.org
www.thegoodacre.org

Bird and the Bees Honey, LLC
James Cook
Owner

Monson's Kabekona Bay Hives
Margot Monson, MS Entomology
mpmonson.insx@gmail.com
22 Ludlow Avenue
St. Paul, MN 55108
651-247-5253

Lori D. Cox, Owner/Operator
Roots Return Heritage Farm, LLC
14525 County Road 40 Carver, MN 55315
425-241-2515

Muskrat Farm
Keith Chrysler & Laurie Schneider, farmers and beekeepers
9503 Norell Avenue
Stillwater, MN 55082

Tara Beekeepers Association
752 Main Street, Forest Park, GA 30297
https://www.tarabeekeepers.org/
tarabeekeepers@gmail.com
404-369-3809

California Minnesota Honey Farms
Jeff Anderson
721 Wells Street
Eagle Bend MN 56446

Honey Pond Farm
Jennifer Berry
747 Madison St.
Comer, GA
30629
jennifer@honeypondfarm.com

MtnHoney
Virginia Webb

349 Gastley Road
Clarkesville, GA 30523
706-754-7062

Niwot Honey Farm
P.O. Box 33, Niwot, Colorado 80544
Niwot, Colorado
Tom Theobald Beekeeper/Owner

Tri-County Beekeepers
Bobby Chaisson
President
4664 Highway 51 South
Lula, Georgia 30554

Adee Honey Farms
515 Jay Street
Bruce, SD 57220
605-627-5621

Ecdysis Foundation
46958 188th Street
Estelline, South Dakota, 57234
www.ecdysis.bio
Jonathan.Lundgren@ecdysis.bio
Ph: 605-695-9878

Bee Squared Apiaries
1617 White Water Ct.
Berthoud, CO 80513
beth@bethsbees.com
http://bethsbees.com

Bird and the Bees Honey, LLC
N9453 Pleasant Hill Rd.
Iola, WI 54945
birdandthebeeshoney@gmail.com
James Cook

Cox Honey of Utah
Darren Cox
PO Box 435
Menden, Utah 84323

Hackenberg Apiaries
Lewisburg, Pennsylvania
570-568-2337
hackenberghoney@gmail.com
https://hackenbergapiaries.us/

Wilson's Honey
6626 Stitt Rd, Altamont, NY 12009
stephenwilson282@gmail.com

Eastern Piedmont Beekeepers Association
431 Hale Ln
Athens GA 30607
Dan Long, President

Mac's Backyard Bees
Bob McDonell
350 Sherwood Drive
Carol Stream, IL 60188
beekeeperbob@gmail.com
630-940-7655

James Doan
PO Box 25
West Clarksville, NY
14786

References

1. Bredeson & Lundgren. *Crop Protection* **106**, 86 (2018).
2. Seagraves & Lundgren. *Journal of Pest Science* **85**, 125 (2012).
3. LaCanne & Lundgren. *PeerJ* **6**, e4428 (2018).
4. Douglas & Tooker. *Environmental Science & Technology* **49**, 5088 (2015).
5. Krupke *et al*. *Journal of Applied Ecology* **54**, 1449 (2017).
6. Mourtzinis *et al. Scientific Reports* **9**, 11207 (2019).
7. Milosavljevic *et al*. *Crop Protection* **119**, 166 (2019).
8. Alford & Krupke. *Journal of Economic Entomology* **111**, 689 (2018).
9. Labrie *et al. PLoS ONE* **15**, e0229136 (2020).
10. Douglas *et al. Journal of Applied Ecology* **52**, 250 (2015).
11. Hokkanen *et al. Arthropod-Plant Interactions* **11**, 449 (2017).

12. Wulff *et al. International Journal of Molecular Sciences* **20**, 783 (2019).
13. Pecenka & Lundgren *Basic and Applied Ecology* **40**, 19 (2019).
14. Altieri. *Agriculture, Ecosystems and Environment* **74**, 19 (1999).
15. Stinner & House. *Annual Review of Entomology* **35**, 299 (1990).
16. Birgé *et al*. *Journal of Environmental Management* **183**, 343 (2016).
17. Lin. *BioScience* **61**, 183 (2011).
18. Lundgren & Fausti. *Science Advances* **1**, e1500558 (2015).
19. Rowen *et al*. *Agriculture, Ecosystems and Environment*, in press (2020).
20. Hendrix *et al. BioScience* **36**, 374 (1986).
21. Briones & Schmidt. *Global Change Biology* **23**, 4396 (2017).
22. Tillman *et al. Journal of Economic Entomology* **97**, 1217 (2004).
23. Philippot *et al. Nature Reviews Microbiology* **11**, 789 (2013).
24. Damien *et al. Agriculture Ecosystems and Environment* **247**, 418 (2017).
25. Lundgren & Fergen. *Applied Soil Ecology* **51**, 9 (2011).
26. Wiedenmann & Smith. *Biological Control* **10**, 16 (1997).
27. Zak *et al*. *Ecology* **84**, 2042 (2003).
28. Salazar *et al*. *Oecologia* **181**, 1199 (2016).
29. Letourneau *et al. Ecological Applications* **21**, 9 (2011).
30. Bianchi *et al. Proceedings of the Royal Society B* **273**, 1715 (2006).
31. Barbosa *et al. Annual Review of Ecology, Evolution & Systematics* **40**, 1 (2009).
32. Ebeling *et al. Basic and Applied Ecology* **26**, 50 (2018).
33. Teague *et al. Agriculture, Ecosystems and Environment* **141**, 310 (2011).
34. Fincher. *Journal of the Georgia Entomological Society* **16**, 301 (1981).
35. Sanchez-Bayo & Wyckhuys. *Biological Conservation* **232**, 8 (2019).
36. Cavallaro *et al. Chemosphere* **226**, 945 (2019).
37. de Lima e Silva *et al*. *Environmental Toxicology and Chemistry* **39**, 548 (2020).
38. Pisa *et al. Environmental Science and Pollution Research* **22**, 68 (2015).
39. Mogren & Lundgren. *Scientific Reports* **6**, 29608 (2016).
40. Botias *et al. Environmental Science & Technology* **49**, 12731 (2015).
41. David *et al. Environment International* **88**, 169 (2016).
42. Bredeson & Lundgren. *Ecotoxicology* **28**, 222 (2019).
43. Hughes-Berheim *et al. Scientific Reports* **9**, 4534 (2019).

Ecdysis Foundation
46958 188th Street
Estelline, South Dakota, 57234
www.ecdysis.bio
Jonathan.Lundgren@ecdysis.bio
Ph: 605-695-9878