ORGANIC TRANSITION and NONTOXIC PRACTICES

SOIL MANAGEMENT | JANUARY 23, 2023

EPA, USDA, and Interior Challenged To Incorporate in All Decisions Impact on Climate Crisis, from Soil to Pesticides

There is no doubt that the climate crisis is being experienced worldwide. And the consequences are undeniably grave. Beyond Pesticides advocates incorporating scientific understanding of the grave health and environmental effects into the deliberations on all policy decisions regarding petrochemical pesticide registrations and synthetic fertilizer use in agriculture and nonagricultural land management. Of critical importance, in this context, is the effect of policy decisions on soil health—in particular, soil organic carbon, which sequesters atmospheric carbon and reduces its damaging atmospheric effects.

The broad perspective embodied in President Biden's Executive Memorandum (EM) *Modernizing Regulatory Review* issued on his first day in office, creates a mandate across all federal agencies for future-oriented public health and safety protections. As well as environmental stewardship, more protections are urgently needed to abate the climate crisis. A separate executive order, *Tackling the Climate Crisis at Home and Abroad*, states, "The United States will also move quickly to build resilience, both at home and abroad, against the impacts of climate change that are already manifest and will continue to intensify according to current trajectories."

A comprehensive resiliency policy requires EPA to cease allowing the continued degradation of soil and ecosystems that are so critical to abating the climate crisis when alternatives are available and could be promoted. Missing from EPA's registration program are the steps necessary to reduce and eliminate the contribution of petrochemical pesticides and fertilizers to the climate, recognizing the viability of the $63 billion organic industry that is growing, despite EPA's continuing commitment to the status-quo allowance of chemicals unnecessary to achieve agricultural productivity and land management goals. EPA's failure in this regard constitutes a public health threat, a reneging of the agency's responsibility to environmental stewardship, and a missed opportunity and mandate to ensure a livable future.

A key missing element of EPA's review is the impact of pesticide registration decisions on soil health—in particular, soil organic carbon, which sequesters atmospheric carbon away from damaging atmospheric effects. Although the soil is commonly recognized as a sink for atmospheric carbon, there is a false narrative that says carbon can be sequestered in the soil through chemical-intensive no-till agriculture. Now the Rodale Institute's 40-Year Report on their *Farming Systems Trial* should end the myth of the toxic, petrochemical-based, GMO-herbicide, no-till systems. Rodale's scientific trials clearly show that these degenerative no-till systems are inferior to Regenerative Organic Agriculture on every key criterion.

The highest yields of corn in the tilled organic manure system and the best increases in soil organic carbon were produced with an organic manure system and limited tillage (tilled every other year). Of importance to climate resilience, organic corn yields have been 31 percent higher than chemical-intensive/industrial farming systems in drought years.

The trials show that herbicide no-till systems do not produce higher levels of soil organic carbon (SOC) than tillage systems. This result is consistent with reviews of 194 studies comparing no-till and tilled fields.

According to André Leu, international director at Regeneration International, "The main reason for the loss of soil carbon in farming systems is not tillage; it is synthetic nitrogen fertilizers. Research shows that there is a direct link between the application of synthetic nitrogenous fertilizers and a decline in soil carbon." In addition, those same nitrogenous fertilizers act as potent greenhouse gases when volatilized to the atmosphere.

Thus, chemical-intensive agriculture and nonagricultural land management contribute to climate change in multiple ways. If we are to be serious about combating climate change and mitigating its impacts, all agencies must consider climate impacts when making decisions. This means that the U.S. Environmental Protection Agency (EPA) must not approve registrations of pesticides that harm the soil or facilitate agricultural practices that interfere with carbon sequestration. It means that the U.S. Department of Agriculture (USDA), in a much more aggressive way, must lead the transition to organic agriculture as a replacement for chemical-intensive practices and should cease all support for chemical-intensive agriculture immediately. It means that the Department of Interior (DOI) must manage all public lands with organic practices that ensure soil health and all that means for a livable future.

SOURCE: Rodale Institute, *Farming Systems Trial: 40-Year Report*, 2022.

AGRICULTURE | FEBRUARY 24, 2023

Perennial Crops Identified as Tools To Fight Biodiversity Collapse

Among the solutions to the dire state of global biodiversity is, *Civil Eats* reports, perennial agriculture, which improves biodiversity both on- and off-farm. Increased adoption of perennial cropping provides critical on-farm habitat for many kinds of pollinators, insects, birds, and myriad additional creatures. Below ground, where plant roots remain active year-round, perennials create far-richer ecosystems for microbial communities and fungal networks. Planting annual crops—and often, the same ones year after year across huge swaths of acreage, as conventional agriculture generally does—leads to multiple bad outcomes: intensive synthetic pesticide and fertilizer use and the harms that flow from them; poor soils; erosion; inefficient holding and use of water; depleted carbon capacity; and a denuded above-soil landscape and diminished microbial, fungal, and nutrient environment

below. Thus, perennial cropping boosts on-farm biodiversity as noted, and benefits off-farm biodiversity by reducing the unsavory impacts, on the broader environment, of traditional, chemically intensive, monoculture farming.

Biodiversity loss has emerged in the past decade as yet another crisis humanity faces—one that continues to go unaddressed at the level the loss requires. Beyond Pesticides has written extensively about the crisis and the central solution of ending the use of toxic, synthetic pesticides as soon as possible, and certainly within the next decade. Doing so would eliminate one of the chief contributors to the diminution of biodiverse populations, and of pollinators, in particular.

Speaking to the capacity of perennials to impact species, a chief scientist at the Kansas-based The Land Institute (TLI)—which has conducted extensive and foundational work on perennial agriculture—Tim Crews, PhD cuts to the chase: "A vegetated landscape is going to accommodate species that a tilled, denuded landscape as far as the eye can see does not. There are going to be a lot of species that take advantage of it."

The Land Institute website notes, "Many fruit, forage, and some vegetable crops, including fruit trees, alfalfa, grapes, asparagus, and olive trees, are perennials that have been grown for thousands of years. The Land Institute is working to add perennial grains, legumes, and oilseed crops to the list." Among the perennial crops the institute is investigating and promoting are: Kernza®, a wheatgrass whose seeds provide grain, and whose foliage, post-harvest, can be forage for livestock.

Research in 2022 in *Frontiers in Plant Science* concludes that, "Perennial grain crops could make a valuable addition to sustainable agriculture, potentially even as an alternative to their annual counterparts. . . . Presently, perennial grain crops are not grown at large scale, mainly due to their early stages of domestication and current low yields." Yet TLI has made significant headway, especially with Kernza, which has successfully moved into small, niche markets as a viable grain crop. The TLI researchers note that the roots of this plant can extend as much as 10 feet into the soil, "delivering atmospheric carbon to the soil and efficiently taking up nutrients and water." They also say that its slender, long seed heads can, under good growing conditions, actually contain more seeds than a typical annual wheat head. The researchers are working, with each breeding cycle, to increase Kernza's seed size, which achievement would enhance its marketability.

Agricultural perennials can include orchards (fruit and nut trees), row crops, agroforestry, and integrated pasture lands (silvopasture). In addition to the biodiversity benefits, perennials yield multiple soil, food security, and climate benefits. For the agricultural producer, they also, compared with annual crops:

- Do not have to be reseeded or replanted every year.
- Do not require annual plowing/tilling.
- Do not need pesticides to help get them established.
- Protect soil from erosion.
- Improve soil structure.
- Increase ecosystem nutrient retention, carbon sequestration, and water infiltration.
- Reduce farmers' costs via lowered need for pricey inputs (e.g., synthetic fertilizers and pesticides, and laborious tilling and planting.

The Land Institute website asserts that increased use of perennials "stands to catalyze a rich culture around food production and supply chain development. Research is emerging to understand the social and economic strategies needed to support these new agricultural systems. . . . Given that grains make up over 70% of our global caloric consumption and over 70% of our global croplands, transitioning from an extractive annual model to a perennial model is the best chance we have to create a truly regenerative food future."

A primary ethos in perennial agriculture is learning from Nature and using approaches that mimic or reproduce what works in the natural world. For instance, "monocrops" are not generally found growing naturally; rather, diverse plant species grow together and in relationship. (The dominant use of monocropping in conventional agriculture, in fact, contributes to pollinator decline and biodiversity loss.) TLI conducts ecological intensification research that seeks to find optimal combinations of perennial species—polycultures that mimic the benefits found in native and natural ecosystems.

A chief TLI scientist, Ebony Murrell, PhD explains: "The idea with perennial crops is that you want them to stay in the ground for many years, which means you're not rotating anymore. So how do you take that diversity in time and move it to diversity in space?" One important answer: planting together different perennial plant crops that will benefit one another. Examples of such a strategy might include:

- Planting silflower (a perennial sunflower) with a perennial groundcover as a natural weed barrier.
- Alternating rows or areas of Kernza and alfalfa; the alfalfa provides nitrogen, and prevents Kernza from clumping together, which can result in lowered production; without its companion, Kernza will tend to produce less after a few years.
- Supporting pollinators by growing together two flowering species that bloom at slightly different times.
- Incorporating into a farm system trees or shrubs that generate fruits and/or nuts, edible leaves, and/or mushrooms that help support growth of other species.

Polycultures have a lot to offer re: restoring biodiversity. The title of 2022 research published in *Environmental Entomology* reveals its conclusions: "Native Flowering Border Crops Attract High Pollinator Abundance and Diversity, Providing Growers the Opportunity to Enhance Pollination Services." The research finds that non-crop plantings, as borders, hedgerows, buffer strips, or crop strips, diversify landscapes and offer more habitat in heavy production areas. The research finds that such plantings, with various combinations of natives—silflower, cup plant, sanfoin (a forage legume), Kernza, white alfalfa,

and a mix of "prairie" species (including liatris, helianthus, mints, native grasses, and asters)—yielded "a significant, positive relationship between pollinator abundance and floral resource amount and bloom duration."

The title of another bit of research from 2022, published in *Ecosphere*, is similarly revealing of its findings: "Woody Perennial Polycultures in the U.S. Midwest Enhance Biodiversity and Ecosystem Functions." The paper points to the potential, saying, "Concepts from ecology and complex adaptive systems suggest that persistent structural heterogeneity and functional diversity are key for supporting biodiversity, ecosystem services, and resilience, but these concepts have not been extensively applied in agriculture, which is still dominated by annual monocropping systems. Perennial agriculture seems to embody these ecological concepts."

The paper continues, "We found that perennial fields had (1) more diverse soil fungal, invertebrate, plant, and bird communities . . .; (2) less compacted soil; (3) denser ground cover; (4) more active carbon, organic carbon, and nitrogen and the same available phosphorus in the top layer of soil; and (5) more species of predatory, detritivorous, and herbivorous insects, and approximately fourfold higher abundance of herbivorous insects. . . . [T]hese findings indicate that woody perennial polyculture fields in the U.S. Midwest are characterized by higher biodiversity and ecosystem functions than adjacent conventional fields."

Research published early in 2023 in Frontiers in *Sustainable Food Systems* emphasizes not only the many benefits of perennial agriculture, but also, the need for changes in federal policy and "a range of support structures. Federal policymakers should support perennial agriculture by establishing safety nets like those available for annual crops, centering perennial practices in cost-sharing conservation programs, facilitating market opportunities, and investing in perennial agriculture research and development."

There has been some increasing governmental support to advance aspects of the perennial agriculture movement. In 2020, the U.S. Department of Agriculture (USDA) awarded "$10 million to a coalition of farmers, scientists, educators, policymakers, and food industry players to help scale up Kernza production. The five-year Kernza CAP initiative, spearheaded by The Land Institute and the University of Minnesota, recently released its year-two annual report." *Civil Eats* identifies the Savanna Institute as a nonprofit that works on advancing agroforestry and perennial agriculture in the Midwest. The organization will use some of the $60 million allocated by USDA in 2022 to ramp up its work to "catalyze the development and adoption of resilient, scalable agroforestry."

To the argument for the transition off of synthetic chemical inputs should be added those for the transformation of what and how farmers grow. The biodiversity benefits of using more perennial crops, as noted above, are one part of the story, but expanding the profoundly narrow range of food crop varieties currently grown is another biodiversity issue. The International Development Research Centre (IDRC) asserts that most agriculture across the world is focused on a very small number of varieties designed for intensive production. Indeed, IDRC notes that the food supply depends on roughly 150 plant species. Of those, a mere 12 provide three-fourths of the world's food, and more than half of the world's caloric food energy comes from rice, wheat, and maize. This reduced diversity, coupled with increased industrialization, leads to dramatically reduced genetic diversity, a.k.a. genetic erosion, which can spell trouble for the future of successful and sustainable food production.

In the 2022 research paper *Perennials as Future Grain Crops: Opportunities and Challenges*, researchers highlight some of the risks of our current agricultural *modus operandi*. "For millennia, the repeated selection and breeding of plants has led to the development of multiple, high-yielding annual grain crops finely tuned for growth under specific environmental regimes. In the twentieth century, cropping systems were developed that took advantage of readily available resources and agrichemical development, with the focus primarily on grain yield. However, considering the current range of complex challenges that agriculture faces, including climate change, pandemics, [biodiversity loss], and war, the focus must now be on ensuring food security in a more environmentally friendly and socially robust way. Continued climate change is rendering our existing cultivars increasingly vulnerable to stress, and ultimately unfit for many regions of the world, serving as another impetus for reinventing agriculture."

Research published in 2020 by the U.S. National Institutes of Health/National Library of Medicine reenvisions the role of perennials in a revisioned agricultural landscape, saying "Greater adoption of a wider array of perennial vegetables could help to address some of the central, interlocking issues of the 21st century: climate change, biodiversity, and nutrition. The great diversity of PVs [perennial vegetables] is a powerful tool to address the loss of crop biodiversity. As perennials, PVs sequester carbon, particularly the woody species. Many PVs are high in the key nutrients needed to remedy nutrient deficiencies that impact billions of people."

The Savanna Institute's Fred Iutzi sees, in perennial agriculture, powerful potential for solving multiple problems, including biodiversity loss. *Civil Eats* cites his conviction that, "[W]e need to think of agricultural productivity in a more holistic way that includes factors like biodiversity. 'One of the biggest challenges in front of humanity is how we get both ample food while providing a stable climate, healthy soil, clean water, and biodiversity. . . . We have to expect both from our agricultural landscapes."

SOURCES: Emma Scott, et al., Policy pathways for perennial agriculture, *Frontiers in Sustainable Food Systems*, Volume 6, 2022, https://doi.org/10.3389/fsufs.2022.983398

Christina Cooke, Perennial Crops Boost Biodiversity Both On and Off Farms. Researchers Explain How. *Civil Eats*, February 16, 2023, https://civileats.com/2023/02/16/perennial-crops-boost-biodiversity-farms-habitat-science-kernza/.

AGRICULTURE | APRIL 18, 2023

Crop Diversification with Intercropping Effective at Reducing Pest Pressures, Study Finds

Crop diversification is effective at reducing pest abundance in growing climates across the globe, according to a meta-analysis published this month in the *Journal of Applied Ecology*. The meta-analysis, which includes a review 44 field studies from six continents, provides greater weight to approaches that work with natural processes, rather than those focused on human-made chemical sprays for pest management.

Within the studies reviewed, researchers aim to understand the associational effects that result in either associational resistance (a decrease) or associational susceptibility (an increase) in insect herbivores on the primary crop being grown. Researchers reviewed a range of variables, comparing pest numbers in monocultures versus bicultures, evaluating whether the pest is a generalist or specialist, how it feeds (checking or piercing/sucking), its origin (native/non-native), as well as climate, crop type (only onions, brassicas, cotton, and cucurbits were evaluated), plot size, and the experimental design within each particular study.

In sum, the review represents one of the most comprehensive evaluations of intercropping to date. And the results confirm the benefits many farmers and gardeners across the world have found anecdotally in their own plots. "Overall, intercropping proved to be very effective against pests, but it did vary based on the pest and their feed preferences," said study coauthor Philip Hahn, PhD of University of Florida. "It also depended on crop type, with cabbage and squashes showing the strongest resistance, while resistance was less strong for onions and cotton."

Bicultures provide a significant reduction in pest pressure. But this approach is most effective in protecting crops from generalist predators. "In the studies we examined, we found intercropping was more effective for generalist pests that feed on a variety of crops," Dr. Hahn said. "Specialist pests that target one type of crop were less affected." This makes sense, as pest predators that evolved a close relationship with a crop are much less likely to be enticed to feed on a crop it did not specialize in consuming.

The effect of intercropping did appear to wane as latitudes increased, but only for certain crops and certain insect pests—specifically specialist, piercing, and native pests. "We did find a stronger benefit for pest suppression at lower latitudes—so, in tropical systems versus northern temperate systems," Dr. Hahn said. "There are lots of reasons we could have found that pattern, of course; the tropics are places where there tend to be more species of insects year-round. It was surprising that the pattern was not as strong as I would have expected."

The meta-analysis and studies previously reported on by Beyond Pesticides

show the benefits of increasing crop diversity on farms. A 2020 study finds that crop diversity in agriculture is just as important as plant diversity in non-commercial landscapes, and that less diversity leads to more pesticide use. A 2021 study finds that multi-crop farmlands produce higher biomass and seed yields than single crop monocultures. While intercropping and multi-cropping provide numerous benefits, monocropping contributes to the loss of biodiversity, including pollinator populations, according to a 2019 study.

It is incredibly important to continue research like the present study, so scientists can aid farmers in determining the best natural strategies to take as part of their production practices. But it is apparent from the data collected that one generally cannot go too wrong with such an approach. "There are a few combinations that seem to be particularly effective at reducing pest abundance," Dr. Hahn indicates. "Overall, for growers interested in organic methods, intercropping seems to be a very effective tool."

SOURCE: Philip Hahn and Joseph Cammarano, Environmental context and herbivore traits medicate the strength of association effects in a meta-analysis of crop diversity, *Journal of Applied Ecology*, 60(5)2023, pp875-885.

AGRICULTURE | JULY 12, 2023

Cultivating with Natural Predators Gets Farmers Off the Pesticide Treadmill, According to Study

A study by University of Delaware entomologist Thabu Mugala and colleagues finds that modifications to their farming methods can reduce slug damage when those changes also encourage natural slug predators, allowing farmers to avoid the endless cycle of pesticide dependency, pest resistance, genetically engineered crops, and synthetic fertilizers. With insects as the target for tens of millions of pounds of agricultural pesticide use, growers of the highest-production crops in the U.S., corn and soybeans, continue to find slugs to be a serious problem. Corn and soybean growers who have adopted no-till or conservation tillage and cover crops often think these practices worsen the problem by increasing moisture and decaying plant material in fields, which slugs love. But the cause-and-effect picture is more nuanced and requires strategies that nurture ecological balance.

Slugs are the most damaging non-arthropod pest in no-till corn production in the U.S., and truly effective chemical deterrents do not exist at agricultural scale, as Beyond Pesticides noted here, although biological methods may be on the horizon, such as a parasitic nematode already used in Europe that shows promise. The most voracious natural slug hunters are ground beetles, but harvestmen (daddy longlegs), and wolf spiders also eat them.

The Mugala study, "Ground beetles suppress slugs in corn and soybean under conservation agriculture," investigates 41 fields in Mid-Atlantic states through two growing seasons. The researchers looked at the interactions among cover cropping, tillage, preplant insecticide applications, weather, and natural enemies on slug populations and activity.

Slugs are mollusks and generalists, making use of both living and decaying plants, and cool, wet weather often triggers a slug outbreak. Farmers dealing with slugs know that tillage disrupts the soil microclimates that slugs like, and are tempted to use it, especially because, once started, a slug outbreak is difficult to suppress by chemical means. The available chemicals are expensive, do not work well in damp environments, and kill wildlife, according to Mugala et al., who also observe that while "there is no commercially available biological control agent for slugs in North America, there is an array of native and exotic predatory and parasitic natural enemies of slugs present." Many of the pesticides used against insects, including neonicotinoid seed treatments, also kill these other beneficial arthropods, as well as other soil invertebrates important to cycling nutrients naturally.

Some slug baits are also problematic. Many contain metaldehyde, which as Beyond Pesticides reported in March, hampers the growth of vegetables and is quite toxic to many animals. Other anti-slug weapons may be difficult to use on field scales, such as bread-dough or beer bait. One Lithuanian study found that invasive Spanish slugs would not eat a lethal dose of either metaldehyde or iron phosphate pellets, and about 17 percent of the pellets were removed nightly from the study area by earthworms.

Less toxic regenerative methods may help to manage slugs, but they have the added advantage of helping their predators, and some tweaks to tillage and cover cropping may discourage slugs while encouraging their enemies. Mugala et al. report that the timing of cover crop removal affects slugs' depredations—doing it too soon before planting gives slugs a leg up, so to speak. While a 2022 study of chemical-intensive corn production found reduced need for slug bait with the use of row cleaners to remove plant debris in seed rows and the application of nitrogen fertilizers at night, this approach ignores the value of natural predators and ecosystem services (see more).

The pesticide industry has long tried to monkey-wrench agricultural independence; Monsanto introduced Roundup-Ready soybeans in 1996 and claimed genetically modified seeds would enable sustainable (and now regenerative) agriculture by eliminating the need for tillage. Unfortunately (but inevitably) the target weeds became resistant to Roundup, and many farmers returned to tillage and even stronger chemicals.

Adding to the uncertainty about the best way to deal with slugs, some of the research data can appear contradictory; a 2013 survey of Shenandoah Valley farmers found that 13 percent of no-till fields planted with corn and soybeans showed slug damage, while only one percent was reported for conventionally-farmed fields. But another study found that farmers who always used insecticide at planting report the most slug damage, independent of their tilling practices. This may be because their arthropod predators suffer sharp declines in fields applied with pesticides and where seeds have been treated with neonicotinoids. Farmers may be blaming regenerative methods for damage that is actually caused by pesticides.

The pesticide industry has long tried to monkey-wrench agricultural independence; Monsanto introduced Roundup-Ready soybeans in 1996 and claimed genetically modified seeds would enable sustainable (and now regenerative) agriculture by eliminating the need for tillage. Unfortunately (but inevitably) the target weeds became resistant to Roundup, and many farmers returned to tillage and even stronger chemicals. The first insect resistance to a pesticide (sulfur-lime) was noted in 1914. With each iteration of this Darwinian process, the industry's response is to develop a variant of the failed pesticide rather than developing ecologically-based pest management and abandoning chemical-intensive agricultural practices that ignore the ecosystem in which they operate.

Where once the industry touted the Green Revolution and the utter dependence of agriculture on its products to feed the world, now it is trying to convince people that it is on the sustainability bandwagon, all the while continuing to market its non-regenerative products. In Syngenta's words, "Although the green revolution has been successful in feeding a rapidly growing human population, it has also depleted the Earth's soil and its biodiversity and contributed to climate change. These extractive practices are not sustainable. We must move quickly to transform agriculture by employing a suite of practices known as regenerative agriculture." The company manufactures the herbicide atrazine, a notorious endocrine disrupter.

Even as it claims progressive goals, the industry also continues its old-school scaremongering. CropLife America, the agricultural chemical industry's powerful lobby group, claims that "Without pesticides, farmers would need twice as much land to grow the same amount of food due to reduced yields." This is not true. Many farmers have reduced or eliminated pesticides without significant loss of yields or profits.

Despite the industry's use of the right buzzwords and its attempts to clothe itself in the virtues of regenerative practices, pesticide use has not decreased. Just the opposite. In the U.S., about 196 million pounds of pesticides were used

in agriculture in 1960; by 1981 it was 632 million pounds; by 2020 it was up to more than a million *tons*. The U.N. Food and Agricultural Organization put global usage in 2022 at just over four million tons, with the U.S. in the lead and Brazil second.

Farmers are already familiar with Integrated Pest Management (IPM), which looked like a step in the right direction when President Richard Nixon directed federal agencies to integrate it into agriculture in 1972. The U.S. Department of Agriculture (USDA) update in 2018 describes IPM as "a science-based, sustainable decision-making process that uses information on pest biology, environmental data, and technology to manage pest damage in a way that minimizes both economic costs and risks to people, property, and the environment." But it took two decades for USDA, the Environmental Protection Agency (EPA), and the Food and Drug Administration (FDA) to jointly agree to get IPM in place on 75 percent of U.S. acres by 2000. IPM has not been universally popular, and it has not weaned agriculture off pesticides. By 2001, some kind of IPM had been practiced on 70 percent of crop acreage, but pesticide use increased during the same interval, with little decline in the use of the most toxic pesticides.

More recently, organic and regenerative agriculture have been expanding. Between 2012 and 2017, U.S. cover crop usage increased by 50 percent. Still, cover crops are in use in less than five percent of croplands nationwide, reflecting a stubborn resistance to a core practice of regenerative agriculture. There remains among many farmers a fear, encouraged by the pesticide industry, that abandoning pesticides will result in pest apocalypse, yield reduction, and penury.

Agriculture will likely only survive and thrive if pesticide use declines rapidly. Nontarget effects of pesticides ranging from neonicotinoid insecticides to dicamba are wreaking havoc with the balance among plants, animals, and humans. It should not take yet another generation to make the transition to sustainable food production, whether you call it integrated pest management or regenerative agriculture. See Beyond Pesticides webpages on Organic Agriculture and Keeping Organic Strong.

SOURCE: Mugala T, Brichler K, Clark B, Powell GS, Taylor S, Crossley MS. Ground beetles suppress slugs in corn and soybean under conservation agriculture. *Environ Entomol.* 2023 May 26:nvad047, https://pubmed.ncbi.nlm.nih.gov/37235638/.

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ORGANIC SYSTEMS | SEPTEMBER 7, 2023

Of Note During Organic Month, Study Finds Organic Diet and Location Affect Pesticide Residues in the Body

During Organic Month, the importance of organic practices is brought into sharp focus by a study published in July in *Environmental Health Perspectives*, which emphasizes the importance of an organic diet and location to residues of pesticides in the body. The study finds urinary levels of the weed killer glyphosate significantly decrease through an organic diet for pregnant individuals living further than 0.5km (~1640 ft) from an agricultural field. However, the study finds that adopting an organic diet among pregnant individuals living closer than 0.5km to an agricultural area does not significantly decrease glyphosate levels, indicating alternative sources of contamination outside of diet. Although past studies prove time and time again that an organic diet can reduce the levels of pesticides in the body, far too few studies investigate how the intervention of the organic diet can alter glyphosate levels among pregnant individuals living near or far from agricultural fields on which the herbicide is used. Furthermore, pesticides' presence in the body affects human health, especially during vulnerable life stages like childhood, puberty, pregnancy, and old age.

The study raises the complexity of fully tracking multiple exposures to glyphosate and other pesticides and the need for a more holistic or systemic solution, as embraced by those transitioning to organic management practices and/or the need for regulatory decisions that eliminate the use of toxic chemicals based on the availability of nontoxic alternative practices and products.

Pesticide exposure during pregnancy is of specific concern as health effects for all life stages can be long-lasting. This study highlights the importance of where you live and the associated

exposure patterns. In the study population, the primary source of chemical exposure appears to differ among vulnerable populations depending on rural-urban location. Suppose rural communities' primary exposure source comes from agricultural uses, while urban communities mainly encounter glyphosate through diet. Or, suppose that residential and urban populations get multiple glyphosate exposures from diet, landscaping, park and playing field use, and roadside or rights-of-way management. In these cases, as this study notes, "[I]t is necessary to understand sources of exposure in diverse populations to develop effective exposure-reduction recommendations."

Conducted in Idaho, the researchers evaluate the urinary glyphosate concentrations of 39 pregnant individuals living near (0.5km or less; rural) and from (more than 0.5km; urban) agricultural fields routinely treated with pesticides. Randomly, participants receive a supply of organic or conventional (non-organic) groceries (grown with chemical-intensive practices) over two weeks to determine the glyphosate concentration in urine samples. The study compares the difference in urine sample glyphosate concentration between the organic and conventional grocery weeks, stratifying by proximity to agricultural fields. The results find urinary glyphosate levels among individuals furthest from agricultural fields (urban) are moderately lower than those of individuals living near agricultural fields (rural), with the concentrations decreasing when switching from a conventional to an organic diet. Thus, the study suggests that "diet is an important contributor to glyphosate exposure in people living >0:5 km from agricultural fields; for people living near crops, agriculture may be a dominant exposure source during the pesticide spray season."

Glyphosate is the most commonly used active ingredient in the U.S. and worldwide, appearing in many herbicide formulations and readily contaminating soil, water, food, and other resources. As the active ingredient in the popular weed killer Roundup™, with use growing especially during the last few decades, extensive glyphosate use has put human, animal, and environmental health at risk. Four out of five U.S. individuals over six years have detectable levels of glyphosate in their bodies. Exposure to glyphosate has implications for the development of various health anomalies, including cancer, Parkinson's disease, developmental and birth disorders, and autism. Although the U.S. Environmental Protection Agency (EPA) classifies glyphosate herbicides as "not likely to be carcinogenic to humans," stark evidence demonstrates links to various cancers, including non-Hodgkin lymphoma. EPA's classification perpetuates adverse impacts, especially among vulnerable individuals, like pregnant women, infants, children, and the elderly. Glyphosate's ubiquity threatens 93 percent of all U.S. endangered species, resulting in biodiversity loss and ecosystem disruption (e.g., soil erosion, loss of services, and trophic cascades). Moreover, chemical use has been increasing since the inception of crops genetically modified to tolerate glyphosate.

Not only do health officials warn that continuous use of glyphosate will perpetuate adverse health and ecological effects, but that use also highlights recent concerns over antibiotic resistance. It is commonly used on crops grown from genetically engineered (GE) companion seeds for various staple crops (e.g., soybeans, cotton, and corn).

These GE seeds are glyphosate-tolerant, whose attribute has allowed growers to apply the herbicide and expect that it will kill weeds and not harm the crop. This calculation is changing, however, as weeds develop resistance to glyphosate, causing the industry to double down on its chemical solutions.

This study is one of the first "to examine the effect of an organic diet intervention on glyphosate among people living near and far from agricultural fields." Most notably, this study is the first to investigate the impact of an organic diet mediation on glyphosate exposure during pregnancy. Pregnancy is a critical window of susceptibility for exposure to glyphosate and other environmental chemicals, as prenatal exposure has associations with adverse birth outcomes that can impact subsequent generations.

Previous studies demonstrate a significant reduction (up to 70 percent for glyphosate) in urinary pesticide metabolites (breakdown products from parent compounds) achieved by a dietary shift from consuming conventionally grown food to organically grown foods in as little as a week. This subject research furthers the investigation of the impacts of an organic diet on pesticide exposure. Like this article, the paper, *Organic Diet Intervention Significantly Reduces Urinary Glyphosate Levels in U.S. Children and Adults*, reports on the second phase of a two-part study evaluating the same set of urine samples.

Although the results of this study and others suggest an organic diet effectively reduces exposure to pesticides for most of the general population, rural areas have difficulty avoiding glyphosate exposure because of its use on farms. Thus, sources of glyphosate exposure in rural areas are far beyond diet. Organic agriculture is not magically "free" of all chemicals, given the reality of pesticide drift and background levels in the environment. However, the National List of Allowed and Prohibited Substances, overseen by the National Organic Standards Board and subject to public review and comment, establishes the prohibition of toxic pesticides in certified organic production under the USDA organic seal.

This September, celebrate National Organic Month to improve and sustain human, animal, and environmental health. Emissions from fossil-fuel-based synthetic pesticides and nitrogen fertilizers continue to threaten the ecosystem, fueling the climate crisis. A complete switch from chemical-intensive agriculture to regenerative organic agriculture can significantly reduce the threat of the climate crisis by eliminating petrochemical, synthetic fertilizers and toxic pesticide use. Furthermore, supporting the use of alternative practices such as polyculture rather than monoculture, mulching systems instead of herbicides for weed management, animal integration, and other organic practices assist in eliminating the need for pesticides and their movement through air (pesticide drift) and into waterways (runoff).

As for glyphosate, Beyond Pesticides has challenged the registration of this chemical in court due to its impacts on soil, air, water, and health. While legal battles press on, the agricultural system can eliminate the use of toxic synthetic herbicides to avoid the myriad of problems they cause. Instead, the main focus can be the conversion to regenerative-organic systems and using least-toxic pest control to mitigate harmful pesticide exposure, restore soil health, and reduce carbon emissions. Public policy must advance this shift, rather than allow unnecessary reliance on pesticides. Purchasing organic food whenever possible—which never allows glyphosate use—can help curb exposure and adverse health effects. Beyond Pesticides provides tools, information, and support to take local action: check out our factsheet on glyphosate/Roundup and the report, Monsanto's Roundup (Glyphosate) Exposed.

SOURCE: Carly Hyland, et al., Urinary Glyphosate Concentration among Pregnant Participants in a Randomized, Crossover Trial of Organic and Conventional Diets, *Environmental Health Perspectives,* 131(7) 2023, https://doi.org/10.1289/EHP12155.

MORE ON THIS SUBJECT

(Reflection) This Organic Month, Transition Your Park to Organic Land Management—September 14, 2023

Standards Now Open to Public Comments To Protect the Integrity of USDA Organic!—September 18, 2023

PARKS & PLAYING FIELDS | JUNE 1, 2023

New York City Parks Dept. and Advocates Announce Organic Demonstration Sites Following Passage of Law

Eco-Friendly Parks for All (EFPA),[1] a partnership of environmental, public health and advocacy organizations, has teamed up with Beyond Pesticides, New York City Parks and Recreation Department, and Stonyfield Organic Yogurt to celebrate the success of pilot organic land management programs at eight sites across the five boroughs. The demonstration programs,[2] directed by Beyond Pesticides board member and nationally recognized natural turf expert Chip Osborne, were initiated by the coalition after the city council adopted new legislation on Earth Day in 2021 prohibiting the use of chemical pesticides on all New York City parks.

"We are excited to be working with the City of New York on organic land management practices that protect community health and the environment, and support efforts to mitigate climate change and biodiversity decline," said Jay Feldman, executive director of Beyond Pesticides, "Organic practices, such as those being used on these demonstration sites, eliminate fossil fuel petroleum-based products and sequester atmospheric carbon in the soil, combating the climate crisis. It's a win for the city, the public, and the environment."

The new law, Intro 1524, required to be fully implemented by the fall of 2022, restricts pest management products to those compatible with organic systems, which eliminates synthetic weed killers like glyphosate (Roundup), tied to cancer by the World Health Organization, and bee-toxic insecticides like neonicotinoids, which have been prohibited by many communities and countries.

The demonstration sites are part of Beyond Pesticides' nationwide Parks for a Sustainable Future program, with the long-term goal of adopt organic practices that rely on methods and products that support soil biology and soil health, while beautifying parks and playing fields by strengthening the grass plants to be better able to stand up to the stress associated with use. In New York City, the program also features the use of compost from the city's Sanitation Department, which can provide valuable nutrients to park grounds and reduce the cost of fertilizer.

The press conference was held on June 1, 2023 on the baseball field at Morningside Park in Harlem at 11 AM EDT (Manhattan Ave. and W 112 Street).

A few words from EFPA members and stakeholders:

- "We are proud of the significant reduction in pesticide use at Parks, and our collaboration on this pilot with Eco-friendly Parks for All will further demonstrate what can be achieved through our continued and expanded use of sustainable landscaping practices," said NYC Parks Deputy Commissioner for Environment and Planning Jennifer Greenfeld.
- "The Mount Sinai Children's Environmental Health Center applauds the implementation of this legislation as a major victory for children's health. Outdoor play and access to green spaces is essential to health and well-being—all families have a right to safe, pesticide-free parks," said Sarah Evans, PhD, Assistant Professor of Environmental Medicine and Public Health at the Icahn School of Medicine at Mount Sinai.
- "It's critical that municipal governments take these positive steps forward to make our parks safer for people and our cities more sustainable," said Patti Wood, Executive Director of Grassroots Environmental Education, one of the Coalition's founding members. "We're hoping this will help convince other cities across the country that they can do it too!"
- Bertha Lewis, Founder and President of The Black Institute, said, "This initiative not only benefits the environment, but it also addresses environmental justice by ensuring that our Black and Brown communities have access to safe, healthy, and sustainable parks. We're working together to create a better future for all New Yorkers, regardless of their background, by promoting organic land management practices that protect our people."
- Paula Rogovin, NYC public school teacher for 44 years (now retired)

said, "It is a joy of a lifetime to see this law, introduced in 2015 on behalf of my kindergarten students from PS 290, coming to fruition. No one is too young or too old to advocate for a better world for all."

- "Stonyfield is pleased to collaborate and support the city's efforts as a leader in sustainability and now organic land management with demonstration sites that serve as an opportunity to adopt practices that meet the environmental and health challenges of our time," said Mairead Dunphy-Fabrycki, Public Relations Manager, Stonyfield Organic Yogurt, which helped underwrite the costs of the pilot program.
- "Eco-friendly lawn care takes a responsible approach to maintaining our green spaces, including parks like Pelham Bay Park. The use of pesticides can have harmful effects on our environment and the health of humans and animals. By adopting eco-friendly practices, we can promote the growth of healthy parks and green spaces without compromising the health of our community," said New York City Council Member Marjorie Velázquez. "These practices not only protect our environment but also contribute to the resilience and sustainability of our communities for generations to come."
- "By embracing sustainable practices, families can enjoy the beauty of our parks without it being a health hazard. We support Eco-Friendly Parks for All and The Black Institute in ensuring New York City parks are safe and sustainable," said New York City Council Member Darlene Mealy.
- "Parks are invaluable public resources that help us maintain the health of our communities," said New York City Council Speaker Adrienne E. Adams. "It's important that our parks and public spaces utilize eco-friendly practices so that New Yorkers can enjoy them for generations to come. These sustainable measures to ban chemical pesticides in our parks, as passed by the City Council in 2021, are important to ensuring that our city is accessible. I thank Eco-Friendly Parks for All for their work to protect our communities and our city's natural biodiversity."

What can people do?

It is critically important to educate people and our communities on not only the hazards associated with cosmetic lawn care pesticides, but the availability of alternative practices and products. Check out Beyond Pesticides' 40 Commonly Used Lawn Pesticides factsheet and infographic, as well as alternatives for safer lawn care, myths about organic playing field management, and stopping systemic environmental racism in New York City parks. Beyond Pesticides urges people to take this work to the next level and sign up to be a Parks Advocate!

People do not have to be an expert on landscaping management or the health effects of every pesticide used on playing fields. What communities do need to know is that children are being unnecessarily exposed to chemicals that can impair their health, and that a safer, proven way exists.

Steps to take: Determine whether a state, school or community has a law or policy governing pesticide usage in and around schools, or on public lands. Find out whether, and how well, it is being implemented. If you do not have a law, call for an organic land care policy in the community. Petition the school and the town parks department to convert the playing fields to organic care and require that the grounds maintenance director or contracted professional be trained in organic land care.

For more information, contact Beyond Pesticides at info@beyondpesticides.org

SOURCES:

Eco-Friendly Parks for All founding members include Beyond Pesticides, The Black Institute, Grassroots Environmental Education, Children's Environmental Health Center, at Mount Sinai Institute for Exposomic Research, (Icahn School of Medicine) and Voters for Animal Rights.

Demonstration sites include Bronx—Claremont Park, Mapes Playground (Jacobo Field); Brooklyn—Canarsie Park (cricket field) and Lincoln Terrace; Manhattan—Morningside Park; Queens—Rufus King Park; Staten Island—Rev. Dr. Maggie Howard Playground and Mahoney Playground.

SOIL MANAGEMENT | NOVEMBER 1, 2023

NFL Players Association Calls for Stadiums To End Synthetic Turf Use

As communities consider maintenance and renovation of their playing fields, it is not uncommon for synthetic (or artificial) turf to come up as an alternative to natural grass. Promoters of synthetic turf argue that it provides a solution to climate change, reduces water use and maintenance costs, and allows for year-round play. But is this true? Is synthetic turf an environmentally responsible alternative to its organic grass counterpart? An established and growing body of scientific evidence is demonstrating environmental and health risks with synthetic turf. In addition, there is growing concern for the safety of those playing on artificial grass, which has led to a call from the National Football League's (NFL) Players Association to utilize natural grass on all 30 NFL stadiums after New York Jets quarterback, Aaron Rodgers, suffered a season-ending Achilles tear in September and Kansas City Chiefs tight end Travis Kelce suffered a mid-game ankle injury.

Synthetic turf playing fields are reliant on polluting plastic (can contain perfluoroalkyl and polyfluoroalkyl substances-PFAS) and toxic pesticides for managing bacteria, mold, and fungus, create contaminated water runoff, and cover over the natural environment,

which is critical to preserving health and biodiversity, and averting climate disasters. Artificial fields can cost over $1 million for the field installation, drainage system, and any additional costs for water treatment for an approximately 10-year lifespan, not including the game-day and ongoing maintenance costs. Manufacturers also recommend watering the synthetic field during the hottest time period because of the heat generated by the artificial material. The National Recreation and Park Association (NRPA) writes on synthetic turf: "[T]he high surface-level temperatures recorded on these fields compared to natural turf have been well-documented. Since grass leaves release water vapor (or transpire) and the evaporation of that water vapor leads to cooling, grass fields rarely get above 100° F. [Synthetic] Turf fields, in comparison, regularly rise well above 100° F. Penn State University's Center for Sports Surface Research conducted studies comparing surface temperatures of synthetic turfs composed of various fiber and infill colors/materials and found that the maximum surface temperatures during hot, sunny conditions averaged from 140° F to 170° F. The high surface-level temperatures on synthetic fields can lead to dehydration, burns and blisters if exposed skin comes into contact with the hot surface, as well as heat stroke." Restricted play is advised when temperatures exceed 80° F.

Synthetic turf is widespread across the United States. According to a multi-federal-agency presentation, there were 12,000 to 13,000 synthetic turf fields in the U.S. in 2019, with 1,200 to 1,500 new installations each year. Based on estimates, the global artificial turf market was valued at $8.1 billion in 2021, and it is expected to reach over $12 billion by 2027. Many of these fields have recycled tire crumb rubber, and a small fraction use coconut-based alternatives. According to Dan Bond, the president and CEO of the Synthetic Turf Council, "Over 90 percent of those fields have crumb rubber infill, and the other infills—the coconut, the EPDM, the virgin rubber, thermoplastics—are 1 to 2 percent." Mr. Bond elaborated in an article by Athletic Business, "It's [coconut infill] a very small market share. It's growing, but it certainly is not going to overtake crumb rubber in five years." Typically produced from discarded tires, crumb rubber has been shown to contain carcinogens and heavy metals.

A groundbreaking study, The dark side of artificial greening: Plastic turfs as widespread pollutants of aquatic environments, has unearthed some disturbing revelations on the use of artificial turf, which has become a pervasive fixture on sports fields and playgrounds. This comprehensive study, prominently featured in the *Environmental Pollution* (June 2023) journal, has cast a spotlight on the dire consequences of plastic fibers from artificial turf, which are wreaking havoc on marine ecosystems.

The study has uncovered multiple entry points, such as river transport and stormwater runoff, where plastics and microplastics can enter watersheds. Once they make their way into the water, these fibers pose a menacing threat to marine life, leading to a host of health issues and, tragically, even mortality. These fibers also accumulate in sediments, compromising the overall health of aquatic ecosystems.

The authors of the study call for immediate intervention to tackle artificial turf pollution. The study authors indicate that plastic fields require enhanced waste management practices to staunch the plastic fibers from entering aquatic habitats. The results of this study serve as a call to policymakers,

sports organizations, and the general public.

Communities discussing synthetic versus natural turf are faced with a number of issues that go to safety, environmental health, and cost. The chemicals used to manage synthetic turf for bacteria, mold, and fungus raise serious health issues and represent a threat that does not exist in organic land management. A builder of sports facilities, American Athletic, states, "Beyond surface cleaning, the artificial turf should be sanitized weekly or monthly to protect the players' and coaches' health. This disinfection requires special solvents, cleansers, and antimicrobial products to remove invisible particles and bacterial growth. You should strive to sanitize the field after every game and throughout the school day if it's used for physical education classes."

When all the synthetic turf issues are considered, including chemical use, maintenance, heat effects, water contamination and treatment, playability and safety, organic turf offers an approach that checks all the critical boxes for protecting health and the environment at a competitive price. Organic management practices build soil health, cycle nutrients naturally, enhance turf resiliency, reduce water use, and do not use petrochemical pesticides or fertilizers. The organic alternative is central to a community's discussion about its residents' commitment to both the elimination of practices and products that are petrochemical-based and the ability of organically managed soils to draw down (sequester) atmospheric carbon, which contributes to mitigating global warming and erratic temperatures.

Learn more about how easy it is to create non-plastic and organic turf care. Prevent plastics from entering your local community with toxic and unsafe astroturf and artificial grass. Sign up to be a Parks Advocate today to encourage your community to transition to organic land management. Session 3 of the National Forum, *Transformative Community-Based Change from the Ground Up: Managing Parks and Playing Fields with Organic Practices and Policies*, is available here. This session is for all who want beautiful landscapes, parks, and playing fields without the reliance on petrochemical pesticides and fertilizers. The subject matter is crosscutting and will inform people concerned about their health and community health, elected officials (from town, city, county, regional, state to school boards) interested in effecting movement away from toxic chemical reliance, and land managers and landscapers who work in parks and on playing fields and other landscapes.

SOURCE: William P. de Haan, et al., The dark side of artificial greening: Plastic turfs as widespread pollutants of aquatic environments, *Environmental Pollution*, (334)122094, 2023; https://doi.org/10.1016/j.envpol.2023.122094.

MORE ON THIS SUBJECT

Sports World Rejects Synthetic Turf, Favors Natural Grass as Organic Offers Safe Alternative—November 6, 2023

Hear From the Grassroots at the Third Session of National Forum on Transformative Community-Based Change—November 29!
—November 24, 2023

Grassroots Power: Discover How Organic Local Action Can Transform Public Spaces on Nov 29—National Forum Series
—November 22, 2023

Viruses Shown to Be Effective Biological Control
—November 30, 2023

PROTECTING ORGANIC INTEGRITY | JANUARY 27, 2023

Enforcement Rules for Organic Standards Far Surpass Those in Chemical-Intensive Agriculture

The U.S. Department of Agriculture (USDA), through its Agricultural Marketing Service (AMS), announced on January 19 its final rulemaking, the Strengthening Organic Enforcement Rule (SOE). The new requirements aim to strengthen the integrity of the National Organic Program (NOP) through both enhanced oversight and enforcement of existing program regulations, and the introduction of new ones to address occurrences of fraud in organic supply chains. Beyond Pesticides welcomes this important step in increased rigor for the burgeoning organic sector; the organization has long advocated for strong enforcement of the provisions of the 1990 Organic Foods Production Act (OFPA), the statute that gave rise to the NOP.

It must also be noted that there is a significant difference between the (appropriate) attention being paid to oversight and enforcement in organic, and the long-standing lack of same in regard to the U.S. Environmental Protection Agency's (EPA's) pesticide regulations, weak as they are. Beyond Pesticides Executive Director Jay Feldman commented, "It is difficult to have a balanced conversation about any weaknesses in organic enforcement—which must be strengthened—without assessing the entire food system. NOP provides the structure and the requirements for compliance with the OFPA. Not only does this far surpass anything that exists in the chemical-intensive food production sector, but also, advocates, government, and members of the agricultural community work continually to improve it. We must work to ensure that people can trust the USDA organic label, and know

that the system is 'wired' to ensure its integrity." To this end, those working in organic, believing in continuous improvement, have indicated that there must be vigilance in oversight and enforcement, as captured by Beyond Pesticides' coverage of a 2010 USDA Office of the Inspector General (OIG) report.

To the point about lack of rigor in the regulation and enforcement of conventional (chemical) agriculture: the U.S. Government Accountability Office (GAO) has repeatedly identified flaws in federal oversight and enforcement related to pesticide restrictions, starting more than 40 years ago. See Beyond Pesticides' coverage of an EPA Office of the Inspector General's report on the agency's inefficacy. Other coverage has included this report by Harvard Law School's Environmental and Energy Law Program in 2020, and coverage of (1) a 2021 GAO report on poor protection of farmworkers from pesticides, (2) a GAO report on EPA's "conditional" registrations practice, and (3) another GAO report finding that EPA "does not have sufficient chemical assessment information to determine whether it should establish controls to limit public exposure to many chemicals that may pose substantial health risks."

The Federal Register publication of the SOE (which will be effective March 20, 2023) asserts that the rulemaking is designed to "strengthen oversight and enforcement of the production, handling, and sale of organic agricultural products. The amendments protect integrity in the organic supply chain and build consumer and industry trust in the USDA organic label by strengthening organic control systems, improving farm to market traceability, and providing robust enforcement of the USDA organic regulations." *The Washington Post* reporting notes, "Key updates to the rules include requiring certification of more of the businesses, such as brokers and traders, at critical links in organic supply chains. It also requires organic certificates for all organic imports and increases inspections and reporting requirements of certified operations."

Even deeper into the weeds, the AMS announcement includes a list of specific topics addressed: "applicability of the regulations and exemptions from organic certification; National Organic Program Import Certificates; recordkeeping and product traceability; certifying agent personnel qualifications and training; standardized certificates of organic operation; unannounced on-site inspections of certified operations; oversight of certification activities; foreign conformity assessment systems; certification of producer group operations; labeling of nonretail containers; annual update requirements for certified operations; compliance and appeals processes; and calculating organic content of multi-ingredient products."

This new rulemaking finalizes the draft version proposed by USDA in 2020. USDA has taken some small steps to improve enforcement of NOP requirements, including, for example, a memo to "put a stop to the practice of allowing organic certification for container systems produced on land managed with substances, such as the herbicide glyphosate, which are not permitted in organic production."

Chief Executive of the Organic Trade Association, Tom Chapman, remarked that the new rulemaking represents "the single largest revision to the organic standards since they were published in 1990," adding that it should help boost confidence in the organic label. According to *The Washington Post*, Mr. Chapman indicated that the move "raises the bar to prevent bad actors at any point in the supply chain."

Executive Director of the National

Organic Coalition, Abby Youngblood, commented that the organization "applauds the USDA for their sustained work to bring this rule to completion. Organic producers' livelihoods depend on strong and consistent enforcement of organic regulations. For more than a decade, operations have been undercut by fraudulent products that have no business carrying the organic seal. NOC strongly supports provisions in this rule that will give USDA and certification agencies more authority to crack down on bad actors."

Recent high-profile cases of "organic fraud" have brought increased attention to the issue of producers representing their products (e.g., non-organic grain, dairy, meat, or produce) as organic, and typically harvesting an undue premium price for the scheme. More recently, others in the organic supply chain have entered the fraudulent arena. And as the sector has grown, some "food manufacturers" source ingredients from abroad, which makes it more challenging to assure that such items are legitimately organic. Domestic producers recognize, and voice, that enabling such companies to market their products as organic—absent better oversight and enforcement—undermines trust in the label and makes a distinctly uneven playing field for "genuine Certified Organic" vs. "faux-organic."

Both *The Washington Post* in 2017 and *The New Yorker* in 2021 covered such incidents. (That first article covers a shipment of soybeans from Ukraine, via Turkey, to California, during which trip the beans were miraculously transformed from conventionally grown/treated with pesticides to "organic.") Beyond Pesticides wrote an article in response to the somewhat "organic skeptical" coverage in *The New Yorker* article, "The Great Organic Food Fraud," in which it was explained how NOP operates, and provided fuller context for thinking about fraud in the organic sector, given the state of conventional, chemical-intensive agriculture and the massive harms it inflicts on public health and the environment.

Last year, a Minnesota farmer was federally indicted for fraud because of his scheme to sell what he claimed were organically grown grains—but were not, according to the FBI—to buyers in Pennsylvania and elsewhere. He netted some $46 million from those sales. A co-conspirator farmer in the case has also been charged in the scheme. Another example is that of several individuals and entities (out of Dubai and Turkey) being charged by the U.S. Department of Justice in the District of Maryland for a 2015–2017 multimillion-dollar scheme to export non-organic grain into the U.S. to be sold as Certified Organic.

Some in the organic sector note that the increased demand for organically produced foods in recent years may be contributing to the increase in such cases. The *MinnPost* writes, "The booming organic produce market is worth at least $63 billion per year. Increasing demands for organic grains have raised their prices to double or even triple the cost of grains grown conventionally with synthetic fertilizers, pesticides and herbicides. But for those who purchase grain, it's difficult, if not impossible, to tell organic grain from non-organic grain, making fraud hard to detect and prosecute. And the temptation to sell crops at a much higher price is difficult for some to resist." USDA has indicated, according to *MinnPost*, that the growth of the organic industry, for example, "has attracted many businesses to the USDA organic label and increased the complexity of global organic supply chains," perhaps overwhelming the capacity of organic industry watchdogs.

USDA said in its press release on the new rule, "Complexity makes oversight and enforcement of the organic supply chains difficult because organic products are credence goods, which means that their organic attributes, or 'integrity,' cannot be easily verified by consumers or businesses who buy organic products for use or resale. The elements needed to guarantee organic integrity—transparent supply chains, trusted interactions between businesses, and mechanisms to verify product legitimacy—are more difficult to achieve in the increasingly complex modern organic industry." This reality explains the importance of "eternal vigilance" on the part of federal regulators, and evolution of NOP to respond to the dynamism of the organic sector.

U.S. Representative Chellie Pingree (D) of Maine welcomes the new SOE regulations, saying in a statement from her office, "When rule-breakers cheat the system, it sows seeds of doubt about the organic label's integrity and jeopardizes the future of the industry as a whole. As a longtime organic farmer, I know how expensive and time consuming it is to adhere to the required standards to earn a USDA [C]ertified [O]rganic label. It's been a long wait, but I am pleased that the USDA and the Biden Administration are publishing a final rule that works to help consumers trust that the food they're paying for was actually farmed in a way that supports soil health, minimizes synthetic material usage, and strengthens biodiversity, as the organic label suggests. Equally importantly, it is critical that farmers who comply with the rigorous certification standards are not losing sales to fraudulent growers, suppliers, or importers."

Beyond Pesticides is among the most ardent of voices for organic integrity, as evidenced by the organization's consistent urging of steps to protect it. (For more, see here, here, here, and the organization's webpage, Keeping Organic Strong.) Beyond Pesticides recognizes that protecting and improving the organic sector is an ongoing project, and is hopeful that the new rule will make meaningful differences in NOP oversight and enforcement—bolstering trust of the Certified Organic designation and label by the public and, indeed, by elements of the organic supply chain itself. Advocates for organic integrity look forward to the improvements this SOE is designed to launch, will pay attention to its impacts on the organic sector, and continue to encourage public engagement with keeping organic strong.

SOURCE: Laura Reiley, USDA moves to crack down on "organic" fraud, *The Washington Post,* January 19, 2023, https://www.washingtonpost.com/business/2023/01/19/usda-rule-organic-fraud/.

PROTECTING ORGANIC INTEGRITY | APRIL 3, 2023

A Livable Future Tied to Growth of Organic Land Management with Strong Standards

The National Organic Standards Board (NOSB) opened its public comment period, with comments on organic standards due by 11:59 pm EDT April 5. April 5 was also the deadline for registering for the public comment webinar on April 18 and 20, which precedes the online meeting April 25-27—in which the NOSB deliberates on issues concerning how organic food is produced. Written comments are submitted through Regulations.gov.

As always, there are many important issues on the NOSB agenda this Spring. For a complete discussion, see Keeping Organic Strong (KOS) and the Spring 2023 issues page, where Beyond Pesticides' comments are posted on all issues facing the NOSB at this meeting. In the spirit of "continuous improvement," Beyond Pesticides urges the public to submit comments (using comments on the KOS page) that contribute to an increasingly improved organic production system. In addition to the key issues suggested (below), Beyond Pesticides urges the public to visit its KOS page and pick additional issues to comment on. (The public is welcome to cut-and-paste from the Beyond Pesticides' comments posted on its KOS page.) Here are some high priority issues for Beyond Pesticides:

Prohibit the Routine Allowance of Ingredients Processed with Ion Exchange. Because the ion exchange process is a chemical process, all organic ingredients processed in this manner must be subject to review by the NOSB. Ion exchange creates synthetic ingredients through chemical change—removing some components and substituting other chemicals—that are used in processed food. It is not simply filtration. Chemicals in the ion exchange resins may leak into the food product. Yet, the Handling Subcommittee of the NOSB is proposing to allow any and all resins without review. To maintain the integrity of the organic label, resins must be subject to full National List (National List of Allowed and Prohibited Substances) review to determine whether these ingredients meet organic standards, rather than establishing a blanket allowance of ion exchange in organic processing.

Organic Agriculture is Climate-Smart Agriculture. In a draft letter to Secretary of Agriculture Tom Vilsack, the NOSB has written an excellent primer on how organic agriculture responds to the climate emergency. An important caveat is that NOP and certifiers must hold organic producers to the letter and spirit of the *Organic Foods Production Act*, which requires that organic production be soil-based, incorporate diversity, and protect the environment. Operations based on hydroponics or confined animal facilities, and those that replace native ecosystems with organic farms do not meet those requirements. The

NOSB has made its position clear on those issues and must insist that NOP and certifiers carry out NOSB recommendations and consistently enforce the law—for the sake of reducing climate change, biodiversity loss, and human health impacts, as well as fairness. The NOSB should also stress the need for USDA to dramatically increase support for converting chemical-intensive agriculture to organic. It is critical that the National Organic Program ask, "What more should USDA be doing to advance organic?" As the Board states, the resiliency of organic is established: "Organic is the solution to mitigating climate change *and* responding to it." However, despite the astronomical growth in organic consumption in the U.S., conversion to organic agriculture lags behind demand. USDA could and should require the adoption of organic/climate-smart practices a prerequisite for receiving the benefits of its programs and abandon its promotion of chemical-intensive agriculture supported by the biotech/chemical industry.

Plastic mulch is under consideration this year as a part of its five-year review cycle. This is part of the larger issue relating to the use of plastic in organic production and handling. Awareness is growing about the impacts of plastic—and the microplastic particles resulting from its use—on human health and the environment. Plastics manufacture requires transportation of hazardous chemicals, such as those involved in the recent train derailment in East Palestine, Ohio. Plastic mulch should not be relisted as allowable in organic production. Moreover, the NOSB should initiate action to eliminate all uses of plastic in organic processing and packaging.

The NOSB should use the review (or sunset) process to eliminate nonorganic ingredients in processed organic foods. Materials listed in §205.606 in the organic regulations are nonorganic agricultural ingredients that may comprise 5 percent of organic-labeled processed foods. The intent of the law is to allow restricted nonorganic ingredients (fully disclosed and limited) when their organic form is not available. However, materials should not remain on §205.606 if they can be supplied organically, and we can now grow virtually anything organically. The Handling Subcommittee needs to ask the question of potential suppliers, "Could you supply the need if the organic form is required?" The materials on §205.606 up for sunset review this year are made from agricultural products that can be supplied organically and thus should be taken off the National List of allowed materials.

MORE ON THIS SUBJECT

Strong Organic Standards Require Continuing Public Involvement; Comments Are Due 11:59pm EDT April 5—March 20, 2023

PROTECTING ORGANIC INTEGRITY | DECEMBER 11, 2023

USDA Supports Expansion of "Organic" Hydroponically-Grown Food, Threatening Real Organic

Update: This Daily News is updated to address the organic status of the company cited in the piece, Merchant's Garden. The article now indicates that the company is certified as organic under a different name (Merchant's Garden Agrotech) than the name used in the USDA press release. As a result, their name did not appear in USDA's Organic Integrity Database (OID) at the time of the original Daily News and Action of the Week posting. USDA updated OID on December 8, 2023, the same day that it received a complaint on this matter from former National Organic Standard Board chair Jim Riddle. The critical focus of the piece remains the same: It is not disclosed to consumers on food products labeled "organic" when that food or ingredients are grown hydroponically. Beyond Pesticides, as indicated in the article, views hydroponic as a non-organic growing practice that does not meet the spirit and intent of the organic system, as defined in the Organic Foods Production Act.

U.S. Department of Agriculture (USDA) Secretary Tom Vilsack announced on November 27, 2023 funding that appears to be supporting the expansion of "organic" hydroponic, an approach to food production that has been criticized by the vast majority of the organic community as a process that violates foundational organic principles. The funding, under USDA's Rural Business and Value-Added Producer Grants program, is intended to assist in financing an expansion of rural businesses, including 185 projects worth nearly $196 million. Organizations representing organic producers and consumers have told the USDA's National Organic Program that hydroponic food production, as a form of conventional chemical-intensive agriculture, does not meet the standards of soil-based food production required for USDA organic labeling. Currently, federal law does not require that hydroponically produced food be labeled, leaving consumers unable to distinguish production practices at the point of sale.

One of the projects highlighted in the USDA announcement states, "Merchant's Garden LLC is a hydroponic and aquaponic farm in Tucson, Arizona. The company will use a $250,000 Value-Added Producer Grant to expand

marketing and sales of prepackaged salad mixes to help them become a local supplier of organic leafy greens for southern Arizona." However, Merchant's Garden's website does not make any organic claims for its produce, so Beyond Pesticides' question why USDA is promoting this hydroponic/aquaponic producer as "organic."

Beyond Pesticides has said: "Taxpayer dollars should not used to finance a hydroponic/aquaponic operation that does not comply with the *Organic Foods Production Act* (OFPA). If products from this operation are to be sold as "organic," it will cause harm to producers who comply with OFPA. It will also deceive consumers who purchase organic products believing that such products are produced in healthy, fertile soil, as required by the organic law and regulations. To the extent that hydoponic operations supplant soil-based (real) organic operations, these subsidies negate the climate and biodiversity benefits of organic agriculture."

The *Organic Foods Production Act*, at 6513(b), requires that all organic crop production operations submit and follow organic plans that "shall contain provisions designed to foster soil fertility, primarily through the management of the organic content of the soil through proper tillage, crop rotation, and manuring." The same section of OFPA goes on to state, "An organic plan shall not include any production or handling practices that are inconsistent with this chapter."

It is widely understood that organic farms support soil health, help sequester carbon dioxide, and avoid the use of materials like soluble nitrogen fertilizers that contribute many times as much warming potential as carbon dioxide. Beyond Pesticides advocates that USDA's financial support should go to new and transitioning organic farms.

By a decisive vote in 2010, the USDA's National Organic Standards Board determined that hydroponic and aquaponic operations are inconsistent with OFPA and do not qualify for organic certification. Under the law, the National Organic Program (NOP) is required to determine whether Merchant's Garden LLC complies with section 6513(b) of OFPA and whether the operation intends to sell their hydroponically-grown products as "organic." If the operation does not comply, NOP is required to ensure that it is not certified organic.

Historically, perhaps the most important principle of organic production is the "Law of Return," which, together with the rule "Feed the soil, not the plant" and the promotion of biodiversity, provide the ecological basis for organic production.

Historically, perhaps the most important principle of organic production is the "Law of Return," which, together with the rule "Feed the soil, not the plant" and the promotion of biodiversity, provide the ecological basis for organic production. (Sir Albert Howard. *The Soil and Health: The Study of Organic Agriculture* (1940), and *An Agricultural Testament* (1947).) Together, these three principles describe a production system that mimics natural systems. The Law of Return says that what is taken from the soil must be returned to the soil. Non-crop organic matter is returned directly or through composting plant materials or manures. To the extent that the cash crop removes nutrients, they must be replaced by cover crops, crop rotation, or additions of off-site materials when necessary.

The dictum to "Feed the soil, not the plant" reinforces the fact that soil is a living superorganism that supports plant life as part of an ecological community. Soil organisms are not fed to plants in isolation to have them process nutrients for crop plants. The soil is fed to support a healthy soil ecology, which is the basis of terrestrial life.

Finally, biological diversity is important to the health of natural ecosystems and agroecosystems. Biodiversity promotes balance, which protects farms from outbreaks of damaging insects and disease. It supports the health of the soil through the progression of the seasons and stresses associated with weather and farming. It supports our health by offering a diversity of foods.

A 2010 National Organic Standards Board report embraces these foundational principles but also contrasts organic production and "conventional" chemical-intensive agriculture. At the time of the passage of OFPA, the organic community's characterization of soil as alive was viewed with amusement by the "conventional" agriculture experts, who saw soil as a structure for supporting plants, while farmers poured on synthetic nutrients—and the poisons that had become necessary to protect the plants growing without the protection of their ecological community. Interestingly, organic producers at that time compared conventional agriculture to hydroponics.

Conventional agriculture has now learned something about soil life—enough to promote some use of cover crops despite continued reliance on petrochemical nitrogen. On a parallel track, practitioners of hydroponics have learned the value of biology in their nutrient solutions. However, in both cases, the lessons have not been completely understood. This is made very clear from the hydroponics industry explanation that "bioponics" (non-sterile hydroponics) depends on biological activity.

It is the case that bioponics relies on biological activity in the nutrient solution to break down complex molecules and make them available to the plants. It is also true that the nutrient solution in bioponics has an ecology—as all biological systems do. However, the hydroponics industry repeatedly calls this a "soil ecology," although it is merely an artificial mimic of soil ecology and a reductionist approach to manipulating nature.

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A quote from the *Omnivore's Dilemma* 2006) by Michael Pollan can provide some perspective on the importance of organic as envisioned by the early adopters of the practices and the drafters of OFPA:

"To reduce such a vast biological complexity to NPK [nitrogen-phosphorous-potassium] represented the scientific method at its reductionist worst. Complex qualities are reduced to simple quantities; biology gives way to chemistry. As [Sir Albert] Howard was not the first to point out, that method can only deal with one or two variables at a time. The problem is that once science has reduced a complex phenomenon to a couple of variables, however important they may be, the natural tendency is to overlook everything else, to assume that what you can measure is all there is, or at least all that really matters. When we mistake what we can know for all there is to know, a healthy appreciation of one's ignorance in the face of a mystery like soil fertility gives way to the hubris that we can treat nature as a machine."

The ecological system of a hydroponic nutrient system is described by the hydroponics industry to be more like a fermentation chamber—a means of processing plant nutrients—than the soil ecosystem of an organic farm. The three principles cited above are explained in further detail below:

The Law of Return. In a soil-based system, residues are returned to the soil by tillage, composting, or mulching. In a bioponics system, the residues may be composted; the residue is not returned to the bioponic system, closing the loop. The inputs that are typically identified in bioponics include many agricultural products—animal-based compost, soy protein, molasses, bone meal, alfalfa meal, plant-based compost, hydrolyzed plant and animal protein, composted poultry manure, dairy manure, blood meal, cottonseed meal, and neem seed meal—and these are produced off-site, with no return to their production system. While most organic growers depend on some off-site inputs, most of the fertility in a soil-based system comes from practices that recycle organic matter produced on-site. The cycling of organic matter and on-site production of nutrients—as from nitrogen-fixing bacteria and microorganisms that make nutrients in native mineral soil fractions available to plants—is essential to organic production. The Law of Return is not about feeding plants but about conserving the biodiversity of the soil-plant-animal ecological community.

Feed the soil, not the plant. The description of the bioponics system and case studies reveal how much bioponics relies on added plant nutrients. These nutrients may be made available through biological processes, but they are added to feed the plants, not the ecosystem. Here is an example of a case study of bioponic tomatoes:

After planting the seedlings in this growing media, it is necessary to add supplemental nutrition throughout the

growing cycle (approximately one year). About once per week, solid and liquid nutrients are added to the growing media. Some fertilizers can be applied through the irrigation lines because they are soluble enough and will not clog the lines. The use of soluble nitrogen fertilizers is limited because of their high costs, for instance, for plant-based amino acids. [S]odium nitrate . . . will be used as a lower cost nitrogen source. Soluble organic-compliant inorganic minerals, such as potassium and magnesium sulfate, are also added through the irrigation system.

Biodiversity. The definition of "organic production" in the organic regulations requires the conservation of biodiversity. As stated in the National Organic Program Guidance on Natural Resources and Biodiversity Conservation (NOP 5020), the preamble to the final rule establishing the NOP explains, "[t]he use of 'conserve' [in the definition of organic production] establishes that the producer must *initiate practices to support biodiversity and avoid, to the extent practicable, any activities that would diminish it.* Compliance with the requirement to conserve biodiversity requires that a producer incorporate practices in his or her organic system plan that are beneficial to biodiversity on his or her operation." (76 FR 80563) [Emphasis added.]

Under this guidance, while the hydroponics industry may say it is not diminishing soil and plant biodiversity, certified organic operations must take active steps to support biodiversity. On a soil-based organic farm, many practices support—from crop rotations to interplanting to devoting space to hedgerows and other nonproductive uses. These practices are also used by organic farmers producing food in greenhouses. However, bioponics is a monocultural environment that does not support biodiversity.

INTEGRATING ORGANIC ALTERNATIVE IN EVALUATING PESTICIDE REGISTRATION | AUGUST 21, 2023

Health Advocates Urge EPA Integration of Safer Chemicals and Organic Practices in Pesticide Assessments

As the U.S. Environmental Protection Agency's (EPA) Safer Choice program asks for public input into the expansion of its work to label green chemicals, the need to recognize the importance of holistic management systems in sync with nature looms large. Will simple chemical substitution ignore the value of natural processes that require nurturing for a sustainable future? EPA's Safer Choice program is a non-regulatory program that identifies alternative chemicals for a number of uses that meet expanded safety criteria.

For problems requiring a chemical solution—for example, laundry detergents—EPA's Safer Choice is a valuable resource, and consumers can look for products with the Safer Choice label, which requires that EPA review *all* chemical ingredients that must meet safety criteria for both human health and the environment, including

carcinogenicity, reproductive and developmental toxicity, toxicity to aquatic life, and persistence in the environment. While EPA's Safer Choice/Design for the Environment (DfE) program performs alternatives analyses on chemicals and identifies chemicals that are less hazardous, it stops short of identifying systems that make chemical inputs unnecessary. Substituting a less toxic pesticide, for example, is not the same as switching to available organic methods. [For pesticidal uses, the program is called Design for the Environment (DfE), which has so far been limited to disinfectants.]

Like Safer Choice, the National Organic Program (NOP) established by the *Organic Foods Production Act* (OFPA), is a label-centered program. Relying on consumer demand for food without pesticides or other chemical additives, produced in a way that benefits health, ecology, and biodiversity, NOP establishes standards for producers to use the organic label. OFPA does not require organic producers to use safer inputs. Rather, it requires them to adopt a system consistent with organic principles—building soil, increasing biodiversity, and producing healthy food—using only inputs that are natural (non-synthetic) or are approved for a specific use by the National Organic Standards Board and placed into regulations on the National List. The growth of organic food sales in the U.S.—exceeding $60 billion in 2022—is based on consumer recognition of the value of organic food.

The organic program could have a larger impact if EPA, in its pesticide registration program, recognized that pesticide uses are unreasonable if the goals of the use could be met by available organic methods.

Similarly, Safer Choice would have a larger impact if expanded and incorporated into regulatory programs, as part of a system. The heart of the Clean Water Act (CWA) program, for example, is the National Pollution Discharge Elimination System permit. EPA has largely ignored the elimination part of this program. Instead, EPA says, "An NPDES permit will generally specify an acceptable level of a pollutant or pollutant parameter in a discharge." There are two ways that the Safer Choice program could improve CWA implementation. First, the chemical and toxicological analyses required by Safer Choice could identify priorities for elimination. Second, the Safer Choice alternatives analyses could identify alternative processes that could eliminate those substances and create a list of substances for which NPDES permits might be allowed for specified uses—analogous to the National List in NOP.

In the arena of pesticide regulation, EPA could determine that the registration of a toxic substance is unreasonable in light of the availability of alternative practices and products identified by the Safe Choice program.

These applications are consistent with policies of EPA and the Biden administration. EPA characterizes Safer Choice as being part of the agency's pollution prevention (P2) program, which EPA defines as "any practice that reduces, eliminates, or prevents pollution at its source prior to recycling, treatment, or disposal." EPA says, "Pollution prevention approaches can be applied to all potential and actual pollution-generating activities, including those found in the energy, agriculture, federal, consumer and industrial sectors. Prevention practices are essential for preserving wetlands, groundwater sources and other critical ecosystems—areas in which we especially want to stop pollution before it begins." P2, in concert with President Biden's Executive Order 14057 on catalyzing American clean energy industries and jobs through federal sustainability and accompanying Federal Sustainability Plan, establishes a framework for applying Safer Choice to eliminate harmful practices and emissions by compelling a transition to practices that build a climate- and sustainability-focused economy.

Note: Beyond Pesticides will continue the discussion on Safer Choice in future postings, both in the context of suggesting an expansion of the program, as well as in the context of what is needed to meet the challenges of severe health threats, biodiversity collapse, and the climate emergency—systemic change in the way synthetic chemicals are regulated.

Note: Beyond Pesticides began its Safer Choice program prior to EPA's.

MORE ON THIS SUBJECT **Is "Safer Choice" Eliminating Hazardous Chemical Use through Management and Product Choice?**—August 10, 2023

GREENWASHING—MISLEADING ON THE SOLUTION | FEBRUARY 3, 2023

With Environmental Collapse on the Horizon, California's Sustainable Pest Management "Roadmap" Misses Mark

On January 26, California's Environmental Protection Agency (CalEPA), Department of Pesticide Regulation (CDPR), and Department of Food and Agriculture (CDFA) announced a new "roadmap" for sustainable pest management (SPM). The plan is promoted by the agencies as an accelerator of the state's commitment to transitioning away from "high-risk pesticides" and toward "adoption of safer, sustainable pest control practices," and to eliminating "priority [high-risk] pesticides" by 2050. Although *Sustainable Pest Management: A Roadmap for California* recognizes the state (and federal) failure of current pesticide policies and land management practices

to restrict pesticides sufficiently, environmental advocates say that even this plan does not "meet the moment." Its relative ambition (compared to what most states are doing), still does not, according to those advancing transformative change, adequately address the current existential health, biodiversity, and climate crises. With these crises being especially urgent, meaningful change is the adoption of approaches predicated on ensuring healthy soil biology. This calls for the deployment of a plan for the wholesale transition to organic systems that eliminate all materials/inputs that are harmful to soil health, ecosystems, natural resources, and the health of humans and all living organisms.

The California roadmap was developed by a team of 33 people—25 members of the Sustainable Pest Management Work Group and eight comprising the Urban Subgroup. The designation of the Urban Subgroup was a wise move, according to Beyond Pesticides, because although public perception is that "pesticides" are related to agriculture—and certainly agriculture is the central focus of much discussion about pesticides—the reality is that pesticide use in urban areas is real and not insignificant. In fact, studies have documented that the poundage of pesticide use per acre is often higher in non-agricultural areas, such as golf courses and lawns. These urban uses happen in residences, businesses, and institutions, and have been evidenced through studies that focus on wastewater, surface waters, and stormwater.

The plan defines SPM as an "evolution" of the IPM (Integrated Pest Management) concept—defined by the University of California Statewide Integrated Pest Management Program (UCIPM) as an ecosystem-based strategy that focuses on long-term prevention of pests or their damage, using strategies such as habitat manipulation, biological controls, resistant plant varieties, and modified horticultural practices. But UCIPM goes on to add, "Pesticides are used only after monitoring indicates they are needed according to established guidelines, and treatments are made with the goal of removing only the target organism. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment."

Beyond Pesticides has been critical of IPM as it has generally been executed in agriculture because IPM has largely failed to achieve the goals of its original conceit—significant reduction of synthetic pesticide use. Researchers on IPM have noted that over the decades since the inception of the IPM concept some 60 years ago, deployment of strategies has focused far more on reducing negative environmental impacts than on using ecological processes to replace chemical pesticides—an approach that would advance sustainability. Other factors mitigating against the original ideal have included: poor education of practitioners on the concept, multiple and competing definitions of IPM, lack of understanding of ecological concepts that were to underlie IPM, inadequate research and funding, and agrochemical industry lobbying against IPM programs.

The roadmap document describes SPM as a "a process of continual improvement that integrates an array of practices and products aimed at creating healthy, resilient ecosystems, farms, communities, cities, landscapes, homes, and gardens. SPM examines the interconnectedness of pest pressures, ecosystem health, and human wellbeing."

It identifies its goals as (1) eliminating the use of Priority Pesticides by transitioning to sustainable pest management practices, and (2) adopting SPM as the de facto pest management system in California, all by 2050. Beyond Pesticides considers 2050 far, far too late in the game for meaningful changes in the faces of the above-referenced crises.

Those Priority Pesticides are defined as "pesticide products, active ingredients, and groups of related products within the context of specific product uses or pest/location use combinations that have been deemed to be of greatest concern and warrant heightened attention, planning, and support to expedite their replacement and eventual elimination. The criteria for classifying pesticides as 'Priority Pesticides' includes . . . hazard and risk classifications, availability of effective alternative products or practices, and special consideration of pest management situations that potentially cause severe or widespread adverse impacts."

The keystone actions the plan sets out are these:

- prioritize prevention of pest problems: prevent the establishment of new invasive pest species, and proactively eliminate pest-conducive conditions both in agricultural and urban settings;
- coordinate state-level leadership: create an accountable and connected leadership structure to champion SPM in the field, effectively embed SPM principles across agencies, and improve coordination;
- invest in building SPM knowledge through research and outreach, for both agricultural and urban sectors: invest in SPM-focused research and outreach so that all pest management practitioners have equal and adequate access to the support and resources necessary to develop and implement their own SPM system;
- enhance health and environmental monitoring and data collection: expand and fully fund health and environmental monitoring infrastructure, data collection, and interpretation; and,
- improve the state's pesticide registration and continuous evaluation processes, and bring alternative products to market: create mechanisms to improve DPR's registration review process and to prioritize and expedite safer, more sustainable alternative products to high-risk pesticides, and improve processes for evaluating currently registered pesticides.

Those actions all sound great . . . until that last one, according to Beyond Pesticides. Improving a pesticide registration process is, in the view of Beyond Pesticides, somewhat akin to the storied rearrangement of the deck chairs on the *Titanic* as it sinks. As Executive Director Jay Feldman commented, "We are no longer in a period of environmental and health challenges, associated with chemical-intensive agriculture and land management, that permits us simply to 'minimize reliance on the use of toxic pesticides.' We must eliminate all petrochemical pesticides and fertilizers in the context of agricultural systems." He continued, "An example of good intentions gone awry is that the SPM document contains the word 'fertilizer' exactly once, and then only in reference to consolidation in the chemical input (synthetic pesticide and fertilizer) sector. And 'soil fertility' is mentioned just once—in a sidebar on expanding non-pesticidal methods. An SPM program that is a genuinely holistic response to multiple crises—health, climate, and biodiversity—must proscribe the currently ubiquitous use of synthetic fertilizers, as well as pesticides, in dominant, chemically intensive land management systems." Use of petrochemical pesticides and fertilizers represents the antithesis of sound efforts to build biologically healthy soil—the basis of any truly sustainable agricultural pest management system.

To its credit, the SPM plan includes important aspects of a truly sustainable approach. It asserts (p. 16), "In agricultural settings, SPM is rooted in an agroecological approach that considers the whole farm as well as the wider landscape in which it sits. . . . The practices and products together aim to build healthy, pest-resilient agroecosystems that reduce the need for external inputs. Agricultural SPM takes a systems approach to pest prevention and management, while considering environmental health, social equity, and economic viability each step of the way. Therefore, SPM facilitates, where possible, an enhancement of the following co-benefits:

- improving soil health, water quality, use efficiency, and supply; air quality; and biodiversity;
- advancing climate mitigation and adaptation;
- increasing nutrient density in crops while maintaining yields;
- improving land management practices;
- improving farmer and farmworker working conditions; and,
- increasing community health and well-being."

The roadmap also includes proposed robust efforts to bring alternative (presumably, non–synthetic chemical) pest control products to market. But the plan continues to rest on an underlying assumption that "pesticides are here to stay," at least in the short and medium term. The SPM document includes a section on "SPM and Pesticides" (see p. 79) that asserts, "There will no doubt be times when all other pest management options have been exhausted, and still a significant pest pressure remains. . . . In these cases, pesticides may still be employed, so long as the intention is to apply these products in a targeted way, as needed in order to eradicate the pest(s) and continue with a holistic, integrated pest management approach that aims to build overall system health. Pesticides and pesticide-related uses include but are not limited to a. fumigants, b. repellents, c. use of seeds that have been treated with pesticides, d. antibiotics, e. herbicides, f. fungicides, g. insecticides." That is a very large "escape hatch" to a pesticide path of least resistance for producers.

Additionally, the proposed SPM action, Improve California's Pesticide Registration and Continuous Evaluation

(p.19), begins with a focus on a transition to lower-risk chemicals—which presumably include perhaps less-risky, but nonetheless, synthetic compounds for which there is insufficient evaluation by the state or the U.S. Environmental Protection Agency (EPA). The roadmap asserts, "DPR must . . . improve its processes for evaluating currently registered pesticides."

But if the historical record offers any instruction, this would be, at best, a long-term process, and would be fought against aggressively by the agrochemical industry. A plan that would respond to the urgency of the moment would forward the principles of organic, regenerative, agroecological approaches, rather than the SPM approach of tweaking a broken pesticide regulatory system in which chemicals are not adequately evaluated for efficacy or essentiality. See Take Action: Sustainable "Roadmap" Falls Short of What Is Needed To Solve Existential Crises.

It should be noted that reform of California's pesticide registration system (as well as the national EPA registration system) would appropriately require an analysis of nontoxic alternatives. Yet, to address the current crises, reform must also—given the limitations of the current state of pesticide risk assessment, which fails to integrate the range of vulnerabilities in the human population, data gaps, untested health outcomes, exposures to pesticide mixtures and potential synergistic effects, and a range of other complexities that go unaddressed through testing protocols—require adoption of the Precautionary Principle, with its built-in protective ethos.

Beyond Pesticides asserts that there is an urgent imperative to recreate agricultural policy and practices on the scaffolding of organic systems, as defined in the 1990 U.S. Organic Foods Production Act (OFPA). Organic is a framework with a ban on synthetic fertilizers and a National List of Allowed and Prohibited Substances that is required to be established and updated on a five-year cycle with a cradle-to-grave analysis of allowed substances. Beyond Pesticides holds that this system should be continually improved, and expanded to become the dominant approach to agricultural and other land management in the U.S.

Mr. Feldman concludes, "Decades ago, I would have said that the SPM plan was a good start. But with today's realities, I would have to call this a false start that does not embrace the true changes that are required for our times and the crises we face. *Now* is the time to transform our approach to agricultural and nonagricultural land management. We *can* stop using synthetic pesticides and fertilizers; we need a plan—based on precautionary, organic, and regenerative principles—to move us forward to that goal, and we need it ASAP."

SOURCE: https://www.cdpr.ca.gov/docs/sustainable_pest_management_roadmap/spm_roadmap.pdf and https://www.cdpr.ca.gov/docs/sustainable_pest_management_roadmap/spm_executive_summary.

CHEMICAL FAILURE, EFFICACY, AND CLIMATE | FEBRUARY 15, 2023

Glyphosate Weed Killers Reduce Crop Yields and Hamper Climate Mitigation Efforts

Glyphosate use in grassland pastures reduces crop yield and impedes climate change mitigation, find two studies (1,2) published this month from the University of Turku, Finland. While massive public relations campaigns by the agrichemical industry have poured in millions of dollars to convince politicians and the public that pesticides are necessary to 'feed the world' and address the climate crisis, the data does not support these claims. "Only in recent years, we have started to realise that intensive agriculture and agrochemical pollution in fact contribute to a reversal of the intended purpose. Soils are polluted with pesticides and at the same time, extreme weather events erode soil nutrients," says study coauthor Benjamin Fuchs, PhD.

Researchers approached their investigation through two separate experiments on the grass *Festuca pratensis,* an important forage crop grown for grazing animals throughout the world. The first experiment was conducted in an enclosed greenhouse, while the second took place in a field setting. For both experiments, plots were separated between glyphosate-sprayed and unsprayed controls. All plots received three different approaches to cutting the grass: one group that was intensely cut to two inches (5cm), the second group cut to six inches (15cm), and the third group remained uncut. To determine effects, scientists measured total root biomass and total yield. For the greenhouse experiment, plant chlorophyll and shoot (above-ground plant material, not including roots) biomass was also recorded separately.

For all experiments and plot variables, none saw glyphosate use having a positive impact on yield or biomass. For the greenhouse experiment, shoot biomass was lowest in grasses cut intensively and those growing in glyphosate-sprayed soils. In general, the more frequently the grass was cut, the larger the reduction in root biomass. However, even among uncut grasses, those grown in glyphosate-sprayed soils showed the lowest root biomass. Chlorophyll content also followed this pattern, with

those in the most intensively cut grouping showing the lowest content if also grown in soils where glyphosate was applied.

The similarity of the greenhouse results to those of the field experiment adds considerable weight to the study's ultimate conclusions. Intensively cut grasses show the lowest root biomass, and roots grown in glyphosate-sprayed soils are found to be six grams lighter than those grown in soils that have not been sprayed with the chemical.

The primary finding of these studies is surprising to researchers—regardless of cutting intensity and other factors, glyphosate use reduces the root growth of the grasses.

"This demonstrates a tremendous limitation to the potential carbon binding and storage belowground when soils are polluted by pesticide. Considering the vast amount of pesticides applied to agricultural fields yearly, we can conclude that the impact on soil quality is a major driver of limited root growth, carbon sequestration, and consequently plant resilience and productivity," Dr. Fuchs says.

Fodder grasses are grown throughout the world for grazing, hay, or silage, and glyphosate is often used to treat these pasturelands. When these plants grow, they take in carbon from the atmosphere and bind it into soils through root growth. "[U]nderstanding how pesticide pollution in soil and intensive management limit plant productivity is the key to optimising intensive grassland-based agriculture in a sustainable and climate-friendly way," says Dr. Fuchs.

It is becoming increasingly clear that addressing climate change means reining in all fossil-fuel based products, including the use of hazardous pesticides. As the pesticide industry continues to push claims that their products are the only solution for a growing population on a warming planet, the science shows the opposite. Less intensive, more ecologically friendly organic agricultural practices are better at combating climate change, while the use of toxic chemicals undermines the ability to embrace this more beneficial approach.

For more information on the dangers ongoing pesticide use poses to our ability to combat climate change, see talks from Beyond Pesticides recent climate change webinar, featuring Rachel Bezner Kerr, PhD, Cornell University professor and coauthor of the definitive United Nations (UN) report on climate and food production and Andrew Smith, PhD, chief operating officer of the Rodale Institute and coauthor of several landmark reports on soil biology and carbon sequestration, including the just released *Farming Systems Trial—40-Year Report*.

Take the opportunity to express your concerns to USDA, EPA, and Congress by urging them to incorporate climate change considerations into all future policy decisions.

SOURCES:

Sanna Keronen, et al., Management practices and soil properties affect plant productivity and root biomass in endophyte-symbiotic and endophyte-free meadow fescue grass, *Journal of Sustainable Agriculture and Environment*, December 12, 2022, https://doi.org/10.1002/sae2.12035

Rainio Laihonen, et al., Root biomass and cumulative yield increase with mowing height in *Festuca pratensis* irrespective of *Epichloë* symbiosis. *Sci Rep* 12, 21556 (2022). https://doi.org/10.1038/s41598-022-25972-y.

CHEMICAL FAILURE, EFFICACY, AND CLIMATE | MARCH 2, 2023

Groups Challenge EPA on Allowing Toxic Pesticides that Do Not Even Work and Without Its Review

On February 22, a group of 65 nonprofit organizations (including Beyond Pesticides) filed a citizen petition with the U.S. Environmental Protection Agency (EPA) that asks the agency to close a gaping—and well exploited—regulatory loophole by revoking a 1984 regulation that waived efficacy data requirements in pesticide evaluations. This means that EPA has, for 39 years, registered pesticides without demonstrated proof of efficacy and benefits. The petition is aimed primarily at the widespread use of neonicotinoid insecticides (neonics), which are so harmful to hundreds of species—and to bees, other pollinators, and birds, in particular—that many advocates have insisted they should be banned altogether. Beyond Pesticides has advocated for a neonics ban because of their extensive harms to pollinators, multiple other organisms (including humans), ecosystems, and natural resources.

The Center for Food Safety, Pesticide Action Network North America, Center for Biological Diversity, Beyond Pesticides, and other advocates have filed lawsuits in recent years to get EPA to act protectively on neonics and other pesticides. The coalition of groups in the subject case seeks to rein in a plethora of harmful impacts of neonics, given EPA's overall lack of protective action. (For recent developments, see here and here.) Indeed, in the absence of effective neonic regulation, many localities and states (e.g., Maine, Maryland, New York, New Jersey, Massachusetts, Portland and Eugene, Oregon), as well as France and unitary state entities, such as the European Union and the United Kingdom, have taken steps to ban or curb significantly the use of these noxious compounds.

Led by PEER (Public Employees for Environmental Responsibility) and the American Bird Conservancy (ABC), the petition "asks EPA to amend its existing regulation for registrations of all neonicotinoid insecticides and other systemic insecticides so as to require all registration and reregistration applicants to provide performance (efficacy) data to ensure that the benefits of their products actually exceed their costs, including to society and to the environment." Beyond Pesticides Executive Director Jay Feldman asserts that EPA does not evaluate the efficacy of pesticides, except for those deemed to have public health benefits (such as those used in a public health emergency or for a "special local need"); even then, he says agency action on the latter has hardly been stellar.

According to the Environmental Health Newsletter (EHN), the current, ubiquitous use of neonics has arisen in large part from that 1984 EPA waiver, which said, "rather than require efficacy data, the Agency presumes that benefits exceed risks." EHN also notes that, "The petition specifically calls for the EPA to reinstate performance data re-

quirements and says if the companies failed to provide such information, the EPA should revoke their product registrations. The rule change would include products currently on the market."

Neonics are the most widely used class of insecticides globally; they impact roughly 100 million acres annually in the U.S. In a PEER press release subtitled "Neonicotinoid insecticides targeted for wreaking eco-havoc despite lack of economic benefits," Senior Counsel Peter Jenkins commented, "While EPA should hold all pesticides to a higher standard, for the neonics we have voluminous published evidence on their lack of efficacy, their prophylactic overuse, and the environmental harm they are causing. The threat they pose to long-term ecosystem integrity is especially insidious."

Launched to market two decades ago, use of neonics increased significantly when the treatment of crop seeds with the compounds took hold. This marked "an unprecedented shift toward large-scale, preemptive insecticide use," and has contributed to the insect apocalypse underway—as evidenced by a 75 percent decline in insect abundance.

The impacts on pollinators are of extreme concern, both generally and because these creatures are critical to food production. The U.S. Geological Survey (USGS) recently reported, for example, that the western bumble bee underwent a 57 percent decline from1998–2020. The use of neonics, and pesticides broadly, threatens not only global ecosystems, but also, food production that depends on pollinators. Neonic seed treatments are commonly used on cotton, soybean, wheat, canola, wheat, sunflower, potato, and many vegetables seeds.

A chief contributor to bee, other pollinator, and bird decline, neonics affect the central nervous systems of organisms. The chemicals impair, for example, bees' foraging, navigational, and learning behaviors, and immune responses, and often result in paralysis and death. As Beyond Pesticides has written, "These individual impacts are compounded at the level of social colonies, weakening collective resistance to common parasites, pathogens, and other pesticides . . . thus leading to colony losses and mass population declines. In 2018, more than two hundred scientists coauthored a 'call to restrict neonicotinoids' on the basis of the bulk of evidence implicating neonicotinoids in mass pollinator and beneficial insect declines."

Neonics are systemic compounds, meaning that they move throughout a plant's vascular system, and are present not only in plant tissues, but also, in pollen, nectar, and guttation droplets. Organisms that feed off of treated plants (and those that grow from treated seed) thus ingest the compounds and suffer the risks outlined above; this includes beneficial insects. Any plant remnants left in the field also harbor the compounds, polluting the soils on which they decompose. Neonics can persist for long periods in soil, and are highly water soluble; they can be transported by rain or irrigation systems to surface waters, waterways, and groundwater.

Yet another vector for exposures is the neonic dust that becomes airborne when treated seeds are planted. Together, these paths account for much of the contamination of drinking water by neonics. Neonic impacts on health, via compromise of the central nervous system, is not limited to the insect and bird world. Humans are also at risk, with established associations between neonic exposures and neurotoxicity, reproductive anomalies, hepatic and renal damage, and an increase in gene expression linked to hormone-dependent breast cancer.

Acting director of the pollinator initiative at the Natural Resources Defense Council, Daniel Raichel, commented: "The failure to regulate treated seeds creates a gigantic regulatory blind-spot —allowing one of the largest and most widespread uses of pesticides to go almost completely untracked and unregulated."

Research published in the *Proceedings of the National Academy of Sciences Journal* in 2020 adds to the arguments against this class of insecticides: "[N]eonicotinoid exposure is far higher than necessary to achieve plant protection and yield objectives. Neonicotinoid seed coatings rarely improve crop yield, and neonicotinoids are applied preventively to vast areas of turf, which cover more land in the United States than any other irrigated crop, even when pests are absent or below thresholds. . . . Risks to many terrestrial, aquatic, and detrital organisms and ecosystems have been documented. Considering these risks, advocacy groups have frequently promoted outright bans on all neonicotinoids in all circumstances, and this stance seems easy to justify."

Efficacy facts belie the intensive use of neonics as seed treatments. EPA itself (in 2014) reported that "seed treatments with neonicotinoid insecticides provide little or no overall benefit in controlling insects or improving yield or quality in soybean production." (See the detailed EPA letter on the underlying research here.) Research in 2019, as reported by Beyond Pesticides, found that neonic-treated soybeans provide negligible benefits to farmers in terms of yield and overall economic benefit. Environmental advocates maintain that EPA, in its neonic registrations and reregistrations, ought to be evaluating whether pesticide compounds—especially those with such demonstrated harms as neonics—are necessary and effective *before* introducing them into the environment or allowing their continued deployment.

It is instructive, in discussion of the petition's attention to efficacy, to note that under the Organic Foods Production Act (OFPA), the U.S. Department of Agriculture's (USDA's) National Organic Program (NOP) operates with attention to the *necessity* of a substance: "NOSB members use specific criteria when voting on substances, including the essentiality for the substance and its impacts on human health and the environment." If EPA were to operate like NOP, it would find that if a neonic does not work, it is entirely unnecessary.

Mr. Feldman comments, "The justification EPA has used for efficacy of

pesticides is that 'the marketplace determines efficacy,' and that 'farmers and consumers wouldn't buy them if didn't work.' When we're talking about toxic substances and acknowledged hazards and risks, it is inappropriate for an agency to allow harm, especially if the product doesn't work or perform as intended." In 2021, a coalition of groups, including PEER and Beyond Pesticides, issued a scathing critique of the performance of EPA's Office of Pesticide Programs—embedded in the groups' advocacy for a series of 25 reforms.

The subject petition is the most recent strategy used by advocates to pressure EPA to curb the use of neonics by altering its registration (and reregistration) process for them (and all pesticides) to take into account their efficacy. The petition tackles one specific aspect of EPA's process on one class of insecticides. The agency's track record, on so many pesticides, is to deal with one compound (under a narrow range of circumstances and/or narrow time frame and/or specific exposure levels) at a time. Beyond Pesticides has dubbed this the "whack-a-mole" struggle on pesticides.

Each regulatory baby step at EPA, each judicial settlement or knock-down of a particular pesticide, each bit of research demonstrating harms—these represent small, incremental advances on a pesticide problem that is vast in scope. But this approach is seen as wholly inadequate to the devastation that toxic pesticides are causing, and it continues the "collision course" we are on re: human health and well-being, biodiversity collapse, and the climate crisis. A precautionary approach—captured in organic, regenerative agriculture and land management protocols—is *far* more suited to the task of genuinely protecting public health and the environment than EPA's current, industry friendly, piecemeal approach.

The availability of alternative materials and practices that prevent (or vastly reduce) toxic hazards, as are used in organic management, makes the dependence on synthetic chemical pesticides even more reprehensible, according to environmental advocates. As consistent readers of *the Daily News* are aware, Beyond Pesticides pursues a vision of a genuinely protective approach to pests (floral or faunal) in agriculture and land management, via a transition from chemical dependency to organic land management in food production, and in parks, playing fields, and all recreational and public spaces. In the meantime, efforts to push EPA will continue to move the needle, however slowly and haltingly.

SOURCE: Citizen Petition to the Environmental Protection Agency, Petition for Rulemaking to Amend EPA's 1984 Pesticide Regulation that Waived Efficacy data Requirements, February 16, 2023.

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More Data Shows Failure of Crops Genetically Engineered to Incorporate Insecticide

Into the annals of "entropic methods of agricultural pest control" arrives recent research showing that pests are, unsurprisingly, developing resis-tance to a genetically engineered (GE) biopesticide used for more than 90 percent of U.S. corn, cotton, and soybeans. Bt (*Bacillus thuringiensis*) is a naturally occurring bacterium; the versions deployed in conventional agriculture are engineered into Plant Incorporated Protectants (PIPs)—GE ingredients "inserted" into seeds for multiple kinds of crop plants. These PIPs target multiple crop-destructive insect species, including (in larval form) the corn rootworm and cotton bollworm, in particular. Beyond Pesticides continues to warn that "controls," whether synthetic chemical pesticides or GE "biological" agents (such as GE Bt) that target living things (e.g., pests and weeds) are not sustainable over time because—in addition to the harms they cause—the issue of resistance will ultimately thwart their efficacy.

There are two basic categories of genetic engineering employed in conventional agriculture. One technology transfers genetic material into seed to make plants tolerant of specific herbicide compounds that will be applied after planting (for example, the infamous "Roundup Ready," glyphosate-tolerant seeds and plants). The other comprises plant-incorporated protectants (PIPs), in which the genetic material introduced causes endogenous production of proteins harmful to particular insect pests. (See much more on Bt through the Beyond Pesticides Bt archive.)

As *U.S. Right to Know* (USRTK) explains in its coverage of a 2016 independent research study on the subject, "Crops engineered with Bt genes express specific proteins (known as Cry proteins) that make the crops toxic to specific insects—the plants effectively provide their own insecticide—[theoretically] reducing the need for chemical applications. . . . Th[is] research adds to evidence that after 20 years of use of crops engineered to tolerate herbicides and resist certain harmful insects, both technologies are losing effectiveness."

Corn seed engineered with Bt was developed in 2003 by Monsanto and deployed to deal with the Western corn rootworm. EPA stepped in early on to require that producers using Bt products create so-called "refuge" areas—fields

of specific size and proximity (to the Bt fields) that are planted without PIPs. These "refuge" areas aimed to ensure that breeding would occur between non-resistant rootworms from the untreated corn and resistant individuals that would emerge from the areas planted with Bt varieties. The theory is that such breeding would dilute the frequency of the genes that encode resistance and inhibit their inheritance in subsequent generations of rootworms.

This refuge tweak has largely failed, in part because of noncompliance. PIP manufacturers responded to that issue by creating a farmer-friendlier "refuge in a bag" system that allowed farmers to avoid setting aside some of their field areas as free of the Bt trait. How? By encouraging the spreading of uneven low doses of the Bt toxin to feeding insects throughout all their fields. Monsanto "'touted refuge-in-a-bag' as fast and convenient for farmers, allowing them to plant the specialized seed 'fence row to fence row.'" In reality, the tactic catalyzed resistance in the insects over time. *Progressive Farmer* warned of this in 2012.

In addition, critics of EPA's introduction of the "refuge" tactic noted that to be at all effective, the refuge areas needed to be much bigger than EPA required. In 2012, a study concluded that, "EPA should more than double the percentage of corn acres planted to mandated refuges to delay insect resistance." (One investigator and co-author of that study was the same Bruce Tabashnik, PhD who was lead author on the subject study cited above.)

The increasing recognition of developing resistance to GE-Bt-as-PIP underscores several problems:

1) all pesticides are ultimately doomed to fail because of the all-but-inevitable development of resistance in organisms (including weeds);
2) the response of industry and the U.S. Environmental Protection Agency (EPA) to resistance continues to be, respectively, doubling down on chemical approaches, and/or tweaking use parameters to try to rein in problematic impacts; and,
3) there are many Bt strains, some of which are permitted for pest management purposes in organic agriculture (in addition to the many GE insecticide versions); the increasing use of Bt in GE-plus-chemical agriculture —and the resulting uptick in resistance —represent a real threat to this useful tool for the organic sector.

EPA acknowledges the resistance issue: "Like [with] most pesticides, insects are capable of developing resistance to Bt proteins. In Bt PIPs, this risk may be heightened by the fact that:

- Bt proteins are expressed at high levels in most or all plant tissues;
- the proteins are produced by the plant continually during the growing season (i.e., throughout the lifespan of the plant); and,
- some of the major target pests, such as European corn borer, corn rootworm, and pink bollworm, feed almost exclusively on corn or cotton.

These factors can increase insect exposure to the controlling toxins (Bt protein) and hence, increase selection pressure for resistance. That means that if the toxin kills susceptible insects, those that survive and reproduce are more likely to be resistant to the toxin."

The issue of resistance to Bt began to be noticed in 2008 in cotton bollworms —a mere five years after initial deployment of Bt products. The industry claim that genetic manipulation of plants

would result in reduced pesticide use began to be exposed as false a decade ago. In 2013, *The Wall Street Journal* noted that, as resistance to Bt products began to ratchet up and corn rootworm damage surged, farmers returned with a vengeance to chemical insecticides—unraveling a central argument for the GE Bt strategy. (Beyond Pesticides wrote about typical industry response to resistance in 2019: "Manufacturer response is often either to find a new chemical, or to 'double down' with combined-ingredient products that may be effective until the next wave of resistance develops.")

A 2013 study published in *PNAS* (the *Proceedings of the National Academy of Sciences*) concluded that, "The widespread planting of crops genetically engineered to produce insecticidal toxins derived from the bacterium *Bacillus thuringiensis* (Bt) places intense selective pressure on pest populations to evolve resistance.... These [early] cases of resistance by western corn rootworm highlight the vulnerability of Bt maize to further evolution of resistance from this pest and, more broadly, point to the potential of insects to develop resistance rapidly."

In 2020, EPA issued a draft proposal for ways to "improve" the problem of pest resistance for Bt PIPs in corn and cotton crops. The agency's goal was to "prolong the durability of Bt PIPs from pests." Zeroing in on the lack of meaningful changes in the proposal, Beyond Pesticides, led a group of nine other advocate organizations, commented on it: "The agency is proposing changes to three aspects of ... insect resistance management that consist of new resistance definitions, increased resistance monitoring and mitigation efforts, and modified annual reporting to the agency. *These changes do not address or impact the biology of pest populations developing resistance, but only the recognition and identification of such resistance* [emphasis by Beyond Pesticides]. In addition to the above proposed framework changes, the agency is considering options to ... increase percent of refuge in seed blend products, and change ... refuge compliance measures. These options at best will only delay the development of more prevalent pest resistance to Bt toxins.... [W]e find that the proposed new resistance management framework ... will do little to curb the trajectory in the increasing resistance." (See comment here.)

In that same year, EPA also began considering a proposal to reduce, gradually, the use of some Bt corn and cotton products in an attempt to combat pest resistance. One tactic was a three-year "phasedown" to some unspecified "minimal acreage cap" of Bt products for corn. The agency also considered (again) increasing the ratio of non-Bt corn seeds in blends used in "refuge" areas, the aim being to slow resistance by allowing nonresistant insects to mate with resistant insects. The proposal received significant pushback from grower groups and the crop protection industry. The former is very accustomed to use of Bt PIPs and considers them still useful despite evidence that efficacy is time limited, given galloping resistance. The latter is looking to Hoover up profits from this technology for as long as it can.

The very human, and very unwise, tendency to think short term is on full display throughout the agrochemical and agro-biotech sectors, as well as at EPA. In 2020, Beyond Pesticides wrote: "Resistance to pesticides is nearly inevitable. Development of resistance is an entirely normal, adaptive phenomenon: organisms evolve, 'exploiting' beneficial genetic mutations that give them survival advantage. For nearly a century, human response to this has been primarily a chemical 'chasing' of such evolutionary changes—developing a compound that kills the offending organism (whether pest or weed or bacterium or fungus) for a while. Organisms nearly inevitably change to become resistant to that particular chemical assault, whereupon people—the chemical industry, researchers, applicators, farmers, public health workers, clinicians, et al.—have typically moved on to the next chemical 'solution.'" To the "chemical" critique, "biotechnical" approaches can now readily be added.

Last year, Beyond Pesticides coverage of a study on emerging Crispr technology quoted Ethan Bier, PhD on that new technology. His comment is equally relevant in this Bt context, and underscores Beyond Pesticides' perspective: "This is no silver bullet. You never win when you try to play the evolutionary game with insects." We would add, "or with other living organisms." Industry focus on, and EPA collusion with, the search for "silver bullets" without precautionary forethought to the issue of resistance is the Achilles heel of pesticide—and now biotech—dependence in conventional agriculture. These are eventually doomed to failure, and meanwhile, EPA continues to power the pesticide and GE treadmills.

Beyond Pesticides believes that consideration of (1) the incorporation into food crops of genes from a natural bacterium, such as Bt, (2) the development of herbicide-tolerant crops and their paired use with herbicides, such as Roundup Ready soybeans and glyphosate, and (3) the ongoing planetary assault by thousands of synthetic pesticide compounds leads to the conclusion that these GE and chemical approaches to agriculture and pest management are short sighted and dangerous, and as noted above, entropic by their very nature. At broad scale, they generate adverse environmental, human health, biodiversity, climate, and economic consequences; they also are undermining the use of Bt as a biological pest management tool in organic production. Regenerative organic approaches are the only genuinely sustainable practices, and are the linchpin of a thoughtful, future-conscious route forward for humankind.

SOURCE: Bruce Tabashnik, et al., Global Patterns of Insect Resistance to Transgenic Bt Crops: The First 25 Years, *Journal of Economic Entomology*, Volume 116, Issue 2, April 2023, Pages 297–309, https://doi.org/10.1093/jee/toac183. A correction has been published: *Journal of Economic Entomology*, Volume 116, Issue 2, April 2023, Page 648, https://doi.org/10.1093/jee/toad013.