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Organic Systems

The Path Forward

Public health threats of foodborne diseases are curtailed through soil health and balanced ecological systems

While some have assumed that organic produce is more likely to be contaminated with pathogens, recent research demonstrates the opposite is true. According to a study evaluating the benefit of soil organisms, organic farming promotes natural resistance to common foodborne human pathogens. By protecting valuable species of dung beetles and soil bacteria, organic farming systems naturally act to clean up and decompose potentially pathogen-bearing animal feces. These natural systems suppress pathogens on organic farms, but chemical-intensive farms are left with higher levels of fecal residues and are therefore significantly more likely to yield produce carrying such foodborne pathogens as *E. coli*. The authors of a new study emphasize that curbing the spread of common foodborne pathogens could save thousands of lives and prevent millions of illnesses each year.

ECOSYSTEM SERVICES OF ORGANIC

The study, "Organic farming promotes biotic resistance to foodborne human pathogens," published in the *Journal of Applied Ecology*,[1] compares dung beetle populations, soil bacteria diversity, and feces removal rates on 70 organic and chemical-intensive broccoli farm fields across the west coast of the U.S. In addition to studying field conditions, the authors conducted additional microcosm studies to directly test the effects of dung beetles and soil microbes on the suppression of introduced *E. coli*.

Results from field analyses show that organic management practices lead to greater biodiversity among dung beetles and soil microbes, which translate to higher rates of feces removal. Microcosm results confirm that by removing fecal matter, the beetles and microbes retained by organic management reduce potential *E. coli* contamination. These new findings add to the list of ecosystem services unique to organic farms, further bolstering the case for organic as not only an ecological but an economical solution to global food production.


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In the context of recently reviewed insect declines worldwide (featured in the Spring 2019 issue of *Pesticides and You*) and general biodiversity declines (as reported elsewhere in this issue), this study also serves as a warning of yet another key ecosystem service that will certainly be lost unless a major agricultural transformation to organic systems is undertaken. Dung beetles, whose actions in soils not only protect against pathogens, but also unlock critical nutrients, are in decline. The impacts of dung beetles on soil fertility are vital to the sustainability of farms and pastures used to maintain livestock. By burying and processing feces on cattle farms, dung beetles increase soil nitrogen by 80%. By increasing soil organic matter, dung beetles simultaneously increase water infiltration, thus stabilizing farms and heavily grazed areas against erosion, flooding, and drought.

APPRECIATING DUNG BEETLES

Findings from this study highlight the need for dung beetle diversity in addition to abundance, because some dung beetles bury feces more effectively than others. Notably, researchers find that the commonly introduced species *O. nuchicornis,* which tends to dominate over other species and reduce overall diversity, is less effective at burying feces, with consequences for both *E. coli* contamination and soil fertility. Similarly, previous work attests to the importance of soil microbial diversity for maintaining ecosystem services. The key to healthy produce and fertile soils, across the board, is diversity.

BOX 1

Getting Off the Treadmill

Ignoring nature has become exceedlingly perilous. Insects and microbes that act to control crop pests and fertilize the soil eliminate the need for pesticide and chemical fertilizer use. Reliance on chemical controls creates a vicious treadmill: pesticide use kills natural agents of pest control, thus creating a demand for more pesticide use, which kills more of the beneficial organisms, and so on.

INSECTS AND DIVERSITY IN DECLINE

Due to agrochemical use, this precious diversity is in decline. Monitoring in Europe, according to the 2019 review of insect declines,[2] shows the greatest terrestrial loss of insect biodiversity on record to date: more than 60% of documented dung beetle species are in decline. Soil microbial diversity, too, is threatened by continued application of pesticides in industrialized agriculture. Soil fumigants, which are highly toxic gases, are used on a wide range of high-value crops to control nematodes, fungi, bacteria, insects, and weeds. They wipe out entire soil communities, thus necessitating the use of other chemicals to provide the fertility and pest control services that soil organisms would otherwise provide. In addition to fumigating soil, which intentionally kills all living organisms in the soil, other chemical-intensive practices also threaten soil life. Glyphosate, the most widely used herbicide, is also an antibiotic. Glyphosate-tolerant plants release glyphosate into the soil, where it has a continued adverse impact on soil microbial diversity.

REGENERATIVE AGRICULTURE

"Regenerative" agriculture is a term with a range of interpretations, but the key element is improving soil health through carbon sequestration. Robert Rodale, one of the early proponents of organic agriculture, coined the term to characterize a process that moves beyond sustainable maintenance and into improvement of resources. This methodology is gaining traction in the farming world because it is economically beneficial to farmers and promotes environmental remediation. A 2018 study, "Regenerative agriculture: merging farming and natural resource conservation profitably,"[3] shows that ecologically-based farming systems have fewer pests and generate higher profits than their chemical-intensive counterparts.

Regeneration International offers the following definition: "'Regenerative Agriculture' describes farming and grazing practices that, among other benefits, reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity—resulting in both carbon drawdown and improving the water cycle." Agriculture contributes, by some estimates, up to 30% of global greenhouse gas emissions. On the other hand, soil is an enormous potential area for carbon storage (a "sink") and benefits from the additional carbon structure. Healthy, carbon-rich soil stores water and erodes less, making fields more tolerant to disruptive weather, such as heavy rain or drought.

Some no-till advocates, while focused on improving soil health and reducing inputs, find it difficult to move away from synthetics entirely. According to no-till advocate and Arkansas

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BOX 2

Greenwashing or Real Solutions

General Mills announces a "regenerative" approach that includes some continued toxic chemical dependency

Corporate food giant General Mills has thrown some weight behind "regenerative" agriculture, committing to converting one million acres of farmland to regenerative practices by 2030. Some—but not all—of the initiative involves organic land management, and the company is silent in this initiative on the use of genetically engineered plants and related technologies.

General Mills lays out three foci within its definition of regenerative agriculture:

1. **Healthy Soil:** Carbon rich, biologically active soil plays an essential role in cleaning and storing water, supporting biodiversity and regulating the climate.
2. **Above-Ground Biodiversity:** Diversity in crop varieties, grazing animals, wildlife and pollinators supports resilient ecosystems that can better withstand disease, pests and climate fluctuations.
3. **Farmer Economic Resilience:** Regenerative agriculture practices can strengthen whole farm profitability and resilience over time.

"Practitioners who have done this the longest point to the fact that, in extreme years, their farms will do better than those who do not," says Jerry Lynch, General Mills' chief sustainability officer. "After some transition time, depending on their location and cropping system, farmers are saving a lot of money because they're using fewer inputs."

General Mills is making significant investments, including grand-scale land conversions and working with training partners. They have donated $650,000 to the nonprofit organization Kiss the Ground for training and coaching. Part of the company's million-acre effort includes converting 34,000 acres in South Dakota from conventional chemical-intensive farmland management to certified organic through a partnership with Midwestern BioAg.

The heavy involvement of General Mills might raise some eyebrows in a field generally dominated by small, even anti-establishment farmers and advocates. (That skepticism might be supported by the fact that Beyond Pesticides last year negotiated a legal settlement against General Mills regarding their misleading "100% Natural Oats" label on Nature Valley Granola Bars.)

Addressing cynicism of investment by their corporate entity in organic, Carla Vernon, president of General Mills' natural and organic business stated, "We feared the skepticism of General Mills would overshadow the good work of our natural and organic brands, but Big Food must be at the table if we are going to make a difference at scale."[6]

Like all food producers, General Mills has a bottom line that will be affected indiscriminately by climate change and pollinator decline. Mr. Lynch told *Successful Farming,* "The trend is increased demand, and coupled with a dwindling natural resource supply, and the pressure facing farming communities, we are concerned with that."

farmer Adam Chappel, "You can't quit [synthetic fertilizer and herbicides] cold-turkey," but he notes that after a few years in the practice, "I don't need seed treatments for my cotton anymore. I've taken the insecticide off my soybeans. I'm working toward getting rid of fungicides…. I'm hoping that eventually my soil will be healthy enough that I can get rid of all of it all together."[4] However, many programs that are dependent even on reduced pesticide and synthetic fertilizer use maintain a dependency on those toxic inputs because the soil biology is not fully supported by practices and amendments that grow the biomass and ultimately nutrient cycling.[5]

REGENERATIVE ORGANIC = REAL ORGANIC?

There is crossover between regenerative and other agricultural movements, such as organic or no-till. In the face of erosion of the organic label by hydroponics and big agriculture, the Real Organic Project (ROP)—a coalition of farmers and advocates—will bolster the organic label with an add-on label, reiterating the importance of soil in organic. "Organic Farming was defined back in its infancy as a farming method that is centered on maintaining fertile and biologically healthy soil," states the organization's website.

In 2017, the Rodale Institute introduced a label for regenerative agriculture food using the USDA certified organic as a baseline requirement. With another add-on to the organic label, Regenerative Organic Certification (ROC) involves three pillars of soil health, animal welfare, and social fairness. The group's definition of soil health includes no synthetic inputs (i.e., pesticides or fertilizers).

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Devon cattle out on pasture at Luna Bleu Farm, a diversified Real Organic Project farm in South Royalton, Vermont. Devon cattle are efficient grazers and produce high-qualify beef on a grass-based diet.

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Current NOSB member and Real Organic Project farmer, Emily Oakley, harvests head lettuce at her farm, Three Springs Farm in Oklahoma. The cover crop rotations provide the large majority of the soil fertility required for the intensive vegetable production the following year.

REGENERATIVE ORGANIC—FOR THE FUTURE

Whatever the motive, industry involvement is significant in a growing organic regenerataive movement. Robert Rodale remarked in a 1989 interview, "I don't think the average person aspires to live in a sustained environment, they want to live in something that's expanding and getting better, so I think the idea of regeneration is more appealing."[7]

Retaining and capturing carbon in the soil is both good for soil health and is a means of addressing the climate crisis, which is fueled by rising levels of atmospheric carbon. The choice for agriculture is between a full-scale adoption of practices that eliminate fossil fuel-based pesticides and fertilizers to protect and enhance nature and its ecosystem services, and adopting some measures that offer a partial solution, but do not meet the looming climate and biological diversity crises. While organic, as embraced by the *Organic Foods Production Act*, defines and sets a certification framework for enforcing whole systems approaches that cycle nutrients naturally in the soil and respects biodiversity, other approaches fall short of this transformative strategy. As a result, terms, such as "regenerative," "ecological," and "sustainable," are used without definition and a public process for ensuring methods that meet the rhetoric and the urgent need for an expedited response to the environmental and public health crises on the horizon. Instead, "organic" must be defined in a way that embraces regenerative, ecological, and sustainable practices.

ENDNOTES

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6 Painter, K. 2019. Food corporation hunt organic natural startups. *Star Tribune*.

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