A Natural Defense

Ideas For Boosting Natural Pest Control In Organic Gardens

BY RITA BRHEL
P&D Correspondent

When left alone, nature provides the perfect balance between predator and prey among both plants and animals.

Organic producers are trying to find the same sort of balance with the end goal being dominance of a specific harvestable species, whether that be corn, cattle, or tomatoes, through non-chemical means.

The question is, how far to let nature take its course.

Helen Atthowe of VeganicPermaculture.com has been experimenting with using as natural of pest control as possible in large-scale vegetable production for more than 25 years.

In the beginning, "we had more success with crops in soil covered all year round than we did with vegetables in soil covered all year round," she said.

A native of Montana, Atthowe began her organic career in Georgia. It was her first glimpse of using a cover crop, which was intriguing though not impressive in regards to vegetables. Then, she moved to New Jersey where she worked on an organic farm that used straw mulch, rather than a cover crop. This effort was very effective at controlling weeds, but it was also too expensive for a sustainable operation.

In 1986, Atthowe worked on a different organic garden in New Jersey with 25 acres, using what is known as a living mulch, which is basically letting the weeds grow and mowing them. She moved back to Montana in 1992 and developed a 30-acre organic garden, using a planted legume mix for the living mulch. She noticed that the perennial legumes, while harder to control and a bit "wild-looking" toward the end of the season, were more effective at controlling unwanted weeds.

Atthowe wanted to learn how to manage the living mulch between the rows, so she applied for and received a grant through the U.S. Department of Agriculture's Sustainable Agriculture Research and Education (SARE) program for on-farm, producer-led research. She compared soil health by way of biodiversity variants between two management methods:

1. Mowing the living mulch once in the spring, summer, and fall with annual light tillage;

2. Mowing the living mulch once a month from spring through summer.

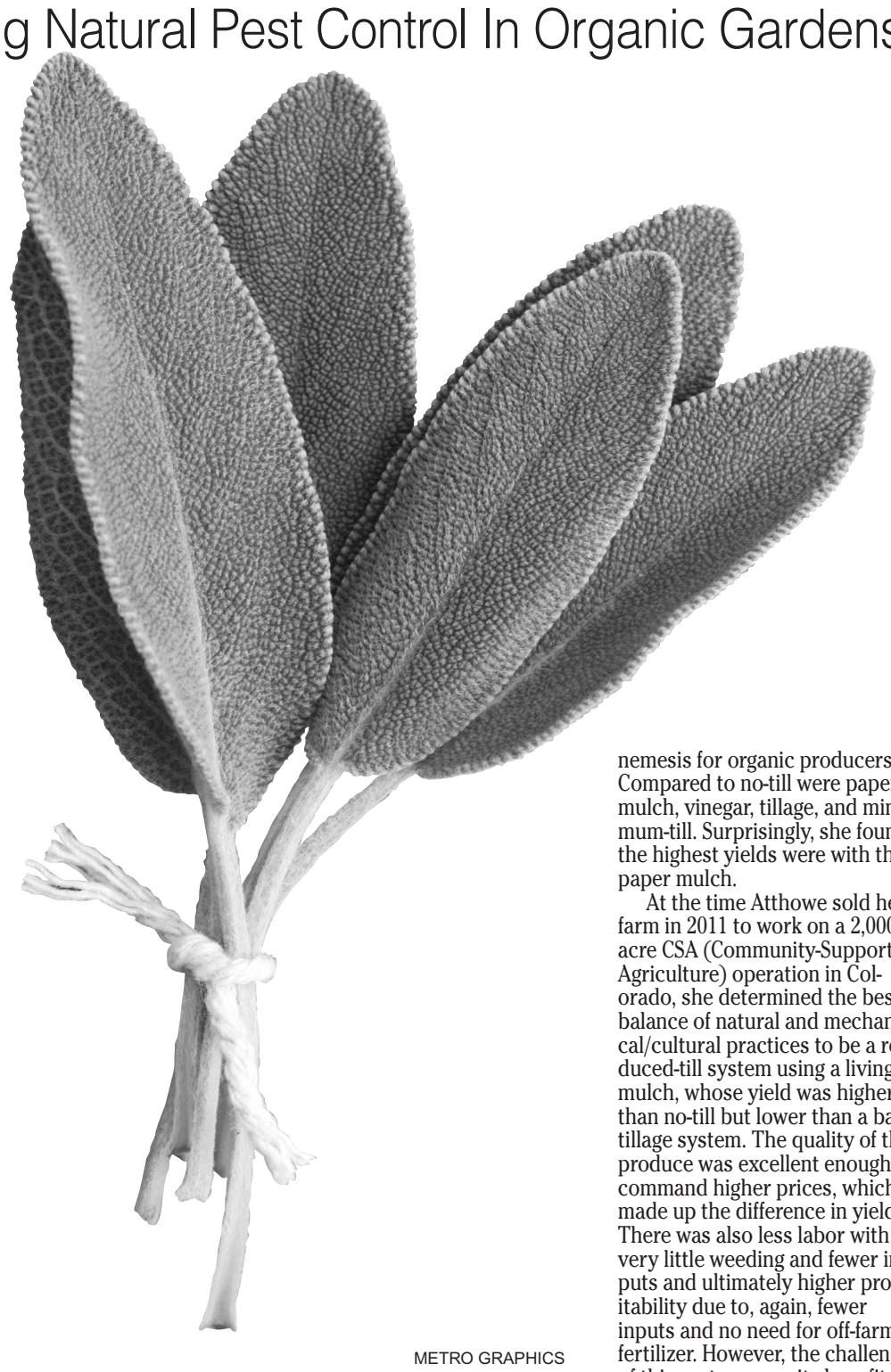
What Atthowe found was that monthly mowing, without tilling, led to higher amounts of soil organic matter, more earthworms and more microbes. Not tilling kept the soil profile intact, and the more frequent mowing ensured a regular application of fertility-boosting plant residue in the form of grass clippings.

In 1995, Atthowe also began leaving her broccoli stands to flower post-harvest. This provided a refuge for beneficial insects and wind protection.

"Not only insects, but also birds started moving in, which was exciting to see those inter-relationships," Atthowe said. "We got to the point where we had minimal pest problems. I'm not saying that we didn't have pests, but that their damage was well below acceptable levels. It was a great example of, build it and they will come."

By this point, she began to notice significantly better yields, improved cold tolerance, and more beneficial insects such as parasitic wasps and predatory flies that target aphids. The birds kept caterpillar numbers very low. Spiders were able to overwinter, and new beneficial began moving in, such as the predaceous stink bug that eats the Colorado potato beetle. There were also a greater number of snakes, which kept the vole problems down.

Soil microbial habitat also improved, which translated into disease suppression and higher nutrient levels. Even soil organic matter percentage climbed high enough that there was no longer need to add composted manure, which is usually a staple for organic gardens, even though Atthowe's garden was seeing extreme yields — to the tune of 50,000 pounds of peppers per acre.



METRO GRAPHICS

"I didn't know how to market, because the quality was so good," said Atthowe, who sold through direct-marketing options.

This doesn't surprise Rex DuFour, an agricultural program specialist with the National Center for Appropriate Technology in Davis, Calif.: "If you look at a forest, there's no need for conventional pest management because natural processes have taken care of that."

Biodiversity to encourage beneficial insects is important, as is high levels of organic matter in the soil and cover cropping, he said. Many organic producers also diversify their operations by incorporating livestock into their horticultural operation. Chickens are especially popular in vegetable operations because of their small size and ease of handling.

"In organic management, growers are especially dependent on prevention," DuFour said. "There are a few differences between regular IPM [Integrated Pest Management] and organic IPM, and one of them is the ecological emphasis. The mechanical methods, such as tilling, are the next to the last resort. The chemical methods, spraying, are the last resort. The biological, yes, that's what you want to use."

Most producers focus on beneficial insects, DuFour said, but there are many other species that can be of great help, as Atthowe discovered. For example, the spider is an especially important, yet often overlooked, resource for organic systems: "Spiders in an ecosystem can actually change insect behavior. Pest insects will abandon plants that are known to be a spider habitat."

How do you attract spiders, birds, beneficial insects and other helpful biodiversity? As Atthowe did, "if you have a diversity of habitats in your agricultural system, you will have a diversity of these predators," DuFour said.

Encouraged by what she witnessed in her garden, Atthowe wanted to see if she could get to a point where biodiversity could eliminate the need for tillage in the seed beds. Using another SARE grant, she tried no-till brussel sprouts with a red clover cover. However, this trial did not prove as intuitive. The study showed lower soil temperatures and lower nitrogen levels, but the main reason for the 36 percent smaller yield was that the cover crop choked out the brussel sprouts. While there was more soil organic matter in the no-till beds, more nitrogen was found in the tilled beds; usable nitrogen was not available in reasonable levels in the no-till.

"The best yields and quality were in minimum-till beds," Atthowe said. "We had big lines at the farmers markets, which made our egos very happy and our pocketbooks even happier."

On the flip side, she noticed incredible natural pest control in the no-till beds. Insect pests and weeds were lowest in the no-till, and beneficial of all categories were highest.

In 2007, she conducted a weed study to put no-till to the test again, this time in controlling weeds, which are the crucial nemesis for organic producers. Compared to no-till were paper mulch, vinegar, tillage, and minimum-till. Surprisingly, she found the highest yields were with the paper mulch.

At the time Atthowe sold her farm in 2011 to work on a 2,000-acre CSA (Community-Supported Agriculture) operation in Colorado, she determined the best balance of natural and mechanical/cultural practices to be a reduced-till system using a living mulch, whose yield was higher than no-till but lower than a basic tillage system. The quality of the produce was excellent enough to command higher prices, which made up the difference in yield. There was also less labor with very little weeding and fewer inputs and ultimately higher profitability due to, again, fewer inputs and no need for off-farm fertilizer. However, the challenges of this system were its benefits: More biodiversity meant the introduction of both beneficials and new pests, such as bird and vole damage, and encroachment by grasses into the living mulch. There is also the cost of seeding the mulch, which increases with multiple passes.

"As with many organic practices, there's always a cost-benefit equation," added DuFour.

SDSU Develops New Technology To Protect Pigs Against E.coli

BY KINDRA GORDON
For SDSU College of Agriculture & Biological Sciences

BROOKINGS — South Dakota State University is partnering with animal health leader Boehringer Ingelheim Vetmedica, Inc. to develop a new technology to protect pigs against a deadly form of E. coli.

The research and resulting technology was developed by associate professor Weiping Zhang and professor David Francis in SDSU's Veterinary and Biomedical Sciences Department. Their work focused on a group of E. coli bacteria called enterotoxigenic Escherichia coli, or ETEC. ETEC bacteria produce toxins called enterotoxins that affect the tissues lining the intestine and cause vomiting and diarrhea in swine.

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DENICHIRO OTSUGA

Currently, there are no preventative solutions offered by the major veterinary biological companies to combat ETEC. Denichiro Otsuga, former director of SDSU's Technology Transfer Office (TTO), saw a commercialization opportunity in the SDSU invention to provide the solution to the unanswered market need. However, in order for the pork producers to take advantage of the SDSU invention and reduce their losses to ETEC, SDSU needed an industrial partner to help commercialize the technology.

"True to its land-grant mission, SDSU provides solutions to problems people face in the region, often through research activities but also by partnering with companies," Otsuga explains. SDSU and the University of Minnesota collaborated years ago in developing a patented vaccine for PRRS, or porcine reproductive and respiratory syndrome, that has been licensed to Boehringer Ingelheim Vetmedica Inc. and sold as a vaccine to prevent the death of piglets.

That long-standing relationship with Boehringer Ingelheim Vetmedica made SDSU look to the company for a possible partner on development of the latest SDSU invention to protect the health of swine herds and create value to the producers.

SDSU researchers' innovation is that they altered the toxin genes to make the bacterium produce a non-poisonous "toxoid," then genetically fused the genes of two modified toxins to enhance their immune reaction. The bacterium producing the resulting "fusion protein" plus other important products could be used to develop a vaccine to fight against the ETEC bacteria.

SDSU filed a patent application before publishing its research findings on the technology. The technology also has possible applications in human health, for which Zhang is conducting research projects funded by the National Institute of Health and the Bill & Melinda Gates Foundation, and is pursuing and developing a patent position in collaboration with the TTO.

SDSU's Technology Transfer Office works with SDSU scientists to protect the intellectual property they develop through their research. The office also works with private industry to bring those SDSU discoveries out of the laboratory and into the marketplace where they can provide practical solutions to the problems people face.

The research is one of the ongoing projects in SDSU's Center for Infectious Disease Research and Vaccinology, which looks for new ways to diagnose and treat infectious disease in humans and domestic animals.