CROP PRODUCTION

The Biologicals Race is On

Your guide to unlocking the mystery of microorganisms.
(Farm Journal)

By FARM JOURNAL EDITORS March 29, 2021

Your guide to unlocking the mystery of microorganisms

On Derek Martin's Illinois farm, an unlikely tool serves as one of the most valued

pieces of equipment: a microscope. He trains the lens into the secret life of his fields, beneath a realm where hundreds of millions of bacteria and fungi teem in a single teaspoon of soil.

Martin has found the pick that turns the lock of profit on his operation — the realm of biologicals. And the mystery, he says, is not so mysterious at all.

Once pilloried as voodoo ag, biologicals have gained credibility in the past 15 years. The use of microorganisms to improve crop potential and soil health through the application of living-matter cocktails has attracted increasing grower attention, and in just a handful of years in the future, the use of biologicals could become commonplace.

“Biologicals are here to stay and they are going to be key management practices in our quest for high yields, but you better understand how they work and what they do, if you’ll have any clue of how to best use them,” says Fred Below, University of Illinois plant physiologist.

No More NPK Dumps

Outside Mt. Pulaski, Ill., Martin, alongside his brother, Doug, and father, Jeff, grows 6,000 acres of corn and soybeans. In the early 1980s, Jeff’s concerns over soil erosion led to no-till, a rarity in the region at the time.

In 2013, Martin began researching and experimenting with a mix of biologicals, and by 2019, he had 100% of his ground under biological applications.

“I compare biologicals to human anatomy — probiotics. You need a good immune

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system to fight disease, and so does your soil," he says.

The results, Martin explains, have been a revitalization of soil and a substantial boost in ROI: "Enough NPK dumps on our fields. We now spend less on inputs, yet have either kept yield steady or increased it across the whole operation."

Essentially, Martin operates a science lab just off his turn rows, examining fungi and soil samples under the microscope and making biological brews as a dealer for AgriBio Systems. For three years, he's planted soybeans naked — no fungicides or insecticides.

"Actually, we put on a biological treatment that literally costs a couple bucks, versus the old treatment that could reach $15 to $30 per bag of beans," Martin says. "Our biological program has produced soil with strong immunity, and it's healthy enough to fight off diseases. Several years ago, our neighbors dealt with phytophthora in beans. We didn't, and it's no accident."

Near Fort Wayne, Ind., Matt Bohrer grows corn and soybeans. He began using biologicals in 2019, applying a variety of products in-furrow and through foliar sprays.

"We're looking for better efficiency of nutrient uptake and better yields," Bohrer says.

His interest was spurred by hearing biological presentations from companies, along with research. It's early, but Bohrer is pleased with results: "Last year we were really dry but had some of our best yields ever. I reserve judgement for the long haul, but we really like what we've seen so far."

Biologicals are categorized by the living and the dead, explains Connor Sible, University of Illinois doctoral student in crop physiology. Beneficial microbes are the living and biostimulants are the dead. They can be applied during:

- Seed treatments
- In furrow with starter fertilizer
- Vegetative stages (with post herbicide,foliar application)
- Reproductive stages (with fungicide or insecticide)
- Deployed with dry fertilizer or on crop residues

Too often, farmers give up on biologicals too soon, Martin says.

“We don’t ruin soil in a year, and we don’t fix it in a year,” he says. “With biologicals, you take the money you spend on your crop, and instead spend it more efficiently. You may be taking it away from the potassium budget and moving it to gypsum or boron, or maybe you apply a biological instead.”

Martin says soil biology has exploded in conjunction with cover crops on his farm. This has led to increased water infiltration, water-holding capacity and drought tolerance.

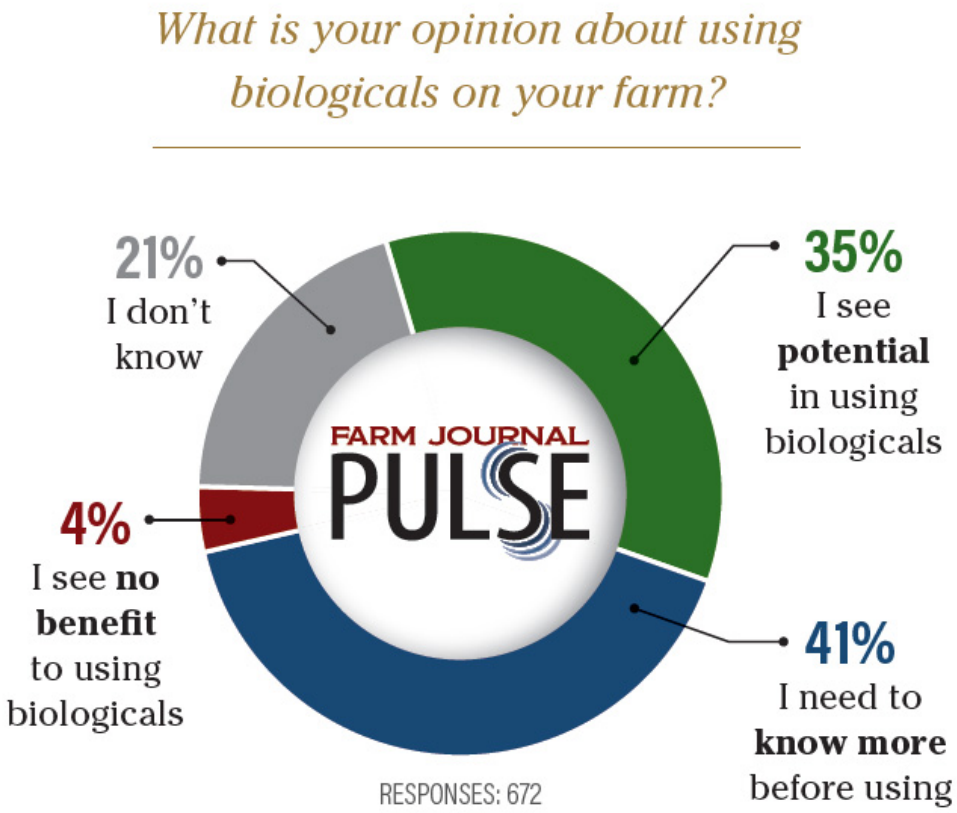
A Farmer's Ear

Agriculture has long walked a road of synthetic addiction, relying on time-honored formulas: X amount of corn and soybeans demands a X amount of NPK. Right or wrong, the formulas are a dump-and-replenish calculus.

A biological approach attempts to reduce synthetic inputs without reducing yield or profit, all while increasing life in soil and crop.

Biologicals have faced skepticism from many growers concerned about the merits of “bug juice,” but the narrative is changing, contends Chris Masters, CEO of Biovante, a company providing biologically based seed treatments, soil additives and fertility products.

“When farmers see the merits of biologicals, every attitude changes,” he says. “But how do you educate on a mass scale, when most agronomists and retailers know little about biologicals, or, especially when most universities don’t have the funding for this research, or don’t usually even have a microbiologist on staff? That is starting to change, and now private entity research is delving into biologicals.”



As such, the adoption rate and approval of biologicals is mixed across farm country, adds Sam Taylor, RaboResearch farm inputs analyst: "Somewhere in the region of 65% of farmers err on the side of negativity on biologicals. Availability is a factor, as is if they have retailers who provide assurance it's worth the investment."

Taylor points to the nutrient use efficiency market and how retailers have used those products to build sales while building farmer confidence as a possible model for expanding biological sales.

The Race is On

From multinational companies such as BASF, Bayer and Corteva, to players such as Indigo, Marrone Bio Innovations and Pivot Bio, companies are in a race searching billions of possible microbes. Some are doing proprietary research, while others buy up companies in the space.

"The largest market for biopesticides is conventional crops," says Keith Jones, executive director of the Biological Products Industry Alliance. He estimates more than 400 companies are interested in biostimulants and at least 200 already have biostimulant products.

Biologicals aren't new to farming. In March, Valent U.S.A.'s DiPel, which contains a naturally occurring subspecies of Bacillus thuringiensis (Bt) celebrated its 50th

anniversary. The biological insecticide was first registered by EPA in 1971.

“Bt in general is the most widely used biological worldwide,” says Jill Calabro, product development manager at Valent U.S.A. “That research and development is making biologicals more user friendly.”

Not all biologicals are created equal. Product labels can list three, seven or even 12 bacteria strains. Some products work with water, or dechlorinated water, or even water at a certain temperature.

“Our Biovante biologicals can be tank-mixed with the right chemicals or fertilizer, but farmers hear about others where they may have to refrigerate or make the brew, and they run away,” Masters says.

New products can have shelf lives of two years and don’t activate until they are exposed to soil moisture. Others store, blend and spread just like commercial fertilizer products.

The Road of ROI

Prior to biologicals, Martin applied 200 lb. to 220 lb. of nitrogen (N) to corn acres, close to the industry standard of 1.1 units of N per bushel of corn. At 0.7 units of N, Martin believes he can further whittle use to 0.5 units.

“We’ve spent every year dropping our N on corn because we’re capturing more N out of the atmosphere through improved photosynthesis,” he says. “In the beginning, we didn’t spend less, but now we’re seeing some serious savings, and we have the same yields or better as guys who spend the full amount on seed treatment, mass application of P and K, or 200 lb. of N.”

Short-term ROI with biologicals is the exception, not the rule, Martin notes. “You’re looking for consistent, gradual improvement to your soil, and that translates to serious ROI in three to five years.”

Martin never dreamed a microscope would be part of his standard toolbox, but the instrument is part of a biological approach dating back to the origins of farming.

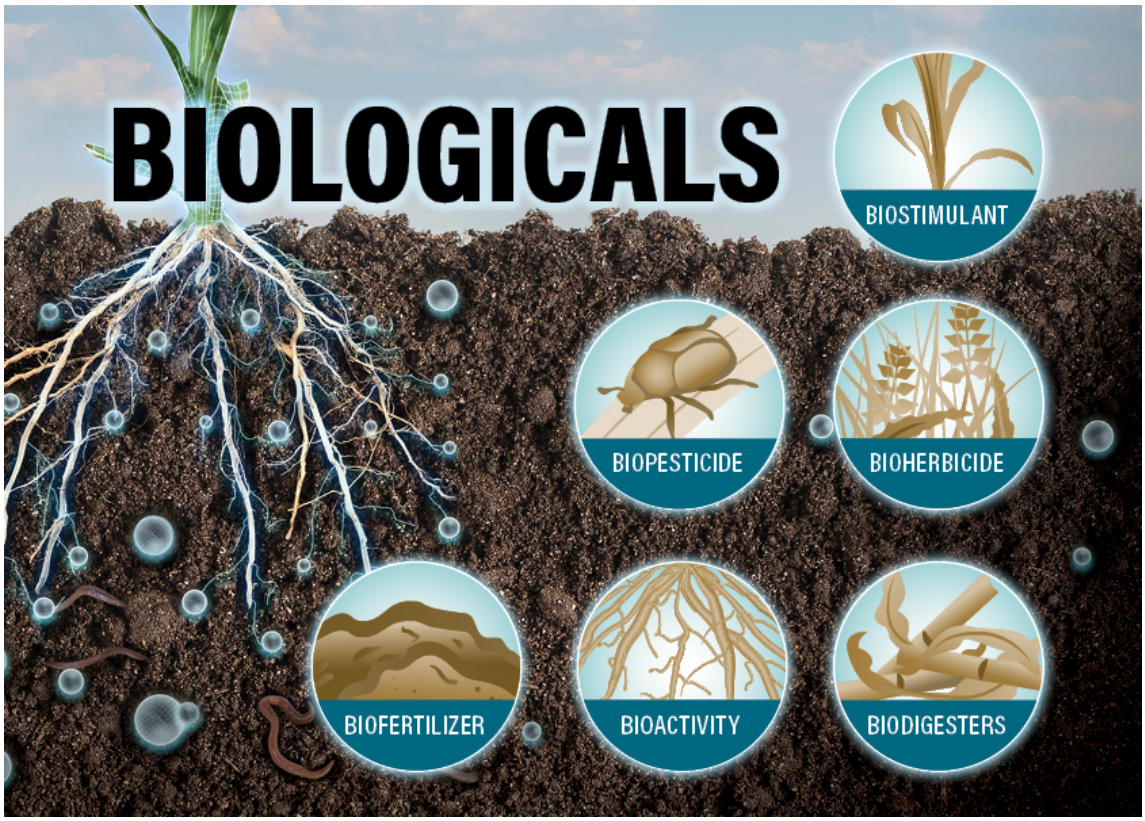
“Biologicals have always been a part of farming, but we kind of forgot,” he says. “If a system is broken, it’s because the biology is broken. If you restore the biology of the soil, it’s a game changer. In the very near future, biologicals will be at the forefront of agriculture.”

How is the biological industry evolving?

Ernie Sanders, Pivot Bio: “Several scientific tools and technologies will drive new innovation at a pace we’ve never seen before. There are literally trillions of microbes in a teaspoon of soil that give unlimited potential to find new solutions.”

Corey Huck, Syngenta: “The biologicals market is set to double in size over the next five years. The increasing trend of sustainable agriculture in the global market, low residue levels and supportive regulations are the key factors driving the growth of the market.”

Jill Calabro, Valent U.S.A.: “We’ve definitely reached a point where we’re pivoting. Biologicals now are more effective than they ever have been, and what’s great about that is now they are better able to be integrated into traditional production practices.”



Tools Derived From Nature

Biological is an umbrella term for a host of microscopic possibilities. They fit into three broad categories, says Fred Below, University of Illinois plant physiologist: plant growth regulators, beneficial microbes and biostimulants. Whether it’s bacteria, viruses, protozoa or fungi, all plants are surrounded by billions of these organisms from the roots to the tip of the leaves. Here’s just a taste of the types of biologicals.

- **Biofertilizer:** Microorganisms that improve fertility, nutrient uptake, nitrogen fixation and growth promotion.
- **Biostimulant:** Biologically based products that improve plant health, nutrition and growth, while helping tolerate abiotic stress such as cold or drought.
- **Biopesticide:** Naturally occurring substances or microorganisms that control pests.
- **Bioherbicide:** Microorganisms such as bacteria, viruses or fungi, microbial metabolites and some insects that target a specific weed's defenses.
- **Bioactivity:** Adding microbes or other naturally occurring organisms that can help increase nutrient availability, soil function, activity and root growth.
- **Biodigesters:** Utilizing microbes to help break down crop residue after harvest.

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Mr. B • 2 months ago

Bayer and other big ag companies sell a lot of bio-pesticides and fungicides already, like Rootshield and Serenade. And there are lots of smaller companies doing really interesting research with more and more products. You see a lot of these products in the greenhouse industry, they are mainstream now.

I was talking to a mycorrhizae company rep and he was talking about how use of their products have skyrocketed on big farms on the Canadian Prairies. They really are helpful.

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Snake Oil LOL! Sort of like man made climate change!

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