



Biological crop inputs are a booming market with many new products entering the marketplace. These products often claim to enhance soil nutrient supply and/or improve fertilizer use efficiency, resulting in improved yields. Growers wanting to incorporate biologicals should recognize that not all products are created equally. By broadening their understanding and asking the right questions, growers can increase their chances of biological success.

Definitions:¹

Biologicals: Nature-based crop production inputs that are either living organisms or products naturally derived from living organisms. Benefits can range from pest control to improved root growth and nutrient uptake to enhanced nitrogen fixation to increased soil health via increased microbial presence. Biologicals are typically divided into two categories – those that generate a plant response and those that mitigate in-season pests.

- **Biostimulant:** Nature-based input that stimulates processes such as nutrient uptake, nutrient use efficiency, abiotic stress tolerance, or crop quality or yield. Biostimulants are not federally regulated but may be state-regulated.
 - **Microbial Biostimulant:** Living microbes (e.g., fungi, bacteria) that promote plant growth via germination, development, stress tolerance, or water/nutrient efficiency activities.
 - 1) **Biofertilizer:** A microbial biostimulant that specifically fosters the acquisition of nutrients.
 - **Natural Product Biostimulant:** Substance or extract naturally derived from plants, microbes, or other organisms. Examples include biopolymers (i.e., chitin or chitosan), seaweed extracts, humic, and vitamins.
- **Biopesticides:** Nature-based input that repels, prevents, mitigates, or destroys unwanted pests and/or diseases. Examples include naturally occurring substances, the microbe itself, or substances expressed by the plant via incorporated microbial genetic material (plant-incorporated protectant). The EPA federally regulates biopesticides, and approved products can be viewed [here](#).

¹ North Carolina State University. [Agricultural Biologicals](https://soilmanagement.ces.ncsu.edu/agricultural-biologicals/). <https://soilmanagement.ces.ncsu.edu/agricultural-biologicals/>. Accessed 7/23/25.

Factors driving biological product demand:²

- Soil Health Benefits
- Carbon Dioxide Reduction
- Labor Safety & Flexibility
- Biodiversity
- Improved Return On Investment
- No pesticide residues
- No resistance

3 Signs of a Reputable Biological Product³

1. **Specific use instructions:** Label specificity can be a gauge of a quality product.
2. **Significant field data:** Strive to see a yield increase of 7% at least 80% of the time.
3. **Scientific support:** Information on how the product works should be readily available; it is not good enough for a company to simply state “it is the best” or “provides guaranteed results”, etc.

Questions to determine if a biological product is a good fit for an operation:⁴

- Does the product address a specific need or vulnerability of the farm?
- Does the product work with the current practices and equipment of the farm?
- Does the product affect other aspects of the integrated pest management plan?
- Does the product have field trials that align with the current production system?
- Does the product provide a benefit to the operation?
 - Benefits to look for include increased soil organic matter, reduced carbon intensity score, negative ecosystem impact, and/or support of general soil/water quality goals.

2 [Where Can Farmers Expect the Next Level-Up Technology in Biologicals? - AgWeb](https://www.agweb.com/news/where-can-farmers-expect-next-level-technology-biologicals). <https://www.agweb.com/news/where-can-farmers-expect-next-level-technology-biologicals>. Published 7/2025. Accessed 8/2025.

3 [3 Questions Every Farmer Should Ask About Biological Products - AgWeb](https://www.agweb.com/news/3-questions-every-farmer-should-ask-about-biological-products). <https://www.agweb.com/news/3-questions-every-farmer-should-ask-about-biological-products>. Published 6/2025. Accessed 8/2025.

4 Timac Agro USA. [Key Questions To Ask Before Investing in Biologicals](https://us.timacagro.com/news/plant-nutrition/investing-in-biological-solutions/). <https://us.timacagro.com/news/plant-nutrition/investing-in-biological-solutions/>. Published 2/28/2024. Accessed 8/15/25.

Points to Consider

What is the difference between fertilizer and biostimulant?

- Fertilizers provide nutrients for direct uptake by the plant. Whereas biostimulants stimulate beneficial biological processes, which can increase plant nutrient acquisition.⁵
- The living nature of microbial biostimulants can create unpredictability and variation. Results can vary from field to field and year to year. Microbial products can be affected by environmental variables such as location, weather, and soil type, to name just a few.

Can biostimulants improve fertilizer efficiency?⁶

- Environmental loss of nitrogen (N) fertilizers reduces efficiency since the product is no longer present where it was applied. Bacterial inoculants that fix N can supplement the anticipated N losses.
- Low efficiency of phosphate (P) fertilizers may be attributed to their unavailability for crop uptake, rather than nutrient movement from the application site. A biological that upregulates the turnover of P in the soil solution results in better crop uptake and thus increases P fertilizer efficiency.
- A biostimulant may reduce some fertilizer needs by increasing plant-available nutrition in the soil, but the effect could be only short-term. Farmers should be cautious of the long-term implications of use, such as possible soil nutrient depletion, and address them accordingly.

What are the major categories of microbial biostimulants, and how do they work?⁷

- Rhizosphere stimulation and residue decomposition bacteria: stimulate root growth and development, in addition to prompting native microbe action, which helps to cycle organic matter.
- Phosphorus-solubilizing bacteria or fungi: release inorganic P back into the soil after solubilization.
- Nitrogen-fixing bacteria: live along the root line and feed on exudates, providing additional N that is less susceptible to loss.
- Arbuscular mycorrhizal fungi (AMF) – expand the crops' root system via a large hyphae network, improving fertilizer efficiency.

5 North Carolina State University. [Agricultural Biologicals](https://soilmanagement.ces.ncsu.edu/agricultural-biologicals/). <https://soilmanagement.ces.ncsu.edu/agricultural-biologicals/>. Accessed 7/23/25.

6 The University of Illinois at Urbana Champaign. [Role of Biologicals in Enhancing Nutrient Efficiency in Corn and Soybean](https://cropphysiology.cropsci.illinois.edu/wp-content/uploads/2023/03/Crops-Soils-2023-Sible-Role-of-Biologicals-in-Enhancing-Nutrient-Efficiency-in-Corn-and-Soybean.pdf). <https://cropphysiology.cropsci.illinois.edu/wp-content/uploads/2023/03/Crops-Soils-2023-Sible-Role-of-Biologicals-in-Enhancing-Nutrient-Efficiency-in-Corn-and-Soybean.pdf>. Published 2023. Accessed 7/25/25.

7 The University of Illinois at Urbana Champaign. [Role of Biologicals in Enhancing Nutrient Efficiency in Corn and Soybean](https://cropphysiology.cropsci.illinois.edu/wp-content/uploads/2023/03/Crops-Soils-2023-Sible-Role-of-Biologicals-in-Enhancing-Nutrient-Efficiency-in-Corn-and-Soybean.pdf). <https://cropphysiology.cropsci.illinois.edu/wp-content/uploads/2023/03/Crops-Soils-2023-Sible-Role-of-Biologicals-in-Enhancing-Nutrient-Efficiency-in-Corn-and-Soybean.pdf>. Published 2023. Accessed 7/25/25.

How is biological product performance best measured on the farm?

Ideally, a biological baseline will be created before using biological products so that impacts and the value of any added biological products can be measured. Traditional soil sampling often only reports soil content as parts per million of nutrients, which does not directly equate to the soil's biological status. If comprehensive biological data is desired, consider some nontraditional sampling methodologies such as: ⁸

- POXC (Permanganate Oxidizable Carbon) Soil Test – carbon content⁹
- PFLA (Phospholipid fatty acid) Soil Test – microbial biomass¹⁰
- Plant sap analysis¹¹
- In-field water infiltration testing¹²
- Haney soil health data with h3a extraction¹³
- BeCrop Test - microbial DNA profiling¹⁴



- 8 Timac Agro USA. Key Questions To Ask Before Investing in Biologicals. <https://us.timacagro.com/news/plant-nutrition/investing-in-biological-solutions/>. Published 2/28/24. Accessed 8/15/25.
- 9 The Ohio State University. Active Soil Carbon Methodology. <https://soilfertility.osu.edu/sites/soilf/files/imce/Protocols/POXC%20Protocol%20-%20OSU%20Soil%20Fertility%20Lab%20%28Oct%202019%29.pdf>. Accessed 8/15/25.
- 10 The Ohio State University. The PLFA Soil Health Test | Agronomic Crops Network. <https://agcrops.osu.edu/newsletter/corn-newsletter/2019-09/plfa-soil-health-test>. Accessed 8/15/25.
- 11 [Plant Sap Analysis | Newage Laboratories](https://www.newagelaboratories.com/plant-sap-analysis). <https://www.newagelaboratories.com/plant-sap-analysis>. Accessed 8/15/25.
- 12 NRCS USDA Measuring [Soil Health Infiltration](https://www.nrcs.usda.gov/wps/cm1s_proxy/https://ecm.nrcs.usda.gov%3A443/fncmis/resources/WEBP/ContentStream/idd_F0EF7A61-0000-CC17-A648-8DD17684E276/0/1percentinfiltration.pdf). https://www.nrcs.usda.gov/wps/cm1s_proxy/https://ecm.nrcs.usda.gov%3A443/fncmis/resources/WEBP/ContentStream/idd_F0EF7A61-0000-CC17-A648-8DD17684E276/0/1percentinfiltration.pdf
- 13 NRCS USDA Soil Health Nutrient Tool - [HaneyTest.pdf](https://www.nrcs.usda.gov/sites/default/files/2022-09/HaneyTest.pdf). <https://www.nrcs.usda.gov/sites/default/files/2022-09/HaneyTest.pdf>. Accessed 8/15/25.
- 14 [BeCrop Test | Biome Makers](https://biomemakers.com/becrop-test). <https://biomemakers.com/becrop-test>. Accessed 8/15/25.