



# BIOLOGICAL SOLUTIONS

*REGENERATE YOUR SOIL*



# YOUR SOIL IS THE ENGINE OF YOUR AGRICULTURAL SYSTEM.

It is an ecosystem full of life that needs to be carefully managed to maintain its ability to function optimally. When the soil is not functioning at full capacity, future sustainable productivity, environmental quality, and net profits are jeopardized.

Soil microbes are an important key to a healthy functioning soil. These organisms help with cycling nutrients, mineralization of organic matter, and maintaining soil structure.

A healthy soil will have a large and diverse population of beneficial organisms to carry out these functions and help maintain a healthy soil status.



## THE ANDERSONS BIOLOGICAL PRODUCT LINE-UP

**Bio Pass®**, **Bio Pass LG**, and **Bio Reverse®** are designed to mix with liquid fertilizers and provide ease-of-use, efficiency, and a positive return on investment (ROI). Each product provides 300 billion colony-forming units (CFUs) per pint. The microbes in these products are naturally occurring and sourced from high performing soils. After the microbes come out of sporulation, they begin reproducing and doubling their populations every 45-60 minutes depending on soil temperature. The Andersons microbial packages use proprietary formulation-stabilizing technology, allowing the products to have a shelf life of two years.

### FEATURES & BENEFITS

- Formulated with naturally occurring microbes from healthy soils
- Deliver beneficial and viable microbes at time of applications
- May be tank mixed with liquid fertilizers
- Build and maintain healthy soils

### FREQUENTLY ASKED QUESTIONS

**Q: Why is there a microbial package for corn and wheat and a different one for legumes?**

**A:** The microbial strains in Bio Pass and Bio Pass LG differ to accommodate the varying needs of these crops. Each product contains eight strains of microbes, with these microbes serving a unique purpose for the specific crop.

**Q: Are Bio Pass, Bio Pass LG, and Bio Reverse easy to mix with my liquid applications?**

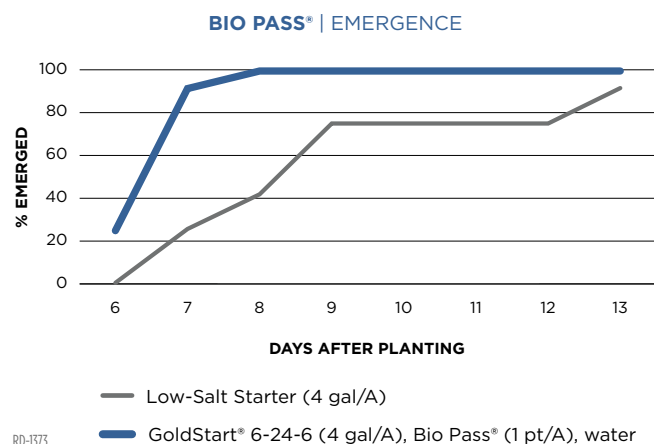
**A:** Yes, The Andersons scientists spent significant time and resources to design Bio Pass, Bio Pass LG, and Bio Reverse so they would easily mix with liquid applications.



To see how these products fit into The Andersons High Yield Solution programs, visit [AndersonsPlantNutrient.com/HighYield](https://www.AndersonsPlantNutrient.com/HighYield)



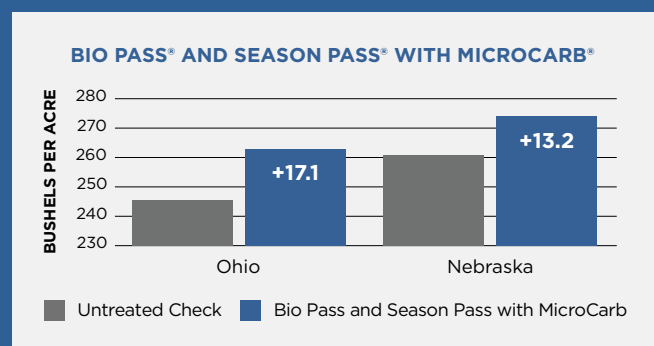
Bio Pass is a robust microbial package specifically designed to work in synergy with liquid starter fertilizer programs for corn and wheat. Bio Pass's specialized blend of bacteria works together in the soil to help kick-off seedlings' early season growth while enhancing the uptake of nitrogen, phosphorus, potassium, and other essential nutrients throughout the season.



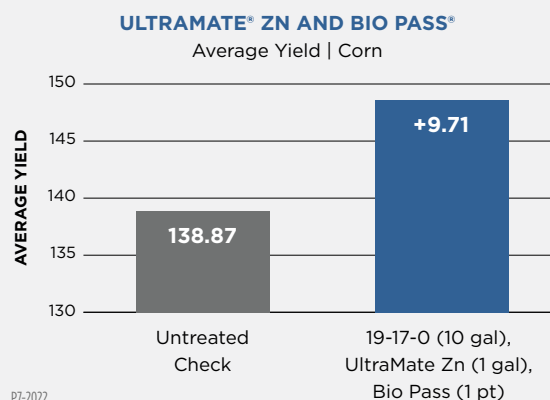
In a greenhouse study, the treatment with liquid fertilizer and Bio Pass emerged 5 days earlier and more uniform than the starter alone.

## INCLUDE A CARBON SOURCE

Carbon is an essential plant nutrient that provides soil microbes with a food source and habitat, stimulating soil microbiology. Our studies show that including a carbon source like The Andersons MicroCarb® with your biological application enhances overall performance and yield results.



This graph shows trials conducted in 2020 in Ohio and Nebraska with Bio Pass added to Season Pass® with MicroCarb. In both trials, Bio Pass was applied at a rate of 1 pint/acre with Season Pass with MicroCarb at 5 gallons/acre. The treatment resulted in a 17.1 and 13.18 bushel/acre increase respectively.



In 2022 in Indiana, UltraMate Zn and Bio Pass were tested in 2x2 placement with 19-17-0. This treatment yielded a 9.71 bushel per acre increase compared to the untreated check.



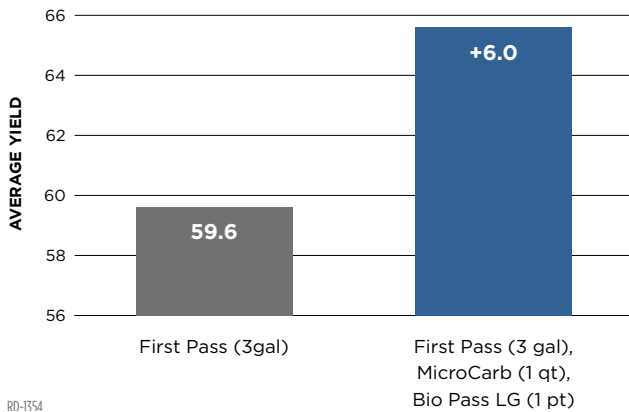
The above trial was conducted in Michigan in 2018. In this trial, the treatment with UltraMate Zn and Bio Pass had significantly larger ears than the untreated check. The treatment had ears measuring 36 kernels long and 18 kernels around compared to the untreated which were only 27 kernels long and 16 around.



Bio Pass LG is a microbial package specifically designed to support soybean and other legume crops' growth and season-long nutrient needs. It may be broadcast-applied in a tank mix with pre-emergence or burndown herbicide, pre-plant incorporated, in-furrow or 2x2 at planting, or through a pivot irrigation system prior to crop emergence.

#### FIRST PASS® WITH MICROCARB® AND BIO PASS® LG

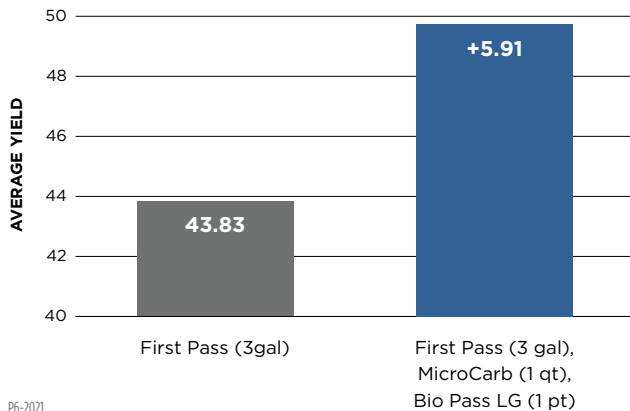
Average Yield | South Dakota



In 2021 in South Dakota, First Pass, Bio Pass LG, and MicroCarb were tested in-furrow. The treatment yielded a 6 bushel per acre increase compared to First Pass alone.

#### FIRST PASS® WITH MICROCARB® AND BIO PASS® LG

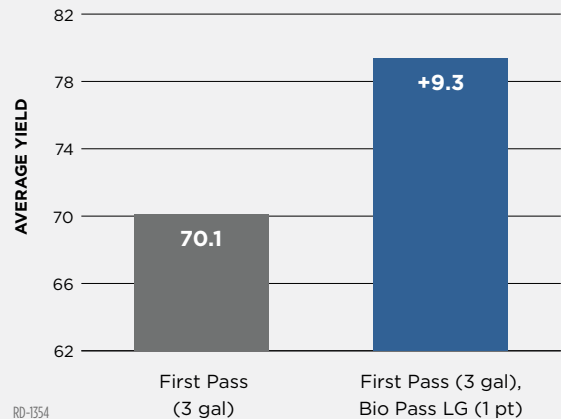
Average Yield | Michigan



When tested in 2021 in Michigan, First Pass, MicroCarb and Bio Pass LG yielded a 5.91 bushel per acre increase compared to First Pass alone. This treatment was placed in-furrow in soybeans.

#### FIRST PASS® WITH BIO PASS® LG

Average Yield | In-Furrow

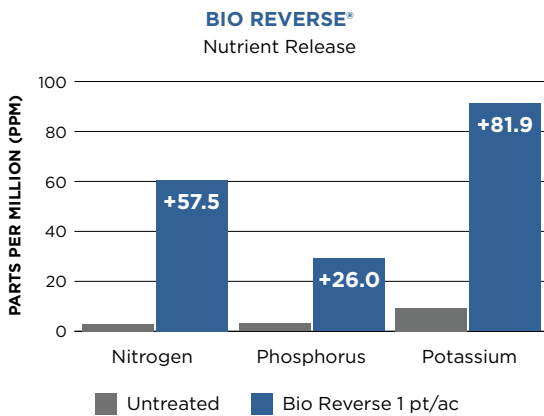


In 2022 in South Dakota, Bio Pass LG was tested with First Pass in-furrow in soybeans. During the season, root digs were pulled to observe differences below ground. When pulling roots, it was noted the roots were larger with more nodules where Bio Pass was applied. The treatment with Bio Pass yielded a 9.3 bushel per acre increase compared to First Pass alone.



**10x**  
more nutrients  
released

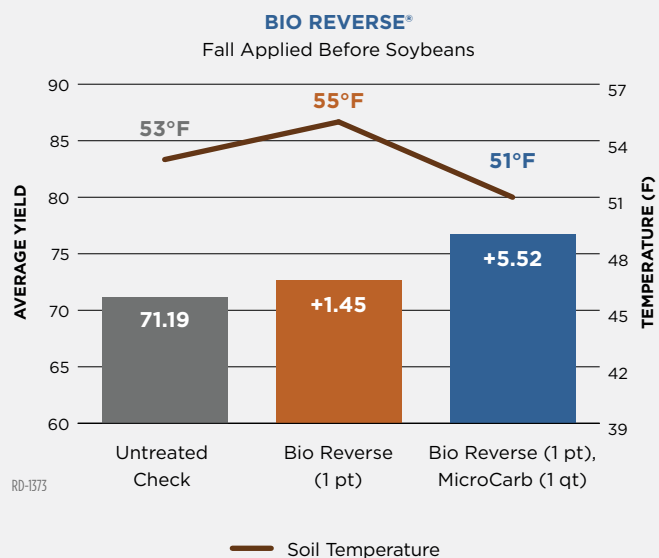
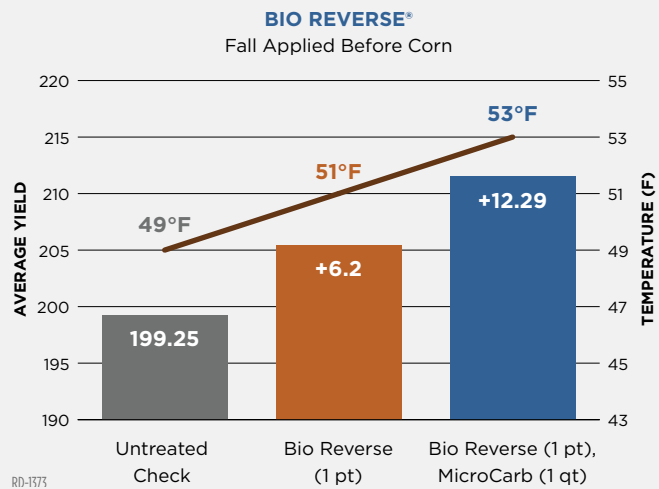
Bio Reverse is a specially selected package of soil-borne microbes chosen for their ability to accelerate crop degradation and composting, thereby significantly reducing residue and releasing nutrients back to the soil. The product is a liquid formulation with a significant volume of colony forming units (CFUs) to ensure excellent coverage and performance. It may be applied year round, whenever there is residue.



Bio Reverse was applied to wheat straw stubble and the nutrient value of rainwater was collected. The Bio Reverse treatment had significant residue breakdown, releasing ten time more nutrients compared to the untreated check.



In this photo, the corn stalks on the left were treated with 1 pt/acre of Bio Reverse in the fall post-harvest. The following spring, the stalks treated with Bio Reverse had more residue breakdown compared to the untreated check on the right.



In 2022 in Wisconsin, Bio Reverse was tested as a residue management program applied in the fall after harvest. Bio Reverse was tested alone and tested with the addition of MicroCarb. The increase in microbial activity in the soil led to warmer soils at planting. Throughout the season, it was noted healthier and greener plants due to the nutrient value of residue being broken down. At harvest, both the corn and soybean plots had increased yield.

# MICROBIAL FUNCTIONS

Biological solutions from The Andersons provide naturally occurring microbial strains chosen to perform specific functions in the soil system. Learn about the primary functions of the microbes in Bio Pass®, Bio Pass LG, and Bio Reverse® below.



## 8 MICROBES

### 300 BILLION CFUS PER PINT

Designed for use in corn and wheat with liquid starter fertilizer programs

#### ***Bacillus formis and Bacillus composti***

Associated with mineralization and cycling of nutrients in the soil, by which the nutrients are released and made more available

#### ***Bacillus laterosporus***

Acts as a biological control or antagonist against plant pathogens

#### ***Bacillus ligniniphilus***

Utilizes lignin as a food source to accelerate breakdown of crop residue

#### ***Thiobacillus sulfooxidans***

Converts elemental sulfur into sulfate, a form that is plant available

#### ***Bacillus oleophilus***

Employs hydrocarbons as a food source and works to improve overall plant health

#### ***Azotobacter chroococcum and Bradyrhizobium denitrificans***

Working in synergy, these two bacteria process  $N_2$  to  $NO_3$  in the nitrogen cycle



## 8 MICROBES

### 300 BILLION CFUS PER PINT

Designed for use in soybeans with liquid starter fertilizer or burndown herbicide programs

#### ***Bacillus megaterium***

Acts as an antagonist with fungicidal and antiviral properties, providing biological control of plant diseases

#### ***Bacillus licheniformis***

Mineralizes and cycles nutrients in the soil

#### ***Bradyrhizobium japonicum***

Increases root nodulation and aids in fixation of nitrogen

#### ***Pseudomonas putida***

Provides biological control of plant diseases by acting as an antagonist to dampen out diseases

#### ***Azotobacter chroococcum, Acetobacter diazotrophicus, Azotobacter vinelandii, and Bacillus azotofixans***

Aid in nitrogen fixation under different conditions



## 4 MICROBES

### 300 BILLION CFUS PER PINT

Designed to reduce residue stubble; may be applied year-round whenever residue is present

#### ***Bacillus cellulolyticus***

Enhances degradation of cellulose

#### ***Bacillus ligniniphilus***

Utilizes lignin as its carbon source to accelerate breakdown of crop residue

#### ***Rhodopseudomonas palustris***

Breaks down lignin and acids found in degrading plants and animal water by metabolizing carbon dioxide in both aerobic and anaerobic environments

#### ***Saccharomyces cerevisiae***

Used as a food source during colony formation by microbial strains



For more information on The Andersons Biological Product Line-Up, visit:  
[AndersonsPlantNutrient.com/Biologicals](https://www.AndersonsPlantNutrient.com/Biologicals)



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