

# SOIL BIOLOGY: THE NEXT FRONTIER FOR RETAILER SERVICE

BioPath® & PowerCoat® FROM  
BIOLOGICAL FERTILIZER COMPLEMENT

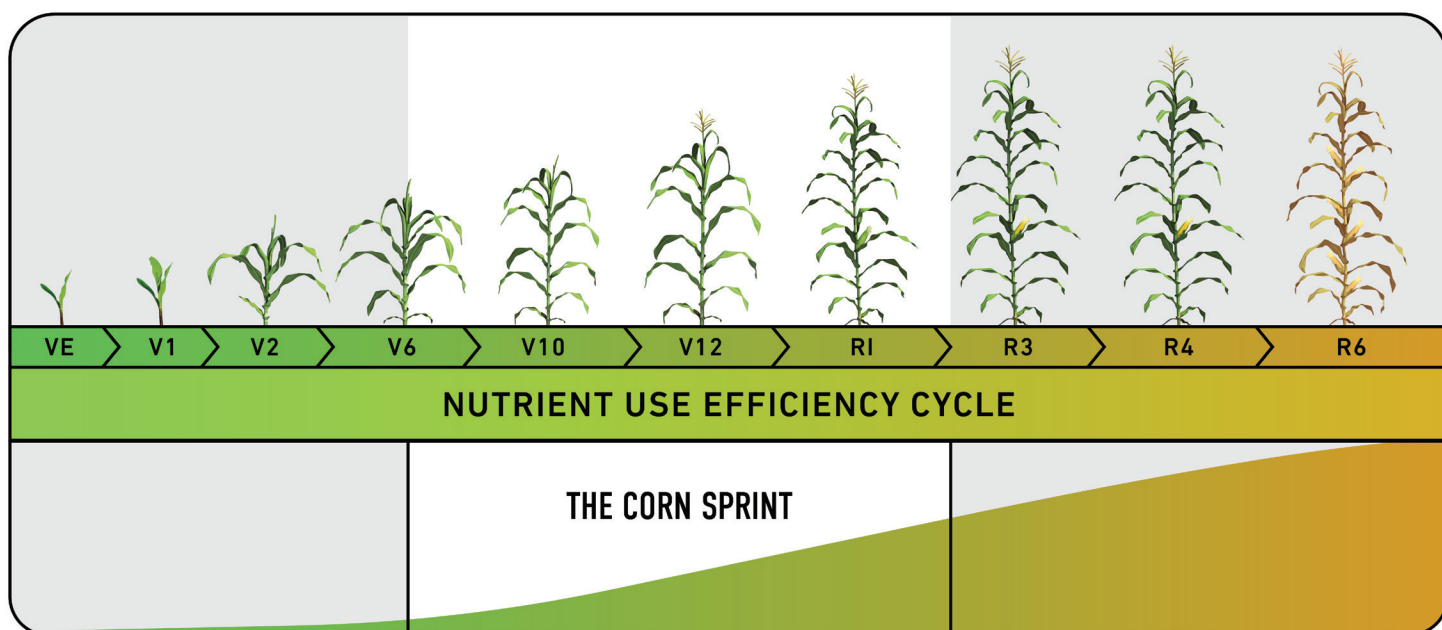


New thinking and agronomic services around balanced crop nutrition can drive success for today's ag retailers. The 4R nutrient management approach — right source, right rate, right time and right place — is fundamental to proactive plant health management and the resilience of the soil biome. Biologicals exemplify the evolution in balanced crop nutrition, and they're driving new agronomic services and retailer opportunities by elevating soil and plant science and their influence on plant health and yield potential.

Strategic supplier partnerships help retailers grow revenue potential and agronomic service with biologicals, and Mosaic wants to partner with innovative, progressive retailers in adopting them. Retailers now have a unique, proven, science-backed and easy-to-sell solution to partner with growers by adding a biological that maximizes nutrient use efficiency and optimizes yield potential.

## BALANCED CROP NUTRITION + NUTRIENT USE EFFICIENCY

Each plant manages nutrient use efficiency through three key nutrient pathways: availability, uptake and utilization. Throughout the growing season, the plant seeks to take in nutrients and use them in the most efficient way possible. If the soil isn't balanced or growing conditions aren't ideal, the plant cannot maximize its health and yield potential. That means your agronomy programs are not given the credit they deserve.



### Availability

Plants build pathways and mechanisms that manage leaf, root, stalk and reproductive development during this early stage. Those systems later help determine plant health, size, weight and crop yield.

### Uptake

Plants absorb and store 60% of nitrogen and 30% of all nutrients used in later stages. During the "Corn Sprint" — a rapid growth from V6 to tassel — the plant accumulates nutrients in stalk and leaf systems, forming its stress management and yield capabilities.

### Utilization

Nutrient utilization occurs throughout the growing season until the plant reaches full maturity. Late in the season, the plant draws from previously stored nutrients to manage late-season stress and maximize ear size and kernel weight, major yield contributors.

You can help growers improve nutrient availability, uptake and utilization by applying an advanced crop nutrition approach.

THE SOIL ECOSYSTEM

The soil ecosystem is the next agronomic frontier for optimizing nutrient use efficiency, and creating necessary chemical, physical and biological balance, which is the first step in achieving advanced crop nutrition. Partnering with Mosaic to add biologicals to corn fertilizer blends — thereby achieving that balance in two of the three necessary areas — will enable retailers and growers to achieve greater ownership of the soil ecosystem, ultimately creating an optimal environment for corn plants.

Plant roots, root exudates and synthetic fertilizer combine in the rhizosphere microbiome to create a nutrient-rich sheath of soil around the plant roots that is vital to nutrient use efficiency, plant health and soil health.

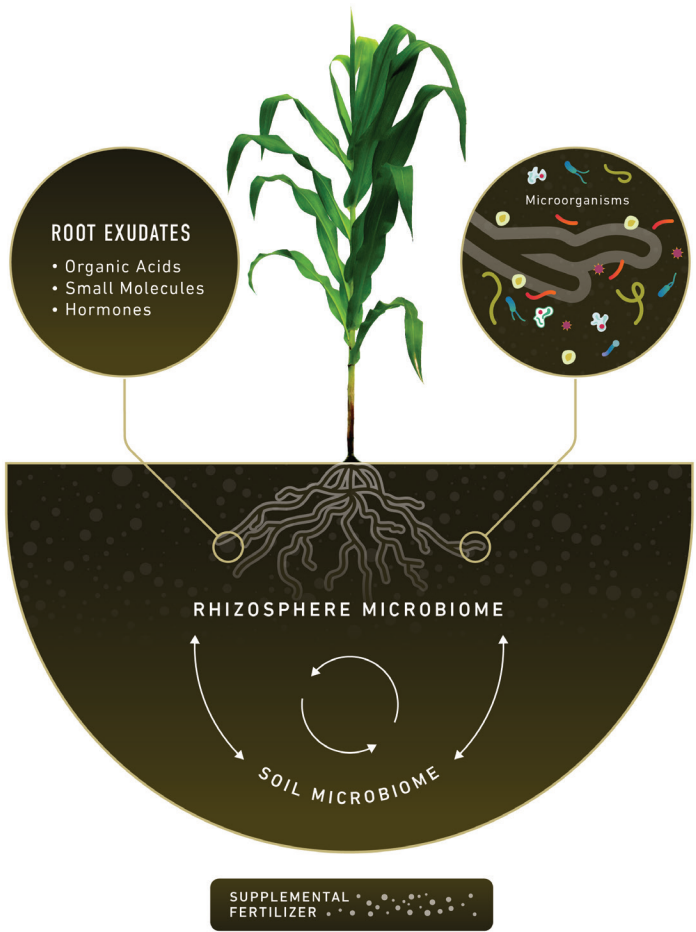


Figure 1: Corn roots excrete root exudates that serve as energy sources for microbes in the rhizosphere that are responsible for mineralizing nutrients in the soil.

EMPHASIZE NUTRIENT EFFICIENCY AND BALANCED CROP NUTRITION WITH CUSTOMERS YEAR-ROUND

Agriculture is growing more complex and technologically advanced each day. Consumer sustainability demands are driving new crop production trends, making biologicals valuable new tools that complement existing nutrient management programs. They increase nutrient availability, uptake and utilization and improve early-season plant growth and vigor optimizing yield potential in corn.

Engaging customers to manage root zone performance throughout the growing season builds relationships, while encouraging an advanced crop nutrition mindset. Ultimately, this will result in strong crop performance and revenue.

Adding a biological can facilitate the chemical, physical and biological processes necessary to achieve advanced crop nutrition and ultimately, optimal corn crop yield.

ABOUT BIOLOGICALS

Biologicals that contain strains of Plant Growth Promoting Rhizobacteria (PGPR) colonize in the rhizosphere to create symbiotic relationships with corn roots, stimulating microbial performance that optimizes nutrient use efficiency.

Adding a biological to fertilizer promotes nutrient availability, uptake and utilization when plants demand a lot from the soil, especially with earlier planting, erratic weather and extended harvest timeframes. Opening key pathways by adding a biological during these times contributes to healthy, high-yielding plants.

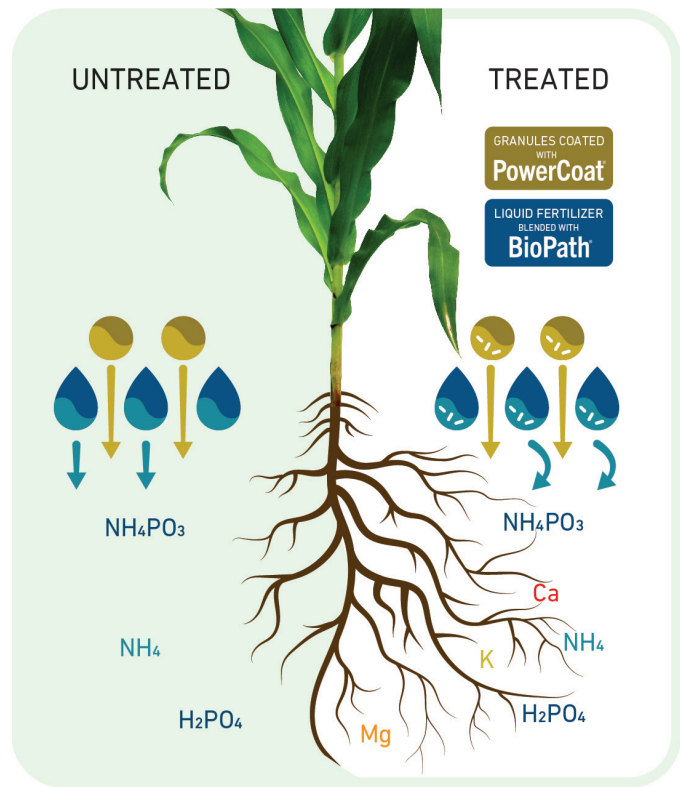


Figure 2: Field trials have demonstrated that corn treated with biologicals containing PGPR produces more above ground biomass because plants developed larger, denser root systems that enabled improved nutrient uptake.

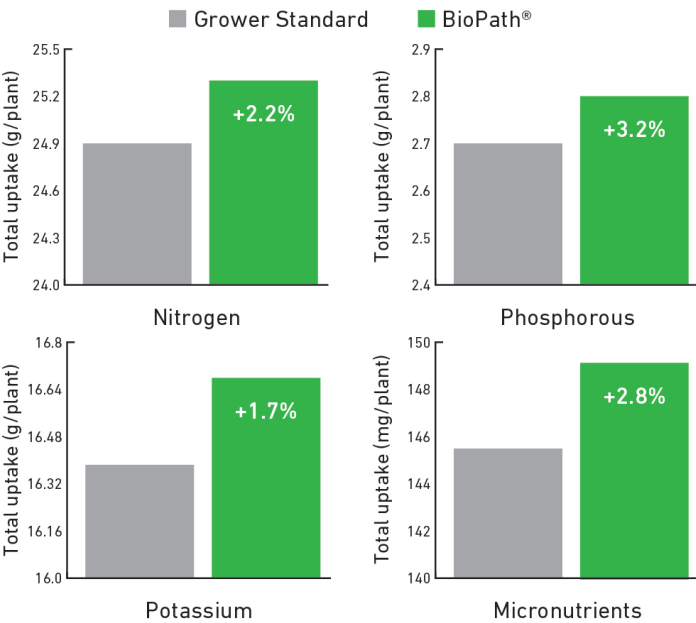
HOW MOSAIC BIOLOGICALS MEET NUTRIENT EFFICIENCY NEEDS AS PART OF ADVANCED CROP NUTRITION

BioPath® and PowerCoat® are biological fertilizer complements from Mosaic with proven strains of PGPR that increases nutrient availability, uptake and utilization. This improves corn plant growth and vigor. The *Bacillus* strains in BioPath and PowerCoat form a symbiotic relationship with corn roots and have been carefully screened and selected for their ability to produce organic acids and enzymes. This makes fertilizer more available to corn plants and improves nutrient solubilization in the root zone, providing the support needed during peak mid-season uptake times like the “Corn Sprint.”

During the nutrient uptake and utilization phase, BioPath or PowerCoat promotes vigorous root development and above-ground biomass via the production of plant growth promoting compounds. By improving availability and uptake in earlier vegetative growth phases, these biological fertilizer complements promote improved in-plant nutrient utilization from tassel to black layer.

While BioPath and PowerCoat have many competitors in the crowded biological market, they have unique differentiators and benefits. There are three distinct advantage over competitive products: ease of use, consistent performance and economics. The strains of *Bacillus* bacteria, their modes of action and use rates are well-tested and understood; On average, both BioPath and PowerCoat achieve an 80% to 90% win rate in research trials and secure strong revenue margins for both retailers and growers. BioPath is compatible with most liquid fertilizers and crop protectants, while PowerCoat can be impregnated on granular fertilizers. Neither have special storage conditions and offer a 24 month shelf-life.

BioPath and PowerCoat stand out in research trials for all the right reasons. They have been proven to complement existing fertilizer programs by improving nutrient use efficiency. In recent trials across the Midwest, sidedress applications of BioPath improved nutrient uptake by up to 3.2% and increased biomass, cob weight and kernel count. BioPath and PowerCoat are not only easy to apply and cost-effective, adding them to fertilizer applications provides 9.6 lbs/acre of additional nutrients compared to an application without the biological. This improved nutrient use efficiency and greater early-season corn plant growth and vigor can increase the return on fertilizer investments and optimize yield potential, resulting in a year-over-year yield advantage of 3.7 bu/acre.



Data reflects the average difference of 325 corn plants across 12 location. Total nutrient uptake = biomass x nutrient concentration.

Figure 3: In 2021 trials, BioPath increased total nutrient uptake by up to 3.2%.

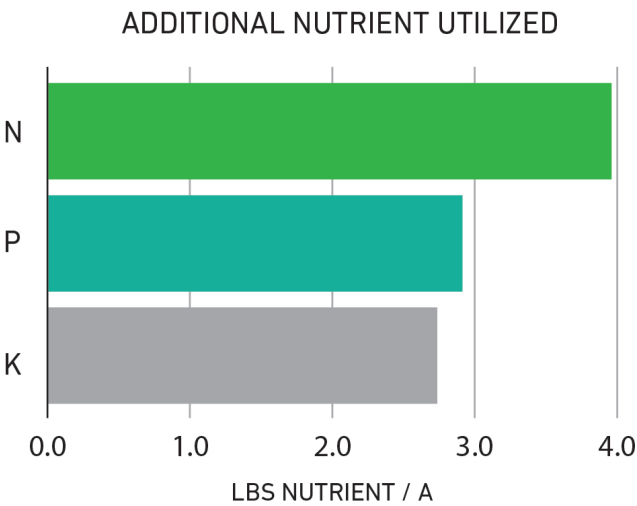


Figure 4: On average, an additional 9.6 lbs/acre of N, P & K are utilized from a sidedress application of BioPath.

CONCLUSION

Today, retailers and growers have a lot of challenges to overcome. The crop production landscape is ever-changing. These challenges require an advanced crop nutrition mindset in which soil and plant health, a sustainable ecosystem, and productivity and profitability are top priorities. Mosaic is committed to partnering with retailers as science-backed advisors to growers. Partnering with fertilizer innovators to continue learning and pushing the crop frontier forward with advanced crop nutrition and biologicals is a key to continued profitability and service offerings. Whether liquid or granular recommendations, BioPath and PowerCoat are, respectively, the first step in enhancing plant and soil health.

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