

## Integration of Biologics, the Soil Microbiome, Fertilizers, and Cover Crops to Optimize Soil Health and Increase Sustainable Crop Productivity

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### Abstract

The challenges to cropping systems with regards to maintaining/improving soil health, reducing agriculture impacts on water use/water quality while increasing crop yields are well documented. As the understanding of the interaction of microorganisms with soil, crops improves new products and techniques are being deployed. For long term improvement, farm fields must be considered a year-round ecosystem rather than only focusing on the crop growing season.

**Keywords:** Biologics; Soil Microbiome; Fertilizers; Cover Crops

### Soil and plant material

Research show that management of soil in farming has improved yet optimization is difficult. No Till systems can cause excess material that fail to break down quickly enough, impacting seed planting, emergence and early plant health in the following season. Harvesting of plant materials, especially in corn-on-corn (maize) rotation situations has shown increased yield, but excess removal has issues, programs have been variable, some processes increase soil compaction.

### Cover crops

The use of cover crops to protect soil and aid in plant material conversion has grown in adoption. Cover crops have proven benefits for water quality and nutrient leaching. However some cover crop systems have caused issues in planting, seed emergence and early season plant health.

### Biologics, nutrients and plant health

Biological treatments in root biome for plant health are commercialized. The use of biologics to aid in breakdown of post-harvest plant material has less research. Advanced timed and/or micro fertilizer delivery systems also may impact early plant interaction with local soil biome.

Promising biologics, bio-stimulants, nanotechnology based compounds need to be proven in the complex environment of the farm ecosystem. Reliable on-farm data from variety of treatments, soils, cropping systems is necessary for success.

### Summary

As knowledge of the interaction of crops, soil, and microbes within the field ecosystem improves, new products to improve farming continue to be available. Though many show promise in testing, efficacy in farmers' fields are variable. Technologies and products need to be commercialized in synergy.

The integration of cropping systems, including biologics, fertilizers and modifying cropping systems to integrate cover crops and alternative crops will be necessary to advance yields and improve soil health and water quality.

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