What are enzymes and what do they do?

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Ever wonder how microbes eat?

The core scientific team at Growcentia has conducted years of research to best understand how enzymes function to support plant growth. We’ve studied how enzymes produced by bacteria and fungi influence soil function and plant production in a range of ecosystems ranging from grasslands to the Arctic, and in a variety of agricultural systems.

Enzymes are the tools that soil microbes use to make nutrients available for microbial and plant uptake. Plants don’t have mouths, and they can only take up nutrients by absorbing them through their cell wall. Enzymes are critical components to support plant growth because most of the organic material in soils and soilless media are too big and insoluble for plants to take up. Therefore, nutrients must first be broken into smaller molecules that the plants can use. To accomplish this, microbes produce enzymes— which are specialized proteins that catalyze the breakdown of large molecules into smaller molecules— and release them into the environment to break down nutrients into smaller forms that plants can uptake!

Carbon is the currency of all life on Earth, and plants get their carbon from the CO₂ in the air. However, plants draw all other essential nutrients required for growth from the soil. Soil microbes produce the enzymes that cycle nitrogen, phosphorus and other nutrients to feed plants. Concurrently, plants feed the microbes using a variety of carbon-rich compounds that leak from plant roots, called exudates, as well as dead root cells. Microbes rely on their extracellular enzymes to break down different forms of carbon, which fuel their activity and growth, and enable them to cycle important macro and micro nutrients for both microbial and plant uptake.

Microbes tend to invest in producing enzymes to meet environmental nutritional needs. Depending on the relative availability of different elements, they focus on producing enzymes that release the nutrients that are most limiting. For example, to acquire phosphorus, microbes produce phosphatase enzymes. To acquire nitrogen, they produce enzymes like chitinases and proteases to break down nitrogen-rich organic compounds.

Beneficial bacteria support plant growth by acting like mini enzyme factories. By continuously producing enzymes, microbes ensure that nutrients are efficiently recycled and delivered to plants- and that waste products don’t accumulate in the soil and soilless media. For growers,
it’s important to recognize that when enzyme-producing microbes are present, plants partner with them to efficiently cycle the nutrients in their environment. Additionally, beneficial bacteria help maintain the proper ratio of nutrients by shifting enzyme production to meet plant nutrient demands.

Using beneficial microbes will maximize plant nutrient uptake, development, quality and yield! In our research, we discovered that plant species influence microbial production of enzymes. For example, plants seem to influence microbes to produce nitrogen degrading enzymes, or phosphorus degrading enzymes so that plants can acquire the right amounts of each nutrient that they need to grow. Microbes help plants get the nutrients they need!

References:


***Interested in how we measure enzymes? Check out this open-access video by co-founders Dr. Bell and Dr. Wallenstein!

General top papers in this field:


