

BIOSTIMULANTS IN CROPPRODUCTION

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Introduction

- Growing demand for high-quality crops to meet food requirements of two billion people on the planet by 2050
- Bio stimulants are natural derivative substances that aid plant growth and development,
- Improve nutrient use efficiency, crop yield, quality, health, and ability to tolerate abiotic stress.
- Biostimulants include seaweed extracts, inorganic compounds to beneficial fungi and bacteria.
- They are not recognized as fertilizer, nor have any pest-killing properties.

What are Biostimulants

Definition

- The Environment Protection Agency (EPA) defined Plant biostimulants as products containing naturally occurring substances, microorganisms, or their synthetic equivalents that, when applied to seeds, plants, or the rhizosphere, stimulate natural processes to enhance nutrient uptake, nutrient efficiency, tolerance to abiotic stress, or crop quality and yield.”
- Biostimulants can influence a plant’s vigor and yield
- Do not protect against pests, diseases and other detrimental factors like weeds,
- They differ from Plant Growth Regulators (PGR) which are chemicals that alter plant growth.
- PGR’s are regulated by the EPA, which provides guidance for their use in agriculture

Categories of Biostimulants

Protein Hydrolysates

- Amino acid-based biostimulants are created through chemical and enzymatic methods commonly associated with protein hydrolysis from crop residue and animal excrement. Essential amino acids and peptides are commonly referred to as the building blocks of protein.
- These amino acids play a crucial part in enhancing plant growth and resilience.
- When incorporated into biostimulant formulations, they help improve nutrient uptake, stimulate root development, and enhance stress tolerance in plants.
- Beneficial in agricultural settings, where plants are often subjected to abiotic stresses such as drought or salinity

Humic and Fulvic Acids:

- Soil organic matter breaks down, to form end products of humic and fulvic acid which are organic acids that are natural biostimulants in soil.
- Formed from the decay of plant, animal, and microbial residues, from the biochemical reactions of soil microbes like bacteria and fungi.
- These organic acids are crucial as they enhance nutrient availability and improve soil structure.
- By chelating essential nutrients, they facilitate better uptake by plants and stimulate beneficial microbial activity, promoting a healthier soil ecosystem.
- This leads to increased crop resilience against diseases and stresses while reducing the need for synthetic fertilizers, making agriculture more sustainable.

Seaweed Extracts & Botanicals:

- Seaweed extract and botanical biostimulants have been in use in agriculture for centuries,
- Recently studied in depth for their biostimulant properties.
- Soil, application of seaweed can enhance water retention and support overall soil health.

Chitosan & Other Biopolymers:

- Chitosan a biostimulant is a modified carbohydrate biopolymer derived from chitin which is a fibrous component of the exoskeleton in the cell walls of fungi, insects and aquatic species like crabs, lobsters ,prawns etc
- In the agricultural sector, chitosan has been used to increase plants ability to survive abiotic stress like cold and hot weather conditions.

Benefits of Biostimulants

- Help protect against the effects of environmental stresses.
- Influence a plant's response to stress and adverse changes in its environment.
- Stimulate plant growth by increasing germination and root development allowing plants for better access of water and minerals.
- Increase grain or fruit fill and improves quality.
- Plants like corn rely on biostimulants to advance grain fill—the period between pollination to when kernels are fully matured.
- Encourage plant growth, optimize grain fill by boosting drought protection during the vital grain fill phase, by allowing the plant to take in more water.
- They can also aid in improving color of fruit and post harvest quality.
- Biostimulants contain particular growth-promoting bacteria for increased crop yields.
- When applied to the seed, biostimulants have been known to increase the leaf area, height, and seedling development.

Difference between biostimulants and conventional fertilizers

- Understanding the differences between them can help in their better use for optimal crop health.

Functionality:

- Fertilizers primarily supply essential nutrients like nitrogen, phosphorus, and potassium that plants need for growth.
- Their primary role is to directly nourish the plant by replenishing nutrient levels in the soil.
- Biostimulants, on the other hand, do not directly provide nutrients.
- Instead, they enhance a plant's ability to absorb and use nutrients more efficiently, stimulating natural processes that promote growth, resilience, and productivity.

Focus on Plant Health:

- Fertilizers are nutrient-based and focus on feeding the plant to ensure it has what it needs for basic physiological processes needed for growth.
- Biostimulants focus on overall plant health, improving stress tolerance, and enhancing the plant's response to environmental conditions like drought or extreme temperatures.

Impact on Soil Health:

- Fertilizers, especially synthetic ones, can sometimes lead to soil degradation over time if not managed carefully, as excessive use can cause nutrient imbalances and harm soil microorganisms and pollute the environment
- Biostimulants contribute positively to soil health by improving the microbial environment and encouraging beneficial biological activity that supports long-term soil fertility.

5 Regulation:

- Fertilizers are strictly regulated based on their nutrient needs of crop and inherent fertility so as to minimize effects on the environment.
- Biostimulants are typically less regulated and fall into a separate category.
- They are defined by their role in enhancing the plant's internal processes rather than acting as a direct source of nutrients.

6 Environmental Impact:

- Fertilizers can lead to runoff and pollution if over-used, contributing to eutrophication in water bodies.
- Biostimulants offer an environmentally friendly solution by reducing the need for excessive fertilizer use and minimizing harmful environmental impacts.

Combination of traditional fertilizers with biostimulants, can provide plants with both the essential nutrients and the biological support they need to thrive, leading to healthier crops and more sustainable yields and environment quality

Reference

Lindsey Robinson,2025,Understanding Biostimulants for Plants ,Verdesian Life sciences N



Thank You