



ALL SYSTEMS GO: THE SCIENCE BEHIND BIOSTIMULANTS



Maximizing genetic potential

For an athlete to reach peak performance, they must do more than train. A proper diet is an important aspect to providing muscles the nutrients they need to recover and grow. Elite athletes often supplement their diets with vitamins, minerals, creatine and other “ergogenic” compounds. An athlete’s inherent genetic physiology responds to these substances, allowing them to increase physical power and enhance mental strength, which often provides a competitive advantage. Plants respond to certain substances known as biostimulants in a similar way, activating metabolism, which influences photosynthesis.

What are biostimulants?

Plant biostimulants are diverse substances and microorganisms used to enhance plant growth.² These products sometimes go by other names, such as plant strengtheners and conditioners, phytostimulants, biofertilizers, bioactivators, or soil, yield, crop and plant growth enhancers.¹¹ These include products with some nutrients, provided that the effect on plant growth is not through direct fertilization. Biostimulants operate through different mechanisms than straight fertilizers, regardless of the presence of nutrients in the fertilizers. Their rapid incorporation into integrated farming throughout the world is being fueled by a number of factors, including:

- Proven performance and acceptance from NGOs, governmental bodies, academia, and the biostimulant industry itself
- Companies offering customized solutions and working to increase awareness of this category
 - The need to restore degraded soil
 - Demand from farmers and consumers for environmentally safe and organic products that can negate the harmful effects of chemical inputs
 - Increasing food production demands

The global market for biostimulants is projected to increase 12% per year and reach over \$2 billion in sales by 2018.¹⁵

What do biostimulants do?

Biostimulants foster plant development in a number of demonstrated ways throughout the crop life cycle, from seed germination to plant maturity. Biostimulants can be applied to plant, seed, soil or other growing media that may enhance the plants ability to assimilate nutrients or provide benefits to plant development.²

EFFECTS²

Improve metabolic efficiency

Enhanced root development

Facilitate nutrient assimilation & translocation

Foster complementary soil microbes

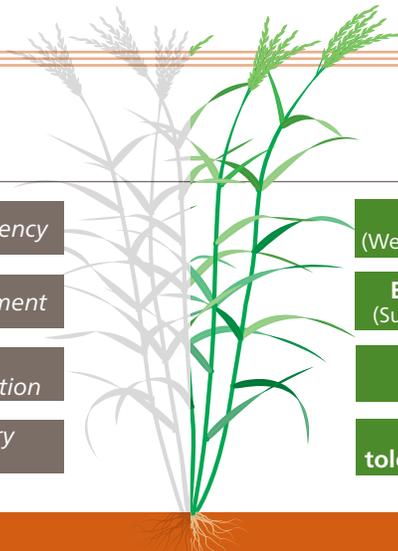
RESULTS²

Increase yield
(Weight, seed & fruit set)

Enhance quality
(Sugar, color, shelf life)

Greater water use efficiency

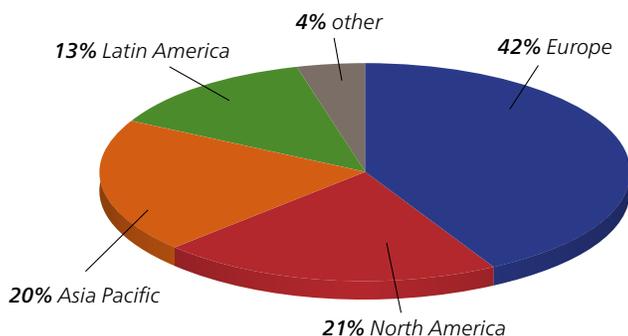
Greater stress tolerance & recovery



A glance at the global biostimulant market

Segmented by active ingredient, the acids (humic, fulvic, etc.) constitute 51% of the market, with seaweed extracts at 37% and the remaining 12% coming from microbial extracts, plant extracts, B-vitamin, chitin, and chitosan.¹²

Current estimate of biostimulant market share



“Many scientific studies have demonstrated the potential of various categories of biostimulants to improve crop production and to ameliorate abiotic stresses such as drought and soil salinity.”²

—Pamela Calvo, Auburn University

Governmental recognition

Despite proliferation of use, no country in the world has a regulatory framework that defines the term “plant biostimulant”. As a result, products need to be placed on the market either under the fertilizer acts or the plant protection products acts. In some cases, products are placed on the market under both (e.g., Canada). This patchwork of regulatory hurdles has led to industry fragmentation and rationality, with few companies operating at a truly global level.^{7,13}

A 2015 study using high-resolution mapping techniques (micro X-ray fluorescence) revealed that foliar application of a biostimulant derived from microbial fermentation greatly enhanced the movement of foliar-applied zinc in sunflower.¹⁰

Results from more than ten published studies suggest that biostimulants based upon plant extracts or microbial cultures may contain metabolites involved in stress perception that can act to ‘prime’ plants to better resist future abiotic or biotic stresses. Once a plant has perceived a stress, biostimulants have also been shown to enhance plant stress tolerance mechanisms.⁹

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Alltech nutrigenomics research in 2015 studied the effect of biostimulants on plant growth hormones.

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