Popular Article

BIOSTIMULANTS: AN ALTERNATIVE TO CONVENTIONAL CROP STIMULATORS

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ABSTRACT

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12.03.2017 **Revised on:** 29.04.2017 **Accepted on:** 01.05.2017 Crop stimulators are the agents which stimulate the growth and developmental physiology of any crop plant in order to have a substantial hike either in yield or in quality attributes. Sometimes these may be attributed with enhanced disease resistance. Biostimulants are primarily the substances which are being collected from various living organisms or biological sources. Its beneficial stimulating effect is expressed when it is applied exogenously on a plant. Biostimulants are having a great importance in crop production especially when the matter deals with organic farming.

INTRODUCTION

Farming is one of the primary occupations in the human civilization. Since the ancient era, our farming attitude has been greatly revolutionized still today. Green revolution of the 1960s' can be sited as a best revolution in crop production, because after that only the extensive use of various chemical inputs started. No doubt, it has multiplied the traditional yield several times, but the hope for sustainability is lost. To feed the rapidly growing educated as well as the self-conscious citizens of a developing country like India, the excess use of various chemical agro-inputs may not be realized as a best option. Hence, day-by-day a reliability is increasing for various alternates of chemical agro-inputs such as use of several biostimulants in crop production practices. Fundamentally, biostimulants are the externally applied biological agents or their products which directly or indirectly stimulate various attributes of the crop production. European Biostimulants Industry Council (EBIC) defined plant biostimulants "a material which contains substance(s) and/or microorganisms whose function when applied to plants or the rhizosphere is to stimulate natural processes to benefit nutrient uptake, nutrient efficiency, tolerance to abiotic stress, and/or crop quality, independently of its nutrient content. Biostimulants have no direct action against

pests and therefore they do not fall within the regulatory framework of pesticides."In the United States, the Biostimulant Coalition, a non- profit group representing the biostimulant industries, proposed the definition for biostimulants as "a beneficial substance or compound other than primary, secondary, and micro plant nutrients that can be demonstrated by scientific research to be beneficial to one or more species of plants, when applied exogenously (Jardin, 2015).

Common features of biostimulants

- 1. The nature of biostimulants is not restrictive *i.e.* it should be diverse.
- 2. The physiological functions are diverse.
- 3. The scientifically demonstrated effects of all biostimulants converge to at least one or several of the agricultural functions
- 4. Economic & environment benefits.

Types of biostimulants

- Humic and fulvic acids
- Protein hydrolysates and other N-containing compounds
- Seaweed extracts and botanicals
- Chitosan and other biopolymers
- Inorganic compounds
- Beneficial fungi

• Beneficial bacteria

Humic and fulvic acids

- Humic substances (HS) are natural constituents of the soil organic matter, resulting from the decomposition of plant, animal and microbial residues, but also from the metabolic activity of soil microbes using these substrates.
- They are extracted from naturally humified organic matter (e.g. from peat or volcanic soils), from composts and vermicomposts, or from mineral deposits (leonardite, an oxidation form of lignite).
- The proposed biostimulation activity of HS also refers
 - Acting on physical, physico-chemical, chemical and biological properties of the soil.
 - To stress protection. (Phenylpropanoid metabolism)
 - Essential contributors to soil fertility

Protein hydrolysates and other N-containing compounds

- Protein hydrolysates (PHs) are an important group of plant biostimulants are mixture of peptides and amino acids, mainly produced by enzymatic and/or chemical hydrolysis of proteins from animal or plant derived raw materials or agro-industrial by-products.
- PHs are known to
 - Increase microbial biomass and activity,
 - ➢ Soil respiration and soil fertility
 - Nutrients availability and acquisition by roots. (Chelating and complexing activities of specific AAs and peptides)
 - Conferring tolerance to abiotic stress

Seaweed extracts and botanicals

- Seaweeds are green, brown and red marine macro algae
- The chemical constituents of seaweed extract include complex polysaccharide (laminarin, alginates and carrageenans and their breakdown products), fatty acids, vitamins, phytohormones, micro and macronutrients, sterols & N-containing compounds like betaines.
- Extracts of brown seaweeds are widely used in horticulture crops largely for their:
 - Plant growth-promoting effects
 - Allelochemicals

- Tolerance to abiotic stresses such as salinity, extreme temperatures, nutrient deficiency and drought. (antioxidants & regulators of endogenous stress-responsive genes)
- > Pathogen antagonists in suppressive soils.

Chitosan and other biopolymers

- Biopolymers Chitosan is a deacetylated form of the biopolymer chitin, produced naturally and industrially.
 - Chitosan as biostimulant helps in;
 - Protection against fungal pathogens,
 - ➤ Tolerance to abiotic stress (drought, salinity, cold stress)and
 - > On quality traits related to primary and secondary metabolisms.
 - Stomatal closure induced by chitosan via an ABA-dependent mechanism.

Beneficial compounds

- Chemical elements that promote plant growth and may be essential to particular taxa but are not required by all plants are called beneficial elements.
- The five main beneficial elements are Al, Co, Na, Se and Si, present in soils and in plants.
- Many effects of beneficial elements are reported by the scientific literature, which
 - Promote plant growth,
 - > Quality of plant products

> Tolerance to abiotic stress. (cellwall rigidification, osmoregulation, reduced transpiration by crystal deposits, thermal regulation via radiation reflection, enzyme activity by co-factors, plant nutrition via interactions with other elements during uptake and mobility, antioxidant protection)

> Interactions with symbionts, pathogen and herbivore response

➢ Protection against heavy metals toxicity

➢ Plant hormone synthesis and signalling

Beneficial fungi

• Fungi interact with plant roots by mutualistic symbioses (i.e. when both organisms live in direct contact with each other and establish mutually beneficial relationships).

- Arbuscule Forming Mycorrhiza (AMF) are a widespread type of endomycorrhiza.
- Metagenomics are an interesting tool to monitor and study microbial associations in the rhizosphere.
- Fungal-based products applied to plants to
 - Bioprotector
 - Biofertiliser
 - Enhance nutrient use efficiency
 - Phytohormone balance
 - > Organ growth and morphogenesis
 - Crop yield and product quality
 - Induce changes in secondary metabolism leading to improved nutraceutical compounds.

Beneficial bacteria

• With regard to the agricultural uses of biostimulants, two main types should be considered

(i) Mutualistic endosymbionts of the type Rhizobium

(ii) Mutualistic, rhizospheric PGPRs ('plant growth-promoting rhizobacteria').

- PGPR inoculants are now regarded as plant 'probiotics'
 - ➢ Supply of nutrients,
 - Increase in nutrient use efficiency,
 - Induction of disease resistance,
 - Enhancement of abiotic stress tolerance,
 - Modulation of morphogenesis by plant growth regulators.

CONCLUSION

As there is growing demand for the organic foods, hence peoples are more concerned about the use of biostimulant products, because it not only enhance the quality traits but also help in tolerance to biotic and abiotic stress, enhance the nutrient efficiency and gives long term benefit in a eco-friendly way.

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