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# Bio stimulants and its application towards soil health improvement [Article ID: SIMM0319]

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#### Abstract

Biostimulants are a set of organic materials and microorganisms that can enhance water assimilation, nutrient uptake, and resilience to abiotic stresses. They represent an innovative and ecofriendly option for sustainable agriculture goals. Biostimulants offer a potentially novel the regulation for and/or approach modification of physiological processes in plants to stimulate growth, to mitigate stress induced limitations, and to increase yield. They can act on plant productivity as a direct response of plants or soils and plant microbiome with subsequent effects on plant productivity

Key words: Biostimulants Importance, types, soil health

#### Introduction

Biostimulants are organic products made up of peptides and amino acids which are readily available. to plants. Products like bio stimulants are seen as an entirely new generation of agricultural tools for sustainable farming. The health of a country's soil is a critical and delicate resource because it determines the overall yield of a country's crops, which feeds their population. It's a serious problem when a country has to rely on outside sources to

meet its population's demand for food and other agricultural products (Kapoore et al., 2021).

Agricultural productivity has enhanced in India as a result of the Green Revolution in order to meet public demand and to sell crop products commercially. With chemical inputs like fertilizers, pesticides, fungicides, insecticides. nematicides and weedicides as well as intensive irrigation practices of green Revolution helped achieve the goal to some extent. When crop yields start declining despite fertilizer application following the Green Revolution, this indicates that the soil has lost its fertility. Beneficial soil organisms can't live there if there are toxic chemicals in the soil. The pollution of groundwater and air, as well as the harm they caused to human and animal health, were all additional consequences of these chemicals. The need to restore soil health and the natural environment is therefore pressing.

Soil and environment can be nourished by using natural fertilizers such as biofertilizers, vermicompost, farmyard and green manure and biopesticides, all of which can be used in a sustainable way to increase crop productivity (Srivastava et al., 2020). An agroecosystem's viability and the services it provides to humanity depend on healthy soil, which must be managed in harmony with environment. Due to human activity, the soil ecosystem and its services have been adversely affected. Soil ecosystems do indeed serve as the basis for all life on Earth, providing food, shelter and oxygen. There are a wide variety of microorganisms that thrive and maintain nutrients in soil. Nutrients in soil are essential to the health.

Nutrients in soil are essential to the health of plants and the foundation of





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agriculture on which people's livelihoods depend and the health of the soil is a determining factor in performance. Plant growth and yield are directly influenced by the quality of the soil in which they grow and are true regardless of how the soil is cultivated. To maintain soil health, it is important to consider everything from its depth to its texture and its porosity to its density and its ability to flow water. Soil health is the capacity of soil to sustain the living community which essentially depends on soil physical, chemical and biological environment.

#### **Biostimulants and its types:**

Large categories of bio stimulants are used as plant growth promoters (PGPs), plant growth promoter rhizobia (PGPR), Mycorrhiza, seaweeds. composted materials, humic substances, protein hydrolysate, fish meal, chitosan, and plant extracts. Each category contains a different type and number of microorganisms, which positively affect the plant growth stages. They also contain a wide spectrum of bioactive compounds and molecules, as well macro- and micronutrients, inducing several direct and indirect benefits for cultivated plants.

#### Sea weed extracts as Bio stimulant:

Seaweed extracts are plant bio stimulants because of their high levels of nitrogen, phosphorus and potassium. Based on their origin and content, bio stimulants can be divided into three major categories: organic, inorganic and synthetic (Yakhin et al., 2017). An extract of brown algae, Ascophyllum nodosum (L.), has been commercialized as Acadian to improve various plant growths attributes under normal and stressful conditions. Kelpak, a brown seaweed extract, can be used as a biological stimulant. Eckol, а new phlorotannin found in Kelpak, has auxin-

like properties and has been shown to promote plant growth in a number of studies. Instead of toxic, polluting chemical fertilizers. seaweed extracts are biodegradable and contain nutrients essential to plant growth (Selvam and Sivakumar, 2014). The efficiency of various liquid fertilizers is thought to be enhanced by additional plant-specific molecules found in seaweed extracts. When plants are exposed to seaweed extracts, bioinformatics studies have identified plant genes that are activated (Jannin et al., 2013). Extracts can also enhance soil structure, water retention capacity and soil microbes. (Nair et al., 2012).

#### Humic acid as Bio stimulant:

Humic substances extracted from various sources have been extensively found to boost iron nutrition of crop plants. In soil sediments, the existence of humified organic matter will further help to build up a supply of Fe for plants that exude metal ligands and provide Fe-HS complexes that can be used directly by plant Fe uptake. Research shows that HS can stimulate the transcriptional and post-transcriptional mechanisms that are involved in Fe acquisition. Fe-HS complexes, instead of other naturally or synthetically derived have chelates, may modified the distribution and allocation of Fe in the plant. Treatment with HS influenced root morphological characteristics and plant membrane activities related to primary and hormonal secondary metabolism, and reactive oxygen balance and nutrient acquisition. There are many ways in which soil- or exogenously supplied sulfonated Fe-HS complexes can influence iron uptake; including providing an easily accessible form of iron and directly affecting plant processes. It may also be considered ecofriendly to use Fe-HS from a An International Multidisciplinary e-Magazine



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variety of sources, sizes and solubilities for crop fertilization (Zanin et al., 2019)

# Arbuscular mycorrhiza and soil aggregation:

Plants, microflora numerous communities and their interactions are all involved in the process of soil aggregation, which is governed by a variety of abiotic factors such as soil texture. For root development, plant emergence, water filtration and a diverse variety of soil characteristics as well as ecosystem process rates, soil aggregation is critical. In soil degradation and land restoration investigations, prior knowledge of soil aggregation is vital (Lehmann et al., 2020). An iron-containing, thermo-stable glycoprotein, glomalin, is excreted from the hyphal exudate of Arbuscular mycorrhiza and acts as an aggregate binder material, which led to the aggregate stability.

## Chitin as Biostimulant:

Chitin is primarily obtained commercially from prawn and crab shells (Sharp, 2013). Sucrose is the most abundant polysaccharide in living organisms and cellulose is the second most common. Chitosan's hydrophobic nature and reduced water solubility and a number of organic solvents limit its functional applications in agriculture and considerably influence the biological properties of chitin. As a result, chemical reactions and the derivatives they produce are critical to better utilization and commercialization of this biopolymer (Shahrajabian et al., 2021). Vegetable crops have been studied extensively for their biostimulating properties. Complex structures, including the protein/CaCO3 /chitin nanofiber complex, that enhanced plant growth in hydroponically grown tomatoes, or polymeric chitin nanofibers, that demonstrate eliciting activities, have

proposed been to overcome the disadvantages of chitin (Dewang and Devi 2022). Tomato growth and nutrient use efficiency have improved. Increasing crop performance was demonstrated by higher water use efficiency after betaine and chitin was applied to lettuce grown in a regulated water deficit irrigation system (Lin et al., 2020). Several studies have been conducted on various biostimulants related to their influence on soil health indicators and their consequence on soil health. Chitosan aid in soil structure stabilization due to its positive charge it gets attracted between diffuse double layer of clay minerals leading to better soil aggregation which prevents soil erosion and accelerated mineralization of soil organic matter (Shahrajabian et al., 2021).

#### Conclusion:

Biostimulants play an important role and improve the efficiency with which plants utilize nutrients. Soil health is improved, as is agricultural resilience to climate shocks. Circular plant biostimulants increase resource efficiencies and minimize nutrient losses. It is reasonable to assume that natural plant biostimulants, as well as microbial inoculants, will play an increasingly important role the in development of environmental and economical viable crop production systems within more resourceful agro-ecosystems over the next few years, laying the groundwork for a bio-based industry-driven future of large-scale sustainable agriculture.

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