Plant Biostimulants, the new wave in crop improvement.

By Dr Shane Sparg

The buzz word globally is biostimulants, but what are they and do we need them in farming today? This article briefly introduces and explains the role of this new category of growth enhancement.

What is a plant biostimulant?

A plant biostimulant is any substance or microorganism applied to plants that is aimed at enhancing nutrition efficiency, stress tolerance and/or crop quality, regardless of the nutrients content. Though globally no legal description has been registered, the term has been used since 1997. However, over more recent years it has become more universally accepted that biostimulants are not fertilizers in the sense they do not contain nutrients intended to be delivered to the plant. Instead, they may facilitate nutrient acquisition. Their main function is focused on plant growth enhancement, while assisting with abiotic stresses, disease tolerance and enhanced crop yields and quality. There is however a number of these biostimulants on the market but they vary in their effectiveness and not all are made of natural and organic inputs.

Types of biostimulants

There are more and more products coming onto the market that are starting to compete in this space. Especially with the global climatic

changes and abiotic stresses that farmers are being faced with that are affecting crop production.

Humic and Fulvic substances are natural constituents of the soil organic matter. They occur from the decomposition of plant, animal and microbial residues, but also from the metabolic activity of soil microbes using these substrates. These compound complexes in the soil thus result from the interplay between the organic matter, microbes and plant roots. Humic substances have been long been recognized as essential contributors to soil fertility, acting on physical, physio-chemical, chemical and biological properties of the soil, increasing uptake of macro- and micronutrients, due to the increased cation exchange capacity of the soil, and further aids in preventing the leaching of plant nutrients - where microorganisms can access or store nutrients.

Amino-acids and peptides mixtures, obtained by chemical and enzymatic protein hydrolysis from agroindustry by-products, from both plant sources and animal tissue wastes, have also been used as biostimulants. These compounds have been shown to play multiple roles as biostimulants of plant growth and effects on N uptake and assimilation. Chelating effects have been reported for some amino acids which may protect plants against heavy metals but also contribute to micronutrients mobility and acquisition.

Seaweed(s) as a source of organic matter and as a fertilizer is ancient in agriculture, but more recently, their biostimulant effects have been

recorded and have become the focus. The commercial use of seaweed extracts, containing micro- and macronutrients, sterols, N-containing compounds like betaines, and hormones, or their purified compounds, which include the alginates, carrageenans, and polysaccharides laminarin have been utilized to promote plant growth. They can be applied to soils, in hydroponic solutions, or as foliar treatments.

Chitosan, a deacetylated form of the biopolymer chitin, produced naturally and industrially, has been developed over the years, focusing on plant protection against fungal pathogens, however broader agricultural uses have resulted in them being affiliated with biostimulants through their ability to improve tolerance to abiotic stress (drought, salinity, cold stress) through stomatal regulation and enhance quality related to primary and secondary metabolisms. Chitosan also assists in keeping plant parasitic and soil borne insects in check, and thus enriches the plant microbial and rhizosphere community.

Some inorganic elements have been identified to promote plant growth and may be essential to certain taxa but are not required by all plants. These are often referred to as beneficial elements. The four main beneficial elements; Co, Na, Se and Si, are present in the soils and in plants as different inorganic salts. Some of which are insoluble, like amorphous silica. The beneficial functions of these elements can be constitutive, like the strengthening of cell walls by silica deposits, or expressed in defined environmental conditions, like pathogen

attack for selenium and osmotic stress for sodium. Hence beneficial elements are not necessarily defined by their chemical benefits, but also to the positive effects on plant growth and stress response.

The stimulating benefit of fungi in a symbiotic relationship with plants is gaining more attention as an increasing interest in the use of mycorrhiza to promote sustainable agriculture, promoting the symbioses to nutrition efficiency (for both macronutrients and micronutrients), water balance, biotic and abiotic stress protection of plants. Recent research indicates to the existence of hyphal networks which interconnect not only fungal and plant partners but also individual plants within a plant community. The ecological and agricultural implications are significant, since there is evidence that the fungal conduits allow for interplant signaling. Fungal-based products used to promote nutrition efficiency, tolerance to stress, crop yield and product quality can be classified as a function of a biostimulant.

Like fungi, bacteria also play a role in plant cell-soil interactions. Though the associations and symbiotic relationships are still being researched it is becoming more accepted that there are certain bacterial stains which function as the “probiotics”, aiding in the supply of nutrients, increase in nutrient use efficiency, induction of disease resistance, enhancement of abiotic stress tolerance, and increasing post harvest qualities.

Botanics, plant derived active compounds, responsible for plant interactions in ecosystems are receiving increasing scientific attention in the context of sustainable crop management. Commonly mulching, crop rotation, intercropping, and cover-cropping is used to gain beneficial interactions between plants and soil (root-zone communities). Further investigations by scientists to these chemical interactions for the development of new biostimulants are being researched. One such true product which is gaining popularity commercially, is Vigo™ (developed and produced in South Africa) www.vigoland.com.

Vigo™ as a biostimulant

As per the accepted groupings of biostimulants, the product Vigo™ would fall under a botanical allelochemical, yet gaining the benefits of containing Amino Acids and the function of the humic substances making it a truly unique product. Referred to as a TCO (True Compound Organic), its recorded benefits are not only diverse but continually growing as the product's usage across the agricultural industry expands. Having a stimulatory effect on the plant's growth, increasing the plant's tolerance to abiotic stresses and ultimately resulting in enhanced yields, the product has a wide usage from turf grasses, through to fruit crops. Agricultural usage translates into economic and environmental benefits: higher crop yield, plant stress resilience, savings of fertilizers, increased quality and profitability of crop products, and enhanced ecosystem services.