Biostimulants

This group of compounds is playing an increasing role in agriculture worldwide. To this end there is now a world biostimulant congress which is held annually.

Recently South Africa introduced a new group of fertilizer i.e. Group 3 to regulate biostimulants. In addition to this there are published guidelines for Group 3 registrations. The guidelines can be downloaded from the Department of Agriculture, Land Reform and Rural Development (DALRRD) or the Fertilizer Association of South Africa (FERTASA).

Biostimulants include seaweed extracts, humic acid, fulvic acid, amino acids and microorganisms. This is not the full list of products regulated in this group. For more information see the FERTASA and DALRRD websites.

a. Seaweed extracts in South African Agriculture

Marine macro-algae or seaweed is a plant-like organism that live attached to rocky or other hard substrata in coastal areas. There are three different groups of seaweeds, namely brown, red and green algae. Seaweed differs considerably in many ultrastructural and biochemical features including photosynthetic pigments, storage compounds, composition of cell walls, presence/absence of flagella, ultrastructure of mitosis, connections between adjacent cells, and the fine structure of the chloroplasts.

Liquid extracts of marine brown algae have been marketed for use in agriculture and horticulture from as early as 1949 but evidence exists for us since Roman times as a soil enhancer. There are about 1800 species of brown algae, most are marine, and are each different. The brown algae commonly known as Norwegian Kelp grows within the intertidal zone, along the North Atlantic coast line. Harvested by hand, these hardy sea-plants serve as the raw resource for the production of soluble extracts for use in plant agriculture.

The most common brown seaweeds in agriculture are Fucus vesiculosus, Ecklonia maxima and Ascophyllum nodosum (Fig.1). A. nodosum is widely regarded as the most used and researched seaweed species in agriculture.
Not all brown seaweeds are the same, differences are important; differences such as origin, growing conditions, harvest methods and extraction process.
The way the seaweed is harvested makes a difference, for instance by-catch, storm tossed and beach dumped seaweed have lower and broken-down essential elements and content, as its already decomposing. Different extraction methods can be used for seaweed extract preparation i.e. water extraction, alkaline extraction, ruptured cell suspension and cryo-microcrushing.

Seaweeds should be considered to be more than just a N, P and K. For many years the main stream thinking was that Cytokinins and Auxins in the extracts are the elements that are responsible for the bulk of physiological benefits in crops. A. nodosum is now known to also contain Alginic Acid, Oligosaccharides, Laminarin, Fucose-containing polysaccharides (FCP's), Amino acids and Micronutrients (Table 2).

Seaweed extract products can be applied in three different ways. First is root application the second is seed treatment and the third is foliar application. The application of seaweed to crops (horticulturally and agriculturally) has many beneficial effects. Table 3 (J.S Craigie (2011)).

Ascophyllum nodosum

Fucus vesiculosus

Ecklonia maxima

Fig 1: Most common brown algae used in Agriculture worldwide, where Ascophyllum and Ecklonia are most commonly used in South Africa

Table 1: Product ingredients and links to efficacy/mode of action found in seaweed extract.		
1	Alginic Acid	Main structural carbohydrate of Ascophyllum, this polymer will be liberated from the cell wall of the algae into water soluble salt forms during the extraction process. These acids and oligosaccharides are strong chelators and can help with nutrient availability/delivery.
2	Oligosaccharides	A large percentage of the organic matter fraction of Ascophyllum extracts is comprised of various poly-and oligosaccharides. Elicitors and stimulators of plant defense mechanisms and their effects.
3	Laminarin	Laminarin is well documented in plant immune-stimulation purposes.

4	Fucose-containing polysaccharides (FCP's)	Many effects such as antiviral, antioxidants and protective capabilities.
5	Amino Acids	Protein content of Ascophyllum is realitively low, what protein is present will be extracted and broken down to constitute amino acids and peptides during process. Serve as building blocks in plant development and microbial activity in the rhizosphere.
6	Micronutients	Including iron, zinc, boron and manganese are present in Ascophyllum. Although low, any amounts can be helpful. May be more bioavailable.
7	Macronutrients	Such as K, Ca, Mg and S are very low however, any amount can be helpful.
As can be seen from the above – seaweed extracts can be considered a "soup" which contain many compounds which act individually or in a combination to help crops attain their maximum potential.		

Adapted from J.S. Craigie (2011)

	Table 2: Benefits of seaweed extracts
1	Improves plant vigor, root development, chlorophyll synthesis.
2	Promotes earlier flowering, fruit set and uniformity.
3	Retards senescence, extends product shelf life.
4	Improves nutritional quality.
5	Imparts stress tolerance, drought, salinity and frost resistance.
6	Alleviates disease, bacterial and fungal.
7	Assists in pest control of insects, soil nematodes.
8	Adjuvant action in pesticide mixtures.

Adapted from J.S. Craigie (2011)

CONCLUSION

Biostimulants are now widely researched and are playing an increasingly important role in agriculture where land is finite and all remains is increased yields and quality.

REFERENCE

Craigie J.S (2011) Seaweed extract stimuli in plant science and Agriculture
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