AGRICULTURAL USES OF SEAWEEDS EXTRACTS

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Abstract
Marine bioactive substances extracted from seaweed are currently used in food, animal feed, as a raw material in the industry and have therapeutic applications. Most of the products based on marine algae are extracted from Brown algae Ascophyllum nodosum. The use of extracts of seaweed in agriculture is beneficial because the amount of chemical fertilizers and obtaining organic yield.

Keywords: seaweeds extracts, Ascophyllum nodosum, Marine bioactive substances

1. INTRODUCTION

Marine bioactive substances extracted from seaweed are currently used in organic farming, in order to avoid excessive application of fertilizers and improving the uptake through the roots or leaves (Mugnai et al, 2008).

Seaweed and seaweed products, obtained directly through:

-physical treatments including dehydration, freezing and grinding;
-extraction with water or aqueous solutions, acid and/or alkaline;
-fermentation

are listed in Annex 1 (fertilizers and soil amendments referred to in article 3 (1)) of Regulation (EC) No. 889/2008 of 5 September 2008 laying down detailed rules for the application of Council Regulation (EC) No. 834/2007 as regards the organic production and labeling of organic products with regard to organic production, labeling and control.

2. THE USE OF SEAWEED IN AGRICULTURE

Several authors mention that seaweed has been used since antiquity as amendments to the soil to increase crop productivity (Chapman and Chapman, 1980, Craigie, 2011). Quoting Newton (1951), Craigie (2011) describes the first mention of the use of seaweed in agriculture. It's about the first half of the 1st century, when it was recommended to use seaweed for transplanting cabbage plantlets. It is also referred to a recommendation from the 4th century to administer the seaweed at the roots of Pomegranate.

Liquid products based on marine algae were introduced in 1950, and now are successfully used worldwide. The British market has emerged for the first time produced "Maxicrop". In 1958 already developed for export sales and is seeking methods of obtaining of dry extracts, more suitable for the export market. The first dried seaweed extracts were exported in 1959. At that time, the use of seaweed fertilizer was supposed to face the traditional way of fertilizing the soil (Booth, 1969).

At the time of placing on the market of seaweed extracts, they were intended to apply through sprays, having to face the dogma of Agriculture who argued that the nutrients you need to get into the plant through the roots, but the leaf does not have photosynthetically role only.

The foliar mineral nutrition has become a practice in agriculture in the 1960s, it was a moment that helped sales of seaweed extracts.

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Seaweeds form an integral part of coastal marine ecosystems. These include mostly multicellular, macroscopic seaweeds that inhabits coastal regions often of the oceans where there are suitable substrates (Khan et al, 2009).
The group, the Brown algae *(Phaeophyta*), with about 2,000 species, is the type most commonly used in agriculture, and *Ascophyllum nodosum*-among them. Other species of Brown algae used in agriculture: *Fucus* spp, *Laminaria* spp., *Sargassum* spp., *Turbinaria* spp.
Khon et al (2009) make a list of commercial products from seaweed, specifying the company producing and using products in agriculture. The large number of products obtained from Ascophyllum nodosum seaweed: Acadian®, Agri-Gro Ultra, Alg-A-Mic, Bio-Genesis™ High Tide™, Biovita, Espoma, Guarantee®, Kelp Meal, Kelpro, Kelprosoil, Maxicrop, Nitrozime, Soluble Seaweed Extract, Stimplex®, Synergy, Tasco®. These products are used in animal feed or as stimulant of plant growth.
Marine bioactive substances extracted from seaweed are used for a long time to improve plant growth and productivity.
Researches in this area are focused on finding and testing the effectiveness of new products. Effects have been reported to stimulate production, increase the efficiency of nutrient use and resistance to various factors and biotic abiotic stress.
Any improvement in the crop technologies that relate to plant roots, referring to optimize absorption of nutrients, the effects, in addition to reducing the negative impact of agriculture on the environment, increasing production and reducing the input into the system.
The mechanism by which these products affect cellular metabolism is based on the physiological action of macro and microelements, amino acids, vitamins and substances (Crouch et al., 1992; Crouch and van Staden, 1993; Reitz and Trumble, 1996; Durand et al., 2003; Stirk et al., 2003). Effects of the extracts are a result of synergistic action of various components in different concentrations, therefore the mode of action of extracts of seaweed still remains an unknown (Fornes et al., 2002; Vernieri et al., 2005). Khan et al (2009) presents the possible mechanisms by which the extracts from seaweed extracts have beneficial effect on agriculture: increased photosynthetic efficiency and carbon assimilation, delayed senescence, antimicrobial, anti-feedent and insect repellent, reduced transpiration, enhances stomatal conductance, modulation of root exudates, efficient water and nutrient uptake.
Application of low concentrations of *Ascophyllum nodosum* extract on the ground or on the foliage of tomato caused an increase in chlorophyll content in the leaves. This increase in chlorophyll content was a result of the decrease in degradation of chlorophyll, which might be due in part to betainei from seaweed extract (Whapham et al., 1993).
Products from seaweed extracts have an effect on the root growth and development. Rayorath et al., 2008 have show that extracts of *Ascophillum nodosum* determines root growth of *Arabidopsis* at very low concentrations (0.1 g L^{-1}), while the plant height and number of leaves were affected at concentrations of 1 g L^{-1}. Stimulating root growth was more pronounced when the extracts were applied in an early stage of growth. Stimulating root growth has produced an increase in biomass (Crouch and van Staden, 1993). Effects of stimulation were observed when the products have been applied to the ground, and when applying foliar (Finnie and Van Staden, 1985). Seaweed concentrate triggers flowering early and fruit formation in a considerable number (Featonby-Smith and van Staden, 1987; Arthur et al, 2003). Seaweed extracts have enhanced the protection of plants against pests and diseases (Featonby-Smith and Van Staden, 1983; Crouch and Van Staden, 1993; Allen et al., 2001).

3. SEAWEED EXTRACTS TESTING AT THE UNIVERSITY OF PITESTI

In the laboratory of Plant Physiology, University of Pitesti, experiments were carried out using the Special Alga product, and we studied the influence of *Ascophyllum nodosum* on the species

Phasolus vulgaris and *Sinapis alba*. Plants have been affected with the Special Alga both foliar and root.

The ALGA SPECIAL presents the following characteristics:

-contains macroelements, microelements, phytohormones, vitamins, enzymes, peptides

-increases the capacity for synthesis of hormonal substances;

-enhances disease resistance to infectious diseases and physiological,

-enhances the flavor, color, fruit preservation.

-increases the sugar level and raises the nutritional value at all plants.

-helps the plants to quickly overcome moments of stress of unfavorable conditions.

We obtained that the fertilization of soil, foliar and caused a significant stimulation of plant growth of beans and mustard. Seaweed extracts have a stimulating effect at low concentrations (Crouch and van Staden, 1993). In the case of beans and mustard plants tested by us, the concentration of 1% "Alga Special" has resulted in significant stimulatory effects. Increased concentration 5% has not significantly affected the intensity of growth.

4. CONCLUSION

1. Taking account of all uses of seaweed extracts (human food, animal feed, phytotherapy, industry), the greatest significance is the application in order to increase plant productivity.
2. Seaweed extracts have a stimulating effect at low concentrations.
3. Effects of stimulation of growth are explained based on the contents of macroelements, microelements, phytohormones, vitamins, sterols, betaines, polysaccharides etc.
4. The mechanisms that explain the stimulation of plant growth and development consist of: modulation of phytohormones, increased photosynthetic efficiency, enhanced stomatal conductance, regulation of bio-synthetic.

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