



## The Potential of Seaweed Extracts for Eco-Friendly Agriculture

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### Introduction:

In the event that plants do not absorb the chemical fertilizers that are applied in agricultural fields, this might result in soil pollution and damage to the plants. A variety of biological niches are occupied by seaweeds, which are also referred to as microalgae. Seaweeds are attached to rocks, the seafloor, or substrates that are several meters deep. These seaweeds are susceptible to light and contain between 80 and 90 per cent water, 50 per cent carbohydrates, 1 to 3 percent lipids, and 7 to 38 percent minerals. The amount of protein that they contain varies, but they include a significant amount of necessary amino acids. For instance, many types of seaweed are exceptionally abundant in elements such as phosphorus, zinc, calcium, and sulphur. It is becoming increasingly clear that chemical fertilizers have some drawbacks, which is why farmers are increasingly considering organic fertilizers. Because organic fertilizers can increase both the health of the soil and the growth of plants, their popularity is growing.

Seaweed products have been shown to

promote increased germination rates and cause significant increases in seedling vigour by enhancing root size and density. The extracts have also been shown to protect seedlings from tomato, cabbage, and marigold transplantation shock. The improved rooting architecture could be a result of trim levels of phytohormones present in the extracts, such as auxins, as well as various stimulatory processes engaged in the plant system upon treatment with these extracts. The enhancement of root systems of plants treated with seaweed extracts was also observed in vegetatively propagated plants. For instance, cuttings from floricultural plants such as marigolds treated with an extract from *E. maxima* led to an increase in root density. Agricultural practices that have been around for a long time typically entail the use of algae for the production of crops like rice and lentils. It has been shown that seaweed fertilizers may improve seed germination, root development, plant resistance to disease, high yield, nutrient absorption, and minimize insect attack. Seaweed fertilizers also have the ability to reduce insect attacks.

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Insects are less likely to attack plants that have been fertilized with seaweed. Several seaweed species, including *Sargassum wightii*, *Sargassum johnstonii*, *Sargassum polycystum*, *Caulerpa racemosa*, *Cladophora rupestris*, *Ulva lactuca*, *Ulva facicata*, *Grateloupia lithophila*, *Gelidiella acerosa*, *Pandina boergesenii*, and *Turbinaria conoides*, provide high-quality extractions that are suitable for use in agriculture for seed treatment, spraying, and soil drench.

### **Chemical Constituents of Seaweed Extracts**

High in nutrients, these seaweed extracts function as organic fertilizers. Among the many trace elements, plant growth hormones (auxins, cytokinin, gibberellins), micronutrients (vitamins A, C, E, and K), minerals (sodium, zinc, magnesium, and calcium), and macronutrients (carbohydrates, protein, and lipids) they include are lipids. Plants can absorb the nutrients they need as a consequence, and bigger harvests are eventually harvested.

### **The impact of seaweed extracts on seed germination**

The impact of seaweed extracts on seed germination is evident in the increased germination rates observed when moderate concentrations of *Cladophora rupestris* and *Ulva lactuca* extracts are applied to black gram (*Vigna mungo*), green gram (*Vigna radiata*), wheat (*Triticum aestivum*), and rice (*Oryza*

*sativa*). Compared to seeds germinated in water, the seeds treated with seaweed extracts exhibit significantly faster germination. When a large amount of the extract is given to Bengal gram (*Cicer arietinum*), the seeds show a reduced germination rate. This is due to the seeds' elevated respiratory activity. To enhance the germination rate, using seaweed extracts at a reasonable dosage is essential.

### **Utilizing extracts of seaweed as a technique for enhancing the quality of the soil:**

As a result of their capacity to improve the characteristics of the soil before cultivation or even while crops are being grown, macroalgae are often used in agriculture as a kind of manure. Additionally, these seaweed fertilizers improve Soil crumbs structure and aeration improvements, Increase the population of beneficial microbes, and Increase enzymatic activity (**proteinase, invertase, urease phosphatases**). These seaweed fertilizers provide the soil with helpful and essential nutrients, increasing the soil's potential to grow a crop. This is a win-win situation. These are beneficial for alkaline soils and areas lacking in minerals, and they can increase the fertility of the soil. Seaweed fertilizers may be obtained in a variety of liquid forms, which are referred to as extracts. These liquid forms are in addition to powdered or dust forms. It has been shown that applying these liquid extracts has a beneficial effect on

the growth of plants and the properties of the soil itself. An improved soil texture leads to an increase in capillary energy, aeration, and nitrogen fixation that will occur in the soil.

### **Seaweed fertilizers are utilized in agriculture to enhance soil fertility.**

- ✓ Seaweed fertilizers and pesticides have demonstrated the ability to suppress root pathogens in tomato and sunflower plants, reducing fungal root infections, nematode galls on roots, and nematode penetration in roots.
- ✓ Increased fruit weight and flesh thickness and firmness, vibrant colour, and higher mineral content
- ✓ Increased expression of root transporter genes
- ✓ Increased nutrient use efficiency
- ✓ Increased uptake of macro and micronutrients
- ✓ Increased chlorophyll content, photosynthetic rates and stomatal conductances.
- ✓ Improved resilience to transplantation shock
- ✓ They serve as natural stimulators for plant growth, enabling plants to withstand adverse conditions such as drought, disease, or frost.
- ✓ Furthermore, these seaweed extracts possess medicinal properties that can treat ailments such as arthritis, colds,

influenza, worm infections, and certain fungal infections.

### **Summary**

Biostimulants made from seaweed extract are suitable for food production and the environment. They help plants grow faster and be more resistant to pests, diseases, and abiotic pressures. The nutritional value of foods handled with seaweed extract is also improved, as they contain more antioxidants. The good results rely on the type of seaweed used, its quality, makeup, application method, quantity, and how often it is used. It has been shown that seaweed products can change the microbiome of the rhizosphere and phyllosphere. More research is needed to confirm how helpful natural and imported bugs are in helping plants grow. Seaweed extracts and products can be used with other chemical and non-chemical sources in agriculture. Using the least amount of poisons possible can make the effects stronger. However, applying dirt is still hard on the economy because it requires much effort. To protect seaweed resources and avoid overuse, growing economically important seaweeds for new biostimulants or market goods is essential. More research and development should be done to find the best ways to use seaweeds and their products in sustainable farming. Seaweeds have the potential to be used as a source of green fertilizers, which may result in

improved seed germination, more profound root growth, enhanced resistance to sick plants, increased nutrient absorption, and high yield. Seaweed cultivation and development has the potential to become one of the most rapidly developing fields of environmentally friendly and sustainable agriculture, as well as a fantastic business opportunity in the not-too-distant future.

## References

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