Seaweed Extract as a Biostimulator

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ABSTRACT

Seaweed extracts (SWEs) are gaining popularity as a sustainable crop production due to their numerous benefits for both crops and the environment. Seaweed extracts are utilized in a variety of ways, including seed treatment, foliar spray, and soil application, to protect plants and promote growth. Seaweed extract is more beneficial than chemical fertilizer because it is biodegradable, non-toxic, and environmentally friendly. Seaweed products have been widely used as bio stimulants in crop production which contains growth regulators like cytokinin, auxins, gibberellins, and betaines, as well as macronutrients like Ca, K, P, and micronutrients like Fe, Cu, Zn, B, Mn, Co, and Mo that are essential for plant growth and development. Seaweed extracts are commercially available on the market.

INTRODUCTION

Seaweeds are multicellular marine macroalgae that are typically seen along coastal areas. India has a total coastline exposure of 7516.6 km, which includes both island and mainland areas that are extremely rich in seaweed species in intertidal locations. Based on the pigments found in macroalgae, which are categorized into three groups:

Rhodophyta (red algae), *Phaeophyta* (brown algae), and *Chlorophyta* (green algae) (Boukhari *et al*. 2020). Brown seaweeds (Phaeophyta) are the most often utilized in agriculture of the three primary varieties (red, brown, and green). The most important brown weeds include *Ascophyllum nodosum* (L.), *Fucus* spp., *Laminaria* spp., *Sargassum* spp., and *Turbinaria* spp., which are currently being used as partial or complete alternatives to chemical fertilizers (Reddy *et al*. 2024). It contains bioactive molecules such as auxins, cytokines, and other growth-promoting substances, as well as amino acids, vitamins, and major and minor minerals, all of which promote plant growth. Potassium in seaweed extract helps plants resist biotic and abiotic stresses. Furthermore, the organic compounds derived from seaweed extracts are biodegradable, non-polluting, non-hazardous, and ecofriendly. The dominant seaweed producing states include Tamil Nadu, Gujarat, Maharashtra, Goa, Lakshadweep, Andhra Pradesh, and Karnataka.

Application methods of seaweed extract:

According to Margal *et al*. (2023) seaweed extract application methods are:

- **Drip application**: The soil application of liquid seaweed extracts through drip@ 0.5-1 L^{-1} water at various critical growth stages of different crops.

- **Foliar application**: Foliar application of seaweed extract @ 2-5 ml L^{-1} of water at various critical growth stages of different crops.

Nitrogen - 0.18 %	Sodium - 0.13 %
Phosphorus - 0.48 %	Iron - 256.0 ppm
Potassium - 1.89 %	Zinc - 11.87 ppm
Calcium - 0.11 %	Copper - 15.62 ppm
Magnesium - 0.01 %	Manganese - 13.12 ppm

- **Granular application to soil**: The granules of seaweed application was recommended @10-20 kg $acre^{-1}$ during sowing.

Seed treatment: For good germination of crop seeds, seed treatments were done by algal liquid extracts at different concentrations of 0.5, 2.5 and 10 %.

Nutrient composition of seaweed extract:

Methods of preparation:

Two extraction methods are used for preparation of seaweed extract:

- ✓ First method - The dried seaweed 50 g was boiled in 150 ml of distilled water in water bath for 30 minutes.

- ✓ Second method- The prepared seaweed powder of 50 g added to 150 ml of distilled water and kept it for 2 days.

After the samples was centrifuged at 4250 rpm for 5 minutes and filtered with Whatman number 1 filter paper. This solution was considered as a 100% algal liquid extract.

Advantages of using seaweed extract:

1. Seaweed extracts contain multiple growth regulators such as cytokinins, auxins, gibberellins and various macro and micronutrients necessary for plant growth and development. It improves mineral absorption, nutrient use and due to its organic and bio-degradable properties.

2. It helps in promoting the growth of beneficial soil microorganisms, increasing nutrient uptake from soil, enhancing antioxidant properties and developing tolerance to environmental (abiotic and biotic) stress.

3. The alkaline nature of seaweed extract helps in neutralizing acidic soils, creating a more favourable environment for plant growth and microbial activity.

4. Brown seaweed extract, contains alginic acid, which improves soil structure, water retention, and enhances microbial activity, contributing to long-term soil health.

5. Compounds present in seaweed extract, such as polysaccharides and polyphenols, can induce systemic resistance in plants, helping them to combat various fungal, bacterial, and viral diseases.

6. The combined effects of improved plant growth, stress tolerance, nutrient uptake, and disease resistance can ultimately lead to increased crop yields and productivity.

Significance of seaweed extract in agriculture:

Liquid extracts derived from seaweeds have recently gained popularity as foliar sprays for various crops, including cereals, legumes, and many vegetable species. The positive benefits of foliar seaweed extract sprays increase crop yields. Seaweed extract also protects plants against fungal, bacterial, and viral diseases. Seaweed not only promotes plant growth but also improves the physical, chemical, and biological properties of the soil. Seaweed extracts, which contain organic components such as macronutrients, micronutrients, growth hormones, amino acids, vitamins, cytokines, and sterols, play a significant role in environmentally sustainable agricultural production. Seaweed extracts account for almost 33% of the global bio-stimulant market. The global market for seaweed is rising, with an annual growth rate of 8.9% (Polat *et al*. 2023).

Commercial Products of Seaweed extract in India:

1. Aquagri (Godrej Agrovet)	Biozyme, Sargamax
2. Coromandel International	Coseaweed, Coacomin
3. Rallis India Limited	Palnor , Biozyme
4. Avi Agri Nutrients	Seaweed Sap, Seaweed Granules
5. Krishak Shakti	Seaweedzyme, Seaweed Powder
6. **Bharat Fertilizers**	BF Seaweed
7. **Upl Agro**	Seaweed Sap
8. **Agrolutions**	SeaCrop
9. IFFCO	Sagarika

CONCLUSION:

The beneficial roles of using seaweeds as bio-stimulants in agriculture are given more attention in present day. Marine algae are extremely rich in secondary metabolite chemicals, which make them resistant to various climatic and environmental stress conditions, as well as potentially improving agricultural soil fertility and accelerating plant growth. Seaweed-derived products have also been successfully used in a different industry of medical, food, and agriculture sector. However, many of these applications could be enhanced, and their fields applications may be expanded. microbiological and soil ecological fundamental research on the impact of seaweed treatments on the soil microbial community and its activities and processes is required to determine how to apply this type of biofertilizer more successfully.

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