

Seaweed: Role in Alternative Fertilizer and Disease Management

S. Sam Praveen Kumar¹, Rallabandi Divyalatha², Neela Avani Pradeepika¹

¹M. Sc (Agri.) Agronomy Research Scholar, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj

²M. Sc (Ag.) Plant Pathology, Department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj

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Introduction:

With increasing population seeks demands for food production. This induced higher usage of inorganic fertilizer incorporation in soil for higher production. 42% of India's districts use 85% of chemical fertilizer (Standing Committee Report, 2016). Chemical fertilizer consumption has raised 15.81% between financial years 2015-16 to 2020-21 (up to Feb 2021). Unknowingly, imbalanced chemical fertilizer produced food to dining cause human health problems. Saline environmental bioactive algae extracted from seaweed plays a great role in various agricultural and horticultural purposes. It is also utilized as agricultural bio-stimulants (ABs) (EBIC,2012). The utilization of macroalgal ABs on crop plants can generate numerous benefits with reported effects including enhanced rooting, higher crop and fruit yields, enhanced photosynthetic activity, and resistance to fungi, bacteria, and viruses (Sharma *et al.*, 2014).

Why seaweed is needed for alternative fertilizer?

One study says the imbalance application of chemical fertilizer causes a rise in soil temperature and soil infertility. According to the New Delhi-based National Academy of Agricultural Sciences (NAAS), our country's annual soil loss rate is about 15.35 tonnes per hectare, resulting in a loss of 5.37 to 8.4 million tonnes of nutrients. The loss of soil has another immediate major impact on crop productivity. Marine algae bioactive substances extracted from seaweed are the new generation of natural organic fertilizer which contain all essential nutrients, amino acids, vitamins, cytokinin, and auxin-like promoting hormone.

Seaweed act as a plant nutrient-bearing fertilizer. Especially in foliar spray, as a means to avoid excessive fertilizer application and to improve mineral absorption through leaves.

Response of Crop with Seaweed Fertilizer:

Many different formulations of seaweed, including LSF (Liquid Seaweed Fertilizer), powder, and granular, are available in the market. Whole or finely chopped algal manures have been used, and all are beneficial for cereals, pulses, and many flowering plants. The advantage of seaweed manure is that it is free from weed seeds and other pathogenic fungi. (Begum *et al.*, 2018). Cytokinin and Gibberellin, which are present in seaweed extracts, are thought to be responsible for enhanced yield attributes, probably because they reduce flower and pod drop, delay fruit senescence, and increase flower and fruit size. Furthermore, trace elements (Fe, Cu, Zn, Co, Mo, Mn, and Ni), vitamins, minerals, and amino acids also increase the ability to grow (Bai *et al.*, 2008; Pramanick *et al.*, 2012 and Shankar *et al.*, 2015).

How does seaweed control plant disease?

Seaweeds are under constant investigation for biological activity to identify novel and potentially useful bio-pesticides. Researchers revealed numerous benefits of seaweed application including elevating biotic and abiotic stress and enhancing the post-harvest shelf life of perishable commodities.

- Foliar spray of *Ascophyllum nodosum* extracts reduced *Phytophthora capsici* in *Capsicum* spp. and *Plasmopara viticola* in grape. The improved disease resistance is attributed to elevated peroxidase activities and increased levels of the phytoalexin calcdiol in the pepper plants (Lizzy *et al.*, 1998).
- Cotton seeds treated with an aqueous formulation of *Sargassum wightii* extract develop significant levels of resistance to the bacterial pathogen when challenge with *Xanthomonas tapestries* at the seedling stage (Raghavendra *et al.*, 2007).
- When greenhouse-grown carrot plants were sprayed with 0.2% *Ascophyllum nodosum* extract and inoculated with the fungal pathogens *Alternaria radical* and *Botrytis cinerea*, plants showed improved resistance to infectious and signs of fast recovery (Jayraj *et al.*, 2011).

- Spray application of *Ascophyllum* extract significantly reduced the incidence of bacterial leaf spots of tomato plants under greenhouse conditions (Ali *et al.*, 2013).

Disease Resistance:

- General improvement of the vigor of plants.
- Preformed resistance as described by an increase in phenolic components, flavonoids, antioxidants, pigments, tannins, reduced levels of free sugars, and so on.
- Induced systemic resistance. Seaweed extracts possibly contain several types of signal molecules, including oligosaccharides, Polysaccharides, peptides, proteins, and lipids.
- Antimicrobial activity of the seaweed compounds or ingredients inhibits, annul, or kills the pathogenic microbial cells.
- Enhanced suppressiveness of soil or growing medium, a shift in microbial dynamics resulting in that foliar application of a marine plant extract from *Ascophyllum nodosum* led to enhance activities various defense-related enzymes.

Anti and microbial activity:

Twelve different seaweeds are collected in India for antibacterial against pathogen *Pseudomonas syringae* on *Gymnema Sylvestre*. Seaweeds extract promotes plant health by affecting the rhizosphere microbial community and also triggers the growth of the beneficial microbial community.

Conclusion:

To be most effective, dried seaweed or seaweed extracts must be integrated into regular crop management programs to be used as an alternative fertilizer and disease management. Moreover, private entrepreneurs and research institutes/ agencies should contribute scientific and technical expertise. It is essential to educate the farmer in the area where seaweed cultivation is feasible about the importance of alternative fertilizer and the benefits of using seaweed in agriculture in a variety of ways.

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