

Seaside Wealth: Riding the Wave of Income with Seaweed

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Abstract- Humans have been constantly ground breaking on different aspects to make their livelihood more sustainable. This has reached to an abrupt height by the discovery of DNA sequencing technologies and genetic engineering. This new era of biotechnology helps us to engineer an organism with the desired trait and to get desired product. Collaboration of biology, technology and business is the basis for a bio-enterprise and its fruitful economy. Bio business is aimed to commercialize the bio products as well as to increase and improve the researches to protect the human race. It has the potentials to develop products to protect the environment from diseases, fuel production, feed the hungry and various other products. The current gap in industrial knowledge of biotech products have to be filled by bio entrepreneurship which helps to improve economy, social well being, environmental friendliness and sustainable development. Agriculture is one of the important field of sustainable living where biotechnology plays a vital role. This study gives a clear idea about the production and marketing of agricultural biologicals (Bio stimulants, Bio fertilizers, Bio pesticides) that can reduce the usage of carcinogens/ Chemicals and get good profit out of it.

Key words: Biotechnology, Biologicals, Bio stimulants, Bio pesticides, Genetic engineering.

1.0 INTRODUCTION:

In the near future, agriculture has to face the twin challenges of feeding a growing global population and minimize the environmental impact of cropping systems. Agricultural biologicals include all the biological substances that enhance the growth of crops as well as control the pests and weeds. Many plants and microorganisms have the ability to produce phytochemicals and secondary metabolites that can stimulate the crop growth and yield, qualitatively and quantitatively. Azola, Sea weeds, Bacteria, algae and fungi play an vital role as agricultural biologicals. They themselves or by their products helps to improve the soil fertility, texture and structure which indirectly improves crops growth. Phytochemicals such as Flavonoids, alkaloids, saponins, enzymes and proteins enhances the products. In this study we focused more on the microbial substances (bio stimulants, bio fertilizers and bio control agents) that can be cultivated /produced economically and results in good profit which turns us bio entrepreneurs

Bio stimulants:

Bio stimulant is a substance which enhances the nutrition efficacy, stress tolerance, crop quality traits when applied to plants / seeds. They lack both a substantial nutritional content and a protective nature against infections. However, they improve plants' ability to withstand abiotic stressors like heat and drought, which benefits agricultural yields, crop quality, and soil fertility. Microorganisms, seaweed extracts, algae preparations, plant and animal extracts, as well as humic and Fulvic acids, are all examples of bio stimulants. The majority of these substances are effective in the rhizosphere, or base zone, of plants. (Humitech.com)

1. Extracts of seaweed:
2. Amino Acids
3. Fulvic and humic acid
4. Complex Bio stimulants

These categories of bio stimulants bring together all the elements that promote germination, root growth, and chlorophyll production.

The usage of Microbial Bio stimulants, which many farmers are unaware of, is the most recent practise in the agricultural sector. These stimulants aid in the introduction of mycorrhizal fungi, non-pathogenic bacteria, and other soil microorganisms. They improve the crop's quality by enhancing the plant's natural nutrient uptake and tolerance to abiotic stresses. This stimulates the plant's natural processes. The innovative use of natural and microbiological elements encourages farmers to practise sustainable farming practises and safeguards our natural resources. (amproject.org)

Benefits of bio stimulants

Using bio stimulants on one's farm has significant advantages -

1. Bio stimulants help counteract the effects of environmental stress.
2. Bio stimulants boost grain quality and fill.
3. Bio stimulants promote the growth of plants.

Generally speaking, bio stimulants work through different processes than conventional fertilisers and offer vital nutrients for plant metabolism that promote plant growth. These metabolic pathways stimulate the expression of genes that can affect cell size and division, root and shoot development, and the timing of reproduction. (alltech.com)

2.0 REVIEW OF LITERATURE :

Dhriti Battacharyya et al (2015) reviewed the growth promoting efficiency and their ameliorating effect on crop tolerance to abiotic stresses such as salinity, extreme temperatures, nutrient deficiency and drought of brown seaweed extracts. Recent researches have shed light on the possible molecular mechanisms activated by seaweed extracts. They give an update of the current state of our understanding of the chemical constituents of brown seaweed extracts and the physiological effects they induce on plants with particular reference to horticultural crops

Crouch et al (2008) reviewed the modern day application of commercial seaweed products in horticulture. They listed the areas of seaweed application that are of particular importance to the horticulturist and stated though seaweed products have high potential for horticultural practices they are being underutilized. Although the reason for this is unclear, a better knowledge of seaweed application will hopefully increase their usage.

Mohammed EL Mehdi EL Boukhari et al ,(2020). Aimed to provide fresh insights into the concept of seaweed extract (SE), through addressing the subject in newfangled standpoints based on current scientific knowledge, and taking into consideration both academic and industrial claims in concomitance with market's requirements. The crucial extraction process as well as the effect of such products on nutrient uptake and their role in abiotic and biotic stress tolerance are scrutinized with emphasizing the involved mechanisms at the metabolic and genetic level. Additionally, some often overlooked and indirect effects of seaweed extracts, such as their influence on plant microbiome are discussed. Finally, the plausible impact of the recently approved plant biostimulant regulation on seaweed extract industry is addressed.

2.1 Objective :

- 1.To Promote cultivation of marine algae with established manufacturing facilities to produce nutrients for crop & animal applications, and Carrageenan.
- 2.To extract growth hormones, micronutrients, macronutrients and rich amino acid profiles from natural marine algae
- 3.To define the appropriate time of application that helps to optimize plant nutrient uptake and builds stronger plant cell structures increasing yield and hence, providing higher returns to the farmer.

3.0 MATERIALS AND METHODS

Seaweeds as bio stimulants :

Seaweeds are excellent sources of the phytochemicals required by the plants and animals for their growth and development .Seaweed cultivation introduction in Indian coastal waters to provide livelihood opportunity to coastal communities is a major development. The model using self-help groups mainly comprising of women is an innovative model not practiced anywhere globally. Offering a fixed pre-determined price to provide a predictable income is also been put into practice for the first time, this model de-risks the cultivators in India as the market risk is the biggest impediment faced by the cultivators in other countries.

3.1 Cultivation Methods :

Cultivation of seaweed is an easy process. It requires only water with appropriate salinity . Coastal areas are apt to grow the seaweeds. With out any additional nutrients the macro algae grows well in marine water . Changes in the salinity affects the yield

Processing of Seaweed :

Most of the marine algae doubles within 15 days . Harvesting can be done every 15 days, after harvest the seaweed should be dried in sunlight, powdered and extracted with organic solvents for phytochemicals and for biofertiliser / bio control agents . Fresh algae can be used for sap / bio stimulant preparation .

4.0 RESULT AND DISCUSSION

Algal sap as biostimulant :Kappaphycus alvarezii and Gracilaria edulis are the 2 important algal species that stimulates the crop growth . Many research on food crops like grains, pulses, fruits and vegetables have proven the increased growth and yield after the usage of seaweed sap as seed germinator and foliar spray. It improves the spike length, number and weight of the kernals. It also increases the nutrient content of the food crops by 5.72% Nitrogen and 37.54 % Magnesium in maize, almost 78% of yield increased in fruits and vegetables .

Business innovation : Sea weed farming is a promising business in this era. Without much investment we can earn a promising profit from this. We can extract the sap from the fully grown seaweed and market it or can sell harvested algae to Agro companies who are already stabilized their position in the market. Apart from agro companies, many food, cosmetic, pharmaceutical companies are ready to purchase seaweed from the cultivators because seaweed is one of the major ingredient in most of their products.

Organic Farming : People were realized the harmful effects of Chemical fertilizer. growth promoters and pest controllers. Almost all of these are carcinogens. Most of the farmers are returning to Organic or natural farming . This is the space for our biologicals . The sap from algae, the powdered algae and the solvent extracted algae can be used as organic growth promoters .These products are non hazardous and non Carcinogens .

Seaweed biologicals are already captured their position in the market, only requirement is quality products. As we have the responsibility to develop a cancer free generation, carcinogen free food is our basic need.

5.0 FUNDING AGENCIES :

Seaweed farming is being promoted by organisations such as FAO, International Finance Corporation, World Bank Group and is a subject matter of study of many researchers such as Brian Crawford of Coastal Resources Centre, University of Rhode Island. Aquaculture foundation creates awareness and with support from government departments imparts training to the interested participants; further it supports them in getting the subsidy support from the government departments such as DRDA, Department of Fisheries etc. and financing from various financial institutions and banks. In AFI along with MS University will identify the SHG women beneficiaries and coordinate the entire project;

Market trends of bio stimulants

In 2021, the market for bio stimulants was estimated to be worth USD 2.85 billion. The market is anticipated to expand at a CAGR of 11.43% from 2022 to 2029, rising from USD 3.14 billion in 2022 to USD 6.69 billion in 2029. The COVID-19 pandemic has been unprecedented and shocking, with demand across all regions being lower than expected compared to pre-pandemic levels. According to data by experts, the global market grew by 5.09% less in 2020 than it did in 2019.

The global market for inorganic fertilisers (primary nutrients) is expanding at a rate of 1.3% to 1.8% each year. Given the development prospects in these categories, the major market participants are concentrating on a number of profitable product niches, including the specialty fertiliser and organic fertiliser segments. Additionally, products with a high level of nutrient content, versatility, and environmental friendliness are in high demand from crop farmers. These all point to a bright future for the global market for biostimulants. (fortune business insights).

6.0 DEVELOPING BIOSTIMULANTS FROM WASTE RECYCLING

A path to waste recycling and reduction is paved by the creation of biostimulants from byproducts, which benefits growers, the food sector, registration and distribution businesses, as well as consumers. The following conditions must be met when choosing designated by-products to be used as biostimulants: lack of pesticide residue, low cost of collection and storage, ample supply, and synergy with other valorization pathways. Numerous national and international projects, including NOSHAN, SUNNIVA, and Bio2Bio, have been started over the years with the goals of (i) examining how by-products from the food and agricultural industries can be valued and (ii) determining the mode of action of biostimulants derived from organic waste streams. Vermicompost, composted urban waste, sewage sludge, protein hydrolysate, and derivatives of chitin/chitosan have all been shown to be effective in agriculture and horticulture. Other classes of waste-derived biostimulants or raw organic material with bio stimulant components have also shown effectiveness.

The active components found in various types of biomass with potential bio stimulant activity belong to a wide variety of molecules, which includes phytohormones (cytokinin, auxins, gibberellins, brassinosteroids, ethylene, and abscisic acids) (Letham and Palni, 1983; Mussig et al., 2006; Pimenta Lange and Lange, 2006; Werner and

Schmulling, 2009; Wolters and Jurgens) Phytohormones have been found in seaweed extracts and are thought to be potential bioactive components of this class of bio stimulants (Khan et al., 2009; Stirk et al., 2014; Stirk and Van Staden, 2014). Algal extracts contain a variety of polysaccharides, including alginate, fucoidan, and betaines, as well as proteins and minerals that support plant growth in addition to hormones (Sharma et al., 2014).

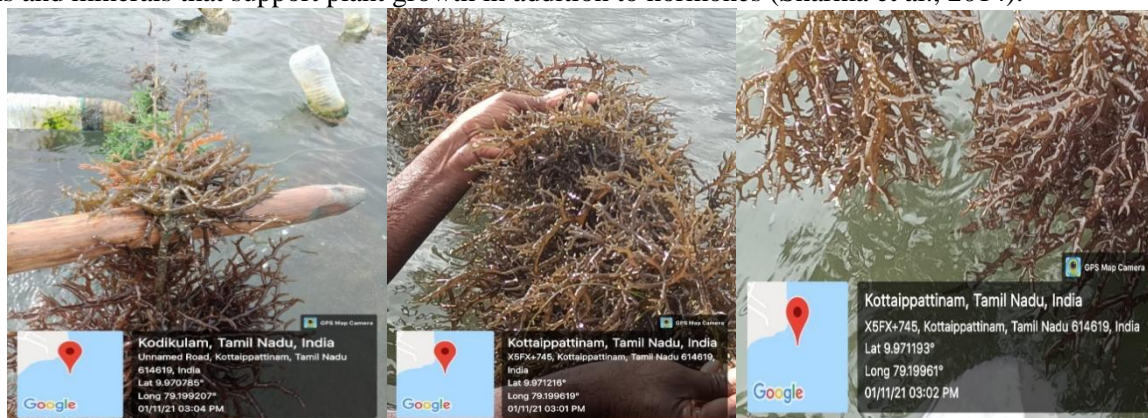


Figure :1 Seaweed cultivation for biostimulant production

7.0 CONCLUSION :

It is anticipated that additional research and development will increase the number of biostimulants derived from by-products as the worldwide market for biostimulants expands. The development of biostimulants for a specific market is also necessary due to the global nutritional imbalance. Here, we examined some instances of biostimulants made from seaweed and agricultural waste and talk about why algal biomass is such a useful resource for the creation of new agrochemicals.

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