Effect of Seaweed Liquid Fertilizer of *sargassum wightii* on the Yield Characters of *Cluster Bean* and *Lettuce Pland* Growth

RUSA 2.0_Rashtriya Uchchatar Shiksha Abhiyan

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Abstract- Seaweeds are marine macroalgae growing in the intertidal and subtidal zones of marine waters. Based on pigmentation, seaweeds are classified as green seaweeds (Chlorophyta), brown seaweeds (Phaeophyta) and red seaweeds (Rhodophyta). Seaweeds are thalloid plants having immense economic uses as human food, animal feed, fuel, fertilizers, source for fine chemicals, iodine, mannitol and phycocolloids. Seaweeds are the sole source for phycocolloids which are catagorised into agar, carrageenan and algic. These phytochemicals find use in various industries as solubilizer, solidifier and sizer agents. In recent years, liquid extracts of seaweeds known as Seaeweed Liquid Fertilizers (SLF) and that of Seaweed termed as Seaeweed Liquid Fertilizers (SGLF) are being used. There are a number of methods of extracting SLF and SGLF. The mode of application of SLF and SGLF could be soaking, foliar spray or as a soil drench. SLF can be used both for horticultural crops and other crops especially the pulses. All the three kinds of seaweeds (green, brown and red) could be employed for SLF preparation. Although a number of seaweed based commercial extracts have come out in the international markets, our country is lagging behind, in spite of plethora of research work on the application of SLF.

Key words: Sargassum wightii Extract, SLF and SFL Cluster Bean and Lettuce Pland Seeds.

INTRODUCTION
Seaweeds are marine macroalgae growing in the intertidal and subtidal zones of marine waters. Based on pigmentation, seaweeds are classified as green seaweeds (Chlorophyta), brown seaweeds (Phaeophyta) and red seaweeds (Rhodophyta). Seaweeds are thalloid plants having immense economic uses as human food, animal feed, fuel, fertilizers, source for fine chemicals, iodine, mannitol and phycocolloids. Seaweeds are the sole source for phycocolloids which are catagorised into agar, carrageenan and algic. These phytochemicals find use in various industries as solubilizer, solidifier and sizer agents (Venkataraman Kumar, 2005, 2010).
Seaweeds are the marine angiosperms constituting a small taxonomic group. However their uses are plenty such as acting as nursery beds for fishery production, exclusive food for sea animals like Dugong (Sea cow) and green turtles, buffer between coral and mangrove ecosystem, recycling of mineral nutrients and resistance of water currents. Apart from these ecological services, seagrasses find use as human food (Kannan, 2010), nutraceuticals and antioxidant resources (Athiperumalsami et al, 2008, 2010) and in recent years as fertilizers (Venkataraman Kumar, 2011).

Intensive crop cultivation demands excessive use of chemical fertilizers at the cost of soil health. Utilization of organics in agriculture particularly for seed treatment would be ecofriendly and cost effective. Seaweeds constitute one of the important living sources of the ocean that might serve as an alternative to synthetic fertilizers (Metting et al, 1991). Seaweed extracts marketed as fertilizer additives for the beneficial effects (Booth, 1965), owing to the presence of plant growth substances, particularly kinetin and cytokinins (Tay et al, 1985; Mooney and Van Staden, 1986; Crouch and Van Staden, 1993) and antioxidants (Arnold et al, 1993). The use of seaweeds as substitutes for conventional synthetic fertilizers is increasing (Ramamoorthy et al, 2006).

Application of fertilizers plays an important role in the yield of crops. But the continuous use of inorganic fertilizers has made the soil infertile for cultivation, besides eutrophication of surface water and contamination with nitrogen of sub surface water. In order to overcome this problem, the use of organic fertilizers is recommended now-a-days. There are many types of organic manures; they are blood, bones, farmyard manure, fish, garden refuse, horn shavings, leaves, malt dust, night soil, woolen rags and seaweeds. These, the most abundant and easily available source is seaweeds. Seaweeds can be used in many ways to increase soil fertility (Sylvia et al, 2005). Indian coastal area is rich in algal diversity. Our coastal area covers about 7000 km and harbors about 844 marine algal species belonging to different families and genera (Oza and Zaidi, 2001). The potential areas in India for luxuriant growth of species of red, brown and green algae are the south east coast of Tamil Nadu from Mandapam to Kanyakumari covering 21 islands in the Gulf of Mannar, Gujarat coast, Lakshadweep and Andaman - Nicobar islands (Kaliaperumal and Kalimuthu, 1999).

An adequate amount of potassium, nitrogen, growth hormones, micronutrients, humic acids etc, present in seaweeds make its excellent fertilizer. Unlike chemical fertilizers derived from seaweeds (*Fucus, Laminaria, Ascophyllum, Sargassum, etc.*) are biodegradable, non-toxic, non-polluting and non-hazardous to human, animals and birds. Chemical fertilizers have degraded the
fertility of the soil by making it acidic, rendering it unsuitable for rising crops. Further, throughout the world are switching over to organic fertilizers. Seaweed manure besides increasing the soil fertility, increase the moisture holding capacity and supplies adequate trace metals thereby improving the soil structure (Dhargalkar and Pereira, 2005).

Use of seaweeds is a common practice in coastal areas throughout the world. In India, it is used for coconut plantations especially in coastal Tamil Nadu and Kerala (Silas et al, 1986). Most of the seagrasses are used extensively as soil fertilizer for coconut and other plantations (Kannan and Thangaradjou, 2005).

In recent years, liquid extracts of seaweeds known as Seaweed Liquid Fertilizers (SLF) and that of Seaweed termed as Seaweed Liquid Fertilizers (SGLF) are being used. There are a number of methods of extracting SLF and SGLF. The mode of application of SLF and SGLF could be soaking, foliar spray or as a soil drench. SLF can be used both for horticultural crops and other crops especially the pulses. All the three kinds of seaweeds (green, brown and red) could be employed for SLF preparation. Although a number of seaweed based commercial extracts have come out in the international markets, our country is lagging behind, in spite of plethora of research work on the application of SLF (Venkataraman Kumar, 2010).

MATERIALS AND METHODS

Collections of seaweeds
The brown seaweed Sargassum wightii were collected from Rameshwaram.

Preparation of SLF (Seaweed Liquid Fertilizer)

After collection marine plants were brought to the laboratory and washed thoroughly with water for the complete removal of extraneous matter and then subjected to extraction by the following method.

**Autoclave method (Rama Rao, 1990)**

100g of the seaweed was weighed and cut into small pieces to which 1L of distilled water was added. It was autoclaved at 15 lb pressure for one hour. The extract was filtered and stored in a refrigerator.

**Hot Extraction Method**

Collect the fresh brown and wash thoroughly to remove all epiphytes and sand particles with tap water. Dry the washed and cleaned seaweed in shade for three to five days at room temperature. Keep the shade dried seaweed in an oven at 60°C for 24 hours.

Hand crush and grind using mixer-grinder
Collect the coarse powder
Mix the coarse powder with Tap water in ratio of 1:20 (W/V) (50 grams powder in one liter tap water)
Boil or steam boil or Autoclave at 121°C, 20 lbs for 60 minutes

The resultant concentrated seaweed extract is considered as 100% seaweed extract. As the seaweed liquid fertilizer contains organic matter therefore add a preservative (1 gram of Potassium nitrate to 1 litre of seaweed extract) before packing in bottles, cans or drums.

**Process Flow sheet**

Preparation of Seaweed Liquid Fertilizer
( **Hot Extraction Method Using Powdered Seaweed**)

Collect the fresh brown or green seaweed

Wash thoroughly with tap water to remove all epiphytes and sand particles

Shade dry for 3-5 days and Keep in an oven at 60°C for 24 hours

Hand crush and Grind using mixer-grinder

Collect the coarse powder

Mix the coarse powder with Tap water in ratio of 1:20 (W/V) (50 grams powder in one liter tap water)

Boil or steam boil or Autoclave at 121°C, 20 lbs for 60 minutes
Filter through cheesecloth

Gather the Biomass from the cheesecloth, dry and use as Poultry feed or soil fertilizer

Collect the filtrate and centrifuge or keep it overnight

Add a preservative (1 gram of Potassium nitrate to 1 litre of seaweed extract)

Pack in bottles, cans or drums and store

Prepare 1-5 % dilutions of SLF and spray on the crops

RESULTS

SPECIES DESCRIPTION

Sargassum wightii (J. Agarth)
Division: Phaeophyta
Class: Phaeophyceae
Order: Dictyotales
Family: Dictotaceae
Genus: Sargassum
Species: wightii

Key for identification:
Plants dark brown, 20-30 cm length in height with a well-marked hold fast, upper portion richly branched axes cylindrical, glabrous leaves 5-8 cm long 2-9 broad leaves tapering at base apex mid inconspicuous vesicles large spherical or ellipsoidal being 5-8 cm long and 3-4 m (broad plate)

Table 1. The Macronutrients & Trace Elements Analyzed In The Seaweeds Extraction of SLF

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Nutrient</th>
<th>Sargassum wightii (mg/l)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Calcium</td>
<td>170</td>
</tr>
<tr>
<td>2</td>
<td>Magnesium</td>
<td>167.1</td>
</tr>
<tr>
<td>3</td>
<td>Sodium</td>
<td>490</td>
</tr>
<tr>
<td>4</td>
<td>Potassium</td>
<td>310</td>
</tr>
<tr>
<td>5</td>
<td>Iron</td>
<td>6.931</td>
</tr>
<tr>
<td>6</td>
<td>Phosphorus</td>
<td>54.17</td>
</tr>
<tr>
<td>7</td>
<td>Chloride</td>
<td>1180</td>
</tr>
<tr>
<td>8</td>
<td>Sulphate</td>
<td>39.45</td>
</tr>
<tr>
<td>9</td>
<td>Copper</td>
<td>0.858</td>
</tr>
<tr>
<td>10</td>
<td>Zinc</td>
<td>1.037</td>
</tr>
</tbody>
</table>

Fig. 1. Sargassum wightii
<p>| | | |</p>
<table>
<thead>
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<th></th>
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</thead>
<tbody>
<tr>
<td>11</td>
<td>Nitrate</td>
<td>114.14</td>
</tr>
<tr>
<td>12</td>
<td>Cobalt</td>
<td>0.049</td>
</tr>
<tr>
<td>13</td>
<td>Manganese</td>
<td>1.095</td>
</tr>
<tr>
<td>14</td>
<td>Boron</td>
<td>3.891</td>
</tr>
</tbody>
</table>

The resultant concentrated seaweed extract is considered as 100% seaweed extract. As the seaweed liquid fertilizer contains organic matter therefore add a preservative (1 gram of Potassium nitrate to 1 litre of seaweed extract) before packing in bottles, cans or drums.

**Application on Crop Plants:**

Dilute this seaweed extract in the ratio of 1-3 % and apply as spray on the crops.

1 % = 1 litre seaweed extract in 99 litre water
2 % = 2 litre seaweed extract in 98 litre water
3 % = 3 litre seaweed extract in 97 litre water

**Application on Seeds:**

Soak the seeds in 1-3 % dilution of seaweed extract for 24 hours. Shade dries the treated seeds and then sow or disseminate in the fields.

**Plants / crops on which SLF can be used or applied**

Can be used for any kind of plants (crop plants, ornamental plants, flowering plants etc.)

**How it affects the plants / crops**

Seaweed Liquid fertilizer is a natural bio-product, non-toxic, completely biodegradable and can be used for all crops at any stage of growth. SLF increases plant productivity, uptake of soil nutrients, resistance to some pests, drought and stress and improves seed germination. Plant response is immediate and positive. SLF also stimulates beneficial microorganisms of the root systems and plant growth, improves soil crumb structure and moisture retaining capacity of the soil.

**Comparative study Paddy seed germination between SLF concentrations**

The paddy seeds are soaked into the different concentrations (1 % to 3%) of SLF for 24 hours than Shade dries the treated seeds and then sow fields. Three percentages (3%) of SLF is more seed germination then others.
Fig. 2. SLF Extraction Process
Fig. 3. Seed Germination with Different Concentration of SLF

A. Lettuce Seed
B. Cluster Bean Seed
**Figur: 3 SLF SEEDS**

**Figur: 4 SLF Growth Values Day**
Table 3 SLF Plants Growth Values

<table>
<thead>
<tr>
<th>Seaweed Extract</th>
<th>0%</th>
<th>5%</th>
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<tbody>
<tr>
<td>7th day</td>
<td></td>
<td></td>
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<tr>
<td>15th day</td>
<td></td>
<td></td>
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<tr>
<td>30th day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60th day</td>
<td></td>
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<tr>
<td>7th day</td>
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<tr>
<td>15th day</td>
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<tr>
<td>30th day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60th day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster Bean Seed (cm)</td>
<td>29</td>
<td>34</td>
</tr>
<tr>
<td>-----------------------</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>Lettuce Seed (cm)</td>
<td>26</td>
<td>35</td>
</tr>
</tbody>
</table>

Cluster Bean seed  
Control

Cluster Bean seed  
Sample

Lettuce seed  
Control

Lettuce seed  
Sample
CONCLUSIONS
The efficacy of the three different SLF concentrations 3% of SLF is more efficient seed germination than others. The detailed study on the determination of the most effective percentage of seaweed liquid fertilizer (SLF) extraction three different concentrations Paddy resulted in suggesting the following recommendations:

- Out of three concentrations of 3% of SLF is most effective seed germination.
- SLF thus obtained could be used for soaking seeds, foliar spray or even as a soil drench.
- 100% SLG thus obtained should be much diluted and then used in different ways as suggested above.

REFERENCES:


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