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INFLUENCE OF SEAWEED LIQUID FERTILIZER OF *ENTEROMORPHA LINZA* (L.) J.AG. (GREEN SEAWEED) ON *VIGNA RADIATA* (L.) R.WILCZEK. IN THOOTHUKUDI, TAMIL NADU, INDIA

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ABSTRACT

The present study deals with the investigation of the effect of Seaweed Liquid Fertilizer of *Enteromorpha linza* (L.) J.Ag. on seed germination, shoot length, root length, biochemicals and pigment content of *Vigna radiata* (L.) R.Wilczek. The Seaweed Liquid Fertilizer prepared from *Enteromorpha linza* (L.) J.Ag. was observed to possesses the positive effect on the shoot and root length of *Vigna radiata* (L.) R.Wilczek. The biochemicals such as total carbohydrates, proteins, lipids, phenols, chlorophylls and carotenoids were also increased when the *Vigna radiata* (L.) R.Wilczek. treated with high concentration of Seaweed Liquid Fertilizer. The seed germination, shoot length, root length, biochemical and pigment contents was found to be maximum in 10% SLF. *Enteromorpha linza* (L.) J.Ag. can be used as biofertilizer for the growth of *Vigna radiata* (L.) R.Wilczek.

INTRODUCTION

The improvement of agricultural system results the higher production of crops and enhance the sustainability of the system. One such approach is the use of biostimulants which can enhance the effectiveness of conventional mineral fertilizers. Due to the reasons the farmers are being compelled gradually day by day to turn towards various options like organic manures, biostimulants, growth regulators etc [1]. One of such options is the use of seaweed extracts as biofertilizer. Marine bioactive substances extracted from seaweeds are used in agricultural and horticultural crops and many beneficial effects may be achieved in terms of enhancement of yield and quality. Seaweed liquid extracts obtained from seaweeds have recently gained importance as biostimulants for many crops including various cereals, pulses and different vegetable species [2]. Seaweed extracts contain major and minor nutrients, amino acids, vitamins, cytokinins, auxin and abscisic acid like growth promoting substances and have been reported to stimulate the growth and yield of plants, develop tolerance to environmental stress, increase nutrient uptake from soil and enhance antioxidant properties. Seaweed liquid extracts have recently gained importance as foliar sprays for many crops including various grasses, cereals flowers and vegetable species [3].

In recent years the use of natural seaweed products as substitutes to the conventional synthetic fertilizers has assumed importance. In agriculture, the application of seaweeds are so many, as soil conditioners, fertilizers and green manure, due to the presence of high amount of potassium salts, micronutrients and growth substances. The growing agricultural practices need more fertilizers for higher yield to satisfy food for human beings. There are

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many growth hormones, regulators and promoters available to enhance yield attributes. The developed countries utilized such growth hormones in cultivation of crops.

In India utilization of seaweeds and the extracts, seaweed liquid fertilizers will be useful for achieving higher agricultural production. In recent years, the use of seaweed extracts have gained in popularity due to their potential use in organic and sustainable agriculture [4] especially in rainfed crops, as a means to avoid excessive chemical fertilizer applications and to improve mineral absorption. Unlike chemical fertilizers, extracts derived from seaweeds are biodegradable, nontoxic, non-polluting and non-hazardous to humans, animals and birds [5]. Considering each and every corner of the above discussion, an experiment was conducted to study the effect of Seaweed Liquid Fertilizer of *Enteromorpha linza* (L.) J.Ag. on growth and yield of *Vigna radiata* (L.) R. Wilczek.

MATERIALS AND METHODS

Collection of sample

Enteromorpha linza (L.) J.Ag. (Figure 1) is a green seaweed shows much attention in the recent years due to native vegetation. *Enteromorpha linza* (L.) J.Ag. was collected from Hare island, Thoothukudi in the south east coast of Tamil Nadu, India during the month of June 2014. Samples were rinsed with marine water to remove debris and epiphytes. The entire epiphytes were removed using soft brush. In the laboratory, the seaweeds are once again washed in freshwater and stored in refrigerator for further analysis.

Selection and Surface Sterilization of Seeds

Vigna radiata (L.) R.Wilczek. is one of the common pulses and cultivated since ancient times in India. Green gram is properly indigenous to India. It is grown in almost all the states in India. Therefore, *Vigna radiata* (L.) R.Wilczek. was selected in the present study. About 100 seeds the test plant immersed in a beaker of water. The seeds which floated on the surface of water were removed. The seeds which sunk to the bottom of the beaker were selected for the study. The selected seeds were washed in running tap water for 5 minutes and rinsed with distilled water for 5 minutes. After washing, the seeds were sterilized by keeping in 0.1% mercuric chloride for 5 minutes. The surface sterilized seeds were washed in distilled water and rinsed 5 times for 5 minutes each [6]. The surface sterilized and rinsed seeds were employed for the present study.

Preparation of Seaweed Liquid Fertilizer

Air dried plant sample was finely ground with mortar and pestle and 10g was weighed on electronic balance. 100ml distilled water was added. The mixture was incubated for two days (48h). Thereafter, the extract was filtered through What-man No.1 filter paper. Now, the extract was made up into 100ml with distilled water (10%). From this, various concentrations of extract were prepared using distilled water in the following manner,

Percentage of Conc.	Extracts (ml)	Distilled water (ml)
Control	-	100
2.5%	25	75
5.0%	50	50
7.5%	75	25
10%	100	-

Bio Assay

Ten seeds were germinated in shade using Petri plates at room temperature (33°C) for each treatment. For each treatment, 10 seeds were placed in sterilized Petri plates on Whatman No.1 filter paper and 5ml of aqueous extractions (2.5%, 5.0%, 7.5% and 10%) were added on the first day. Controls were treated with an equal volume of distilled water [7]. The same volume of extracts and distilled water were added on subsequent days on daily basis [8]. The treatments were replicated three times in a completely randomized manner. Followed by total carbohydrates [9], total protein [10], total lipid [11], total phenol [12], total chlorophyll and total carotenoids [13] were also estimated. The results obtained were tabulated and presented in the figures.

RESULTS AND DISCUSSION

Effect of SLF of *Enteromorpha linza* (L.) J.Ag. on *Vigna radiata* (L.) R.Wilczek.

The Seaweed Liquid Fertilizer of *Enteromorpha linza* (L.) J.Ag. was used as base for *Vigna radiata* (L.) R.Wilczek. Germination of seed was observed on 4th day and frequency of germination was found to be 100% in control and all treatments (Table-1 & Figure-2)

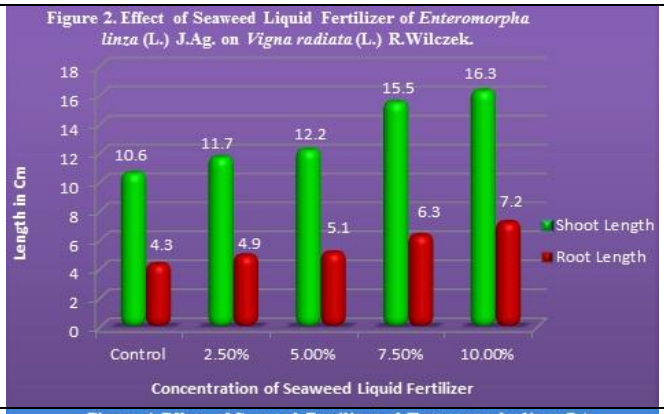
This treatment resulted in stimulation of shoot and root growth. Average shoot length in control was found to be 10.6cm (100%). The minimum stimulation of shoot length was recorded 11.7cm in 2.5% concentration of SLF (10.38%). Followed by the shoot growth was increased to 12.2cm in 5.0% (15.09%) and 15.5cm in 7.5% (46.23%). When the concentration of SLF increased to 10%, the maximum stimulation of shoot length was reached to 16.3cm (53.78%). Average root length in control was found to be 4.3cm (100%). The minimum stimulation of root length was observed 4.9cm in 2.5% concentration of SLF (13.95%). Followed by the root growth was increased to 5.1cm in 5.0% (18.60%) and 6.3cm in 7.5% (46.51%). When the concentration of SLF increased to 10%, the maximum stimulation of root length was reached to 7.2cm (67.44%).

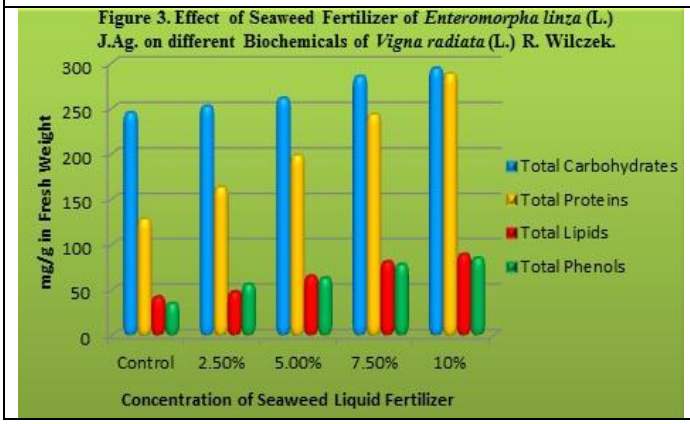
As shown in Table-2, total carbohydrates content in control was 245mg/gm, followed by increasing trend of

carbohydrates was observed in 2.5% (252mg/g), 5.0% (261mg/g), 7.5% (285mg/g) and 10% (294mg/gm). Total protein content in control was 128mg/gm, followed by 2.5% (163mg/g), 5.0% (198mg/g), 7.5% (243mg/g) and 288mg/gm in 10%. Total lipid in control was found to be 42mg/g. The amount of lipid in 2.5% was 48mg/g, followed by increasing trend was observed to 65mg/g (5.0%), 81mg/g (7.5%) and 89mg/g (10%). Total phenol content in control was 35mg/gm, followed by increasing trend of phenols was noted in 2.5% (56mg/g), 5.0% (63mg/g), 7.5% (78mg/g) and 10% (85mg/gm). Total chlorophyll content in control was 3.941mg/gm, followed by 2.5% (4.129mg/g), 5.0% (4.386mg/g), 7.5% (4.728mg/g) and 4.924mg/gm in 10%. Total carotenoid in control was recorded to be 1.080mg/g. The carotenoid content in 2.5% was 1.321mg/g, followed by increasing trend was observed to 1.524mg/g (5.0%), 1.653mg/g (7.5%) and 1.736mg/g (10%). When the concentration of Seaweed Liquid Fertilizer *Enteromorpha linza* (L.) J.Ag. was increased, all the phytochemicals content were also increased.

Seaweed extract, the rich source of several primary nutrients like Potassium, Phosphorus, secondary nutrients like Calcium, Magnesium, trace elements like Zinc, Copper, Iron, Manganese and beneficial elements like Nickel, Sodium etc. Seaweed extracts stimulate various aspects of growth and development resulting in around good health of the plants while deliberating the effect of seaweed extracts on crops the aspects of root development and mineral absorption, shoot growth and photosynthesis and ultimately crop yield, even vegetative propagation can also be taken into consideration. Due to the presence of good amount of Phosphorus in it, the Seaweed Liquid Fertilizers (SLF) proliferate root development, enhance root to shoot ratio, thereby, making the plants more able to mine adequate nutrients from the deeper layer of soil and influence crop maturity as a whole. As Phosphorus is the important constituent of Nitrate reductase (NADP), the niacin component of Vitamin-B complex, helps in photosystem-I to produce NADPH. As SLF is a very good source of Potassium, it helps in regulating the water status of the plants, controls the opening and closing of stomata and thereby the photosynthesis to a large extent. The meristematic growth and disease resistance are also influenced by it due to the manifestation of good impact of Potassium. Calcium being present in seaweed extracts helps in enzyme activation, cell elongation and cell stability. The present findings coincide with those of earlier studies made in *Cajanus cajan* [14], maize and ragi [15], *Vigna catajung* and *Dolichos biflorus* [16]. Statistically significant differences were observed for shoot length, root length, fresh and dry weight. A positive response was observed at 10% SLF of *Enteromorpha linza* (L.) J.Ag. soaked seedlings.

Figure 1. Natural Habit of *Enteromorpha linza* (L.) J.Ag.





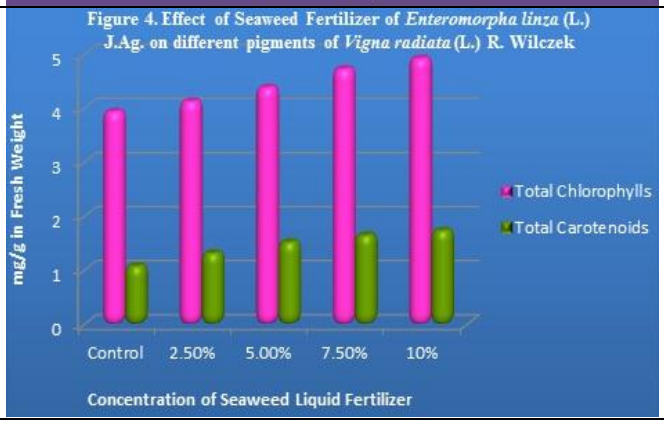


Table 1. Effect of Seaweed Liquid Fertilizer of *Enteromorpha linza* (L.) J.Ag. on shoot and root length of *Vigna radiata* (L.) R.Wilczek.

Treatment	Seed germination (%)	Shoot length (cm)	Increased Shoot length (%)	Root length (cm)	Increased root length (%)
Control	100	10.6±0.12	-	4.3±0.11	-
2.5%	100	11.7±0.11	10.38	4.9±0.16	13.95
5.0%	100	12.2±0.07	15.09	5.1±0.13	18.60
7.5%	100	15.5±0.13	46.23	6.3±0.05	46.51
10%	100	16.3±0.14	53.78	7.2±0.16	67.44

Table 2. Effect of Seaweed Fertilizer of *Enteromorpha linza* (L.) J.Ag. on different Biochemicals of *Vigna radiata* (L.) R.Wilczek.

Biochemicals (mg/g)	Concentration of Plant Extracts				
	Control	**2.5%**	**5.0%**	**7.5%**	**10%**
Total Carbohydrates	245*	252*	261*	285*	294*
Total Proteins	128*	163*	198*	243*	288*
Total Lipids	42*	48*	65*	81*	89*
Total Phenols	35*	56*	63*	78*	85*
Total Chlorophylls	3.941*	4.129*	4.386*	4.728*	4.924*
Total Carotenoids	1.080*	1.321*	1.524*	1.653*	1.736*

* An average of Triplicates

CONCLUSION

From the present study, it can be concluded that Seaweed Liquid Fertilizer prepared from the green seaweed *Enteromorpha linza* (L.) J.Ag. can be applied to the important crop plant *Vigna radiata* (L.) R.Wilczek. showed better results in all aspects of germination, growth, biochemical and pigment concentration. It is probably due to the presence of growth promoting hormones and nutrients in more quantities in the green seaweed, Seaweed Liquid Fertilizer can be applied to various crop plants in order to enrich the nutrient content of the soil and intern to increase the growth and yield of cultivable plants.

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