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EFFECT OF SEAWEED LIQUID FERTILIZER OF *LAURENCIA PEDICULARIOIDES* BOERGESEN ON THE GROWTH AND BIOCHEMICAL CHARACTERISTICS OF *PENNISETUM GLAUCUM* (L.) R.BR.

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ABSTRACT

The use of seaweeds as manure in agricultural land is very ancient and common practice in many countries. The use of seaweeds as fertilizer in crop production has a long tradition in coastal areas all over the world. Seaweeds possess most of the trace elements and plant growth hormones required for plants' growth. It was reported that seaweed manure is rich in potassium, nitrogen and phosphorus. There are many plant growth hormones, regulators and promoters available to enhance yield attributes. Hence the present study has been made to investigate the effect of Seaweed Liquid Fertilizer (SLF) of *Laurencia pedicularioides* Boergesen on seed germination, shoot length, root length, biochemicals and pigment content of *Pennisetum glaucum* (L.) R.Br. was studied. The Seaweed Liquid Fertilizer prepared from *Laurencia pedicularioides* Boergesen was observed to have the positive effect on the shoot and root length of *Pennisetum glaucum* (L.) R.Br. The biochemicals such as total carbohydrates, proteins, lipids, phenols, chlorophylls and carotenoids were increased when the *Pennisetum glaucum* (L.) R.Br. treated up to 10% of Seaweed Liquid Fertilizer. The seed germination, shoot length, root length, biochemical and pigment content were maximum at 10% SLF. *Laurencia pedicularioides* Boergesen can be used as biofertilizer for the growth of *Pennisetum glaucum* (L.) R.Br.

INTRODUCTION

Seaweeds or macroalgae are marine plants belonging to the thallophyta of plant kingdom. Seaweeds are rich in minerals, proteins, lipids, carbohydrates, vitamins, bromine, iodine etc. Therefore, seaweeds have been harvested for many centuries particularly in Japan and China where the seaweeds form a part of the staple food [1]. In recent years, seaweed extracts as liquid fertilizers have come in market. Recent researches have proved that Seaweed Liquid Fertilizer (SLF) is better than other chemical fertilizers [2]. Seaweeds have recently gained importance as foliar sprays for several crops because the extract contains growth promoting hormones, cytokinins, trace elements, vitamins and amino acids [3].

One of the well documented beneficial effects of seaweed extracts is that it enhanced the seed germination and plant growth. Seaweed extracts have been shown to induce resistance to frost, fungal and insects attach, reduce red spider, aphid and nematode infestation and increase nutrients uptake from soil. The seaweed fertilizers application will be useful now for achieving higher production. The most commonly using brown seaweed is *Ascophyllum nodosum*. Seaweed extracts are now available commercially labeled as Maxicorp [4]. Seaweed meals

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provide an approximately equivalent amount of N, less P compared to most animal manures. Applications of chemical fertilizers certainly compensate the deficiency of nutrients in soil. Whereas, in excess it affects soil and plants in due course. Recent researchers proved that seaweed fertilizers since they are very economic, cheap and ecofriendly [5]. Seaweed fertilizer was found to be superior to chemical fertilizer because to the high level of organic matter aids in retaining moisture and minerals in the upper soil level available to roots. Hence, the present study was undertaken to investigate the effect of different SLF concentrations of *Laurencia pedicularioides* on the growth and biochemical characteristics of *Pennisetum glaucum* (L.) R.Br.

MATERIALS AND METHODS

Collection of sample

Laurencia pedicularioides Boergesen (Figure-1) is a red seaweed shows much attention in the recent years due to native vegetation. *Laurencia pedicularioides* Boergesen was collected from Manapad coast in the south east coast of Tamil Nadu, India during the month of November 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

Pennisetum glaucum (L.) R.Br. is one of the important cereals and cultivated in almost all the states in India. Therefore, *Pennisetum glaucum* (L.) R.Br. 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[4]. 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 [6]. The same volume of extracts and distilled water were added on subsequent days on daily basis [7].The treatments were replicated three times in a completely randomized manner. Followed by total carbohydrates [8], total proteins [9], total lipids [10], total phenols [11], total chlorophylls and total carotenoids [12] were also estimated. The results obtained were tabulated and presented in the figures.

RESULTS AND DISCUSSION

Effect of SLF of *Laurencia pedicularioides* Boergesen on *Pennisetum glaucum* (L.) R.Br.

The Seaweed Liquid Fertilizer of *Laurencia pedicularioides* Boergesen was used as base for *Pennisetum glaucum* (L.) R.Br. 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 5.2cm (100%). The minimum stimulation of shoot length was recorded 6.3cm in 2.5% concentration of SLF (21.15%). Followed by the shoot growth was increased to 7.4cm in 5.0% (42.30%) and 7.9cm in 7.5% (51.92%). When the concentration of SLF increased to 10%, the maximum stimulation of shoot length was reached to 8.2cm (57.69%). Average root length in control was found to be 7.1cm (100%). The minimum stimulation of root length was observed 8.3cm in 2.5% concentration of SLF (19.90%). Followed by the root growth was increased to 8.8cm in 5.0% (23.94%) and 9.4cm in 7.5% (32.39%). When the concentration of SLF increased to 10%, the maximum stimulation of root length was reached to 11.5cm (61.97%).

As shown in Table-2, total carbohydrates content in control was 188mg/gm, followed by increasing trend of carbohydrates was observed in 2.5% (198mg/g), 5.0% (227mg/g), 7.5% (232mg/g) and 10% (241mg/gm). Total protein content in control was 144mg/gm, followed by 2.5% (152mg/g), 5.0% (167mg/g), 7.5% (189mg/g) and 194mg/gm in 10%. Total lipid in control was found to be 81mg/g. The amount of lipid in 2.5% was 88mg/g, followed by increasing trend was observed to 96mg/g (5.0%), 104mg/g (7.5%) and 111mg/g (10%). Total phenol

content in control was 70mg/gm, followed by increasing trend of phenols was noted in 2.5% (79mg/g), 5.0% (88mg/g), 7.5% (94mg/g) and 10% (114mg/gm). Total chlorophyll content in control was 3.44mg/gm, followed by 2.5% (3.59mg/g), 5.0% (3.67mg/g), 7.5% (3.79mg/g) and 3.86mg/gm in 10%. Total carotenoid in control was recorded to be 0.92mg/g. The carotenoid content in 2.5% was 1.03mg/g, followed by increasing trend was observed to 1.22mg/g (5.0%), 1.38mg/g (7.5%) and 1.49mg/g (10%). When the concentration of Seaweed Liquid Fertilizer *Laurencia pedicularioides* Boergesen was increased, all the phytochemicals content was increased.

The utilization of seaweeds in agriculture and horticulture has a long history. Ancient Greeks and Chinese applied seaweed mulches to the soil. Some of the commercially available liquid seaweed like Cytex, Goemer GA 14, Kelpak 66, Maxicrop sea crop 16, Seaspray, Seamac, Seamagic-3 etc. The *Pennisetum glaucum* (L.) R.Br. seeds soaked with lower concentrations (2.5%) of the *Laurencia pedicularioides* Boergesen extracts showed lower rate of germination, while the higher concentrations (10%) of the extracts showed rapid germination. The increased germination percentage at high concentrations may be due to the presence of some growth promoting substances such as IAA and IBA, Gibberellins, cytokinins, micronutrients, vitamins and amino acids in *Laurencia pedicularioides* Boergesen extracts. The present findings coincide with those of earlier studies made in *Cajanus cajan* [13], maize and ragi [14], *Vigna catajung* and *Dolichos biflorus* [15]. Statistically significant differences were observed for shoot length, root length, fresh and dry weight. A positive response was observed at 10% SLF of *Laurencia pedicularioides* Boergesen soaked seedlings.

Table 1. Effect of Seaweed Liquid Fertilizer of *Laurencia pedicularioides* Boergesen on shoot and root length of *Pennisetum glaucum* (L.) R.Br.

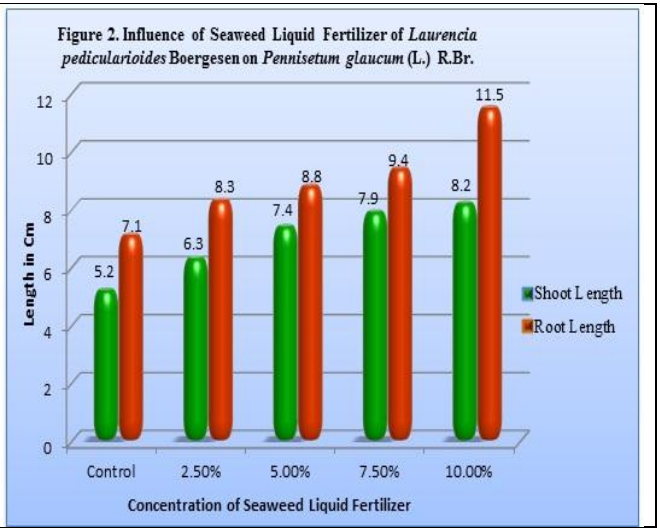
Treatment	Seed germination (%)	Shoot length (cm)	Increased Shoot length (%)	Root length (cm)	Increased root length (%)
Control	100	5.2±0.04	-	7.1±0.11	-
2.5%	100	6.3±0.12	21.15	8.3±0.10	19.90
5.0%	100	7.4±0.02	42.30	8.8±0.13	23.94
7.5%	100	7.9±0.21	51.92	9.4±0.06	32.39
10%	100	8.2±0.03	57.69	11.5±0.16	61.97

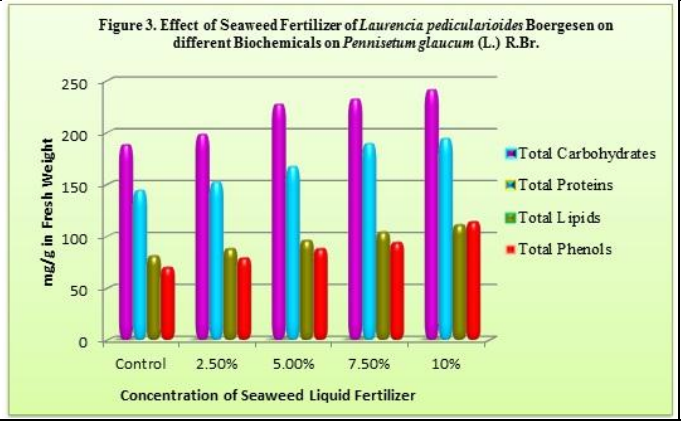
Table 2. Effect of Seaweed Fertilizer of *Laurencia pedicularioides* Boergesen on different Biochemicals of *Pennisetum glaucum* (L.) R.Br.

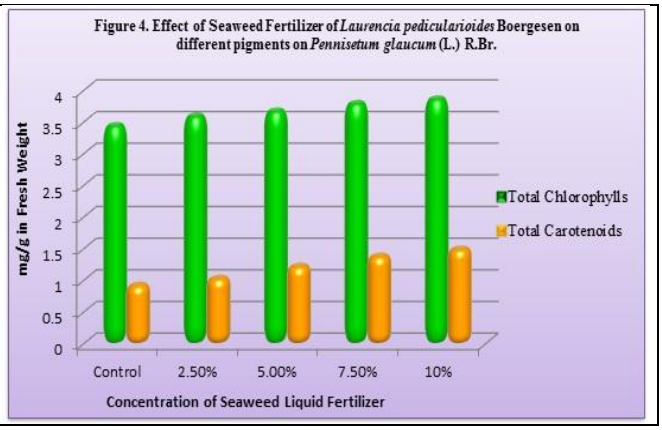
Biochemicals (mg/g)	Concentration of Plant Extracts				
	Control	**2.5%**	**5.0%**	**7.5%**	**10%**
Total Carbohydrates	188*	198*	227*	232*	241*
Total Proteins	144*	152*	167*	189*	194*
Total Lipids	81*	88*	96*	104*	111*
Total Phenols	70*	79*	88*	94*	114*
Total Chlorophylls	3.44*	3.59*	3.67*	3.79*	3.86*
Total Carotenoids	0.92*	1.03*	1.22*	1.38*	1.49*

* An average of Triplicates.

Figure 1. Natural Habit of *Laurencia pedicularioides* Boergesen







CONCLUSION

From the present study, it is concluded that Seaweed Liquid Fertilizer prepared from the red seaweed *Laurencia pedicularioides* Boergesen can be applied to the important crop plant *Pennisetum glaucum* (L.) R.Br 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 red seaweed, Seaweed Liquid Fertilizer can be applied to various crop plant 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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