



# A Comparative Study on the Effect of Seaweed Liquid Fertilizers on the Growth and Yield of *Vigna radiata* (L.)

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## ABSTRACT

The effect of liquid extracts of two seaweeds, *Caulerpa peltata* and *Gracilaria corticata* on seed germination, growth and pigment contents of Greengram (*Vigna radiata* L.) was studied. The extracts promoted seed germination at lower levels of seaweed liquid fertilizer application. The plant treated with 4% seaweed liquid fertilizer of *Gracilaria corticata* showed maximum shoot length, root length, number of leaves, number of fruits, number of root nodules, chlorophyll contents (*a*, *b* and total chlorophyll).

## INTRODUCTION

Seaweeds are marine macro algae available largely in shallow coastal waters. Seaweeds as manure have been recognized for a long time in other countries. However, in India very little information is available on the beneficial effects of seaweeds to improve crop growth (Bhosle et al. 1975). At present we use chemical fertilizers in large quantities to compensate the deficiency of nutrients in soil. The abundant use of chemical fertilizers adversely affects soil and plants. Seaweed fertilizers are preferred not only due to their nitrogen, phosphorus and potash content but also because of the presence of trace elements and metabolites similar to plant growth regulators. The application of seaweed fertilizers for different crops was of great importance to substitute the commercial chemical fertilizers and to reduce the cost of production. Liquid fertilizers derived from seaweeds are found to be superior to chemical fertilizers due to high level of organic matter, micro and macro elements, vitamins, fatty acids and growth regulators (Booth 1969).

The growing agricultural practices need more fertilizers for higher yield to satisfy the need of food for human beings. Developed countries utilize growth hormones in the cultivation of crops. In India utilization of seaweeds and their extracts will be useful for achieving higher agricultural production.

The present study intends to investigate the effect of Seaweed Liquid Fertilizer (SLF) prepared from *Gracilaria corticata* and *Caulerpa peltata* on the growth, yield, seed germination and pigment concentration of *Vigna radiata*.

## MATERIALS AND METHODS

The seaweeds *Gracilaria corticata* and *Caulerpa peltata* were selected for the present study. The above seaweeds were collected from Tikkodi (11°29' N Lat. and 75°33' E Long.), Kerala. The healthy plants were collected and stored in polythene bags. The collected seaweeds were immediately brought to the laboratory and washed in tap water to remove salt from the surface and then used for extract preparation.

Seaweed extract from *Gracilaria corticata* and *Caulerpa peltata* were prepared by following the method of Gandhiyappan & Perumal (2001). 50g wet weight of algae was homogenized in 50 mL distilled water. The extract was filtered through a muslin cloth and stored in a plastic jar. All the extracts were labelled properly and stored in a refrigerator for further use. The stored extracts were considered as 100% concentration. From this, different concentrations of the extract (1%, 2%, 3% and 4 %) were prepared.

Certified seeds of *Vigna radiata* were procured from Regional Agricultural Research Station, Pattambi, Kerala. The parameters used for the study were:

### A. Germination studies

1. Germination %
2. Vigour index
3. Growth index
4. Phytotoxicity
5. Phytomass
6. Productivity

### B. Morphological studies

1. Height of the plant
2. Length of the roots
3. Number of leaves
4. Number of flowers
5. Number of Fruits
6. Number of root nodules
7. Phytomass
8. Productivity

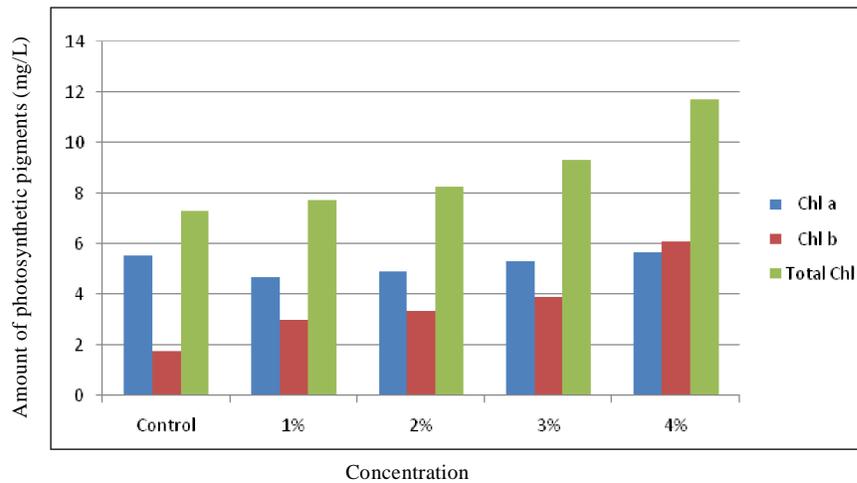


Fig. 1: Effect of *Gracilaria corticata* on photosynthetic pigments.

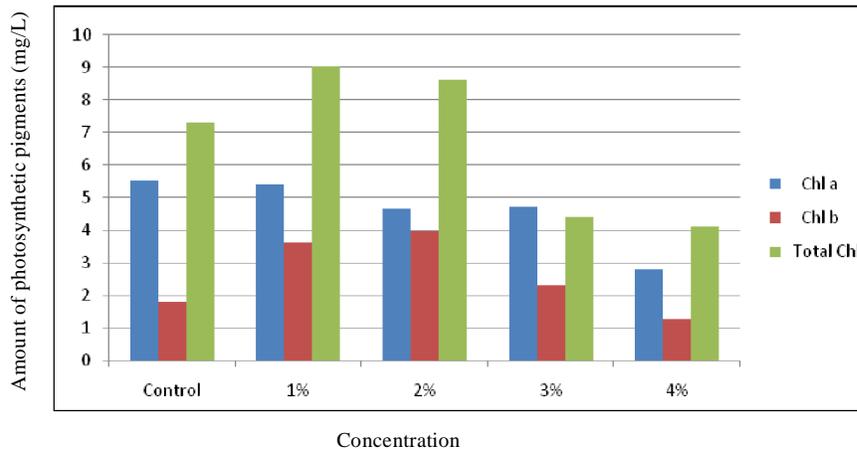


Fig. 2: Effect of *Caulerpa peltata* on photosynthetic pigments.

**C. Biochemical studies:** Estimation of total chlorophyll content was determined by Arnon (1949).

#### Germination Study

The germination study was conducted in March. The seeds were surface sterilized using 0.1% mercuric chloride for 1 to 2 minutes and rinsed with distilled water. Then 20 numbers of the seeds were soaked in different concentrations of the extracts for 12 hrs. The control seeds were soaked in distilled water for the same period. Triplicates were maintained for each treatment. The treated seeds were kept under observation for 3 days. The percentage of germination, radicle length and hypocotyl length were noted.

#### Morphological Study

The selected seeds were sown in seed beds. Germination started and the seedlings reached 3-4 leaved condition. Six

seedlings were transplanted in pots filled with potting mixture. Triplicates were kept for each concentration of the extract. The extracts of the two seaweeds were sprayed on the plants from the day of initiation up to 50 days at intervals of 3 days. For control plants, distilled water alone was sprayed. The growth parameters such as height of the plant, length of the root, number of flowers, number of fruits, number of root nodules, fresh weight, dry weight, phytomass and productivity were studied in different concentrations.

#### RESULTS AND DISCUSSION

The results of the study are given in Tables 1-4, and Figs. 1-2. The seed germination was recorded maximum at lowest concentration of both the algal treatments. The obtained results were coinciding with previous studies of Aitken & Senn (1965). Maximum radicle and hypocotyl length was observed at the higher concentration of *Gracilaria corticata* while

Table 1: Effect of *Gracilaria corticata* extract on seed germination in *Vigna radiata*.

Parameters	Concentration				
	Control	1%	2%	3%	4%
Germination percentage (%)	100±3.47	96.6±3.42	83.3±3.31	90±3.40	93.3±3.41
Hypocotyl length (cm)	4.13± 0.43	4.31±0.51	4.29±0.52	8.32±0.53	12.67±0.51
Radicle length (cm)	3.83±1.08	4.12±1.11	3.62±1.01	4.55±1.18	5.44±1.18
Seedling length (cm)	7.96±0.54	8.43±0.53	7.91±0.54	12.87±0.54	18.11±0.54
Growth index (cm)	-	1.05	0.99	1.61	2.27
Vigour index (cm)	7.96	8.14	6.59	11.58	16.90
Phytotoxicity	-	-7.57	5.48	-18.79	-42.63
Fresh weight (g)	0.31	0.29	0.29	0.34	0.41
Dry weight (g)	0.04	0.045	0.036	0.030	0.050
Phytomass	0.27	0.24	0.25	0.31	0.36
Productivity	0.09	0.08	0.08	0.1	0.12

Table 2: Effect of *Caulerpa peltata* extract on seed germination in *Vigna radiata*

Parameters	Concentration				
	Control	1%	2%	3%	4%
Germination Percentage (%)	100 ± 2.56	100 ± 2.56	100 ± 2.56	96.6 ± 2.54	80 ± 2.30
Hypocotyl length (cm)	4.13 ± 1.2	5.31 ± 1.5	3.16±1.5	3.16 ± 1.2	1.46 ± 1.2
Radicle length (cm)	3.83 ± 1.02	4.63 ± 1.02	5.50 ± 0.03	4.87± 0.02	4.59 0.03
Seedling length (cm)	7.96 ± 1.24	9.94 ± 1.3	8.66 ± 1.2	8.03 ± 1.22	6.05 1.23
Growth index (cm)	-	1.24	1.08	0.81	0.76
Vigour index (cm)	7.96	9.94	8.66	7.75	4.84
Phytotoxicity	-	-20.88	-43.6	-27.15	-19.84
Fresh weight (g)	0.31	0.28	0.25	0.22	0.20
Dry weight (g)	0.04	0.057	0.056	0.055	0.055
Phytomass	0.27	0.22	0.19	0.16	0.14
Productivity	0.09	0.074	0.064	0.053	0.048

*Caulerpa* treated seeds showed the minimum growth. Phytotoxicity was found to be decreased at higher concentration of *Gracilaria* but growth index and vigour index *vice versa*. In *Caulerpa* treated plants the growth index and vigour index were found to be decreased from lower to higher concentration and phytotoxicity *vice versa*. Negative value for phytotoxicity reflects the tolerance of the plant.

In the present study the seeds treated with 4% of *Gracilaria* extract showed better results in growth parameters such as shoot length, root length, number of flowers and fruits of the plant. The growth enhancing potential of seaweeds might be attributed to the presence of macro and micro nutrients (Challen & Hemmingway 1965). Another view is that red algae contain agar in their cell walls which enhance plant defence against pest diseases (Wajahatullah Khan et al. 2009).

Gerald (2004) recorded that addition of seaweed manure in soil enhances the symbiotic relationship between microorganisms in the soil. Similar results were recorded in seaweed treated plants with maximum number of root nodules. The higher concentration of the *Gracilaria* extract promoted

the chlorophyll content of green gram when compared with control plants. Blunden et al. (1997) reported that the seaweed extract applied as foliar spray enhanced the leaf chlorophyll level in plants. The pigment content such as Chl. *a*, Chl. *b* and total chlorophyll showed maximum results observed at higher concentrations of *Gracilaria corticata*.

In general, it was observed that the seaweed liquid fertilizers prepared from the red algae, *Gracilaria corticata* when applied to crop plants gave better results in all aspects of growth to yield and soil nutrient contents when compared to the seaweed liquid fertilizer prepared from the green algae, *Caulerpa peltata*.

## CONCLUSION

The present investigation revealed that seaweed species were potential source of fertilizer. Present findings encourage the application of such seaweeds as natural fertilizers in agricultural sector. Hence, this simple practice of application of ecofriendly seaweed liquid fertilizer to crops may be useful for the growers for attaining better germination, growth and yield.

Table 3: Effect of *Gracilaria corticata* extract on yield, and yield attributing characters of *Vigna radiata*.

Parameters	Concentration				
	Control	1%	2%	3%	4%
Height of plant (cm)	23.57	28.17	30.8	25.6	32.2
Number of leaves	5	6	6	7	8
Number of fruits	2	3	4	5	6
Number of flowers	4	2	2	3	5
Number of root nodules	1	2	3	3	4
Length of root (cm)	12.8	15.3	12.8	17.1	17.7
Fresh weight (g)	6	12.25	10.5	11.25	16.25
Dry weight (g)	4.56	3.26	3.08	2.01	4.93
Phytomass	1.44	8.99	7.42	9.24	11.32
Productivity	0.028	0.17	0.14	0.18	0.22

Table 4: Effect of *Caulerpa Peltata* extract on yield and yield attributing characters of *Vigna radiata*

Parameters	Concentration				
	Control	1%	2%	3%	4%
Height of Plant (cm)	23.57	28.4	28.1	25.5	21.6
Number of leaves	6	7	7	5	4
Number of fruits	2	8	7	5	4
Number of flowers	4	6	7	3	1
Number of root nodules	1	7	3	4	1
Length of root (cm)	12.8	16.3	15.02	13.5	8.67
Fresh weight (g)	6	13.7	10	5	1.75
Dry weight (g)	4.56	6.67	5.69	3.24	1.08
Phytomass	1.44	7.03	4.31	1.76	0.67
Productivity	0.028	0.14	0.086	0.035	0.013

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