

EFFECT OF SEAWEED LIQUID FERTILIZER ON THE GROWTH AND BIOCHEMICAL COMPOSITION *MACROTYLOMA UNIFLORUM*

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The effect of seaweed extract of *Gracilaria corticata* at different concentrations were investigated on *Macrotyloma uniflorum* (horse gram). The seeds of horse gram were placed in different petridishes and each petridishes are treated with 1-5% of algal solutions. One petridish is treated with water (control). Then the germination percentage, seedling length, phytotoxicity, growth index, phytomass and chlorophyll content is tested after 20 days. After treating the five different concentrations of algal solutions, 4% solution has more effect on horse gram at parameters like germination percentage, seedling length, phytotoxicity, growth index and phytomass. Also the chlorophyll content was more at the 5% concentration.

Keywords: Seaweed extract, germination percentage, phytotoxicity, growth index, phytomass.

INTRODUCTION

Agriculture is the primary source of livelihood for about 58% of India's population. The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year due to its immense potential for value addition, particularly within the food processing industry. The Indian food and grocery market are the world's sixth largest, with retail contributing 70% of the sales (IBEF, 2020).

India is facing intense problem of population outburst like climate change, severe energy crisis etc. But the major problem is the shortage of food and starvation. This can be overcome by increasing food production. For this farmers are using fertilizers to increase the food production. Chemical fertilizers drastically increased the food production within a short period of time. But the land lost its fertility due to the continuous application of chemical fertilizer and as a result fertile land changed to waste land. To overcome this, organic fertilizers are used. Sea weeds can be used as organic fertilizer.

Seaweed Liquid Fertilizer was first produced commercially in the United Kingdom in the year of 1950 (Stephenson, 1968). These are widely used in countries like Norway, Denmark, France, Ireland, USA, South Africa and Australia. Seaweed Liquid fertilizer (SLF) is used as an organic fertilizer produced from seaweed extracts. About 12000 varieties of seaweeds are used as organic fertilizers. They are rich in vitamins,

minerals, antioxidants and fibers. Magnesium, zinc, potassium, iron and nitrogen are the major trace elements found in them. They also contain major and minor amount of nutrients, amino acids and growth hormones like auxin, cytokinin, betaines, gibbelerins and abscisic acid (Zhang et al., 2003) and increases the antioxidant properties (Verkleij, 1992).

Seaweed has a vital role in the production of plant's own auxin. In the case of cytokinin, it initiate the growth with greater vigour. It also stops the senescence in the plants. Osmotic processes in the plants are controlled by betaines. It increases the water uptake especially in the dry conditions and also in stress conditions (Cindy, 2019). These will help to increase the growth and production of vegetables, fruits and other crops (Blunden, 1991, Crouch and Van Staden, 1994). The seaweeds used for this present study is *Gracilaria corticata* J.Agardh. *Gracilaria corticata* is a red algae. This algae has worldwide distribution.

The seeds used is the *Macrotyloma uniflorum* (Lam.) Verdc. which is commonly called as horse gram. It is an edible legume which is also considered as a traditional Ayurvedic cuisine. An attempt was made to increase the productivity of *Macrotyloma uniflorum* using the SLF of *Gracilaria corticata*.

MATERIALS AND METHODS:

Preparation of Seaweed Liquid Fertilizer:

Seaweeds are collected from the coastal area of Thikkodi located in Kozhikode district near Koyilandy (11°29'N Lat. And 75°33'E Long.), Kerala. The healthy samples are handpicked and washed thoroughly with sea water to remove all the epiphytes and other impurities. They are transferred into a polythene bag, stored in an ice box and then transferred to the laboratory. Again the sample is washed thoroughly in running tap water to remove the salt content. The seaweed collected for study is *Gracilaria corticata*. 500 gram of fresh material is taken and cut into small pieces. Add 500ml of distilled water. Samples are extracted with blender and then with mortar and pestle. It was filtered through a double layered muslin cloth to remove all the debris. These filtrates are taken as the 100% SLF (Pise and Sabale, 2010). From this 100% solution different concentrations like 1%, 2%, 3%, 4%, and 5% are prepared by adding distilled water and is denoted as GC₁, GC₂, GC₃, GC₄, GC₅.

The seeds of *Macrotyloma uniflorum* (horse gram) is collected from the Agricultural office, Thalakkulathur, Kozhikode, Kerala. Treat the seeds with 1%-5% concentrations of SLF.

The parameters is for the study were:

Germination studies:

- i) Germination studies
- ii) Seedling length
- iii) Phytotoxicity
- iv) Growth index

v) Phytomass

Biochemical studies:

i) Chlorophyll (Arnon, 1949)

RESULTS:

Germination studies

Germination Percentage

Germination percentage of horse gram on applying the algal solution of *Gracilaria corticata* calculates on the fifteenth day of germination. In the present study germination percentage shows high for the algal treated seeds. 100% seed germination is obtained in GC2, GC3, GC4, GC5. But the germination percentage of control is only 50% (Table 1 and figure 1).

Seedling Length

In the present study the radicle length varies from 4.1cm to 5.5cm in *Gracilaria* treated seeds. Plumule length varies from 9.8cm to 12.3cm. The seedling length varies from 13.9cm to 17.5cm. The highest seedling length was observed in 4% solution of algal extract, i.e. 17.5cm. But the control (C0) has only 14.5cm length (Table 1 and figure 2).

Table 1. Germination studies of *Macrotyloma uniflorum* on applying the SLF of *G. corticata*

	Germination Percentage(%)	Seedling Length(cm)	Phytotoxicity	Growth index	Phytomass
C ₀	50	14.5	0	0	0.908
GC ₁	90	16.3	-10.64	1.12	1.171
GC ₂	100	13.9	12.76	0.96	1.278
GC ₃	100	15.2	0	1.03	0.918

GC ₄	100	17.5	-17.02	1.21	1.581
GC ₅	100	17	-12.77	1.17	1.039

Figure 1: Germination percentage of horse gram

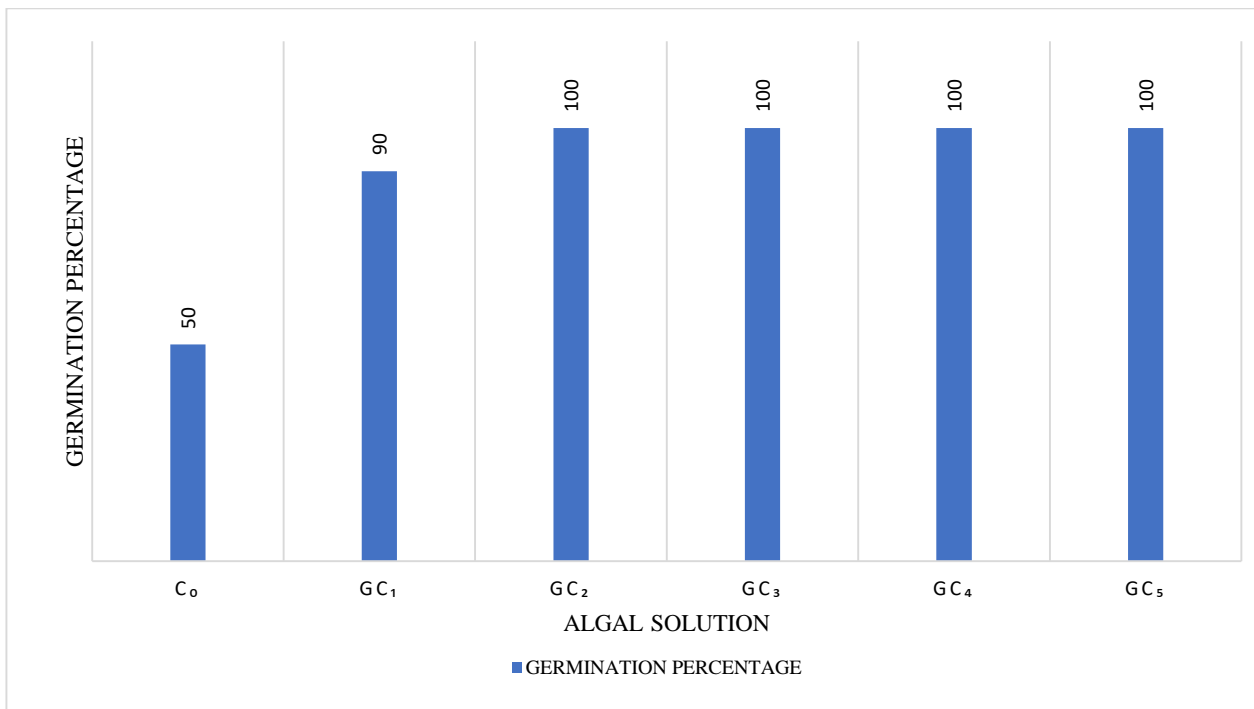
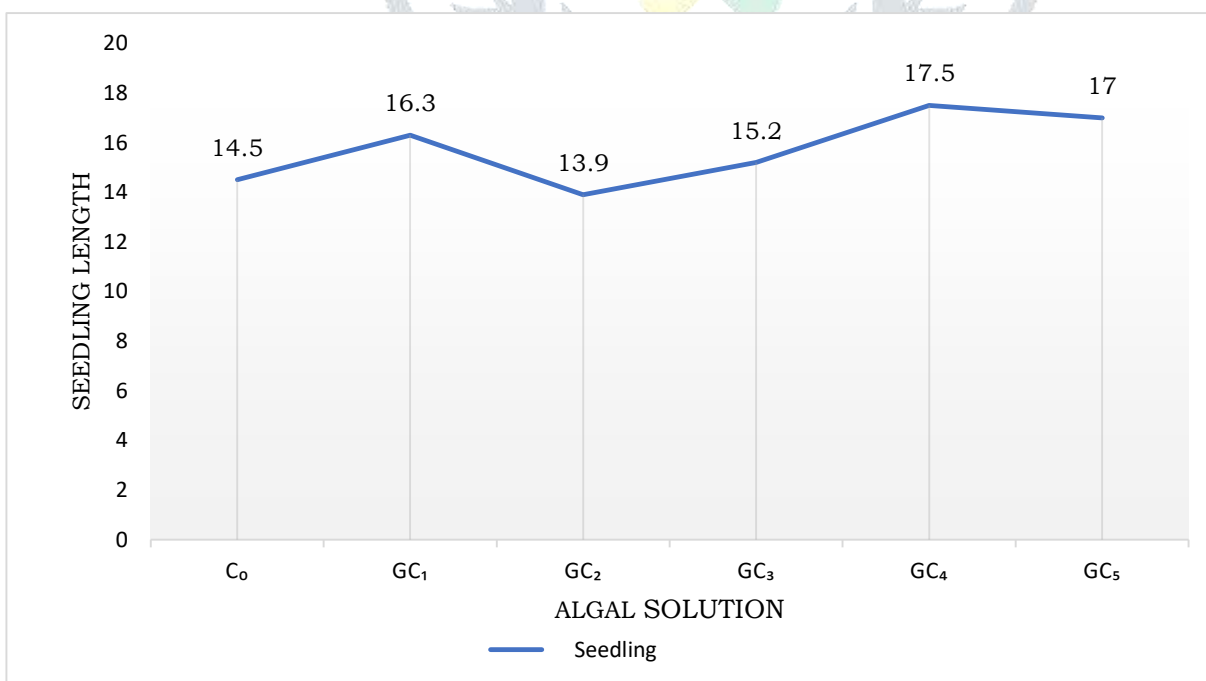


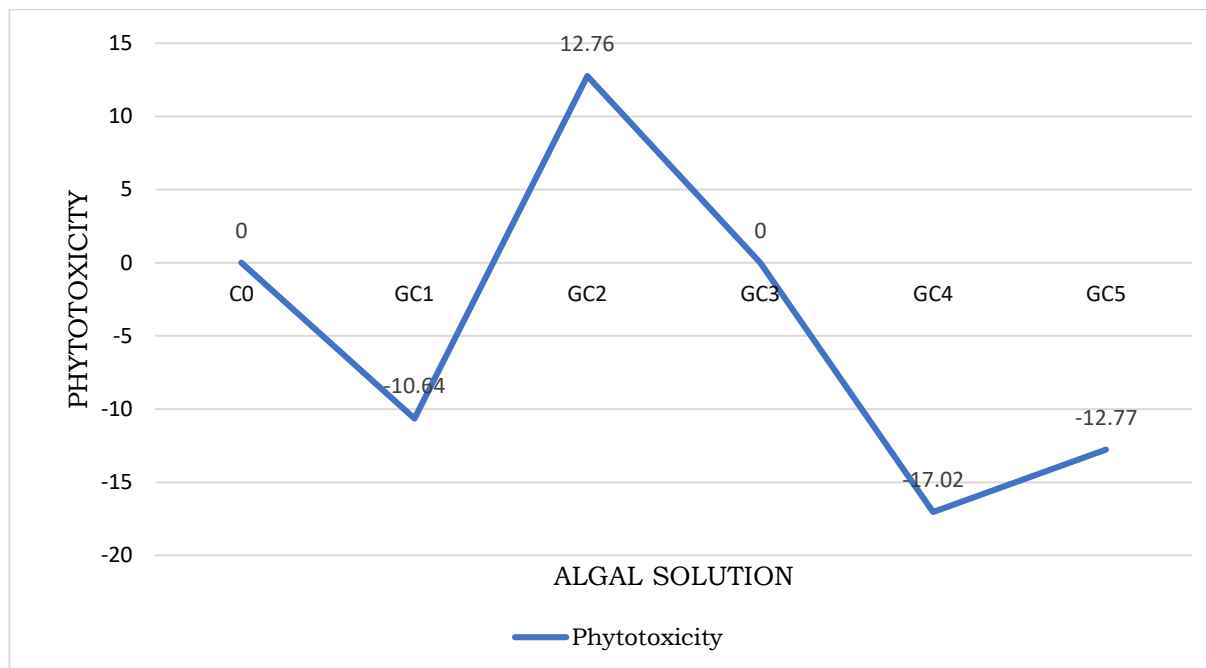
Figure 2: Seedling length of Horse gram



Phytotoxicity

In the present study the growth index values of *G.corticata* ranges from 0 to 1.21. The highest value is observed on 4% solution (GC4). The growth index of GC1, GC2, GC3 and GC5 is 1.12cm, 0.96cm, 1.03cm and 1.17cm respectively (Table 1 and figure 3).

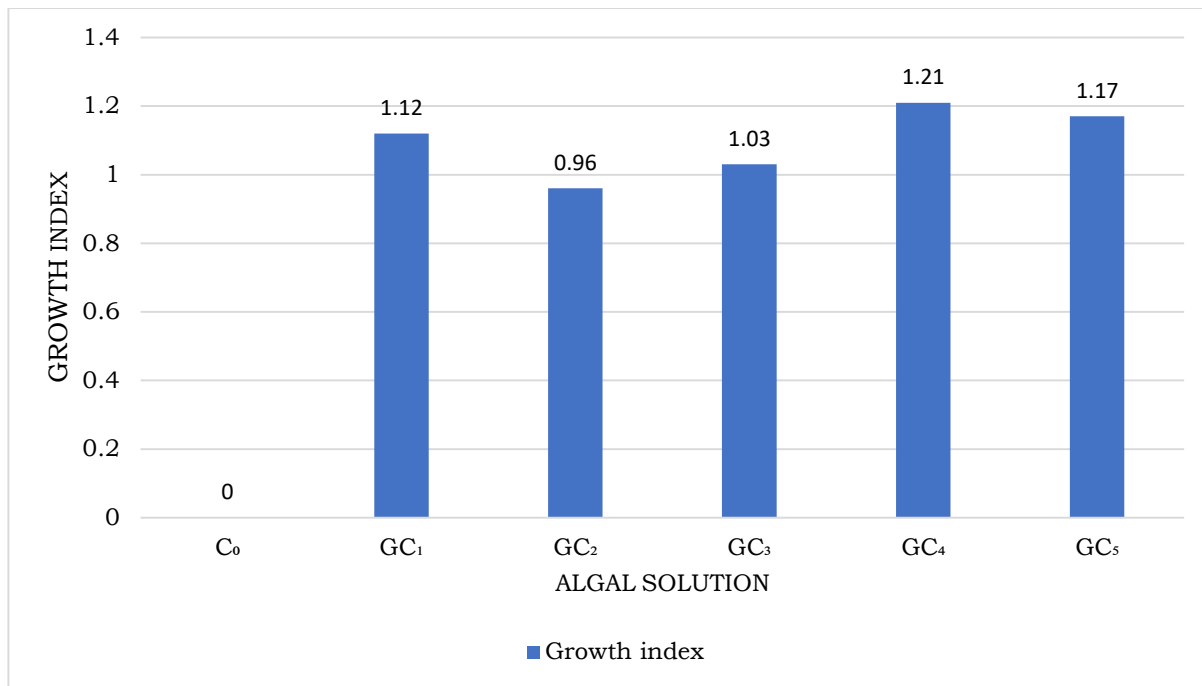
Figure 3: Phytotoxicity of horse gram



Growth Index

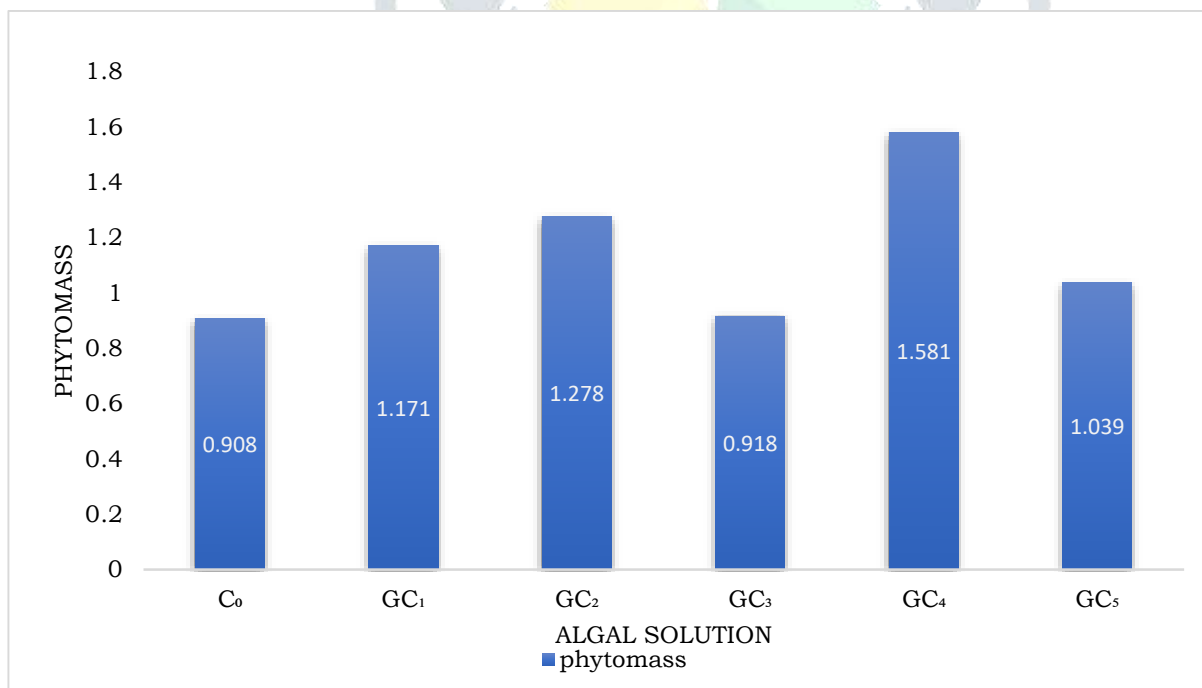
In the present investigation the fresh weight and dry weight of *Gracilaria* treated plant was maximum at 4% (GC4) solution, i.e. 2.209g and 0.628g respectively. The control (CO) treated plant shows the minimum fresh weight and dry weight (1.380g and 0.472g) when compared to *Gracilaria* treated plants. So the phytomass was maximum for GC4 (1.581g) (Table 1 and figure 4).

Figure 4: Growth index of horse gram



Phytomass

In the present investigation the fresh weight and dry weight of *Gracilaria* treated plant was maximum at 4% (GC₄) solution, i.e. 2.209g and 0.628g respectively. The control (C₀) treated plant shows the minimum fresh weight and dry weight (1.380g and 0.472g) when compared to *Gracilaria* treated plants (Table 1 and figure 5).



Biochemical Studies

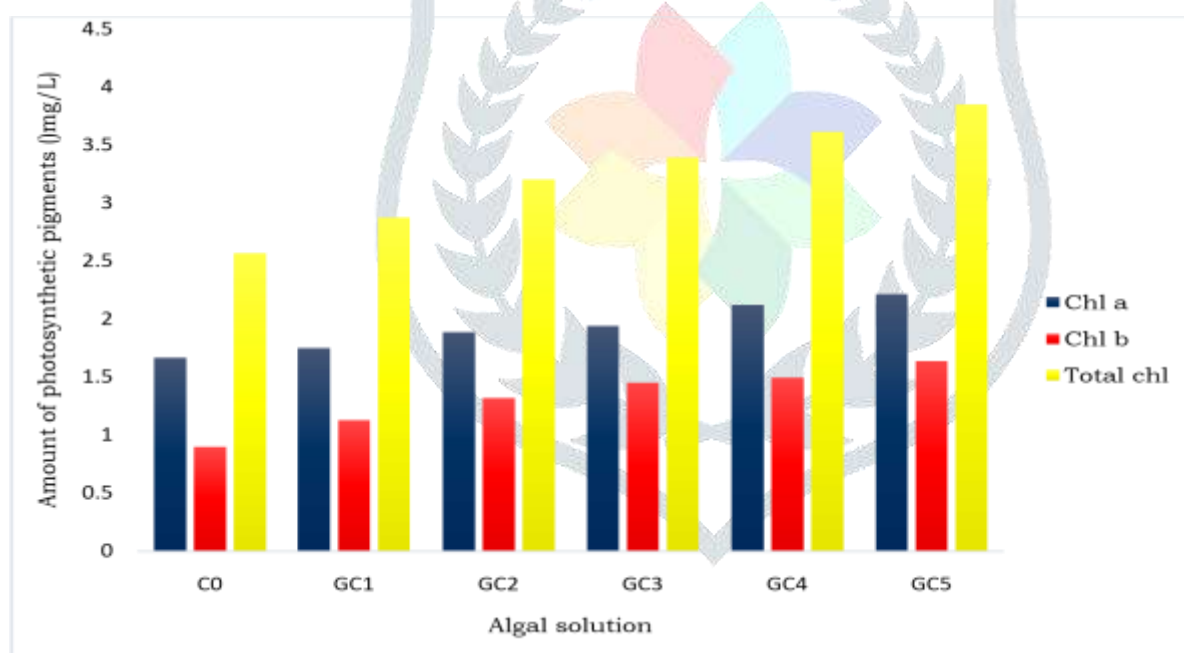
In the present study the chlorophyll a of horse gram treated with algal solution of *Gracilariacorticata* varies from 1.669mg/g/Fw to 2.213mg/g/Fw, chlorophyll b varies from 0.897mg/g/Fw to 1.638mg/g/Fw and the

total chlorophyll was 2.566mg/g/Fw to 3.850mg/g/Fw. The chlorophyll content was more on 5% solution (GC5) of when compared to the control (C0) (Table 2 and figure 6).

Table 2. Chlorophyll content of *Macrotylomauniflorum*

	Chlorophyll a (mg/g/Fw)	Chlorophyll b (mg/g/Fw)	TotalChlorophyll (mg/g/Fw)
C ₀	1.669	0.897	2.566
GC ₁	1.750	1.130	2.879
GC ₂	1.886	1.321	3.206
GC ₃	1.943	1.452	3.395
GC ₄	2.121	1.497	3.617
GC ₅	2.213	1.638	3.850

Figure 6. Chlorophyll content of *Macrotyloma uniflorum*



DISCUSSION

The *Arachis hypogea* seeds were treated with the algal solution of *Hypnea musciformis* showed higher germination percentage on 2% solution i.e. 98% and the germination percentage of control was only 78% (Ganapathy and Sivakumar, 2014). *Cyamopsis tetragonoloba* treated with *Rosenvingea intricata* has more germination percentage on 20% and 30% solutions and in the case of control it was 90% (Thirumaran et al., 2009). Radicle length and plumule length is taken by using thread and scale. So the radicle length and plumule length together forms the seedling length. Use of seaweed extract of *Stoechospermum*

marginatum on cluster bean increased the shoot length and root length on 1% solution (Sivasangari et al., 2011). The 1% concentration of *Padina boergesenii* increases the shoot length and root length of *Rhizophora mucronata* (Pise and Sabale, 2010). Phytotoxicity values ranges from -17.02 to 12.76 in *Gracilaria* treated plants. The least value is -17.02 of 4% solution (GC4) and the highest value is 12.76 of 2% solution (GC2). Negative values of phytotoxicity indicates the tolerance of plants. *Vigna mungo* treated with the algal solution of *Caulerpa racemosa* showed that the phytotoxicity was increased with increase in SLF concentration and it was maximum at 3% solution (Abhilash et al., 2012). The growth index of *Vigna radiata* was high at 4% solution when it is treated with *G.corticata* and in *Caulerpa* treated plants growth index was high at 1% solution (Chitra and Sreeja, 2013). The fresh weight and dry weight (272.09g and 397.51g) was maximum when *Helianthusannuus.L* was treated with 2.5% solution of the seaweed *Sargassumwightii* (Akila and Jeyadoss, 2010). Foliar application of seaweed liquid extracts of *Caulerparecemosa* (T1), *Sargassumwightii* (T2), *Turbinariaornate* (T3) and Mixture of SLF (T4) on *Ocimumsanctum* has more fresh weight and dry weight than control. Mixture of SLF (T4) has maximum fresh weight (10.2g) and dry weight (2.96g) (Veeranan et al., 2018). The concentration of total chlorophyll and chlorophyll a were found increased as the concentration of SLF of *Sargassumwightii* increases. The plant received with 1% solution showed maximum chlorophyll content (Ashok et al., 2012). The SLF of *Sargassumwightii* was applied on *Helianthusannuus.L*, chlorophyll a, chlorophyll b and total chlorophyll was maximum at 2.5% solution (2.95 mg/g/Fw, 1.21 mg/g/Fw and 4.06 mg/g/Fw) (Akila and Jeyadoss, 2010).

In the present study after treating the five different concentrations of algal solutions, 4% (GC4) solution of *Gracilaria corticata* has more effect on horse gram at parameters like germination percentage, seedling length, phytotoxicity, growth index and phytomass. High chlorophyll value value was obtained at 5% solution of SLF.

CONCLUSION

The present investigation reveals that the seaweed liquid fertilizers can be used as an organic fertilizer instead of using chemical fertilizers which causes harm to soil and living organisms. Seaweed is abundantly available from the coastal areas so it is a cheapest source for the fertilizer production. So the seaweed liquid fertilizer is very useful to the society especially to the farmers.

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