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Influence of seaweed liquid fertilizer of *Sargassum wightii*, *Turbnearia arnata* on the seed germination, growth and productivity of vegetable crops.

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Abstract

The present investigation is an attempt to study the influence of seaweed liquid fertilizer (SLF) extracted from the marine green algae *Sargassum wightii*, *Ulva lactuca* on the growth parameters of vegetable crops such as chilli, Tomato. The seeds were soaked in different concentrations of SLF viz., 0.5%, 1.5%, 2.5%, 5%, 10% conc. The seed germination, shoot length, root length, number of lateral roots, number of leaves, number of flowers, number of vegetables, , weight of vegetables was found maximum at low conc. (1.5%) of SLF. Hence the present study found that low conc. (1.5%) of SLF shows the higher growth, yield compared to the other concentrations of SLF and control.

Keywords: Seaweed liquid fertilizers, control, productivity, growth, yield.

Introduction

Seaweeds or macro algae are aquatic plants belonging to the thallophyta of plant kingdom. Seaweeds are rich in minerals, protein, lipid, carbohydrate, vitamins, bromine, iodine etc. So algae have been harvested by man for centuries particularly in Japan and China where they form a part of the staple food. In recent years, seaweed extracts as liquid fertilizers have come in market. Recent researches have proved that SLF is better than other chemical fertilizers (Sekar et al., 1995; Rajkumar Immanuel and Subramanian, 1999; Gandhiyappan and Perumal, 2001; Selvaraj et al., 2004; Lingakumar et al., 2006). Seaweeds have recently gained importance as foliar sprays for several crops (Thivy, 1961; Metha et al., 1967; Bokil et al., 1974) because the extract contains growth promoting hormones (IAA and IBA), cytokinins, trace elements, vitamins and amino acids (Challen and Hemingway, 1965). The growing population is facing pressure on food production and to meet the increasing demand, farmers are using chemical fertilizers to enhance their crop production. Chemical fertilizers mixed with pesticides get accumulated in plants which lead to health problems in human due to bio - magnification [Hansra BS.et al., 1993] Seaweeds are important marine renewable resources. They are used as ford, feed, fodder, fertilizer, agar, alginate, carageenan and source of various fine chemical [Sahoo. D. et al., 2000] In recent years, the use of natural fertilizer [Hong N, et al., 2007] has allowed for substitution in place of conventional synthetic fertilizer [Crouch IJ et al., 1993]. Seaweeds contain all the trace elements and plant faster growth and yield in cereal crops, vegetables, fruits, growth hormones required by plants. It was also reported orchards and horticultural plants [Thivy, F., 1961, Metha, V.C. et al., 1973, Bokil, K.K. et al., 1974]. that seaweed manure is rich in potassium but poor in India is an agricultural country; nearly 70% of the nitrogen and phosphorus then the farm manure [Kingman, A.R. et al., 1982]. There population thrives in rural areas, engaged in agriculture are many plant growth hormones, regulators and making the backbone of our economy. The fast growing promoters available to enhance yield attributes [Crouch, I.J. and J. Van Staden, 1991, 1992, 1993]. Population is mounting tremendous pressure in food Seaweed liquid fertilizers will be useful for achieving production in the country. To meet out this increasing higher agricultural production, because the extract demand, farmers use chemical fertilizers to enhance the contains growth promoting hormones (IAA and IBA), crop production. The toxic chemicals (arsenic and Cytokinins, Gibberellins, trace elements, vitamins, cadmium) from the chemical fertilizers accumulate in aminoacids, antibiotics and micronutrients [Booth, E., 1965].

Material & methods

A. Study area:

The study area of the sample collection was Visakhapatnam. Visakhapatnam lies on the east coast of India between latitudes17^0 14^1 30^{11} and 17^0 45^1 and longitudes 83^0 16^1 25^{11} and $83^0 21^1 30^{11}$ with vast resources of marine algal species.

B. Collection of sample:

The seaweed sample *Sargassum wightii*, *Ulva lactuca* was collect from the coast of Visakhapatnam. The algal sample was handpicked and washed thoroughly with seawater to remove all the impurities, sand particles and epiphytes, transported to the laboratory and washed thoroughly using tap water to remove the salt on the surface of the sample. The algal material was spread on blotting paper to remove excess water. They were shade dried. The dried seaweed is finally pulverized in the commercial grinder and powdered seaweed samples are used for further analysis.

C. Preparation of seaweed liquid fertilizer:

The seaweed liquid fertilizer is prepared by the method Ramarao (1990). The seaweed powder was added with distilled water in a ratio 1:20(w/v) and autoclaved at 1200 15 1bs/sq for min. hot extract was filtrate through double layered cheese cloth. The filtrate was taken and stored refrigerator. The extract was used to prepare different concentration of SLF by adding distilled water.

D. Seed soaking:

The seaweed liquid fertilizer was prepared with different concentration that is 0.5%, 1.5%, 2.5%, 5%, 10%. Then the sowing seeds were soaked in particular concentration of SLF and control for 12 hrs. Then the seeds sowed and observed for germination and early growth. The weeds were removed regularly and watering was done daily for the test plants.

E. Analysis:

Plants from each treatment were randomly drawn for various analyses. The grown parameter including germination percentage, fresh and dry weight, roots length and shoot length was calculated. Foliar application was done in once in five days for the test plants.

F. Statically analysis:

Data was analyzed statistically using ANOVAs for CRD. All the measurements were triplicates.

Result

The physic chemical properties of the extract of seaweed have been analyzed. The extract contained macro nutrients like nitrogen, phosphorus, potassium, magnesium, calcium and micro nutrients like iron, manganese, zinc, copper and growth hormones like cytokinin, auxin .

The seaweed extract was found in effective in increasing the growth and yield in the low level of SLF (1.5% conc. of Sargassum wightii and Ulva lactuca). Maximum seed germination of chilli and tomato was observed in low conc. (1.5% conc.) of SLF and minimum germination rate was reported high conc. (10%onc. of Sargassum wightii and Ulva lactuca) and control. The growth parameters and yield parameters were recorded in the plants treated with SLF. This observation is in conformity with the earlier report on the promotional effect of Zizypus mauratiana with crude extract of seaweed. Increased yield in banana, potato, oranges, ground nut. Similar trend was also observed in bhendi, tomato, okra and cow pea. The present study revealed that the foliar treatments using extract Sargassum wightii and Ulva lactuca exhibits promising effects on growth and yield characteristics of the test plant chilli and tomato. The

growth promoting properties of the seed treatment using seaweed extract improves the quality of the soil and increase the crop yield. This study also confirms that use of SLF is a wise eco friendly technique to enhance crop production. The results obtained from the growth and yield parameters of brinjal treated with different concentrations of SLF Sargassum wightii, Ulva lactuca and control are presented table 1(1.1, 1.2), 2(2.1, 2.2), 3(3.1, 3.2) and 4(4.1, 4.2).

Table: 1.1 Effect of seaweed extract, *Saargassum wightti* on the growth of Chilli

Parameters	Control	0.5 % concentration	1.5% concentration	2.5% concentration	5% concentration	10% concentration
Root length	15.25±0.2	20.86±0.1	22.99±0.15	20.20±0.3	18.95±0.2	17.26±0.25
Shoot length	43.96±0.11	57.18±0.13	61.21±0.2	54.72±0.32	52.95±0.15	45..81±0.14
No. of leaves	54.05±0.15	90.56±0.2	120.95±0.25	85.20±0.22	80.11±0.10	70.32±0.15
No. of flowers	47.15±0.15	80.35±0.01	101.50±0.2	79.90±0.15	67.67±0.06	54.20±0.15
Fresh weight	12.05± 0.2	18.36± 0.4	22.99± 0.32	15.85± 0.20	13.36± 0.4	11.20± 0.15
Dry weight	4.10± 0.11	9.05± 0.24	11.85± 0.33	7.20± 0.10	6.50± 0.22	5.02± 0.4

Table: 1.2 Effect of seaweed extract, *Saargassum wightti* on the yield of chilli

Parametes	Control	0.5 % concentration	1.5% concentration	2.5% concentration	5% concentration	10% concentration
No. of fruits	33.67±0.1	61.92±0.5	88.18±0.2	58.56±0.25	50.49±0.2	40.25±0.3
Fruit fresh weight	2.45±0.2	2.62±0.1	2.78±0.15	2.59±0.2	2.66±0.11	2.50±0.01

Table: 2.1 Effect of seaweed extract, *Saargassum wightti* **on the growth of Tomato**

Parameters	Control	0.5 % concentration	1.5% concentration	2.5% concentration	5% concentration	10% concentration
Root length	6.01±0.2	10.36±0.45	12.26±0.30	8.86±0.50	7.20±0.2	6.40±0.10
Shoot length	16±0.1	25.3±0.35	29.3±0.20	23.0±0.3	20.80±0.3	18.25±0.10
No. of leaves	6.01±0.1	12.36±0.45	14.53±0.5	10.20±0.2	8.33±0.4	7.50±0.1
No. of flowers	10.66±0.4	13.14±0.4	17.26±0.2	12.26±0.2	11.66±0.41	10.75±0.15
Fresh weight	3.60±0.50	8.18±0.50	10.06±0.45	7.30±0.2	5.10±0.5	4.60±0.5
Dry weight	1.06±0.1	3.96±0.20	5.96±0.25	3.01±0.25	2.56±0.1	2.54±0.45

Table: 2.2 Effect of seaweed extract, *Saargassum wightti* **on the yield of Tomato**

Parametes	Control	0.5 % concentration	1.5% concentration	2.5% concentration	5% concentration	10% concentration
No. of fruits	6.66±0.47	10.66±0.4	12.66±0.41	9.26±0.3	8.56±0.47	7.75±0.15
Fruit fresh weight	1.66±0.47	4.66±0.36	5.76±0.41	3.26±0.41	2.86±0.47	2.06±0.25

Table: 3.1Effect of seaweed extract, *Ulva lactuca* on the growth of Chilli

Parameters	Control	0.5 % concentration	1.5% concentration	2.5% concentration	5% concentration	10% concentration
Root length	15.25±0.2	18.96± 0.15	20.96± 0.10	18.02± 0.1	16.72± 0.8	15.25± 0.9
Shoot length	43.96±0.11	52.93± 0.1	56.95± 0.02	50.72± 0.2	46.35± 0.6	43.96± 0.4
No. of leaves	54.05±0.15	71 ± 0.5	74 ± 0.4	65 ± 0.5	62± 0.4	50± 0.5
No. of flowers	47.15±0.15	80.85± 0.2	95.35±0.41	75.50± 0.3	73.25± 0.05	60.32± 0.25
Fresh weight	12.05± 0.30	18.80± 0.05	20..99± 0.11	16.96± 0.01	15.23± 0.10	13.33± 0.30
Dry weight	3.10± 0.11	5.32± 0.02	7.76± 0.20	4.96± 0.21	4.20± 0.1	3.80± 0.10

Table: 3.2 Effect of seaweed extract, *Ulva lactuca* on the yield of Chilli

Parametes	control	0.5 % concentration	1.5% concentration	2.5% concentration	5% concentration	10% concentration
No. of fruits	33.67±0.1	50.20± 0.14	54.70± 0.2	40.95± 0.22	38.80± 0.4	35.10± 0.3
Fruit fresh weight	2.45±0.2	2.66±0.11	2.85±0.15	2.62±0.1	2.59±0.2	2.50±0.01

Table: 4.1 Effect of seaweed extract, *Ulva lactuca* on the growth of Tomato

Parameters	Control	0.5 % concentration	1.5% concentration	2.5% concentration	5% concentration	10% concentration
Root length	2.73±0.05	4.3±0.13	5.23±0.56	5.03±0.13	4.6±0.15	3.93±0.17
Shoot length	15.9±1.5	21.5±0.02	25.0±0.20	24.3±0.66	22.1±1.46	20.3±0.02
No. of leaves	6.01±0.1	10.33±0.4	12 ± 0.4	11.22±1.4	10.01±0.4	6.51±0.1

No. of flowers	3.2±0.43	4.3±0.28	5.0±0.37	4.3±0.13	4.0±0.12	3.20±0.44
Fresh weight	2.74±0.36	3.18±0.29	5.71±0.28	5.50±0.15	4.16±0.05	2.97±0.39
Dry weight	1.06±0.1	2.56±0.1	5.96±0.25	3.96±0.20	3.01±0.25	1.56±0.12

Table: 4.2 Effect of seaweed extract, *Ulva lactuca* on the yield of Tomato

Parametes	control	0.5 % concentration	1.5% concentration	2.5% concentration	5% concentration	10% concentration
No. of fruits	2.6±0.43	3.1±0.20	4.5±0.38	4.1±0.43	3.8±0.12	3.00±0.441
Fruit fresh weight	20.7±1.62	22.6±2.10	28.5±1.45	25.0±0.20	23.3±1.70	21.2±1.00

Conclusion

The seaweed extract prepared from S. wightii and U. lactuca was found to be promising in possessing fertilizer activity. Hence, this simple practice of application of eco friendly seaweed liquid fertilizers to vegetables is recommended to the farmers for attaining better growth and yield over chemical fertilizers. Seaweed extracts can be recommended as bio fertilizer to be used alone or in combinations with other bio fertilizers and applied to either soil or foliage for improved growth. With abundant distribution, great regeneration potential and easy mass cultivation, the seaweed bio fertilizer seems a feasible substitute to synthetic fertilizers. If such seaweeds extracts are used for organic farming, our dependence on chemical fertilizers can be reduced.

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