

BIOSTIMULANT EFFECT OF SEAWEED LIQUID EXTRACT ON *CAPSICUM ANNUUM*

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ABSTRACT

The present study pot experiment was conducted to identify the potential of *Sargassum wightii* seaweed liquid extracts were given to the tested plant in form of foliar spray.

The presence of micro and macro nutrients, vitamins, growth hormones and other constituents in the seaweed extract might be very much useful to the crops and also the liquid seaweed extracts could serve as eco-friendly product for sustainable agriculture.

KEYWORDS: Seaweed Extract, *Sargassum Wightii*, *Capsicum Annum*, Plant Immunity

INTRODUCTION

Agriculture is the backbone of our country. Organic agriculture is a holistic production management system which promotes and enhances agro-ecosystem health including biodiversity, biological cycles, and soil biological activity. Synthetic fertilizers were used widely in the days of agricultural purposes which had led to cause severe health and environmental hazards such as soil erosion, water concentration, pesticide poisoning, water logging, salinization, depletion of biodiversity, etc. Thus, farmers are switching over to organic fertilizers for sustainable agriculture. Manure derived from living resources is biodegradable, nontoxic, non-polluting and non-hazardous to soil ecosystem. (Dhargalkar.V.K.et al., 2005).

Seaweeds are the macroscopic marine algae found attached to the bottom in relatively shallow coastal water. Liquid fertilizers derived from natural sources like seaweeds are found to be viable alternatives to fertilizing input for agricultural crops due to its high level of organic matter, micro and macro elements, vitamins, fatty acids and also rich in growth regulators. (Crouch U.et al.,1993).

Seaweed extract is a new generation of natural organic fertilizers containing highly effective nutritious source and promotes faster germination of seeds, increase in yield and resistant ability of seaweeds increases humus content of the soil, thereby ameliorating the soil texture and preservation of its moisture.

The extracts of brown seaweed are widely used in the horticulture and agricultural crops for their plant growth promoting effects and for their ameliorating effect on crop tolerance to abiotic stress. Macroalgae are characterized by producing large array of biologically active biocidal substances against plant infecting pathogens. These macroalgae can be generally considered as promoting multifunctional bioinoculants and eco-friendly environmental tools in recent trends of organic farming.

Species like Fucus, Laminaria, Sargassum are used as biofertilizer in Agriculture. The brown alga have a source of potash and iodine, while bromine is sourced from red seaweed (Prescott.,1984).

In recent years the use of natural seaweed products as substitutes to the conventional synthetic fertilizers has assumed importance. Thus, the extracts are applied to improve nutritional status, vegetative growth, yield and fruit quality in crop plants.

The present study was undertaken to evaluate the fertilizing efficiency of brown seaweed liquid extracts of *Sargassum wightii* liquid extracts on *Capsicum annum*.

MATERIALS AND METHODS

Preparation of Seaweed Liquid Extracts (SLE)

The marine alga *Sargassum wightii* belongs to Phaeophyceae was collected from seashore area of Subashnagarbeach, Porbandar, Gujarat. The alga was brought to the laboratory and washed thoroughly in tap water for 3 times to remove all epiphytes, sand particles and associate fauna. The wet weight of sample of collected brown alga was taken, shadow dried and then the sample dry weight was determined. Different concentrations of boiled extracts were prepared by mixing appropriate level of liquid extracts with tap water. The SLE concentrations used in this experiment were ranged from 0.5%, 1.0%, 1.5%, 2.0% ,and control.



Figure 1: Sargassum Wightii Seaweed.

Selection of Test Plant

The test plant selected for the present study was *Capsicum annum*. The seeds were collected from dried *Capsicum annum* only one matured reddish coloured chilly used.

Growth promoting efficiency of SLE on *Capsicum annum* seedlings:

Healthy seeds free from visible infection, with uniform size were segregated and soaked in seaweed extract for 1 hour.

Earthen ware pots 25 cm diameter filled with soil. The seed to seed distance in pot was maintained as 3-5 cm and the pots were irrigated regularly.

Vegetative Growth parameters of Capsicum annum (Pot study)

Seed germination: Germination test determines the percentage of seeds that are alive in any seed lot. While the rate of germination varies slightly across varieties, seeds should absorb moisture with 2 days and produce a root and the first leaf within 4 days. In Capsicum annum the germination percentage was calculated using this formula:

Germination (%) = $\frac{\text{Number of seeds germinated}}{\text{Number of seeds on a pot}}$

Number of seeds on a pot

Physico-chemical and hormone analysis of SLE:

The Physical characteristics such as colour, pH were observed using standard method. The composition of elements such as Copper, Manganese, Iron, Zinc, Nitrogen, Potassium, Magnesium and Sodium were estimated using 450nm at spectrophotometer. Further, the liquid extract of marine alga was also subjected for estimation of auxin, gibberlin and cytotoxin.

Test Selected Plant

Scientific Classification:

Kingdom: Plantae

Clade:Tracheophytes

Clade:Angiosperms

Clade:Eudicots

Clade:Asterids

Order:Solanales

Family:Solanaceae

Genus:Capsicum

Species: Capsicum annum

Binomial name: Capsicum annum

Foliar application of different concentrations 0.5%,1.0%,1.5%,2.0% and control of liquid extracts was given to potted plants for 20 days. Growth parameters shoot length, root length, total height, total fresh and dry weight, leaf area and moisture content were determined.

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Growth parameters were observed in 5 weeks old treated and control plants. Yield characteristics were measured in 90 days old plants .All pot experiments were done in four replicates each under natural conditions.

FRESH AND DRY WEIGHT

Uprooted plants were washed with distilled water and it was blotted with blotting paper to check the fresh weight of the plant. It was then shade dried to obtain the dry weight of the sample.

Leaf Area: Fresh leaves were taken plucked from the plant and were subjected for the analysis of leaf area.

RESULT

Table 1: Seed Germination

Treatments	Germination Period	Number of Plants	Germination %
Control	9 days	2	20%
0.5%	6 days	10	100%
1.0%	6 days	10	100%
1.5%	6 days	7	70%
2.0%	6 days	3	30%

Influence of liquid extracts of *Sargassum wightii* on growth seed germination of Chilli plant (*Capsicum annum*)

Table 2: Influence of Liquid Extracts on Growth Characteristics of Chilly Plant

Treatments	Shoot Length	Leaf Length
Control	14cm	7.5cm
0.5%	60cm	15cm
1.0%	40cm	14.5cm
1.5%	18cm	11cm
2.0%	25cm	12cm



Figure 1: Seaweed Liquid Extract Control, 0.5%, 1.0%, 1.5%, 2.0% Treated Capsicum annum (30days) Plant.

Table 3: Influence of Liquid Extracts of *Sargassum Wightii* on Yield Parameters

Seaweed Treatments	Number of Branches	Number of Flowers	Number of Fruit	Number of Seed
Control	No branches	19 flowers	16fruits	9 seeds
0.5%	10 branches	65flowers(96 days flower appear)	58 fruits	45 seeds
1.0%	6 branches	52flowers(122 days flower appear)	46 fruits	34 seeds
1.5%	2 branches	32flowers(148 days flower appear)	26fruits	22seeds
2.0%	2 branches	30 flowers(152days flower appears)	23 fruits	20seeds

Table 4: Influence of Liquid Extract of *Sargassum Wightii* on Yield

Treatments	Number of Fruits	Fruit Length
Control	16	7.2cm
0.5%	58	13cm
1.0%	46	13.5cm
1.5%	26	12.2cm
2.0%	23	12.0cm

**Figure 2: Seaweed Liquid Extract (0.5%) Treated *Capsicum Annuum* Plant.**



Figure 3: Shows Growth of Control Capsicum Annum Plant.



Figure 4: Seaweed Extract 2.0% Treated Plant.



Figure 5: Seaweed Extract 1.5% Treated *Capsicum Annuum* Plant.

Table 5: Physicochemical Chemical Parameter Analysis Report of Seaweed Liquid Extract

Parameters	Report
pH	7.9
Colour	Brown colour
Cu	1.8mg/l
Zn	1.6mg/l
Nitrogen	7.4mg/l
Ca	8.2mg/l
Mg	15.7mg/l
K	1.41mg/l
Na	5.3mg/l
Mn	1.53mg/l
Fe	0.76mg/l

The manurial analysis of liquid extracts of our experimental brown marine alga revealed the presence of Potassium 1.41mg/l, Copper 1.8mg/l, Manganese 1.53mg/l, Zinc 1.6mg/l, Iron 0.76mg/l, Sodium 5.3mg/l, and Magnesium 15.7mg/l was found to be abundant in the extract.

Similarly, in case of phytohormones analysis, cytokinin 5.5mg/l was found to be more when compared to auxin 2.5mg/l and gibberellins 2.8mg/l.

In our experiments, use of seaweed liquid extracts of *Sargassum wightii* significantly promoted the rate of growth and physiology of *Capsicum annuum* plant. There was a noticeable increase in growth and biochemical parameters when 0.5% and 1.0% of seaweed liquid extract of *Sargassum wightii* applied to *Capsicum annuum* plant higher concentrations were found to show inhibiting effect on all the above parameters studied. Further, the retarding effect (reduction by 2%-27%) in growth parameters was corresponding to increase in the concentration 2.0%. In the present study younger plants are killed by the seaweed extract. After 20 days of seedling only first irrigate with normal water then applied the seaweed liquid extract.

Inhibitive effect was observed when the plants were treated with higher concentration 2.0%.

In general, low concentrations of liquid extracts of seaweed extracts had maximum positive influence on growth and yield characteristics of plant *Capsicum annuum* as reported in previous studies due to the presence of micro and macro elements, growth hormones and vitamins. Further, presence of phycocolloids and other ingredients in brown algae may also be responsible for better enhancement in growth and yield production.

Seaweed Liquid Extract (SLE) at low concentrations 0.5%, 1.0% exhibited promoting effect on growth and yield parameters. Higher concentrations 2.0% SLE were found to show inhibitory effect.

DISCUSSION

The lower concentration 0.5% of seaweeds extract significantly increased the shoot length, leaf breadth, leaf length, root length. *Sargassum wightii* promoted shoot length, root length, fresh and dry weight respectively. (Durand.N.et al.,2003).

Growth enhancement by seaweed extracts may be due to components such as macro and microelement, amino acids, vitamins, cytokinins, auxins and abscisic acid-like growth substances which affects cellular metabolism in treated plants leading to enhanced growth and crop yield. (Ordog.V.Stirk .W.A.et al.,2004).

The increased growth of these crops may be due to the occurrence of some growth promoting substances present in the seaweed extract. (Blunden.G.et al.,1997).

These hormones play an important role in enhancement of cell size and cell division and together they complement each other as cytokinins are effective in shoot formation and Auxin in root development, while micronutrient improve soil health. (Liu.Z.,Lijun.,2011.) Yield increases in seaweed extract treated plants are through to be associated with hormonal substances present in the extracts, especially cytokinins. Cytokinins have been implicated in nutrient mobilization in vegetative plant organs as well as reproductive organs. (Letham.D.S.,1994).

CONCLUSIONS

The use of seaweed extracts has been widely reported to enhance the plant growth vigour and productivity and improve resistance to pest and diseases. In seaweeds and the extracts are an alternative agricultural input endowed with multiple beneficial effects on plant growth and productivity. In this study also emphasizes that seaweed extracts were recently found to boost plant immunity.

The seaweed extract have now gained much wider acceptance as plant "biostimulants".

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