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ALTERNATE SOURCE FOR NOURISHING THE PULSES SEEDLINGS

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Abstract

In India seaweeds are not used extensively except for production of phyco-colloids, being a rich source of vitamins, minerals and growth promotors, they can be of immense help to the coastal farmers for their use as a source of organic fertilizer. The effect of seaweed liquid fertilizer on the growth and biochemical characteristics of *Lablab purpureus* L. Sweet, and *Cyamopsis tetragonoloba* L. Taub., were studied. The growth parameters such as seed germination percentage, root length, shoot length, seedling fresh weight and seedling dry weight were carried out. The biochemical characteristics like estimation of total chlorophyll, estimation of protein, estimation of total sugar and estimation of reducing sugar were also worked out. The results of growth parameters were gradually increased upto 25% of SLF treated seedlings when compared with control. Our results proved that the seaweed liquid fertilizer promote the growth of the seedlings due to the presence of micro, macro elements and growth hormones in the extract which is responsible for the enhancement of the growth of the pulses.

Key words: Alternate source, phyco-colloids, *Lablab purpureus* L. Sweet, *Cyamopsis tetragonoloba* L. Taub.

Introduction

Intensive crop cultivation requires the use of chemical fertilizers. The chemical fertilizers deteriorate soil quality and disturb the homeostasis of ecosystem. The toxic chemicals from the chemical fertilizers accumulate in plants and plant product causing health problems to humans by bio magnification (Hansra, 1993). Therefore the current trend is to explore the possibility of supplementing chemical fertilizers with organic manures particularly the seaweeds. The seaweed fertilizers are often found to be more successfully promoting the productivity than the chemical fertilizers, (Bokil *et al*., 1974). In agriculture, the application of seaweeds are so many as soil conditioner, fertilizers and green manure due to the presence of high amount of potassium salts, micronutrients and growth substances like auxin, gibberellins and cytokinin (Williams *et al*., 1981). On the basis of these qualities, the seaweed extracts are being marketed as liquid fertilizers under different trade names in western countries and in India. The present investigation was carried out to determine the effect of seaweed liquid fertilizers on growth and biochemical characteristics of *Lablab purpureus* L. Sweet and *Cyamopsis tetragonoloba* L. Taub.

Materials and Methods

Collection of seaweed

The marine macro algae, *Sargassum wightii* was collected during low tide from Rameswaram coastal area (Lat. $19^0$25' N & $70^0$15' E) in southeast coast of Tamil Nadu. They were hand picked and washed thoroughly with seawater and finally with fresh water to remove all the unwanted impurities, epiphytes and adhering sand particles. It was surface sterilized in 10% sodium.

Hypochlorite solution and then rinsed with sterile distilled water. The water was drained off and the algal material was spread on blotting paper to remove excess water.

Preparation of crude extract

1 kg of seaweed was cut into small pieces and boiled with one liter of distilled water for an hour and filtered. The crude filtrate was taken as 100% concentration of the seaweed liquid fertilizers (SLF) and from this different concentrations (5%,15%,25%,50%, and 100%) were prepared using distilled water (Bhosle *et al.,* 1975). As

the SLF contained organic matter, it was refrigerated between 0^0C and 4^0C. The chemical composition of the crude extract was analyzed by the method described by American Public Health Association (APHA, 1995) and tabulated (Table 1).

The different concentrations of the crude SLF such as 5%, 15%, 25%, 50% and 100% were prepared and were treated for *Lablab purpureus* L. Sweet and *Cyamopsis tetragonoloba* L Taub.

Collection of seeds

The study material for this investigation is *Lablab purpureus* L. Sweet. and *Cyamopsis tetragonoloba* L. Taub. The seeds were collected from seed farm near Cuddalore. The seeds with uniform size and weight were chosen for the experimental purpose and the seeds were pretreated with 0.001N Ag Cl_2 to avoid fungal attack.

Treatment of SLF

Ten seeds were soaked in each concentration viz. 5 %, 15%, 25%, 50% and 100% SLF for 24 hours. The control seeds were soaked in distilled water. The experiment was conducted in the field. The soaked seeds were sown in respective plots. Daily the seeds were irrigated with different concentrations of SLF. On 10^{th} day, early growth parameters such as root length, shoot length, seedling fresh weight, seedling dry weight and germination percentage were calculated and the results were tabulated.

Biochemical analysis

On 15^{th} day, the fresh leaves were collected to carry out the various biochemical analysis as follows.

Estimation of Chlorophyll (Arnon, 1949)

Estimation of Protein (Lowry *et al.,* 1951),

Estimation of Total sugar (Dubios *et al.,* 1956)

and Estimation of Reducing sugar (Nelson, 1944).

Table 1: Chemical Composition of Crude SLF.

S.No	General Parameters	Quantity
	Colour	Brown
	pH	6.26
	Chemical Parameters	Mg/l.
1.	Nitrate	142.00
2.	Phosphate	48.46
3.	Potassium	240.15
4.	Sulphate	53.22
5.	Chloride	2180.00
6.	Sodium	501.25
7.	Calcium	188.20
8.	Magnesium,	122.19
9.	Iron	0.98
10.	Zinc	0.97
11.	Copper	1.56

Results and Discussion

Seed germination in cluster bean showed lesser percentage in control and higher percentage of seed germination was observed in 15% and 25% of SLF treated seeds. A decreasing germination percentage was observed in 50% and 100% of SLF treated seeds. It was also found that the treated seeds showed higher percentage of germination than control (Table 2, & 3). The increased seed germination percentage at low concentration may be due to the presence of growth promoting substances (Jenning and Tulloch, 1965). The extract contains micro-nutrients, auxin and cytokinin and other growth promoting substances which was proved by Spinelli *et al., (*2010). The present study is in consonance with the earlier results of Shakila and Selvi, (1997) and Anandharaj and Venkatesalu (2001 & 2002). In low percentage of SLF (*i.e.* 5%, 15% and 25%), the root length is increased and then decreased at 50% and 100%. This was synchronized with the findings of Mostafa and Eldin (1999). They also denoted that at lower concentration the SLF is not only increases the length of root, it also enhances the growth of lateral roots. This result was coinciding with the results of Ramya *et al.,* (2010) and at the same time the higher concentrations retarded the plant growth due to stress and wilting of leaves.

It was already proved that the increased seedling growth may be due to the presence of Phenyl acetic acid and other closely related compounds in the SLF by Fries, (1977); Taylor and Wilkinson, (1977). Similar results were recorded in *Cajanus cajan* (Mohan *et al.,* 1994). Some workers like Blunden and Wildgoose, (1977; Hong *et al.,* (1995); Strike and Van Staden, (1997 a & b) have suggested that the plant hormones present in seaweed concentrations were responsible for most of the improved growth and vigor of the plants. The present research shows that the chlorophyll content gradually increases and the values were comparatively higher in the treated seedlings than control. This was supported by Thirumal Thangam and Maria Victoria Rani in Sorghum (2006). This was also might have contributed to increased metabolic activity due to enhanced photosynthesis.

Iron, copper and magnesium are essential elements which act as a catalyst for the synthesis and maintenance of chlorophyll (Paul and Nougkynrih, 1996). Nickel at low level also increases the chlorophyll (Narwal *et al.,* 1996). The seaweeds were known to have cytokinin (Stephen *et al.,* 1985) which inhibits degradation of

Table 2: Shows the effect of crude SLF on growth and biochemical parameters of *Lablab purpureus* L. Sweet

		Growth parameters				Biochemical parameters			
Conc.of SLF	Germination (%)	Root length (in cm)	Shoot length (in cm)	Seedling fresh weight (mg/g fr.wt.)	Seedling dry weight (mg/g fr.wt.)	Total Chlorophyll (mg/g fr.wt.)	Total protein (mg/g fr.wt.)	Total sugar (mg/g fr.wt.)	Reducing sugar (mg/g fr.wt.)
control	93	2.58	8.97	2.72	0.95	1.54	1.44	2.91	0.86
5%	97	3.73	11.04	2.96	0.98	1.71	2.60	5.34	1.68
15%	100	4.11	12.55	4.27	1.84	2.27	2.73	6.19	2.84
25%	100	3.98	12.00	3.68	1.79	1.83	2.69	4.92	1.57
50%	95	3.47	8.61	2.83	0.86	1.65	1.91	3.68	1.49
100%	89	2.23	7.05	1.64	0.42	1.52	1.38	2.82	0.63

Table 3: Shows the effect of crude SLF on growth and biochemical parameters of *Cyamopsis tetragonoloba* L. Taub

		Growth parameters				Biochemical parameters			
Conc.of SLF	Germination (%)	Root length (in cm)	Shoot length (in cm)	Seedling fresh weight (mg/g fr.wt.)	Seedling dry weight (mg/g fr.wt.)	Total Chlorophyll (mg/g fr.wt.)	Total protein (mg/g fr.wt.)	Total sugar (mg/g fr.wt.)	Reducing sugar (mg/g fr.wt.)
control	90	2.71	9.60	0.41	0.90	0.76	1.98	9.67	2.12
5%	96	2.98	10.35	1.63	1.29	1.41	3.12	10.27	3.75
15%	100	3.98	13.10	4.89	1.70	2.27	3.73	12.38	3.98
25%	99	3.20	12.48	3.36	1.59	1.93	3.64	11.14	3.81
50%	96	2.75	10.16	1.12	0.56	1.05	2.01	9.85	2.89
100%	80	2.60	8.21	0.34	0.12	0.54	1.45	8.46	1.99

chlorophyll and break down of protein molecules which increased chlorophyll a and b. All the factors together played a role in increasing the content of chlorophyll. The total sugar content increased gradually with increased concentrations of SLF treated plants upto 25%, while beyond this concentration showed the decreasing trend. The same trend was observed by *hypnea musciformis* with NPK applications in black gram by Tamil selvan and Kanan, (1994). Similar observations were also reported in black gram and green gram by Lingakumar *et al.,* (2006) and Sivashankari *et al.,* (2006) respectively.

The highest protein and reducing sugar were observed at 15% and 25 % of SLF treated plants and the lowest values of those biochemical contents were observed in 100% of SLF treated plants. The increase in the protein at lower concentration of SLF might be due to absorption of most of the necessary elements by seedlings as reported by Kanan and Tamilselvan (1990) and Rajkumar Immanuel and Subramanian (1999). As in this case of investigation, the lowest values of biochemical constituents were recorded in the control and 100% *Sargassum wightii* extract soaked plants by Sivashankari *et al.,* (2006).

Conclusion

The results of growth parameters were gradually increased upto 25% of SLF treated seedlings when compared with control. These are due to the presence of various elements in seaweed liquid fertilizer. Marine algae contain more than 60 trace elements in a concentration much higher than in terrestrial plants. These elements enhances the increase of seed germination percentage, root length, shoot length, seedling fresh weight and seedling dry weight. The uptake of all the minerals by the shoot was substantially higher than control in presence of the seaweed extracts. SLF has caused an increase in pigment content, total protein, total sugar and reducing sugar in the lesser concentrations than the control. This indicates the presence of growth promoting substances which also might have contributed to increase the metabolic activity due to enhanced photosynthesis. Brown seaweeds are rich in polysaccharides coupled with their hydrophilic property which makes the compound important in the agricultural and pharmaceutical industries.

All the results obtained from this investigation indicated that the application of eco-friendly seaweed liquid fertilizers to the pulses is recommended to the growers for attaining better germination, growth and yield.

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