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POTENTIAL OF SEAWEED LIQUID FERTILIZERS (SLFS) ON SOME AGRICULTURAL CROP WITH SPECIAL REFERENCE TO PROTEIN PROFILE OF SEEDLINGS

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ABSTRACT

The effect of crude seaweed extracts from the green seaweed *Ulva lactuca* and the brown seaweed *Sargassum wightii* was studied on germination and protein profile of five different crops viz., *Amaranthus roxburghinus* (sirukeerai), *A. tricolor* (mulakeerai), *Arachis hypogea* (ground nut), *Capsicum annum* (chilli) and *Tagetes erecta* (marigold) seedling. The seeds of five different test plants were treated with 1.0% SLF of both seaweeds for 6h durations and allowed to grow under laboratory conditions. Five day old seedlings of *Amaranthus roxburghinus, A. tricolor, Arachis hypogea* and *Tagetes erecta* and ten day old seedling of *Capsicum annum* were subjected for protein profile analysis.

INTRODUCTION

The application of seaweed concentrates has many beneficial effects on plants (Abetz, 1980). Seaweed polysaccharides, which are in the place of cellulose of land plants can be extracted readily as the products like algin, agar and carrageenan. Four avenues of economic uses of seaweeds are being currently investigated in India and they are antibiotics, bioenerg, liquid fertilizer and cultivation (Thivy, 1982). Seaweed meals provide an approximately equivalent amount N less P, but more K, total salt and readily available microelements compared most animal manures (Simpson and Hayes, 1958). Apart from macro and micronutrients seaweed contain many growth promoting hormones like cytokinin, gibberellin and auxin (Tay *et al.* 1987). Seaweed extracts are known to enhance seed germination and plant growth (Bhosle *et al* 1975, Sekar *et al.* 1995). The total standing crop of seaweeds from intertidal and shallow waters of all maritime states and Lakshadweep islands was estimated as 91,339 tons (wet weight). The quantity of seaweeds growing in deep waters of Tamil Nadu was estimated as 75,372 tons (wet weight) in an area of 1,863 sq. km. from Dhanushkodi to Kanyakumari (Kaliaperumal and Kalimuthu, 1997). In the present investigation, the effect of the seaweed liquid fertilizers (SLFs) obtained from *S. wightii* and *U. lactuca* on the germination and protein profile of seedling of five different agricultural crops.

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MATERIAL AND METHODS

The SLF was prepared from the green seaweed *Ulva lactuca* and *Sargassum wightii* as per the procedure of Rama Rao (1990). The both SLFs were taken for the analysis of micro and macro elements as well as plant growth regulators like auxin and cytokinin. Mature seeds of the test plants were obtained from the Tamil Nadu Agro service center at Arakkonam near Chennai. The effect of the both SLFs on the seed germination and protein profile of seedlings of five different crops was made under the laboratory conditions at $30\mu Em^{-2}S^{-1}$ light intensity, 12 h/12 h light dark cycle and 24 ±1ºC. Twenty seeds of each crop were surface sterilized with 0.1% mercuric chloride for one minute and washed thorough in sterilized distilled water. Then they were soaked 1.0% of both S. *wightii* and *U. lactuca* SLFs for 6h of duration, separately. After the treatment the seeds were placed on a sterilized moist hand made filter paper in a petriplate and kept under laboratory conditions for germination except *Arachis hypogea*. Every day 2mL of distilled water was added to the filter paper in order to compensate the loss of evaporation. The effect of SLFs on germination of *Arachis hypogea* was carried out in acid washed coarse sand. The coarse sand was initially washed thoroughly twice with tap water followed by treating with conc. HCl and washed thoroughly in running tap water for 30 minutes in order to remove the acid and nutrients present in the sand. It was then dried at room temperature. Three hundred gram of the acid washed sand was taken in a plastic cup (7.5 cm diameter and

9.5 cm height) and a pinhole was made at the bottom in order to avoid stagnant water. To each cup five SLF treated seeds were placed just 2.0 cm below the surface if sand. Then the sand was wet with distilled water and kept under laboratory condition. The germination and protein profile (Laemmile, 1970) of the seedlings were analyzed at the end of 5th day but in *Capsicum annum* on 10th day since it showed a delayed germination.

RESULTS

Analysis of seaweed extracts revealed that the macro and micro nutrients was maximum found in *Ulva lactuca* followed *Sargassum wightii*. The green algae contained higher auxin and cytokinin than brown algae (Table 1). The seeds of five different test plants were treated with 1.0% SLF of both seaweeds for 6h durations and allowed to grow under laboratory conditions. Five day old seedlings of *Amaranthus roxburghinus, A. tricolor, Arachis hypogea* and *Tagetes erecta* and ten day old seedling of *Capsicum annum* were subjected for protein profile analysis. Plate 1a shows the protein profile of *A. roxburghinus, A. tricolor* and *Arachis hypogea. Amaranthus roxburghinus* when treated with both SLFs did not show any changes in its protein bands.

Table : 1 The macro and micro elements and Plant Growth Regulators of the 1.0% SLF of *Sargassum wightii* and *Ulva lactuca*

Compositions	*Sargassum wightii* SLF	*Ulva lactuca* SLF
Macro Elements (mg/L)		
N	24.6	24.1
P	4.3	20.2
K	319	210
Ca	100	190
Mg	50	352
Micro elements (mg/L)		
Fe	3.6	7.2
Mn	Nil	Nil
Cl	162	150
F	0.20	0.35
Plant growth regulators (µg/L)		
Auxin	83	95
Cytokinin	137	186

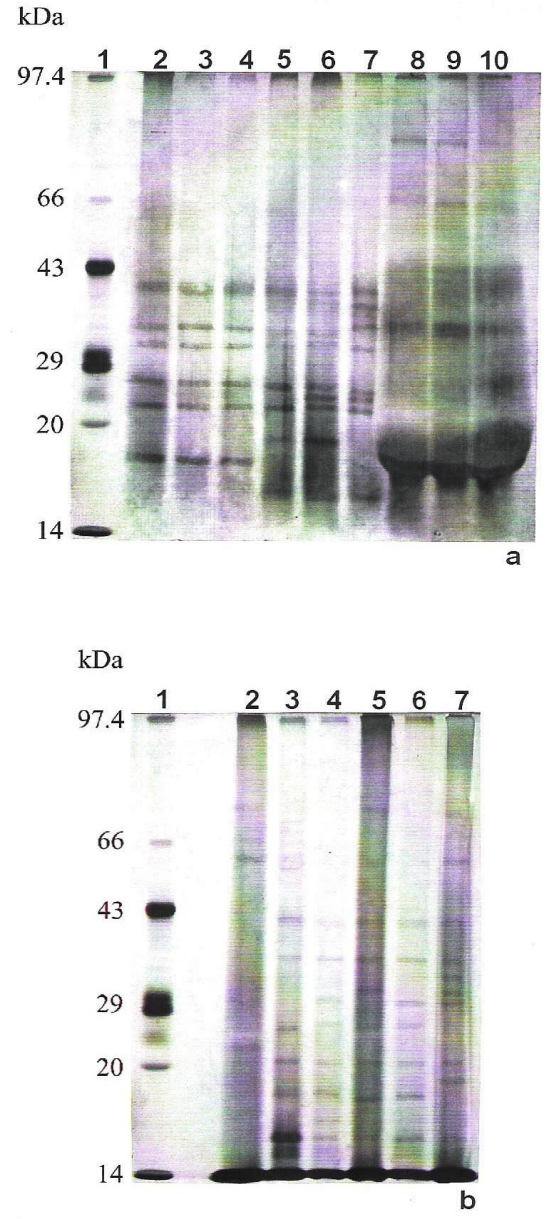

Plate 1. Protein profile of seedlings

a.
1. Marker
2. Control
3. *Amaranthus roxburghinus* treated with *U. lactuca* SLF
4. *Amaranthus roxburghinus* treated with *S. wightii* SLF
5. Control
6. *Amaranthus tricolor* treated with *U. lactuca* SLF
7. *Amaranthus tricolor* treated with *S. wightii* SLF
8. Control
9. *Arachis hypogea* treated with *U. lactuca* SLF
10. *Arachis hypogea* treated with *S. wightii* SLF

b.
1. Marker
2. Control
3. *Capsicum annum* treated with *S. wightii* SLF
4. *Capsicum annum* treated with *U. lactuca* SLF
5. Control
6. *Tagetes erecta* treated with *S. wightii* SLF
7. *Tagetes erecta* treated with *U. lactuca* SLF

Whereas, *A.tricolor* treated with *U. lactuca* SLF showed two additional protein bands of 22.3 kDa and 38.8 kDa when compared to control. *Arachis hypogea* with both SLFs showed an additional protein band at each 25.6 kDa. Five additional protein bands viz. 15.0, 17.0, 20.6, 36.4 and 42.0 kDa were appeared in the seedlings of *Capsicum annum* under *U. lactuca* SLF treatment. Whereas, only two additional bands of 15.0 kDa and 15.6 kDa were appeared under *S. wightii* SLF treatment (Plate 1b). The protein profile of *Tagetes erecta* showed an additional band of 29.0 kDa under *U. lactuca* SLF treatment. Whereas, two additional bands of 29.0 kDa and 33.8 kDa were appeared under *S. wightii* SLF treatment.

DISCUSSION

Seaweed products are known to enhance the germination of seeds, increase the uptake of plant nutrients, impact a degree of frost resistance and make plants better to withstand phytopathological fungi and insect pests (Booth, 1969). Dilute extracts were found to be more effective than the concentrated extracts (Bukhari and Untawale, 1978). The analysis of protein content of root and shot system of *Vicia faba* showed that *Cladophora dalmatica, Enteromorpha intestinalis, Ulva*

lactuca, Corollina mediterranea, Jania rubens and *Pterocladia pinnata* extracts increased protein content in both root and shoot system. The height amount of proteins was obtained in shoot system under the treatment *Entromorpha* and *Jania* extracts. In contrast of nucleic acid were reduced in both root and shoot system except for *Ulva* extract, which slightly increased nucleic acid content. The total soluble sugars increased in both root and shoot system under the treatment of green and red algal extract (El-Sheekh and El-Saied, 1999). A group of maturation proteins has been correlated with the ability of the seed to progress in to seedling growth. The levels of maturation proteins and soluble saccharide, especially stachyose were markedly different in axes of seeds under going different treatments (Blackman *et al*. 1992). Auxins may act either by turning on the expression of certain genes or by being involved in the modification of key gene products (Liu *et al*. 1991). It was implied that α-naphthalenacetic acid may induced some specific proteins during germination including the acidic lipoxygenases in soybean embryos. In present study, among the five different crops treated with 1.0% SLF of both seaweeds, the green *Amaranthus roxburghinus* did not show any additional bands in contrast to the rest of crops. A maximum of five additional bands appeared in *Capsicum annum* under *U. lactuca* SLF. Further, one or two bands appeared in *Amaranthus tricolor, Araches hypogea Tagetes erecta* was suggested the possible role of plant growth regulators like auxin and cytokinin as well as macro and micro elements present in the SLFs for the the appearance of those induced proteins. The plant growth regulators play a significant role in cell division, cell elongation and cell differentiation factors and cell type specific gene (Johri and mitra, 2001).

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