



Studies on the Effect of Seaweed Liquid Fertilizer on the Flowering Plant *Tagetes erecta* in Field Trial

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ABSTRACT

The effect of crude extract from the brown seaweed *Sargassum wightii* and their combination with recommended rate of chemical fertilizers on the growth, biochemical feature and yield of the flowering plant *Tagetes erecta* (marigold) was studied. The extract showed maximum activity at 1.0% SLF. The crude seaweed extracts with combination with 50% recommended rate of chemical fertilizers were also showed a peak activity.

KEYWORDS: Seaweed Liquid Fertilizer, Seaweed extract, Marigold, *Sargassum wightii*, *Tagetes erecta*

INTRODUCTION

One of the well documented beneficial effects of seaweed extracts is that it enhanced the seed germination and plant growth [1]. Seaweed extracts have been shown to induce resistance to frost, fungal and insects attack, reduce red spider, aphid and nematode infestation and increase nutrients uptake from soil [2]. The seaweed fertilizers application will be useful now for achieving higher production. Recent seaweed extracts as liquid fertilizers (SLF) has come in the market for a simple reason that they contain many growth promoting hormones like auxin, gibberellins, trace elements, vitamins, amino acids and micronutrients [3]. The most commonly using brown seaweed is *Ascophyllum nodosum*. Seaweed extracts are now available commercially labeled as Maxicorp (sea born), Algifert (marinure), Goemar GA 14, Seaspray, Seasol, SM3, Cylex and Sea crop 16 [4]. Seaweed meals provide an approximately equivalent amount of N, less P but more K, total salts and readily available micronutrients compared to most animal manures [5]. Apart from macro and micronutrients seaweed contains many growth promoting hormones like cytokinin, gibberellin and auxins [6]. Applications of chemical fertilizers certainly compensate the deficiency of nutrients in soil. Whereas, in excess it affects soil and plants in due course. Recent researchers proved that seaweed fertilizers since they are very economic, cheap and ecofriendly [7]. Considering the above important facts, the present study was undertaken to find out the effecting plant marigold.

MATERIALS AND METHODS

The marine macro algae *Sargassum wightii* was collected from Pudumadam coastal region of Gulf of Mannar. The collected seaweed was washed thoroughly with seawater to remove the sand particles, impurities and macroscopic epiphytes and again washed water. Seaweed liquid fertilizer (SLF) was prepared as described by Rama Rao (1990). The algal sample was added with distilled water in a ratio of 1 : 20 (w/v) and autoclaved at 121°C, 15 lbs/sq. inch for 30 minutes. The hot extract was filtered through a double layered cheese cloth and allowed to cool at room temperature. The seaweed liquid fertilizer was taken for the analysis of macro and microelements [9] and plant growth regulators such as Auxin [10] Cytokinin [11].

Experiments on *Tagetes erecta* were conducted at Panchalam near Tindivanam, Tamil Nadu. These experimental trials were conducted in rows. For each experiments ten plants per row was taken. The 25m² field was spread with 100 Kg Farm Yard Manure and ploughed thoroughly for two times and a final plough by spacing 30 X 30 cm (ridges and furrows) and irrigated. One or two 30 day old seedlings were transplanted along a side ridges at 30 cm spacing. Application of different

concentrations of SLF as well as recommended rate of chemical fertilizers plus 1.0% SLF was made on the plants grown in the plants were irrigated every week.

Different concentrations of *S. wightii* SLF viz. 0.25%, 0.5%, 1.0% and 1.5% were used for this study. One litre of different concentration of SLF taken and applied 100mL/hill by soil drench on 0 day and 30th day corresponding the days of chemical fertilizer application.

The plant grown in the field was also applied with different proportions of recommended rate of chemical fertilizers plus 1.0% of *S. wightii* SLF on 0 day and 30th day. The 100% recommended rate of chemical fertilizers of marigold Urea – 62.5 Kg/ha, Super Phosphate – 120.0 Kg/ha and Potash – 25 Kg/ha were applied on 0 day for basal and only Urea – 62.5 Kg/ha was applied at 39th day for example Urea – 6.25 g/row applied on 30th day. One litre of 1.0% SLF was taken and mixed with respective proportions of chemical fertilizer thoroughly and distributed equally to 10 plants in row (100 mL/hill).

Thirty day old plants were taken for the following parameters: total plant height, shoot and root height (cm), total fresh weight, shoot and root fresh weight, total dry weight, shoot and root dry weight (g), and number of branches. The biochemical parameters of third young leaf namely total chlorophyll, chlorophyll a, chlorophyll b [12] total protein [13], total carbohydrate [14] and lipid [15] (mg/g fresh weight) were also recorded. At the end of 60th day the mature flowers of *T. erecta* were picked out and recorded their number and fresh weight (Kg).

RESULTS AND DISCUSSION

The result of the present study indicated that the growth characteristic, height and number of branches increased in the seaweed treatments including the combined effect of seaweed plus chemical fertilizers. Stephenson (1974) while experimenting with *Ascophyllum* and *Laminaria* liquid fertilizers on potatoes, corns, peppers, tomatoes, pineapples and oranges found that lower concentrations of liquid fertilizers accelerated growth than the higher concentrations. In present study a greater plant height and number of branches were observed in the plant treated with 1.0% of *S.wightii* SLF and 1.0% SLF plus recommended rate of chemical fertilizers indicating the synergistic influence of the seaweeds and chemical fertilizer (Table 1, 2).

Table 1: Effect of *Sargassum wightii* SLF on the growth of *Tagetes erecta* under field trial on 30th day

Parameters	F-value	P-value	Concentrations				
			ST1	ST2	ST3	ST4	ST5
Total plant height (cm)	58.31	0.00**	29.60 ± 1.14 ^a	33.60 ± 3.05 ^a	41.00 ± 2.64 ^b	48.00 ± 1.41 ^c	41.60 ± 1.67 ^b
Shoot height (cm)	48.46	0.00**	25.60 ± 1.67 ^a	29.20 ± 2.86 ^a	36.00 ± 3.00 ^b	42.60 ± 1.14 ^c	37.40 ± 1.51 ^b
Root height (cm)	3.69	0.02*	4.00 ± 0.70 ^a	4.40 ± 0.54 ^{ab}	5.00 ± 0.70 ^{ab}	5.40 ± 0.54 ^b	4.20 ± 0.83 ^{ab}
Total fresh weight (g)	48.99	0.00**	65.86 ± 4.68 ^a	76.08 ± 9.43 ^a	97.28 ± 6.45 ^b	112.00 ± 3.37 ^c	97.36 ± 3.22 ^b
Shoot fresh weight (g)	50.55	0.00**	57.48 ± 5.12 ^a	68.22 ± 6.42 ^b	86.08 ± 7.46 ^c	100.00 ± 2.72 ^d	87.62 ± 3.36 ^c
Root fresh weight (g)	7.15	0.00**	8.48 ± 1.48 ^a	9.46 ± 0.83 ^{ab}	11.20 ± 1.25 ^{bc}	11.80 ± 0.71 ^c	9.74 ± 1.15 ^{abc}
Total dry weight (g)	62.85	0.00**	28.48 ± 3.85 ^a	32.20 ± 5.37 ^b	41.17 ± 5.14 ^c	47.40 ± 2.70 ^d	41.28 ± 2.57 ^c
Shoot dry weight (g)	50.55	0.00**	24.32 ± 4.09 ^a	28.87 ± 5.13 ^b	36.43 ± 5.97 ^c	42.32 ± 2.18 ^d	37.08 ± 2.69 ^c
Root dry weight	6.66	0.00**	4.16 ± 1.19 ^a	3.33 ± 0.67 ^{ab}	4.74 ± 1.24 ^{bc}	5.08 ± 0.57 ^c	4.12 ± 0.92 ^{abc}
Number of branches	8.60	0.00**	1.20 ± 0.83 ^a	2.20 ± 1.09 ^{ab}	3.60 ± 1.14 ^{bc}	4.20 ± 0.44 ^c	3.20 ± 0.83 ^{bc}

Note: * denotes significant at 5% level

** denotes significant at 1% level

different alphabets between concentration denotes statistically significant based on multiple range test (Tukey -HSD test).

S - *Sargassum wightii* T - Treatment

ST1	-	Control
ST2	-	0.25 % SLF
ST3	-	0.5% SLF
ST4	-	1.0% SLF
ST5	-	1.5% SLF

Table 2: Effect of different proportions of recommended rate of chemical fertilizers + 1.0% *Sargassum wightii* SLF on *Tagetes erecta* under field trial on 30th day

Parameters	F-value	P-value	Concentrations					
			CST1	CST2	CST3	CST4	CST5	CST6
Total plant height (cm)	11.43	0.00**	33.20 ± 2.28 ^b	34.20 ± 2.04 ^{bc}	38.00 ± 2.55 ^c	34.20 ± 1.48 ^{bc}	30.20 ± 1.78 ^{ab}	28.80 ± 2.58 ^a
Shoot height (cm)	6.20	0.00**	28.00 ± 2.66 ^{ab}	28.60 ± 2.67 ^{ab}	31.16 ± 2.31 ^b	28.30 ± 1.58 ^{ab}	25.08 ± 1.71 ^a	24.22 ± 2.43 ^a
Root height (cm)	12.85	0.00**	5.20 ± 0.57 ^{ab}	5.60 ± 0.65 ^b	6.84 ± 0.65 ^c	5.90 ± 0.22 ^{bc}	5.12 ± 0.28 ^{ab}	4.58 ± 0.33 ^a
Total fresh weight (g)	12.32	0.00**	71.52 ± 3.03 ^{bc}	71.78 ± 4.68 ^c	79.40 ± 5.47 ^c	71.68 ± 3.10 ^{bc}	63.22 ± 3.75 ^{ab}	60.30 ± 5.46 ^a
Shoot fresh weight (g)	7.51	0.00**	60.58 ± 3.05 ^{bc}	60.28 ± 6.01 ^{bc}	65.28 ± 4.89 ^c	59.34 ± 3.28 ^{abc}	52.52 ± 3.59 ^{ab}	50.72 ± 5.12 ^a
Root fresh weight (g)	10.34	0.00**	10.94 ± 1.19 ^{ab}	11.50 ± 1.40 ^{ab}	14.12 ± 1.59 ^c	12.34 ± 0.49 ^{bc}	10.70 ± 0.62 ^{ab}	9.58 ± 0.70 ^a
Total dry weight (g)	12.54	0.00**	30.27 ± 2.42 ^b	30.38 ± 3.74 ^b	33.60 ± 3.74 ^b	30.33 ± 2.47 ^b	26.75 ± 3.01 ^a	25.52 ± 4.40 ^a
Shoot dry weight (g)	7.52	0.00**	25.64 ± 2.46 ^{bc}	25.51 ± 4.80 ^{bc}	27.63 ± 3.91 ^c	25.11 ± 2.62 ^{abc}	22.20 ± 2.87 ^{ab}	21.46 ± 4.09 ^a
Root dry weight (g)	9.48	0.00**	4.63 ± 0.93 ^{ab}	4.87 ± 1.12 ^{ab}	5.97 ± 0.91 ^c	5.22 ± 0.41 ^{bc}	4.55 ± 0.49 ^{ab}	4.06 ± 0.57 ^a
Number of branches	3.52	0.01*	2.60 ± 0.89 ^{ab}	3.60 ± 1.14 ^b	3.80 ± 1.30 ^b	3.00 ± 1.00 ^{ab}	2.60 ± 0.54 ^{ab}	1.60 ± 0.54 ^a

Note:

: * denotes significant at 5% level

** denotes significant at 1% level

S - *Sargassum wightii* T - Treatment C - Chemical fertilizer

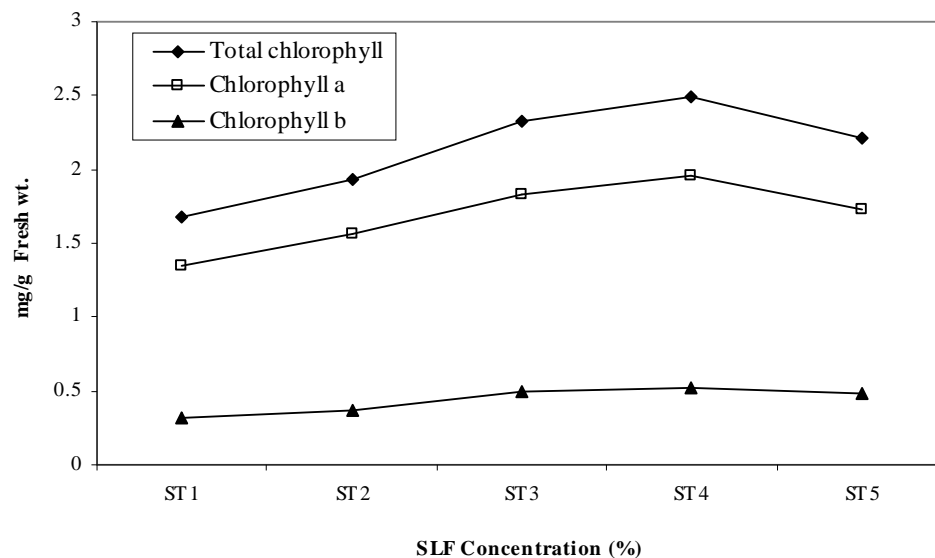
CST1 - 100% recommended rate of chemical fertilizer

CST2 - 75% recommended rate of chemical fertilizer + 1.0% SLF

CST3 - 50% recommended rate of chemical fertilizer + 1.0% SLF

CST4 - 25% recommended rate of chemical fertilizer + 1.0% SLF

CST5 - 1.0% SLF only CST6 - Water Only

Fig.1a Effect of different concentrations of *Sargassum wightii* SLF on the pigments of *Tagetes erecta* on 30th day

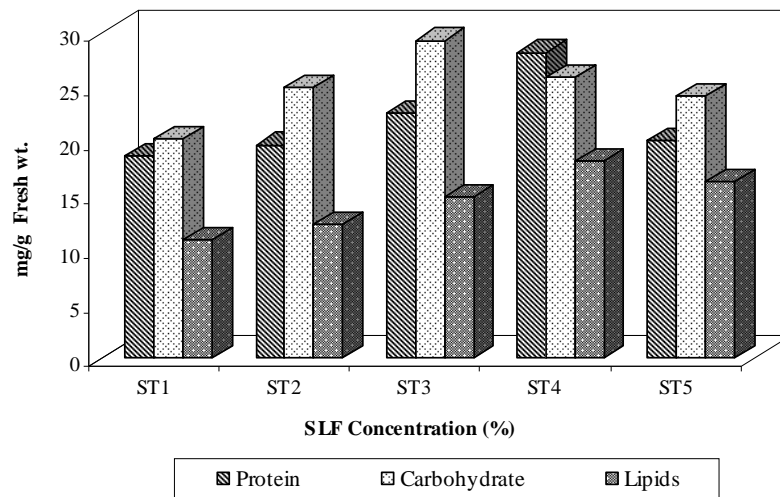
The plants treated with higher seaweed dosage and seaweed dosage up to 2g plus chemical fertilizers. Carbohydrate and protein contents of seed were increased. At higher dosage levels the seaweeds plus

chemical fertilizer carbohydrate and protein contents were decreased [17]. In present work the 0.5% SLF showed a maximum accumulation of carbohydrate whereas, 1.0% SLF contained maximum total protein content. However, the plants that applied with 50% recommended rate of chemical fertilizers plus 1.0% SLF showed a maximum accumulation of both carbohydrate and protein content of third young leaf (Fig. 1a – 2b).

With regard to the number of pods per plant and seeds per pod, the treatment with 2g of *Hypnea musiformis* plus chemical fertilizer yielded result superior to any other treatments. In our investigations 50% recommended rate of chemical fertilizers plus 1.0% of *Sargassum wightii* SLF showed the maximum yield to any other treatments (Table 3).

The brown seaweed *Sargassum wightii* contained higher amounts of cytokinins (192 µg/L) than the auxin (90 µg/L). Analysis of SLF among the macronutrient revealed that Potassium was maximum followed by Magnesium, Calcium, Nitrogen and Phosphate. In the micronutrients Chloride was the maximum followed by Iron and Ferrous content.

Fig.1b Effect of different concentrations of *Sargassum wightii* SLF on the total protein, total carbohydrate and total lipid content of *Tagetes erecta* on 30th day



ST1 - Water only, ST2 - 0.25% SLF, ST3 - 0.5% SLF, ST4 - 1.0% SLF, ST5 - 1.5% SLF

Fig.2a Effect of different concentrations of recommended rate of chemical fertilizers + 1.0% *Sargassum wightii* SLF on the pigments of *Tagetes erecta* on 30th day

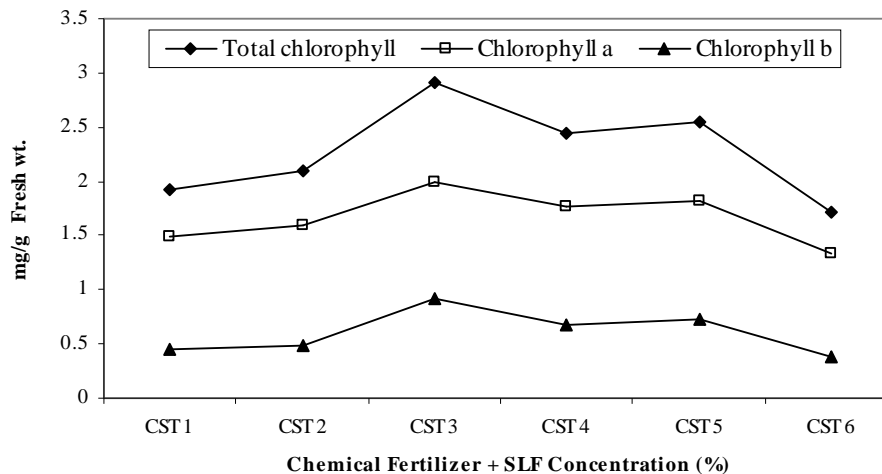
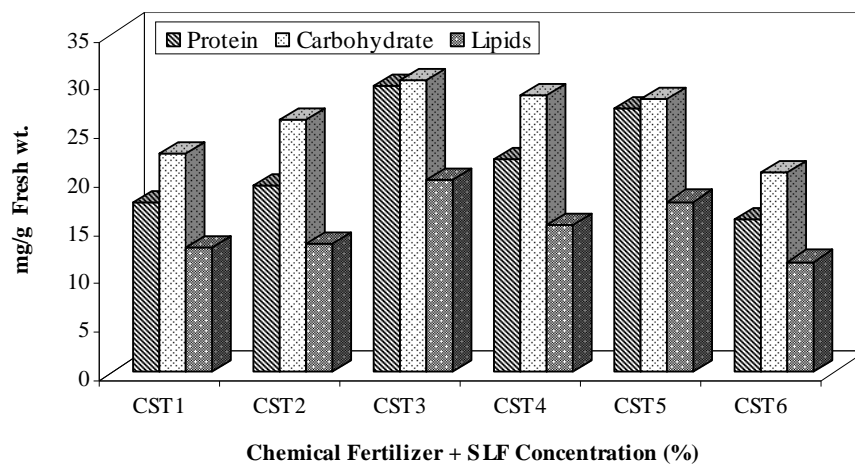


Fig.2b Effect of different concentrations of recommended rate of chemical fertilizers + 1.0% *Sargassum wightii* SLF on the total protein, total carbohydrate and total lipid content of *Tagetes erecta* on 30th day



CST1 - 100% recommended rate of chemical fertilizer
 CST2 - 75% recommended rate of chemical fertilizer + 1.0 % SLF
 CST3 - 50% recommended rate of chemical fertilizer + 1.0 % SLF
 CST4 - 25% recommended rate of chemical fertilizer + 1.0 % SLF
 CST5 - 1.0 % SLF only
 CST6 - water only

Table 3: Effect of different concentrations of *Sargassum wightii* SLF and different proportions of recommended rate of chemical fertilizers + 1.0% SLF on the yield of *Tagetes erecta*

Concentrations	Number of Flowers/10 plant	Fresh weight of flowers/10 plant (Kg)(a row)	Proportions	Number of Flowers/10 plants (a row)	Fresh weight of flowers/10 plants (a row) (Kg)
Control	85	1.20	100% recommend rate of chemical fertilizers	115	1.80
0.25% SLF	93	1.31	75% recommend rate of chemical fertilizers + 1.0% SLF	122	1.72
0.5% SLF	109	1.53	50% recommend rate of chemical fertilizers + 1.0% SLF	130	2.33
1.0% SLF	120	1.69	25% recommend rate of chemical fertilizers + 1.0% SLF	120	1.66
1.5% SLF	111	1.56	SLF only	118	1.60
			Water only	92	1.20

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