ISSN NO. 2320-5407

Journal homepage:http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

THE EFFECT OF SEAWEED ORGANIC FERTILIZER ON GROWTH AND BIOCHEMICAL PARAMETERS OF DIFFERENT FLOWERING PLANTS

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Manuscript Info *Abstract*

Manuscript History:

Received: 25 July 2014
Final Accepted: 26 August 2014
Published Online: September 2014

Key words:

Marine seaweeds, *Lens culinaris*, *Phaseolusmungo*, Stimulator,Plant growth

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Marine sea weeds are frequently regarded as biofertilizer, soil conditioner and generally exploits as promoter in healthier crop production because algae have a lots of plant growth- boosting compounds. Present study inclusively showed a variable effect of different seaweed concentration in two important staple food crops *Lens culinaris* (Black Masoor) and *Phaseolusmungo* (Green Mung). Analysis of data revealed that two seaweed species *Sargassum* and *Sapthoglossum* in the form of organic fertilizer, regarding stimulator of seed germination and growth parameters (shoot) index as well as enhancer of biochemical attributes of both pulses.

Highest growth rate in both leguminous species were observed treated with 3gm and 6 gm of seaweed dried organic fertilizer. And the lowest growth index was found at 12gm, 15gm and 19gm of seaweed fertilizer. Therefore results showed that 3gm and 6 gm treatment were more suitable for plant growth as compared to other treatments.

Introduction

Seaweeds are marine macro algae, which form an important component of the marine living resources of the world. Seaweeds are marine non-flowering plant which lack flowers, true shoot, root, stem and leaf system. Seaweed contains 10 to 20 times the amount of minerals, trace elements, and vitamins than found in commercially grown land vegetables. Seaweed is used to help to build and sustain the broad nutritional balance of vitamins, minerals, and vital nutrients on which optimum health and vitality depend. They are low-calorie foods, with a high concentration of minerals, vitamins, proteins (digestible and indigestible), carbohydrates, and lipids (Orduña-Rojas and Robledo,2002).Different forms of sea weed preparation such as LSF (Liquid Seaweed Fertilizer), SLF (Seaweed Liquid Fertilizer) LF (Liquid Fertilizer), and either whole or finally chopped powered algal manure have been used and all of them have been reported to produce beneficial effects on cereals, pulses, and flowering plant (Chapman, 1980). The Pakistan has a coastline of about 1050 km; 250 km of which of this stretch falls within the Sindh province (to the east and bordering India) and 800 km in Baluchistan in the west, bordering Iran. The coast to the west of the Karachi harbor up to Buleji consists of the sandy beaches of Manora, Sand spit and Hawksbay. Buleji is located between Hawkesbay and Paradise point, covering a distance of 800 meters. The intertidal Zone at Buleji is from 230 ft to 900 ft; depending upon the topography of the coast. This is a triangular rocky platform where seaweeds are found abundantly during low tides (Saifullah, 1991).

Many studies in the past three decades have found wide application in modern agriculture for using marine macro algae as fertilizer (Verkleij, 1992). They are used as whole or finely chopped powdered algal manure or aqueous extracts.

MATERIAL AND METHODS:

All seaweeds for present investigation were collected from Buleji point, Karachi coast. The rocky site of Buleji is easily approachable and harbor good quantity of seaweeds. At low tide, the seaweeds are found at the exposed coast. The collected seaweeds were washed with seawater on the spot, and then the plants were immediately put in polyethylene plastic bags with a little hole to leak out seawater drops. The remaining processes for analysis of different physical and biochemical parameters were done in laboratory. The studied specimens of seaweeds such as *Sargassum* and *Sapthoglossum* belong to *Pheaophyceae* (Brown algae). Both species were utilized as manure and grind with an electric grinder to obtain homogenous powder. The powder was thoroughly mixed to the garden soil by making replicates of the pots. This mixture was a left to decompose for four weeks. The seeds of experimental plants, *Phaseolusmungo and Lens culinaris*, after inoculation were transferred to pots filled with 1kg of garden soil mixed with different concentration of seaweed manure such as 3gm,6gm,9gm,12gm,15gm and 19gm.

BIOCHEMICAL ANALYSIS OF FLOWERING PLANTS TREATED WITH SEAWEED FERTILIZER:

The biochemical content such as total protein, total carbohydrate and total amino acid were estimated by using standard methods. Protein in sample was estimated by Lowery *et.al*, 1951) method. Carbohydrate content estimated by using with Anthrone reagent as described by Yemm and Willis, 1954). Amino acid was estimated by using Ninhydrin. All measurements were performed triplicates.

RESULTS:

The Seaweed Sample were collected from Buleji site of Karachi coast and identified taxonomically according to the classification of Shameel (2001). Two species belonging to phaeophyta (*Sargassum & Sapatoglassum*) were examined their effect on flowering plants in the form of manure.

Analysis of data showed a variable effect of seaweed concentration. But the highest growth in all parameters of flowering plants were observed treated with 6gm concentration of both seaweed dried organic fertilizer. And the lowest growth rate was observed at 15 mg and 19 mg of seaweed fertilizer (Table 1-2). Biochemical analysis showed a variant results as increasing the concentration of sea weeds the carbohydrate ratio increased at 3gm to 6 gm but at higher concentration this ratios were decreased in both pulses in response to both treatment (table 2-6) as well as shoot length also showed similar results higher shoot length was obtained at 3gm and 6gm (table 1-2) although other biochemical parameters revealed different observation protein content and amino acid concentration gradually increased from 0gm to 6gm then decreased and after that increased in *Lens culinaris* (Table 4 & 6) while in *Phaseolusmungo* protein content and amino acid first increased and then decreased (Table & 5) under the exposure of *Sargassum & Sapatoglassum* treatment.

Table 1: Physical Parameters (Shoot length) under the treatment of *Sargassum* in *Phaseolusmungo* and *Lens culinaris*

Treatments (gm)	Shoot length in *Phaseolusmungo*(cm)	Shoot length in *Lens culinaris*(cm)
0	15.887±3.715	58.636 ± 3.290
3	28.976 ± 1.837	87.087±6.874
6	29.712 ± 1.623	89.149 ± 6.406
9	28.685 ± 2.256	84.295 ± 5.577
12	24.643 ± 1.400	84.906 ± 6.271
15	10.6 ± 1.544	71.463 ± 3.923
19	10.347 ± 1.710	67.128 ± 4.997

Results showed in Mean±S.E.M Value in parenthesis indicates percent increase (+) or percent decrease (-) over control. Mean followed by different letter shows significant result at the level of standard error.

Table 2: Physical Parameters (Shoot length) under the treatment of *Sapthoglossum* in *Phaseolusmungo* and *Lens culinaris*

Treatment *Sapthoglossum*(gm)	Shoot length in *Phaseolusmungo*(cm)	Shoot length in *Lens culinaris*(cm)
0	20.548 ± 1.140	50.248 ± 4.836
3	23.82 ± 0.272	79.752 ± 5.492
6	27.041 ±0.565	84.975 ± 5.059
9	25.196 ±0.434	79.444 ± 4.9169
12	12.506 ±0.857	72.273 ± 4.708
15	16.598 ± 0.477	69.016 ± 3.608
19	12.267 ± 0.644	57.763 ± 3.312

Results showed in Mean±S.E.M; Value in parenthesis indicates percent increase (+) or percent decrease (-) over control. Mean followed by different letter shows significant result at the level of standard error

Table 3: Biochemical parameter of *Phaseolusmungo* treated with *Sargassum* sps. in the form of seaweed organic fertilizer.

Treatments *Sargassum*(gm)	Carbohydrate (mg/g)	Protein (mg/g)	Amino acid (mg/g)
0	10.995 ± 2.041	0.595± 0.237	0.4744 ± 0.109
3	24.452± 12.341	1.1385 ± 0.371	0.696 ± 0.253
6	29.492 ± 10.809	1.284 ± 0.5872	0.71 ± 0.186
9	24.345± 12.752	1.0518± 0.498	0.573 ± 0.092
12	18.592 ± 7.763	0.989± 16.329	0.5277 ± 258.521
15	19.984± 9.719	0.758± 0.649	0.492 ± 0.412
19	18.882 ± 6.742	0.756 ± 0.211	0.487 ± 0.164

Table 4: Biochemical parameter of *Lens culinaris* treated with Sargassum sps. in the form of seaweed organic fertilizer.

Treatments(gm)	Carbohydrate (mg/g)	Protein (mg/g)	Amino acid (mg/g)
0	17.065 ± 3.466 (0)	0.747± 0.036 (0)	0.71 ± 0.574 (0)
3	21.105 ± 0.783 (+23.674)	0.867 ± 0.062 (+16.064)	0.7376 ± 1.317 (+44.732)
6	25.089 ± 1.777 (+47.020)	0.57 ± 0.417 (-23.694)	0.645 ± 0.026 (+47.183)
9	21.044 ± 0.658 (+23.322)	0.5166 ± 0.388 (-30.923)	0.753 ± 0.045 (+6.056)
12	14.902 ± 3.420 (-12.675)	1.4276 ± 0.210 (+62.998)	0.9116 ± 0.030 (+28.394)
15	13.313 ± 5.617 (-77.632)	1.4410± 0.064 (+79.518)	0.5302± 17.914 (-15.591)
19	10.003 ± 3.466 (+41.382)	1.4600 ± 0.032 (+95.448)	0.3402 ± 0.323 (-88.760)

Results showed in Mean±S.E.M; Value in parenthesis indicates percent increase (+) or percent decrease (-) over control. Mean followed by different letter shows significant result at the level of standard error

Table 5: Biochemical parameter of *Phaseolusmungo* treated with *Spathoglossum sps*. in the form of seaweed organic fertilizer

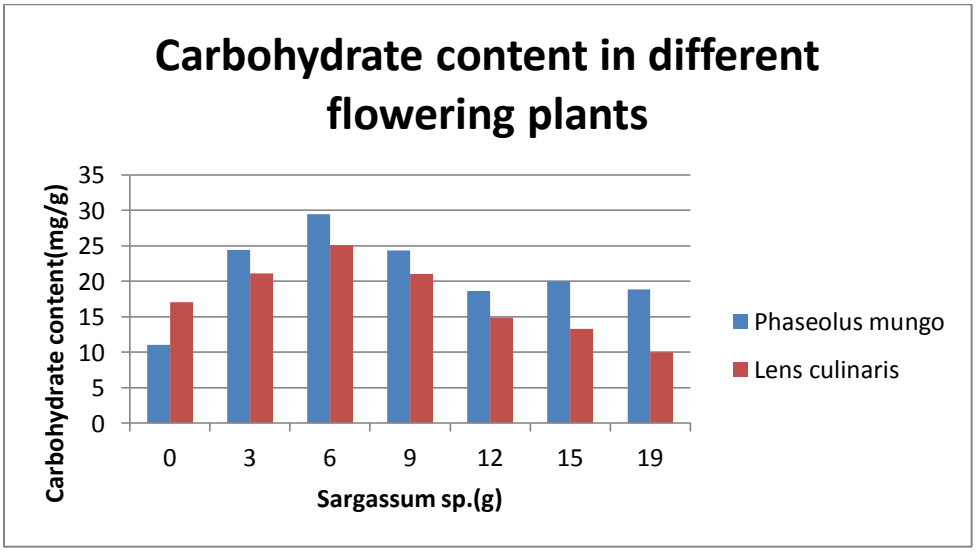
Treatments(gm)	Carbohydrate (mg/g)	Protein (mg/g)	Amino acid (mg/g)
0	17.269 ±0.494 (0)	0.4854± 0.998 (0)	0.4522 ± 0.103 (0)
3	24.883 ± 6.359 (+6.056)	0.620 ± 0.260 (-79.182)	0.7467±0.310 (+65.044)
6	28.473± 8.555 (+242.992)	0.688 ± 0.199 (-82.533)	0.8366± 0.335 (+84.955)
9	21.729 ± 12.185 (+35.235)	0.606 ± 0.546 (-84.615)	0.6142 ± 0.197 (+35.840)
12	20.555 ± 12.958 (+38.825)	0.582 ± 0.403 (-87.763)	0.5635 ± 0.101 (+24.557
15	18.951±1.902 (+183.225)	0.508 ± 0.015 (-87.103)	0.4969 ± 0.057 (+35.840)
19	18.189 ± 12.360 (+12.360)	0.489 ± 0.151 (-87.585)	0.4382 ± 0.022 (-3.097)

Table 6: Biochemical parameter under the treatment of Spathoglassum sps .in *Lens culinaris*

Treatments(gm)	Carbohydrate (mg/g)	Protein (mg/g)	Amino acid (mg/g)
0	19.603 ± 6.360 (0)	0.352 ± 0.130 (0)	0.589 ± 0.150 (0)
3	33.287±5.224 (+69.805)	0.712 ± 0.092 (+102.272)	0.663 ± 3.235 (+35..122)
6	31.463±3.377 (+ 60.500)	0.860 ± 0.262 (+144.318)	0.689 ± 0.198 (+16.977)
9	21.648 ± 19.748 (+10.432)	0.649 ± 0.128 (+84.375)	0.551 ± 0.070 (-6.451)
12	19.638 ± 6.108 (+102.203)	0.804 ± 0.133 (+128.409)	0.543 ± 0.084 (-7.809)
15	18.099 ± 7.977 (+43.340)	1.255 ± 0.132 (+256.534)	0.857± 0.333 (+45.500)
19	14.263 ± 18.261 (+125.797)	1.458 ± 0.466 (+314.204)	0.917 ± 0.235 (+55.687)

Results showed in Mean±S.E.M; Value in parenthesis indicates percent increase (+) or percent decrease (-) over control. Mean followed by different letter shows significant result at the level of standard error.

Fig 1: Carbohydrate content in *Phaseolusmungo, and Lens. Culinaris* under different concentrations of (SOF) *Sargassum sp*



2: Protein content in *Phaseolusmungo and Len culinaris* under different concentrations of (SOF) *Sargassum* sps.

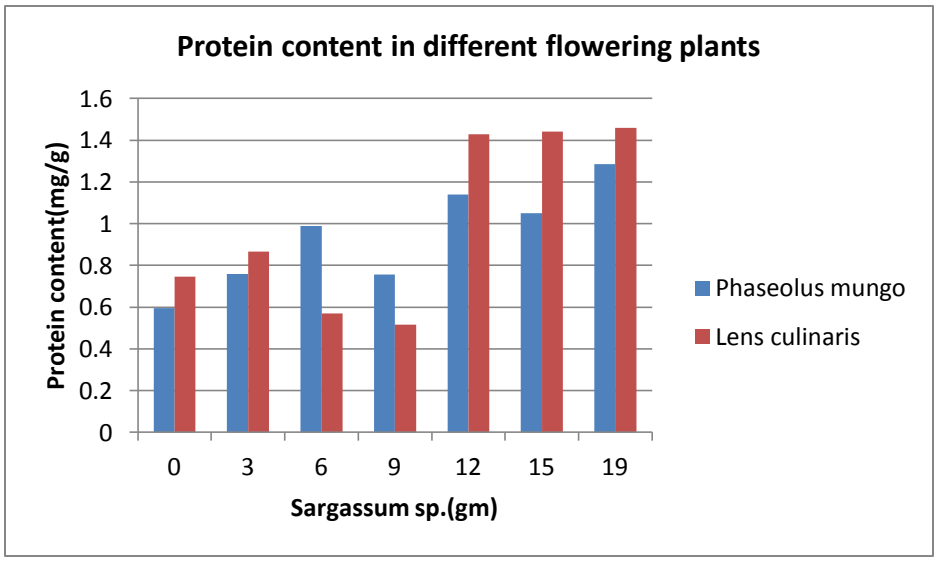


Fig 3: Amino acid content in *Phaseolusmungo and Lens culinaris* under different concentrations of (SOF) *Sargassum* sp.

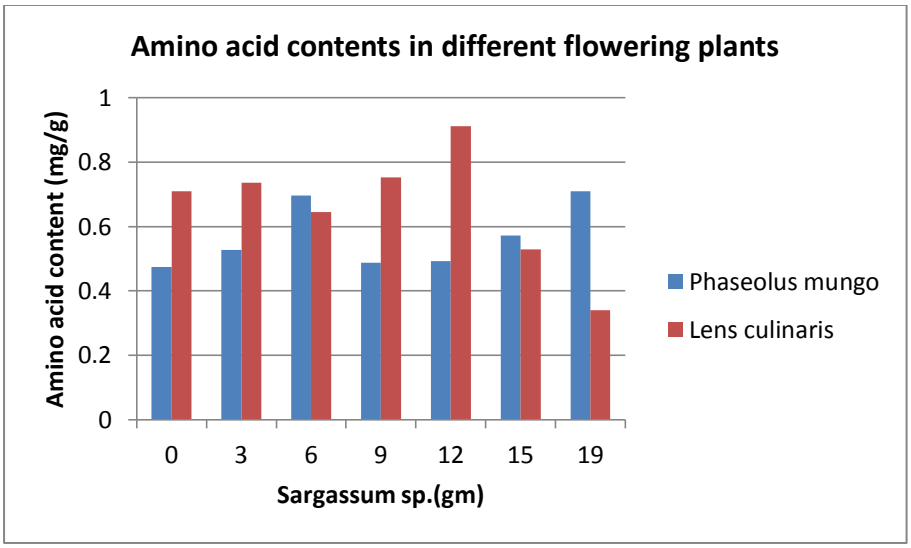


Fig 4: Carbohydrate content in *Phaseolusmungo, and Lens culinaris* under different concentrations of (SOF) *Spathoglassum sps.*

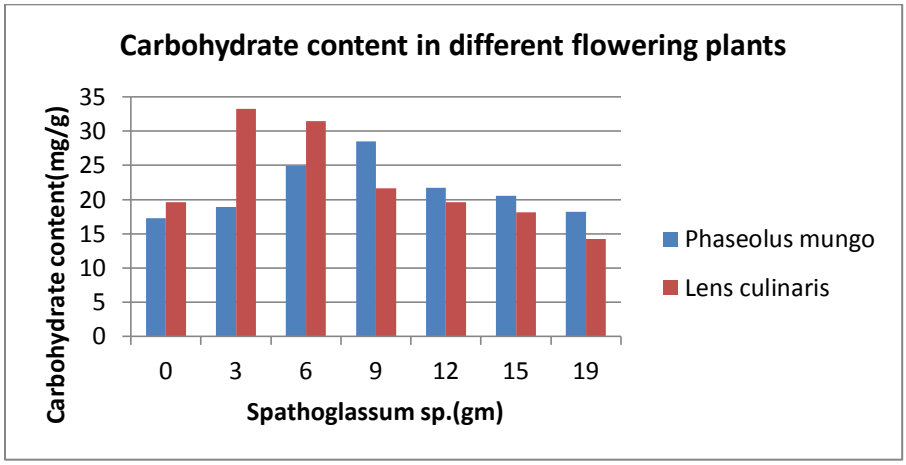


Fig 5: Protein content in *Phaseolusmungo and Lens culinaris* under different concentrations of (SOF) *spathoglassum sp.*

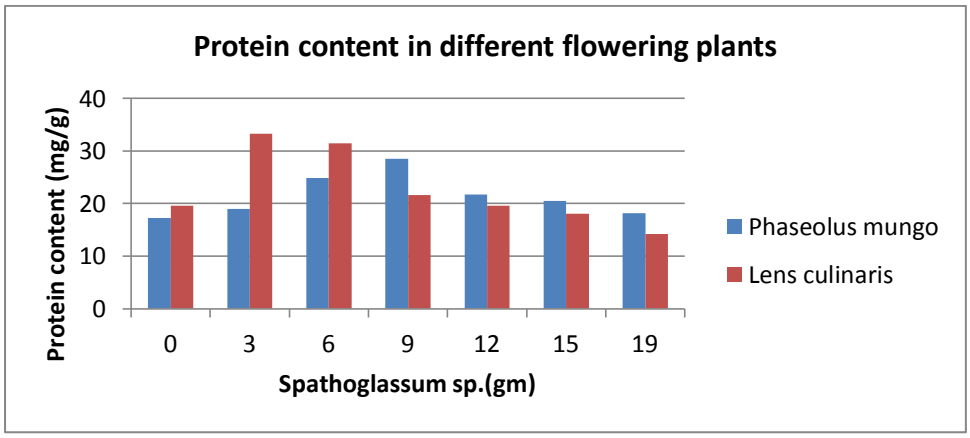


Fig 6: Amino acid content in *Phaseolusmungo and Lens culinaris* under different concentrations of (SOF) *Spathoglassum sps.*

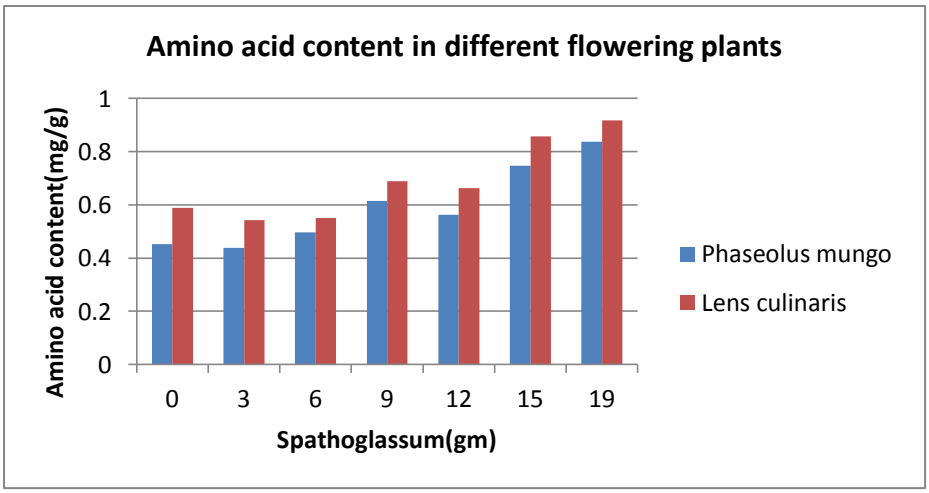


Fig 7: Effect of dried sargassum as fertilizer on *Phaseolusmungo and Lens culinaris* shoot length

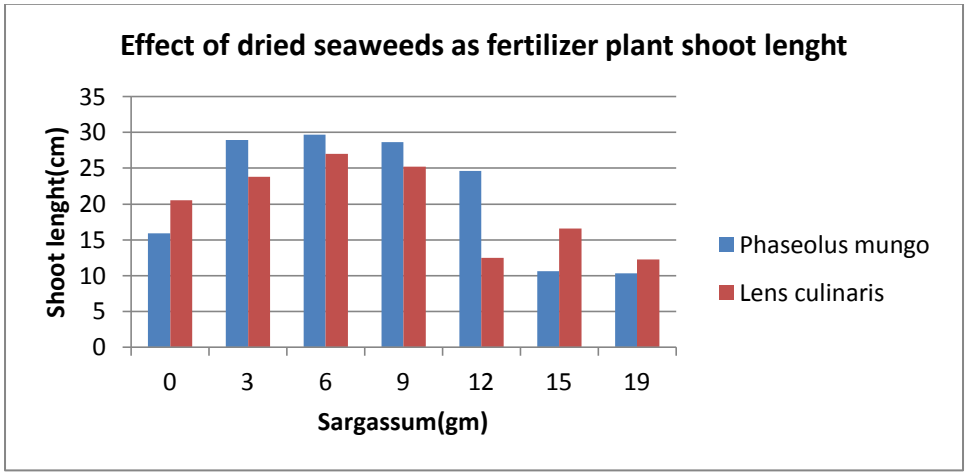
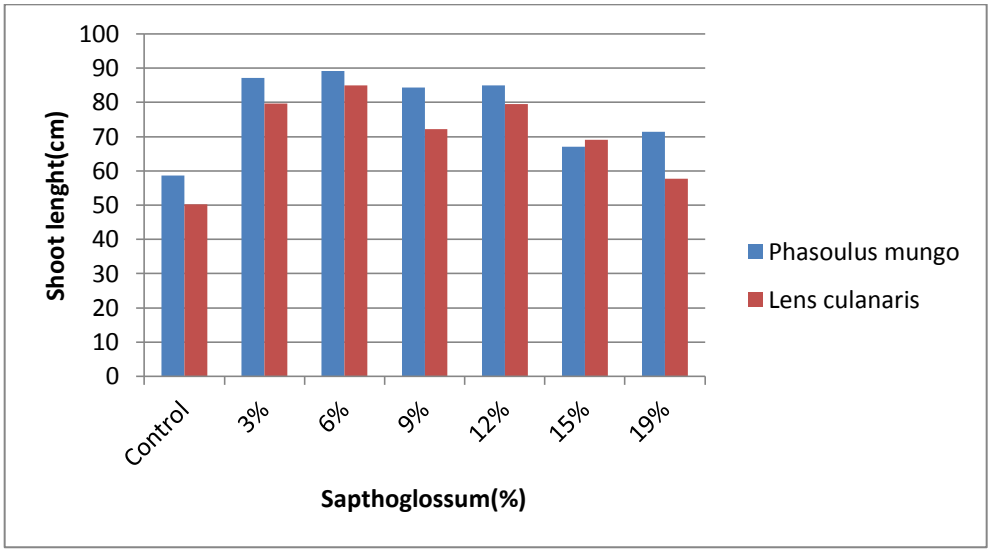


Fig 8: Effect of seaweed organic fertilizer Sapthoglossum on *Phaseolusmungo and Lens culinaris* shoot length



DISCUSSION:

Application of inorganic fertilizer for promoting the growth of important staple food crops has been used for many decades. But synthetic manure adversely affected the soil chemistry thus soil become less affable for plant growth, in addition to it become also harmful for human health (Camargo & Alonso 2006). Recently sea weeds gaining more importance as the growth stimulator. Sea weeds are natural growth stimulator which enhance of plant growth at various level of plants life (Fleurence, 1999). The coast of Karachi is inhabited by a variety of seaweeds. Marine algae show a plentiful and luxuriant growth along the coast and inshore water (Shameel and Tanaka 1992). Saifullah (1991) reported high production of seaweeds on the Buleji rocky ledge. Seventy-eight species of seaweeds growing in the coastal water of Pakistan have been reported as potentially useful (Afaq-husain*et.al.* 2001). Seaweeds are one of our unutilized natural resources.

Current study demonstrated that the application of seaweed organic fertilizer of *Sargassum sps.* And *Sapthoglossum sps* .at concentration of 3gm, 6gm and 9gm showed maximum growth index in both pulses *Phaseolusmungo* and *Lens culinaris*.(Bai*et al*,2011) was also reported the similar results that the addition of *Padinapavonia* was found to be most effective in enhancing the growth parameters in *Vagnaradiata.*

Earlier investigations were revealed that sea weeds are riches in macro and micro minerals. Macro minerals such as sodium potassium calcium phosphorus chlorine magnesium etc. and micro elements like nickel, fluoride, boron, selenium, molybdenum etc are abundantly found in sea weeds (Jameson, 1993, Jimnenez Escrig and Goni, 1999). Besides this *Sargassumtenerrimum*, *Sargassumswartzii*, *Sargassumhorneri*, *Padinatetrastometica*, *Sapatoglassum* also contain the growth promoter hormones like auxins, gibberellins and cytokines. *Sargassum* species are also used as biofertilizer in agriculture (Hong et al 2007).

The biochemical parameters like carbohydrate, protein and amino acid were studied at different concentration of seaweed organic fertilizer and the observed data showed high carbohydrate content at 6gm in *Phaseolusmungo* and *Lens culinaris* (Qari R & Qasim, 1993). The protein value was increased at 6gm, and lowest at 19gm of sea weed organic fertilizer in *Phaseolusmungo* while in *lens culinaris* was found different results in which at 3gm to 6gm protein content and amino acid percentage increased after that decreased and at 19gm the maximum value of protein and amino acid concentrations were obtained. These plants showed higher ability to absorb and metabolite the nutrients from the soil that was supplemented by the seaweed extracts (Abdel-Mawgoud*et.al*, 2010). But at higher concentration of sea weeds sometime become harmful due to the presence of salt which cause the slightly stress condition that's why stress protein formed and amino acid concentration also abnormally increased to overcome this stress.

The present study confirms the previous finding of many researchers as the maximum enhancement in growth and biochemical parameters were observed at 3mg, 6mg and 9mg concentrations of seaweed organic fertilizer because the soil is richest in minerals contents which enhanced the all physiological processes such as photosynthesis as well as all metabolic process(Zavodnik,1987) ultimately all biochemical parameters index improved in response to application of sea weeds organic fertilizer showed carbohydrate, protein and amino acid content concentration increased in the presence of this application in both leguminous species(Dave and Parekh,1975; Akhtar and Sultana, 2002; Hussain et al, 2003.).

CONCLUSION

The present study established that the application of selective seaweed species *Sargassum* and *Sapthoglossum* as an organic fertilizer at several concentrations promote growth index in both pulses *Phaseolusmungo* and *Lens culinaris* and also serve as stimulator of seed germination and growth parameters (shoot) index as well as enhancer of biochemical attribute of both pulses.

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