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Preparation of Organic Fertilizer from Seaweed and its Effect on the Growth of Some Vegetable and Ornamental Plants

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Abstract

Seaweed, *Codium Iyengarli* Borg., which grow wild on the coast of Karachi were utilized for the preparation of compost, tested for the growth of vegetables, and flowering plants. Seaweed manure significantly increased the rate of growth of plants. Higher contents of moisture, lipid and protein were observed in some vegetable plants when grown in lower percentages of seaweed compost.

Introduction

There are reports where marine algae have been gathered for centuries for the purpose to use them as fertilizer in the countries like Australia, France, Great Britain, India, Japan, New Zealand, Scotland, Spain and USA. The first record of the use of seaweed as fertilizer reported from the first century AD, where Chinese, Greeks and later Vikings used them as manure for their crops, where wet or dried seaweed were deposited on land for providing nutrients. In the fourth century. Seaweed was used as a partial substitute of manure. Quality of shelf life of peach increased by spraying of liquid fertilizer and tomatoes showed an increase by 37 percent in the plots treated with seaweed fertilizer (Chapman and Chapman, 1980).

An increase in the yield of Soybean, sweet potato, sweet corn, and melon were observed when seaweed fertilizer was used. Seaweed manure has an advantage over farm manure since it is free from weeds and fungi and has been found to eliminate "black spots" from roses, reduces brown rots of peaches, increases resistibility of crop plants to pest and diseases caused by aphids, red spider mites, powdery mildew and the fungi responsible for damping of seedlings (Chapman and Chapman, 1980). Seaweed contain essential minerals such as Ca, K, Mg, PO₄, S, N, Fe, Cu, Mn, Bo and Zn and has been found to increase the sugar contents in melon because of high content of potash. Seaweed fertilizer is suitable for root crops and cabbage. Zia 1990 investigated that seaweed fertilizer is beneficial for plant growth, because of the presence of organic and inorganic constituents which increase the nutrient uptake and help in the assimilation of carbohydrates and protein contents of plants. The application of seaweed manure increase the growth, yield, flowering and fruiting period of plants. Wahab (1991) found out that different concentration of seaweed effect differently on different plants viz. Zinnia and other related plants showed best growth in 50 percent concentration of seaweed manure plus soil.

Seaweed fertilizer is beneficial for plant growth because of the presence of organic inorganic and constituents, which increase the nutrient uptake and help in assimilation of carbohydrate and protein contents of the plant and hence increase the plant yield. Marine algae contain a good amount of minerals, therefore in USA, UK, France and Norway etc. Seaweed fertilizer is used as a liquid spray to

supplement the horticultural plants utilized seaweed fertilizer along with normal fertilizer in the field. He noted favourable results by increase of 60-70 percent yield of the experimental plants. It is noticeable that seaweed fertilizer increase the resistibility against disease and reduce the chance of insect attack. This fertilizer also increase the water holding capacity of the soil. Nature of the seaweed fertilizer is alkaline.

From the present study I am confident that it will surely give good results at large scale, use of seaweed fertilizer as supplement will be feasible in the Karachi and its surroundings, because of tones of seaweed cast as drifted seaweed at the seashore, which nature has given us so generously, can be collected free of charge and may be utilized as a best fertilizer in our horticulture and agriculture.

Materials and Methods

Seaweed material was collected from coastal region of Buleji during the months of December - February 1997-1998. Samples were gathered into netted baskets for the drainage of seawater, and brought to the laboratory where seaweed were washed with freshwater in order to remove the sand and other contaminations. Only one species of green seaweed *Codium Iyengarli* Borg., was utilized as manure on three vegetable. In the laboratory seaweed were air dried, ground with an electric grinder to obtain homogenous powder. The powder was mixed to the garden soil.

Different concentrations were prepared as follows:

Percentage of Seaweed	Qbantity of soil in gm
Control	Nil
	500
	495 = 5%
	490 = 0%
	485 = 15%
	480 = 20%

Five pots of 2 kg capacity were prepared for each experimental plants. In each pot mixture of seaweed and soil was transferred. Each pot contained a mixture of seaweed and soil. These pots were left for one week for decomposition by daily watering. Experimental plants selected were the species of Sunflower, Gram and Spinach. After decomposition of seaweed, sowing of seeds were performed. In each pot 5 seeds of respective plants were

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sown and left for germination with daily watering. Height of plant in centimeters, was noted weekly. At the end of the experiment the whole plant with roots were weighed, belonging to every concentration of seaweed plus soil.

Biochemical Analysis: After five months, plants were harvested, dried, samples were ground and stored in the plastic container for biochemical analysis: Ash was determined by standard method of AOAC. (1984). Lipid was extracted according to Triebold and Aurand (1963) method by Soxhlet apparatus. Protein was determined by copper catalyst Kjeldhal method according to the procedure of AOAC. (1984). Crude fiber was also determined according to the procedure of AOAC. (1984). Gross energy was estimated by Bomb Calorimeter (Parradecabetic model 1242). Minerals like Calcium, sodium, potassium, copper, iron and chloride were determined according to the procedure followed by AOAC. (1984).

Results and Discussions

Applications of Seaweed *Codium Iyengarli* on three different plants and its effect on their growth yield and nutritional values are discussed in the light of the previous findings. The aim of this work was to develop resistibility among the plants against diseases and to obtain better and quick growth. For this purpose four different concentrations of Seaweed plus garden soil was prepared viz. 5 percent, 10 percent, 15 percent and 20 percent a control was also taken for the sake of comparison, cultivated plants such as Sunflower, Gram, Spinach, were selected as experimental plants. This work was carried out for twelve weeks (from June to August, 1998). Weekly observations were taken. Several observations show that seaweed enhance the growth and nutrient elements of plants. Current work is in favor of the results of (Booth, 1965; Chapman and Chapman, 1980; Blunden, 1971; Zia *et al.*, 1995; Zahid *et al.*, 1998).

Physical Parameters: Effect of seaweed fertilizer vary from plant to plant viz. the highest growth of Gram, Sunflower, Spinach, were observed in 20 percent concentration of *Codium Iyengarli* (Table 1). Physical parameters of Gram plant show that highest weight of fresh plant remain more or less the same in 20 percent seaweed concentration. Dry weight of plant was also highest in control. Water content was noted more or less the same in control and 20 percent. Highest fresh weight of whole Sunflower plant was noted in 10 percent seaweed concentration. Highest dry weight in 5 percent and highest water content in 10 percent seaweed concentration respectively. In case of Spinach plant highest fresh weight and dry weight and water content of whole plant were recorded in 20 percent seaweed concentration (Table 2).

Biochemical Parameter: Gram plant shows highest protein, in 10 percent, fiber contents in 10 percent and 20 percent, fat contents was highest in 5 percent, Ash content

was highest in 10 and 15 percent, carbohydrate was highest in 20 percent, whereas Gross energy was highest in more or less the same in all the per cent ages.

Table 1: Effect of different concentrations of *Codium Iyengarli* on the growth of gram, sunflower and spinach

Weeks	Control	5%	10%	15%	20%
Gram					
1st	12.06	12.06	15.21	16.89	13.71
2nd	19.67	19.76	19.80	19.96	19.21
3rd	20.69	23.42	24.25	25.75	23.71
4th	24.20	26.49	26.69	27.20	27.29
5th	25.10	27.20	27.80	28.00	27.00
6th	27.00	28.50	28.80	29.23	28.76
7th	28.73	29.50	30.00	32.20	33.70
8th	29.50	29.90	21.25	35.26	34.90
9th	30.06	32.00	33.00	35.95	36.16
10th	30.80	32.35	34.95	36.60	39.00
11th	32.07	33.50	36.11	38.50	39.00
12th	33.70	35.00	37.11	30.25	41.20
Sunflower					
1st	1.80	2.20	3.60	3.90	4.00
2nd	2.30	2.30	4.40	4.60	4.20
3rd	3.40	1.40	6.00	5.40	6.50
4th	4.70	2.80	7.10	7.00	9.20
5th	5.30	3.20	10.20	8.20	6.90
6th	6.20	5.40	13.40	10.90	7.30
7th	7.30	7.80	17.60	8.40	7.30
8th	8.60	9.70	19.20	13.10	9.50
9th	9.60	10.20	21.30	14.50	10.20
10th	10.10	12.90	25.20	16.70	12.30
11th	12.20	13.60	28.30	18.90	14.50
12th	14.90	15.70	32.80	20.10	17.30
Spinach					
1st	3.00	5.25	8.00	10.00	13.35
2nd	6.50	8.50	14.00	21.25	25.25
3rd	8.20	12.48	19.00	25.90	30.45
4th	10.00	16.00	24.00	28.70	34.50
5th	14.02	19.50	27.00	34.40	41.30
6th	18.50	23.75	33.00	39.50	46.00
7th	20.75	26.90	37.00	44.80	52.00
8th	23.20	28.50	41.00	48.70	54.30
9th	25.90	31.40	45.20	52.50	59.80
10th	27.80	35.60	49.50	58.40	65.90
11th	30.50	37.70	36.10	62.50	67.90
12th	33.50	42.90	45.00	68.50	73.00

Sunflower plants shows highest protein, fiber and fat contents in 20 percent seaweed concentration. Quantity of carbohydrates remain the same from Control to 20 percent concentration (Table 3).

In Spinach plant highest protein was observed in 15 percent and 20 percent. Highest fiber contents in 10, 15

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and 20 percent. Highest fat was observed in 15 and 20 percent. While highest fiber was observed the same quantity from control to 20 percent. Highest carbohydrates was found in 10, 15 and 20 percent. Gross energy remained the same from control and all the concentration.

Table 2: Physical parameters of gram plant, sunflower and Spinach

Concentrations	Fresh Wt.	Dry Wt.	Water content
Gram plant			
Control	5.20	1.39	3.89
5%	2.92	0.77	2.15
10%	4.36	1.10	3.26
15%	4.00	0.98	3.02
20%	5.22	1.28	3.94
Sunflower			
Control	75.50	20.08	55.42
5%	87.50	25.00	62.50
10%	95.00	20.05	74.25
15%	80.50	15.00	65.50
20%	72.09	10.50	61.59
Spinach			
Control	168.00	7.38	162.62
5%	237.00	7.75	229.62
10%	336.00	8.10	327.80
15%	374.00	8.26	365.74
20%	525.00	8.40	516.60

Table 3: Bio chemical parameters of coram, sunflower and spinach plant.

	Protein	Fiber	Fat	Ash	CHO	Energy
Gram Plant						
Control	1.30	3.50	13.0	40	45.7	22.02
5%	1.20	3.24	21.0	34	43.8	22.51
10%	3.90	3.90	8.8	48	39.3	22.61
15%	1.40	3.95	14.4	48	50.2	22.56
20%	1.60	3.00	9.4	37	52.0	22.59
Sunflower						
Control	26.8	10.75	3.40	3.5	21.0	40.21
5%	28.7	11.10	3.42	3.4	21.7	40.18
10%	29.4	11.76	3.60	3.0	21.9	40.21
15%	30.2	12.00	3.82	3.6	22.0	40.26
20%	32.4	12.90	4.48	3.8	22.0	40.33
Spinach						
Control	27.2	9.08	3.3	22.9	32.0	27.07
5%	27.8	9.16	3.4	23.0	32.0	27.09
10%	28.0	9.44	3.6	23.0	32.5	27.09
15%	28.7	9.59	3.8	23.1	32.7	27.22
20%	28.7	9.76	3.8	23.2	32.8	27.29

Elemental Analysis: In the elemental analysis Na, Ca, Mg, Fe, Cu, K and Cl are well studied in control and 5, 10, 15

and 20 percent seaweed concentration in which experimental plants was grown for the period of twelve weeks. Gram plant shows high quantity of Sodium in all the experimental plants. Including control. Calcium, Magnesium Iron and Copper were highest in controlled plants. Potassium and Chloride were highest in 15 percent concentration. Sunflower plant shows highest quantity of Sodium and Calcium in 20 percent. Magnesium was highest in 10 percent, 15 percent and 20 percent. Iron remain

Table 4: Elemental analysis of gram plant, sunflower, Spinach treated with *Codium Iyengarli*

	Na	Ca	Mg	Fe	Cu	K	Cl
Gram Plant							
Control	1.1	3.9	20	0.32	1.2	25	1.02
5%	1.1	3.1	20	0.32	1.2	25	1.08
10%	1.2	3.9	20	0.32	1.2	25	1.00
15%	1.1	3.1	20	0.32	1.2	25	1.09
20%	1.2	3.1	20	0.32	1.2	25	1.04
Sunflower							
Control	1.1	2.4	2.1	0.25	1.2	25	1.31
5%	2.0	3.9	3.0	0.24	1.2	27	1.41
10%	2.3	4.8	3.0	0.26	1.2	29	1.52
15%	3.5	6.9	3.1	0.31	1.2	30	1.58
20%	5.2	8.2	3.1	0.40	1.2	30	1.60
Spinach							
Control	1.5	2.3	3.03	0.25	1.32	25	1.31
5%	2.0	3.9	3.05	0.25	1.22	27	1.4
10%	2.4	5.2	3.09	0.29	1.25	29	1.5
15%	3.8	6.8	3.05	0.26	1.25	30	1.57
20%	5.0	8.0	3.05	0.29	1.26	30	1.6

Table 5: Biochemical Analysis of *Codium Iyengarli*

Crude Protein (gm)	Crude fiber (gm)	Crude fat (gm)	Ash (gm)	Gross energy (Kcal)	CHO (gm)
16.69	7.95	1.58	39.93	21.69	45.25

Table 6: Elemental Analysis of *Codium Iyengarli* in ppm

Na	K	Ca	Mg	Cu	Cl
1.05	18.40	3.20	1.60	0.50	2.00

same in all the concentrations including control. Quantity of Copper remained the same in all concentrations. Potassium was highest in 15 percent and 20 percent concentrations. Chloride remained the same in all concentrations. (Table 4). In case of Spinach plant, quantity of Sodium, Calcium and Magnesium were highest in all the concentrations including control. Iron and Copper remained the same. Potassium found highest in 20 percent while Chloride also remained high in all concentrations (Table 5,6).

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References

AOAC., 1984. Official Methods of Analysis. 19th Edn., Association of Official Analytical Chemistry, Washington, DC., USA., pp: 40-160.

Blunden, G., 1971. Effects of aqueous seaweed extract as a fertilizer additive. Proceedings of the 7th International Symposium on Seaweed Research, August 8-12, 1971, Sapporo, Japan, pp: 584-589.

Booth, E., 1965. Some properties of seaweed manures. Proceedings of the 5th International Seaweed Symposium, August 25-28, 1965, Halifax, pp: 349-358.

Chapman, V.J. and D.J. Chapman, 1980. Seaweed and their Uses. 3rd Edn., Chapman and Hall Ltd., London, Pages: 327.

Triebold, H.G. and L.W. Aurand, 1963. Food Composition and Analysis. Devan Nostrad Company Inc., Princeton, New Jersey, pp: 14-34.

Wahab, R., 1991. Effect of Seaweed fertilizer on seasonal vegetables. M.Sc. Thesis, University of Karachi, Pakistan.

Zahid, P.B., Z. Zia and A. Ali, 1998. Effect of Seaweed manure on growth of *Capsicum annum* L. (Chilli: Mirch). Hamdard Medicus, 41: 74-77.

Zia, Z., 1990. Utilization of Seaweed as manure. M.Phil Thesis, University of Karachi, Pakistan

Zia, Z., P.B. Zahid and A. Ali, 1995. The effect of seaweed manure on *Abelmoschus esculentus* L. (Lady's finger, Bhindi). Sind Univ. Res. J. (Sci. Ser.), 27: 175-182.