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Effect of spraying with different concentrations of Seaweeds extracts on vegetative growth and yield of two cultivars of Peas (*Pisum sativum* L.)

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Abstract

The study was carried out during the2017, spring growing season in the college of Agriculture, University of Dohuk, Kurdistan region, Iraq, to determine the effects of seaweeds extract (Alga 600) on two pea cultivar (*Pisum sativum L.*) which are Ambrosia(A) and Szesciotygodniowy (B) were grown in plastic bags. Results of vegetative growth characters, quality and yield characteristic showed cultivar (A) gave a high early yield.plant^{-1}(20.77g) compared with (B) cultivar that showed lower yield (16.22g). Plants treated with 4ml.L^{-1} of seaweeds extracts in the both cultivars gave good results in total yield especially in A cultivar (137.07g) as compared with control which gave lower total yield (94.9g).The results of number of nuduls.plant^{-1}, length of nodules and width of nodules (mm),showed cultivar (A) gave high value which were(22.08, 15.65 and 6.23) respectively which significant different in compared with (B) cultivar. Mineral contents (NPK),cultivar (A) showed high percentages which were (3.67,0.29and 3.33%) respectively, compared to the cultivar B which gave lower percentages (3.37, 0.27 and 3.08%) respectively, and treating plant with 4ml.L^{-1} resulted in high nitrogen (3.84%) compared to lower value (2.88%) for the control, results of protein%, also cultivar A gave high value of protein percentage (22.74%) compared to the cultivar B (21.06%).

Introduction

Pea (*Pisum sativum* L.) is one of the most important and popular crop of Fabaceae family grown in Iraq and many countries all over the world. India and Afghanistan are the origin of pea. It has many nutritional values such as high content of protein, carbohydrates, phosphorus, iron, calcium and vitamins A and B *[1]*. The area of planted with this approximately 12-15% of the total area of earth in the cultivated world and world yield of pea seeds was 97% was 27%from the seeds of world *[2]*.The planted areas in Iraq was 900 Acrethat produce 15584.4 kg., and the total yield was 1500 ton *[3]*.There is a great need for further studies under Iraq condition for the purpose of improving the quality and quantity of the crop as well as the reduction of environmental pollution which caused by chemical fertilizers.

Seaweed extracts widely used as organic fertilizers and natural promoters to enhance vegetative growth and increase yield of many horticultural crop, furthermore, these natural products and organic fertilizers are very cheap and safe for ecology and humans as compared with chemical products and plant growth regulators, such products are recommended as they are economical and safe for environment plant growth regulators*[4]*.

Information on the role of seaweed as a source of nutrients and as a growth promoting substance *[5]* and *[6],* under tidal region of sea and serve as an excellent source of food, fodder *[7]*. Recently, bioactive substances extracted from marine algae are used in agricultural and horticultural crops as bio-fertilizers to improve their yield and quality and to reduce the negative environmental impact *[8]*. Seaweeds provide an

excellent source of bioactive compounds such as essential fatty acids, vitamins, amino acids as well as minerals, and growth promoting substances, antioxidants *[9]*and *[10]*.The chemical analysis of seaweeds and their extracts has revealed the presence of a wide variety of plant growth-promoting substances such as auxins, cytokinins, and betaines and the positive responses of seaweeds improving germination, root development, leaf quality, general plant vigor and resistance to pathogens*[11]*. The aim of this study is to test the effect of seaweeds extract (Alga 600) on growth and yield of two cultivar of pea(*Pisum sativum* L).

Material and methods:

The experiment was carried out on 22 February, to 15 June 2017 at research farm, college of Agriculture, University of Duhok. Seeds were planted in plastic bags (21.5 cm-2 diameter). Mixture of soil and animal manure were used (1:2). As temperature degrees raised, the soil was put around the plastic bags to reduce the high temperature effect on roots. Two factors in randomized Complete Block Design (RCBD) was used with 4 replicates, the first factors was seaweeds extracts at four levels (0, 2 ,4 and 6 ml.L-1), the second was two verities (Ambrosia (A) and Szesciotygodniowy (B)), so the experiment consist 8 treatments (2*4). Liquid seaweeds extracts (Alga 600) sprayed three times at 15 days intervals. First spraying were after plant reach five leaves, second spraying after 15 days of first spraying and third spraying after 15 days of second spraying. Data were analyzed by using SAS program *[12]*. The experimental traits was as follows:

A. Vegetative growth characteristic, that include:

Leaf area as describe by Bn Salman (1996) *[13]*, Chlorophyll content (SPAD)(It was determined by using Spad Meter -502, Konica Minolta), plant length (cm), branch number, stem diameter (mm) and fresh weight (g.plant-1).

***B. Quality characteristic of pea*,**that include:

Pods weight (gm), number of seed. pod-1 , dry weight of 100 seed (g), pods number.plant-1 , pods length, length and width of nodules.

C. Yield characteristic of pea,that include:

Early yield, and total yield as describe by AL-Sahaf (1989) *[14]*.

D. nutrient contents of pea,that include:

Total nitrogen and protein percentage were determined according to AOAC (2000) *[15]*, Phosphorus According to colorimetric method using Spectrophotometer *[16]*., and K According to flame method using Flame photometer instrument *[15]*.

Results and Discussion:

A. Results:

Table: (1) Shows no significant differences between cultivar A and B pea cultivar with regard to leaf area, while 2, 4 and 6ml.L^{-1} seaweeds extracts were superior to the control with respect to leaf area. Maximum leaf area (3.29 cm^2) obtained from 2ml.L^{-1} while control treatment gave minimum value. Seaweeds extracts combined with both cultivars were not different significantly, while all the combination were superior to the combination of both cultivars with the control. Maximum leaf area was (3.58cm^2) obtained from 2ml.L^{-1} seaweeds and B cultivar.

Table (1) indicates to the effect of seaweeds extract regard to chlorophyll content the data shows that there was significant differences with regard to chlorophyll SPAD according to the A cultivar its appears significantly increased which reaches (42.17 SPAD) compared with (37.83 SPAD) in B cultivar. In the same time there was significant differences as a result of the concentration of seaweeds extract on the chlorophyll content other hand the effect of interaction between the treatment indicated that there was significant difference in the interaction with 4ml.$^{-1}$ of seaweeds and A cultivar that gave higher value of chlorophyll (47.77SPAD) compared with untreated plants treatments that gave lower value of chlorophyll (33.13 SPAD).

Table-1: Effect of seaweed extracts,cultivar and their interactions on vegetative growth Characteristic of pea.

Cultivar	leaf area(cm^2)					Chlorophyll				
	Seaweeds extract				Effect of cultivar	Seaweeds extracts				Effect of cultivar
	0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}		0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}	
A	2.08 bc	3.00 ab	2.75 a-c	2.82 a-c	2.66 a	33.13 c	45.60 a	47.77 a	40.13 ab	42.17 a
B	1.83 c	3.58 a	3.33 a	3.25 a	3.00 a	41.83 bc	33.43 c	36.70 bc	39.37 b	37.83 b
Effect of cultivar	1.96 b	3.29 a	3.04 a	3.04 a		37.48 c	39.52 b	42.23 a	39.75 b	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

Table (2): Table (2) indicates the effect of seaweeds extracts on regard of plant length (cm) Bcultivar gave high length of plant (42.91cm) compared to the A cultivar that gave (32.89cm) in the same time there was significant differences on plant length as a result of the concentration of seaweeds extracts on the other hand the effect of interaction between the treatment indicated that there was significant difference in the interaction between concentration 4ml.L^{-1} with B cultivar (53.97) compared with interaction between control and B cultivar that gave lower value of length (22.67). Table (2) also indicates significant differences between cultivar regard to branch number.$plant^{-1}$ and maximum number (4.17) obtained from B cultivar , whereas 6ml.L^{-1} recorded the highest value of branch number.$plant^{-1}$ (4.83)which was significantly different from other concentration specially the control that gave lower number of branch per plant (3.33)in both cultivar, and the interaction among 6ml.L^{-1}seaweeds extracts with A cultivar gave the highest value (5.00) branch number .$plant^{-1}$.

Table-2: Effect ofseaweed extracts,cultivar and their interactions on vegetative growth Characteristic of pea.

Cultivar	Plant length (cm)					Branch number.$plant^{-1}$				
	Seaweeds extracts				Effect of cultivars	Seaweeds extracts				Effect of cultivars
	0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}		0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}	
A	23.67 c	41.00 bc	34.00 c	46.33 a	32.89 b	3.33 b	4.00 ab	3.67 ab	5.00 a	4.00 b
B	22.67 c	50.67 ab	53.97 a	44.33 b	42.91 ab	3.33 b	4.33 ab	4.33 ab	4.67 ab	4.17 a
Effect of seaweed extracts	23.17 c	45.83 a	43.98 ab	45.33 ab		3.33 b	4.17 ab	4.00 ab	4.83 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

Table (3) Refer to the effect of seaweeds extracts, cultivar and their interaction with regard to stem diameter and fresh weight of pea it was showed that there was no significant differences between (A) and (B) cultivar in the same time there was significant differences on stem diameters as a result of the seaweeds extracts treating plant with seaweeds extract significantly different compared with control that gave lower diameter (3.00mm)on the other hand the effect of interaction between the treatment indicated that there was significant difference in the treatments.

Regarding the fresh weight of pea it also refers that the B cultivar showed significant increase that gave high fresh weight which reaches (53.99g) in cultivar B in the same time there was significant increase on stem diameter as a result of the concentration of seaweeds extracts compared with untreated plant the other hand the effect of interaction between the treatment indicated that there was significant difference in the all interaction compared with untreated plant with seaweeds.

Table-3: Effect ofseaweed extracts,cultivar and their interactions on vegetative growth Characteristic of pea.

Cultivar	Stem diameter(mm)					Fresh weight(g.plant^{-1})				
	Seaweeds extracts				Effect of cultivars	Seaweeds extracts				Effect of cultivars
	0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}		0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}	
A	2.33 b	4.00 a	4.33 a	4.00 a	3.56 a	36.30 cd	29.30 d	48.50 bc	56.27 ab	42.60 b
B	3.67 ab	4.33 a	4.00 a	4.00 a	4.00 a	37.70 cd	69.37 a	58.33 ab	50.57 bc	53.99 a
Effect of seaweeds extracts	3.00 b	4.17 a	4.17 a	4.00 a		37.00 b	49.33 a	53.42 a	53.42 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

Table (4 and 5): Indicated the effect of seaweeds extracts, cultivar and their interaction on quality characteristic of pea (pods weight , number of seed. pods^{-1}and dry weight, of seeds and in table 5 contain pods length and pods number. plant^{-1}of pea the data showed that there was significant differences according to the cultivar seaweeds extracts in A cultivar significantly increased which reaches (2.32 gm. pods^{-1})compared with(2.10gm.pod^{-1})in B cultivar in the same time there was significant differences on pod weight as a result of the concentration of seaweeds extract on the other hand the effect of interaction between the treatment indicated that there was significant difference in the treatments, the interaction between B cultivar that treated with 4ml.L^{-1}of seaweeds extract gave higher value of pods weight (2.92gm) compared with other interaction.

Concerning the number of seed .pod-1 of pea it also refers that the A cultivar showed significant increase that gave high number of seed. Pod^{-1}(6.17) in cultivar A compared with B cultivar that gave (5.83) seed. pod^{-1} treating plant with 4ml.L^{-1} gave highest number of seed per pods that reached (6.67) seed. pod-1compared with control. Concerning the interaction between seaweeds extracts and cultivar it was showed that the interaction between 4ml.L^{-1}and A cultivar (7.00seed. Pod^{-1}) compared with control.

Regarding the dry weight of seeds, the results indicated that cultivar B had high significant effects on dry weight of seeds (16.78) than cultivar A(15.72gm) .The dry weight was also significantly affected by concentration of seaweeds extract levels, the plant treated with 4 and 2ml.L^{-}1seaweds extract had high dry weight (17.90 and 17.8gm) respectively as compared with the control (14.1gm). It also indicates that B cultivar treated with 4 ml.L^{-1}of seaweeds extracts levels significantly affected the dry weight as compared with untreated plant of A cultivar (Table 4).

Table-4:Effect ofseaweed extracts,cultivar and their interactions on quality characteristic of pea.

Cultivar	Pods weight (gm)				Effect of cultivars
	Seaweeds extract				
	0	2ml.L-1	4ml.L-1	6ml.L-1	
A	1.88 bc	2.73 bc	2.92 a	1.74 ab	2.32 a
B	1.45 c	1.78 bc	2.25 a-c	2.93 a	2.10 b
Effect of Seaweeds extract	1.83 b	2.09 b	2.58 a	2.33 ab	
Cultivar	**Number of seed .pod-1**				**Effect of cultivars**
	Seaweeds extract				
	0	2ml.L-1	4ml.L-1	6ml.L-1	
A	5.33 b	6.67 ab	7.00 a	5.67 b	6.17 a
B	5.33 b	6.00 a	6.67 ab	5.33 ab	5.83 b
Effect of Seaweeds extract	5.3 a	6.33 a	6.67 a	5.33 a	
Cultivars	**dry weight of seeds (g)**				**Effect of cultivars**
	Seaweeds extract				
	0	2ml.L-1	4ml.L-1	6ml.L-1	
A	13.87 d	17.87 b	15.60 c	15.53 c	15.72 b
B	14.33 cd	17.80 b	20.20 a	14.80 cd	16.78 a
Effect of Seaweeds extract	14.10 c	17.83 a	17.90 a	15.17 b	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

Regarding the table (5) it was refers that there are significant differences among cultivar; (A) cultivar gave higher pods .plant^{-1} (11.09) than cultivar B (9.83). The plant treated with 4ml.L^{-1} seaweeds extract had high pods number.plant^{-1} (13.17) as compared with the untreated plant (7.8) pod.plant^{-1}. It also indicates that interaction among treatment showed significant increase in the number of pods.plant^{-1} as compared with untreated plant with seaweeds extract. Regarding the length of pods it appeared that there are no significant among cultivar, treating plant with 4ml.L^{-1} of seaweeds extract gave long length as compared with other treatment, the interaction between treatments showed significant differences as compared with the untreated plant with seaweeds extract.

Table-5: Effect of seaweeds extract ,cultivar and their interactions on quality characteristic of pea.

Cultivars	pods number.plant^{-1}					pods length(cm)				
	Seaweeds extract				Effect of cultivars	Seaweeds extracts				Effect of cultivars
	0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}		0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}	
A	9.67 a	10.02 ab	13.67 a	11.00 a	11.09 a	7.00 ab	7.53 ab	8.50 a	6.17 ab	7.30 a
B	6.0 c	9.67 ab	12.67 a	11.00 a	9.83 b	6.93 b	4.33 b	6.80 ab	7.43 ab	6.38 a
Effect of seaweeds extracts	7.8 c	9.83 b	13.17 a	11.00 ab		6.97 b	5.93 b	7.65 a	6.80 a	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

Regarding the table (6) there was significant different regard with the number, length and width of nodules, cultivar A gave more number of nodules than cultivar B, the plant treated with 4m.L^{-1}seaweeds extract had high number of nodules (23.50) as compared with the untreated plant (14.50 noduls.plant^{-1}), It also indicates that interaction among treatment showed significant increase in the number of nodules.plant^{-1}as compared with control. Concerning the length of nodules, there significant increased among cultivar., cultivar A gave better length of nodules (15.65 mm), compared with (15.58 mm) of cultivar B, in the other hand treating plant with 4ml.L^{-1} gave higher length of nodules(18.17 mm)compared with control that gave lower value (11.5 mm).

In the same time it was showed there are significant increases in width of nodules among cultivar, cultivar A, gave high width which reach (6.23mm) as compared with cultivar B, treating plant with 4ml.L^{-1} seaweeds extract showed significant increase in the width of nodules pant treated with 4ml.L^{-1} of seaweeds extract gave (7.16mm) of nodules compared with other treatment. Regarding the interaction, the best interaction was shown in the interaction between 4ml.L^{-1} of seaweeds extract and cultivar A, compared with other interaction.

Table- 6: Effect of seaweeds extract, cultivar and their interactions on quality characteristic of pea.

Cultivar	Number of nodules.plant^{-1}				Effect of cultivars.
	Seaweeds extract				
	0	2ml.L-^{1}	4ml.L^{-1}	6ml.L^{-1}	
A	14.33 b-d	22.00 b	32.67 a	19.33 bc	22.08 a
B	12.67 d	19.67 bc	16.33 b	16.33 b-d	16.25 b
Effect of Seaweeds extract	14.50 c	20.83 ab	23.50 a	17.83 bc	
Cultivar	**length of nodules (mm)**				**Effect of cultivars.**
	Seaweeds extract				
	0	2ml.L-^{1}	4ml.L^{-1}	6ml.L^{-1}	
A	9.67 c	17.66 a	17.60 a	17.67 a	15.65 a
B	13.33 b	15.00 ab	18.67 a	15.33 ab	15.58 b
Effect of Seaweeds extract	11.5 c	16.331 ab	18.17 a	16.50 ab	
Cultivar	**width of nodules (mm)**				**Effect Of cultivars**
	Seaweeds extract				
	0	2ml.L-^{1}	4ml.L^{-1}	6ml.L^{-1}	
A	4.52 c	7.33 a	7.77 a	5.33 b	6.23 a
B	4.60 c	6.22 ab	6.55 ab	6.01 ab	5.84 b
Effect of Seaweeds extract	4.54 c	6.77 ab	7.16 a	5.67 b	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

Table (7) Indicated to the effect of seaweeds extracts , cultivar and their interaction regard with the yield characteristic (early yield and total yield gm.plant^{-1}) the data showed that there was significant differences in early yield according to the cultivar, in cultivar A significantly increased which reaches (20.36gm.plant^{-1}) compared with (16.63gm.plant^{-1}) in the cultivar B, in the same time there was significant differences on early yield as a result of the concentration of seaweeds extracts on the other hand the effect of interaction between the treatment indicated that there was significant difference in the interaction between plant treated with 4ml.L^{-1} cultivar (A) which gave high early yield which reached (23.47gm.plant^{-1}) compared with untreated plants treatments.

Regarding the total yield (gm.plant^{-1}) of pea , the results showed significant increase in cultivar which reaches (123.67) gm.plant^{-1}in A cultivar, in the same time there was significant increase on total yield as a result of the concentration of seaweeds extracts on the other hand the effect of interaction between the treatment indicated that there was significant difference in the cultivar A, and seaweeds extracts at (4 and 2ml.L^{-1}) that gave high value of total yield kg.plant^{-1} (142.80 and 141.20gm.plant^{-1}) respectively compared with the other treatment.

Table -7:Effect of seaweeds extract, cultivar and their interactions on yield of pea

Cultivar	Early yield (gm.plant^{-1})					Total yield gm.plant-1				
	Seaweeds extract				Effect of cultivars	Seaweeds extracts				Effect of cultivars
	0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}		0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}	
A	15.77 b	22.53 ab	23.47 a	19.70 ab	20.36 a	95.33 cd	141.20 a	142.80 a	115.33 bc	123.67 a
B	14.97 b	14.17 b	20.00 ab	17.40 ab	16.63 b	94.60 cd	121.80 ab	131.33 ab	89.80 d	109.38 b
Effect of seaweed extracts	16.18 b	18.35 ab	21.73 a	17.73 ab		94.97 b	131.50 a	137.07 a	102.57 b	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

Table (8) Refer to the effect of seaweeds extracts , cultivar and their interaction on mineral nutrient content of peas, the data showed that there was significant differences in nutrient according to the percentage of nitrogen in cultivar A significantly increased the percent of nitrogen which reaches(3.64%) compared with (3.37%) in the cultivar B, in the same time there was significant differences on nitrogen percentage as a result of the concentration of seaweeds extracts on the other hand the effect of interaction between the treatment indicated that there was significant difference in the interaction between plant treated with 4ml.L^{-1}cultivar A, which gave high percentage of nitrogen which reached (3.89%) compared with untreated plants treatments.

Concerning the percentage of phosphor in the seeds of pea it also refers that the cultivar showed significant increase in A cultivar which reaches (0.29%), on the other hand the effect of interaction between the treatment indicated that there was significant difference in the A cultivar and concentration of seaweeds extracts at 6m.L^{-1} ,that gave high value of phosphorus (0.36%) compared with the untreated plant with seaweeds extracts .

In the same time the percentage of potassium in the seeds of peas also showed significant increase among cultivar also in the concentration the seaweeds extract that showed significant different compared the untreated plant with seaweeds .Regarding the interaction the interaction between 4m.L^{-1}of seaweeds extracts and cultivar A gave higher value of potassium percentage (3.84%) compared the untreated plant with seaweeds.

Table (8) also refer to the effect of seaweeds extracts , cultivar and their interaction on percentage of protein in the pea, the data showed that there was significant differences in the percent of protein according to the cultivar, in cultivar A significantly increased which reaches (22.74%) compared with (21.06 %) in the cultivar B, in the same time there was significant differences in protein percentage as a result of the concentration of seaweeds extracts on the other hand the effect of interaction between the treatment indicated that there was significant difference in the interaction between plant treated with 4ml.L^{-}1and cultivar A which gave high percentage of protein (24.22%) compared with control plants treatments.

Table -8:Effect of seaweeds extract ,cultivar and their interactions on nutrient content and protein percent of pea.

Cultivar	Nitrogen %				Effect Of cultivars	Phosphorus%				Effect of cultivars
	Seaweeds extracts					Seaweeds extract				
	0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}		0	2ml.L^{-1}	4ml.L^{-1}	6ml.L-1	
A	3.04 bc	3.85 a	3.89 a	3.84 a	3.64 a	0.22 bc	0.28 ab	0.32 ab	0.36 a	0.29 a
B	2.71 c	3.61 ab	3.85 a	3.31 ab	3.37 b	0.21 c	0.33 ab	0.22 a-c	0.35 a	0.27 b
Effect of seaweeds extracts	2.88 b	3.73 a	3.84 a	3.57 ab		0.24 b	0.30 ab	0.27 ab	0.35 a	

Cultivar	Potassium%				Effect Of cultivars	Protein%				Effect of cultivars
	Seaweeds extracts					Seaweeds extracts				
	0	2ml.L^{-1}	4ml.L^{-1}	6ml.L^{-1}		0	2ml.L^{-1}	4ml.L^{-1}	6ml.L-1	
A	2.90 c	3.06 ab	3.84 a	3.51 ab	3.33 a	19.02 c	23.88 ab	24.22 a	24.00 ab	22.74 a
B	2.63 c	3.07 ab	3.06 ab	3.55 ab	3.08 b	16.95 c	22.54 bc	24.07 a	20.68 bc	21.06 b
Effect of seaweeds extracts	2.77 b	3.07 ab	3.45 a	3.53 a		17.99 b	23.21 ab	24.07 a	22.34 ab	

Means within a column, row and their interactions followed with the same letters are not significantly different from each other according to Duncan's multiple range test at 5% level.

B. Discussion

Tables (1, 2 and 3) show significant increase in plant heights, branch number, leave area and total chlorophyll SPAD, increasing vegetative growth components by the effect of cultivar and seaweeds extracts may be attributed to the role of seaweeds extracts on improving soil fertility and increasing the availability of nutrient element. Important plant hormones like Auxins, Gibberellins and Cytokine which induce cell division and increasing cell enlargement and lead to balance of physiological and biological processes and consequently growth characteristics would be improved *[17]*.

It is observed from the mentioned results that a significant increase occurred in pods length, number of seeds.pods-1, number of pod.plant-1 weight of dry seeds.pod^{-1} and length of nodules, width of nodules and number of nodols.plant^{-1} early yield and total yield gm.plant^{-1} the improvement of fruit quality may be attributed to better growth of plant (Table 1, 2 and 3) as results of different rate of seaweeds extracts. The effect of seaweeds extracts on the growth of nodal potato explants cultured in vitro was examined. 0.2% SWC significantly accelerated shoot growth and development. When applied at a concentration of 0.4% the number of axillary shoots per node increased. Seaweeds have been utilized in agriculture for many centuries. Commercial exploitation of seaweed as a plant additive has however, met with variable success owing to conflicting reports on the value of seaweed for crop improvement. Reports in recent studies showed that seaweed concentrates increase plant vigor and yield have resulted in a renewed interest in the modern day application of commercial preparations.

Because of the many adverse effects of synthetic fertilizers upon the environment there is a need for natural sources of fertilizers and soil ameliorants. This combined with the ability of seaweeds to improve plant growth, their ease of application and relatively low costs, has led to an increased interest in natural seaweed products., seaweed extracts may be due to its role in increasing the leaves numbers, leaf area and dry weight so the physiological activities as photosynthesis and providing plant by nutrition and these could

be the reasons of increasing fruit weight *[18]*. The effect of seaweed extracts lead to increase the percentage of the total soluble substances because of its effect on increasing leaf area and efficiency of the photosynthesis process *[19]*.

Concentrations of N. P and K., were increased in the seeds of pea receiving seaweeds extracts as shown in Tables(8). These data indicated that the growth of pea plants was improved by cultivar and seaweeds extracts as a result of increase nutrient content in leaves. With respect to bio-stimulants, it was found that seaweeds extracts has an enhancing effect on the absorption and translocation of minerals. This may be due to its effect on enhancing metabolism. They also found that extracts has an enhancing effect on the absorption and translocation of minerals *[20]*. This might contribute to regulating the nutritional and the adaptability state of stressed plants *[21]*.Increasing P soil content due to the application of organic fertilizers (Table 8) might be a result of its decomposition and producing organic acids, which increases the nutrients availability in the soil *[22]*.

Concerning the protein percentage in seeds of pea plant it was show from table (8) that the rate of protein was through the effect of the cultivar and concentration of seaweeds extracts which may be due to the improving vegetative growth of plant and up taking the nutrient element that make plant better in the rate of protein. Effect of seaweeds concentrations and cultivar on protein percentage increase may be due to the improvement of nutrient uptake which causes better vegetable growth *[23; 24]*.

References

[1] Hassan, A.A., "*Vegetable fruits*". Al-Dar Al-Arabia Publications and distribution Cairo, Egypt, pp: 241. (1997).

[2] Vance, C.P.; Graham P.H. and Allen D.L. "*Biological nitrogen fixation phosphorus*", A critical future need, FoPedrosa, M. Hungria, M.C., Yates and W.E. Newton, eds., Nitrogen fixation from molecules to crop productivity. Kluwer Academic Publishers. Dordercht, The Netherlands, pp. 506-514. (2000).

[3] Central Statistical Organization- Iraqi. "*Ministry of planning*", mop/ www.mop.gov.iq.for agricultural production. (2012).

[4] Kowalski, B.; Jager, A.K. and AnstadenJ. V. "*The effect of seaweed concentrate on the invitro growth and acclimatization of the potato plants*", Potato Research, Vol.(42), No.1, pp. 131-139. (1999).

[5] Datta, A. S.; Das, M. B. and Basu, T.K. "*Effect of krikelp powder (seaweed extract) and inorganic fertilizer on growth and productivity of pigeon pea under new alluvial zone of West Bengal*", Environment and Ecology, Vol.(21), No.4, pp. 823-826. (2003).

[6] Saravanan, S.; Thamburaj, S. V.; Eeraragavathatham, D. and Subbiah, A. "*Effect of seaweed extract and chlomequat on growth and fruit yield of tomato (Lycopersicon esculentumMill)* ", Indian Journal of Agricultural Research, Vol. (37), No.2, pp.79-87. (2003).

[7] Parthiban, C.; Saranya, C.; Hemalatha, A.; Kavith, B. and Anantharaman,P. "*Effect of seaweed liquid filterer of Spatoglossumasperumon the growth and pigment content of Vignaradiata*", International Journal of Recent Scientific Research, Vol.(4), pp. 1418–1421. (2013).

[8] Houssien,A.A.; Ismail, A.A. and Sabra,F.S. "*Bioactive substances extracted from seaweeds as a biocontrol agents, effects and identification"* , Journal of Agricultural Research, Vol. 37, pp. 460–473. (2011).

[9] Bhaskar, N. and Miyashita, K. "*Lipid composition of Padinatetratomatica (Dictyotales, Phaeophyta), a brown seaweed of the west coast of India*", Indian Journal of Fisheries, Vol.(52), pp. 263-268. (2005).

[10] Spann, T.M. and Little, H.A. "*Applications of a commercial extract of the brown seaweed Ascophyll and umnodosum increases drought tolerance in container-grown 'Hamlin' sweet orange nursery trees*", Hort. Science, Vol.(45), pp. 1-6. (2011).

[11]Khan, W.; Rayirath, U.P.; Subramanian, S.; Jithesh, M.N.; Rayorath, P.; Hodges,A.T.; Critchley, J.S.; Craigie, J.; Norrie, B. and Prithiviraj, D.M. "*Seaweed extracts as bio-stimulants of plant growth and development*", Journal of Plant Growth Regulators, Vol.(28), pp. 386–399. (2009).

[12] Anonyme. "*Humic Acid*", Plant Meds (American Lawn Care Company). Washington.File://G:.humicacid.htm. (2005).

[13] Bn Salman, M.M. "*Effect of soil content of moisture, salinity and pacloputrazol, (PP333) on vegetative growth, flowering and mineral content of tomato plant (Lycopersiconesculentume Mill) Early person cv*". MSc. Thesis, college of Agriculture and Forestry, University of Mousel. Ministry of Higher Education and Scientific Research- Republic of Iraq. (1996). (In Arabic).

[14] AL-Sahaf, F. H. "*Practical Plant Nutrition*", Ministry of Higher Education and Scientific Research. Bagdad Univ. Iraq. (1989). (In Arabic).

[15] A.O.A.C. "*Official Method of Analysis*", 11th edition Washington D.C. Association of official analysis chemist. P. 1015. (2000).

[16] Matt, J. "*Calorimetric Determination of Phosphorus in Soil and Plant Material with Ascorbic Acid*", Soil. Sci., Vol.(109), pp. 219-220. (1970).

[17] Jianguo, Y.U.; Shuiying, Y.E.; Ujuan, Z. Y. and Yingchang, S. "*Influence of humic acid on the physiological andbiochemical indexes of apple tress*", Forest Res., Vol.(11), No.6, pp.623-628. (1998).

[18] Al- Saaberi, M. R. S. "*Effect of Some Agricultural Treatments on Growth, Yield of Lettuce Lactuc sativa L*", MS.C Thesis Horticulture Sciences University of Mosul College of Agriculture and Forestry. (2005).

[19] Jensen, E. "*Seaweed, fact or fancy*". Published by Moses the Midwest Organic and Sustainable Education. From the broad Caster. Vol.(12), No.3, pp.164-170. (2004)

[20] Sivakumar, K. and Devarajan, L. "*Influence of K- humate on the yield and nutrient uptake of rice*", Madras Agricultural Journal, Vol.(92), pp. 718-721.(2005).

[21] Jianguo, Y.U.; Shuiying, Y.E.; Yujuan, Z. and Yingchang, S. "*Influence of humic acid on the physiological andbiochemical indexes of apple tress*", Forest Res., Vol.(11), No.6, pp.623-628. (1998).

[22] Mahmoud, M.R. "*Improvement of soil fertility and sorghum production as a result of composts and phosphorus fertilizers application*", Minia J. of Agric. Res. and Develop. Vol.(20), No. 3, pp.553-572. (2000).

[23]Akinremi, O.O.; Janzen, H.H.; Lemke, R.L. and Larney, F. J. "*Response of canola, wheat and green beans to leonarditeadditions*", Canadian Journal of Soil Science, Vol. (80), pp. 437-443.(2000).

[24] Padem, H.; Ocal, A. and Alan, R. "*Effect of humic acid added foliar fertilizer on seedling quality and nutrient content of eggplant and pepper*", Acta Horticulture, Vol.(491), pp. 241-246. (1997).