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Effect of sowing dates and foliar spray with algae extract on cluster bean (*Cyamopsis tetragonoloba* L.)

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Abstract : This research was conducted at El-Qantara Sharq station, North Sinai, Egypt for Desert Research Center during the two successive seasons of 2013 and 2014. The main objective was to study the effect of different planting dates (1st May, 15th May and 1st June), the concentrations of various algae extract (0, 1, 2 cm^3/l) and the interaction on the vegetative growth, production of seed yield and Guaran content in *Cyamopsis tetragonoloba* L. plant. The obtained results indicated the possibility of obtaining the highest values of the vegetative growth, seed yield, guaran content and chemical components in Guar plant, when the plants are cultivated on 1st May and sprayed with algae extract at a rate of 2 cm^3/ L under the conditions of the experiment.
Keywords: Cluster bean- sowing dates - extract algae - *Cyamopsis tetragonoloba* L.-Guar.

Introduction

Cyamopsis tetragonoloba or Cluster bean or Guar belongs to the family Fabaceae (Leguminaceae) (Wongand and Parmar [1]). This plant proved to be drought tolerant and grown in the arid and semi-arid land, cultivated successfully under the Egyptian environmental conditions, especially in Sinai; (Razin [2] and Razin *et al.* [3]).The economic importance due to the guar plant is a natural source of galactomannan,known commercially as guar gum, at ranging content between 25-30% of the seeds; (Synthelabo[4]), this gum is characterized by high weight viscosity and the ability to blend into the cold water, allowing its use in the food industry and in pharmaceuticals. It is used as an appetite suppressant, laxative, loss of appetite, anti-ulcer, and hypoglycaemia (Undersander*et al.*[5]).It is used in some industries such as petroleum and textile crackers, paper, ink, adhesives and plastics industry, tobacco industry, pharmaceutical industry and cosmetics. The seeds contain 21-25% protein (Haksar and Kendurkar[6]) making the plant is used as fodder for cattle. Guar contains many important nutrients and phytochemical such as saponin and flavonoids and is well-known as a traditional plant used in folklore medicine as reported by Duck[7]. Pavithra and Lakshmi[8] show that the results of the study revealed that the compost applied to guar plants (*Cympopsis tetragonoloba*) showed increased germination percentage, root length, shoot length and number of leaves than the untreated plants.

The planting date specified for the production of the crop's success or failure is determined by the date of appropriate agricultural factors such as temperature in the area, the length of the lighting period and the intensity of radiation.

Some studies on sowing dates had been carried out by Deka *et al.* [9] on cluster bean plant showed that, 1st July sowing at 45 x 30 cm spacing was suitable for cluster bean production where economics was also most remunerative option with a highest benefit; cost ratio of 2.83 on *Cyamopsis tetragonoloba* L. (Ali *et al.* [10]). Results of the early planting date on *Trigonella foenum-graecum* L., increased the yield, active ingredients and

protein content in the seeds. (Mansur, *et al.*[11], Hayawi [12] , Kaya *et al.* [13], Khalaf [14], Lopez *et al.* [15]) found that, the different sowing dates affected on the dry matter, plant height and seed yield of Chickpea. (Attememe [16]) on *Rosmarinus officinalis* L., and (Satyanarayana[17]) on *Plantago ovate*stated that the early sowing date improved significantly vegetative growth characters, oil yield, and plant height, fresh and dry weights and increased the chemical components.

The application of blue-green algae is one of the recent trends in bio-fertilization of plants where it contains high levels of organic matter, which represents 50% decrease of the chemical fertilizers cost (Gollan and Wright [18]) raising the production and increasing the capacity of plant to withstand various stress conditions; however it contains alga *Ascophyllum nodosum* that has 62% of the amino acids, such as (Tyrossine, Proline, Glycine, Tryptophane, Glutamic acid… etc.) and many of the most important vitamins including vitamin B-12. Algae extract also contains protein at 58.2% by dry weight, carbohydrates represent 23.2 - 24.5% of its weight (Chapman and Chapman [19], Senn [20]) as well as it contains high levels of the major mineral elements which are important and necessary for plant growth, (Cu, Fe, Ca, Mg, Mn, P, and Zn) (Marrez *et al.*[21]). It contains high levels of various plant hormones such as auxin and cytokinin, which is considered an important and vital for plant growth and increase production worker as reported by Kemka *et al.*, [22], Aly and Esawy [23], Mokhaimer [24].

Algae extract foliar application was recommended for increasing the growth parameters, chemical constituents and yield components of *Lepidium sativum* L. and *Plantago ovate* (Bashir[25]), common bean (Hegazi *et al.*[26]), soybean (Rathore *et al.*[27]), *Trigonella foenum-graecum* L. (Pise and Sabale[28]), *Cyamopsis sp*. (Ramya *et al*.[29]) and *Cyamopsis tetrogonolaba* (Thirumaran *et al.*[30]). Genaidy *et al*[31] found that treating seedling of olive with algae extract when planted under sandy culture recorded the maximum values of number of leaves/seedling and gave the tallest root/ seedling. The main objective was to study the effect of different planting dates, the concentrations of various algae extract and the interaction on vegetative growth, production of seed yield and Guaran content in *Cyamopsis tetragonoloba* L. plants.

Materıals and Methods

The present work was carried out at El-Qantara Sharq station, North Sinai, Egypt at Desert Research Center during the two successive seasons of 2013 and 2014; aiming to investigate the effect of planting date and spraying with green algae extract and their interactions on the vegetative growth, guaran production and chemical constituents of guar plant. Guar (*Cyamopsis tetragonoloba*L.) seeds were obtained from Research Centre of Medicinal and Aromatic Plants, Dokky, Giza. Seeds were sown on 1st May, 15th May and 1st June in both seasons. After three weeks from planting, germinated plants were thinned to be one plant/hill. The irrigation water through drip irrigation and the plants received normal agricultural practices whenever they were needed. The mechanical and chemical properties of the used soil are shown in Table (A) according to Chapman and Pratt [32].

Table (A): Mechanical and chemical properties of the experimental soil.

Mechanical analysis	Value	Chemical analysis					
		Soluble anions (meq/l)	Value	Soluble cations (meq/l)	Value	Available (mg/l)	Value
Fine sand %	43.28	CO_3^-	-	Ca^{++}	8.92	N	0.16
Coarse sand %	42.26	Cl^-	9.00	Mg^{++}	7.95	P	13.21
Silt %	13.28	SO_4^{--}	25.35	Na^+	20.42	K	69.67
Clay %	1.18	pH	8.29	K^+	1.21	$CaCO_3$	6.20
Soil texture	Sandy			E.C mmhos/ cm	3.85		

The plot area was 2× 3 m^2, and each plot contained 40 plants. The distance between rows was 50 cm. and 30 cm. between hills. The experimental design was split plot including 9 treatments with three replications; planting date in the main plot, while spraying with the algae extract in the sub plot. The concentrations of algae extract (A.E.) were [(control, 1 and 2 cm/L)], while the planting dates were on (1st May, 15th May and 1st June). The source of algae extract is from Algal Biotechnology Unit, National Research Center, Egypt.The plants were sprayed with algae extract after 60 and 90 days from sowing and the untreated plants were sprayed with tap water until the run off.

The following data were recorded:

1. Vegetative growth parameters: Growth parameters for guar included the following measurements: plant height (cm), number of branches / plant, dry weight/ plant (g).

2. At harvesting, the central rows of each plot were used for yield component determinations of guar plants as follows:

Pods of guar were harvested after 150 days of seed sowing in both seasons to determine: weight of seeds per plant (g) and yield of seeds per feddan (Kg) which calculated as follows; yield of seeds/feddan (fed.) = seed yield/plant x No. of plants/feddan for each treatment and seed index (g) (weight of 1000 seeds).

3. Chemical constituents determination: Guaran percentage was determined only in guar seeds according to the method described by (Anderson[33]) guaran content per plant (g) was calculated by multiplying the guaran percentage by weight of seeds per plant for each treatment, Guaran content per feddan was calculated by multiplying the guaran content per plant by number of plants/fed. for each treatment, total carbohydrate percentage was determined in guar seeds according to (Dubios *et al.*[34]), total nitrogen percentage was determined in guar seeds according to (Naguib[35]), total protein percentage was calculated in either seeds of guar by multiplying total nitrogen percentage by the factor 6.25 to obtain the percentage of total protein, total phosphorus percentage was determined in guar seeds according to the methods adapted by (Hucker and Catroux[36]), and potassium percentage was determined in guar seeds by using flame photometer according to the method described by (Brown and Lilleland[37]).

Data of the present work were statically analyzed and the differences between the means of the treatments were considered significant or highly significant when they were more than the least significant differences (L.S.D) at the 5% level using the computer program (Statistic version[9]) (http://www.statistix.com/freetrial.html) (Analytical Software[38]).

Results and Dıscutıon

1- Effect of the sowing dates:

Effect of the sowing dates on the growth of guar are presented in Table (1) results showed that the vegetative growth parameters are significantly affected in the first sowing date (1stMay) giving the highest value for plant height (124.47 and 126.96 cm.), number of branches per plant(17.42 and 19.16) and dry weight per plant (224.61 and 274.85 g.) in the first and second seasons; respectively.

Table (1): Effect of the sowing dates on the vegetative growth parameters of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments	Plant height (cm)		Number of branches per plant		Dry weight of plant per plant(g)	
	Season1	Season 2	Season 1	Season 2	Season 1	Season 2
1st May	124.47	126.96	17.42	19.16	224.61	274.85
15th May	105.38	107.49	14.46	15.90	190.07	240.31
1stJune	95.70	97.62	11.44	12.59	172.55	222.79
L.S.D. at 5%	1.50	1.53	0.22	0.24	2.70	2.70

It was also observed that there was a direct relationship between growth and yield components determination of guar plants hence, that some sowing dates in Tables (2 and 3) gave the highest values for weight of seeds per plant (18.67 and 20.91g);seeds yield per feddan (522.82 and 585.56 kg);Guaran percentage (28.46 and 31.30 %); Guaran content per plant (5.35 and 6.59 g); Guaran content per feddan (149.99 and 184.79 kg); total protein percentage(23.73 and 25.16 %) and seed index (27.38 and 33.28 g) in 2014 and 2015; respectively.

Table (2): Effect of the sowing dates on the yield components of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments	Weight of seeds per plant(g)		Yield of seeds per fed. (kg)		Seed index	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
1st May	18.67	20.91	522.82	585.56	27.38	33.28
15th May	14.87	16.65	416.34	466.31	23.18	29.08
1stJune	12.94	14.49	362.35	405.84	21.06	26.96
L.S.D. at 5%	0.29	0.33	8.31	9.30	0.33	0.33

Table (3): Effect of the sowing dates on the active ingredients of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments	Guaran percentage		Guaran content per plant (g)		Guaran content per fed. (kg)		Protein percentage	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
1st May	28.46	31.31	5.36	6.60	149.99	184.79	23.74	25.16
15th May	23.10	25.42	3.44	4.24	96.35	118.70	18.90	20.03
1st June	20.39	22.43	2.64	3.26	74.01	91.18	16.47	17.46
L.S.D. at 5%	0.43	0.47	0.13	0.16	3.52	4.33	0.34	0.36

Furthermore, the presented data in Table (4) demonstrate that the early sowing date (1stMay) gave the highest values for chemical constituents such as total carbohydrate percentage (29.13 and 32.04 %), total nitrogen percentage (3.79 and 4.02 %), total phosphorus percentage(0.418 and 0.458 %) and total potassium percentage (1.22 and 1.25 %) in 2014-2015; respectively.

On the other hand, the data presented in Table (1) dissect that the later sowing date(1stJune) gave the lowest values of plant height (95.70and97.62 cm), number of branches per plant (11.44and 12.580 and dry weight of plant per plant (172.55and 222.79 g) in 2014 and 2015 seasons; respectively.

However, in Tables (2 and 3) the sowing date of 1st June was effective on yield production such as weight of seeds per plant (12.94 and 14.49g), weight of seeds per feddan (362.35 and 405.84 kg), Guaran percentage (20.39 and 22.43 %), Guaran content per plant (2.64 and 3.25 g), Guaran content per feddan (74.01 and 91.18 kg), total protein percentage (16.47 and 17.46 %) and seed index (21.05 and 26.95 g) in 2014 and 2015 seasons; respectively.

The data in Table (4) revealed that, the later sowing dates led to decreasing the highest values for chemical constituents as total carbohydrates percentage (26.54 and 29.19 %), total nitrogen percentage (2.63 and 2.79 %), total phosphorus percentage (0.290 and 0.317 %) and total potassium percentage (0.85 and 0.86 %) in 2014 and 2015 seasons; respectively.

Table (4): Effect of the sowing dates on the chemical constituents of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments	Carbohydrate percentage		Nitrogen percentage		Phosphorus percentage		Potassium percentage	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
1st May	29.13	32.05	3.80	4.03	0.419	0.459	1.23	1.25
15th May	27.41	30.15	3.02	3.20	0.333	0.364	0.98	1.00
1st June	26.54	29.20	2.64	2.80	0.290	0.318	0.85	0.87
L.S.D. at 5%	0.13	0.15	0.05	0.05	0.030	0.033	0.02	0.02

In fact, the earlier sowing date gave the highest productivity of guar content, which was increased significantly as compared with the different sowing dates. The increase in guar vegetative growth and its crop

might be due to the early sowing date, however, the content of the nutrients and active substances are correlated with availability of suitable environmental conditions. Activation of photosynthesis in relation to high temperature can be reflected on increasing the plant height; number of branches and plant weight through resulting in the availability of the heat requirement to increase the proportion of the flowers on the plant and thus increasing the contract on the plant ratio due to increased photosynthesis rate and availability of food, which is reflected on the increase in the number of pods on the plant and the weight of seeds per plant, which is reflected the yield increase per acre resulting and subsequently increase of the active substance in the seeds. The results agreed with that obtained by (Ali *et al.* [10]) on *Cyamopsis tetragonoloba* L., and (Abd Al-Khaliq *et al.* [39]) on *Trigonell afoenum-graecum* L.

The later sowing date is not adequate to take the advantage of the appropriate thermal needs, and this declines the efficiency of the photosynthesis process with a shortage of food crisis for plant growth, where valley fever inhabited the pods from the fullness of seeds and thus the proportion of metabolic materials stored will fall and with the increase in equipment for respiratory process producing a small in weight by small amount of seeds, because the low grain harvest lowered the plant height and the number of nodes in the centuries that was reflected in the lack of seed yield per acre and thus the lack of effective material in seeds .This agreed with the work of (Satyanarayana[17]) on *Plantago ovate;* (Patel,[40]) on cluster bean; (Ali *et al.*,[10]) on *Cyamopsis tetragonoloba* L. and (Kaya, *et al.*,[13]) on *Cicer areitinum*.

2- Effect of algae extract

Increasing algae extract concentrations 1 or 2 cm^3/L increased significantly the vegetative growth parameters, yield components and chemical constituents as compared to the control in 2014 and 2015; respectively. The effect of algae extract concentrations on the growth of guar plants is presented in Table (5). The data revealed that the highest values for plant growth had been recorded when they were sprayed with 2 cm^3/L algae extract concentration in 2014 and 2015; respectively. The values increased gradually reaching the highest plant height of (114.3 and 116.6 cm.), number of branches per plant (15.3 and 16.9) and dry weight per plant (206.3 and 256.5 g) in 2014 and 2015; respectively.

Table (5): Effect of algae extract on the vegetative growth parameters of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments	Plant height(cm)		Number of branches per plant		Dry weight per plant(g)	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
Control	102.74	104.80	13.42	14.76	185.30	235.54
A.E. 1cm^3/L	108.48	110.65	14.56	16.01	195.69	245.93
A.E. 2cm^3/L	114.32	116.61	15.34	16.88	206.25	256.49
L.S.D. at 5%	1.57	1.60	0.25	0.28	2.83	2.83

The data in Tables (6 and 7) showed the highest values for weight of seeds per plant (16.65 and 18.64 g); weight of seeds per feddan (466.22 and 522.16 kg), guaran percentage (25.61 and 28.17 %), guaran content per plant (4.39 and 5.40 g), guaran content per feddan (122.91 and 151.43 kg), total protein percentage (21.18 and 22.45 %) and seed index (25.15 and 31.05 g) in 2014 and 2015; respectively.

Table (6): Effect of algae extract on the yield components of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments	Weight of seeds per plant(g)		Weight of seeds per fed. (kg)		Seed index	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
Control	14.34	16.07	401.62	449.82	22.60	28.50
A.E. 1cm^3/L	15.49	17.35	433.68	485.72	23.87	29.77
A.E. 2cm^3/L	16.65	18.65	466.22	522.16	25.15	31.05
L.S.D. at 5%	0.31	0.35	8.71	9.75	0.34	0.34

Table (7): Effect of algae extract on the active ingredients of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments	Guaran percentage		Guaran content per plant (g)		Guaran content per fed. (g)		protein percentage	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
Control	22.37	24.60	3.25	4.00	90.99	112.10	18.24	19.34
A.E. 1cm^3/L	23.97	26.37	3.80	4.68	106.44	131.13	19.68	20.86
A.E. 2cm^3/L	25.61	28.18	4.39	5.41	122.91	151.43	21.18	22.45
L.S.D. at 5%	0.44	0.48	0.16	0.20	4.60	5.67	0.38	0.41

Data in Table (8) presented the chemical constituents such as total carbohydrates percentage (28.21 and 31.04 %), total nitrogen percentage (3.38 and 3.59 %), total phosphorus percentage (0.373 and 0.410 %) and total potassium percentage (1.09 and 1.11 %) in 2014 and 2015; respectively.

Table (8): Effect of algae extract on the chemical constituents of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatment	Carbohydrate percentage		Nitrogen percentage		Phosphorus percentage		Potassium percentage	
	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
Control	27.18	29.89	2.92	3.09	0.322	0.351	0.94	0.96
A.E. 1cm^3/L	27.69	30.46	3.15	3.34	0.347	0.380	1.02	1.04
A.E. 2cm^3/L	28.22	31.04	3.39	3.59	0.373	0.410	1.10	1.12
L.S.D. at 5%	0.13	0.15	0.054	0.054	0.023	0.026	0.020	0.022

The effects might be attributed to strengthen the impact of the algae extract on the laurel plant growth characteristics to the auxin content of the algae extract, which has an active role in cell division, which is reflected in the increase in the length, number of branches and the dry weight / plant (Golan and Wright[18]). It is well known that algae extract is a rich source of potassium and contains large amounts of calcium, copper, iron, magnesium, manganese, phosphorus, zinc (Marrez *et al* [21]), which have a significant role in cell division and expansion as well as stimulate the process of photosynthesis, and this in turn is reflected on the increase in plant growth, the number of pods and seeds per plant (Lopez *et al.*,[41]). It also contains key nutrients (N, P and K), which are very essential for the growth and development of plants (Chapman and Chapman[19], Attememe[16]). These results may explain the great benefits of algae extract to complete the laurel plants with the requirements of organic and non-organic food (Zodape[42], Khan, *et al* [43]).

These results reflected the great benefits of algae extract on supplementing guar plants with their requirements from organic and mineral nutrients. These results are in conformity with those reported by(Shalaby and El-Ramady[44]) on garlic; (Tantawy and Atef,[45]) on *Lupinus termis*; (Pise and Sabale,[28]) on *Trigonella foenum-graecum* L. and (Abou El-Khair, *et al* [46]) on garlic plant.

3- Effect of the interaction

Data presented in Table (9) showed that the vegetative growth parameters, yield components and chemical constituents of guar seeds were significantly influenced by the interaction between sowing dates and algae extract concentrations in 2014 and 2015; respectively.

The sowing date of 1stMay with application of 2 cm^3/L algae extract affected significantly on the highest values of vegetative growth parameters such as plant height (134.56 and 137.26 cm), number of branches per plant (18.26 and 20.09) and dry weight per plant (242.88 and 293.12 g) in 2014 and 2015; respectively.

The data in Tables (10 and 11) showed that the yield components increased, such as: weight of seeds per plant (20.68 and 23.16 g), weight of seeds per feddan (579.14 and 648.64 kg), guaran percentage (31.29 and

34.42 %), guaran content per plant (6.47 and 7.97 g), guaran content per feddan (181.30 and 223.36 kg), total protein percentage (26.29 and 27.87 %) and seed index (29.60 and 35.50 g) in 2014 and 2015; respectively.

Table (9): Effect of the interaction between the sowing dates and algae extract on the vegetative growth parameters of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments		Plant height (cm)		Number of branches per plant		Dry weight per plant (g)	
		Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
1st May	Control	113.54	115.81	16.50	18.15	204.84	255.08
	A.E. 1cm^3/L	125.30	127.80	17.50	19.25	226.11	276.35
	A.E. 2cm^3/L	134.56	137.26	18.27	20.09	242.88	293.12
15th May	Control	93.00	107.03	14.57	16.02	189.26	239.50
	A.E. 1cm^3/L	102.05	104.09	13.40	14.74	184.05	234.29
	A.E. 2cm^3/L	104.00	111.34	15.40	16.94	196.90	247.14
1st June	Control	92.63	94.49	10.37	11.40	167.00	217.24
	A.E. 1cm^3/L	95.22	97.13	11.60	12.76	171.69	221.93
	A.E. 2cm^3/L	99.25	101.23	12.37	13.60	178.97	229.21
L.S.D. at 5%		2.66	2.71	0.42	0.46	4.81	4.81

Table (10): Effect of the interaction between the sowing dates and algae extract on the yield components of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments		Weight of seeds per plant(g)		Weight of seeds per fed. (kg)		Seed index		Total protein percentage	
		Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
1st May	Control	16.49	18.48	461.85	517.28	24.98	30.88	20.96	22.22
	A.E. 1cm^3/L	18.84	21.10	527.48	590.77	27.56	33.46	23.96	25.40
	A.E. 2cm^3/L	20.69	23.17	579.14	648.64	29.61	35.51	26.30	27.87
15th May	Control	14.21	15.91	397.79	445.53	22.45	38.35	18.06	19.15
	A.E. 1cm^3/L	14.78	16.56	413.87	463.54	23.09	28.99	18.75	19.88
	A.E. 2cm^3/L	15.62	17.49	437.37	489.85	24.01	29.91	19.88	21.07
1st June	Control	12.33	13.81	345.22	386.65	20.38	26.28	15.71	16.65
	A.E. 1cm^3/L	12.85	14.39	359.69	402.86	20.95	26.85	16.33	17.32
	A.E. 2cm^3/L	13.65	15.28	382.15	428.01	21.83	27.73	17.38	18.42
L.S.D. at 5%		0.53	0.59	14.78	16.54	0.59	0.59	0.63	0.68

Table (11): Effect of the interaction between the sowing dates and algae extract on the active ingredients of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments		Guaran percentage		Guaran content per plant (g)		Guaran content per fed. (g)		Total protein percentage	
		Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
1st May	Control	25.40	27.94	4.19	5.16	117.32	144.54	20.96	22.22
	A.E. 1cm^3/L	28.69	31.56	5.40	6.66	151.34	186.45	23.96	25.40
	A.E. 2cm^3/L	31.29	34.42	6.48	7.98	181.30	223.36	26.30	27.87
15th May	Control	22.17	24.39	3.15	3.88	88.21	108.68	18.06	19.15
	A.E. 1cm^3/L	22.98	25.28	3.40	4.19	95.12	117.19	18.75	19.88
	A.E. 2cm^3/L	24.16	26.58	3.78	4.65	105.70	130.23	19.88	21.07
1st June	Control	19.53	21.48	2.41	2.97	67.43	83.08	15.71	16.65
	A.E. 1cm^3/L	20.25	22.28	2.60	3.21	72.86	89.76	16.33	17.32
	A.E. 2cm^3/L	21.39	23.53	2.92	3.60	81.73	100.70	17.38	18.42
L.S.D. at 5%		0.75	0.83	0.26	0.32	7.37	9.07	0.63	0.68

Data in Table (12) reflected that, the treatment of 1stMay and 2 cm^3/L algae extract gave the highest values for chemical constituents such as: total carbohydrates percentage (30.04 and 33.04 %), total nitrogen

percentage (4.20 and 4.46 %), total phosphorus percentage (0.460 and 0.510 %) and total potassium percentage (1.36 and 1.38 %) in 2014 and 2015; respectively compared to the other treatments.

Table (12): Effect of the interaction between the sowing dates and algae extract on the chemical constituents of *Cyamopsis tetragonoloba* plant in 2014 and 2015 seasons.

Characters / Treatments		Total carbohydrate percentage		Nitrogen percentage		Phosphorus percentage		Potassium percentage	
		Season 1	Season 2	Season 1	Season 2	Season 1	Season 2	Season 1	Season 2
1st May	Control	28.15	30.96	3.35	3.56	0.373	0.403	1.08	1.11
	A.E. 1cm^3/L	29.21	32.13	3.83	4.06	0.423	0.463	1.24	1.26
	A.E. 2cm^3/L	30.04	33.05	4.21	4.46	0.460	0.510	1.36	1.39
15th May	Control	27.11	29.82	2.89	3.06	0.317	0.347	0.93	0.95
	A.E. 1cm^3/L	27.37	30.11	3.00	3.18	0.330	0.363	0.97	0.99
	A.E. 2cm^3/L	27.75	30.53	3.18	3.37	0.350	0.383	1.03	1.05
1st June	Control	26.27	28.90	2.51	2.66	0.277	0.303	0.81	0.83
	A.E. 1cm^3/L	26.50	29.15	2.61	2.77	0.287	0.313	0.85	0.86
	A.E. 2cm^3/L	26.86	29.55	2.78	2.95	0.307	0.337	0.90	0.92
L.S.D. at 5%		0.24	0.27	0.10	0.11	0.044	0.049	0.03	0.04

The effect may be attributed to the interaction between the sowing dates and spraying with algae extract in relation to the cultivation of the plants as relation to took necessary for the growth of the heat requirement and that might be achieved through spraying algae extract to activate Indol Acetic Acid (IAA) and lead to increasing photosynthesis, which is reflected in the vegetative growth parameters, yield components and chemical constituents determination. Studies of (Shehata, *et al.*, [47]) on celeriac plant, (Sridhar and Rengasamy [48]) on *Tagetes erecta*; (Haroun and Hussein, [49])on *Lupinus termis* and (Thirumaran, *et al.*, [50], Patel [40], Ali *et al.*, [10]) on *Cyamopsis tetrogonolaba* L. showed similar results.

References

1. Wong, L. J. and Parmar, C., 1997. *Cyamopsis tetragonoloba* (L.) Taubert. Record from Prose abase. Faridah Hanum, I & van der Maesen, L.J.G. (Editors). PROSEA (Plant Resources of South-East Asia) Foundation, Bogor, Indonesia.
2. Razin A. M. 1978. Effect of major nutrients and water levels on the biochemical constituents of guar plants *Cyamoposis tetragonoloba*. M.Sc. Thesis, Ain Shams Univ., Cairo.
3. Razin, A. M.; Eid, M. N.; El-Damati, A. H. and El-Hinnawy, S. I. 1980. Effect of irrigation and fertilization on growth and mucilage of guar plant (*Cyamoposis tetragonoloba*) Bull. NRC.
4. Synthelabo, S. A. 1969. Guar gum-containing composition for treating gastrointestinal disorders. Appl. 6941 821, e4 Dec.; 6 pp. Chem. Abst., Vol. 77, 3624a (1972).
5. Undersander, D. J. ; Putnam, D. H. ; Kaminski, A. R. ; Kelling, K. A. ; Doll, J. D. ; plinger, E. S. and Gunsolus, J. L., 1991. Guar. In alternative Field Crop Manual, University of Wisconsin, University of Minnesota.
6. Haksar, C. N. and Kendurkar, S. G. 1959. Analysis and uses of guar gum. Research-Lab. Gover., Gwallior, India
7. Duke J.A., 2002. Handbook of medicinal herbs. 2nd Ed. CRC Press, Washington DC. pp: 118-119.
8. Pavithra, R. and M. Lakshmi, Prabha (2014) Degradation of Leaf Litter by Vermicomposting and its Effect of Growth on *Cyamopsis tetragonoloba*. International Journal of ChemTech Research 6, (5), 2985-2992
9. Deka K.K., Das Milu R., Bora P. and Mazumder, N. 2015. Effect of sowing dates and spacing on growth and yield of cluster bean (*Cyamopsis tetragonoloba*) in subtropical climate of Assam, Indian Journal of Agricultural Research 49(3):250-259.
10. Ali, Z.; Shafic, Zahul M.; Hussain, Ziaul M. and Bashu M. 2004. Sowing dates effects on growth, development and yield of guar (*Cyamopsis tetragonoloba* L.) under rainfed conditions of pothowar region. J. Agric Res. 42 (2): 33-40.

11. Mansour, B. M.; Boselah, N. A.; Youssef, and Amine, I. S. 1991. Effect of sowing dates on growth, seed yield and Alkaloids content of *Atropa belladonna* Linn. Bull. Fac of Agric. Univ. of Cairo/Eygpt. 24 (1): 71-86.
12. Hayawi, A. J. A. 2012. Effect of plant density and planting date on growth, yield components of chickpeas. M. Sc. Thesis, Fac. of Agriculture and Forestry, Univ., of Mosul, Iraq.
13. Kaya, M.; A. Sanli and M. Tonguc 2010. Effect of sowing dates and seed treatments on yield, some yield parameters and protein content of chickpea (*Cicera reitinum*). African Journal of Biotechnology, 9(25): 3833-3839
14. Khalaf, A. S. 2009. Effect of sowing dates on growth, yield and yield compo-nents of three varieties of winter chickpea (*Cicera rietinum* L.). J. of Duhok Univ., 12, (1): 39-42.
15. Lopez -Bellido, F. J.; Lopez –Bellido R. J.; Khalil Sh.K. and L. Lopez –Bellido 2008. Effect of planting date on winter kabuli Chickpea growth and yield under rainfed Mediterranean conditions. Agronomy Journal, 100: 957-964.
16. Attememe, J.Y.A., 2009. The effect of humic acid and seaweed extracts on the growth, chemical characteristics of *Rosmarinus officinalis* L. The 6thScientific conference, Biology Dept., College of Education, University of Tikrit. Plant Sci., 1-17.
17. Satyanarayana G. Reddy 2014. Effect of date of sowing and nitrogen on growth and yield of Isabgol (*Plantago ovata*) G. Satyanarayana Reddy, Agrotechnol, and 2:4.
18. Gollan, J.R. and J.T. Wright 2006. Limited grazing by native herbivores on the invasive seaweed caulerpa. Taxi folia in a temperate. Australia Estuary Marine and Fresh Water Research. 57(7):685-694
19. Chapman, V. J and Chapman, D.J. 1980. Seaweeds and their uses. 3rd ed. Chapman and Hall, USA. pp. 334.
20. Senn, T. L. 1987. Seaweed and plant growth. Faith printing co. Taylor, South Corolina, 166pp.
21. Marrez, D. A., Naguib, M. M.; Sultan, Y. Y.; Daw Z. Y. and Higazy, A. M. 2014. Evaluation of chemical composition for *Spirulina platensis* in different culture media. Res. J. Pharmaceutical, Biol. and Chem. Sci., 5(4): 1161-1171.
22. Kemka H.O.; Rebecca, A.A. and Gideon O.A, 2007. Influence of temperature and pH bioresource and protein biosynthesis in putative *Spirulina sp*. BioresourceTechnol, 98: 2207-2211.
23. Aly, M. S. and Esawy, M. A. 2008. Evaluation of *Spirulina Platensis* as bio-stimulator for organic farming systems. J. Genetic Eng. & Biotech., 6(2): 1-7.
24. Mokhaimer, G. A 2008. Blue green algae. Shams no (91). 2.
25. Bashir, A. 2007. Effect of different sowing dates on physiochemical attributes of halo on (*Lepidium sativum* L.) and isabgol (*Plantago ovata; Forssk*). University of Agriculture, Faisalabad (Pakistan). Dept. of Botany.
26. Hegazi, A.Z.; Mostafa, S.S.M. and Ahmed, H.M.I. 2010. Influence of different cyanobacterial application methods on growth and seed production of common bean under various levels of mineral nitrogen fertilization. Nature and Science Journal, 8(11):183-194.
27. Rathore, S. S.; Chaudhary, D. R.; Boricha, G. N.; Ghosh, A.; Bhatt, B. P.; Zodape, S.T. and Patolia, J. S. 2009. Effect of seaweed extract on the growth, yield and nutrient uptake of soybean (Glycine max) under rainfed conditions. South African Journal of Botany 75(2):351-355.
28. Pise, N.M. and Sabale, A.B. 2010. Effect of seaweed concentrates on the growth and biochemical constituents of *Trigonella foenum-graecum* L. Journal of Phytology, 2(4): 50–56.
29. Ramya, S. S.; S. Nagaraj and N. Vijayanand 2010.Bio fertilizing efficiency of brown and green algae on growth, biochemical and yield parameters of *Cyamopsis sp.* (L.) Taub. Recent Research in Science and Technology, 2(5): 45-52.
30. Thirumaran, G.; Arumugam, M.; Arumugam, R. and Anantharaman, P. 2009. Effect of seaweed liquid fertilizer on growth and pigment concentration of *Cyamopsis tetrogonolaba* (L) Taub. American-Eurasian Journal of Agronomy 2 (2): 50-56.
31. Genaidy E. A. E., M. A. Merwad and Laila, F. Haggag (2015) Effect of Algae, Humic Acid and Waste Organic Material in Culture Media on Growth Performance of "Picual" Olive Seedlings. International Journal of ChemTech Research 8, (11), 43-50.
32. Chapman, H. and Pratt, P. 1971. Methods of analysis for soil, plant and water. Univ. of California, Bull. No.376, Davis, Cal., 96616. U.S.A.
33. Anderson, E. 1949. Endosperm mucilage's of legumes: occurrence and composition. Ind. Eng. Chem. 41: 2887-2890.

34. Dubios, H.; Gillo, K.A.; Hamillon, J.; Robers, R. and Smith, I. 1956. Colorimetric method for determination of sugars and related substances. Anal. Chem. 28:350.
35. Naguib, M. I. 1969. Colorimeter determination of nitrogen components of plant tissues. Bull. Fac. Sci., Cairo Univ. 43: 1-9.
36. Hucker, T. W. G. and Catroux, G. 1980. Phosphorus in sewage ridge and animal waste slurries. Proceeding of the EEC Seminar, Haren (Gr); Groningen Netherlands, 12, 13 June.
37. Brown, J.D. and Lilleland, O. 1964. Rapid determination of potassium and sodium in plant material and soil extracts by flame photometer. Proc. Amer. Soc. Hort. Sci., 48: 341-46.
38. Analytical Software 1985: Data analysis software for researchers 1985.
39. Abd Al-Khaliq, S. Mahdi, Shurook M.K. Saadedin and Hassin A.y. 2009. Effect of seeding date and phosphate fertilizer on Growth and yield of pods of *Trigonella foenum-graecum*L. Tikrit Univ. of Agr. Journal Sciences Vol. 2 (9).
40. Patel, P.L., Pathak, A.R. and Patel, K. M. 2002. Correlated response in cluster bean (*Cyamopsis tetragonoloba* L. Taub). Prog. Agri. 2 (2); 189-190.
41. Lopez, R.; Cabrera, F.; Madejan, E.; Sancho, F. and Alvares, M. 2008. Urban compost as an alternative for peat in forestry nursery growing media. Dynamic soil. Dynamic plant, 1: 60-66.
42. Zodape, S. T. 2001.Seaweeds as a bio fertilizer, J SciInd Res, 60. 378-382.
43. Khan, W.; U.P. Rayirath; S. Subramanian; M. N. Jithesh; P. Rayorath; D. M. Hodges; A. T. Critchley; J. S. Craigie; J. Norrie and B. Prithiviraj 2009. Seaweed extracts as bio stimulants of plant growth and development. J Plant Growth Regul 28:386–399.
44. Shalaby, T.A. and El-Ramady, H. 2014. Effect of foliar application of bio-stimulants on growth, yield, components, and storability of garlic *(Allium sativum* L.). Australain Journal of Crop Sciences, 8(2):271-275.
45. Tantawy, S.T.A. and Atef, N.M. 2010. Growth responses of *Lupinus termis* to some plant growth promoting cyanobacteria and bacteria as bio fertilizers. Journal of Food, Agriculture & Environment Vol.8 (3&4): 1178-1183.
46. Abou El-Khair, E. E.; Al-Esaily, I. A. S. and Ismail, H.E.M., 2010. Effect of foliar spray with humic acid andgreen microalgae extract on growth and productivity of garlic plant grown in sandy soil. J. Product. &Dev., 15(3): 335- 354.
47. Shehata, S. M.; Abdel-Azem, H. S.; Abou El-Yazied, A. and El-Gizawy, A. M. 2011. Effect of foliar spraying with amino acids and seaweed extract on growth chemical constitutes, yield and its quality of celeriac plant. European Journal of Scientific Research. 58. (2), pp.257-265.
48. Sridhar, S. and Rengasamy, R. 2010. Effect of seaweed liquid fertilizer on the growth, biochemical constituents and yield of *Tagetes erecta*, under field trial. Journal of Phytology, 2(6): 61–68.
49. Haroun, S.A. and Hussein, M.H. 2003. The primitive effect of algal biofertilizers on growth, protein pattern and some metabolic activities of *Lupinus termis* plants grown in siliceous soil. Asian Journal of Plant Sciences, 2 (13): 944-951.
50. Thirumaran, G.; Arumugam, M.; Arumugam, R. and Anantharaman, P. 2009. Effect of seaweed liquid fertilizer on growth and pigment concentration of *Abelmoschus esculentus* (l) medikus. American-Eurasian Journal of Agronomy, 2 (2): 57-66.

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