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The difference in the Physiological response of the wheat plant to the effect of algae extracts and hydrogel

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Keywords: *Pithophora roettleri*, *Compsopogon caeruleus*, Bio Fertilization, Hydrogel, Wheat Growth Properties.

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Abstract:

The study aims to test the effect of two algae, Compsopogon *caeruleus*, and *Pithophora roettleri*, in three concentrations (2, 1, and 0.5). Hydrogel (4, 2) g/kg. The current study included vegetative growth characteristics: The wheat germination rate plant height, root length, water content, leave area, total chlorophyll content dry weight, root and shoot total, and. was affected by fertilization treatments. And their Interference with concentrations and gel. The treatments in which each alga was used alone outperformed the Interference treatment between them in terms of the dry weight of the shoot, as it reached 1.26 and 1.27 grams for C. *caeruleus* and P. roettleri, respectively, while the best treatment was for weight. Root dryness of P.roettleri alga amounted to 0.19 grams. As for plant height, the best treatments were recorded with P. roettleri and C. *caeruleus*, respectively, as they reached 50.03 and 49.17 cm. In root length, the highest length was recorded when treated with C. *caeruleus* algae and reached 13.19 cm. The highest leave area was also recorded when treated with P.roettleri algae and reached 12.47 cm. The highest total and total chlorophyll content was recorded. Chlorophyll a when treated with the alga C. *caeruleus* reached 22.70 and 8.44 mg/g, respectively, while chlorophyll's content reached the highest percentage in the algae P.roettleri and reached 15.15 mg/g. Adding the hydrogel at a concentration of 2g/kg soil had a significant effect on the mentioned characteristics, while it was the concentration of 4 gm/kg of soil for the gel had a significant increase in the concentration of chlorophyll a, b, and total chlorophyll an over the rest of the

treatments. Laboratory results showed the effect of aqueous extracts on the wet biomass of both algae, and with the two concentrations (1, 2%), there was a significant increase in (seed germination, length of the petiole, root, and dry weight for wheat. The results of the anvil experiments indicated the presence of varying effects of aqueous extracts of wet living mass. Both the interaction between the algae and the gel, along with their concentrations, played a stimulating and moral role in some of the studied traits.

Keywords: *Pithophora roettleri*, *Compsopogon caeruleus*, Bio Fertilization, Hydrogel, Wheat Growth Properties.

اختلاف الاستجابة الفسيولوجية لنباتات الحنطة لتأثير مستخلصات الطحالب والهلام المائي

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الخلاصة:

وتهدف الدراسة الى اختبار تاثير جنس *Compsopogon caeruleus* وجنس هو *Pithophora roettleri* ومعاملة التداخل (الطحلبين معاً) وبثلاث مكررات وفق تصميم القطاعات العشوائية الكاملة وثلاث تراكيز(٠,٥، ١، ٢٪)مع الهلام المائي (٢,٤) غم\كغم تربة لنباتات الحنطة صنف مودة نسبة انبات الحنطة ارتفاع النبات(سم)وطول المجموع الجذري(سم)والمحتوى المائي ومساحة الورقة (سم٢) ومحتوى الكلوروفيل الكلي ومحتوى كلوروفيل*a*ومحتوى كلوروفيل*b* الوزن الجاف(غم)للنبات(المجموع الجذري والمجموع الخضري) الى بهذه الطحالب اظهرت المعاملات وتداخلاتها مع التراكيز والهلام تفوق المعاملات التي استخدم فيه كل طحلب لوحده على معاملة التداخل بينهما في صفة الوزن الجاف للمجموع الخضري اذ بلغ١,٢٦,١,٢٧غم لكل من طحلب *C. caeruleus* وطحلب *P. roettleri* على التوالي في حين كانت افضل معاملة للوزن الجاف الجذري عند طحلب *P. Roettleri* إذ بلغ٠,١٩ غم اما ارتفاع النبات كانت افضل المعاملات *P. roettleri* و*C.caeruleus* على التوالي اذ بلغا ٥٠,٠٣,٤٩,١٧سم وفي طول المجموع الجذري بلغ اعلى طول عند المعاملة بطحلب *C. caeruleus* وبلغ١٣,١٩سم ولقد سجل اعلى مساحة ورقية عند طحلب *P. roettleri* وبلغ١٢,٤٧سم اما من حيث محتوى الكلوروفيل الكلي ومحتوى كلوروفيل*a*بلغت اعلى نسبة عند المعاملة بطحلب *C.caeruleus* وبلغا٢٢,٧٠و٨,٤٤ملغم\غم في حين بلغ محتوى كلوروفيل *b* اعلى نسبة عند الطحلب *P. roettleri* وبلغت١٥,١٥ملغم\غم .وان اضافة الهلام المائي عند التركيز٢غم\كغم تربة تاثير معنوي في الصفات المذكورة بينما كان التركيز٤غم\كغم تربة للهلام تفوق معنوي في كل من تركيز الكلوروفيل*a*و*b*والكلي على بقية المعاملات. واظهرت النتائج المختبرية لتاثير المستخلصات المائية للكتلة الحية الرطبة لكل من الطحلبين وبالتركيزين(٢،١)% زيادة معنوية في (انبات البذور,طول الرويشة,والجذير,والوزن الجاف. واشارت نتائج تجارب السنادين الى وجود تاثيرات متباينة للمستخلصات المائية للكتلة الحية الرطبة لكل من التداخل بين الطحالب والهلام مع تراكيزهما دوراً تحفيزياً ومعنوياً في بعض الصفات المدروسة.

الكلمات المفتاحية: *Pithophora roettleri*، *Compsopogon caeruleus*، التسميد الحيوي، الهلام المائي، خصائص نمو الحنطة.

1. Introduction:

Algae live in various environments in marine water, freshwater, and places where moisture is available. Algae differ among themselves, including small ones that cannot be seen without a microscope and consist of a single cell, and large ones [1]**.** Algae have been used in the field of fertilization and can be defined as the process through which the plant is provided with nutrients according to the method in which they are added to the plant. Mixing fertilizer with the soil may be sprayed on the plant, and [2] .Algae bio-fertilization led to a significant increase in plant height, fresh and dry weight of the root and shoot mass, and leaf area of the plant after decomposition of the algae extracts. Algae work to increase soil fertility [3]. Currently, the great interest in agriculture has led to the use of algae extracts as a new system. Because these extracts are non-toxic and eco-friendly [4]. Wheat is one of the most prominent cereal crops and the most cultivated and productive in the world. It has a role in achieving food security and contains a percentage of protein ranging from 8-14% [5]. Hydrogel products do not contain a group of colloidal substances. Water-philic trap hydrogel and these polymers have gained a wide position in recent years in the fields of crops due to their high ability to retain water. A study [6] indicated the use of fertilizers at a concentration of 120 kg/ha not coated with gel and 120 kg/ha coated with gel, It showed that the concentrations of fertilizer coated with gel achieved a significant increase in grain yield.

2. Materials and Methods

2.1 Collecting algae samples: Samples were collected on September 15, 2023, from the Tigris River in the Qayyarah area, Mosul District, Nineveh Governorate. Then the samples were washed with liquefied water several times, as well as with distilled water, to clean them of dust and dirt, and they were dried. Diagnosis of algae: Algae genera were identified based on phenotypic diagnosis, and their phenotypic characteristics were noted based on the taxonomic keys of algae.

2.2 Source of wheat seeds: Mawaddah wheat seeds were obtained from the Seed Certification Center in Nineveh and tested for their vitality. Hydrogel: The gel was prepared from local markets by a Turkish company. Source of agricultural soil: The soil was prepared from the village of Al-Kasr, southeast of Mosul, Al-Hamdaniya district, and was sieved to get rid of the stones that hinder the growth of seeds.

2.3 Preparation of aqueous extracts: Aqueous extracts of the two algae *(P. rottieri* and *C. cearuleus)* were prepared at concentrations(2,1,0.5)% weight/volume by mixing the dry living mass with distilled water using an electric mixer (Sliver Crest) type for ten minutes. It was filtered using Whatman filter paper and the filtrate was collected for use in laboratory

experiments and the wire house. The experiment with the anvils (the wirehouse): Anvils with a capacity of (6 kg), a height of (24 kg), and a diameter of (21 cm) were used in the experiment, and 10 wheat seeds were planted At a depth of 0.5 cm from the soil surface, 11/7/2023, with three replicates, 400 ml of extracts were added to the soil, and the control treatment was prepared by adding water only.

2.4 Characteristics of vegetative growth of wheat plants:

1- Plant height and root system length (cm) were measured using a ruler.
2- Leave area (cm). Leaf area = length of Leave x maximum width of paper x 0.905 [8].
3- Water content: The water content was estimated using the method of [7]. The third leaf (homogeneous in age and shape) was taken from the seedlings, and to obtain the dry Relative water content %=100×(dry weight - wet weight)/(dry weight - swelling weight)weight (D.W), it was dried for 48 hours as in the following equation
4- Estimating the dry weight of the shoot and root system: using an electric oven at (70) for (48) hours for drying.
5- Determination of chlorophyll in leaves: The content of total chlorophyll a and b in plant leaves was estimated according to the method and the light absorption of the filtrate was read at wavelengths (645-663) nm using a spectrophotometer. Total chlorophyll content (mg/g) = (A645) +8.02) A663) +20.2 [9].

3. Results and Discussion

3.1 Plant height (cm): It was noted from the results (1) that there were significant differences in the effect of hydrogel on the height of wheat plants, as the highest height was reached when the soil was treated with hydrogel at a concentration of 2 g/kg of soil, except the control treatment. The reason for this is that the gel is considered a good storage of nutrients, as it led to the retention of both water and nutrients. Providing it to the plant as needed during the growth period [5] and between the effects of the type of algae, there are no significant differences when treated with two algae *C. caeruleus* and *P. roettleri* in the height of wheat plants, while the lowest height was reached when treated with the synergy recorded 47.26 cm. The table shows the effect of algae concentrations, which is 2% concentration, amounting to 48.31%, although it was not significantly superior to the control treatment. As for the interference (algae and gel concentration), it was observed when treating the soil with algae and gel that there were no significant differences between the treatments. And in the interference (concentrations of algae extract and gel concentration). There are significant differences, as the gel at the concentration of 2 g/kg soil was significantly superior to the rest of the treatments and recorded 55.00 cm. The table also showed that there was no significant difference between the

algae used and its concentrations are rising Plant. As for the binary interference (algae and its concentrations and gelatin and its concentrations) between the presence of significant differences in the height of wheat plants, the highest was recorded The height of the plant when treated with interference at a concentration of 2% reached 56.67 cm, while the effect of the gel levels at a concentration of 2 g/kg soil did not differ significantly with algae and their concentrations. This reflects the role of the extract in increasing the growth and elongation of cells and tissues, as it plays an important role in the height of the plant because it contains growth-regulating hormones, including auxins, which It has a role in cell division in topical meristem and thus increased plant length [2].

Table 1: The effect of aqueous extracts of algae and hydrogel on plant height (cm)

Algae type	Algae con(%)	Hydrogel con.gm\kg soil			Algae type Algae con.	Effect of algae type	Effect of algae con.
		Control	2	4			
C. caeruleus	0.0	1.44 cde	1.88 a	1.53 bc	1.62 a		
	0.5	1.19 f-i	1.67 b	0.84 k	1.23b		
	1	1.50 bcd	0.73 kl	0.73 kl	0.99 d		
	2	1.30 d-h	1.20 f-i	1.25 e-i	1.25 b		
P. roettleri	0.0	1.44 cde	1.88 a	1.53 bc	1.62 a		
	0.5	1.13 g-j	0.85 k	1.32 c-g	1.10 c		
	1	1.33 c-g	1.27 e-i	0.84 k	1.15 bc		
	2	1.40 c-f	1.35 c-g	0.76 kl	1.17 bc		
Algae Interference	0.0	1.44 cde	1.88 a	1.53 bc	1.62 a		
	0.5	1.11 hij	1.28 d-i	0.46 mn	0.95 d		
	1	1.08 ij	0.94 jk	0.36 n	0.80 e		
	2	1.21 e-i	0.61 lm	0.43 mn	0.75 e		
Algae type * Hydrogel con.	*C. caeruleus*	1.36 a	1.37 a	1.09 c		1.27 a	
	P. roettleri	1.33 a	1.34 a	1.11 bc		1.26 a	
	Interference	1.21 b	1.18 bc	0.70 d		1.03 b	
	0.0	1.44 b	1.88 a	1.53 b			1.62 a
Algae con. * Hydrogel con.		1.14 d	1.27 c	0.88 fg			1.10 b
	1	1.30 c	0.98 ef	0.64 h			0.98 c
	2	1.31 c	1.06 de	0.82 g			1.06 b
Effect of hydrogel con.		1.30 a	1.30 a	0.97 b			

*Values with different letters indicate significant differences at the 5% probability level according to the Duncan multiple range test.

3.2 The length of the root system Length (cm): It was noted in Table 2 that when the soil was treated with hydrogel, an increase in root length at a concentration of 2 g/kg of soil amounted to 12.96 cm. The reason for this is that the increase in the length of the root system indicates that the plant needs loose soil to grow taller. Hydrogel is considered one of the soil improvers, and thus the roots go deeper and curl. Within the hydrogel, this is consistent with [13], as he showed the role of the gels in the soil, as they work to retain water and fertilizers, improve soil aeration, reduce evaporation, and thus led to plant improvement. The effect of the type of algae was found to be higher root length when treated with *C. caeruleus* algae reaching 13.19 cm. It was also observed that there was a significant increase between (concentrations of algae extracts), as the highest length reached the 2% concentration, recording 12.46 cm, except for the comparison treatment, while the two concentrations (0.5 and 1)% did not differ

significantly in root length. As for the Interference The binary (algae and gel concentration) *C.caeruleus* outperformed the rest of the treatments significantly with a length of 14.17 cm, while between the Interference (concentrations of algae extracts and gel concentration), the best root length was reached when wheat plants were treated with the gel level of 2 g/kg Soil with a length of 16.43 cm and a concentration of 2%, which recorded 14.06 cm. The results of (the algae used and their concentrations) also showed a significant effect between the treatments, and the highest root length was recorded when treated with *C. caeruleus* algae at a concentration of 2% and a length of 13.81 cm. In the double Interference (algae and gel and their concentrations) it was observed when treating the soil with *C. caeruleus* alga at a concentration of 2% gave the best root length, which reached 17.25 cm and was significantly superior to the rest of the treatments. The reason for the increase in the length of the root system may be because the algae extracts contain growth hormones similar to plant growth hormones, which have a role in elongating and dividing the size of the cells and increasing the branching and growth of the roots within the soil, this agreed with the increase shown in results for length of the root system, as mentioned in **Table 3**, is that the algae *Cladophora sp*. with concentrations of (1,2,3) on the sesame plant led to a significant increase in the length of the root compared to the control treatment **[14]**.

Table 2: The effect of algae extracts and hydrogel on root system length (cm)

Algae type	(%).Algae con	Hydrogel con.gm\kg soil			Algae type Algae .con	Effect of algae type	Effect of .algae con
		Control	2	4			
C. caeruleus	0.0	12.42b-g	16.43 ab	11.50 d-g	13.45 ab		
	0.5	13.33 a-f	14.33 a-d	11.67 c-f	13.11 abc		
	1	13.67 a-f	10.50 d-g	13.00 a-f	12.39 a-d		
	2	17.25 a	12.67 a-g	11.50 d-g	13.81 a		
P. roettleri	0.0	12.42 b-g	16.43 ab	11.50 d-g	13.45 ab		
	0.5	10.00 d-g	11.00 d-g	12.67 a-g	11.22 b-e		
	1	16.25 abc	10.75 d-g	11.67 c-g	12.89 a-d		
	2	12.75 a-g	13.75 a-e	12.00 b-g	12.83 a-d		
Algae Interference	0.0	12.42 b-g	16.43 ab	11.50 c-g	13.45 ab		
	0.5	13.00 a-f	9.25 efg	9.50 efg	10.58 de		
	1	9.75 d-g	12.00 b-g	9.00 fg	10.25 e		
	2	12.17 b-g	12.00 b-g	8.05 g	10.74 cde		
Algae type * .Hydrogel con	*C. caeruleus*	14.17 a	13.48 ab	11.92 b		13.19 a	
	P. roettleri	12.85 ab	12.98 ab	11.96 b		12.60 b	
	Interference	11.83 b	12.42 ab	9.51 c		11.26 c	
Algae con. * .Hydrogel con	0.0	12.42 bcd	16.43 a	11.50 cd			13.45 a
	0.5	12.11 bcd	11.53 cd	11.28 cd			11.64 b
	1	13.22 bc	11.08 cd	11.22 cd			11.84 b
	2	14.06 b	12.81 bcd	10.52 d			12.46 ab
.Effect of hydrogel con		**12.95 a**	**12.96 a**	**11.13 b**			

*Values with different letters indicate significant differences at the 5% probability level according to the Duncan multiple range test.

3.3 Leave water content: The results of **Table 3** show that treating wheat plants of the Mawada variety with hydrogel at a concentration of 2 g/kg of soil resulted in an increase in water content by 6.73%. This may be due to the ability of the gel to retain water and moisture for a long period in addition to its role in improving the physical and biological characteristics of the soil. **[11]**. As for the effect of the type of algae, the algae *C. caeruleus* was significantly

superior to the rest of the treatments by 7.12%. It was noted that the effect of the concentration of the algae was that the concentration of 1% gave the best result, amounting to 5.28%, although it was not significantly superior to the treatment Control. Between the two-way Interference (algae and gel concentration), there were significant differences between the treatments, as the highest water content was recorded when the soil was treated with *C. caeruleus* algae, amounting to 8.88%. As for the interaction (algae concentrations with gel concentrations), the highest increase in water content was observed when using the gel concentration of 2 g/kg soil. In the Interference (the algae used and their concentrations), the highest increase in water content was reached when treated with *C. caeruleus* algae at a concentration of 2%, reaching a rate of 8.21%, while the lowest relative water content was reached when treated with Interference at the concentration was (1.2) % and reached 2.43 in the triple intervention (algae and gel and their concentration). There are significant differences between the treatments. The highest percentage was reached when treated with *C. caeruleus* algae, at 13.78%, which is the highest percentage compared to the treatments and gel. The reason for the increase in water content in the algae may be due to its containing of nutrients, including potassium, which increases the ability of plant leaves to retain water and moisture, as it plays a role in controlling the opening and closing of stomata. These results are consistent with the study **[9]** when using seaweed (Soluamine and Seamino) at a concentration of 2.5% gave a significant increase. In the water content of the urethral flora.

Table 3: The effect of algae extracts and hydrogel on the Leave water content %.

Algae type	(%)Algae con	Hydrogel con.gm\kg soil			Algae type .Algae con	Effect of algae type	Effect of .algae con
		Control	2	4			
C. *caeruleus*	0.0	3.56 j-m	11.59 b	6.43 def	7.19 b		
	0.5	9.04 c	3.32 j-m	3.55 j-m	5.30 cd		
	1	13.78 a	5.64 efg	3.86 i-l	7.76 ab		
	2	9.12 c	10.14 c	5.38 e-h	8.21 a		
P. *roettleri*	0.0	3.56 j-m	11.59 b	6.43 def	7.19 b		
	0.5	7.35 d	4.47 g-j	2.22 mno	4.68 de		
	1	6.80 de	4.21 h-k	5.88 ef	5.63 c		
	2	3.90 i-l	5.21 f-i	4.29 g-j	4.47 e		
Algae Interference	0.0	3.56 j-m	11.59 b	6.43 def	7.19 b		
	0.5	5.97 def	6.69 de	3.81 i-l	5.49 c		
	1	2.77 k-o	3.02 j-n	1.50 o	2.43 f		
	2	2.62 l-o	3.33 j-m	1.87 o	2.61 f		
Algae type * .Hydrogel con	C. *caeruleus*	8.88 a	7.67 b	4.81 de		7.12 a	
	P. *roettleri*	5.41 d	6.37 c	4.71 e		5.49 b	
	Interference	3.73 f	6.16 c	3.40 f		4.43 c	
Algae con. * .Hydrogel con	0.0	3.56 fg	11.59 a	6.43 c			7.19 a
	0.5	7.45 b	4.83 de	3.19 g			5.16 b
	1	7.79 b	4.29 ef	3.75 fg			5.28 b
	2	5.21 d	6.23 c	3.85 fg			5.10 b
.Effect of hydrogel con		6.00 a	6.73 a	4.31 b			

*Values with different letters indicate significant differences at the 5% probability level according to the Duncan multiple range test.

3.4 Leave area (cm): The data in **Table 4** indicated that there were significant differences in the leaf area of wheat plants growing in soil treated with hydrogel. The highest area was obtained with the gel at a concentration of 2 g/kg of soil, reaching 12.48 cm compared to the

control treatment. The reason for this may be that the gel provides good nutritional and water storage for the plant during the growth period, which leads to an increase in the leave area of the plant [5]. As for the effect of algae, it was observed when treated with *P. roettleri* algae, and it was significantly superior to the rest of the treatments with an area of 12.47 cm. As for the effect of algae concentrations, it reached the highest increase in leaf area was 11.34 cm, except for the control treatment. The two-way Interference (algae and gel concentration) was observed when treating the soil with *P. roettleri* algae with the gel at a concentration of 2 g/kg soil and with an area of 13.71 cm, and it significantly outperformed the rest of the treatments. In the Interference (algae extract concentrations and gel concentration), it was found that in the gel treatment at the concentration of 2 gm/kg of soil, the highest leaf area was recorded, amounting to 16.24 cm, compared to the control treatment. It was also noted from the results that there were significant differences between (the algae used and their concentrations). It was found that the highest concentration at 1% was for the algae *P. roettleri*, except for the control treatment. As for the binary Interference (the algae and the gel and their concentrations) The best leave area was recorded when the soil was treated with *P. roettleri* algae at a concentration of (0.5 and 1%) with gel at a concentration of 2 gm/kg of soil with an area of 14.25 cm compared to the treatment. The reason for this is that the algae stimulate cell division, elongation, and expansion, and increase the efficiency of the photosynthesis process, thus increasing the leave area [9]. These results are consistent with the study of the effect of foliar spraying of green pepper seedlings with extracts of green algae *Chlorella vulgaris* at a concentration of 0.4%, causing an increase in leaf area compared to the control treatment. [12].

Table 4: The effect of algae extracts and hydrogel on the leaf area (cm)

Algae type	Algae (%).con	Hydrogel con.gm\kg soil			Algae type .Algae con	Effect of algae type	Effect of algae con.
		Control	2	4			
C. caeruleus	0.0	11.73 b-f	16.24 a	13.19 bcd	13.72 a		
	0.5	10.13 f-h	10.83 d-g	7.69 ij	9.55 d		
	1	13.77 bc	6.98 ij	12.99 bcd	11.25 c		
	2	11.56 c-f	13.91 abc	12.82 bcd	12.77 ab		
P. roettleri	0.0	11.73 b-f	16.24 a	13.19 bcd	13.72 a		
	0.5	12.40 b-e	14.25 ab	10.07 e-h	12.24 bc		
	1	12.38 b-e	12.37 b-e	13.94 abc	12.90 ab		
	2	11.76 b-e	11.97 b-e	9.31 f-i	11.01 c		
Algae Interference	0.0	11.73 b-f	16.24 a	13.19 bcd	13.72 a		
	0.5	12.92 bcd	11.59 c-f	12.21 b-e	12.24 bc		
	1	7.09 ij	9.04 ghi	5.88 j	7.34 e		
	2	7.39 ij	10.09 e-h	8.26 hi	8.58 d		
Algae * type Hydrogel .con	C. *caeruleus*	11.80 b	11.99 b	11.67 b		11.82 b	
	P. roettleri	12.07 b	13.71 a	11.63 b		12.47 a	
	Interference	9.78 c	11.74 b	9.89 c		10.47 b	
	0.0	11.73 c	16.24a	13.19 b			13.72 a
Algae * con. Hydrogel .con	0.5	11.82	12.22 c	9.99 de			11.34 b
	1	11.08 cd	9.46 e	10.94cd			10.49 c
	2	10.24 de	11.99 bc	10.13 de			10.79 bc
.Effect of hydrogel con		11.22 b	12.48 a	11.06 c			

*Values with different letters indicate significant differences at the 5% probability level according to the Duncan multiple range test.

3.5 Estimation of chlorophyll content: Table 5 indicates that there are significant differences between the treatments when treating the soil with the gel, as it was given better at the concentration of 4 g/kg of soil, and its percentage reached 7.96%, except for the control treatment. The explanation for this is that the hydrogel can retain water and provide it to the plant with the property of osmosis, and this in turn works to provide suitable conditions for the plant in terms of moisture inside the plant, ventilation of the roots, and increased plant growth, and these results are consistent with **[15]**. It was noted that the effect of the type of algae reached the highest percentage when treated with *C. caeruleus* algae, reaching 8.44%. As for the concentrations of the algae extracts, the two concentrations (1.0.5%) were superior. morally in content Chlorophyll, except the control treatment, reached (7.31, 7.81) %, while the dual Interference (algae and gel concentration) reached the highest percentage when treating the soil with the synergistic treatment of 11.15% and the gel at a concentration of 4 g/kg soil. In the effect of the algae used and their concentrations on the chlorophyll content when treated with algae *C. caeruleus* at a concentration of 1%, the highest increase was recorded at 9.50%, although it was not significantly superior to the control treatment. As for the triple Interference (algae and its concentrations with the gel and its concentrations), there were significant differences, as the highest percentage was reached at the synergistic treatment at a concentration of 1%, reaching 16.54, followed by *C. caeruleus* algae with the gel at a concentration of 4 g/kg. Soil by 15.05%. This may be because these extracts work to increase the absorption of magnesium from the soil, which leads to improving root growth and increasing their efficiency in the Absorption of nutrients, as well as the fact that these extracts contain micro- and macro-nutrients, thus increasing the concentration of chlorophyll a in the plant **[9]**.

Table 5: The effect of algae extracts and hydrogel on the Leaves of chlorophyll a.

Algae type	Algae (%).con	Hydrogel con.gm\kg soil			Algae type .Algae con	Effect of algae type	Effect of .algae con
		Control	2	4			
C. caeruleus	0.0	8.68 c	7.61 cde	13.24 b	9.84 a		
	0.5	7.96 cd	4.70 fg	ت11. 55 b	8.07 b		
	1	8.83 c	4.61 fg	15.05 a	9.50 a		
	2	8.67 c	6.53 de	3.79 g	6.33 cd		
P. roettleri	0.0	8.68 c	7.61 cde	13.24 b	9.84 a		
	0.5	8.10 cd	8.61 c	4.34 fg	7.02 c		
	1	4.04 g	7.81 cde	4.52 fg	5.46 de		
	2	6.69 de	3.45 g	4.32 fg	4.82 ef		
Algae Interference	0.0	8.68 c	7.61 cde	13.24 b	9.84 a		
	0.5	13.28 b	3.11 g	4.13 g	6.84 c		
	1	16.54 a	4.62 fg	4.24 fg	8.47 b		
	2	6.08 ef	3.33 g	3.84 g	4.42 f		
Algae type * .Hydrogel con	*C. caeruleus*	8.54 b	5.86 d	10.91 a		8.44 a	
	P. roettleri	6.88 c	6.87 c	6.61 cd		6.79 c	
	Interference	11.15 a	4.67 e	6.36 cd		7.39 b	
	0.0	8.68 c	7.61 de	13.24 a			9.84 a
Algae con. * .Hydrogel con	0.5	9.78 b	5.47 f	6.67 e			7.31 b
	1	9.80 b	5.68 f	7.94 cd			7.81 b
	2	7.15 de	4.44 g	3.99 g			5.19 c
.Effect of hydrogel con		8.85 a	5.80 c	7.96 b			

*Values with different letters indicate significant differences at the 5% probability level according to the Duncan multiple range test.

3.6 Determination of chlorophyll b content: It was noted from **Table 6** that the highest increase in the effect of the gel at a concentration of 2 g/kg of soil in the chlorophyll b content reached 14.36%, although it was not superior to the control treatment. The reason for this may be attributed to the hydrogel, which works to dissolve the nutrients necessary for plant growth, which are included in the composition of Chlorophyll **[16]**. In terms of the effect of algae type, *P. roettleri* algae was significantly superior to the rest of the treatments, reaching 15.15%. As for the effect of the concentrations of algae extracts, there were no significant differences between the two concentrations (0.5 and 1%), as they were significantly superior to the rest of the treatments. In the Interference (algae and gel concentration), the highest percentage was reached when treating *P. roettleri* algac with the gel, and it reached 2 g/kg soil compared to the rest of the treatments. In the effect of the concentrations of algae extracts with the gel concentration, the highest percentage was reached at a concentration of 2 gm/kg of soil and was recorded at 21.71%. As for the effect of the algae used and their concentrations, it was observed when treating soil growing with wheat plants. The best result was recorded when treated with *P. roettleri* algae at a concentration of 2% and amounted to 18.88%. The Interference (algae and its concentrations and the gel and its concentrations) was found to have the highest increase when treating the soil planted with wheat plants when treated with *P.roettleri* algae at a concentration of 0.5% with the gel at a concentration of 2 g/kg soil and it reached 27.52%, which was significantly higher than the control treatment and the reason for the increase may be due to what the algae extracts contain and gibberellins which stimulate the opening and maturation of flower buds, and auxins, which have a role in cell division and elongation, which have a role in increasing the chlorophyll content of leaves **[17]**.

Table 6: The effect of algae extracts and hydrogel on the determination of Leaves chlorophyll b

Algae type	Algae (%).con	Hydrogel con.gm\kg soil			Algae type .Algae con	Effect of algae type	Effect of algae .con
		Control	2	4			
C. caeruleus	0.0	8.68 ijk	7.60 k	11.36 ghi	9.21 f		
	0.5	22.32 bc	12.72 fg	9.83 h-k	14.95 bc		
	1	15.18 ef	27.01 a	4.64l	15.61 b		
	2	8.68 bc	7.60 g-j	11.36ghi	9.21 cd		
P. roettleri	0.0	8.68 ijk	7.60	11.36 ghi	9.21 f		
	0.5	15.77 e	27.52 a	9.89 h-k	17.73 a		
	1	19.79 d	14.56 ef	9.94 h-k	14.76 bc		
	2	22.64 b	23.38 b	10.63 g-j	18.88 a		
Algae Interference	0.0	8.68 ijk	7.60 k	11.36 ghi	9.21 f		
	0.5	18.18 d	10.51 g-j	9.02 h-k	12.57 de		
	1	11.51 gh	14.96 ef	8.41 jk	11.63 e		
	2	20.07 cd	8.21 jk	7.57 k	11.95 e		
Algae type * .Hydrogel con	*C. caeruleus*	17.15 ab	14.48 c	8.62 e		13.42 b	
	P. roettleri	16.72 b	18.26 a	10.46 d		15.15 a	
	Interference	14.61 c	10.32 d	9.09 e		11.34 c	
	0.0	8.68 gh	7.60 h	11.36 f			9.21 c
Algae con. * .Hydrogel con	0.5	18.76 b	16.92 g	9.58 g			15.08 a
	1	15.50 d	18.84 b	7.66 h			14.00 b
	2	21.71 a	14.06 e	8.95 gh			14.91 a
.Effect of hydrogel con		16.16 a	14.36 b	9.39 c			

*Values with different letters indicate significant differences at the 5% probability level according to the Duncan multiple range test.

3.7 Estimation of total chlorophyll content (a+b): Table 7 shows that there were significant differences between the treatments in the effect of the gel, as the highest percentage was reached with the gel at a concentration of 2 g/kg of soil, at a rate of 20.90%, although it was not significantly superior to the control treatment. The reason for this may be that the hydrogel can retain moisture which makes the soil fragile and increases its permeability through the swelling process of the gel, which helps to make the soil brittle thus the roots can penetrate the soil and thus have a positive effect in increasing plant growth **[18]**. As for the effect of the type of algae, it reached the highest percentage of chlorophyll content when treated with *C. caeruleus* algae recorded at 22.70%. As for the effect of algae concentrations, the 2% concentration was significantly superior to the rest of the concentrations, except for the control treatment. As for the interaction between the algae types and the gel concentration, there were no significant differences between the algae *C. caeruleus* and the synergistic treatment in their effect on the chlorophyll content. As for the Interference between the concentrations of algae and the concentration of the gel, it reached the highest percentage at the concentration of 2% and reached 30.84%. The results showed that the algae used with its concentrations gave the best results Algae *C. caeruleus* at a concentration of 2% and 25.88%. The reason for this may be attributed to the fact that these extracts contain many nutritional elements that are involved in the synthesis of the chlorophyll molecule, such as magnesium and other elements that are involved in the construction of the chlorophyll molecule **[19]**.

Table 7: The effect of algae extracts and hydrogel on the total chlorophyll content (a + b)

Algae type	Algae (%).con	Hydrogel con.gm\kg soil			Algae type .Algae con	Effect of algae type	Effect of .algae con
		Control	2	4			
C. caeruleus	0.0	20.59 ij	22.22 hi	24.67 fgh	22.49 b		
	0.5	25.73 efg	16.40 kl	14.10 lm	18.74 c		
	1	28.87 cde	29.37 cd	12.81 mn	23.69 b		
	2	35.65 a	14.96 klm	27.02 def	25.88 a		
P. roettleri	0.0	20.59 ij	22.22 hi	24.67 fgh	22.49 b		
	0.5	22.60 ghi	33.93 ab	14.24 klm	23.59 b		
	1	23.83 f-i	21.03 i	14.46 klm	19.78 c		
	2	30.70 bc	26.65 def	14.93 klm	24.09 b		
Algae Interference	0.0	20.59 ij	22.22 hi	24.67 fgh	22.49 b		
	0.5	32.72 ab	12.70 mn	13.76 lm	19.73 c		
	1	31.41 bc	17.54 jk	9.56 n	19.50 c		
	2	26.18 def	11.54 mn	11.67 mn	22.49 d		
Algae type * .Hydrogel con	*C. caeruleus*	27.71 a	20.74 d	19.65 d		22.70 a	
	P. roettleri	24.43 c	25.96 b	17.08 e		22.49 a	
	Interference	27.72 a	16.00 ef	14.92 f		19.55 b	
Algae con. * .Hydrogel con	0.0	20.59 e	22.22 de	24.67 c			22.49 a
	0.5	27.02 b	21.01 de	14.03 g			20.69 b
	1	28.04 b	22.65 d	12.28 h			20.99 b
	2	30.84 a	17.72 f	17.87 f			22.14 a
.Effect of hydrogel con		26.62 a	20.90 b	17.21 c			

*Values with different letters indicate significant differences at the 5% probability level according to the Duncan multiple range test.

3.8 Shoots Dry weight of shoots (g): It was observed from **Table 8** that when treating the soil with hydrogel at a concentration of 2 g/kg soil, it gave an increase in dry weight, except for the control treatment. The reason for the increase may be attributed to the fact that the hydrogel

can retain plants with food materials for a longer period thus increasing their percentage in dry weight [5]. As for the effect of algae type, there was no significant difference between the algae *C. caeruleus* and P. *roettleri* in dry weight, and they outperformed the i Interference treatment, reaching (1.27, 1.26) mg, respectively, and in the effect of concentrations. Algae extracts gave the highest significant increase at the concentration of 0.5% and reached 1.10 mg, except for the control treatment. As for the Interference In the duo (algae and gel), there were no significant differences when treated with *C. caeruleus* algae**, *P.roettleri*** algae, and the gel at a concentration of 2 gm/kg soil in its effect on the dry weight of the shoot. In the Interference (algae and gel concentrations), there were significant differences. The highest increase was reached when treated with hydrogel at a concentration of 2 gm/kg soil, and it was recorded at 1.88 mg. When using (algae and their concentrations), when treating the soil with *C.caeruleus* algae, at two concentrations (1.2%), the highest increase in the dry weight of the shoots is highest. As for the Interference (algae and its concentrations and the gel and its concentrations), it gave the highest results when treating the soil with *C. caeruleus* algae at a concentration of 0.5% with the gel at a concentration of 2g/kg of soil and it reached 1.67mg. The reason for the increase in dry weight may be the result of increased absorption of Nutrients from the root leads to increased vegetative growth, and this positively affects the dry weight of the plant [10].

Table 8: The Effect of algae extracts and hydrogel on the shoot's dry weight

Algae type	Algae con(%)	Hydrogel con.gm\kg soil			Algae type Algae con.	Effect of algae type	Effect of algae con.
		Control	2	4			
C. caeruleus	0.0	1.44 cde	1.88 a	1.53 bc	1.62 a		
	0.5	1.19 f-i	1.67 b	0.84 k	1.23b		
	1	1.50 bcd	0.73 kl	0.73 kl	0.99 d		
	2	1.30 d-h	1.20 f-i	1.25 e-i	1.25 b		
P. roettleri	0.0	1.44 cde	1.88 a	1.53 bc	1.62 a		
	0.5	1.13 g-j	0.85 k	1.32 c-g	1.10 c		
	1	1.33 c-g	1.27 e-i	0.84 k	1.15 bc		
	2	1.40 c-f	1.35 c-g	0.76 kl	1.17 bc		
Algae Interference	0.0	1.44 cde	1.88 a	1.53 bc	1.62 a		
	0.5	1.11 hij	1.28 d-i	0.46 mn	0.95 d		
	1	1.08 ij	0.94 jk	0.36 n	0.80 e		
	2	1.21 e-i	0.61 lm	0.43 mn	0.75 e		
Algae type * Hydrogel con.	*C. caeruleus*	1.36 a	1.37 a	1.09 c		1.27 a	
	P. roettleri	1.33 a	1.34 a	1.11 bc		1.26 a	
	Interference	1.21 b	1.18 bc	0.70 d		1.03 b	
	0.0	1.44 b	1.88 a	1.53 b			1.62 a
Algae con. * Hydrogel con.		1.14 d	1.27 c	0.88 fg			1.10 b
	1	1.30 c	0.98 ef	0.64 h			0.98 c
	2	1.31 c	1.06 de	0.82 g			1.06 b
Effect of hydrogel con.		1.30 a	1.30 a	0.97 b			

*Values with different letters indicate significant differences at the 5% probability level according to the Duncan multiple range test.

3.9 Roots Dry weight of the root system (g): The results shown in **Table 9**: The best result was given when treating the soil in the gel at a concentration of 2 g/kg of soil compared to the control treatment which amounted to 1.15 mg. This may be attributed to the roots benefiting from the ability of the hydrogel to retain nutrients for the longest possible period. It also has a role in reducing the Loss of nutrients and increasing penetration of roots into the soil [11]. As

for the effect of algae type, *P. roettleri* algae was significantly superior to the rest of the treatments, reaching 0.19 mg. The effect of algae concentrations was observed, reaching the highest increase in dry weight At a concentration of 1%, it was recorded as 0.18 mg. As for the Interference between the types of algae and the concentration of the gel when treated with *P.roettleri* algae with the gel at a concentration of 2 gm/kg soil, the interaction was also observed between the concentration of the algae extract and the concentration of the gel. The highest concentration reached 2 gm/kg soil compared to the control treatment, and it was significantly superior to the rest of the treatments and recorded as 0.19 mg. The effect of the algae used and their concentrations was found when treated with *P.roettleri* algae, which gave the highest concentration of 1% and amounted to 0.24 mg, while the results of the triple Interference (algae and its concentrations) showed that the gel and its concentrations were better The result when treating the soil with *P.roettleri* algae at a concentration of 1% and the gel at a concentration of 2 g/kg of soil gave 0.31 mg, while the lowest weight was recorded when treating the Interference algae at a concentration of 0.5% with the gel at a concentration of 4% and it amounted to 0.05 mg. The reason for this may be that the algae extracts have a role in increasing the growth of the root system by increasing the number of lateral branches, which increases the absorption of nutrients and increases their percentage in dry weight **[2]**.

Table (9) the effect of algae extracts and hydrogel on the root dry weight.

Algae type	Algae (%)con	Hydrogel con.gm\kg soil			Algae type .Algae con	Effect of algae type	Effect of .algae con
		Control	2	4			
C. caeruleus	0.0	0.14 ij	0.12 kjl	0.11 lm	0.12 f		
	0.5	0.11	0.12 klm	0.23 c	0.15 d		
	1	0.14 ij	0.11 kl	0.21 d	0.15 d		
	2	0.13 ijk	0.12 klm	0.11 kl	0.12 f		
P. roettleri	0.0	0.14 ij	0.12 klm	0.11 kl	0.12 f		
	0.5	0.18 efg	0.21 d	0.20 d	0.20 b		
	1	0.24 bc	0.31 a	0.17 fgh	0.24 a		
	2	0.25 b	0.19 de	0.11 kl	0.19 c		
Algae Interference	0.0	0.14 ij	0.12 klm	0.11 kl	0.12 f		
	0.5	0.13 jk	0.12 jkl	0.05 n	0.10 g		
	1	0.14 ij	0.12 jkl	0.16 gh	0.14 e		
	2	0.18 ef	0.15 hi	0.09 m	0.14 e		
Algae type * .Hydrogel con	*C. caeruleus*	0.13 d	0.12 e	0.17 b		0.14 b	
	P. roettleri	0.20 a	0.21 a	0.15 c		0.19 a	
	Interference	0.15 c	0.13 d	0.10 f		0.13 c	
	0.0	0.14 e	0.12 f	0.11 fg			0.12 c
Algae con. * .Hydrogel con	0.5	0.14 de	0.15 cd	0.16 c			0.15 b
	1	0.17 b	0.18 ab	0.18 ab			0.18 a
	2	0.19 a	0.15 c	0.11 g			0.15 b
.Effect of hydrogel con		0.16 b	0.15 b	0.14 c			

*Values with different letters indicate significant differences at the 5% probability level according to the Duncan multiple range test.

4. Conclusions:

Isolating two genera of algae, one of which is a red algae, the genus *C. caruleus*, and the other genera belongs to the green algae *P. roettleri*. Adding algae extracts to the wheat crop led to a significant stimulation of the studied traits, treated with *C. caeruleus* algae at a

concentration of 2%, which exceeded significantly the rest of the treatments compared to the control treatment. Adding the gel, especially at a concentration of 2 grams, had a positive effect on most of the traits studied. We conclude that improving plant growth may be because algal extracts contain quantities of growth regulators, which include gibberellins and cytokinins, which work to increase plant growth.

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