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ORIGINAL ARTICLE **OPEN ACCESS**

The Effect of Adding Hydrogel to Saline Soil on The Growth of *Triticum aestivum L* Growing under Periods of Drought

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ABSTRACT
The study was conducted in the wired house / Department of Biology / College of Education for Pure Sciences . Using plastic pots and including cultivar of wheat (Ibaa) in soil treated with three levels of Salinity (zero , 3 , 6) g.kg^{-1} of sodium chloride with the addition of three levels of hydrogel (zero , 4 , 8) g.kg^{-1} and exposing the plants after (40) days from planting to three periods of Drought (zero , 6, 12) days , order knows the effect of that treatment on some physiological characteristics of wheat . The results were statistically analyzed and found that exposing plants to the first and second drought periods showed a negative effect, especially the second drought period , on plant height , relative water content , leaf area , and total chlorophyll characteristics. The decrease percentage (19.9 , 27.4 , 20.3) and exposing plants to salinity levels , especially 8 gm, showed a negative effect on all of the above traits with a percentage of (10.5 , 5.5 , 12.5 , 15.7) % , respectively. At the same time, there was an increase in the proline content when exposed to drought periods and salinity levels compared to the comparison factor. The results showed that exposing wheat plants to two types of stress (Drought and Salinity) can improve their growth through the above characteristics by treating them with two levels of hydrogel , especially the level 4 g.kg^{-1} soil . The binary interactions between the three factors significantly affected the studied traits.
***Keywords** : Drought. Salinity. Hydrogel. Wheat.*

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INTRODUCTION

Wheat is one of the most important cereal crops in the world and the most cultivated and produced, and it has a major role in achieving food security. The area planted with wheat in 2018 reached 214 million hectares , and production reached 34,254 tons of Hectares^{-1} [11]. When water is not available to plants in the required quantities, it negatively affects the growth characteristics and emergence of the whole plant, including the anatomical morphological, physiological and biochemical aspects , resulting in a reduction in the size of the plant and the leaf area [3]. Salinity is among the abiotic stresses that threaten the agricultural system and affect all physiological processes from seed germination to plant growth; Sodium chloride is one of the most common and most harmful salts in the growth of crops [18]. Hydrogels are water-based polymers that can absorb large amounts of water; the use of hydrogels significantly reduces the effect of drought stress on the plant; it is used to enhance the efficiency of nutrient use in water , and, more importantly, in areas with semi- unsecured rainfall , as it can provide water and nutrients to the plant, It also works to aerate the soil and increase the porosity of the soil [1]. Since Iraq suffers in general from Drought and lack of rain as well is one of the countries affected by Salinity, it has become necessary to find ways to reduce environmental stresses. The researchers' success in this work is a step in the right direction . The current study explores the possibility of using hydrogel to improve some indicators of Drought and salt tolerance of wheat.

MATERIAL AND METHODS

The experiment was carried out in the wirehouse and laboratories of the Department of Biology/ College of Education for Pure Sciences / University of Mosul 2021/2022 . Soil was brought from agricultural fields in Al - Khazir area/east Mosul , cleaned and softened , and placed in plastic containers weighing 8 kg^{-1}. The soil was treated with three levels of Salinity (zero , 3 , 6) g.kg^{-1} of sodium chloride , and three levels of hydrogel (zero , 4 , 8) g.kg^{-1}. Were added. On 2021/12/23 , 10 seeds of the cultivar (Ibaa 99) wheat was planted. The seeds were obtained from the Iraqi State Seed Company in Mosul . The germination rate was 95 % . After 16 days of planting , the number of seedlings was reduced to five seedlings in each pot , and irrigation was controlled by weighing the pot daily and adding water as needed to obtain the field capacity

(75 %). After 41 days from the planting date, the plants were exposed to two drought periods (6 , 12) days with the presence of a control treatment (without Drought) . After 30 days of Drought, three replicates were used to study some characteristics.

Studied traits

1. Plant height (cm), using a ruler.
2. The total chlorophyll content in the leaves according to the method reported by [25] and carotenoids using the method [15].
3. Leaf area (cm^2) The leaf area was calculated using the method [17] .
4. Relative water content (%) The relative water content was calculated according to the method [27].
5. Proline content According to the method [5].

All results were recorded and analyzed as a factorial experiment using C.R.D (Completely Randomized Design) using [26] program. The means were compared according to Duncan's Multiple Ray test at a probability level of 0.05.

RESULTS AND DISCUSSION

Plant height

Table (1) shows a significant decrease in the plant height at the probability level of 5 % due to the exposure of wheat plants to the first and second drought periods. The percentage of decrease was (9.73 and 19.94 %) , respectively , compared to the control treatment; moisture depletion led to a significant decrease. The reason for this is that water stress reduces the relative water content , which determines cell division and expansion , which reduces photosynthesis and cell elongation activities in the plant, and reduces plant height [31]; this result is consistent with [33] in that water stress reduces plant height The plant especially when it occurs at the beginning of the plant's life. Regarding the effects of Salinity, we noticed a significant decrease in plant height at high salinity levels. The percentage of decrease was (5.12 and 10.50) % , respectively , compared to the control treatment, in Water absorption and the effect on metabolic processes [20], where he explained [34] that exposing wheat seedlings to three levels of sodium chloride led to the reduction of root and shoot reduction .

Table 1. Effect of levels of hydrogel on plant height of wheat (Ibaa 99) plant under different levels of salinity and drought periods

Salinity	Hydrogel	Periods of Drought			Hydrogel x salinity	Effect hydrogel	salinity effect
		Control	First Drought	Second Drought			
zero	zero	68.5 jk	59.50 m	36.40 o	54.80 f		
	$4g.kg^{-1}$	84.5 a	84.00ab	81.50 d	83.33 a		
	$8g.kg^{-1}$	74.75 g	73.00 h	73.50 h	73.75 c		
$3 g.kg^{-1}$	zero	69.25 j	50.25 n	28.00 q	49.16 g		
	$4g.kg^{-1}$	84.00ab	83.25ab	77.75 f	81.83 b		
	$8g.kg^{-1}$	69.25 j	69.50 j	71.50 i	70.08 d		
$6 g.kg^{-1}$	zero	67.25 l	32.25 p	17.75 r	39.10 h		
	$4g.kg^{-1}$	83.2 b-c	82.30cd	80.00 e	81.83 b		
	$8g.kg^{-1}$	67.88kl	69.19 j	68.80jk	68.62 e		
hydrogel × Drought	zero	68.41 e	47.33 f	27.51 g		47.75 c	
	$4g.kg^{-1}$	83.90 a	83.35 a	79.75 b		82.33 a	
	$8g.kg^{-1}$	70.62 d	70.56 d	71.26 c		70.81 b	
Salinity × Drought	zero	75.91 a	72.16 c	63.80 e			70.62 a
	$3g.kg^{-1}$	74.10 b	67.83 d	59.08 g			67.00 b
	$6g.kg^{-1}$	72.86 c	61.24 f	55.51 h			63.20 c
Effect drought		74.30 a	67.07 b	59.48 c			

***Means following difference letters are significant at p = 0.05 based on Duncan's multiple range test**

As for the effect of the concentrations used from the hydrogel only , the highest increase in plant height at the concentration (4 g . kg^{-1} soil) and a lower percentage at the concentration (8g . kg^{-1} soil) with a percentage of (72.41 and 48.29)% , respectively , compared to the control treatment And both of them outperformed the control treatment and the reason for this is that the hydrogel led to the retention of water and nutrients and its provision to the plant during its growth stages. According to the plant's need , that is , the hydrogel acted as a storage for moisture and nutrients [15, 8]. These results are in agreement with [10].

Regarding the Interaction between hydrogel and Drought, a significant superiority was obtained in the plant height at gel concentration (4 g . kg^{-1} of soil) and the treatment without drying over the rest of the treatments .
As for the Interaction between (Salinity and Drought) , there was a significant decrease in plant height as the concentration of Salinity increased and the period of Drought compared with the control.
As for the Interaction between (hydrogel and Salinity), a significant superiority was obtained in the plant height characteristic at gel concentration (4 g. kg^{-1}soil) over the rest of the treatments , while a significant decrease was observed in plant height when using salinity level (6 g . kg^{-1} soil) .
As for the triple Interaction between (hydrogel , Salinity, and Drought) , the plants not exposed to Drought and Salinity and the treatment with concentration (4g.kg^{-1} soil) hydrogel outperformed the plants compared to the remaining 27 treatments

Total chlorophyll (mg.g fresh weight)

Table (2) shows a significant decrease in the total chlorophyll content at the 5% probability level, This is as a result of the exposure of wheat plants to two drought periods, and the percentage of decrease was varied in the second dry period compared to the control treatment, at a rate of (12.40 and 20.30%), respectively, To explain this result, many studies have shown the existence of correlational relationships between the phenomenon of water deficiency in leaves and the content of plant pigments such as chlorophyll a, chlorophyll b, total chlorophyll and carotenoids with a decrease in soil moisture, and these results are consistent with [14] when exposed to Two cultivars of wheat plant drought led to a decrease in the content of chlorophyll a and total chlorophyll in both cultivars , and the reason may be due to the fact that the chlorophyll contents had a further decrease in all wheat genotypes with increasing levels of water stress, because the thylakoid membranes disintegrate when the cells are dehydrated [23]. One of the manifestations of the effect of Drought on plants is the reduced growth in severe cases , the stopping of the photosynthesis process , and thus the decrease in plant pigments the results of our study agree with [32],

Table 2. Effect of levels of hydrogel on (Total chlorophyll) of wheat (Ibaa 99) plant under different levels of salinity and drought periods

salinity	Hydrogel	Periods of Drought			Hydrogel x salinity	Effect hydrogel	salinity effect
		Control	First Drought	Second Drought			
zero	zero	2.60 b-d	2.58 b-e	1.93 lm	2.37 d		
	4g.kg^{-1}	2.95 a	2.89 b	2.61 b-d	2.81 a		
	8g.kg^{-1}	2.68 bc	2.53 d-f	2.36 gh	2.52 b		
3 g.kg^{-1}	zero	2.62 b-d	2.10 jk	1.98 k-m	2.23 e		
	4g.kg^{-1}	2.99 a	2.72 b	2.55 c-e	2.75 a		
	8g.kg^{-1}	2.70 b	2.41 f-h	2.23 i	2.44 c		
6 g.kg^{-1}	zero	2.29 hi	1.67 n	1.63 n	1.86 g		
	4g.kg^{-1}	2.71 b	2.22 ij	2.01 kl	2.31 d		
	8g.kg^{-1}	2.45 e-g	1.93 n	1.87 m	2.08 f		
hydrogel × Drought	zero	2.50 c	2.11 f	1.84 g		2.15 c	
	4g.kg^{-1}	2.88 a	2.61 bc	2.39 d		2.62 a	
	8g.kg^{-1}	2.61 b	2.22 e	2.15 ef		2.32 b	
Salinity × Drought	zero	2.74 a	2.66 b	2.30 e			2.56 a
	3g.kg^{-1}	2.77 a	2.41 d	2.25 e			2.47 b
	6g.kg^{-1}	2.48 c	1.94 f	1.83 f			2.08 c
Effect drought		2.66 a	2.33 b	2.12 c			

The decrease in the content of chlorophyll a, chlorophyll b, and carotene is mainly due to the damage to chloroplasts by reactive oxygen species (ROS). The results of our study agree with (Nasrin*, et al*,. 2020) that there was a significant decrease in the total chlorophyll content in leaves due to Drought .
Regarding the effects of salt stress, we notice a significant decrease in the total chlorophyll content at high salinity levels. The percentage of decrease was (3.64, 15.78%), respectively, compared to the control treatment The reason for the decrease may be due to a decrease in photosynthesis due to an increase in free radicals or (ROS) in chloroplasts, and this leads to the destruction of chlorophyll molecules due to the effects of salt stress [24], Salt stress also indirectly slows down photosynthesis on plants. Photosynthesis is directly related to transpiration, stomata conduction, chlorophyll contents, and water stress, which are affected under salinity stress [5]. Our results agree with [13]. Treatment Soil with different concentrations of sodium chloride led to a decrease in the content of the main plant pigments in the wheat plant.
As for the effect of the concentrations used for the hydrogel any , the highest increase in the total chlorophyll content at the concentration (4g.kg-1 of soil) was achieved by (21.86 %) compared to the

control treatment. The reason for this superiority may be attributed to the fact that the hydrogel maintains the moisture content of the soil Increasing the permeability of the soil through the process of swelling and contraction of the hydrogel , which leads to making the soil brittle , so that the roots can easily penetrate into the soil and have a positive effect on soil aeration and plants get good growth. This result is consistent with [26, 28, 30].

In terms of the Interaction between hydrogel and Drought, a significant superiority was obtained in the character of the total chlorophyll content at the gel concentration (4.g kg^{-1} of sol) and the treatment without Drought on the rest of the treatments. As for the Interaction between Salinity and Drought, there was a significant decrease in the characteristic of the total chlorophyll content. The salinity concentrations increased, and the dry period .

As for the Interaction between hydrogel and Salinity, the gel reduced the negative effect of Salinity on total chlorophyll .

As for the triple Interaction between (hydrogel × salinity × drought) , the lowest result (1.63) appeared at the second dry period and the second salinity level and in soils that did not contain hydrogel .

Relative water content (%)

Table 3. Effect of levels of hydrogel on (Relative water content) of wheat (Ibaa 99) plant under different levels of salinity and drought periods

Salinity	Hydrogel	Periods of Drought			Hydrogel x salinity	Effect hydrogel	salinity effect
		Control	First Drought	Second Drought			
zero	zero	89.30 c	80.70 j	60.33 u	76.77 e		
	$4g.kg^{-1}$	93.20 a	87.30 e	67.80 p	82.76 a		
	$8g.kg^{-1}$	90.10 b	83.50 h	64.31 q	79.30 c		
$3\ g.kg^{-1}$	zero	87.20 e	78.70 k	63.50 r	76.46 e		
	$4g.kg^{-1}$	89.20 c	82.40 i	70.40 o	80.66 b		
	$8g.kg^{-1}$	86.30 f	79.30 k	61.70 t	75.76 f		
$6\ g.kg^{-1}$	zero	85.40 g	74.60 m	58.70 v	72.90 h		
	$4g.kg^{-1}$	88.30 d	77.10 l	68.20 p	77.86 d		
	$8g.kg^{-1}$	87.50 e	73.00 n	62.70 s	74.40 g		
hydrogel × Drought	zero	87.30 c	78.00 f	60.84 i		75.30 c	
	$4g.kg^{-1}$	90.20 a	82.20 d	68.80 g		80.40 a	
	$8g.kg^{-1}$	87.90 b	78.60 e	62.90 h		76.40 b	
Salinity × Drought	zero	90.80 a	83.80 d	64.13 h			79.50 a
	$3g.kg^{-1}$	87.50 c	80.10 e	65.20 g			77.60 b
	$6g.kg^{-1}$	87.00 c	74.90 f	63.20 i			75.10 c
Effect drought		88.40 a	79.60 b	64.10 c			

The results in Table (3) show that treating wheat plants with two drought periods reduces the water content , especially during the second dry period , and the percentage decrease is (9.95 , 27.48) % , respectively , compared to the control treatment . The relative water content is one of the important criteria to know the water condition of the plant and the reason for the stomata with increased water shortage in the soil to reduce water absorption and transpiration and consistent with [10, 12] exposing wheat plants to Drought (35 %) field capacity showed a negative effect on the relative water content compared to field capacity (85) % .

It was also found that there was a significant decrease in the relative water content when using salinity levels . Especially the concentration (6 g . kg^{-1} of soil) and the percentage of decrease was (5.53) % compared to the control treatment , and this may be because salt stress prevents the absorption of water through effort, Osmosis , which inhibits the absorption of water , and because of the toxicity of ions inside the plant , and these two reasons prevent cells from dividing and increasing their expansion , as well as affecting the activity of the main enzymes , and this affects the water content (El - Hendawy *et al*,. 2019) , and this is consistent with [36] mentioned that the increase in Salinity in the growth medium leads to a weakening Absorption of water and nutrients by plant cells.

As for the effect of hydrogel concentrations only , the concentration of ($4g.kg^{-1}$ of soil) was significantly superior to the rest of the treatments , and it amounted to (6.77 %) compared to the control treatment. The soils to which the hydrogel was added benefited from the ability of the hydrogel to retain moisture for a longer period as well as Improving some physical and biological properties of the soil [1], Which leads to reducing the effect of negative tension on the plant and thus increasing the water content of the flag leaf (%), These results are in agreement with [31, 32] when using four levels of hydrogel , a significant response to the characteristics of relative water content and total chlorophyll content of the wheat plant .

Regarding the Interaction between (hydrogel and Salinity) , the Table showed the highest increase in water content when using salinity concentration (zero) and hydrogel concentration (4 g kg^{-1} of soil) , as well as the highest in the triple Interaction between hydrogel , Salinity, and Drought.

Leaf area (cm^2)

Table (4) shows a significant decrease in leaf area due to wheat plants being exposed to two drought periods. The decrease was more evident in the second dry period compared to the control treatment at a rate of (10.13 , 14.71) % , respectively. Here we note that the leaf area decreased with an increase Periods of Drought The leaves of the plant are considered the most affected by Drought, and the decrease in the absorbed water explains this as a result of the plants being exposed to Drought, which in turn works to reduce the leaf water effort , which causes a decrease in light reactions [35]. Exposing plants to drought periods , especially the second drought period , would reduce plant height , leaf area , and plant efficiency in extracting water from the soil .

Table 4. Effect of levels of hydrogel on (Leaf area) of wheat (Ibaa 99) plant under different levels of salinity and drought periods

salinity	Hydrogel	Periods of Drought			Hydrogel x salinity	Effect hydrogel	salinity effect
		Control	First Drought	Second Drought			
zero	zero	20.20 hi	18.08 j	16.10 kl	18.12 d		
	$4g.kg^{-1}$	32.34 ab	31.02 bd	29.88 b	31.08 a		
	$8g.kg^{-1}$	25.21 e	23.66 e-g	23.09 fg	23.98 b		
3 $g.kg^{-1}$	zero	17.15 jk	15.00 l	14.9 l	15.68 e		
	$4g.kg^{-1}$	33.16 a	30.98 bd	30.40 cd	31.50 a		
	$8g.kg^{-1}$	24.44 ef	22.70 f-g	21.75 gh	22.96 c		
6 $g.kg^{-1}$	zero	18.80 ij	9.13 m	6.11 n	11.34 f		
	$4g.kg^{-1}$	32.03a-c	29.87 d	29.60 d	30.50 a		
	$8g.kg^{-1}$	23.10f-g	23.00 f-g	20.50 hi	22.20 c		
hydrogel × Drought	zero	18.71 f	14.07 g	24.25 h		19.01 c	
	$4g.kg^{-1}$	32.51 a	30.62 b	22.35 b		28.49 a	
	$8g.kg^{-1}$	24.25 c	23.12 d	18.73 e		22.03 b	
Salinity × Drought	zero	25.91 a	24.25 b	23.02 c			24.39 a
	$3g.kg^{-1}$	24.91 b	22.89 c	22.35 c			23.38 b
	$6g.kg^{-1}$	24.64 b	20.66 d	18.73 e			21.34 c
Effect drought		25.15 a	22.6 b	21.45 c			

Regarding the effects of Salinity, it is clear that the leaf area decreased significantly with the increase in salinity levels , reaching (23.38 , 21.34)% , respectively , compared to the comparison treatment (24.39) . The decrease in leaf area may be due to the increase in harmful ions inside the leaf, and the decrease in the number of leaves and size is due to the increase in Salinity, as the increase in the leaf area depends on the swelling of the leaf. The unfavorable environmental conditions lead to a decrease in the leaf area as a result of inhibiting the leaf's width and reducing the process of photosynthesis in the plant [1]. This obtained result agrees with the results [2] .

As for the effect of the concentrations used of hydrogel only, the highest increase in leaf area was obtained in plants grown in soil to which hydrogel was added at the concentration (4 $g.kg^{-1}$ soil) and at a lower percentage at the concentration (8 $g.kg^{-1}$ soil) at a rate of (49.86, 17.83%) respectively compared to the control treatment. This is because the hydrogel provides good nutritional and water storage for the plant during the growth period and reduces water consumption and fertilizer loss, which is in agreement with (Montesano, *et al*,. 2015). The use of different levels of hydrogel achieved a significant increase in plant height and leaf area of wheat plants.

In terms of the Interaction between hydrogel and Drought, adding hydrogel to the soil reduced the negative effect of Drought on leaf area .

As for the Interaction between Salinity and Drought, there was a significant decrease in the characteristic of leaf area as the concentration of salinity and drought period increased compared with the control.

As for the Interaction between hydrogel and Salinity, there was a significant superiority in leaf area character at gel concentration (4 $g.kg^{-1}$ of soil) at the three salinity levels compared with the rest of the treatments .

As for the triple Interaction between hydrogel , Salinity, and Drought, it outperformed the plants that were not exposed to Drought and treated with a concentration (4 g .kg^{-1} of soll) and at a level of Salinity (3 g . kg^{-1} of soil), and the value was (33.16) cm^2.

Proline content (µmol.gm fresh weight)

The results in Table (5) indicate that the thirst of wheat plants (first and second Drought) showed an increase in the content of the amino acid (proline) in the leaves of plants subjected to thirst with a percentage of (5.84 , 7.56) micromol. Gm, respectively , compared to the control treatment , and it is noted from the Table There is a significant increase in the accumulation of proline in the leaves of the wheat plant as the periods increase Water stress, and this is consistent with [6], When four cultivars of wheat were exposed to different levels of Drought, it led to a significant increase in proline content, As explained by researchers [16, 29], that the reason for this increase is proline , which acts as a stress regulator and protects plants from a decrease in water stress by maintaining the osmotic regulation in the plant .
As for the salinity treatment, we notice a significant increase in the concentration of proline as the salinity concentration increases compared to the control treatment with a percentage of (29.67, 125.1%). The reason for this increase may be because the accumulation of amino acids, especially proline, is one of the defense mechanisms that plants use to cope with water shortage [30], And for its positive role in regulating the osmotic effort of plant cells, which increases the cells' ability to absorb water and nutrients from the growth environment, and then maintain cell elongation, open stomata, and efficiency of carbon metabolism processes, which in turn leads to maintaining plant growth under conditions of water shortage [3].

Table 5. Effect of levels of hydrogel on (Proline content) of wheat (Ibaa 99) plant under different levels of salinity and drought periods

salinity	Hydrogel	Periods of Drought			Hydrogel x salinity	Effect hydrogel	salinity effect
		Control	First Drought	Second Drought			
zero	zero	5.00 f-i	5.01 e-i	8.70 a-c	6.23 b		
	$4g.kg^{-1}$	2.10 j	2.33 j	2.45 ij	2.29 c		
	$8g.kg^{-1}$	3.15 h-j	4.18 f-j	3.22 h-j	3.51 c		
$3\ g.kg^{-1}$	zero	5.60 d-h	6.10 c-e	8.99 c-e	7.31 c		
	$4g.kg^{-1}$	2.43 ij	3.02 h-j	3.30 h-j	2.91 c		
	$8g.kg^{-1}$	5.00 f-i	5.12 d-h	6.03 d-g	5.38 b		
$6\ g.kg^{-1}$	zero	5.50 c-f	9.10 ab	11.80 a	8.80 a		
	$4g.kg^{-1}$	7.36 b-d	8.55 ab	12.76 a	9.55 a		
	$8g.kg^{-1}$	7.44 b-d	8.00 a-c	10.80 a	8.74 a		
hydrogel × Drought	zero	5.36 c	7.15 ab	9.83 a		7.44 a	
	$4g.kg^{-1}$	3.96 d	4.63 cd	6.17 c		4.92 c	
	$8g.kg^{-1}$	5.19 cd	5.76 bc	6.68 bc		5.87 b	
Salinity × Drought	zero	3.41 d	3.84 d	4.79 cd			4.01 c
	$3g.kg^{-1}$	4.34 cd	5.16 c	6.10 c			5.20 b
	$6g.kg^{-1}$	6.76 b	8.55 a	11.78 a			9.03 a
Effect drought		4.84 c	5.84 b	7.56 a			

The Table also shows a significant difference in the decrease of proline when treating the hydrogel. Its percentage was (33.87 and 21.10)% , respectively , compared to the control treatment. We did not find There is a link between the addition of hydrogel and proline in research, and our study is considered, a pioneer in this field. In the case of Interaction between hydrogel and Salinity only, and the highest increase of proline was obtained when treating salinity concentration (6 $g.kg^{-1}$ soil) and a hydrogel concentration ($4gm.kg^{-1}$ soil) with a ratio of (9.55) micromol/gm fresh weight .
It was also shown in the Table, in the case of the triple Interaction between hydrogel, Salinity, and dehydration , that the lowest decrease in the proportion of proline was obtained. Its percentage was (2.10 µmol/g fresh weight) at the treatment of wheat plant with (zero) salinity concentration and not exposed to Drought and a hydrogel (4 g . kg^{-1} of soil).

CONCLUSION

Based on the results, it has become necessary to use the gel technique, especially in areas that are almost guaranteed rain, and to determine the appropriate level to obtain the best growth, especially with the price of the gel significantly reduced.

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