IMPACT OF POLYMERS, DIFFERENT IRRIGATION PROGRAMS AND SELENIUM FOLIAR ON REDUCING AMOUNT OF IRRIGATION WATER FOR IRIS PLANTS

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ABSTRACT

The experiment was carried out in one of the green houses of the research station A of the Department of Horticulture and Landscape Design during fall season 2020/2021 This study was aimed to reducing the amount of irrigation water using factorial experiment with in split plot designed by The study included three factor , First factor, the quality of irrigation water (main plots) and at three levels: (irrigation with water from the Tigris River 0.92 dm s^{-1}(I_0), alternating irrigation (one irrigation with saline water followed by irrigation with the water of the Tigris River(I_1), Alternating irrigation (two irrigations with saline water, followed by irrigation with the water of the Tigris River(I_2), Second factor was the addition of Polyacrylamide (0, 1.5,2.5) g of $soil^{-1}$ his symbol(P_0,P_1.P_2). Third factor was spraying with selenium with three concentrations (0, 10,20) mg L^{-1} his symbol (S_0,S_1,S_2) The results showed The addition of polymers led to decrease in the amount of irrigation water used to irrigate Iris, as the amount of irrigation water decreased with an increase in the concentrations of added polymers. Also, the polymers contributed at a concentration of 2.5 g kg of $soil^{-1}$ percentage of dry matter in leaves, percentage of carbohydrates in leaves, N, P, K, percentage the water potential in the leaves, relative water content, stomata area and the reduction in the activity of the enzyme Superoxide dismutase led to an increase in the salinity of the irrigation water to a decrease in all characteristics and an increases in the activity of the sod and spraying with selenium at a concentration of 20 mgL^{-1} increased all study parameters and reduced enzyme activityed.

Keyword: Polyacrylamide,water salinity, sodium selenite, water potential .
***Part of Ph.D.Dissntation of the 1st author**

تأثير اضافة البوليمرات ونوعية مياه الري والرش بالسيلينيوم في تقليل كمية مياه الري لنبات الأيرس

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المستخلص

نفذت التجربة في احد البيوت البلاستيكية التابعة للمحطة البحثية A لقسم البستنة وهندسة الحدائق للموسم الخريفي 2021/2020 بهدف التقليل من كمية مياه الري نفذت كتجربة عاملية وفق ترتيب القطع المنشقة بتصميم القطاعات العشوائية وتضمنت ثلاث عوامل العامل الاول نوعية مياه الري وبثلاث مستويات هي (الري بماء نهر دجلة $0.92\ dm\ s^{-1}$,الري المتناوب (رية واحدة بمياه مالحة تعقبها رية بمياه نهر دجلة),الري المتناوب(ريتان بالمياه المالحة تعقبها رية بمياه نهر دجلة،العامل الثاني اضافة البوليمرات (0 و1.5 و2.5)غم كغم تربة$^{-1}$ رمز له (P_0 وP_1 وP_2),العامل الثالث الرش بالسيلينيوم وبثلاث تراكيز هي (0 و10و20) ملغم لتر$^{-1}$ ورمز له (S_0 وS_2 وS_3).فأظهرت النتائج أن أضافة البوليمرات ادت إلى التقليل من كمية مياه الري المستعملة لري نبات الأيرس إذ قلت كمية مياه الري بزيادة تراكيز البوليمرات المضافة كذلك أسهمت البوليمرات عند التركيز 2.5 غم لكل كغم تربة$^{-1}$ النسبة المئوية للمادة الجافة في الاوراق, النسبة المئوية للكربوهيدرات في الأوراق,النسبة المئوية للعناصر K,P,N الجهد المائي في الاوراق, محتوى الماء النسبي, ومساحة الثغور وخفض فعالية انزيم Superoxide dismutase أدت زيادة ملوحة مياه الري إلى خفض جميع الصفات وزيادة فعالية الانزيم وأدى الرش بالسيلينيوم بتركيز 20 ملغم لتر$^{-1}$ إلى زيادة جميع مؤشرات الدراسة وخفض فعالية أنزيمSuperoxide dismutase .

الكلمات المفتاحية: البولي اكرلاميد , ملوحة مياه الري,سيلينات الصوديوم,الجهد المائي.
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INTRODUCTION

Iraq and most other countries of the world suffer from a lack of rainfall and scarcity of water resources, and in light of the decreasing water supplies coming to Iraq from neighboring countries, so it is necessary to follow a scientific irrigation practice to rationalize water consumption, and since water is one of the most important factors that limit plant growth and agricultural productivity in many areas of the world, therefore, has recent need have emerged to find scientific methods used to ration irrigation water. One of these methods used is super water-absorbing polymers, as this is one of the modern methods of treating the agricultural soils physical properties of such as their benefits in improving the properties of sandy soils and the ability to retain water and reduce Irrigation water consumption and thus improving water use efficiency (11) There are other means used to rationalize the consumption of fresh water, which is the use of saline water in agriculture through alternating irrigation with fresh water, especially if we know that fresh water does not exceed 1%, so efforts in various parts of the world have been directed to the use of more saline water sources such as springs, wells and agricultural drainage water (8) Therefore, the alternating irrigation strategy is important to save quantities of fresh water and thus use it to irrigate plants that are highly sensitive to salinity (9) Selenium is one of the rare and useful elements of the plant and has a role in raising the activity of enzymatic antioxidants such as peroxidase, glutathione peroxidase and superoxide, which increases the plant's tolerance to abiotic stress conditions, including water and salt stress through its association with amino acids and the formation of complexes of selenium proteins (1) The study aimed to reduce the quantities of added water by adding polymers, and to know the effect of the interaction between polymers and spraying with selenium in reducing stress.

MATERIALS AND METHODS

The experiment was carried out in one of the greenhouses of the research station A of the Department of Horticulture and Landscape Design / College of Agricultural Engineering Sciences / University of Baghdad during fall season 2020/2021 If the research was carried out as factorial experiment according to split plot designed and with three replications to study the effect of three factors: The first factor is the quality of irrigation water (the main plots) at three levels: (irrigation with the water of the Tigris River 0.92 dms^{-1}, alternating irrigation (one irrigation with saline water followed by irrigation with river water), alternating irrigation (two irrigations with saline water, followed by irrigation with the water of the Tigris River, Sodium chloride salt was used at a concentration of 10 dms^{-1}, The second factor was the addition of Polyacrylamide (0, 1.5 and 2.5) gm of soil-1, the third factor was spraying with selenium at three concentrations (0, 10 and 20) mg L^{-1}. Foliar application was repeated every 3 weeks (1) and until the end of the experiment Irrigation treatments were distributed within the main plots and the treatments for spraying with selenium and polymers were distributed within the secondary plots The averages of the treatments were compared with the least significant difference (L.S.D) test and at a significant level of 0.05 Iris bulbs were planted in Iris white excelsior dated 1/ October /2020 In plastic bags of 10 kg of soil, a layer of gravel was placed inside the bags. The planting bags were filled with 7 kg of soil, which was brought from one of the banks of the Tigris River, and the irrigation process was done up to field capacity. Irrigation was repeated when Soil drained 35% of Prepared water until the end of the experiment 1/ May/2021 and on the basis of the weighted method the amount of irrigation was calculated water by multiplying the number of irrigations by the amount of water used to irrigate one seedling and for each month of the planting month Percentage of dry matter in leaves .(%) Leaves were collected from each plant, after which the fresh weight was measured , leaves were then dried using an electric oven at a temperature of 70 degrees Celsius until the stable weight was obtained and the ratio was calculated as follows- :

Percentage of dry matter in leaves = dry weight of leaves / wet weight of leaves x 100

The percentage of carbohydrates in the leaves (%).The carbohydrates in the leaves were estimated according to the method described by (18). Water potential in leaves. The water

potential was estimated by the flow drop method, as different concentrations of sugar solutions of known voltage were prepared in test tubes and a few drops of methylene blue dye were added Placed inside tubes without dye, a piece of known area was taken from the leaves of the iris plant for 30 minutes, then the leaves were lifted and a drop was taken from the tubes of the colored solutions and added to the uncolored tubes of similar concentration. The drop diffusion indicates that the concentration remains the same, meaning that the solution is diffusion-neutral (34). The relative water content of the leaves. Calculations were carried out according to (5). as the leaves were cleaned of dirt , weighed and then immersed for 3 hours in water and weighed after extracting them from the water (weight when saturated with water) after which they were dried in the oven and their dry weight was taken as follows, Relative water content = leaf wet weight - dry weight / weight after saturation - dry weight

Percentage of Nitrogen in leaves (%): Nitrogen is estimated by Kejldahl-Micro(17).

Percentage of phosphorous in leaves (%).- Phosphorus was estimated using ammonium molybdate and Absorption was measured using Spectrophotometer at 882 nm according to the method used by (26).

Percentage of Potassium in leaves(%): Potassium is estimated by Flamephotometer (31).

Determination of the activity of the enzyme superoxide dismutase. The effectiveness was estimated by riboflavin and nitrobutyrate according to the method used by (32) .

Stomach area (μ^2)The paper was fully expanded and the bottom surface of the paper was cleaned to remove dust and coated with a light layer of colorless nail polish because it contains cellulose acetate. It is left for a period of time to dry and a transparent adhesive is fixed on it to make a stomata imprint. This layer is then removed and fixed on glass slides to be examined under a microscope using the eyepiece with a magnification of (40x) and the objective with a magnification of 100x) (30) and Calculation of stomata area were done according to the ellipse equation are:

$$\mathbf{A = a * b * \pi}$$

a represents the radius of the length of the gap

b is the radius of the stoma width

RESULTS AND DISCUSSION

Amount of irrigation water (liters)

Table (1) shows that the irrigation treatments did not record a difference between them in the amount of irrigation water needed by Iris.As for the addition of polymers, treatment P_0 was significantly superior in recording the highest amount of irrigation water to 28.86 liters compared to treatment P_2, which recorded the lowest amount of irrigation water amounting to 18.07 liters.When spraying with selenium, treatment S_0 was significantly superior in recording the highest amount of irrigation water amounting to 23.83 liters compared to treatment S_2, which recorded the lowest amount of irrigation water amounted to 23.01 liters .The results of the binary interaction between irrigation factors and the addition of polymers indicated that I_0P_0 treatments were superior in recording the highest amount of irrigation water amounting to 28.95 liters compared to treatment I_1P_2 which recorded the lowest amount of irrigation water amounting to 18.06 liters.The interaction effect between irrigation and selenium spray resulted in the moral superiority of I_0S_0 treatment in recording the highest amount of irrigation water amounted to 23.96 liters compared to treatment I_2S_2 which recorded the lowest amount of irrigation water amounted to 22.99 liters.In the bilateral interaction between the addition of polymers and spraying with selenium, treatment P_0S_0 significantly outperformed in recording the highest amount of irrigation water amounting to 29.35 liters compared to treatment P_2S_2, which recorded the lowest amount of irrigation water amounting to 17.74 liters Also, treatment $I_0P_0S_0$ was significantly superior in the triple interaction between the studied factors, as it recorded the highest amount of irrigation water amounting to 29.74 liters compared to treatment $I_2P_2S_2$ which recorded the lowest amount of irrigation water amounting to 17.74 liters.

Percentage of dry matter in leaves(%).

The results in Table 1 indicate the moral superiority of the irrigation treatments I_1 and I_0 in giving them the highest percentage of dry matter in the leaves, which amounted to (26.86, 26.71%) respectively, while the

percentage of dry matter in the leaves decreased when treatment I_2 reached 22.75%.As for the addition of polymers, it had a positive effect in increasing the percentage of dry matter, as treatment P_2 was significantly superior in giving the highest percentage of dry matter amounting to 25.87%, while the percentage decreased when treatment P_0 reached 24.95%. And when spraying treatments with selenium, treatment S_2 was significantly superior in recording the highest characteristic of 26.86% compared to control treatment S_0, which recorded the lowest dry matter percentage of 23.59%. also, treatments I_1P_1 and I_0P_2 were significantly superior, as they recorded (27.42 , 27.30)%, respectively, which did not differ significantly from I_1P_2 treatment, which scored 26.88%, while treatment I_2P_0 recorded the lowest percentage of dry matter amounted to 22.29% in the bilateral interaction treatments between irrigation and addition of polymers. As for the bilateral interaction between the quality of irrigation water and spraying with selenium, the treatment I_1S_2 was significantly superior, which scored 28.72%, compared to the treatment I_2S_0, which recorded the lowest percentage of dry matter that reached 21.17% in regard to the binary interaction between the addition of polymers and spraying with selenium, the two treatments P_2S_2 and P_1S_2 which did not differ significantly between them outperformed them in giving the highest percentage of dry matter of the leaves reaching (27.20,26.80)% while the percentage decreased to reach 23.17% in the treatment P_0S_0. the triple interaction between the effect of irrigation water quality, the addition of polymers and spraying with selenium showed the significant superiority of the two treatments $I_1P_2S_2$ and $I_1P_2S_1$, which recorded (28.83 , 28.79)%, which did not differ significantly from the treatments $I_1P_1S_2$, $I_1P_0S_2$ and $I_1P_1S_1$ as they recorded (28.70, 28.65 ,28.49 The percentage of dry matter in the treatment $I_2P_0S_0$ reached 20.43%.

Table 1. The effect of polymers and the quality of irrigation water and spraying with selenium and the interaction between them in Amount of irrigation water (liters) and percentage of dry matter in Iris leaves(%).

Treatment		The amount of irrigation water(Liter)				percentage of dry matter in leaves			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	29.74	23.54	18.61	23.96	25.63	25.46	26.17	25.75
	S_1	28.60	22.82	17.85	23.09	26.37	26.81	27.80	27.00
	S_2	28.52	22.72	17.75	23.00	26.78	27.40	27.94	27.37
I_1	S_0	29.14	23.54	18.61	23.76	23.46	25.06	23.02	23.85
	S_1	28.81	22.82	17.85	23.16	26.74	28.49	28.79	28.01
	S_2	28.70	22.71	17.74	23.05	28.65	28.70	28.83	28.72
I_2	S_0	29.16	23.52	18.61	23.76	20.43	20.86	22.24	21.17
	S_1	28.60	22.82	17.84	23.09	22.14	22.40	23.20	22.58
	S_2	28.50	22.71	17.74	22.99	24.31	24.32	24.83	24.49
$L.S.D_{0.05}$	0.22				0.15	0.98			0.58
I*P	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
	I_0	28.95	23.02	18.07	23.35	26.26	26.56	27.30	26.71
	I_1	28.88	23.02	18.06	23.32	26.28	27.42	26.88	26.86
	I_2	28.75	23.02	18.07	23.28	22.29	22.53	23.42	22.75
$L.S.D_{0.05}$	0.15				N S	0.58			0.45
P*S	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
	S_0	29.35	23.53	18.61	23.83	23.17	23.79	23.81	23.51
	S_1	28.67	22.82	17.84	23.11	25.09	25.90	26.60	25.86
	S_2	28.58	22.71	17.74	23.01	26.58	26.80	27.20	26.86
$L.S.D_{0.05}$	0.12				0.07	0.56			0.32
P		28.86	23.02	18.07		24.95	25.50	25.87	
$L.S.D_{0.05}$		0.07				0.32			

Percentage of carbohydrates in the leaves(%).: The results in Table 2 show the effect of irrigation water quality on the percentage of carbohydrates in the leaves. Treatment I_1 was significantly superior in recording the highest percentage of carbohydrates, which amounted to 3.834%, while the percentage of carbohydrates decreased to 3.665% in treatment I_2.and the addition of polymers affected the percentage of carbohydrates, so the treatment of adding P_2 polymers recorded 3.985%, significantly superior to the treatment of no addition P_0 which recorded 3.555% also spraying with selenium had a significant effect on the percentage of carbohydrates, as the spraying treatment S_2 recorded 3.917% compared to the treatment S_0, which recorded 3.555%.The bilateral interaction between the quality of irrigation water and the addition of polymers showed the significant superiority of I_1P_2 treatment in increasing the percentage of carbohydrates, which amounted to 4.103%, while the percentage of carbohydrates decreased to 3.476% in the I_2P_0 treatment. in the bilateral interaction between irrigation and spraying treatments with selenium, treatment I_1S_2 was significantly superior in giving the highest percentage of carbohydrates in leaves, which amounted to 4,000%, while this percentage decreased in treatment I_2S_0, which recorded 3.476%.with regard to the bilateral interaction between the addition of polymers and spraying with selenium, the treatment P_2S_2 affected the percentage of carbohydrates, which recorded 4.150%, significantly superior to the treatment P_0S_0, which recorded the lowest percentage of carbohydrates, which amounted to 3.305%. The results of the triple interaction between the studied factors showed the significant superiority of the two treatments $I_1P_2S_2$ and $I_0P_2S_2$ in giving them the highest percentage of carbohydrates, which amounted to (4.283 and 4.266)%. respectively, and the percentage of carbohydrates in the leaves decreased when the treatment $I_2P_0S_0$ recorded 3.270%.

Percentage of nitrogen(%).

It is clear from the results of the statistical analysis in Table 2 that the quality of irrigation water had a negative impact on reducing the percentage of nitrogen, as the treatment I_2 recorded the lowest percentage of nitrogen, which amounted to 1.08% compared to the treatment I_0, which recorded 1.17% .The results of adding polymers also showed the significant superiority of treatment P_2 in the percentage of nitrogen, as it gave 1.22%, superior to the comparison treatment P_0, which gave 0.99% .Spraying plants with selenium was accompanied by a significant increase in the percentage of nitrogen, as S_2 spraying treatment gave 1.21%, while the non-spraying treatment S_0 recorded 1.01%.When the bilateral interaction between irrigation and the addition of polymers was applied the treatment I_0P_2 was significantly superior by giving them 1.25%, which did not differ significantly from the treatments I_1P_2 and I_2P_2 which gave (1.22 , 1.21)%, while the percentage of nitrogen decreased to reach 0.93% when the treatment I_2P_0.The results of the binary interaction between irrigation and spraying treatments with selenium showed the significant superiority of I_0S_2 treatment in giving the highest nitrogen percentage, which amounted to 1.30% compared to treatment I_2S_0, which recorded the lowest percentage, which amounted to 0.98%, as for the effect of the bilateral interaction between the addition of polymers and spraying with selenium, the treatment P_2S_2 was significantly superior, as it recorded 1.32%, superior to the treatment P_0S_0, which recorded the lowest percentage of nitrogen amounted to 0.83%.the results of the triple interaction between the quality of irrigation water and the addition of polymers and sprinklers with selenium indicated that the treatment $I_0P_2S_2$ was superior in recording the highest nitrogen content, which amounted to 1.37%, which did not differ significantly from the treatments $I_0P_1S_2$, $I_2P_2S_2$, $I_1P_2S_2$, $I_0P_2S_1$ and $I_1P_2S_1$ as they scored (1.32, 1.30, 1.29 , 1.25,1.23) respectivy While the percentage of nitrogen decreased in the treatment $I_2P_0S_0$, which recorded 0.76%.

Table 2. The effect of polymers and the quality of irrigation water and spraying with selenium and the interaction between them in the percentage of carbohydrates and nitrogen in the Iris leaves(%).

Treatment		percentage of carbohydrate in leaves(%)				percentage of nitrogen(%)			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	3.303	3.586	3.856	3.582	0.94	1.09	1.15	1.06
	S_1	3.643	3.800	4.090	3.844	1.06	1.16	1.25	1.15
	S_2	3.776	3.810	4.266	3.951	1.21	1.32	1.37	1.30
I_1	S_0	3.343	3.590	3.886	3.606	0.79	1.04	1.13	0.99
	S_1	3.683	3.863	4.140	3.895	1.00	1.11	1.23	1.11
	S_2	3.816	3.900	4.283	4.000	1.07	1.17	1.29	1.18
I_2	S_0	3.270	3.530	3.630	3.476	0.76	1.06	1.11	0.98
	S_1	3.550	3.793	3.213	3.718	1.00	1.09	1.22	1.10
	S_2	3.610	3.890	3.900	3.800	1.05	1.17	1.30	1.17
$L.S.D_{0.05}$	0.017				0.010	0.14			0.08
I*P	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
	I_0	3.574	3.732	4.071	3.792	1.07	1.19	1.25	1.17
	I_1	3.614	3.784	4.103	3.834	0.95	1.11	1.22	1.09
	I_2	3.476	3.737	3.781	3.665	0.93	1.10	1.21	1.08
$L.S.D_{0.05}$	0.010				0.007	0.08			0.07
P*S	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
	S_0	3.305	3.568	3.791	3.555	0.83	1.06	1.13	1.01
	S_1	3.625	3.818	4.014	3.819	1.02	1.12	1.23	1.12
	S_2	3.734	3.866	4.150	3.917	1.11	1.22	1.32	1.21
$L.S.D_{0.05}$	0.010				0.005	0.08			0.04
P		3.555	3.751	3.985		0.99	1.13	1.22	
$L.S.D_{0.05}$		0.005				0.04			

Percentage of phosphorus(%).

The results of the analysis in Table 3 show the percentage of phosphorous to the significant superiority of the comparison treatment I_0 in recording the highest percentage of phosphorous, which amounted to 0.272%, while the irrigation treatment I_2 reduced the percentage of phosphorus, which amounted to 0.230% and the treatments of adding polymers significantly affected this trait as the P_2 treatment gave 0.292% superior to that of P_0 which gave 0.212% .The effect of spraying the plant with selenium on the percentage of phosphorous the S_2 spraying treatment was significantly superior, as it scored 0.277%, compared to the non-spray treatment S_0, which recorded 0.228%. As for the bilateral interaction between irrigation and the addition of polymers, the treatment I_0P_2 which recorded 0.314% was significantly superior to the treatment I_2P_0 which recorded 0.192%.As for the results of the bilateral interaction between irrigation and spraying agents with selenium, the treatment I_0S_2 outperformed the rest of the treatments by giving the highest phosphorous percentage of 0.296% compared to I_2S_0 treatment which gave the lowest phosphorous percentage of 0.204%.The binary interaction between the addition of polymers and spraying with selenium was significantly superior to the treatment P_2S_2 in giving the value of 0.322% compared to the comparison treatment P_0S_0, which recorded the lowest percentage of phosphorus of 0.186%.In regard to the triple interaction between the studied factors, the treatment $I_0P_2S_2$ was significantly superior in giving the highest phosphorous ratio of 0.346%, while the $I_2P_0S_0$ treatment recorded the lowest phosphorous ratio of 0.163%.

Percentage of potassium(%).

The results in Table 3 show that irrigation treatments led to a clear decrease in potassium, as the percentage of potassium decreased in treatment I_2 to 1.151% compared to treatment I_0, which recorded the highest potassium percentage of 1.213%.the addition of polymers achieved the highest percentage of potassium, as the treatment P_2 was significantly superior in recording 1.320% compared to treatment P_0, which recorded the lowest percentage of potassium, which amounted to 1.034%. When spraying with selenium, treatment S_2 scored

1.260%, significantly superior to the comparison treatment S_0, which recorded 1.108%. The bilateral interaction between irrigation treatments and the addition of polymers, the treatment I_0P_2 outperformed, as it recorded the highest percentage of potassium, which amounted to 1.347%, while the treatment I_2P_0 gave the lowest percentage of potassium, which amounted to 0.991%.The bilateral interaction between irrigation and spraying with selenium showed significant superiority of I_0S_2 treatment, which scored 1.287%, compared to treatment I_2S_0, which recorded the lowest percentage of potassium, which was 1.081%. The dual interaction between the addition of polymers and spraying with selenium showed a significant superiority for the treatment P_2S_2 to record 1.384%, while the treatment P_0S_0 gave the lowest percentage of potassium, which amounted to 0.946%.The results of the triple interaction between the quality of irrigation water, the addition of polymers and spraying with selenium indicated that the treatment $I_0P_2S_2$ was significantly superior by giving 1.416 % compared to the treatment $I_2P_0S_0$ which recorded the lowest percentage of potassium which was 0.886%.

Table 3. The effect of polymers and the quality of irrigation water and spraying with selenium and the interaction between them in The percentage of phosphorus and potassium in the Iris leaves(%).

Treatment		percentage of phosphorus(%)				percentage of potassium(%)			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	0.216	0.253	0.286	0.252	1.013	1.126	1.276	1.138
	S_1	0.233	0.266	0.310	0.270	1.080	1.210	1.350	1.213
	S_2	0.256	0.286	0.346	0.296	1.146	1.300	1.416	1.287
I_1	S_0	0.180	0.226	0.276	0.227	0.940	1.126	1.246	1.104
	S_1	0.206	0.246	0.293	0.248	1.023	1.200	1.316	1.180
	S_2	0.243	0.266	0.323	0.277	1.136	1.260	1.390	1.262
I_2	S_0	0.163	0.213	0.236	0.204	0.886	1.106	1.250	1.081
	S_1	0.186	0.236	0.266	0.230	0.973	1.166	1.286	1.142
	S_2	0.226	0.250	0.296	0.257	1.113	1.236	1.346	1.232
$L.S.D_{0.05}$	0.009				0.005	0.012			0.006
I*P	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
	I_0	0.235	0.268	0.314	0.272	1.080	1.212	1.347	1.213
	I_1	0.210	0.246	0.297	0.251	1.033	1.195	1.317	1.182
	I_2	0.192	0.233	0.266	0.230	0.991	1.170	1.294	1.151
$L.S.D_{0.05}$	0.005				0.004	0.006			0.003
P*S	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
	S_0	0.186	0.231	0.266	0.228	0.946	1.120	1.257	1.108
	S_1	0.208	0.250	0.290	0.249	1.025	1.192	1.317	1.178
	S_2	0.242	0.267	0.322	0.277	1.132	1.265	1.384	1.260
$L.S.D_{0.05}$	0.005				0.003	0.007			0.004
P		0.212	0.249	0.292		1.034	1.192	1.320	
$L.S.D_{0.05}$		0.003				0.004			

Superoxide dismutase activity(Absorption unit.mg^{-1}).: It is reveal from the results in Table 4 that irrigation treatments affected the effectiveness of Sod enzyme, as treatment I_2 recorded the highest concentration of the enzyme amounted to 10.13 Absorption unit.mg^{-1}, compared to treatment I_0, which recorded the lowest concentration of enzyme reaching 8.37 Absorption unit.mg^{-1}.while the addition of polymers led to a decrease in the enzyme's activity, as the treatment P_2 recorded the lowest activity of the enzyme amounting to 9.05 Absorption unit.mg^{-1} compared to the control treatment P_0 which recorded the highest activity of the enzyme amounting to 9.49 Absorption unit.mg^{-1}. The Spraying selenium effected the effectiveness of Sod enzyme, as the treatment S_2 reduced the enzyme's effectiveness, amounting to 9.09 Absorption unit.mg^{-1}, compared to the treatment of not spraying with selenium S_0, which led to an increase in the activity of the enzyme, which amounted to 9.47 Absorption unit.mg^{-1}.as for the bilateral interaction

between irrigation treatments and the addition of polymers, treatments I_2P_0 and I_2P_1 excelled in recording the highest concentration of the enzyme, reaching (10.20 , 10.14) Absorption unit.mg^{-1} compared to treatment I_0P_2 which led to a decrease in enzyme activity, which recorded 8.03 Absorption unit.mg^{-1}.in the bilateral interaction between irrigation and spraying with selenium, the treatments I_2S_0, I_2S_1 and I_2S_2 were superior in giving them the highest activity of Sod enzyme, which amounted to (10.18, 10.13 , 10.9 Absorption unit.mg^{-1}), respectively, while the enzyme activity decreased when treated with I_0S_2 to record 8.16 Absorption unit mg^{-1}. Whereas, the binary interaction between adding polymers and spraying with selenium recorded the significant superiority of treatment P_0S_0 in recording the highest activity of the enzyme amounting to 9.65 Absorption unit.mg^{-1} compared to the treatment P_2S_2 which led to a decrease in the enzyme activity as it recorded 8.83 Absorption unit.mg^{-1}. The results of the triple interaction in the same table showed that treatment $I_2P_0S_0$ was significantly superior in increasing the enzyme activity, which amounted to 10.24 Absorption unit.mg^{-1}, which did not differ significantly from the treatments $I_2P_1S_0$, $I_2P_0S_1$, $I_2P_0S_2$, $I_2P_1S_1$ and $I_2P_2S_0$, as they scored (10.19, 10.19, 10.16, 10.14,10.13) Absorption unit.mg^{-1} compared to the treatment $I_0P_2S_2$, which recorded the lowest activity of Sod enzyme, which was 7.80 Absorption unit.mg^{-1}.

Water potential in leaves (bar).

It is shows from Table 4 that the irrigation treatments had a significant effect on the water potential of the leaf, as the irrigation treatment I_0 achieved the highest rate (the least negative) that amounted to -0.44 bar, compared to the irrigation treatment I_2, which gave the lowest rate (the most negative) that amounted to -5.75 bar. Also, the addition of polymers had a significant effect, as treatment P_2 gave the highest rate (less negative) which amounted to -2.09 bar compared to the comparison treatment P_0, which recorded the lowest rate (more negative) which amounted to -3.63. Spraying with selenium had a significant effect on this trait, as the spraying treatment S_2 at concentration (20) mg L^{-1} gave the highest rate (less negative) of -2.59 bar compared to the treatment of no spray which recorded the lowest rate (most negative) of -3.12 bar .It is noted from the same table the results of the binary interaction between irrigation treatments and the addition of polymers to the superiority of treatment I_0P_2 significantly in recording the highest rate (less negative) of -0.30 bar compared to treatment I_2P_0 which recorded the lowest rate (more negative) of -6.96 bar. when the two interactions between the irrigation and spraying treatments with selenium, the results indicate the moral superiority of the treatment I_0S_2 in giving it the highest rate (the least negative) amounting to -0.37 bar compared to the treatment I_0S_0 which gave the lowest rate (the highest negative) amounting to-6.13bar. The bilateral interaction between the addition of polymers and spraying with selenium, the treatment P_2S_2 was significantly superior in recording the highest (lowest negative) rate of -1.80 bar compared to treatment P_0S_0 which recorded the lowest rate (highest negative) of -3.89 bar. Also, treatment $I_0P_2S_2$ was significantly superior in the triple interaction between the study factors, as it recorded the highest rate (less negative) -0.24 bar compared to treatment $I_2P_0S_0$ which recorded the lowest rate (more negative) of -7.29 bar.

Table 4. The effect of polymers and the quality of irrigation water and spraying with selenium and the interaction between them in Superoxide Dismutase (gm^{-1}units of absorption) and water potential in Iris leaves (bar).

Treatment		Superoxide Dismutase activity				water potential in leaves (bar)			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	8.80	8.60	8.30	8.56	-0.69	-0.48	-0.36	-0.51
	S_1	8.70	8.50	8.00	8.40	-0.58	-0.46	-0.32	-0.45
	S_2	8.50	8.20	7.80	8.16	-0.51	-0.38	-0.24	-0.37
I_1	S_0	9.93	9.70	9.40	9.67	-3.70	-2.59	-1.83	-2.71
	S_1	9.63	9.40	9.06	9.36	-3.33	-2.32	-1.48	-2.38
	S_2	9.30	9.10	8.70	9.03	-2.96	-2.08	-1.10	-2.05
I_2	S_0	10.24	10.19	10.13	10.18	-7.29	-6.13	-4.98	-6.13
	S_1	10.19	10.14	10.06	10.13	-7.04	-5.78	-4.44	-5.75
	S_2	10.16	10.11	10.01	10.09	-6.55	-5.43	-4.07	-5.35
$L.S.D_{0.05}$	0.11				0.09	0.15			0.15
I*P	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
	I_0	8.66	8.43	8.03	8.37	-0.59	-0.44	-0.30	-0.44
	I_1	9.62	9.40	9.05	9.35	-3.33	-2.33	-1.47	-2.38
	I_2	10.20	10.14	10.07	10.13	-6.96	-5.78	-4.50	-5.75
$L.S.D_{0.05}$	0.09				0.09	0.15			0.15
P*S	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
	S_0	9.65	9.49	9.27	9.47	-3.89	-3.07	-2.39	-3.12
	S_1	9.51	9.34	9.04	9.29	-3.65	-2.85	-2.08	-2.86
	S_2	9.32	9.13	8.83	9.09	-3.34	-2.63	-1.80	-2.59
$L.S.D_{0.05}$	0.05				0.03	0.04			0.02
P		9.49	9.32	9.05		-3.63	-2.85	-2.09	
$L.S.D_{0.05}$		0.03				0.02			

Relative water content (%).

Table 5 shows that no differences were recorded among the irrigation parameters in the relative water content. As for the addition of polymers, treatment P_2 was significantly superior in recording the highest relative water content of 70.30% compared to treatment P_0, which recorded 57.75%.when spraying with selenium, treatment S_2 was significantly superior in recording the highest relative water content of 69.30% compared to treatment without spraying S_0, which recorded the lowest relative water content of 54.80%. The results of the binary interaction between irrigation factors and the addition of polymers indicated that the treatments I_2P_2, I_1P_2 and I_0P_2 were superior in recording the highest relative water content of (70.57, 70.50 , 69.83)%, respectively, compared to treatment I_0P_0, which recorded the lowest relative water content of 57.57%. interactions between irrigation and spraying factors with selenium resulted in significant superiority of the treatments I_2S_2, I_1S_2 and I_0S_2 in giving them the highest relative water content, they scored (70.01, 69.33 , 68.56)% sequentially compared to the treatment I_0S_0, which gave the lowest relative water content of 54.77%. The bilateral interaction between the addition of polymers and spraying with selenium, the treatment P_2S_2 was significantly superior in recording the highest relative water content of 80.93% compared to treatment P_0S_2, which recorded the lowest relative water content of 52.69%.Also, the treatments $I_1P_2S_2$, $I_2P_2S_2$ and $I_0P_2S_2$ were significantly superior in the triple interaction between the studied factors, as they scored (81.17, 81.12 ,80.52)% sequentially compared to the treatment $I_2P_0S_0$ which recorded the lowest relative water content of 52.02%.

Stomata area(micron^2).

The results in Table 5 indicat a significant effect of irrigation treatments on stomata area, as treatment I_1 excelled in recording the highest stomata area of 15.07 microns^2, which did not differ significantly from treatment I_0, which recorded 14.84 microns^2, and the stomata area decreased to 11.87 microns^2 in treatment I_2. While the addition of polymers led to the significant superiority of treatment P_2 in recording the highest stomata area of

15.85 microns^2 while the stomata area decreased in treatment P_0 to 12.21 microns^2 .When spraying with selenium, treatment S_2 was significantly superior in giving the highest stomata area of 15.21 microns^2 compared to treatment S_0 which recorded the lowest stomata area of 12.55 microns^2 .In the bilateral interaction between the irrigation treatments and the addition of polymers, the two treatments I_1P_2 and I_0P_2 were significantly superior in recording the highest stomata area of (17.37 , 16.55) microns^2 compared to the I_2P_0 treatment, which recorded the lowest stomata area of 10.08 microns^2. The binary interaction between irrigation and spraying treatments with selenium showed the significant superiority of I_1S_2 treatment, which recorded 16.62 microns^2, which did not differ significantly from treatments I_0S_2 and I_1S_1, which recorded 16.14 and 15.33 microns^2, while the treatment I_2S_0 recorded the lowest stomata area of 10.90 microns^2.As for bilateral interactions between the addition of polymers and spraying with selenium, the treatment P_2S_2 was significantly superior in recording the highest stomata area of 17.00 microns^2 compared to the treatment P_0S_0 which recorded the lowest stomata area of 10.18 microns^2. The triple interaction between the study factors, the treatment $I_1P_2S_2$ was significantly superior, which recorded 18.40 microns^2, which did not differ significantly from the treatments $I_0P_2S_2$ and $I_1P_2S_1$, which recorded (17.36,17.30) microns^2, and the stomata area was reduced in the treatment $I_2P_0S_0$ to reach 9.20 microns^2.

Table 5. The effect of polymers and the quality of irrigation water and spraying with selenium and the interaction between them in Relative water content (%) and stomata area(micron^2) in Iris leaves

Treatment		Relative water content (%)				stomata area(micron^2)			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	53.03	54.90	56.38	54.77	11.52	13.40	15.56	13.49
	S_1	58.31	60.57	72.58	63.82	13.46	14.46	16.73	14.88
	S_2	61.37	63.78	80.52	68.56	15.50	15.56	17.36	16.14
I_1	S_0	53.02	54.96	56.42	54.80	9.83	13.50	16.43	13.25
	S_1	58.32	60.77	73.92	64.34	13.63	15.06	17.30	15.33
	S_2	61.50	65.32	81.17	69.33	15.73	15.73	18.40	16.62
I_2	S_0	52.02	55.62	56.83	54.82	9.20	11.40	12.10	10.90
	S_1	58.33	62.12	73.75	64.73	10.03	11.90	13.60	11.84
	S_2	63.83	65.07	81.12	70.01	11.03	12.40	15.23	12.88
$L.S.D_{0.05}$	4.12				2.14	1.46			1.39
I*P	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
	I_0	57.57	59.75	69.83	62.38	13.49	14.47	16.55	14.84
	I_1	57.61	60.35	70.50	62.82	13.06	14.76	17.37	15.07
	I_2	58.06	60.94	70.57	63.19	10.08	11.90	13.64	11.87
$L.S.D_{0.05}$	2.14				N S	1.39			1.42
P*S	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
	S_0	52.69	55.16	56.54	54.80	10.18	12.37	14.08	12.55
	S_1	58.32	61.15	73.42	64.30	12.76	13.81	14.56	14.02
	S_2	62.24	64.72	80.93	69.30	14.70	15.87	17.00	15.21
$L.S.D_{0.05}$	2.49				$L.S.D_{0.05}$	0.52			$L.S.D_{0.05}$
P		57.75	60.34	70.30	1.43	12.21	13.71	15.85	0.30
$L.S.D_{0.05}$		1.43				0.30			

It is noted from the results of Tables (1,2,3) that the amount of irrigation water decreased with an increase in the concentrations of added polymers, and this is due to the ability of polymers to improve the physical properties of the soil and increase the effectiveness and ability of the soil to retain water, and thus reduce watering rates and have the ability to retain water 400 times its weight in addition to giving what It is estimated to be about 95% of water goes to growing plants, and thus increases the efficiency of the plant to obtain water, and the main and most prominent factor in these materials is their ability to release water instead of holding water (10,24). The spraying with selenium also reduced the amount of added water due to the ability of selenium to reduce the impact of water stress through its role in getting rid of free radicals, including the cleavage of hydrogen peroxide into two water molecules. the extraordinary ability of cellular membranes to withstand water stress and prevent the denaturation of plant protein metabolism compounds, and this mechanism is one of the most successful biological means through which the plant

works to withstand stress in the presence of selenium (15). Notes from table (2,3) The percentage of dry matter and carbohydrates in the leaves were significantly superior in the flow concentrations of saline water in treatment I_1 (irrigated with saline water followed by irrigation with river water) This increase may be appropriate for the continuation of the growth process and improving its indicators It was also explained by the plant's need for small amounts of salt represented by nutrient ions that contribute to increasing growth and increasing salinity levels. A significant decrease in the percentage of dry matter and carbohydrates in leaves was observed. This may be due to the effects of treatment salinity in reducing leaf area and chlorophyll in leaves and the effect of this in inhibiting The efficiency of the photosynthesis process, and its effect on the activity of the enzymes responsible for reducing carbon dioxide, especially the enzyme RUBP carboxylase (Rubisco) (19). These results agree with what was obtained (22).The increase in the salinity of the irrigation water led to a decrease in the plant's nutrient content, because the concentration of sodium chloride in the soil solution led to an increase in the osmotic potential of the soil solution, which made it difficult for the plant to absorb water and ions, and there was inhibition in the growth and division of cells, as well as damage to cell membranes, which affects negatively in its selective permeability (2). Results show that the addition of polymers has significantly outperformed in improving all vegetative growth indicators, due to its role in preventing water infiltration into the depths of the soil away from the root system and thus maintaining the readiness of water and the moisture content in the soil for a longer period when plants are exposed to Lack of water (28). these materials have the ability to retain large amounts of water and nutrients when added to the soil, making it ready for plant growth whenever it is needed (25). It is also noted that the addition of polymers to the soil leads to an improvement in the physical properties of the soil, including aeration, and thus leads to the presence of nutritional elements (6, 7, 25). Polymers can also reduce salt stress on plants directly by improving soil properties or indirectly through their role in increasing the metabolism of plants to tolerate salt.It is noted that selenium has a significant effect on increasing the concentration of nitrogen, phosphorous and potassium ions in the leaves, and the concentration increased by increasing the concentration of selenium (tables 2,3) foliar applied to on the plant. Absorption of nutrients in the growth medium (3,14). It is also believed that the increased absorption of nutrients is due to the role of selenium as an antioxidant for cytochromes, which has a role in the cytochrome pump to absorb salts (27). and this result agrees with what was obtained by(33) as they noticed an increase in the total soluble carbohydrates concentration the tubers and the concentration of nitrogen and potassium ions the leaves by treating the potato leaves with selenium at a concentration of 20 gm ft^{-1} compared to the no-spray treatment. It is noted from the results of Table (4,5) that the reason for the decreasing water potential in the leaf by the increase in the salinity of irrigation water may be due to the high osmotic effort in the soil, which impedes the plant's absorption of water, which leads to a decrease in its water effort (Table 4) and this led to a decrease in cell swelling and weakness in the processes of division and elongation (21), the reason for the increase in the stomata area in the low concentrations of the salinity of the irrigation water may be attributed to its role in increasing the levels of antioxidant enzymes, including superoxide dismutase (Table 4), which prompted the plant to resist stress, while the area stomata significantly decreased. The stomata by increasing the salinity level of the irrigation water may be due to the increase in the free gusts and the closure of the stomata and the synthesis of quantities of ABA acid in the cells of the epidermis of the leaf, and then it accumulates in the guard cells and works to influence the area and size of the stomata (Table 5) and this is consistent with (20,12).It is noticed that the water stress, the relative content of the leaves and the area of the stomata increase, as in (Tables 4 , 5), when adding polymers to the soil. It reduces the number of watering times in addition to improving the plant characteristics and reducing the total amount of water required for

irrigation in addition to improving the aeration in the root zone and increasing the microbial activities in the soil (13).It is believed that selenium works to cleave the oxidizing factors inside the plant, turning the hydrogen peroxide molecule into two water molecules through its cleavage (16). It also contributes to the formation of Aquaporins, which contributes to increasing the efficiency of cellular transport of water within the plant tissues and increasing the relative water content inside the leaf This contributes to resistance to environmental stresses (23,4). Perhaps the reason for the decrease in water stress (the most negative) is due to the high levels of stress, which in turn will affect the stomata area (Table 5). The reason for increasing the stomata area may be due to an increase in selenium concentrations sprayed on the plant indicates the role of selenium in resisting water stress and these results agree with what was obtained (29).

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