QUALITY OF IRRIGATION WATER , FOLIAR APPLIED SELENIUM AND SOIL POLYMER IN IMPROVING VEGETATIVE AND FLOWERING CHARACTERISTICS OF IRIS PLANTS.

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ABSTRACT

The experiment was conducted in a green house at the Department of Horticulture and Landscaping design College of Agriculture engineering Sciences for the fall season 2020-2021 to determine the response of the Iris plant to bear the conditions of abiotic stresses by studying the effect of irrigation with saline water on the vegetative and flowering characteristics of the plant.The study included three factor, the 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), The second factor is the addition of Polyacrylamide (0, 1.5,2.5) g of $soil^{-1}$ his symbol(P_0,P_1.P_2). The third factor is foliar applied selenium using three concentrations (0, 10,20) mg L^{-1} his symbol(S_0,S_1,S_2) Results showed that that increasing salinity of irrigation water led to a decrease in all vegetative characteristics and flowering, increasing the efficacy of the enzyme Peroxidase and Proline, increasing both chlorine and sodium in the leaves. Spraying with selenium at a concentration of 20 mg L^{-1} as well as adding polymers at a concentration of 2.5 g led to an increase in the vegetative and flowering characteristics of the plant, reducing the elements chlorine and sodium in the leaves, and decreasing the effectiveness of the enzyme Peroxidase and Proline.

Keyword:vase life, Peroxidase,Polyacrylamide, Proline.
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دراسة نوعية مياه الري والرش بالسيلينيوم واضافة البوليمرات إلى التربة في تحسين الصفات الخضرية والزهرية لنبات الأيرس

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المستخلص

نفذت التجربة في احد البيوت البلاستيكية لقسم البستنة وهندسة الحدائق/ كلية علوم الهندسة الزراعية/ جامعة بغداد في الجادرية للموسم الخريفي 2021/2020 بهدف تحديد مدى أستجابة نبات الأيرس في تحمل ظروف الاجهادات اللاحيوية عن طريق دراسة إثر السقي بالمياه المالحة في مواصفات النبات الخضرية والزهرية. لدراسة تأثير ثلاث عوامل العامل الاول نوعية مياه الري (القطع الرئيسية) وبثلاث مستويات هي (الري بماء نهر دجلة $0.92\ dm\ s^{-1}$,الري المتناوب (رية واحدة بمياه مالحة تعقبها رية بمياه نهر),الري المتناوب(ريتان بالمياه المالحة تعقبها رية بمياه نهر دجلة، العامل الثاني اضافة البوليمرات Polyacrylamide (0 و1.5 و2.5)غم كغم تربة$^{-1}$,العامل الثالث الرش بالسيلينيوم وبثلاث تراكيز هي (0 و10و20) ملغم لتر$^{-1}$.اظهرت النتائج أن زيادة ملوحة مياه الري أدت إلى خفض جميع الصفات الخضرية والزهرية وزيادة فعالية انزيم Peroxidase والبرولين وزيادة كل من عنصر الصوديوم والكلور في الأوراق وأدى الرش بالسيلينيوم بتركيز 20 ملغم لتر$^{-1}$ كذلك أضافة البوليمرات عند التركيز2.5غم إلى زيادة صفات نمو النبات الخضرية والزهرية والتقليل من عنصري الصوديوم و الكلور في الأوراق وخفض فعالية انزيم Peroxidase والبرولين.

الكلمات المفتاحية:العمر المزهري,البيروكسيديز,البولي اكرلاميد,البرولين.
مستل من أطروحة دكتوراة للباحث الاول.

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INTRODUCTION

Iris spp. Iris is a flowering ornamental plant belonging to the family Iridaceae. The genus Iris includes about 200 species, some of them are annuals and others are perennials. It is propagated by true bulbs or rhizomes according to the species. Its flowers are successful in interior flower arrangement and as cut (21) Water is one of the most important factors that limit plant growth and agricultural production in many regions of the world, as population expansion and economic activity have led to a shortage of water, especially in arid and semi-arid areas. The water problem is expected to worsen further, so water conservation and improvement of efficiency Irrigation is one of the important issues in water management (12). Given the limited fresh water for irrigation, it may resort to the use of alternative water sources. Therefore, the trend of using saline water as an alternative source has emerged recently to meet part of the water need in agriculture, including the use of alternating irrigation (which is irrigation with saline water). Followed by the use of fresh water) a good way to confront water scarcity and easy to use (3, 5) In a studied effect of salt stress on the water content and photosynthesis in *Iris lacteal* plant using different concentrations of sodium chloride (0,50,100,150,200) mmol l^{-1}, the results showed a decrease in the water content and increase in the concentration of carbon dioxide in the cells and the rate of transpiration decreased directly with increase salt concentrations used(28). and other means used to rationalize water consumption and reduce watering are polymers, as they work to link soil particles with each other, enhance soil permeability, improve its physical properties and reduce the amount of water Total required for irrigation (11), in Iraqi; there are many promising studies that promoted the use of polymers to reduce water use (6, 7) .Selenium also has an important role for plants, as it has a role in overcoming various stresses by raising the activity of enzymatic antioxidants, it enters as a cofactor for these antioxidants, which converts the toxic H_2O_2 hydrogen peroxide compound resulting from the effect of water stress into H_2O water molecules (15),and since herbs and ornamental plants are an integral part of the ecosystem, most of these plants have been used in many countries of the world to treat and solve many problems in the ecosystem (20). Therefore, the study aimed was carried out to determine the extent of the response of the Iris plant to with stand the conditions of abiotic stresses by studying the effect of irrigation with saline water on the vegetative and flowering characteristics of Iris plant.

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 in Jadiriyah during fall season 2020/2021. Plastic bags of 10 kg of soil were used. A layer of gravel was placed inside the bags. The planting bags were filled with 7 kg of soil. Which were brought from one of the banks of the Tigris River, the bags were planted with bulbs of iris and the research was carried out as a factorial experiment according to the arrangement of the split plot desigh with complete random sectors and with three replications to study the effect of three factors, the first factor is the quality of irrigation water (main plots) and 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, using sodium chloride salt with a concentration of 10 dms^{-1}(8). the second factor is the addition of Polyacrylamide (0, 1.5 ,2.5) (gm kg $soil^{-1}$ the third factor spraying with selenium at three concentrations (0, 10 and 20) mg L^{-1}, was used and spraying is repeated every 3 weeks (1) until the end of the experiment. To the limits of field capacity, irrigation was repeated when the soil drained 35% of the ready water until the end of the experiment 1/May/2021. On the basis of the weighted method, the averages of the treatments were compared with the test of the least significant difference L.S.D at the level of significance 0.05. Plant height (cm). The height was measured from the stem contact with the soil surface and to the highest peak reached by the plant growth during flowering stage. Leaf area of plant (cm^2), Three leaves were taken randomly from each plant at the beginning of flowering and the area was calculated by the Digimizer program according to the following equation Plant leaf area cm^2 = average of one leaf area cm^2 × leaves number of each plant. The relative content of chlorophyll in leaves (SPAD UNIT),The estimation of the relative content of chlorophyll at the beginning of flowering was done by using a device (Chlorophyll Meter) SPAD 502. Determination of the effectiveness of peroxidase enzyme (Absorption unit.mg^{-1}), The peroxidase enzyme efficacy was estimated according to the method described by (27). Leaf content of elemental chloride (mg kg^{-1}), it was measured by slaking method with silver nitrate (16). The percentage of sodium in the leaves(%),the flame apparatus was estimated according to the method described by (10). Vase life(day), Three flowers from each experimental unit were collected in the early morning and placed in plastic containers containing 5% sugar solution and citric acid at a concentration of 200 mg L^{-1}, according to the flowering age by the number of days from flower opening until signs of wilting appear. Blooming time (day), the duration of flower survival on the plant was calculated for two flowers each experimental unit from flower bud opening until signs of wilting appear. The percentage of carbohydrates in flowers(%), it was estimated according to the method used by (17). Determination of proline acid in leaves (µg fresh $weight^{-1}$), the proline content of leaves was estimated according to the method used by (9).

RESULTS AND DISCUSSION

Plant height (cm)

The results in Table 1 indicate that the irrigation treatments caused a significant decrease in plant height, as the I_2 irrigation treatment (two irrigations with salt water followed by irrigation with river water) gave the lowest plant height of 33.77 cm compared to the control treatment I_0which recorded the highest plant height of 37.48 cm. Results also showed in the same table that the addition of polymers had a significant effect on the height of the plant, as the treatment P_2 at the concentration of 2.5 g kg of $soil^{-1}$ gave the highest plant height of 37.00 cm, while the treatment P_0 without the addition of polymers recorded the lowest plant height of 34.18 cm.Spraying with selenium had a significant and clear effect on plant height, as the treatment of spraying with selenium S_2 at concentration 20 mg L^{-1} recorded the highest plant height that reached 36.66 cm compared to the comparison treatment S_0 recorded the lowest height of 34.85 cm. Results of the binary interaction between the irrigation treatments and the addition of polymers indicated a significant difference, as the treatment I_0P_2 gave the highest plant height, which reached 38.33 cm, which did not differ significantly from the treatments I_1P_2 and I_0P_1, which recorded 37.55 and 37.44 cm, while the I_2P_0 treatment recorded a significant decrease in plant height to reach 31.77 cm.As for the bilateral interaction between irrigation and spraying treatments with selenium, it significantly affected the plant height, as the treatment I_0S_2 recorded the highest height that reached 38.44 cm, which did not differ significantly from the treatment I_0S_1 which recorded 37.55 cm, while the plant height decreased to 33.22 cm when the treatment I_2S_0. The bilateral interaction between the addition of polymers and spraying with selenium, results showed the superiority of the treatment P_2S_2 in recording the highest height in this trait of 37.88 cm, while the height decreased when treatment P_0S_0, which recorded the lowest height of 33.00 cm. The triple interaction between the irrigation treatments, the addition of polymers and the spraying with selenium, the treatment $I_0P_2S_2$ significantly affected the plant height to 39.33 cm, which did not differ significantly from the treatments $I_1P_2S_2$, $I_0P_2S_1$ and $I_0P_1S_2$ as they recorded (36.66, 36.33 , 36.33) cm, respectively, and a decrease in plant height occurred 30.66 cm when $I_2P_0S_0$ transaction.

Leaf area of plant (cm^2).

The results in Table 1 show that irrigation treatments had a significant effect on the leaf area, as the two treatments I_0 and I_1 recorded the highest leaf area reaching (220.42 , 219.82) cm^2, while the leaf area decreased to 185.78 in treatment I_2.While the addition of polymers led to a significant difference in leaf area, as the treatment P_2 at the concentration of 2.5 gm kg of soil^{-1} gave the highest leaf area amounted to 220.42 cm^2 compared to treatment P_0 which gave the lowest leaf area amounted to 195.14 cm^2.Treatment Spraying with selenium showed a significant effects in this trait, so treatment S_2 was significantly superior, as it recorded 216.61 cm2 compared to treatment S_0, which recorded the value of 199.02 cm^2. As for the bilateral interaction between the quality of irrigation water and the addition of polymers significant superiority of I_0P_2 treatment was acueived by giving it the highest leaf area that reached 237.60 cm^2, while the leaf area decreased to 181.19 cm^2 in treatment I_2P_0 .while the bilateral interaction between the quality of irrigation water and spraying with selenium recorded a significant difference in leaf area, as the two treatments I_1S_2 and I_0S_2 recorded the highest leaf area, amounting to (231.20, 230.19) cm^2 sequentially, as alternating irrigation and spraying with selenium reduced the effect of salt stress, while there was a clear decrease in leaf area as I_2S_0 treatment was 182.91 cm^2 .The results of the binary interaction between polymers and spraying with selenium showed the significant superiority of the treatment P_2S_2 to giving the highest leaf area reaching 231.04 cm^2, while the leaf area decreased in treatment P_0S_0 to reach 186.57 cm^2. The triple interaction between the factors of the study indicated that there was a significant and clear difference in the leaf area if the treatment $I_0P_2S_2$ recording the highest leaf area amounting to 254.31 cm^2, while there was a significant decrease in this trait when the treatment $I_2P_0S_0$ gave 177.26 cm^2.

Table 1. Effect of polymers , the quality of irrigation water , spraying with selenium and the interaction between them in Plant height (cm) and Leaf area of Iris plant (cm^2).

Treatment		Plant height (cm)				Leaf area(cm^2)			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	35.66	36.33	37.33	36.44	200.61	210.87	223.16	211.55
	S_1	36.66	37.66	38.33	37.55	203.91	219.32	235.32	219.52
	S_2	37.66	38.33	39.33	38.44	215.57	220.69	254.31	230.19
I_1	S_0	32.66	35.33	36.66	34.88	181.83	211.59	214.33	202.58
	S_1	34.33	37.33	37.33	36.33	202.46	235.95	238.60	225.67
	S_2	35.33	36.66	38.66	36.88	208.32	239.94	245.34	231.20
I_2	S_0	30.66	34.00	35.00	33.22	177.26	182.99	188.49	182.91
	S_1	32.00	33.66	34.66	33.44	182.35	184.92	190.75	186.00
	S_2	32.66	35.66	35.66	34.66	183.95	187.85	193.48	188.43
$L.S.D_{0.05}$	1.24				0.95	6.19			4.81
I*P	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
	I_0	36.66	37.44	38.33	37.48	206.70	216.96	237.60	220.42
	I_1	34.11	36.44	37.55	36.03	197.54	229.16	232.76	219.82
	I_2	31.77	34.88	35.11	33.77	181.19	185.25	190.90	185.78
$L.S.D_{0.05}$	0.95				0.94	4.81			4.79
P*S	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
	S_0	33.00	35.22	36.33	34.85	186.57	201.82	208.66	199.02
	S_1	34.33	36.66	36.77	35.77	196.24	213.40	221.56	210.40
	S_2	35.22	36.88	37.88	36.66	202.61	216.16	231.04	216.61
$L.S.D_{0.05}$	0.61				0.35	3.05			1.76
P		34.18	36.11	37.00		195.14	210.40	210.40	
$L.S.D_{0.05}$		0.35				1.76			

Relative content of chlorophyll leaves (SPAD UNIT): It is noticed from the results in Table 2, that there was a clear effect of the quality of irrigation water on the chlorophyll content of leaves, as there was a significant decrease in treatment I_2 (irrigation with salt water followed by irrigation with river water) amounting to 41.66 SPADUNIT compared to treatment I_0 which amounted to 47.03 SPAD UNIT.when polymers were added, treatment P_2 was significantly superior by giving it the highest chlorophyll content of 46.01 SPAD UNIT, While the chlorophyll content decreased in treatment P_0, reaching 43.66 SPAD UNIT.As for the effect of spraying with selenium, treatment S_2 was significantly superior in recording the highest chlorophyll content of 45.96 SPAD UNIT, while there was a clear decrease in chlorophyll content that reached 43.51 SPAD UNIT when treating S_0 without spraying with selenium. the results of the binary interaction in the same table between the quality of irrigation water and the addition of polymers showed the significant superiority of the two treatments I_0P_2 and I_0P_1 as they recorded (47.52 and 46.96) SPAD UNIT sequentially, which did not differ significantly from the treatments I_0P_0 and I_1P_2 which recorded (46.61 , 46.22) SPAD UNIT sequentially. there was a clear decrease of chlorophyll at I_2P_0 treatment to 39.38 SPAD UNIT. the results of the binary interaction between irrigation and spraying with selenium gave the significant superiority of treatment I_0S_2 in recording the highest chlorophyll content of 48.06 SPAD UNIT, which did not differ significantly from treatments I_0S_1 and I_1S_2, which recorded (47.21 , 46.84) SPAD UNIT sequentially, and the chlorophyll content of treatment I_2S_0 decreased to 40.62 SPAD UNIT. As for the results of the binary interaction between the addition of polymers and spraying with selenium, the treatment P_2S_2 was significantly superior in giving it the highest content of chlorophyll in the leaves of Iris plant amounted to 46.94 SPAD UNIT compared to the treatment of no addition P_0S_0 which recorded the lowest content of chlorophyll amounting to 42.12 SPAD UNIT. In the triple interaction between the studied factors, the treatment $I_0P_2S_2$ was significantly superior in recording the highest chlorophyll content of 48.53, which did not differ significantly from the treatments $I_0P_1S_2$, $I_0P_2S_1$, $I_0P_0S_2$, $I_0P_1S_1$ and $I_1P_2S_2$ treatment. $I_2P_0S_0$ The lowest chlorophyll content was 37.50 SPAD UNIT.

Effect of peroxidase enzyme (Absorption unit mg^{-1}): The results in Table 2 show that the quality of the irrigation water had a significant effect on increasing the activity of the peroxidase enzyme, as treatment I_2 was significantly superior by giving it the highest increase rate of 9.53 Absorption unit mg^{-1} compared to treatment I_0 which recorded 6.35 Absorption unit mg^{-1}. As for the treatments of adding polymers, it worked on reducing the activity of the peroxidase enzyme, as the treatment P_2 recorded the lowest activity of the enzyme, amounting to 7.96 Absorption unit mg^{-1}, compared to the treatment of P_0, which recorded the highest activity of the enzyme amounting to 8.27 Absorption unit mg^{-1}. the spraying with selenium also reduced the activity of the peroxidase enzyme, as the spraying treatment S_2 recorded the lowest concentration of the enzyme amounting to 7.92 Absorption unit mg^{-1} compared to the treatment of S_0, which recorded the highest concentration of 8.28 Absorption unit mg^{-1} . in the bilateral interaction between irrigation and the addition of polymers, the treatment I_2P_0 was significantly superior in recording the highest activity of peroxidase enzyme, which amounted to 9.71 Absorption unit mg^{-1}, compared to treatment I_0P_2, which recorded the lowest activity of the enzyme, which amounted to 6.20 Absorption unit mg^{-1}. the results of the bilateral interaction between irrigation and spraying with selenium showed that the treatment I_2S_0 was significantly superior in recording the highest enzyme concentration that reached 9.71 Absorption unit mg^{-1} compared to the treatment I_0S_2, which recorded the lowest enzyme concentration of 6.20 Absorption unit mg^{-1}.when the dual interaction between the addition of polymers and spraying with selenium, the treatment P_0S_0 excelled in giving the highest enzyme activity which amounted to 8.52 Absorption unit mg^{-1} compared to the P_2S_2 treatment which recorded the lowest enzyme activity amounting to 7.80 Absorption unit mg^{-1}. the results of the triple interaction between the study factors gave the significant superiority of treatment $I_2P_0S_0$ in recording the highest enzyme concentration of 9.93 Absorption unit mg^{-1} compared to treatment $I_0P_2S_2$ which recorded the lowest enzyme concentration of 6.10 Absorption unit mg^{-1}.

Table 2. Effect of polymers , the quality of irrigation water , spraying with selenium and the interaction between them in content of chlorophyll (spad unit) and peroxidase (Absorption unit mg^{-1}) of Iris plant

Treatment		Chlorophyll				Peroxidase activity			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	45.50	45.70	46.26	45.82	6.70	6.43	6.30	6.47
	S_1	46.66	47.20	47.76	47.21	6.53	6.43	6.20	6.38
	S_2	47.66	48.00	48.53	48.06	6.30	6.20	6.10	6.20
I_1	S_0	43.36	43.83	45.10	44.10	8.93	8.60	8.50	8.67
	S_1	44.96	45.83	46.43	45.74	8.60	8.50	8.40	8.50
	S_2	46.63	46.76	47.13	46.84	8.30	8.20	8.10	8.20
I_2	S_0	37.50	40.60	43.76	40.62	9.93	9.70	9.50	9.71
	S_1	39.50	40.63	44.00	41.37	9.70	9.53	9.36	9.53
	S_2	41.16	42.63	45.16	42.98	9.50	9.40	9.20	9.36
$L.S.D_{0.05}$	1.51				1.39			0.13	0.06
	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
I*P	I_0	46.61	46.96	47.52	47.03	6.51	6.35	6.20	6.35
	I_1	44.98	45.47	46.22	45.56	8.61	8.43	8.33	8.45
	I_2	39.38	41.28	44.31	41.66	9.71	9.54	9.35	9.53
$L.S.D_{0.05}$	1.39				1.42	0.06			0.02
	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
P*S	S_0	42.12	43.71	45.15	43.51	8.52	8.24	8.10	8.28
	S_1	43.37	44.55	45.80	44.77	8.27	8.15	7.98	8.14
	S_2	45.04	46.06	46.94	45.96	8.03	7.93	7.80	7.92
$L.S.D_{0.05}$	0.58				0.33	0.07			0.04
P		43.66	44.57	46.01		8.27	8.11	7.96	
$L.S.D_{0.05}$		0.33				0.04			

Leaf content of element chloride (mg kg^{-1}).

The results of Table 3 indicate that the irrigation treatments had a significant effect on increasing the chloride content of Iris leaves. Irrigation treatment I_2 recorded the highest chloride content of 301.89 mg kg-1 compared to treatment I_0 which recorded the lowest chlorine content of 87.93 mg kg^{-1}.While the addition of polymers reduced the chloride content of Iris leaves, the treatment of adding P_2 polymers recorded the lowest chloride content of 206.52 mg kg^{-1} compared to treatment P_0, which recorded 221.41 mg kg^{-1}. Spraying with selenium showed its moral effect, as the treatment of spraying with selenium S_2 recorded the lowest content of chloride in the leaves reching 208.15 mg kg^{-1} compared to the treatment of not spraying with selenium S_0 which recorded the highest increase in chloride content in leaves reaching 218.07 mg kg^{-1}. the bilateral interaction between irrigation agents and the addition of polymers gave the treatment I_2P_0 significantly superiority in recording the highest chloride content in leaves 307.22 compared to I_0P_2 treatment, which recorded the lowest chloride content in leaves 82.44 mg kg^{-1}. In the bilateral interaction between irrigation and spraying treatments with selenium, treatment I_2S_0 was significantly superior in recording the highest chloride content of 307.67 mg kg^{-1} compared to treatment I_0S_2, which recorded the lowest chloride content of 84.44 mg kg^{-1}. As for bilateral interaction between adding polymers and spraying with selenium, treatment P_0S_0 was significant in recording the highest chloride content of 228.67 mg kg^{-1} compared to treatment P_2S_2, which recorded the lowest chloride content of 202.33 mg kg^{-1}. In the triple interaction between irrigation agents, addition of polymers and spraying with selenium, treatment $I_2P_0S_0$ was significantly superior in recording the most expensive chloride content of 315.00 mg kg^{-1} compared to treatment $I_0P_2S_2$ which recorded the lowest chloride content of 80.00 mg kg^{-1}.

Percentage of sodium in the leaves (%).

The results presented in Table 3 show that there is a significant differences for the element sodium in the leaves, as the I_2 irrigation treatment was significantly superior in recording the highest sodium content of 0.482 % compared to the comparison treatment I_0 which recorded the lowest percentage of sodium, which amounted to 0.209%. The addition of polymers led to a decrease in the sodium content in the leaves, as the treatment of P_2 polymers at a concentration of 2.5 mg kg^{-1} recorded 0.310%, compared to the treatment of not adding polymers P_0, which recorded the highest sodium content of 0.419%. Spraying with selenium also reduced the sodium content of leaves, as the treatment of spraying with selenium S_2 at a concentration of 20 mg L^{-1} recorded 0.330%, compared to the treatment of no spraying S_0, which recorded the highest content of sodium in the leaves 0.386%. In the bilateral interaction between irrigation and addition of polymers, treatment I_2P_0 was significantly superior in recording the highest sodium content of 0.556 %compared to treatment I_0P_2 which recorded the lowest sodium content of 0.194%. The bilateral interaction between irrigation and spraying treatments with selenium showed the significant superiority of I_2S_0 treatment in recording the highest sodium content of 0.536% compared to I_0S_2 which recorded the lowest sodium content of 0.202%. when the two interactions between the addition of polymers and spraying with selenium, the treatment P_0S_0 was significantly superior in recording the highest sodium content in the leaves by 0.461 % compared to the P_2S_2 treatment which recorded the lowest sodium content of 0.298%. The results of the triple interaction between the studied factors gave the treatment $I_2P_0S_0$ significant superiority in giving it the highest sodium content of 0.639% compared to the treatment $I_0P_2S_2$ which recorded the lowest sodium content of 0.188%.

Table 3. Effect of polymers, the quality of irrigation water , spraying with selenium and the interaction between them in content of chloride (mg kg^{-1})and percentage of sodium in the leaves (%) of Iris plant

Treatment		Cl (mg kg^{-1})				Na(%)			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	102.00	89.00	86.00	92.33	0.233	0.215	0.199	0.216
	S_1	96.33	83.33	81.33	87.00	0.227	0.208	0.194	0.209
	S_2	91.33	82.00	80.00	84.44	0.220	0.198	0.188	0.202
I_1	S_0	269.00	247.67	246.00	254.22	0.511	0.365	0.342	0.406
	S_1	257.67	244.00	240.00	247.22	0.475	0.347	0.332	0.384
	S_2	254.67	239.33	235.00	243.00	0.445	0.331	0.317	0.364
I_2	S_0	315.00	306.00	302.00	307.67	0.639	0.545	0.425	0.536
	S_1	306.00	300.67	296.33	301.00	0.549	0.502	0.400	0.483
	S_2	300.67	298.33	292.00	297.00	0.479	0.407	0.390	0.425
$L.S.D_{0.05}$	3.32				1.91	0.009			0.004
I*P	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
	I_0	96.56	84.78	82.44	87.93	0.226	0.207	0.194	0.209
	I_1	260.44	243.67	240.33	284.15	0.477	0.348	0.330	0.385
	I_2	307.22	301.67	296.78	301.89	0.556	0.484	0.405	0.482
$L.S.D_{0.05}$	1.91				1.42	0.004			0.002
P*S	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
	S_0	228.67	214.22	211.33	218.07	0.461	0.375	0.322	0.386
	S_1	220.00	209.33	205.89	211.74	0.417	0.352	0.309	0.359
	S_2	215.56	206.56	202.33	208.15	0.381	0.312	0.298	0.330
$L.S.D_{0.05}$	1.94				1.12	0.005			0.003
P		221.41	210.04	206.52		0.419	0.346	0.310	
$L.S.D_{0.05}$		1.12				0.003			

Vase life(day).

The results in Table 4 indicate that the irrigation water quality caused a significant decrease in the Vase life of the plant, as the I_2 irrigation treatment gave the shortest vase life of 5.81 days compared to the control treatment I_0, which recorded 7.55 days.While the addition of polymers led to an increase in the vase life, as the treatment P2 recorded the highest rate in the average vase life, which amounted to 7.25 days, sequentially, compared to the treatment P0, which recorded the lowest vase life of 6.07 days. and when spraying with selenium treatments, treatments S_2 and S_1 were significantly superior in giving them the highest average vase life of (7.11 , 6.88) days, respectively, compared to treatment S_0, which recorded the lowest vase life of 6.18 days. The results of the bilateral interaction between the quality of irrigation water and the addition of polymers indicated that the two treatments I_0P_2 and I_0P_1 were superior to each other in giving them the highest rate of vase life (8.11 , 7.66) days respectively, compared to treatment I_2P_0, which recorded the lowest rate in vase life of 5.22 days while the results of the binary interaction between irrigation and spraying with selenium gave the superiority of I_0S_2 treatment in recording the highest vase life of 8.11 days, while there was a clear decrease in vase life of 5.33 days in I_2S_0 treatment. In the bilateral interaction between the addition of polymers and spraying with selenium, the treatments P_2S_2, P_1S_2 and P_2S_1 were significantly superior, as they scored (7.66, 7.33 , 7.22) days sequentially compared to treatment P_0S_0, which recorded the lowest rate in the average vase life of 5.44 days. In the triple interaction between the study factors, the treatment $I_0P_2S_2$ excelled, which recorded 8.66 days, which did not differ significantly from the two treatments I_0P2S_1 and $I_0P_1S_2$, which recorded (8.33 ,8.00) days respectively, while the vase life of the treatment $I_2P_0S_0$ decreased to 4.66 days.

The duration of the flower's stay on the plant (day).: The data in Table 4 shows the moral superiority of treatments I_0 and I_1 in giving them the highest flowering period of 6.63 and 6.22 days, respectively, while treatment I_2 recorded the lowest flowering period of 5.25 days.while the addition of polymers led to the moral superiority of treatment P_2, which recorded the highest flowering period of 6.55 days, compared to treatment P_0 which recorded the lowest flowering period of 5.29 days. The results of spraying with selenium in the same table showed that the treatment of spraying with selenium S_2 was significantly superior at the concentration 20 mg L^{-1}. the highest flowering period was 6.29 days compared to the comparison treatment S_0, which recorded 5.77 days.as for the bilateral interaction between irrigation and the addition of polymers, treatment I_0P_2 excelled in recording the highest flowering period of 7.33 days, while treatment I_2P_0 recorded the lowest flowering period of 4.44 days. The bilateral interaction between irrigation and spraying with selenium showed the superiority of treatments I_0S_2 and I_0S_1, which did not differ significantly between them in giving the highest flowering period of 7.00 and 6.55 respectivly days compared to treatment I_2S_0 which recorded the lowest flowering period of 5.11 days. AS for bilateral interaction between the addition of polymers and spraying with selenium, the treatment P_2S_2 outperformed, recording 6.77 days, which did not differ significantly from the treatments P_2S_1, P_1S_2 and P_2S_0, as they recorded the highest flowering period of (6.44, 6.44, and 6.44 days) consecutively, while the flowering period decreased in the treatment P_0S_0. giving 4.77 days. AS for the triple interaction between the studied factors the treatments $I_0P_2S_2$, $I_0P_2S_0$, $I_1P_2S_2$, $I_0P_2S_1$ and $I_0P_1S_2$, significant difference was recorded between them, while the flowering period decreased to 4.00 days in the $I_2P_0S_0$ treatment.

Table 4. Effect of polymers , the quality of irrigation water , spraying with selenium and the interaction between them in Vase life and The duration of the flower's stay on the Iris plant (day).

Treatment		vase life(day)				flower's life on the plant(day)			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	6.33	7.33	7.33	7.00	5.33	6.33	7.33	6.33
	S_1	6.66	7.66	8.33	7.55	6.00	6.66	7.00	6.55
	S_2	7.66	8.00	8.66	8.11	6.33	7.00	7.66	7.00
I_1	S_0	5.33	6.33	7.00	6.22	5.00	6.33	6.33	5.88
	S_1	6.66	7.33	7.33	7.11	5.66	6.33	6.66	6.22
	S_2	6.33	7.33	7.66	7.11	6.00	6.66	7.00	6.55
I_2	S_0	4.66	5.33	6.00	5.33	4.00	5.66	5.66	5.11
	S_1	5.66	6.00	6.33	6.00	4.66	5.66	5.66	5.33
	S_2	5.33	6.33	6.66	6.11	4.66	5.66	5.66	5.33
$L.S.D_{0.05}$	0.89				0.50	0.89			0.52
	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
I*P	I_0	6.88	7.66	8.11	7.55	5.88	6.66	7.33	6.63
	I_1	6.11	7.00	7.33	6.81	5.55	6.44	6.66	6.22
	I_2	5.22	5.88	6.33	5.81	4.44	5.66	5.66	5.25
$L.S.D_{0.05}$	0.50				0.39	0.52			0.41
	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
P*S	S_0	5.44	6.33	6.44	6.18	4.77	6.11	6.44	5.77
	S_1	6.33	7.00	7.33	6.88	5.44	6.22	6.44	6.03
	S_2	6.77	7.33	7.66	7.11	5.66	6.44	6.77	6.29
$L.S.D_{0.05}$	0.52					0.51			0.29
P		6.07	6.85	7.25	0.30	5.29	6.25	6.55	
$L.S.D_{0.05}$		0.30				0.29			

Percentage of carbohydrates in flowers(%).: Table 5 indicates that the percentage of carbohydrates was negatively affected by irrigation treatments, as the percentage of carbohydrates in flowers decreased by 3.968% in treatment I_2 compared to treatment I_0, which recorded the highest percentage of carbohydrates in flowers, which amounted to 4.058%. As for the addition of polymers, the treatment of P_2 was superior in giving it the highest percentage of carbohydrates, which amounted to 4.353% compared to treatment P_0, which recorded 3.787%. When spraying with selenium, the treatment of spraying S_2 was significantly superior in giving the highest percentage of carbohydrates in flowers, which amounted to 4.231% compared to the treatment of no spraying S_0 which recorded 3.863%. The bilateral interaction between irrigation factors and the addition of polymers gave the significant superiority of I_1P_2 treatment, which scored 4.434%, compared to treatment I_2P_0, which recorded the lowest percentage of carbohydrates in flowers, which amounted to 3.706%. As for the bilateral interaction between irrigation factor and spraying with selenium, treatment I_1S_2 was significantly superior in recording the highest percentage of carbohydrates in flowers that amounted to 4.307% compared to treatment I_2S_0 which recorded 3.753%. The results of the binary interaction between the addition of polymers and spraying with selenium showed that the treatment P_2S_2 was significantly superior, as the highest percentage of carbohydrates was recorded in the flowers, which amounted to 4.451% compared to the treatment P_0S_0, which recorded the lowest percentage of carbohydrates, which amounted to 3.498%. The results of the triple interaction between the irrigation factor, the addition of polymers and the spraying with selenium gave a significant superiority of the treatments $I_1P_2S_2$, $I_1P_2S_0$ and $I_0P_2S_2$ as they scored (4.493, 4.476 ,4.466) % sequentially compared to the treatment $I_2P_0S_0$ which recorded the lowest percentage of carbohydrates in flowers that amounted to 3.453%.=

Proline acid in leaves (µg fresh weight^{-1}).

The results of Table 5 show that the irrigation treatments had a clear effect in increasing the concentration of proline, as the irrigation treatment I_2 gave the highest concentration of proline, which amounted to 1.370 µg fresh weight^{-1}, compared to the treatment I_0, which recorded the lowest concentration of proline, which amounted to 1.159 µg fresh weight^{-1}. The addition of polymers also showed a clear effect in decreasing the concentration of proline, as the treatment P_2 recorded the lowest concentration of proline, which amounted to 1.137 µg fresh weight^{-1}, compared to the treatment P_0 which recorded the highest concentration of proline which was 1.422 µg fresh weight^{-1}. The results of the same table showed that spraying with selenium led to a decrease in the concentration of proline, as treatment S_2 recorded the lowest concentration of proline, which amounted to 1.160 µg fresh weight^{-1}, compared to treatment S_0, which recorded the highest concentration of the enzyme which was 1.388 µg fresh weight^{-1}. in the bilateral interaction between irrigation treatments and the addition of polymers, treatment I_2P_0 was significantly superior in giving it the highest concentration of proline, which amounted to 1.573 µg fresh weight^{-1}, compared to treatment I_0P_2 which recorded 1.041 µg fresh weight^{-1}. Also, treatment I_2S_0 was significantly superior in recording the highest concentration of proline, which amounted to 1.506 µg fresh weight^{-1}, compared to treatment I_0S_2, which recorded the lowest concentration of proline, which amounted to 1.064 µg fresh weight^{-1}, when the two interactions between irrigation and spraying treatments with selenium.the results of the bilateral interaction between the addition of polymers and spraying with selenium showed a decrease in the concentration of proline, as the treatment P_2S_2 recorded the lowest concentration of proline which was 1.026 µg fresh weight^{-1} compared to the treatment P_0S_0 which recorded the highest concentration of proline which was 1.540 µg fresh weight^{-1}. In the triple interaction between irrigation factors, addition of polymers and spraying with selenium, the treatment $I_2P_0S_0$ was significantly superior by recording the highest concentration of proline, which reached 1.726 µg fresh weight^{-1}, while the concentration of proline decreased in the treatment $I_0P_2S_2$, which recorded 0.906 µg fresh weight^{-1}.

Table 5. Effect of polymers , the quality of irrigation water , spraying with selenium and the interaction between them in percentage of carbohydrates in flowers(%) and Proline (µg fresh weight^{-1}) of Iris plant

Treatment		percentage of carbohydrates(%)				Proline (Μg^{-1})			
	S	P_0	P_1	P_2	I*S	P_0	P_1	P_2	I*S
I_0	S_0	3.503	3.786	4.400	3.896	1.316	1.246	1.190	1.251
	S_1	3.846	4.006	4.293	4.048	1.266	1.193	1.026	1.162
	S_2	3.983	4.236	4.466	4.228	1.176	1.110	0.906	1.064
I_1	S_0	3.540	3.800	4.476	3.938	1.576	1.393	1.250	1.406
	S_1	3.900	4.146	4.333	4.126	1.450	1.276	1.166	1.297
	S_2	4.190	4.240	4.493	4.307	1.296	1.170	1.046	1.171
I_2	S_0	3.453	3.726	4.080	3.753	1.726	1.476	1.316	1.506
	S_1	3.763	3.973	4.243	3.993	1.560	1.306	1.206	1.357
	S_2	3.903	4.180	4.393	4.158	1.433	1.180	1.126	1.246
$L.S.D_{0.05}$	0.032				0.019			0.014	0.008
	I	P_0	P_1	P_2	I	P_0	P_1	P_2	I
I*P	I_0	3.777	4.010	4.386	4.058	1.253	1.183	1.041	1.159
	I_1	3.876	4.062	4.434	4.124	1.441	1.280	1.154	1.291
	I_2	3.706	3.960	4.238	3.968	1.573	1.321	1.216	1.370
$L.S.D_{0.05}$	0.019				0.016			0.008	0.006
	S	P_0	P_1	P_2	S	P_0	P_1	P_2	S
P*S	S_0	3.498	3.771	4.318	3.863	1.540	1.425	1.302	1.388
	S_1	3.836	4.042	4.290	4.056	1.372	1.258	1.153	1.272
	S_2	4.025	4.218	4.451	4.231	1.252	1.133	1.026	1.160
$L.S.D_{0.05}$	0.018				0.010			0.008	0.004
P		3.787	4.010	4.353		1.422	1.261	1.137	
$L.S.D_{0.05}$			0.010				0.004		

The results of tables (1-5) indicate that the reason for the decrease in vegetative growth indicators is due to the direct effect of salts in the irrigation water in inhibiting the action of enzymes, as salinity leads as a result to a decrease in the absorption of water and nutrients that contribute to the growth and elongation of the plant, which caused a significant reduction in the height of the plant Table (1) The reason may be indirect, which is attributed to the effect of salinity on the physical and chemical properties of the soil and the increase in the osmotic potential of the soil solution around the root zone, which reduced water absorption and increased the May have absorption of salts, which in turn led to inhibition of the growth, expansion and elongation of cells, and that the osmotic effect and imbalance the food intake caused by salinity is the one that affected the lack of absorption of water and nutrients. The reason for the decrease in the average leaf area is due may be to the fact that the increase in salinity levels led to a decrease in the number of cells or a decrease in the size of cells (4). It may be due to the osmotic effect caused by the decrease in the amount of the water entering the plant and the lack of swelling effort of the leaf cells leads to a decrease in its elongation and therefore a decrease in the leaf area Table (1). the cause of chlorophyll decline may be attributed to the NACL salt. Adequate amounts of nitrogen were obtained, the enzyme nitrate reductase decreased, and the production of ethylene gas was increased, which destroys chlorophyll pigment, especially in high salinity concentrations, and thus led to an increase in the salinity also led to an increase in the activity of the chlorophyll-degrading enzyme, and consequently a decrease in the chlorophyll content (1). the increase in the concentration of sodium ion in the leaves of the plant and in a direct manner with the increase in the salt concentration in the irrigation water may be due to the increase in the absorption of sodium due to the increase in its concentration in the growth medium (26), and thus these large quantities of toxic ions are withdrawn into the vacuoles of the plant cells through the Na^+/H^+ Antiport pump through the vacuolar membrane and thus withdraws water to sustain the life of the plant. Thus, the sodium ion quickly enters the cell interior due to the negative voltage of the cell membranes inside, and then the sodium ion may accumulate more inside the cells than it accumulates in the cell walls (1). The increase in the concentration of chloride ion in the leaves directly synchronized with the increase in the concentration of NaCl salt in the used irrigation water may be due to an increase in its concentration in the growth medium, which leads the plant to increase its absorption and then its accumulation in the leaves. The chloride ion enters the roots by means of Cl-Carriers As well as many non-selective anion channels leading to its accumulation after that in high concentrations in the cells of the roots, then moving with the transpiration current to the leaves and being trapped in the vacuoles as it contributes to salt tolerance in cooperation with the sodium ion (18) and these results agree with (25) when irrigating the ornamental onion plant saundersiae Ornithogalum grown in pots and under protected cultivation conditions with saline water, which led to an increase in the plant's content of chloride and sodium. It is noticed that there is a significant increase in the superoxide dismutase enzyme and proline acid with an increase in the salinity of the irrigation water Table (2, 5). The increase in the antioxidant enzymes may be due to the plant's exposure to abnormal conditions such as the tension caused by the salinity of the irrigation water. The high content of proline in leaves may be attributed to its relationship Organizes imposing plants to environmental stresses leading to the accumulation of some nitrogen compounds. Among them is proline because it is osmotically active and restores the balance of the enzymatic facilities NADP and NADPH and protect enzymes from the danger of water or salt stress (2). It is an osmo-protector that makes the plasma membranes more stable and scavenges free radicals. The accumulation of proline is considered an indicator of sensitivity or tolerance of the plant. this result is similar to (19). 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 aeration. leads to the loudness of the nutritional elements, as polymers have titles It can retain large amounts of water and nutrients when added to the soil, making it ready for plant growth whenever needed (23). Polymers can also reduce salt stress on plants directly by improving soil properties or indirectly through its role in increasing the metabolism of plants to tolerate excess salt.the results of spraying with selenium showed an improvement in the indicators of vegetative and flowering growth, perhaps due to its joint role with enzymatic and non-enzymatic antioxidants, so it enters the synthesis of glutathione peroxidase and increases its effectiveness and works to sweep the toxic, oxidizing hydrogen peroxide radical of the plastid membranes and transforms it into water molecules, thus reducing its concentration and toxicity. A non-enzymatic antioxidant for its ability to inhibit the magnetic moment of free radicals(14). Also, spraying with selenium has an effect in reducing the concentration of sodium and chlorine ions in the leaves table(3), reducing the effectiveness of antioxidant enzymes tables (1 , 5), and it appears from these results that selenium has a role in reducing the external oxidative stress and improving the ionic balance in the leaves, and this effect can also return to improve the permeability of the membranes and increase the concentration of the protein that protects the cell membranes and the enzymes associated with the membranes (24), and these results are consistent with what was obtained by (13), where the concentration of sodium and chloride ions in leaves was reduced by treating tomato with selenium compared to untreated plants.

REFERENCES

1. Abbas, M. F., A. A. Abdullah and N. N. Hamid. 2018. Effect of salinity of irrigation water and spraying with selenium on the chemical components of the leaves of two okra cultivars grown in greenhouses. Journal of Agricultural, Environmental and Veterinary Sciences , 2 Issue (2) p467-477

2. Al-Bayati, F. F., J.I. Al-Hadithi and N. H. Al-Bayati. 2005. Effect of irrigation water salinity and soil moisture level and texture on the growth of *Citrus aurantium* L. Anbar Journal of Agricultural Sciences, 3: Issue (1)p:356-364

3. Al-Hamdani, S. Abdel-Wahhab and M. S. Muhammad. 2014. Effect of salinity of irrigation water and spraying with amino acids (proline and arginine) on the growth and yield of potato Solanum tuberosum. Diyala Journal of Agricultural Sciences 6(2) 154_163

4. Al-Khatib, B. A. H. and H. J. M. Al-Najm. 2015. Effect of irrigation water salinity and magnetization and moisture depletion on the growth and yield of potatoes. Anbar Journal of Agricultural Sciences, 13: Issue (2)p143-152

5. Al-Mashhadani, T.A. K. 2018. Effect of Biofertilizer, Type of Irrigation Water And Potassium Spray On The Growth Of Caladiums. M.S.C. Thesis, Department of Horticulture and Landscape Engineering, College of Agriculture. Anbar University

6. Al-Rubaie; A. H. S. and K. D. H. Al-Jubouri. 2023. Effect of tocopherol, trehalose and soil improvement in water productivity and industrial potatoes under water stress. Iraqi Journal of Agricultural Sciences, 54(4):979-995. https://doi.org/10.36103/ijas.v54i4.1787

7. Al-Rubaie; A. H. S. and K. D. H. Al-Jubouri. 2023. Response of growth and yield of industrial potatoes to soil improvement and spraying with tocopherol and trehalose under water stress. Iraqi Journal of Agricultural Sciences, 54(4):963-978. https://doi.org/10.36103/ijas.v54i4.1786

8. Bai, W. B., P. F. Li,. H.Fujiyama, and F. C. Fan. 2008. Some physiological responses of Chinese iris to salt stress . Pedosphere. 18(4): 454–463

9. Bates, L., R. and I. Teare . 1973 . Rapid determination of free proline for water-stress studies. Plant and Soil, 39(1): 205-207

10. Black, C.A .1965 . Methods of soil analysis . part 2. chemical and Microbiological poroperties . Am . Soc . Agron., Inc , Madison Wisconoson , USA, 4(2)p:567-584

11. Dabhi, R., N., Bhatt, and B. Pandit, 2013. Super absorbent polymers an innovative water saving technique for optimizing crop yield. International Journal of Innovative Research in Science, Engineering and Technology , 2: 10. 5333-5340

12. Darini, A. K , N Roohangiz , K, Ahmed and T Mohammadreza.2015. Effect of superabsorbent polymer on lawn under

drought stress condition. Agriculture Science Developments,4(2):22-26

13. Edelstein, M. ; D, Berstein. ; M, Shenker. ; H, Azaizeh,. and M, Ben-Hur. 2016. Effects of selenium on growth parameters of tomato and basil under fertigation management. HortScience, 51(8) 1050-1056

14. Elizabeth, A. H. ; Pilon-Smits and F. Q., Colin. 2010. Selenium metabolism in plants: R. Hell and R. -R. mendel (eds.). Cell biology of metals and nutrients. Springer-Verlag Berlin Heidelberg,pp543-555

15. Hassanuzzaman , M. , A. and M. S. Fujita. 2010. Selenium in higher plants: physiological role antioxidant metabolism and tolerance . Jour. of Plant Sciences, Academic Journals , 18(5):1-22

16. Jackson, M. L. 1958. Soil Chemical Analysis. Prentice Hall Inc Engleweed Cliif. N. J.pp:789-795

17. Joslyn, M. A., .1970 . Methods In Food Analysis ,Physical, Chemical And In Strumentel Methods Of Analysis,2nd Ed. Academic Press. New Yourk And London,pp234-245

18. Kamaluldeen, J. ; I. A. M .Yuns. ; A. Zerihun, ; J. J. ,Bruhl. and P ,Kristiansen. 2014. Uptake and distribution of ions reveal contrasting tolerance mechanisms for soil and water salinity in okra *Abelmoschus esculentus* L. and tomatoes *Solanum esculentum*. Agricultural Water Management, 146: 1-28

19. Khan, M. A.; M. U. Shirazi; S.M. Mujtaba; E. Islam; S. Mumtaz; A. Shereen; R. U. Ansari and M.Y. Ashraf. 2009. Role of proline, K/Na ratio and chlorophyll content in salt tolerance of wheat *Triticum aestivum* L. Pak. J. Bot., 41(2):633- 638

20. Lai, H.Y. and Z.S. Chen .2009.In-situ selection of suitable plant for the phytoremediationof multi-metals contaminated sites in central Taiwan International Journal of Pytoremediation 11(5):235-250

21.Namdar, A. Q. M. and K. G.S. Al-Saad. 2017. Effect of spraying with thiamine (B1) and Aller on the growth, flowering and production of bulbs of IRIS SPP. Journal of Tikrit University for Agricultural Sciences. 17 Issue (2):145-156

22. Obeid,S.H. and B.M. Jaber.2018. Chemical composition and antioxidant activity of *pelargonium graveolens* oil. Iraqi Journal of Agricultural Sciences,49(5):811-816. https://doi.org/10.36103/ijas.v49i5.41

23. Orikiriza, J.B, A. Hillary, E .Gerald, D. K .John, W .Martin,and H. Aloys 2013. Effects of hydrogels on tree seedling performance in temperate soils before and after Water Stress. Journal of Environmental Protection, 4, 713-721

24. Preedy, V. R. 2015. Selenium Chemistry, Analysis, Function and Effects. Royal Soc. of Chem, Cambridge. Uk. p:642-647

25. Salachna, P; A. Z and Cezary Podsiadło.2016.Respose of Ornithogalum saundersiae bak to salinity stress. Acta Sci. Pol. Hortorum Cultus. 15(1) :123-134

26. Taiz , L. and E. Zeiger. 2006. Plant Physiology.4th edition Annal of Botany Company . Publisher Sinecure Associates, p:568-580

27. Yakelin, R ,E. Perez ,E. S, A. R. Meneses and F.Fernandez.2001. Peroxi¬dase and polyphenoloxidase activites in tomato roots inoculated with glomus clarum or glomus fasciculatum. Enero-marzo, 5(2)11-16

28. Yuan, W.,Y.X. Feng. J.Y. Oubo, and X.Y.Feng.2012. Effects of Salt Stress on Water Content and Photosynthetic Characteristics in *Iris lactea* Var. Chinensis Seedling Middle-East Journal of Scientific Research 12 (1): 70-74.