Effect of the salinity of irrigation water and spraying with selenium in the yield indicators and the qualitative traits for two cultivars of the Okra plant (*Abelmoschus esculentus* L.) cultivated in greenhouses

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ABSTRACT

A factorial experiment with split-split-plots was conducted according to the Randomized Complete Block Design (RCBD), with three replicates during the 2017 winter season in one of the non-heated greenhouses with dimension of (9 × 25 m) in one of Abu Al-Khaseeb /Hamdaan orchards, Basra, in Clay-Silty soil to investigate the effect of three factors, which included the response of two cultivars of Okra plant (Al-Knissry and Al-Batra) irrigated with water of different salinity levels (RO, 2,4,8 $ds.m^{-1}$ NaCl), and external treatment with selenium (0,10, 20 $mg.L^{-1}$ Na_2SeO_4). it was conducted by spraying on the total vegetative at a rate of one spraying every three weeks for the period after two weeks of the germination to the age of two months (three sprayings during the cultivating season), and their interactions in the yield and the qualitative traits for the Okra plant. The results were analyzed using variance analysis and the averages were compared according to the least significant difference (L.S.D) at the probability level of 0.05. The most important results can be summarized as follows:

The Irrigation with two saline concentrations (4, 8 $ds.m^{-1}$ NaCl) led to reducing the number of pods per plant, the average weight of pod, plant yield, total production and the concentration of vitamin C in pod significantly, while the concentration of Total Soluble Solids in the pods increased significantly with increasing the concentration of salinity in the irrigation water. Al-Knissry cultivar was significantly excelled on the Al-Batra cultivar in the number of pods per plant, the concentration of vitamin C and Total Soluble Solids in the pods. As for the average weight of pod and plant yield and total production, in which Al-Batra cultivar was significantly excelled on Al-Knissry cultivar. The interaction between the factors experiment had a significant effect on all studied traits. The plants spraying with selenium at a concentration of (20 $mg.L^{-1}$ Na_2SeO_4) led to a significant increase in the studied yield indicators and the concentration of vitamin C and Total Soluble Solids in the pods. The effect was increased by increasing the spraying concentration.

keywords: Okra, Salinity, Cultivar, Selenium, yield, chemical traits.

*Research paper from Ph.D. thesis for the third author.

تأثير ملوحة مياه الري والرش بالسلينيوم في مؤشرات الحاصل والصفات النوعية لصنفين من نباتات الباميا (*Abelmoschus esculentus* L.) المزروعة في البيوت البلاستيكية

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الخلاصة

أُجريتْ تجربة عاملية منشقة لمرتين حسب تصميم القطاعات العشوائية الكاملة Randomized Complete Block (R.C.B.D.) Design لثلاث مكررات خلال الموسم الزراعي الشتوي 2017 في أحد البيوت البلاستيكية غير المدفأة وبأبعاد 9 × 25 م في أحد بساتين ابي الخصيب/حمدان، في تربة طينية غرينية (Clay-Silty) لمعرفة تأثير ثلاثة عوامل والتي تضمنت إستجابة صنفين من نبات الباميا (الخنيصري والبترا) المروية بمياه ذات مستويات ملحية مختلفة (RO،2،4،8 ديسمنز.م$^{-1}$ NaCl)، والمعاملة الخارجية بعنصر السلينيوم (صفر،10،20 ملغم.لتر$^{-1}$ Na_2SeO_4) وتمت رشاً على المجموع الخضري بمعدل رشة واحدة كل ثلاث اسابيع للفترة من بعد

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الإنبات بإسبوعين الى عمر الشهرين (ثلاث رشات خلال موسم الزراعة)، وتداخلاتهم في الحاصل والصفات النوعية لنبات الباميا. حللت النتائج باستعمال تحليل التباين وقورنت المتوسطات حسب اختبار اقل فرق معنوي(Least Significant Differences (L.S.D عند مستوى احتمال0.05. ويمكن تلخيص أهم النتائج بما يأتي:-

أدى الري بالتركيزين الملحيين 4 و 8 ديسمنز.م$^{-1}$ NaCl الى خفض عدد القرنات.نبات$^{-1}$ ومعدل وزن القرنة وحاصل النبات الواحد والانتاج الكلي وتركيز فيتامين ج في القرنات معنوياً، بينما زاد تركيز المواد الصلبة الذائبة الكلية في القرنات معنوياً وبشكل طردي بزيادة تركيز الملوحة بمياه الري. تفوق صنف الخنيصري معنوياً على صنف البترا في عدد القرنات.نبات$^{-1}$وتركيز فيتامين ج والمواد الصلبة الذائبة الكلية في القرنات، اما معدل وزن القرنة وحاصل النبات الواحد والانتاج الكلي فقد تفوق فيها صنف البترا معنوياً على صنف الخنيصري، وكان للتداخل بين عوامل التجربة تأثير معنوي في جميع الصفات المدروسة. ادى رش النباتات بالسلينيوم بتركيز 20 ملغم.لتر$^{-1}$ Na_2SeO_4 الى زيادة معنوية في كل من مؤشرات الحاصل المدروسة وتركيز فيتامين ج والمواد الصلبة الذائبة الكلية في القرنات وازداد التأثير طردياً بزيادة التركيز المرشوش.

الكلمات المفتاحية : الباميا, الملوحة, الصنف, السلينيوم, الحاصل, صفات نوعية.

مستل من اطروحة الدكتوراه للباحث الثالث.

1. INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is considered an important summer vegetable crop in Iraq and the world which belongs to the Malvaceae family. It is cultivated to use their favorite green fruits in the Iraqi table, which is eaten after cooking or drying or canning. Okra grows in tropical and subtropical regions and their native country is Africa (20). The cultivated area with Okra in Iraq for the year 2015 is about (16.750 ha) with a production of (124000 tons), with an average production of (7.403 tons.ha^{-1}), which is a low average compared to the Arab countries such as Jordan (33.780 tons.ha^{-1}), Kuwait (14.763 tons.ha^{-1}), Saudi Arabia (14.193 tons.ha^{-1}), Egypt (11,507 tons.ha^{-1}), and Oman (9.254 tons.ha^{-1}). Okra is classified as moderately sensitive to salt, where the ideal level for the salinity of irrigation water for Okra cultivation is 3.4 ds.m^{-1}, the yield decreases with increasing salinity of irrigation water. For the purpose of cultivating Okra plants in soils affected with saline or that is irrigated with water of high saline level (more than 3.4 ds.m^{-1}), it is necessary to use some methods that increase the tolerance of Okra plants for salinity, thus reduce the adverse effects of salinity. The exposure of Okra plant to the salt stress in the stages of flowering and the pods filling led to a significant decrease in the fruit yield (10), Minas and Gupta (23) indicated that there was a reduction in the Okra yield amounted to (90, 75, 50%)when irrigating with saline water levels of (6.7, 3.9, 2.1 ds.m^{-1}), respectively. Shahid et al., (25) found in their study of the effect of saline stress on Phenotypic and physiological traits on the Okra plant (Chinese red cultivar), after the exposure of the plant to salinity at levels of (25, 50, 75 mM), the increase in salinity levels led to a reduction in the weight of pod, Almtory (3) obtained in his study for the effect of the quality of irrigation water in the yield of the Okra plant (local cultivar) and for two seasons using three treatments of irrigation water (Tap water, Tap water + river water, river water) a significant increase in the concentration of vitamin C and carbohydrates in the pods when treating it with Tap water, The values decreased with increasing salinity concentration in the other two qualities of irrigation water. Several studies have shown that external treatment with selenium increases the tolerance of plants to abiotic stress conditions, including Salinity (11; 14; 16; 17; 30). One of the main effects of selenium in increasing plant tolerance to saline stress appears to be increasing antioxidant plant capacity by promoting the effectiveness of antioxidant enzymes such as SOD and POD (15; 30). Yassen et al., (32) found when spraying selenium on the potato plant (Sponta cultivar) with three concentrations (0, 20, 40 g.ft^{-1}) showed a significant increase in plant yield. The increase was a direct increase with the spraying concentration, as for the size of pod and its

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content of carbohydrates has been increased in values to a concentration of (20 $g.ft^{-1}$). In a study conducted by Al-Mentafjy (2) on the effect of spraying selenium with three concentrations (0, 10, 20 $mg.L^{-1}$ NaHSeO3) on coriander plant (Coriandrum sativum L.) obtaining a significant increase in the number of fruits, the number of main and secondary inflorescence, weight of 1000 fruit, and the yield of experimental unit in m^2, where the values have increased with increasing the spraying concentration. Khalifa et al., (19) showed when spraying the Selenium with three concentration (distilled water, 16, 32 µm Na2SeO4) on two cultivars of Lactuca sativa (Great lakes and Balady) and for two seasons significant increases in head weight, its size, total yield and concentration of total soluble solids. The concentration of Na_2SeO_4 gave the highest value for the mentioned traits for both cultivars and seasons. Because there is no study under local conditions for the use of selenium in improving the salinity for the Okra plant. This experiment aims to:

1- Effect of salinity levels in the yield indicators and the qualitative traits for Okra plant.
2- Identification of the appropriate cultivar (Al-Knissry and Al-Batra) for the circumstances of the experiment.
3- The extent of the response of the Okra plant under saline stress conditions for spraying with selenium and its impact on the yield indicators and the qualitative traits for Okra plant.
4- Effect of interaction between the three factors of the study and its effect on the yield indicators and the qualitative traits for Okra plant.

2. MATERIALS AND METHODS

The study was conducted during the agricultural season 2017 in one of the non-heated greenhouses with a dimension of (9 × 25 m) in one of Abu Al-Khaseeb /Hamdaan orchards, Basra, in Clay-Silty soil. The soil of the greenhouse was analyzed before cultivation by taking random samples from different places and in two depth (0-30 cm and 0-60 cm). Table (1) shows the physical and chemical traits for the soil of the greenhouse where it is estimated in the Central Laboratory, College of Agriculture, University of Basra.

Table 1: Physical and chemical traits of field soil for the 2017 season

Traits	Value	The used method
PH (pH)	7.28	Page et al., (24)
Electrical conductivity (E.C) ds.m-1	6.11	
Organic matter%	3.1	
Nitrogen availability (mg.kg-1)	18.77	
Phosphorus availability (mg.kg-1)	3.84	
Potassium availability (mg.kg-1)	95.47	
Soil separates		Black (6)
Sand%	14.88	
Clay%	52.34	
Silt %	32.78	
Soil texture	Clay-Silty	

The experiment included the effect of irrigation water salinity and spraying with selenium in the growth and yield of two cultivars of the okra plant. The treatments were as follows:

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1) Two cultivars of Okra plant (Al-Knissry and Al-Batra).
2) Irrigation with salinity water (RO, 2, 4, 8 $ds.m^{-1}$ NaCl).
3) External treatment with selenium (0,10, 20 $mg.L^{-1}$ Na_2SeO_4). it was conducted by spraying on the total vegetative at a rate of one spraying every three weeks for the period after two weeks of the germination to the age of two months (three sprayings during the cultivating season), and their interactions in the yield and the qualitative traits for the Okra plant.

The Randomized Complete Block Design (RCBD) is used according to split-split-plot design, where the salinity levels of irrigation water represent the main plot and the cultivars are sub-plot and the spraying levels with selenium are sub-sub-plot. The land of the greenhouse (9 × 25 m) was plowed twice perpendicular with a 30 cm depth. The soil was then smoothed and then divided into eight lines, with 25 m length and width of 0.5 m, the distance of 0.5 m between one line and another, a distance of 0.75 m left from each side of the house. Each line was divided into 9 experimental units with a length of 2.4 m and left a distance of 1.7 m at the entrance and end of each line. The drip irrigation system was used to irrigate the plants, and the furrows of cultivation were covered with the black plastic. The samples were randomly distributed to the experimental units in each line and the seed pits were prepared. Each experimental unit consisted of twelve seed pits in each side of the two lines side, in a reciprocal manner and at a cultivating distance of 40 cm. The soil was fertilized with a decomposed organic fertilizer of (0.45 m^3 for the house), equivalent to (5 m^3 per dunum). The superphosphate (45% P_2O_5) was also added with the rate of (40 $kg.dunum^{-1}$). The rest of the line was filled with a riverine mixture and for the height of 10 cm. The drip irrigation system was used to irrigate the plants by linking them to water reservoirs, The capacity of the tank is 1000 L, Their number is four which placed at a height of 1 m above the surface of the earth. The first was allocated to pump RO water and the second was 2 $ds.m^{-1}$ concentration of NaCl and the third was 4 $ds.m^{-1}$ concentration of NaCl and the fourth was 8 $ds.m^{-1}$ concentration of NaCl.

The cultivation of greenhouses and agricultural service operations

The irrigation of greenhouse soil was started by an irrigation system (without saline concentrations) two days before cultivating the seeds to moisten the soil. The seed was then cultivated in the experimental units at 1/1/2017 so that three seeds were cultivated in each pit on both sides of the line alternatively, at a distance of 40 cm, it was diluted to one plant after germination, the plants were irrigated with irrigation water according to the treatment after two weeks of germination. All service operations and for all treatments were conducted as is the practice in the production of this crop of fertilization and control, the compound fertilizer (20-20-20) added at a rate of (100 $kg.dunum^{-1}$) on the two batches, the first one when the thinning operation was conducted and the second at the flowering (28). where the fertilizer was placed under the drippers at a distance of 5 cm and a depth of 5 cm. The fertilizer was then covered and irrigated immediately after fertilization. The fertilizer of the chelated iron (Fe.HI,7% EDDHA) was added to the total vegetative at a concentration of (0.5 $g.L^{-1}$) to treating the iron deficiency in the soil and on three batches in the third, fifth and seventh week of cultivation and a preventive program was conducted to protect the field from insects and diseases during the two seasons of the experiment. The experimental measurements were taken from three plants in each experimental unit at the end of the growing season and included the number of pods per plant, the average weight of pod (g), plant yield (g), total production ($kg.m^{-2}$), the concentration of vitamin C (mg/100 g fresh

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weight), and Total Soluble Solids (%) in the pods.

3. RESULTS AND DISCUSSION

Table (2) shows that the study factors and their interactions have a significant effect on the number of pods per plants. It is observed that with an increase in the concentration of irrigation water salinity to the two concentrations (4, 8 $ds.m^{-1}$), it is noted a significant decrease in this trait. Al-Knissry cultivar is also excelled on the Al-Batra cultivar. Sodium silicate also had a significant effect on this trait, where the sprayed plants with a concentration of (20 $mg.L^{-1}$) were excelled compared to the other two treatments, which did not differ significantly. The interaction between the cultivars and the quality of the irrigation water showed a significant effect in this trait, where the plant of the Al-Knissry cultivar that irrigated with a concentration of (2 $ds.m^{-1}$ NaCl) gave the highest average for the number of pods amounted to (45.37 $pods.plant^{-1}$) compared to the lowest number amounted to (28.07 $pods.plant^{-1}$) produced from the plants of the Al-Batra cultivar that irrigated with a concentration of (8 $ds.m^{-1}$ NaCl). It is noted from the interaction between the cultivars and spraying with Sodium selenate, the effect was significant, where the plant of the Al-Knissry cultivar that sprayed with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) gave the highest number of pods amounted to (41.58 $pods.plant^{-1}$) compared to the lowest number of pods amounted to (36.05 $pods.plant^{-1}$) in plants of Al-Batra cultivar untreated with Selenium. The interaction between the salinity of irrigation water and the spraying with Sodium selenate showed that the effect was significant, The irrigated plants with RO water and spraying with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$), gave the highest number of pods for this interaction amounted to (46.72 $pods.plant^{-1}$) compared to the lowest average amounted to (27.83 $pods.plant^{-1}$) in the plants irrigated with a concentration of (8 $mg.L^{-1}$) and untreated with Selenium. The results of the triple interaction showed that the highest number of pods was found in the plants of Al-Knissry cultivar that irrigated with RO water and spraying with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) which amounted to (48.44 $pods.plant^{-1}$) compared to the lowest number of pods amounted to (26.55 $pods.plant^{-1}$) in the plants of Al-Batra cultivar that irrigated with a concentration of (8 $mg.L^{-1}$) and untreated with Selenium. It was found that the interaction between the cultivars and the salinity of the irrigation water was significant in this trait. where the plant of the Al-Batra cultivar that irrigated with a concentration of (2 $ds.m^{-1}$ NaCl) gave the highest average weight of pod amounted to (4.89 g)compared to the lowest number amounted to (2.70 g) produced from the plants of the Al-Knissry cultivar that irrigated with a concentration of (8 $ds.m^{-1}$ NaCl). It is also noticed from the bi-interaction between the cultivars and the spraying with selenium that the effect was significant. where the plant of the Al-Batra cultivar that sprayed with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) gave the highest average amounted to (4.06 g) compared to the lowest average amounted to (3.20 g) in plants of Al-Knissry cultivar untreated with Selenium. The interaction between the salinity of irrigation water and the spraying with Sodium selenate also showed that the effect was significant, where the highest average weight for the pod amounted to (5.24 g) produced from the plants irrigated with saline water at a concentration of (2 $ds.m^{-1}$) and spraying with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) compared to the lowest average amounted to (2.74 g) produced from the plants irrigated with saline water at a concentration of (8 $mg.L^{-1}$) and untreated with Selenium. The results of the triple interaction showed that the highest average for this trait amounted to (5.42 g) produced from the plants of Al-Batra that irrigated with saline water at a concentration of (2 $ds.m^{-1}$) and spraying with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) compared to the lowest weight amounted to (2.58 g) in the plants of Al-Knissry cultivar that

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irrigated with a concentration of (8 $mg.L^{-1}$) and untreated with Selenium. It is clear from the same table that the study factors and their interactions have a significant effect on the weight of pods, where observe a significant increase in the average weight of pod for the plant irrigated with a concentration of (2 $ds.m^{-1}$) compared to other concentrations. However, the rising concentration of irrigation water salinity to levels (4, 8 $ds.m^{-1}$) was significant in this trait. Al-Knissry cultivar was also significantly excelled on Al-Batra cultivar. The treating with selenium had a significant effect on the average weight of the pod, and a significant increase was observed in it where the values increased by increasing the used concentration.

Table 2: Effect of salinity of irrigation water and spraying with selenium in two cultivars of the Okra plant and the interaction between them in the yield indicators (the number of pods and weight of pod).

Cultivar	The salinity of irrigation water ($ds.m^{-1}$)	**Number of pods per plant**				**The average weight of pods (g)**			
		Na_2SeO_4 ($kg.m^{-2}$)			The salinity of irrigation water NaCl ($ds.m^{-1}$) × cultivars	Na_2SeO_4 ($kg.m^{-2}$)			The salinity of irrigation water NaCl ($ds.m^{-1}$) × cultivars
		0	10	20		0	10	20	
Al-Knissry	**RO**	42.33	44.78	48.44	45.18	3.40	3.48	3.70	3.54
	2	44.11	45.55	46.44	45.37	3.99	4.56	5.06	4.53
	4	34.00	36.00	39.00	36.33	2.86	2.99	3.33	3.06
	8	29.11	30.22	32.44	30.59	2.58	2.69	2.84	2.70
Al-Batra	**RO**	42.88	41.55	45.00	43.14	3.65	3.76	4.06	3.82
	2	41.89	42.66	43.67	42.74	4.28	4.98	5.42	4.89
	4	32.89	33.44	36.33	34.22	3.19	3.31	3.61	3.37
	8	26.55	27.66	30.00	28.07	2.91	3.09	3.16	3.05
LSD 0.05			1.87		0.98		0.10		0.06
Average effect of Na_2SeO_4		36.72	37.73	40.16	**Effect of cultivars**	3.36	3.61	3.90	**Effect of cultivars**
LSD 0.05			1.34				0.07		
Cultivars × Na_2SeO_4	Al-Knissry	37.38	39.14	41.58	39.37	3.20	3.43	3.74	3.46
	Al-Batra	36.05	36.33	38.75	37.04	3.51	3.78	4.06	3.78
LSD 0.05			1.32		0.48		0.07		0.01
					The effect of the salinity of irrigation water				The effect of the salinity of irrigation water
The salinity of irrigation water × **Na_2SeO_4**	**RO**	42.61	43.16	46.72	44.16	3.52	3.62	3.91	3.68
	2	43.00	44.11	45.05	44.05	4.13	4.77	5.24	4.71
	4	33.44	34.72	37.66	35.27	3.02	3.15	3.47	3.21
	8	27.83	28.94	31.22	29.33	2.74	2.89	3.00	2.88
LSD 0.05			1.53		0.73		0.10		0.05

Table (3) shows that the study factors and their interactions have a significant effect on the plant yield. where the plants that irrigated with saline water at a concentration of (2 $ds.m^{-1}$ NaCl) showed a significant increase compared to the rest of the concentrations in this trait. A significant decline was observed in this trait in the plants that irrigated with the highest two

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levels of salinity (4, 8 ds.m^{-1} NaCl), especially at salinity level (8 ds.m^{-1} NaCl). The cultivar also had a significant effect, where Al-Batra cultivar was significantly excelled on Al-Knissry cultivar in this trait. The same table indicates that spraying with Sodium selenate has a significant effect on this trait, where the plants that sprayed with Na_2SeO_4 at a concentration of (20 mg.L^{-1}) was excelled on the rest of the concentrations and the effect was increased by increasing the used concentration. The interaction between the cultivars and the salinity of the irrigation water showed a significant difference between the treatments in this trait. where the plant of the Al-Batra cultivar that irrigated with saline water at a concentration of (2 ds.m^{-1} NaCl) gave the highest plant yield amounted to (208.99 g) compared to the lowest yield amounted to (82.59 g) produced from the plants of the Al-Knissry cultivar that irrigated with a concentration of (8 ds.m^{-1} NaCl). It is also noticed from the bi-interaction between the cultivars and the spraying with selenium that the effect was significant. where the plant of the Al-Batra cultivar that sprayed with Na_2SeO_4 at a concentration of (20 mg.L^{-1}) gave the highest average amounted to (157.32 g) compared to the lowest average amounted to (119.61 g) in plants of Al-Knissry cultivar untreated with Selenium. The interaction between the salinity of irrigation water and the spraying with selenium also showed a significant difference between treatments, where the highest plant yield amounted to (236.06 g) produced from the plants irrigated with saline water at a concentration of (2 ds.m^{-1}) and spraying with Na_2SeO_4 at a concentration of (20 mg.L^{-1}) compared to the lowest yield amounted to (76.25 g) produced from the plants irrigated with saline water at a concentration of (8 mg.L^{-1}) and untreated with Selenium. As for The triple interaction between the treatments showed a significant effect, where the highest average for this trait amounted to (236.69 g) produced from the plants of Al-Batra cultivar that irrigated with saline water at a concentration of (2 ds.m^{-1}) and spraying with Na_2SeO_4 at a concentration of (20 mg.L^{-1}) compared to the lowest yield amounted to (75.10 g) produced from the plants of Al-Knissry cultivar that irrigated with saline water at a concentration of (8 mg.L^{-1}) and untreated with Selenium. It is clear from the same table that the study factors and their interactions have a significant effect on the total production, where the plants that irrigated with saline water at a concentration of (2 ds.m^{-1} NaCl) showed a significant increase compared to the rest of the concentrations in this trait. A significant decline was observed in this trait in the plants that irrigated with the highest two levels of salinity (4, 8 ds.m^{-1} NaCl), especially at salinity level (8 ds.m^{-1} NaCl). The cultivar also had a significant effect, where Al-Batra cultivar was significantly excelled on Al-Knissry cultivar in this trait. The same table indicates that spraying with Sodium selenate has a significant effect on this trait. The interaction between the cultivars and the salinity of the irrigation water showed a significant effect on this trait. where the plant of the Al-Batra cultivar that irrigated with saline water at a concentration of (2 ds.m^{-1} NaCl) gave the highest production yield amounted to (1.044 kg.m^{-2}) compared to the lowest production amounted to (0.412 kg.m^{-2}) produced from the plants of the Al-Knissry cultivar that irrigated with a concentration of (8 ds.m^{-1} NaCl). It is also noticed from the bi-interaction between the cultivars and the spraying with selenium that the effect was significant. where the plant of the Al-Batra cultivar that sprayed with Na_2SeO_4 at a concentration of (20 mg.L^{-1}) gave the highest production amounted to (0.786 kg.m^{-2}) compared to the lowest production amounted to (0.598 kg.m^{-2}) in plants of Al-Knissry cultivar untreated with Selenium. The interaction between the salinity of irrigation water and the spraying with selenium also showed that the effect was significant, where the highest production amounted to (1.180 kg.m^{-2}) produced from the plants irrigated with saline water at a concentration of (2 ds.m^{-1}) and spraying with

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Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) compared to the lowest production amounted to (0.381 $kg.m^{-2}$) produced from the plants irrigated with saline water at a concentration of (8 $mg.L^{-1}$) and untreated with Selenium. The results of triple interaction between the study factors showed that the highest average for this trait amounted to (1.183 $kg.m^{-2}$) produced from the plants of Al-Batra cultivar that irrigated with saline water at a concentration of (2 $ds.m^{-1}$) and spraying with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) compared to the lowest production amounted to (0.375 $kg.m^{-2}$) produced from the plants of Al-Knissry cultivar that irrigated with saline water at a concentration of (8 $mg.L^{-1}$) and untreated with Selenium.

Table 3: Effect of salinity of irrigation water and spraying with selenium in two cultivars of the Okra plant and the interaction between them in the yield indicators (the plant yield and total production).

Cultivar	The salinity of irrigation water ($ds.m^{-1}$)	**Number of pods per plant**				**The average weight of pods (g)**			
		Na_2SeO_4 ($kg.m^{-2}$)			The salinity of irrigation water NaCl ($ds.m^{-1}$) × cultivars	Na_2SeO_4 ($kg.m^{-2}$)			The salinity of irrigation water NaCl ($ds.m^{-1}$) × cultivars
		0	10	20		0	10	20	
Al-Knissry	**RO**	143.92	155.83	179.22	159.93	0.719	0.779	0.896	0.799
	2	175.99	207.70	234.98	205.52	0.879	1.038	1.174	1.027
	4	97.24	107.64	129.87	111.16	0.486	0.538	0.649	0.555
	8	75.10	81.29	92.129	82.59	0.375	0.406	0.460	0.412
Al-Batra	**RO**	156.51	156.22	182.70	164.79	0.782	0.781	0.913	0.823
	2	179.28	212.44	236.69	208.99	0.896	1.062	1.183	1.044
	4	104.91	110.68	131.15	115.32	0.524	0.553	0.655	0.576
	8	77.26	85.46	94.80	85.61	0.386	0.427	0.474	0.428
LSD 0.05			6.63		4.12		0.033		0.020
Average effect of Na_2SeO_4		123.37	137.20	156.62	**Effect of cultivars**	0.616	0.686	0.783	**Effect of cultivars**
LSD 0.05							0.009		
Cultivars × Na_2SeO_4	Al-Knissry	136.22	134.25	0.681	39.37	0.598	0.671	0.777	3.46
	Al-Batra	140.01	137.32	0.700	37.04	0.632	0.686	0.786	3.78
LSD 0.05			2.54		1.71		0.012		0.008
					The effect of the salinity of irrigation water				The effect of the salinity of irrigation water
The salinity of irrigation water × **Na_2SeO_4**	**RO**	149.98	156.23	0.812	162.50	0.749	0.781	0.913	3.68
	2	177.59	210.40	1.037	207.47	0.887	1.052	1.180	4.71
	4	100.98	109.36	0.566	113.21	0.504	0.546	0.653	3.21
	8	76.25	83.63	0.422	84.47	0.381	0.418	0.468	2.88
LSD 0.05			5.36		3.47		0.026		0.017

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Table (2) notes that with the increase in the concentrations of irrigation water salinity to concentrations of (4, 8 ds.m^{-1} NaCl), it observed a significant decrease in the number of pods per plant. Tables (2, 3) shows that the plants irrigated with a concentration of (2 ds.m^{-1} NaCl) showed a significant increase in the traits of the average weight of pod, plant yield, and total production (kg.m^{-2}) compared to the rest of the concentrations. This increase in salt level may be appropriate for the continuation of the growth process and improvement of its indicators, It may also be explained by the need for plants to have small amounts of salts, which are the nutrients that contribute to increasing growth (26, 4). and with increasing salinity levels to concentrations (4 and 8 ds.m^{-1} NaCl) obtained a significant decrease in these traits. The concentration of (8 ds.m^{-1} NaCl) was the most important effect. This may be due to the role of direct saline stress in the raising osmotic pressure (more negative), which causes a decrease in the amount of water available to the plant, which reflected in the decreasing the number of fruits and its weight, especially if this stress coincided at the beginning of the flowering stage and the fruit filling stage (10; 31), as well as the direct impact for the salt stress in increasing ionic of (Na^+ and Cl^-), which affect significantly the food balance and manufacturing carbohydrates materials necessary for the fruit growth, as well as the role of salinity in inhibiting the absorption of nutrients such as potassium and calcium (9; 13). In addition to the direct and negative effects of increasing the concentration of (Na^{++}, Cl^-) in the plant tissues, Its enzymatic activity may cause the deposition of proteins. Its inhibitory effect may appear in the level of enzymatic activity that causes the deposition of proteins. Enzymes are also linked to energy-related pathways such as glycolytic decomposition and functional inhibition of the effective location of these important enzymes in the metabolic processes responsible for the formation of carbohydrate in the leaves and then transferred to the fruits. The plant also removes additional energy to reduce the concentration of sodium ions by transferring it to the gap or outside the cytoplasm via the cell membrane by the transporters, which derives its energy under the normal conditions of the H+ - ATPase pump, it is often inhibited by Na+, Which drives the plant to consume its carbohydrate inventory to release energy and thus reduce the amount of the transfer of fruit, causing a decrease in the weight of the fruit (9). The indirect effect of high salinity can also be added to the degradation of soil physical properties and their composition (13). These results agree with (Ünlükara et al., 29; Almtory, 3) that indicate a decrease in the yield indicators of the Okra plant such as the number of pods per plant, the weight of pod, plant yield and total production by increasing the salinity concentrations of irrigation water. Table (2) shows the significant excelling for the Al-Knissry cultivar on Al-Batra cultivar in the number of pods per plant. Table (3, 4) shows the excelling of Al-Batra cultivar significantly on Al-Knissry cultivar in the average weight of pod, plant yield and the total productivity. This excelling may be due to the influence of genetic factors among the species in the yield indicators, It also depends on the sensitivity of these cultivars to bear the saline levels for the irrigation water. It is noted from tables (2, 3) that the studied yield indicators such as the number of pods per plant and the average weight of the pod and the plant yield and the total production (kg.m^{-2}) have increased in a combined and direct increase with the concentration of selenium sprayed on plants. These results coincided with the effect of spraying these concentrations on the improvement of the studied traits of vegetative growth that have a direct effect on the improvement of the yield and its components. It is believed that the optical properties of selenium have a significant role in the electron transport system, increase the efficiency of Ribulose-1.5-bisphosphate carboxylase enzyme, inhibit the photophysiological process leading to

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the production of free radicals and the accumulation of Glycolate due to the high salt stress, thus increasing the accumulation of dry matter in the plant, Selenium also plays an important role in increasing the relative water content of the plant, which leads to an increase in the solubility of the dry matter and ease of transmission to the fruit. It is also believed that selenium has a role in reducing the accumulation of Abscisic acid, which causes the fall of fruits (18). Selenium acts as an antioxidant by inhibiting the production of free radicals, reducing the efficiency of the enzymes and increasing the efficiency of the enzymatic antioxidant system, which led to reduces the effect of salt stress and increase the growth of the fruit and hence the total productivity, These results agree with (Al-Mentafjy, 2) who indicated that the yield indicators such as the number of fruits in the main and secondary inflorescence, the weight of 1000 fruit and the yield of the experimental unit significantly affected by the treating the Coriander plant with selenium where the values increased significantly with increasing the spraying concentration. Table (4) shows that the salinity of irrigation water has a significant effect on the concentration of vitamin C in the pods. The irrigation of plants with a concentration of (2 $ds.m^{-1}$) NaCl led to a significant increase in this trait compared to irrigation with the rest of the concentrations. It is also noted that with using higher concentrations of salinity of irrigation water at Concentrations of (4, 8 $ds.m^{-1}$) NaCl, there was a significant decrease in this trait. It is noted from the table that the cultivar did not have any significant effect on the concentration of vitamin C in the pods. Sodium silicate also had a significant effect on this trait, where spraying the plants with it showed a significant effect on the concentration of vitamin C in the pods. The effect increased with increase in concentration. The bi-interaction between the cultivars and the salinity of the irrigation water showed a significant in this trait. where the plant of the Al-Batra cultivar that irrigated with saline water at a concentration of (2 $ds.m^{-1}$ NaCl) gave the highest for this trait amounted to (33.60 $mg.100\ g^{-1}$) compared to the lowest concentration in the plants of the Al-Knissry cultivar that irrigated with a concentration of (8 $ds.m^{-1}$ NaCl) which amounted to (23.35 $mg.100\ g^{-1}$). It is also noticed from the bi-interaction between the cultivars and the spraying with selenium that the effect was significant. where the plant of the Al-Knissry cultivar that sprayed with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) gave the highest average amounted to (30.35 $mg.100\ g^{-1}$) compared to the lowest average amounted to (26.58 $mg.100\ g^{-1}$) in plants of Al-Batra cultivar untreated with Selenium. The bi-interaction between the salinity of irrigation water and the spraying with selenium showed that the effect was significant, where the highest average amounted to (35.00 $mg.100\ g^{-1}$) in the pods of the plants irrigated with saline water at a concentration of (2 $ds.m^{-1}$) and spraying with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) compared to the lowest average amounted to (21.25 $mg.100\ g^{-1}$) produced from the plants irrigated with saline water at a concentration of (8 $mg.L^{-1}$) and untreated with Selenium. As for The triple interaction between the treatments showed a significant effect, where the highest concentration of vitamin C amounted to (35.24 $mg.100\ g^{-1}$) produced from the plants of Al-Knissry cultivar that irrigated with saline water at a concentration of (2 $ds.m^{-1}$) and spraying with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) compared to the lowest average amounted to (21.22 $mg.100\ g^{-1}$) produced from the plants of Al-Batra cultivar that irrigated with saline water at a concentration of (8 $mg.L^{-1}$) and untreated with Selenium. It is clear from the same table that the study factors and their interactions were significantly affected by the concentration of the percentage of total soluble solids in the pods. The irrigation of the plants at the concentration of (8 ds.m-1 NaCl) showed a significant increase in this trait on the rest of the salinity treatments. It is noted a significant increase in this effect by increasing the used salt

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concentration. The cultivars also had a significant effect, where Al-Knissry cultivar was significantly excelled on Al-Batra cultivar, Selenium had a significant effect on this trait, where the sprayed plants with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) on the rest of the concentrations and the effect increase with increasing the used concentration. The interaction between the cultivars and the quality of the irrigation water showed a significant effect in this trait, where the plant of the Al-Knissry cultivar that irrigated with NaCl at a concentration of (8 $ds.m^{-1}$) gave the highest average amounted to (6.394 %) compared to the lowest average amounted to (5.501 %) produced from the plants of the Al-Batra cultivar that irrigated with RO. It is noted from the interaction between the cultivars and spraying with Sodium selenate, the effect was significant, where the plant of the Al-Knissry cultivar that sprayed with Na2SeO4 at a concentration of (20 $mg.L^{-1}$) gave the highest average amounted to (7.059 %) compared to the lowest average amounted to (4.799 %) in plants of Al-Batra cultivar untreated with Selenium. The interaction between the salinity of irrigation water and the spraying with Sodium selenate showed that the effect was significant, The irrigated plants with saline water at concentration of (8 $ds.m^{-1}$) and spraying with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) gave the highest average for this interaction amounted to (7.136 %) compared to the lowest average amounted to (4.461 %) in the plants irrigated with RO and untreated with Selenium. The results of the triple interaction showed that the highest percentage was found in the plants of Al- Knissry cultivar that irrigated with saline water at a concentration of (8 $ds.m^{-1}$ NaCl) and spraying with Na_2SeO_4 at a concentration of (20 $mg.L^{-1}$) which amounted to (7.283 %) compared to the lowest percentage amounted to (4.403 %) in the plants of Al-Batra cultivar that irrigated with RO and untreated with Selenium.

Table (4) shows that the irrigated plants with saline water at a concentration of (2 $ds.m^{-1}$ NaCl) led to a significant increase in the concentration of vitamin C in the pods compared to the rest of the concentrations, It is also noted that the use of higher concentrations of irrigation water at concentrations of (4, 8 $ds.m^{-1}$ NaCl) obtained a significant decrease in this trait, which may be due to the fact that this vitamin is very sensitive to oxidation, it is linked to the oxidation and reduction reactions, it is a reducing the free radicals generated by salt (12; 27). This result agrees with (Almtory, 3). It is observed that the concentration of vitamin C in the pomegranate seeds significantly decreased by increasing the concentration of salinity in irrigation water. As shown in the same table, irrigating the plants with a concentration of (8 $ds.m^{-1}$ NaCl) led to a significant increase in the percentage of total soluble solids in the pods compared to the rest of the salinity concentrations. This may be due to the low water content in the fruit, leading to an increase in their dry matter content, including their content of Total Soluble Solids (21). This result agrees with (Malash et al., 22) that the concentration of total Soluble Solids in the fruits of the tomato plant (*Solanum lycopersicum* L.)increase with increasing salinity concentration in irrigation water. From Table (5), Al-Knissry cultivar was also significantly excelled on Al-Batra cultivar in the percentage of total soluble solids in the pods. This superiority may be due to the effect of genotypes among the cultivars on the studied qualitative traits for the crop. Also, it depends on the sensitivity of these cultivars to bear the saline levels for Irrigation water. It is noted from the same table above (4) that spraying with selenium has an effect on increasing the indicators of the studied qualitative traits for the yield. The increase was a direct with increase in the concentration of the saline, which can be attributed to its positive role in reducing the salinity damage on the plant and improving its nutritional status, In addition to the role of

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selenium in maintaining the hormonal balance within the plant tissues by promoting the work of growth-promoting hormones such as Auxins and Gibberellins and the prevention of growth-inhibiting hormones such as Abscisic Acid. This result agrees with (Abbas, 1) by increasing the concentration of vitamin C in the seeds of sorghum bicolor by soaking the seed with selenium compared to untreated seeds, This result also agrees with (Castillo-Godina et al. (7) who showed increasing the concentration of vitamin C in the fruits of the tomato significantly as a result of treating the plants with selenium compared to untreated plants.

Table 4: Effect of salinity of irrigation water and spraying with selenium in two cultivars of the Okra plant and the interaction between them in the yield indicators (the Concentration of vitamin C and Total Soluble Solids in pods).

Cultivar	The salinity of irrigation water ($ds.m^{-1}$)	**Number of pods per plant**				**The average weight of pods (g)**			
		Na_2SeO_4 ($kg.m^{-2}$)			The salinity of irrigation water NaCl ($ds.m^{-1}$) × cultivars	Na_2SeO_4 ($kg.m^{-2}$)			The salinity of irrigation water NaCl ($ds.m^{-1}$) × cultivars
		0	10	20		0	10	20	
Al-Knissry	**RO**	28.28	30.08	31.63	30.00	4.520	5.963	6.860	5.781
	2	31.48	33.44	35.24	33.38	4.893	6.093	6.933	5.973
	4	25.28	27.15	29.21	27.21	5.200	6.100	7.160	6.153
	8	21.29	23.40	26.14	23.61	5.490	6.410	7.283	6.394
Al-Batra	**RO**	28.38	29.73	30.53	29.55	4.403	5.616	6.483	5.501
	2	31.87	34.15	34.76	33.60	4.800	5.836	6.716	5.784
	4	25.53	26.61	28.68	26.94	4.816	5.886	6.860	5.854
	8	21.22	22.74	26.08	23.35	5.176	6.150	6.990	6.105
LSD 0.05			1.40		0.81		0.118		0.068
Average effect of Na_2SeO_4		26.67	28.41	30.29	**Effect of cultivars**	4.912	6.007	6.910	**Effect of cultivars**
LSD 0.05			0.49				0.041		
Cultivars × Na_2SeO_4	Al-Knissry	26.58	28.52	30.55	28.55	5.025	6.141	7.059	6.075
	Al-Batra	26.75	28.31	30.02	28.36	4.799	5.872	6.762	5.811
LSD 0.05			0.70		NS		0.059		0.034
					The effect of the salinity of irrigation water				The effect of the salinity of irrigation water
The salinity of irrigation water × **Na_2SeO_4**	**RO**	28.33	29.90	31.08	29.77	4.461	5.790	6.671	5.641
	2	31.68	33.80	35.00	33.49	4.846	5.965	6.825	5.878
	4	25.40	26.88	28.95	27.08	5.008	5.993	7.010	6.003
	8	21.25	23.07	26.11	23.48	5.333	6.280	7.136	6.250
LSD 0.05			0.99		0.57		0.083		0.048

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REFERENCES

1. **Abbas, S.M.(2012).** Effects of low temperature and selenium application on growth and the physiological changes in sorghum seedlings. Journal of Stress Physiology & Biochemistry,8(1):268-286.
2. **Al-Mentafji, H. N. H.(2016).** Role of Selenium and Brassinolide in Growth and Active Compounds for Coriander Plant (Coriandrum sativum L.) Exposed to Water Stress. Ph.D. A Dissertation, Dept. of Biology., College of Education for Pure Sciences (Ibn Al-Haitham), Univ. of Baghdad, Iraq. (In Arabic).
3. **Almtory, F.I.O.(2014).** Effect of Irrigation Water Quality and Foliar Application of Pottasium nitrate and Tocopherol on Growth and Yield of Okra Plants *Abelmoschus esculentus* L. Moench C.V Local. Ph.D. A Dissertation, Dept. of Horticulture and Landscape Design., Coll. of Agric., Univ. of Basrah, Iraq. (In Arabic).
4. **Al-Zubaidy, A.H. and Al-Smaak, K.A.(1992).** The Interaction Between Soil Salinity and Potassium Fertilizer and its Effect on the Growth and Tolerance of Sweet Corn and the Distribution of Some Ions in the Soil. M.Sc. Thesis, Coll. of Agric., Univ. of Baghdad, Iraq. (In Arabic).
5. **A.O.A.D.: Arab Organization for Agricultural Development (2016).** Arab Agricultural Statistics Yearbook– Vol. No. (36) Khartoum, pp.76. (In Arabic).
6. **Black, C.A. (1965).** Method of Soil Analysis. Part(1). Physical properties. Am. Soc. Agron. Inc. Publisher, Madison, Wisconsin, USA.
7. **Castillo-Godina, R.G.; Foroughbakhch-Pournavab, R. and Benavides-Mendoza, A.(2016).** Effect of selenium on elemental concentration and antioxidant enzymatic activity of tomato plants. The Journal of Agricultural Science,18:233-244.
8. **Chai, Q. ; Gan, Y. ; Zhao, C.; Xu, H.; Waskom, R.M.; Niu, Y. and Siddique, K.H.M.(2016).** Regulated deficit irrigation for crop production under drought stress. A review. Agron. Sustain. Dev., 36(3):1-21.
9. **David, M. O., and Nilsen, E. T.(2000).** The physiology of plant Under Stress. John Wiley & Sons, Inc.
10. **Duzyaman, E. (1997).** Okra: botany and horticulture. Horticulture Reviews, 21: 41-72.
11. **Feng, R.; Weic, C. and Tud, S.(2013).** The Role of Selenium in Protecting Plants Against Abiotic Stresses. Environmental and Experimental Botany, 87: 58-68.
12. **Goodwin, T.W. and Mereer, E.I.(1985).** Introduction to plant biochemistry 2nd ed.Oxford: Pergam on Press.
13. **Grattan, S. R., and Grieve, C. M.(1999).** Salinity–mineral nutrient relations in horticultural crops. Scientia Horticulturae, 78: 127– 157.
14. **Habibi, Gh. and Sarvary, S.(2015).** The role of selenium in lemon balm against salt stress. Iranian Journal of Plant Physiology, 5(3):1425-1433.
15. **Hasanuzzaman, M.; Nahar, K. and Fujita, M.(2013).** Plant Response to Salt Stress and the Role of Exogenous Protectants to Mitigate Salt-Induced Damages. In Ecophysiology and response of plants under Salt Stress(P.Ahmad et al., ed) Springer Science, 25-64.
16. **Hashem, H.A.; Hassanein, R.A.; Bekheta, M.A. and El-Kady, F.A.(2013).** Protective role of selenium in canola (*Brassica napus* L.) plant subjected to salt stress. Egypt. J. Exp. Biol. (Bot.), 9(2):199-211.
17. **Hawrylak-Nowak, B.(2009).** Beneficial effects of exogenous selenium in cucumber seedlings subjected to salt stress. Biol. Trace. Elem. Res., 132(1-3):259-269.
18. **Jalal, A.G. and Jing-Quan, Y. (2016).** Plant Hormones under Challenging Environmental Factors. Springer.Netherland.
19. **Khalifa, G.S.; Abdelrassoul, M.; Hegazi, A. and Elsherif, M.H.(2016).** Mitigation of

ISSN 2072-3875

saline stress adverse effects in lettuce plant using selenium and silicon. Middle East J. Agric. Res., 5(3):347-361.

20. Kochhar, S.L. (1986). Tropical Plants. A textbook of Economic Botany. Macmillan.

21. Lu, C.; Qiu, N.; Wang, B. and Zhang, J.(2003). Salinity treatment shows no effects on photosystem II photochemistry but increases the resistance of photosystem II to heat stress in halophyte Suaeda salsa. J. Exp. Bot., 54(383):851- 860.

22. Malash, N. M.; Ali, F. A.; Fatahalla, M. A.; Khatabb, E.A.; Hatemb, M.K. and Tawficb, S. (2008). The response of tomato to irrigation with saline water applied by different irrigation methods and water management strategies. International Journal of Plant Production, 2(2): 101-116.

23. Minhas, P. S., and Gupta, R. K.(1993). Using high salinity and SAR waters for crop production–Some Indian experiences. pp: 423–2. In: Leith, H.and Al–Masoom (eds.). Towards the Rational Use of High Salinity Tolerant Plants (vol.2.). Kluwer Academic Publishers, Amsterdam, The Netherlands.

24. Page, A. L.; Miller, R. H., and Keeney, D. R.(1982). Method of Soil and Analysis Part 2, 2nd ed, Agron. 9. Publisher, Madison, Wisconsin, USA.

25. Shahid, M. A.; Pervez, M. A.; Ball, R. M.; Ayyub, C. M.; Abbas, T. and Akhtar, N.(2011). Salt stress effects on some morphological and physiological characteristics of okra (*Abelmoschus esculentus* L.). Soil Environ ., 30(1): 66-73.

26. Shukry, H.M. (1994). Evaluation of the Water Quality of Sadaam River and its Validity for Wheat Seeding. M.Sc. Thesis, Coll. of Agric., Univ. of Baghdad, Iraq. (In Arabic).

27. Smirnoff, N. (1996). The function and metabolism of ascorbic acid in plants. Ann. Bot.,78:661-669.

28. Taher, A. H. (2005). Effect of Spraying with Different Concentrations of Nitrogen, Zinc and Manganese in Growth and Yield of Okra *Abelmoschus esculentus* L., M.Sc. Thesis, Coll. of Agric., Univ. of Baghdad, Iraq. (In Arabic).

29. Ünlükara, A.; Kurunç, A.; Kesmez, G.D., and Yurtseven, E.(2008). Growth and evapotranspiration of okra (*Abelmoschus esculentus* L.) as influenced by salinity of irrigation water. Journal of Irrigation and Drainage Engineering, 134(2):160-166.

30. Walaa, A.e. ; Shatlah, M.A.; Atteia, M.H. and Sror, H.A.M.(2010). Selenium induces antioxidant defensive enzymes and promotes tolerance against salinity stress in cucumber seedlings (*Cucumis sativus*). Arab Universities Journal of Agricultural Sciences, 18(1):65-76.

31. Yadav, S.; Irfan, M.; Ahmad, A. and Hayat, S.(2011). Causes of salinity and plant manifestations to salt stress: A review. J. Environ. Biol., 32, 667-685.

32. Yassen, A.A.; Safia, M.A., and Sahar, M.Z.(2011). Impact of nitrogen fertilizer and foliar spray of selenium on growth, yield and chemical constituents of potato plants. Australian Journal of Basic and Applied Sciences,5(11):1296-1303.

ISSN 2072-3875