Al-Furat Journal of Innovations in Agricultural Sciences (FJIAS)

EFFECT OF SILICON ON THE GROWTH OF GRAPE SEEDLINGS UNDER SALT STRESS

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FJIAS 2025, 1(3): 53-67

Abstract: *The experiment was conducted in the lath house of the College of Agriculture, Al-Qasim Green University, during the 2019 and 2020 growing seasons, to study the effect of salinity of irrigation water and spraying with potassium silicate on the growth of grape seedlings. The experiment included three factors, and the first factor was three levels of irrigation water salinity (2, 4, 6 ds.m^{-1}). The second factor is spraying with potassium silicate at three levels (0,2,4 ml/liter), and the third factor is three cultivars of seedless American grapes (Summer Royal, Flame, and Crimson) and the interactions between them. A factorial experiment was conducted according to a Randomized Complete Blocks Design (R.C.B.D) with three replicates. The arithmetic means were compared according to the least significant difference (L.S.D) test under the 5% probability level, and the results indicated the following. The grape seedlings irrigated with water with a salinity level of 2 ds.m^{-1} gave the highest average in seedling height, number of leaves and leaf content of carbohydrates, nitrogen and phosphorous compared to irrigation treatments with water with a salinity level of 6 ds.m^{-1}, which gave the lowest average. Summer Royal grape cultivar was significantly excelled on Flame and Crimson cultivars in all studies traits .The spraying potassium silicate at a concentration of 4 ml/L gave the best results in most of the vegetative growth traits such as the height of seedlings, the number of leaves and the content of leaves from carohydrate, nitrogen and phosphorous compared to the comparison treatment, which gave the lowest average in the mentioned traits. the triple interaction treatments, the best triple interaction was found, which gave the best results, which was the interaction between the cultivar Summer Royal and the salinity of the irrigation water at a concentration of (2 ds.m^{-1}) and potassium silicate spray at a concentration of 4 ml/liter in the characteristics of seedling height, number of leaves and leaf content Carbohydrates and the percentage of nitrogen and phosphorous.*

Keyword: potassium silicate, cultivar Crimson, cultivar Summer Royal, cultivar Flame, salt stress

1.INTRODUCTION

Vitis vinifera L. is deciduous fruit in temperate regions belonging to the vitaceae family, which includes 14 genera and more than 1000 species [6]. It grows in many places of the world under a wide range of different environmental conditions in the subtropical, warm temperate and cold temperate regions. The area planted with grapes in the world is estimated at 7.5 million hectares [8] .While the area planted with grapes in Iraq is estimated at 146,000 dunums, with a production of 350,000 tons annually, and the number of varieties in Iraq is estimated at about 70 cultivars, most of which are concentrated in the province of the northern region of Sulaymaniyah, Erbil and Dohuk, which includes more than 7 million grapevines, distributed among about 58 local, regional and global cultivars. Grape production has doubled over the past ten years by 50%.As for the central region, grape cultivation spreads in the provinces of Najaf, Karbala, and Babylon, where the province of Najaf comes first.Babylon provinces rank second in the Middle Euphrates region in terms of the cultivated area of 6480 dunums, with a production of 16,079 tons.It includes more than 518.684 vines spread in most of its orchards, and the productivity of a single vine is estimated at 31 kg [1]. The problem of salinity is a determining factor in the expansion of the cultivated areas, where scientific studies have unanimously agreed that soil salinity affects the growth and yield of grapes [11]. as well as the aggravation of this problem annually, which reduces the arable areas. As 19.5% of the irrigated lands and 2.1% of the dry lands are affected by salinity in the world [4]. Grape cultivars vary among themselves in the extent of their tolerance to NaCl when tested in the field. The lands of the central and southern regions of Iraq are also characterized by a high percentage of salinity that The cultivation of grapes is widespread. Therefore, it is necessary to pay attention to the selection of the most tolerant cultivars of saline irrigation water suitable for the Iraqi environment in order to improve the salt tolerance of grapes, including the use of silicon, which has important roles in many physiological processes, the most important of which is improving the efficiency of photosynthesis and the protein and carbohydrate content. Increasing the effectiveness of roots to absorb nutrients and reducing sodium ion toxicity by reducing the flow of sodium ions from the soil solution to plants, thus reducing the osmotic effort inside cells, increasing the ratio of potassium to sodium, increasing the effectiveness of antioxidant enzymes and reducing the toxicity of elements [5]. It regulates the average of transpiration and thus reduces water loss from the plant, increases the effectiveness of antioxidant enzymes, and works to strengthen cell walls, which leads to mechanical support for the aerial parts of the plant.It stimulates the plant to develop some mechanisms that enable it to resist or withstand various stress conditions, whether vital or abiotic, especially under salt stress conditions [13]. Based on the foregoing, the research was conducted to achieve the following aims:Comparison of grape cultivars Summer Royal Seedless, Flame Seedless and Crimson Seedless in terms of their tolerance to different levels of salinity of irrigation water by studying vegetative indicators and chemical and enzymatic variations under the influence of different levels of salinity of irrigation water in order to determine the most tolerant cultivar.Explanation of the

effect of potassium silicate in mitigating the damages of different levels of salinity of irrigation water on the vegetative growth of the grape cultivars under study.

2. MATERIALS AND METHODS

The research was conducted in lath house of the Department of Horticulture and Landscaping belonging to the College of Agriculture / Al-Qasim Green University for two agricultural seasons, the first from 1/1/2019 to 30/8/2019 and the second from 1/1/2020 to 30/8/2020. The research was conducted on seedlings of three cultivars of seedless American grapes of one year old, homogeneous in size as much as possible in their vegetative growth. It was obtained from the General Company for Horticulture and Forests / Horticultural Station in Al Hindiya District, Karbala provinces, planted in polyethylene bags of 2 kg capacity. The seedlings were trimmed by removing all excess growth and keeping three branches on the main stem of each seedling, Then the seedlings were transferred from polyethylene bags to pots with a diameter of 32 cm, containing a mixture of soil loam with peat moss at a ratio of 1:3. All service operations were conducted equally for all seedlings.The floor of lath house was covered with black nylon to prevent the growth of bushes and weeds and to avoid the descent of salty irrigation water to the floor of the canopy.Follow a program to control insects that appeared during the period of planting seedlings. The seedlings were supported by supports and tied to the ceiling of lath house to prevent the seedlings from lying on the ground. The nitrogen fertilizer was added to the seedlings in two batches, the first at the beginning of the growing season and the second 30 days after the date of the first batch.

2.1. Treatments and experimental design

The study included the effect of spraying with potassium silicate, grape cultivars and salt stress on the growth of grape seedlings

The treatments were as follows:

1- **Grape cultivars**: Three American seedless cultivars are (Crimson, Flame and Summer Royal)

2- **Spraying with silicon**: It sprayed the seedlings with silicon in the form of potassium silicate K_2SiO_3 (the manufacturer of the fertilizer used is the Turkish company Agrisensis) With three concentrations (0,2 ,4 ml/liter) and by seven foliar sprays, 15 days apart from the next, provided that the date of the first spray is seven weeks after the opening of the first vegetative bud.

3- **Irrigation water salinity**: The seedlings were irrigated at three levels (2, 4, 6 $ds.m^{-1}$) and the pots were irrigated with equal quantities of saline irrigation water at each irrigation, and the number of days between irrigation and another is determined according to the prevailing weather conditions when watering.A three-factor experiment was conducted with three replications in a randomized complete block design, where the first factor represented the salinity levels of irrigation water (2,4,6 $ds.m^{-1}$).As for the second factor, the American seedless grape varieties (Crimson Seedless, Summer Royal and Flame), and the third factor was the levels of potassium silicate spraying (0,2,4 ml/L).Thus, The Randomized Complete Block

Design (RCBD)with three replicates and the number of treatments 3 x 3 x 3 = 27 treatments for one replicate, the number of experimental units is 81 experimental units and 3 seedlings per experimental unit.

2.2. Irrigation and spraying process with silicon

Drainage water used saline water from one of the drains located near the University of Babylon, and it had an electrical conductivity of more than (18 $ds.m^{-1}$). The water was emptied into a tank with a capacity of 5000 liters as a base solution from which the irrigation water of the two salt levels was prepared (4,6 $ds.m^{-1}$). As for the control treatment, river water with an electrical conductivity of 2 $ds.m^{-1}$ was used.The seedlings were irrigated according to the saline levels used in the experiment by mixing (river water and drainage water) inside each tank and making the required dilution according to the following dilution equation:

first concentration x first volume = second concentration x second volume

The seedlings were irrigated during the first month with river water for all the pots, and then the process of exposing the plants to salt stress using the prepared salt levels began, and the irrigation operations continued whenever the plant needed water.The first spraying of potassium silicate was conducted seven weeks after the opening of the first vegetative bud and in conjunction with irrigation with irrigation water salinity treatments. The potassium silicate was sprayed on the vegetative growth in the early morning until complete wetness using a 3-liter sprinkler with the addition of equal amounts of fertilizer for each experimental unit and the process of foliar fertilization was conducted Seven times, 15 days apart, Tween 20 was added with the solution when spraying at a concentration of 0.01% as a diffuser. The control treatment was sprayed with distilled water only, and the spraying process was conducted after irrigation to increase the efficiency of the seedlings in absorbing the sprayed substance.

2.3. Studied traits

1- Seedlings Height (cm)

2- The number of leaves (leaf. $seedling^{-1}$)

3- Carbohydrate content of leaves (%)

4- Percentage of nitrogen in leaves (%)

5- Percentage of phosphorous in leaves (%)

3. RESULTS AND DISCUSSION

3.1. RESULTS

3.1. 1 Seedling height (cm)

The results in Table (1) showed that the salinity of irrigation water had a significant effect on the seedlings height. The treatment of irrigation water salinity with a concentration of (2 ds.m^{-1}) gave the highest height of seedlings for the two seasons was (88.2 cm) and (91.6 cm), respectively, As for the treatment of irrigation water at a concentration of (6 ds.m^{-1}), it gave the lowest seedling height for the two seasons, which was (69.1 cm, 72.0 cm).The results also showed that the cultivars had a significant effect on the height of seedlings, the cultivar Summer significantly excelled on the rest of the other cultivars and gave the highest height of seedlings for the two seasons, which reached (111.2 cm) and (113.4 cm), respectively. Whereas, Crimson cultivar gave the lowest seedling height for the two seasons, which was (55.1 cm) and (56.8 cm), respectively. While spraying with potassium silicate had non-significant effect on the height of seedlings and for the two seasons, spraying with a concentration of 4 mm / liter gave the highest average of seedling height and for the two seasons, which was (79.8 cm) and (82.6 cm), respectively. Whereas, the control treatment gave the lowest seedling height for the two seasons, which was (77.9 cm) and (75.1 cm), respectively. As for the interaction between (cultivars and irrigation water salinity), the combination treatment (Summer + irrigation water at a concentration of 2 (ds.m-1) excelled and gave the highest average of seedling height for the two seasons was (137.0 cm) and (142.8 cm), respectively,While the treatment (Crimson cultivar + irrigation water with a concentration of 2ds.m-1) gave the lowest height of seedlings in the first season, it was (54.3 cm), while in the second season, the treatment (Crimson cultivar + irrigation water with a concentration of 6ds.m-1) gave the lowest height seedlings reached (53.8 cm).The interaction treatment between salinity of irrigation water at a concentration of 2 ds.m^{-1} + spraying with potassium silicate at a concentration of 4 ml/liter gave the highest average of seedling height for the two seasons, which reached (97.1 cm) and (104.0 cm) respectively.While the treatment (the salinity of the irrigation water at a concentration of 6 ds.m^{-1} + without spraying potassium silicate) gave the lowest height of seedlings for the first season was (68.3 cm), while the treatment gave the salinity of the irrigation water at a concentration of 6 ds.m^{-1} + without spraying potassium silicate). The minimum height of seedlings for the second season (70.2 cm).As for the interaction treatment between (Summer cultivar + spraying with potassium silicate at a concentration of 4 ml / liter) it gave the highest height for seedlings of the two seasons, it reached (113.5 cm) and (122.8 cm) respectively, while the treatment of Crimson cultivar + sprayed with potassium silicate at a concentration of 4 ml / L). The lowest height of seedlings for the first season was (52.8 cm),As for the second season, the interaction treatment between (Crimson cultivar + without potassium silicate spray) showed the lowest seedling height (55.9 cm).The results of the same table showed that the triple interaction between the study factors had a significant effect on the height of seedlings. The treatment of the interaction consisting of (Summer cultivar + irrigation water at a concentration of 2ds.m-1 + spraying with potassium silicate at a concentration of 4 ml / L) and gave the highest height of seedlings for the two seasons reached (166.8 cm) and (181.1 cm) respectively. Where the interaction treatment (Crimson cultivar + irrigation water salinity at a concentration of 2 ds.m-1) + spraying with potassium silicate at a concentration of 2 ml/L) gave the

lowest seedling height for the first season was (49.2 cm).While the results showed that the triple interaction (Crimson cultivar + irrigation water salinity at a concentration of 6 ds.m^{-1}) + without spraying with potassium silicate) gave the lowest seedling height for the second season, which was (49.6 cm).

Table 1. Effect of cultivars, salinity of irrigation water , potassium silicate spraying and the interaction between them on the height of grape seedlings (cm)

Growing season 2019					Cultivars × The salinity of Irrigation water	Growing season 2020			Cultivars × The salinity of Irrigation water
Salinity of Irrigation Water (ds.m^{-1})	Cultivars	potassium silicate ml/liter				potassium silicate ml/liter			
		0	2	4		0	2	4	
2	Summer	120.9	123.2	166.8	137.0	105.0	142.4	181.1	142.8
	Flim	77.7	73.0	68.9	73.2	67.2	76.1	67.6	70.3
	Crimson	58.0	49.2	55.5	54.3	63.0	58.9	63.2	61.7
4	Summer	118.5	128.9	86.9	111.4	110.2	117.1	93.5	106.9
	Flim	65.5	68.4	81.3	71.7	64.6	66.6	66.5	65.9
	Crimson	55.5	63.1	51.3	56.6	55.0	57.6	52.2	54.9
6	Summer	85.5	82.7	86.9	85.1	90.5	87.3	93.7	90.5
	Flim	62.3	72.4	68.8	67.8	70.5	76.6	68.3	71.8
	Crimson	57.1	54.6	51.6	54.4	49.6	54.8	57.0	53.8
L.S.D 0.05		21.38			12.35	16.15			9.32
					salinity				salinity
The salinity of Irrigation water x potassium silicate	2	85.6	81.8	97.1	88.2	78.4	92.5	104.0	91.6
	4	79.8	86.8	73.2	79.9	76.6	80.4	70.8	75.9
	6	68.3	69.9	69.1	69.1	70.2	72.9	73.0	72.0
L.S.D 0.05		12.35			7.13	9.32			5.38
					Cultivars				Cultivars
Cultivars × Potassium Silicate	Summer	108.3	111.3	113.5	111.2	101.9	115.6	122.8	113.4
	flim	68.5	71.3	73.0	70.9	67.5	73.1	67.5	69.3
	Crimson	56.9	55.6	52.8	55.1	55.9	57.1	57.5	56.8
L.S.D 0.05		12.35			7.13	9.32			5.38
Potassium silicate effect average		77.9	79.5	79.8		75.1	81.9	82.6	
L.S.D 0.05		7.13				5.38			

3.1.2 The number of leaves (leaf. Seedlings^{-1}).

The data in Table (2) showed that the salinity of the irrigation water had a significant effect on the number of leaves, where it was significantly excelled on the salinity of the irrigation water with a concentration of (4ds.m^{-1}) and gave the highest average number of leaves for the two seasons, which amounted to (42.13. leaf. seedlings^{-1}).Whereas, the treatment of salinity of irrigation water with a concentration of (6 ds.m^{-1})gave the lowest number of leaves which reached (36.83 leaf.seedling-1), (34.44 leaf.seedling-1) for the two seasons respectively.The cultivar Summer also significantly excelled and gave the highest number of leaves on the seedling and for the two seasons, reaching (51.46 leaf.seedling^{-1}), (47.05 leaf.seedling^{-1}), respectively.Followed by the cultivar Flame and gave the number of leaves for both seasons amounted to

(38.07 leaf.seedling-1), (40.11 leaf.seedling-1), while the variety Crimson gave the lowest number of leaves for both seasons reached (28.67 leaf.seedling-1), (28.25 leaf. seedling^{-1}).The results also showed that silicon spray had a significant effect on the number of leaves, where the treatment (potassium silicate spray at a concentration of 4 ml/L) excelled and gave a number of leaves that amounted to (42.27 leaf. seedling $^{-1}$ the highest average of leaves reached (40.18 leaf.seedling-1), while the treatment without spraying potassium silicate gave the lowest average of leaves and for the two seasons it reached (36.10 leaf.seedling-1), (36.04 leaf. seedling^{-1}).The results also showed that the bi-interaction between the cultivar and the salinity of the irrigation water had a significant effect on the number of leaves.), (51.67 leaf, seedlings^{-1}), respectively. Whereas, the interaction treatment (Crimson cultivar + irrigation water salinity with a concentration of 6 ds.m^{-1}) gave the lowest number of leaves for the two seasons was (25.87 leaf.seedling-1), (23.86 leaf.seedling-1) respectively.Whereas, the interaction treatment between (irrigation water salinity 4ds.m^{-1} + spraying with potassium silicate at a concentration of 2 ml / liter gave the highest average number of leaves reached (44.11 leaf.seedling-1) and (45.64 leaf.seedling-1) for the two seasons, respectively. The interaction treatment (irrigation water salinity at a concentration of 6 ds.m^{-1} + without potassium silicate spray) gave the lowest number of leaves for the two seasons 33.06 leaf. seedling-1. The results of the bilateral interaction between the cultivar and potassium silicate showed the interaction (Summer cultivar + spraying with potassium silicate at a concentration of 4 ml/L)excelled and gave the highest number of leaves and for both seasons, which amounted to (57.44 leaf. seedling-1) While the interaction between (Crimson cultivar + without potassium silicate spray) gave the lowest number of leaves for the two seasons: (25.89 leaf.seedling^{-1}), (27.33 leaf.seedling^{-1}), respectively.As for the triple interaction, the treatment of the triple interaction (Summer cultivar + spraying with potassium silicate at a concentration of 4 ml/L + salinity of irrigation water at a concentration of 4 ds.m^{-1}) was excelled, giving the highest average number of leaves for the first season, which amounted to (60.00 leaf. seedlings^{-1}).Whereas, the interaction treatment (Summer cultivar + silicon spray at a concentration of 4 ml / L + the salinity of irrigation water at a concentration of 2 ds.m-1) gave the highest average number of leaves for the second season, which amounted to (57.73 leaf. seedlings^{-1}). While the interaction treatment (Crimson cultivar + irrigation water salinity at a concentration of 6 ds.m^{-1} + without spraying potassium silicate) gave the lowest number of leaves for the two seasons was (22.67 leaf. seedlings^{-1}), (22.30 leaf. seedlings^{-1})

Table 2. Effect of cultivars, salinity of irrigation water , potassium silicate spraying and the interaction between them on number of leaves of grape seedlings (leaf. seedling-1)

Growing season 2019					Cultivars × The salinity of Irrigation water	Growing season 2020			Cultivars × The salinity of Irrigation water
Salinity of Irrigation Water (ds.m^{-1})	Cultivars	potassium silicate ml/liter				potassium silicate ml/liter			
		0	2	4		0	2	4	
2	Summer	51.43	53.00	59.33	54.59	46.93	50.33	57.73	51.67
	flim	34.00	32.27	39.47	35.24	32.53	33.97	35.97	34.16
	Crimson	24.67	29.97	29.07	27.90	26.83	25.97	25.30	26.03
4	Summer	41.33	48.67	60.00	50.00	36.20	47.67	54.77	46.21
	flim	44.00	50.33	38.10	44.14	51.87	53.40	44.63	49.97
	Crimson	30.33	33.33	33.10	32.26	32.87	35.87	35.83	34.86

6	Summer	42.67	53.67	53.00	49.78	41.63	43.40	44.77	43.27
	flim	33.83	33.00	37.67	34.38	33.23	37.73	37.67	36.21
	Crimson	22.67	24.27	30.67	25.87	22.30	24.30	24.97	23.86
L.S.D 0.05		9.33			5.39	14.32			8.27
					salinity				salinity
The salinity of Irrigation water x potassium silicate	2	36.70	38.41	42.62	39.24	35.43	36.76	39.67	37.29
	4	38.56	44.11	43.73	42.13	40.31	45.64	45.08	43.68
	6	33.06	36.98	40.44	36.83	32.39	35.14	35.80	34.44
L.S.D 0.05		5.39			3.11	8.27			4.78
					Cultivars				Cultivars
Cultivars × Potassium Silicate	Summer	45.14	51.78	57.44	51.46	41.59	47.13	52.42	47.05
	flim	37.28	38.53	38.41	38.07	39.21	41.70	39.24	40.11
	Crimson	25.89	29.19	30.94	28.67	27.33	28.71	28.70	28.25
L.S.D 0.05		5.39			3.11	8.27			4.78
Potassium silicate effect average		36.10	39.83	42.27		36.04	39.18	40.18	
L.S.D 0.05		3.11				4.78			

3.1.3 The percentage of carbohydrates in the leaves (%).

The results of Table (3) showed that the salinity of the irrigation water had a significant effect on increasing the carbohydrate content in the leaves. The treatment with concentration (2 ds.m^{-1}) gave the highest carbohydrate content in the leaves for the two seasons (5.49 and 5.45%), respectively.Whereas, the treatment with a concentration of (6 ds.m^{-1}) gave the lowest carbohydrate content in the leaves amounted to (4.27, 4.34%), respectively. The results of the table also showed that the Summer culitvar was significantly superior to the rest of the other cultivars and gave the highest percentage of carbohydrates in the leaves and the two seasons, which amounted to (6.55 and 6.64 %), respectively, while the Crimson cultivar gave the lowest percentage of carbohydrates in the leaves for the two seasons, which amounted to (2.74, 2.77%), respectively.As for the silicon spray, the potassium silicate spraying treatment at a concentration of 4 ml/liter was superior and gave the highest average percentage of carbohydrates in the leaves for the two seasons, which amounted to (5.80, 5.83)%, respectively, while the control treatment gave the lowest percentage of carbohydrates in the leaves of the two seasons amounted to (4.02, 3.99%) respectively.The results also showed that the interaction between the cultivars and the salinity of the irrigation water had a significant effect in increasing the percentage of carbohydrates in the leaves.Whereas, the interaction treatment (Crimson cultivar + irrigation water salinity with a concentration of 6 (ds.m^{-1}) gave the lowest percentage of carbohydrates in the leaves of the two seasons (2.29, 2.27%), respectively.Whereas, the interaction treatment consisting of (the salinity of irrigation water at a concentration of 2 ds.m^{-1} + and a potassium silicate spray at a concentration of 4 ml/L) gave the highest percentage of carbohydrates in the leaves of the two seasons, which amounted to (6.62, 6.77 %), respectively. Whereas, the interaction treatment (the salinity of irrigation water at a concentration of 6 ds.m-1 + without spraying potassium silicate) gave the lowest percentage of carbohydrates in the leaves of

the two seasons (3.64, 3.63%), respectively.As for the interaction between the cultivar and spraying with potassium silicate, the results showed the superiority of (the cultivar Summer + potassium silicate spray at a concentration of 4 ml/L) and gave the highest percentage of carbohydrates in the leaves for the two seasons, which amounted to (8.42, 8.49%), respectively.Also, the interaction treatment (Crimson cultivar + without potassium silicate spray) gave the lowest percentage of carbohydrates for the two seasons, which was (1.68, 170%), respectively.Whereas, the interaction treatment consisting of (the salinity of irrigation water at a concentration of 2 $ds.m^{-1}$ + and a potassium silicate spray at a concentration of 4 ml/L) gave the highest percentage of carbohydrates in the leaves of the two seasons, which amounted to (6.62, 6.77 %), respectively. Whereas, the interaction treatment (the salinity of irrigation water at a concentration of 6 $ds.m^{-1}$ + without spraying potassium silicate) gave the lowest percentage of carbohydrates in the leaves of the two seasons (3.64, 3.63%), respectively.As for the interaction between the cultivar and spraying with potassium silicate, the results showed the cultivar Summer + potassium silicate spray at a concentration of 4 ml/liter) excelled and gave the highest percentage of carbohydrates in the leaves for the two seasons, which amounted to (8.42, 8.49%), respectively.Also, the interaction treatment (Crimson cultivar + without potassium silicate spray) gave the lowest percentage of carbohydrates for the two seasons, which was (1.68, 170 %), respectively.The results in Table (3) also showed that the triple interaction between cultivars, salinity of irrigation water and spraying with potassium silicate had a significant effect on the percentage of carbohydrates in the leaves.The interaction treatment consisting of (Sumer cultivar+ irrigation water salinity at a concentration of 2$ds.m^{-1}$ + potassium silicate spray at a concentration of 4 ml/L) excelled and gave the highest percentage of carbohydrates which amounted to (8.69, 9.13 %). As for the interaction treatment consisting of (Crimson cultivar + irrigation water salinity at a concentration of 6ds.m-1+ without potassium silicate spray) it gave the lowest percentage of carbohydrates (1.45, 1.37 %), respectively.

Table 3. Effect of cultivars, salinity of irrigation water , potassium silicate spraying and the interaction between them on the percentage of carbohydrates in the leaves of grape seedlings (%).

Growing season 2019					Cultivars × The salinity of Irrigation water	Growing season 2020			Cultivars × The salinity of Irrigation water
Salinity of Irrigation Water ($ds.m^{-1}$)	Cultivars	potassium silicate ml/liter				potassium silicate ml/liter			
		0	2	4		0	2	4	
2	Summer	5.03	7.55	8.69	7.09	4.91	7.62	9.13	51.67
	Flim	6.58	5.16	7.05	6.27	6.13	4.81	6.74	34.16
	Crimson	1.92	3.27	4.12	3.11	1.99	3.27	4.41	26.03
4	Summer	4.50	6.65	8.50	6.56	4.56	6.62	8.29	46.21
	Flim	5.60	4.16	5.03	4.93	5.67	4.10	4.95	49.97
	Crimson	1.66	3.15	3.61	2.81	1.72	3.07	3.62	34.86
6	Summer	4.22	5.75	8.07	6.01	4.41	6.13	8.04	43.27
	Flim	5.23	4.14	4.17	4.52	5.11	4.21	4.34	36.21
	Crimson	1.45	2.46	2.95	2.29	1.37	2.47	2.95	23.86
L.S.D 0.05		0.65			0.37	0.69			0.40
					salinity				salinity
The salinity of Irrigation	2	4.51	5.33	6.62	5.49	4.35	5.23	6.77	5.45
	4	3.92	4.66	5.72	4.77	3.98	4.57	5.62	4.73

water x potassium silicate	6	3.64	4.12	5.07	4.27	3.63	4.28	5.11	4.34
L.S.D 0.05		0.37			0.22	0.40			0.23
					Cultivars				Cultivars
Cultivars × Potassium Silicate	Summer	4.58	6.65	8.42	6.55	4.63	6.79	8.49	6.64
	Flim	5.81	4.49	5.42	5.24	5.64	4.35	5.35	5.11
	Crimson	1.68	2.96	3.56	2.74	1.70	2.94	3.66	2.77
L.S.D 0.05		0.37			0.22	0.40			0.23
Potassium silicate effect average		4.02	4.70	5.80		3.99	4.69	5.83	
L.S.D 0.05		0.22				0.23			

3.1.4 Percentage of nitrogen in leaves (%)

The results in Table (4) showed that the salinity of the irrigation water had a significant effect on the nitrogen content in the leaves. The treatment of the salinity of the irrigation water with a concentration of (2.4 ds.m-1) was significantly excelled on the control treatment without showing differences between them and gave the highest nitrogen content in the leaves. It reached (2.08, 2.04)% for the two seasons respectively. Whereas, the control treatment gave the lowest nitrogen content for the two seasons, which amounted to (1.88, 1.81)%, respectively .The results of the table also showed the Summer cultivar significantly excelled on the rest of the other cultivars and gave the highest percentage of nitrogen in the leaves and in the two seasons amounted to (2.88, 2.89) %, respectively.Where Crimson cultivar gave the lowest nitrogen content in leaves for both seasons (1.23 and 1.21%) respectively.The table also showed the treatment (potassium silicate spray at a concentration of 4 ml/L) excelled and gave the highest average of nitrogen in the leaves for the two seasons amounted to (2.07 and 2.11)%, respectively, while the treatment without potassium silicate spray gave the lowest percentage of nitrogen in the leaves for both seasons amounted to (1.85, 1.78) %, respectively. The results also showed that the interaction between the cultivars and the salinity of the irrigation water had a significant effect in increasing the percentage of nitrogen in the leaves(3.07, 3.16%), respectively, while the interaction between (Crimson cultivar + Irrigation water salinity with a concentration of 6 $ds.m^{-1}$) gave the lowest nitrogen content in the leaves for the two seasons was (1.13 and 1.12%), respectively.Whereas, the interaction treatment (the salinity of irrigation water at a concentration of 2 $ds.m^{-1}$ + potassium silicate spray at a concentration of 4 ml / liter) gave the highest nitrogen content in the leaves of the two seasons, which amounted to (2.12, 2.27) %, respectively. While the interaction treatment (the salinity of irrigation water at a concentration of 6 ds.m-1 + without spraying potassium silicate) gave the lowest nitrogen content in the leaves for the two seasons, which was (1.52 and 1.37)%, respectively. While the results showed that the interaction between (Summer cultivar + potassium silicate spray at a concentration of 2 ml/L) gave the highest percentage of nitrogen in leaves that reached (3.04%) for the first season, while the interaction between (Summer + potassium silicate spray at a concentration of 4 ml/L) was higher. The percentage of nitrogen in the leaves was (3.11%) for the second season, while the lowest percentage of nitrogen in the leaves was when the interaction (Crimson cultivar + without potassium silicate spray) for the two seasons was (1.12, 1.15)%, respectively.The results in Table (4) also showed that the triple interaction between cultivars, salinity of

irrigation water and spraying with potassium silicate had a significant effect on the percentage of nitrogen in leaves, as the two interaction treatments consisting of (Summer cultivar + salinity of irrigation water at a concentration of 2ds.m^{-1}+ excelled potassium silicate spraying at a concentration of 4 ml/L) and it gave the highest percentage of nitrogen in the leaves of (3.21, 3.55%) for the two seasons, respectively, while the lowest percentage at the triple interaction was when the interaction between (Crimson cultivar + salinity of irrigation water at a concentration of 6ds.m^{-1}+ without spraying Potassium silicate) and it gave the lowest percentage of nitrogen in the leaves for the first season was (1.03%), and in the second season, the interaction that gave the lowest percentage was (Crimson cultivar+ salinity of irrigation water at a concentration of 6 ds.m^{-1} + potassium silicate spray at a concentration of 2 ml/liter) and reached (1.04%).

Table 4. Effect of cultivars, salinity of irrigation water , potassium silicate spraying and the interaction between them on the percentage of nitrogen in the leaves of grape seedlings (%)

Growing season 2019					Cultivars × The salinity of Irrigation water	Growing season 2020			Cultivars × The salinity of Irrigation water
Salinity of Irrigation Water (ds.m^{-1})	Cultivars	potassium silicate ml/liter				potassium silicate ml/liter			
		0	2	4		0	2	4	
2	Summer	2.97	3.04	3.21	3.07	2.84	3.08	3.55	3.16
	Flim	1.81	1.78	1.87	1.82	1.80	1.75	1.94	1.83
	Crimson	1.17	1.24	1.29	1.23	1.18	1.29	1.33	1.27
4	Summer	3.09	3.06	2.95	3.03	2.99	3.09	2.98	3.02
	Flim	1.94	1.74	1.89	1.86	1.91	1.80	1.87	1.86
	Crimson	1.16	1.42	1.40	1.33	1.21	1.20	1.35	1.25
6	Summer	1.86	3.03	2.76	2.55	1.56	3.11	2.80	2.49
	Flim	1.67	2.23	1.98	1.96	1.48	2.12	1.90	1.83
	Crimson	1.03	1.07	1.29	1.13	1.07	1.04	1.25	1.12
L.S.D 0.05		0.31			0.18	0.30			0.17
					salinity				salinity
The salinity of Irrigation water x potassium silicate	2	1.98	2.02	2.12	2.04	1.94	2.04	2.27	2.09
	4	2.06	2.07	2.08	2.07	2.03	2.03	2.06	2.04
	6	1.52	2.11	2.01	1.88	1.37	2.09	1.98	1.82
L.S.D 0.05		0.37			0.22	0.40			0.18
					Cultivars				Cultivars
Cultivars × Potassium Silicate	Summer	2.64	3.04	2.97	2.88	2.46	3.09	3.11	2.89
	Flim	1.81	1.92	1.91	1.88	1.73	1.89	1.90	1.84
	Crimson	1.12	1.24	1.33	1.23	1.15	1.18	1.31	1.21
L.S.D 0.05		0.18			0.10	0.17			0.10
Potassium silicate effect average		1.85	2.06	2.07		1.78	2.05	2.11	
L.S.D 0.05		0.10				0.10			

3.1.5 Percentage of phosphorous in leaves (%)

The results of Table (5) showed that there were significant differences for the salinity of irrigation water on the percentage of phosphorous in the leaves and for the two seasons, where the treatment of (irrigation water salinity with a concentration of (2 ds.m^{-1}) was excelled and gave the highest percentage of phosphorous in the leaves and both seasons was (0.32% and 0.32%), respectively, while the salinity of irrigation water with a concentration of (4 ds.m^{-1}) gave the lowest percentage of phosphorous in the leaves for the two seasons, amounting to (0.28%) and (0.28%), respectively.The results of the table also showed that (Summer) was significantly excelled on the rest of the other cultivars and gave the highest percentage of phosphorous in the leaves and for the two seasons, which amounted to (0.51%) and (0.50%), respectively, while (Crimson) gave the lowest percentage of phosphorus in the leaves for the two seasons amounted to (0.13% and 0.13%), respectively.As for the potassium silicate spraying, the potassium silicate treatment with a concentration of 4 ml/L was superior and gave the highest average of phosphorous in the leaves for the two seasons, which amounted to (0.32%) and (0.31%), respectively, while the treatment without potassium silicate spray gave the lowest percentage. The phosphorous in the leaves of the two seasons amounted to (0.28%) and (0.29%), respectively.The results of the table also showed that the interaction between the cultivars and the salinity of the irrigation water had a significant effect in increasing the percentage of phosphorous in the leaves. (0.53%), as for the second season, the same treatment of the interaction significantly outperformed all other interactions and gave the highest percentage of phosphorus that reached (0.51%), while the lowest percentage of phosphorus in leaves was at the interaction (Crimson cultivar + irrigation water salinity at a concentration of 4 ds. m^{-1})values were (0.12%) and (0.13%) for the two seasons, respectively.Whereas, the interaction treatment (salinity of irrigation water at a concentration of 2 ds.m^{-1} + potassium silicate spray at a concentration of 4 ml/L) gave the highest percentage of phosphorous in the leaves of the two seasons, amounting to (0.35%) and (0.34%), respectively, while the lowest percentage of phosphorus was recorded When the interaction treatment (the salinity of irrigation water at a concentration of 4ds.m^{-1}+ without potassium silicate spraying) was given (0.25%) and (0.25%) for the two seasons, respectively.While the results showed that the interaction between the cultivars and potassium silicate spraying had a significant effect on the percentage of phosphorus in the leaves, the interaction treatment (Summer cultivar + potassium silicate spray at a concentration of 4 ml/L) gave the highest percentage of phosphorus in the leaves for both seasons amounted to (0.54and 0.52%). respectively. While the interaction treatment (Crimson cultivar + without potassium silicate spray) gave the lowest percentage of phosphorous in leaves that was (0.11%) and (0.12%) for the two seasons, respectively.The results of Table (5) also showed that the triple interaction between cultivars, salinity of irrigation water and spraying with potassium silicate, had a significant effect on the percentage of phosphorous in leaves, where the interaction treatment consisting of (Summer cultivar + salinity of irrigation water at a concentration of 2ds.m^{-1}+ silicate spray excelled on Potassium at a concentration of 4 ml / L), and it gave the highest percentage of phosphorous in the leaves of the two seasons, amounting to (0.61%) and (0.56%), respectively.

Table 5.Effect of cultivars, salinity of irrigation water , potassium silicate spraying and the interaction between them on the percentage of phosphorous in leaves of grape seedlings (%)

Growing season 2019					Cultivars × The salinity of Irrigation water	Growing season 2020			Cultivars × The salinity of Irrigation water
Salinity of Irrigation [1]Water (ds.m-)	Cultivars	potassium silicate ml/liter				potassium silicate ml/liter			
		0	2	4		0	2	4	
2	Summer	0.49	0.48	0.61	0.53	0.52	0.46	0.56	0.51
	Flim	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
	Crimson	0.11	0.15	0.14	0.14	0.12	0.14	0.14	0.13
4	Summer	0.51	0.49	0.53	0.51	0.49	0.49	0.51	0.50
	Flim	0.14	0.26	0.23	0.21	0.14	0.28	0.23	0.22
	Crimson	0.11	0.11	0.14	0.12	0.11	0.12	0.14	0.13
6	Summer	0.49	0.47	0.49	0.48	0.51	0.49	0.50	0.50
	Flim	0.28	0.29	0.28	0.28	0.28	0.28	0.28	0.28
	Crimson	0.11	0.16	0.12	0.13	0.12	0.16	0.13	0.14
L.S.D 0.05		0.03			0.02	0.03			0.02
					salinity				salinity
The salinity of Irrigation water x potassium silicate	2	0.30	0.31	0.35	0.32	0.31	0.30	0.34	0.32
	4	0.25	0.29	0.30	0.28	0.25	0.30	0.29	0.28
	6	0.29	0.31	0.30	0.30	0.31	0.31	0.30	0.31
L.S.D 0.05		0.02			0.01	0.02			0.01
					Cultivars				Cultivars
Cultivars × Potassium Silicate	Summer	0.50	0.48	0.54	0.51	0.51	0.48	0.52	0.50
	Flim	0.24	0.29	0.27	0.27	0.24	0.29	0.27	0.27
	Crimson	0.11	0.14	0.13	0.13	0.12	0.14	0.14	0.13
L.S.D 0.05		0.02			0.01	0.02			0.01
Potassium silicate effect average		0.28	0.30	0.32		0.29	0.30	0.31	
L.S.D 0.05		0.01				0.01			

3.2. Discussion

There was a significant decrease in most of the vegetative growth traits when irrigating the seedlings of three grape cultivars with salt water. The reason may be due to the increase in soil salinity as a result of irrigating it with salt water, which increases its Osmotic pressure. Its Water potential decreases, leading to a decrease in the availability of water and nutrients for the plant, so the swelling effort of the plant cells decreases, and then the decrease in cell division and elongation ([2], [12]).t is clear that salinity can reduce plant growth or deteriorate due to the osmotic effect, toxicity of some ions, and imbalance of nutrient absorption [10]. Salt stress causes a decrease in plant growth and productivity by disrupting physiological processes, especially carbon metabolism [7].The decrease in the vegetative growth traits and the content of the leaves of carbohydrates and nutrients studied by the increase in the level of salts in the irrigation water may be due to the increase in its concentration in the soil solution and the direct negative effects of this, such as inhibiting the enzymatic activity in the plant cells, and disrupting the nutritional balance or through the dysfunction of cell membranes, As well as its effect on photosynthesis, respiration, and electron transport pathways[3]. the decrease may be due to the indirect effects of salinity by affecting the properties of the soil and then the negative impact on the growth of seedlings, where the high osmotic

potential of the soil solution at high salinity levels of the irrigation water causes a deficit in water absorption. Which works to reduce the inflated pressure of the cell, which affects the softness of its wall and the lack of cell expansion and elongation, thus reducing the vegetative characteristics of the seedlings, which negatively affects the content of the leaves of nutrients [9].

4. CONCLUSIONS

Through the study, we can conclude the following: -

Irrigation with saline water had a negative effect on the vegetative traits of seedlings, The cultivars have differed in their tolerance for irrigation with saltwater, The cultivar Summer Royal was more tolerant of it, followed by the two cultivars Flame and Crimson, respectively, according to the significantly excelled of it in most of the studied traits, the content of the leaves of nutrients, Spraying with potassium silicate had a significant effect on increasing the salinity tolerance of the cultivars under study, Spraying with potassium silicate had a significant effect on the concentration of nutrients in the leaves of seedlings irrigated with saltwater

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