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Effect of Spraying with Proline on Two Cultivars of Potato Under Salt Stress

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Abstract: *During the fall season on September 15, 2019, the experiment was carried out on one of the farms belonging to a farmer in the Al-Tahmaziya area, the Hilla city, Babylon province. This experiment included a study of the effect of four concentrations of NaCl (without addition, 4, 8,10 dsm^{-1}) and proline spraying at a concentration of (0, 200, 250 ppm) on two potato cultivars(Burren and Riviera). The experiment was conducted according to the Split split-plot design with three replicates, where the main plot occupied the cultivars. As for the proline subplot, the sub-sub- the plot was occupied by NaCl, and the results were The cultivars showed significant differences between them in effect on the studied traits, where the Burren cultivar was significantly excelled and gave the highest values for the traits of the number of tubers 7.63 tubers.plant $^{-1}$, the fresh weight of the tubers was 601.25 g, while the Riviera cultivar excelled and gave the highest values for root length traits 40.75 cm, leaf sodium, and a chloride content (3.87 and 3.43%), respectively. The treatment of proline spraying with a concentration of 250 ppm was significantly excelled and gave the highest values of root length traits 40.06 cm, the number of tubers 8.61 tubers. Plant $^{-1}$, while the concentration 200 ppm significantly excelled and gave the highest value of the fresh weight of tubers, amounted to 680.53 g. The results of the experiment also showed that adding sodium chloride to irrigation water harmed the root growth traits and the quantitative and qualitative traits, especially the concentration of 10 dsm^{-1}, where it gave the lowest values for most of the studied traits in comparison with the control treatment that gave the highest values. The triple interaction treatment consisting of (Burren cultivar + proline spraying at a concentration of 250 ppm + 4 dsm $^{-1}$) was significantly excelled and gave the highest value in the quality of the number of tubers 11.90 tubers.plant^{-1}, and the treatment of (Burren + Proline spraying at a concentration of 250 ppm + 4 dsm $^{-1}$) was significantly excelled and gave the highest value for the fresh weight of tuber 846.10 g.***

Key words: *Proline; Salt Stress; NaCl; cultivars; Folair Application.*

1.INTRODUCTION

Potato is one of the most important vegetable crops in the Arab world and the world, especially the Americas due to the abundance of productivity and its tolerance to various environmental conditions, where it occupies the first place in terms of cultivated area and productivity, so the area occupied with this crop increases by about 23 million hectares, equivalent to 46% of the total area cultivated with tuber vegetables.[1] The importance of potatoes as an important source of energy comes because they contain high amounts of protein, where it contains many vitamins and amino acids, where it is a basic source of 18

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amino acids out of 20 amino acids [2]. The area planted with potatoes in Iraq reached 31,786 acres in 2016, with a production equivalent to 190,702 tons, and a yield of 5999.6 kg/acre [3] Potato crop production is affected by many environmental factors, the most important of which is the salinity of soil and water, where it is one of the environmental stresses that negatively affect the growth and productivity of this crop [4], As salinity has two types of effects on plants, primary effects in reducing the water stress of the growth medium and the occurrence of disturbances in the ionic balance and secondary effects including inhibition of cell expansion and influence on photosynthesis and inhibition of cellular metabolism and production of active oxygen species and hormonal imbalance and The effect on protein metabolism [5,6,7] For the purpose of studying the salinity factor, there are several methods, including exposing plants to different levels of salts by adding these salts to irrigation water and controlling the quantities of adding them, noting that the effect of salinity on plants depends on the severity of salt stress, the time of its occurrence and the length of time the plant is exposed to it and the stage of plant growth [8].In a study conducted by each of [9] on potato yield, it decreased by 12% when increasing the concentration of dissolved salts in irrigation water from 640 mg L^{-1} to 704 mg L^{-1}. increasing the salt concentration from 1.6 (to 4.3) dsm^{-1} led to a decrease in plant height, total chlorophyll, total yield and marketable yield. To reduce the negative effect of salinity, some organic compounds, including amino acids (proline) are used as external treatments at specific concentrations to reduce the stress caused by salinity [10]. It is one of the amino acids that accumulate in plants when exposed to salt stress because of its effective protective osmotic role [11], and reduces the concentration of salinity because it helps absorb large quantities of water [12] and also maintains the vitality of the plant cell by preventing protein breakdown. In the plant cell it preserves the plant [13].The aim of study is knowing the best combination of the studies factors, interfering with the suggestion of irrigation water on growth and production indicators.

2. MATERIALS AND METHODS

The study included the effect of NaCl and Proline on two cultivars of potato. The field experiment was conducted during the autumn season of 2019 on 15/9/2019 in one of the farms belonging to a farmer in Al-tahmaziya area belonging to the city of Hilla,Babylon province. The soil was prepared with two perpendicular tillage to the Moldboard plows at a depth of 30 cm. after which the soil was softened and levelled. The field was divided into three replicates. Each replicate included 24 experimental units in a Furrow shape, leaving a distance of 75 cm between one furrow and another, as well as leaving 1 m between one replicate and another. Field soil samples were taken randomly before cultivation to determine the physical and chemical properties of the soil (Table 1).The experiment was conducted by the RCBD (Randomized Complete Block Design) according to Split Split plot Design and with three replications, where the experiment included three factors. The first main factor was the use Sof two cultivation of potato, namely (Burren and Riviera), while the second factor involved the use of three concentrations of the amino acid proline, namely:

1- The control treatment without adding proline.

2- Add 0.02 g of proline powder to 1L distilled water and spraying the vegetative growth at a concentration of 200 ppm.

3- Add 0.025 g proline powder to 1L distilled water and spraying the vegetative growth at a concentration of 250 ppm.

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The third-factor sub-secondary includes the use of four concentrations of NaCl solution, which are:

1- control treatment without NaCl.

2- 4 dsm^{-1} concentration of NaCl.

3- 8 dsm^{-1} concentration of NaCl.

4- 10 dsm^{-1} concentration of NaCl.

The drip irrigation system was used and tanks were equipped with the required salt concentrations for the purpose of irrigating the plants with the salt concentrations used in the experiment. The experiment contained 72 experimental units, at an average of 24 experimental units for each replicate, and the length of one experimental unit was 4 m. The seeds of the two potato cultivars(Burin and Riviera) were cultivated in a pit, with a full tuber in the pit, 25 cm apart from another. All agricultural operations to serve the crop, including weeding, removing weeds, and controlling pests and diseases, were performed similarly for all plants. Harvesting took place 100 days after cultivation.

Table 1. Some physical and chemical properties of soil

Traits		Units	Autumn season
PH		————	7.2
EC		dsm^{-1}	7.17
N		$mg.kg^{-1}$	25.9
P		$mg.kg^{-1}$	12.4
K		$mg.kg^{-1}$	206
Organic matter		$g.kg^{-1}$	1.2
Soil separates	Sand	$g.kg^{-1}$	675
	Silt	$g.kg^{-1}$	220
	Clay	$g.kg^{-1}$	105
Soil Texture		———	Loamy sand

3.RESULTS AND DISCUSSION

3.1.Root length (cm)

The results in Table (2), showed that the cultivars had a significant effect in increasing the root length (cm), where it was significantly excelled to the Riviera cultivars and gave the highest root length of 40.75 cm, while the Burren cultivar gave an average root length of 37.12 cm, while the results showed that proline spraying had a significant effect in increasing Root length, where it was significantly excelled to the treatment of proline spraying at a concentration of 250 ppm, and it gave the highest root length of 40.06 cm. While the control treatment without spraying gave the lowest root length of 37>49 cm, while the addition of sodium chloride had a significant effect in increasing the root length, where it was significantly excelled to the treatment of adding sodium chloride at a concentration of 10 dsm^{-1} and it gave the highest root length of 48.64 cm, while the addition of chloride was given a significant effect. Sodium, at a concentration of 8 dsm^{-1}, has a minimum root length of 39.37 cm. While the control treatment gave

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the minimum root length of 32.01 cm. The results also showed that the di-interaction between the cultivars and proline had a significant effect in increasing the length of the rootstock, as the interaction treatment (cultivar Riviera + spraying with proline at a concentration of 250 ppm) was significantly higher and gave the highest average root length of (42.25 cm), respectively. Whereas, the minimum root length was when the interaction treatment (cultivar Burren + Proline spray at 200 ppm concentration) was 35.71 cm. Also, the interaction between the cultivars and the addition of sodium chloride had a significant effect on the same traits used treatment, where the interaction treatment between (Riviera cultivar + addition of sodium chloride at a concentration of 10 dsm^{-1}) was significantly excelled to the rest of the other treatments and gave the highest root length of 50.43 cm. Whereas, the interaction treatment (cultivar Burren + without adding of NaCl) gave the minimum root length of 30.23 cm. Also, the interaction treatment between (without proline + adding sodium chloride at a concentration of 10 dsm^{-1}) significantly excelled on the rest of the other interaction treatments and gave the highest root length of 51.72 cm, while the control treatment (without adding the lowest root length was 31.15 cm). Also, the triple interaction between study factors had a significant effect to increase root length, where the interaction treatment (cultivar Riviera + without spraying proline + addition of sodium chloride at a concentration of 10 dsm^{-1}) gave the highest root length of 52.73 cm, while the control treatment gave (cultivar Burren + Proline spraying at a concentration of 200 ppm + without adding sodium chloride) the minimum root length was 29.13 cm.

Table 2. Genotypic response of potato to spraying with proline under salt stress and its effect on root length (cm)

cultivars	Proline (ppm)	Salinity concentrations(dsm^{-1})NaCl				average
		0	4	8	10	
Burren	0	29.73	32.77	37.97	50.70	37.79
	200	29.13	31.50	34.87	47.33	35.71
	250	31.83	37.70	39.47	42.50	37.87
Riviera	0	32.57	36.00	41.57	52.73	40.72
	200	32.40	36.10	38.83	49.77	39.27
	250	36.37	40.33	43.50	48.80	42.25
L.S.D 0.05		2.46				1.33
Salinity concentrations(NaCl) * cultivars						average
Burren	30.23	33.99	37.43	46.84		37.12
Riviera	33.78	37.48	41.30	50.43		40.75
L.S.D 0.05	1.49					1.54
Salinity concentrations(NaCl) * proline						average
0	31.15	34.38	39.77	51.72		39.25
200	30.77	33.80	36.85	48.55		37.49
250	34.10	39.02	41.48	45.65		40.06
L.S.D 0.05	1.73					0.91
Salinity concentrations(NaCl)	32.01	35.73	39.37	48.64		

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L.S.D 0.05	1.03	

3.2. Number of tubers (tuber.plant^{-1})

The results in Table (3), showed that the Burren cultivar had a significantly excelled and it gave the highest number of tubers, reaching 7.63 tuber.plant^{-1}, while the Riviera cultivar gave an average number of tubers of 7.37 tuber.plant^{-1} , As it was significantly excelled to the treatment of proline spraying at a concentration of 250 ppm, and it gave the highest number of tubers reaching 8.61 tuber.plant^{-1}. It was followed by the proline spraying treatment at a concentration of 200 ppm, which gave an average of 8.11 tuber.plant^{-1}, while the control treatment without spraying gave the lowest number of tubers, which reached 5.78 tuber.plant^{-1}. The addition of sodium chloride also had a significant effect on increasing the number of tubers, where it was significantly excelled to the treatment of adding sodium chloride at a concentration of 4 dsm^{-1} and it gave the highest number of tubers, reaching 9.72 tubers. Then, the addition of sodium chloride at a concentration of 8 dsm^{-1} amounted to 9.14 tuber.plant^{-1}, while the adding sodium chloride at a concentration of 10 dsm^{-1} gave the lowest number of tubers, reaching 4.74 tuber.plant^{-1}. The results also showed that the bi-interaction between the cultivars and proline had a significant effect in increasing the number of tubers, where the interaction treatment (Riviera cultivars + spraying with proline at a concentration of 250 ppm) was significantly higher and gave the highest average number of tubers, which reached 8.71 tuber.plant^{-1} . While it was the lowest number of tubers when the interaction treatment (cultivar Riviera + without proline spraying) gave 5.58 tuber.plant^{-1}. Also, the interaction between cultivars and the addition of sodium chloride had a significant effect on the same traits, where the interaction treatment between Riviera cultivars + addition of sodium chloride at a concentration of 4 dsm^{-1}) was significantly excelled on the rest of the other treatments and gave the highest number of tubers, which reached 9.50 tubers.plant^{-1} , While the interaction treatment (cultivar Burren + addition of NaCl at a concentration of 10 4 dsm^{-1}) gave the lowest number of tubers, which reached 4.58 tubers. Also, the interaction treatment was superior between (proline spraying at a concentration of 250 ppm + adding sodium chloride at a concentration of 8 dsm^{-1}) and (spraying proline at a concentration of 200 ppm + adding sodium chloride at a concentration of 8 dsm^{-1}) and (proline spraying at a concentration of 250 ppm + adding sodium chloride at a concentration of 10 dsm^{-1}) without significant difference between them and gave the highest number of tubers (11.70,11.37, 11.15) tuber.plant $^{-1}$ respectively, while the control treatment gave (proline spraying at a concentration of 200 ppm + addition of sodium chloride at a concentration of 10 gm. Plant -1) and gave the lowest number For the tubers it reached 4.47 tuber.plant^{-1}. Also, the triple interaction between the study factors had a significant effect to increase the number of tubers, where the interaction treatment (cultivar Burren + proline spraying at a concentration of 250 ppm + addition of sodium chloride at a concentration of 4 dsm^{-1}) gave the highest number of tubers reaching 11.90 tubers.plant^{-1}.While the control treatment (Burren cultivar + Proline spraying at a concentration of 250 ppm + addition of sodium chloride at a concentration of 10 dsm^{-1}) gave the lowest number of tubers 4.47 tubers plant^{-1}.

3.3. The fresh weight of tuber (g)

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The results in Table (4) showed that the Burren cultivar significantly excelled and gave the highest average of fresh weight amounted to 601.25 g, while the Riviera cultivar gave an average of the fresh weight of the tubers amounted to 592.22 g. The results also showed that proline spraying had a significant effect on the fresh weight of the tubers. The treatment of proline spraying at a concentration of 200ppm gave the highest average of fresh weight of the tubers, reaching 680.53 g. It was followed by proline spraying treatment at 250 ppm and it gave the fresh weight of tubes amounted to 633.70 g, while the lowest fresh weight for the tubers, when compared with no spraying, was 475.98 g. The addition of sodium chloride at a concentration of 4 dsm^{-1} gave the highest fresh weight of the tubers, reaching 716.47 g, followed by the addition of sodium chloride at a concentration of 8 dsm-1 that gave an average of 670.40 g soft weight. While the control treatment gave the tubers the lowest fresh weight of 394.23 g. While the results of the same table showed that the bi-interaction between proline and the cultivars had a significant effect on the fresh weight of tubers, the interaction treatment consisting of (Burren cultivar + Proline at a concentration of 200 ppm) was significantly excelled to the interaction treatment, and it gave

Table 3. Genotypic response of potato to spraying with proline under salt stress and its effect on the number of tubers (tuber. Plant -1)

cultivars	Proline (ppm)	Salinity concentrations(dsm^{-1})NaCl				Average
		0	4	8	10	
Burren	0	6.77	6.50	5.83	4.87	5.99
	200	6.70	11.40	10.73	4.70	8.38
	250	6.33	11.90	11.63	4.17	8.51
Riviera	0	6.47	6.10	5.43	4.30	5.58
	200	6.10	10.90	10.10	4.23	7.83
	250	6.03	11.50	11.10	6.20	8.71
L.S.D 0.05		1.41				0.90
Salinity concentrations(NaCl) * cultivars						Average
Burren	6.60	9.93	9.40	4.58		7.63
Riviera	6.20	9.50	8.88	4.91		7.37
L.S.D 0.05	0.95					1.16
Salinity concentrations(NaCl) * proline						average
0	6.62	6.30	5.63	4.58		5.78
200	6.40	11.15	10.42	4.47		8.11
250	6.18	11.70	11.37	5.18		8.61
L.S.D 0.05	0.94					0.49
Salinity concentrations (NaCl)	6.24	9.72	9.14	4.74		
L.S.D 0.05	0.56					

the highest average of fresh weight of the tubers was (684.94 g) while the treatment was given. The control treatment (Riviera cultivar + without adding proline) the minimum fresh weight of the tubers was (463.68 g). Also, the interaction between cultivars and salinity concentrations had a significant effect on the same traits, where the interaction between (Burren cultivar + 4 dsm^{-1}) gave the highest average fresh

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weight of the tubers which reached 719.15 g, while the interaction treatment gave (Riviera cultivar + addition of NaCl at a concentration of 10 dsm^{-1}) The minimum fresh weight of the tubers was 392.47g.The interaction treatment consisting of (proline spraying at a concentration of 250 ppm + addition of sodium chloride at a concentration of 4 dsm^{-1} significantly excelled and gave the highest average fresh weight of the tubers, reaching 839.81 g, while the treatment (proline spraying at a concentration of 250ppm + addition of sodium chloride at a concentration of 10 dsm^{-1} gave the lowest weight average of the fresh tuber reached 373.85 g. While the results in Table (4) showed that the triple interaction between (cultivars, proline and sodium chloride) had a significant effect on the fresh weight of the tubers, the results showed that the interaction treatment (the cultivar Burren + Proline spray at a concentration of 250 ppm + the addition of NaCl at a concentration of 4 dsm^{-1}) Significantly excelled on the rest of the other interaction treatments gave the highest fresh weight of the tubers, reaching 846.10 g, while the triple interaction treatment (cultivar Riviera + proline spraying at a concentration of 250 ppm + addition of sodium chloride at a concentration of 10 dsm^{-1}) gave the lowest fresh weight for the tubers, reaching 373.80 g.

Table 4. Genotypic response of potato to spraying with proline under salt stress and its effect on fresh weight of tubers(g)

cultivars	Proline (ppm)	Salinity concentrations(dsm^{-1})NaCl				average
		0	4	8	10	
Burren	0	638.97	517.60	416.34	380.22	488.28
	200	679.89	793.75	832.30	433.82	684.94
	250	522.91	846.10	779.23	373.90	630.54
Riviera	0	565.68	515.84	397.16	376.04	463.68
	200	664.17	792.00	820.70	427.58	676.11
	250	563.51	833.51	776.65	373.80	636.87
L.S.D 0.05		44.08				29.09
Salinity concentrations(NaCl) * cultivars						average
Burren	613.92	719.15	675.96	395.98		601.25
Riviera	597.79	713.78	664.84	392.47		592.22
L.S.D 0.05	44.08					7.89
Salinity concentrations(NaCl) * proline						average
0	602.33	516.72	406.75	378.13		475.98
200	672.03	792.87	826.50	430.70		680.53
250	543.21	839.81	777.94	373.85		633.70
L.S.D 0.05	33.82					25.10
Salinity concentrations (NaCl)	605.85	716.47	670.40	394.23		
L.S.D 0.05	16.92					

3.4. The percentage of sodium in leaves (%)

The results in Table (5) showed that the Riviera cultivar had a significantly excelled on the Burren cultivar in the content of leaves of sodium, where it gave 3.87% compared to 3.69%, and the results of the same table showed that spraying proline had a significant effect on plant tolerance to salt stress, where it gave the concentration 250ppm the lowest sodium content in the leaves. It reached 3.72%, compared to the

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control treatment that gave 3.76%, followed by the 200 ppm treatment that gave 3.85%. The results also showed that the addition of sodium chloride with irrigation water had a significant effect in increasing the sodium concentration in the leaves, where the addition treatment at a concentration of 10 dsm^{-1} gave the highest sodium content in the leaves in the leaves 5.20%, followed by the addition treatment at a concentration of 8 dsm^{-1} which gave 4.21% , While the comparison treatment without adding the lowest sodium content in the leaves gave 3.32%. Also, the bi-interaction between cultivars and proline had significant effects, where the interaction treatment (cultivar Riviera + Proline spray 200 ppm) gave the highest average of the sodium content of leaves, reaching (3.98%), while the interaction treatment (cultivar Burren + Proline spraying at a concentration of 250 ppm) Where, the bi-treatment (cultivar Riviera + addition of sodium chloride 10 dsm^{-1}) excelled the highest average of sodium content in leaves, reaching (5.30 dsm^{-1}), while the interaction treatment (cultivar Burren + without addition) gave the lowest sodium content in the leaves. The bi-interaction (200 ppm proline spraying + 10 dsm^{-1} sodium chloride addition), the highest sodium content in the leaves was 5.40%.While the control treatment without adding the lowest sodium content of leaves was 2.10%. The results of the same table also showed that the triple interaction between the cultivars, proline and sodium had a significant effect on the sodium content of the leaves, where the combined treatment (Riviera + spray proline at a concentration of 200 ppm + addition of sodium

Table 5. Genotypic response of potato to spraying with proline under salt stress and its effect on The percentage of sodium in leaves (%)

cultivars	Proline (ppm)	Salinity concentrations(dsm^{-1})NaCl				average
		0	4	8	10	
Burren	0	2.07	3.60	4.20	5.07	3.73
	200	2.33	3.17	4.17	5.23	3.72
	250	2.27	3.23	3.97	5.00	3.62
Riviera	0	2.13	3.40	4.57	5.07	3.79
	200	2.63	3.43	4.30	5.57	3.98
	250	2.50	3.50	4.07	5.27	3.83
L.S.D 0.05		0.34				0.29
Salinity concentrations(NaCl) * cultivars						average
Burren	2.22	3.33	4.11	5.10		3.69
Riviera	2.42	3.44	4.31	5.30		3.87
L.S.D 0.05	0.29					0.38
Salinity concentrations(NaCl) * proline						average
0	2.10	3.50	4.38	5.07		3.76
200	2.48	3.30	4.23	5.40		3.85
250	2.38	3.37	4.02	5.13		3.72
L.S.D 0.05	0.22					0.16
Salinity concentrations (NaCl)	3.32	3.39	4.21	5.20		
L.S.D 0.05	0.11					

chloride at a concentration of 10 dsm-1) excelled and gave the highest average of sodium content in leaves, which reached 5.57%, while the treatment of (cultivar Burren + Proline without addition + NaCl without addition) gave the lowest average of 2.07%.

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3.5.The percentage of chloride in leaves (%)

The results in Table (6), showed that Riviera cultivar significantly excelled and it gave the highest chloride percentage in leaves amounted to 3.43%, while the Burren cultivar gave an average of 3.21% for chloride in leaves. While the treatment without proline spraying significantly excelled and gave the highest chloride content in the leaves 3.40%, while the proline spraying treatment at a concentration of 250 ppm gave the lowest chloride content in the leaves of 3.20%. Also, the addition of sodium chloride had a significant effect in increasing the chloride content of the leaves. It was significantly excelled to the treatment of adding sodium chloride at a concentration of 10 dsm^{-1}, and it gave the highest chloride content in the leaves, which amounted to 4.01%, while the control treatment (without addition) gave the lowest chloride content in the leaves which amounted to 2.59%. The results also showed that the bi-interaction between cultivars and proline had a significant effect on the chloride content in the leaves, where the interaction treatment (Riviera cultivar + spraying with chloride at a concentration of 200 ppm) was significantly higher and gave the highest average of chloride content in the leaves at 3.50%, while the lowest content of proline in the leaves was higher. When the interaction treatment (the Burren cultivar + spraying with a concentration of 200 ppm), it gave 3.01%, and the interaction between the cultivars and the salinity

Table 6. Genotypic response of potato to spraying with proline under salt stress and its effect on the percentage of chloride in the leaves (%)

cultivars	Proline (ppm)	Salinity concentrations(dsm^{-1})NaCl				average
		0	4	8	10	
Burren	0	2.80	3.03	3.73	3.97	3.38
	200	2.63	2.83	3.60	3.87	3.23
	250	2.47	2.63	3.20	3.73	3.01
Riviera	0	2.20	3.37	3.90	4.17	3.41
	200	2.83	3.10	3.87	4.20	3.50
	250	2.63	3.17	3.67	4.10	3.39
L.S.D 0.05		0.106				0.064
Salinity concentrations(NaCl) * cultivars						average
Burren	2.63	2.83	3.51	3.86		3.21
Riviera	2.56	3.21	3.81	4.16		3.43
L.S.D 0.05	0.066					0.075
Salinity concentrations(NaCl) * proline						average
0	2.50	3.20	3.82	4.07		3.40
200	2.73	2.97	3.73	4.03		3.37
250	2.55	2.90	3.43	3.92		3.20
L.S.D 0.05	0.074					0.044
Salinity concentrations (NaCl)	2.59	3.02	3.66	4.01		
L.S.D 0.05	0.43					

concentrations had a significant effect on the same traits, it was significantly excelled to the interaction treatment between (cultivar Burren + and the addition of NaCl at a concentration of 10 dsm^{-1}) on the rest of the other treatments and gave the highest average of chloride content in the leaves which amounted to

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4.16%, while the interaction treatment (Riviera cultivar + without addition) gave the lowest chloride content in the leaves reached 2.56%.The interaction treatment between (proline spraying at a concentration of 250 ppm + adding sodium chloride at a concentration of 10 dsm^{-1}) significantly excelled on the rest of the other interaction treatments and gave the highest average of chloride in the leaves amounting to 4.07%, while the control treatment (without addition) gave the lowest chloride content in the leaves reaching 2.50%, while the triple interaction between the study factor (cultivar, chloride and sodium chloride) had a significant effect on the chloride content in the leaves, The interaction treatment (cultivar Riviera + spraying proline at a concentration of 250ppm + addition of sodium chloride at a concentration of 10dsm^{-1}) gave the highest chloride content in the leaves of 4.20%, while the control treatment (cultivar Riviera + without adding proline + without adding sodium chloride) gave the lowest content For chloride in the leaves it amounted to 2.20%.

The results showed that the cultivar had a significantly excelled in the root length trait (Table 2) due to the nature of the genetic traits of each cultivar and the extent of the varieties 'response to environmental conditions, that is, the presence of genetic variation between them and this is due to the control of genetic factors related to the genotype to show the trait [14]. Root with increased salt concentrations is the lack of abundance of water and nutrients in the area surrounding the roots, so plants are forced to deepen their depth in the soil in search of water and nutrients, which is the only natural methods that plants use to obtain water and nutrients [15]. Proline also has a vital role in developing the plant's ability to withstand stress. Many plants can increase proline production in response to abiotic stresses by inducing the P5CS gene responsible for proline synthesis [16]. Proline plays an important role in the induction of genes for tolerance to environmental stress [17,18]. The cultivars differ from each other in the nature of growth, maturity, quantity and quality of the yield, and that the increase in the quantitative traits, the number of tubers and the fresh weight of the tubers may be due to the positive role of proline in regulating the osmotic effort, the regulation of protein building, and the increase of the chlorophyll pigment, thus increasing the photosynthesis processes and thus increasing the growth traits.[19] Thus, this is reflected in an increase in photosynthesis and aggregation of nutrients in the tubers and thus an increase in the number of tubers (Table 3), Proline also has a role in reducing the risk of dehydration on the plant, which leads to the activation of internal hormones and the rest of the Growth promoters and the continued absorption of micro and macronutrients, which leads to an increase in the area of the leaves and increase their efficiency in the process of carbon representation and its products and its movement towards the storage areas in the tubers and thus shows the positive effect in increasing the fresh weight for tubers (Table 4). As for the elements sodium and chloride, proline has an important role in reducing the content of sodium and chloride in the leaves, Tables (5 and 6). This is due to the role of proline in reducing the ionic toxicity resulting from the large gathering of sodium and chloride ions in the cytoplasm, which leads to an ionic imbalance and this can be resisted by Transferring the sodium and chloride ions to the vacuoles, thus reducing the sodium and chloride content of the leaves in Table (4 and 5). This is consistent with [9,20] on the potato plant, It is also evident that the salinity has led to the accumulation of chloride ions in the leaves of plants, Table (6), especially at the high level of salinity, where the presence of chloride in the plant is directly or indirectly responsible for inhibiting plant growth by absorbing or removing negative ions from the plant such as Nitrate NO3- [21] Or that the absorption of large amounts of chloride may damage the leaves and then decrease the process of carbonate representation, which negatively affects the growth and production of the plant and this is consistent with [22] on potato, [23] on pepper and [24] on eggplant.

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4. CONCLUSIONS

The Riviera cultivar excelled the Burren cultivar by giving the highest values in root length and leaf content of chloride and sodium, except for the two traits of the number of tubers and the fresh weight of the tubers, in which the Burren cultivar was significantly excelled. The addition of NaCl lead to irrigation water led to negative effects on most of the studied traits, and the effect increased by increasing the salinity concentration of irrigation water and for all the studied traits. Proline application by foliar treatment had a significant effect in increasing the ability of plants to withstand salt stress, the concentration of 250 ppm affected significantly with highest values for the most of studied traits.

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