Effect of Irrigation Water and Ascorbic Acid on Growth and Physiological Characteristics of Tomato

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Abstract

An experiment was conducted under the conditions of a plastic house in Najaf Governorate at the Agricultural Research Station affiliated to the College of Agriculture - University of Kufa for the (2024-2025) growing season, with the aim of determining the effect of irrigation water quality and spraying with ascorbic acid on the growth, yield and some physiological characteristics of two tomato varieties, local and black cherry. The experiment was carried out (RCBD) with three replicates where the two varieties of tomatoes (local regular tomato and black cherry tomato) were in the main plots, irrigation water types (tap water, well water and 1:1 mixture) in the sub-plots, while the sub-sub plot was and the third factor contained three levels of foliar ascorbic acid (0, 150, 300) mg L-The results indicated that tap water (W1) was superior in plant height, nitrogen percentage, and phosphorus percentage, recording values of 202 cm, 3.00%, and 0.34%, respectively. In contrast, the saline water treatment (W2) resulted in the highest mean values of potassium percentage and abscisic acid concentration (mg g^{-1}), reaching 4.05% and 83.06 mg g^{-1}, respectively. The mixed water treatment at a 1:1 ratio (W3) produced the highest carbohydrate percentage, which reached 3.00%. The black cherry tomato cultivar showed significant differences in carbohydrate percentage, nitrogen percentage, and abscisic acid concentration, with values of 2.98%, 2.78%, and 77.65 mg g^{-1}, respectively. Conversely, the local tomato cultivar exhibited significant superiority in plant height and potassium percentage, recording values of 191 cm and 3.78%, respectively. Moreover, the application of ascorbic acid at a concentration of 300 mg L^{-1} significantly enhanced most of the studied traits compared with lower concentrations and the control treatment. The two-way interaction between water quality and cultivar (W1V1) had a significant effect on nitrogen percentage, reaching 3.22%. However, the interaction (W1V2) exerted a greater influence on plant height, potassium percentage, and abscisic acid concentration, with values of 208 cm, 4.16%, and 90.77 mg g^{-1}, respectively. The highest phosphorus percentage (0.34%) was observed under the interaction (W2V2).Additionally, the interaction between water quality and ascorbic acid (W1C2) resulted in the highest values of plant height, carbohydrate percentage, nitrogen percentage, and phosphorus percentage, recording 213 cm, 3.43%, 3.36%, and 0.38%, respectively. The interaction (W2C0) produced the highest abscisic acid content (117.78 mg g^{-1}), whereas the interaction (W2C2) recorded the highest potassium percentage (4.61%).The interaction between cultivar and ascorbic acid (V1C0) showed significant effects on carbohydrate, nitrogen, phosphorus, and potassium percentages, reaching 3.32%, 3.07%, 0.34%, and 4.02%, respectively. In contrast, the interaction (V2C2) resulted in the highest plant height, which reached 199 cm. Regarding the three-way interaction among water quality, cultivar, and ascorbic acid, the interaction (W1V1C2) produced the highest nitrogen and phosphorus percentages, reaching 3.61% and 0.38%, respectively. Meanwhile, the interaction (W1V2C2) recorded the greatest plant height and potassium percentage, with values of 220 cm and 4.78%, respectively. The interaction (W2V1C2) achieved the highest carbohydrate

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percentage (3.70%), whereas the interaction (W2V2C2) recorded the highest phosphorus percentage (0.38%). Finally, the interaction (W3V1C0) resulted in the highest abscisic acid concentration, reaching 115.16 mg g^{-1}.

Keywords: Foliar Application, Protected farming, *solanum*.

Introduction

Tomato (Solanum lycopersicum L.) is considered one of the most nutritionally important horticultural crops due to the high nutritional value of its fruits. Tomato fruits are a rich source of essential nutrients that play a vital role in human health, including mineral elements such as nitrogen, phosphorus, potassium, magnesium, calcium, and iron, as well as vitamins, particularly vitamin A and vitamin C. In addition, tomatoes contain significant amounts of carbohydrates, proteins, and lipids, along with various organic acids such as malic and citric acids, and a wide range of phenolic compounds. Moreover, tomato fruits are distinguished by their high content of bioactive pigments, especially carotenoids and lycopene, which are largely responsible for their strong antioxidant activity. [1] Cherry tomato cultivars are of particular interest due to their high concentrations of vitamins (A, B-complex, and C). Their consumption is widely recognized as beneficial to human health as well as essential mineral elements including phosphorus, potassium, magnesium, and calcium [2]. Salinity stress imposes osmotic stress, specific ion toxicity, nutrient imbalance, and oxidative stress on plants, thereby disrupting numerous physiological and biochemical processes, particularly photosynthesis. These disturbances ultimately lead to severe limitations in plant growth, development, and productivity [3] [4]..Ascorbic acid is a crucial non-enzymatic antioxidant involved in plant defense mechanisms under saline stress conditions. It plays a significant role in enhancing plant tolerance to salinity and facilitates the utilization of saline water in hydroponic cultivation systems [5] Moreover, ascorbic acid regulates cellular homeostasis in plants exposed to environmental stresses by efficiently scavenging reactive oxygen species generated during abiotic stress conditions. This function enhances plant resistance to oxidative damage induced by ultraviolet radiation, heavy metals, salinity, drought, temperature extremes, and other environmental stresses. In addition, ascorbic acid is involved in numerous physiological and metabolic processes essential for plant growth and development [6] Ascorbic acid plays an important role in plants and in the fundamental regulatory mechanisms of plant physiology, including its involvement in plant hormone biosynthesis, the regulation of plant growth and development, and its pivotal role in responses to environmental stresses, including salt stress [7]

Material and Methods

Experimental Site and Field Soil Characteristics:

A field experiment was carried out to planting of tomato during the 2025 growing season in a plastic house affiliated to College of Agriculture Research Station, University of Kufa. The study aims to evaluate local(s25) and cherry tomatoes for their growth and yield response to different types of irrigation drip water and foliar spraying with ascorbic acid. Soil preparation was carried out by plowing and loosening. Random soil samples were then taken from different locations at depths of 0-30 cm to determine the physicochemical properties (Table 1). Samples of the irrigation water used in the experiment were also taken and analyzed (Table 2).

Table 1. Physical and chemical indicators of field soil before and after planting

Value	Unit	Type of Analysis
7.23	--	(pH)
2.5	dS m^{-1}	(EC)
2.4	%	Organic Matter
85.4	mg Kg^{-1}	Potassium (K+)
41.7		Nitrogen
65.6		Phosphorus (p)
872	g Kg^{-1}	Sand
66		Clay
62		Gilt
Sandy loam		Texture

Table 2. characteristics of water used for irrigation

Na+ $mMol.l^{-1}$	Mg++ $mMol.l^{-1}$	Ca++ $mMol.l^{-1}$	Cl- $mMol.l^{-1}$	pH	EC $ds.m^{-1}$	Source
5.3	7.6	8	15.0	7.8	3.7	*saline well water* (W2)
2.4	4.6	2.3	7.7	7.2	1.5	River Water (W1)

Experimental Design and Statistical Analysis:

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The experiment was conducted using a Nested-Factorial experiment design with three replicates and three factors: The first factor consisted of three types of irrigation water: river water (W1), saline well water (W2), and a 1:1 mixture of river water and well water (W3), which were assigned to the main plots arranged in strips along the transect. The second factor included two tomato varieties: the local indeterminate tomato variety (V1) and the black cherry tomato variety s25 (V2), which were allocated to the subplots. The third factor: three levels of ascorbic acid spraying with distilled water (C0), 150 mg L^{-1} (C1), and 300 mg L^{-1} (C2) in the sub-subplots, with 54 experimental units (3 × 2 × 3) [15]. Experimental data were analyzed using SAS 9.4 v (2012) using the PROC MIXED procedure. The means of the coefficients for the factors were compared with their interactions using the least significant difference at the 0.05 probability level.

Parameters studied:

The following traits were studied: plant height (cm), Carbohydrates *(%)*, Nitrogen (%), Phosphorus (%), Potassium (%) and Abscisic acid **(mg g^{-1})**

Discussion:

1. *effect of experimental treatments on plant height* (cm):The results presented in Table (1) indicate that the second cultivar, cherry tomato (V2), was significantly superior, producing the highest mean plant height of 191 cm, compared with the first cultivar, common tomato (V1), which recorded the lowest mean of 180 cm. Data in Table (1) also show a significant difference among water types in plant height (cm). The fresh water treatment (W1) was superior, giving the highest mean plant height of 202 cm, whereas well water (W2) resulted in the lowest mean of 175 cm. Foliar application with ascorbic acid (C2) showed a significant superiority by producing the highest mean plant height of 193 cm, compared with the control treatment (C0), which gave the lowest value of 179 cm.The same table shows that the binary interaction between water type and cultivar had a significant effect on plant height. The interaction treatment W1V2 recorded the highest mean plant height of 208 cm, whereas the interaction W2V1 resulted in the lowest mean of 169 cm.The binary interaction between water type and foliar application of ascorbic acid also had a significant effect, as the interaction W1C2 produced the highest mean plant height of 213 cm, compared with the interaction W2C0, which recorded the lowest mean of 165 cm. This finding is consistent with [9] on pepper plants .In contrast, the binary interaction between cultivars and foliar application of ascorbic acid showed no significant differences. The interaction V2C2 achieved the highest mean plant height of 199 cm, whereas the interaction V1C0 recorded the lowest mean of 174 cm.Furthermore, the results in Table (3) indicate a significant superiority of the triple interaction. The interaction W1V2C2 produced the highest mean plant height of 220 cm, while the interaction W2V1C0 resulted in the lowest mean of 156 cm.

2. *effect of experimental treatments on* Carbohydrates (%):The results presented in Table (1) indicate that the second cultivar, cherry tomato (V2), was significantly superior, recording the highest

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mean carbohydrate content of 2.98%, compared with the first cultivar, common tomato (V1), which gave the lowest mean of 2.88%.A significant difference was observed among water types in carbohydrate percentage. The fresh water treatment (W3) resulted in the highest mean value of 3.00%, whereas well water (W2) recorded the lowest mean of 2.79%.Foliar application with ascorbic acid (C2) showed a significant superiority, producing the highest mean carbohydrate content of 3.38%, compared with the control treatment (C0), which gave the lowest value of 2.49%.The same table shows that the binary interaction between water type and cultivar had a significant effect on carbohydrate percentage. The interaction treatment W2V1 produced the highest mean carbohydrate content of 3.17%, while the interaction W3V1 recorded the lowest mean of 2.78%.Data in the same table also revealed a significant effect of the binary interaction between water types and foliar application of ascorbic acid. The interaction W1C2 achieved the highest mean carbohydrate percentage of 3.43%, compared with the interaction W2C0, which recorded the lowest mean of 2.30%. This result is in agreement with the findings of [9] on pepper plants.No significant differences were observed in the binary interaction between cultivars and foliar application of ascorbic acid. The interaction V2C2 recorded the highest mean of 3.32%, whereas the interaction V1C0 gave the lowest mean of 2.45%.

Furthermore, the results in Table (3) indicate a significant superiority of the triple interaction. The interaction W2V1C2 recorded the highest mean carbohydrate content of 3.70%, compared with the triple interaction W2V1C0, which resulted in the lowest mean of 2.15%.

3. *effect of experimental treatments on* Nitrogen (%):The results presented in Table (1) indicate that the second cultivar, cherry tomato (V1), showed significant superiority by recording the highest mean nitrogen percentage of 2.78%, compared with the first cultivar, common tomato (V2), which gave the lowest mean of 2.72%.Data in Table (1) also reveal a significant difference among water types in nitrogen percentage. The fresh water treatment (W1) was superior, producing the highest mean nitrogen content of 3.00%, whereas well water (W2) resulted in the lowest mean of 2.44%.Foliar application with ascorbic acid (C2) showed a significant superiority, giving the highest mean nitrogen percentage of 3.05%, compared with the control treatment (C0), which recorded the lowest value of 2.47%.The same table shows that the binary interaction between water type and cultivars had a significant effect on nitrogen percentage. The interaction treatment W1V1 produced the highest mean nitrogen content of 3.22%, whereas the interaction W1V2 recorded the lowest mean of 2.32%.Data in the same table also indicated a significant effect of the binary interaction between water types and foliar application of ascorbic acid. The interaction W1C2 gave the highest mean nitrogen percentage of 3.36%, compared with the interaction W1C0, which recorded the lowest mean of 2.25%. . No significant differences were observed in the binary interaction between cultivars and foliar application of ascorbic acid. The interaction V2C2 achieved the highest mean nitrogen percentage of 3.07%, whereas the interaction V1C0 recorded the lowest mean of 2.46%.Furthermore, the results in Table (3) indicate a significant superiority of the triple interaction, as the interaction W1V1C2 produced the highest mean nitrogen percentage of 3.61%, whereas the lowest mean (2.20%) was recorded under the corresponding triple interaction treatment. This result is in agreement with the findings of [9], and [9] on pepper plants

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4. ***effect of experimental treatments on*** **Phosphorus (%)**:The results presented in Table (1) indicate that there were no significant differences among cultivars in phosphorus percentage.Data in Table (1) show a significant difference among water types in phosphorus content, as the fresh water treatment (W1) recorded the highest mean value of 0.34%, compared with well water (W2), which gave the lowest mean of 0.27%.Foliar application with ascorbic acid (C2) showed a significant superiority by producing the highest mean phosphorus percentage of 0.35%, compared with the control treatment (C0), which recorded the lowest value of 0.28%.The results presented in the same table also indicate that the binary interaction between water type and cultivars had a significant effect on phosphorus percentage. The interaction treatment W2V2 produced the highest mean phosphorus content of 0.34%, whereas the interaction W1V2 recorded the lowest mean of 0.27%.Data in the same table further revealed a significant effect of the binary interaction between water types and foliar application of ascorbic acid. The interaction W1C2 achieved the highest mean phosphorus percentage of 0.38%, compared with the interaction W1C0, which recorded the lowest mean of 0.26%.No significant differences were observed in the binary interaction between cultivars and foliar application of ascorbic acid. The interaction V2C2 recorded the highest mean phosphorus content of 0.34%, whereas the interaction V1C0 gave the lowest mean of 0.27%.

Furthermore, the results in Table (3) indicate a significant superiority of the triple interaction. The interaction W1V1C2 produced the highest mean phosphorus percentage of 0.38%, whereas the triple interaction W1V2C0 resulted in the lowest mean of 0.25%. This result is in agreement with the findings of [7], [8]on pepper plants

5. ***effect of experimental treatments on*** **Potassium (%)**:The results presented in Table (1) indicate a significant difference among cultivars in potassium percentage. Cultivar V2 was superior, recording the highest mean value of 3.78%, compared with cultivar V1, which gave the lowest mean of 3.71%.Data in Table (1) also reveal a significant difference among water types in potassium percentage. Well water (W2) produced the highest mean potassium content of 4.05%, whereas fresh water (W1) recorded the lowest mean of 3.38%.Foliar application with ascorbic acid (C2) showed a significant superiority, giving the highest mean potassium percentage of 4.20%, compared with the control treatment (C0), which recorded the lowest value of 3.34%.The results in the same table indicate that the binary interaction between water type and cultivars had a significant effect on potassium percentage. The interaction treatment W1V2 produced the highest mean potassium content of 4.16%, whereas the interaction W1V1 recorded the lowest mean of 3.26%.Data in the same table further showed a significant effect of the binary interaction between water types and foliar application of ascorbic acid. The interaction W2C2 achieved the highest mean potassium percentage of 4.61%, compared with the interaction W1C0, which recorded the lowest mean of 3.13%.A significant difference was also observed in the binary interaction between cultivars and foliar application of ascorbic acid. The interaction V2C2 recorded the highest mean potassium percentage of 4.02%, whereas the interaction V1C0 gave the lowest mean of 3.28%.Furthermore, the results presented in Table (3) indicate a significant superiority of the triple interaction. The interaction W1V2C2 produced the highest mean potassium percentage of 4.78%, whereas the triple interaction W2V2C0 resulted in the lowest mean of 3.10%. This result is in agreement with the findings of [8], and [9] on pepper plants

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6. ***effect of experimental treatments on*** **Abscisic acid (mg g^{-1})**:The results presented in Table (1) indicate a significant difference among cultivars in abscisic acid concentration. Cultivar V1 was superior, recording the highest mean value of 77.65 mg g^{-1}, whereas cultivar V2 gave the lowest mean of 75.45 mg g^{-1}.Data in Table (1) also reveal a significant difference among water types in abscisic acid concentration. The well water treatment (W2) resulted in the highest mean concentration of 83.06 mg g^{-1}, compared with fresh water (W1), which recorded the lowest mean of 78.61 mg g^{-1}.Foliar application with ascorbic acid showed a significant effect, as treatment C0 produced the highest mean abscisic acid concentration of 100.23 mg g^{-1}, compared with treatment C2, which recorded the lowest mean of 57.03 mg g^{-1}.The results in the same table indicate that the binary interaction between water type and cultivars had a significant effect on abscisic acid concentration. The interaction treatment W1V2 produced the highest mean value of 90.77 mg g^{-1}, whereas the interaction W1V1 recorded the lowest mean of 63.74 mg g^{-1}.Data in the same table further showed a significant effect of the binary interaction between water types and foliar application of ascorbic acid. The interaction W2C0 achieved the highest mean abscisic acid concentration of 117.78 mg g^{-1}, compared with the interaction W2C2, which recorded the lowest mean of 55.43 mg g^{-1}. This result is consistent with the findings of [8] on pepper plants. A significant difference was also observed in the binary interaction between cultivars and foliar application of ascorbic acid. The interaction V1C0 recorded the highest mean abscisic acid concentration of 102.46 mg g^{-1}, whereas the interaction V2C0 gave the lowest mean of 56.06 mg g^{-1}.Furthermore, the results presented in Table (3) indicate a significant superiority of the triple interaction. The interaction W3V1C0 produced the highest mean abscisic acid concentration of 115.16 mg g^{-1}, while the triple interaction W2V1C2 resulted in the lowest mean of 45.33 mg g^{-1}.

Tomato (*Solanum lycopersicum*) is a crop that is moderately sensitive to salinity due to its effects on all physiological processes carried out by the plant. Therefore, tomato plants are more suitable for irrigation with low-salinity [10].Salinity has negative effects on plant growth and development, including the induction of oxidative stress in plants, which is primarily responsible for reducing crop productivity and consequently poses a challenge to global food security. Plants respond to salinity by activating homologous mechanisms that counteract salt-induced disturbances. These responses include the activation of several signaling components, such as the abscisic acid (ABA) pathway and reactive oxygen species (ROS) [11].A study was conducted on pepper plants using saline water at concentrations of 0.5 and 30 mM NaCl on the cultivar *Yolo Wonder*. The results showed that the mean potassium and nitrogen contents in the fruits were (30.09, 29.52) and (178.04, 118.73) mg g^{-1}, respectively [8].[12] reported that foliar spraying of three determinate tomato cultivars—Hatoof, Super Red, and Speedy—grown in desert regions with ascorbic acid at concentrations of 50 and 100 mg L^{-1} during the seedling production stage and one month after transplanting led to improvements in most vegetative and flowering growth parameters, leaf carbohydrate content, and an increase in yield and fruit quality. The concentration of 50 mg L^{-1} was the most effective.[8] demonstrated that foliar application of ascorbic acid at concentrations of 0, 100, 200, and 400 mg L^{-1} on pepper plants under saline conditions resulted in increased plant height, leaf nitrogen, phosphorus, and potassium contents, as well as ascorbic acid content in the fruits. The concentration of

400 mg L^{-1} produced the highest values of nitrogen, phosphorus, and potassium.In a study by [13] on eggplant plants to investigate physiological responses, growth, and yield following treatment with ascorbic acid at concentrations of 100 and 200 mg L^{-1} during both growing seasons, the treatments led to an increase in leaf nitrogen, phosphorus, and potassium content

Results

Table 1.Effect of The Single-treatments combinations on Growth and Some Physiological Characteristics of Tomato

Treatments		Plant height (cm)	Carbo hydrates (%)	Nitrogen (%)	Phosphorus (%)	Potassium (%)	Abscisic acid **(mg g^{-1})**
Water Type	W1	202	2.99	3.00	0.34	3.38	78.61
	W2	175	2.79	2.44	0.27	4.05	83.06
	W3	180	3.00	2.81	0.32	3.81	67.98
$LSD_{0.05}$		**3.36**	**0.02**	**0.06**	**0.01**	**0.08**	**1.76**
Tomato Varieties	V1	180	2.98	2.78	0.31	3.71	77.65
	V2	191	2.88	2.72	0.31	3.78	75.45
$LSD_{0.05}$		**3.00**	**80.60**	**0.01**	**0.00**	0.02	**0.55**
Ascorbic Acid Concentrations	ASC0	179	2.49	2.47	0.28	3.34	100.23
	ASC150	185	2.91	2.74	0.30	3.70	72.39
	ASC300	193	3.38	3.05	0.35	4.20	57.03
$LSD_{0.05}$		**0.60**	**0.04**	**0.02**	**0.00**	**0.04**	**1.66**

Table 2. Effect of The dual-treatments combinations on Growth and Some Physiological Characteristics of Tomato

Treatments			Plant height (cm)	Carbo hydrates (%)	Nitrogen (%)	Phosphorus (%)	Potassium (%)	Abscisic acid **(mg g^{-1})**
Water Type X Tomato Varieties	W1	V1	195	2.95	3.22	0.33	3.26	78.44
		V2	208	2.81	2.32	0.27	4.16	90.77
	W2	V1	168	3.17	2.80	0.31	3.70	63.74
		V2	182	3.04	2.78	0.34	3.49	78.78
	W3	V1	178	2.78	2.57	0.28	3.93	75.35
		V2	183	2.82	2.81	0.32	3.92	72.22
$LSD_{0.05}$			**3.10**	**0.04**	**0.05**	**0.00**	**0.04**	**1.67**
Water Type	W1	ASC0	192	2.63	2.57	0.30	3.13	89.97

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X Ascorbic Acid Concentrations		ASC 150	200	2.92	3.08	0.34	3.24	80.94
		ASC 300	213	3.43	3.36	0.38	3.76	64.92
		ASC 0	165	2.55	2.25	0.26	3.35	117.78
	W2	ASC 150	176	2.76	2.38	0.28	4.19	75.97
		ASC 300	184	3.07	2.70	0.29	4.61	55.43
		ASC 0	179	2.30	2.58	0.28	3.55	92.93
	W3	ASC 150	180	3.05	2.76	0.30	3.68	60.27
		ASC 300	182	3.64	3.08	0.38	4.22	50.73
$LSD_{0.05}$			**1.04**	**0.06**	**0.04**	**0.01**	**0.06**	**2.88**
Tomato Varieties X Ascorbic Acid Concentrations	V1	ASC 0	174	2.45	2.47	0.28	3.29	102.46
		ASC 150	180	2.45	2.47	0.28	3.29	102.49
		ASC 300	187	3.16	2.80	0.30	3.82	74.42
	V2	ASC 0	184	3.32	3.07	0.34	4.02	56.06
		ASC 150	190	2.54	2.46	0.27	3.29	97.99
		ASC 300	199	2.66	2.67	0.31	3.58	70.37
$LSD_{0.05}$			**N.S.**	**0.05**	**0.03**	**00.0**	**0.05**	**2.35**

N.S. means non-significance at a probability level of 0.05

Table 3. Effect of the triple -treatments combinations on Growth and Physiological Characteristics of Tomato.

Water Type X Tomato Varieties X Ascorbic Acid Concentrations			Plant height (cm)	Carbohydrates (%)	Nitrogen (%)	Phosphorus (%)	Potassium (%)	Vitamin C **(mg g⁻ ¹)**
W1	V1	ASC0	188	2.53	2.61	0.30	3.15	91.54
	V1	ASC150	191	2.95	3.45	0.32	3.25	81.33
	V1	ASC300	206	3.35	3.61	0.38	3.37	62.45
	V2	ASC0	195	2.65	2.20	0.25	3.21	120.41
	V2	ASC150	209	2.86	2.25	0.27	4.50	91.51
	V2	ASC300	220	2.92	2.50	0.29	4.78	60.41
W2	V1	ASC0	156	2.15	2.60	0.29	3.50	95.45
	V1	ASC150	171	3.67	2.70	0.30	3.70	50.44
	V1	ASC300	177	3.70	3.11	0.35	3.91	45.33
	V2	ASC0	175	2.72	2.53	0.30	3.10	88.40
	V2	ASC150	180	2.89	2.70	0.35	3.22	80.55
	V2	ASC300	190	3.51	3.11	0.38	4.16	67.40
W3	V1	ASC0	177	2.45	2.30	0.26	3.48	115.16
	V1	ASC150	178	2.66	2.50	0.28	3.88	60.44
	V1	ASC300	178	3.22	2.90	0.29	4.44	50.45
	V2	ASC0	181	2.46	2.56	0.26	3.60	90.41
	V2	ASC150	181	2.42	2.81	0.29	3.65	70.11
	V2	ASC300	186	3.57	3.05	0.41	4.52	56.14
$LSD_{0.05}$			**1.47**	**0.04**	**0.03**	**0.00**	**0.04**	**1.97**

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Conclusions;

1. The results of the study showed that fresh irrigation water exhibited a significant superiority in all studied traits for both cultivars compared to other types of irrigation water.
2. Ascorbic acid at a concentration of 300 mg L^{-1} showed significant superiority in all studied traits.
3. The interaction between fresh irrigation water and ascorbic acid at 300 mg L^{-1} resulted in significant superiority in all studied traits for both cultivars under investigation.

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