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Effect of Alpha Tocopherol and Moringa Leaf Extract on Growth of Marjoram Under Salinity Stress

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ABSTRACT

Salinity limits growing of aromatic and medicinal plant. A pot experiment was split plot design in the Farm of the Ornamental Plants, Fac. Agric., Minia Univ. during the two experimental seasons of 2022 and 2023 to evaluate the effect of alpha tocopherol (200 ppm) and moringa leaf extract (10%) as sub-plot on growth of marjoram under salinity stress (0.0, 500, 1000, and 2000 ppm NaCl), as main plot.

The obtained data illustrated that all examined vegetative growth parameters were considerably decreased with levels of salinity during both seasons for the three grazing. The least results were recorded with the high salinity level (2000 ppm NaCl).

Foliar application of vitamin E (200 ppm) and moringa leaf extract (10%) noticeably increased the previous characters in all cases. The best results were observed with vitamin E in all tested parameters.

Generally, significant positive effect was shown for all growth parameters due to the interaction between salinity and alpha tocopherol and moringa leaf extract. It is recommended that to spray marjoram plants with alpha tocopherol (200 ppm) to mitigate bad effects of salinized water.

KEYWORDS: *Origanum majorana*, salinity, vitamin E, MLE.

1. INTRODUCTION

Origanum majorana, also known as sweet marjoram, belongs to the Lamiaceae family and is synonymous with *Majorana hortensis* Moench. This herb is indigenous to the Mediterranean region and is cultivated in several countries across Asia, North Africa, and Europe, including Spain, Hungary, Portugal, Germany, Egypt, Poland, and France. *Origanum majorana* typically grows to a height of 30 to 60 cm and is characterized by its perennial bushy nature. The plant features oblique rhizomes, hairy shrub-like stalks, opposite dark green oval leaves, and white or red flowers in clustered bracts. The leaves are whole, with larger ones being fragmented, and are oblate to broadly elliptical in shape. In herbalism, marjoram is primarily used to address various gastrointestinal disorders and aid in digestion (Andrews, 1961; Mohsen *et al*., 2016 and Jafari *et al*., 2022). In Egypt, the leaves have been traditionally utilized to combat cold and chill (Bina and Rahimi, 2017).

Salinity poses a significant challenge to plants, particularly when they are irrigated with saline water. This environmental condition

hinders crop metabolic functions by impacting the osmotic potential within the plant's root zone (Baâtour *et al*., 2012). The presence of salinity leads to ion toxicity as a result of the excessive absorption of sodium (Na+), ultimately impeding plant growth and development through heightened osmotic stress and nutrient imbalances (Cornillon and Pallix, 1997 and El-Baz *et al*., 2003).

It was found that saline water affected most of the morphological and vegetative growth parameters of medicinal plants (Caliskan *et al.* 2017 and Abdou *et al.*, 2024).

Farmers in recently reclaimed areas encounter challenges with limited saline irrigation water resources. This is due to the fact that alpha tocopherol (Soltani *et al*. 2012; Ali and Hussein, 2019 and Sadiq *et al*., 2019) and moringa extracts (Abdalla, 2013; Hassanein *et al*., 2019; Alkuwayti *et al*., 2020; Gadallah *et al*., 2020 and Mousa *et al*., 2020) have been shown to have a positive impact on the vegetative growth and chemical composition of economically important plants.

So, this investigation targeted to investigate the effect of vitamin E and moringa leaf extract on mitigate harmful impacts of salinized water on marjoram plant growth.

2. MATERIALS AND METHODS

Pot experiment was done at the Farm of the Ornamental plants, Fac. Agric., Minia Univ., Egypt during 2022 and 2023 to study the effect of alpha tocopherol and moringa leaf extract on growth of marjoram under salinity stress.

Marjoram homogeneous rooted cuttings were transplanted (middle of March) in the two experimental seasons, in plastic pots (25-cm-diameter filled with 4.850 kg sandy soil) one transplant/pot. The primary characteristics of the soil were performed according to ICARDA (2013) as listed in Table 1.

Table 1. The primary characteristics of the soil.

Soil character	Values		Soil character	Values	
	2022	2023		2022	2023
Mechanical analysis:			**Macronutrients:**		
Sand (%)	90.00	91.00	**Total N (%)**	0.01	0.01
Silt (%)	6.90	5.70	**Available P (ppm)**	2.56	2.86
Clay (%)	3.10	3.30	**Na^+ (mg/100 g soil)**	2.44	2.53
Soil type	Sandy	Sandy	**K^+ (mg/100 g soil)**	0.71	0.75
Chemical analysis:			**Micronutrients (DTPA-Extractable):**		
pH (1:2.5)	8.26	8.31	**Fe (ppm)**	1.01	1.04
E.C. (dS/m)	1.15	1.18	**Cu (ppm)**	0.33	0.36
O.M.	0.01	0.02	**Zn (ppm)**	0.34	0.35
$CaCO_3$	14.60	13.90	**Mn (ppm)**	0.56	0.61

The experiment was laid out in a split plot with 3 replications, included 12 treatments. The 4 levels of salinized water arranged in the main plot (0, 500, 1000 and 2000 ppm NaCl), while, alpha tocopherol, vitamin E (200 ppm) and moringa leaf extract, MLE (10%) plus control were in the sub-plots. Alpha tocopherol was supplied by Sigma Chemical Company, USA. Aqueous extract of moringa at 10 % (100 ml/l) was prepared according to (Phiri and Mbewe, 2010).

Each plot was irrigated with 500 ml. The salinity treatments took place after 10 days from transplanting, starting from 25th March according to the designated concentration till the experiment end. The plants were sprayed with alpha tocopherol and moringa leaf extract four times with one month interval starting from 7th May till 7th August. The plants were sprayed till full wetness. the two experimental seasons, the plants were grazing three times (1st of June, 1st August and 1st October) by grazing plants above the soil surface (at 3 cm).

At the three grazing times, the following data were recorded: plant height (cm), number of branches and leaves, leaves area (cm^2) as well as fresh and dried herb weights per grazing (g) and per season].

Statistical analysis

The collected data underwent tabulation and were then analyzed statistically using MSTAT-C (1986), where a LSD test at a

significance level of 0.05 was utilized to compare the treatment averages.

3. RESULTS AND DISCUSSION

3.1.Vegetative growth

There were significant differences among the salinity water and alpha tocopherol and moringa leaf extract treatments for plant height, branches and leaves number, leaf area and fresh and dried herb weights per grazing and per season during 3 grazing in both seasons facing check treatment (Tables 2-8). Referring to the salinity concentrations, the highest values of the abovementioned characters were achieved with tab water (without salinity). While the lowest values for all previous traits were obtained with the high salinity concentration (2000 ppm). The least reductions for all values of all vegetative growth tested parameters were recorded with low water salinity level (500 ppm). In the same time, 1000 ppm NaCl observe intermediate values. It is interesting that, plant height and leaf area were the best in the first grazing, followed by the 2nd grazing, then the 3rd grazing. On contrast, branch and leaves number and herb fresh and dry weights were the best in the third grazing, followed by the 2nd grazing, then the 1st one. Regarding the herb fresh and dry weights per plant per season, the declines were 38.92, 54.38 and 61.31% for fresh weight and 37.25, 53.56 and 60.74% for herb dry weight due to 500, 1000 and 2000 ppm NaCl, respectively in the first season. Similar trends were detected in the second one.

Salinity poses a significant challenge to plants, particularly when they are irrigated with saline water. This environmental condition hinders crop metabolic functions by impacting the osmotic potential within the plant's root zone (Baâtour *et al*., 2012).

Our findings are in agreement with those obtained by Caliskan *et al.* (2017), Abdelkader *et al*. (2019), Mehriz *et al*. (2021), Jafari *et al.* (2022), Abdou *et al*. (2024) and Aly *et al.* (2024).

Regarding the effect of foliar application of (vitamin E and moringa leaf extract), data clarified that the highest values of examined vegetative growth were obtained with vitamin E. In the same time, MLE augmented second order comparing with control during both seasons for the three grazing. The increment in herb fresh and dry weights per plant per season registered 46.16 and 31.50% fresh weight and 45.27 and 30.41% dry weight due to vitamin E and moringa leaf extract, respectively over the control in the first season. The same trend was detected in the second one.

Tocopherols have been found to promote greater absorption of ions, improved transfer of ions, and heightened metabolic activities. As a result, there is a rise in the processes involved in carbon building, leading to enhanced growth of plants. Consequently, plants that have been treated with vitamins exhibit a high plant growth (Ali and Hussein, 2019).

In accordance with our results those mentioned by Lalarukh and Shahbaz (2018), Abdou *et al*. (2019), Ayyat *et al*. (2021) and Abdou and Badr (2022).

The positive effect of moringa leaf extract may be due to it is rich in auxins, cytokinins, abscisic acid, zeatin, vitamin E, ascorbates, phenolics and minerals (Foidl *et al*., 2001 and Nagar *et al*., 2006). So, it can be used as biostimulant to improve plant growth.

In agreement with our results those investigated by Sakr *et al*. (2018), Abdel-Rahman and Abdel-Kader (2020), Mohamed *et al*. (2020), Ayyat *et al*. (2021) and Sardar *et al*. (2021).

The interaction was significant for plant height, branches and leaves number, leaf area and fresh and dried herb weights per grazing and per season during 3 grazing in both seasons facing check treatment (Tables 2-8). The least values were produced with plants irrigated with 2000 ppm NaCl and sprayed with tab water. So, to alleviate the deleterious effects of salinity, it should spray plants with vitamin E (200 ppm), followed by moringa leaf extract (10%).

Farmers in recently reclaimed areas encounter challenges with limited saline irrigation water resources. This is due to the fact that alpha tocopherol (Soltani *et al*. 2012; Ali and Hussein, 2019 and Sadiq *et al*., 2019) and moringa extracts (Abdalla, 2013; Hassanein *et al*., 2019; Alkuwayti *et al*., 2020; Gadallah *et al*., 2020 and Mousa *et al*., 2020) have been shown to have a positive impact on the vegetative growth and chemical composition of economically important plants.

Table 2. Effect of alpha tocopherol and moringa leaf extract on plant height (cm) of marjoram under salinity stress in the three cuttings during both seasons.

Sub-plots treatments (B)	Irrigation water salinity (ppm) (A)									
	0.0	500	1000	2000	Mean (B)	0.0	500	1000	2000	Mean (B)
	The first season (2022)					The second season (2023)				
The first cut.										
Control	25.58	18.00	17.83	17.16	19.64	39.80	37.50	35.80	32.50	36.40
Vitamin E (200 ppm)	32.33	20.83	20.33	19.83	23.33	45.20	40.80	40.00	37.16	40.79
Moringa leaf extract (10%)	29.75	20.66	19.83	19.66	22.48	42.20	40.20	38.70	35.83	39.23
Mean (A)	29.22	19.83	19.33	18.88	21.82	42.40	39.50	38.17	35.16	38.81
L.S.D. at 5 %	A: 1.51		B: 0.95		AB: 1.90	A: 1.86		B: 1.05		AB: 2.10
The second cut.										
Control	20.66	20.00	17.00	14.16	17.96	31.00	26.66	24.00	23.83	26.37
Vitamin E (200 ppm)	25.88	23.83	22.00	21.33	23.26	35.33	29.60	29.30	26.83	30.27
Moringa leaf extract (10%)	23.33	22.33	20.33	19.83	21.46	33.50	29.20	27.70	25.66	29.02
Mean (A)	23.29	22.05	19.78	18.44	20.89	33.28	28.49	27.00	25.44	28.55
L.S.D. at 5 %	A: 1.21		B: 0.63		AB: 1.26	A: 1.45		B: 0.84		AB: 1.68
The third cut.										
Control	14.60	11.60	11.85	10.16	12.05	25.20	21.40	21.50	21.16	22.32
Vitamin E (200 ppm)	17.75	14.50	13.00	11.60	14.21	30.80	26.33	26.20	25.70	27.26
Moringa leaf extract (10%)	16.40	14.25	12.08	11.58	13.58	29.00	25.70	25.66	25.16	26.38
Mean (A)	16.25	13.45	12.31	11.11	13.28	28.33	24.48	24.45	24.01	25.32
L.S.D. at 5 %	A: 1.11		B: 0.33		AB: 0.66	A: 1.23		B: 0.42		AB: 0.84

Table 3. Effect of alpha tocopherol and moringa leaf extract on branches number per plant of marjoram under salinity stress in the three cuttings during both seasons.

Sub-plots treatments (B)	Irrigation water salinity (ppm) (A)									
	0.0	500	1000	2000	Mean (B)	0.0	500	1000	2000	Mean (B)
	The first season (2022)					The second season (2023)				
The first cut.										
Control	4.33	3.50	3.33	2.16	3.33	6.53	5.44	5.12	4.52	5.40
Vitamin E (200 ppm)	6.50	5.83	5.60	5.00	5.73	7.13	6.28	5.88	5.86	6.29
Moringa leaf extract (10%)	5.66	5.50	4.60	4.00	4.94	6.72	6.00	5.72	5.46	5.98
Mean (A)	**5.50**	4.94	4.51	3.72	4.67	6.79	5.91	5.57	5.28	5.89
L.S.D. at 5 %	A: 0.51		B: 0.42		AB: 0.84	A: 0.84		B: 0.51		AB: 0.1.02
The second cut.										
Control	17.80	14.60	11.60	10.83	13.71	19.92	15.69	15.25	14.50	16.34
Vitamin E (200 ppm)	21.80	17.00	14.50	14.16	16.87	23.08	17.80	17.08	16.67	18.66
Moringa leaf extract (10%)	18.60	16.60	14.00	13.33	15.63	22.40	17.67	16.50	16.33	18.23
Mean (A)	**19.40**	16.07	13.37	12.77	15.40	21.80	17.05	16.28	15.83	17.74
L.S.D. at 5 %	A: 1.80		B: 1.11		AB: 2.22	A: 1.92		B: 1.22		AB: 2.44
The third cut.										
Control	29.00	27.00	22.33	16.50	23.71	34.26	23.98	22.54	19.32	25.03
Vitamin E (200 ppm)	38.16	29.33	29.83	19.83	29.29	37.36	33.36	26.86	23.98	30.39
Moringa leaf extract (10%)	37.16	28.00	28.66	19.33	28.29	34.98	29.88	26.42	22.44	28.43
Mean (A)	**34.77**	28.11	26.94	18.55	27.09	35.53	29.07	25.27	21.91	27.95
L.S.D. at 5 %	A: 2.10		B: 1.85		AB: 3.70	A: 2.13		B: 1.87		AB: 3.74

Table 4. Effect of alpha tocopherol and moringa leaf extract on leaves number per plant of marjoram under salinity stress in the three cuttings during both seasons.

Sub-plots treatments (B)	Irrigation water salinity (ppm) (A)									
	0.0	500	1000	2000	Mean (B)	0.0	500	1000	2000	Mean (B)
	The first season (2022)					The second season (2023)				
The first cut.										
Control	21.33	20.33	19.16	16.00	19.21	23.46	23.20	22.40	22.93	23.00
Vitamin E (200 ppm)	25.00	23.66	21.50	18.80	22.24	26.93	26.56	24.88	24.26	25.66
Moringa leaf extract (10%)	23.33	22.00	21.16	18.50	21.25	24.80	24.00	23.73	23.20	23.93
Mean (A)	23.22	22.00	20.61	17.77	20.90	25.06	24.59	23.67	23.46	24.20
L.S.D. at 5 %	A: 1.10		B: 0.85		AB: 1.70	A: 0.46		B: 0.22		AB: 0.44
The second cut.										
Control	24.60	22.30	21.00	20.30	22.05	26.93	26.40	25.60	24.00	25.73
Vitamin E (200 ppm)	29.00	28.00	25.60	22.60	26.30	28.08	27.20	26.66	25.86	26.95
Moringa leaf extract (10%)	26.60	25.00	24.00	22.00	24.40	28.00	26.96	26.40	25.33	26.67
Mean (A)	26.73	25.10	23.53	21.63	24.25	27.67	26.85	26.22	25.06	26.45
L.S.D. at 5 %	A: 1.15		B: 0.86		AB: 1.72	A: 0.80		B: 0.51		AB: 1.02
The third cut.										
Control	27.20	24.48	24.80	23.73	25.05	29.76	28.88	28.24	27.73	28.65
Vitamin E (200 ppm)	32.80	29.86	27.46	25.86	29.00	32.00	30.88	30.13	29.60	30.65
Moringa leaf extract (10%)	30.93	29.60	26.93	25.60	28.27	30.96	30.40	29.84	28.56	29.94
Mean (A)	30.31	27.98	26.40	25.06	27.44	30.91	30.05	29.40	28.63	29.75
L.S.D. at 5 %	A: 1.21		B: 0.92		AB: 1.84	A: 0.75		B: 0.42		AB: 0.84

Table 5. Effect of alpha tocopherol and moringa leaf extract on leaf area (cm2) of marjoram under salinity stress in the three cuttings during both seasons.

Sub-plots treatments (B)	Irrigation water salinity (ppm) (A)									
	0.0	500	1000	2000	Mean (B)	0.0	500	1000	2000	Mean (B)
	The first season (2022)					The second season (2023)				
The first cut.										
Control	1.51	1.40	1.35	1.25	1.38	1.47	1.30	1.15	1.02	1.24
Vitamin E (200 ppm)	1.98	1.95	1.46	1.76	1.79	1.82	1.74	1.68	1.29	1.63
Moringa leaf extract (10%)	1.74	1.67	1.61	1.37	1.60	1.78	1.52	1.32	1.26	1.47
Mean (A)	1.74	1.67	1.47	1.46	1.59	1.69	1.52	1.38	1.19	1.45
L.S.D. at 5 %	A: 0.05		B: 0.04		AB: 0.08	A: 0.06		B: 0.05		AB: 0.10
The second cut.										
Control	0.81	0.64	0.61	0.48	0.64	1.10	0.79	0.92	0.71	0.88
Vitamin E (200 ppm)	0.87	0.83	0.79	0.59	0.77	1.56	1.23	1.13	1.12	1.26
Moringa leaf extract (10%)	0.86	0.82	0.78	0.58	0.76	1.29	1.22	1.01	0.96	1.12
Mean (A)	0.85	0.76	0.73	0.55	0.72	1.32	1.08	1.02	0.93	1.09
L.S.D. at 5 %	A: 0.04		B: 0.03		AB: 0.06	A: 0.05		B: 0.04		AB: 0.08
The third cut.										
Control	0.67	0.62	0.43	0.39	0.53	0.64	0.59	0.53	0.52	0.57
Vitamin E (200 ppm)	0.77	0.74	0.55	0.48	0.64	0.79	0.78	0.7	0.66	0.73
Moringa leaf extract (10%)	0.76	0.68	0.53	0.47	0.61	0.73	0.72	0.69	0.65	0.70
Mean (A)	0.73	0.68	0.50	0.45	0.59	0.72	0.70	0.64	0.61	0.67
L.S.D. at 5 %	A: 0.03		B: 0.02		AB: 0.04	A: 0.02		B: 0.01		AB: 0.02

Table 6. Effect of alpha tocopherol and moringa leaf extract on herb fresh weight/plant/grazing (g) of marjoram under salinity stress in the three cuttings during both seasons.

Sub-plots treatments (B)	Irrigation water salinity (ppm) (A)									
	0.0	500	1000	2000	Mean (B)	0.0	500	1000	2000	Mean (B)
	The first season (2022)					The second season (2023)				
The first cut.										
Control	29.60	23.68	22.84	17.44	23.39	42.24	30.80	27.76	27.68	32.12
Vitamin E (200 ppm)	38.44	38.32	32.04	31.24	35.01	43.04	35.12	34.40	33.36	36.48
Moringa leaf extract (10%)	36.56	29.16	28.64	25.40	29.94	42.76	32.48	33.92	29.84	34.75
Mean (A)	34.87	30.39	27.84	24.69	29.45	42.68	32.80	32.03	30.29	34.45
L.S.D. at 5 %	A: 1.62		B: 1.11		AB: 2.22	A: 1.51		B: 1.14		AB: 2.28
The second cut.										
Control	53.60	41.09	21.42	13.64	32.44	49.55	39.24	33.75	30.06	38.15
Vitamin E (200 ppm)	67.41	47.25	25.11	21.96	40.43	52.02	51.12	44.91	36.18	46.06
Moringa leaf extract (10%)	63.18	45.63	24.89	17.06	37.69	51.84	41.49	38.43	34.20	41.49
Mean (A)	61.40	44.66	23.81	17.55	36.85	51.14	43.95	39.03	33.48	41.90
L.S.D. at 5 %	A: 1.95		B: 1.81		AB: 3.62	A: 1.85		B: 1.72		AB: 3.44
The third cut.										
Control	57.36	25.36	21.64	21.40	31.44	49.92	46.84	47.04	39.60	45.85
Vitamin E (200 ppm)	99.40	40.92	36.92	31.24	52.12	75.84	58.56	58.56	49.92	60.72
Moringa leaf extract (10%)	91.68	36.88	31.60	28.52	47.17	59.60	56.40	54.96	47.12	54.52
Mean (A)	82.81	34.39	30.05	27.05	43.58	61.79	53.93	53.52	45.55	53.70
L.S.D. at 5 %	A: 2.11		B: 1.93		AB: 3.86	A: 2.05		B: 1.81		AB: 3.62

Table 7. Effect of alpha tocopherol and moringa leaf extract on herb dry weight/plant/grazing (g) of marjoram under salinity stress in the three cuttings during both seasons.

Sub-plots treatments (B)	Irrigation water salinity (ppm) (A)									
	0.0	500	1000	2000	Mean (B)	0.0	500	1000	2000	Mean (B)
	The first season (2022)					The second season (2023)				
The first cut.										
Control	5.37	4.30	4.15	3.17	4.25	7.73	5.64	5.08	5.07	5.88
Vitamin E (200 ppm)	6.98	6.96	5.82	5.67	6.36	7.88	6.43	6.30	6.10	6.68
Moringa leaf extract (10%)	6.64	5.29	5.2	4.61	5.44	7.82	5.94	6.21	5.46	6.36
Mean (A)	6.33	5.52	5.06	4.48	5.35	7.81	6.00	5.86	5.54	6.31
L.S.D. at 5 %	A: 0.71		B: 0.49		AB: 0.98	A: 0.75		B: 0.45		AB: 0.90
The second cut.										
Control	9.65	7.40	3.86	2.45	5.84	8.99	7.12	6.13	5.46	6.93
Vitamin E (200 ppm)	12.13	8.51	4.52	3.95	7.28	9.44	9.28	8.15	6.57	8.36
Moringa leaf extract (10%)	11.37	8.21	4.48	3.07	6.78	9.41	7.53	6.97	6.21	7.53
Mean (A)	11.05	8.04	4.29	3.16	6.63	9.28	7.98	7.08	6.08	7.61
L.S.D. at 5 %	A: 1.11		B: 0.55		AB: 1.10	A: 1.12		B: 0.51		AB: 1.02
The third cut.										
Control	8.60	3.80	3.25	3.21	4.72	8.24	7.73	7.76	6.53	7.57
Vitamin E (200 ppm)	14.91	6.14	5.54	4.69	7.82	12.51	9.66	8.24	7.01	9.36
Moringa leaf extract (10%)	13.75	5.53	4.74	4.28	7.08	9.83	9.31	9.07	7.77	9.00
Mean (A)	12.42	5.16	4.51	4.06	6.54	10.19	8.90	8.36	7.10	8.64
L.S.D. at 5 %	A: 1.68		B: 1.11		AB: 2.22	A: 1.52		B: 1.12		AB: 2.24

Table 8. Effect of alpha tocopherol and moringa leaf extract on herb fresh and dry weights/plant/season (g) of marjoram under salinity stress in the three cuttings during both seasons.

Sub-plots treatments (B)	Irrigation water salinity (ppm) (A)									
	0.0	500	1000	2000	Mean (B)	0.0	500	1000	2000	Mean (B)
	The first season (2022)					The second season (2023)				
	Fresh weight/plant (g)									
Control	140.6	90.1	65.9	52.5	87.3	141.7	116.9	108.6	97.3	116.1
Vitamin E (200 ppm)	205.3	126.5	94.1	84.4	127.6	170.9	144.8	137.9	119.5	143.3
Moringa leaf extract (10%)	191.4	111.7	85.1	71.0	114.8	154.2	130.4	127.3	111.2	130.8
Mean (A)	179.1	109.4	81.7	69.3	109.9	155.6	130.7	124.6	109.3	130.0
L.S.D. at 5 %	A: 5.6		B: 3.8	AB: 7.6		A: 4.9		B: 3.85	AB: 7.70	
	Dry weight/plant (g)									
Control	23.6	15.5	11.3	8.8	14.8	25.0	20.5	19.0	17.1	20.4
Vitamin E (200 ppm)	34.0	21.6	15.9	14.3	21.5	29.8	25.4	22.7	19.7	24.4
Moringa leaf extract (10%)	31.8	19.0	14.4	12.0	19.3	27.1	22.8	22.3	19.4	22.9
Mean (A)	29.8	18.7	13.9	11.7	18.5	27.3	22.9	21.3	18.7	22.5
L.S.D. at 5 %	A: 1.6		B: 1.2	AB: 2.4		A: 1.4		B: 0.8	AB: 1.6	

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الملخص العربي

تأثير ألفا توكوفيرول ومستخلص أوراق المورينجا على نمو البردقوش تحت إجهاد الملوحة

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لأن الملوحة تحد من نمو النباتات العطرية والطبية، تم تنفيذ تجربة الأصيص بتصميم القطعة المنشقة في مزرعة نباتات الزينة بكلية الزراعة جامعة المنيا خلال موسمي تجريبيين ٢٠٢٢ و ٢٠٢٣ لتقييم تأثير ألفا توكوفيرول (٢٠٠ جزء في المليون) ومستخلص أوراق المورينجا (١٠٪) كعامل ثانوي على نمو البردقوش تحت إجهاد الملوحة (٠,٠، ٥٠٠، ١٠٠٠، و ٢٠٠٠ جزء في المليون كلوريد الصوديوم)، كعامل رئيسي.

أوضحت النتائج التي تم الحصول عليها أن جميع صفات النمو الخضري المدروسة انخفضت بشكل كبير مع مستويات الملوحة خلال موسمي التجربة للحشات الثلاث. وتم تسجيل أقل القيم مع مستوى الملوحة العالي (٢٠٠٠ جزء في المليون كلوريد الصوديوم). أدى الرش الورقي بفيتامين هـ (٢٠٠ جزء في المليون) ومستخلص أوراق المورينجا (١٠٪) إلى زيادة ملحوظة في الصفات المدروسة في جميع الحالات. لوحظت أفضل النتائج مع فيتامين هـ في جميع الصفات المختبرة.

وبشكل عام، أظهرت النتائج تأثيراً إيجابياً كبيراً للتفاعل بين الملوحة وألفا توكوفيرول ومستخلص أوراق المورينجا على جميع صفات النمو. ويوصى برش نباتات البردقوش بفيتامين هـ (٢٠٠ جزء في المليون) للتخفيف من الآثار الضارة للري بمياه مالحة.

الكلمات المفتاحية: أوريجانوم ماجورانا، الملوحة، فيتامين هـ، مستخلص أوراق المورينجا.