Improving Resistance of *Dracaena Marginata* Plants to Salinity Using Biofertilization

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ABSTRACT

Two types of biofertilizers were used in experiment conducted in the greenhouse of Zohria Garden-Horticulture search Institute, Agricultural Research Center in the 2021 and 2022 seasons, with the aim of alleviating the harmful effects of irrigation with saline water on at 0, 2000, 3000 and 4000 ppm on the *Dracaena marginata* plant by using the biofertilizers Nabta root at 5 cm/ liter and Vitol (micro carbon) at 1 cm/ liter. The results were as follows: adding Nabta root with saline water at a concentration of 3000 ppm gave the highest results for all shoots and roots characteristics and increased the content of chlorophyll b and carotenoid in leaves and total carbohydrates in the shoots and roots. While increasing the salinity irrigation water by more than 3000 ppm gave the lowest results in all shoots and roots characters. Increasing the salinity increased the concentration of total phenols, proline and sodium in the shoots and roots, and reduced the concentration of total indoles and calcium in the shoots and roots.

Recommendation: It is recommended to add Nabta root at 5 ml/L to the plants every month to reduce the harmful effect of irrigation water salinity.

Keywords: Salinity- Biofertilizer- Nabta root- Vitol- Micro carbon and Dracaena.

INTRODUCTION

Dracaena is a genus of about 40 species of shrubs classified in the Family Agavaceae. The demand for shoot-tops of *Dracaena marginata* is still increasing in Europe. It’s known as the Madagascar dragon tree, evergreen, growing up to 200 cm with shiny leaves 30 to 40 cm long. The colored leaves set colorful contrasts in living rooms, gardens and balconies. It conjures a tropical atmosphere in every living room and captivates with rich leaf green. It prefers the bright condition place with lots of sun but without direct sunlight. It tolerates semi-shade to a shady places but it will grow slower (Anonymous, 2011 and Ladha,2011).

Nabta root contains the amino acid GPRS, which stimulates the roots, reduces the problems of salinity and root rot, helps plants benefit from the elements in the soil, reduces the use of nitrogen fertilizers by 30%, equalizes the pH level in the soil, stimulates flowering, sets nodes, and improves the characteristics of The fruits. It is used alone and cannot be mixed.(Nabta product was obtained from Biotec com.)

Vitol a general growth stimulant that contains a complex of macro and micro elements with micro-carbon technology needed to stimulate growth. It stimulates the natural production of gibberellins within the plant. It increases energy production within the plant, helps the plant regain its activity and grow well after being exposed to environmental pressures, and is a stimulant for the root system.(vitol product was obtained from Huma gro com.)

Assefat (2006) found that increasing the salinity level decreased all vegetative and root growth compared with the control on *Khaya sengalensis* plant. Also, pigments content decreased with increasing the salt concentration except with carotenoids which increased with increasing salt concentration. The different salt concentrations reduced total carbohydrates, nitrogen, phosphorus and potassium percentages in the leaves, stems and roots, while sodium and calcium contents increased with increasing salt concentration. The content of proline in fresh leaves increased with increasing salt concentration. All biofertilizers improved the growth parameters, total carbohydrates, leaves pigments and mineral (N, P and K) contents. Abd El-Magied (2011) studies the effect of biostimulants on magnolia seedlings, found that the treatment with humic acid at 2ml/L gave the thickest stem, heaviest fresh weight of stems and roots and longest roots, whereas, amino acid at 2ml/L increased the leaf area. Hussien (2011) studied the effect of saline water on *Oroxylum indicum* and *Ceiba pentandra* L., it was reported that treating the plants with saline water at 3000 ppm recorded the highest total carbohydrates and N, P, K contents in leaves and stems of *Oroxylum indicum*, whereas saline water at 1500 ppm gave the best content of total carbohydrates in stem. Also, the lowest levels of saline water (1500 and 3000 ppm) recorded the best content of total carbohydrates, N, P and K in the leaves and stem of *Ceiba pentandra* L. plant. On the other hand, the highest levels (4500 and 6000 ppm) decreased them. El Ziat (2011) mentioned that using saline irrigation water with *Conocarpus erectus* plants caused reduction in all vegetative growth parameters, as well as the content of chlorophyll a and b, total carbohydrates, P and K%. Raising the salt concentration in the irrigation water increased the contents of Na, Ca and proline%. Abul-Mgd (2016) on *Kochia scoparia* L. reported that treating the plants with nitrobein at 3g/pot + rock phosphate at 30g/pot gave the tallest plants. Plants were treated with nitrobein (3g/pot) + phosphorein (3g/pot) + rock phosphate (30g/pot) increased the fresh and dry weights of shoots and total carbohydrates%. Nagdy (2018) on *Artemisia annua* plant found that the saline irrigation water decreased different growth characters, photosynthetic pigments and nutrients uptake (NPK). On the other hand, total carbohydrates, proline and total phenolic compounds were increased with increasing saline irrigation water levels. Kamal (2018) reported that treating the plants with algae at 5g/L and fulvic acid at 5 ml/L were significantly increased the plant height and stem diameter. Treating the plants with algae at 5g /L or chitosan at 1g/L significantly increased the number of leaves and leaf area. While, chitosan at 1g/L produced the heaviest fresh and dry weights of leaves. All treatments promoted the root formation of plants, and increased the contents of carbohydrates, P and K in leaves of *Dracaena* plants. Abdel-Ghani (2019) reported that treating *Plectranthus amboinicus* plants with seaweed extract and salicylic acid resisted water salinity and water salinity at 3000 ppm increased the concentration of Na and proline. Whereas, seaweed extract and salicylic acid treatments significantly increased plant height, leaf area, fresh and dry weights/ plant, pigment contents, total carbohydrates, N, P and K%, while, decreased Na and proline content. Sadiq and Abdullatif (2023) studied the effect of biofertilization on the resistance of salt water irrigation on lilium plant, they found that the interaction between biofertilizers and tap water gave the highest results for plant height, stem diameter, leaf area, root length, dry weight of roots and the concentration of proline in leaves.

The aim of this study was resisting the harmful effect of irrigation with salt water on the *Dracaena marginata* plants by using the biofertilizers.

MATERIALS AND METHODS

Two types of biofertilizers were used in experiment conducted in the greenhouse of Zohria Garden- Horticulture Research Institute, Agricultural Research Center, Egypt in the 2021 and 2022 seasons, with the aim of resisting the harmful effect of irrigation with saline water on the *Dracaena marginata* plant by using of biofertilizers. The height of plant was about 30 and 31 cm, having 34 and 35 leaves and stem diameter 9.1 and 9.3 mm in the first and second seasons, respectively. The plants were planted in 16 cm plastic pots in a media consisting of peatmoss + perlite in a 1:1 v:v ratio **(Table A).**

Table (A): Some physical properties of the growing media

B.D.	W.H.C	pH	E.C.
0.648	157	3.5	0.88

B.D.: Bulk density (g/cm3); **W.H.C.:** Water holding capacity (cm3/100g growing media); **E.C.:** Electrical conductivity (mmohs/ m^3)

The biofertilizers used were plants (untreated plants, Nabta root at a concentration of 5 cm/ liter and Vitol (micro carbon) at a concentration of 1 cm/ liter), and using four salinity water at a concentration 0, 2000, 3000 and 4000 ppm. (sodium chloride salt).

Data recorded:

Data were recorded on vegetative growth, root characters and chemical composition.

Vegetative growth:

- Height of plant (cm).
- Diameter of stem (mm).
- Leaf area (cm^2).
- Number of leaves/ plant
- Fresh and dry weights of shoots (g).

Root characters:

- Length of root (cm).
- Fresh and dry weights of roots (g).

Chemical composition:

- Chlorophyll a, b and carotenoid contents (mg/g F.W.) were determined as described by Fahmy (1970).
- Total carbohydrates (%) were determined as described by Herbert et al (2005).
- Proline: was determined according to the method of Bates et al. (1973).
- Phenols and indoles contents in leaves (mg/ 100g D.W.) were determined according to A.O.A.C. (2000) and Larsen et al. (2006), respectively.
- **Mineral contents:** Nitrogen was determined in plants with sulfuric acid using the semi-micro Kjeldahl method (Walinga et al. 1995). Phosphorus was determined by colorimetric method (A.O.A.C., 2000). Potassium and calcium in shoots were determined using flame photometer apparatus according to Walinga et al (1995).

The experiment was laid as completely randomized in a factorial design, with 12 treatments, each treatment contained 3 replicates and each replicate contained 4 plants. The obtained data were statistically analyzed using ANOVA LSD test at 5% (Mead et al., 1993).

RESULTS AND DISCUSSION

- Effect of saline water, biofertilizers and their interaction on the vegetative growth of Dracaena marginata plant.

Data in **Tables (1 and 2**) showed that irrigating the plants with saline water at 2000 and 3000 ppm gave the best results for height plant (43.05, 43.42, 45.16 and 45.14 cm). While adding saline water at 3000 ppm increased the number of leaves (51.83and 53.33 /plant), stem of diameter (12.18 and 13.39 mm), leaf area (27.52 and 29.32 cm2) and fresh and dry weights of shoots (27.47, 28.64, 5.43 and 6.05 g) in the first and second seasons respectively. Whereas, using salinity water at 4000 ppm decreased significantly all growth characters in the both seasons. These results are disagreement with those obtained of Assefat (2006) on *Khaya sengalensis* plant.

On the other hand, the application of Nabta root increased significantly all growth characters (height of plant 42.76 and 44.58 cm, number of leaves /plant 46.88 and 50.04, stem of diameter 11.65 and 12.44 mm, leaf area 25.73 and 27.80 and fresh and dry weights of shoots 23.19, 27.04, 4.63 and 5.64 g) in the two seasons, respectively. Followed by the treatments of Vitol in the two seasons. A similar trend was obtained on *Plectranthus amboinicus* by Abdel Ghani (2019) she reported that the biofertilizers significantly increased the plant height, leaf area and fresh and dry weights of plants.

The interaction effects between the biofertilization and salinity of water on plants indicated that the vegetative growth increased compared to the plants treated with saline water only. The combined treatment using Nabta root with saline water at 3000 ppm gave the best results for plant height 46.92 and 49.03 cm, formation of leaves /plant 55.00 and 59.50, stem of diameter 13.98 and 14.87 mm, leaf area 29.53 and 31.88 cm2 and fresh and dry weights of shoots 29.73, 31.00, 6.09 and 7.08 g in the first and second seasons, respectively.

- Effect of saline water, biofertilizers and their interaction on the roots characters of *Dracaena marginata* plant.

Data presented in **Table (3)** display the effect of irrigation water salinity and biofertilization on the rooting of the dracaena plant.

Irrigation of plants with saline water at concentration 3000 ppm increased the length of root (81.14 and 86.44 cm) and fresh and dry weights of roots (33.42, 39.04, 8.55 and 10.77 g) in the first and second seasons, respectively. On the other hand, increasing the salinity of water above 3000 ppm decreased the characters of roots in both seasons. Using Nabta root increased significantly all roots parameters, followed by the Vitol treatment compared with untreated plants. Similar trend was observed by Kamal (2018) on *Dracaena surculosa*, stated that treating the plants with biofertilization promoted the root formation.

The interaction between saline water and biofertilization showed that adding Nabta root with salinity water at 3000 ppm gave the best result with all characteristics of roots length of root (90.71 and 93.75 cm), fresh and dry weights of roots (35.60, 43.45, 9.08 and 11.71 g).

- Effect of saline water, biofertilizers and their interaction on the chemical composition of *Dracaena marginata* plants.

Data in **Tables (4-6**) demonstrated that using saline water at 2000 ppm increased the content of chlorophyll a in leaves (1.460 and 1.434 mg/g F.W.), whereas using salinity at 3000 ppm increased chlorophyll b (0.750 and 0.827 mg/g F.W.) and total carbohydrates in shoots (23.67 and 25.22%) and roots (24.35 and 26.18%). On the other hand, increasing the salinity level in irrigation water increased the content of total phenols in shoots and roots, but decreased the carotenoids content in leaves and the content of total indoles in shoots and roots. The results are agreement with those obtained by Hussien (2011) on *Oroxylum indicum* and *Ceiba pentandra* L. plants and Nagdy (2018) on *Artemisia annua* plant. Adding biofertilizers to plants under that investigated in this study increased the chlorophyll a, b, carotenoid contents in leaves, and the total carbohydrates and indoles in shoots and roots, and the best result of chlorophyll a (1.419 and 1.410 mg/g F.W.), carotenoid (0.233 and 0.329 mg/g F.W.) and total carbohydrates in shoots (23.79 and 25.31%) and roots (23.74 and 25.20%) was recorded by adding Nabta root, whereas, adding the Vitol gave the best result of chlorophyll b (0.683 and 0.760 mg/g F.W.). On the other hand, using the biofertilization decreased the total phenols in shoots and roots, in the two seasons respectively. Similar trend was obtained on *Khaya sengalensis* plant by Assefat (2006) and on *Plecctranthus amboinicus* plant by Abdel-Ghani (2019).

Using the Vitol in plants treated with salinity at 2000 ppm increased the chlorophyll a (1.492 and 1.453 mg/g F.W.), whereas the using Nabta root on plants grown under saline irrigation at 3000 ppm gave the highest content of chlorophyll b (0.906 and 0.991 mg/g F.W.), carotenoid (0.387 and 0.380 mg/g F.W.) and total carbohydrates in the shoots (25.82 and 27.54%) and roots (25.55 and 27.86%), in both seasons, respectively. On the other hand, using the Vitol with saline water gave the lowest content of total phenols and the highest content of indoles in roots. Whereas, using the Nabta root decreased the content of phenols and increased the content of indoles in shoots, in the two seasons.

Table (1). Effect of Nabta root and Vitol on height of plant (cm), number of leaves/ plant and stem of diameter (mm) of *Dracaena marginata* irrigated with different level of water salinity and their interaction in the first and second seasons (2021 and 2022).

Treatments	Height of plant (cm)			Mean	Number of leaves/ plant			Mean	Stem of diameter (mm)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	34.23	40.83	38.30	37.79	41.00	40.00	43.50	41.50	9.53	10.64	10.20	10.12
2000 ppm	41.57	45.37	42.20	43.05	46.50	53.50	49.50	49.83	11.00	12.13	11.15	11.43
3000 ppm	38.97	46.92	44.36	43.42	48.50	55.00	52.00	51.83	10.46	13.98	12.11	12.18
4000 ppm	32.80	37.93	37.80	36.18	38.13	39.00	42.00	39.71	8.90	9.87	9.28	9.35
Mean	36.89	42.76	40.67	-	43.53	46.88	46.75	-	9.97	11.65	10.69	-
L.S.D. 5%	A= 1.09	B= 0.94	AB= 1.89		A= 1.33	B= 1.15	AB= 2.31		A= 0.06	B= 0.05	AB= 0.11	
Second season												
0000 ppm	36.13	42.27	40.87	39.76	42.00	41.50	44.00	42.50	10.29	10.91	10.76	10.65
2000 ppm	43.53	47.17	44.77	45.16	48.00	56.17	51.00	51.72	12.31	13.45	12.91	12.89
3000 ppm	40.49	49.03	45.89	45.14	46.50	59.50	54.00	53.33	11.63	14.87	13.68	13.39
4000 ppm	33.83	39.87	39.07	37.59	40.00	43.00	45.00	42.67	9.41	10.54	10.00	9.98
Mean	38.49	44.58	42.65	-	44.13	50.04	48.50	-	10.91	12.44	11.84	-
L.S.D. 5%	A= 1.44	B= 1.25	AB= 2.49		A= 1.43	B= 1.24	AB= 2.48		A= 0.08	B= 0.07	AB= 0.14	

Table (2). Effect of Nabta root and Vitol on leaf area (cm2) and fresh and dry weights of shoots (g) of Dracaena marginata irrigated with different level of water salinity and their interaction in the first and second seasons (2021 and 2022).

Treatments	Leaf area (cm^2)			Mean	Fresh weight of shoots (g)			Mean	Dry weight of shoots (g)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	21.13	25.06	23.86	23.35	15.30	19.45	17.43	17.39	2.80	3.50	3.58	3.29
2000 ppm	26.34	27.95	26.53	26.94	24.00	27.35	25.88	25.74	4.10	5.87	4.15	4.71
3000 ppm	24.29	29.53	28.74	27.52	25.56	29.73	27.13	27.47	4.89	6.09	5.32	5.43
4000 ppm	15.97	20.37	19.79	18.71	13.00	16.25	15.65	14.97	2.47	3.06	2.66	2.73
Mean	21.93	25.73	24.73	-	19.47	23.19	21.52	-	3.57	4.63	3.93	-
L.S.D. 5%	A= 0.69	B= 0.79	AB= 1.37		A= 1.27	B= 1.10	AB= 2.20		A= 0.12	B= 0.10	AB= 0.21	
Second season												
0000 ppm	22.60	26.53	25.24	24.79	19.02	23.85	23.65	22.17	4.00	4.53	4.18	4.24
2000 ppm	28.51	29.41	27.92	28.61	24.55	29.67	27.15	27.12	4.65	6.73	5.97	5.78
3000 ppm	26.03	31.88	30.05	29.32	26.00	31.00	28.93	28.64	5.07	7.08	6.00	6.05
4000 ppm	17.90	23.37	21.91	21.06	14.45	23.65	20.85	19.66	3.60	4.21	4.07	3.96
Mean	23.76	27.80	26.28	-	21.00	27.04	25.15	-	4.33	5.64	5.06	-
L.S.D. 5%	A= 0.56	B= 0.64	AB= 1.11		A= 1.38	B= 1.19	AB= 2.39		A= 0.11	B= 0.10	AB= 0.19	

Table (3). Effect of Nabta root and Vitol on length of root (cm) and fresh and dry weights of roots (g) of *Dracaena marginata* irrigated with different level of water salinity and their interaction in the first and second seasons (2021 and 2022).

Treatments	Length of root (cm)			Mean	Fresh weight of roots (g)			Mean	Dry weight of roots (g)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	65.13	72.69	70.41	69.41	19.35	27.50	20.45	22.43	3.68	7.67	4.82	5.39
2000 ppm	74.93	82.02	76.89	77.95	30.45	33.25	31.40	31.70	7.77	8.72	8.11	8.20
3000 ppm	71.02	90.71	81.70	81.14	31.40	35.60	33.27	33.42	8.08	9.08	8.48	8.55
4000 ppm	51.83	72.00	62.97	62.27	18.55	22.55	21.59	20.90	4.20	7.15	6.11	5.82
Mean	65.73	79.36	72.99	-	24.94	29.73	26.68	-	5.93	8.16	6.88	-
L.S.D. 5%	A= 1.08	B= 0.94	AB= 1.87		A= 0.30	B= 0.26	AB= 0.52		A= 0.82	B= 0.07	AB= 0.14	
Second season												
0000 ppm	71.26	74.59	74.43	73.43	22.60	31.30	21.55	25.15	4.90	7.92	5.53	6.12
2000 ppm	80.02	90.09	83.72	84.61	35.57	39.05	36.60	37.07	9.51	10.56	9.95	10.01
3000 ppm	77.20	93.75	88.37	86.44	34.90	43.45	38.78	39.04	9.84	11.71	10.76	10.77
4000 ppm	56.22	65.13	64.04	61.80	21.40j	30.30	25.53	25.74	4.74	7.79	6.89	6.73
Mean	71.18	80.89	77.64	-	28.62	36.03	30.62	-	7.25	9.50	8.28	-
L.S.D. 5%	A= 2.17	B= 1.88	AB= 3.76		A= 0.34	B= 0.29	AB= 0.58		A= 0.05	B= 0.05	AB= 0.09	

Table (4). Effect of nabta root and vitol on chlorophyll a, b and carotenoid (mg/ g F.W.) of *Dracaena marginata* irrigated with different level of water salinity and their interaction in the first and second season (2021 and 2022).

Treatments	Chlorophyll a (mg/ g F.W.)			Mean	Chlorophyll b (mg/ g F.W.)			Mean	Carotenoids (mg/ g F.W.)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	1.456	1.436	1.481	1.458	0.409	0.752	0.896	0.686	0.140	0. 290	0.361	0.296
2000 ppm	1.402	1.487	1.492	1.460	0. 694	0.625	0.81	0.718	0.471	0.142	0.207	0.273
3000 ppm	1.478	1.400	1.443	1.440	0.593	0.906	0. 921	0.750	0.076	0. 387	0.177	0.181
4000 ppm	0.600	1.351	0.813	0.921	0.316	0.434	0.344	0.365	0.045	0.112	0.199	0.119
Mean	1.234	1.419	1.307	-	0.439	0.679	0.683	-	0.183	0.233	0.236	-
L.S.D. 5%	A= 0.011	B= 0.013	AB= 0.022		A= 0.017	B= 0.019	AB= 0.034		A= 0.015	B= 0.017	AB= 0.030	
Second season												
0000 ppm	1.393	1.390	1.173	1.319	0.557	0.419	0.562	0.513	0.282	0.327	0.313	0.307
2000 ppm	1.438	1.411	1.453	1.434	0.622	0.971	0.720	0.771	0.165	0.257	0.132	0.185
3000 ppm	1.326	1.450	1.442	1.406	0.544	0.991	0.945	0.827	0.147	0.380	0.159	0.219
4000 ppm	0.963	1.390	1.351	1.235	0.323	0.608	0.812	0.581	0.061	0.352	0.284	0.242
Mean	1.280	1.410	1.355	-	0.512	0.747	0.760	-	0.164	0.329	0.222	-
L.S.D. 5%	A= 0.012	B= 0.014	AB= 0.024		A= 0.017	B= 0.020	AB= 0.034		A= 0.010	B= 0.012	AB= 0.021	

Table (5). Effect of Nabta root and Vitol on total carbohydrates (%), indoles (mg/100g D.W.) and phenols (%) of Dracaena marginata in shoots irrigated with different level of water salinity and their interaction in the first and second season (2021 and 2022).

Treatments	Total carbohydrates (%)			Mean	Indoles (mg/100g D.W.)			Mean	Phenols (g/ 100g D.W)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	20.95	23.34	21.58	21.96	5.85	8.23	6.74	6.94	0.621	0.560	0.454	0.545
2000 ppm	22.76	24.90	22.31	23.33	5.26	6.75	5.73	5.91	0.726	0.566	0.583	0.625
3000 ppm	21.55	25.82	23.65	23.67	3.56	5.11	5.51	4.73	0.804	0.616	0.705	0.708
4000 ppm	20.50	21.12	21.05	20.89	3.33	4.95	4.72	4.33	0.822	0.629	0.735	0.729
Mean	21.44	23.79	22.15	-	4.50	6.26	5.67	-	0.743	0.623	0.619	-
L.S.D. 5%	A= 0.80 B= 0.92 AB= 1.60				A= 0.29 B= 0.34 AB= 0.58				A= 0.015 B= 0.018 AB= 0.031			
Second season												
0000 ppm	21.84	24.81	22.89	23.18	6.91	8.70	7.48	7.70	0.563	0.490	0.519	0.52
2000 ppm	24.23	25.88	24.97	25.03	5.71	6.70	6.81	6.41	0.590	0.549	0.568	0.55
3000 ppm	22.46	27.54	25.67	25.22	3.91	5.22	4.51	4.55	0.704	0.569	0.604	0.62
4000 ppm	20.99	23.01	22.54	22.18	3.09	4.69	4.30	4.03	0.942	0.776	0.811	0.84
Mean	22.38	25.31	24.02	-	4.91	6.33	5.78	-	0.700	0.596	0.626	-
L.S.D. 5%	A= 0.55 B= 0.64 AB= 1.10				A= 0.22 B= 0.25 AB= 0.44				A= 0.016 B= 0.019 AB= 0.032			

Table (6). Effect of Nabta root and Vitol on total carbohydrates (%), indoles and total phenols (%) of Dracaena marginata in roots irrigated with different level of water salinity and their interaction in the first and second season (2021 and 2022).

Treatments	Total carbohydrates (%)			Mean	Indoles (mg/100g D.W.)			Mean	Total phenols (g/ 100g D.W)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	21.38	23.97	22.93	22.76	3.99	5.15	7.45	5.53	0.520	0.429	0.340	0.430
2000 ppm	21.76	24.96	23.42	23.38	2.78	4.59	6.29	4.55	0.549	0.461	0.393	0.468
3000 ppm	23.34	25.55	24.17	24.35	2.35	5.73	6.90	4.99	0.581	0.562	0.455	0.533
4000 ppm	18.66	20.48	20.96	20.03	1.74	3.65	3.74	3.04	0.675	0.673	0.603	0.650
Mean	21.29	23.74	22.87	-	2.71	4.78	6.09	-	0.581	0.531	0.448	-
L.S.D. 5%	A= 0.57 B= 0.66 AB= 1.14				A= 0.25 B= 0.29 AB= 0.50				A= 0.019 B= 0.022 AB= 0.039			
Second season												
0000 ppm	22.75	25.01	24.68	24.15	6.10	6.85	7.42	6.79	0.421	0.409	0.331	0.387
2000 ppm	23.01	26.46	23.99	24.49	5.05	5.70	4.55	5.10	0.539	0.449	0.386	0.458
3000 ppm	24.36	27.86	26.31	26.18	2.72	3.62	3.94	3.43	0.574	0.556	0.456	0.529
4000 ppm	19.72	21.47	22.94	21.38	1.70	2.31	3.71	2.57	0.669	0.616	0.578	0.621
Mean	22.46	25.20	24.48	-	3.89	4.62	4.91	-	0.551	0.508	0.438	-
L.S.D. 5%	A= 0.72 B= 0.83 AB= 1.44				A= 0.27 B= 0.31 AB= 0.53				A= 0.022 B= 0.026 AB= 0.045			

Tables (7 and 8) indicated that the untreated plants gave the highest content of nitrogen in shoots (2.86 and 2.88%) and roots (2.91 and 3.06%) and the content of potassium in shoots (1.55 and 1.59%), whereas the exposure to saline water at 2000 ppm increased the content of phosphorus in shoots (0.283 %) and roots (0.334 %) in the first season. On the other hand, using the saline water at 3000 ppm gave the highest content of phosphorus in shoots (0.298%), while, increasing the salinity to 4000 ppm increased the content of phosphorus in roots (0.328%) in the second season. The content of potassium in roots gave the highest value with saline water at 2000 ppm (1.58 and 1.51%). These results are in agreement with those obtained of Hussien (2011) on *Oroxylum indicum* plant and *Ceiba pentandra* L. plant. Using the biofertilization treatments didn't give any significantly difference in nitrogen % concentration in the roots. Addition the Vitol to plants increased the concentration of nitrogen (2.87 and 2.83% DW) and phosphorus (0.340 and 0.325%) in shoots. Whereas, addition the Nabta root to plants increased the concentration of potassium in shoots (1.56 and 1.51%). On the other hand, plants grown without using any biofertilizers showed increases in the concentration of phosphorus and potassium in roots.

The Vitol addition to plants irrigated with saline water increased the content of nitrogen in shoots, while adding Nabta root combined with salinity at 2000 ppm increased the nitrogen content in the roots (3.02%) and concentration of phosphorus in roots (0.330%), in the first season. Using the Vitol with salinity at 2000 ppm gave the highest content of phosphorus in shoots (0.376 and 0.397%), while, using it with salinity at 4000 ppm gave the highest content of phosphorus in roots (0.382 and 0.399%). Potassium concentration in the shoots increased by using Nabta root with addition salt. Whereas, the Vitol was the best with salt water to increase the concentration of potassium in roots.

Data presented in **Tables (9 and 10)** showed that increasing the salinity concentration increased the contents of proline and sodium and decreased the content of calcium in shoots and roots, in the two seasons. Similar results were obtained on *Conocarpus erectus* plant by El-Ziat (2011). Adding the Vitol to the plants had the greatest impact on decreasing the proline content in shoots (100.63 and 107.44 mg/100g), while the greatest effect on the roots was with the addition of Nabta root (22.83 and 21.83mg/100g). Also, adding Nabta root to plants led to a decrease in the sodium content in the shoots (0.797 and 0.716%) and roots (0.660 and 0.604%), in the two seasons, respectively. The highest calcium content in the shoots was with the addition of Nabta root (1.71 and 1.69%), and in roots with the addition of Vitol (1.75 and 1.68%). Addition of the biofertilization to plant reduced the harmful effect of salinity on plant, using the Vitol with a salinity at 2000 ppm gave the lowest value of proline in the shoots (82.67 and 95.97 mg/100g), while the lowest value in roots was with the use of Nabta root without using salinity (15.35 and 13.45 mg/100g). The lowest sodium value in the shoots was with the use of Vitol or Nabta root without saline water irrigation, in both seasons, while the lowest value in the roots was with the addition of Nabta root with salinity at 2000 ppm (0.549%), in the first season and using it without salinity (0.499%), in the second season. The calcium content in the plant increased by adding biofertilizers with irrigation with salt water. The highest value of calcium was in shoots when using the Nabta root without irrigation with salt water (2.52 and 2.00%) and in the roots was using Vitol without salinity (2.19 and 2.35%).These results are agreement with those obtained by Abdel-Ghani (2019) on *Plectranthus amboinicus* plant.

It is recommended to add Nabta root at 5 ml/L to the plants every month to reduce the harmful effect of saline irrigation water.

Table (7). Effect of Nabta root and Vitol on nitrogen (%), phosphorus (%) and potassium (%) of Dracaena marginata in shoots irrigated with different level of water salinity and their interaction in the first and second seasons (2021 and 2022).

Treatments	Nitrogen (%)			Mean	Phosphorus (%)			Mean	Potassium (%)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	2.59	3.01	2.97	2.86	0.221	0.225	0.272	0.239	1.66	1.57	1.42	1.55
2000 ppm	2.78	2.53	281	2.71	0.167	0.306	0.376	0.283	1.53	1.57	1.46	1.52
3000 ppm	2.82	2.33	2.90	2.68	0.127	0.300	0.359	0.262	1.16	1.47	1.13	1.25
4000 ppm	2.52	2.89	2.79	2.73	0.136	0.243	0.354	0.244	1.35	1.62	1.45	1.47
Mean	2.68	2.69	2.87	-	0.163	0.269	0.340	-	1.43	1.56	1.37	-
L.S.D. 5%	A= 0.07 B= 0.08 AB= 0.14				A= 0.010 B= 0.012 AB= 0.021				A= 0.04 B= 0.05 AB= 0.09			
Second season												
0000 ppm	2.64	3.04	2.95	2.88	0.255	0.241	0.299	0.265	1.60	1.67	1.50	1.59
2000 ppm	2.60	2.60	2.79	2.66	0.206	0.342	0.397	0.315	1.49	1.60	1.42	1.50
3000 ppm	2.75	2.32	2.84	2.64	0.154	0.289	0.328	0.257	1.20	1.40	1.08	1.23
4000 ppm	2.50	2.75	2.73	2.66	0.11	0.275	0.274	0.220	1.20	1.37	1.42	1.33
Mean	2.62	2.68	2.83	-	0.181	0.287	0.325	-	1.37	1.51	1.36	-
L.S.D. 5%	A= 0.06 B= 0.07 AB= 0.12				A= 0.021 B= 0.024 AB= 0.042				A= 0.03 B= 0.04 AB= 0.07			

Table (8). Effect of Nabta root and Vitol on nitrogen (%), phosphorus (%) and potassium (%) of Dracaena marginata in roots irrigated with different level of water salinity and their interaction in the first and second seasons (2021 and 2022).

Treatments	Nitrogen (%)			Mean B	Phosphorus (%)			Mean	Potassium (%)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	3.28	2.54	2.90	2.91	0.356	0.228	0.202	0.262	1.46	1.15	1.33	1.31
2000 ppm	2.86	3.02	2.88	2.92	0.419	0.330	0.252	0.334	1.60	1.52	1.61	1.58
3000 ppm	2.03	2.94	2.90	2.62	0.282	0.245	0.254	0.260	1.38	0.92	1.28	1.19
4000 ppm	2.77	2.90	2.75	2.81	0.295	0.254	0.382	0.310	1.19	1.06	1.23	1.16
Mean A	2.74	2.85	2.86	-	0.338	0.264	0.273	-	1.41	1.16	1.36	-
L.S.D. 5%	A= 0.12 B= N AB= 0.24				A= 0.013 B= 0.015 AB= 0.027				A= 0.05 B= 0.05 AB= 0.09			
Second season												
0000 ppm	3.19	2.94	3.05	3.06	0.379	0.291	0.279	0.316	1.58	1.39	1.29	1.42
2000 ppm	2.88	2.73	2.81	2.81	0.400	0.299	0.209	0.366	1.52	1.44	1.57	1.51
3000 ppm	2.14	2.64	2.60	2.46	0.311	0.283	0.201	0.265	1.30	1.09	1.37	1.25
4000 ppm	2.70	2.60	2.50	2.60	0.370	0.215	0.399	0.265	1.10	1.00	1.21	1.10
Mean	2.73	2.73	2.74	-	0.365	0.272	0.272	-	1.38	1.23	1.36	-
L.S.D. 5%	A= 0.15 B= N AB= 0.30				A= 0.009 B= 0.011 AB= 0.019				A= 0.07 B= 0.08 AB= 0.13			

Table (9). Effect of Nabta root and Vitol on proline (mg/100g D.W.), sodium (%) and calcium (%) of Dracaena marginata in shoots irrigated with different level of water salinity and their interaction in the first and second seasons (2021 and 2022).

Treatments	Proline (mg/100g D.W.)			Mean	Sodium (%)			Mean	Calcium (%)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	132.75	95.79	102.02	110.19	0.730	0.692	0.686	0.703	2.04	2.52	2.05	2.20
2000 ppm	130.57	123.96	82.67	112.40	0.970	0.856	0.963	0.930	1.20	1.78	1.38	1.45
3000 ppm	146.46	114.88	104.10	121.81	1.015	0.766	0.892	0.891	1.04	1.59	1.65	1.43
4000 ppm	155.32	131.90	113.10	133.44	1.036	0.874	0.910	0.940	0.60	0.94	0.66	0.73
Mean	141.28	116.63	100.47	-	0.938	0.797	0.863	-	1.22	1.71	1.44	-
L.S.D. 5%	A= 3.15 B= 3.64 AB= 6.30				A= 0.036 B= 0.042 AB= 0.073				A= 0.15 B= 0.17 AB= 0.29			
Second season												
0000 ppm	130.84	99.70	113.02	114.52	0.683	0.582	0.608	0.624	1.84	2.00	2.10	1.98
2000 ppm	133.44	115.42	95.97	114.94	0.989	0.781	0.884	0.885	1.22	1.94	1.74	1.63
3000 ppm	144.33	124.79	105.88	125.00	0.945	0.690	0.825	0.820	1.17	1.73	1.50	1.46
4000 ppm	156.23	132.85	114.90	134.66	1.239	0.810	0.899	0.983	0.59	1.10	1.00	0.90
Mean	141.21	118.19	107.44	-	0.964	0.716	0.804	-	1.20	1.69	1.59	-
L.S.D. 5%	A= 3.09 B= 3.57 AB= 6.19				A= 0.055 B= 0.064 AB= 0.110				A= 0.13 B= 0.15 AB= 0.25			

Table (10): Effect of Nabta root and Vitol on proline (mg/100g D.W.), sodium (%) and calcium (%) of Dracaena marginata in roots irrigated with different level of water salinity and their interaction in the first and second seasons (2021 and 2022).

Treatments	Proline (mg/100g D.W.)			Mean	Sodium (%)			Mean	Calcium (%)			Mean
	Untreated	Nabta	Vitol		Untreated	Nabta	Vitol		Untreated	Nabta	Vitol	
First season												
0000 ppm	18.93	15.35	17.45	17.24	0.629	0.558	0.566	0.584	1.84	1.91	2.19	1.98
2000 ppm	27.44	20.05	18.64	22.04	0.673	0.549	0.630	0.617	1.47	1.56	1.63	1.55
3000 ppm	28.93	23.50	27.70	26.71	0.698	0.687	0.698	0.694	1.24	1.68	1.77	1.57
4000 ppm	35.35	32.41	29.18	32.31	0.918	0.844	0.730	0.831	1.19	1.26	1.41	1.28
Mean	27.66	22.83	23.24	-	0.730	0.660	0.656	-	1.43	1.60	1.75	-
L.S.D. 5%	A= 1.14 B= 1.31 AB= 2.27				A= 0.026 B= 0.030 AB= 0.053				A= 0.07 B= 0.08 AB= 0.13			
Second season												
0000 ppm	18.05	13.45	16.70	16.07	0.600	0.499	0.653	0.584	1.79	2.01	2.35	2.05
2000 ppm	25.94	19.99	23.93	23.29	0.627	0.503	0.601	0.577	1.49	1.69	1.51	1.56
3000 ppm	30.18	22.05	26.00	26.08	0.754	0.614	0.723	0.697	1.33	1.50	1.48	1.44
4000 ppm	39.35	31.82	30.82	34.00	0.875	0.801	0.794	0.823	1.06	1.46	1.39	1.30
Mean	28.38	21.83	24.36	-	0.714	0.604	0.693	-	1.42	1.67	1.68	-
L.S.D. 5%	A= 1.12 B= 1.30 AB= 2.25				A= 0.040 B= 0.046 AB= 0.080				A= 0.06 B= 0.7 AB= 0.12			

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الملخص العربى

تحسين مقاومة نباتات الدراسينا مارجيناتا للملوحة بإستخدام التسميد الحيوى

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تم استخدام نوعين من الأسمدة الحيوية فى تجربة اقيمت فى الصوب فى حديقة الزهرية فى موسمين 2021 و 2022 بهدف مقاومة التأثير الضار للرى بالمياه المالحة على نبات الدراسينا. وكانت المعاملات كالآتى: تسميد حيوى:مركب نبتة روت بتركيز 5 سم/لتر ومركب فيتول بتركيز 1سم/ لتر. استعملت 4 تركيزات للملوحة (كلوريد الصوديوم) (0 ،2000، 3000، 4000 جزء فى المليون) وكانت النتائج كالآتى: إضافة نبتة روت مع الماء المالح بتركيز 3000 جزء فى المليون أعطت أعلى النتائج لكل الصفات الخضرية والجذرية وزيادة كلوروفيل ب والكاروتين فى الأوراق والكربوهيدرات الكلية فى المجموع الخضرى والجذور. بينما أدت زيادة ملوحة ماء الرى أكثر من 3000 جزء فى المليون إلى نقص فى كل الصفات الخضرية والجذرية. أدت زيادة الملوحة إلى زيادة تركيز الفينولات الكلية والبرولين والصوديوم فى المجموع الخضرى والجذرى، بينما قللت تركيز الإندولات والكالسيوم فى المجموع الخضرى والجذرى .
التوصية: يوصى بإضافة نبتة روت بتركيز 5 سم/لتر كل شهر إلى النباتات لتقليل الأثر الضارلملوحة ماء الرى.