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EFFECT OF SALINITY OF IRRIGATION WATER ON GROWTH AND NUTRITIONAL STATUS OF MANGO NURSLINGS

Wahdan, M.T.
Suez Canal Univ., Faculty of Agric., Dept. of Horticulture

ABSTRACT

Two mango cultivars (Succary Abiad and Zebda), were irrigated with five concentrations of saline water (0,500, 1000, 2000 and 4000 ppm). The irrigation solution was prepared from a mixture of NaCl + $CaCl_2$ + $MgSo_4$ (1 : 1 : 1 w/w/w). A reduction in survival %, vegetative growth (stem length, leaf number, leaf area, fresh and dry weight) was associated with increasing salinity in the irrigation water and this was greater in Zebda cv. than Succary Abiad cv. The salinity treatments increased Na^+, Cl^- and Ca^{++} concentrations in leaves of nurslings in both cultivars. The accumulation of sodium, chloride and calcium in the leaves was higher in respect to the more sensitive cultivar (Zebda) than the tolerant cultivar (Succary Abiad). It was concluded that the difference in salinity tolerance was probably based on the ability of Succary Abiad to restrict Na^+ and Cl^- from the leaves and so it can be used as a salt tolerante mango rootstock in saline soils.

INTRODUCTION

The mango is one of the most horticultural important crops in Ismailia Governorate. It occupies more than 40% of plantation area of mango in Egypt, which reached about 102353 feddan (Statistics of Ministry of Agric., 2001).

Many studies have been made on the effect of salinity on plant growth. In this connection, Hassan and Abou El-Azayem (1990) mentioned that mango is more tolerant to salt stress than the apricot, peach and almond, respectively. Schmutz and Ludders (1998 and 1999) working on some mango cultivars nurslings mentioned that plant height, stem thickness, total number of leaves, leaf area and dry matter decreased with increasing salt concentrations in irrigation water. Moreover, using saline water reduced leaf area and leaf cell elongation which affected the activity of the terminal meristem (Schmutz and Ludders, 1993, and Schmutz, *et al.*, 1993). Mild symptoms of chloride toxicity are scorched leaf tips and margins and leaf curling, while in more severe cases growth ceases, leaves abscise and tress die (Kadman *et al.*, 1976; Gazit and Kadman, 1980 ; Samra, 1985). Schmutz *et al.*, 1993; Hoult *et al.*, (1997) and Schmutz and Ludders (1998 and 1999) reported that as salinity increased the accumulation of Na^+, Cl^-, K^+, Ca^{2+} and Mg^{2+} in leaves was increased. However, Ahmed and Ahmed (1997) showed that, increasing salinity caused adverse effects on the uptake of N^+, P^+, K^+, $Ca^{2+}$and Mg^{2+}.

The extension in cultivated area is mostly located in the new reclaimed lands which have some problems, including soil salinity as well as saline water used for irrigation. Nevertheless, there is no specific rootstock

recommendation for commercial mango cultivars, which could be successfully used in these regions. Selecting salt tolerance rootstocks is a tool used to improve productivity under these conditions. So, the present study aimed to evaluate the tolerance of Succary Abiad and Zebda mango nurslings to irrigation with saline water containing 0, 500, 1000, 2000 and 4000 ppm in mixture of NaCl, $CaCl_2$ and $MgSO_4$ (1:1:1 w/w/w). Through this approach a suitable recommendation for choosing salt tolerant rootstock may be propped.

MATERIALS AND METHODS

The present study was conducted throughout two successive seasons (2000/2001 and 2001/2002) in the experimental farm of the Faculty of Agriculture, Suez Canal University, Ismailia, Egypt. In each season, full ripe mango fruits of Succary Abiad and Zebda cvs. were harvested at the first of August from 17-year-old trees grown in private orchard at Abou-Sweer, Ismailia Governorate. The seeds were immediately extracted, hard endocarps were carefully husked by using secateur. The kernels were sown with convex edge up at depth of 3-5 cm in black polyethylene bags (35 x 20cm) filled with loamy sandy soil (5kg/bag), each contained one seed. One-month-old healthy nurslings with greenish leaves, with their stones attached and nearly uniform in growth vigour were used. All the conventional operations were conducted on bags. In each season, on first of September, salt treatments were started. The growing nurslings were subjected to saline irrigation water which prepared with a mixture of NaCl + $CaCl_2$+ $MgSO_4$ (1:1:1 w/w/w). Five concentrations of saline irrigation water were used as follows: 0, 500, 1000, 2000 and 4000 ppm. At each time of irrigation the moisture content of medium was adjusted at about field capacity. Salt accumulation in the soil was minimized by weekly leaching with the same solution.
So, the experiment comprised ten treatments in split plot design (2 cultivars x 5 salinity levels), each treatment was replicated three times on ten nurslings per plot. The main plots represented cultivars of mango, while the salinity levels were devoted to the sub-plot. The following measurements were carried out:

I- Survival percentage:

Nurslings which survived and with stood salt treatment without salinity symptoms, were considered survivors and were recorded as percentage.

II- Growth parameters:

In each season, at the first week of April, number of leaves remainder per plant, length of plant (cm) and leaf area $(cm)^2$ were recorded. Moreover, the nurslings were gently removed, fresh and dry weight of leaves, stems and roots were determined. Specific leaf area (SLA), leaf weight ratio (LWR) and leaf area ratio (LAR) were also calculated as follows:
Specific leaf area (SLA) = total leaf area / leaf dry weight

Leaf weight ratio (LWR) = total leaves dry weight / total plant dry weight
Leaf area ratio (LAR) = SLA x LWR. according to Hashim *et al.*(1988).

III-Leaf nutritional status:

1- Total carbohydrates (%) were assayed by the method of Stewart, 1974.
2- Mineral content Total nitrogen content was determined by using the Micro-Kjeldahl method (Black, 1983). Phosphorus was determined colormetrically by the method of Troug and Meyer (1929). Sodium, potassium and calcium were estimated by flame photometer apparatus according to Brown and Lilleland (1946). Magnesium was determined by using a Perkin-Elmer Atomic Absorption spectrophotometer Model 305B.Chloride content in leaves was assessed according to the methods described by Higinbothan *et al.*, (1967).

The obtained data were statistically analyzed according to methods described by Snedecor and Cochran (1980) and L.S.D. test used to differentiate means using the MSTAT-C Statistical Package (MSTAT-C,1990).

RESULTS AND DISCUSSION

There was variability among both mango cultivars in their response to irrigation water salinity. The survival for nurslings of Succary Abiad cv. was 69.5 and 66.51% compared with Zebda cv. which was 60.08 and 53.79 in both seasons, respectively. Saline treatments reduced survival from 100% at control to 27.4 and 21.03 at 4000 ppm in both seasons, respectively (Table 1).

Regarding the effect of irrigation water salinity, data in Table (1) also reveal that in both seasons, stem length of both cultivars was significantly decreased with increasing salinity compared to the control. There were significant differences in stem length between cultivars; the highest values were obtained with Succary Abiad cv. compared by Zebda cv. in both seasons. The same trend was noticed with root length but without significant differences between cultivars in the second season only. This reduction in stem length as a result of water salinity might be attributed to reduction in cell size or the cells number. Similar results were reported by Schmutz and Ludders (1999).

It is clear from the results in Table (2) that significant differences among cultivars and concentrations were obtained for leaves No. / plant, leaf area (cm^2) and foliage area / plant in the two studied seasons. However the interaction between the two factors (cvs. and conc.) was significant for the three parameters in both seasons, also. In general, salinity significantly reduced number of leaves per plant, leaf area and so foliage area per plant, but reduction in Zebda cv. was stronger than in Succary Abiad cv. in both seasons. At low saline condition the leaf number was even increased. For leaf area, two major processes are responsible, in the beginning cell division, later cell elongation. It seems that salinity has the major influence on cell elongation, enhanced by increasing water stress during the salt treatment (Schmutz and Ludders, 1993).

Table (1): Effect of irrigation water salinity on survival (%), stem length (cm) and root length (cm) of Succary Abiad and Zebda mango nurslings in 2000 and 2001 seasons.

Concentration (ppm)	Survival (%)			Stem length (cm)			Root length (cm)		
	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average
First season									
Control	100	100	100	28.7	23.4	26.05	19.3	17.45	18.38
500	90	77.25	83.63	26.15	22	24.08	19.6	18.5	19.05
1000	76.30	61.95	69.13	25.05	19.35	22.2	17.1	16.2	16.65
2000	46.15	41.45	43.80	22.35	17.65	20.0	17.85	15.7	16.78
4000	35.05	19.75	27.40	19.55	15.95	17.75	13.35	12.7	13.03
Average	69.50	60.08	64.79	24.36	19.67	22.02	17.44	16.11	16.78
LSD at level 5% for cons.		8.82			1.11			1.9	
LSD at level 5% for cvs.		5.58			0.7			1.2	
LSD at level 5% for Interaction		12.48			1.57			2.69	
Second season									
Control	100	100	100	27.3	24.3	25.85	19.9	18.15	19.03
500	89.95	72.15	81.05	25.95	21.7	23.83	19.6	18.05	18.83
1000	71.30	49.30	60.30	23.75	21.25	22.50	16.8	19.05	17.93
2000	46.00	30.75	38.38	20.9	18.45	19.68	18.3	14.95	16.63
4000	25.30	16.75	21.03	20.25	19.15	19.70	12.75	12.4	12.58
Average	66.51	53.79	60.15	23.63	20.99	22.31	17.47	16.52	17.0
LSD at level 5% for cons.		5.72			3.19			2.43	
LSD at level 5% for cvs.		3.61			2.02			N.S.	
LSD at level 5% for !nteraction		8.08			4.51			3.43	

Table (2): Effect of irrigation water salinity on leaf number per plant, leaf area (cm)^2 and foliage area (cm)^2 per plant of Succary Abiad and Zebda mango nurslings in 2000 and 2001 seasons.

Concentration (ppm)	leaves number/plant			leaf area (cm)^2			foliage area (cm)^2/ plant		
	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average
First season									
Control	11	7.4	9.2	96.45	75.35	85.9	1061.1	557.7	809.4
500	9.3	5.9	7.6	90.75	64.65	77.7	844	381.5	612.8
1000	8.45	5.2	6.83	73.7	58.05	65.88	623.8	301.7	462.8
2000	7.5	3.5	5.5	65.1	51.9	58.5	488.7	181.5	335.1
4000	5.8	2.25	4.03	59.9	45	52.45	347.2	101.3	224.3
Average	8.41	4.85	6.63	77.18	58.99	68.09	673	304.7	488.9
LSD at level 5% for cons.		0.88			1.97			72.56	
LSD at level 5% for cvs.		0.56			1.25			45.89	
LSD at level 5% for Interaction		1.24			2.79			102.61	
Second season									
Control	10.55	7.3	8.93	94.25	74.15	84.2	995.3	539.3	767.3
500	9.3	6.7	8.0	87.8	62.95	75.38	817.1	421.5	619.3
1000	7.9	5.6	6.75	71.1	58.15	64.63	561.3	326.4	443.9
2000	5.7	3.45	4.58	65.65	52.9	59.28	374.7	182.2	278.5
4000	5.65	2.65	4.15	62.7	45.9	54.3	354.7	121.7	238.2
Average	7.82	5.14	6.48	76.3	58.81	67.56	620.6	318.2	469.4
LSD at level 5% for cons.		1.35			4.52			100.6	
LSD at level 5% for cvs.		0.85			2.86			63.64	
LSD at level 5% for Interaction		1.91			6.39			142.3	

Data in Table (3) show that the effect of irrigation water salinity on specific leaf area (SLA), leaf weight ratio (LWR) and leaf area ratio (LAR) in nurslings of Succary Abiad and Zebda mango cultivars. Concerning SLA data in the same table illustrate that nurslings of Zebda cv. had higher SLA values than those of Succary Abiad cv. These values decrease from (341.2 and 201.4) at control to 177.0 and 159.2 at 1000 and 2000 ppm in both seasons, respectively. In contrast, nurslings of Succary Abiad cv. had LWR values higher than those of Zebda cv. in both seasons. Increasing salinity tended to decrease LWR especially in the second season, the lowest values (0.32 and 0.25) were obtained with the highest concentration (4000 ppm) in both seasons, respectively. This trend of SLA and LWR may be due to the great leaf and nursling dry weights of Succary Abiad compared with Zebda cultivar. Regarding to, LAR which consist of two components, specific leaf area (SLA) and leaf weight ratio (LWR), where LAR = SLA x LWR. LAR is a useful indication of the leafiness of the plant. Data illustrate that increasing salinity led to a decrease in LAR in both cultivars during the two seasons, without significant variances between cultivars in both seasons.

From the data in Tables (4 and 5), it is clear that salinity at all concentrations in both seasons caused significant reduction in leaf, stem, root and total plant fresh and dry weights. Concerning the interaction between concentrations and cultivars, data in Tables (4 and 5) also, reveal that Zebda cv. is significantly more affected by salinity than Succary Abiad cv. The same trend was recorded in both seasons. The lowest values of total plant fresh weight (5 and 3.95 g/plant) were obtained with Zebda cv. at 4000 ppm compared with (12.1 and 9.4 g/plant) with Succary Abiad cv. at the same concentration in both seasons, respectively.

This result had attributed to the great effect of salinity on several processes of building up the osmotic pressure of the developing cell, by osmotic adjustment of salt accumulation to meet the increasing osmotic pressure of rooting media. The finding of Munns et al., (1982), Zekri and Parsons (1990) and El-Deeb (2002) emphasized these results.

With respect to the total carbohydrates and Carbohydrate/N ratio it is clear from the obtained results in Table (6) that carbohydrates level in the leaves of mango was insignificantly increased with increasing salt concentrations in both seasons. However, carbohydrates leaf content of Zebda mango cv. was higher than it of Succary Abiad especially in the second season. Concerning the effect of the interaction between the salinity and cultivars it is clear that no significant differences obtained within each cultivar during both seasons, with any concentration, except Zebda cv. in the first season only As for the effect of salinity on C/N ratio, data in Table (6) also revealed that C/N ratio of Zebda cv. was significantly increased compared with Succary Abiad also, with increasing salinity in the second season only. These results confirmed the findings of Khalil, (1998) who reported that, the increment of salt concentration reduced water absorption and so may cause disorders in physiology of plant for example, reduction of photosynthesis and protein content, in contrast increment of respiration and accumulative of carbohydrates as non reducing sugars.

Table (3): Effect of irrigation water salinity on SLA (Specific leaf area), LWR (leaf weight ratio) and LAR (leaf area ratio) Succary Abiad and Zebda mango nurslings in 2000 and 2001 seasons.

Concentration (ppm)	SLA			LWR			LAR		
	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average
First season									
Control	191.8	490.5	341.2	0.43	0.26	0.34	81.99	124.4	103.2
500	231.7	189.6	210.7	0.42	0.33	0.37	91.1	60.17	75.64
1000	185.1	168.8	177.0	0.38	0.37	0.37	66.09	63.08	64.58
2000	159.8	244.0	201.9	0.44	0.26	0.35	67.88	58.00	62.94
4000	168.5	233.6	201.1	0.41	0.23	0.32	67.94	41.56	54.75
Average	187.4	265.3	226.3	0.41	0.29	0.35	75.0	69.45	72.22
LSD at level 5% for cons.		N.S.			N.S.				
LSD at level 5% for cvs.		N.S.			0.08				
LSD at level 5% for Interaction		241.4			0.18				
Second season									
Control	191.7	211.1	201.4	0.36	0.38	0.37	68.68	73.85	71.27
500	173.6	215.7	194.7	0.38	0.3	0.34	66.09	58.89	62.49
1000	140.8	237.5	189.2	0.35	0.26	0.31	48.3	62.41	55.35
2000	134.4	184.0	159.2	0.29	0.27	0.28	38.38	51.14	44.82
4000	156.5	210.9	183.7	0.29	0.22	0.25	44.2	43.43	43.76
Average	159.4	211.9	185.65	0.33	0.29	0.31	53.13	58.83	55.98
LSD at level 5% for cons.		N.S.			0.08				
LSD at level 5% for cvs.		52.38			N.S.				
LSD at level 5% for Interaction		117.1			0.12				

Table (4): Effect of irrigation water salinity on leaf, stem and root fresh weight (g) of Succary Abiad and Zebda mango nurslings in 2000 and 2001 seasons.

Concentration (ppm)	Fresh weight of leaf (g)			Fresh weight of stem (g)			Fresh weight of root (g)			Total fresh weight (g)		
	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average
First season												
Control	6.75	3.05	4.90	6.05	3.10	4.58	6.45	3.20	4.83	19.25	9.35	14.30
500	5.80	2.15	3.98	5.55	3.90	4.73	5.55	3.00	4.28	16.9	9.05	12.98
1000	5.15	2.05	3.60	6.0	3.60	4.80	5.30	2.45	3.88	16.45	9.40	12.28
2000	4.25	1.80	3.03	5.55	2.75	4.15	5.10	1.70	3.40	14.90	8.05	10.58
4000	3.45	1.20	2.33	4.65	1.80	3.23	4.00	2.00	3.00	12.10	6.20	8.55
Average	5.08	2.05	3.57	5.56	3.03	4.30	5.28	2.47	3.88	15.92	8.40	11.74
LSD at level 5% for cons.		0.26			1.12			0.80			7.55	
LSD at level 5% for cvs.		0.16			0.71			0.51			1.61	
LSD at level 5% for Interaction		0.36			1.58			1.14			1.02	
Second season											2.23	
Control	6.65	2.65	4.65	6.10	3.40	4.75	6.95	3.1	5.03	19.70	9.18	14.43
500	5.05	2.25	3.65	5.40	2.40	3.90	5.60	1.95	3.78	16.05	6.60	11.33
1000	4.75	1.75	3.25	5.10	2.30	3.70	4.75	1.45	3.10	14.60	5.50	10.05
2000	4.55	1.60	3.08	4.85	2.10	3.48	4.45	1.45	2.95	13.85	5.15	9.50
4000	3.15	0.40	1.78	3.65	2.10	2.88	2.60	1.45	2.03	9.40	3.95	6.68
Average	4.83	1.73	3.28	5.02	2.46	3.74	4.87	1.88	3.38	14.72	6.07	10.40
LSD at level 5% for cons.		1.21			1.03			1.79			3.36	
LSD at level 5% for cvs.		0.77			0.65			1.13			2.12	
LSD at level 5% for Interaction		1.71			1.45			2.53			4.75	

Table (5): Effect of irrigation water salinity on leaf, stem and root dry weight (D.W.)of Succary-Abiad and Zebda Succary Abiad and Zebda mango nurslings in 2000 and 2001 season.

Concentration (ppm)	Dry weight of leaf (g)			Dry weight of stem (g)			Dry weight of root (g)			Total dry weight (g)		
	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average
First season												
Control	5.60	1.15	3.38	3.2	1.65	2.43	4.5	1.7	3.1	13.3	4.5	8.9
500	3.85	2.10	2.98	1.8	2.05	1.93	3.6	2.2	2.9	9.25	6.35	7.8
1000	3.55	1.85	2.70	3.1	1.85	2.48	2.9	1.35	2.13	9.55	5.05	7.3
2000	3.45	1.05	2.25	2.45	1.4	1.93	1.8	1.35	1.58	7.7	3.8	5.75
4000	2.30	0.60	1.45	1.4	0.85	1.13	1.8	1.1	1.45	5.5	2.55	4.03
Average	3.75	1.35	2.25	2.39	1.56	1.98	2.92	1.54	2.23	9.06	4.45	6.76
LSD at level 5% for cons.		1.62			0.98			1.32			3.2	
LSD at level 5% for cvs.		1.03			0.62			0.83			2.02	
LSD at level 5% for Interaction		2.3			1.39			1.86			4.53	
Second season												
Control	5.20	2.55	3.88	3.6	2.1	3.35	4.65	2.25	3.45	14.45	6.9	10.68
500	4.70	2.15	3.43	3.5	2.75	2.9	4.65	2.3	3.48	12.4	7.2	9.8
1000	4.00	1.40	2.70	3.6	2.4	3.0	4	1.65	2.83	11.6	5.45	8.53
2000	2.80	1.00	1.90	3.8	1.45	2.63	3.35	1.25	2.3	9.95	3.7	6.83
4000	2.30	0.60	1.45	2.9	0.9	1.9	2.85	1.2	2.03	8.05	2.7	5.38
Average	3.80	1.54	2.67	3.59	1.92	2.76	3.9	1.73	2.82	11.29	5.19	8.24
LSD at level 5% for cons.		0.55			0.57			0.48			0.9	
LSD at level 5% for cvs.		0.35			0.36			0.3			0.57	
LSD at level 5% for Interaction		0.77			0.81			0.67			1.27	

Table (6): Effect of irrigation water salinity on total carbohydrates and carbohydrate/N ratio of Succary Abiad and Zebda mango nurslings in 2000 and 2001 seasons.

Concentration (ppm)	Total carbohydrates (%)			Carbohydrate / N		
	Succary	Zebda	Average	Succary	Zebda	Average
First season						
Control	6.08	4.41	5.24	4.12	2.66	3.39
500	5.50	5.95	5.73	3.38	4.05	3.71
1000	6.16	7.26	6.71	3.58	4.80	4.19
2000	7.04	5.84	6.44	4.95	3.58	4.26
4000	6.14	7.56	6.85	3.77	4.01	3.89
Average	6.18	6.20	6.19	3.96	3.82	3.89
LSD at level 5% for cons.		N.S.			N.S.	
LSD at level 5% for cvs.		N.S.			N.S.	
LSD at level 5% for Interaction		2.53			1.36	
Second season						
Control	3.68	7.76	5.72	2.14	4.48	3.31
500	2.73	6.51	4.62	1.94	4.15	3.05
1000	5.43	7.08	6.25	3.25	4.77	4.01
2000	5.66	7.55	6.61	4.01	4.93	4.47
4000	5.27	8.59	6.93	3.41	7.16	5.28
Average	4.55	7.50	6.02	2.95	5.10	4.02
LSD at level 5% for cons.		N.S.			0.99	
LSD at level 5% for cvs.		1.56			0.63	
LSD at level 5% for Interaction		3.49			1.40	

As shown in Table (7) it is concluded that, leaf N content significantly reduced with 2000 ppm of saline water in the first season and with all concentrations except 1000 ppm in the second one. No significant differences between the two cultivars concerning N content were observed in both seasons. Concerning the effect of the interaction between salinity and cultivars data in the same table show that, the most depressive effect on leaf N content was produced by 2000 ppm in Succary Abiad cv. (1.42%) in the first season But in the second one , the highest salinity (4000 ppm) gave the lowest N leaf content (1.23%) of Zebda cv.

Leaf P content was inversely affected by salinity with a significant difference between concentrations used during two seasons. It also, affected by genotype with a significant variance among cultivars in the second season only. With respect to the effect of interaction between salinity and cultivars on leaf P content, the obtained results in Table (7) revealed that lowest P level in the leaves (0.14 and 0.18%) was obtained with Succary Abiad cv. at 4000 and 2000 ppm of salinity in both seasons respectively.

Concerning the effect of salinity on leaf K content, data in Table (7) also illustrated that values of leaf K content fluctuated from (1.04%) at 2000 ppm to (1.38%) at 4000 ppm compared with control (1.13%) in the first season. But in the second one, against trend was observed, leaf K content was inversely affected by salinity. With regard to effect of the interaction between salinity and cultivars, data in the same table show that Succary Abiad leaf K content decreased from (1.14 and 1.8%) in the control to (0.9 and 1.21%) at 2000 and 1000 ppm in both seasons, respectively. The competitive effect of Na^{++} on the absorption of K^{+} may be reasonable reason for these results. Similar results were reported by Haggag *et al* (1994) on mango and El-Deeb *et al.* (2004) on olive.

From data listed in Table (7) it is clear that Ca level in the leaves of mango was significantly increased progressively with increasing salt concentration in both seasons. Significantly higher Ca content was found in leaves of Zebda cv. compared to Succary Abiad cv. during two seasons. Regarding to the interaction between the two factors under study the highest values of leaf Ca content (2.67 and 2.77%) were obtained at 4000 ppm with Zebda cv. in both seasons, respectively compared to (0.93 and 1.74%) with Succary Abiad cv. at the same concentration in two seasons, also.

As similar to Ca, significant increments in leaf Na and Cl content were recorded due to salt stress during two seasons in both cultivars under study. With respect to the interaction between salinity and cultivars, data in Table (8) also reveal that all concentrations of salinity caused a significant increase in uptake of Na and Cl as compared to control in both seasons, with Zebda cv. only. No significant differences in Succary Abiad leaf Na content were found as a result of salinity in both seasons.

On the other hand, significant variances in Succary Abiad leaf Cl content were obtained in the second season only as effect of salinity.

Concerning the effect of salinity on leaf Mg content, data in Table (8) obtained that no significant differences between concentrations of salinity were observed in both seasons.

Table (7): Effect of irrigation water salinity on N, P, K, and Ca leaf content (%) of Succary Abiad and Zebda mango nurslings in 2000 and 2001 seasons.

Concentration (ppm)	N%			P %			K %			Ca %		
	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average
First season												
Control	1.56	1.66	1.61	0.21	0.19	0.20	1.14	1.11	1.13	0.68	1.51	1.09
500	1.62	1.47	1.55	0.21	0.21	0.21	1.12	1.31	1.21	0.72	2.47	1.60
1000	1.72	1.52	1.62	0.17	0.26	0.21	1.02	1.26	1.14	0.89	2.67	1.78
2000	1.42	1.62	1.52	0.29	0.24	0.27	0.90	1.17	1.04	1.05	2.39	1.72
4000	1.62	1.68	1.65	0.14	0.23	0.18	1.10	1.66	1.38	0.93	2.67	1.80
Average	1.59	1.59	1.59	0.20	0.22	0.21	1.05	1.30	1.18	0.85	2.34	1.60
LSD at level 5% for cons.		0.11			0.08			0.13			0.45	
LSD at level 5% for cvs.		N.S.			N.S.			0.08			0.29	
LSD at level 5% for Interaction		0.16			0.11			0.18			0.64	
Second season												
Control	1.72	1.73	1.72	0.31	0.31	0.31	1.80	1.01	1.41	1.18	1.76	1.47
500	1.42	1.57	1.49	0.20	0.25	0.22	1.21	1.05	1.13	1.36	2.37	1.86
1000	1.67	1.47	1.57	0.20	0.31	0.25	1.21	1.21	1.21	1.62	2.31	1.96
2000	1.42	1.52	1.47	0.18	0.28	0.23	1.26	1.35	1.31	1.86	2.30	2.08
4000	1.52	1.23	1.37	0.21	0.23	0.22	1.32	0.58	0.95	1.74	2.77	2.25
Average	1.55	1.50	1.52	0.22	0.27	0.24	1.36	1.04	1.20	1.55	2.30	1.92
LSD at level 5% for cons.		0.16			0.05			0.15			0.37	
LSD at level 5% for cvs.		N.S.			0.03			0.10			0.23	
LSD at level 5% for Interaction		0.23			0.07			0.21			0.52	

Table (8): Effect of irrigation water salinity on Mg, Na, and Cl leaf content of Succary Abiad and Zebda mango nurslings in 2000 and 2001 seasons.

Concentration (ppm)	Mg (%)			Na (%)			Cl (%)		
	Succary	Zebda	Average	Succary	Zebda	Average	Succary	Zebda	Average
First season									
Control	0.05	0.03	0.04	0.08	0.13	0.10	0.65	0.39	0.52
500	0.04	0.03	0.04	0.12	0.20	0.16	0.48	2.38	1.43
1000	0.04	0.03	0.04	0.08	0.31	0.20	0.47	0.48	0.47
2000	0.04	0.04	0.04	0.16	0.35	0.25	0.48	1.10	0.79
4000	0.04	0.04	0.04	0.15	0.43	0.29	0.56	0.59	0.57
Average	0.04	0.03	0.04	0.11	0.28	0.20	0.53	0.99	0.76
LSD at level 5% for cons.		N.S.			0.10			0.25	
LSD at level 5% for cvs.		0.004			0.06			0.16	
LSD at level 5% for Interaction		0.008			0.14			0.35	
Second season									
Control	0.04	0.03	0.04	0.12	0.13	0.12	0.25	0.34	0.29
500	0.04	0.03	0.03	0.14	0.22	0.18	0.41	0.37	0.39
1000	0.04	0.04	0.04	0.13	0.41	0.27	1.23	0.43	0.83
2000	0.04	0.04	0.04	0.16	0.65	0.40	0.41	0.37	0.39
4000	0.05	0.03	0.04	0.16	0.63	0.39	0.96	1.73	1.35
Average	0.04	0.03	0.04	0.14	0.41	0.28	0.65	0.65	0.65
LSD at level 5% for cons.		N.S.			0.05			0.06	
LSD at level 5% for cvs.		0.01			0.03			N.S.	
LSD at level 5% for Interaction		0.015			0.07			0.29	

While, leaf Mg content of Succary Abiad cv. was higher than it of Zebda cv. in both seasons. With respect of the interaction between the two factors under study, data also reveal that in the first season at 500 and 2000ppm a significant difference between the two cvs. was observed. While, in the second one no significant difference between two cvs. was observed at all concentrations except 4000 ppm

These results confirmed the findings of Haggag *et al.*, (1994); Schmutz & Ludders (1998 and 1999); Maklad, (2003) and El-Deeb *et al.*, (2004). It was concluded that the difference in salinity tolerance was probably based on the ability of Succary Abiad cv. to protect leaves from excessive Na^+ and to accept higher Cl^- contents in the leaves without severe growth damage.

It is apparent from the foregoing discussion that nurslings of the sensitive Zebda cultivar accumulated the ions (Na^+ and Cl^-) in toxic amounts in the leaves, while Succary Abiad nurslings appeared to have some ability to exclude them. And so, it can be used as a salt tolerant polyembryonic rootstock in saline soils.

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تأثير الملوحة على النمو والحالة الغذائية لشتلات المانجو

محمد طه وهدان
قسم البساتين – كلية الزراعة – جامعة قناة السويس

أجريت هذه التجربة لدراسة تأثير الري بمياه مالحة (مخلوط من كلوريد الصوديوم و كلوريد الكالسيوم وكبريتات الماغنسيوم بنسبة ١ : ١ : ١ وزناً) على نسبة بقاء الشتلات حيه وعلى النمو الخضري (طول الساق ، عدد الأوراق و مساحة الورقة والوزن الطازج والجاف) وكذلك على محتوى الأوراق من العناصر المعدنية وكانت أهم النتائج ما يلي :

١- انخفاض النسبة المئوية لبقاء الشتلات حيه كلما زاد تركيز الأملاح وكانت نسبة الشتلات الحية في الصنف السكري الأبيض أكثر منها في الصنف زبدة في الموسمين.

٢- أدى الري بالمياه المالحة إلى نقص في طول الساق والجذر وعدد الأوراق ومساحة الورقة والمساحة الورقية للنبات وكان النقص طرديا مع زيادة التركيز المضاف وكان التأثير في الصنف زبدة أكثر منه في السكري الأبيض في الموسمين.

٣- أدى الري بالمياه المالحة إلى تراكم أيونات الصوديوم والكلور وكذلك الكالسيوم في أوراق شتلات الزبدة أكثر منه في أوراق شتلات السكري الأبيض في الموسمين وربما يرجع ذلك إلىتراكم أيوني لصوديوم ولكلور في أوراق لزبدة بينما كان لعكس صحيحا في أوراق شتلات السكري الأبيض. وبالتالي يمكن التوصية باستخدام الصنف السكري الأبيض كأصل عديد الأجنة – للمانجو في الأراضي التي ترتفع بها نسبة الأملاح.