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INFLUENCE OF SALINITY OF IRRIGATION WATER ON GROWTH AND YIELD OF VALENCIA ORANGE TREES GROWN ON NEW RECLAIMED SOILS.

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ABSTRACT

The effect of four levels of saline irrigation water (394&1130,1447 and 2045 ppm) on growth, some chemical components (leaf chlorophyll a,b and carotene, shoot starch and total carbohydrates), leaf mineral contents, tree fruiting, yield and physical and chemical fruit properties of Valencia orange trees cultivated at new reclaimed areas were studied for three (1999,2000 and 2001) successive seasons. Shoot number, shoot length, number of leaves/shoot of different growth cycles, tree canopy, leaf area, leaf specific weight, leaf chlorophyll a,b and carotene contents, shoot starch and total carbohydrates, leaf (P,K and Ca), fruit set percentage, fruiting percentage, yield as (fruit No./tree, Kg./tree), fruit weight, fruit size and Juice weight percentage, were adversely affected by salinity of irrigation water. On the contrary it increased leaf (N, Na, Cl, Zn, Fe and Mn), June drop, T.S.S, Acidity, T.S.S/Acid ratio and Vitamin C.

INTRODUCTION

Salinity is one of the troublesome stress that can cause a poor harvest in many agriculture crops , particularly in arid regions where saline soils are prevalent due to insufficient irrigation water. Salinity inhibits the plant growth by affecting both water absorption and biochemical processes, such as nitrogen assimilation and protein biosynthesis (Dubey, 1994). Under saline conditions , the plant fail to maintain the required balance of organic constituents leading to suppressed growth and yield . Reductions in citrus growth with salinity of irrigation water had been previously reported by (Bernstein & Hayard 1958 and Haggag 1977).Also , reductions in citrus yield with salinity of irrigation water is expected as it had been described as salt sensitive crop (Mass and Hoffiman , 1977).

Salinity conditions have a direct effect on plant nutrition (Kafkafi , 1987). Recently a close relationship between mineral nutrition and carbohydrate had been described (Fischer & Bremer , 1993 and Haggag *et al* ., 1995) . Carbohydrates constitute a reserve pool which may put back into use for vegetative and reproductive growth . The presence of carbohydrate reserves in leaves , stems , trunk , and root of citrus trees is well documented by Wallerstein *et al* . (1974) . and Yelenosky and Guy (1977). Furthermore, Jones *et al* . (1975) . reported that correlations between fruiting and starch levels were always higher than correlations with soluble sugars or total carbohydrate levels .

This study aimed to throw some light on the effect of salinity of irrigation water on growth , some chemical components and yield of Valencia orange trees .

MATERIALS AND METHODS

This investigation was carried out during three successive seasons (1999 &2000 and 2001) in four orchards having Valencia orange (Citrus sinensis .(L) Osback) trees budded on sour orange (Citrus aurantium L.)

root stock . The first orchard located at EL. Nobaria , North EL – Tahreer Province , while the others located at EL – Kattbia and Kilometer point 75 and 92 along Cairo - Alexandria high way . The trees age at these orchards were about 12 – 15 years old planted at 5x 5 m . apart . Salinity of irrigation water used at the four orchards were 394 (control) ,1130 , 1447 and 2045 ppm respectively (Table 1) .

Table (1): Analysis of irrigation water used (ppm).

Experimental orchard	Tss	Ca	Mg	Na	K	CO3	HCO3	SO4	Cl
1 (control)	394	56	27	32	8	-	9	120	142
2	1130	104	39	290	8	-	6	348	335
3	1447	140	62	355	9	-	12	336	533
4	2045	190	108	426	10	-	46	768	497

Drip irrigation system was employed at the four orchards. The orchards soil physical and chemical analysis was carried out according to the standard methods outlined by Wilde *et Al.* (1985) and the data are presented in Table (2).

Table (2): Physical and chemical characteristics of investigated soils.

Soil physical and chemical characteristics	Experimental orchard			
	1	2	3	4
Particle size distribution				
Sand%	90.5	89.2	87.9	92.3
Silt%	5.3	4.0	7.2	5.2
Clay%	4.2	6.8	4.9	2.5
Texture grade	sandy	sandy	sandy	sandy
pH(1:2.5 extract)	7.8	8.1	7.9	8.0
E.C.(1:2.5 extract) (mmhos/cm)	1.5	1.8	2.2	2.4
$CaCO_3$ %	3.9	5.2	4.8	6.0
O.M %	0.22	0.35	0.29	0.27
Available macronutrients:				
Total N%	0.021	0.017	0.019	0.023
P(Olsen ,ppm)	2.5	3.2	3.5	2.8
K(ammonium acetate, ppm)	3.0	2.8	2.5	2.6

The narrow range of soil and climate differences at the four locations played the major factor in chosing these orchard . Fifteen trees , uniform in vigor and representing the average size of trees in each orchard were chosen to carry out this study. Valencia orange trees at the chosen orchards received nearly the same management and the fertilizer doses.

1- Vegetative growth

On 1st March of the three seasons, four branches (about 2-2.5 cm) in diameter were labeled on different treated tree directions to determine shoot number, shoot length and number of leaves per shoot of spring, first and second summer and autumn growth cycles. Each year, tree height and diameter were measured in autumn. The canopy volume was then calculated using the Turrell formula (1946).

2- Some leaf parameters

2-1. Leaf area using a planimeter and leaf dry weight were measured .

2-2. Leaf chlorophyll a,b and carotene contents were determined using the method of Wettstein (1957).

3- Shoot carbohydrate contents

Were determined calorimetrically as gm. Glucose per 100 gm. shoot dry weight according to Smith *et.al* (1956).

4- Leaf nutrient contents

For mineral analysis, 20 mature leaves of 6 months old from non fruiting spring shoots were collected in September of the three seasons, then oven dried at 70^0C and ground for chemical determinations as follows.

0.2 gm. Of each ground sample was digested using the procedure suggested by Jackson (1958). The digested solution was used for the determinations of N, P, K, Ca, Mg, Na, Cl, Fe Zn and Mn nutrients .

Total nitrogen was estimated according to microkjeldahl method as described by Pregl (1945).Total phosphorus was determined by the method recommended by Chapman and Pratt (1961).

Chloride was extracted from the ached samples with hot water and titrated with a standard silver nitrate solution and then determined as employed by Higinbothan *et al.* (1967) .

Moreover,K,Ca,Mg,Na,Fe,Zn and Mn were determined directly in the diluted digested solution using the atomic absorption spectrophotometer (Perkin Elmer 3300). Anyhow, N, P, K, Ca, Mg, Na and Cl elements were calculated as percentages in dry matter, whilst Zn, Fe and Mn were estimated on the basis of ppm .

5- Tree fruiting

$$\text{5-1. Fruit set \%} = \frac{\text{Number of developed fruitlets}}{\text{Persistent number of flowers}} \times 100$$

5-2. June drop : At early May and end of June, number of fruitlets on the selected branches was counted and the percentage of fruit drop was calculated according to the equation given by Vyvyan (1946).

$$Q = \frac{\text{Log } x_1 - \text{Log } x_2}{t_1 - t_2} \times 100$$

Where : x_1 & x_2 = No. of fruits/tree at t_1 and t_2 times.

$$\textbf{5-3.Fruiting\%} = \frac{\text{No. of fruits at harvesting time on the tagged branches}}{\text{Total No. of tagged flowers}} \times 100$$

6- Yield

At harvest time, yield of each tree was recorded as number of fruits and Kg. per tree. A sample of ten fruits from each tree were taken to study.

7- Physical and chemical fruit properties

7-1. Physical fruit properties

Fruit weight, volume and juice weight percentage were measured.

7-2.Chemical fruit properties

Total soluble solids (%) using hand refractometer, titration of total acidity (%),Vitamin C (mg/100 gm .juice) according to (A.O.A.C.1975) and total soluble solid/acid ratio were determined.

Any way, these treatments were arranged in a complete randomized blocks design and each treatment was replicated three times with five trees per each replicate. All data were statistically analyzed using the procedure outlined by Snedecor and Cochren (1972). Also, data were tested for least significant differences to compare the averages of the determined parameters.

RESULTS AND DISCUSSION

1-Vegetative growth

1-1. Shoot number.

It is quite clear from Table (3) that increasing salinity of irrigation water decreased significantly shoot number produced at different growth cycles compared with the control. These results were true in the three successive seasons.

1-2. Shoot length.

The rate of shoot elongation was adversely affected by salinity of irrigation water as shown in Table (3). Shoot elongation was scarcely affected by differences of salinity concentrations of irrigation water used (1130 , 1447 and 2045 ppm) ,but a pronounced differences from the control (394 ppm) were observed. The differences in shoot length decrease of spring and autumn growth cycles was obvious to reach the significant level .

1-3. No. of leaves / shoot.

It is obvious from Table (3) that shoots on low saline irrigation water had significantly higher number of leaves of spring growth cycle in the three successive seasons. On the other hand, the differences was lacked to be significant from the others (first & second summer and autumn) growth cycles.

1-4. Tree canopy.

It is clear from Table (3) that irrigating mature Valencia orange trees with saline irrigation water caused a slight decrease in tree canopy compared with the control (394 ppm) in the three studying seasons . However , the differences between the control and saline irrigation water treatments (1130 , 1447 and 2045 ppm) in this respect were so small to reach the significant level.

These results are in conjunction with those obtained by Minessy *et al.* (1973), Caro *et al* . (1979), Gobran (1989) and Haggag (1997), They found that growth of new shoots, tree height, tree diameter and vegetative growth were adversely affected by salinity.

2- Some leaf parameters .

2-1. Leaf area .

It is clear from Table (4) that salinity treatments decreased leaf area below the control (394 ppm) . However , the differences reached significant level in case of (2045 ppm) treatment only . These results are true in the three studying seasons.

Table(3) The influence of salinity of irrigation water on vegetative growth of valencia orange trees (seasons,1999,2000and2001)

Experimental orchard	Salinity of irrigation water (ppm)	Spring growth cycle			Frist summer growth cycle			Scond summer growth cycle			Autumn growth cycle			Canopy volume m³/tree
		shoots No.	shoot length	leaves No./shoot	shoots No.	shoots length	leaves No./shoot	shoot No.	shoot length	leaves No./shoot	shoots No.	shoot length	leaves No./shoot	
(season 1999)														
1(control)	394	28.5	12.3	6.7	15.5	9.5	7.1	14.8	11.2	7.0	8.4	4.5	3.5	18 00
2	1130	23.6	11	5.8	13.8	9.2	8.8	12.9	10.8	6.9	7.9	3.9	3.2	17 72
3	1447	20.2	10.2	4.9	12.6	9.0	8.6	12.3	10.6	6.7	7.5	3.6	3.0	17 53
4	2045	17.4	9.9	4.5	11.7	8.8	6.4	11 8	10.2	6.6	6.8	3.2	2.9	17.25
L.S Dat 0.05		3.61	1.15	1 05	1.96	N.S	N.S	1.87	N.S	N.S	1.06	0.42	N S	N.S
(season 2000)														
1(control)	394	27.3	12 2	6.6	15.2	9 4	6.8	14.6	11.0	6.9	8.3	4.2	3.3	18.36
2	1130	22.5	10.9	5.7	13.6	9.1	6.8	12.5	10.7	6.8	7.8	3.7	3.2	18.07
3	1447	20.0	10 1	4 6	12 1	8.9	6.3	12.0	10 5	6.5	7.3	3.4	3.0	17.88
4	2045	16.8	9.8	4.2	11.9	8.5	6.1	11.4	9.9	6.4	8.8	3.2	2 8	17.60
L.S Dat 0 05		3.31	1.23	1.08	1.84	N.S	N.S	1.77	N.S	N.S	1.01	0.39	N.S	N.S
(season 2001)														
1(control)	394	27.7	12.0	6.5	15.0	9.4	6.7	14.6	11.0	6.9	8.2	4.2	3.3	18 54
2	1130	21.9	10.7	5.4	13.5	9.0	6.4	12.4	10.5	6.7	7.8	3.7	3.1	18.25
3	1447	18.8	10.0	4.5	11.9	8.8	6.2	12.0	10.4	6.5	7.3	3.2	2 9	18.06
4	2045	16.5	9.6	4.1	11 3	8.3	6.0	11.3	9.7	6.3	6.7	3.0	2.7	17.78
L.S Dat 0.05		3.28	1.25	1.17	1 78	0.98	N.S	1.73	N.S	N.S	0.97	0.44	N S	N.S

Table(4): Effect of salinity of irrigation water on some leaf parameters and shoot carbohydrates contents of valencia orange trees (seasons,1999,2000and2001)

Experimental orchard	Salinity of irrigation water (ppm)	Leaf area (cm2)	Dry weight of 100(cm2) leaves(gi)	Leaf chlorophyll and carotene contents (mg/l)			Shoot chrbohydrates contents	
				chl.a	chl.b	Carotene	Starch %	Total chrbohydrates %
(season 1999)								
1(control)	394	19.2	1.02	3.81	3.64	1.88	13.09	17.79
2	1130	18.2	0.98	3.52	3.50	1.85	10.89	14.70
3	1447	16.4	0.95	3.39	3.40	1.80	8.29	13.05
4	2045	14.3	0.92	3.26	3.27	1.73	5.85	7.90
L.S.Dat 0.05		3.50	0.082	0.15	0.09	N.S	1.98	2.67
(season 2000)								
1(control)	394	20.8	0.99	3.60	3.72	1.47	12.36	16.69
2	1130	19.1	0.96	3.46	3.57	1.43	10.63	14.35
3	1447	17.6	0.95	3.29	3.36	1.30	8.18	11.04
4	2045	16.2	0.93	3.18	3.23	1.23	5.97	8.05
L.S.Dat 0.05		3.65	N.S	0.12	0.11	N.S	1.65	2.23
(season 2001)								
1(control)	394	20.2	1.00	3.67	3.75	1.69	12.74	17.20
2	1130	19.6	0.97	3.51	3.60	1.62	10.82	14.43
3	1447	18.5	0.96	3.39	3.49	1.58	8.53	11.48
4	2045	16.8	0.94	3.25	3.35	1.45	6.05	8.16
L.S.Dat 0.05		3.32	N.S	0.14	0.12	N.S	1.85	2.52

2-2. Leaf specific weight.

In all studied seasons, it is interesting to notice that salinity treatments generally decreased the values of leaf specific weight (dry weight of 100 Cm^2 leaves) in respect to the analogous ones of the control. Significant differences were clear with (2054 ppm) treatment at the first season only. The obtained data are in line with those of Abd-EL-Aziz *et al*. (1985) and Gobran (1989) who reported that, citrus plants treated with high level of salinity showed a reduction in leaf area and dry weight of leaves.

2-3. Leaf chlorophyll a , b and carotene contents.

Results concerning leaf chlorophyll a and b contents had significantly negative effect in the three seasons of study with increasing salinity of irrigation water as shown in Table (4).

Referring to salinity treatments and their relation to leaf carotene content, It is clear from Table (4) that in the three studying seasons, salinity treatment decreased insignificantly leaf carotene content.

The decrease of leaf chlorophyll a , b and carotene contents were greatly suppressed at the orchard irrigated with high levels of salinity (1447 ppm and 2045 ppm) compared with the lowest level of salinity (394 ppm). These results were true at the three studying seasons. Moreover it reflected the important effect of salinity on chlorophylls activity which had been differed positively or negatively according to the level of salinity (Sivtsev *et al.* 1973). Also, it is considerable that, the difference in chlorophylls activity depends on the salt exerted salinity (Austenfeld, 1976).

These result are in line with those obtained by Sherif (1985) and Gobran (1989). they found that salinity generally decreased chlorophyll a , b and carotene contents of citrus leaves.

2-4. Shoot carbohydrates content.

Table (4) shows that effect of different levels of irrigation water salinity on starch and total carbohydrates contents of Valencia orange shoots caused insignificant decrease in both shoot starch and total carbohydrates contents upon increasing salinity of irrigation water can be easily noticed in the three seasons of study.

The adverse effects of salinity on photosynthetic activity of leaves as previously reported by Gale *et al.*(1967) and Downton (1977) can interpret this reduction of starch and total carbohydrate contents . There is no doubt that selective supply of roots to the aerial part of both ions and specific phytohormones , which were adversely affected by salinity (Zofia and Czajkowska, 1981) may be responsible , partially at least , for the depression of photosynthetic activity .

4- Leaf nutrient contents .

It is quite evident from Table (5) that leaf nitrogen content of saline irrigation treatments increased as compared with those of the control (394 ppm) . Such effect was statistically observed at (1447 and 2045 ppm) treatments . That was true in the three studying seasons .

Table(5): Effect of salinity of irrigation water on leaf nutrient contents of valencia orange trees (seasons,1998,1999and2000)1999 , 2000 and 2001 and 2001)

Experimental orchard	Salinity of irrigation water (ppm)	N	P	K	Ca	Mg	Na	Cl	Zn	Fe	Mn
		Elements concentration									
		%							(ppm)		
(Season 1999)											
1(control)	394	2.12	0.310	1.89	5.30	0.220	0.23	0.59	6.70	337.0	50.0
2	1130	2.45	0.290	1.75	5.00	0.250	0.37	0.73	9.35	380.0	39.5
3	1447	2.58	0.282	1.64	4.60	0.270	0.50	0.76	11.23	395.0	66.7
4	2045	2.67	0.275	1.61	4.53	0.280	0.55	0.85	15.30	420.0	80.3
L.S.Dat 0.05		0.40	0.02	0.25	0.62	0.025	0.12	0.12	1.25	25.6	8.9
(Season 2000)											
1(control)	394	2.16	0.320	1.62	5.05	0.210	0.17	0.48	7.35	359.7	45.0
2	1130	2.52	0.310	1.58	4.80	0.227	0.35	0.52	9.50	376.2	31.2
3	1447	2.62	0.295	1.52	4.56	0.248	0.52	0.61	10.97	405.6	72.3
4	2045	2.68	0.280	1.48	4.47	0.267	0.60	0.78	13.85	455.2	86.0
L.S.Dat 0.05		0.42	0.028	0.21	0.55	0.015	0.15	0.11	1.18	13.5	10.5
(Season 2001)											
1(control)	394	2.10	0.330	1.61	5.27	0.205	0.21	0.55	6.95	401.3	53.7
2	1130	2.41	0.305	1.54	5.20	0.223	0.37	0.62	9.32	432.5	36.3
3	1447	2.65	0.290	1.44	4.80	0.245	0.55	0.72	11.50	464.3	60.2
4	2045	2.82	0.275	1.31	4.60	0.265	0.65	0.82	14.56	498.7	84.0
L.S.Dat 0.05		0.47	0.030	0.21	0.61	0.016	0.13	0.14	1.32	22.3	12.3

Respecting leaf phosphorus content at the three successive seasons , data presented in Table (5) showed that , plants irrigated with saline irrigation water were lower in their leaf phosphorus content than those of the control .Moreover , the significance was observed only in case of high saline irrigation water (2045 ppm) .

Concerning leaf potassium content, it is found that trees irrigated with saline water were mostly poor in leaf potassium content as compared with the control (394 ppm) . Moreover , high level of saline irrigation water treatment (2045 ppm) caused a significant decrease .

As for leaf Ca content , it is quite evident from Table (5) that treating Valencia orange trees with different levels of saline irrigation water decreased obviously leaf Ca content in respect of control treatment . Such effect from the statistical point of view mostly observed in case of high saline water treatment (2045) .

Considering leaf Mg content, data in Table (5) declared that in all studying seasons, salinity treatments increased leaf Mg content significantly over the control in most cases.

Referring to leaf Na content , it is quite evident from Table (5) that salinity treatments raised up remarkably leaf Na content in respect of the analogous ones of the control. Significant differences were observed in all cases. Moreover, high level of salinity surpassed remarkably all other treatments of saline water in increasing leaf Na content.

Regarding leaf Cl content, tabulated data, indicated that salinity treatments increased significantly leaf Cl content compared with the control (394 ppm) in all studying seasons. Moreover , high level of saline irrigation water caused a remarkable increase in leaf Cl content (Table 5).

Concerning leaf Zn content, it is clear from Table (5) that control trees had generally leaves with low amount of Zn as compared with those treated with saline irrigation water. Any how, significant differences were observed in all cases during the three seasons of study.

Considering leaf Fe content, it is quite evident from Table (5) that citrus plant irrigated with different saline water treatments were mostly higher significantly in their leaf Fe content in respect of those of the control. This result was true in the three successive seasons.

Concerning leaf Mn content, Table (5) disclose that salinity concentration varied in their effect. Thus, while low level of salinity (1130 ppm) treatment, decreased significantly leaf Mn content in respect of the corresponding ones of the control (394 ppm), The high rate of salinity values took the other way around. That was true in all seasons of study. Moreover, leaves of Valencia orange tree treated with high level of salinity (2045 ppm) were more significantly higher in their values than the analogous ones received low level (1130 ppm).

These findings were in accordance with those obtained by Guillen *et al.* (1979) on some citrus rootstocks who found that nitrogen and iron content was increased while Mn decreased by salinity treatments. Aly *et al.* (1986) pointed out that salinity reduced phosphorus ,potassium and Zn in plant tissue. While it caused an increase in Na and Cl contents, Patil and

Bhambota (1980) found that increasing the salinity level of irrigation water induced Ca decrease, while it increased Mg in citrus leaves.

5- Tree fruiting .

5-1 .Fruit set percentage .

It is quite evident from Table (6) that in all studying seasons , irrigated Valencia orange trees with saline water decreased significantly fruit set percentage .

5-2. June drop percentage .

Table (6) reveals that, in the three successive seasons , June drop percentage increased significantly with increasing salinity of irrigation water .

5-3. Fruiting percentage .

As for the effect of saline irrigation water on fruiting percentage, it is clear from Table (6) that around the three seasons of study, increased salinity of irrigation water caused a significant decrease in fruiting percentage.

The obtained results go in line with those mentioned by Howie and Lloyd (1991) mentioned that Washington navel orange trees irrigated with high salinity water had reduced flowering intensities and lower rates of fruit set. They suggested that unimpaired growth of fruits on high salinity trees during summer and autumn occurred, despite appreciable leaf abscission. They added that reserve carbohydrate was used for growth during this period. Twigs on high salinity trees had a much reduced starch content at the time of floral differentiation in winter. Twig starch content and extract of floral differentiation varied a similar way when examined as a function of leaf abscission, suggesting that reduced flowering and fruit set in salinized citrus trees is due to low levels of reserve starch, most of which has been used to support fruit growth in the absence of carbohydrate production during summer and autumn.

6- Yield

Concerning fruit number per tree, it is interesting to notice that salinity treatments generally decreased significantly fruit number per tree as compared with the control. Such decrease varied from (10.8-7.5-11.9%), (16.3-15.5-18.1%) and (26.7-30.5-19.6%) for (1130 ppm, 1447 ppm and 2045 ppm) treatments , respectively. (Table6).

As for yield of Valencia orange tree as Kg/tree, it is clear that salinity treatments decreased significantly tree yield as compared with the control. This result was true in the three successive seasons.

7- Physical and chemical fruit properties.

7-1. Physical fruit properties.

Data illustrated in Table (6) show, in general, that the studied parameters i.e. (fruit weight, fruit size and juice weight percentage)were insignificantly decreased with increasing salinity of irrigation water.

Table(6): Effect of salinity of irrigation water on fruiting parameters,yield and physical and chemical fruit properties of Valencia orange trees (seasons,1999,2000and2001)

Experimental orchard	Salinity of Irrigation water (ppm)	fruiting parameters			yield		physical fruit properties			chemical fruit properties			
		Fruit set %	June drop %	Fruiting %	Fruits No. Per tree	Kg. per tree	Fruit weight (g.)	Fruit Size (C.C)	Juice weight %	T.S.S. %	Acidity %	T.S.S/ Acidity (1:x)	Vitamin c mg/100 ml Juice
(Season 1999)													
1(control)	394	28.5	75.6	1.42	435	76.1	175.4	196.2	42.5	8.5	0.92	9.24	35.5
2	1130	24.6	86.5	1.23	388	66.7	172.2	192.8	40.2	9.5	0.98	9.69	40.3
3	1447	21.4	88.9	1.09	364	61.5	169.0	189.3	38.6	10.0	1.02	9.8	41.1
4	2045	18.8	93.2	0.95	319	52.6	165.0	184.8	35.3	10.4	1.03	10.08	42.4
L.S.Dat 0.05		2.9	6.4	0.13	32	8.2	N.S	N.S	N.S	0.55	N.S	N.S	N.S
(Season 2000)													
1(control)	394	27.8	72.8	1.36	400	72.8	182.1	203.8	43.2	9.2	0.95	9.68	36.7
2	1130	24.7	83.4	1.19	370	65.9	178.2	199.6	39.9	10.0	1.01	9.90	39.8
3	1447	22.5	90.4	1.05	338	58.1	172.0	192.6	37.3	10.5	1.05	10.00	40.9
4	2045	20.9	95.3	0.92	278	46.7	168.2	188.4	35.0	11.0	1.09	10.09	41.8
L.S.Dat 0.05		2.5	7.3	0.12	28	4.2	N.S	N.S	N.S	0.46	N.S	N.S	N.S
(Season 2001)													
1(control)	394	26.4	69.9	1.32	392	69.8	178.0	199.4	40.8	9.0	0.96	9.38	36.5
2	1130	23.8	78.3	1.16	345	59.3	172.1	192.6	38.9	9.8	1.01	9.70	39.5
3	1447	22.2	88.2	1.02	321	54.6	170.3	190.7	36.7	10.3	1.03	10.00	41.2
4	2045	19.5	92.5	0.90	276	45.5	165.2	185.0	34.3	10.8	1.05	10.29	41.9
L.S.Dat 0.05		2.3	5.6	0.11	29	7.4	N.S	N.S	N.S	0.63	N.S	N.S	N.S

7-2. Chemical fruit properties.

Table (6) show in the three seasons of study that salinity treatments increased significantly T.S.S% as compared with the control, while the other studied parameters i.e., (Acidity % & T.S.S/Acid ratio and Vitamin C) increased insignificantly with increasing salinity of irrigation water.

These results are in agreement with that found by Haggag (1997) who indicated that yield reduction associated with increasing salinity of irrigation water was mainly due to the reduction in the number of fruit/tree more than to the reduction in average of individual fruits weight.

These findings also are in agreement with those obtained by Howie and Lloyd (1991) They pointed out that measurements of Brix : acid ratio showed that fruits of high salinity trees reached maturity standards 25 days after fruits on low salinity trees.

These results showed to what extent using saline water depressed growth and yield of Valencia orange tree which considered an important factor help the growers to choose the fruit tree cultivated at areas depending on saline water only available.

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تأثير ملوحة مياه الري على نمو ومحصول أشجار البرتقال الفالنشيا المزروعة فى الأراضي المستصلحة حديثا

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أجرى هذا البحث لمدة ثلاثة أعوام (١٩٩٩و٢٠٠٠و٢٠٠١) . واختير له أربع مزارع مزروعة بالبرتقال الفالنشيا تقع فى النوبارية و الخطاطبة و الكيلو ٧٥،٩٢ طريق القاهرة الإسكندرية الصحراوي. وكان تركيز ملوحة مياة الري فى هزة المزارع(٢٠٥٤،١٤٤٧،١١٣٠،٣٩٤، جزء فى المليون). حسب تحليل مياة الري.

وقد أوضحت الدراسة أن استخدام ماء الري المالح فى ري أشجار البرتقال الفالنشيا سبب نقص فى عدد الأفرع وطول الأفرع و عدد الأوراق على الفرع فى كل دورات النمو و حجم الشجرة و المساحة الو رقية والوزن النوعي للأوراق ، ومحتوى الأوراق من كلوروفيل ا ، ب والكاروتين ، و محتوى الأفرع من النشا والكربوهيدرات الكلية و محتوى الأوراق من عناصر (الفسفور و البوياسيوم و الكالسيوم) و النسبة المئوية للعقد والأثمار و المحصول عددا و وزنا ووزن وحجم الثمرة وكذلك النسبة المئوية للعصير.

وعلى العكس من ذلك نتج عن استعمال الماء المالح فى ري أشجار البرتقال الفالنشيا زيادة محتوى الأوراق من عناصر (النيتروجين و الصوديوم و الكلورين و الزنك و الحديد و المنجنيز) و تساقط يونيو و نسبة المواد الصلبة الذائبة و الحموضة ونسبة المواد الصلبة الذائبة إلى الحموضة ، وكذلك فيتامين ج .