RESULTS AND DISCUSSION

IV. RESULTS AND DISCUSSION

IV.I. First experiment: Effect of different salt concentration, sodium adsorption ratio (S.A.R.) and chloride level (Cl:SO₄ ratio) in irrigation water on transplants of three olive cultivars:

In this regard specific and interaction effects of four factors i.e., (a) olive cultivar (Coronaiki, Manzanillo and Aghizi), (b) salt concentration (control, 2000, 4000 and 6000 ppm), (c) sodium adsorption ratio (SAR-3 and 6), and (d) low and high Cl:SO₄ ratio, as well as their combinations were investigated pertaining the response of the following measurements:

IV.I.I. Vegetative growth:

IV.I.I. Stem, root and total plant length (cm):

Data obtained during both 2000 & 2001 experimental seasons are presented in Table (3).

A- Specific effect:

Concerning the specific effect of the different factors involved in this studies i.e., olive cultivars, salinity concentrations, sodium adsorption ratio (S.A.R.) and chloride level (Cl:SO₄ ratio) on stem, root and total plant length (cm), data obtained in Table (3), showed that Coronaiki transplants had statistically the greatest values of three growth measurements followed in a descending order by Aghizi cvs. and Manzanillo cvs. during 2000 and 2001 seasons.

Regarding the specific effect of salinity concentration, data obtained revealed that three investigated rates (2000, 4000 and 6000 ppm) saline solutions resulted in an obvious decrease below control (tap water) in stem, root and total plant length (cm.) of olive transplants during two seasons. Such decrease was significant as compared to those of tap water irrigated transplants. On the other hand, the most depressive effect was always concomitant to the highest concentration i.e., 6000 ppm during both seasons of study; however, the 2000 ppm saline solution exhibited the lowest decrease. Meanwhile, the 4000 ppm concentration was intermediate in this concern, whereas differences between the three salinity concentrations were significant as each was compared to two other ones during two seasons of study. The obtained results, regarding the specific effect of salt concentration in irrigation water are in agreement with that reported by Wilcox et al., (1951) they mentioned that salinity of soil solution may affect growth of plant in two ways: 1st the osmotic pressure of the solution may be high enough to limit the availability of water to the plant or 2nd high concentration of salts in the solution may facilitate the uptake of one or more of the presentations so that an accumulation may result and cause a derangement of the normal metabolism of the plant. In addition, Pokroveskey, (1957) found that in glycophytes both cell division and cell elongation were inhibited with increased salinity. However, Antipov, (1958) showed that the smaller size of alfalfa plants grown in saline areas, due to reduction in cell number rather than in cell size.

Moreover, Makhija et al., (1980) found that rising salinity levels (above 7.5 mmhos/cm conductivity of saturation extract) causing growth reduction on guava seedlings. They found that accumulation of Cl and Na in toxic concentration in plant tissues and nutrient imbalance were the main effects of salinity. Behairy et al., (1984) on Thompson seedless and American grape plants, Khamis et al., (1984) on guava and olive seedlings, Ikram et al., (1992) on Manzanillo and Picual olive cvs., El-Said et al., (1995) on some olive cultivars Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings, they found that stem length was depressed by raising salinity concentrations.

Concerning the specific effect of sodium adsorption ratio (S.A.R.), it is quite clear that increasing S.A.R. from 3 to 6 in irrigation water resulted significantly in depressing the stem, root and total plant length (cm.) of olive transplants during two seasons of study. Similar observation was also found by El-Deen et al., (1979) on olive seedlings, Behairy et al., (1984) on Thompson seedless and American grape, Khamis et al., (1984) on guava and olive seedlings, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings, they found that increasing sodium adsorption ratio (S.A.R.) resulted in significant reduction of stem, root and plant length.

As for the specific effect of the chloride level (Cl:SO₄ ratio) of saline solution used for irrigation on stem, root and plant length, it could be noticed from data in Table (3) that the higher ratio in irrigation water resulted significantly decreasing

in stem, root and plant length of olive cultivars during two seasons of study. In this respect, **Omar**, (1996) on apricot and mango seedling and **Abd El-Mageid**, (1998) on almond seedlings reported that increasing Cl:SO₄ ratio significantly decreased stem, root and plant length. On the other hand, **Abd El-Aziz** et al., (1985) on some citrus rootstock seedlings and **Kabeel**, (1985) on some deciduous fruit species, they found that increasing Cl:SO₄ ratio did not affect stem length.

B- Interaction effect:

Referring the interaction effect of the four investigated factors i.e., olive cultivars, salinity concentration, S.A.R. and Cl:SO₄ ratio on both stem and root length as well as total plant length, data in Table (3) showed obviously avariable response of olive transplants to the different combinations during two seasons of study. The most depressive effect regarding stem, root and plant lengths was exhibited by such combination of Aghizi transplants irrigated with the highest salinity concentration (6000 ppm) x S.A.R. 6 x higher Cl:SO₄ ratio, during 2000 and 2001 experimental seasons. On the other hand, the least decrease in stem, root and plant length below the analogous ones of control was detected by Coronaiki transplants irrigated with 2000 ppm saline solution of S.A.R.-3 and lower Cl: SO₄ ratio as compared to those continuously irrigated with tap water during 2000 and 2001 seasons. Other combinations were in between the aforesaid two extremes.

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Total plant of length (cm) Coron. Manz. Aghizi 2.26g	12.25c 40.15h 32.12et 38.18A 20.000			gation I reaminis
Total plant of length (cm) Coron. Manz. Aghizi	2000 21.20.20 06.85, 89.46b 72.26g	-	Chichara	•
Total plant of length (cm) Coron Manz Aghizi	Aghizi	Vian	C. Hively	/
	Coron. Manz Aghizi	oinations in Sailing	nd their comb	SAR; Cl:SO4 a
		· · · · · · · · · · · · · · · · · · ·	חנן; ויטטר אווים ני	ble (3): Plant heigh

*, **,*** and **** means refer to specific effect of olive exx.salinity concentration. SAR and Cl.SO4 ratio, respectively. Values within the same column or row for any of four investigated factors, followed by the same letter's were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

IV.I.I.2. Number of laterals and leaves per plant:

Concerning the specific and interaction effects of four investigated factors (olive cultivar; salinity concentration; sodium adsorption ratio (S.A.R.), chloride level (CI:SO₄ ratio) and their combinations on number of both laterals and leaves per plant, data obtained during both 2000 and 2001 seasons are presented in Table (4).

A- Specific effect:

With regard to the specific effect of cultivar, data obtained during two seasons displayed that the response of both parameters (Nº of laterals and leaves/plant) followed typically the same trend. Whereas, Coronaiki cvs. was statistically the superior discendingly followed by Manzanillo and Aghizi cvs. which ranked statistically last during two seasons of study. The same trend was found partially by **Ikram** *et al.*, (1992) on olive seedlings.

As for the specific effect of salinity concentration, data obtained revealed that any of the three investigated saline concentration (2000, 4000 and 6000 ppm) resulted in an obvious decrease in laterals and leaves per plant during 2000 and 2001 experimental seasons. Such decrease was significant as compared to those of tap water irrigated transplants. On the other hand, the 6000 ppm saline solution resulted significantly in the greatest injurious for number of both laterals and leaves per plant.

Such decrease in number of laterals and leaves with higher concentration of salinity levels were more remarkable in different fruit crops, as reported by **Pandey and Divate**, (1976) on grapevine, Sari-El-Deen et al., (1979) on olive seedlings, Abd El-Karim, (1991) on mango varieties, Sweiden et al., (1982) on apricot Kabeel, (1985) on some deciduous, Ikram et al., (1992) on olive seedlings, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings. They mentioned that, number of leaves per plant decreased considerably with increasing salt concentration in irrigation water.

Regarding the specific effect of sodium adsorption ratio (S.A.R.), data in Table (4) revealed that the higher ratio S.A.R.-6 resulted significantly in depressing both number of laterals and leaves per plant than the lower one i.e., S.A.R.-3 in olive transplants during the two seasons of study. These results are in conformity with the findings of Sari-El-Deen et al., (1979) and Ikram et al., (1992) on olive plants, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond plants. They found that increasing S.A.R. in irrigation water resulted in significant reduction in number of leaves per plant.

With regard to the specific effect of Cl:SO₄ ratio of saline water used for irrigation on both number of laterals and leaves per plant, it could be observed from data in Table (4) that the higher ratio resulted in a significant decrease in number of laterals and leaves than lower one during the two seasons of study. These results are in conformity with the findings of **Kabeel**, (1985) on some deciduous fruit seedlings, **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond seedlings.

Tables (4): Number of leaves and laterals/plant of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations: SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

1.693 ₀ 1.557 _{pq} 1.277 _s 1.027 _u 0.917 _v 0.777 _w 1.880C	1	Low=2.32		SAR and Clisc	concentration	latters	by the same	followed	effect values of each lowed by the same letters was concentration of SAR and C. S. H. Low = 2.32A Live 2.499
1.693o 1.557pq 1.277s 1.027u 0.917v 0.777w 1.880C	9.A	SAK 3=2.3		High=70.71		IVE CVS - salinity	effect of o	to specific	Ul investigated f
1.6930 1.557pq 1.277s 1.027u 0.917v	2.06B	A.CC.2	73B	SAR 6=69.7		Low=73 65	-	304)	**************************************
1.693o 1.557pq 1.277s 1.027u	1.027 _u	167.1		60.02C	JA COD	SAR 3=74 67 A		2	Mean*** (CLC)
1.693o 1.557pq 1.277s 1.027;	1.22st	1.4/1		42.79z	+	+			Meanan (C.S.)
1.693o 1.557pq	1.285	1.58pq	53.72D	_	50.61m	_	High cl	L	Mean*
1.6930	1.53gr	1.61p		47.77x	20.491	+	1	SAR 6 L	
1000	1.72no	1.75no		50.76w	60.02r	60.34		-	6000 ppm
1.033Im	1.78mn	1.861		52.74v	62.38q	64 11	7	SARTI	
1.9/3K	1.97	2.00k	65.150	55.731	65.910	66.636 mec.o.	High cl	-	
2.1931	2031	2.19		57.72s	68.26n	70 30	Ow c	SADE	
2.3331	2.33	2.39		60.71	71.791	72 011:	High cl	_	4000 ppm
US/70:4	2 47h	2.72f		62.69g	/4.15	30.20	Low c	SADE	
2 577.1	2.562	3.00e	76.59B	65.680	77.68h	79 200	High cl	-	
2000	2.100	3.47d		67.68n	80.03g	30115	Low c	SARA	
3 582	3.83b	5.08a	AIC.PLL	70.66m	83.56f	85.48	High cl	-	2000 ppm
2.4.1. T. 11211.			11/2	99.52c	969.777	PSC 08	Low cl	SAR	
Hid	.38A	LOW=2.38A		2001	1	125.719		Outtrol)	Les (Control)
SAR 6=2 11D	2.48A	3AK 3=2.48A	0.90B						Tan water (
1.86C	4.11B	S.D.	69.97B	SAK 6=69.97B	54A	Low=73.54A		10000	
0.72p	0.770	2.424		300.00	74.47A	SAR 3=74.47A		CISO	Mean (Cl.SO.)
0.75p	1.000	1.25n		700.09	70.55B	7.27A		(SAR)	Mean*** (SAR)
0.///p	200	1.47m		45 38-	52.85vw	1869.70		Cvs.)	Mean* (Cvs.)
1.000	1 227	1.50m	55.56D	47.370	55.06u	57.50	High cl	JAK 6	
1.223n	13	1.751		49 160	57.251	007.700	Ow C	645	
1.4/m	1.53m	1.781		52.00w	60.56qr	62.70	High c	CARA	6000 ppm
1./8	175	2.00k		53.89v	62.76p	66.730	Low cl	SADO	
2.027k	1 971	2.03k	66.130	56 731	66.070	(2.36)	High c	SAK 6	
2.28	3000	2.28		28.63	68.26n	Ť	I man	2	
2.47	0 10 10 10 10 10 10 10 10 10 10 10 10 10	2.53	\dagger	61 460	71.57lm		High	SAIAS	4000 ppm
+	2 52	2.75h		63.35n	73.77k	1	-	0,00	
_	2.94fc	3.25e	76.98B	66.180	77.08j	2000		O ANG	
+	3 226	3.53d		68.07n	/9.28	1	\neg	SADA	
+	4.286	5.28a	A74.001	70.91m	82.58g	86.83	High c		2000 ppm
		1	100 45	94.55c	411.011	1	_	SAR 3	
Aghizi	aut.	-	ŀ	2000		120.60a		. ap water (Control)	BIEM du
	_	Coron	Mean**	rang.	-				Ton
Number of laterals/plant	Number	+	\dashv	Aghiri	Manz	Coron	//		Silburas
		1	ol leaves/plant	- vullber of leaves/plant	Tagnimy.		Cultivars	/	Irrigation Treaming

RESULTS AND DISCUSSION

B-Interaction effect:

Regarding the interaction effect of the investigated four factors i.e., olive cultivars, salinity concentration, S.A.R. and Cl:SO₄ ratio of saline water used for irrigation on number of laterals and leaves/plant, Table (4) shows a considerable and statistical effect in both seasons of study, where the most depressive effect on both number of laterals and leaves/plant was in closed relationship to transplants irrigated with the highest salinity concentration (6000 ppm) with higher S.A.R.-6 and Cl:SO₄ ratio, however the least decrease in number of laterals and leaves/plant was detected by Cronaiki transplants irrigated with 2000 ppm saline solution with S.A.R.-3 and lower Cl:SO₄ ratio as compared with plants irrigated with either tap water (control) or other saline solutions during the two seasons of study. Other combinations were in between the aforesaid two extremes. The same finding was obtained by Kabeel, (1985) on some deciduous fruit seedlings, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings.

IV.I.I.3. Average leaf area and total assimilation area/plant:

The average leaf area and total assimilation area per plant estimated in Cm² in response to specific effect of olive cultivars, salt concentration, S.A.R. and Cl:SO₄ ratio as well as interaction effect of their combinations were investigated. Data obtained during both 2000 and 2001 experimental seasons are presented in Table (5).

A- Specific effect:

Table (5) displays that both parameters responded specifically to olive cultivar, whereas, Aghizi was the superior while Manzanillo was the inferior. The response was pronounced with both average leaf area and total assimilation area/plant, whereas, differences were significant as three cultivars were compared each other during both 2000 and 2001 experimental seasons.

Referring the specific effect of salinity concentration, obtained data exhibited that both leaf area and assimilation area per plant followed typically the same trend of response. Anyhow, it was quite clear that all three investigated saline concentrations (2000, 4000 and 6000 ppm) resulted in an obvious decrease in both leaf area and assimilation leaf area (cm2) during $1^{\underline{st}}$ and $2^{\underline{nd}}$ seasons. Such decrease was significant as compared to those of tap water irrigated olive transplants. On the other hand, the most depressive effect was always in concomitant to the highest concentration i.e., 6000 ppm during both seasons of study; however, the 2000 ppm saline solution exhibited the lowest decrease. Meanwhile, the 4000 ppm concentration was intermediate in this concern, whereas differences between the three salinity concentrations were significant as each was compared to two other ones during first and second of study. These results are in coincident with the finding of El-Said et al., (1995) on olive cvs. Bernstein, (1965) reported that the reduction in leaf growth probably may be due to either increasing osmotic pressure, which paralleled to depress of

water absorption, or excess of certain ions which seem to have specific toxic impact especially sodium.

Salem, (1981) on grapevine proved that salinity had a general depressing effect on leaf formation and this may be due to the physiological hunger (Russell, 1961) or metabolic disturbance (Gale et al., 1967) and/or may be to the physiological drought stress (Shannon, 1984).

Concerning the specific effect of sodium adsorption ratio (S.A.R.), it is quite clear that increasing S.A.R. from 3 to 6 in irrigation water resulted significantly in depressing the average leaf area and total assimilation leaf area/plant during the two seasons of study.

As for the specific effect of the Cl:SO₄ ratio of saline solution used for irrigation on average leaf area and assimilation leaf area (cm²), it could be noticed from data in Table (5) that (increasing Cl:SO₄ ratio in irrigation water reduced significantly both average leaf area and total assimilation area during two seasons of study.

B-Interaction effect:

Referring the interaction effect of the investigated four factors i.e., olive cultivar, salinity concentration, S.A.R. and Cl:SO₄ ratio on the average leaf area and assimilation leaf area/plant, data obtained in Table (5) showed that the most depressive effect was coupled with combination represented irrigation Manzanillo transplants with 6000 ppm saline solution of S.A.R.-6 and higher Cl:SO₄ ratio, whereas the lowest average leaf area and assimilation leaf area were resulted. On the other hand, the lowest decrease in both average leaf area and

Tables (5): Total assimilation and average leaf area (cm2) of olive transplant in response to specific and interaction effects of olive cultivars;salt concentrations; SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

Tap wat: 2000 ppm 4000 ppm 6000 ppm	Tap water (Control)	3 Low cl High cl Cow cl High cl Low cl High cl Low cl High cl Low cl Low cl Low cl High cl	534.24a 372.62c 1 342.09d 317.67e 289.53f 267.28g 241.49hi 221.16k 197.72mn 179.07op 158.22qr	343.22d 339.44ij 219.87kl 219.87kl 204.06m 186.23n 171.66p 155.14r 141.82st 127.00uv 114.93v 101.43w	2000 504.74b 351.85d 322.70e 300.14f 275.24e 252.19h 228.03ik 208.58lm 186.64no 168.97pn 149.45n	460.73A 293.29B 199.89C		4.58a 4.26c 4.07d 3.89e 3.70fg 3.52h 3.52h 3.16kj 3.16kj 3.16kj 2.97m-o	12 12 10	4.58a 4.26c 4.07d 4.07d 3.89e 3.70fg 3.52h 3.52h 3.34jj 3.16kl 2.97mo
Mean Mean	Mean* (Cvs.) Mean*** (SAR)	High cl	125.42uv 260.60A SAR 3=	5.42uv 80.62x 0.60A 175.09C SAR 3=262.79A	118.57v 246.04B SAR 6=	NOSE NOSE	/ /	3 22 12	3 22 12	2.42m 2.24vw 3.35A
Fater (Tap water (Control)		Low	Low=255.20A	High=232.64B 2001	32.64B		SAR 3= Low=3	SAR 3=3.31A Low=3.24A	\mathbb{H}
2000 Tap Water	SAR 3	Low cl	500.76a 332.91c	334.73c 223.27m	486.45b 324.49d	440.65A		4.13a	HI	3.36g 3.9
1	SAR 6	Low cl	306.02e 283.75g 258.44i	204.83o 190.25p 172.62q	297.45f 275.74h 251.10j	260.07B	. 1	3.72d 3.55e	-	-
	SAR 6	High cl Low cl High cl	214.59n 195.93p 175.00g	143.53s 130.95u 116.91w	208.41no 190.46p 169.66a	181.13C	1 1 50 1.	3.22h 3.05jk 2.89j	+	+1
6000 ppm	SAR 6	High cl	139.18st 124.12v	92.99 ₃ , 83.00 ₂	153.65r 135.20tu 120.73vw	116.82D	112 12	2.56p 2.39r	+	+
Mean* (C	(Cvs.)	rugn ci	109.36x 233.53A	73.32z 156.25C	106.60x	$iggl\{$	2.11uv	N 33	1.81y 1.71z	-
Monney	SAK)	1	SAR 3=237.64A	7.64A	SAR 6=207.14B	u	13.	3.07A	2.500	2.500 2.
Mean*** (S	(Cl:SO ₄)		A70.074	.02A	High=214.15R	ISB	- 1	I named to	A POOL	11gh=214,15B

*, **,*** and **** means refer to specific effect of olive cvs., salinity concentration.' SAR and Cl:SO4 ratio, respectively. Values within the same column or row for effect values of each investigated factor but small letters for interaction of their combination.

assimilation leaf area were detected by Aghizi transplants irrigated with 2000 ppm saline solution of S.A.R.-3 and lower Cl:SO₄ ratio as compared to those continuously irrigated with tap water during 2000 and 2001 seasons. Moreover, other combinations were in between the aforesaid two extremes.

IV.I.I.4. Leaves fresh and dry weights per plant:

Data obtained during both experimental seasons of 2000 & 2001 regarding the specific and interaction effects of four investigated factors (olive cultivar; salt concentration; S.A.R. and Cl:SO₄ ratio), as well as their combinations are presented in Table (6).

A- Specific effect:

With regard to the specific effect of olive cultivar, tabulated data in Table (6) show that both parameters (fresh and dry weight) followed typically the same trend. Hence, Coronaiki transplants had the greatest leaves fresh and dry weights, while Manzanillo transplants had the lightest values and Aghizi cultivar was in between during 2000 & 2001 seasons. In this respect, El-Said et al., (1995) showed a wide variations, between Rosciolo, Boutellan, Nabal, Mission, Wordan Kronaki, Toffahi, Manzanillo, Mostazal, Aghizi, Picual, Verdale, Pocama and Hamed olive cvs. regarding their salt tolerance.

Concerning the specific effect of salinity concentrations, data obtained revealed that, the leaves fresh and dry weights were gradually decreased by increasing the level of salinity concentration in irrigation water. Such decrease was significant as compared to those of tap water irrigated olive transplants. Herein, the greatest loss in leaves fresh and dry weight was

noticed at the highest salt concentration (6000 ppm) during two seasons of study. However, the 2000 ppm saline solution showed the lowest loss in the fresh and dry weights of leaves during 1st and 2nd seasons. In addition, 4000 ppm concentration was intermediate in this concern during two seasons of study, whereas, differences between the three salinity concentrations (2000, 4000 and 6000 ppm) were significant as each was compared to the two other ones for both fresh and dry weight of leaves on olive transplants during 2000 & 2001 seasons.

The obtained results are in line with those mentioned by Taha et al., (1972); Khamis et al., (1984) and El-Din et al., (1992) on olive. Such reduction in plant growth might be due to low available water for tissue development rather than deficiency of inorganic nutrient supply (Copper et al., 1952 and El-Gabaly, 1958).

Regarding the specific effect of sodium adsorption ratio (S.A.R.), data in Table (6) clear that increasing it from 3 to 6 in irrigation water caused significant decrease in leaves fresh and dry weights of olive transplants during the two seasons of study. These results are in harmony with the findings of **Behairy** et al., (1984) on Thompson and American grape plants, **Kabeel**, (1985) on some deciduous fruit seedlings, **El-Khateeb**, (1989) on fig plants, **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond seedlings, who found that increasing (S.A.R.) resulted in a significant reduction in fresh and dry weights of leaves.

With respect to specific effect of chloride levels (Cl:SO₄ ratio) of saline solution used for irrigation on fresh and dry

weights of leaves, data are in Table (6). It could be noticed that leaves fresh and dry weight presented significantly decreased by increasing Cl:SO₄ ratio in irrigation water during two 2000 & 2001 seasons. These results are in agreement with **Kabeel**,(1985) on Thompson seedless grape, Meet Ghamr peach and Hollywood plum seedlings, **El-Khateeb**, (1989) on fig plants, **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants.

B- Interaction effect:

As for the interaction effect between olive cultivar; salt concentration, sodium adsorption ratio (S.A.R.) and chloride level (Cl: SO₄ ratio) on fresh and dry weights of olive leaves it is quite clear that the most depressive effect on leaves fresh and dry weights was exhibited by combination between Manzanillo cultivar x highest salinity concentration (6000 ppm) x S.A.R.-6 x higher Cl:SO₄ ratio. Whereas, the lower decrease of leaves fresh and dry weights was detected by Coronaiki transplants irrigated with 2000 ppm saline solution of S.A.R.-3 and lower Cl: SO₄ ratio during both 2000 and 2001 seasons. Moreover, other combinations were in between the aforesaid two extremes. These results are similar to that achieved by Kabeel, (1985) on some deciduous fruit species, El-Khateeb, (1989) on fig plant, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings.

Tables (6): Leaves fresh and dr. weight (gm.) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl: SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

Irrigation Treamtnts		Cultivars	Coron	Mana	Manu	4	\dagger	Leave dry	Leave dry weight (gm.)	
The street of th		V	COLOIL	NIBINZ	Aghizi	Mean**	Coron	Manz	Aghiri	\dashv
Tan water	Control				2000		ŀ	-	- Carried	Warv.
June day	and marce (Control)		26.218	20.77g	22.41d	72 124	200			
	SAR 3	Low cl	24.63b	19.52	21 06f	43.13A	6.78a	5.30f	5.69e	5074
2000 ppm	T	+	23.84c	18.90k	20.39h		6.37b	4.981	5.34f	1
	SAR 6	Low cl	22.53d	17.86m	19.27	20.47B	6.17c	4.82jk	5.17g	
	+	╆	21.75	17.240	18.591		5.82d	4.55m	4.89ij	5.24B
	SAR 3	Low cl	20.44h	16.20g	17.48no	1	5.62e	4.39n	4.72	
4000 ppm		+-	19.65	15.58	16.80n		5.28f	4.13p	4.43n	1
	SAR 6	Low cl	18.341	14.541	1560-	16.77C	5.08h	3.979	4.260	
		High cl	17.55n	13.91u	15.016		4.741.1	3.70s	3.98g	4.290
	SAR 3	Low cl	16.24q	12.87w	13.00.		4.54m	3.55t	3.807r	
6000 ppm		High cl	15.45r	12.25x	13.21v		4.20op	3.28u	3.521	
	SAR 6	Low cl	14.15u	11.21y	12.10x	13.06D	3.99q	3.12v	3.35u	,
Mean*	Cor	tright Ci	13.36v	10.592	11.42		3.66s	2.85w	3.07v	3.341)
~1			19.55A	15.50C	16.72B		104.0	2.69x	2.897w	
Magness	(SARC)		SAR 3=18.47A	18.47A	SAR 6	SAR 6=16 88D	ACO.C	3.95C	4.24B	
	((1:504)		Low=17.97A	7.97A	High	High=17 700	SAR 3-4.73A	4.73A	SAR 6=4.32B	4 32R
an water					2001	COOL	LOW=	LOW=4.60A	High=4.45B	1.45B
miss (Collifor)	Control)		25.50a	20.41h	22.35d	37 75				
						44. /JA	0.078	5.281	P18'5	5.89A
2000	SAR 3	Low cl	24.22b	19.38j	21.23f		200			
2000 ppm		targer CI	23.45c	18.77k	20.55h	2 000 0000	0.240	5.01)	5.52g	
	SAR 6	LOW CI	22.17d	17.75m	19 43;;	20.41B	0.040	4.851	5.34h	
		rugh Ci	21.66e	17.34n	18.99		5.72e	4.59n	5.05j	S728
	SAR 3	Low cl	20.90g	16.73op	18 371		186.6	4.480	4.941	
4000 ppm	+	High cl	19.63	15.71q	17.20n		5.39h	4.32p	4.76m	
	SAR 6	Low cl	18.86k	15.10s	16.53p	17.17C	3.03j	4.06q	4.470	
	+	La udita	17.59m	14.08u	15.411		4.861	3.90r	4.30p	4.440
6000	SAR 3	High cl	15.820	13.47v	14.741		4335	3.041	4.01g	
mdd ooo	+	on of	1DCC:CT	12.44x	13.63v		4010	3.480	3.83s	
	SAR 6	High cl	13./81	11.83y	12.96w	13.53D	3810	3.22W	3.540	3 581)
Mean* (C	(Cvs.)		10 50	210.01	11.84v		3 480	3.00%	5.5 /V	
- 1	(SAR)	+	AKE.CI	15.68C	17.17B	\bigvee	5.054	3.775	3.08X	
Mean**** /	1.60		3AK 3=18.62A	£62A	SAR 6=17.09R	7,000	20000	4.130	4.46B	\langle
10000	(CT:304)	-	Lon=18.26A	26A	High=17 440	440	SAR 3-4.82A	.82A	SAR 6=4.47B	47B
日日 - こに 野野トト	,					-	LOW-1	2A	Low=4.72A	

for any of four investigated factors. followed by the same letter's were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination. respectively. Values within the same column or row

IV.I.I.5. Stem, roots and total plant fresh and dry weights:

Data obtained regarding the specific effect of olive cultivar, salt concentrations, S.A.R. and Cl:SO₄ ratio as well as interaction effect of their combinations on stem, roots and total plant fresh and dry weights are presented in Tables (7, 8 and 9).

A- Specific effect:

Tables (7, 8 and 9) show that Cronaiki transplants had the heaviest stem, roots and total plant fresh and dry weights followed in descending order by Manzanillo and Aghizi. However, differences were significant for the fresh and dry weight of stem, roots and total plant for a given cultivar was compared to those of the two other ones.

Concerning the specific effect of salinity concentration, data obtained revealed that, stem, roots and total plant fresh and dry weights were gradually decreased by increasing the level of salinity during two seasons. Such decrease was significant as compared to those of tap water irrigated transplants. On the other hand, the greatest loss in both fresh and dry weight of stem, roots and total plant were resulted by using the highest salt concentration (6000 ppm) during both seasons of study, however, the 2000 ppm saline solution showed the lowest loss in fresh and dry weights of stem, roots and total plant. Meanwhile, the 4000 ppm concentration was intermediate in this concern. Differences between the three salinity concentrations were significant as each was compared to two other ones during two seasons of study. Such results appeared to agree with those obtained by Jindal et al., (1976) on mango cultivar, Rokba et al., (1979) on some citrus rootstocks, Behairy et al., (1984) on Thompson and American grape plants, Gasser, (1986) on Avocado, El-Hawary, (1987) on grape and Abd El-Karim, (1991) on mango seedlings, all found that the dry weight of different plant organs was decreased gradually by increasing the level of salinity in the irrigation water. Such decrease in the plant dry weight, under stress of salinity, may be due to the physiological hunger (Russel, 1961).

With respect to the specific effect of sodium adsorption ratio (S.A.R.), it was quite clear that increasing S.A.R. from 3 to 6 in irrigation water significantly decreased fresh and dry weights of stem, roots and total plant during 2000 and 2001 seasons. These results are in agreement with those reported by **Khamis** et al., (1984) on guava and olive seedlings, **Behairy** et al., (1984) on Thompson and American grape plants, **Kabeel**, (1985) on some deciduous fruit species, **Omar**, (1996) on apricot and mango seedlings.

Regarding the specific effect of the CI:SO₄ ratio of saline solution used for irrigation on fresh and dry weights of stem, roots and total plant of olive transplants data are presented in Tables (7, 8 and 9). It is clear that the fresh and dry weights of stem, roots and total plant decreased significantly by rising CI: So₄ ratio during 2000 and 2001 seasons. This results are in general agreement with the findings of Abd El-Aziz, et al., (1985) on some citrus rootstocks and Kabeel, (1985) on some deciduous fruit species.

B-Interaction effect:

As for the interaction effect of the four investigated factors i.e., olive cultivar, salinity concentration, S.A.R. and Cl:SO₄ ratio, on fresh and dry weights of plant organs (stem, roots and total plant) Tables (7, 8 and 9) clear that the specific effect of each investigated factor was reflected on its various combinations. Herein, the heaviest fresh and dry weights of stem, roots and total plant were significantly in closed relationship with Coronaiki transplants irrigated with 2000 ppm saline solution of S.A.R.-3 and lower Cl:SO₄ ratio during 2000 and 2001 seasons. On the contrary, Aghizi transplants under saline solution at 6000 ppm x S.A.R.-6 with higher Cl:SO₄ ratio were the inferior as fresh and dry weights of their stem, roots and total plant were concerned. Such trend was true during both seasons of study. Moreover, other combinations were in between the aforesaid two extremes. This result is similar to that achieved by Kabeel, (1985) on some deciduous species, El-Kateeb, (1989) on fig plants, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond plants.

The reduction in fresh and dry weights of olive transplants organs (leaves, stem, roots and total plant) under three levels of salinity might be attributed to osmotic pressure of the substrate which may restrict the uptake of water by plant roots (Hayward and Spur, 1943) or may due to the absorption of particular ions from the saline medium to a toxic accumulation or to decrease of essential nutrients (Wodleigh and Goush, 1944). In addition, Greenway, (1963), suggested

that such growth reduction was due to the drastic changes in the ion relationship of plants.

From the above results one may conclude that growth of olive transplants, as being indicated from the values of fresh and dry weights of plant organs (leaves, stem, roots and total plant) stem length, root length number of leaves and/ or laterals per plant have been adversely affected by the application of saline solution which may lead to the suggestion that salinity induced earliness of plant senescence, as a result of the accumulation of toxic levels of some ions (Na⁺ and/ or Cl⁻) this may adoptive mechanism in olive to retranslocate excess amount of Na and/or Cl⁻ out of younger leaves to the older leaves to put them away from the physiologically active tissues, (Winter, 1982). On the other hand, the control plants (non-stressed plants) did not show such decline in their plant organs fresh and dry weight, probably because of the balanced ion composition in their tissues.

Moreover, the reduction of growth with increased values of osmotic pressure (O.P.) of the external nutrient solution has been reported by **Bernstein and Hayward**, (1958), who indicated that the degree of reduction in growth caused by water stress in the same weather, the total soil moisture stress composed mainly of tension or osmotic components. They suggested that salinity like drought may reduce the water potential of plant cells on the plant that the cells, or one or both of its components osmotic potential and pressure potential (turgor pressure) became limiting to growth.

Slatyer, (1961), showed that when plants are exposed to osmotic substrates, a sufficient amount of the substrate is

Tables (7): Stem fresh and dry weight (gm.) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

10.59a 9.08ef 10.76a 8.90f 10.32b 8.26hi 9.99c 7.26m 8.46h 6.59q 7.25m 5.72hu 6.48pq 5.35wx 8.80A 5.25wx 5.66m 7.73h 6.59c 7.60jk 8.92f 7.60jk 8.92f 7.60jk 6.99mm 5.68t 6.24b 5.31u 6.59c 7.42k 5.95qr 6.95mm 5.68t 6.24b 5.31u 6.59c 5.38u 6.25A 7.25B 5.25ar 5.2	1	- Chris	Lon=20.73A	Lou		(0.3.5)	Mean
10.99a 9.08ef 7.73kl 9.2* 10.76a 8.90f 7.57l 10.76a 8.90f 7.57l 10.32b 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.52d 7.90jk 6.48pq 9.22e 7.62kl 6.48pq 8.79fg 6.99m 5.95st 8.01ij 6.65pq 5.40v 7.69kl 6.35qr 5.40v 6.92no 5.35wx 4.55z 6.48pq 5.25wx 4.55z 6.48pq 7.28B 6.19C 8.80A 7.28B 6.19C 8.80A 7.28B 6.19C 9.68d 8.88f 7.42k 10.00c 8.88f 7.42k 10.00c 8.91e 7.66j 7.69i 10.00c 8.91e 7.69i 7.28i 10.00c 8.91e 7.43k 10.00c 8.91e 7.69i 6.89n 9.25e 7.60jk 6.36p 9.25e 7.60jk 6.05q 8.50g 7.23l 6.05q 8.50g 7.23l 6.59o 9.25e 7.69k 6.36p 9.25e 7.69k 6.36p 9.25e 7.50jk 6.35p 9.25e 7.50jk 7.50jk 9.25e		Ulaha	SAR 3=21.03A	SAR		(SAP)	14,000
10.59a 9.08ef 7.73kl 9.2* 10.59a 8.90f 7.57l 10.32b 8.53gh 7.26m 10.32b 8.53gh 7.26m 9.99c 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.22c 7.62kl 6.48pq 9.22c 7.62kl 6.48pq 8.79fg 7.26m 5.54vv 7.59kl 6.63pq 5.40v 7.59kl 6.53pq 5.40v 7.59kl 6.53pq 5.40v 7.25m 5.99kl 5.09kl 6.48pq 5.35wx 4.88y 6.48pq 5.35wx 4.55z 6.48pq 5.35wx 4.75w 6.59n 9.16e 7.66j 5.82rs 10.76a 9.16e 7.66j 7.27i 10.00c 8.24h 6.89n 9.25e 7.60jk 6.35p 8.50g 7.23l 6.05q 8.50g 7.23l 6.05q 8.50g 7.23l 6.59o 8.51h 6.59o 5.28u 7.42k 6.32p 4.75w 6.66o 5.31u 4.44x 6.67C 6.67C 8.52A 7.25B 5.67 5.68 5.67C 5.68 5.67C 6.67c 5.68 6.67C 5.68 6.67c 6.67C 6.68 5.69 6.67c 6.67c 6.68 5.69 6.67c 6.67c 6.67c 6.67c 6.68 5.69c 6.67c 6.67c 6.68 5.21c 6.67c 6.67c 6.68 5.21c 6.67c 6.67c 6.68 5.21c 6.69c 5.21	SAR 6=19.54B	SAR 6	33.054	200.02		1. (CAS.)	Mean,
10.59a 9.08ef 7.73kl 9.2*	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	16.57C	19.87B	t	High ci		
10.59a 9.08ef 7.73kl 9.2*	8.53A	12.13z	14.54vw	17.08g	_	SAR 6	6000 ppm
10.99a 9.08ef 7.73kl 9.2*	_	12.97y	15.5511		High cl	SAKS	
10.59a 9.08ef 7.73kl 9.2* 10.76a 8.90f 7.57l 10.32b 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.92e 7.62kl 6.49pq 9.22e 7.26m 5.95st 8.01ij 6.63pq 5.40v 7.69kl 6.35qr 5.40v 7.25m 5.99st 5.09sv 6.92no 5.35wx 4.55z 6.48pq 7.28B 6.19C 8.80A 7.28B 6.19C 8.80A 7.28B 6.19C 10.76a 9.16e 7.66j 10.76a 9.16e 7.65j 10.76a 9.16e 7.43k 10.00c 8.88f 7.43k 10.43b 8.88f 7.43k 10.00c 8.24h 6.89n 9.25e 7.60jk 6.36p 8.92f 7.60jk 6.36p 8.92f 7.63i 6.59o 8.17h 6.59o 5.52rs 7.74ij 6.59o 5.52rs 5.52r 4.98v 5.52rs 6.52r 4.98v 6.89n 7.42k 6.52r 4.98v 6.52r 4.98v 6.85v 6.52r 4.98v 6.85v 6.52r 4.98v 6.85v 6.52r 4.98v 6.85v 7.21k 6.52r 4.98v 7.22k 6.52r 7.22k 6.52r 4.98v 7.22k 7.22k 7.22k 7.22k	15 97D 6.99min	13.59x	16 305		2 Low cl	2	
10.79a 9.08ef 7.73kl 9.2	7.42k	14.43w	17300	T	High cl	SAKO	
10.59a 9.08ef 7.73kl 9.2	7./41	15,06uv	18.060		-	2	4000 ppm
10.59a 9.08ef 7.73kl 9.2 10.37ba 8.90f 7.57l 10.32b 8.53gh 7.26m 8.5 10.32b 8.26hi 7.03mm 9.99c 8.26hi 7.03mm 9.99c 7.62kl 6.49pq 9.22e 7.62kl 6.48pq 9.22e 7.62kl 6.63pq 5.40v 8.01ij 6.63pq 5.40v 7.69kl 6.63pq 5.40v 7.25m 5.95st 5.95st 6.92no 5.72tu 4.86y 7.25m 5.95st 4.86y 6.92no 5.72tu 4.55z 6.48pq 5.35wx 4.55z 6.48pq 5.35wx 4.55z 6.48pq 5.35wx 4.55z 6.48pq 5.35wx 4.55z 6.48pq 7.28i 6.19C 8.80A 7.28i 5.40v 10.76a 9.16e 7.45k 10.00c 8.88f 7.42k 10.00c 8.51g 7.12lm 9.25e 7.60jk 6.636p 8.92f 7.23i 6.636p 9.25e 7.60jk 6.80m 9		15.90st	19.040	-	_	SAKS	
10.59a 9.08ef 7.73kl 9.2 10.75a 8.90f 7.57l 10.32b 8.53gh 7.26m 8.5 10.32b 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.99c 7.62kl 6.49pq 9.22e 7.62kl 6.48pq 9.22e 7.62kl 6.48pq 9.22e 7.62kl 6.48pq 9.25e 7.69kl 6.59m 5.95st 5.95st 6.48pq 5.54vv 7.25m 5.95st 5.98v 6.92no 5.72tu 4.85v 6.48pq 5.35wx 4.55z 6.48pq 5.35wx 4.55z 6.48pa 7.28B 6.19C 8.80A 7.28B 6.19C 8.80A 7.28B 6.19C 8.80A 7.28B 7.28B 10.76a 9.16c 7.66j 10.76a 9.16c 7.66j 10.76a 8.88f 7.12lm 9.25e 7.61j 6.65q 9.25e 7.61j 6.05q	8.50g	16.53	10.01	24,441	Low cl	;	
10.79a 9.08ef 7.73kl 9.2 10.76a 8.90f 7.57l 10.32b 8.26hi 7.03mn 9.99c 8.26hi 7.03mn 9.99c 7.62kl 6.48pq 9.22e 7.26m 5.95st 6.49pq 9.22e 7.26m 5.95st 6.59qr 5.94v 7.26m 5.95st 5.94v 7.25m 5.95st 5.94v 7.25m 5.95st 5.95st 5.95st 5.95st 5.95st 4.85y 6.48pq 5.35wx 4.55z 7.28B 5.40v 7.40st 7.40s	8.921	17.36q	1108 00	25.526	High cl	DALO	
10.76a 9.08ef 7.73kl 9.2 10.76a 8.90f 7.26m 8.10f 7.25m 8.25gh 7.26m 8.25gh 7.03mn 9.99c 7.62kl 6.49pq 9.22e 7.62kl 6.63pq 5.95st 6.63pq 5.95st	9.25e	17.99p	21 57	26.500	_	6,3	2000 ppm
10.76a 9.08ef 7.73kl 9.2 10.76a 8.90f 7.57l 10.32b 8.53gh 7.26m 8.19gh 7.52hi 9.99c 8.26hi 7.03mn 9.55d 7.62kl 6.49pq 9.22e 7.62kl 6.49pq 8.79fg 7.26m 5.95st 8.01ij 6.63pq 5.40v 7.69kl 6.53qr 5.40v 7.25m 5.72tu 4.85y 6.48pq 5.72tu 4.85y 6.48pq 5.25wx 4.55z 6.48pq 7.28B 5.40v 8.80A 7.28B 5.40v 8.80A 7.28B 5.40v 10.76a 9.16e 7.66i 10.76a 9.16e 7.66i 10.76a 9.16e 7.43k 10.43b 8.88f 7.12lm 10.00c 8.74b 6.89n	-	18.830	320.63	27.380	-	SAKS	
10.99a 9.08ef 7.73kl 9.2 10.75a 8.90f 7.57l 10.75a 8.90f 7.25m 8.39h 7.03mn 9.99e 8.26hi 7.03mn 9.99e 7.62kl 6.49pq 9.22e 7.62kl 6.49pq 9.22e 7.26m 6.18rs 7.26m 5.95st 8.79fg 6.63pq 5.40v 7.09kl 6.63pq 5.40v 7.25m 5.99st 5.09sy 7.25m 5.95st 5.09sy 6.92no 5.72tu 4.86y 6.92no 5.72tu 4.85z 6.48pq 5.35wx 6.19C 8.80A 7.28B 5.08c 6.48pq 5.35wx 6.19C 8.80A 7.28B SAR 6-7.2 8.80A 3-7.83A High=7.33 10.76a 9.16e 7.43k 10.76a 8.81e 7.12lm	23.01B	19.45mm	23.320	28.560	-	G A D	
10.99a 9.08ef 7.73kl 9.1 10.76a 8.90f 7.57l 10.76a 8.53gh 7.26m 8.26hi 7.03mn 9.99e 8.26hi 7.03mn 9.99e 7.62kl 6.49pq 9.22e 7.26m 6.18rs 7.26m 8.79fg 6.63pq 5.95st 8.46h 6.63pq 5.40v 7.69kl 5.99st 5.99st 5.99st 5.99st 5.99st 5.99st 5.99st 6.92no 5.72hu 4.86y 7.26m 6.35qr 5.40v 7.25m 5.72hu 4.85z 6.48pq 5.72hu 4.55z 6.48pq 5.25wx 6.19C 8.80A 7.28B 5.40c 6.48pq 5.25wx 6.92no 5.72hu 4.86y 5.92no 5.72hu 4.85z 6.48pq 5.25wx 6.19C 8.80A 7.28B 5.40c 6.48pq 5.25wx 6.19C 6.48pq 5.25wx 6.19C 7.26h 6.25q 7.26h 7	10.43b	20.2914	24 3 af	29.458		Tap water (Control)	Tan water
9.08ef 7.73kl 9.2 8.90f 7.57l 8.90f 7.26m 8. 8.25hi 7.26m 8. 8.25hi 7.26m 8. 8.26hi 7.03mn 8. 8.26hi 7.03mn 8. 8.26hi 7.26m 5.49pq 6.43pq 5.40tv 6.35qt 5.40tv 6.35qt 5.40tv M 6.45qt 5.	25.15A 10.768	20.921	25 000				
9.08ef 7.73kl 9 8.90f 7.57l 8.90f 7.57l 8.53gh 7.03mn 8.26hi 7.03mn 7.90jk 6.72op 7.62kl 6.49pq 7.62kl 6.49pq 7.62kl 6.58rs 9 7.50m 5.95rs 6.63pq 5.64uv 6.63pq 5.64uv 6.63pq 5.64uv 6.35qr 5.09xy 6.63pq 4.86y 7.28B 6.19C		2001	TOW-TITE	Lon		(Cl:SO4)	Меап***
9.08ef 7.73kl 9 8.90f 7.57l 8.90f 7.57l 8.90f 7.26m 8.26hi 7.03mn 8.26hi 6.72op 7.62kl 6.49pq 7.26m 6.48rs 6.99m-0 5.95st 6.63pq 5.40v 6.63pq 5.40v 6.35qr 5.99xy no 5.72m 4.865z pq 5.35wx 4.865z pq 5.35wx 6.19C pq 5.35wx 6.19C pq 7.28B SAR 6-7.71A High=7.71A High=7.71A		High=20.37B	71 744	0.00		(SAR)	Mean***
9.08ef 7.73kl 9 8.90f 7.57l 8.90f 7.57l 8.53gh 7.26m 8.26hi 7.03mn 8.26hi 7.03mn 7.90jk 6.72op 7.62kl 6.49pq 7.62kl 6.48rs 6.69m-0 5.95st 6.63pq 5.40uv 6.63pq 5.40uv 6.63pq 5.40uv 6.35qr 5.95st 6.35qr 5.95st 9.486y 4.865y 9q 5.72tu 4.86y 9q 5.35wx 4.85z 9q 5.35wx 4.85z 9q 5.35wx 4.85z 9q 5.35wx 4.85z 9q 7.28B 6.19C		SAR 6=20.04B	SAR 3=21.57A	SAR 3=		(Cvs.)	Mean.
9.08ef 7.73kl 9 8.90f 7.57l 8 8.90f 7.57l 7.26m 8 8.26hi 7.03mm 6.720p 7.62kl 6.49pq 7.62kl 6.48rs 6.98m 5.95st 6.63pq 5.40v 6.35qr 5.40v 5.99st 5.99st 4.86y pq 5.35wx 4.85z pq 5.35wx 4.85z pq 5.35wx 4.55z pq 5.35wx 6.19C	1	17.19C	20.05B	24 094	I High C		
9.08ef 7.73kl 9 8.90f 7.57l 8.90f 7.57l 8.53gh 7.26m 8.26hi 7.03mm 7.90jk 6.72op 7.62kl 6.49pq 7.62kl 6.9pm 5.95st 6.9pm 5.95st 6.9pm 5.40v 6.35q 5.40v 6.35q 5.95xv 4.85y 6.35vx 4.55z 6.90m 5.35vx 4.55z	8.80A	12.65w	14.76tu	17.73op	LOW CI	SAR 6	Popo phur
9.08ef 7.73kl 9 8.90f 7.57l 8.90f 7.26m 8.25hi 7.03mn 8.26hi 7.03mn 7.90jk 6.72op 7.62kl 6.49pq 7.62kl 6.48rs 7.26m 5.95m-0 5.95st 6.63pq 5.64uv 6.63pq 5.64uv 6.35qr 5.40v 6.35qr 5.40v 6.59sr 5.99st 9.59st 5.99st 10.59st 5.99st 11.540v 12.540v 13.540v 14.55pst 5.95st 15.40v 15.59st 5.95st 15.40v 16.55pst 5.95st 16.55pst 5.95st 16.55pst 5.95st 16.55pst 5.95st 17.72tu 4.86v		13.51v	15.76rs	16 03 m	High Ci		1000
9.08ef 7.73kl 9 8.90f 7.57l 8.90f 7.26m 8.25gh 7.03mn 8.26hi 7.03mn 7.90jk 6.72op 7.62kl 6.49pq 7.62kl 6.48rs 9.726m 5.95st 6.63pq 5.64uv 6.63qr 5.40v 5.99st 5.09xy	+	14.15uv	16.51qr	19 83ik	Lower	SAR 3	
9.08ef 7.73kl 9 8.90f 7.57l 8.90f 7.57l 8.53gh 7.26m 8.26hi 7.03mn 7.90jk 6.72op 7.62kl 6.49pq 7.26m 6.18rs 9 7.26m 5.95rs 6.99m-0 5.95rs ii 6.63pq 5.64uv 6.35or 5.40v		15.01st	17.51op	21.541	High ci	O. A. A.	
9.08ef 7.73kl 9 8.90f 7.57l 8.90f 7.57l 8.53gh 7.26m 8.26hi 7.03mn 7.90jk 6.72op 7.62kl 6.49pq 7.62kl 6.49pq 7.62kl 6.59m 6.63pq 5.64uv 6.63pq 5.64uv	7	15.65rs	18.26m-o	23.140	Low cl	SAR 6	4000 ppm
9.08ef 7.73kJ 9 8.90f 7.57l 8.53gh 7.26m 8.26hi 7.03mn 7.90jk 6.72op 7.62kJ 6.49pq 7.26m 6.18rs 9 6.99n-0 5.95st	8.401		19 2613	24.0418	High cl	3.4.0	
9.08ef 7.73kl 9 8.90f 7.57l 8.90f 7.26m 8.53gh 7.03mn 7.90jk 6.72op 7.62kl 6.78pq 6.78pq	+		21.011 20.02ik	25.246	Low cl	2 473	
9,08ef 7.73kJ 8,90f 7.57l 8,53gh 7.26m 8,25kh 7.03mn 7,90jk 6.72op		18 01n-p	21.01.	26.15d	High cl	SAKO	
9,08ef 7,73kl 9,08ef 7,73kl 8,90f 7,57l 8,33gh 7,03mn 8,26hi 7,03mn	+	18.66l-n	22.77h	27.35c	Low cl		2000 ppm
9.08ef 7.73kl 9.08ef 7.57l 8.90f 7.57l 8.53gh 7.26m	-	105111	23.52gh	28.25b	High cl	SAR 3	
9.08ef 7.73kl 9.08ef 7.57l 8.90f 7.57l	10.32b	_	24.52ef	29.458	I ON C	OUCLOT)	Tap water (Control)
9.08ef 7.73kl	-	+	25.02e	30.06a	-		
	10.99a	1	20				Irrigation Treamtnts
		9	MINIT	Coron	Chinais	/,	
Many.	Mean** Coron M	-	Mana	4	T	,	
Aohizi Mean**		ht (gm.)	Stem fresh weight (gm.)		1		

*, **** and *** means refer to specific effect of olive cvs.:salinity concentration.' SAR and Cl:SO4 ratio, respectively. Values within the same column of for any of four investigated factors. followed by the same letter/s were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

Tables (8): Root fresh and dry weight (gm.) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

73B	SAR 6=5.73B	A.	J. 10. 0. J.		High=12 07B	A	Vereranor			SAR 6=5.73B
	1		SAR 3=6 314	48	3AK 0=12.74B		1 on=12 c		(CI:SO ₄)	C. Itali
	1550	5.14B	.75A	1)7A	SAR 3-14.07A	L	(MEGO)	Magazin
	2.78v	3.14u	-	1	10.110	11.36B	27A		AD	Mean*** /S
4.131	3.13u				6.161	6.95X	JCC.DI	1		Mean* (Cvs.)
1120	3.34tu	-	+	9.17D	_	7.81vw	11.87q	High c	SAR 6	
	3.69rs	_				8.34uv	12.66no	+	+	ooo ppm
	3.90qr	4.39p	-		8.17uv	9.201	13.98k	_	SAR 3	6000
3.330	4.25p				8.630	9.73st	14.77]	t	+	
	4.45op	5.02n	392	12.32C	9.40st	10.597	16.09h	LOW C	SAR 6	
	4.80n	5.41lm	_		9.86s	11.12r	16.88g	C) training		mdd noor
	5.01 n	5.64lm	8.33e		10.63r	11.99pq	18.20f	LOW CI	SAR 3	4000
6.99B	5.36lm	6.04k	9.13d		11.09	12.51op	18.99e	D Light		
	5.57lm	6.28k	7.490	15.52B	12.390-q	13.38lm	20.31d	TI NOW CO	SAR 6	
	5.921	6.84ij	0.000	_	12.320-a	13.90kJ	21.11C	To refer	+	mdd ooos
8.89A	6.97hi	308.7	10.000		13.09mn	14.76j	074.12	High	SAKS	2000
		200	11 860	19.83A	15.411	385.71	20.000	Ow C	4	
3.31B	HES-9-digital				2001	1	36 60.		Control)	Jap water (Control)
GTAR.	34K 0=0.19B	714	Low=6.714	.44B	High=13.44B					
	GAP C	.83A	SAR 3=6.83A	3.19B	JAK 0=13.19B	304	LOW=14 36 4		(Cl:SO ₄)	MESTA
1	2005	6.28B	7.38A		246	4.544	SAR 3=14.54A		(SAK)	
	3.26x	3.92v	4.6178	1	JF1 11	13.35B	15.71A		(615)	1
4.54D	3.65w	4.39tu	5.16p		6.96p	8.35n	9.81m	Liferu	(Cr.)	Mean*
	3.88v	4.67r	3.490	9.64D	7.790	9.35m	10.981	10 # 01	SAR 6	
	4.27u	5.14p	6.04lm		8.291	9.61m	11.68k	In tuffitt		mdd none
	4.51st	5.420	Nor.o		9.12m	10.941	12.85	Low Ci	SAR 3	6000
6.04C	4.89q	5.88mn	6.91		9.62m	11.54k	13.55	मार्था ट		
	5.13p	6.17]	7.24h	12.86C	10.441	12.53	14.72h	Low cl	SAR 6	
	5.520	6.63j	7.79g		10 041	13.13	15.42g	High cl		4000 ppm
	5.75n	6.91i	8.12f		11 -71	14.12h	16.58f	LOR C	SAR 3	
7.54B	6.141	7.38h	8.67e		12.26	14.71h	17.29e	High c	\dagger	
n G	6.37k	7.66g	P0076	16.05B	13 10	15.71g	18.45d	TO# C	SAR 6	
	6.76ij	8.12f	9.55b		13.59	16.31f	19.15c	Hugh cl	T	2000 ppm
9.374	7.77g	9.35c	B04.01		14 42h	17.30e	20.33b	Ton C	SAR 3	
			10.00	19.954	16.58f	19.89b	B/ C.C.	4	1	
v.eau					2000				Tap water (Control)	Tap wate
	Manz Achiri	Manz	Coron.	Mean**	Aghizi	Manz	COLOTT			
	110	* *** ***								TO BUILD TO STATE OF THE PARTY

for any of four investigated factors. followed by the same letter's were not significantly different 5% level where capital letters were used for interaction of their combination.

Tables (9): Total plant fresh and dry weight (gm.) of olive transplant in response to specific and interactioneffects of olive cultivars; salt concentrations; SAR; Cl: SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

		Toronto.	Ton	High=50.2918	High	0W=52.87A	mun		(SAK)	Niean***
High=17.61B	High=	Ou=18.53A	- Tun	0-47,300	SAK C	SAR 3=53.78A	SAR 3		(013)	Mean (Cis.)
SAR 6=1/.285	SAR 6	SAR 3=18.08A	SAR	10 30B	43.910	46.91B	60.19A		1	
	15.08C	16.45B	21.32A	\langle	30.13	32.30x	41.13st	High c	SAR 6	
	10.30z	11.23y	14.468	-	32.85X	35.20w	44.91qr	Low cl		6000 ppm
3	11.24y	12.26w	15.80pg	38.67D	34.61w	37.08v	47.34op	High c	SAR 3	
13.460	11.85x	12.93v	10.001		37.34v	39.97m	\$1 12lm	Talent of		
	12.81v	13.951	18.92K		39.10u	41.86s	\$2.56k	Low cl	SAR 6	4000 ppm
	13.420	15.649	20.26	40.700	41.82s	40.05ep	39.778	High cl	OAMO	
17.11C	14.571	16.310	21.14g	780 av	43.591	49.55mm	63.541	Low cd	2 473	
	12.920	17.33m	22.49f		46 30pg	21.421	65.98e	High cl	SAKO	
	16.025	18.001	23.37e		48.07no	53.70K	68.99d	Low cl	7 473	2000 ppm
	17.30m	18.87k	24.53d	59.00B	50.65mm	55.991	71.94c	High cl	SAR 3	
20.68B	18.041	19.64	25.53c		55.31)	58.47gh	75.20b	I ow cl	(ontro)	Tap water (Control)
	18.87k	20 7th	435.75	6/./3A	58.68gh	62.87f	81648			
23.97A	20.441	22.29f	861 oc	12 73 4	1007				C1.504)	Nean
					1	5.30A	Low=53.30A		(CI-SOL)	
0.100	right.	9.03A	Low=19.03A	1.17B	High=51.17B	H.SOA	SAK 3=34.30A		(SAR)	٠.
816B	574K 6 316B	19.40A	SAR 3=19.40A	49.96B	SAR 6=49.96B	40.075	59.09A		(Cvs.)	Mean. (
17.798	SAB 6=17.79B	drc./1	21.24A	$\sqrt{}$	45.05C	10801	40.908	High cl	-	
$\langle $	15650	11.97	14.54r		31.04w	30.320	44.06pq	Low cl	2 473	6000 ppm
	11.50%	12.961	15.73q	39.100	33 40v	20.27	46.960	High d	SAN 2	
13.85D	12.330	13.78s	16.76p	20.100	35.65u	41.32rs	50.13kd	Low cd	-+	
	13.201	14.77r	17.92n		38.021	43.71pq	53.04ij	High ci	SAR 6	2000 CO
	13.95s	15.59q	18.91KJ		42.64qr	46.33no	56.20h	LOW C		4000 ppm
	14.821	16.58p	20 111	49.65C	44.90op	48.72lm	59.11g	High cl	SAR 3	
17 600	15.57q	17.390	27.308		47.26mm	51.33ik	62.100	High CI	+-	
	16.44p	19.20%	23.301		49.511	53.72i	65.000	Low c	SAR 6	2000 ppm
	17 180	20.191	24.48d	37.032	51.88	56 344	71.240	High cl	JANJ	
21.35B	1	21.01h	25.49c	E0 63B	54.141	61.3461	74.41b	Low cd	\dashv	
	19.00	22.10g	26.68b		405 95	02.090	79.638		ntrol)	Tan water (Control)
T. Commercial Commerci	+	23./36	28.748	68.59A	60 44fg	4				100
74554	4	1			2000	1	-			Imination Treamints
	A Print	Manz.	Coron.	Mean**	Aghizi	Manz.	Coron.	Cultivars	0	
Mean**				1	veight (gm.)	Total plant fresh weight (gm.)	To	1		
	eight (gm.)	Total plant dry weight (gm.)	To	-						

*, **,*** and **** means refer to specific effect of olive cvs.*salinity concentration,* SAR and Cl.SO4 ratio, respectively. Values within the same column or row for any of four investigated factors. followed by the same letter's were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

absorbed to increase the (L.O.P.) by an amount equal to the increase in solute (L.O.P.).

Also, in this regard, **Strongonov**, (1962) attributed the depressive effect of salinity on growth to the disturbance in metabolic pathway of plants as a result of the adverse effect of salts on enzymatic activities. While, **Delane** et al., (1982) indicated that reduction in plant height, fresh and dry weights of plants in located in the photosynthetic or the growing tissues, and that in either cases, the inhibition could be arised from the adverse effect of Na and Cl ions on metabolism or from disturbed water relations.

IV.I.II. some physiological properties of leaf:

In this regard leaf relative turgidity; leaf water potential; hard leaf character; leaf succulence grade; transpiration rate and osmotic pressure were the investigated physiological properties of olive leaves pertaining their response to specific and interaction effects of four studied factors (olive cultivars, salt concentration, sodium adsorption ratio and chloride level) and their possible combinations, respectively.

IV.I.II.1. Leaf relative turgidity:

Data obtained during both 2000 & 2001 seasons are presented in Table (10).

A- Specific effect:

Concerning the specific effect of the different factors involved in this study i.e., olive cultivars; salinity concentration; S.A.R. and (Cl:SO₄ ratio) on leaf relative turgidity, data obtained in Table (10) showed that Koronaiki olive cultivar had the

greatest value of leaf relative turgidity followed by Manzanillo cvs., while Aghizi cvs. ranked last. Such trend was true during two seasons of study regarding the response of leaf relative turgidity %, whereas, variances were significant during two seasons as each cultivar compared to two other ones.

Referring the specific effect of salt concentration, it is quite evident that all three investigated saline solutions (2000, 4000 and 6000 ppm) resulted in an obvious decrease in leaf relative turgidity % over control during the two seasons of study. Such decrease was significant as compared to those of tap water irrigated transplants. On the other hand, the most depressive effect was always in concomitant to the highest concentration i.e., 6000 ppm during both seasons of study, however, the 2000 ppm saline solution exhibited the lowest decrease. Meanwhile, the 4000 ppm concentration was intermediate in this concern, whereas the differences between the three salinity concentrations were significant as each was compared to two other ones during two seasons of study. Analogical results were obtained by Bernstein, (1961) on various plants, Fenn et al., (1970) on avocado trees, and Nomir, (1994) on kaki plants.

Regarding the specific effect of sodium adsorption ratio (S.A.R), it is quite clear that increasing S.A.R from (3 to 6) in irrigation water decreased significantly the leaf relative turgidity % in olive cultivars during two seasons of study.

As for the specific effect of the (Cl: SO_4 ratio) of saline solution used for irrigation on leaf relative turgidity % data in Table (10) showed that the higher ratio caused a significant

decrease in leaf relative turgidity % than lower ratio during the $1^{\underline{st}}$ and $2^{\underline{nd}}$ seasons of study.

B-Interaction effect:

Regarding the interaction effect of the investigated four factors i.e., olive cultivars; salinity concentration; S.A.R; and Cl:SO₄ ratio on leaf relative turgidity %, data in Table (10) showed obviously the combination between the Aghizi cvs. x highest salinity concentration (6000 ppm) x SAR-6 x higher(Cl:SO₄ ratio) exhibited the lowest value of leaf relative turgidity % Moreover, three other combinations of 6000 ppm saline solution for the same olive cultivar ranked second in an increasing order. On the other hand, the lowest decrease in leaf relative turgidity % (L.R.T. %) was detected by Koronaiki cv. irrigated with 2000 ppm saline solution of S.A.R- 3 and lower (Cl:SO₄ ratio) as compared to those continuously irrigated with tap water during 2000 and 2001 seasons. Other combinations were in between. Such trend was to great extent prevailing during both seasons.

IV.I.II.2. Leaf water potential (L.W.P.):

A- Specific effect:

Concerning the specific effect of the different factors involved in this study i.e., olive cultivars; salinity concentration; S.A.R; and (chloride level Cl:SO₄ ratio) on leaf water potential, data as shown in Table (10) revealed that Coronaiki olive cultivar exhibited the greatest value of L.W.P. in both seasons, while the reverse was found with Aghizi olive cultivar.

With respect to the specific effect of salt concentration, Table (10) displays that leaf water potential values tended to decrease significantly when salinity level was increased. In this respect, El-Hefnawi, (1986) on guava plants and Nieves et al., (1991) on citrus. In this concern, Stevens & Harvey, (1990) proved that the increase in salinity caused a decline in leaf water potential and an increase in leaf petiole Na⁺ and Cl⁻ content. However, Kaul, (1981) on guava plants found that salt stress reduced plant water status (especially with SO4) and increased leaf diffusive resistance.

Regarding the specific effect both S.A.R and (Cl:SO4 ratio) of saline solution used for irrigation on leaf water potential, it could be noticed from data in Table (10) that the higher ratio of either S.A.R or (Cl:SO4)increased leaf water potential as compared to those of lower ones during 2000 and 2001 experimental seasons.

B- Interaction effect:

As for the interaction effect of the investigated four factors i.e., olive cvs. x salinity concentration x S.A.R x (Cl:SO₄ ratio) on leaf water potential, data obtained in Table (10) showed that the highest value was statistically coupled with the irrigated olive transplants with tap water (especially Coronaiki and Manzanillo cvs.) fallowed by those represented the combination of Coronaiki transplants irrigated with 2000 ppm of S.A.R (3 or 6) and lower or higher (Cl:SO₄ ratio), whereas the least decrease in (L.W.P.) was resulted. On the other hand, the highest reduction in (L.W.P.) was detected by Aghizi cvs. x 6000 ppm x S.A.R- 3 and/ or 6 with both lower and higher chloride levels

Tables (10): Leaf relative turgidity and leaf water potential of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

2	High=64.3	A	LOW=64.38	1	2000		olive cve selini	fic effect of	efer to speci	and *** means refer to specific effect of olive cus; salimit comments to the comments of the c
38A	SAR 6-64.38A	8A	3AK 3=64.38A	B	High=54 37B	A	LOW=56.15A	-	1004)	
X	63.52C	BC	0 VY.CO	1	SAR 6=53.06R	IA	SAR 3=57.41A	-	50	Mean**** (Cl-SO)
	59.20i	+	+	XI.	46.08C	53.75B	ATC.TO		(SAR)	Меап*** (S.
	_	_		<i>n</i> '	32.82x	38.52v	-	†		Mean* (Cvs.)
59 31 D	L	+	+	42.07D		40.98u		High ci	SAR 6	
	59.20	-	485.65			43.69st	\vdash	+	+	6000 ppm
	62.15g	-	H		38.76v	45.18rs	_		SAR 3	
04.26C	62.16g				41.31u	48.14q	55.12jk	+		
	62.16g	-	L	51.90C	43.211	50.37op			SAR 6	
	62.16g	62.29fg			45.75	53.33lm	61.06g	High cl	+	4000 ppm
	66.59e	66.73cd	66.80c		47.670	55.55ik	63.60f	Low cl	SAR 3	
66.71B	66.61de	66.72ce	-	_	50 2100	58.52h	66.99e	High cl	1	
	66.60de	66.73cd	66.80c	62.28B	57 1100	60.742	69.54d	Low cl	SAR 6	
	66.59e	66.74cd			\$4.65k1	63.70f	72.93c	High cl		2000 ppm
74.11A	73.98b	74.13a	14.228	White	56 56#	65.92e	75.47b	LOW C	SAR 3	•
			1	74144	63.55f	74.07bc	84.80a	1		
4.86A	High=64.86A	.04A	A+0.40-00		2001				Control)	Tap water (Control)
64.86A	SAR 6=64.86A	4.84A	AF8.40-C AFC	.49B	High=\$4.49B	.60A	Low=56.60A			
M	63.85B	03.690	Weren	3.16B	SAR 6=53.16B	7.93A	SAR 3-57.93A		(CI-SO)	Mean****
	59.311	0.00D	100 10		48.12C	54.46B	36.99A		(SAR)	
1000	59.311	59.64h	5071		32.56w	36.84uv	176.66	Target of	(Cvs.)	Mean* (
50 550	59.32	59.62h	50 71L	40.90D	35,33v	39.98t	43.31s	Hind Cl	SAR 6	
	59.311	59.63h	50.70h		38.10tu	43.12s	46.71qr	rugin ci		outo ppm
	63.03g	63.32f	Thr. Co		40.181	45.47r	49.26op	LOW CI	SAR 3	
03.2/0	63.03g	63.34f	63.445		42.95s	48.61pq	52.65mn	High cl	1	
	63.02g	63.35f	63.43f	51.95C	45.03rs	50.95no	55.20 1	Low cl	SAR 6	
1	63.02g	63.34f	63.44f		47 7000	54.10m	58.60jk	High cl		4000 ppm
	66.74d	67.07c	67.15c		49 88on	56.45kJ	61.15hi	Low cl	SAR 3	
7 06.96B	66.72d	67.07c	67.16c		52 64mm	59.59	64.55g	High cl	\mid	
	66.72d	67.06c	07.1/6	62.80B	54.73lm	61.93h	67.10ef	_	SAR 6	
	66.39e	67.06c	67.18c		57.49ik	65.07fg	70.49d	+-		2000 ppm
74 41 4	74.12b	74.50a	74.018	VAC.	50 58::	67.42e	73.04c	_	SAR 3	
			21.6	77 544	69.28de	78.41b	84.93a	4	(Contract)	
Mean**	imig.		ſ		2000				Tan water (Control)	Tan water
	Anhie	Manz	Coron.	Mean**	Aghizi	Manz.	Coron.			Stutter I manual
	1. 11.									Tingles T

for any of four investigated factors, followed by the same letter's were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

(Cl:SO₄ ratio) during the two seasons of study. In addition, other combinations were in between the abovementioned two extremes.

IV.I.II.3. Hard leaf character and leaf succulence grade:

Data obtained during both 2000 and 2001 seasons, regarding the response of hard leaf character (gm. dry matter/dec²) and leaf succulence grade (H_2O in gm/dec^2) are presented in Table (11).

A- Specific effect:

It is quite clear that each of the aforesaid two investigated physiological characteristics i.e., hard leaf character (H.L.C.) and leaf succulence grade (L.S.G.) followed its own trend regarding the response to specific effect of any of the four studied factors. Hence, the trend of response to the specific effect of a given investigated factor for one physiological character is entirely conflicted with the analogous one of the other characteristic.

Nevertheless, the highest value of hard leaf character was significantly coupled with leaves of Aghizi cultivar. The reverse was true with Coronaiki cvs., while Manzanillo cvs. was significantly intermediate during both seasons. On the other hand, the trend of response to specific effect of olive cultivar took the other way around as the leaf succulence grade (L.S.G.) was concerned. Whereas, Coronaiki leaves showed the highest value of leaf succulence grade followed in a descending order by Manzanillo cvs., followed by Aghizi cvs. Differences between the three olive cultivars were significant during both 2000 and 2001 experimental seasons.

Referring the specific effect of salt concentration it is quite evident that hard leaf character (H.L.C.) of olive leaves was significantly higher for all three investigated (2000, 4000 and 6000 ppm) saline solutions as each resulted in an obvious increase in hard leaf character (H.L.C.) over control during the two seasons of study. Such increase was significant as compared to those irrigated with tap water (control). On the other hand, the highest value of hard leaf character (H.L.C.) was significantly always in concomitant to the severest salt stress (6000 ppm) during 2000 and 2001 experimental seasons. Differences during both seasons were significant as the 3 investigated salt concentrations were compared each other.

Nevertheless, the trend of response pertaining the specific effect of salt concentration on leaf succulence grade (L.S.G.) of olive transplants took the other way around as compared to the previously discussed trend for the hard leaf character (H.L.C.).Hence the leaf succulence grad (L.S.G)was significantly decreased with increasing salt concentration. The greatest value of leaf succulence grade (L.S.G.) was significantly always in concomitant to the severest salt stress (6000 ppm) during 1st and 2nd seasons. Differences during both seasons was significant as the three investigated salt concentrations were compared each other. Analogical results were reported by, El-Hefnawi, (1986) on guava seedlings and Nomir, (1994) on kaki plants who found that the higher salinity levels significantly depressed leaf succulence grade.

Regarding the specific effect of both sodium adsorption ratio (S.A.R) and chloride level (Cl:SO₄ ratio); data as shown in

Table (11) revealed that the higher ratio of both S.A.R and (Cl:SO₄ ratio) resulted significantly in increasing both hard leaf character and leaf succulence grade during the two seasons of study.

B-Interaction effect:

Table (11) reveals that both physiological properties (H.L.C. and L.S.G.) responded significantly to the interaction effect of various combinations between four studied factors (olive cultivars; salt concentration; SAR; and Cl:SO₄ ratio). However, the highest value of hard leaf character (H.L.C.) was always in significant concomitant to leaves of Aghizi cvs. x 6000 ppm x S.A.R- 6 with high (Cl:SO₄ ratio) during the two seasons of study. Meanwhile, the least hard leaf character (H.L.C.) value was exhibited by Coronaiki cvs. x 2000 ppm x SAR 3 with low chloride level (Cl:SO₄ ratio). Moreover, other combinations were in between the abovementioned two extents.

As for the leaf succulence grade (L.S.G.), Table (11) shows that Coronaiki cvs. x 2000 ppm x S.A.R- 3 x low chloride level (Cl:SO₄ ratio) exhibited statistically the greatest value after those continuously irrigated with tap water during both 2000 & 2001 experimental seasons. However, Aghizi cvs. transplants irrigated with 6000 ppm salt concentration x SAR 6 with high chloride level had the least value of leaf succulence grade (L.S.G.) during 2000 and 2001 seasons, respectively. In addition, other combinations were in between.

Tables (11): Leaf succulence grade (L.S.G) and hard leaf character (H.L.C) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

0.285ah 0.22 0.297eg 0.313e-c 0.330c 0.347h 0.340a 0.380a 0.286A	4400	0.22.0-0.2200	4875	High=0 487 B	07A	Low=0.507A		:SO4)	Mean""" (Cl:SO4)
	2/8	CAD 3-0	0.472B	SAR 6=0.472B	518A	SAR 3=0.518A		AK)	(NAK)
	+	0.2160	$\sqrt{}$	0.451C	0.500B	0.598A		3.)	Marketti (C13.)
	0.30764 0.3	0.290f-h		0.337r	0.377p	0.450m	High cl		Mann (C.
	+	0.280%	0.4200	0.357q	0.393op	0.4731	Low ci	SAR 6	
	0.27/m	0.260:-1-		0.380p	0.420n	0.500k	High cl		6000 ppm
83gh 0.251B	+	1-1050.0		0.393op	0.437mm	0.520ij	Low cl	SAR 3	
_		0 2371-0		0.380p	0.423n	0.507jk	High cl	+-	
/3n-J	-	0 7777	0.468C	0.4000	0.437mm	0.527hi	LOW C	SAR 6	
		0.2130-1		0.420n	0.467]	0.560g	High cl		4000 ppm
V-1007.0	+	0.2075-5		0.437mn	0.4801	0.580f	LOW C	SAR 3	
	0.2170-0	0.200grs		0.4831	0.540h	0.643d	High cl	+	
0.208C	+	0 180tm	doke.n	0.513i-k	0.567fg	0.680c	Low cl	SAR 6	Ç.
0.7371-0		0.177u	0 4050	0.523h-j	0.580f	0.690c	High ci		2000 ppm
72. 0.1301	+	0.170uv		0.560g	0.623c	0.747h	LOW CI	SAR 3	
0.157. 0.134	0.130w 0	0.120w	0.778A	0.680c	0.755b	0.900a		,	
				2001		0.000		ontrol	Tan water (Control)
High=0.217A	206B	Low=0.206B	0.475B	High=0.475B	NOOK	Vonc.o-uor	-		
SAR 6=0.219A		SAR 3=0.203B	=0.471B	SAR 6=0.471B	VIIC	ATTEON MAG		CI:SO ₄)	Mean**** (Cl:SO ₄)
0.255A	0.210B 0.	0.187C		0.445C	0.48/B	0.004A		(SAR)	
0.335a		0.243g		0.3100	U.54(m)	0.420%	the state of	Cw	Mean* ((
0.313b 0.204A	0.257ef 0.	0.230i		0.353n	0.305m	0.400	High cl	SAR 6	
	_	0.223jk	0.387D	0.340n	0.5/5m	0.402	I ow of		6000 ppm
0.287c	-	0.210m		0.363m	0.4001	0.4901	High ci	SAR 3	
0.280d		0.203n		0.3901	0.430k	0.550h	rugh Ci		55
0.221B	+	0.1930	0.400	0.417k	0.455)	0.560g	T-0#. CI	SAR 6	
0 257ef		0.187p	0.4830	0.420k	0.4651	367.00	in udan		4000 ppm
240oh	1	0.177qr		0.453j	0.4961	0.61/1	LOW CI	SAR 3	
0.2376	_	0.173rs		0.490i	0.530h	0.667c	High ci	T	
0.1890	+	0.1671	0.0021	0.520h	0.567€	0.700d	LOW C	SAR 6	
0 22011		0.160ш	0 6070	0.520h	0.573g	0.717c	rugh ci	T	2000 ppm
+	1	0.150v		0.557g	0.617f	U. /6Ub	LOW CI	SAR 3	
0.153v 0.131D	0.127w (0.113x	0.768.4	0.677c	0.727c	0.900a		Common	
				2000		0.000		Control	an water (Control)
Aghizi Mean**	Manz	Coron.	Mean**	Aghizi	Manz	Coron.			Irrigation Treamtnts
	H.L.C.				- 1		Cultivars		/

^{*, ***,****} and **** means refer to specific effect of olive exestalinity concentration; SAR and CLSO4 ratio, respectively. Values within the same column or row for any of four investigated factors, followed by the same letters were not significantly different 5° level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for

IV.I.II.4. Transpiration rate and osmotic pressure:

Data obtained during both 2000 and 2001 experimental seasons regarding the specific and interaction effects of olive cultivars; salinity concentration; S.A.R and chloride levels(Cl:SO₄ ratio),on the transpiration rate and osmotic pressure are presented in Table (12).

A- Specific effect:

It is quite clear that each investigated physiological characteristic i.e., transpiration rate and osmotic pressure followed its own trend regarding the response to specific effect of any of the four factors under study. Hence, the trend of response to the specific effect of a given investigated factor for a given physiological character is entirely conflicted with the analogous trend of the other. Nevertheless, the highest transpiration rate was significantly coupled with leaves of Aghizi cultivar, while the reverse was true with Coronaiki cvs., Manzanillo cvs. was significantly intermediate during both seasons. On the other hand, the trend of response to specific effect of olive cultivar took the other way around as the osmotic pressure was concerned. Whereas, Coronaiki leaves showed the highest value of osmotic pressure followed in a descending order by Manzanillo and Aghizi cultivars. Differences between 3 cultivars were significant during 2000 and 2001 experimental seasons.

As for the specific effect of salt concentration, it is quite evident that transpiration rate of olive leaves, data obtained in Table (12) that all three investigated saline solutions (2000; 4000 and 6000 ppm) resulted in an obvious decrease in transpiration

rate of olive cultivar leaves during both seasons. Such decrease was significant as compared to those of tap water irrigated transplants(control).On the other hand, the most depressive effect was always in concomitant to the highest concentration i.e., 6000 ppm during both season of study, however the 2000 ppm saline solution exhibited the lowest decrease. Meanwhile, the 4000 ppm concentration was intermediate in this concern, however, differences between three concentrations were significant as each compared to the two other ones during two seasons of study. The obtained results, regarding the specific effect of salt concentration, in available water irrigation agree with that reported by Ragab, (1979) on citrus seedlings; Walker et al., (1979) on guava trees; Beshir, (1982) on sultani fig transplants; El-Hefnawi, (1986) on guava seedlings and Nomir (1994) on kaki plants. In this concern, Beshir, (1982) reported that sultani fig transplants irrigated with different saline solutions of concentrations ranged between 2000 to 7000 ppm, induced an obvious reduction in the transpiratoryate, the rate of reduction was proportional with the applied salt concentrations. She added that transpiration rate showed fluctuations in response to date of sampling whereas as the season was advanced the rate of transpiration gradually decrease from July to October. While Ragab,(1979) proved that transpiration rate of the sour orange seedlings was hindered by the majority of the used salinity treatments with few exception.

Nevertheless, the trend of response pertaining the specific effect of salt concentration on leaf osmotic pressure of olive transplants took the other way around as compared to the previously discussed one with the transpiration rate. Hence, the increased significantly osmotic pressure was concentration was increased. The greatest osmotic pressure was significantly always in concomitant to the severest salt trees (6000 ppm) during the two seasons of study. Differences during both seasons were significant as the three investigated salt concentrations were compared each other. Analogous results were obtained by Bernstein, (1961) in various plants; Lloyd and Howie, (1989) on Navel orange and Nomir, (1994) on kaki. In this concern, some reports on vegetable plants mentioned that rising the level of applied salts resulted in favourable effect on the succulence grade of plant leaves which was explaned on the basis of the increase in osmotic pressure by salinity (Bernstein, 1961 and El-Gizawy, 1973). However, Lloyd and Howie, (1989) added that as more negative leaf osmotic potential resulting from increased foliar Na and Cl concentrations resulted in maintenance of leaf turgor.

Concerning the specific effect of sodium adsorption ratio (SAR) data in Table (12) clearly show that increasing (S.A.R) from 3 to 6 in irrigation water depressing transpiration rate during the two seasons of study.

Nevertheless, the trend of response pertaining the specific effect of (S.A.R) from 3 to 6 on leaf osmotic pressure of olive transplants took the other way around as compared to that pervasively discussed with the transpiration rate. Hence, the osmotic pressure was significantly increased as the level of S.A.R increased from 3 to 6 during 2000 and 2001 seasons.

As for the specific effect of (Cl:SO₄ ratio), it is quite evident that transpiration rate of olive leaves was significantly decreased with increasing chloride level. While the specific effect of (Cl:SO₄ ratio) on osmotic potential, it was significantly increased as (Cl:SO₄ ratio) raised during the two seasons of study.

B-Interaction effect:

Table (12) reveals that the transpiration rate responded obviously to the various combinations of the four investigated factors. Hence, the highest rate was always in significant concomitant to leaves of Coronaiki transplants irrigated with 6000 ppm saline solution of S.A.R- 6 and higher rate of (Cl:SO₄ ratio) during 2000 and 2001 experimental seasons. Meanwhile, the least transpiration rate was exhibited by Aghizi transplants x 2000 ppm salt concentration x S.A.R-3 and low(Cl:SO₄ ratio). Moreover, other combinations were in between the aforementioned two extents.

As for the osmotic pressure, Table (12) shows that both combination represented either Coronaiki or Manzanillo transplants irrigated with 6000 ppm salt concentration of S.A.R-6 and higher (Cl: SO₄ ratio) exhibited statistically the greatest value during both 2000 and 2001 experimental seasons. However, Aghizi transplants irrigated with 2000 ppm saline solution of S.A.R- 3 and low chloride level (Cl:SO₄ ratio) had the least value of osmotic pressure during the two seasons of study. In addition, other combinations were in between.

Tables (12): Transpiration rate and osmotic pressure of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations, SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

R 6=0.662B
0.807A 23.97A 23.75B
\vdash
0.480r 31.72c 31.32c
0 434D 29.68d
27.72ef
25.89g
0.807h 0.650C 23.36i 23.18i
0.877f 21.40jk 21.23jk
0.937e 20.94jk 20.78k
18.98mn
0.884B 18.53n
1.140b 16.57p 16.44p
1.200a 1.020A 15.07q 14.95q
2001
High=0.643B Low=21.77B
SAR 6=0.622B SAR 3=21.13B
0.820A 23.76A 23.36B
0.400st 32.86a 32.34a
0.300D
0.617m 28.28d 27.83d
26.90e
25.37f
0.817i 0.617C 23.85g 23.47g
22.32h
0.950f 20.80i 20.47i
19.27
1.090c 0.833B 17.74k 17.46L
-
Aghizi Mean** Coron. Manz.
I ranspiration rate
Osmotic pressure

^{*, **, ***} and **** means refer to specific effect of olive cvs.salinity concentration? SAR and Cl.SO4 ratio, respectively. Values within the same column or row for any of four investigated factors. followed by the same letter/s were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

IV.I.III. Chemical composition:

In this regard photosynthetic pigments (chlorophyll A & B and carotenes); (free amino acids & proline); mineral composition and some enzymes activity (catalase and peroxides) in olive leaves as well as stem total carbohydrates and soluble sugars were concerned.

IV.I.III.1. Photosynthetic pigments (foliar pigments):

Leaf chlorophyll (A & B) and carotenes contents of olive transplants in response to specific and interaction effects of four studied factors of experiment were investigated. Data obtained during both 2000 and 2001 experimental seasons are presented in Table (13).

A- Specific effect:

Referring the specific effect of olive cultivar, Table (13) reveals that Coronaiki transplants had the highest value of leaf chlorophyll(A & B) and carotenes contents followed in a descending order by Aghizi and Manzanillo transplants during the two seasons of study. Differences in this concern were significant during 2000 and 2001 experimental seasons.

Concerning the specific effect of salinity concentrations, data obtained revealed that, leaf chlorophyll (A & B) and carotenes were gradually decreased by increasing the level of salinity concentration in irrigation water. Such decrease was significant as compared to those of tap water irrigated olive transplants during the study. Meanwhile, the greatest reduction in chlorophyll (A & B) and carotenes of leaves were noticed at the highest salt concentration (6000 ppm) during both seasons of

study. However, 2000 ppm saline solution exhibited the lowest decrease in both chlorophyll (A & B) and carotenes contents. Meanwhile, 4000 ppm concentration was intermediate, whereas differences between the three salinity concentrations were significant as each was compared to the two other ones for both photosynthetic pigments (chlorophyll A & B) and carotenes contents during 2000 and 2001 seasons. Thus it could be stated that salinity reduced severely the photosynthetic pigments content in olive leaves. These results are in coincidence with the findings of Caster & Myers, (1963); Ravikovitchs & Porath, (1967); Kanwar & Bhambota, (1968); Bhambota & Kanwar, (1970); Ragab, (1979) and Nieves et al., (1991) on citrus; Pandy and Divate, (1976) and Petrosyan et al., (1979) on grapevines; Koul, (1981) and Kabeel, (1985) on peach and salt concentration (6000 ppm) during 2000 and 2001 seasons. However, 2000 ppm saline solution showed the lowest loss in chlorophyll (A & B) and carotenes contents during the two seasons of study. In addition, the 4000 ppm concentration was intermediate in this concern during 1st and 2nd seasons, whereas differences between the three salinity concentration levels (2000, 4000 and 6000 ppm) were significant as each was compared to the two other ones for both leaf chlorophyll (A & B) and carotenes on olive transplants during 2000 and 2001 seasons.

These results confirmed that reported by many investigators (Caster & Myers, 1963; Ravikovitchs & Porath, 1967; Kanwar & Bhambota, 1968; Bhambota & Kanwar, 1970; Ragab, 1979 and Nieves et al., 1991 on citrus; Petrosyan

et al., 1979; Kaul, 1981 and Ali, 1985 on plum and El-Hammady et al., 1993 on mango).

With respect to the specific effect of sodium absorption ratio (S.A.R); it is quite clear that increasing SAR from (3 to 6) in irrigation water resulted in a significantly in decreasing leaf photosynthetic pigments contents of olive transplants as shown from (Table 13) during the two seasons of study. Similar observation was also found by **Kabeel**, (1985) on three deciduous fruit species and **Abd El-Mageid**, (1998) on almond seedlings.

As for the specific effect of chloride level (Cl:SO4 ratio) of saline solution used for irrigation on olive leaves content of chlorophyll (A & B) and carotenes (Table 13), shows that the higher ratio of chloride in irrigation water resulted significantly in decreasing leaves chlorophyll (A & B) and carotenes contents during 2000 and 2001 seasons. The same finding was obtained by **Kabeel**, (1985) on three deciduous fruit species and **Abd El-Mageid**, (1998) on almond seedlings.

B-Interaction effect:

Referring the interaction effect of the different combinations between four investigated factors on leaves chlorophyll (A & B) and carotenes contents of olive leaves, data obtained in (Table 13) showed obviously a variable response during two seasons. The most depressive effect on leaves chlorophyll (A & B) and carotenes contents was exhibited by such combinations represented either (Manzanillo cvs. x highest salinity concentration /6000 ppm x SAR- 6 regardless of chloride level)or (Aghizi cvs. x 6000 ppm x S.A.R- 6 x higher Cl:SO₄

Tables (13): Leaf Chlorophyll (A); chlorophyll (B) and carotenes contents of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

(CESO4)	Mosnana	Mean*** (SAR)	Mean' (Cvs.)		6000 ppm				4000 ppm				2000 ppm		Lap water (Control)		Mean*** (Cl:SO4)	Mean (SAR)	Mean" (Cvs.)			6000 ppm				4000 ppm				2000 ppm		Lap water (Control)		Prigation Treamints	
(1:304)	20.00	CAR	15.)	SAR 6		SAR 3		SAR 6	T	SAR 3		SAR 6		SAR 3	Control)		(CI:SO4)	(SAK)	(AR)		SAR 6		SAR 3	Ī	SAR 6		SAR 3		SAR 6		SAR 3	Control)			
				High cl	ow of	Here	rugn ci	10 407	13 udita	LOW C	High cl	Low cl	High cl	Low d			i			High cl	Low cl	High cl	Lowel	High cl	Low cl	High cl	Lowd	High cl	Lowel	High cl	Low cl				Cultivara
Low=1.245A	SAK 3=1.267A	2000	1 3404	0.853m	0.5.00	d-us-hori	1.09/mm	1.167.	1.2.2.0	1.2956-1	1.345gh	1.413ef	1.467c	1.537d	1.7472		Low=	SAR 3	1.1844	0.8301	0.8735	0.9235	d.3670	1.033no	1.0951.1	1.143hi	1.205€	1.250f	1.31366	1.363c	1.4236	1.5652		Corron	Т
.245A	1.267A		11:10	0.7834	0.00.35	ibesen	0.90.500	1.0 3000	h.10sm	1.1901	1.2131	1.285ij	1.330ы	J.Ces. 1	1.613c		Low=1.085A	SAR 3=1.105A	0.967C	0.695v	0.72mm	0.75%	0.8271	0.86715	0.520q	0.950р	1.010op	1.055mn	1.103jk	1.143hi	1.157g	1.7976		Mana	Chion
High=1.187B	5AR 6=1.165B	40.111	4351	0.813m	201.5.0	pdose.	1.040op	1.103m	1.1731	1.270KJ	1.270ik	1.337gh	1.387fg	1.453e	1.683b		High=	SAR 6	0.990B	0.710xx	0.750vw	0.793u	0.84751	0.887r	0.9579	0.980p	1.035no	1.073lm	1.1500	1.167h	33555	1.343cd		Aghizi	Chiorophyli (A)
.187B	1.165B				0.907D				1.1400				1 368B		1.681A	2001	High=1.040B	6=1.021B	\bigvee			68117				10080	1		1.000	מבחרו		1.401A	21	Mean**	-
Low=0.489A	SAR 3-0.494A	No.	13530	0.43/np	0.450mn	0.47783	0.490).	0.510	0.520h-j	0.537gh	0.563f	0.587€	0.603d	0.627c	0.7402	01	Low=0.321A	SAR 3=0.325A	0.324A	0.253u-x	0.265r-u	0.273p-r	0.290no	0.297l-n	0.3071-1	0.317hi	0.320gh	0.343de	0.353d	0.367c	0.373c	0.453a	2000	Coron.	
489A	1.494A	טייסאפר		0.313x	0.55/W	0.355v	0.367th	0.3836.0	0.393st	0.403rs	0.410rs	0.435n-q	0.445no	0.463 lm	0.547g		.321A	0.325A	0.296C	0.23712	0.245x-z	0.250v-x	0.2605-1	0.267e-t	0.283op	0.295m-o	0.303j-m	0.310h-k	0.320gh	0.330fg	0.340cf	0.407b		Manz	Chioro
High=0.472B	SAR 6-0.307B	0.4/0B		0.363v	0.397st	0.417qr	0.4300-g	0.447m-o	0.463lm	0.483k	0.493k	0.513ij	0.530g-I	0.543g	0.650b		High=0.311B	SAR 6=0.307B	0.304B	0.233z	0.247w-y	0.257t-w	0.270q-s	0.277pq	0.290no	0.300k-n	0.313h-j	0.320gh	0.333ef	0.343de	0.353d	0.413b		Aghizi	Chiorophyli (B)
472B	0.307B				0.390D				0.55.0			g/15.0	deis		0.646A	-	.311B	0.307B	\bigvee		0.2300				0.29/	200			0.3408			0.424A		Mean**	
i nwen i	SAR 3=0.	0.330A	V.4."VA	0.243174	0.260t	0.273r	0.2970	0.310n	0.323m	0.340k	0.360;	208£.0	0.390f	0.407d	0.483a		Low=0.	SAR 3=0	0.361A	0.267vw	0.270v	0.287	0.307r	0.320p	0.340n	0.3531	0.373	0.397h	0.410g	0.417f	0.450cd	0.507a		Coron.	
VELE	0.373A	0.299C	7517.0	0.223x	0.240w	0.247m	0.260t	0.277qr	0.290p	0.310n	0.320m	0.340k	0.350	0.370h	0.450c).366A		0.332C	0.243z	0.250z	0.263wx	0.283tu	0.297s	0.3130	0.3300	0.346m	0.3601	0.3771	0.3936	0.410s	0.453c		Manz.	Car
Higher 310B	SAR 6=0.313B	0.316B	7117.0	0.233x	0.250u	0.267s	0.280g	0.2970	0.310n	0.3301	0.340k	0.3601	0.373h	0.397e	0.457b		High	SAR 6	0.3SAB	0.257v	0.260xv	0.280u	0.297s	0.317pg	0.3330	0.347m	1595 0	0.380;	0.4076	0.4276	0.447d	0.493b		Aghizi	Carotein
3102	0.313B	\langle			0.241D			00	2000			0.3668			0.463A		High=0.352B	SAR 6=0.345B			0.272D				0.3360				0.406B			0.484A		Mean**	

ratio) lowest values of chlorophyll (A & B) and carotenes were detected. Coronaiki cvs. irrigated with 2000 ppm saline solution of S.A.R.- 3 and lower (Cl:SO₄ ratio) showed a relative higher values of 3 photosynthetic pigments as compared to those continuously irrigated with tap water which exhibited statistically the highest values during 2000 and 2001 seasons.

Other combination are in obetween the aforesaid two extremes. These results confirmed those of **Kabeel**, (1985) on grape, peach and plum seedlings and **Abd El-Mageid**, (1998) on almond seedlings.

The decline in leaf contents of photosynthetic pigment of salt stressed plants might be due to the decrease in the absorption of some minerals needed for chlorophyll biosynthesis, like as iron and magnesium (Reddy, 1967).

IV.I.III.2. Total carbohydrates and soluble sugars:

Total carbohydrates and soluble sugars contents in shoots dry matter of olive transplants as influenced by specific and interaction effects of olive cultivar; salinity concentration, sodium adsorption ratio (S.A.R.); chloride level (Cl:SO₄ ratio) and their combinations were investigated. Data obtained during both 2000 and 2001 seasons are presented in Table (14).

A- Specific effect:

Regarding the specific effect of olive cultivars, Table (14) displays that both components followed two opposite trends. In this respect, total carbohydrates of transplants in Coronaiki were significantly higher than both Manzanillo and Aghizi cultivars. However, the reverse was true with total soluble sugars, whereas

Aghizi olive transplants contained significantly higher sugars followed by Manzanillo and Coronaiki transplants during 2000 and 2001 seasons.

the specific effect With regard to of salinity data obtained displayed that, stem total concentration, carbohydrates decreased significantly with increasing salt concentration in the irrigation water comparing with those of the control (tap water) in stem olive cultivars during first and second seasons of study. Moreover, differences between salinity levels were significant. The data of the present investigation considering the effect of salinity stress on total carbohydrates agreed with those obtained by other investigators such as Nasr et al., (1977); Aly, (1979); Beshir, (1982) and Lloyd & Howie, (1989) who proved that the actual amounts of carbohydrates in different plant organs were adversely affected by rising salinity level.

Referring the response of total soluble sugars (on dry weight basis), in stem of olive cultivar it was noticed that an opposite trend was detected to that of carbohydrates, where sugars were increased gradually with increasing salts concentration in the irrigation water from 2000 ppm to 6000 ppm during the two seasons of study.

Such trend is in agreement with the obtained results Nasr et al., (1977) on stone fruits; Aly, (1979) on grapevine; El-Hefnawi, (1986) on guava found that high salinity levels increased total free sugars. On the contrary, many investigators Sourial et al., (1978); Rajasekaran & Shanmugavelu, (1983); Sourial et al., (1985) and Lloyd & Howie, (1989) proved that

the percentage of total sugars decreased in leaves as salinity level increased.

Regarding the specific effect of sodium adsorption ratio (SAR) from (3 to 6), it is quite clear that total carbohydrate content significantly decreased by increasing sodium adsorption ratio (S.A.R) while soluble sugars took the other way around during the two seasons of study.

Referring the specific effect of chloride level (Cl:SO₄ ratio) of saline solution used for irrigation, it could be noticed from (Table 14) that the higher ratio from (Cl:SO₄ ratio) in irrigation water caused significantly decrease in stem total carbohydrates of olive plants during $1^{\underline{s}t}$ and $2^{\underline{n}d}$ seasons. On the contrary, total soluble sugars increased significantly by didn't raising salts concentration during the $1^{\underline{s}t}$ season but during the $2^{\underline{n}d}$ season it didn't respond .

B-Interaction effect:

Concerning the interaction effect on the investigated 4 factors i.e., olive cultivar, salinity concentration, sodium adsorption ratio and chloride level (Cl:SO₄ ratio) on both stem – total carbohydrates and total soluble sugars contents, data obtained in (Table 14) showed obviously significant response during 2000 and 2001 seasons. The most depressive influences on both stem total carbohydrates and total soluble sugars were exhibited by that combinations between Aghizi x the highest salinity (6000 ppm) x (S.A.R- 6) x higher (Cl:SO₄ ratio) and Coronaiki olive cvs. x (2000 ppm) x (S.A.R-3) and lower (Cl:SO₄ ratio)for former and later components, respectively compared with those of continuously irrigated with tap water

Tables (14): Stem Total carbohydrates and total sugars (%) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

High=3.400	High	Low=3.343B	Low=	High=26.26B	High=	7.28A	Low=27.28A		(10S:L)	Mean**** (Cl:SO ₄)
SAK 0-3.343A	SAK 0	-3.285B	SAR 3=3.285B	SAR 6=25.78B	SAR 6	27.75A	SAR 3=27.75A		(SAR)	Mean*** (SAR)
	3./46A	3.623B	3.1260	\bigvee	24.18C	26.53B	27.26A		Cvs.)	Mean* (Cvs.)
	27484	4.9130	4.257e		17.56v	19.291	19.671	High cl	SAKO	
	4.4800	4.330d	3.7301		18.59u	20.41s	21.50r	Low cl	24.5	6000 ppm
4.217A	4.3230	4.220et	3.6071	20.66D	19.621	21.56r	22.66q	High cl	SAKS	
	4.1/01	4.017g	3.477k		20.66s	22.67q	23.68p	Low cl	2	
	4.0201	3.863h	3.350m		21.69	23.82p	24.30 o	High cl	SAK 0	
	3.8/Un	3.7171	3.2230		22.72q	24.94no	25.45mn	Low cl		4000 ppm
3.535B	3.7101	3.610	3.093p	24.95C	23.76p	26.08lm	26.61kl	High cl	SAKS	
	3.360	3.433KI	2.970q		24.78no	27.20k	28.10j	Low cl	2	
	3.410	3.28/n	2.840TS		25.83m	28.34j	29.25i	High cl	SAK 0	
	3.4101	3.13/p	2.7101		27.18k	29.81hi	30.41gh	Low cl	_	2000 ppm
2.966C	3.1000	3.000q	2.58/u	29.63B	28.22	30.94fg	31.56ef	High cl	SAKS	
	2.94/9	2.853r	2.460v		29.26	32.07de	32.72d	Low cl	5	
7.0107	2.1918	2.7231	2.333w	36.89A	34.43c	37.74b	38.50a		Control)	Tap water (Control)
1017	2 707	2222			2001					
0.013.4	Tight of our	drch.	L0W-3.454D	8.488	High=28.48B		Low=29.45A		(CI:SO ₄)	Mean**** (
2 6104	JAN 0	3.3710	SAK 3=3.3YID	28.003	SAR 6=28.00B	9.93A	SAR 3=29.93A		(SAR)	Mean***
1889 5	4.0104 E-3 6844	3.412B	3.3/00		25.92C	27.74B	31.28A		(Cvs.)	Mean* (
\langle	10104	00707	4.40/0		19.55Z	20.93y	23.60u	High cl	OANO	
	4.8000	4.083tg	4.017gh		20.59	22.03x	24.84s	Low cl	2404	6000 ppm
4.303A	4.0400	3.91/h-j	3.8800	23.05D	21.61x	23.14v	26.08pq	High cl	SAKS	
	4.44/d	3.813jk	3.747kl		22.64w	24.231	27.34n	Low cl	_	
	4.323e	3.657lm	3.613mm		23.67u	25.33r	28.571	High cl	SAR 6	
	4.1801	3.513no	3.4800		24.70s	26.43op	29.81k	Low cl	-	4000 ppm
3.647B	3.9/3m	3.37/p	3.350p	27.550	25.73qr	27.54mn	31.06	High cl	SAKS	
	3.810JK	3.277pq	3.210qr		26.760	28.641	32.30i	Low cl	-	
	3.683IM	3.110rs	3.077st		27.79m	29.75k	33.54g	High cl	SAK 6	
	3.52/no	2.967m	2.943u		28.821	30.85j	34.78c	Low cl	-+	2000 ppm
3.074C	3.333p	2.837v	2.810vw	32.05B	29.84k	31.95i	36.03d	High d	SAKS	
	3.210qr	2.713wx	2.677x		30.88j	33.05h	37.27b	Low cl	4	
2.7071	3.0135-0	2.56/9	2.540v	37.49A	34.32f	36.73c	4].428		ontrol)	Tap water (Control)
7070	3 013	3 6 7 7			2000					
	range.	ZIIEIN	Coron.	Mean"	Aghizi	Manz	Coron.	Cunivass		Irrigation Treamints
Mosnes	Anhiei		,		Times (10)	I Otal Car politurates (10)		7		
	ars (%)	Total sugars (%)			d-atec (%)	Total anthohu				

^{*. **.***} and **** means refer to specific effect of olive cvs.:salinity concentration.* SAR and Cl:SO4 ratio, respectively. Values within the same column or row for any of four investigated factors. followed by the same letter:s were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

during 2000 and 2001 seasons. Other combinations were in between the abovementioned two extents as shoot total carbohydrates and total soluble sugars were concerned.

IV.I.III.3. Leaf salinity hazard coefficient (L.S.H.C.): A- Specific effect:

Concerning the specific effect of the different factors involved in this study i.e., olive cultivars, salt concentration, S.A.R and chloride level (Cl:SO₄ ratio) in irrigation water used on leaf salinity hazard coefficient (L.S.H.C.), data in Table (15) showed that Coronaiki cultivar had statistically the highest value of (L.S.H.C.) followed in a descending order by Manzanillo and Aghizi cultivars, during the two seasons of study.

Regarding the specific effect of salinity concentration, data obtained in Table (15) revealed that three investigated saline solutions (2000, 4000 and 6000 ppm) resulted in an obvious increase in leaf salinity hazard coefficient (L.S.H.C.) of olive transplants during 2000 and 2001 experimental seasons. Such increase was significant as compared to those of tap water irrigated transplants. On the other hand, it could be noticed that (L.S.H.C.) increased gradually with increasing salt concentration in irrigation water from 2000 ppm to 6000 ppm. In this concern, non salinized seedlings appeared to contain usually lower (L.S.H.C.) value than those in salinized ones during 2000 and 2001 seasons. These findings are in agreement with those of Fadl & Sari El-Deen, (1979) working on olive; Mohamed et al., (1991) on orange and El-Sayed et al., (1995) on some olive cultivars.

Tables (15): Leaf salinity hard coefficient (L.S.H.C) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

				L.S.H.C.		
	c	ultivars	Coron.	Manz.	Aghizi	Mean**
ition Treamints			0.847p	0.683t	0.637u	0.722D
Tap water (Control)		2000	0.000		
			0.910l-n	0.723s	0.670t	
	CART	Low cl	0.943jk	0.7338	0.6771	0.811C
2000 ppm		High cl	0.980hi	0.783r	0.723s	
		Low cl High cl	1.007g	0.820q	0.763r	
	CONTRACTOR STATE	Low cl	0.947jk	0.867op	0.787r	
	CADI	High cl	1.073f	0.890no	0.810q	0.940B
4000 ppm		Low cl	1.137d	0.917lm	0.847p	
222-6 1818	SAR 6	High cl	1.177c	0.960ij	0.870op	
		Low cl	1.180c	0.993gh	0.900mn	
	SAR 3	High cl	1.237b	1.007g	0.927kl	1.103A
6000 ppm		Low cl	1.257b	1.060f	0.953j	
	SAR 6	High cl	1.440a	1.183c	1.100e	
Mean	(Cvs.)	Ing. C	1.087A	0.894B	0.820C	
	* (SAR)		SAR 3=	0.878B	The state of the s	6=0.959A
	(Cl:SO4)		Low=0	.895B	Hig	n=0.942A
Mean	(61.004)		2001			0 530D
Tan water	r (Control)	11.5	0.543r	0.567pq	0.450u	0.520D
Tap wate		Low cl	0.587no	0.570o-q	0.463u	
	SAR 3	High cl	0.607lm	0.593mn	0.487t	0.577C
2000 ppm		Low cl	0.637jk	0.623kl	0.513s	
	SAR 6	High cl	0.657i	0.650ij	0.537r	
		Low cl	0.690h	0.667i	0.553qr	
	SAR 3	High cl	0.703h	0.700h	0.573op	0.671B
4000 ppm	GADE	Low cl	0.737g	0.707h	0.597mn	
	SAR 6	High cl	0.767f	0.737g	0.623kl 0.627k	
	SAR 3	Low cl	0.790e	0.750g	0.627k 0.657i	
	SARS	High cl	0.810d	0.833c	0.657i	0.787A
6000 ppm	SAR 6	Low cl	0.823cd	0.830c	0.6671 0.770f	1
		High cl	0.957a	0.933b	0.7761 0.578B	
	1* (Cvs.)	C.	0.716A	0.704A		R 6=0.682A
	** (SAR)			=0.630B		gh=0.674A
Mean**	** (Cl:SO4)	.cc.		-0.638B		gir 0.07421

^{*; **; ***} and **** means refer to specific effect of olive evs; salinity concentration; SAR and Cl:SO4 ratio, respectively. Values within the same column or row for any of four investigated factors, followed by the same letter/s were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

Referring the specific effect of both sodium adsorption ratio (SAR) and chloride level (Cl:SO₄ ratio), it was quite clear that the higher ratio of either S.A.R or (Cl:SO₄ ratio) significantly increased leaf salinity hazard coefficient (L.S.H.C.) than the lower ones in olive transplants during the two seasons of study.

B-Interaction effect:

As for the interaction effect of different combination between the four investigated factors i.e., olive cultivars, salinity concentration, S.A.R and chloride level (Cl:SO₄ ratio) on leaf salinity hazard coefficient (L.S.H.C.) value, data obtained in Table (15) showed obviously the variable response during the two seasons. The highest value of (L.S.H.C.) was detected by that combination between Coronaiki and/or Manzanillo x highest salinity concentration (6000 ppm) x S.A.R-6 x high a chloride level. However the lowest (L.S.H.C.) value was detected by such combination represented Aghizi transplants irrigated with 2000 ppm saline solution of SAR 3 and lower or higher chloride level (Cl:SO₄ ratio) during 1st and 2nd seasons, respectively. Moreover, other combinations were in between the aforementioned two extents.

IV.I.III.4. Total free amino acids and proline contents:

Total free amino acids and proline levels in fresh leaves of 3 olive cultivars under study in response to salt concentration, S.A.R. and chloride level were investigated. Data obtained are tabulated in (Table 16).

A- Specific effect:

With regard to the specific effect of olive cultivar (Table 16) displays that both total free amino acids and proline contents responded obviously and both followed the same trend. Herein, leaves of Aghizi transplants were the richest followed by Manzanillo, while Coronaiki had the poorest leaves. Differences were significant during both 2000 and 2001 experimental seasons as either total free amino acids or proline level in fresh leaves of a given cultivar was compared to the analogous ones of two other cultivars.

Referring the specific effect of salt concentration in irrigation water, Table (16) reveals that both total free amino acids and proline

followed the same trend. Whereas, the levels were gradually increased by increasing salt concentration in irrigation water. Anyhow, the highest levels for both total free amino acids and proline contents were always in concomitant to leaves of olive transplants subjected to the severest salt stress (6000 ppm). The reverse was true with tap water irrigation transplants followed by those irrigated with 2000 ppm salt concentration. Meanwhile, the 4000 ppm saline solution was intermediate in this concern. Differences between the three salinity concentrations were significant as each compared to the two other ones regarding the response of leaf total free amino acids and proline contents during 2000 and 2001 experimental seasons. This results are in agreement with the findings of **Kessler and Smir**, 1968; Joham, 1971; El-Hefnawi, 1986 and Nomir, (1994) who found that leaves of highly salinized treatments recorded higher values of

free amino acids in comparison with the untreated transplants. In additions, salt-stress increased leaves proline content is in conformity with those obtained by Bates et al., (1973); Downton & Loveys, (1981); Kaul, (1981); Rajasekaran & Shanmugavelu, (1983); Nieves et al., (1991); Sweidan et al., (1992); El-Hammady et al., (1993) and Nomir, (1994). Therefore, it can be easy stated that beside the previously mentioned toxic effect of (Na, Cl and phenolic compounds) from on side, it may be considered that accumulation of amino acid "proline" in plant leaves as a result of salinity stress from the other side could be considered as an important role for salinity tolerance. Concerning the specific effect of both sodium adsorption ratio (S.A.R) from 3 to 6 and chloride levels (Cl:SO₄ ratio) in irrigation water on leaf free amino acids and proline contents, it could be noticed from data in Table (16) that the higher ratio significantly increased both leaf total free amino acids and proline contents during the two seasons of study.

B-Interaction effect:

As for the interaction effect of the four investigated factors i.e., olive cultivars, salt concentration, S.A.R. and chloride levels (Cl:SO₄ ratio), on leaf total free amino acids and proline contents, data presented in Table (16) showed obviously the variable response of olive transplants to the different combinations used during the two seasons. The highest values of both leaf free amino acids and proline contents were detected by that combination between Aghizi cvs. x 6000 ppm x S.A.R- 6 x

Tables (16): Leaf proline and total free amino acids contents (mg/100g.f.w.) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

363b 270a 28A 363B 270a 38A 5AR 6=6.304A		7 27 2	Low-5.325B	High=0.248A	Hi).237B	Low=0.237B		(CISO)	Mean**** (Cl:SO)
8.851A	SAK	SAR 3=5.152B	SAR 3	SAR 6=0.253A	SAI	0.232B	SAR 3=0.232B		(SAR)	Mean*** (SAR)
8.851A	ASCU.	6.5328	4.4960		0.263A	0.253B	0.231C		(Cvs.)	Mean* (Cvs.)
8.851A	11.270a	10.460b	9.920gh		0.343a	0.330b	0.28/I 0.303d	High cl	SAR 6	:
0 021	10.363b	9.620c	6 487	0.306A	37100	0.5076	3/77.0	High ci		6000 ppm
	9.913c	9.200d	5.980kl		0.3030	0.293e	0.267h	Low cl	SAR 3	12
1	PE10 0	9 3676	0.1710		0.2936	0.280g	0.2571	High cl		
	1000.1	7.113g	4.69/pq		0.277g	0.267h	0.243j	Low cl	SAR 6	1000 pp.11
6.295B	3077.1	0.09/111	4.440qr	0.257B	0.263h	0.2531	0.233k	High cl	JAN J	4000
	7.312G	5.8531	3.8438		0.253i	0.243j	0.2201	Low cl	CAD 2	
1	1000.0	5.43 /mn	3.30381		0.240j	0.230k	0.207n	High cl	JAK 0	
_	4.960op	4.603q	2.990u		0.2231	0.213m	0.197pq	Low cl		2000 ppm
3.949C	4.50/qr	4.183r	2.733u	0.207C	0.213m	0.203no	0.187r	High c	SAKS	
	3.607st	3.3471	1.660w		0.200op	0.193q	0.173s	Low cl		
1.90/D	A/ C7.7	2.0934	1.370w	0.158D	0.167t	0.160u	0.147v		Control)	Tap water (Control)
-	, , ,				2001					
THE CAPACIT	utiliti	0335	L0W=4.033D	High=0.232A		.222B	Low=0.222B		(CI:SO ₄)	Mean***
27464	JAK 0	4.48UD	SAK 3=4.480D	SAR 6=0.237A	SAR	0.216B	SAR 3=0.216B		(SAR)	Mean***
64D 6=5330A	0.09/A	4.8/88	3.977C		0.248A	0.227B	0.222C		(Cvs.)	Mean* (
	10.980a	8.03/e	6.603hi		0.327a	0.300c	0.290d	High cl	SAKO	
	10.1230	7.3431	5.997j	37.77.00	0.313b	0.287d	0.280e	Low cl	200	6000 ppm
7.631A	9.5906	7.050g	5.660k	0.288A	0.300c	0.277e	0.270f	High cl	SAK 3	
	8.673d	6.400i	5.120lm		0.287d	0.263g	0.257hi	Low cl		
	8.237e	5.930j	4.853n		0.277e	0.253ij	0.247%	High cl	SAR 6	
	7.180fg	5.2731	4.313op	0.2402	0.260gh	0.2401	0.2371	I ow cl		4000 ppm
5.438B	6.780h	4.940mn	4.043q	0 740R	0.250jk	0.227m	0.220no	High c	SAR 3	
	5.923	4.280p	3.503r		0.2371	0.2170	0.210p	I on cl		
	5.557k	3.950q	3.237s		0.223mn	0.203q	0.197r	High C	SAR 6	
	4.5000	3.293s	2.697u	0.1710	0.210p	0.190s	0.187s	I on cl		2000 ppm
3.340C	4.063q	2.9631	2.427v	0 1910	0.197r	0.1801	0.1771	High c	SAR 3	
	3.207s	2.303v	1.887w		0.187s	0.170u	0.167u	I ow c		Janes day
1.7571	2.257v	1.647x	1.367y	0.151D	0.160v	0.150w	0.143x		ontrol)	Tan water (Control)
					2000					
Mean.	Aghizi	Manz	Coron.	Mean**	Aghizi	Manz	Coron	Cultivars		Imigation Treamtnts
					Tour die					

^{*: **.***} and **** means refer to specific effect of olive cvs.*salinity concentration.' SAR and Cl:SO4 ratio, respectively. Values within the same column or row for any of four investigated factors, followed by the same letter is were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

higher (Cl:SO₄ ratio). However, the lowest values of leaf total free amino acids and proline contents were detected by Coronaiki transplants irrigated with 2000 ppm saline solution of SAR 3 and lower (Cl:SO₄ ratio)as compared to those continuously irrigated with tap water (control) during both 2000 and 2001seasons Moreover, other combinations were in between the aforesaid two extents. The obtained results regarding the increase in total free amino acids and proline levels in leaves of salt stressed olive transplants may reflects the decrease in protein synthesis that consequently lead to more accumulation of free amino acids and proline from one hand. On the other hand, presence of proline plays an important role for increasing salt tolerance through its major function to increase amount of bound water in plant tissue. Moreover, the higher level of total free amino acids and proline in Aghizi leaves rather than two olive cultivars may explains the relative higher resistance of such cultivar against higher salt concentration.

V-I-III.5- Catalase and peroxidase enzymes activities:

Data obtained regarding activities of both catalase and peroxidase enzymes in leaves of olive transplants as affected by olive cultivar; salt concentration, sodium adsorption ratio (S.A.R.) and chloride level (Cl: SO4 ratio) during two 2000 and 2001 seasons are presented in Table (17 & 18).

Concerning the catalase activity, it is quite clear that no obvious variances could be detected with advancement of estimation time. Moreover, 3 olive cultivars varied pertaining catalase activity in their leaves, where Manzanillo had higher

rate followed by Coronaiki while Aghizi was the inferior during two seasons of study.

Nevertheless, catalase activity responded obviously to salt stress, where the activity was decreased by increasing salt concentration and increased with increasing either sodium adsorption ratio or chloride level (Cl:SO4 ratio) during two seasons of study.

Referring, the response of peroxidase activity, Table (18) shows that trends were entirely changed. Hence, peroxidase activity was gradually increased as the time of estimation was advanced during two seasons of study. In addition, leaves of Manzanillo showed the highest peroxidase activity followed in a descending order by Coronaiki while Aghizi was the inferior in this concern during the two seasons of study.

Furthermore, peroxidase activity responded obviously to salt stress, the activity was increased gradually with increasing salt concentration and decreased with increasing both sodium adsorption ratio (S.A.R) and chloride level (Cl:SO4 ratio) in irrigation water during two seasons of study. Meanwhile, the peroxidase activity in relation to salt stress i.e., salt concentration; SAR and chloride level) followed an opposite trend to that previously discussed with catalase enzyme during (2000 and 2001) experimental seasons.

Generally, it could be safely concluded that both catalase and peroxidase activities followed two conflicted trends regarding their response to salt concentration, sodium adsorption ratio (S.A.R.) and chloride level (Cl:SO4 ratio) however, both showed the same trend through the advancement of estimation time. On the other hand, both catalase and peroxidase enzymes followed nearly the same trend regarding the influence of cultivar, whereas Manzanillo cvs. showed in most cases the greatest activity.

Such results are in general agreement with Lapina et al., (1976) on bean plants who found that salinity decrease the activity of cyclic and non cyclic phospharylation in bean plants noted from low salt resistance. Sodium chloride stimulated the activity of both types of photophosphorylation in several salt resistant plant species; whereas sodium sulphate inhibited photophosphorylation in these plants. On the contrary, Kaul, (1981) on guava reported that salt stress increased hydrolytic activity and distured the metabolism in guava cvs. which was grown in nutrient culture with Nacl, Na2So4 or CaCl2 all three salts at E.S. 6.9 and 2 mhos cm. From another points of view, Kaur & Gupta, (1970) on pea cvs., found that dehydrogenase activity in the shoots and roots of both varieties (perfection as salt sensitive and T-163 relatively salt tolerant) increased with salt concentration, being inversely related to salt toxicity. In T-163 polyphenol oxidase activity was greater in the roots than in the shoots and decreased with increasing salt concentration. Peroxidase activity was far greater in T-163 than in perfection.

Tabel (17): Catalaze enzyme activaty as influenced by specific effects and interaction of olive cultivar; salt concentrations; sodium adsorption ratio (SAR); chlorid levels (Cl:SO4 ratio) and their combinations.

spec			Mes			6000 ppm				and a contract	4000 ppm				2000 ppm			ontro (tap water)	T				specia	emoit		Mean			6000 ppm				4000 ppm				2000 ppm		Control (tap water)	rements			
specific effects	;		Mean of Time	-	SAR 6		377.5	1 413	100000000000000000000000000000000000000	SAR 6		SAR 3	1	SAR 6		SAR 3		٥					II CHECK	enecific effects		Mean of Time		SAR 6		SAR 3		SAR 6		SAKS		SAR 6		SAR 3					
13			ē	-	High	Lo _x	High	Low	High	Lon	uğın	100		High	I ow	High	Lon			Time							got	Uich	ngn	1,00	night.	Lon	uğu	10%	High	Lon	uğu	LOW			/	1	
Coron.		1		0.1140	0 1092	0.0920	0 1002	0.0909	0 1140	0 1441	0.1201	0 1367	0000	0 1656	0.0732	0.0821	0 1518	0 1626	Coron.			0.144	0 197	Coron.			0.1128	0 1265	0.1005	0.0063	0.0863	0.0817	01111	2001.0	0.0000	52000	0360	00000	00846	-	Coron.		
Manza	01110	olive or	0.1220	0.1433	0 1027	4110	8580 0	0 1490	0.1596	0 1003	0.1040	0 1326	0 1187	0 0841	0.0389	0.2634	0.2252	0.2287	Manza.	0			0.128	Manza.	olive cvs.	0.116	0.1279	0 1766	0 2305	2000	0.1011	0 1385	0.0880	2880	13110	0 1006	0.0868	3051	0 1935	01141	Manza.		
- April	1			0.1078	17133	0.067	0 (486	1251	6.10.9	, , ,	2	2138	1000	0:179	0.100	6 1003	0.1705	0:228	Aghizi				0.108	Aghizi			0.1069	1511.0	01707	0 1185	25500	0 0933	0 1031	0690	0.0686	23013	20668	0 143	55800	01210	Aghizi		
	cont			0.1155	0 1079	0.0928	0 1011	0.095	0.1140	37110	0 1463	0.1258	0.0711	0 1646	0.0746	0.0879	0 1503	0.1624	Coron.				0.147	cont.	32		0.1122	0.1205	8101.0	0 0947	0.0859	0.0804	0 1318	0.1728	01543	380.0	0.1257	0.0948	0.0875	0.1192	Coron.		
	2000	salinity concentration	0.1250	0.1505	0.1825	0.1154	0.0857	0.1534	01504	0 1582	8651.0	0.1331	0.1164	0.0846	0.0408	0.2645	0.2274	0.2342	Manza.		7		0.123	2000	salinity concentration	0.116	0.1280	0 1758	0.2292	0.0965	1660.0	0.1379	0.0868	0.0683	0.1331	0.1823	0.0865	0.1305	0 1419	0.0965	Manza.	15	
-010	4000	ncentrati		0.1081	0.0707	0.0667	0.0321	2001	0 1417	0.1051	0 1231	0.1389	56800	0.1183	0.1051	0.1037	0 1 700	0.1112	Agnus				0.119	4000	centration		0.1065	1511.0	0.1713	0.1179	0.0553	0 0922	0.1031	-	-	-	0.0671	0 1173	11800	0.2183	-		
0.09	6000	on		0.1156	0.1085	67.60.0	0.1000	South of	0.0931	01157	0.1480	0.1259	0.0713	0.1648	0.0709	0.0871	0.0000	0.1038	Caron				0.109	6000	3		0.1126	0.1187	+	0.0945	1	0.0807	0 1327	0.1739	0.1542	-	0.1272	1960 0	+-	0 1221	+-		
0.092	3	SA	0.1250	0.1505	0 1840	0.11.50	0.000	0.0857	0.1505	0.1589	0.1582	0 1340	0.1182	0.0846	0.0400	0.707.0	0.2674	0.000	CARE O	Manza	30		0.105	3	SAR	0.116	-	-	+	0.0970	+	╁	0.0866	0.0690	0 1317	0.1845	-	0 1304	1	+-	-	4	
0.96	6	SAR		0.1070	0.0004	0.0000	0.066	0.0515	0 1475	0 1048	0 1235	0.1406	0.0902	0.1173	0.104	0.1040	0.1025	+	+	Aghizi			0.129	0	1		0.1069	╆	+-	+-	+	+-	0.1041	+-	0.0689	+	+-	0.1195	+	+-	+	+	
0.104	١.	CISO	2	0.1151	0 107	-	-+	-	0.0941	01161	0.1496	+-	+	+	-+-	+	+	-	-	Coron.		Catalase 2001	0.113	+		21.57	0.1143	+		+-	+	+	1	-	+	-	-	+	+-	+-	-1-	-	36
0.102	Η.	٤	0.1700	2000	0.000	01310	0 1154	9530 0	0.1525	0.1595	0.1715	0 1353	01170	00000	0000	1000	0.2684	0.2250	0.2366	Manza	45	1007	0.121	=	1	0.1.1	0.1404	+	+	+	+	+	1	+	+	+	1	+	+	+	+	1	34
					0 109¢	\$890.0	0 0661	0.0551	0.1504	0.1052	0.1239	0 1487	00000	00000	23.5	0 1028	0 1047	01814	91110	Aghizi							6.1007	+	+	+	4	+	+	+	+	+	+	+	1	+	3515.0	+	
					0.1156	0 1107	0 0946	0 1006	8560 0	1_	_		- 1		_	- 1		_	-	Coron.							-		0 1265	-	_	0.000	+	1	-	-	_	-	_	- 1	0 1240 0	_	
			-	-		0 1825 0	211.0	0.0876	0.1521 0	_	+		13510	01173 0	0.0797 0		0.2686 0	0.2251 0	0.2367 0	Manza. A							-	-1	_			0.0997 0.0	01414 00		0.4550 0.0700	-			-			Manza Aghizi	60
			-		-	_	0.0667 0.	0 0504 0				_			_	0.1010 00	0.1081 0.0866	0.1739 0.1	_	Aghizi Coron.		1					-	-	-+	-	-	-	-	+	-	-	-	+	-	-	-	nizi Coron.	
				0.1	0.1134 6.1	0.1096 0.1	0.0907 0.1132	+	+			_			0.1588 0.0775	0.0615 0.0450	866 0.2703	0 1531 0 2251	0.1584 0.2	ron. Manza.	-	75						141 0.1278	-		143 0 0968	_	-	-	-+	-	-				_	n. Nanza.	75
				0.1240	0.1509 0.10	_	132 0.0658	-	1	-	_ 1	_	339 0.1436		775 0.1106	450 0 1013				nza. Aguizi										- 1	68 0 1173		_	0.1061	0.0682	0.0712	-					a. Aghizi	
					0.1079 0.1131	96 0 1091	+-				0 1151					13 0 0599	90 0.0863					-						0.1130	0.1216	8 0 1035	0 0943 0 0971	0.0870	0.0833	0.1348	0.1721 0.0679	0.1571	0.0865	0.1253	0.1189 0.0954 0.1292	0.0867	0 1252	Coron	
				0.1240	0.1507	0.1830		0.0004	1880	0 1502	01495	0.1578	0 1255 0 1340	0.0717 0.1189	0 0767	0.0425	0.0863 0.2771 0.1000	0.2245	01010 02020 01010	2000	Manza	90					0.116	0.1279		0.2271		0 0000	0.1414 0.0922	0.0872	0.1721 0.0679 0.0677	0.1346	0.0865 0.1829 0.1071	0.1253 0.0868 0.0662	0.1292	0.1401 0.0777	0.0937	Manza.	90
					0.1088					0 1552	0.1037		0 1430			0.0974	01000	-0810	0110	71107	Aghizi							0.1075	0.1151	0.1743	01197	0.0566	0.0922	0 1067	0.0677	0.0715	0.1071	0.0662	0.1195	0.0777	0.2233	Aghizi	

Tabel (18): Peroxidase enzyme activaty as influenced by specific effects and interaction of olive cultivar. Salt concentrations, sodium adsorption ratio (SAR); chlorid levels (CI:SO4 ratio) and their combinations in irrigation water during 2000 & 2001 seasons.

0	Manza Aghizi Coron, Manza Aghizi Coron Manza Ashiri	C 1958 0.2246 0.1317	High 01394 01104 01281 0.1694 01201 0.1444 0.1908	01868 0136: 01310 01942 01493 01649 02056 01606 01806	18th 0.1236 0.182" 0.1662 0.1560 0.1920 0.1752 0.1808 0.2010 0.1830	01880 01812 0141 02564 01984 01688 02937 02285 01886	Low 0.1348 0.1812 0.1403 0.1943 0.1952 0.1541 0.2024 0.2032	0.1668 0.175 0.116 0.1415 0.1983 0.1210 0.1518 0.2060 0.1261	0.1000 0.1275 0.1382 0.1733 0.1367 0.1643 0.1754 0.1466 0.1863	0.1144 0.1765 0.1655 0.1249 0.2010 0.1931 0.1356 0.2185 0.2177	01211 02000 01818 01367 02318 02092 01407 02468 02252	0.1320 0.167: 0.1322 0.1612 0.1981 0.1503 0.1873 0.2308 0.2283		0.1674 0.2155 0.1918 0.1831 0.2445 0.2100 0.1674	High 0.1892 0.1685 0.1672 0.2155 0.1818 0.1831 0.2445 0.2199 0.1939 0.1848 0.184 0.168 0.151 0.172 0.187 0.188 0.188 0.703 0.183	High 0.1892 0.1685 0.1672 0.2155 0.1818 0.1831 0.2446 0.2190 0.1939 0.187 0.186 0.187 0.203 0.183 0.203 0.183 0.203 0.183 0.203 0.183 0.203 0.183	High 0.882 0.1683 0.1674 0.2155 C.1918 0.1831 0.2465 0.2150 0.1939 0.235 0.154 0.155 0.172 0.187 0.169 0.188 0.203 0.183 0.24 0.157 0.176 0.176 0.176 0.189 0.183 0.23 0.176 0.1776 0.191 0.183	High 0.1892 0.1885 0.1674 0.2155 0.1815 0.1831 0.2446 0.2190 0.1939	High 0.1892 0.1688 0.1672 0.2155 0.1918 0.1831 0.2464 0.2190 0.1693 0.2295 0.1851 0.1851 0.1851 0.1852 0.1919 0.1919 0.1919 0.1852 0.1852 0.1852 0.1852 0.1852 0.2193 0.2293 0.1853 0.2293 0.1853 0.2293 0.1852 0.18	High 0.882 0.1685 0.1672 0.2155 0.1918 0.1821 0.2466 0.2190 0.1839 0.235 0.1851 0.1851 0.1851 0.1852 0.1855 0.1851 0.1852 0.1855 0.2190 0.1859 0.235 0	High 0.1822 0.1685 0.1672 0.2155 0.1918 0.1821 0.2464 0.2190 0.1693 0.2265 0.1825 0.1825 0.1825 0.1825 0.1825 0.1825 0.1825 0.1825 0.1825 0.1825 0.1825 0.1825 0.2185 0.1825 0.2185 0.203 0.1825 0.2185 0.1726 0.172	High 0.1892 0.1685 0.1672 0.2155 0.198 0.1881 0.2464 0.2196 0.1893 0.2245 0.2196 0.1893 0.2245 0.2196 0.1893 0.2245 0.1851 0.185 0.2196 0.1893 0.2245 0.1851 0.185 0.203 0.183 0.2245 0.1851 0.185 0.2164 0.185 0.2194 0.185 0.2194 0.202 0.185 0.2145 0.185 0.2194 0.202 0.191 0.	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	-	+	+	H	H	╀	+	1	-	H	-	-	-				1	H		Н		+	+	+++	+++	++++	+++++	+++++									
	Н	+	+	-	Н	-	-	Ͱ	H			-	1	+	0	salinit	H	H			HI	++11	++++1		+	++++++			+++++++++++++++++++++++++++++++++++++++			1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
60	Н	-	+	+	\vdash		Н	H	Н	-	-	4	+	+	-	v concent	L		\vdash	11	$H \mid \mathbf{L}$	++1	+++1	++++							1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	3 7 0 0 0 0 5 7 0 5	1 2 2 0 0 0 2 3 5 5	87	0. Ap 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
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IV.I.III.6. Leaf mineral composition:

Leaf N, P, K, Ca, Mg, Na, Fe, Mn and Zn contents in response to specific and interaction effects of olive cultivar; salinity concentration, sodium adsorption ratio (S.A.R.); chloride level (Cl:SO₄ ratio) and their possible combinations were investigated. Data obtained during both 2000 and 2001 experimental seasons are presented in Tables (19, 20 and 21).

Leaf nitrogen content:

A- Specific effect:

Table (19) displays that leaf-N % responded specifically to each of the 4 investigated factors. Hence, Coronaiki had statistically the richest leaf in its nitrogen content, followed in a descending order by Aghizi and Manzanillo transplants during the 1^{st} and 2^{nd} seasons.

With respect to the specific effect of different salt concentration in the irrigation water on leaf nitrogen content of olive cultivars, it is obvious from the results of the Table (19) that leaf nitrogen % of salt stressed transplants decreased significantly with as compared to those of control (tap water) irrigation. Moreover increasing salts concentration in the irrigation water differences were also significant between 3 saline solution during the two seasons of study.

These results are similar to those obtained by other investigators such as Sari El-Deen et al., (1979) and Emtithal et al., (1995) on olive seedlings; Abd El-Karim, (1991) on mango; Abd El-Massih et al., (1979) on some citrus rootstock seedlings, Abd El-Aziz et al., (1985) on guava and olive

American grape; Behairy et al., (1985) on Thompson seedless and American grape; Behairy et al., (1985) on guava and olive seedlings, Kabeel, (1985) on some deciduous fruit species, Omar, (1996) on apricot and many plants and Abd El-Mageid, (1998) on almond seedlings. All stated that nitrogen content decreased significantly with increasing salt concentration in irrigation water. Moreover, in this respect, Shehata, (1989) postulated that excess Cl in saline water, used for irrigation, antagonized the uptake of nitrate by the affected plants. It might also be attributed to rapid protein decay under saline conditions Prisco and O'Leary, (1972), the reduced capacity from protein synthesis Aliza et al., (1967).

As for the specific effect of sodium adsorption ratio (S.A.R.) in the irrigation water in olive leaf nitrogen content, data presented in Table (19). Show that the nitrogen content in leaves was significantly decreased by increasing sodium adsorption ratio (S.A.R.) from (3 to 6)during the study. These results are in confirmity by Sari El-Deen et al., (1979) on olive seedlings; Kabeel, (1985) on three deciduous fruit species, Sharaf et al., (1985) on Thompson seedless and American grape, El-Khateeb, (1989) on fig varieties, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings.

With respect to the specific effect of Cl:SO₄ ratio (chloride level) on leaf N content, data from Table (19) show clearly that leaf nitrogen content in olive transplants decreased

with increasing levels of chloride (Cl:SO₄ ratio) in irrigation water. This results are in harmony with those reported by **Kabeel**, (1985) on some deciduous fruit seedlings, **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants.

B-Interaction effect:

Regarding the interaction effect of the four investigated factors i.e., olive cultivar; salt concentration; S.A.R. and (Cl:SO₄ ratio) on leaf nitrogen content, data obtained in Table (19) showed obviously that the most depressive effect was observed with that combination between Manzanillo transplants x highest salinity concentration (6000 ppm) x SAR- 6 x higher (Cl:SO₄ ratio) during two seasons of study. Moreover, the lowest decrease in leaf-N content below Control (tap water) irrigation was detected by Coronaiki transplants irrigated with 2000 ppm saline solution of S.A.R- 3 and lower (Cl:SO₄ ratio) during 2000 and 2001 seasons. On the other hand, other combinations were in between in this concern.

Leaf phosphorus content:

A- Specific effect:

Regarding the specific effect of the different factors involved in this study i.e., olive cultivar; salinity concentration; S.A.R. and chloride level (Cl:SO₄ ratio) on the leaf-P content, in Table (19) clearly shows that Coronaiki transplants had the highest value of leaf-P content while Aghizi olive leaves were the poorest during 2000 and 2001 experimental seasons.

With respect to the specific effect of salt concentration, it is clear as shown from Table (19) that leaf phosphorus level was significantly affected by salt concentration in the irrigation water. In this regard, phosphorus level decreased as salinity level increases. These results are in accordance with those obtained by El-Kholi et al., (1979); on oranges, Salem, (1981) on grapevines and Omar, (1996) on mango seedlings. They reported that leaf-P content decrease as salinity level increase.

On the other hand, other studies have revealed that salinity treatment increase leaf-P content, Abd El-Karim et al., (1991) on some mango varieties; El-Azab et al., (1978) on apricot and peach and Abd El-Messih et al., (1984) on the Washington navel orange. Another trend was also obtained by Ragab, (1979) and Sherif, (1985) on some citrus rootstocks. They found that salinity did not significantly change leaf-P content. This contradiction of findings may be attributed to the different response of fruit species to the saline solutions.

Referring the specific effect of sodium adsorption ratio (SAR) from (3 to 6) under investigation, it was quite clear that the higher ratio i.e., S.A.R.- 6 significantly decreased leaf-P content in olive seedlings during two seasons of study. This result is similar to that reported by El-Khateeb, (1989) on some fig varieties and Omar, (1996) on mango seedlings.

In this respect, Bernstein et al., (1956) in stone fruits and almond and Kabeel, (1985) on three deciduous fruit seedlings. Reported that leaf- P content did not differ by increasing sodium adsorption ratio (S.A.R.).

As for the specific effect of chloride levels (Cl:SO₄ ratio) of saline solutions used for irrigation on leaf-P content, it could be noticed from data in Table (19)that leaf-P content significantly decreased by increasing chloride level (Cl:SO₄ ratio) during the first and second season of study.

B-Interaction effect:

Results in Table (19) showed the effect of the interaction between olive cultivar, salts concentration, sodium adsorption ratio (S.A.R.) and chloride level (Cl:SO₄ ratio) in the irrigation water on leaf phosphorus content. The results revealed that leaf-P content exhibited significantly the highest level by such combination between Coronaiki cvs. x 2000 ppm x S.A.R.- 3 x low (Cl:SO₄ ratio). On the contrary Aghizi cvs. x 6000 ppm x S.A.R.- 6 with high(Cl:SO₄ ratio) treatment has the lowest leaf-P value during the two seasons of study. Other combinations were in between the aforesaid two extremes.

Leaf potassium content:

A- Specific effect:

It is obvious from the results of Table (19) that Coronaiki cvs. had the higher leaf-K % content followed in a descending order by Manzanillo cvs., while Aghizi cvs. Was the inferior trend in both seasons. In addition, irrigation with salinized water decreased significant by leaf potassium level below control.

From these results, it could be noticed that K leaf % decreased gradually with increasing salt concentration in the irrigation water from 2000 ppm to 6000 ppm. In this concern, non salinized plants appeared to contain K level usually higher

than those in salinized ones during 2000 and 2001 seasons. Differences were significant between 3 saline solutions during two seasons of study. This depressive effect of salinity on K % level may explain the competitive effect of Na⁺ ions existed in the prepared saline growth media on the absorption of K⁺ ion.

This results are similar to that reported by Rains, (1972), who confirmed such competition between Na⁺ and K⁺ ions in the growth media. In addition, Cooper et al., (1952), who stated that increasing Ca content in irrigation water depressed K concentration of grape fruit leaves. Pearson et al., (1957) found that increasing level of salinity, as NaCl in irrigation water caused a decrease in leaf potassium content.

Similar findings were also reported by Jindal et al., (1979) on mango seedlings; Abd El-Messih et al., (1979) and Khamis & Darwish, (1981) on some citrus rootstocks; Singh et al., (1983) on olive, guava and Jujuba, Behairy et al., (1985) on guava and olive; Kabeel, (1985) on three deciduous fruit species, El-Khateeb (1989) on some fig varieties, Abd El-Karim, (1991) on mango seedlings, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings. They stated that potassium content in leaves decreased by raising salt concentration in irrigation water.

Regarding the specific effect of sodium adsorption ratio (S.A.R.), it is quite clear that leaf-K concentration was significantly decreased by increasing sodium adsorption ratio (S.A.R.) during two seasons of study. In this respect, **Bower and Wedleigh**, (1949) reported that increasing the exchangeable Na % of the substrate resulted in a decrease in plant K content.

Similar findings were also reported by **Kabeel**, (1985) on three deciduous fruit seedlings, **El-Khateeb**, (1989) on some fig varieties, **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond seedlings.

Referring the specific effect of chloride level (Cl:SO₄ ratio) of saline solution used for irrigation on leaf-K content, it could be noticed from Table (19) that the higher (Cl:SO₄ ratio) in irrigation water significantly decreased in leaf-K content of olive transplants during 1st and 2nd seasons. In this respect, **Kabeel**, (1985) on three deciduous fruit plants, **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond seedlings, who reported that increasing chloride level in irrigation water decreased leaf-K concentration in plant leaves but this decrease was not significant.

B-Interaction effect:

Concerning the interaction effect of the investigated four factors i.e., olive cultivar, salinity concentration, sodium adsorption ratio (S.A.R) and chloride level (Cl:SO₄ ratio), on leaf-K content, data obtained in Table (19) showed obviously the significant variances in this concern, during 2000 and 2001 seasons. The most depressive effect on leaf-K content was detected by that combination between Aghizi cvs. irrigation with the highest salinity (6000 ppm) level of SAR- 6 and higher (Cl:SO₄ ratio), whereas the highest decrease was resulted. Moreover, the lowest decrease in leaf-K content below control was detected by Coronaiki transplants irrigated with 2000 ppm saline solution x S.A.R.- 3 and lower (Cl:SO₄ ratio), during 2000 and 2001 seasons. Other combinations were in between the

Tables (19): Leaf Nitrogen; phosphorus and potassium (%) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations, SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

NAK 0=1.338B	4	.487A	Low=1	210B	High=0.210B	222A	Low=0.222A	066B	High=2.066B	244A	Low=2.244A	-	(Cl: SO ₄)	Mean*** (C
1	1	:[SAP 3=	1.199B	SAR 6=0.199B).233A	SAR 3=0.233A	.001B	SAR 6=2.001B	309.A	SAR 3=2.309A		(MAC)	
+	SP .	1 376R	1.445A	$\sqrt{}$	0.177C	0.195B	0.249A	N	2.090B	1.7840	2.2734		(CAD)	
_	7 3	0.677	0.710x		0.070x	0.077x	0.103u-w		0.897 _X	0.767v	0.977¤	High cl		
WA/70'0		0.0740	0.800	0.114D	0.087wx	W1600	0.123st	1107017	1.150~	0.98Cm	1.250u	Low cl	SAR 6	W.C.
_	SC/	0.870,5	0.917tu	;	0.107t-v	0.120s-и	0.157pq	1 1980	1.293tu	1.103v	1.4075	High cl	+	6000 ppm
+	Lá	2000	4000		0 1278	0.1335	0.167op		1.547r	1.520:	1.6839	LOW CI	SAR 3	
	0	1.2420	1 173-		0 1470	0.157pg	0.210kJ		1.653q	1.410s	1.797g	High cl	-	
╁	-	m//c.1	TWO PET	0.2000	0 160~	0.180mp	0.220ik	1.9400	1.9430	1.6604	2.115n	Low cl	SAR 6	200 000000
_		1 277	froor.		0 187mn	0.200lm	0.263f-h	10,00	2.087n	1.780€	2.267;	High cl	⊢	4000 ppm
+		1,4001	1 560		0.190mn	0.2101	0.273c-g		2.2671	1.937c	2.467	FOW. C	SAR 3	
1 540		1 610:	1 690h		0.210kl	0.357出	D005.0		2.447	2.090n	2.660h	Frigh Cl		
1 68	- 1	1 7670	1.853f	de la	0.227jk	0.247hi	0.320€		2.5931	2.215m	2.820g	LOW CI	SAR 6	
1 7670		18536	1.943c		0.247hi	0.270€€	0.347Ъ	2.629R	2.773g	7.307%	2010.6	13 udru		2000 ppm
1.8676		1.963c	2.053d		0.257gh	0.280cf	0.360b		2.917f	2.490	3.170:	Low cl	SAR 3	
21126		2 1835	2.290a	0.336A	0.287de	0.323c	0.397a	3.536.4	3.607b	5.0803	3.9202		om oil	,
	- 1						1	2001					ontroll	Tan water (Control)
High=1.436B		SA	Low=1.536		High=0.211B		LOW-U.LLSA		Own Over Hally					
SAR 6=1.389B		83A	SAR 3=1.583A	B.	SAK 6=0.202B		APC7.0-C MVC		U.ab-7 0770		.na=2 2361		Cl:SO ₄)	Mean**** (Cl:SO ₄)
1.375C	l ~	1.434B	1.4/2A		0.1030	0.00	CAD 3-0-2		SAR 6=7 BOKE		SAR 3-2 3044		SAR)	Mean*** (SAR)
0.687v	l'''	0.740X	0.750X		0.0000	0.000	0.2364	\langle	2.084B	1.8000	2.262A		VS.)	Mean* (Cvs.)
0.783 WX	-	0.813W	W.C.9.0		0.020	0.000	0.113tu		0.967x	0.8370	1.05(14	High cl		
0.8900	T	0,440	0.5000	0.1260	0 110	0.1264	0.143r	1	1.183u	1.020w	1.287;	Low cl	SAR 6	
1.0201		0.04381	0 0 0 0		0.120st	0.140	0.153pq	יייייייייייייייייייייייייייייייייייייי	1.327s	1.1400	1.4375	High cl		6000 ppm
	1	1000	1077		0.1278	0.147@	0.1630		1.540q	1.330s	1.670p	Low cl	SAR 3	
1 130	1 15	1 167gr	1 2030		0.147gr	0.160ap	0.183n		1.683p	1.4537	1.850n	High ci		
1360	ľ	+	1 34370	0.1980	0.1670	0.180n	0.2131		1.903m	1 2735	2.0631	TOW. C	SAR 6	
1 1	3 7		1.480im	,	0.187n	0.2171	0.2431	71661	2.0471	1.7670	2.225k	High cl		4000 ppm
1 4071-1	1	1 547	1.603		0.203m	0.227jk	0.253gh		2.223k	1.917m	2.417	Low cl	SAR 3	
- : :		1583	1 733:		0.220k1	0.247hi	0.280€		2.403	2.077	2.607€	High cl		
1 7226	- ["	1 707	1.8530	0.2.38	0.233	0.260fg	0.297d		2.550h	2.200k	2.7671	TOM. C	SAR 6	
17571	9 (1.9100	1.957f		0.250hi	0.280e	0.320c	2611B	2.730f	2.360	2.960€	High cl	T	2000 ppm
	٠١	20136	2.070d		0.263f	D797d	0.333b		2,943€	2.5436	3.197c	TOM C	SAR 3	
2.1676	0,	2.247b	2.3072	0.331A	0.293d	0.327pc	0.373a	3.536A	3.597b	3.1076	3.9032		Common	Trans. dev
	- 1						100	2000		,	, , , ,		Controll	Tan water (Control)
Aghizi	0	Manz	Coron.	Mean**	Aghizi	Manz	Coron.	Mean**	Aghizi	Nanz	Colour	V		Irrigation Treamints
Potassium %	12	1 2	T		a standard as ve		1					Cultivars		1
1	1				harm at	Phosn			Nitrogen %	Vito				

*; **.*** and **** means refer to specific effect of olive exampliation, SAR and Cl:SO4 ratio, respectively. Values within the same column or row for any of four investigated factors, followed by the same letter's were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

abovementioned two extents as leaf-K content were concerned. Similar results were obtained by **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond seedlings.

Leaf calcium content:

Results pertaining the specific and interaction effects of olive cultivar; salts concentration; S.A.R; (Cl:SO₄ ratio) and their combinations on leaf-Ca % are presented in Table (20).

A- Specific effect:

Regarding the specific effect of olive cultivar; salt concentration; S.A.R and chloride level (Cl:SO₄ ratio) in irrigation water on leaf-Ca content, Table (20) clearly show that Aghizi olive leaves had statistically the highest value of Ca content, while the reverse was true with Coronaiki transplants during both seasons.

With respect to the specific effect of salt concentration in irrigation water on leaf calcium % of olive transplants, it could be noticed that leaf-Ca concentration, on dry weight basis increased gradually with increasing salts concentration in irrigation water from up to 6000 ppm. In this concern, non salinized olive transplants appeared to contain usually lower leaf Ca % than those in salinized ones during 2000 and 2001 seasons.

This might be due to according to Wallace et al., (1952) to that plants with low K content, obtained under salinity conditions, trend to compensate their low K content by either high calcium and/ or magnesium content in leaves.

These results confirmed also findings of Makhija et al., (1980); El-Hefnawy, (1986) on guava seedlings; Kabeel, (1985) on some grape, peach and plum seedlings; Abd El-Ghani, (1990) on peach, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond plants. All reported that leaf-Ca content in salt treated plants was increased with increasing salinity levels. On the other hand; Divate and Pandy, (1981-b) on grapevine and Singh et al., (1983) on Jujuba and guava plants, found that high NaCl in the growth media decreased calcium content.

Referring the specific effect of sodium adsorption ratio (S.A.R.), it was quite clear that the higher ratio i.e., S.A.R.- 6 significantly increased leaf Ca content than the lower one i.e., SAR-3 in olive transplants during the first and second seasons of study. These results are similar to that obtained by **Kabeel**, (1985) on three deciduous fruit species, **El-Khateeb**, (1989) on some fig varieties, **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants.

Concerning the specific effect of the chloride level (Cl:SO₄ ratio), of saline solution used for irrigation water on leaf-Ca content in olive transplants, it could be noticed from results in Table (20) that the higher ratio resulted in a significant increase as compared to the lower ones during 2000 and 2001 seasons. In this respect **Kabeel**, (1985) on some deciduous fruit species, **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants found that leaf-Ca content increased by increasing (Cl:SO₄ ratio) but such increase was not significant.

B-Interaction effect:

As for the interaction effect of the four investigated factors i.e., olive cultivar; salinity concentration; sodium adsorption ratio (SAR) and chloride level (Cl:SO4 ratio), on leaf-Ca content, data obtained showed obviously the variable response of olive transplants to the different combinations used during the two seasons of study. The higher leaf-Ca% was detected by that combination between Aghizi transplants x highest salinity concentration (6000 ppm) x S.A.R.- 6 x higher(Cl:SO₄ ratio) while, the lowest leaf-Ca content was detected by Cronoaiki transplants irrigated with 2000 ppm saline soultion of S.A.R.- 3 and lower (Cl:SO₄ ratio) as compared to those continuously irrigated with tap water (control) during both 2000 and 2001 seasons. These may mean that four factors can act together in affecting Ca level, each factor affected Ca level in separable way. Other combinations were in between the abovementioned two extents as leaf-K content were concerned. Similar results were obtained by Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings.

Leaf magnesium content:

The specific and interaction effects of olive cultivar; salts concentration; sodium adsorption ratio (S.A.R.); chloride level (Cl:SO₄ ratio) in irrigation water and their combination on leaf magnesium level of olive transplants are presented in Table (20).

A- Specific effect:

With respect to the specific effect of the different factors involved in this study i.e., olive cultivar; salts concentration;

S.A.R. and (Cl:SO₄ ratio) on the leaf-Mg content, data as shown in Table (20) revealed that Coronaiki cvs. showed the highest value of leaf-Mg content followed in a descending order by manzanillo cvs. and Aghizi cvs., during the two seasons of study.

Concerning the specific effect of salinity concentration; data obtained revealed that all three investigated concentrations (2000, 4000 and 6000 ppm) saline solutions, resulted in decreasing in leaf-Mg content of olive transplants during the two seasons of study. Such decrease was significant as compared to those of tap water (control) irrigated transplants. On the other hand, generally a gradual decrease in leaf-Mg content was shown as salinity in irrigation water increased during 1st and 2nd seasons of study.

These findings could be supported with those of Wallace et al., (1952) who reported that plant with low K level was generally asociated by either high calcium and/or magnesium contents in leaves. These results are confirmed with the findings of El-Khateeb, (1989) on some fig varieties, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings all mentioned that leaf-Mg content decreased significantly by using different saline solutions in irrigation water as compared with those irrigated with tap water. On the other hand, Downton, (1978) found that leaf-Mg content tended to increase in avocado by salinity. Moreover, El-Azab and Minessy, (1975) on grape, guava and olive and Nasr et al., (1977) on plum showed that leaf-Mg content did not differ markedly with salinity condition.

Regarding the specific effect of sodium adsorption ratio (S.A.R.), it was quite clear that the higher ratio i.e., S.A.R- 6 significantly decreased leaf Mg content of olive cultivars during 2000 and 2001 seasons. This result is confirmed with the findings of El-Khateeb, (1989) on some fig varieties, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings, whe reported that leaf-Mg content significantly decreased with increasing sodium adsorption ratio (S.A.R.).

With respect to the specific effect of chloride level (Cl:SO₄ ratio), in saline solution used for irrigation on leaf-Mg content, it could be noticed from data in Table (20) that leaf-Mg content was significantly decreased in olive transplants during the two seasons of study. The same trend was reported by **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants.

B-Interaction effect:

As for the interaction effect of the different combination between four investigated factors i.e., olive cultivar; salinity concentration; S.A.R. and chloride level (Cl:SO₄ ratio), on leaf-Mg content, data obtained in Table (20) showed obviously the variable response during 2000 and 2001 experimental seasons. The highest decrease in leaf-Mg content was exhibited by such combination between Aghizi transplants x highest salinity concentration (6000 ppm) x S.A.R.-6 and higher (Cl:SO₄ ratio), while the lowest leaf-Mg content was detected by Coronaiki transplants irrigated with 2000 ppm saline solution of S.A.R. 3 and lower (Cl: SO₄ ratio) as compared to those continously

irrigated with tap water (control) during the two seasons of study. Other combinations were in between the aforesaid two extremes. Similar results were obtained by Omar (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings.

Leaf sodium content:

Data presented in Table (20) declared the specific and interaction effects of olive cultivars; salts concentration; sodium adsorption ratio (S.A.R.); chloride level (Cl:SO₄ ratio) in irrigation water and their combination on leaf-Na level of olive transplants

A- Specific effect:

With regard to the specific effect of olive cultivar; salts concentration; S.A.R. and chloride level (Cl:SO₄ ratio) on leaf Na content, Table (20) clearly shows that Aghizi cvs. transplants exhibited the highest value of leaf-Na content, while the opposite was true with Coronaiki cvs. during the two seasons of study.

Regarding the specific effect of salts concentration in irrigation water, it is quite clear that Na level significantly increased with increasing salt concentration in irrigation water up to 6000 ppm during the 1st and 2nd seasons. In addition, untreated transplants had least value of leaf-Na concentration.

These results confirmed the findings of Abd El-Messih et al., (1979); Mobayen and Milthorope, (1980) and El-Ashram et al., (1985) on some citrus rootstocks; Makhijia et al., (1980) on guava seedlings, Behairy et al., (1985) on guava and olive seedlings, Bartolini et al., (1991) on olive plants and Abd El-

Karim, (1991) on mango seedlings. They stated that as the salinity level of the irrigation water increased, a subsequent increase was observed in Na accumulation in plants.

As for the specific effect of sodium adsorption ratio (S.A.R.) on leaf-Na content, the obtained results showed that higher S.A.R. significantly increased Na content in leaves than lower level during 2000 and 2001 seasons. These results are in accordance with the findings of **Sharaf** et al., (1985) on Thompson seedless and American grape, **El-Khateeb**,(1998) on some fig varieties, **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants.

Concerning the specific effect of chloride level (Cl:SO₄ ratio) of saline solution used for irrigation on leaf Na content, it could be noticed from Table (20) that the higher Cl:SO₄ ratio significant by increased leaf-Na concentration during the first and second seasons of study. These results are in conformity with the findings of **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants, who stated that higher ratio of Cl:SO₄ resulted in a significant increase of leaf-Na content. Another study, **Kabeel**,(1985) on grape, peach and plum reported that leaf sodium content was not affected by increasing chloride levels (Cl:SO₄ ratio) in irrigation water.

B-Interaction effect:

As for the interaction effect of different combination between the four investigated factors i.e., olive cultivar; salinity concentration; S.A.R. and chloride level (Cl:SO₄ ratio) on leaf Na content, data obtained in Table (20) showed obviously the

Tables (20): Calcium; magnesium and sodium (%) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations; SAR; Cl:SO₄ ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

0.00		3	I Owe	11B	High=0.60	4A	LOW-0.03					vific affact a	efer to spec	******* and **** means refer to specific effect of classes and the control
6B SAR K-1 6184	6B	0.49	SAR 3=0.496B	81B	SAR 6-0.581B	Z.A.	APC0.0=0.63 (1	.954A	High=2.954A	90B	Low=2.790B	-		
1	\$26B	-	0.470C	\bigwedge	0.619B	Ť.	E G V S	-3.046A	SAR 6=3.046A	702B	3-AK 3=2.702B	+	T-SOA)	Mean**** (Cl:SO ₄)
	17de	0.9	0.803f-h		0.347u	+	+	V	3.109A	ST-SK-T	1		SAR)	Mean*** (SAR)
7	21	0.847e-p	0.757h-j		_	0.505.0	_		4.297a	4.15/6	77636	1	(Cvs.)	Mean* (C
RI 1.037c	PI	0.773g-I	0.683jk	0.400		+	0.450r	3.773.A	4.053c	3.893d	3.593f	High cl	SAR 6	
+-	13	0.657k-m	0-1565.0		0.487p	+	0.500p		3.863d	3.693e	3.417h	High cl		6000 ppm
-	8 1	0.583m-o	0.5230-q		0.5730		-		3.490g	3 5770	3.257	Low cl	SAR 3	
o-q 0.780g-J	0	0.533e-q	0.473qr	0.561C	0.6071	0.5170	0.570m	3,046B	3.3131	3.167k	3.0901	High cl	SAR 6	
+	5 1 2	0.40318	0.41378		0.647k	-	0.670		3.153kJ	3.000m	2.780c	High cl		4000 ppm
_		0.337st	0.353et		0.703;	_	0.730h		2.907n	2.7930	2.595p	Low cl	SAR 3	
-		+	0.250u-w	0.742B	0.7532	+	0.780f		2.587p	2.633p	2.443g	High cl	0.1970	
-	30	0.203v-x	0.187wx		0.0000		0.827d	2.317C	2.5171	2,177.7	2 297r	Low cl	SAR	STORY BUILDING
0.207v-x	×	0.143 _X	0.127x	0.917A	0.9536	0.700;	0.857c		2.1131	2.0550	2.0534		SAK 3	2000 ppm
	- 1					0 610	0.987	1.833D	1.930v	WCC0.1	1 002	Low of	2	
High=0.657A		Low=0.589B	Lov	STORE	GRICO-uărr			2001		1 062	1717		(Control)	Lap water (Control)
SAR 6=0.695A		SAR 3=0.551B	SAR	d.Sus.B	Unit o di Sus B	553 A	Low-0.553A	High=2.852A	High	100				
0.929A	B	0.531B	0.515C		CAPCE.O	5684	SAR 3=0.568 A	SAR 6=2,941A	SAR	66AB	Low=2 664B		(Cl:SO ₄)	Mean***
1.617a	121	0.923g	0.897g		0.4040	0.4716	0.579A	N	J.40J.A	2 576B	SAR 3=2 576B		(SAR)	Mean***
h 1.497b	79	_	0.820gh		0 273	0.260u	0.320s		20101	2 7800	2.2450		(Cvs.)	Niean"
1.367c	14	\vdash	0.770h-j	0.342D	0.343r	0.300t	0.367q	3.024A	4.5936	3.6431	3.0601	High cl	SAR 6	
+	2113	+	0.687j-m		0.383p	0.363q	0.400m		4.370c	3.433h	2.780m	+		ovov ppm
	F	d-weegen	0.633k-n		0.4130	0.393p	0.483]		4.163c	3.2671	2.650n		SAR 3	6000
1	10	+	0 5775	0.486C	0.450m	0.430m	0.530		3.953d	3.113%	2.5130	High cl	\dagger	
_	31		0.407/1-11	,	0.4801	0.460m	0.560;	2.868B	3.780	2.9601	2.380qr	-	SAR 6	
w 0.6101-o	V	W 0.353vW	0.35 /VW		0.520	0.500k	0.610h		2 5 4 7 5	2.800	2.250s			4000 ppm
x 0.490q-t	14	+	XW002.0		0.600h	0.5731	0.700c		135.6	2 6435	2.1201	3 Low c	SAR 3	
_	20	-	VX002.0	0.644B	0.640€	0.610h	0.747d	2.2040	2 0721	2.337r	1.880v	6 Low cl	SAR 6	
╁	1.	+	0.000		0.673f	0.643g	0.790ь	3366	2657	2.0971	1.680w	High cl	T	and a second
4	:1	+	0 133	0.807A	0.770c	0.733d	0.917a	1.7900	2.433	1.917	1.540x	-	SAR 3	2000 nom
H	1	F	1					0007	2.225	1.753w	1.410x		and marci (Control)	and day
Z. Aghiyi	5	n. Manz	Coron.	Mean**	Aghizi	Manz.	Coron	TAXABIT.	-	1				Tan wet
Sodium (%)			-	1			,	M	Aghizi	Manz	TOTOL			
					97 1 111110							/	1	The state of the s

were not significantly different 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination. the same column or row for any of four investigated factors. followed by the same letters

variable response during 2000 and 2001 seasons. The highest leaf Na content was detected by that combination between the Aghizi transplants irrigated with the highest salinity concentration (6000 ppm) of S.A.R. 6 and higher (Cl:SO₄ ratio), while the lowest increase of leaf-Na content was detected by those Coronaiki olive transplants irrigated with 2000 ppm saline solution of S.A.R.-3 and lowest (Cl:SO₄ ratio) as compared to those continuously irrigated with tap water during 2000 and 2001 seasons. Other combinations were in between the aforesaid two extremes. The same trend was obtained by **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants.

Leaf iron content:

Results presented in Table (21) show the specific and interaction effects of olive cultivar; salt concentration in irrigation water; S.A.R.; (Cl:SO₄ ratio) and their combination on leaf-Fe content in olive transplants.

A- Specific effect:

Concerning the specific effect of olive cultivar on leaf Fe content, Table (21) clearly shows that Coronaiki transplants had the highest leaf-Fe content, while Aghizi cvs. showed the least value during two seasons of study.

With respect to the specific effect of salinity concentration, obtained results indicated generally that salts concentration in irrigation affected had significant effect on leaf Fe content. It is also clear that all three saline solutions (2000, 4000 and 6000 ppm) resulted in an obvious decrease in leaf Fe content during 2000 and 2001 seasons. Such decrease was

significant as compared to those of tap water irrigated transplants (control).

These results could be confirmed with findings of Khalil, (1979); Aly et al., (1986 a) on citrus; Abd El-Aziz et al., (1985), on guava and olive and El-Hefnawy, (1986) on guava. On the contrary, Gasser, (1986) on avocado, reported that leaf-Fe concentration was increased by increasing salinity. In this concern and from another point of view, Bartobini et al., (1991) working on olive plants, found that leaf-Fe content was not changed in different salinity levels.

Referring to the specific of sodium adsorption ratio (S.A.R.) in irrigation water, it was quite clear that increasing sodium adsorption ratio (S.A.R.) from (3 to 6) in irrigation water significantly decreased leaf-Fe content in olive transplants during two seasons of study. These results in conformity with the findings of Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond plants.

As for the specific effect of (Cl:SO₄ ratio) of saline solution used for irrigation water on leaf iron content, it could be noticed that increasing it significantly decreased leaf-Fe content during the two seasons of study. These results are in line with those reported by Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond seedlings.

B-Interaction effect:

Table (21) shows the interaction effect between salts concentration; sodium adsorption ratio (S.A.R.) and chloride level (Cl:SO₄ ratio) on leaf-Fe content of olive cultivar transplants.

These obtained results revealed that different combinations of four investigated factors can act together in affecting Fe level in plant leaves during 2000 and 2001 experimental seasons. In addition, pattern of Fe distribution showed that leaves of Aghizi plants irrigated with high salt concentration (6000 ppm) of higher S.A.R.-6 and (Cl:SO₄ ratios) had the lowest value of leaf Fe low concentration when compared with plants irrigated with tap water during the two seasons of study. On the other hand the greatest value of in leaf-Fe content was detected by Coronaiki plants irrigated with 2000 ppm saline solution x S.A.R.- 3 x lower (Cl: SO₄ ratio) as compared to control (tap water) during 2000 and 2001 seasons. Other combinations were in between the aforesaid two extremes. This was agreed with the findings of Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond plants.

Leaf manganese content:

The effect of olive cvs.; salts concentration, S.A.R. and chloride level (Cl:SO₄ ratio) in irrigation water and their combinations on leaf-Mn content of olive transplants are shown in Table (21).

A- Specific effect:

Regarding the specific effect of olive cultivar, on leaf-Mn content, Table (21) clearly shows that Coronaiki transplants had the highest value of leaf-Mn content descendingly followed by Manzainello and Aghizi transplants whereas differences between 3 cultivars were significant as compared each other during 2000 and 2001 experimental seasons.

Concerning the specific effect of salts concentration, data obtained revealed that all three investigated concentrations (2000, 4000 and 6000 ppm) of saline solutions resulted in an obvious decrease in leaf-Mn content below control during 2000 and 2001 experimental seasons. Such decrease in leaf-Mn content was significant as compared to those of tap water irrigated plants (control); whereas, differences between the three salinity concentrations were significant as each was compared to the two other ones during the two seasons of study. The obtained results, regarding the specific effect of salt concentration, in irrigation water agree with that reported by Patil and Potil ,(1982) on pomegranate. Who found that, leaf-Mn content was decreased with increasing salinity concentration in irrigation water. In this respect, Gasser, (1986) found that leaves of some avocado rootstock seemed to accumulate higher amounts of Mn than fuerte leaves under five salinity levels. However, Bartolini et al., (1991) on olive plants, reported that leaf-Mn concentration was unaffected by different salinity levels. From another point of view, Dilley, (1958) found that increasing Cl in the soil caused an increase in leaf Mn content of apple, peach and cherry.

With respect to the specific effect of sodium adsorption ratio (S.A.R.), it was quite clear that the higher ratio i.e., S.A.R. 6 resulted significantly in decreasing leaf Mn content during two seasons of study. This agrees with the findings of **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants.

As for the specific effect of the Cl:SO₄ ratio of saline solution used for irrigation on leaf manganese content, it could be noticed that increasing the level of Cl:SO₄ ratio in irrigation water significantly decreased leaf-Mn content during 2000 and 2001 experimental seasons. The same finding was obtained by **Omar**, (1996) on apricot and mango seedlings.

B-Interaction effect:

Regarding the interaction effect of different combination between the four investigated factors i.e., olive cultivar; salinity concentration; S.A.R. and Cl:SO₄ ratio, on leaf Mn content, data obtained in Table (21) showed obviously a variable response during 2000 and 2001 seasons.

Herein, the least leaf-Mn content was detected by the combination between the Aghizi cvs. transplants irrigated with 6000 ppm saline solution of S.A.R.- 6 and highest Cl:SO₄ ratio, while the reverse was true with Coronaiki cvs. transplants irrigated with 2000 ppm saline solution of S.A.R.- 3 and lower Cl:SO₄ ratio as compared to those irrigated with of other combination during 2000 and 2001 seasons. Other combinations were in between the aforesaid two extremes.

Leaf Zinc content:

A- Specific effect:

Concerning the specific effect of olive cultivars, on leaf-Zn content, data obtained in Table (21) showed that Coronaiki cvs. transplants had the highest value of leaf-Zn content followed in a descending order by Manzanillo cvs. and Aghizi cvs. transplants during the two seasons of study.

Regarding the specific effect of salts concentrations, data in Table (21) clearly show that leaf-Zn concentration of olive cultivar transplants significantly decreased with increasing salts concentration in irrigation water during 2000 and 2001 seasons. On the other hand, the most depressive effect was always in concomitant to the highest concentration i.e., 6000 ppm during both seasons of study, however, the 2000 ppm concentration exhibited the lowest decrease below control. Meanwhile, the 4000 ppm concentration was intermediate in this concern, whereas differences between the three salinity concentrations were significant as each was compared to two other ones during two seasons of study. These findings were early supported by those of Patil and Potil, (1982) on pomegranate, El-Hefnawi,(1986) on guava, Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond plants. They found that salinity caused clear reduction in leaf-Zn content. However, Gasser, (1986) on avocado proved that leaf-Zn generally increased by salinity. From another point of view, Bartolini et al., (1991) declared that Zn concentration in olive leaves was not changed by salinity levels.

With respect to the specific effect of sodium adsorption ratio (S.A.R.), it was quite clear that leaf-Zn content was decreased by increasing it from (3 to 6). Such decrease was significant during the two seasons of study. This result is similar to that achieved by **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond plants.

As for the specific effect of chloride level (Cl:SO₄ ratio) of saline solution used in irrigation water on leaf-Zn content, it could be noticed from data in Table (21) that increasing it

significantly decreased leaf-Zn content during the two seasons of the study. This confirms the earlier findings reported by Omar, (1996) on apricot and mango seedlings and Abd El-Mageid, (1998) on almond plants.

B-Interaction effect:

Referring the interaction effect of the four investigated factors i.e., olive cvs., salinity concentration, S.A.R. and Cl:SO₄ ratio, on leaf-Zn content, data obtained in Table (21) showed obviously the variable response of olive transplants to the different combinations during 2000 and 2001 seasons. It could be noticed that the most depressive effect on leaf- Zn content was detected by such that combinations represented Aghizi irrigated with the highest salinity concentration transplants (6000 ppm) of S.A.R.- 6 and higher Cl:SO₄ ratio whereas the lowest leaf-Zn content was resulted. On the other hand, the least decrease in leaf-Zn content was detected by Coronaiki olive transplants irrigated with 2000 ppm saline solution of S.A.R. 3 lower Cl:SO₄ ratio as compared to control (tap water) during both seasons of study. Other combinations were in between the aforesaid two extremes.

Generally, it could be concluded that the reduction in growth of olive transplants associated with salinity stress noticed in the present investigation might be attributed to the harmful effect of salts on plant growth which is related to nutrient changing of their forms in the soil or to the compition between the salt cations and anions with the nutrients. Other causes are more related to the plant itself, which affect its ability to absorb water or directly affect the plant biochemical to toxicity, **Balha**, (1984).

Tables (21): Leaf iron; manganese and Zinc contants (ppm) of olive transplant in response to specific and interaction effects of olive cultivars; salt concentrations;SAR; Cl:SO4 ratio and their combinations in saline irrigation water during 2000 & 2001 seasons.

26	SAR 6=59.26B	AZA	I ou=62 02.42A	В	High=38.21	A	LOW=39.88.	1			line and a second	fic effect of a	fer to speci	and **** means refer to specific effect of climate the control of
IVI	150	61.57B	SAR 3-65	9B	SAR 6=37.19B	0A 5	SAR 3-40.90A	OR SYB	High=116 70B	OA.	Low=124.00A	L	(CE:304)	
	35.57 _X	+	+	1	32.45C	B	43.77A 37	1	SAR (=117	1	SAR 3=128.20A		(SAK)	Means (C
43.92D	_	_	-		20.810	-	-	12	20.312	+	+	1.	vs.)	Mean (Cvs.)
	44.94rs 42.06uv	46.56r	48.37q	28.22D	24.97op 21	29.52n 24	31.14mn 2	75.76D 31		69.22x 61	82.52w 6	High cl	R 6	<u> </u>
1	48.31q	+	52 100	1	26.870	+	-	_	69.67xx	-	-	F	+	6000 ppm
58.10C	53.050	-	59.541	_	29.13n	_	_	523	84.04vw	87 781 3	+	+	SAR 3	
	57.69m 56.17mm	60.88kJ	63.26ij	37.04C	1-	38.57gh 3:	44.13e 3	109.83C			123.78m	Low cl	SAR 6	
	61.76jk	68.04h	70.70g		36.25jj	+	1		104.79s 97.841	118.18p 1	140.29; 132.03k	High cl	SAR 3	4000 ppm
72.36B	68.01h	75.21f 71.63e	78.14e 74.42f	45.23B		-	\dashv	7	121.73n 113.88q	-	-	-	0 ALEC	
87.6ZA	+	80.58d	83.72c	-	40.69fg	47.440	_	46 020	_	-	364.671	+	can,	- Popul
3	F8C 08	89.54b	93.03a	52.37A	\vdash	+	54 925		7	-	186.406	High cl	SAR 3	2000 nnm
2	88C.70=udru	,					61 305	177.75A	153.72g	172.56d	-			
	History	5.74A	LOW-65.74A	1.21B	rugn=51.21B		1	2001			1		Control)	Tap water (Control)
12	SAR 6=61 05B	₹ 3=67.27A	SAR 3=	50.46B	3AK 0=30.46B	82A	Low=32.82A	9.66B	High=119.66B	AKO.	AK0./77-407			
1	57.560	61.26B	67.83A	X	210.67	3.574	3-	15.92B	SAR 6-115.92B	31.43A	I ou-197 (6)		(Cl:SO ₄)	Mean****
	37.25		43.79rs		100.01	30 448	+	\setminus	112.31B	Secret	SAD 3-1		(SAR)	Mean***
45.59D	\neg	_	47.69pq		19 02:	19.77	22.62r-t		38.64Z	200.002	131 064		(Cvs.)	Mean*
		50.21op 46.69qr	55.47n 51.58o	22.68D	20.86tu	22.71r-t	26.550-q 24.58q-s	75.88D	66.86yz	68.44	78.29w	Low cl High cl	SAR 6	
39.900		57.27mn 53.74no	59.36lm		23.72rs	26.660-q 24.86gr	30.48lm 28.52m-o		84.98v	85.99uv	98.77 _f	Low cl High cl	SAR 3	6000 ppm
	57.12mn	-	67.15hi	29.92C	27.98n-p	30.39lm 27.80n-p	32.45kl	113.52C	103.57q	105.29p 94.76s	121.79	High cl	SAR 6	
	+-	+	74.94e		29.58mn	32.20kl	36.87f-h		120.00m 109.760	121.09lm 112.31n	130.15k	High cl	SAR 3	4000 ppm
74.37B	70.36f-h	71.36f	78.83d	37.41B	32.90jk	36.05g-I	41.79bc		130.63jk	131.62	150.57h	+		
+	\dashv	-	88.61b		35.09h-i	37.40c-g	42.60b	151.90B	149.83h	140.39	163.94e		SAR 6	
80 404	82.78c	88.10b	97.32a	44.07A	39.8860	39 424	44.07b		154.36g	157.94f	177 654	High c	SAK 3	2000 ppm
\vdash	H	1				A3 164	49.178	183.15A	173.18d	175.50c	200.778	٦	Control	
Mean	Aghizi	Ma	Coron	Mean**	Aghizi	Manz.	Coron.	'vican'	9	-			Tan water (Control)	Tap wate
1	Zinc (ppm)	7.11			(mdd) seams		,		Aghizi	Manz	Coron			reamtnts
					֡									

*. **.*** and **** means refer to specific effect of olive cvst.salinity concentration.* S.A.R. and Cl:SO4 ratio, respectively. Values within the same column or row for any of four investigated factors, or their combination.

IV.II. Second experiment: Effect of foliar sprays with phosphorus, potassium and zinc on saline stressed transplants of three olive cultivars.

In this regard specific of three investigated factors namely: a olive cultivar (Coranaiki; Manzanello and Aghizi); sprayed nutrient elements (P & K each at 500 ppm and Zn at 100 ppm), chloride levels of saline solutions 6000 ppm of S.A.R-6 (low & high) and their possible combinations on salinity stressed olive transplants were studied pertaining the response of the following parameters:

IV.II.I. Vegetative growth measurements:

IV.II.1. Stem, root and total plant length (cm):

Data obtained during both 2000 and 2001 experimental seasons regarding the specific effect of three investigated factors involved in this study i.e., olive cultivar; sprayed nutrient element; Cl:SO₄ ratio and interaction effect of their combinations are presented in Table (22).

A- Specific effect:

Concerning the specific effect of the olive cultivar, it is quite evident that Coronaiki cultivar transplants had statistically the tallest stem, root and total plant, followed in a descending order by Manzanillo, while the reverse were detected with those of Aghizi transplants during the two seasons of study.

Referring the specific effect of sprayed nutrient element it is so clear as shown from Table (22) that both phosphorus and potassium each sprayed solely at 500 ppm as well as zinc ADTA at 100 ppm foliar spray resulted in an obvious increase in

three parameters (stem, root and total plant length) of saline stressed transplant as compared to the unsprayed ones during two seasons of study. In this concern 100 ppm Zn ADTA sprayed transplants exhibited significantly the greatest increase in their stem; root and total plant length followed in a descending order by those sprayed with potassium and phosphorus each at 500 ppm during 2000 and 2001 experimental seasons. In this respect, Miller and Deidda, (1975) demonstrated that some parameters of young olive trees were seriously affected by phosphorus application and Khamis et al., (1985) on found that p foliar sprayed of saline stressed rooted cuttings of two grape species slightly increased their stem length compared with unsprayed plants irrigated with saline water.

On the other hand, **Huffaker and Wallace**, (1959) reported that the high rates of K fertilizer prevent the absorption of Na by plants to which Na is not a nutritive element and by plants that need a high ratio of (Ca + Mg): (K + Na) in the nutritional requirement. Also, **Khamis** et al., (1985) reported that, potassium not only ameliorated the harmful effect of salinity, but also encouraged the vegetative growth of saline stressed transplants of two grape species.

Moreover, spraying olive transplants grown under saline condition with Zn micronutrient surpassed in their stem, root and total plant length than those irrigated with saline solution. This effect may be due to the physiological effect of these nutrient. The result of Zn spray is in agreement with the findings of **Rejupt** et al., (1976) on mango trees who found that spraying ZnSO₄ at 0.2-0.8 % in January increased length of the terminal

shoots. In this respect Zn stimulated cell elongation by encouraging cell walls to stretch Nason, (1950) as a result of its function biosyntheses of tryptophan a precursor of the plant auxin IAA. In addition, Behairy et al., (1985) on saline stressed transplants of guava and olive mentioned that Zn nutrient improved their vegetative growth.

With regard to the specific effect of chloride level (Cl:SO₄ ratio) on stem, root and total plant length, it could be observed from data in Table (22) that the higher Cl:SO₄ ratio resulted in a significant decrease in both stem and root length and consequently the total plant length during two seasons of study. Similar results were also found by **Omar** (1996) on apricot and mango seedlings.

B-Interaction effect:

As for the interaction effect of various combinations between olive cultivars; sprayed element and chloride level (C1:SO₄ ratio) on stem; root and total plant length of olive transplants, data in Table (22). indicated obviously that the tallest stem; root and total plant were closely related of Coronaiki transplants irrigated with 6000 ppm saline solution of S.A.R-6 lower C1:SO₄ ratio sprayed with Zn ADTA at 100 ppm. However the shorttest stem root and total plant length were detected by irrigated Aghizi transplants with 6000 ppm solution of S.A.R-6 higher C1:SO₄ ratio and sprayed with phosphorus at 500 ppm which ranked later just prior unsprayed ones treatment during 2000 and 2001 experimental seasons. In addition, other combinations were in between.

Table (22): Plant height; root and total plant length of 6000 ppm; 6 SAR saline solution irrigated olive transplant as influenced by specific and interaction effects of olive cultivar; foliar spray with some nutrient elements; Cl:SO4 ratio and their combinations during 2000 & 2001 experimental seasons.

The second secon	Mean*** (Cl:SO4)		Mean* of	Zinc	Fotassium	rnospnorus	Control (6000SAR 6)			Mean (Cl:SO4)		Mean" of the	Zinc	Potassium	Phosphorus	Control (6000SAR 6)		Treamints	
	(100		of cvs.	High d	High cl	High cl	High cl	Low cl		SO ₄)		High d	Low cl	High d	High d	High cl	Lowel		Cultivars
10.1	131	- 1	45.20A	47.75 c	45.42 de	43.19 g	38.64 k	40.83;			_	43.55 f	50.42 a	## 22 e	40.83 g	36.97 I	38 14 :	Coron	_
2002	43.08.4	Low	42.95 B	12.44 gh	42.28 h	12.08 h	37.751 45.22 c	40 10 ::	2002	41 66 4	AT. A.D. D	43.36 f	45.42 d	35.92 n	39.81 h	37.25 k	37 52 :	Manza.	Plani
33	202	- 1	36.34 C	37.64 l	35.97 m	36.25 m	29.61 n	30 17 -			33.40 €	36.33 m	40.89 g	32.80 o	30.17 q	28.55 s	30 43	Aghizi	Plant height (cm)
39.94 B	ngn		$\sqrt{}$	44.51 A	43.06 B	42.23 C	36.20D		37.400	rugn		43.33 A		41.33 B	38.97 C	34.65 D	11 415	Mean**	
26.0			75 94 A	34.77 a 27.33 f	26.40 h	24.02 ij	15.97 n	1007			27.17 A	29.70 d	35 80 8	32.47 bc	30.23 d 24.12 g	18.39 J 17.65 k	2000	Coron.	
26.02 A	Low.	64.17 D	22 70 B	30.40 c	23.91 j	18.601	13.33 o 12.84 p		26.27 A	Low	23.91 B	27.99 f	419 CE	31.95 c	28.98 e 16.45 lm	17.02 l 15.06 n		Manza.	Root
20.30 B	High	20.75 C	7 35 00	29.51 d	18.601	26.78 g 17.03 m	12.45q 11.82 r		20.	Н	19.01 C	23.02 h	21.00	27.41 f	23.83 g 15.96 m	15.16 n 13.83 o		Aghizi	Root length (cm)
0 B	gh			28.18 A	26.21 B	24.32 C	13.94 D		20.46 B	High		28.42 A		25.59 B	23.26 C	16.19 D		Nean**	
69.10A	Low	71.14A	15.000	84.63a	80.90b 71.82g	76.85d 67.21i	58.05m 54.61n		67.93A	Low	71.18A	73.25e	75.24e	82.69b	77.93d 64.95h	56.53k 54.63m		Coron	H
0A	3.	65.74B	165.00	79.15c	75.31e 66.19k	73.85f 60.69l	53.52o 50.59p		3A	1446	65.16B	78.22d 71.35g	30.94K	79.26c	72.40f 56.25kl	54.55m 52.31n		Manza.	Total length of plant (cm)
60.22B	High	57.09C	16.00	70.12h	66.80j 54.57n	67.39i 53.28o	42.62q 41.43r		57.94B	Hi	52.47C	62.08 ₁ 59.36 ₁	44.48p	64.94h	55.751 46.13o	44.64p 42.41q		Aghizi	of plant (cr
2B	#	X		72.68A	69.27B	66.55C	50.14D		14B	High	\bigvee	71.75A		66.93B	62.24C	\$0.85D		Mean**	m)

effect values of each investigated factor but small letters for interaction of their combination. any of three investigated factors followed by the same letter/s were not significantly different at 5% level where capital letters were used for distinguishing specific *, **, *** means refer to specific effect of olive cvs.; sprayed nutrient element treatment and Cl:SO4 ratio, respectively Values within the same column or row for

IV.II.1.2. Number of laterals and leaves per plant:

A- Specific effect:

With regard to specific effect of olive cultivar, Table (23) reveals that Coronaiki transplants had significantly the greatest number of both laterals and leaves per plant, followed in a descending order by transplants while Aghizi cvs. Manzanillo was the inferior. Such trend was true during both 2000 and 2001 seasons.

Referring the specific effect of sprayed nutrient element, it is quite clear that three solutions of P;K and Zn foliar sprays resulted in significant increase in both parameters (Nº of laterals & leaves) per each saline stressed transplant. However, the increase in both parameters exhibited by P foliar spray was statistically more pronounced significant by followed in a descending order by Zn and K foliar sprays during both seasons of study. In this respect, Miller and Deidda, (1975), demonstrated that some parameters of young olive trees were positively affected by phosphorus applications. In addition, Sari El-Deen et al., (1979) mentioned that number of leaves in olive seedlings grown under salinity treatment was affected by rising phosphorus concentration. Moreover, Khamis et al., (1985) on Thompson and American grape rooted cuttings and Behairy et al., (1985) on olive and guava seedlings mentioned that spray with either p; k or Zn improved vegetative growth of salinity stressed plants.

Regarding the specific effect of chloride level (Cl:SO₄ ratio) of saline water used for irrigation on number of laterals and leaves per transplant, it could be observed from data in

Table (23): Number of laterals and leaves (plant) of 6000 ppm; 6 SAR saline solution irrigated olive transplant as influenced by specific and interaction effects of olive cultivar; foliar spray with some nutrient elements; Cl:SO4 ratio and their combinations during 2000 & 2001experimental seasons.

		Ī	TAUMDER 0	Number of laterals / plant	lant		Number of leav	fleaves / plant	
Treamtnts	/	Coron	Manza.	Aghizi	Mean**	Coron.	Manza.	Aghizi	Mean**
				2000				9	
Control (6000SAR 6)	Low cl	1.39ij	0.831	1.07 k	1050	49.24 0	13.87	3171	
Phoenham	Low cl	3 399	0.751	1.00 k	עכט.ז	47.22 p	41.82 s	47.15 p	45.85 D
rnosphorus	High cl	2.94d	1.94g	3.25 b	2.44 A	87.20 a	76.54 f	83.84 b	75 06 A
Potassium	Low cl	2.83de	1.78h	1.97 g		875.17	50.96 K	69.91 h	, DOO: 0
!	High cl	2.25f	1.06 k	1.50 i	1.90 C	60.061	/6.55 f 58.07 n	77.86 d	68.85 C
Line	High cl	2.28 f	1.83 gh	2.78 e	2.28B	81.27 c	67.96 i	77.17 e	
Mean* of cvs.	CYS.	2.43 A	1376	102.5		72.07 g	61.19 k	65.33	70.83 B
Mean*** (Cl:SO ₄)	(108	L	Low		High	68.78 A	60.86 C	65.80 B	\bigvee
		2.1	2.18 A		1 66R		104	High	办
				2001		/0.2	70.82 A	59.47 B	7 B
Control (6000SAR 6)	High cl	1.53 I 1.33m	1.03 n 0.97 n	1.30 m	1.235 D	57.20 o	47.17r	53.78 p	
Phosphorus	Low el High el	3.22a 2.75c	2.00i . 1.531	3.03 b	2.500 A	101.1 a	43.65s 86.85 d	51.29 q 100.40 a	07 40 1
Potassium	Low cl High cl	2.35 fg 2.23 h	2.03 i	2.27gh	2.354 C	88.98 c	63.56 n 80.34 f	79.71 f 86.83 d	0/.40 A
Zinc	Low cl	3.00 b	2.42 ef	2 53 Y		68.59	65.62 m	67.151	/6.25 C
Mean* of our	High cl	2.47 de	1.89	1.981	2.382 B	86.29 d 75.76 g	74.77 h 67.85k	85.60 e	76.88 B
O I Committee of the	.13,	2.36A	1.70 C	2.10 B	$\langle $	78 17 A	66.73	10.961	
Mean*** (Cl:SC		Low	*	- 1	igh		00.23 C	74.47 B	\mathbb{N}
		2.22A	A	1.8	9 B	Lot		High	-
Mean*** (Cl:SO4) Low High Low 2.22A *** *** means reference of the control of t		Lov 2.22	A	1.8 H	High 1.89 B	/8.1/A 6 Low 79.11 A	66.23 C	74.47 B High 66.80 B	可草一
*** means rafaman	L							00.00	7

any of three investigated factors followed by the same letter/s were not significantly different at 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination. ve cvs.; sprayed nutrient element treatment and Cl:SO4 ratio, respectively Values within the same column or row for Table (23 that the higher ratio resulted in a significant decrease in number of both laterals and leaves/plant. Similar results were also found by **Kabeel**, (1985) on some deciduous fruit seedlings; **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond seedlings.

B-Interaction effect:

As for the interaction effect of the three investigated factors i.e., olive cultivar; sprayed nutrient element and chloride level (Cl:SO₄ ratio) on number of both laterals and leaves per transplant, Table (23) shows a considerable and statistical effect in both seasons of study. Herein, the greatest values of both parameters i.e, number of laterals and leaves per plant were in closed relationship to Coronaiki transplants sprayed with P at 500 ppm and irrigated with 6000 ppm saline water of S.A.R- 6 and low chloride level during 2000 and 2001 seasons. On the contrary, the least number of both parameters (laterals and leaves per transplants) was generally coupled with unsprayed Manzanillo transplants irrigated with 6000 ppm salinity concentration, S.A.R-6 and higher chloride level during two seasons of study. Moreover, other combinations were in between the aforesaid two extremes.

IV.II.I.3. Average leaf area and total assimilation area/plant:

The average leaf area and total assimilation area / plant estimated in cm² in response to specific and interaction effects of olive cultivars, kind of sprayed nutrient element (P, K and Zn) and Cl:SO₄ ratio as well as their combinations were investigated.

Data obtained during both 2000 and 2001 experimental seasons are presented in Table (24).

A- Specific effect:

Concerning the specific effect of olive cultivar, Table (24) reveals that the greatest area of either individual leaf or the total assimilation area per plant was significantly coupled with Coronaiki transplants during both 2000 & 2001 experimental seasons. On the contrary, Manzanillo cvs. had significant by the smallest leaf area and assimilation area/plant during 1st and 2nd seasons. In addition Aghizi cvs. was in between in this respect during the study. Such trend of response for total assimilation leaf area per transplant to the specific effect of olive cultivar could be logically explained on that fact depending on the unparallel rate variance between three studied olive cultivars pertaining the response of number of both (laterals & leaves per plant) from one hand and average leaf area of each cultivar from the other. Hence, the aforesaid three growth measurements (N^{o} of laterals, leaves/plant and leaf area) will be reflected directly on the total assimilation area per plant.

As for the specific effect of nutrient element sprayed, it is quite evident as shown from Table (24) that P; K and Zn foliar spray resulted in a significant increase in both leaves measurements i.e., average leaf area and total assimilation area/plant as compared to control (salinity stressed transplants with no nutrients spray). Such trend was true during both seasons, however, phosphorus foliar spray was the most effective in this concern followed in decreasing order by Zn and K foliar spray.

Table (24): Average leaf and Total assimilation area (cm) of 6000 ppm; 6 SAR saline solution irrigated olive transplant as influenced by specific and interaction effects of olive cultivar ; foliar spray with some nutrient elements; Cl:SO4 ratio and their combinations during 2000 & 2001 experimental seasons.

Mean*** (Cl:SO4)		Mean* of cvs.		Zinc	A Composition	Potassium		Phaspharus		Control (6000SAR 6)			Mean*** (Cl:SO4)		Mean* of cvs.		Zinc	I Otassium	Datasian	Phosphorus	1	Control (6000SAK 6)	- Constant		Treamtnts		
Ď		cvs.	High ci	Low cl	High cl	Low cl	High cl	Low cl	rugn ci	Low cl			(ĵ		CVS.	High of	Low cl	High cl	Low cl	High cl	Low cl	High cl	Low cl		/	/ r	Cultivars
2		3.00A	2.72.1	3.10 de	3.14 d	3.13 d	3.34 0	3.46 a	2.41 111	2.48 h			3	1	2.80 A	1.91 0	3.10 c	2.61 h	3.25 b	2.87 e	3.45 a	2.03 m	2.11 1			Coron	
2.84A	Low	7.400	3 180	2.87 t	1.00	, 1.63 1.63	1.10%	3.07 de	2011	1.90 m		00 /1	7 63 A	Low	2.19 C	T.DON	2.64gh	2.30 K	2.50 y	2.02 m	2.43 J	1.63 n	1.66 n			Manza.	Leaf a
		4.750	7 73B	2.901	fr 10.7	3.03 e	2 1 1	3 12 4	2 76 5	2.09 1	1007		2		2.47 B	1.70	2.69 g	1.44	2.5/11	2./81	3.12 c	1. /O n	2.00 m	2000		Aghizi	Leaf area (cm)
2.63B	High		$\langle $	2.853 B		2.771 C		3.160 A		2.162 D			2.35 B	High			2.696 B		2.613 C		2.777 A		1.858 D			Mean**	
23,		200	228.21A	207.00 j	2 06 200	210.60 1	3 08 177	247.30 g	335 80 a	123.80 o	u 00 221		192	1	190.30 A	1 75 001	194.00 h	P.00.05.	154 60 k	353000	200.50	35.00 q	99.65 P			Coron	
131.93 A	Lon	0.00	168.99C	195.00 k	4 08 ecc	152.90 m	211.30 i	157.01 m	234.80 h	81.63 г	89 46 a		192.34A	LOW	100.75	136 03 C	140.90 m	179 70 ;	133.80 n	191 40 hi	177 90 0	186.00	68318	7000		Manza.	Assimilation Leaf area
100	170	H	219.26B	219.70 i	281.30 d	162.90 1	269.60 ef	264.60 f	314.30 b		127.60 o		142.		H	175.39 B	178.50 j	218.30 e	146.701	209.10 f	199.70 ₪	272 10 b	80 43 I	08 31 50		Aghizi	Leat area (cm)
2000	170 DSB	High	\bigvee	238.1 / D		213.16 C	21210	230.77	258 07 A	111.001	111 (37)		142./85	100	High		191.68 B		181.430	361 136	211.68 A		85.44 D			Mean**	- 1

*,**,*** means refer to specific effect of olive cvs.; sprayed nutrient element treatment and Cl:SO4 ratio, respectively Values within the same column or row for any of three investigated factors followed by the same letter/s were not significantly different at 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

With respect to the specific effect of the Cl:SO₄ ratio of saline solution used for irrigation on average leaf area and total assimilation area/plant (cm²), it could be noticed from data in Table (24) that the higher ratio significantly decreased both leaves parameters during 2000 & 2001 experimental seasons.

B-Interaction effect:

Referring the interaction effect of the investigated three factors i.e., olive cultivar; sprayed nutrient element and chloride level (Cl:SO₄ ratio) on average leaf area and total assimilation leaf area/plant, data obtained from Table (24) showed that the Manzanillo cvs.(at higher Cl:SO₄ ratio) spraying salinity stressed transplants of with Zink ADTA, whereas exhibited least increase in the values of average leaf area and assimilation leaf area over control. On the other hand, the highest increase in both average leaf area and assimilation area values were detected by their Coronaiki transplants irrigated with 6000 ppm saline solution of S.A.R.-6 and lower chloride level after had been sprayed with phosphorus during 2000 and 2001 seasons. Moreover, other combinations were in between the aforesaid two extremes.

IV.II.I.4. Leaves fresh and dry weights per plant: A- Specific effect:

Referring the specific effect of olive cultivars, data in Table (25) clear that leaves fresh and dry weights of salinity stressed olive transplants followed usually the same trend of response during both 2000 & 2001 experimental seasons. Hence, Coronaiki transplants had always the heaviest fresh and dry weights of leaves during both seasons of study. The reverse was

true with Manzanillo transplants which characterized by their lightest leaves weights (fresh and dry). Moreover Aghizi cvs. was intermediate. Differences were significance as compared each other during both seasons of study. Regarding the specific effect of sprayed nutrient element Table (25) displays that spraying salt stressed olive transplants with any of P; K or Zn resulted in an obvious increase over the control (unsprayed salt stressed transplants). However, the increase in both fresh and dry weights of leaves was significant during both seasons, but phosphorus was statistically more effective than zinc followed in a descending order by potassium foliar spray during two seasons of study. The obtained results are in line with those mentioned by **Khamis** *et al.*, (1985) on Thompson and American grape rooted cuttings and **Behairy** *et al.*, (1985) on olive and guava seedlings.

As for the specific effect of chloride levels (Cl:SO₄ ratio) of saline solution used for irrigation on leaves fresh and dry weights, data are founds in Table (25). It is noticed that leaves fresh and dry weights showed significant decrease with increasing of Cl:SO₄ ratio in water irrigation during two 2000 and 2001 seasons. These results are in agreement with the findings of **Kabeel**, (1985) on Thompson seedless grape, Meet Ghamr peach and Hollywood plum seedlings; **El-Khateeb**, (1989) on fig plants; **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond seedlings.

B-Interaction effect:

With regard to the interaction effect of different combination between olive cultivars, sprayed element and

Table (25): Fresh and dry weights of leaves (gm) of 6000 ppm; -6 SAR saline solution irrigated olive transplant as influenced by specific and interaction effects of olive cultivar ; foliar spray with some nutrient elements; Cl:SO4 ratio and their combinations during 2000 & 2001experimental seasons.

	Cultivars		Fresh weigh	Fresh weight of leaves (gm)	(m)		Dry weight of leav	of leaves (gm)	
Treamints		Coron	Manza	Aghizi	Mean**	Coron	Manza.	Aghizi	Mean**
				2000					
7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Low cl	10.70	9 581	1-1590			,		
Control (0000SAK 6)	High el	10.26jk	9.19n	9.32m	9.781D	3.820	> (P	3.850	3.25D
Phosphorus	Low cl	18.95a	16.82c	17.06bc		8879	8 72.04	0.5004	
a morphoon and	High cl	15.63d	13.42g	14.22f	16.02A	7370	6.551	7.095	7.77A
Potaccium	Low cl	17.65ab	15.84d	16.82c		0,000	0.015	1150.7	
Y OCHESTIANI	High cl	13.05gh	12.07	12.75hi	14.70C	401.6	5.07	8.180	7.15C
7:	Lon cl	17.66ab	14.93e	15 70d		0.17	4.72	0.221	
Zille	High cl	15.66d	13.22g	13 440	15.10B	7 10h	875.7	8.011	7.33B
Mean* of cvs.	CVS.	14.95A	13.13C	13.62B	\bigvee	6.72A	5.98C	6 43R	
Mean*** (Cl:SO4)	(10°)	Low		High		Low		High	
		15.11A		12.69B		7.00A		575 B	
				2001					
Control (6000SAR 6)	Low cl	11.600	9.671	10.21q		3.73	3 26ik	1:05	
	High cl	11.09p	8.95s	9.74	10.210	3.16ik	2.87k	3 09k	3.23D
Phosphorus	Low cl	20.50a	17.80e	19.08b	4 20 1	9.87a	871c	4000	
	High cl	18.81c	13.03m	15.14j	1739A	8.54cd	6.371	7.83ef	8.44A
Potassium	Low cl	18.05d	16.42g	16.54g	15.100	8.53cd	8.06d-f	8 17ah	
	High cl	13.91k	12.75n	13.451	15.190	6.61hi	6.31i	6.58hi	7.38C
Zinc	Low cl	17.50f	15.331	16.25h		8410-	7 50fa	7025	
2000	High cl	15.36i	13.481	13.91k	15.31B	7 0030h	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	6 00L:	7.42B
Mean* of cvs.	CVS.	15.85A	13.43C	14.29B	$\sqrt{}$	6.98A	0.240	6610	
Mean*** (Cl:SO4)	<u>0</u>	Low.		High		Low		High	
		15.75A		13.30B		7.23A		4107	

any of three investigated factors followed by the same letter/s were not significantly different at 5% level where capital letters were used for distinguishing specific *, **, *** means refer to specific effect of olive cvs.; sprayed nutrient element treatment and Cl:SO4 ratio, respectively Values within the same column or row for effect values of each investigated factor but small letters for interaction of their combination

chloride levels (Cl:SO₄ ratio) on leaves fresh and dry weights of olive transplants, data presented in Table (25). Showed a variable response in both fresh and dry weights of leaves / plant during two seasons of study. Anyhow, the greatest value of leaves fresh and dry weights were generally in closed relationship to 500 ppm phosphorus sprayed Coronaiki transplants irrigated with 6000 ppm saline solution of S.A.R-6 and lower Cl:SO₄ ratio during 2000 and 2001 seasons. Meanwhile, the reverse was true with unsprayed Manzanillo and Aghizi transplants irrigated with saline water having S.A.R-6 higher chloride levels (Cl:SO₄ ratio)during both seasons of study. In addition other combinations were in between the aforesaid two extremes.

IV.II.I.5.Fresh and dry weights of stem; root and total plant:

A- Specific effect:

Concerning the specific effect of the different factors involved in this study i.e., olive cultivar, sprayed element and chloride level (Cl:SO₄ ratio) on stem; root and total plant fresh and dry weights, data in Tables (26, 27 and 28) showed that Coronaiki transplants had the heaviest stem, root and total plant dry weights, followed in descending order by Manzanillo and Aghizi cvs. However, differences were significant as the fresh and dry weights of stem; root or total plant for a given cultivar were compared to the analogous ones of the two other cultivars.

Regarding the specific effect of sprayed nutrient element, Tables (26, 27 and 28) display that P; K and Zn each sprayed solely at 500 and 100 ppm for two former and later ones respectively increased obviously the stem; root and total plant

(fresh and dry weights) rather than analogous ones of the unsprayed salt stressed olive transplants (control) during both seasons of study. However, phosphorus was more effective than either potassium or Zinc and the increase exhibited by its application in six weight measurements of stem; root and total plant (F. W. & D. W.) over the unsprayed salt stressed olive transplants (control) were significant during 2000 and 2001 seasons. This results is in agreement with the findings of **Khamis** et al., (1985) on Thompson seedless and American grape plants. Who, found that spraying P and/ or K, reduced the salinity damage and increased leaves, stem; root and total plant dry weights. In addition, **Behairy** et al., (1985) found that p & k foliar sprays improved the leaves; stem; roots and total plant dry weights of salinity stressed seedlings of olive and guava.

With respect to the specific effect of Chloride levels (Cl:SO₄ ratio) of saline solution used for irrigation on fresh and dry weights of stem; root and total plant, data are presented in Tables (26, 27 and 28). It is quite clear that fresh and dry weights of plant organs (stem;root and total plant) were significantly decreased by increasing Cl:SO₄ ratio in irrigation water during two 2000 and 2001 seasons. This results go in line with that found by **Kabeel**, (1985) on three deciduous fruit species, **El-Khateeb**, (1989) on fig plants; **Omar**, (1996) on apricot and mango seedlings and **Abd El-Mageid**, (1998) on almond seedlings.

B-Interaction effect:

As for the interaction effect of the three investigated factors i.e., olive cultivars; sprayed nutrient element and chloride

Table (26): Fresh and dry weights of stem (gm) of 6000 ppm; -6 SAR saline solution irrigated olive transplant as influenced by specific and interaction effects of olive cultivar; foliar spray with some nutrient elements; Cl:SO4 ratio and their combinations during 2000 &2001experimental seasons.

B	5.66 B	6.73 A	6.7	15.41 B	_	10 30 A	19.	(1)	TATE OF THE PARTY
12	High	Low	1	High		Low	7	O.O	Magness (Cl-SO)
V	4.59C	6.33 B	7.66A	\bigvee	12.62 C	17.10 B	22.48 A	cvs.	Mean* of cvs.
5.84 C	4.59 jk 3.90 m	5.47 gh 5.54 gh	8.40 bc 7.11 e	16.50 C	12.60 m 9.95 op	16.02 j 15.56 jk	23.97 e 20.91 i	Low cl High cl	Zinc
6.59 B		8.75 b 5.51 gh	8.46bc 7.68 d	19.50 B	15.20 k 9.80 op	25.72 d 14.621	30.39 b 21.26 hi	Low cl High cl	Potassium
7.39 A		7.66d 7.62 d	9.37 a 8.17c	22.99 A	21.59 gh 12.39 m	22.43 f 22.10 fg	32.12 a 27.32 c	Low cl High cl	Phosphorus
4.95 D	4.22 k-m 3.30 n	5.36 h 4.71 ij	6.25 f 5.86 fg	10.60 D	9.91 qp 9.50 p	10.21 o 10.11 o	12.50 m 11.35 n	Low cl High cl	Control (6000SAR 6)
t	5.13 B	5.84A	5.2	13.55 B	7001	02 A	16.02		ett
1 3	High	Low	1	High		Low	1	0,0	Mean*** (Cl:SO4)
\bigvee	4.69 C	5.69 B	6.06 A	\bigvee	12.30 C	15.34 B	16.73 A	cvs.	Mean* of evs.
4.98 C	4.89 fg 3.78 i	5.49 e 4.89 fg	5.58 e 5.22 ef	12.12 C	10.24 1 7.77 o	14.54 i 12.64 j	14.80 i 12.71 j	Low el High el	Zinc
5.76 B		6.16 d 5.69e	6.98 c 6.17 d	17.67 B	15.96 h 12.73 j	19.26 d 17.56 g	22.12 b 18.38 e	Low cl High cl	Potassium
7.37 A	7.02 c 6.56 cd	7.93 ab 6.97 c	8.12 a 7.59 b	19.88 A	20.65 c 17.33 g	22.02 b 18.23 ef	23.03 a 18.01 f	Low el High el	Phosphorus
3.84 D	3.32 j 2.44 k	4.56 gh 3.86 i	4.71 g 4.13 hi	9.487 D	7.31 p 6.38 q	9.54 m 8.92 n	12.80 j 11.97k	Lon cl High cl	Control (6000SAR 6)
					2000				
Mean**	Aghizi	Manza.	Coron	Mean**	Aghizi	Manza.	Coron		Treamints
	of stem(gm)	Dry Weight of stem		н)	Fresh Weight of stem(gm)	Fresh Weig		Cultivars	/

^{*, **, ***} means refer to specific effect of olive cvs.; sprayed nutrient element treatment and Cl:SO4 ratio, respectively Values within the same column or row for any of three investigated factors followed by the same letter/s were not significantly different at 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

Table (27): Fresh and dry weights of root (gm) of 6000 ppm; 6 SAR saline solution irrigated olive transplant as influenced ratio and their combinations during 2000 & 2001experimental seasons. by specific and interaction effects of olive cultivar; foliar spray with some nutrient elements; Cl:SO4

	Mean*** (Cl:SO4)	Mean" of cvs.	Zinc Low cl	Potassium High cl	Phosphorus Low cl High cl	Control (6000SAR 6) Low cl High cl		3	Mean*** (Cl:SO4)	Mean* of cvs.	Zinc Low cl High cl	Potassium Low cl High cl	Phosphorus Low cl High cl	Control (6000SAR 6) Low cl High cl		Treamints	/
10		12.37 A	cl 12.21 e		-	-		1:		13.19 A	cl 14.83 b	nel 13.28 d	_	h cl 8.68 j		Coron.	
10.69 A	Low	9.56 B	9.73 g 9.53 g	10.74 f 9.49 g	13.93 d 8.36 h	7.78 hi 6.92 jk		11.54 A	Low	10.87 B	12.61 e 9.90 hi	11.14 f 10.23 gh	14.24 c 13.09 de	8.59 i 7.15 kl		Manza	
.8	I	7.09 C	7.72 hi 6.66 jk	8.41 h 6.34 k	7.98 hi 6.54 k	6.91 jk 6.16 k		9		7.96C	7.50 k 7.03 kJ	10.57 g 8.65 j	9.43 i 6.83 lm	7.30 KI 6.36 m	2000	Aghizi	
8.66 B	High	\bigvee	9.42 C	10.45 B	11.62 A	7.20 D	2001	9.80 B	High	\bigvee	10.74 C	11.60 B	12.15 A	8.21 D		Mean**	111111111111111111111111111111111111111
5.3	T	6.28 A	7.04 c 4.81 h	7.61 b 6.75 d	8.02 a 5.99 f	5.30 g 4.69 h		5.	1	6.29A	6.87 b 5.95 d	7.61 a 6.29 cd	7.61 a 6.57 bc	5.29 e 4.12 g		Coron	
5.31 A	Low	4.66 B	4.46 i 4.29 i	6.21 e 3.97 j	6.39 e 5.40 g	3.54 k 3.04 l		5.63 A	Low	5.13 B	5.97 d 4.53 fg	5.28 e 4.91 ef	6.78 b 6.12 d	4.07 g 3.39 h		Manza.	
4.22	Hi	3.36 C	3.82 j 2.58 n	3.60 k 2.87 lm	4.74 h 3.58 k	2.94 l 2.71 mn		4.6	Н	3.99 C	5.13e 3.33h	5.01 e 4.13g	4.47 fg 3.38 h	3.46 h 3.02 h		Aghizi	(Pers)
4.22 B	High	\bigvee	4.50 C	5.17 B	5.69 A	3.70 D		4.65 B	High	\bigvee	5.298 C	5.538 B	5.823 A	3.892 D		Mean**	,

^{*, **, ***} means refer to specific effect of olive cvs.; sprayed nutrient element treatment and Cl:SO4 ratio, respectively Values within the same column or row for any of three investigated factors followed by the same letter/s were not significantly different at 5% level where capital letters were used for distinguishing specific effect, values of each investigated factor but small letters for interaction of their combination.

Table (28): Fresh and total plant dr. weight (gm) of 6000 ppm; 6 SAR saline solution irrigated olive transplant as influenced ratio and their combinations during 2000 & 2001experimental seasons. by specific and interaction effects of olive cultivar; foliar spray with some nutrient elements; Cl:SO4

				21.00		45.82 A	4	004)	Mean (Choos)
13.67 12	15.0	19.27 A	19	37 36 B				S	
OR	12.0	20:		High		Low			
4	High	.04			34.00 €	#0.09 B	50.70 A	cvs.	Mean* of cvs.
\bigvee	14.58 C	17.23 B	20.92 A	\langle	3000	38.5/m	46.93 h	High cl	Zinc
1,57,6	13.67 n	16.64 j	18.92 g	41.23 C	36.58 n	41.08 k	53.67 e	Low cl	7:
17 97 C	16.34 k	15.791 17.43 h	21.05 e	10.40	29.591	36.86 n	45.98 i	High cl	Potassium
19.09 B	16.901	23.02 c	24.60 b	15 13 B	40.151	52 89 f	65.33 6	High ci	
	15.861	19.39 f	22.70 d	52.01 A	48.65 g 34.07 o	54.16 d 43.49 i	70.57 a	Low cl	Phosphorus
71 35 A	21.14 e	22.76 d	า6 27 a		10.10	20.30 0	29.86 r	High cl	Control (6000 SALK 9)
71.07 12	9.09 r	10.62 q	13.72 n	28.01 D	27.03 t	27.66 s	32.12 f	Low cl	COORSAR 6
11 80 11	10.46 q	17 l6 p	15.78		2001	1			
				30.00	36	42.68 A	42	(1)	Mean*** (Cl:SO4)
2 B	15.52 B	18.47 A	18.	ON B		L0#:			
3	High	Low	1	High	- 1	07:00	44./4 A	cvs.	Mean* of cvs.
	15.12 C	16.80 B	19.07 A	\bigvee	33.87C	30 50 R	40.951	High cl	Line
	13.99 n	16.001	18.28 h	38.00 C	28.25 a	42.07 n	47.29 d	Low cl	7inc
17.61 C	18.04 i	18.79 g	20.57 d	•	33 43 0	39.80	44.701	High cl	Potassium
10.41	14.60 m	16.51 k	18.76 g	43.96 B	43.35 g	46.25 e	55.48 b	Low cl	
18 14 R	18.47 h	19.44 f	21.53 c		38.38 k	44.74 f	47.51 d	High cl	Phosphorus
20.96 A	17 03 i	22.94 b	24.55a	48.05 A	47.14 d	54.08 c	56.42 a	Tow of	
10:57	8.11 s	9.741	12.06 o	27.48 D	24.25 t 22.06 u	27.71 r 25.26 s	34.66 m	Low cl	Control (6000SAR 6)
10 97 D	10.63 q	11.34 p	13.06.1		2000		-		Callinis
					9	I X X X X X X X X X X X X X X X X X X X	Coron		Treemints /
Mean**	Aghizi	Manza	Coron	Mean**	A ohizi	Manza		Cmusars	
	Weight (gm)	Total plant dry weight		B)	sh weight (gr	Total plant fresh weight (gm)			
					Vi)				

*, **, *** means refer to specific effect of olive cvs.; sprayed nutrient element treatment and Cl.SO4 ratio, respectively Values within the same column or row for any of three investigated factors followed by the same letter/s were not significantly different at 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

levels (CI:SO₄ ratio), on stem; root and total plant fresh and dry weights, data presented in Tables (26, 27 and 28) showed obviously a variable response of these measurements to the different investigated combinations during the two seasons. The highest values of stem; root and total plant fresh and dry weights of olive cultivars were detected by that combination representing spraying 500 ppm p solution to irrigated coronaiki transplants with saline water of S.A.R-6 and higher CI:SO₄ ratio. Meanwhile, the lowest increase in stem; root and total plant fresh and dry weights over control were detected by those Aghizi transplants irrigated with 6000 ppm of S.A.R-6 and higher chloride levels and sprayed with 100 ppm ZnSO₄ during the two seasons of study. In addition, other combinations were in between the abovementioned two extremes.

IV.II.II. Leaf physiological properties:

In this respect six leaf physiological properties namely: a) leaf relative turgidity (L.R.T.); b) leaf water potential (L.W.P.); c) hard leaf character (H.L.C.); d) leaf succulence grade (L.S.G.); e) transpiration rate (L.T.R.) and f.) osmotic pressure (L.O.P.) of salt stressed transplants belonging to 3 olive cultivars under study (Coronaiki, Manzanillo and Aghizi) in response to foliar sprays with 3 nutrient elements (P & K each at 500 ppm and Zn at 100 ppm) were investigated. Data obtained during both 2000 & 2001 seasons regarding the specific and interaction effects of olive cultivars; sprayed element; chloride levels (Cl:SO₄ ratio) and their combinations are presented in Tables (29, 30 and 31).

IV.II.II.1. Leaf relative turgidity (L.R.T.):

A- Specific effect:

With regard the specific effect of olive cultivar, it is quite evident that Coronaiki transplants had the greatest value of such characteristic (L.R.T.), followed by Manzanillo transplants, while Aghizi cultivar ranked statistically last and differences were significant as compared each other during two seasons of study.

As for the specific effect of sprayed nutrient element, data presented in Table (29) displayed that spraying salt stressed transplants with any of P, K and Zn resulted in an obvious increase over the control (unsprayed salt stressed transplants). However, the increase was significant during both seasons, but potassium was statistically more effective than phosphorus especially during 1st season while Zn foliar spray ranked last during 2000 and 2001 experimental seasons.

Regarding the specific effect of Cl:SO₄ ratio of saline solution used for irrigation on leaf relative turgidity; it could be noticed that the higher ratio significantly decreased leaf relative turgidity during two seasons.

B-Interaction effect:

With respect to the interaction effect of the investigated three factors i.e., olive cultivars, fertilizer kind sprayed nutrient element and chloride levels (Cl:SO₄ ratio) on leaf relative turgidity, in Table (29) shows obviously the variable response to the different combinations during two seasons of study. Anyhow, the greatest value of leaf relative turgidity was generally in

closed relationship to 500 ppm potassium sprayed transplants of Coronaiki cvs. irrigated with saline water at 6000 ppm of S.A.R-6 and lower Cl:SO₄ ratio during 2000 and 2001 seasons. Meanwhile, the reverse was true with sprayed Aghizi transplants with Zn at 100 ppm and irrigated with saline solution of higher Cl:SO₄ ratio during two seasons of study. In addition other combinations were in between the aforesaid two extremes.

IV.II.II.2. Leaf water potential (L.W.P.):

A- Specific effect:

Concerning the specific effect of the different factors involved in this study i.e., olive cultivar, sprayed nutrient element and chloride level (Cl:SO₄ ratio) on leaf water potential, Table (29) clearly shows that Coronaiki transplants had statistically the highest value of leaf water potential (L.W.P.) followed in a descending order by Manzanillo cvs. while, Aghizi cvs. was the inferior.

Regrading the specific effect of sprayed nutrient element, it was quite clear that leaf water potential (L.W.P.) was increased in leaves of P; K or Zn foliar sprayed at 500 ppm for two former element and 100 ppm for later one. Such increase was significant as compared with salt stressed transplants. However, the increase exhibited over control by any of 3 sprayed elements was significant, but differences between three sprayed elements were not significant during 2000 and 2001 experimental seasons.

As for the specific effect of the Cl:SO₄ ratio of saline solution used for irrigation on leaf water potential (L.W.P.), it could be noticed from data in Table (29) that the higher ratio

Table (29): leaf relative turgidity (LR.T.) and leaf water potential (LW.P) of 6000 ppm; 6 SAR saline solution irrigated olive transplant as influenced by specific and interaction effects of olive cultivar ; foliar spray with some nutrient elements ; Cl. SO4 ratio and their

66.72A
Low ·
67.79A 65.10 B
\vdash
+
72.08 d 70.95 fg 73.30 b 70.78 g
-
51.45 k 49.25 l 48.84 m 48.77 m
64.51 A
1011
00.774
74.53 b 69.72 j
75.42 a 70.31 hi
71.41 e 68.26 m
-
+
46.60 o 45.81 P
1
Coron. Manza.
LW.P

effect values of each investigated factor but small letters for interaction of their combination. any of three investigated factors followed by the same letter/s were not significantly different at 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.

slightly decreased it below the lower one but difference was not significant that during two seasons of study.

B-Interaction effect:

Data presented in Table (29) displayed the more pronounced response to specific effect of sprayed nutrient element rather than the analogous one of either Cl:SO4 ratio or olive cultivar reflected clearly on interaction effect of these investigated factors. Hence, Coronaiki combination showed generally higher values of (L.W.P.) than those of turn other olive cultivars. Anyhow, the foliar sprayed salt stressed transplants of Coronaiki evs. (especially of lower Cl:SO₄ ratio) with either Zn or k solution during $1^{\underline{st}}$ and $2^{\underline{nd}}$ seasons respectively. showed significantly the highest value in this concern. On the contrary, unsprayed salt stressed transplants (control) especially of Aghizi cvs. were statistically the inferior during both seasons. Moreover, other combinations were between abovementioned two extremes with relative tendency of variance.

IV.II.II.3. Hard leaf character (H.L.C.):

A- Specific effect:

Referring the specific effect of olive cultivar, Table (30) displays that Aghizi cvs. had the greatest value of such character (H.L.C.), followed by Manzanillo cvs. transplants, while Coronaiki cvs. ranked statistically last and differences were significant as cultivars were compared each other during both seasons.

Meanwhile, hard leaf character (H.L.C.) respond specifically to the sprayed nutrient elements, where H.L.C. was significantly decreased by foliar spray with (P & K at 500 ppm) and Zn at 100 ppm. In this concern, Zn foliar spray more effective followed by K and P foliar spray and the differences between 3 nutrient elements were significant during 2000 and 2001 experimental seasons.

As for the specific effect of the chloride level (Cl:SO₄ ratio), of saline solution used for irrigation on hard leaf character (H.L.C.), it could be noticed from data in Table (30) that the higher ratio resulted in a significant increase during two seasons of study.

B-Interaction effect:

With regard to the interaction effect of various combinations between 3 studied factors i.e., olive cultivar, sprayed elements and chloride level (Cl:SO₄ ratio) on hard leaf character (H.L.C.) of salt stressed olive transplants, Table (30) shows that the unsprayed salt stressed transplants (control) especially those of Aghizi cvs. had the greatest value of hard leaf character during both seasons of study. regarless of Cl:SO₄ ratio. On the contrary, Coronaiki cvs. foliar sprayed with Zn at 100 ppm and irrigated with saline solution of S.A.R.-6 and higher chloride level resulted in the least value of H.L.C. and seemed to be statistically the inferior during 2000 & 2001 experimental seasons. In addition, other combinations were in between the aforesaid two extremes.

IV.II.II.4. Leaf succulence grade (L.S.G.):

A- Specific effect:

Regarding the specific effect of olive cultivar on leaf succulence grade (L.S.G.), it is quite clear that olive cultivars could be significantly arranged in a descending order showed that Coronaiki cvs. was the superior, followed by Manzanillo cvs. (second)and Aghizi cvs. which ranked third during both 2000 & 2001 seasons.

As for the specific effect of sprayed nutrient element, Table (30) reveals that spraying the salt stressed transplants with either P or K each at 500 ppm and / or Zn at 100 ppm increased significantly L.S.G. However, Potassium foliar spray was more effective, followed in a descending order by Zn and P foliar spray, but differences between 3 sprayed elements were significant during two seasons of study.

Referring the specific effect of chloride level (Cl:SO₄ ratio) on leaf succulence grade (L.S.G.), it is quite clear that the higher ratio significantly increased leaf succulence grade during two seasons.

B-Interaction effect:

It is quite evident as shown from Table (30) that the response of leaf succulence grade of salt stressed olive transplants to the interaction effect of different combinations between 3 investigated factors, i.e., olive cultivar, sprayed nutrient elements and chloride level (Cl:SO₄ ratio) represented a

Table (30): Hard leaf character (H.L.C.) and leaf succulence grade (L.S.G.) of of 6000 ppm; 6-SAR saline solution irrigated foliar spray with some nutrient elements; Cl:SO4 ratio and their combinations during 2000 & 2001 experimental seasons. as influenced by specific and olive transplant as influenced by specific and interaction effects of olive cultivar;

		200	ç	0.25 A	0.2	0.23 B		1:SO4)	Mean*** (Cl:SO4)
0.63 A	0.	ALL		rugn	12	Low		Will S	
High	ŀ	Low	_1	1		0.23.0	0.21 C	of cvs.	Mean" of cvs.
	0.49 C	0.59 B	0.65 A	\langle	0.774	0.20	0.1918	High cl	Zilic
	0.58gh	0.60 g	0.67 e	0.20 D	0.201	3161.0	0.18 gh	Low cl	7inc
0.59 B	0.48 k	0.58 हुफे	0.60 €		0.000	0.25	0.28 e	High cl	Potassium
0.// A	0.67 e	0.85 b	0.92a	0.23 B	0.26 c	0.22 e	0.20 fg	Low cl	
	0.451 0.62 f	0.59 g	0.65e	0.21	0.25 c	0.25 cd	93 61.0	High cl	Phosphorus
0.54 B	0.451	051 j	0.59g	2	0.23de	0.10 fo	0.17.0	High ci	Court of Cooper
0.11.0	0.42m	0.54 i	0.57 h	0.30 A	0.36a 0.37 a	0.29 b	0.25cd	Low cl	Control (6000SAR 6)
0.410	0.27p	0.32 0	4950		1007				
				3	V.F.7.0	0.23B	0.5	304)	Mean*** (CI:304)
0.57 A	0.5	0.51 B	0.5		name.	Low		S	
High	н	Low		*\		U.LJAD	0.208	of cvs.	Mean, o
	0.44C	0.55 B	0.63 A	$\sqrt{}$	0.774	O. L. J.	0.1681	High cl	Zilik
	0.47 k	0.66 cd	0.67 c	0.19C	0.211gn	0.19 h	0.17 jk	Low cl	7:
0 58 B	0.451	0.59fg	0.61e		1.02.0	0.10	0.21 tgh	High cl	Potassium
	0.61e	0.67c	0.77a	0.22B	0.23 f	0.22 tg	0.18 ijk	Low cl	
0 64 A	0.51 hi	0.61ei	0.67bc		0.32 c	0.22 fg	0.21 站	High cl	Phosphorus
0.500	0.50 ij	0.58 g	0.60 6	0.21B	0.21 fgh	0.16 kJ	0.15 1	Low cl	
0 668	0.41 m	455.0	V 57.0		0.37a	0.31 cd	0.26 e	High cl	Control (6000SAR 6)
0.37C	0.29 0	0 40 H	0.4/K	0.32A	0.37 a	0.34 b	0.294	Low cl	
	a 9c 0	2			2000				Ireaminis
	4	Manna	Coron.	Mean"	Aghizi	Manza.	Coron.		: /
Mean"	Aohizi	Marie .)		E Syptem)	H.L.C (ury maner graces)		Cultivars	/
	LS.G (HZOg /Decz)	LS.6 (HZ			or allect)	TT C /de mot			seasons.

^{*, **, ***} means refer to specific effect of olive cvs.; sprayed nutrient element treatment and Cl.SO4 ratio, respectively Values within the same column or row for any of three investigated factors followed by the same letter/s were not significantly different at 5% level where capital letters were used for distinguishing specific effect values of each investigated factor but small letters for interaction of their combination.