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PHYSIOLOGICAL STUDIES ON GROWTH AND SALT TOLERANCE OF SOME FRUIT PLANTS

1- EFFECT OF THE DIFFERENT SALTS CONCENTRATIONS, SODIUM ADSORPTION RATIO (SAR), AND CHLORIDE LEVELS ($CL:SO_4$ RATIO) IN IRRIGATION WATER ON VEGETATIVE GROWTH AND LEAF PHOTOSYNTHETIC PIGMENTS.

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ABSTRACT

This study covers the effect of the different concentrations of salts (2000, 4000 and 6000 ppm) combined with two levels from both SAR (3 & 6) and (low & high) of $Cl:SO_4$ ratio, on some vegetative growth measurements and leaves photosynthetic pigments content (chlorophyll A, B and caroteinoids) of both beachilyfolia and communis pear rootstocks transplants during 2004 and 2005 consecutive seasons in the experimental farm at El-Kanater Horticultural Research Station.

The obtained data concerning the specific effect revealed that all studied growth parameters (lengths of stem, root, total plant length and stem diameter) and dry weights of plant organs (leaves, stems, roots and total dry weight of plant) as well as leaf photosynthetic pigments content i.e., (chlorophyll A, B and caroteinoids), all being progressively decreased by all the used salinity concentrations and increasing both SAR from 3 to 6 and $Cl:SO_4$ ratio from low to high in irrigation water as compared to the control (transplants irrigated with tap water). Moreover, the most depressive effect was more pronounced with the highest salts concentrations (6000 ppm) and two higher levels of either SAR or $Cl:SO_4$ ratio in irrigation water.

Furthermore, with regard to the interaction effect of three investigated factors, data indicated that the specific effect of any studied factor in this investigation was directly reflected on the interaction effect of its combinations. However transplants irrigated with the higher salts concentration combined with the higher levels of both SAR and $Cl:SO_4$ ratio i.e., (6000 ppm x SAR6 x higher $Cl:SO_4$ ratio) exhibited statistically the greatest rate of reduction in all abovementioned studied characters. Whereas, the least decrease was always in concomitant to such those irrigated with (2000 ppm x SAR3 x lower or $Cl:SO_4$ ratio). In addition, the other combinations were in between the aforesaid two extremes for both beachilyfolia and communis pear rootstocks during the two experimental seasons of study.

INTRODUCTION

Pear is one of the most important deciduous fruits in Egypt. For that, in recent years there has been a steady increase in the area cultivated with pear to meet the continuous rise in demand for pear fruits for local consumption in Egyptian markets.

Undoubtedly, the expansion of agricultural land needs a great amounts of suitable irrigation water which already is not sufficient to meet all the expected demands in this respect. In addition to that, the limited amounts of water is an ever growing crisis that may face us in Egypt in future due to the natural aridity in the region, the increasing population and land reclamation projects which represented a very important sector in the agricultural development programmes for increasing the cultivated area.

Salinity is one of the most serious and oldest environmental problems affecting approximately one third of earth's irrigation land. There are many factors affecting the salinity-yield relationship such as the physical

The possibility of using saline water for irrigation, especially underground water is considered as a limiting factor and great value for the success of the projects of new land reclamation, which it is still very limited source until now, however many problems are expected to arise. These problems would be related to the excessive accumulation of saline salts in the soil because this water contains a considerable amounts of harmful salts as an actual limiting factors for growth and productivity of transplants and fruit trees.

There is a little of available information for fruit growers about the possibility of some pear and other deciduous rootstocks to grow under conditions of new reclaimed lands and probability of these rootstocks to tolerance for irrigated with saline water Kabeel (1985), Schreiner and Ludders (1992), Bondok *et al.*, (1995), Osman (2005) and Darwesh (2006) on some deciduous rootstocks transplants.

Therefore, the main objectives of the present investigation was planned and carried out to study the influence of irrigation with prepared salinized water at different concentrations of salts at (2000, 4000 and 6000 ppm) combined with two levels from both sodium adsorption ratio (SAR 3 & 6) and chloride: sulphate ratio (low & high) on some vegetative growth measurements and leaves photosynthetic pigments contents of the two studied pear rootstocks (*Pyrus communis* and *P. beachilyfolia*).

MATERIALS AND METHODS

The present investigation has been undertaken throughout the two consecutive seasons of 2004 and 2005 in the experimental farm belonging to El-Kanater Horticultural Research Station, Qalyoubia Governorate Egypt.

Uniform and healthy one-year-old transplants of two pear roostocks namely: *Pyrus communis* and *Pyrus beachilyfolia* were the plant materials used in this study. In both seasons of study and during the first week of February, pear rootstock transplants were transplanted individually each in clay pot of 35 cm. in diameter that previously had been field with specific weight of media consisting of clay and sand at equal proportion (by volume). Mechanical and chemical analysis of the experimental soil from 0 to 30 cm. depth just before pear investigated treatments had been started are shown in Table (1). These standard methods used in this respect were described by Piper (1950). Available nitrogen was determined according to Allam (1951) and Jackson (1958).

Table (1): Physical and chemical analyses of the experimental soil.

Depth (cm.)	Sand %	Silt %	Clay %	Soil texture	Soil extract pH 1:25	E.C. (1:5) ds/m	Soluble cations				Soluble anions			
							Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{--}	HCO_3^{-}	Cl^{-}	SO_4^{--}
0-30	21.10	25.90	52.60	Clay loam	7.86	0.195	0.74	0.22	0.68	0.17	0.55	0.80	-	0.47

Irrigation with the different investigated saline solution was carried out twice weekly by adding (¾) liter per each pot starting from the first week of June until the last week of October throughout the two seasons of study. To prevent salts accumulation pots were irrigated with tap water every 12 days, then rewatering with salt solutions applied the next day. Control treatment was supplied periodically two times every week with tap water only at (¾) liter/pot. The experiment was conducted to study the effect of different saline solutions on the two pear rootstocks transplants. Therefore, the following investigated saline solutions treatments were representative of the different twelve combinations between three levels of saline concentrations (2000, 4000 and 6000 ppm), two levels of sodium adsorption ratios (SAR3 and SAR6) and two levels of chloride: sulphate ratios (low and high $Cl:SO_4$ ratio) besides irrigation with tap water as the control treatment. Thus, the different studied saline solutions used in this respect were as follows:

1- Tap water (control)
2- Saline solution (2000 ppm) with SAR3 and low $Cl:SO_4$ ratio.
3- Saline solution (2000 ppm) with SAR3 and high $Cl:SO_4$ ratio.

4- Saline solution (2000 ppm) with SAR6 and low $Cl:SO_4$ ratio.
5- Saline solution (2000 ppm) with SAR6 and high $Cl:SO_4$ ratio.
6- Saline solution (4000 ppm) with SAR3 and low $Cl:SO_4$ ratio.
7- Saline solution (4000 ppm) with SAR3 and high $Cl:SO_4$ ratio.
8- Saline solution (4000 ppm) with SAR6 and low $Cl:SO_4$ ratio.
9- Saline solution (4000 ppm) with SAR6 and high $Cl:SO_4$ ratio.
10- Saline solution (6000 ppm) with SAR3 and low $Cl:SO_4$ ratio.
11- Saline solution (6000 ppm) with SAR3 and high $Cl:SO_4$ ratio.
12- Saline solution (6000 ppm) with SAR6 and low $Cl:SO_4$ ratio.
13- Saline solution (6000 ppm) with SAR6 and high $Cl:SO_4$ ratio.

The abovementioned different saline solutions were prepared as shown in Table (2).

The different treatments in this experiment were arranged in a complete randomized block design where each treatment was replicated three times with two transplants for each replicate.

Methodology as has been followed in this investigation is being determined as follows:

1. Morphological characteristics (vegetative growth measurements):

On last week of October during both seasons as the experiment was ended, the effect of the different studied treatments on some vegetative growth measurements were evaluated by the following growth parameters:

1. Stem length (cm).
2. Stem diameter (mm.)
3. Root length (cm).
4. Total length of plant (cm.).
5. Dry weights of plant organs (leaves, stems, roots and total plant dry weight in gm). Both transplants of each replicate were carefully taken out from pots then washed with tap water and followed by distilled water to free them any residues. Thereafter, each transplant was divided individually into its three organs (leaves, stem and root) to be air dried in an electrical oven at 70°C. until a constant weight then weighed then as average dry weight for each plant organ for every replicate was estimated and recorded.

2- Leaf photosynthetic pigments determination:

The quantitative analysis of photosynthetic pigments in response to salinity treatments under study were determined which were extracted by pure acetone in samples of sufficient fresh leaves were taken in four replicates to response the consider treatment. At the second week of August during both seasons in this study, the optical densities of pigments were measured colourimeterically at 662.0, 644.0 and 440.0 to determine chlorophyll's A, B and carotenoids, respectively. The leaf contents of chlorophylls (A, B and carotenoids) were expressed as mg./g. fresh weight and calculated according to the methods described by Brougham (1960) and Saric *et al.* (1967).

*** Statistical analysis:**

All data obtained during each season of this study were subjected to statistical analysis according to the method described by Snedecor and Cochran (1980). However, means values of each investigated factor (specific effect) and their combinations (interaction effect) for every studied parameter were compared according to the Duncan's multiple range test (Duncan, 1955). Since, capital letters were used for distinguishing values within each column or row that represented the specific effect of any investigated factor (salinized water concentration, SAR ratio and Cl level) while, the small letters were employed for interaction effect of their combinations.

RESULTS AND DISCUSSIONS

1- Effect of the different salinity concen-trations combined with different levels of both sodium adsorption ratio (SAR) and chloride level ($Cl:SO_4$ ratio) on some growth measurements:

1-1. Effect on lengths of stem, root and total plant length (cm.); as well as stem diameter (cm.)

A- Specific effect:

Regarding the specific effect of salinity concentrations on stem, root and total plant length as well as stem diameter of both beachilyfolia and communis pear rootstocks transplants, data in Tables (3 & 4) revealed that all the three investigated saline solutions i.e., (2000, 4000 and 6000 ppm.) resulted in an obvious decrease in all abovementioned studied characters during the first and second seasons of study. Such decrease was significant when the three salt concentrations used of 2000, 4000 and 6000 ppm, as compared to the control (transplants irrigated with tap water). On the other

Table (2): Preparation of different saline solutions used.

Saline solution	Salt added per liter															
	$CaCl_2$		$MgSO_4$		KCl		K_2SO_4		Na_2SO_4		NaCl		SAR*	Cl meq/L	SO_4 meq/L	Cl / SO_4 ratio
	g	meq.	g	meq.	g	meq.	g	meq.	g	meq.	g	meq.				
2000 ppm SAR3 low Cl	0.45	8.11	0.50	8.33	0.08	1.07	0.42	4.83	0.25	3.52	0.30	5.13	3.00	14.30	16.68	0.86
2000 ppm SAR3 high Cl	0.80	14.41	0.18	3.00	0.40	5.37	0.10	1.15	0.02	0.28	0.50	8.55	3.00	28.33	4.43	6.40
2000 ppm SAR6 low Cl	0.35	6.31	0.25	4.17	0.15	2.01	0.35	4.02	0.55	7.75	0.35	5.98	6.00	14.30	15.94	0.90
2000 ppm SAR6 high Cl	0.54	9.70	1.10	1.67	0.42	5.64	0.08	0.92	0.10	1.41	0.76	12.99	6.00	28.35	3.99	7.10
4000 ppm SAR3 low Cl	1.10	19.82	1.07	17.83	0.05	0.67	0.95	10.91	0.38	5.35	0.45	7.69	3.00	28.18	34.10	0.83
4000 ppm SAR3 high Cl	1.80	32.43	0.40	6.66	0.90	12.08	0.10	1.15	0.10	1.41	0.70	11.97	3.00	56.47	9.22	6.13
4000 ppm SAR6 low Cl	0.72	12.97	0.88	14.67	0.04	0.53	0.96	1.03	0.54	7.61	0.86	14.70	6.00	28.20	33.30	0.85
4000 ppm SAR6 high Cl	1.25	22.52	0.40	6.67	0.87	11.68	0.13	1.49	0.05	0.70	1.30	22.22	6.00	56.42	8.86	6.37
6000 ppm SAR3 low Cl	1.20	21.62	2.20	37.50	0.02	0.27	0.45	16.67	0.71	10.00	0.37	6.33	3.00	28.20	64.17	0.44
6000 ppm SAR3 high Cl	2.20	39.64	1.25	20.83	0.23	3.09	0.32	15.17	0.20	2.82	0.80	13.68	3.00	56.40	38.83	1.45
6000 ppm SAR6 low Cl	1.11	20.00	1.20	20.00	0.03	0.40	1.85	21.26	1.35	19.07	0.46	7.79	6.00	28.20	60.33	0.47
6000 ppm SAR6 high Cl	1.67	30.00	0.60	10.00	0.44	5.84	1.65	8.96	0.45	6.34	1.20	20.51	6.00	56.35	35.29	1.60

Salts added in grams were estimated as anydrous form

***SAR = Meq**

$$\sqrt{\frac{Na}{\frac{Ca+Mg}{2}}}$$

Table (3): Effect of the different salts concentrations, sodium adsorption ratio (SAR) and chloride levels ($Cl:SO_4$ ratio) of saline irrigation water on stem length (cm.) and stem diameter (cm.) of both beachilyfolia and communis pear rootstocks transplants during 2004 and 2005 seasons

Cultivars / Treatments		Stem length (cm.)						Stem diameter (cm.)					
		Beachilyfolia			Communis			Beachilyfolia			Communis		
		Low	High	Mean*	Low	High	Mean*	Low	High	Mean*	Low	High	Mean*
		1st season											
Control		155.9a	155.9a	155.9A	119.5a	119.5a	119.5A	0.740a	0.740a	0.740A	0.850a	0.850a	0.850A
2000 ppm	SAR3	157.2a	153.6ab	151.4B	118.2a	110.8b	111.1B	0.730a	0.710a	0.695B	0.840a	0.823b	0.818B
	SAR6	148.0bc	146.7c		110.1b	105.4c		0.690ab	0.650bc		0.810bc	0.797c	
4000 ppm	SAR3	144.6cd	140.2d	134.4C	97.23d	85.64e	84.82C	0.620cd	0.590de	0.573C	0.770d	0.740e	0.735C
	SAR6	132.7e	120.1f		80.86f	75.53g		0.560ef	0.520fg		0.740e	0.690f	
6000 ppm	SAR3	111.3g	100.1h	95.8D	70.64h	65.12i	63.47D	0.490gh	0.470gh	0.468D	0.660g	0.610h	0.603D
	SAR6	90.66i	81.22j		60.77j	57.36k		0.460h	0.450h		0.580i	0.560j	
Mean** (SAR 3 & 6)		SAR3	SAR6		SAR3	SAR6		SAR3	SAR6		SAR3	SAR6	
		139.8A	128.9B		98.33A	91.13B		0.636A	0.601B		0.768A	0.735B	
Means*** of CL		Low	High		Low	High		Low	High		Low	High	
		134.0A	128.3B		93.90A	88.48B		0.613A	0.590B		0.750A	0.724B	
		2nd season											
Control		151.2a	151.2a	151.2A	115.6a	115.6a	115.6A	0.713a	0.713a	0.713A	0.900a	0.900a	0.900A
2000 ppm	SAR3	150.2ab	147.2bc	146.4B	112.6a	112.3a	107.2B	0.713a	0.690b	0.683B	0.880b	0.850c	0.833B
	SAR6	147.6bc	140.8d		105.7b	98.16c		0.680b	0.650c		0.810d	0.790e	
4000 ppm	SAR3	136.0e	125.4f	121.2C	89.74d	85.96e	84.68C	0.620d	0.610d	0.598C	0.750f	0.720g	0.703C
	SAR6	117.5g	105.9h		82.13f	80.87f		0.590e	0.570f		0.690h	0.650i	
6000 ppm	SAR3	90.96i	85.41j	83.89D	73.75g	68.11h	68.00D	0.520g	0.490h	0.473D	0.630j	0.580k	0.579D
	SAR6	80.83k	78.36k		67.69h	62.43i		0.450i	0.430j		0.557l	0.550l	
Mean** (SAR 3 & 6)		SAR3	SAR6		SAR3	SAR6		SAR3	SAR6		SAR3	SAR6	
		129.7A	121.7B		96.71A	91.03B		0.634A	0.600B		0.774A	0.726B	
Means*** of CL		Low	High		Low	High		Low	High		Low	High	
		124.9A	119.2B		92.46A	89.06B		0.612A	0.593B		0.745A	0.717B	

*, ** and *** means refer to specific effect of salinity concentration, SAR ratio and $Cl:SO_4$ ratio, respectively. Capital letters were used for comparing values within the same culumn or row separately which representing the specific effect of salinity concentration, SAR ratio and $Cl:SO_4$ ratios, respectively. However, with the interaction effect small letters were used, as means followed by the same letter`s were not significantly different.

Table (4): Effect of the different salts concentrations, sodium adsorption ratio (SAR) and chloride levels (Cl:SO_4 ratio) of saline irrigation water on root length (cm.) and total length (cm.) of both beachilyfolia and communis pear rootstocks transplants during 2004 and 2005 seasons.

Cultivars / Treatments		Root length (cm.)						Total length (stem + root)					
		Beachilyfolia			Communis			Beachilyfolia			Communis		
		Low	High	Mean*	Low	High	Mean*	Low	High	Mean*	Low	High	Mean*
		1st season											
Control		69.33a	69.33a	**69.33A**	32.33a	32.33a	**32.33A**	225.2a	225.2a	**225.2A**	151.9a	151.9a	**151.9A**
2000 ppm	SAR3	67.66ab	67.33ab	**67.25A**	29.26ab	25.07bc	**24.42B**	224.9a	220.9ab	**218.6B**	147.5a	135.8b	**135.5B**
	SAR6	67.33ab	66.66ab		23.21b-d	20.12c-e		215.3bc	213.3bc		133.3bc	125.5c	
4000 ppm	SAR3	63.66ab	61.66bc	**59.63B**	19.82c-e	17.12d-f	**17.31C**	208.3cd	201.8d	**194.0C**	117.0d	102.8e	**102.1C**
	SAR6	57.08c	56.11c		16.14ef	16.14ef		189.8e	176.2f		97.0ef	91.7fg	
6000 ppm	SAR3	48.37d	42.33e	**39.62C**	14.25ef	13.17ef	**12.68D**	159.6g	142.4h	**134.4D**	84.9gh	78.3hi	**76.2D**
	SAR6	34.12f	33.66f		11.29f	12.02f		124.8i	114.9j		72.1ij	69.4j	
Mean** (SAR 3 & 6)		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**	
		61.21A	**56.70B**		**22.92A**	**20.45A**		**201.0A**	**185.6B**		**121.3A**	**111.6B**	
Means*** of CL		**Low**	**High**		**Low**	**High**		**Low**	**High**		**Low**	**High**	
		58.22A	**56.73A**		**20.90A**	**19.42A**		**192.6A**	**185.0B**		**114.8A**	**107.9B**	
		2nd season											
Control		71.66a	71.66a	**71.66A**	33.66a	33.66a	**33.66A**	222.9a	222.9a	**222.9A**	149.3a	149.3a	**149.3A**
2000 ppm	SAR3	67.33ab	67.66ab	**66.17B**	29.66a	24.66b	**24.61B**	217.5ab	214.9b	**212.6B**	142.3ab	136.9b	**131.8B**
	SAR6	65.37ab	64.33ab		22.33bc	21.79b-d		212.9b	205.1c		128.1c	119.9d	
4000 ppm	SAR3	62.66b	61.66b	**58.19C**	18.52c-e	19.19c-e	**17.82C**	198.6c	187.0d	**179.4C**	108.3e	105.2ef	**102.5C**
	SAR6	54.33c	54.11c		17.33d-f	16.22e-g		171.8e	160.0f		99.5fg	97.1g	
6000 ppm	SAR3	42.65d	41.26d	**37.83D**	15.88e-h	13.09f-h	**12.97D**	133.6g	126.7g	**121.7D**	89.6h	81.2i	**90.0D**
	SAR6	34.22e	33.17e		11.67gh	11.22h		115.1h	111.5h		79.4ij	73.7j	
Mean** (SAR 3 & 6)		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**	
		60.82A	**56.11B**		**23.54A**	**20.99B**		**190.5A**	**177.8B**		**120.3A**	**112.0B**	
Means*** of CL		**Low**	**High**		**Low**	**High**		**Low**	**High**		**Low**	**High**	
		56.89A	**56.26A**		**21.29A**	**19.98A**		**181.8A**	**175.4B**		**113.8A**	**109.0B**	

*, ** and *** means refer to specific effect of salinity concentration, SAR ratio and Cl:SO_4 ratio, respectively. Capital letters were used for comparing values within the same culumn or row separately which representing the specific effect of salinity concentration, SAR ratio and Cl:SO_4 ratios, respectively. However, with the interaction effect small letters were used, as means followed by the same letter's were not significantly different.

hand, the saline irrigation treatment of 6000 ppm in the irrigation water had the greatest depressive effect on stem, root, total plant lengths and stem diameter for the two pear rootstocks transplants under study. Whereas the saline irrigation solution treatment of 2000 ppm. exhibited the lowest decrease in aforesaid characters. Meanwhile, the treatment of 4000 ppm salt concentration was intermediate in this respect. Furthermore, the differences between the three salinity concentrations were significant as each was compared to the two other ones. Such trends were true during both 2004 and 2005 seasons of study.

The obtained data are in harmony with those obtained by Kabeel (1985) on some deciduous fruit seedlings, Schreiner and Ludders (1992) on apple; El-Naggar (2002) on persimmon seedlings, Osman (2005) on apple rootstocks and Darwesh (2006) on pear and apple rootstocks. They indicated that stem, root and total plant lengths and stem diameter reduced with increasing salt concentration in the irrigation water.

With respect to the specific effect of sodium adsorption ratio (SAR), data tabulated in the same tables displayed obviously that the higher ratio of SAR i.e., (SAR6) resulted in a significantly depressing of stem, root & total plant lengths as well as stem diameter than the lower one (SAR3) in the two pear rootstocks transplants under study during both 2004 and 2005 seasons. These results are in an agreement with that mentioned by Kabeel (1985) on peach, plum and Thompson grapevines seedlings, Abd El-Magied (1998) on bitter almond rootstocks seedlings and Darwesh (2006) on apple and pear rootstocks transplants.

Concerning the specific effect of chloride level i.e., ($Cl:SO_4$ ratio) of saline water used for irrigation on the four studied growth parameters, it could be noticed from data in Tables (3 & 4) that, the higher ($Cl:SO_4$) ratio resulted in a significant decrease in stem, total plant lengths and stem diameter as compared to the lower one. Such trend was detected with the two pear root-stocks transplants during the two experimental seasons. Meanwhile, the higher ($Cl:SO_4$ ratio) showed a very slight decrease in root length than the lower ones, these differences between the two chloride levels was completely absent from the stand point of statistical analysis during 2004 and 2005 seasons in the two pear rootstocks under study. These results are similar to that achieved by Kabeel (1985) on some deciduous fruit species, El-Naggar (2002) on persimmon seedlings, Osman (2005) and Darwesh (2006) on some rootstocks transplants of apple and pear.

B- Interaction effect:

Referring the interaction effect of the three investigated factors i.e., salinity concentrations, sodium adsorption ratio (SAR) and chloride levels in saline water used for irrigation on stem, root and total plant lengths as well as stem diameter, the obtained results in Tables (3 & 4) show obviously that a considerable and statistical effect on beachilyfolia and communis rootstocks of pear during the two seasons of study was that combination between the highest salt concentration (6000 ppm) x the higher ratio of SAR (SAR6) x higher chloride level ($Cl:SO_4$ ratio), where this treatment exhibited the greatest decrease in stem, root, total plant lengths and stem diameter.

However, the lowest decrease in stem, root, total plant lengths and stem diameter was detected by these rootstocks transplants irrigated with saline solution at 2000 ppm with SAR3 and lower chloride level ($Cl:SO_4$ ratio) as compared to the transplants continuously irrigated with tap water (control). Meanwhile, the other combinations treatments were an intermediate values with various tendency of response in this concern. Such trend was true with both pear rootstocks transplants during the first and second seasons of study. The obtained results could be confirmed with those mentioned by Kabeel (1985), Omar (1996), Abd El-Magied (1998), Osman (2005) and Darwesh (2006) on some deciduous transplants fruit species.

1-2. Effect on dry weights of plant organs (leaves, stems, roots, and total weight of transplants).

A- Specific effect:

Data in Tables (5 & 6) regarding the specific effect of salinity concentrations, indicated obviously that all three investigated concentrations of saline solutions (2000, 4000 and 6000 ppm.) resulted in an obvious decrease in dry weights of plant organs (leaves, stem, roots and total weight of plant) of both beachilyfolia and communis pear rootstocks transplants during the two experimental seasons of study. Such decrease was significant as compared to those pear transplants irrigated with tap water (control). On the other hand, it could be observed generally that a gradual decrease in all studied dry weights for plant organs (leaves, stem, roots and total weight of plant) was shown as salt concentration in irrigation water was increased in the two

seasons. Since, the most depressive effect and the greatest loss in the dry weights of plant organs (leaves, stem, roots and total weight of plant) was always in concomitant to the highest concentration of salinity (6000 ppm.), meanwhile the lowest concentration (2000 ppm.) of saline solution resulted in the lowest decrease in dry weights of plant organs for the two pear rootstocks transplants during two seasons of study. However, salinity concentration of (4000 ppm.) was intermediate in this concern. Furthermore, the differences between the three salinity concentrations levels (2000, 4000 and 6000 ppm) were significant as each was compared to the two other ones for the studied abovementioned measurements of the two investigated pear cvs. rootstocks during both 2004 and 2005 seasons of study. These results are in confirmed with the finding of Meligi *et al.*, (1983), Bondok *et al.*, (1995), Osman (2005) Darwesh (2006) on some decidous fruit rootstocks transplants.

With respect to the specific effect of sodium adsorption ratio (SAR), it is quite evident from results represented in Tables (5 & 6) that increasing SAR from 3 to 6 in irrigation water resulted in a decreasing in dry weights of different plant organs i.e., leaves, stems, roots and total plant weight. Such decrease was significant for the dry weights of all abovementioned measurements of beachilyfolia and communis pear rootstocks except with both stem dry weight of communis root-stock transplants in 2004 and 2005 seasons and leaf dry weight of both beachilyfolia in the first season and communis rootstock in the second one, where those decreases were insignificant. This trend was detected for both the two pear rootstocks cvs. during the two experimental seasons.

Referring the specific effect of chloride levels ($Cl:SO_4$ ratio) of saline solution used for irrigation on dry weight of plant organs under study. It is quite clear from the present data in Tables (5 & 6) that the higher ratio of chloride level i.e., (high $Cl:SO_4$ ratio) resulted in a decreasing in all abovementioned studied measurements than the lower one in both two pear rootstocks transplants but such decrease was not significant in most cases during the 1st and 2nd seasons of study.

These findings could be supported with those obtained by Kabeel (1985), Omar (1996), El-Naggar (2002), Osman (2005) and Darwesh (2006) on some deciduous fruit rootstocks.

B- Interaction effect:

With regard to the interaction effect of all investigated factors under study i.e., salinity concentrations, sodium adsorption ratio (SAR) and chloride levels ($Cl:SO_4$ ratio) on dry weights of plant organs (leaves, stem, roots and total weight of plant) of beachilyfolia and communis pear rootstocks transplants during 2004 and 2005 seasons, data in Tables (5 & 6) displayed obviously that a considerable and statistical response, however all saline solutions significantly decreased those measurements in most cases as compared with those of control in the two seasons of study. Moreover, the most depressive effect of irrigation solutions on dry weights of studied plant organs was in closed relationship to such transplants of beachilyfolia and communis pear rootstocks irrigated with the highest concentration of salinity combined with the higher levels of both SAR and chloride ($Cl:SO_4$ ratio) i.e., (6000 ppm x SAR6 x high $Cl:SO_4$ ratio). On the other hand, the opposite trend was observed with those transplants of pear rootstocks irrigated with the lower concentration of salinity, lower ratio of SAR and the lowest level of chloride i.e., (2000 ppm x SAR3 x low $Cl:SO_4$ ratio). Since, the least reduction in dry weights of different studied plant organs were detected by abovementioned treatment as compared with the control (transplants irrigated with tap water) during the first and second seasons of study. In addition, the other combinations treatments recorded in between values with tendency of variability in their effectiveness as compared to the abovementioned two categories. Such trend was true during 2004 and 2005 seasons. These results are in accordance with those previously reported by Kabeel (1985), Omar (1996), Abd El-Magied (1998), El-Naggar (2002), Osman (2005) and Darwesh (2006) on some deciduous rootstocks transplants.

From the abovementioned results one may conclude that the growth of two pear rootstocks transplants under study i.e., beachilyfolia and communis as being indicated from the values of dry weights of plant organs (leaves, stem, roots, and total weight of plant) from one hand, and the vegetative growth measurements i.e., (stem, root and total length of plant, stem diameter) from the other 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 an adaptive mechanism in two pear rootstocks 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 tissue (Winter, 1982).

2- Effect of the different salts concentrations, sodium adsorption ratio (SAR), and chloride levels ($Cl:SO_4$ ratio) in irrigation water on photosynthetic pigments (leaf content of chlorophyll A, B and carotenoids):

Results obtained are represented in Tables (7 & 8) concerning the specific and interaction effects of the different three studied abovementioned factors on the leaves content of chlorophyll A and B as well as carotenoids content in both two pear cvs. rootstocks under study during the first and second seasons of study.

A- Specific effect:

With respect to the specific effect of the different concentrations of salt in saline solutions used for irrigation on some leaf pigments i.e., (chlorophyll A, B and carotenoids), data obtained in Tables (7 & 8) showed clearly that a negative relationship was observed between all three investigated (2000, 4000 and 6000 ppm) saline solutions and leaf content of pigments (chlorophyll A, B and carotenoids). However, all salinity concentrations abovementioned resulted in an obvious decrease in leaf chlorophyll A and B as well as carotenoids content of both beachilyfolia and communis pear rootstocks transplants during the two seasons. Such decrease was significant as compared to those of tap water irrigated transplants (control). It could be noticed generally that a gradual decrease in leaf pigments content was shown as salinity in irrigation water was increased during the two seasons. Moreover, data revealed that the most depressive effect was always related with the highest salts concentration i.e., (6000 ppm), however the highest values and the lowest decrease in this concern was resulted by the (2000 ppm) saline solution. Since, the (4000 ppm) salts concentration in irrigation water was intermediate. Also, it could be observed that the differences between the three salinity concentrations were significant as each was compared to the two other ones with chlorophyll A, B and caroteinoids content of two pear rootstocks leaves during 2004 and 2005 seasons. Therefore, it could be stated that salinity reduced severely the photosynthetic pigments content in both beachilyfolia and communis pear rootstocks transplants. These results are in agreement with those findings of Pandey and Divate (1976), Kabeel (1985), Osman (2005) and Darwesh (2006) on some deciduous fruit rootstocks.

With regard the specific effect of sodium adsorption ratio of saline solution used for irrigation in suitability of water for irrigation on both chlorophyll A and B as well as caroteinoids content in both beachilyfolia and communis pear rootstocks transplants leaves, it is quite evident from data in the same Tables that increasing sodium adsorption ratio (SAR) from 3 to 6 in irrigation water resulted in significantly decreasing in photosynthetic pigments of leaves i.e., (chlorophyll A & B) and caroteinoids compounds in studied two pear rootstocks transplants during both 2004 and 2005 seasons.

As for the specific effect of chloride levels ($Cl:SO_4$ ratio) of saline solution used for irrigation on the leaves content from chlorophyll A, B and caroteinoids in the two investigated pear rootstocks transplants. It could be observed from results tabulated in the aforesaid two Tables that the higher ratio of chloride in saline solution used for irrigation resulted in decreasing both chlorophyll (A & B) and caroteinoids contents. In other words, increasing the level of chloride from low to high in irrigation water exhibited the highest decrease in photosynthetic pigments compounds (chlorophyll A & B and caroteinoids) of both beachilyfolia and communis pear root-stocks transplants during the two experimental seasons of study. Moreover, such decrease was significant throughout the first and second seasons.

In this concern the obtained results regarding the specific effect of both SAR and chloride levels on the leaves contents from chlorophyll (A & B) and caroteinoids are similar and agreement with those findings by Kabeel (1985), Omar (1996), Abd El-Magied (1998), El-Naggar (2002), Osman (2005) and Darwesh (2006) on some deciduous fruit rootstocks transplants.

B- Interaction effect:

With respect to the interaction effect of the three investigated factors under study i.e., salinity concentrations, sodium adsorption ratio (SAR) and chloride levels ($Cl:SO_4$ ratio) on the leaves content of chlorophyll (A & B) and caroteinoids of both beachilyfolia and communis pear rootstocks transplants, results obtained in Table (8) displayed obviously that the

Table (5): Effect of the different salts concentrations, sodium adsorption ratio (SAR) and chloride levels (Cl:SO_4 ratio) of saline irrigation water on dry weight of both leaves and stem (gm) of both beachilyfolia and communis pear rootstocks transplants during 2004 and 2005 seasons.

Cultivars / Treatments		Dry weight of leaves (gm.)						Total length (stem + root)					
		Beachilyfolia			Communis			Beachilyfolia			Communis		
		Low	High	Mean*	Low	High	Mean*	Low	High	Mean*	Low	High	Mean*
		1st season											
Control		11.53a	11.53a	11.53A	8.11a	8.11a	8.11A	34.98a	34.98a	34.98A	25.47a	25.47a	25.47A
2000 ppm	SAR3	11.22ab	10.88a-c	10.72B	8.01ab	7.32a-d	7.49B	32.11a	31.41ab	30.02B	24.75a	22.53ab	22.26B
	SAR6	10.52a-d	10.25a-e		7.52a-c	7.12b-d		29.12bc	27.45cd		21.36ab	20.41ab	
4000 ppm	SAR3	9.91b-e	9.55c-f	9.46C	6.73cd	6.49d	5.87C	26.69cd	26.22c-e	25.08C	20.11ab	19.65ab	19.20B
	SAR6	9.25d-g	9.11e-g		5.37e	4.88e		24.83de	22.56ef		18.95a-c	18.11a-c	
6000 ppm	SAR3	8.96e-g	8.42fg	8.31D	5.23e	5.11e	4.97D	20.93fg	19.45fg	19.34D	17.33bc	16.82bc	15.62C
	SAR6	7.98g	7.87g		4.92e	4.63e		18.81fg	18.16g		16.21bc	12.11c	
Mean** (SAR 3 & 6)		SAR3	SAR6		SAR3	SAR6		SAR3	SAR6		SAR3	SAR6	
		10.25A	9.76A		6.89A	6.33B		28.35A	26.36B		21.52A	19.76A	
Means*** of CL		Low	High		Low	High		Low	High		Low	High	
		9.91A	9.66A		6.56A	6.24A		26.78A	25.75A		20.60A	19.30A	
		2nd season											
Control		11.22a	11.22a	11.22A	7.76a	7.76a	7.76A	31.77a	31.77a	31.77A	24.66a	24.66a	24.66A
2000 ppm	SAR3	11.13a	10.68ab	10.58B	7.33ab	7.11a-c	6.97B	30.56a	33.20a	30.05B	23.76a	23.11a	22.66A
	SAR6	10.52ab	10.01a-c		6.80a-c	6.65a-d		29.88a	26.55b		22.23a-c	21.55a-c	
4000 ppm	SAR3	9.65b-d	9.15c-e	9.01C	6.25b-e	5.85c-f	5.68C	25.13bc	22.66cd	22.94C	24.11a	22.67ab	21.82A
	SAR6	8.71d-f	8.51d-g		5.39d-g	5.23e-g		22.32cd	21.65de		20.88a-c	19.62a-c	
6000 ppm	SAR3	8.11e-h	7.75f-h	7.60D	4.99e-g	4.82fg	4.57D	20.48d-f	19.66d-f	19.05D	18.45a-c	18.11a-c	17.10B
	SAR6	7.41gh	7.11h		4.38g	4.08g		18.52ef	17.55f		16.23bc	15.61c	
Mean** (SAR 3 & 6)		SAR3	SAR6		SAR3	SAR6		SAR3	SAR6		SAR3	SAR6	
		9.86A	9.34B		6.48A	6.01A		26.90A	25.00B		22.44A	20.68A	
Means*** of CL		Low	High		Low	High		Low	High		Low	High	
		9.54A	9.20A		6.13A	5.93A		25.52A	24.72A		21.47A	20.76A	

*, ** and *** means refer to specific effect of salinity concentration, SAR ratio and Cl:SO_4 ratio, respectively. Capital letters were used for comparing values within the same culumn or row separately which representing the specific effect of salinity concentration, SAR ratio and Cl:SO_4 ratios, respectively. However, with the interaction effect small letters were used, as means followed by the same letter`s were not significantly different.

Table (6): Effect of the different salts concentrations, sodium adsorption ratio (SAR) and chloride levels ($Cl:SO_4$ ratio) of saline irrigation water on dry weight of roots (gm.) and total plant dry weight (gm.) of both beachilyfolia and communis pear rootstocks transplants during 2004 and 2005 seasons.

Treatments \ Cultivars		Dry weight of roots (gm.)						Total plant dry weight (gm.)					
		Beachilyfolia			Communis			Beachilyfolia			Communis		
		Low	High	Mean*	Low	High	Mean*	Low	High	Mean*	Low	High	Mean*
		1st season											
Control		36.19a	36.19a	**36.19A**	23.11a	23.11a	**23.11A**	71.16a	71.16a	**71.16A**	48.58a	48.58a	**48.58A**
2000 ppm	SAR3	36.18a	35.14ab	**33.75B**	22.77a	22.16a	**21.20B**	68.29a	66.55a	**63.78B**	47.52a	44.69ab	**43.47B**
	SAR6	31.44a-c	32.25a-c		20.00ab	19.88ab		60.56b	59.70bc		41.36a-c	40.29a-c	
4000 ppm	SAR3	30.54bc	28.18cd	**26.31C**	18.43bc	18.43bc	**17.23C**	57.23bc	54.40c	**51.38C**	38.54b-d	38.08b-d	**36.44C**
	SAR6	24.21de	22.29ef		16.34cd	15.73cd		49.04d	44.85de		35.29c-e	33.84c-e	
6000 ppm	SAR3	21.24e-g	18.34f-h	**17.78D**	14.36de	13.66de	**12.86D**	42.17ef	37.79fg	**37.12D**	31.69de	30.48d-f	**28.48D**
	SAR6	16.41gh	15.14h		11.91e	11.53e		35.22g	33.30g		28.12ef	23.64f	
Mean** (SAR 3 & 6)		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**	
		30.25A	**26.77B**		**19.50A**	**17.70B**		**58.59A**	**53.13B**		**41.02A**	**37.46B**	
Means*** of CL		**Low**	**High**		**Low**	**High**		**Low**	**High**		**Low**	**High**	
		28.03A	**26.79A**		**18.13A**	**17.79A**		**54.81A**	**52.54A**		**38.73A**	**37.09A**	
		2nd season											
Control		35.30a	35.30a	**35.30A**	22.79a	22.79a	**22.79A**	67.07a	67.07a	**67.07A**	47.45a	47.45a	**47.45A**
2000 ppm	SAR3	35.10a	32.33b	**32.38B**	21.41ab	20.63a-c	**20.55B**	65.66a	65.53a	**62.43B**	45.17ab	43.74a-c	**43.22B**
	SAR6	31.22bc	30.88bc		20.42b-d	19.75b-d		61.10b	57.43c		42.65a-c	41.30a-c	
4000 ppm	SAR3	29.21cd	27.25d	**25.52C**	19.32b-e	19.00c-e	**18.55C**	54.34d	49.91e	**48.46C**	43.43a-c	41.67a-c	**40.37B**
	SAR6	23.39e	22.22e		18.36de	17.52e		45.71f	43.87fg		39.24b-d	37.14cd	
6000 ppm	SAR3	21.48ef	19.21f	**18.40D**	17.52e	14.24f	**13.56D**	41.96g	38.87h	**37.46D**	35.97cd	32.35de	**30.66C**
	SAR6	16.89g	16.03g		12.11g	10.36g		35.41i	33.58i		28.34e	25.97e	
Mean** (SAR 3 & 6)		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**	
		29.40A	**26.40B**		**19.71A**	**18.01B**		**56.30A**	**51.41B**		**42.16A**	**38.69B**	
Means*** of CL		**Low**	**High**		**Low**	**High**		**Low**	**High**		**Low**	**High**	
		27.51A	**26.17B**		**18.85A**	**17.76B**		**53.04A**	**50.89B**		**40.32A**	**38.52A**	

*, ** and *** means refer to specific effect of salinity concentration, SAR ratio and $Cl:SO_4$ ratio, respectively. Capital letters were used for comparing values within the same culumn or row separately which representing the specific effect of salinity concentration, SAR ratio and $Cl:SO_4$ ratios, respectively. However, with the interaction effect small letters were used, as means followed by the same letter's were not significantly different.

Table (7): Effect of the different salts concentrations, sodium adsorption ratio (SAR) and chloride levels ($Cl:SO_4$ ratio) of saline irrigation water on total chlorophyll (A) and (B) of both beachilyfolia and communis pear rootstocks transplants during 2004 and 2005 seasons.

Cultivars / Treatments		Chlorophyll (A)						Chlorophyll (B)					
		Beachilyfolia			Communis			Beachilyfolia			Communis		
		Low	High	Mean*	Low	High	Mean*	Low	High	Mean*	Low	High	Mean*
		1st season											
Control		1.33a	1.33a	**1.33A**	0.88a	0.88a	**0.88A**	1.41a	1.41a	**1.41A**	1.00a	1.00a	**1.00A**
2000 ppm	SAR3	1.27a	1.15b	**1.10B**	0.87a	0.81b	**0.80B**	1.40ab	1.39b	**1.36B**	0.99a	0.97b	**0.95B**
	SAR6	1.01c	0.96cd		0.78c	0.74d		1.35c	1.29d		0.94c	0.91d	
4000 ppm	SAR3	0.94c-e	0.88de	**0.87C**	0.71e	0.67f	**0.65C**	1.22e	1.16f	**1.12C**	0.87e	0.85f	**0.83C**
	SAR6	0.86de	0.81ef		0.63g	0.59h		1.09g	1.03h		0.82g	0.79h	
6000 ppm	SAR3	0.64gh	0.71fg	**0.64D**	0.55i	0.50j	**0.49D**	0.96i	0.90j	**0.87D**	0.76i	0.73j	**0.71D**
	SAR6	0.65gh	0.58h		0.47k	0.43l		0.84k	0.77l		0.70k	0.67l	
Mean** (SAR 3 & 6)		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**	
		1.03A	**0.94B**		**0.74A**	**0.68B**		**1.23A**	**1.15B**		**0.90A**	**0.85B**	
Means*** of CL		**Low**	**High**		**Low**	**High**		**Low**	**High**		**Low**	**High**	
		0.96A	**0.92A**		**0.70A**	**0.66B**		**1.18A**	**1.14B**		**0.87A**	**0.85B**	
		2nd season											
Control		1.16a	1.16a	**1.16A**	0.87a	0.87a	**0.87A**	1.40a	1.40a	**1.40A**	0.93a	0.93a	**0.93A**
2000 ppm	SAR3	1.09ab	1.04bc	**1.01B**	0.86a	0.84a	**0.81B**	1.38ab	1.36ab	**1.34B**	0.93a	0.92a	**0.89B**
	SAR6	0.97cd	0.91de		0.81a	0.75b		1.34b	1.27c		0.86b	0.84b	
4000 ppm	SAR3	0.88de	0.85ef	**0.81C**	0.71bc	0.67cd	**0.65C**	1.20d	1.12e	**1.10C**	0.82c	0.79d	**0.78C**
	SAR6	0.78fg	0.73gh		0.63de	0.58ef		1.07e	0.99f		0.77e	0.73f	
6000 ppm	SAR3	0.70gh	0.63hi	**0.60D**	0.54fg	0.51g	**0.48D**	0.94f	0.88g	**0.84D**	0.70g	0.67h	**0.66D**
	SAR6	0.57ij	0.51j		0.45h	0.41h		0.82h	0.75i		0.64i	0.61j	
Mean** (SAR 3 & 6)		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**		**SAR3**	**SAR6**	
		0.93A	**0.85B**		**0.73A**	**0.67B**		**1.21A**	**1.13B**		**0.84A**	**0.79B**	
Means*** of CL		**Low**	**High**		**Low**	**High**		**Low**	**High**		**Low**	**High**	
		0.88A	**0.83B**		**0.70A**	**0.66B**		**1.16A**	**1.11B**		**0.81A**	**0.78B**	

*, ** and *** means refer to specific effect of salinity concentration, SAR ratio and $Cl:SO_4$ ratio, respectively. Capital letters were used for comparing values within the same culumn or row separately which representing the specific effect of salinity concentration, SAR ratio and $Cl:SO_4$ ratios, respectively. However, with the interaction effect small letters were used, as means followed by the same letter`s were not significantly different.

variable response of the pear rootstocks transplants to the different combinations of irrigation water used during 2004 and 2005 seasons. However, the highest decrease in leaves chlorophyll A, B and caroteinoids content was detected by that combinations (6000 ppm x SAR6 x higher Cl:SO_4 ratio)., while the lowest decrease in leaf pigments content was obtained by those transplants irrigated with (2000 ppm) saline solution of SAR3 and lower chloride level i.e., (2000 ppm x SAR3 x low Cl:SO_4 ratio) as compared to those continuously irrigated with tap water (control) during the two seasons of study. In addition, the other combinations treatments came in between with relatively variable tendency in their effectiveness. These obtained results are coincident with that mentioned by Kabeel (1985); Omar (1996), Abd El-Magied (1998), El-Naggar (2002), Osman (2005) and Darwesh (2006) on some decideuous fruit rootstocks transplants.

From these results it could be stated that the decline in photosynthetic pigments content of salt stressed transplants might be due to the decrease in the absorption of minerals needed for chlorophyll biosynthesis i.e., iron and magnesium (Reddy, 1967) or due to the reduction of chlorophyll molecules (Poljakoff and Gale, 1975) or due to inhibition of chlorophyll synthesis (Patil *et al.*, 1984).

Table (8): Effect of the different salts concentrations, sodium adsorption ratio (SAR) and chloride levels (Cl:SO4 ratio) of saline irrigation water on carotenoids of both beachilyfolia and communis pear rootstocks transplants during 2004 and 2005 seasons.

Treatments \ Cultivars		Carotene					
		Beachilyfolia			Communis		
		Low	High	Mean*	low	High	Mean*
1st season							
Control		1.01a	1.01a	1.010A	0.967a	0.967a	0.967A
2000 ppm	SAR3	0.977b	0.947c	0.956B	0.943b	0.923c	0.926B
	SAR6	0.967b	0.933c		0.937bc	0.900d	
4000 ppm	SAR3	0.903d	0.867e	0.874C	0.863e	0.843e	0.848C
	SAR6	0.880e	0.847f		0.857ef	0.827g	
6000 ppm	SAR3	0.827g	0.773i	0.85D	0.800h	0.770ij	0.779D
	SAR6	0.793h	0.747j		0.787hi	0.760j	
Mean** (SAR3 & 6)		SAR3	SAR6		SAR3	SAR6	
Mean**** (Cl)		0.921A	0.892B		0.890A	870B	
Means*** of CL		Low	High		Low	High	
		0.914A	0.898B		0.885A	0.875B	
2nd season							
Control		0.977a	0.977a	0.977A	0.953a	0.953a	0.953A
2000 ppm	SAR3	0.963ab	0.933cd	0.941B	0.937ab	0.927bc	0.927B
	SAR6	0.950bc	0.917d		0.933b	0.913c	
4000 ppm	SAR3	0.880e	0.863e	0.863C	0.887d	0.863ef	0.868C
	SAR6	0.870e	0.840f		0.873de	0.850f	
6000 ppm	SAR3	0.803g	0.767h	0.779D	0.823g	0.793h	0.802D
	SAR6	0.790g	0.757h		0.810g	0.780h	
Mean** (SAR3 & 6)		SAR3	SAR6		SAR3	SAR6	
Mean**** (Cl)		0.901A	0.879B		0.896A	0.879B	
Means*** of CL		Low	High		Low	High	
		0.895A	0.885B		0.892A	0.883B	

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دراسات فسيولوجية على نمو ومقاومة بعض نباتات الفاكهة للملوحة
١ – تأثير التركيزات المختلفة من الأملاح ونسبة الصوديوم المدمص والكلوريد فى ماء الرى على النمو الخضرى ومحتوى الأوراق من الصبغات النباتية

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أجرى هذا البحث بهدف دراسة تأثير التركيزات المختلفة من الأملاح (٢٠٠٠ – ٤٠٠٠ – ٦٠٠٠ ج.م.م) المتداخلة مع مستويين من كل من نسبة الصوديوم المدمص (٣، ٦) وكذلك الكلوريد: الكبريتات (منخفض – عالى) على بعض قياسات النمو الخضرى ومحتوى الأوراق من بعض الصبغات النباتية (كلوروفيل أ، ب والكاروتينات) لشتلات أصلين من الكمثرى وهما البيتشيليفوليا والكميونس خلال عامين متتاليين ٢٠٠٤، ٢٠٠٥ وذلك بالمزرعة التجريبية لمحطة بحوث البساتين بالقناطر الخيرية – محافظة القليوبية – مصر.

وقد أشارت النتائج المتحصل عليها والمتعلقة بالتأثير النوعي للعوامل تحت الدراسة إلى أن كل القياسات الخضرية المدروسة وهي (أطوال الساق والجذر والنبات الكامل وقطر الساق، وأيضاً الأوزان الجافة للأوراق والساق والجذر والوزن الجاف الكلى للنبات) بالإضافة إلى محتوى الورقة من الصبغات النباتية (كلوروفيل أ، ب والكاروتينات) كل هذه القياسات انخفضت (نقصت) نتيجة استخدام تركيزات الملوحة فى مياه الرى وكذلك بزيادة كل من تركيز الصوديوم المدمص من ٣ إلى ٦ وزيادة مستوى الكلوريد من المستوى المنخفض إلى المستوى العالى وذلك مقارنة بتلك الشتلات التى كانت تروى دائماً بماء الصنبور (الكنترول). والأهم من ذلك فقد أشارت النتائج إلى أن التأثير الأكثر تثبيطاً للنمو كان متلازماً وواضحاً مع التركيز الأعلى من الملوحة (٦٠٠٠ ج.م.م) وكذلك مع المستويات العالية من كل من نسبة الصوديوم المدمص أو الكلوريد.

أما فيما يختص بتأثير التفاعل للعوامل الثلاثة المختبرة فإن النتائج أظهرت أن التأثير النوعى لكل عامل من العوامل المدروسة أنعكس مباشرة على تأثير التفاعل بين هذه العوامل متداخلة مع بعضها حيث أوضحت النتائج أن معاملة الشتلات بمحلول يحتوى على أعلى تركيز من الأملاح مع أعلى مستوى من كل من الصوديوم المدمص والكلوريد (٦٠٠٠ ج.م.م. × صوديوم مدمص ٦ × كلوريد عالى) فى ماء الرى أدت هذه المعاملة إلى أكبر معدل فى النقص فى كل القياسات والصفات المدروسة السابق ذكرها على المستوى الإحصائى بينما كانت أقل القياسات نقصاً فى هذا الخصوص معنوياً متلازمة مع تلك الشتلات التى رويت بمحلول يحتوى على أقل تركيز من الملوحة مخلوطاً بأقل مستوى من كل من الصوديوم المدمص والكلوريد أى (٢٠٠٠ ج.م.م. + صوديوم مدمص ٣ + كلوريد منخفض). هذا بالإضافة إلى أن بقية المعاملات (التراكيب) كانت وسطاً بين الحدين الأعلى والأدنى لكل من أصلى الكمثرى تحت الدراسة فى كلا موسمى التجربة.