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Effect of Magnetic Irrigation Water and Some Anti-Salinity Substances on the Growth and Production of Valencia Orange

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ABSTRACT

The present research was designed to evaluate the effect of magnetizing irrigation water and antioxidants (such as ascorbic acid, Proline acid and salicylic acid)on different growth types such as average leaves number per shoots, shoot length, leaf area, flowers number per meter, fruit set %, yield, fruit quality of Valencia orange, leaf chlorophyll content and nutrients leaf content. Two field experiments were carried out at Wady-Elnatroun which is located at 74 Km Cairo-Alexandria desert roads during the two successive growing seasons of (2012/2013) and (2013/ 2014). Two water treatments were carried out (nun magnetic water and magnetic water), three acids type i.e. ascorbic, salicylic and proline acid were added to the Valencia orange trees and four acids concentrations were used i.e. ascorbic acid (AsA) at(0, 250, 500 and 750 mg/l)), Proline acid (po) at (0, 100, 200 and 300 mg/l) and salicylic acid (SA) at (0, 100, 200 and 300 mg/l). Trees were sprayed with acids to the run off at pit hardening end of March during 2012 and 2013seasons. From results presented, it was found that, all studded characters have significantly affected by irrigation water treatments and anti-salinity substances for both seasons. Magnetic irrigation water enhanced all studded growth characters, fruit set, yield components and fruit qualities and leaves contents of elements compared with nonmagnetic irrigation water in the two seasons of this study. Concerning anti-salinity substance, it was found that, salicylic acid at 300 ppm gave maximum values of growth characters, fruit set and yield compared with ascorbic and Proline, ascorbic and salicylic superiority over Proline in fruit qualities and leaves contents of elements for both seasons.

Key words: Valencia Orange, magnetic water, anti-salinity, Ascorbic acid, Proline, salicylic acid.

Introduction

Citrus is the backbone of fruit crop cultivation in Egypt. During the last few years, citrus area has increased due to increasing demands of local consumption and exports, which is expected to boom in the future. It will know that most of the new reclaimed areas in Egypt are planted with fruit trees especially citrus which considered the first fruit crop in Egypt. The area of citrus has increased rapidly through the last few years and reached about 462772 feddans (Ministry of Agriculture and Land Reclamation of Egypt, 2010). Such extension in area encourages establishing more studies towards finding out an appropriate integrated magnetic water and antioxidants(such as ascorbic acid, Proline amino acid and Salicylic acid) management for improving a production the production and fruit quality. Salinity is an environment stress mainly occurs in arid and semi-arid conditions where rain precipitation is not enough to leach the excess soluble salts from the root zone as well as it can occur in irrigated agriculture cultivations particularly when water of poor quality is used for irrigation. Salt stress causes number of changes in plant metabolism. Among them, ion toxicity, osmotic stress and production of reactive oxygen species (ROS) are most prominent (Mittler, 2002).

Agricultural production is one of the most basic elements contribute to the economic income and food security, despite the problems that accompanied such as lack of water, desertification, salinity and low yield. These problems can be remedied relatively using a technique of magnetic treatment of water. This technique has become the focus of researchers compared the ways physical and other chemicals, as provided by the purity of the environmental and health safety and easy to use. The status of water molecules within a magnetic field leads to change or break down hydrogen bonds between molecules. This leads to change the properties of water, such as electrical systems, increasing the proportion of oxygen dissolved in water, increase the ability to dissolve salts and acids, polymerization, the surface tension, change in the speed of chemical reactions, properties of evaporation, moisture, elasticity, electrical insulation and increased permeability. So bring the water with energy, vitality and-flowing than it was. Later, these changes will effect on the qualities of the material that enters the structure through its effect on the qualities physical or in chemical or physiological processes and biochemical (Al-Jbouri *et al.*, 2006). Antioxidants (such as ascorbic acid) have caught all free radicals produced during plant metabolism, hence increasing plant resistance to stress (Shalata and Peter, 2001). Ascorbic acid is as an antioxidant could be used as a potential growth regulator to improve salinity stress resistance in several

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species (Khan, 2006), to enhance growth and fruit quality (Elsaed *et al.,* 2000 on flame seedless grapevine, Ahmed, 2001 and Mansour *et al.* 2010 on mangoes, Ragab, 2002) on Washington Navel orange, Mostafa, 2004 on banana, Wassel *et al*., 2007 on white banate seedless grapevines and Maksoud *et al.,* 2009 on olive trees). Proline amino acid has been showed to accumulate in plant tissues under various condition (Mnsour, 2000). The proposed function of the accumulated proline is osmosis regulation which has an adaptive mechanism to environmental stress and salinity, other proposed function is maintenance of membrane and protein stability, growth and provisions a store carbon, nitrogen and energy. In this respect, Ezz (1999) mentioned that proline foliar application increased fruit juice, ascorbic acid content peel porline, free amino acid and reducing sugar content of Washington Navel orange and Marsh grape fruit. Furthermore, Takeuchi *et al.* (2008) demonstrated that l-proline treatments caused an increase in sugar content of fruit, glutamic acid content of new leaves and leaf chlorophyll content of Japanese pear tree grown in containers under greenhouse conditions. Also, Caronia *et al.* (2010) worked on (*Citrus sinensis* L) indicated that amino acids especially l-Proline foliar application improved yield, fruit weight, diameter and T.S.S. content. The purpose of the present research is evaluate the effect of magnetic water and some antioxidants to reduce the salinity injuries in relation growth attributes, fruit set, yield and fruit quality traits of Valencia orange trees grown under salt stress.

Materials and Methods

The present investigation was carried out at Wady-Elnatroun city during two successive growing seasons of 2012-2013 and 2013- 2014 to study and evaluate the effect of magnetizing irrigation water and antioxidants on different growth types such as average leaves number per shoots, shoot length, leaf area, flowers number per meter, fruit set %, yield, fruit quality, leaf chlorophyll content and nutrients leaf content of Valencia orange. Trees were sprayed to the run off at pit hardening end of March during 2012 and 2013 seasons. The treatments included magnetic water, nun magnetic water and (ascorbic acid (AsA) at (0, 250, 500 and 750 mg/l), proline acid (po) at (0, 100, 200 and 300 mg/l) and salicylic acid (SA) at (0, 100, 200 and 300 mg/l)). The experimental Valencia orange trees (*Citrus sinensis* L) were 9 year-old and budded on Volkamer lemon (*Citrus volkameriana*), planted at 6 meters between rows and 4 meters between trees and grown in sandy soil. The trees were annually fertilized with 40 units of phosphorus, 160 units of nitrogen and 120 units of potassium as phosphoric acid and multi fertilizers as 12/60/0, 20/20/20, 12/4/60 and calcium nitrate per feddan. Soil samples from the experimental site were analyzed before began the investigation and after investigation to determine main soil physical and chemical characters.

The experimental design was split- split plot arrangements of randomized complete block design with four replicates. Each consisted of one Valencia orange tree as a replicate. The main plots (A) were contained application magnetic and nun magnetic water irrigation drop, the sub-plots (B) antioxidants (such as ascorbic acid, proline acid and salicylic acid) and the sub-sub plots (C) were contained concentration of antioxidants, treatments included water as the control, ascorbic acid (AsA) at (0, 250, 500 and 750 mg/l), Proline acid (po) at (0, 100, 200 and 300 mg/l), salicylic acid (SA) at (0, 100, 200 and 300 mg/l).

To study the effect of different treatments the following parameters were determined:

Vegetative growth

Shoot length: 16 randomized shoot around the periphery each replicate, 4 from each directions were calculated and measured by ruler as (cm), at the three growth cycles.

Leaf area: Twenty- five leaves per tree (the 4 rd leaves / shoot) were picked at September from non-fruiting spring flush shoots, the leaves were wiped with damp cloth, then leaf length and leaf width were measured, and leaf area was estimated using formula: $\text{Leaf area} = {}^{2}\!/_{3} \times length \times width$

Shoot number: calculated by the number of shoot started by four fixed number and in March was first calculation then in September the second one.

Shoot thickness: At late September in both seasons, shoot thicknesses for twenty shoots were measured by hand caliber.

Yield and yield physical and chemical components

Fruit set (%): The flowers on Twenty- five shoots per tree (the 4 rd leaf/shoot) were counted, then the percentage of fruit set was calculated on basis of the number of flowers emerged per shoot and number of developed fruitlets after about two weeks of full bloom according to the following equation according to Westood (1978).

$$\text{Fruit set\%} = \frac{Number\ .of\ .developed\ .fruitlets}{Total\ .number\ .of\ .flowers\ .at\ .full\ .bloom} \times 100$$

Yield (Kg): At harvest time yield (kg) per each treated tree was weighed and recorded. 10 fruits from each replicate were randomly picked to determine fruit physical and chemical properties. Such determinations were carried out as following:
Fruit weight: it was determined by weighing the samples and fruit weight was calculated.
Fruit volume (cm^3): volume of the displaced water when immersing the fruit sample in a jar filled with water and average fruit volume was calculated as (cm^3).
Fruit Rag (%): Weight percentage was determined by weighing the fruit rag samples and calculated as according to the following equation.

$$\text{Fruit Rag Weight \%} = \frac{Fruit\ .RagWeight}{Fruit\ .Weight} \times 100$$

Juice weight (%): Determined by weighing the juice samples. While, fruit juice % was calculated by dividing average juice weight of per fruit by the average fruit weight and calculated according to the following equation $= \frac{Juice\ .Weight}{Fruit\ .Weight} \times 100$.

Total soluble solids (T.S.S %): Was determined by using hand refract meter according to Chen and Mellenthin (1981).
Ascorbic acid (vitamin C): The ascorbic acid content of the juice was determined by titration with 2, 6 dichloro phenol-indo-phenol (A.O.A.C., 1985), and calculated as milli-grams per 100 ml of juice.
Total sugars: Determined in fresh fruit shamble according to Malik and Singh (1980).
Total acidity (%): Was determined as percentage of citric acid by titration with sodium hydroxide and using phenolphthalein 1% as indicator according to the official methods of analysis (Chen and Mellenthin 1981).

Leaf mineral contents

Samples of 25 leaves which were taken to determine contents the leaf mineral contents, ground material of each sample was digested with H2SO4 and H2O2 according to Walf (1982). In the digested material, total nitrogen and phosphorus were determined clorometracly according to Evenhuis and Dewaard (1976) and Murphy and Riley (1962), respectively and potassium was determined by flame voltmeter as decrypted by Chenj and Pray (1951). Calcium, Magnesium and Micronutrients (Fe, Zn, Cu and Mn) leaf contents were determined according to Crter (1993).

Data were, statistically, analyzed as split- split plot design (SSP) according to Gomez and Gomez (1984), using CoStat (1998) program.

Results and Discussion

Vegetative growth

The effect of magnetic water and anti-salinity substances on Vegetative growth attributes during the two growing seasons are presented in Table (1). Regarding magnetic water treatments, it was clear that in both seasons application of magnetic water increased shoot length, leaf area, shoot number and shoot thickness as compared with nonmagnetic water in both study seasons. Concerning anti-salinity substance type, salicylic, ascorbic and Proline were superiority significantly over control, salicylic acid a marked superiority over other types of anti-salinity substances on Vegetative growth attributes i.e. leaf area, shoot number and shoot thickness for two seasons respectively.

The interaction for shoot length was significant between water types and anti-salinity substance concentrations in the first season only. The interactions were significant on leaf area among of water types X anti-salinity concentration, anti-salinity substance type X anti-salinity concentration and water types X anti-salinity substance type X anti-salinity substance concentration on the other side this interaction was not significant between water irrigation types x anti-salinity substance type in the first season. During the second season, all possible interactions among of all studied factors had no significant effect on leaf area of Valencia orange. All possible interactions for shoot number among the three tested factors had no significant effect on shoots number except the interaction between anti-salinity substance type and anti-salinity substance concentration and the interaction between water types and anti-salinity substance types and concentration in the first season. The interactions among the three tested factors had no significant effect on average shoot thickness except the interaction between anti-salinity substance type and anti-salinity substance concentration in the first season.

Vegetative growth attributes, were increased with various significance levels as a result of applying magnetic water was used for irrigation. Similar results were obtained by Ameen *et al.* (2010) and Hozayn and Qados (2010a) and Abd El-All *et al.* (2013).Regarding anti-salinity substances, the ascorbic acid ,proline and salicylic acid are induced increase in growth could be related to enhanced activity of antioxidants that protect the plants from oxidative damage.It could be concluded from the above- maintained results that, magnetic water led to better performers of leaf area in orange trees and anti- salinity substances currently holds a significant position in plant physiology, mainly due to its possession of antioxidant and cellular reductant etc. These result are cope with Al-Sayed (1990) and Khan *et al*. (2012), Noctor and Foyer, (1998), Asada (1999), Hong *et al*. (2000) and El-Tayeb (2005).

Table 1: Effect of magnetic irrigation water and some anti-salinity substances on the vegetative growth parameters of Valencia orange trees and their interaction during 2013 and 2014 seasons.

Treatments	Shoot length (cm)		Leaf area (cm2)		Shoots number		Shoot thickness	
	2013	2014	2013	2014	2013	2014	2013	2014
Irrigation water type (A)								
Nonmagnetic	12.23b	12.03b	31.59b	31.20B	9.68B	9.65b	0.588b	0.599B
Magnetic	13.45 a	13.45a	33.93a	33.020A	11.67A	11.16a	0.681a	0.671A
Anti-salinity type (B)								
Ascorbic	12.80 a	13.00a	32.63a	32.60A	10.63B	10.64a	0.617b	0.622B
Proline	12.32 b	11.84b	31.88b	30.75B	10.15B	9.48b	0.609b	0.602B
Salicylic	13.41 a	13.38a	33.78a	33.26A	11.25A	11.09a	0.677a	0.682a
Anti-salinity substance (ppm) (C)								
0	12.13 c	10.92c	31.88c	30.047C	8.64C	8.83c	0.575d	0.567c
1	12.14c	12.78b	31.94c	31.89B	10.49B	10.32c	0.601c	0.629c
2	12.88b	13.28a	33.02b	32.74B	11.14.B	10.78b	0.667b	0.667a
3	14.24a	13.98a	34.23a	33.72A	12.45a	11.68a	0.696a	0.678a
Interactions								
A × B	N.S.	N.S.	N.S.	N.S	N.S.	N.S.	N.S.	N.S.
A × C	**	N.S	**	N.S	N.S.	N.S.	N.S.	N.S
B x C	N.S.	N.S.	**	N.S.	**	N.S.	**	N.S.
A × B x C	N.S.	N.S.	*	N.S.	*	N.S.	N.S.	N.S.

**Mean values in the same column marked with the same letters are not significantly different at 0.05 level of probability.*, **: significant at 0.05 level of probability. N.S. : not significant. 1, 2 and 3 concentration: Ascorbic (250, 500 and 750 ppm), Proline, Salicylic (100, 200 and 300 ppm).*

Yield and yield physical and chemical components:

The effect of magnetic water and anti-salinity substances on fruit set, yield, fruit weight and fruit volume during the two growing seasons are presented in Table (2). Concerning magnetic water treatments, it was clear that in both seasons application of magnetic water increased fruit set, yield, fruit weight and fruit volume as compared with nonmagnetic water in both study seasons. As for anti-salinity substance type, salicylic, ascorbic and Proline acids were superiority significantly over control, salicylic acid amerced superiority over other types of anti-salinity substances on fruit weight and fruit volume in the second season. Ascorbic acid a marked superiority over other types of anti-salinity substances on fruit weight and fruit volume in the first season

All possible interactions among the three tested factors had no significant effect on fruit set%, except the interaction between water irrigation types x anti-salinity substance type in the first season; also, there was a significant effect by the interaction between anti-salinity substance type x anti-salinity substance concentration in the two seasons. The interaction among four factors had not significant effect on yield per tree (kg) except the interaction between anti-salinity substance type and anti-salinity substance concentration. As for the interaction effects, all possible interactions among the three tested factors had no significant effect. The interactions among the three tested factors had significant effect on fruit juice % in the two seasons of this study. As for the interaction effects, all possible interactions among the three tested factors had significant effect on fruit volume (cm3) except the interaction between water irrigation type x anti-salinity substance concentration and anti-salinity substances type x anti-salinity substance concentration in the first season.

The obtained results showed that, the use of magnetic water irrigation, enhancing moisture contain in the soil which reflect on all plant characters i.e. fruit set, yield, wright and fruit volume. Magnetically treated water has an enhancing effect on the photosynthetic pigments content compared to the control. Magnetic water led to increase of essential elements aided treated water plants to increase their chlorophyll content, which lead to increase carbohydrate product in plant which produces energy for fruit properties. These results were in line with those recorded by Khoshravesh *et al.* (2011) Podlesny and Pietruszewski (2009), Hozayn *et al.* (2011) and Abd El-All *et al.* (2013). As for anti-salinity substances, it was found that, decreased the activity of enzymes maybe by elimination of free radicals. It was found that, these substances play a protective role against ROS that are formed during biotic and abiotic stress. Thease results are in line with those reported by.

The application of organic acids increases the fruit properties by increasing the cell division. Smiroff (1996), Noctor and Foyer (1998), Asada (1999) and Tsugane *et al*. (1999). Thakur and chandel (2004) and Hayat *et al.* (2010)

Table 2: Effect of magnetic irrigation water and some anti-salinity substances on fruit set, yield, fruit weight and fruit volume of Valencia orange trees and their interaction during 2013 and 2014 seasons.

Treatment	Fruit set %		Yield per Tree(kg)		Fruit weight (g)		Fruit volume (cm3)	
	2013	2014	2013	2014	2013	2014	2013	2014
Irrigation water type (A)								
Nonmagnetic	4.338 b	3.876 b	33.06b	32.65b	193.71b	191.64b	220.37b	217.1b
Magnetic	4.996 a	4.098 a	36.79a	35.58a	206.07a	198.39a	231.13a	224.33a
Anti-salinity type (B)								
Ascorbic	4.221 c	3.988 b	33.91b	33.47b	204.36a	194.96b	227.81a	222.8a
Proline	4.556 b	3.767 c	32.81c	32.16c	194.57b	191.58c	221. 8b	215.1b
Salicylic	5.223 a	4.206 a	38.06a	36.72a	200.74a	198.51a	227.7a	224.3a
Anti-salinity substance (ppm)(C)								
0	4.668 c	3.966 b	31.38c	30.08d	192.17d	183.30c	217.2d	211.3c
1	4.991 b	4.258 a	34.25b	33.13c	196.03c	196.72b	224.63c	221.1b
2	5.243 a	4.385 a	35.38b	35.13b	202.14b	198.72	228.1b	222.2b
3	3.767 d	3.340 c	38.71a	38.13a	209.22a	201.32a	233.13a	228.3a
Interactions								
A × B	**	N. S.	**	N. S.	*	**	**	**
A × C	N. S.	N. S.	**	N.S.	N.S.	N.S.	N.S.	*
B x C	**	**	**	*	**	N.S.	N.S.	**
A × B x C	N. S.	N. S.	*	N. S.	**	N. S.	*	*

**Mean values in the same column marked with the same letters are not significantly different at 0.05 level of probability.*, **: significant at 0.05 level of probability. N.S.: not significant. 1, 2 and 3 concentration: Ascorbic (250, 500 and 750 ppm), Proline, Salicylic (100, 200 and 300*

The effect of magnetic water and anti-salinity substances on fruit length, fruit diameter, fruit rag and fruit juice during the two growing seasons are presented in Table (3). Regarding magnetic water treatments, it was clear that in both seasons application of magnetic water increased fruit length, fruit diameter, fruit rag and fruit juice as compared with nonmagnetic water in both study seasons. Concerning anti-salinity substance type, salicylic, ascorbic and Proline acids were superiority significantly over control, salicylic acid amerced superiority over other types of anti-salinity substances on fruit length, fruit diameter, fruit rag and fruit juice in the second season. Ascorbic acid a marked superiority over other types of anti-salinity substances on fruit length in the two seasons and fruit diameter in the second season. Salicylic acid amerced superiority over other types of anti-salinity substances on fruit juice % in the two seasons and fruit diameter in the first season. Proline amerced superiority over other types of anti-salinity substances on fruit rag in the two seasons.

Concerning the interaction effects, as for fruit length, all possible interactions among the three tested factors had no significant effect on fruit length (cm) except the interaction between anti-salinity substance type and anti-salinity substance concentration. Regarding fruit diameter, all possible interactions among the three tested factors had no significant effect on fruit diameter except the interaction between anti-salinity substance type and anti-salinity substance concentration in the second season. As for fruit rag%, all possible interactions among the three tested factors had significant effect on fruit rag % in the two seasons of study. As for fruit juice% all possible interactions among the three tested factors had significant effect on fruit juice % in the two seasons of this study.

fruit length, fruit diameter, fruit rag and fruit juice may be due to the effect of magnetic water on growth parameters of Valencia trees, the magnetic water irrigation enhancing the vegetative growth which reflects on this trait. there are some changes occurred in the physical and chemical properties of water according to magnetic water, mainly hydrogen bonding, polarity, surface tension, conductivity, pH and solubility of salts, and these changes in water properties may be capable of affecting the growth of plants. They assumed that the reduction in water pH and increase in EC in magnetic water may be due to changes in hydrogen bonding and increased mobility of ions. Similar results were reported by Hilal and Hillal (2000b) and Grewal and Maheshwari (2011).With regard anti-salinity substances, this finding might be taken place due to the well-known role of using antioxidant substances which led to enhancing fruit qualities. Exogenous application of anti-salinety substanses, enhanced growth, physiological process and antioxidant activity of carrot plants grown under salinity stress. These results were in line with those obtained by Bolkhina *et al.* (2003), Talaat (2003), Yuan *et al.* (2009) ,Mahmoudi *et al*. (2013).

The effect of magnetic water and anti-salinity substances on TSS % , acidity %, V C % and total sugar % during the two growing seasons are presented in Table (4). Regarding magnetic water treatments, it was clear

that in both seasons application of magnetic water increased TSS % , acidity %, V C % and total sugar % as compared with nonmagnetic water in both study seasons. Concerning anti-salinity substance type, salicylic, ascorbic and Proline acids were superiority significantly over control, salicylic acid amerced superiority over other types of anti-salinity substances on TSS %, acidity %, V C % and total sugar % in the second season. Ascorbic acid amerced superiority over other types of anti-salinity substances on V C % and total sugar % in the two seasons and TSS % and acidity % in the second season. Salicylic acid amerced superiority over other types of anti-salinity substances on TSS% in the first seasons.

Table 3: Effect of magnetic irrigation water and some anti-salinity substances on fruit length, Fruit diameter (cm), Fruit Rag%and Fruit juice %of Valencia orange trees and their interaction during 2013 and 2014 seasons.

Treatment	Fruit length (cm)		Fruit diameter (cm)		Fruit Rag %		Fruit juice %	
	2013	2014	2013	2014	2013	2014	2013	2014
Irrigation water type (A)								
Nonmagnetic	6.92b	7.09B	6.36b	6.26b	34.47 a	35.44 a	39.49 b	39.11 b
Magnetic	7.61a	7.22a	6.42a	6.51a	31.68 b	34.12 a	44.95 a	41.47 b
Anti-salinity type (B)								
Ascorbic	7.43a	7.31a	6.40ab	6.48a	33.22 b	35.44 a	42.00 b	39.35 b
Proline	7.00b	6.97ab	6.32b	6.24b	33.91 a	35.46 a	40.99 c	39.28 b
Salicylic	7.37a	7.18b	6.47a	6.45a	32.09 c	33.44 b	43.65 a	42.24 a
Anti-salinity substance (ppm)(C)								
0	6.95b	6.38d	6.21b	5.91c	32.97 b	34.49 b	42.82 a	40.80 b
1	7.05b	6.97c	6.39a	6.26bc	32.31 bc	33.70 bc	43.12 a	42.16 ab
2	7.07b	7.46b	6.45a	6.63ab	31.98 c	33.05 c	43.63 a	42.74 a
3	8.00a	7.80a	6.54a	6.76a	35.05 a	37.88 a	39.29 b	35.46 c
Interactions								
A × B	N.S.	N. S.	N. S.	N. S.	**	**	**	**
A × C	N.S.	N.S.	N.S.	N. S.	**	**	**	**
B x C	*	N.S.	N.S.	*	**	**	**	**
A × B x C	**	N. S.	N. S.	N. S.	**	**	**	**

**Mean values in the same column marked with the same letters are not significantly different at 0.05 level of probability.*, **: significant at 0.05 level of probability. N.S.: not significant. 1, 2 and 3 concentration: Ascorbic (250, 500 and 750 ppm), Proline, Salicylic (100, 200 and 300*

Table 4: Effect of magnetic irrigation water and some anti-salinity substances on Total soluble solids (TSS)%, Acidity %, Vitamin C %and Total sugar (%)of Valencia orange trees and their interaction during 2013 and 2014 seasons.

Treatment	Total soluble solids (TSS)%		Acidity %		Vitamin C %		Total sugar (%)	
	2013	2014	2013	2014	2013	2014	2013	2014
Irrigation water type (A)								
Nonmagnetic	11.10 b	10.33 b	1.30 b	1.30 b	40.38 b	40.99 b	10.63 b	10.67 b
Magnetic	11.61 a	10.68 a	1.37 a	1.34 a	42.86 a	41.89 a	10.93 a	11.01 a
Anti-salinity type (B)								
Ascorbic	11.58 a	10.67 a	1.36 a	1.36 a	43.80 a	42.34 a	10.97 a	11.02 a
Proline	11.08 b	10.28 b	1.28 b	1.29 b	39.33 c	40.76 b	10.56 c	10.62 b
Salicylic	11.59 a	10.57 a	1.36 a	1.31 ab	41.72 b	41.23 ab	10.81 b	10.86 ab
Anti-salinity substance (ppm)(C)								
0	10.57c	9.76c	1.32b	1.21c	38.46c	38.11c	10.52b	9.97c
1	11.34 b	10.70 b	1.33 b	1.33 b	41.62 b	41.50 b	10.69 b	10.76 b
2	11.56 b	11.09 a	1.33 ab	1.35 ab	42.25 b	42.51 b	10.93 a	11.18 a
3	11.95 a	9.76 c	1.38 a	1.39 a	44.14 a	43.65 a	10.99 a	11.44 a
Interactions								
A × B	N.S.	N.S.	N.S.	N.S.	*	N.S.	*	N.S.
A × C	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	*	N.S.
B x C	N.S.	N.S.	N.S.	N.S.	*	N.S.	*	N.S.
A × B x C	N.S.	N.S.	N.S.	N.S.	**	N.S.	*	N.S.

**Mean values in the same column marked with the same letters are not significantly different at 0.05 level of probability.*, **: significant at 0.05 level of probability. N.S. : not significant. 1, 2 and 3 concentration: Ascorbic (250, 500 and 750 ppm), Proline, Salicylic (100, 200 and 300*

As for TSS% the interaction effects, all possible interactions among the three tested factors had no significant effect on total soluble substances % during the two seasons of this study. As for acidity% the interaction effects among three studded factors on juice acidity %, all possible interaction had no significant different in both seasons. As for V c content, all possible interactions among the three tested factors had not significant effect on V c content in the second season. All possible interactions among the three tested factors had significant effect on V c content except, the interaction between water irrigation types x anti-salinity substance concentration in the first season. As for total sugar %, all possible interactions among the three tested factors had not significant effect on total sugar % in the second season. In the first season, all possible

interactions among the three tested factors had significant effect on total sugar % except, the interaction between water irrigation types x anti-salinity substance types and concentration.

Total soluble solids%, acidity %, vitamin C and total sugar% increased as a result of the mode of action of magnetized water which coursed an increase of nutrients observation from the soil and increases the efficiency of transpiration of these nutrients inside the plants. These results were in harmony with those detected byAbd El-All et al. (2013). Regarding anti salinity substances, this finding could be attributed to the mode of action of anti-salinity substance which may be due to their influence in increasing photosynthetic pigment which reflected on photosynthesis process and led to increase in carbohydrate content. this results opposite with of Takeuchi *et al*. (2008) , Fayed (2010), Hafez *et al.* (2010), El-Razek (2013), Ashraf *et al*. (2012) and Ashraf *et al*. (2013).

Leaf mineral contents

The effect of magnetic water and anti-salinity substances on macro Leaf mineral contents during the two growing seasons are presented in Table (5). Regarding magnetic water treatments, it was clear that in both seasons application of magnetic water increased nitrogen%, phosphorus %potassium%, Calcium% and Magnesium% in Valencia orange leaves compared with nonmagnetic water in both study seasons. As for anti-salinity substance type, salicylic, ascorbic and Proline acids were superiority significantly over control.

As for the interaction effects, all possible interactions among the three tested factors had significant effect on nitrogen percentage in Valencia orang leaves in the first season but, in the second season it clear that, all possible interactions among the three tested factors had not significant effect on nitrogen percentage. With regard the interaction effects, it clear that, all interactions among the studded three tested factors had no significant effect on phosphorus percentage and potassium percentage in Valencia orang leaves for both studded seasons. As for the interaction effects, all possible interactions among the three tested factors had no significant effect on calcium percentage except the interaction between anti-salinity substance type x anti-salinity substance concentration. As for the interaction effects, all possible interactions among the three tested factors had no significant effect on magnesium percentage in the first season. While in the second season it clear that, As for the interaction effects, all possible interactions among the three tested factors had no significant effect except the interaction between water type irrigation x anti-salinity substance concentration.

Magnetic water caused an increase in nitrogen%, phosphorus % potassium%, calcium% and magnesium% in leaves Valencia orange, this increase may be due to that the magnetic water treatment showed higher values for mobile forms of nitrogen, and improved the dissolve of fertilizers in the soil irrigated with magnetized water and increase in the rate of water absorption, and explained the results by the variations induced by magnetic fields in the ionic currents across the cellular membrane with leads to change in the osmotic pressure. These findings were accordance with obtained by Carbonell *et al.* (2004) , Taia *et al.* (2007), Maheshwari and Grewal (2009), Abou El-Yazied *et al.* (2012), Abd El-All *et al.* (2013) and Osman *et al.* (2014). Regarding anti salinity substances, this finding could be attributed to the mode of action of anti-salinity substance which may be due to their influence in increasing maintained the nutrient status by promoting the uptake of element in plants exposed to drought and salinity stress in this respect Gunes *et al.* (2005) , Ali *et al.* (2008), Khan *et al.* (2010) ,El-Razek (2013) and Dawood *et al.* (2014).

The effect of magnetic water and anti-salinity substances on micro Leaf mineral contents during the two growing seasons are presented in Table (5). Regarding magnetic water treatments, it was clear that in both seasons application of magnetic water increased iron ppm, manganese ppm, zinc ppm and cupper ppm in Valencia orange leaves compared with nonmagnetic water in both study seasons. As for anti-salinity substance type, salicylic, ascorbic and Proline acids were superiority significantly over control.

As for the interaction effects, all possible interactions among the three tested factors had no significant effect onIron in the first season. While in the second season it is clear that, all possible interactions among the three tested factors had a significant effect onIron except the interaction between water irrigation types x anti-salinity substance concentration whereas. It was noticed that in the second season. With regard the interaction effects, it clear that, all interactions among the studded three tested factors had no significant effects on manganese ppm, zinc ppm and cupper ppm in Valencia orang leaves for both studded seasons.

Magnetic treatment of irrigation water is an acknowledged technique for achieving high water use efficiencies due to its effect on some physical and chemical properties of water and soil. These changes result in an increased ability ofsoil to get rid of salts and consequently better assimilation of nutrients and fertilizers in plants during the vegetative period. Regarding anti salinity substances, it was noticed that, anti-salinity substances application increases root length exposed to salinity stress, this led to enhancing plant ability in elements aspiration (Abou El-Yazied *et al.* (2012) and Abd El-All *et al.* (2013).

The main calculation of the present study is magnetic irrigation water enhanced all studded growth characters, fruit set, yield components and fruit qualities and leaves contents of elements compared with nonmagnetic irrigation water in the two seasons of this study. Concerning anti-salinity substance, it was found

that, salicylic acid at 300 ppm gave maximum values of growth characters, fruit set and yield compared with ascorbic and Proline, ascorbic and salicylic superiority over Proline in fruit qualities and leaves contents of elements for both seasons.

Table 5: Effect of magnetic irrigation water and some anti-salinity substances on Nitrogen%, Phosphorus %potassium%, Calcium% and Magnesium% of Valencia orange trees and their interaction during 2013 and 2014 seasons.

Treatment	Nitrogen %		Phosphorus %		Potassium %		Calcium %		Magnesium %	
	2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Irrigation water type (A)										
Nonmagnetic	1.72b	1.64 b	0.117 b	0.116 b	1.21 b	1.19 b	1.31 b	1.32 b	0.340 b	0.325 b
Magnetic	1.79a	1.70 a	0.122 a	0.120 a	1.35 a	1.32 a	1.53 a	1.55 a	0.404 a	0.369 a
Anti-salinity type (B)										
Ascorbic	1.78 a	1.72 a	0.122 a	0.120 a	1.31 a	1.28 a	1.43 a	1.44 a	0.379 a	0.349 a
Proline	1.70 b	1.62 b	0.117 c	0.118 a	1.25 b	1.20 b	1.36 b	1.42 a	0.352 b	0.338 a
Salicylic	1.79 a	1.67 a	0.120 b	0.117 a	1.29 ab	1.28 a	1.46 a	1.44 a	0.386 a	0.354 a
Anti-salinity substance (ppm)(C)										
0	1.67c	1.42b	0.115c	0.109c	1.23c	1.14c	1.32c	1.27b	0.333c	0.298c
1	1.76 b	1.71 a	0.122 a	0.119 b	1.25 bc	1.27 b	1.41 b	1.45 a	0.368 b	0.343 b
2	1.78 ab	1.75 a	0.123 a	0.127 a	1.28 b	1.39 a	1.46 a	1.50 a	0.374 b	0.355 b
3	1.81 a	1.81a	0.115 c	0.109 c	1.36 a	1.14 c	1.48 a	1.52 a	0.415 a	0.392 a
Interactions										
A × B	*		N.S.	N.S.	N.S.	N.S.			N.S.	N.S.
A × C	**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	*	N.S.	**
B x C	**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
A × B x C	**	N.S.	N.S.	N.S.	N.S.	N.S.	**	N.S.	N.S.	*

**Mean values in the same column marked with the same letters are not significantly different at 0.05 level of probability.*, **: significant at 0.05 level of probability. N.S. : not significant. 1, 2 and 3 concentration: Ascorbic (250, 500 and 750 ppm), Proline, Salicylic (100, 200 and 300)*

Table 6: Effect of magnetic irrigation water and some anti-salinity substances on iron ppm, manganese ppm ,zinc ppm and cupper ppm of Valencia orange trees and their interaction during 2013 and 2014 seasons.

Treatment	Iron ppm		Manganese ppm		Zinc ppm		Cupper ppm	
	2013	2014	2013	2014	2013	2014	2013	2014
Irrigation water type (A)								
Nonmagnetic	33.27 b	32.64b	31.63 b	31.51 b	13.50 b	11.96 b	11.99 b	13.31 b
Magnetic	42.68 a	39.07a	33.68 a	32.54 a	16.25 a	14.60 a	13.58 a	14.53 a
Anti-salinity type (B)								
Ascorbic	39.32 a	36.42 a	33.82 a	32.69 a	15.19 a	13.63 a	12.82 b	13.66 b
Proline	35.85 b	35.29 a	30.87 b	32.11 a	14.02 b	12.80 b	12.06 c	13.33 b
Salicylic	39.32 a	35.85 a	33.27 a	31.28 a	15.42 a	13.42 a	13.47 a	14.78 a
Anti-salinity substance (ppm)(C)								
0	34.81d	30.75d	29.04c	29.41c	13.35c	10.73c	11.47d	10.70c
1	37.20 c	35.17 c	32.40 b	32.04 b	14.62 b	13.53 b	12.40 c	14.22 b
2	38.92 b	36.75 b	33.37 b	31.07 bc	15.21 b	13.93 b	13.26 b	14.92 b
3	40.96 a	40.75 a	35.81 a	35.59 a	16.32 a	14.93 a	14.01 a	15.86 a
Interactions								
A × B	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
A × C	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
B x C	*	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
A × B x C	N.S.	**	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

**Mean values in the same column marked with the same letters are not significantly different at 0.05 level of probability.*, **: significant at 0.05 level of probability. N.S.: not significant. 1, 2 and 3 concentration: Ascorbic (250, 500 and 750 ppm), Proline, Salicylic (100, 200 and 300)*

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