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RESPONSE OF PEAR SEEDLINGS TO SOME NON-AND MAGNETIZED SALINE IRRIGATION WATER AND HUMIC ACID AND THEIR EFFECT ON GROWTH, LEAF PHYSIOLOGICAL PROPERTIES, LEAF PIGMENTS AND ELEMENTS CONTENTS

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ABSTRACT: This study was conducted during two successive seasons of 2018 and 2019 at El Kanater Horticultural Research Station, Qalyoubeia Government Egypt. The aim of this investigation was to study the effect of salinity levels of non-and magnetized irrigation water alone and in combination with humic acid on one-year-old pear seedlings (*Pyrus communis*) rootstock.

Obtained results revealed that, the two higher concentrations of saline water (1500 and 3000 mg/l) resulted in a gradual significant decreased in all vegetative measurements, dry weights of pear seedling organs, both leaf succulence grade, water potential and leaf content of pigments as well as some leaf elements contents of N, P, K, Mg, Fe, Zn and Mn, Whereas an opposite trends were observed with leaf osmotic pressure, proline content and leaf content of Ca, Na and Cl as compared to the control (270 mg/l –fresh water). On the other hand, seedlings treated with either humic acid or magnetized water were exited significantly an increasing values of vegetative parameters, dry weights of different plant organs, leaf pigments and some macro and micro-nutrients beside Na and Cl as well as both leaf succulence grade and water potential as compared to control (non-magnetized water or non-humic acid) in both seasons of study. The obtained data concluded that the use of magnetized water technique with humic acid applications would be efficiently and safe alternative tool to resolve the problem of irrigating with saline water and to enhance pear rootstock seedlings growth grown under similar conditions of this study.

Key words: Pear seedlings, Magnetized water, Saline water, Humic acid, Growth parameters.

INTRODUCTION

Pear can be considered as one of the major and most important deciduous fruits in Egypt. For that, in the few last decades the areas cultivated with pear was enormously increased to meet the continuous rise in demand for pear fruits for local consumption in Egyptian markets. Serious water shortage becomes the most important problem in Egypt. There is an urgent need to use alternative water sources for irrigation in order to conserve fresh water. Moreover, the expansion of agricultural land need amounts of suitable irrigation water which already is not sufficient to meet all the expected demands in this respect. On the other hand, in Egypt, the supply of water for use in agriculture is becoming increasingly limited while agriculture the main consumed about 80% of the available water where crop production is based mainly on irrigation.

Under the population pressure in Egypt, the need to provide an additional land in future than the present which may

required additional water to face high demands from the ever-increasing population and the expansion of irrigated area for farming to increases food production (Mohamed,2013). Thus, there is a pressing need for system (technology role e.g. magnetic water) saline water treated by passing through a magnetic device called magnetized water, for that, saline water may represent a possible water supply for agriculture production, but it requires innovative and sustainable research and an appropriate transfer of technology.

The successful use of magnets in treating water for irrigation, industry and home use was used in many countries of the world (China, Japan, Australia, Russia, United States and many European countries)(Qudos and Hozayn,2010).

Magnetic water may improved the plant growth characteristics and nutrients uptake (Radhakrishnan and Kumari, 2012), root function (Aladjadjiyan, 2010), as well as chemical composition of plants and plant enzymes (Alikamanoglu and Sen, 2011), Moreover, using magnetic irrigation water was superiority than non-magnetic irrigation water whish gave the best results on vegetative growth, fruiting and yield and increased leaf mineral composition of N, P and k and improved fruit quality (Aly *et al.*, 2015) on Valencia orange trees. On the other hand, the same trend was observed with seedlings of Date palm (Dhawi and Al-Khayri, 2009), Pear betulaefolia rootstock (Osman *et al.*, 2014)) and Soliman *et al*. (2017) who found that irrigation with magnetized water led to a decrease in pH values in soil samples at different depths comparing to soils irrigated with non-magnetized water. Also data show irrigation with magnetized water led to a decrease in EC and soluble ions contents in soil samples at different depths comparing to soils irrigated with non-magnetized water.

The use of magnetized water for irrigation have the positive effect to save irrigation water and the less harmful influence on the environment (Mostafazadeh *et al.,* 2011) Irrigation with magnetized water increased significantly the growth characteristics, kinetin, GA3, nucleic acids (RNA and DNA), potassium, photosynthetic pigments (chlorophyll a and b and carotenoids), photosynthetic activity and translocation efficiency of photo-assimilates as compared with control plants as reported by Moussa, (2011) and Soliman *et al*. (2017).

Humic acids (HA) are the most active components of soil and compost organic matter, stimulate plant growth and consequently yield by acting on mechanisms involved in cell respiration, photosynthesis, protein synthesis, water and nutrient uptake, enzyme activities (Chen *et al.,* 2004), In particular, optimal concentrations able to affect and stimulate plant growth have been generally found in the range of 50-300 mg/L, but positive effects have been also exerted by lower concentrations (Chen *et al.,* 2004). A distinction on the effects of humic acids should be made between indirect and direct effects on plants growth. Indirect effects are mainly exerted through properties such as enrichment in soil nutrients, increase of microbial population, higher cation exchange capacity, improvement of soil structure; whereas direct effects are various biochemical actions exerted at the cell wall, membrane or cytoplasm and mainly of hormonal nature (Varanini and Penton, 2001; Chen *et al.,* 2004).

Therefore, the objective of the current investigation is to evaluate the most effective treatments with salinized water at different concentrations (270, 1500 and 3000 mg/l) either alone or combined with magnetized or non-magnetized water and two treatments of both humic acid (0.0 and 30 cm.) on some vegetative growth

parameters, leaf physiological properties and leaf chemical analysis of pear communis rootstock seedlings.

MATERIAL AND METHODS

The present investigation has been carried out throughout the two consecutive seasons of 2018 and 2019 in the Experimental Farm at El Kanater Horticultural Research Station, Qalyoubeia Government, Egypt. One hundred and eight uniforms in vigor and healthy one-year-old seedlings of pear rootstock (*Pyrus communis*) were the plant used in this study and transplanted individually in plastic bag of 30 cm in diameter during the first week of February and filled with media consisting of clay and sandy at equal proportion by volume.

Some physical and chemical properties of the soil at the used media which were determined before transplanting are presented in Tables (1).

Pear seedlings were representative of the different twelve combination treatments between three factors i.e. (a) three levels of saline water concentrations (270, 1500 and 3000 mg/l.), (b) two types of irrigation water treatments (non-magnetized water and magnetized water) and (c) two rates of humic acid solution (HA) at (0.0 and 30 cm./seedling/year) where the major constituent of humic acid is potassium humate "85%" and folvic acid "3%".

The different studied treatments applied were as follows:

1. **Fresh and non-magnetized Nile water at 270 mg/l + 0.0 cm HA (control)**
2. **Fresh and magnetized Nile water at 270 mg/l + 0.0 cm HA**
3. **Fresh and non-magnetized Nile water at 270 mg/l + 30 cm HA**
4. **Fresh and magnetized Nile water at 270 mg/l + 30 cm HA**
5. **Non-magnetized saline water at 1500 mg/l + 0.0 cm HA**
6. **Magnetized saline water at 1500 mg/l + 0.0 cm HA**
7. **Non-magnetized saline water at 1500 mg/l + 30 cm HA**
8. **Magnetized saline water at 1500 mg/l + 30 cm HA**
9. **Non-magnetized saline water at 3000 mg/l + 0.0 cm HA**
10. **Magnetized saline water at 3000 mg/l + 0.0 cm HA**
11. **Non-magnetized saline water at 3000 mg/l + 0.30 cm HA**
12. **Magnetized saline water at 3000 mg/l + 0.30 cm HA**

Table (1): Physical and chemical properties of the used media.

Parameter	Particle size distribution (%):					Organic matter g / kg	EC (dS/m, media paste extract)	pH (1: 2.5 w/v media water suspension)
	Clay %	Silt %	Fine sand %	Coarse sand %	Texture class			
Value	31.4	33.5	34	1.1	Clay loamy	17	1.1	7.9

Parameter	Solution of cations and anions in media paste extract (mmolc/L):								*Available K mg / kg	*Available P mg / kg	(saturation percent)	$CaCO_3$ g / kg
	Na^+	K^+	Ca^{++}	Mg++	$CO_3^=$	HCO_3^-	Cl^-	$SO_4^=$				
Value	4.1	0.41	3.07	2.63	0	3.85	3.7	2.66	191.9	9.33	67.5	35.9

*** Extracts of NH_4 – acetate (for K), and sodium bicarbonate (for P).**

The plants were irrigated with fresh water till the 30th of April, until the beginning of the experimental treatments. Prior to irrigation, seawater was diluted with fresh water to the required concentrations (1500 and 3000 mg/l) in plastic tank. The diluted seawater was used for irrigation throughout the course of the study that extended to seven months.

Irrigation water passed through a magnetic device (2 inch, output 18 m^3 per hour, 4500 gauss, Made in Germany). The device comprised of two magnets, arranged to the north and south poles. The directions of magnetic field generated at the flow rate as shown in (Fig. 1).

The used three saline irrigation water were both non- and magnetized saline water analyzed for their PH and EC and the obtained data are recorded in Table (2).

The studied treatments were arranged in a factorial experiment as conducted using a complete randomized block design where each treatment was replicated three times and each replicate was represented by three seedlings.

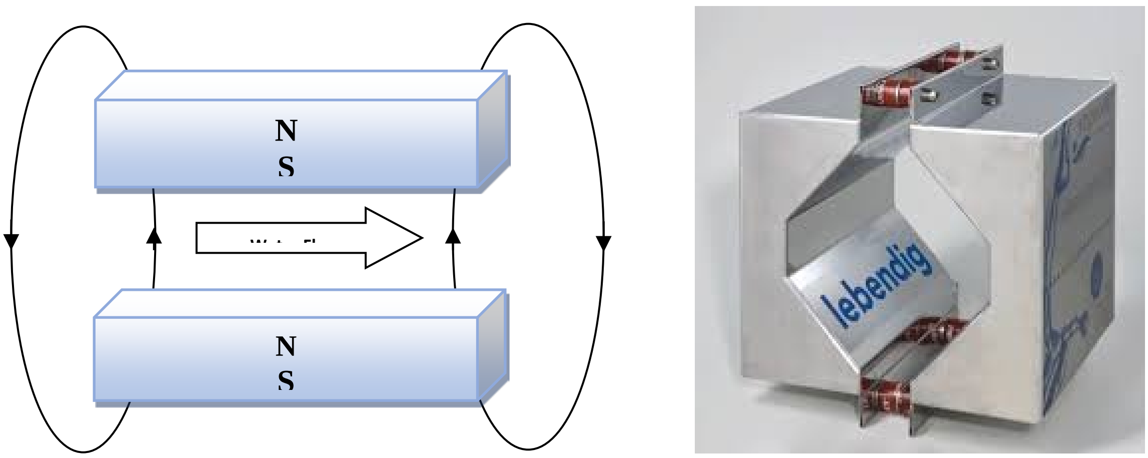

Fig. 1: Schematic of magnetic fields and direction of water flow during the magnetic treatment.

Table (2): Effects of magnetic treatment on mean values of pH and EC in different types of irrigation waters.

Irrigation water type	pH		EC (dS/m at 25° C)	
	Non-Magnetized water	Magnetized water	Non Magnetized water	Magnetized water
Fresh water 270 mg/l	8.15	8.13	0.422	0.417
Saline water 1500 mg/l	8.40	8.36	2.37	2.35
Saline water 3000 mg/l	8.41	8.36	4.74	4.70

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

1. Morphological characteristics (some vegetative growth) parameters:

In both seasons, the effect of the different studied treatments on some vegetative growth measurements were recorded, the measured growth parameters were: plant height (cm), number of leaves /plant, leaf area (cm^2) and dry weights (g) of three plant organs leaves, stem and roots.

2. Physiological properties of leaf:

The following three physiological characters of pear leaves were investigated as follows:

a) **Leaf succulence grade (L.S.G.):** Was calculated as gram H_2O/cm^2 of leaf area according to Nomir, (1994) as following equation:

$$L.S.G. = \frac{\text{Leaf water content (gm)}}{\text{Leaf area (cm)}^2} \text{ gm } H_2O/cm^2 \text{ of leaf}$$

Whereas,

Leaf water content (gm)=

$$\frac{leaves\ fresh\ weight - leaves\ dry\ weight\ at\ end\ of\ experiment}{Number\ of\ leaves\ at\ the\ end\ of\ experiment} \times 100$$

b) **Leaf water potential (L.W.P.):** Was estimated as following equation as suggested by Halma, (1934) and confirmed by Peynado and Young, (1968).

$$\text{Leaf water potential} = \frac{\text{Fresh weight - dry weight}}{\text{Fresh weight}} \times 100$$

c) **Leaf osmotic pressure in bar (L.O.P.):** Was estimated according to the method described by (Gusov, 1960).

3. Chemical analysis:

a) **Leaf chlorophyll contents (a, b and carotenoids):** Which were expressed as mg/g fresh weight and calculated according to the method described by (Saric *et al.*, 1967) using the following equations:

Chlorophyll A = (9.784 x E 662) – (0.99 x E 644) = mg/g fresh weight

Chlorophyll B = (21.426 x E 644) – (4.650 x E 662) = mg/g fresh weight

Carotenoids = (4.685 x E 440) – (0.268 x chl.a + chl. b) = mg/g fresh weight

b) **leaf proline content:** Was estimated in fresh leaves according to the method described by Batels *et al.*, (1973) and confirmed by Draz, (1986).

c) **Leaf nutritional status:** Leaf contents of some macro-elements N, P, K, Ca, Mg, Na and Cl as well as the content of micro-nutrients Fe, Zn and Mn were determined. A 0.5 g of leaves dry materials was digested in 10 ml of concentrated H_2So_4 and $HClo_4$ mixture at mixed ratio of 3:1 as described by Chapman and Pratt (1961). The following procedures were used: Total nitrogen was determined by micro-Kjeldahl method described by Cottenie *et al*., (1982). Whereas, P was determined colorimetrically according to Murphy and Riely (1962). However, other elements (K, Ca, Mg, Na, Cl, Fe, Zn and Mn) were determined by using the Atomic Absorption Spectrophotometer (3300) according to Chapman and Pratt (1961).

Soil analysis:

Particle size distribution was conducted using the pipette method according to Klute (1986). Media pH, electric conductivity (EC) and content of soluble cationic and anionic compositions of the saturation extract of the soil were determined according to the standard methods described by Page *et al.,* (1982).

Statistical analysis:

All obtained results during two seasons were statistically analyzed using analysis of variance method according to Snedecor and Cochran, (1990). However, significant differences among means distinguished according to the Duncan's multiple test range (Duncan, 1955).

RESULTS AND DISCUSSIONS

1. Effect of the studied treatments on morphological characteristics:

a. Vegetative growth measurements:

Referring the effect of salinity levels on some vegetative growth measurements i.e. plant height (cm.), root length (mm) and both number of leaves /plant and leaf area (cm^2) of communis pear rootstock seedlings, data presented in Table (3) revealed that, both two saline water concentrations of (1500 and 3000 mg/l) exhibited an obvious decrease in four vegetative measurements abovementioned during the two seasons of study. Such decrease was significant as compared to the control (seedlings irrigated with fresh and non magnetized Nile water, 270 mg/l) which resulted significantly in the highest plant height, the longest root, the higher number of leaves/plant and the largest leaf area. Meanwhile the saline treatment of water at rate of 3000 mg/l gave statistically the lowest plant height, the shortest root and the least number of leaves/plant more than those found with the treatment of 1500 mg/l. Furthermore, the differences between the three salinity concentrations were significant. Such trends were true during both 2018 and 2019 seasons of study. With respect to the effect of humic acid treatment, data displayed clearly that, pear seedlings treated with humic acid resulted in significantly increase for all vegetative growth parameters abovementioned in this study as compared to the other treatment in the two growing seasons.

Concerning the effect of magnetized water used for irrigation on four vegetative charactars under study, data Table (3) indicated that, the magnetized water for irrigation exhibited a significant increase in plant height, root length, number of leaves /plant and leaf area (cm^2) as compared to the other treatment of communis pear seedlings rootstock.

Regarding the interaction effect of three investigated factors (salinity, and magnetized water humic acid) used on four vegetative growth parameters abovementioned, obtained data in Table (3) showed obviously that, a significant effect on four studied vegetative growth parameters of communis pear rootstock seedlings during the two seasons of study was observed. However, the highest decrease in plant height (cm.), root length (mm), number of leaves/plant and leaf area (cm^2) were resulted by those pear seedlings treated with the highest salinity concentration (3000 mg/l), combined with both non magnetize water and non humic acid added i.e.(3000 mg/l, non magnetized water and non humic acid) treatment as compared to the other investigated combination treatments. Meanwhile, the lowest decrease in vegetative parameters abovementioned was associated with those seedlings with that combination between the lowest salt concentration(270 mg/l) with magnetized water and higher rate of humic acid (30 cm humic acid) i.e. (270 mg/l, magnetized water and 30cm humic acid) treatment. In addation to that, the other remain combination treatments came intermediate between the aforsaid two extremes. Such trends were detected during both 2018 and 2019 seasons of study.

Table (3): Effect of salinity concentrations, magnetized water and humic acid and their combination on some vegetative growth parameters of pear seedling in two seasons 2018, 2019.

Character		Plant height (cm.)			Number of leaves/ plant			Leaf area(cm2)			Root length (cm.)		
Treatments MW Salinity levels	HA	Non.MW	MW	Mean*	Non.MW	MW	Mean*	Non.MW	MW	Mean*	Non.MW	MW	Mean*
2018													
Fresh water 270 mg/l	0.0cm.HA	132.5c	135.3bc	138.1A	107.0b	115.3a	115.2A	31.58cd	32.11c	34.54A	42.20c	43.83ab	43.48A
	30cm.HA	140.5ab	144.0a		117.0a	121.3a		34.78b	39.70a		43.07bc	44.81a	
1500 mg/l	0.0cm.HA	107.5f	114.1e	116.0B	74.33ef	82.33de	83.9B	25.18gh	27.50efg	27.56B	37.45f	38.28ef	38.99B
	30cm.HA	117.5e	124.9d		85.33d	93.67c		27.99ef	29.57de		39.49de	40.72d	
3000 mg/l	0.0cm.HA	82.30i	91.33h	94.5C	54.67g	74.00f	71.1C	20.98i	24.53h	24.38C	26.61i	27.90i	29.01C
	30cm.HA	98.50g	106.0f		75.33ef	80.33def		25.53gh	26.46fgh		29.68h	31.85g	
Mean**		113.14B	119.28A		85.65B	94.45A		27.67B	29.96A		36.42B	37.90A	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		110.505B	121.91A		84.6B	95.5A		26.955B	30.67A		36.04B	38.27A	
2019													
Fresh water 270 mg/l	0.0cm.HA	121.4d	129.7c	137.0A	114.2cd	118.6c	124.9A	34.74cd	36.42c	38.14A	35.25d	36.81c	37.34A
	30cm.HA	145.8b	150.9a		126.7b	140.0a		39.28b	42.12a		37.97b	39.33a	
1500 mg/l	0.0cm.HA	108.9ef	111.4e	116.2B	93.6f	100.1e	91.9B	25.79fg	27.14ef	28.16B	30.41g	31.65f	32.17B
	30cm.HA	120.7d	123.9d		65.8i	108.0d		29.63de	30.09d		32.64e	33.96e	
3000 mg/l	0.0cm.HA	78.29i	84.78h	90.0C	59.4j	60.1j	71.1C	19.33h	23.53g	23.7C	25.48 j	26.81i	27.28C
	30cm.HA	91.13g	105.9f		77.5h	87.2g		25.22fg	26.73f		27.96h	28.88h	
Mean**		111.05B	117.75A		89.5B	102.3A		29.00B	31.01A		31.62B	32.91A	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		105.75B	123.05A		91.0B	100.9A		27.825B	32.18A		31.07B	33.46A	

*, **, and*** means refers to specific effect of salinity concentrations, humic acid and magnetized water, respectively. Capital letters were used for comparing values representing the specific effect of three abovementioned factors, while small letters were used for distinguishing their combination (interaction effect). Means followed by the same abovementioned letters were not significantly different at 5% level. Where MW: Magnetic water Non MW: Non-magnetic water HA: Humic acid

b. Dry weight of seedling organs (leaves,stem and root) of communis pear.

Concerning the effect of salt concentrations, data obtained in Table (4) revealed obviusly that, both two higher investigated concentrations of saline water (1500 and 3000 mg/l) resulted in a gradual decrease in dry weights of all seedling pear organs (leaves,stem and roots) during the two expermental seasons of study. Such decrease was significant as compared to those pear seedlinged treated with the lower saline water concentration (270 mg/l) i.e. Nile water (control) which resulted in the greatest values of dry weights of plant organs. On the other hand, the most depressive effect and greatest loss in dry weights of all seedling organs (leaves,stems and roots) were always in concomitant to the highest salt concentration (3000 mg/l), meanwhile, salt concentration of (1500 mg/l) was intermediate in this respicet. Moreover, the differences between the three treatments (270,1500 and 3000 mg/l) were significant as each was compared to the two other ones for the studied abovementioned measurements of communis pear seedlings during both 2018 and 2019 seasons of study.

Regarding the effect of magnetized water on dry weights of seedling organs (leaves,stems and roots) of communis pear rootstock, it is quite evident from resualts tabulated in Table (4) that using of magnetized water for irrigation exhibited an increasing in dry weights and resulted in the greatest value of different seedling organs as compared to the seedlings were irrigated with non magnetized water which showed the least values in dry weights of plant organs of communis pear seedlings rootstock. Such trend was true during the first and the second seasons of study.

Considering the effect of humic acid treatments on dry weights of plant organs under study,it is quite clear from presnt data in Table (4) that, the higher rate of humic acid (30cm HA) resulted in a significantly increase in all abovementioned studied measuerments than the lower one (0.0 cm HA). Such trend was detected during both seasons of study.

Obtained results concerning the abovementioned growth measuerments were in harmony with the conclusion reported by Al- yassin (2005) and Brito *et al.,* (2014) on citrus trees and Paranava *et al.* (2014) on mango seedlings where thay all revealed that, all groth prameters investigated were decreased by increased the concentration of salt in irrigation water. On the other hand, Osman *et al.* (2014) on pear seedling and Aly *et al.,* (2015) on valancia trees and Soliman *et al*. (2017) on grape they reported that, application of magnetized water improved aforesid growth measuerments investigated under study as compared to non-magnetized water treatments.

In general, it could be concluded that, the greater growth under magnetized water and humic acid could be explained that,water stress decreased cytokine transport from root shoots and increased in amounet of leaf abscisc acid. These changes in hormone balance cause reduction in shoot growth and enlargment as well as leaf expansion Atkinson *et al.* (2000) also, reduction in growth under water stress conditions could be attributed to lower photosynthetic rate and stomatel conductence (Mpelasoka *et al.,* 2001) Moreover, magnetic water wereased the growth by decreasing the hydratis of salt ions and colloids, having apositive effect on salt solubilty leading to leaching of soil salts.

Table (4): Effect of salinity concentrations, magnetized water and humic acid and their combination on dry weight of transplant organs (leaves, stem and root) of pear seedling in two seasons 2018, 2019.

Character		Leaves dry weight (g)			Stem dry weight (g)			Root dry weight (g)		
Treatments MW										
Salinity levels	HA	Non.MW	MW	Mean*	Non.MW	MW	Mean*	Non.MW	MW	Mean*
2018										
Fresh water 270 mg/l	0.0cm.HA	9.23bc	9.42bc	9.605A	26.00b-d	27.16ab	26.97A	14.65bc	15.03b	15.53A
	30cm.HA	9.72ab	10.05a		26.85ab	27.89a		16.01a	16.41a	
1500 mg/l	0.0cm.HA	8.17e-g	8.40ef	8.543B	24.75d	25.17cd	25.56B	12.56ef	12.99e	13.28B
	30cm.HA	8.58de	9.02cd		25.88b-d	26.59a-c		13.37de	14.18cd	
3000 mg/l	0.0cm.HA	8.06e-g	7.68g	7.993C	17.22e	17.49e	17.71C	10.08h	10.71gh	10.94C
	30cm.HA	7.85fg	8.38ef		17.99e	18.14e		10.99g	11.98f	
Mean**		8.60B	8.825A		23.11AB	23.739A		12.945B	13.55A	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		8.49B	8.935A		22.96B	23.89A		12.67B	13.825A	
2019										
Fresh water 270 mg/l	0.0cm.HA	6.967e	8.530b	8.413A	25.59d	27.09bc	27.23A	11.40d	14.54a	13.78A
	30cm.HA	8.953a	9.203a		28.65a	27.57ab		14.38a	14.77a	
1500 mg/l	0.0cm.HA	5.860h	7.403d	7.411B	19.32e	26.03cd	24.83B	7.243 g	11.59cd	10.78B
	30cm.HA	7.923c	8.457b		27.21bc	26.76b-d		11.92c	12.36b	
3000 mg/l	0.0cm.HA	6.112g	6.427f	6.720C	18.473f	19.62e	19.66C	10.143h	7.827f	6.02C
	30cm.HA	6.910e	7.433d		20.35e	20.19e		7.850ef	8.263e	
Mean**		7.1205B	7.9085A		23.27B	24.54A		10.49B	11.56A	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		6.882B	8.1465A		22.69B	25.12A		10.46B	11.59A	

*, **, and*** means refers to specific effect of salinity concentrations, humic acid and magnetized water, respectively. Capital letters were used fo comparing values representing the specific effect of three abovementioned factors, while small letters were used for distinguishing their combination (interaction effect). Means followed by the same abovementioned letters were not significantly different at 5% level. Where MW: Magnetic water

Non MW: Non-magnetic water HA: Humic acid

Furthermore, The beneficial effect of humic acid on growth of plant could be related to the improvement the physical condition of the soil, and increasing nutrients supply as well as improving the efficiency of macro-nutrients and its ability to meet some micro-nutrients rements (El-Nagar, (1996).

2. Effect of the studied treatments on leaf succulence grade and leaf water potential as well as leaf osmotic pressure:

With respect to the effect salt concentrations on leaf succulence grade, leaf water potential and leaf osmotic pressure, it is clear from data tabulated in Table (5) that, a significant relationship was detected between such characters and salt concentration in irrigation water. However, value of leaf osmotic pressure increased significantly with increasing salt concentration in irrigation water from 270 mg/l (control) up to 3000 mg/l in communis pear seedlings rootstock during both 2018 and 2019 seasons of study.

On the other hand, it was noticed from obtained results as shown in Table (5) that, an obvious gradually decreased in the percentage of both leaf succulence grade and leaf water potential with increasing salt concentration in irrigation water. Such decrease in leaf succulence grade and leaf water potential was significant as each concentration was compared to the other one or to those of the control treatment (270 mg/l). Moreover, the most depressing effect was closely related to the highest salinity concentration (3000 mg/l) which exhibited the least values of both leaf succulence grade and leaf water potential throughout the two seasons of study. On the contrary, the least decrease of leaf water potential % was in closed relationship with the lowest salt concentration in irrigation water (270 mg/l, control), meanwhile the saline solution of 1500 mg/l concentration was intermediate in this respect. Such trends were true during both 2018 and 2019 experimental seasons.

Referring the effect of humic acid levels on abovementioned characters of leaf succulence grade and leaf osmotic pressure, obtained results in Table (5) pointed out that, the leaf osmotic pressure was statistically decreased with the higher humic acid levels (30cm) as compared to the lower humic acid rate (0.0 cm). This trend was detected with communis pear seedling during the two experimental seasons of study. Furthermore, considering the effect of humic acid levels on leaf succulence grade and leaf water potential, it could be observed from data represented in Table (5) that, both leaf succulence grade and leaf water potential were increased significantly by increasing humic acid levels from 0.0 to 30 cm. Similar trend was true with communis pear seedlings rootstock in the two seasons of study.

With regard to the effect of magnetized water used in irrigation of communis pear seedlings on leaf osmotic pressure from one hand and both leaf succulence grade and Leaf water potential characters from the second one, data obtained in Table (5) revealed that, two conflicted trends were detected. However, both leaf succulence grade and leaf water potential % were significantly increased by irrigated with magnetized water which showed the greatest value as compared to the other treatment (seedlings irrigated with non magnetized water) which exhibited statistically the lowest value in this concern. On the contrary, the trend of response for leaf osmotic pressure as influenced by magnetized water and non magnetized water took the other way around, where characteristic was significantly decreased by irrigated communis pear seedlings rootstock with magnetized water.

Table (5): Effect of salinity concentrations, magnetized water and humic acid and their combination on leaf succulence grade (L.S.G.) and Leaf water potential (L.W.P) as well as leaf osmotic pressure (L.O.P.) of pear seedling in two seasons 2018, 2019.

Character		L.S.G.			L.W.P			L.O.P.		
Salinity levels	Treatments MW / HA	Non.MW	MW	Mean*	Non.MW	MW	Mean*	Non.MW	MW	Mean*
2018										
Fresh water 270 mg/l	0.0cm.HA	0.0056de	0.0052e	0.0050C	67.28a	67.35a	67.37A	10.94f	10.44g	10.51C
	30cm.HA	0.0050e	0.0043f		67.52a	67.35a		10.48g	10.19g	
1500 mg/l	0.0cm.HA	0.0080b	0.0071c	0.0071B	64.78bc	65.75ab	65.63B	12.17d	11.84d	11.72B
	30cm.HA	0.0070c	0.0063d		66.14ab	65.87ab		11.48e	11.37e	
3000 mg/l	0.0cm.HA	0.0105a	0.0078b	0.0081A	59.92e	62.68d	62.49C	13.57a	13.19b	13.03A
	30cm.HA	0.0072c	0.0069cd		63.72cd	63.63cd		12.59c	12.75c	
Mean**		0.0072A	0.0063B		64.89B	65.44A		11.87A	11.63B	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		0.0074A	0.0061B		64.63B	65.70A		12.03A	11.48B	
2019										
Fresh water 270 mg/l	0.0cm.HA	0.0037f	0.0044e	0.0038C	68.54ab	68.22ab	68.87A	11.65fg	11.33g	11.69C
	30cm.HA	0.0039ef	0.0034f		69.15a	67.78ab		11.90f	13.87c	
1500 mg/l	0.0cm.HA	0.0041e	0.0053d	0.0048B	66.70bc	65.74cd	66.88B	13.48d	13.06e	13.55B
	30cm.HA	0.0050d	0.0050d		67.30a-c	64.81de		13.78cd	14.70a	
3000 mg/l	0.0cm.HA	0.0087a	0.0079b	0.0077A	63.18ef	61.85f	63.53C	14.41ab	14.31b	14.49A
	30cm.HA	0.0075bc	0.0067c		64.30de	60.638g		14.54ab	10.121h	
Mean**		0.0055A	0.0054A		66.10B	66.77A		13.33A	13.15B	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		0.0057A	0.0052AB		65.70B	67.15A		13.45A	13.04B	

*, **, and*** means refers to specific effect of salinity concentrations, humic acid and magnetized water, respectively. Capital letters were used fo comparing values representing the specific effect of three abovementioned factors, while small letters were used for distinguishing their combination (interaction effect). Means followed by the same abovementioned letters were not significantly different at 5% level.

Where MW: Magnetic water Non MW: Non-magnetic water HA: Humic acid

Data in Table (5) indicated that, specific effect of each investigation factor was reflected directly on the interaction effect of its combination. In the other words, pear seedlings irrigated with the highest salt concentration combined with the lower level of humic acid and irrigated with non-magnetized water i.e. (3000 mg/l, 0.0 cm HA and non-magnetized water) treatment statistically exhibited generally the lowest value of both leaf succulence grade and leaf water potential as compared to either other combination treatments or control. Meanwhile, the least effective irrigation saline solution on increasing the leaf succulence grade and leaf water potential were that combination between the least salt concentration, the higher level of humic acid and irrigated with magnetized water i.e. (270 mg/l, 30 cm HA and magnetized water) treatment.

3. Effect of the studied treatments on some chemical constituents:

a. Leaf content of chlorophyll A, B and carotenoids:

Data obtained in Table (6) displayed obviously that a negative relationship was noticed between all investigated saline solution treatments (270,1500 and 3000 mg/l) and leaf content of pigments ((chlorophyll A,B and carotenoids). However, it could be observed that agradual decrease in level pigments content such was shown as salinity in irrigation water was increased during both seasons of study.

Wheras, the most depression effect was always related with the hight salt concentration (3000 mg/l) while the lowest decrease and the highest of level pigments content was resulted by the control treatment (270 mg/l).

Since, the treatment of (1500 mg/l) was inermediate in this cocern. Moreover, it could be mentioned that, the differences between three salinity treatments on the level pigments content (chlorophyll A,B and carotenoids) of communis pear rootstock seedlings in both 2018 and 2019 seasons of study were significant.

As for the obtained results regarding the effect of both HA and magnetized water treatments on the leaves contents of chlor.A,B and carot. Also data in Table (6) that, increasing both HA from 0.0 to 30 cm in irrigation water from one hand and using the magnetized water in irrigation from the other were exhibited significantly an increasing in photosynthetic pigments of leaves chlor.A,B and carot. contents. Moreover, such increase were significant as compared to pear seedlings irrigated with either non- magnetized water or non HA added (0.0 cm HA) during the first and the scond seasons of study.

Data obtained concerning the interaction effect of different combination between three investigated factors (salinity concentration, magnetized water and humic acid) on leaves chlorophyll content during both seasons of study and represented in Table (6) displayed obviously that, pear seedlings irrigated with the highest concentrated saline water (3000 mg/l) combined with both lower level of HA (0.0cm) and non-magnetized water had statistically the poorest leaves in their chlorophyll A,B and carotenoids contents. On the contary, the oppesite trend was detected with pear seedlings supplied continuously with saline solution of 270 mg/l (control) combined with the higher level of HA (30 cm) and magnetized water treatment which had significantly the richest leaves in their chlorophyll A, B and carotenoids contents. In addition to that other combinaion treatments were in between the abovementioned two extremes with relatively variable tendency in their effectiveness. Such trends were detected during both the first and the scond seasons of study.

Table (6): Effect of salinity concentrations, magnetized water and humic acid and their combination on leaf (chlorophyll A, B, carotenoids and proline) contents of pear seedling in two seasons 2018,2019.

Character		chlorophyll A mg/g F.W.			chlorophyll B mg/g F.W.			Carotene mg/g F.W.			Proline mg/g F.W.		
Treatments MW		Non.MW	MW	Mean*	Non.MW	MW	Mean*	Non.MW	MW	Mean*	Non.MW	MW	Mean*
Salinity levels	HA												
2018													
Fresh water 270 mg/l	0.0cm.HA	0.9067a-c	0.9210ab	0.922A	1.106abc	1.111ab	1.115A	0.8670bc	0.8730b	0.894A	0.1327a-d	0.1123b-d	0.1106C
	30cm.HA	0.9263a	0.9337a		1.117ab	1.125a		0.8797b	0.9550a		0.1047cd	0.0930d	
1500 mg/l	0.0cm.HA	0.8547c-f	0.8720b-e	0.869B	1.067b-e	1.074a-e	1.079B	0.8387b-e	0.8457b-e	0.849B	0.1540a-c	0.1450a-d	0.1419B
	30cm.HA	0.8633c-e	0.8847a-d		1.084a-e	1.090a-d		0.8527b-e	0.8607b-d		0.1370a-d	0.1317a-d	
3000 mg/l	0.0cm.HA	0.8067f	0.8273ef	0.829C	1.034e	1.040de	1.044C	0.8037e	0.8083de	0.814C	0.1803a	0.1717a	0.1687A
	30cm.HA	0.8373d-f	0.8443d-f		1.048de	1.053c-e		0.8140c-e	0.8280b-e		0.1650ab	0.1573a-c	
Mean**		0.866B	0.881A		1.076AB	1.082A		0.843B	0.862A		0.146A	0.135B	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		0.865AB	0.882A		1.072B	1.086A		0.839B	0.865A		0.149A	0.131B	
2019													
Fresh water 270 mg/l	0.0cm.HA	0.9550a	0.9630a	0.969A	1.160a-c	1.169ab	1.172A	0.8490ab	0.8560ab	0.858A	0.1255c-e	0.1216d-f	0.1191C
	30cm.HA	0.9747a	0.9823a		1.174ab	1.183a		0.8603ab	0.8677a		0.1160f	0.1135f	
1500 mg/l	0.0cm.HA	0.8577bc	0.8650bc	0.871B	1.107c-g	1.125b-f	1.129B	0.8113b-e	0.8187a-e	0.823B	0.1393c	0.1353cd	0.1344B
	30cm.HA	0.8733bc	0.8883b		1.138 a-e	1.145a-d		0.8260a-d	0.8350a-c		0.1333cd	0.1297c-e	
3000 mg/l	0.0cm.HA	0.8250c	0.8303c	0.834C	1.066g	1.074gf	1.081C	0.7543f	0.7653ef	0.773C	0.1640a	0.1587b	0.1572A
	30cm.HA	0.8373bc	0.8447bc		1.087e-g	1.097d-g		0.7760d-f	0.7943c-f		0.1540b	0.1520bc	
Mean**		0.887AB	0.896A		1.122B	1.132A		0.813B	0.823A		0.139A	0.135AB	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		0.883AB	0.900A		1.117B	1.137A		0.809B	0.827A		0.141A	0.133AB	

*, **, and*** means refers to specific effect of salinity concentrations, humic acid and magnetized water, respectively. Capital letters were used for comparing values representing the specific effect of three abovementioned factors, while small letters were used for distinguishing their combination (interaction effect). Means followed by the same abovementioned letters were not significantly different at 5% level. Where MW: Magnetic water Non MW: Non-magnetic water HA: Humic acid

Obtained results are in harmony with those results reported by Moussa (2011) and Soliman *et al*. (2017), they found that irrigation magnetized water increased significantly the growth characteristics, photosynthetic activity and translocation efficiency of photo-assimilates and photosynthetic pigments (chlorophyll a, b and carotenoids), as compared with control plants.

b. Effect of Leaf proline content:

Considering the effect of saline water used on leaf porline content, it was noticed from obtained resultes in Table (6) That, porline content in the leaves of communis pear seedlings rootstock increased significantly and gradually with increasing the salt concentrations of the irrigation water from 270 to 3000 mg/l. However, pear seedlings rootstock irrigated with the saline water of 3000 mg/l had statistically the richest leaves of porline content, followed by descending order by those irrigated with 1500 mg/l saline solution. Wheras, seedlings irrigated with the lowest salt concentration (270 mg/l ,control) treatment. Obtained results are in harmony with those results reported by Soliman *et al*. (2017), Proline content increased significantly in leaves of grape after magnetic treatment.

c. Leaf mineral contents:

It could be noticed from data presented in Table (7, 8 and 9) that, N, P, K, Mg, Fe, Zn and Mn content in leaves decreased significantly with increasing salinity concentration in irrigation water (1500 and 3000 mg/l) compering of those the control (fresh Nile water, 270 mg/l) which appeared contain usually the higher levels of abovementioned nutrients than those in salinized ones during both seasons of study. However, the opposite trend was remarkable for seedlings irrigated with saline water at the higher salt concentrations (3000 and1500 mg/l) which was significantly increased and gave richest leaves content in (Ca, Na and Cl) with increaseing saline water concentrations (3000 and1500 mg/l) as compered to those of control treatment which induced the last values of (Ca, Na and Cl) these results are similar to that reported by Mesut *et al.* (2010), who suggested that the growing plants in saline media come across generally with major drawbacks; the first is the increase in the osmotic stress due to high salt concentration of soil solution that decreases water potential of soil; the second is the increase in concentration of Na and Cl, exhibiting tissue accumulation of Na and Cl, and inhibition of mineral nutrients uptake.

Concerning the effect of other magnetized water or humic acid levels, data in same Tables showed abviosuly that, increasing the level of humic acid (30 cm.) from one hand irrigated seedlings with magnetic water from another exhibited statistically increased in leaf (N, P, K, Mg, Fe, Zn and Mn) contents and significantly decreased in leaf (Ca, NaandCl) contents of pear rootstock seedlings during the two seasons of study.

Regarding the interaction effect of different combinations between the various variable of three investigated factors on leaf nutrient contents of pear rootstock seedlings, data in the last Tables displyed clearly that, the specific effect of each studied factor i.e.,(salinity, magnetized water and humic acid) was directly reflected on their combination during the two seasons in this study. In the other words, the pear seedlings were irrigated with the highest saline water concentration,combined with non-magnetized water and non applied of humic acid i.e.,(3000 mg/l, non-

Table (7): Effect of salinity concentrations, magnetized water and humic acid and their combination on leaf contents of some macro-elements (N, P, K and Ca) of pear seedling in two seasons 2018, 2019

Character: Salinity levels	Treatments MW: HA	N % Non.MW	N % MW	N % Mean*	P % Non.MW	P % MW	P % Mean*	K % Non.MW	K % MW	K % Mean*	Ca % Non.MW	Ca % MW	Ca % Mean*
2018													
Fresh water 270 mg/l	0.0cm.HA	2.111b	2.116b	2.149A	0.228a-c	0.243ab	0.248A	1.500a	1.571a	1.570A	0.838g	0.732h	0.740C
	30cm.HA	2.123b	2.247a		0.257ab	0.262a		1.589a	1.619a		0.765h	0.623i	
1500 mg/l	0.0cm.HA	2.131b	2.136b	2.139A	0.157a-d	0.172a-d	0.178B	1.221cd	1.300bc	1.306B	1.097d	0.951f	0.998B
	30cm.HA	2.141b	2.147b		0.188a-d	0.194a-d		1.374b	1.329bc		1.039e	0.905f	
3000 mg/l	0.0cm.HA	1.568f	1.745e	1.798C	0.084d	0.097d	0.110C	1.075e	1.089e	1.110C	1.567a	1.347b	1.367A
	30cm.HA	1.906d	1.972c		0.118cd	0.141b-d		1.116de	1.159de		1.387b	1.169c	
Mean**		1.997B	2.061A		0.172B	0.185A		1.313A	1.345B		1.116A	0.955B	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		1.968B	2.089A		0.164B	0.193A		1.293B	1.364A		1.09A	0.98B	
2019													
Fresh water 270 mg/l	0.0cm.HA	2.134b	2.142b	2.159A	0.188cd	0.240a-c	0.232A	1.494b	1.584a	1.574A	0.793h	1.374d	0.922C
	30cm.HA	2.138b	2.221a		0.254a	0.244ab		1.619a	1.598a		0.902g	0.618i	
1500 mg/l	0.0cm.HA	2.107b	2.112b	2.115B	0.085e	0.194bc	0.179B	1.101f	1.408c	1.346B	1.118f	1.736a	1.303B
	30cm.HA	2.117b	2.123b		0.223a-c	0.212a-c		1.399c	1.482b		1.274e	1.084f	
3000 mg/l	0.0cm.HA	1.671f	1.802e	1.841C	0.075f	0.085e	0.103C	1.113g	1.180e	1.188C	1.617b	1.018j	1.471A
	30cm.HA	1.900d	1.991c		0.135de	0.118e		1.267d	1.204e		1.709a	1.539c	
Mean**		2.010B	2.065A		0.160B	0.182A		1.332B	1.409A		1.0236A	1.128B	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		1.995B	2.08A		0.145B	0.198A		1.313B	1.428A		1.276A	1.188B	

*, **, and*** means refers to specific effect of salinity concentrations, humic acid and magnetized water, respectively. Capital letters were used for comparing values representing the specific effect of three abovementioned factors, while small letters were used for distinguishing their combination (interaction effect). Means followed by the same abovementioned letters were not significantly different at 5% level. Where MW: Magnetic water Non MW: Non-magnetic water HA: Humic acid

Table (8): Effect of salinity concentrations, magnetized water and humic acid and their combination on leaf contents of some macro-elements (Mg, Na and Cl) of pear seedling in two seasons 2018, 2019

Character		Mg %			Na %			Cl %		
Treatments MW		Non.MW	MW	Mean*	Non.MW	MW	Mean*	Non.MW	MW	Mean*
Salinity levels	HA									
2018										
Fresh water 270 mg/l	0.0cm.HA	0.748b	0.762a	0.758A	0.636fg	0.555h	0.506C	0.355h	0.343h	0.327C
	30cm.HA	0.756ab	0.767a		0.479i	0.352j		0.323hi	0.286i	
1500 mg/l	0.0cm.HA	0.682e	0.723c	0.708B	0.779d	0.721e	0.703B	0.610de	0.566e	0.531B
	30cm.HA	0.694d	0.734bc		0.686ef	0.626g		0.508f	0.439g	
3000 mg/l	0.0cm.HA	0.641g	0.659f	0.654C	1.073a	1.03ab	1.01A	0.779a	0.746ab	0.724A
	30cm.HA	0.65fg	0.665ef		0.990bc	0.939c		0.709bc	0.663cd	
Mean**		0.695B	0.718A		0.774A	0.704B		0.547A	0.506B	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		0.703B	0.711A		0.799A	0.679B		0.566A	0.488B	
2019										
Fresh water 270 mg/l	0.0cm.HA	0.673cd	0.761a	0.738A	0.594gh	0.546h	0.481C	0.396f	0.387f	0.363C
	30cm.HA	0.763a	0.753a		0.459i	0.324j		0.343fg	0.326g	
1500 mg/l	0.0cm.HA	0.639 d	0.733ab	0.701B	0.839d	0.784e	0.747B	0.663bc	0.620c	0.572B
	30cm.HA	0.740ab	0.693bc		0.723f	0.641g		0.534d	0.470e	
3000 mg/l	0.0cm.HA	0.643e	0.652cd	0.652C	1.096a	1.080ab	1.05A	0.791a	0.769a	0.735A
	30cm.HA	0.661cd	0.650cd		1.027bc	1.005c		0.713b	0.667bc	
Mean**		0.687B	0.707A		0.790A	0.730B		0.573A	0.540B	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		0.684B	0.710A		0.823A	0.697B		0.604A	0.509B	

*, **, and*** means refers to specific effect of salinity concentrations, humic acid and magnetized water, respectively. Capital letters were used for comparing values representing the specific effect of three abovementioned factors, while small letters were used for distinguishing their combination (interaction effect). Means followed by the same abovementioned letters were not significantly different at 5% level. Where MW: Magnetic water Non MW: Non-magnetic water HA: Humic acid

Table (9): Effect of salinity concentrations, magnetized water and humic acid and their combination on leaf contents of micro-nutrients (Fe, Zn and Mn) of pear seedling in two seasons 2018, 2019

Character		Fe ppm			Zn ppm			Mn ppm		
Treatments MW										
Salinity levels	HA	Non.MW	MW	Mean*	Non.MW	MW	Mean*	Non.MW	MW	Mean*
2018										
Fresh water 270 mg/l	0.0cm.HA	112.4cd	112.9bc	113.3A	21.80cd	23.08b	22.79A	71.82d	73.10b	72.78A
	30cm.HA	113.4b	114.6a		22.25c	24.04a		72.57c	73.62a	
1500 mg/l	0.0cm.HA	109.1f	109.5f	110.33B	20.60f	21.11ef	21.08B	68.63g	70.63e	70.00B
	30cm.HA	110.9e	111.7d		20.99f	21.61de		69.81f	70.93e	
3000 mg/l	0.0cm.HA	105.3j	106.3i	106.8C	19.62g	19.81g	19.73C	64.89k	66.66i	66.35C
	30cm.HA	107.4h	108.2g		19.71g	19.76g		66.05j	67.80h	
Mean**		109.76B	110.53A		20.83B	21.57A		68.96B	70.46A	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		109.23B	111.05A		21.01B	21.39A		69.29B	70.13A	
2019										
Fresh water 270 mg/l	0.0cm.HA	110.4d	111.5c	112.03A	22.07d	23.00c	23.35A	71.80c	73.50b	73.30A
	30cm.HA	112.5b	113.7a		23.90b	24.43a		73.50b	74.00a	
1500 mg/l	0.0cm.HA	106.5g	107.6f	108.26B	20.52g	21.50e	20.79B	68.49g	71.80c	69.78B
	30cm.HA	109.0e	109.9d		20.08h	21.05f		69.58f	70.94d	
3000 mg/l	0.0cm.HA	101.9k	102.7j	103.23C	19.11i	19.81h	19.66C	60.09k	66.84i	65.00C
	30cm.HA	103.6i	104.7h		19.80h	19.91h		65.42j	67.67h	
Mean**		107.32B	108.35A		20.91B	21.62A		68.15B	70.57A	
Mean***		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA		0.0cm.HA	30cm.HA	
		106.77B	108.90A		21.00B	21.53A		68.54B	70.19A	

*, **, and*** means refers to specific effect of salinity concentrations, humic acid and magnetized water, respectively. Capital letters were used for comparing values representing the specific effect of three abovementioned factors, while small letters were used for distinguishing their combination (interaction effect). Means followed by the same abovementioned letters were not significantly different at 5% level. Where MW: Magnetic water
Non MW: Non-magnetic water HA: Humic acid

magnetized water and 0.0 humic acid) treatment had the poorest leaves in their nutrient contents (N, P, K, Mg, Fe, Zn and Mn).

The obtained results are in agreement with those of Aly *et al*. (2015), who found that magnetic water caused an increase in nitrogen,phosphorus, potassium, calcium, and magnesium in Valencia orange leaves. Soliman *et al*. (2017), who idicated that, irrigation by magnetic water exhibited an increase in (macro nutrient) nitrogen, potassium and phosphorous contents and (micro nutrient) iron, manganese, copper and zinc contents compared with leaves irrigated with nonmagnetic water of grape leaves.

However,the reserve trend was observed with leaf (Ca, Na and Cl) contents in both seasons. On the other hand, the richest leaves of nutrient contents and the highest values of leaf (N, P, K, Mg, Fe, Zn and Mn) contents were always in concomitant to the pear seedlings irrigated with.,(270 mg/l, magnetic water and humic acid applied) treatment

Generally, it could be indicated that the irrigation of pear seedling rootstock with magnetic water exhibited a positive effect on either macro or micro-nurients among the role of magnetic water in reducing the harmful effects of salinity through salublizing NaCl salt and leaching at out of the soil. Therefore, the plants do not uptake higher amounts of either Na or Cl. Also, the magnetic water improved dissolving of nutrients in the soil irrigated with magnetized water and increases in the rate of water absorption, and explianed 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 (Carbonell *et al.,* (2004).

CONCLUSION

In general, the use of magnetized water technique with humic acid applications (30 cm\plant\year) would be an economically and safe alternative tool to resolve the problem of irrigating with saline water and to enhance pear rootstock seedlings growth grown under similar conditions of this study.

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استجابة شتلات الكمثرى لبعض مياه الري المالحة والممغنطة وحمض الهيوميك وتأثيرها على النمو والصفات الفسيولوجية والصبغات والمحتوى المعدنى للاوراق

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الملخص العربى

اجريت هذة الدراسة خلال موسمين متتاليين ٢٠١٨،٢٠١٩ بالمزرعة البحثية بمحطة بحوث البساتين بالقناطر الخيرية – محافظة القليوبية – جمهورية مصرالعربية، بهدف دراسة تأثير الرى بالماء المالح الممغنط والغير ممغنط مع اضافة حمض الهيوميك على شتلات كمثرى اصل (الكميونس) ذات عمر عام واحد، وأظهرت النتائج المتحصل عليها ان مياه الرى ذات التركيز ألأعلى من الأملاح (١٥٠٠، ٣٠٠٠ ملجم/لتر) أدت الى نقص تدريجى معنويا لكل القياسات الخضرية المدروسة وألأوزان الجافة للأجزاء المختلفة من شتلة الكمثرى وكذلك لكل من الغضاضة والجهد المائى للأوراق وأيضا محتوى ألأوراق من الصبغات اضافة الى محتوى ألأوراق من بعض العناصر (نيتروجين– فوسفور– بوتاسيوم – ماغنسيوم – حديد – زنك – منجنيز) فى حين ان العكس من ذلك لوحظ مع الضغط الأسموزى والبرولين ومحتوى ألأوراق من العناصر(كالسيوم – صوديوم – كلور) وذلك مقارنة بمعاملة الكنترول (المقارنة) والتى كانت تروى بماء النيل (٢٧٠ ملجم/لتر).

ومن الناحية الأخرى فان النتائج اشارت الى ان الشتلات التى تم معاملتها سواء بحمض الهيوميك او ريها بالماء الممغنط أظهرت زيادة معنوية للقياسات الخضرية والأوزان الجافة للأجزاء المختلفة من الشتلة ومحتوى ألأوراق من الصبغات و بعض العناصر الغذائية الكبرى والصغرى وكذلك الغضاضة والجهد المائى للورقة مقارنة بتلك الشتلات التى تم ريها بالماء الغير ممغنط او لم يتم اضافة حمض الهيوميك اليها خلال موسمى الدراسة. ان استخدام تقنية المياه الممغنطة مع حمض الهيوميك يمكن ان تكون أداة بديلة ذات اهمية كبرى وآمنة لحل مشكلة الري بالمياه المالحة وتحسين نمو شتلات الكمثرى في ظل ظروف مماثلة لهذه الدراسة.

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