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Effect of Magnetic Treatment for Irrigation Ground Water on Soil Salinity, Nutrients, Water Productivity and Yield Fruit Trees at Sandy Soil

N.E. Fanous, Amira A. Mohamed and Kh. A. Shaban
Soil, Water and Environment Research, Agric. Res. Center,Giza, Egypt

THIS APPLIED experiment was conducted at private farm (160 feddans), sustained of soil and water salinity, at km80 of cairo-alexandria desert road (the green wealth farms). four electromagnetic devise (6 inch) set up on the main sources of ground irrigation. one well for each agriculture sector apricot, peach, flame-seedless grape and thompson seedless grape sectors. these sectors has been irrigated by magnetic treated water (mtw), beginning of december2013, through a drip system.

The results indicated that mtw has led to non-significant decrease of water salinity (only from 2.183.31- to 2.14- 3.12 dsm-1), ph (from 8.2- 8.3 to 8.258.15-), sar (from 6.47.7- to 5.6-6.0) and hypothetical nacl (from 57.37 – 60.53% to 53.31- 58.15%)

Concerning the effect of mtw on soil chemical properties, the data showed that soil salinity was decreased after using mtw compared with the normal water. soil salinity was decreased from 4.88- 6.15 dsm-1to 2.734.15-dsm-1 and 1.452.83- dsm-1 after one month and eight ones of the magnetic treatment, respectively. besides, ph values were reduced from 8.28.3- to 7.9-8.05 before and after magnetic treatment respectively. as well as the hypothetical nacl and mgcl2 were diminished from 21.5 meq/l and 8.0 meq/l to 6.3 and 3.0 meq/l through eight months from the treatment. it is worth mentioning that the magnetic irrigation had good effects on the availability of npk and micronutrients (fe, zn, cu and mn) all during fertilization season, entail the observed increasing on the yield of fruits. thus, the results indicated that the main beneficial of using mtw were in improving yield for apricot, peach, flame-seedless grape and thompson seedless grape to 40.0, 29.0 28.0 and 19.0 % respectively. also, raising the efficiency of water productivity to 40.2, 29.2,28.0 and 19.3. %, respectively.

Keywords: Magnetic water treatment, Electromagnetic device, Sandy soil, Water and soil salinity, Crop and water productivity.

Introduction

Future availability of pleasing water for agriculture in Egyptian deserts is problematic, as a result of the increase concentration in salinity of the ground irrigation water at several regions. Now, numerous farms in the newly reclaimed soils were irrigated with saline water either from ground wells or treated sewage water, therefore the importance of physical treatment of saline water using magnetic devices become feasible. Magnetic treated water (MTW) is considered as environmentally friendly technique (Nimmi and Medhu, 2009). MTW is produced when water passes through the magnetic field of magnetic permanent device or electromagnetic one, installed on feed pipeline, where all water and salt molecules have internal vibration (Babu, 2010). MTW removes the excess of the soluble salts; reduces pH values, due to MTW have solving for soil salts, and leaches the salts away from roots zone (Hilal et al., 2012). Selim 2008 stated that MTW has induced changes in the solubility of CaCO3 and gypsum. He also indicated that MTW has induced changes in the mobility of nutrient elements in root zone which differces from one element to another according to the element magnetic susceptibility. Using MTW is improved the crop yield and water productivity and save water supply especially with the future water scarcity as mentioned Duarte Diaz etal. (1997) and Hilal et al. (2012)

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The main target of this work is to study the effect of the magnetic treated water (MTW) on irrigation with saline water and its efficiency on salt removal from saline sandy soil, and on the availability of main nutrients, as well as the yield of fruits trees and water productivity.

Materials and Methods

Four field experiments were conducted at a private farm (160 feddans), sustained of soil and water salinity, at Km80 of Cairo-Alexandria desert road (the Green Wealth farms).A four electromagnetic devise (6 inch) was set up on the main sources of ground irrigation . One well for each agriculture sector, apricot, peach, Flame-seedless grape and Thompson seedless grape sectors. These sectors have been irrigated by magnetic treated water (MTW), beginning of December 2013, through a drip irrigation system. One area was selected and bordered at every cultivated sector. Each experimental area includes three dripper's lines (Fig.1).

The magnetic irrigation water was obtained by passing irrigation water through electro-magnetic device installed on every feed water well (EWN Sharaf-3 device, from ITEN Company at Egypt; 220V. 50 CIS or 12 V.D.C. and power consumption 2.4 W/unit). Every device is six inch in diameters which has water discharge about 120 m3/hr. All fertilizers were applied according to the recommendation of the Ministry of Agriculture, Egypt. The fertigation technique was used into a drip irrigation system for NPK-nutrients. Meanwhile, Fe, Zn, Cu and Mn-nutrients are fertilized using spray method. All trees received farmyard manure at rate of 20 m3/fed.

The cultivation distance between trees of apricot, peach, Flame-seedless grape and Thompson seedless grape are 5x5, 5x4, 3x 1.75 and 3x1.75 m , respectively. The drip laterals with drippers were placed at the two sides of trees. The irrigation took place according to the evapotranspiration in this region, namely 2mm at December, January and February; 3mm at March and November; 5mm at April, May, September and October, and 7mm at June, July and August. The total water quantity is 3524 m3/fed. yearly. Thus, the water use per tree yearly for apricot, peach, Flame-seedless grape and Thompson seedless grape is 20.95, 16.78, 4.41 and 4.41 m3/tree, respectively.

Water irrigation samples were taken two-times, the first before setting up the electromagnetic devices (control) and the second six months after fastening the device (MTW). The obtained water samples were submitted to chemical analysis. EC, soluble cations and anions and pH. As well as soluble Fe, Zn, Cu and Mn (Table 3) were estimated by atomic absorption spectrophotometer .

Soil samples were collected from four sites

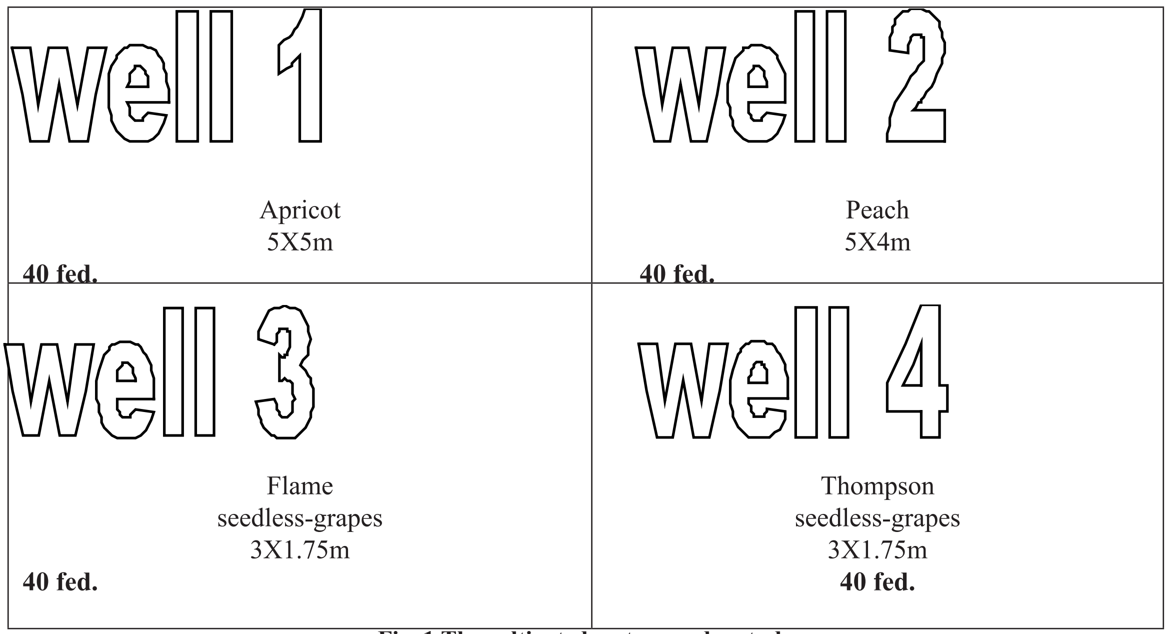

Fig. 1.The cultivated sectors under study

(Replicated) each of apricot, peach, Flame-seedless grape and Thompson seedless grape sectors. The soil samples (at 40 cm depth) were taken three-times; the first one before installing magnetic devices (control). The second and third ones one month after magnetic treatment (January, 2014) and eight months (July, 2014). The main characteristics of soil sites were determined according to Bashour and Sayegh (2007) (Tables 1 and 2).

The Hypothetical salts compositions were calculated for water and soil samples (using Solen System and Planer Graphic according to Arab Mining and Petroleum Ass.(1970).

Mean fresh weight of fruit yields (Kg/tree) for each of eight Apricots, eight peach, and fifteen Flame-seedless grapes and fifteen Thompson seedless-grape trees were recorded.

Water productivity was computed as mean fruit yield (kg) per water use (m3) according to Larcher (1995).

Results and Discussion

Soil and water properties under study before the magnetic irrigation water

Soil properties

Data in Table 1 show the percentage of particle size distribution of the soil under study at the Green Wealth Farm, km 80 Cairo –Alexandria desert road. The soil is characterized by a sand texture (86.9 - 89.9 % sand, 5.3-6.3 silt and 4.8-6.8% clay), with low content of organic matter (0.5-0.7%) and CaCO3 content is ranged between 7.1-8.2%.

Chemical properties of irrigation water before magnetic treatment

The results of chemical analysis for ground water before magnetic treatment were given in Table 3. The electrical conductivity (EC) of the four wells under study is 2.18, 2.55, 2.81 and 3.31 dSm-1which lie at apricot, peach, and Flame seedless grape and Thompson seedless grape regions, respectively.

TABLE 1 . Mechanical analysis of soil samples at the different regions under study

Location	Particle size distribution %			$CaCO_3$ %	OM %	Texture
	sand	silt	clay			
Apricot region	89.9	5.3	4.8	7.8	0.5	**sand**
Peach region	88.7	5.4	5.9	7.3	0.6	**sand**
Flame seedless -grape region	87.8	5.5	6.7	8.2	0.6	**sand**
Thompson seedless- grape region	86.9	6.3	6.8	7.1	0.7	**sand**

TABLE 2. Some soil chemical properties 1 month before magnetic

Properties	Apricot region	Peach region	Flame seedless -grape region	Thompson seedless -grape region
SP	19.5	10.0	21.0	22.0
*EC(dSm^{-1})	4.38	4.88	5.68	6.15
pH	8.3	8.3	8.2	8.2
Soluble cations meq/l				
Ca^{+2}	22.0	19.1	21.8	22.3
Mg^{+2}	5.8	8.8	9.9	10.8
Na^{+}	15.1	19.2	23.5	28.1
K^{+}	1.0	1.4	1.6	1.3
Soluble anions meq/l				
CO_3^{-2}	----	--	--	--
HCO_3	2.1	2.9	3.1	3.2
Cl^{-}	26.6	26.9	33.0	36.5
SO_4^{-2}	15.2	18.7	20.7	22.7

*the main value for EC : 5.27dSm^{-1}

TABLE 3. Some chemical properties of the irrigation water before magnetic treatment

Properties	Well Location				
	well 1	well 2	well 3	well 4	Mean value
EC (dsm^{-1})	2.18	2.55	2.81	3.31	2.71
TDS (ppm)	1388	1632	1798	2118	1734
pH	8.3	8.25	8.25	8.2	8.25
Soluble cations meq/l					
Ca^{+2}	7.0	8.3	8.8	9.9	8.5
Mg^{+2}	1.4	2.0	2.7	3.2	2.3
Na^{+}	13.8	14.4	16.6	19.6	16.1
K^{+}	0.4	0.4	0.5	0.5	0.5
Soluble anions meq/l					
CO_3^{-2}	----	--	--	--	
HCO_3	1.7	1.8	2.5	2.6	2.2
Cl^{-}	17.6	18.9	21.6	24.3	20.6
SO_4^{-2}	3.3	4.4	4.5	6.3	4.6
SAR	6.7	6.4	6.9	7.7	6.9
Class of water	**C3-S2**	**C4-S2**	**C4-S2**	**C4-S2**	**C4-S2**
Available of micronutrients (ppm)					
Fe	1.5	1.4	1.7	1.7	1.6
Zn	1.5	1.3	1.7	1.4	1.5
Cu	0.2	0.2	0.2	0.2	0.2
Mn	0.1	0.1	0.2	0.2	0.2

C_3 = High salinity water C_4= very high salinity water S_2= medium sodium water.

pH values for the same above wells are 8.3, 8.25, 8.25 & 8.2 , respectively. Water salinity of well No.1 (apricot sector) sets at category C3 - S2 namely high salinity with medium sodium adsorption ratio (SAR 6.7). The water of other wells (2, 3 &4) set at category C4-S2 namely, very high salinity with medium sodium adsorption ration (SAR 6.4 -7.7). UNDESCO System, 1954.

The mean content of micro-elements in the irrigation water before magnetic treatment is 1.6, 1.5, 0.2 and 0.2 ppm for Fe, Zn, Cu and Mn, respectively. These values are very low.

The salinity of irrigation water was about 1388, 1632, 1798 and 2118 ppm at Nov.2013 for well 1, 2, 3 and 4 respectively. Concerning, the hypothetical salts composition, the dominant salts in the normal water without magnetization as a mean values of the four wells are 58.8% NaCl, 16.79 % CaSO4 , 8.36% MgCl2, 8.03% Ca(HCO3)2 , 6. 20% CaCl2 and 1.82% KCl.(Table 4).

Magnetic water treatment (MTW)

The changes in water soluble salts, pH, micronutrients and salts composition at the irrigation water after one month of the magnetic treatment are shown in Tables 5 & 6. It noticed that the TDS value of ground water decreased from 1734ppm before the magnetic treatment to 1665ppm after magnetic due to decrease in the water content of chlorides salts, *i.e.* NaCl, KCL, CaCl2 and MgCl2, from 75.18% before the magnetic treatment to 72.63% after magnetic. The percentage of decrease of chloride was about 3.5 %. Hozien (2014) and Stephen (2013) mentioned that the magnetic field volatilizes chlorides as chlorine gas and that can reduce the salinity about 10% .

In spite of the ability MTW to slightly decrease the salinity than in untreated water, however, the salinity categories of MTW still located at the same classes of untreated water (Table 5), *i.e.* C3-S2 for well No.1 and C4-S4 for wells No. 2,3 &4. Also, there is not any evident for change in the content of microelements (Fe, Zn, Cu &Mn) before and after magnetic treatment. As well as pH values have a slight decrease from 8.2-8.3 to 8.15-8.25 before and after treatment, respectively.

TABLE 4. The hypothetical composition of the irrigation water before magnetic treatment

Location	Magnetic treatment	TDS (ppm)	$Ca(HCO_3)_2$ %	$CaSO_4$ %	$CaCl_2$ %	$MgCl_2$ %	NaCl %	KCl %
Well (1)	Without (Nov.2013)	1388	7.47	14.90	7.13	6.6	60.33	1.75
Well (2)	Without (Nov.2013)	1632	8.11	17.53	8.37	7.96	57.37	1.60
Well (3)	Without (Nov.2013)	1798	8.74	15.73	6.30	9.44	58.04	1.75
Well (4)	Without (Nov.2013)	2118	7.80	19.00	3.00	9.40	59.30	2.18
Mean values:	Without (Nov.2013)	1734	8.03	16.79	6.20	8.36	58.80	1.82

TABLE 5. Effect of magnetic water treatment on chemical properties of the irrigation ground water

Properties	Well location							
	well 1		well 2		well 3		well 4	
	Without	with	Without	with	Without	with	Without	With
EC (dsm^{-1})	2.18	2.14	2.55	2.49	2.81	2.66	3.31	3.12
pH	8.3	8.25	8.25	8.2	8.25	8.2	8.2	8.15
Soluble cations meq/l								
Ca^{+2}	7	8.0	8.3	9.8	8.8	10.1	9.9	11.7
Mg^{+2}	1.4	1.3	2.0	1.4	2.7	1.6	3.2	2.2
Na^{+}	13.8	13.2	14.4	13.3	16.6	14.6	19.6	16.7
K^{+}	0.4	0.2	0.4	0.4	0.5	0.4	0.5	0.5
Soluble anions meq/l								
CO_3^{-2}	--	--	--	--	--	--	--	--
HCO_3	1.7	1.7	1.8	1.8	2.5	2.6	2.6	3.1
Cl^{-}	17.6	17.2	18.9	17.7	21.6	19.8	24.3	22.7
SO_4^{-2}	3.3	3.8	4.4	5.4	4.5	4.3	6.3	5.3
SAR	6.7	6.1	6.4	5.6	6.9	6.0	7.7	6.3
class of water	C3-S2	C3-S2	C4-S2	C4-S2	C4-S2	C4-S2	C4-S2	C4-S2
Available of micronutrients (ppm)								
Fe	1.5	1.1	1.4	1.2	1.7	1.6	1.7	1.9
Zn	1.5	1.4	1.3	1.2	1.7	1.4	1.4	1.4
Cu	0.2	0.2	0.2	0.1	0.2	0.1	0.2	0.1
Mn	0.1	0.2	0.1	0.1	0.2	0.1	0.2	0.2

C3 = High salinity water C4= very high salinity water S2= medium sodium water

The reason for using magnetic devices is not for the chemical change of the salts in MTW (only about 10% decrease) but due to the magnetic water's ability to affect directly at the chemical and physical properties of the soil, then its indirect effect on the plant uptake of available nutrients (Selim , 2008; Maheshwari & Grewal , 2009 and Abou El-Yazied et al., 2012). The main properties of MTW are reduction of water molecules, stores within the water. When that water passing through the soil leads to positive charges in the chemical and physical properties , *i.e.* reduce soil EC and pH; improve the soil permeability, fastness water movement to dissolve soil salts, entail a better assimilation of nutrients which become available to plant uptake (Grewal and Maheshwari, 2011).

TABLE 6. Effect of magnetic treatment on the hypothetical composition of the irrigation ground water

Location	Magnetic treatment	TDS (ppm)	$Ca(HCO_3)_2$ %	$CaSO_4$ %	$CaCl_2$ %	$MgCl_2$ %	NaCl %	KCl %
Well (1)	Without (Nov.2013)	1388	7.47	14.90	7.13	6.60	60.33	1.75
	With (Jan.2014)	1369	7.49	16.74	11.01	5.73	58.15	0.88
Well (2)	Without (Nov.2013)	1632	8.11	17.53	8.37	7.96	57.37	1.6
	With (Jan.2014)	1593	7.23	21.69	10.56	5.60	53.21	1.61
Well (3)	Without (Nov.2013)	1798	8.74	15.73	6.30	9.44	58.04	1.75
	With (Jan.2014)	1702	9.74	16.1	11.96	6.0	54.0	1.5
Well (4)	Without (Nov.2013)	2118	7.8	19.0	3.00	9.4	59.3	2.18
	With (Jan.2014)	1996	9.96	17.04	10.61	7.08	53.7	1.61
Mean values:	Without (Nov.2013)	1734	8.03	16.79	6.20	8.36	58.80	1.82
	With (Jan.2014)	1665	8.74	18.63	10.27	6.09	54.75	1.52

Effect of MTW on soil chemical properties

Results of the field experiment due to the effects of MTW on soil properties are recorded in Tables 7(a,b), 8 & 9 and reveal the following:

a-The dissolving of soil salts

There is decrease in EC in soil paste extract where the values decreased from 4.38, 4.88, 5.68 and 6.15 dSm-1 before using MTW (*i.e.* High saline soils)to 2.73,3.28,3.7 and 4.15 dSm-1 (*i.e.* moderate saline soils) after one month of using MTW, then become 1.45, 1.90, 2.48 and 2.83 dSm-1 (*i.e.* low saline soils) after eight months of using MTW. for the cultivation sectors of apricot, peach, Flame seedless grape and Thompson seedless grape , respectively. These results revel that the irrigation with MTW can be considered as one of the most valuable modern technologies that can assist in reducing salt accumulation in soils and improve soil conditions around plant roots. Amiri and Dadkhah(2006); Babu(2010) and Al Khazan et al.(2011) cleared that the dissolving properties of water increase when started with magnetic field as the magnetic water has small molecules, less viscosity, faster water movement and permeability at soil pores. Hilal et al. (2012) mentioned that total salts removal from soil with MTW was greater by 24.39% compared with normal water .MTW removes the excess of soluble salts and leaches the salts for away than root zone (Hilal et al., 2012 and Abou El Yazied et al., 2012).

b. Soil pH

The results clarified that the soil pH is decreased from 8.3-8.2 before using MTW to 8. 2 -8.0 after one month and to 8.03 -7.9 fter eight months from using MTW. Maheshwari and Grewal 2009, Al Khazan et al. 2011 and Abou El Yazied et al. 2012 deduced that reduction in soil pH is due to the effect of magnetic field on organic matter in the soil where it releases relatively greater of organic acids in rhizosphere.

c. Soluble Content of Ca, Mg, K, & Na in Soil

In respect of the essential elements for plants, i.e. Ca, Mg, K and Na, the results revealed that MTW affected the solubility of these elements in the soil. The mean value of soluble contents of these elements are changed from 21.3, 8.8, 1.3 and 21.5% before using magnetic treatment of water to 10.4, 4.7, 0.7 and 6.0% after eight months of using MTW for Ca, Mg, K and Na respectively(Table 7b). This is clear that the solubility of these elements is decreased by 51.2, 46.6, 46.2 and 72.2% respectively. It appears that MTW leads to intensive reduction of soluble Na salts (>70%, meanwhile the decrease of other elements (Ca, Mg and K) is less than 50%. Nave, 2008 said that MTW lead to an increase in all elements content except sodium. This is because Na is paramagnetic elements which have a small positive susceptibility to magnetic fields, while other elements are diamagnetic which are slightly repelled by a magnetic field. Maheshwari and Grewal (2009) and Hilal et al.(2012) recorded an increase of Ca, Mg, K concentration into plants.

TABLE (7a). Effect of magnetic treatment of the irrigation water on soil chemical properties

Properties	location											
	Apricot region			Peach region			Flame seedless-grape region			Thompson seedless-grape region		
	Schedule of magnetic treatment											
	1 B	1A	8A	1 B	1A	8A	1 B	1A	8A	1 B	1A	8A
SP	19.5	20	19.5	20	21	22.5	22	22.5	23	22.5	20.8	21.9
EC (dsm^{-1})	4.38	2.73	1.45	4.88	3.28	1.9	5.68	3.70	2.48	6.15	4.15	2.83
pH	8.3	8.2	8.05	8.3	8.2	8.0	8.2	8.03	7.9	8.2	8.1	7.9
Soluble cations meq/l												
Ca^{+2}	22.0	14.2	7.3	19.1	15.7	9.3	21.8	18.1	11.5	22.3	19.4	13.6
Mg^{+2}	5.8	3.8	3.1	8.8	4.9	3.3	9.9	5.3	6.1	10.8	6.4	6.2
Na^{+}	15.1	8.1	3.4	19.2	10.7	5.5	23.5	12.4	6.5	28.1	14.4	8.2
K^{+}	1.0	1.1	0.6	1.4	0.8	0.6	1.6	1.1	0.7	1.3	1.2	0.7
Soluble anions meq/l												
CO_3^{-2}	---	---	---	---	---	---	---	---	---	---	---	---
HCO_3^{-}	2.1	1.8	1.9	2.9	1.9	2.6	3.1	2.9	2.3	3.3	3.1	2.6
Cl^{-}	26.6	14.4	5.8	26.9	15.9	7.6	33.0	17.3	12.2	36.5	19.3	14.4
SO_4^{-2}	15.2	11	6.7	18.7	14.4	8.5	20.7	16.7	10.6	22.7	19	11.7

1 B = 1month before treated 1 A = 1month after treated 8A= 8 months after treated

TABLE (7b). the mean values of essential elements (Soluble cations meq/l)

	Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}
1month before treated	21.3	8.8	21.5	1.3
8months after treated	10.4	4.7	6.0	0.7

Data in Table 8 show that Ca(HCO3) 2 is decreased from 2.8% to 2.4% before and after using MTW. Samir (2008) cleared that in unmagnetic water, some of carbonates are deposited in soil pores and on the plant roots, but using MTW, and carbonate salts cannot precipitate. As well as, MTW can break the precipitated salts on internal surface of irrigation pipes and laterals, thus the movement of water than untreated.

d. Available Nutrients in Soil

The results in Table 9 revealed the effect of MTW on the micro and macro-nutrients during the fertilization period (from march to July 2014). The mean values of micronutrients are ranged from 3.9, 4.9, 1.0 and 8.0 ppm (at March) to 5.1, 9.5,3.7 and 11.5 ppm (in July) for Fe, Zn, Cu and Mn respectively. Whereas, the mean values of macro-nutrients varied between 62.3. 68.5 and 362.5 ppm (at march) to 32.3, 43.3 and 246.8 ppm (in July) for N,P and K respectively. Noran et al. 1996 and Maheshwari and Grewal,2009 mentioned that plants absorb more water of MTW than non-treated, consequently they uptake more nutrients as a result of water molecules of MTW are minute and small and is reflected on

TABLE 8. Effect of magnetic treatment of irrigation water on the hypothetical composition of soil paste extract (meq/l)

Schedule magnetic treatment	$Ca(HCO_3)_2$	$CaSO_4$	$CaCl_2$	$MgCl_2$	NaCl	KCl
1 month before treated (Nov.2013)	2.8	18.5	0.8	8.0	21.5	1.4
1 month after treated (Jan.2014)	2.4	14.5	0.8	4.3	11.4	1.0
8 months after treated (Agu.2014)	2.4	8.0	1.4	3.0	6.3	0.7

the yield and water productivity. These results clear that MTW have played important role in improving the availability of these elements to plants. Selim (2008) indicated that MTW has induced changes in the mobility of nutrient elements in root zone which there is difference from one element to another according to element magnetic susceptibility.

Effect of MTW on crop production

The crop production of apricot, peach, Flame seedless grape and Thompson seedless grape (Table 10 and Fig. 2) with MTW is increased as compared to those irrigated without treatment. The increase in crop production using MTW for the above trees is 40, 29, 28 and 19% over untreated, respectively.

The difference in the crop production between the different trees lead to different toleration of these trees to water and soil salinity according to Hofman (1977). Hilal and Hillal (2000 a&b) showed that there is indirect effects of MTW on plant growth through its positive effect on the soil

TABLE 9. Effect of magnetic treatment of irrigation water on mean values of available micro and macronutrients (ppm)

Location	Schedule of magnetic treatment	Available micronutrients in soil				Available macronutrients		
		Fe	Zn	Cu	Mn	N	P	K
Apricot region	3 month after treated (marsh2014)	2.7	3.5	0.6	5.3	60	72	308
	6month after treated (july2014)	5.7	11.6	3.7	14.9	32	33	206
Peach region	3 month after treated (march2014)	3.2	4.5	0.8	7.1	55	65	356
	6month after treated (july2014)	4.9	11.9	5.6	13.4	58	66	290
Flame-grape region	3 month after treated (marsh2014)	4.3	5.4	1.3	9.1	69	67	384
	6month after treated (july2014)	4.9	6.9	3.2	8.3	38	38	226
Seedless-grape region	3 month after treated (marsh2014)	5.3	6.3	1.4	10.4	65	70	402
	6month after treated (july2014)	4.7	7.7	2.4	9.3	31	36	265
Mean values	3 month after treated (marsh2014)	3.9	4.9	1.0	8.0	62.3	68.5	362.5
	6month after treated (july2014)	5.1	9.5	3.7	11.5	32.3	43.3	246.8

TABLE 10 . Effect of MTW on crop production

Location	No.of trees/ fed.	Mean of fruits yield					
		Yield before accumulati-on salts in soil	Yield under accumulation Of salts in soil (2013)		Yield After using MTW (2014)		
		Kg/ tree	Kg/ tree	Deficie-ncy rate %	Kg/ tree	Deficie-ncy rate %	Increase rate %
Apricot	168	60	20.4	66	44.4	26	40
Peach	210	50	21.0	58	35.5	29	29
Flame seedless-grape	800	40	19.2	52	30.4	24	28
Thompson seedless- grape	800	20	6.4	68	10.2	48	19

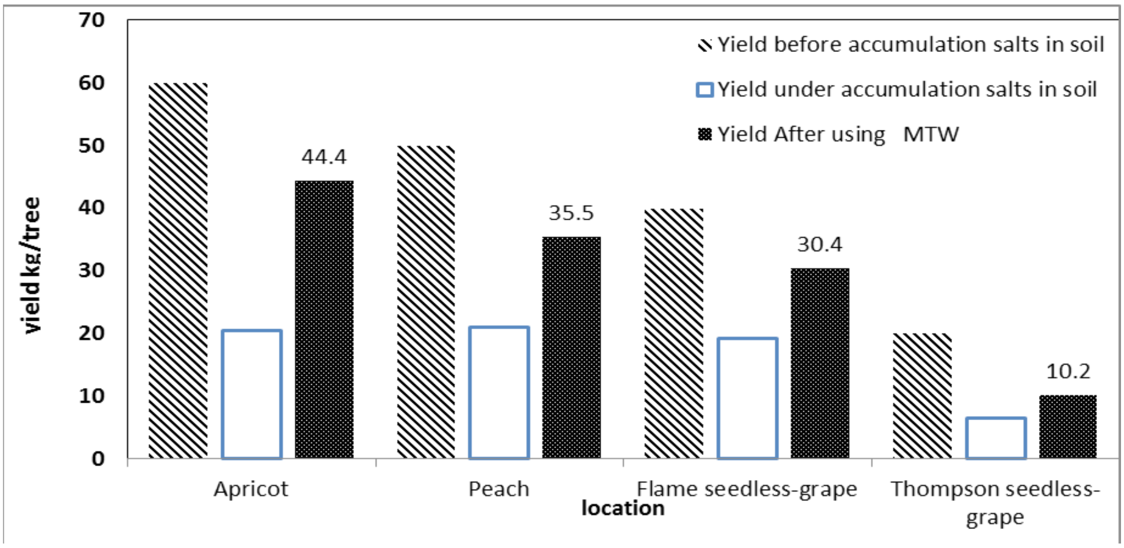

Fig. 2. Effect of MTW on crop production

TABLE 11 . Effect of MTW on water production

Location	Water use/year m³/tree	Water productivity					
		before accumulation salts in soil	under accumulation salts in soil		After using MTW		
		kg/m3	kg/m3	Deficiency rate%	kg/m3	Deficiency rate%	Increasing %
Apricot	20.95	2.86	0.97	33.9	2.12	74.1	40.2
Peach	16.78	2.98	1.25	41.9	2.12	71.1	29.2
Flame seedless	4.41	9.07	4.35	48.0	6.89	76.0	28.0
Thompson seedles	4.41	4.54	1.45	31.9	2.31	51.2	19.3

micro flora and fauna population. Also, Esitken and Turan (2004) cleared that the increasing of the available nutrients and the decreasing of soil pH and soluble salts at soil solution due to using MTW lead to improve nutrient uptake and root growth.

Effect of MTW on water production

As water productivity is based on the amount of yield and water required to produce the yield. Therefore, the efficiency of water productivity, for apricot, peach, Flame seedless grape and Thompson seedless grape (Table 11) increased from 33.9, 41.9, 48.0 and 31.9% before magnetic treatment to 40.2, 29.1, 28.0 and 19.3%, respectively. Yinan et al. (2005) and Charan (2009) reported that a plant's metabolism contains of 90-95% water, therefore MTW increase water uptake and entail plant metabolism.

Conclusion

It is clear that the irrigation with MTW can be considered as a one of the most valuable modern technologies that can improve crop production and alleviate salinity of water and soil, as well as can assist in saving irrigation water.

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تاثير المعالجة المغناطيسية لمياه الرى المالحة على ملوحة التربة والمغذيات والانتاجية المحصولية والمائية فى ارض رملية

نبيل ايليا فانوس , اميرة عشرى محمد وخالد عبده حسن شعبان
معهد بحوث الاراضى والمياه والبيئة – مركز البحوث الزراعية – وزارة الزراعة - مصر

اجريت تجربة باستخدام اجهزة الكتروستاتيكية المغناطيسية فى مزارع الثروة الخضراء بطريق مصر اسكندرية الصحراوى على اربعة ابار فى اربعة انواع من زراعات اشجار الفاكهة وهى المشمش والخوخ والعنب الفيليم والعنب التومسون من خلال نظام رى بالتنقيط. وتم اجراء المتابعة الحقلية والدراسات المعملية على اربعة قطاعات تربة فى كل نوع من انواع الزراعات السابقة.

وقد اظهرت النتائج ان المياه المعالجة الكترو مغناطيسيا ادت الى نقص الاملاح الذائبة بنسبة لم تتجاوز ١٠٪ فى مياه الرى المعالجة حيث نقص التوصيل الكهربى من ٢,١٨-٣,٣١الى ٢,١٤-٣,١٢ .وكذلك نقص رقم الحموضة من ٨,٢-٨,٣ الى ٨,١٥-٨,٢٥ . اما نسبة الصوديوم القابل للادمصاص فقد نقصت من ٦,٤-٧,٧ الى ٥,٦-٦,٠ . وكانت اكثر الاملاح تاثرا بتلك المعالجة الكترومغناطيسيا هى املاح كلوريد الصوديوم والتى نقصت من ٥٧,٣٧ -٦٠,٥٣٪ قبل المعالجة الى ٥٣,٣١-٥٨,١٥٪بعد المعالجة .

اما من جهة تاثير المياه المعالجة الكترومغناطيسيا على الخواص الكيميائية للتربة فقد كانت واضحة جدا حيث انخفضت ملوحة التربة من٤,٨٨-٦,١٥ قبل المعالجة الى ٢,٧٣-٤,١٥ بعد شهر من المعالجة ثم انخفضت الى ١,٤٥-٢,٨٣ بعد ثمانية شهور من المعالجة . كما انخفضت حموضة التربة من ٨,٢-٨,٣ قبل المعالجة الى ٧,٩-٨,٠٥ بعد المعالجة .كما اظهرت النتائج انخفاض نسبة املاح الصوديوم والمغنسيوم بالتربة – والمقدرة حسابيا – من٢١,٥٪ و٨,٠٪ قبل المعالجة الى٦,٣٪ و٣,٠٪ بعد المعالجة على التوالى .

وايضا ظهر تاثيرالمعالجة الالكترو مغناطيسية لماء الرى على زيادة تيسر العناصر الغذائيةالكبرى (نتروجين وفسفور وبوتاسيوم) والعناصر الغذائية الصغرى (حديد وزنك ومنجنيز ونحاس) حيث احتفظت التربة بالتركيزات الميسرة الملائمة لحاجة النباتات طوال فترة النمو .وقد ظهر اثر ذلك على الانتاجية المحصولية للاشجار المنزرعة حيث زادت انتاجية محاصيل المشمش والخوخ والعنب الفيليم والعنب التومسون بنسبة ٤٠,٠ و٢٩,٠ و٢٨,٠ و١٩,٠٪ على التوالى فى القطاعات المعالجة بالمقارنة بقبل المعالجة .

اما بالنسبة للكفائة المائية للمياه المعالجة فقد زادت بنسبة ٤٠,٢ و٢٩,٢ و٢٨,٠ و١٩,٣ ٪ لمحاصيل المشمش والخوخ والعنب الفيليم والعنب الطومسون على التوالى بالمقارنة بقبل المعالجة .

النتائج السابقة تظهر اهمية استخدام تكنولوجيا المعالجة الالكترومغناطيسة فى الاراضى والمياه المالحة لزيادة الانتاجية المحصولية وتوفير مياه الرى