WWJMRD 2018; 4(1): 89-96
www.wwjmrd.com
International Journal
Peer Reviewed Journal
Refereed Journal
Indexed Journal
UGC Approved Journal
Impact Factor MJIF: 4.25
e-ISSN: 2454-6615

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Effect of Drip Irrigation System Salinity and Magnetic Water Treatment on Turnip Yield and Yield Characters

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Abstract
Field experiment was carried out in Research and Production Station, National Research Centre, El-Nobaria district, El-Beheara Governorate, Egypt, to determine the effects of irrigation water differed in salinity (2000 and 4000 ppm as well as canal water, 345ppm) combined with magnetized water technology (with or without) on turnip plants. Obtained results showed that the irrigation of magnetic water increased significantly plant growth characters. While, the same results were achieved concerning with Na and Mg % of pear seedlings in the 1st season and, Fe, Zn, Ca, Mg and B contained in the 2nd one. Protein increased by irrigation with non-magnetic water compared with magnetic one in both seasons.
In most cases, the growth parameters (shoot and root) of pear seedlings were improved significantly by using magnetic technology with a low salinity of irrigation water 1000 ppm canal water, while the opposite trend was recorded by raising the salinity up to 4000 and 5000 ppm without magnetic technology in both seasons.

Keywords: Magnetic unit, Saline water, Drip irrigation, Turnip yield

Introduction
Agriculture is the main user of water due mainly to increase in demand from other users and the occurrence of drought where water resource has become scarce and limited. Egypt has been facing a great challenge, where agriculture uses more than 80% of the total water income and its agriculture is irrigated, high demand from the ever-increasing population and the expansion of irrigated areas puts pressure on the resource (Mohamed, 2013). So it is necessary to provide additional land for farming to increase food production and consequently need a new land to cultivate where the only available is low quality water (e.g. Water saline).
Salinity is one of the most severe environmental factors, which is considered a limiting to the productivity of agricultural crops. Salinity can negatively affect plants through three limited components: osmotic, nutrition's and toxic stresses (Munns 1993). When exposed to salinity, growth and development tend to decline, with consequent reduction in their economic value.
The new research, which specializes in using salt water from the most important fundamentals required in areas of scarcity of water resources. For example, the so-called (magnetic field use technology to address salt water), and magnetically treated water is water, which is going through a magnetic field in order to magnetize treat in a given time. It has been testing the effect of a magnetic field on the use of water for a full year. This technology is limited, and the chemical industry is used in countries that have very few, such as China, Russia, Bulgaria and Poland. Where those countries have recommended the use magnet technology to deal with salt water and use in agriculture, industry and homes. There is rapid development in the use of magnetically treated water in recent times, and the water is magnetically processor consists of an ordinary water allow the passage of magnetic field intensity which in the case of a certain rate of flow with the direction perpendicular to the magnetic field lines. Depending on the physical and chemical properties of water processor magnetically.

(Dandan and Shi, 2013)

Yang, (2007), reported that some research has addressed the relationship of salt stress vegetative growth of the plant and dealt with some other research domain magnetic therapy on the physiological characteristics of the plant water effect (Qiu, 2011; Zhou, 2012). Magnetic water improved the plant growth characteristics and nutrient uptake in wheat (Hozayn and Abdul Qados, 2010), Maize (Zepeda, 2011). In this sense, Ahmed (2013) reported that Recipes vegetative growth and productivity of the crop of tomatoes improved by using magnetically treated water for irrigation, which was largely the salinity of 6000 ppm and significant increase in plant growth, some chemical contents, canal and dry weights of plant occurred compared to control. The study proved that the water is magnetically processor has an important role in the process of soluble salts, which leads to increased concentration of cations and anions positive and negative. Whether to get rid of the salts or weakening activity essential to the lack of access to the soil unproductive phase because of the vulnerability salts after it was productive well, (Hilal and Hillal, 2000b).

Noran, (1996) Found under the drip irrigation system that the difference in the concentration of N, P, K, Ca, and Na in the soil, which was magnetically treated water compared to ordinary water irrigation. He said that the magnetically treated water to be more accessible and acceptable to the plant in the soil solution for untreated. The reason for this is due to the buildup of salt in the form of crystals and also the effect of the deposition of metals dissolved soil.

Grewal and Maheshwari (2011) Found that there has been changes in the physical and chemical properties of water depends on the degrees of magnetic method of treatment. These properties that have changed, including hydrogen bonds and the surface tension and electrical conductivity and salts and pH and polarization. These changes may influence internal pressure on the vegetative growth of the plant properties. It has been found that the lower the pH of the water indicates the increasing water affected by the magnetic field and also changes in hydrogen bonding and increase Duarte Ions (Diaz 1997 movement (and Oucaad these changes to increase the absorption of nutrients by exposure to the magnetic field of the tomato plants.

Mahmoud, (2011) found that using MW on Wheat and Chick-pea enhanced biochemical components (such as photosynthetic pigments) and protein content was increased significantly. Mahmoud and Amira (2010) on chick pea plant and Osman et al., (2014) on peas irrigated by MW significantly increased plant growth, yield and protein content. Magnetic fields have been reported to exert a positive effect on barley plant growth and development Martínez, (2000). Irrigation with magnetically treated water is friendly environmental techniques. Osman et al., (2014) found that increasing water salinity up to 4000 and 5000 ppm with magnetic technology gave the highest values of macro and micronutrients as well as proline % of pear seedlings in two seasons. Therefore, in this work, an attempt was made to understand the applicability of using of magnetized saline irrigation water in evaluation growth and some macro and micro nutrients contents of pear seedlings. The aim of this research work to determine the effects of irrigation water differed in salinity (2000 and4000 ppm as well as canal water, 345ppm) combined with magnetized water technology (with or without) on turnip plants.

Material and Methods

Salinity waters were collected from different wells to represent different salinity levels used with a final EC in the range of 345 to 4000 ppm was reached germination response to salinity levels was monitored visually at 24 hr intervals for the duration of the germination test. A grain was considered to have germinated if the radical exceeded 2 mm length. Water treatments were five salinity (canal water (345), 1000, 2000 and 4000 ppm) and fourth magnetic force (0, 800, 1000 and 2000 gauss) as well as untreated one.

Drip irrigation system was setup according to the treatments. The system consists of (pump: dab model JET 102M, Power 1.0 hp and discharge 0.6- 3.6 m^3h^{-1} and hmax 53.8 m, filter 0.5 inch, pressure gauges, flow-meter, and control valves, main line of PVC pipe of 32 mm, submain line of PVC 25mm and laterals of 16 mm diameter PE tubes lines with built in emitters (discharge of 4 Lh^{-1}at 1 bar operating pressure and 30 cm emitters spacing, The distance between laterals was 90 cm with 21 m long) as presented in Figure (1).

Field experiments were carried out in the Experimental Farm of Agricultural Production and Research Station (APRS), National Research Centre (NRC), El Nubaria Province, Egypt, sandy soil (latitude (30.69 N, 30.668 E, and mean altitude 31 m) above sea level).

The field experiment was a split-plot design. The main plots were magnetic forces treatments. Three magnetic forces treatments were used: zero, 1000 and 2000 Gauss. On the other hand, three salinity treatments (canal water 345, 2000 and 4000 ppm) occupied the sub-plots under turnip crop. Soil and water analysis is in the following Tables (1, 2, and 3).

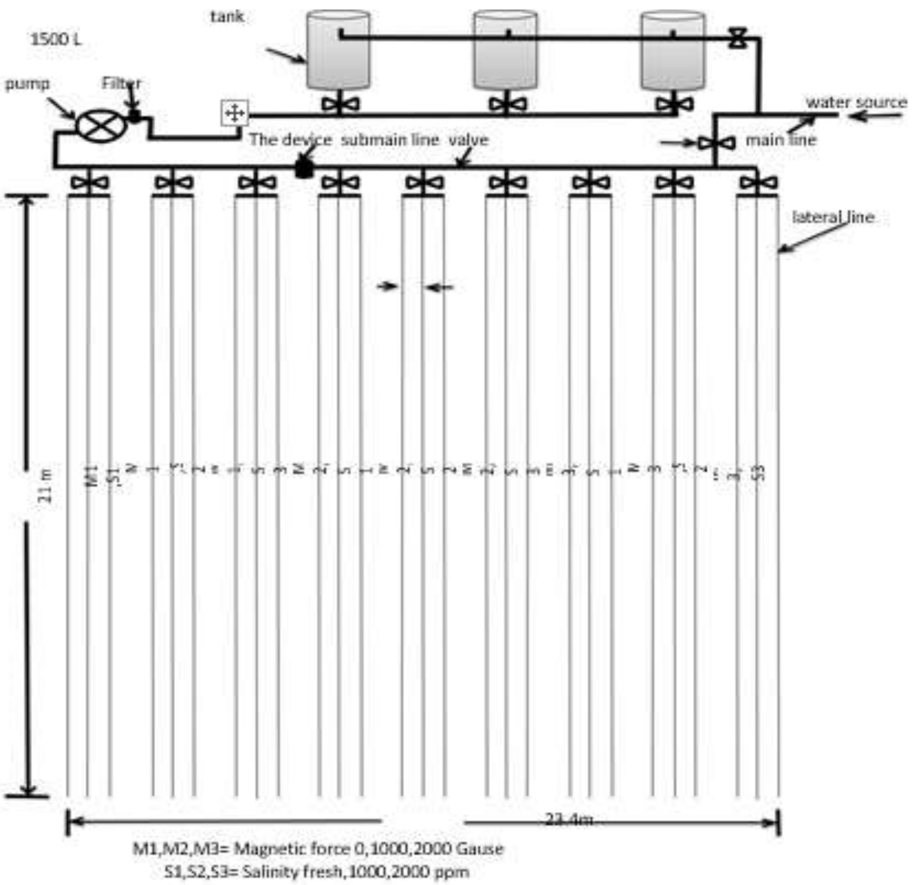

Fig. 1: Layout of the magnetic forces and water treated by the magnetic field in the field under drip irrigation system.

Table. 1: Soil physical properties of the experimental site

Soil sample Depth(cm)	Particle size distribution (%)				Texture class	FC	WP	AW	BD(g/cm3)	HC(cm/h)
	Coarse sand	Fine sand	Silt	Clay		(V/V %)				
0-15	3.7	64.5	15.2	16.6	S	0.22	0.11	0.11	1.45	1.11
15-30	3.8	65.8	14.6	15.8	S	0.22	0.11	0.11	1.43	1.28
30-45	4.6	63.7	16.0	15.7	S	0.22	0.11	0.11	1.43	1.28
45-60	4.6	65.9	15.5	14.0	S	0.21	0.10	0.11	1.42	1.53

(*) Determined as percentage in (V/V %) cm3 Water/ cm3 Soil, (S): Sandy soil; HC: Hydraulic conductivity; and BD: Bulk density.

Table. 2: Chemical analysis of the soil.

Soil sample depths cm)	Cations (Meq/l)				Anions(Meq/l)				pH	E.C (dS/m)
	Ca++	Mg++	Na+	K+	CO3--	HCO3-	Cl-	SO4--		
0-15	6.43	4.89	185.0	18.84	0	5.64	6.65	58.7	8.10	1.97
15-30	11.53	6.49	237.1	25.01	0	5.21	10.53	62.6	8.13	2.98
30-45	12.15	7.97	279.1	26.63	0	3.68	11.48	64.0	8.11	3.61
45-60	12.56	4.17	307.1	32.28	0	3.62	5.6	66.9	8.03	3.76

Table. 3: Some chemical properties of irrigation water.

Water sample	pH	EC ppm	Soluble anions and cations (meq/l)								SAR
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO3^{=}$	$HCO3^{-}$	$SO4^{=}$	Cl^{--}	
Canal	7.34	474.88	2.01	1.68	2.88	0.85	0.0	0.47	3.01	3.94	2.12
Well	7.53	4160.64	21.23	18.28	23.35	2.15	0.0	0.53	28.24	36.24	5.25

EC:Electrical conductive; SAR: Sodium absorption ratio.

Soil Physical and Chemical analysis and irrigation water were measured with using the standard methods after Rebecca (2004) and shown in Tables (1, 2, and 3). All the measured chemical parameters describe the status of the irrigation water and it can be used normally in irrigation. Water salinity treatments were prepared by dilution canal water with saline well. Water requirements through the growing season illustrated in Table (4).

The magnetic field treatments, irrigation water passed through a magnetic device before the application to the plants. The device comprised of two magnets, arranged to the north and south poles. The directions of magnetic field generated at the flow rate diameter 2 inch are shown in (Figure 2).

Fig. 2: The directions of magnetic field generated at the flow rate with diameter 2 inch.

At the end of experiment, vegetative growth parameters (shoot fresh and dray weight (g), plant height (cm), no. of branches / plant, stem diameter (cm), and no. of leaves) were measured. Also, prolien conc., were measured.
Seedlings samples (Shoots and roots) dried at 70ºC; grounded, digested and assigned for analyzing N, P and K. Nitrogen was determined using modified Kjeldahl method, phosphorous was determined calorimetrically using ammonium molybdate and Potassium was determined using the flame spectrophotometry method Black (1982).

Table. 4: Water requirements of turnip crop.

<table>
<tr><th>Month</th><th colspan="2">Nov.</th><th colspan="2">Dec.</th><th colspan="2">Jan.</th><th>Feb.</th></tr>
<tr><th>ETo (mm/day)</th><td colspan="2">2.88</td><td colspan="2">2.49</td><td colspan="2">1.65</td><td>2.54</td></tr>
<tr><th rowspan="2">Stage</th><td>20</td><td>8</td><td>22</td><td>9</td><td>26</td><td>5</td><td>10</td></tr>
<tr><td>Initial stage (20 days)</td><td colspan="2">Development stage (30 day)</td><td colspan="2">Mid –season (35 day)</td><td colspan="2">Late season (15 day)</td></tr>
<tr><th>Kc</th><td>0.5</td><td colspan="2">0.8</td><td colspan="2">1.10</td><td colspan="2">0.6</td></tr>
<tr><th>ETc (mm/day)</th><td>1.44</td><td>2.30</td><td>1.99</td><td>2.74</td><td>1.82</td><td>0.99</td><td>1.52</td></tr>
<tr><th>ETc (m^3 /day / Fed)</th><td>6.1</td><td>9.7</td><td>8.4</td><td>11.5</td><td>7.6</td><td>4.2</td><td>6.4</td></tr>
<tr><th>ETc (m^3 / stage/Fed)</th><td>122</td><td colspan="2">543</td><td colspan="2">668.5</td><td colspan="2">159</td></tr>
<tr><th>Etc total (m^3/season/Fed)</th><td colspan="7">1492.5</td></tr>
<tr><th>IR (m^3/season/Fed)</th><td colspan="7">$= \frac{1492.5\times(1+0.15)}{0.9} = 1907.1$</td></tr>
</table>

Ea = 90 %, LR = 15 %

The results were statistically analyzed using M-Stat computer package to calculate F ratio according to Snedecor and Cochran (1988). Least Significant Differences method (LSD) was used to differentiate between means at the 0.05 probability, level according to Waller, and Duncan (1969).

Results and Discussion

Table (5) illustrated the yield and plant growth characters of turnip an effected by different magnetic force (MF) for saline water. Data notice that the maximum and minimum values of shoot length and shoot weight were obtained of canal water (1000MF) and salinity 4000ppm, 2000 ppm without magnetic effect with respect to the salinity effect, canal water has the superior effect on the previous plant characters with values 50.7 cm and 346.5 g/plant while salinity water 4000 has a negative effect with values 45.3cm and 242.8g/plant. With reduction value11 and 30%. Above control (canal water) in same sequences. Whereas, magnetized saline irrigation water improve those plant characters, where the highest of values were recorded of the 1000 and 2000 magnetic force (MF) with rate of increase 6 and 40%, relative to the untreated one, respectively
Regarding to the root characters, root volume ,height and diameter, one con notice that increased salinity in irrigation water associated with decreasing in the investigation plant characters undu different MF relative to the control. The highest value were recorded at canal, 4000, canal and MF1000, while the lowest one were noticed at 4000, 2000, 2000 ppm under 2000, zero, 2000 MF, respectively.Such findings coincide with those reported by Mesut et al., (2010),
Who pointed out that the plants that grow in saline concentration high solution soil conditions lead first to increase the osmotic pressure and leads to poor absorption of water and nutrients from the soil and secondly lead to increased accumulation of chlorine and sodium and increase their focus, which works to double the absorption of food and mineral elements important for plants.

Table. 5: Effect of magnetic force and water salinity on turnip growth and yield.

Magnetic force	Water salinity	Plant Length	Leaves Weight	Root Width	Root volume	Root height	Rootdia meter	BD	Yield(ton/fed)
Zero	Canal	49.5	266.7	492.0	510.0	8.5	10.8	0.96	22.73
	2000	47.5	194.2	463.1	500.0	7.3	10.6	0.93	21.40
	4000	43.5	207.9	418.4	457.0	8.0	10.2	0.92	19.33

1000	Canal	51.4	388.9	655.6	720.0	8.4	11.3	0.91	30.29
	2000	50.2	284.8	517.6	550.0	8.8	9.5	0.94	23.91
	4000	47.2	262.2	455.3	480.0	9.2	9.9	0.95	21.03
2000	Canal	51.2	384.0	545.3	575.1	8.0	10.8	0.95	25.19
	2000	48.1	317.2	423.6	456.3	8.1	10.6	0.93	19.57
	4000	45.3	258.3	397.9	430.0	8.0	10.3	0.93	18.38
	Mean								
Water Salinity	Canal	50.7	346.5	564.3	601.7	8.3	11.0	0.94	26.07
	2000	48.6	265.4	468.1	502.1	8.1	10.2	0.93	21.63
	4000	45.3	242.8	423.9	455.7	8.4	10.1	0.93	19.58
Magnetic water	Zero	46.8	222.9	457.8	489.0	7.93	10.53	0.94	21.15
	1000	49.6	312.0	542.8	583.3	8.80	10.23	0.93	25.08
	2000	48.2	319.8	455.6	487.1	8.03	10.57	0.93	21.05

Regardless MF, increased irrigation salinity led to reduction on the studied root characters, except 4000 ppm increased root height. The rate of change in root characters were 24, 4 and 6% comparingthe highest values versus lowest ones.

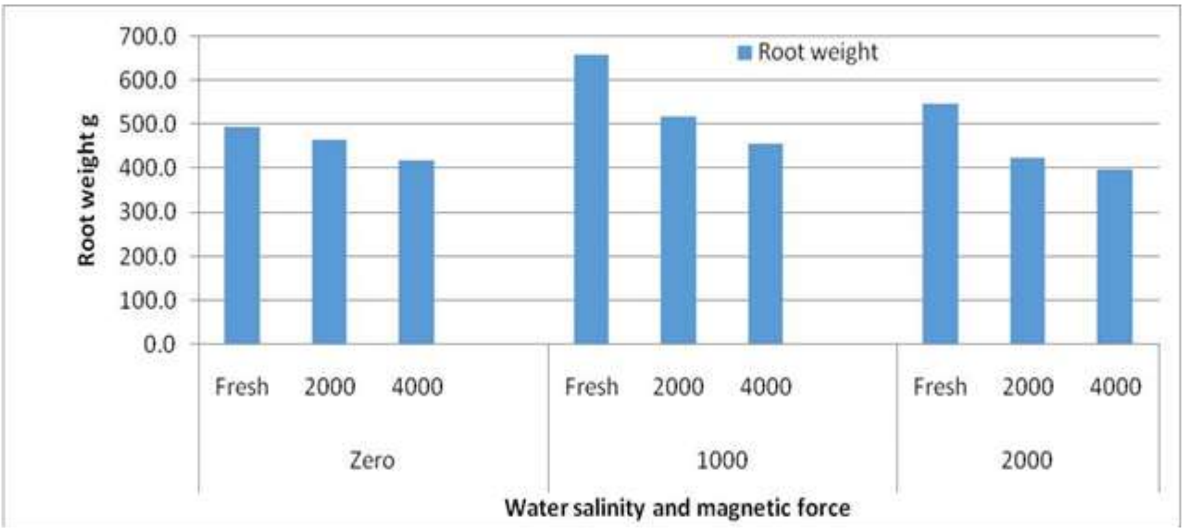

Fig. 2: Effect of magnetic force and water salinity on root weight of turnip.

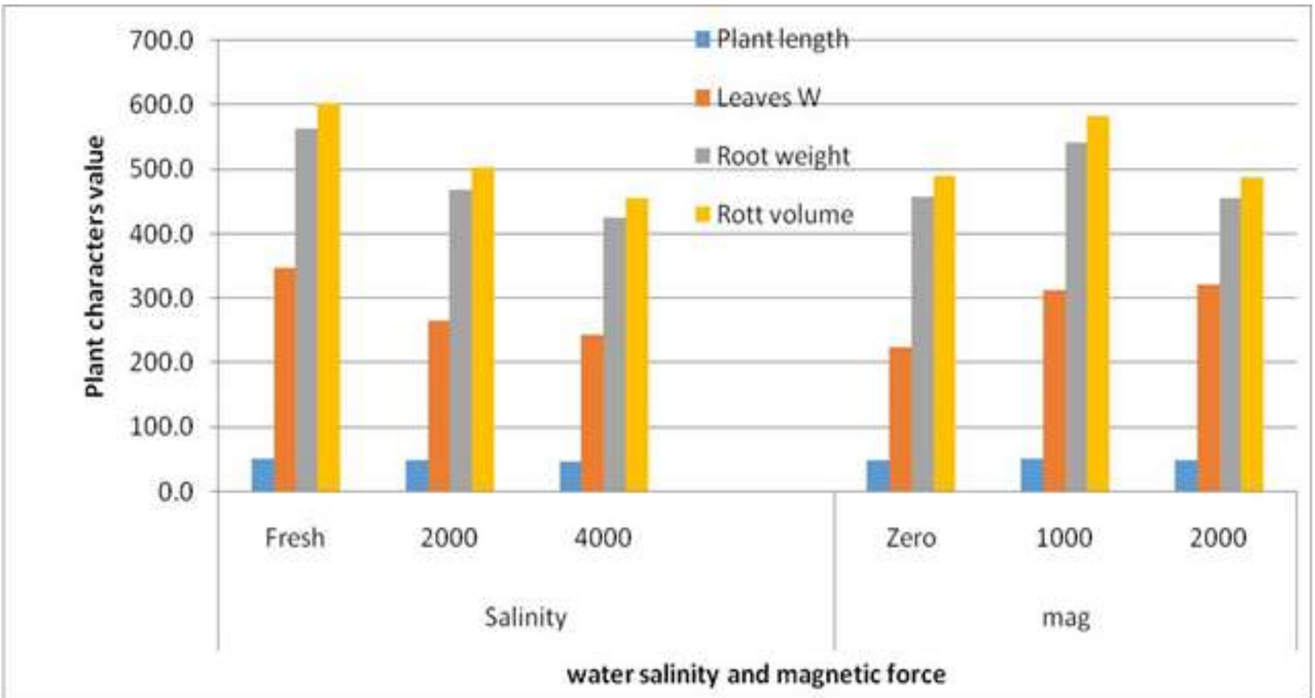

Fig. 3: Effect of magnetic force and water salinity onplant length, leaves weight, root weight and root volume of turnip.

Regarding to the MF effect on the root characters, data point out that MF1000 was superior to improve those characters, except root diameter where mf 2000 was the best. The rate of increase relative to the MF were, comparing with control treatment, 20%, 1000/2000, 11% and 3%2000/4000 in same sequences. This finding is agreed with those obtained by (Munns, 2002), who reported that salinity stress depresses plant growth and development at different physiological levels. The decrease in plant growth by salinity stress might be related to adverse effects of excess salt onion homeostasis, water balance, mineral nutrition and photosynthetic carbon metabolism

The most important plant characters were root yield and density and the last one represent the concentrated material. The highest and lowest values of turnip weight were 655.6 g/plant (canal water +MF1000) and 397.9 g/plant (4000ppm+2000MF). In case of root density the highest value were (0.96, 0.95, 0.95) attained at canal / zero, 4000ppm, 2000pm; canal /2000ppm, respectively.

Regardless MF, salinity irrigation water decreased root weigh value, but 2000ppm was higher than canal followed by 4000ppm. The rate of increase was 33% comparing canal water with 4000ppm while 2000 VS 4000ppm was improved by canal water VS 4000ppm 468.1/423.9= 40%.

It helps the plant absorb water untreated magnetically on the production of the hormone vegetable Aaddy to improve the functions of plant growth and improve the activity of plant cells.

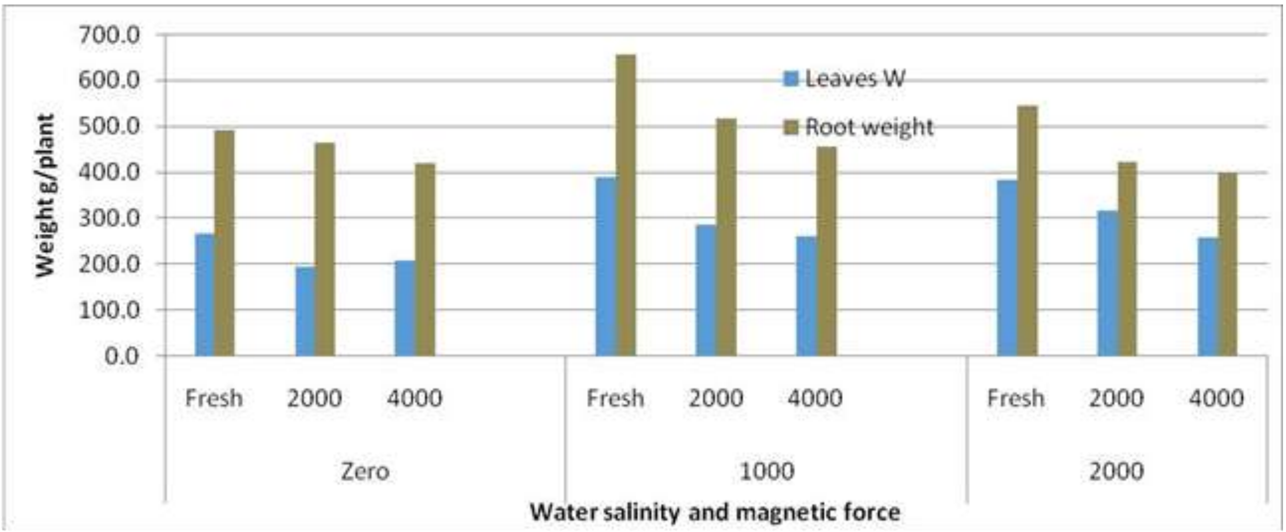

Fig. 4: Effect of magnetic force and water salinity on leaves weight and root weight of turnip.

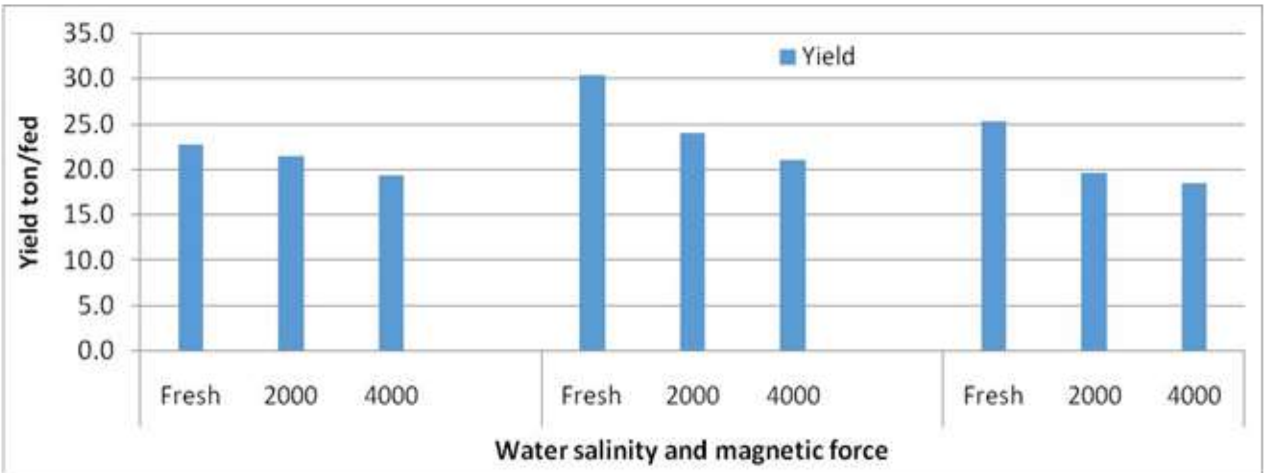

Fig. 5: Effect of magnetic force and water salinity on turnip yield.

In this connection, (Belyavskaya, 2001, 2004; Turker, 2007) concluded that the magnetic water can influence the root growth of various plant species. Also, Muraji, (1992)found that the presence of more of the root growth rate of the atom and that exposing corn seedlings to five degrees of the magnetic fields with frequencies between 40-320 Hz. Yet he found that there i root growth has fallen to corn plants when exposed to temperatures of the magnetic field between 240-320 Hz.

With respect to the MF impact on the root weight. Data pointed out that MF 1000has promotive effect on root weight/ plant with value 542.8/457.8 =19% and 542.8/455.6 =19%.Isolated individually effect of the investigated factors on the root density Table (5) , data on hand showed increased salinity irrigation water decrease root density after 2000 and 4000 ppm relative to the control and same trend was observed of the MF where the untreated root density value was higher than MF1000 and 2000 , 0.933/0.935(1000) sf and 0.934/0.935 (2000) canal.

Data agreed with Maheshwari, and Grewal, (2009) (Muranaka, 2002) which reduces assimilates supply.

Table. 6: Effect of magnetic force and water salinity on turnipWUE.

MF	ppm	Water amount used	N of plants in 1m	Weight of root	Water use efficiency
0	**F**	1907.1	9	492.0	8.78
	2000		9	463.1	8.26
	4000		12	418.4	9.95
1000	**F**		12	655.6	15.59
	2000		8	517.6	8.21
	4000		10	455.3	9.02
4000	**F**		13	545.3	14.05
	2000		10	423.6	8.40
	4000		12	397.9	9.46
LSD 0.05				**5.21**	**0.12**

The most important plant characters were root yield and density and the last one represent the concentrated material. The highest and lowest values of turnip weight were 655.6 g/plant/ (fresh water +MF1000) and 397.9 g/plant (4000ppm+2000MF). In case of root density the highest value were (0.96, 0.95, 0.95) attained at the fresh / zero, 4000ppm, /2000pm; fresh /2000ppm, respectively.

Regardless MF, salinity irrigation water decreased root weigh value, but 2000ppm was higher than fresh followed by 4000ppm. The rate of increase was 33% comparing fresh with 4000ppm while 2000 VS 4000ppm was improved by fresh water VS 4000ppm 468.1/423.9= 40%.

With respect to the MF impact on the root weight. Data pointed out that MF 1000has promotive effect on root weight/ plant with value 542.8/457.8 =19% and 542.8/455.6 =19%.

Isolated individually effect of the investigated factors on the root density tables (5) and (6), data on hand showed increased salinity irrigation water decrease root density after 2000 and 4000 ppm relative to the control and same trend was observed of the MF where the untreated root density value was higher than MF1000 and 2000, 0.933/0.935 (1000) sf and 0.934/0.935 (2000) f

The obtained results agree with (Velikova, 2000), who found that, with Brassica species, photosynthetic rates showed significant decreasing trends with increasing salt concentrations in the rooting medium. Proline increased by irrigated with nonmagnetic water compared with magnetic one in two seasons.

Conclusion

One could notice that increased salinity irrigation water (SW) decrease root density after 2000 and 4000 ppm relative to the control and same trend was observed of the Magnetic force (MF) where the untreated root density value was higher than MF1000 and 2000, 0.933/0.935 (1000) MF and 0.934/0.935 (2000) MF.

It could be concluded to using this MF with 1000 to 4000 gauss to treating the saline water which equal or less than 4000 ppm. Using SW 2000 ppm was better than 4000 ppm. And using mf 1000 gauss was better than 4000 gauss.

References

1. Ahmed AM. 2013. Effects of Magnetized Low Quality Water on Some Soil Properties and Plant Growth, Int. J. Res. Chem. Environ. 3:140-147.
2. Belyavskaya NA. 2001. Ultrastructure and calcium balance in meristem cells of pea roots exposed to extremely low magnetic fields. Adv. Space Res. 28: 645–650.
3. Belyavskaya NA. 2004. Biological effects due to weak magnetic field on plants. Adv. Space Res. 34:1566–1574.
4. Black CA. 1982. Methods of soil analysis. Part 2. Chemical and microbiological properties. Second Edition. Amer. Soc. of Agron. Madison, Wisconsin, U.S. A.
5. Dandan L and Shi Y. 2013. Effects of Magnetized Saline on Growth and Development of Winter Wheat Seedlings. Adv. J. Food Sci. Technol., 5: 1596-1599.
6. Grewal HS and Maheshwari BL. 2011. Magnetic treatment of irrigation water and snow pea and Chickpea seeds enhances early growth and nutrient contents of seedlings. Bioelectromagnetics, 32: 58-65.
7. Hilal MH and Hillal MM. 2000b. Application of magnetic technologies in desert agriculture. II-Effect of magnetic treatments of irrigation water on water on salt distribution in olive and citrus field and induced changes of ionic balance in soil and plant. Egypt. J. Soil Sci., 40:423-435
8. Hozayn M and Abdul Qados AMS. 2010. Magnetic water application for improving wheat (Triticumaestivum L.) crop production. Agric. Biol. J. N. Am., 1: 677-682.
9. Maheshwari L Basant L and Grewal HS. 2009. Magnetic treatment of irrigation water: Its effects on vegetable crop yield and water productivity. Agricultural Water Management, 96: 1229–1236
10. Mahmoud H and Amira MSAQ. 2010. Irrigation with magnetized water enhances growth, chemical constituent and yield of chickpea (Cicerarietinum L.).Agric. And Bio. J. of North Am., 14: 671-676.
11. Mahmoud HAA, Amany and Amira MS AQ. 2011. Irrigation with magnetized water, a novel tool for improving crop production in Egypt. Fifteenth International Water Technology Conference, IWTC-15 2011, Alexandria, Egypt.
12. Mohamed AI. 2013. Effects of Magnetized Low Quality Water on Some Soil Properties and Plant Growth. Int. J. Res. Chem. Environ., 3:140-147.
13. Munns R. 1993. “Physiological Processes Limiting Plant Growth in Saline Soil: Some Dogmas and Hypotheses,” Plant, Cell & Environment, 16:15-24. doi:10.1111/j.1365-3040.1993.tb00840.x
14. Munns R. 2002. Comparative physiology of salt and water stress. Plant Cell Environ. 25: 239-250. Muraji M, Nishimura M, Tatebe W and Fujii T. 1992. Effect of alternating magnetic field on the growth of the primary root of corn. IEEE. Trans.Magn. 28: 1996–2000.
15. Muranaka S, Shimizu K and Kato M. 2002. Ionic and osmotic effects of salinity on single-leaf photosynthesis in two wheat cultivars with different drought tolerance. Photosynthetica 40: 201–207.

16. Osman E.A. M., K.M Abd El-Latif, S.M. Hussien and A.E.A. Sherif, 2014. Assessing the effect of irrigation with different levels of saline magnetic water on growth parameters and mineral contents of pear seedlings. Global Journal of Scientific Researches (online at gjsr.blue-ap.org ©2014 GJSR Journal.) 2(5):128-136, 31 May, 2014
17. Qiu NW, Tan TH, Dai H, Shen X, Han R, Lin Y and Ma ZQ. 2011. Biological effects of magnetized water on seed germination, seedling growth and physiological characteristics of wheat. Plant Physiol. J., 47: 803-810.
18. Snedecor GW and Cochran WG. 1980. one way classification-Analysis of Variance – The random effect model- Two way Classification (Eds) In Statistical Methods. The lowas State Univ. Press Ames lowa USA, 215-273.
19. Turker, M., C. Temirci, P. Battal, and M.E. Erez, 2007. The effects of an artificial and static magnetic field on plant growth, chlorophyll and phytohormone levels in maize and sunflower plants. Phyton Ann. Rei Bot. 46: 271–284.
20. Velikova V, Yordanov I and Edreva A. 2000. Oxidative stress and some antioxidant systems in acid rain-treated bean plants - Protective role of exogenous polyamines, Plant Science. 151:59-66.
21. Waller RA and Duncanm CB. 1969. Abays rule for symmetric multiple comparison problem Amer.
22. State Assoc. Jour.1485-1503.
23. Yang Y, Yang N, Wang L, An L, Zhang C, Yang Q and Wang C. 2007. Effect of salinity on the physiological characteristics in two wheat cultivars. J. Lanzhou Univ., Nat. Sci., 43: 29-33.
24. Zepeda RB, Hernandez CA, Suazo FL, Dominguez AP, Cruz AO, Martinez EO and Hernandez LMS. 2011. Physical characteristics of maize grain and tortilla exposed to electromagnetic field. Int. Agrophys., 25: 389-393.
25. Zhou S, Zhang R, Chu G and Wang W. 2012. Effects of magnetized water in agriculture. Agric. Eng., 2: 44-48.