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Effect of irrigation with saline magnetic water on controlling root rot and vegetative growth parameters of apricot *(Prunus armeniaca L.)* seedlings.

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Abstract

Root rot resulted in mass mortality of young seedlings of commercial apricot seedlings in nursery. The most frequently isolated and the most pathogenic fungi were *Fusarium solani* and *Lasiodiplodia theobromae* (*syn. Botryodiplodia theobromae*). Saline water from local wells is the alternative source to fresh Nile water for irrigating crops in reclaiming area of the desert. In pots experiment under greenhouse conditions in 2014 and 2015 seasons, seedlings which were irrigated with saline water were more severely diseased than those irrigated with fresh Nile water (270 mg/L). Increasing irrigation-water salinity from 1000 to 2000 mg/L significantly increased mortality in apricot seedlings and reduced plant height, leaves number, dry weight and leaf area of non-inoculated and inoculated seedlings. Alleviating such problem of saline irrigating water requires more ways to use available water resources such as using a technique of magnetic treatment. Magnetized saline irrigating water decreased root rot disease and increased plant height, leaves number, dry weight and leaf area of non-inoculated and inoculated apricot seedlings in the two seasons. The lowest disease incidence and the highest growth parameters were recorded in case of treating seedlings with Topsin- M70 combined with magnetic saline water and the efficiency of Topsin- M70 decreased with the increasing of salt water concentrations.

Key Words: apricot, saline irrigating water, magnetic technology, root rot and vegetative growth.

Introduction

Apricot *(Prunus armeniaca L.)* is considered one of the most favorable fruit crops to cultivate under the new reclaimed areas. 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 Nile water. Using water irrigation from local wells in reclaiming area of the desert where the availability of fresh water (non-saline) usually is limited is one of the alternatives. Most of salts dissolved in irrigation water are absorbed by plant and then accumulated in plant tissues which have an important role in increasing root rot disease incidence. Root rot of apricot is one of the important diseases that usually resulted in losses in its yield and young seedlings of commercial apricot nurseries.The response of apricot root rot to salinity were examined alone and in conjunction with inoculation by the primary causal agent of apricot root rot incidence *Fusarium solani* and *Lasiodiplodia theobromae* under greenhouse conditions. Salt stress has been found to predispose seedlings to infection by root rot incidence and reduced plant parameters. Several studies on the interactions between pathogens and salinity have indicated to occurrence an increase in disease incidence at higher salinities such as the case for *Pythium aphanidermatum* on *Agrostis palustris* (Rasmussen and Stanghellini, 1988), *Phytophthora capsici* on chilli pepper (Sanogo, 2004), *Phytophthora parasitica* on tomato (Swiecki and MacDonald, 1991) and *Fusarium* crown rot in tomato (Triky-Dotan *et al*. 2005) who reported that the effect of salinity on plant disease may result from its effect on one or more of the biotic components involved in the disease: the pathogen, the host, microbial activity in the soil, or abiotic components of the soil.

The saline water was treated by passing during a magnetic device called magnetized water before the application to the seedlings. The successful use of magnets in treating water for irrigation, industry and home use was used in Australia, Bulgaria, China, England, Japan, Poland, Portugal, Russia, Turkey and the United States (Qados and Hozayn, 2010). Magnetized saline irrigating water reduced root rot disease and increased plant height, leaves number, dry weight and leaf area of non-inoculated and inoculated apricot seedlings. Magnetic water treatment could be used to enhance growth, chemical constituents and productivity of chickpea under greenhouse conditions (Mahmoud and Abdul Qados, 2010). The main objective of this study was to characterize the effect of salinity and using magnetic water on apricot root rot under greenhouse conditions. Addressing these issues may help to generate knowledge valuable for management programs for controlling the diseases under saline conditions.

Materials and Methods

1- Isolation and identification of the causal pathogens.

Diseased apricot seedlings were collected from nursery of El-Qanater El-Khairia Horticultural Research Station, Agricultural Research Centre during 2013 and 2014 growing seasons. The roots of the diseased seedlings were washed carefully with tap water to remove the adhering soil particles, then cut into small pieces (about 1 cm length), and surface sterilized by immersing them in 5% sodium hypochlorite solution for five minutes. The segments were rinsed several times in sterilized water then dried between folds of filter papers and aseptically transferred onto sterilized petri dishes containing PDA. The dishes were incubated at 27-28ºC for 7 days. The colonies were counted, picked up and cultured on another petri dishes containing PDA. Isolated fungi were purified using the hyphal tip and/or single spore techniques. Pure cultures were identified according to Gilman (1957), Booth (1971), Nelson *et al.* (1983) and Barnett and Hunter (2006).

2-Pathogenicity tests of the isolated fungi.

For preparing fungal inocula, the tested fungi were grown on autoclaved barely medium at 28ºC for two weeks. They were separately added to the potted soil at the rate of 5% (w/w) then irrigated every day and left for ten days to ensure distribution of the inoculum before transplanting seedlings. At the beginning of growing season during the first week of January, one year-old apricot seedlings cv. Amar were transplanted in pots (25 cm. diam.), filled with infested or uninfested soil. Three seedlings were cultivated in each pot and four pots were used for each treatment. Pots were arranged in the greenhouse in a completely randomized design with four replicates. Transplanted seedlings received only tap water periodically. Disease incidence was recorded as percentage of infected seedlings after 90 days from seedlings replanting.

Some physical and chemical properties of the soil at the experimental site which were measured and determined before planting are presented in Table 1.

Table 1. Physical and chemical analysis of an experimental soil.

A. Physical analysis							B. Chemical analysis			
Clay %	Silt %	Sand %			Soil texture	Saturation	O.M g/kg	EC dS/m	pH(1: 2.5)	$CaCO_3$ g / kg
		Fine	Coarse	Total						
31.4	33.5	34.0	1.1	35.1	Clay loamy	67.5	17.0	1.1	7.9	35.9
					B. Chemical analysis					
Cations and anions (mmolc/L)								Available nutrients (mg/kg)		
Na^+	K^+	Ca^{++}	Mg++	CO_3^-	HCO_3^-	Cl^-	SO_4^-	N	P	K
4.10	0.41	3.07	2.63	0.0	3.85	3.70	2.66	39.45	9.33	191.9

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

Soil analysis:

Particle size distribution was conducted using the pipette method according to Klute (1986). Soil pH, electric conductivity (EC) and cationic and anionic compositions of the saturation extract of the soil were determined according to the standard methods described by Page *et al.* (1982).Nitrogen was determined using modified Kjeldahl method, phosphorous was determined colourimetrically using ammonium molybdate and ammonium metavanadate according to the procedure outlined by Ryan *et al.*(1996). Potassium, sodium , calssium and maganisium were determined using the flame spectrophotometry method of Black (1982).

3- Assessing the effect of irrigation with different concentrations of saline magnetic water and soil drench with Topsin-M70 on apricot seedlings root rot disease.

This study was conducted in plant pathology greenhouse at El-Qanater El-Khairia Horticultural Research Station, Agricultural Research Centre in the two successive seasons (2014 and 2015) to investigate the ability of using magnetized saline water in irrigating apricot seedlings. Two factors were possibility studied; watering plant with saline water and the other factor was the effect of magnetic technology on saline water used in plants irrigation. Seawater was diluted with tap water to prepare three concentrations (1000, 1500 and 2000mg/L).On the magnetic field treatments, irrigation water passed through a magnetic device before the application to the seedlings. 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 . Soil infestation with each test pathogen *F. solani* and *L. theobromae* was carried out as mentioned before. Apricot seedlings cv. Amar (one -year old) were transplanted in pots (25 cm. diam.), filled with infested or uninfested soil during the first week of January. Three seedlings were transplanted in each pot and four pots were used for each treatment. The fungicide Topsin-M70 (Thiophanate methyl) was applied at the rate of 3g/L water. This experiment was designed as following:

Control = seedlings watered with fresh Nile water, 270 mg/L.

B1= seedlings transplanted in non- infested soil.

B2= seedlings transplanted in infested soil drenched with Topsin-M70.

B3= seedlings transplanted in infested soil non-drenched with Topsin-M70.

Transplanted seedlings received only tap water periodically. After one month seedlings were irrigated with either saline water or magnetic water. The same number watered with either fresh Nile water or magnetic fresh Nile water as control. Each pot received 200mL of saline water or magnetic water. Every three irrigation with saline water seedlings received fresh water to prevent the accumulation of salinity. All plants were kept under greenhouse conditions. After 90 days from seedlings replanting disease incidence of apricot root rot for each treatment was estimated.

4- Assessing the effect of irrigation with different concentrations of saline magnetic water and soil drench with Topsin-M70 on vegetative growth parameters of apricot seedlings.

At the end of experiment, plants were separately uprooted, thoroughly washed with running tap water to remove soil particles from roots. Plant height (cm/plant), number of leaves, dry weight (g/plant) and leaf area (cm^2/plant) for whole plant were used to study the response of growth of apricot seedlings to irrigation with saline and magnetic water and soil drench with Topsin-M70.

Statistical analysis

The experiment was arranged in a randomized complete design and the obtained data were subjected to analysis of variance and significant differences among means according to Snedecor and Cochran (1980). In addition significant differences among means were distinguished according to the Duncan's multiple tests range (Duncan, 1955).

Results

1- Isolation and Identification of the Causal Pathogens.

Disease symptoms including discoloration of the vascular system in the basal stems, and wilting of the plant were demonstrated. Data in Table 2 show that the isolation from diseased apricot seedlings yielded six species representing four fungal genera. *Fusarium solani and Lasiodiplodia theobromae* were the highest frequency percentage in the two seasons (45.84 and 47.22%) and (25.00 and 27.79%), respectively, followed by *Fusarium oxysporum* which recorded (11.11 and 6.94%), respectively while the other pathogens were less frequent.

Table2. Frequency (%) of the isolated fungi from diseased apricot seedlings during the two seasons 2013 and 2014.

Isolated fungus	Frequency %	
	Season 2013	Season 2014
Aspergillus spp.	2.78	2.78
Fusarium semitectium	6.94	8.33
Fusarium oxysporum	11.11	6.94
Fusarium solani	45.84	47.22
Rhizoctonia solani	8.33	6.94
Lasiodiplodia theobromae	25.00	27.79

2-Pathogenicity test of the isolated fungi.

Data in Table 3 show that the tested fungi were differed in their pathogenic capability. *F. solani* and *L. theobromae* were found to be highly pathogenic to apricot seedlings both after 60 and/or 90 days of transplanting (41.66 and 58.33%) and (25.00 and 33.33%), respectively. On the other hand, *F. oxysporum,* F. *semitectium and R. solani* caused the lowest percentages of infection (from 8.33 to 16.66%), respectively. *Aspergillus* spp. didn't show any pathogenic effect. For all fungi tested, the disease incidence was greater when determined 90 days after transplanting in infested soil than 60 days. Results showed that *F. solani and L. theobromae* were the main pathogens caused high percentages of apricot seedlings mortality and seedlings showed a typical root rot with a poor fibrous root development.

Table 3. Percentage of root rot disease incidence on apricot seedlings recorded after 60 and 90 days of transplanting in infested soil.

Isolated fungus	Days after transplanting in infested soil	
	60	90
Aspergillus spp.	0.0	0.0
F. semitectium	8.33	16.66
F. oxysporum	8.33	16.66
F. solani	41.66	58.33
R. solani	8.33	8.33
L. theobromae	25.00	33.33

3-Assessing the effect of irrigation with different concentrations of saline magnetic water and soil drench with Topsin-M70 on apricot seedlings root rot disease.

Data presented in Tables 4 and 5 indicate that saline stress has an important role in increasing root rot disease incidence. Increasing water salinity concentrations from 1000 to 2000mg/L significantly increased mortality of apricot seedlings inoculated with *F. solani and L. theobromae* and of uninoculatd seedlings. The highest infection percentage was found at 2000 mg/L of saline water, while the lowest ones were at 1000 mg/L in the two seasons. Data also illustrate the effect of using a technique of magnetic treatment of saline water and treatment with the fungicide (Topsin-M70) on the incidence of apricot seedlings root rot. Using a technique of magnetic treatment of saline water decreased the infection percentage of root rot disease. The lowest disease incidence was recorded in the case of treating the seedlings with Topsin- M70 combined with magnetic saline water compared with non - fungicides and the efficiency of Topsin-M70 decreased with the increasing of salt water concentrations.

Table 4. Effect of irrigation with saline water, magnetic water and soil drench with Topsin-M70 on root rot disease incidence % of apricot seedlings infested with *F. solani* in 2014 and 2015 seasons.

Treatment		Disease incidence%					
		Season 2014			Season 2015		
(A) Salt content	(B) Soil	C1	C0	Mean	C1	C0	Mean
A1(Control) 270 mg/L	B1	0.00k	0.00k	0.00K	0.00j	0.00j	0.00K
	B2	8.33j	16.66i	12.49H	0.00j	8.33i	4.17J
	B3	33.33g	58.33d	45.83D	25.00g	50.00d	37.50D
Mean		13.89F	25.00D	19.44D	8.33G	19.44E	13.89D
A2 1000 mg/L	B1	0.00k	8.33j	4.17J	0.00j	8.33i	4.17J
	B2	16.66i	25.00h	20.83G	8.33i	16.66h	12.49H
	B3	41.66f	66.66c	54.16C	33.33f	58.33c	45.83C
Mean		19.44E	33.33C	26.39C	13.89F	27.77D	20.83C
A3 1500 mg/L	B1	0.00k	16.66i	8.33I	0.00j	16.66h	8.33I
	B2	25.00h	33.33g	29.17F	16.66h	25.00g	20.83F
	B3	50.00e	75.00b	62.50B	41.66e	66.66b	54.16B
Mean		25.00D	41.66B	33.33B	19.44E	36.11B	22.77B
A4 2000 mg/L	B1	8.33j	33.33g	20.83G	8.33i	25.00g	16.67G
	B2	33.33g	41.66f	37.49E	25.00g	41.66e	33.33E
	B3	58.33d	83.33a	70.83A	58.33c	83.33a	70.83A
Mean		33.33C	52.77A	43.05A	30.55C	50.00A	40.28A
G. mean		8.33C	25.00B	58.33A	7.99C	17.70B	52.08A
Mean (C)		22.91B	38.19A		18.05B	33.33A	
Mean (B)	B1	2.08F	14.58E		2.08E	12.50D	
	B2	20.83D	29.16C		12.50D	22.19C	
	B3	45.83B	70.83A		39.58B	64.58A	

*Means with the same letters are not significantly different according to Duncan's Multiple Range Test.
C1= magnetic water. C0 =non magnetized water.
A1 (Control) = seedlings watered with fresh Nile water, 270 mg/L. B1 = seedlings transplanted in non- infested soil.
B2= seedlings transplanted in infested soil drenched with Topsin-M70. B3 = seedlings transplanted in infested soil non- drenched with Topsin-M70.

Table 5. Effect of irrigation with saline water, magnetic water and soil drench with Topsin-M70 on root rot disease incidence % of apricot seedlings infested with *L. theobromae* in 2014 and 2015 seasons.

Treatment		Disease incidence%					
		Season 2014			Season 2015		
(A) Salt content	(B) Soil	C1	C0	Mean	C1	C0	Mean
A1(Control) 270 mg/L	B1	0.00g	0.00g	0.00j	0.00h	0.00h	0.00I
	B2	0.00g	8.33g	4.17I	0.00h	0.00h	0.00I
	B3	16.66f	33.33d	25.50E	16.66f	25.00e	20.83D
Mean		5.33F	13.89D	9.89D	5.55G	8.33E	6.94D
A2 1000 mg/L	B1	0.00h	8.33g	4.17I	0.00h	8.33g	4.17H
	B2	8.33g	16.66f	12.49G	8.33g	16.66f	12.49F
	B3	25.00e	41.66c	33.33C	16.66f	33.33d	25.66C
Mean		11.11E	22.22C	16.66C	8.33F	19.44D	14.11C
A3 1500 mg/L	B1	0.00h	16.66f	8.33H	0.00h	16.66f	8.33G
	B2	16.66f	25.00e	20.83F	16.66f	25.00e	20.83D
	B3	33.33d	50.00b	41.67B	33.33d	50.00b	41.67B
Mean		16.66D	30.55B	23.61B	16.66E	30.55B	23.61B
A4 2000 mg/L	B1	8.33g	33.33d	20.83F	8.33g	25.00e	16.67E
	B2	25.00e	33.33d	29.17D	16.66f	25.00e	20.83D
	B3	41.66c	66.66a	54.16A	41.66c	66.66a	54.16A
Mean		25.00C	44.44A	34.72A	22.22C	38.89A	30.55A
G. mean		8.33C	16.66B	38.66A	7.29C	13.54B	35.58A
Mean (C)		14.58B	27.86A		13.30B	24.30A	
Mean (B)	B1	2.08F	14.58D		2.08F	12.50D	
	B2	12.50E	20.83C		10.41E	16.67C	
	B3	29.16B	48.16A		27.41B	43.75A	

*Means with the same letters are not significantly different according to Duncan's Multiple Range Test.
C1= magnetic water. C0 =non magnetized water.
A1 (Control) = seedlings watered with fresh Nile water, 270 mg/L. B1 = seedlings transplanted in non- infested soil.
B2= seedlings transplanted in infested soil drenched with Topsin-M70. B3 = seedlings transplanted in infested soil non- drenched with Topsin-M70

4- Assessing the effect of irrigation with different concentrations of saline magnetic water and soil drench with Topsin-M70 on vegetative growth parameters of apricot seedlings infested with *F. solani*.

Data in Tables 6, 7, 8 and 9 illustrate that the combination of salinity and enhanced disease incidence led to significant reductions in vegetative growth parameters. There were correlation between increasing salinity and decreasing vegetative growth parameters of apricot seedlings. Treatment of less salinity (fresh Nile water, 270 mg/L) gave the higher vegetative characters as compared to the high salinity. Increasing irrigation-water salinity from 1000 to 2000mg/L significantly reduced plant height, leaves number, dry weight and leaf area in the two seasons. Vegetative growth parameters of apricot seedlings were significantly affected by salinity levels above 1000mg/L. Using a technique of magnetic treatment of saline irrigating water increased plant height, leaves number, dry weight and leaf area in the two seasons comparing with untreated irrigating water. The highest vegetative growth parameters were recorded in case of treating the seedlings with Topsin-M70 combined with magnetic saline water compared with non - fungicides and the efficiency of Topsin-M70 decreased with the increasing of salt water concentrations.

Table 6. Effect of saline water, magnetic water irrigation and soil drench with Topsin- M70 on plant height (cm/plant) of apricot seedlings infested with *F. solani* in 2014 and 2015 seasons.

Treatment		Plant height (cm)					
		Season 2014			Season 2015		
(A) Salt content	(B) Soil	C1	C0	Mean	C1	C0	Mean
A1(Control) 270 mg/L	B1	60.99a	59.55b	60.27A	63.30a	61.94b	62.62A
	B2	59.29b	58.31bc	58.80B	61.48b	60.89bc	61.19B
	B3	57.22c	55.58d	56.40CD	59.60d	56.37f	57.98CD
Mean		59.17A	57.81B	58.49A	61.46A	59.73B	60.60A
A2 1000 mg/L	B1	57.17c	55.36d	56.56C	59.73cd	57.30ef	58.52C
	B2	55.90d	55.13d	55.52D	58.30e	56.47f	57.39DE
	B3	54.57d	43.10e	53.83E	57.03f	56.20f	56.62E
Mean		56.08C	54.53D	55.31B	58.36C	56.66D	57.51B
A3 1500mg/L	B1	51.32f	44.33h	47.83F	54.33g	44.60j	46.07H
	B2	47.83g	41.20i	44.52G	51.70h	43.73jk	49.47F
	B3	44.90h	40.07i	42.49H	48.40i	42.87k	47.28G
Mean		48.02E	41.87F	44.94C	51.48E	43.73F	47.61C
A4 2000 mg/L	B1	37.87k	34.23k	35.41I	38.40l	34.60n	36.50I
	B2	36.60j	31.40lm	33.13J	36.63m	34.23no	35.43J
	B3	32.23l	30.23m	31.23K	36.13m	33.07o	34.60J
Mean		34.57G	31.95H	32.26D	37.06G	33.97H	35.51D
G. mean		50.02A	47.99B	45.99C	51.78A	50.42B	48.71C
Mean (C)		49.46A	46.54B		52.09A	48.52B	
Mean (B)	B1	51.83A	48.37BC		53.94A	49.61C	
	B2	49.91B	46.51CD		52.03AB	48.83C	
	B3	47.23C	42.24D		50.29B	47.13D	

*Means with the same letters are not significantly different according to Duncan's Multiple Range Test.
C1= magnetic water. C0 =non magnetized water.
A1 (Control) = seedlings watered with fresh Nile water, 270 mg/L. B1 = seedlings transplanted in non- infested soil.
B2= seedlings transplanted in infested soil drenched with Topsin-M70. B3 = seedlings transplanted in infested soil non- drenched with Topsin-M70.

Table 7. Effect of saline water, magnetic water irrigation and soil drench with Topsin-M70 on leaves number /plant of apricot seedlings infested with *F. solani* in 2014 and 2015 seasons.

Treatment		Number of leaves					
		Season 2014			Season 2015		
(A) Salt content	(B) Soil	C1	C0	Mean	C1	C0	Mean
A1(Control) 270 mg/L	B1	28.60a	28.34a	28.47A	30.93a	30.33a	30.63A
	B2	27.37b	27.33b	27.35B	28.67b	28.23bc	28.45B
	B3	26.46c	26.30c	26.38C	28.27bc	27.33d	27.80C
Mean		27.48A	27.33A	27.40A	29.29A	28.63B	28.96A
A2 1000 mg/L	B1	25.20ef	25.50de	25.35D	27.37d	27.00d	27.18D
	B2	26.00cd	24.80fg	25.40D	27.67cd	25.97e	26.82D
	B3	23.10hi	21.60k	22.35F	25.17f	24.77f	24.97E
Mean		24.77B	23.97C	24.37B	26.73C	25.91D	26.32B
A3 1500 mg/L	B1	24.23g	23.40h	23.82E	25.17f	25.13f	25.15E
	B2	22.50ij	22.03jk	22.27F	23.93g	23.00h	23.47F
	B3	20.30l	18.03n	19.17H	23.17h	20.77i	21.97G
Mean		22.07D	21.43E	21.75C	24.09E	22.97F	23.53C
A4 2000 mg/L	B1	20.53l	20.07l	20.30G	22.80h	20.80i	21.80GH
	B2	21.37k	19.27m	20.32G	22.73h	20.17i	21.45H
	B3	16.47o	15.37p	15.92I	19.10j	17.80k	18.45I
Mean		19.46F	18.23G	18.84D	21.54G	19.59H	20.57D
G. Mean		24.48A	23.83B	20.95C	26.19A	25.05B	23.30C
Mean (C)		23.40A	22.78B		25.41A	24.28B	
Mean (B)	B1	24.53A	24.43A		26.57A	25.81B	
	B2	24.31A	23.36B		25.75B	24.34C	
	B3	21.58C	20.33D		23.92CD	22.67D	

*Means with the same letters are not significantly different according to Duncan's Multiple Range Test.
C1= magnetic water. C0 =non magnetized water.
A1 (Control) = seedlings watered with fresh Nile water, 270 mg/L. B1 = seedlings transplanted in non- infested soil.
B2= seedlings transplanted in infested soil drenched with Topsin-M70. B3 = seedlings transplanted in infested soil non- drenched with Topsin-M70.

Table 8. Effect of saline water, magnetic water irrigation and soil drench with Topsin-M70 on dry weight (g/plant) of apricot seedlings infested with *F. solani* in 2014 and 2015 seasons.

Treatment		Dry weight(g/plant)					
		Season 2014			Season 2015		
(A)Salt content	(B)Soil	C1	C0	Mean	C1	C0	Mean
A1(Control) 270 mg/L	B1	15.22a	14.33b	14.78A	17.03a	14.65b	15.84A
	B2	13.55c	13.14bc	13.34B	14.43b	13.16c	13.70B
	B3	12.63d	11.23e	11.93C	13.05c	12.87cd	12.96C
Mean		13.8	12.9	13.35A	14.83A	13.56B	14.20A
A2 1000 mg/L	B1	10.39f	10.57f	10.47D	12.49cd	12.00ef	12.24D
	B2	10.20f	10.24f	10.22D	11.85f	11.69f	11.77E
	B3	9.75fg	9.43g	9.59E	11.61f	11.39de	11.50F
Mean		10.11	10.08	10.09B	11.98C	11.17CD	11.84B
A3 1500 mg/L	B1	9.31g	8.64h	8.97F	10.06g	9.81g	9.93G
	B2	9.20g	8.50h	8.85F	9.76gh	9.57gi	9.66H
	B3	7.12i	6.31j	6.71G	9.56g-i	9.32i	9.44I
Mean		8.54	7.82	8.34C	9.79D	9.57DE	9.68C
A4 2000 mg/L	B1	6.54j	6.54j	6.54G	9.03i	8.27j	8.65J
	B2	6.13j	5.66k	6.89H	7.23k	7.14kl	7.18K
	B3	5.60kl	5.60m	5.55H	6.65kl	6.42l	6.53L
Mean		6.09	4.26	6.01D	7.64F	7.27FG	7.46D
G. mean		10.19	9.57	7.71C	11.87	10.87	10.11C
Mean (C)		9.63	8.76		11.06	11.4	
Mean (B)	B1	10.36	10.02		12.15	11.18	
	B2	9.77	9.38		10.82	10.39	
	B3	9.44B	6.89C		11.07D	8.69E	

*Means with the same letters are not significantly different according to Duncan's Multiple Range Test.
C1= magnetic water. C0 =non magnetized water.
A1 (Control) = seedlings watered with fresh Nile water, 270 mg/L. B1 = seedlings transplanted in non- infested soil.
B2= seedlings transplanted in infested soil drenched with Topsin-M70. B3 = seedlings transplanted in infested soil non- drenched with Topsin-M70.

Table 9. Effect of saline water, magnetic water irrigation and soil drench with Topsin-M70 on leaf area (cm^2)/plant of apricot seedlings infested with *F. solani* in 2014 and 2015 seasons.

Treatment		Leaf area (cm^2)					
		Season 2014			Season 2015		
(A) Salt content	(B) Soil	C1	C0	Mean	C1	C0	Mean
A1(Control) 270 mg/L	B1	20.57a	20.10a	20.33A	19.70a	19.30a	19.50A
	B2	19.93a	18.40b	19.17B	18.63b	18.17bc	18.40B
	B3	18.10bc	17.80c	17.85C	17.77c	17.70c	17.73C
Mean		19.53A	18.77B	19.12A	18.70A	18.39A	18.55A
A2 1000 mg/L	B1	18.83e	17.77bc	17.28D	18.60b	18.17bc	18.38B
	B2	16.80d	15.87e	15.85E	16.40d	16.40d	16.40D
	B3	14.67f	14.60f	14.63F	15.50e	15.17e	15.33E
Mean		16.10C	15.74D	15.92B	16.83B	16.58B	16.71B
A3 1500 mg/L	B1	16.57d	14.90f	15.73E	16.30d	15.20e	15.75E
	B2	15.03f	14.63f	14.83F	16.40d	15.10ef	15.75E
	B3	13.93g	13.73gh	13.83G	14.47fg	14.40g	14.43F
Mean		15.18E	14.42F	14.80C	15.72C	14.90D	15.31C
A4 2000 mg/L	B1	12.90ij	12.47j	12.68HI	14.17gh	13.63hi	13.90G
	B2	13.17hi	12.60ij	12.88H	14.27gh	12.93j	13.60G
	B3	12.30j	12.23j	12.27I	13.13ij	12.80j	12.97H
Mean		12.89G	12.43H	12.61D	13.86E	13.12F	13.49D
G. mean		16.76A	15.80B	14.47C	16.88A	16.04B	15.12C
Mean (C)		16.09A	15.42B		16.29A	15.75B	
Mean (B)	B1	17.92A	16.31B		17.19A	16.57B	
	B2	16.23B	15.37C		16.42B	15.65C	
	B3	14.75D	14.59D		15.21CD	15.02D	

*Means with the same letters are not significantly different according to Duncan's Multiple Range Test.
C1= magnetic water. C0 =non magnetized water.
A1 (Control) = seedlings watered with fresh Nile water, 270 mg/L. B1 = seedlings transplanted in non- infested soil.
B2= seedlings transplanted in infested soil drenched with Topsin-M70. B3 = seedlings transplanted in infested soil non- drenched with Topsin-M70.

Discussion

Root rot resulted in mass mortality of young seedlings of commercial apricot seedlings in nursery. The occurrence of root rot fungi on apricot was examined in nurseries from 2013 to 2014. Fungi isolated from the roots were used for the infection of apricot seedlings in pots experiment. The most frequently isolated and the most pathogenic fungi were *Fusarium solani* and *Lasiodiplodia theobromae (syn. Botryodiplodia theobromae)* that cause high percentages of apricot seedling mortality. Seedlings showed a typical root rot with a poor fibrous root development.

Fresh water is the best option for plant growth and water shortage problem could stress plant and reduce its productivity. Shortage of fresh water is compelling researchers toward the use of saline irrigation water. Using water irrigation from local wells in reclaiming area of the desert where the availability of fresh water (non-saline) usually is limited as one of the alternatives. Salinity is the accumulation of salts (often dominated by sodium chloride) in soil and water to levels that impact on plants. Salinity is one of the problem predisposing factors makes plant more susceptible against disease and affect plant growth. Regarding tolerance to saline water apricot is considered to be highly sensitive to salinity and adversely affected by irrigation with saline water at levels exceeding 1000 mg/L. The incidence of root rot disease of apricot was significantly increased under irrigation with saline water, as observed under greenhouse conditions. Increasing irrigation-water salinity from 1000 to 2000 mg/L significantly increased mortality in apricot seedlings inoculated with *F. solani and L. theobromae* and reduced plant height, leaves number, dry weight and leaf area in the two seasons. The highest infection percentage was found at 2000 mg/L of water salinity, while the lowest one was when seedlings were watered with Nile water (270 mg/L) in the two seasons.

Several studies on the interactions between pathogens and salinity showed an increase of disease incidence at higher salinities such as the case for *Fusarium* crown rot in tomato; the increased root rot was attributed directly to the effect of salinity on the host without any concomitant salinity effect on the pathogen (Triky-Dotan *et al*. 2005). Surveys in Oman provided anecdotal evidence that farms with high salinity levels suffered proportionately higher levels of *Pythium* damping-off disease (Al-Kiyumi, 2006). Salinity increased the incidence of *Phytophthora* root rot of citrus (Blaker and MacDonald, 1986). Al-Sadi *et al*. (2010) found that increasing mortality in cucumber seedlings at higher salinity levels may imply a synergistic interaction between salinity stress and salinity-tolerant *Pythium* species on cucumber seedlings, resulting in greater seedling losses.

Bernstein and Kafkafi (2002) showed that high salinity may affect plant physiology via morphological, anatomical, metabolic, and biochemical changes, such as water relations; number and size of stomata; stem, leaf, root, and membrane structure; photosynthesis; protein synthesis; lipid metabolism; thickening of the cuticle; ion homeostasis and membrane function; water uptake and transport, salt accumulation; metabolic pathways; and synthesis of osmolytes, enzymes, and nucleic acids. The above changes inflicted on the plant by high salinity might be associated with increased susceptibility to the pathogen. Salinity may lead to decrease in other nutrient ions in the tissues, including K+, which frequently is connected with resistance to pathogens. Shani and Dudley (2001) explained that soil salinity affects the plant growth by producing an ionic imbalance or water deficit state in the expanded leaves. The yield loss related to reduced photosynthesis, high energy and carbohydrate expenses in osmoregulation and interference with cell functions in saline conditions. Parida and Das (2005) showed that as salts accumulate in saline discharge areas they can reach levels that affect plants in a number of ways. Under normal conditions, plants readily obtain water from the soil by osmosis (movement of water from a lower salt concentration outside the plant to a higher salt concentration in the plant). As soil salinity increases this balance shifts making it more difficult for plants to extract water. Plant growth can be directly affected by high levels of toxic ions such as sodium and chloride. Excess sodium accumulation in leaves can cause leaf burn, necrotic (dead) patches and even defoliation. Plants affected by chloride toxicity exhibit similar foliar symptoms, such as leaf bronzing and necrotic spots in some species. An excess of some salts can cause an imbalance in the ideal ratio of salts in solution and reduce the ability of plants to take up nutrients. This leads to poor plant health, a loss of productive species and dominance of salt-tolerant species. Nischwitz *et al*. (2002) showed that salt stress is one of the important factors for increased incidence of *M. phaseolina* rot in melon.

Magnetic water is water that has been passed through a magnetic field. Magnetic water treatment devices are environmentally friendly, with low installation costs and no energy requirements. Therefore, they take an important place in the list of environmental clean methods and harmless technology (Abou El-Yazied *et al.* 2012). Magnetic water treatment is currently used in Australia, Bulgaria, China, England, Japan, Poland, Portugal, Russia, Turkey and the United States for many purposes (Qados and Hozayn, 2010). Using a technique of magnetic treatment of saline irrigating water decreased apricot disease incidence and increased plant height, leaves number, dry weight and leaf area in the two seasons comparing with untreated irrigating water. The lowest disease incidence and the highest vegetative growth parameters were recorded in case of treating the seedlings with Topsin-M70 combined with magnetic saline water compared with non - fungicides and the efficiency of Topsin-M70 decreased with the increasing of salt water concentrations. These results are in harmony with findings obtained by Radhakrishnan and Kumari (2012) who reported that magnetic water can be used to decrease the disease incidence and improved the plant growth characteristics and nutrients uptake in soybean. Mahmoud and Abdul Qados (2010) showed that magnetized water significantly increased plant height, fresh and dry weight (g/plant) and protein content of Chick-pea. Also**,** the irrigation by magnetized water increased significantly plant height, no. of leaves / plant, fresh and dry weight, as well as survival rate, N and P% than those irrigated by non-magnetized water on young seedlings of pears betulaefolia rootstock (Osman *et al.* 2014). Germination of broad bean seeds was found to take place 2-3 days earlier when seeds underwent magnetic treatment (Podleoney *et al.* 2004). The irrigation with magnetic water proved to be a good technology to enhance growth, yield and quality of onion when compared with non-magnetized water (El Sagan and Abd El Baset, 2015). Sami and Ali (2009) reported that high level of saline in irrigating water decreased quality of vegetative characters of *Gerbera james*. Magnetized saline irrigating water increased number of leaves; leaves area; chlorophyll percentage, off shoot and fresh and dry weight of leaves of 4 ds/m level .The application of a magnetic field on water decreased the hydration of salt ions and colloids, having a positive effect on salt solubility, accelerated coagulation and salt crystallization. Magnetic water increased leaching of excess soluble salts, lowered soil alkalinity and dissolved slightly soluble salts (Hilal and Hilal, 2000). Magnetic water is considered one of the several physical factors affects plant growth and development. Magnetic water fields are induced biochemical changes and use as a stimulator for growth, the treated water by a magnetic device called magnetic water, when water is magnetized, some chemical and physical properties changed that may be causing changes in plant characteristics, growth, and production (El Sayed, 2014). Magnet water treatment does not change the chemistry of the water. It alters the structure of liquid water. No effect on super-molecules in normal water. However, in a magnetic treatment device, as the water passes through the magnetic field, all super-molecules vibrate. This will intensify the internal vibration of these super-molecules to the breaking point. These super-molecules fracture and release their encaged particles. Thus the two ions (positive and negative, or cations and anions, respectively) of a kind needed to form scale are never able to come close enough together to initiate the scale forming reaction. After magnetization, the molecules line up in sequence “+-+-” resulting in reduced surface tension, reduced viscosity, increased dissolvability, increased permeability and increased oxygen content hence making nutrients more readily available to plants. Fracturing of a number of super-molecules of the treated water decreases the surface tension. Surface tension plays a key role in the effective irrigation of plants. Magnetically treated water runs off a cleaned surface faster and in thinner sheets because surface tension is reduced. Due to reduction of surface tension the movement of water is fast in plant system. Hence plant absorbs more water results in faster growth (Siddeswaran *et al.* 2013).

It may be concluded from the present finding that the incidence of apricot root rot disease increases as salinity of irrigation water is increased. This fact must be taken in consideration especially with apricot plantations in cultivated areas depending mainly on ground water which has higher salinity concentration. Magnetized saline irrigating water may be used throughout integrated pest management (IPM) to keep environment clean and keep human health. Before this technology can be recommended to use, could be need for more studies.

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تأثير الرى بالماء المالح الممغنط على مكافحة مرض عفن الجذور ونمو شتلات المشمش

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تؤدى الإصابة بمرض عفن الجذور إلى موت الكثير من شتلات المشمش فى المشتل . وكان كلا من فطرى فيوزاريوم سولانى ولاثيوديبلوديا ثيوبرومى أكثر الفطريات تكرارا فى العزل من الشتلات المصابة كما كانا أكثر قدرة على إحداث المرض. يعتبر الماء المالح المستخرج من الأبار هو المصدر البديل لمياة النيل وذلك لرى المحاصيل فى الأراضى الصحراوية المستصلحة. ولقد أجريت تجربة فى الصوبة فى عامى 2014 ،2015 لدراسة تأثيرى الشتلات بتركيزات مختلفة من الماء المالح والماء المالح الممغنط (1000، 1500، 2000 ملليجرام/ لتر) مقارنة بالرى بماء النيل (270 ملليجرام/ لتر) على مرض عفن الجذور ونمو الشتلات . ولقد أثبتت النتائج أن الشتلات التى رويت بالماء المالح كانت أكثر إصابة من الشتلات التى رويت بماء النيل. ولقد أدت زيادة الملوحة من 1000 إلى 2000 ملليجرام/ لتر إلى زيادة موت الشتلات ونقص طول الشتلات وعدد الأوراق والوزن الجاف ومساحة سطح الورقة فى الشتلات المعدية والغير معدية فى الموسمين. لذا فإن حل مشكلة ملوحة ماء الرى يتطلب إستخدام مصادر المياة المتاحة عن طريق مغنطة الماء المالح. ولقد أثبتت النتائج أن مغنطة الماء المالح أدت إلى نقص الإصابة بالمرض وزيادة طول الشتلات وعدد الأوراق والوزن الجاف ومساحة سطح الورقة للشتلات الغير معدية والمعدية فى الموسمين. وكانت أقل نسبة إصابة وأعلى نمو سجل فى الشتلات المروية بالماء الممغنط والمعاملة بمبيد توبسين إم 70 مقارنة بالشتلات الغير معاملة ولقد قلت كفاءة المبيد بزيادة تركيز الماء المالح.