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Effect of Magnetic Water Treatment on Salt Tolerance of Selected Wheat Cultivars

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Abstract: The morphological characters were used in this study to estimate the effect of magnetic water on plant growth of some selected cultivars of wheat under saline condition,and also to estimate the salt tolerance of these selected cultivars as compared with the local cultivar during the germination and seedling stages. Results showed that the selected cultivars (Digila and Furrat) were superior in all growth characters measured to those of the local cultivar (Tamooz 2) at both water treatments when grown in salinized soil (EC= 16 days/m). The selected cultivars exhibited more than twice and third shoot and root fresh and dry weights compared with that obtained from Tamooz 2 cultivar. Results also indicated that the highest value percentage of realizing response to the water treatments was in magnetized water in both cultivars, but the growth of selected cultivars was much higher than those of the local cultivar(Tammoz 2). It is important to bear in mind that the significant improvement in selected cultivars (Dijila and Furrat) was achieved in their salt tolerance, and also the significant improvement in growth of all cultivars used was achieved by using magnetic water. There is then a strong possibility that further increase in salt tolerance obtained by using magnetic water.

Keywords*: magnetic water treatment, wheat cultivars*

Introduction

The abiotic stresses such as salinization and aridity have become the main problem in upgrading the yield production per unit and total yield of wheat by a big margin in Iraq. The genetic improvement of salt tolerance in wheat is paying more attention by the breeders to overcome salinity problem to sustain increases in food production (Munns 2005). Plant breeders have made significant achievements improving salinity tolerance in a number of agriculturally potential crops through artificial selection and conventional breeding techniques (Shannon 1998; Ashraf 2002).

The development of new genotypes or cultivars with high salt tolerance is very important in Iraq to exploitation of salt affected soils in the middle and south of Iraq. Some genotypes and cultivars have been selected for salt tolerance through improvement and breeding programgrown well under saline conditions (Al-Mishhadani, 2012). On other hand, Epstein *et al*. (1980), reported that salt tolerant line of crop species an attractive possibility for exploitation of salt affected soils and for overcoming the salinity problems.

Various effortshave been made from time to time to improve seed germination plant growth and yield production under saline condition using multidimensional approaches. One of these approaches, in addition to the breeding and genetic approach is using magnetized water for irrigation (Babar Ijaz, et al 2012). The improvement in seed germination that is very important stages in plant growth have been achieved by magnetic field (Pietruszewski and Kania 2010). This treatment has been used alone or with other invigoration techniques to shorten the period between planting and emergence (Basra et al. 2002). Studies have shown that germination characters of the maize seedsexposed to a magnetic field are enhanced (Anjati et al. 2012). Also wheat seeds exposed to magnetic fields of 50 to 300 μT increased seedling vigor, respiratory quotient and α-amylase activity as compared to control seeds. On the other hand, Samir (2008) reported that some physical and chemical properties changed when water pass through a magnetic field, therefore the magnetized water has different chemical and physical properties and action than ordinary water. N. Hirota et al. (1999) studied the effect of magnetic field on the germination and growth of cucumber plants, when a lot magnetic field was applied, shoot length increased . But Samir (2008) reported that the static electromagnetic field had no effect on root length, but there was a significant increase in the number of root hairs.

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The present studyaimed to assess the possibility of improving salt tolerance of some selected cultivars under saline conditions by using magnetized water.

Material and Methods

Two pot experiments were conducted in the plastic house during two seasons (2012-2011, 2011-2012) to study the response of growth of wheat selected cultivars for magnetized water under saline conditions. The two wheat cultivars (Furrat and Digila) were selected through plant improvement and breeding program (Iraq). The experiments were carried out in pots, set up in a glass house in a completely randomized design with three blocks. The pots were filled with salinized soils which the electrical conductivity (EC) was 16 ds/m at the both season. In the first season (2010-2011) Dijila and Tamooz 2 (local cultivar)cultivars were applied, while in the second season (2011-2012) Furrat and Tamooz 2 also applied . Sowing date was in the third week of November in both seasons. Half of the potwas irrigated with magnetized water (2000 Gauss), while the other pots were irrigated with the raw water for all growth stages. Six seeds in each pot were sown and NPK and N fertilizer were applied through the period of the experiment.

At 60 days from sowing date, plant fresh and oven dry weight of shoots and roots were determined. The percentage of the response to the magnetized water was calculated. Data were subjected to analysis of variance according to the experimental design.

Results and discussion

Shoot fresh and dry weight

The change of growth characters of the shoots wheat plant of the two cultivars and of the two water treatments under saline condition is shown in table 1. There are significant differences between Dijila and Tamooz 2 cultivars in shoot fresh and dry/pot weights under saline conditions at both water treatments. The total fresh and dry weights of the Dijila cultivar were less affected than those of the local cultivar (Tamooz 2) were grown at salinity condition (16 ds/m) which exhibited higher shoot fresh and dry weights than local cultivars (Table 1). At the two water treatments, Dijila cultivar gave shoot fresh and drier weights more than four times to those of Tamooz 2 cultivars, when grown at salinity condition (EC 16 ds/m).

The results of shoots dry weight of Furrat and local cultivar (Tamooze 2) of the second season are summarized in table 3. There were significant differences between Futrrat and Tamooz cultivars in shoots dry weight/plant at the both water treatments were grown at salinity condition (EC= 16 ds/m). At the both treatments, there is a significant increase in shoot dry weight/plant of Furrat cultivar as compared with those of Tamooz 2 cultivars (Table 3).

This result reflects the large differences between Dijila , Furrat and Tamooz 2 cultivars in their salt tolerance. Improving cultivars with high salt tolerance, which can be grown in salt affected soils to provide acceptable growth and seed yield overcome salinity problems (Al-Mishhadani, 2012). The variability in response to the growth of the two cultivars to salinity was examined at germination and seeding stage, since in wheat, those stages are considered as being more sensitive to salinity than the adult one (Maas and Hoffman, 1977). Clearly, the results of several works indicated that there is a strong correlation under saline conditions between early development and yield at harvest stage (Al-Mashhadani and Al-Hadithi, 2006, Al-Mishhadani, 2012). These differences between the two cultivars in their responses to salinity due to the genetic variation in salt tolerance (Azhar and McNeilly, 1989, Al-Mishhadani et al, 2003, Al-Mishhadani, 2012). However , the superiority of the Dijila cultivar in shoot fresh and dry weights of the local cultivar (Tamooz 2) may due to the superiority of these cultivars in plant height, number of tiller/plant , and in leaf number and width.Similarly,Al-Mishhadani (2012) reported that high shoot fresh and dry weights means high tillers and leaves number which are very important for yield production under salt conditions.

The results of analysis of variance showed that there are significant differences between the magnetic and raw water in their effects on shoot fresh and dry weight of the both wheat cultivars. The changes of shoots fresh and dry weight of wheat plants irrigated with magnetic and raw water are shown in Tables (1,3). Wheat plants of the both cultivars irrigated with magnetic water exhibited highly significant increases in plant shoot fresh and dry weight over the control that irrigated with raw water under salinity condition. On average over both seasons, these increases were much higher in Furrat cultivar at the above parameters (Table 1,3).

The percentage of the response to magnetic water was summarized in table (4), this result revealed that the percent of the response reached to 82%, 88.8%, 78.9% and 81.8%of the first season and 45.1%, 40.8% on the second season in the above parameters, respectively.

The stimulatory effect of magnetized water on the shoot growth reported in this study may be due to the increase in seed germination percentage, plant tillering and leave number and area. In this connection, Aladjadiyan (2002) showed that exposure of Zea mays seeds to magnetic water has a favorable effect on the development of shoots in the early stages. This is very important for the response of plants to the salinity,since this stage is moresensitive to salinity than others growth stages (Maas and Hoffman, 1977). Clearly, Al-Mashhadani (2012) indicated that there is a strong correlation under saline conditions between early development and yieldat harvest stage. Also the results confirming that seedling performance of wheat plants can provide a good pointer to adult performance in these species. Atak et al. (2003) and Aycih and Alikamanaglu (2005) concluded that magnetic field increased the shoot and regeneration rate and their fresh weight in soybean and Paulownia organ cultivars. Also moreover, Alike et al (2008) and Nasher (2008) concluded that, magnetized water increased plant growth. On other hand ions mobility and ion uptake improved under magnetic field(Pietruszewshi, 1999), and this is very important for photo stimulation and growth in wheat plants. This is an improvement in shoot growth may be due to the biochemical changes and altered enzyme activities. Moreover , the magnetic field has the ability to change water properties. Thus, magnetized water increase rice chlorophyll content (Tian et al. 1989). Similarly, the observed results of this study, indicated that theleaves color more darker green under magnetic field than those of raw water.

Root fresh and dry weight

The results of root fresh and dry weight of the both season, in Table 2,3 shows that the root fresh and dry weight of Dijila and Furrat cultivars were significantly much higher than those of local cultivars (Tamooz 2) at both water treatments, when grown under salinity conditions (EC=16 ds/m). The two selected cultivars (Dijila and Furrat) were superior in root fresh and dry weights perpot or per plant at 16 ds/m to those of the local cultivar (Tamooz 2) at both water treatments (Table 2,3). This reflects the large differences between the two selected cultivar and local cultivar in their salt tolerance. Similar results to those reported here have been confirmed by Al-Mashhadani and Al-Hadithi, 2006. This improvement in salt tolerance in the two selected cultivars (Dijila and Furrat) may due to that theses cultivars were selected from F2 population which generation generally contains a much wider range of genetic variation in salt tolerance after exposure of these materials to the salinity (EC=30 ds/m) for 6-5 cycles of screening and selection. Therefore, there is a big genetic variation in salt tolerance between the two cultivars (Dijila and Furrat) and local cultivars (Tamooz 2).

The results in Tables 2,3 shows that irrigation wheat plants with magnetized water induced significant marked increase in root fresh and dry weight of all cultivars as compared to the raw water. At magnetic treatment, the root growth of Dijila and Furrat cultivars much higher than those of Tamooz 2 cultivars. Similarly , Atak et al. (2003), Aycih and Alikamanoglu (2005), and Tahir and Karim (2010) concluded that magnetic field increased shoot and root growth of soybean and chickpea.According to this result , the magnetic field has a significant effect on water and therefore on plant growth. Also,this result reflected that irrigated wheat plants with magnetic water improved root growth under salinity condition, which is an important point to improve salt tolerance in wheat plants. Since there is a high correlation between root growth and salt tolerance under salinity conditions.

Table 1. Effect of magnetic water on shoot growth of wheat cultivars grown under salinity conditions in the first season.

Cultivars	Shoot fresh weight (mg/pot)		Shoot dry weight (mg/pot)	
	Treatments		Treatments	
	Raw water	Magnetic water	Raw water	Magnetic water
Dijila	81.4	823	43.8	371
Tamooz 2	21.3	270	18.0	180
LSD(0.01) C x t		43.2		12.2

Generally, the conclusions of this result are magnetized water has very affective effects on seed germination and plant growth under salinity conditions, and also the selected cultivars (Dijila and Furrat) are more salt tolerant than the local cultivarsespeciallyof magnetized water when grown at a high salinity level.

Table 2: Effect of magnetic water on root growth of wheat cultivars grown under salinity conditionsin the first season.

Cultivars	Root fresh weight (mg/pot)		Root dry weight (mg/pot)	
	Treatments		Treatments	
	Raw water	Magnetic water	Raw water	Magnetic water
Dijila	124.8	850	58.9	303
Tamooz 2	83.0	389	40.8	114
LSD(0.01) C x t	40.9		12.2	

Table 3. Effect of magnetic water on shoot growth of wheat cultivars grown under salinity conditions in the second season.

Cultivars	Shoot dry weight (mg/pot)		Root dry weight (mg/pot)	
	Treatments		Treatments	
	Raw water	Magnetic water	Raw water	Magnetic water
Furrat	70.5	128.4	14.7	30.4
Tamooz 2	48.1	81.6	8.1	16.9
LSD(0.01) C x t	2.8		1.32	

Table 4. Percentage of wheat cultivars response to magnetic water under salinity conditions.

Cultivars	First season 2010-2011				Cultivars	Second season 2011-2-12	
	Shoot weight		Root weight			Shoot dry weight	Root dry weight
	Fresh	Dry	Fresh	Dry			
Dijila	82.0	78.9	74.6	67.5	Furrat	43.1	51.6
Tamooz 2	88.8	81.8	63.8	43.6	Tamooz 2	40.8	52.1

References

Aladjadiyan A, (2002) Study of the influence of magnetic field on some biological characteristics of *Zea mays. J. Cell Moll. Biol.*, **2**, 113-119.

Al-Mashhadani II, Al-Shamma Azi-Aldeen M, Attiya HJ, (2003) Some genetic studies of salt tolerance in yield and its components of some selected genotypes of wheat. *J. Iraqi Agri. Sci.* **34,** 111-118.

Al-Mashhadani II, Al-Hadithi A, (2006). Estimation of salt tolerance by some selected genotypes of wheat under naturally salinized field condition. *J. of Agri. Explo.*, **4**, 74-78.

Al-Mashhadani I. I. (2012). Breeding and selection of some lines of bread wheat for salt tolerance. *J. of Agri. Sci. & Tech. **B2***, 934-939.

Anjali A, Shantha N, Verma APS, Jashi DK, Pathak PC, Jyotana B, (2012) Pre-treatment of seeds with static magnetic field ameliorates soil water stress in seedling of maize (*Zea mays* L.). *Indian J. Biochem, & Biophys.*, **49**, 63-70.

Ashraf M, (2002) Salt tolerance of cotton: Some new advance. Plant Sci., **21**, 1-30.

Atak C, Emiroglu O, Aklimanoglu S, Rzakoulieva A, (2003) Stimulation of regeneration by magnetic field in soybean (*Glycine max* L. Merrill) tissue cultures. *J Cell Mol. Biol.*, **2**, 113-119.

Aycih O. and Alikamanoglu S. (2005).The effect of magnetic field on Paulownia tissue culture plant cell.Tissue and Organ Culture. **83**(1): 1109-1114.

Azhar FM, McNielly T, (1989) Heritability estimates of variation for NaCl tolerance in sorghum bicolor. J. *Agron. And Crop Sci.*, **159**, 269-277.

Babar Ijaz, Shakeel A, Jatoi, Dawood A, Shahid M, Sadar US, (2012).Changes in germination behavior of wheat seeds exposed to magnetic field and magnetically structured water. *African J. Biotech*, **11**, 3575- 3582.

Basra SMA, Zia MN, Mehmood T, Afzal I, Khaliq A (2002) Comparison of different invigoration techniques in Wheat (*Triticum aestivum* L.) seeds.Pak. *J. Arid. Agric.* **5**, 11-16.

Epstein E, Norlyn JD, Rush DW, Kingsbury RW, Kelley DB, Cunningham GA, Wrona AF, (1980) Saline Culture of Crops: A Genetic Approach. *Science*, **210** (4468), 339-404.

Hirota N, Nakagawa J, Kitazawa K, (1999) Effects of a magnetic field on the germination of plants. *J. Appli. Phy*., **85**, no.8.

Maas EV, Hoffman GJ, (1977) Crop Salt Tolerance–Current Assessment.J.of the Irrigation and Drainage Division, **103**, 115-134.

Munns R, (2005) Genes and salt tolerance: bringing them together. *New Phytologist*, **167**: 645-665.

Nasher SH, (2008) The Effect of magnetic water on growth of chick-pea seeds. *Eng. & Tech*. **26**,(9).

Pietruszewski S, (1999). Influence of pre-sowing magnetic biostimulation on germination and yield of wheat. *Int. Agrophys*., **13**, 241-244.

Pietruszewski S, Kania K, (2010) Effect of magnetic field on germination and yield of wheat. Int. Agrophys., **24**:297-302.

Samir H,Nasher, (2008) The Effect of Magnetic Water on Growth of Chick-Pea Seeds. *Eng. & Tech*. **26**, No.9.

Shannon MC, (1998), Adaptation of plants to salinity.Advn.Agron., **60**, 75-119.

Tahir N, Karim HFH, (2010) Impact of magnetic application of the parameters to growth of chick pen. *Jordan J. of Biological Sci*. **3**, 175-184.

Tian WX, Kuang YL, Mei ZP, (1989) Effect of magnetic water on seed germination, seedling growth and grain yield of rice. *J Jilin Agric Univ*., **11**, 11-6.