The effect of magnetic water on some of the components of sunflower plant

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Abstract: In order to investigate the effect of magnetic water on some of the components of sunflower plant under salt stress, a factorial experiment was conducted in a completely randomized design with two water type factors (W) and salinity (S) in three replications at the Research Faculty of the Faculty of Engineering Sciences Shahid Chamran School of Ahvaz was launched. The water type factor was investigated as the main factor including two levels, magnetic water (W1) and normal (W2) and salinity factor as a sub-factor including three levels, salinity of Karun River (S1), water salinity of 4 dS/m (S2) and 6 dS/m (S3). The results showed that the magnetic water increased 7.8 and 6.6 plant height and stem diameter compared to the control. Treatment S1 (salinity of Karun River water) and S3 treatment (salinity 6 dS/m) had the most negative effects on sunflower plant yield components.
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1. Introduction

Restricting access to freshwater and increasing population has led humans to use savory and unconventional water for their food supplies. According to available statistics, more than 10.6 billion cubic meters of surface water in Iran are salty water (Nowshadi et al., 2013).

Salinity of irrigation water and soil causes various morphological, physiological and biochemical changes in plants. In addition, salt tolerance in plants is not a constant and may vary in different stages of growth of each species (Sairam and Srivastava, 2001). Therefore, the use of saline waters or unconventional waters in agriculture without proper management reduces the quantity and quality of the products. In this regard, one of the methods used in recent years in agricultural water management is to cross the irrigation water from a magnetic field. By magnetizing irrigation water without adding or lowering water, the physical and chemical properties of water, such as hardness, specific gravity, viscosity, salinity, surface tension, electrical conductivity and solubility change. In this situation, due to the lack of use of chemicals to remove calcite, environmental contamination does not occur in this way (Ahmadi, 2010). This technology, while changing the physical and chemical properties of water, improves its refining power and solubility so that the plant easily absorbs and uses essential nutrients for its growth, and the remaining soluble and non-useful materials are directed to drainage systems and vents. Existing plants simply allow these crushed minerals to pass through the drains of the lower classes of soil (Ashrafi and Behzad, 2011). Therefore, the use of magnetized water on the growth and yield of plants, despite the huge resources of salt water, should be considered. Esitken, and Turan (2004) observed using magnetized irrigation water that increased the number of flowers and aerial parts and the total amount of strawberry fruit. Turker et al. (2007) investigated the effects of magnetic field on root dry weight of corn and sunflower seeds and concluded that the magnetic field on corn root dry weight was ineffective but increased the dry weight of the sunflower root. Nashir (2008), investigated the effect of magnetic water on the growth of chickpea seedlings, which significantly increases the irrigation of magnetic water from the crop and plant height. Amira et al. (2010) emphasize the effect of magnetic water on performance, yield components and Chemical properties of lentil were observed and observed that irrigation of lentil plants with magnetic water, plant height, fresh and dry weight of the plant increased compared to control treatment Ahmadi et al. (2014) investigated the effects of magnetic water on the morphological traits of Stevia rebaudiana Bertoni. The results showed that magnetic water had a significant effect on height, chlorophyll, leaf area index, leaf length, leaf fresh and dry weight at 1% level, and concluded that magnetized water greatly improved morphological traits the plant is stevia. According to the review of the sources, the optimal effect of magnetic water on the growth and yield of plants is seen. The purpose of this study was to investigate the effect of magnetic water on some of the components of Sunflower plant under salt stress.

2. Material and Methods

This research was carried out in a field experiment at the Faculty of Water Engineering, Shahid Chamran University of Ahvaz, on sunflower hysun25. Factorial experiment was conducted in a completely randomized design with two water type factors (W) and salinity (S) in three replications (R). The water type factor as the main factor consists of two levels, magnetic water (W1) and normal (non-magnetic) (W2) and salinity factor as a sub-factor including three levels, salinity of the Karun River (S1), water salinity of 4 dS/m (S2) and 6 dS/m (S3). It should be noted that the salinity of Karun river water with a mean salinity of 2.2 dS/m was considered as a control treatment. The cultivation took place on January 30, 2017, manually with a distance of 30 cm from each other in 18 rows, 6 meters long and 75 cm apart.

The plants were irrigated in order to settle with Karun River water and applied on March 28, 2017. Irrigation scheduling was carried out in order to keep soil moist and kept constant for two days using a class A evaporation pan. In order to provide magnetic water, the Aqua Correct device was used within a half-inch path with a field strength of 6500 Gauss. The method of preparation of saline water was that at first, water drainage with salinity of 13.6 dS/m from the farm No. 2 of the Faculty of Agriculture of Shahid Chamran University of Ahvaz was prepared and then by mixing with the water of the river Karun with an electrical conductivity of 2/2 dS/m, with salinity of 4 and 6 dS/m. The plant was picked up on July 7, 2017. The traits included the plant height, stem diameter, fresh and dry weight of the stem, fresh and dry weight of the leaves. To this end, 10 plants per row (a total of 180 plants) were ground and immediately transferred to the laboratory. After separating the plant components from the height of the plant with one meter of fabric and the stem diameter was measured by the caliper, the fresh weight of the stem and leaf was measured with a digital scale, and then in an oven at 70 ° C for 48 hours And their dry weight was measured. Statistical analysis of data was done using SPSS22 software and comparison of the meanings by Duncan's multi-domain test.

3. Results and Discussion

stem height

According to the analysis of variance table, the effects of water type and salinity on sunflower plant height have a significant effect on 1% level. However, the interaction between type of water and salinity on plant height was not significant (Table 1). The use of magnetic water increased the height of the plant by 14.7 cm (7.8%) compared to non-magnetic water. Huzayin and Abdul Qados (2010) reported that irrigation of wheat plants increased by 13.58% with magnetic water. Magnetic water appears to increase the water solubility of the water, and as a result, absorption of food from the soil increases the plant's vegetative growth. As the salinity increases, plant height decreases (Table 2). It is also observed that the highest and lowest stem height is related to salinity S1 and S3, which is 191.8 and 162.78 cm, respectively. According to Table 2, there was no significant difference between S2 and S1 treatments, and both treatments were in group a, while S3 was significantly different in group b (Table 2). It seems that decreasing plant height by increasing salinity of irrigation water can be attributed to the disruption of the photosynthesis system and the reduction of photosynthetic material production to be sent to the growing parts of the plant and hence the lack of access to the plant to the genetic potential in terms of height. Shannon (1986) states that increased salinity in the water and root environment causes a sharp decrease in the growth of the aerial and plantar stalks, causing significant damage to the plant's yield. Khan et al. (1995) also stated that the negative effects of salinity on plant growth due to low osmotic potential of the soil solution (osmotic stress), ionic effects (salinity stress), nutritional imbalance or a set of these factors are caused, so when The plant grows in saline conditions, its photosynthesis activity decreases and can reduce the length of the stem (Viera Santos, 2004).

Table 1: Analysis of variance of evaluated traits

sources Change	df	stem height	Stem diameter	wet weight of Stem	dry weight of Stem	wet weight of leaf	dry weight of Leaf
R	2	8.15^{ns}	3.85^{ns}	26358.51^{ns}	36092.7^{ns}	275571.35^{ns}	85454.11^{ns}
W	1	972.41**	9.67**	382553.25*	146761.52^{ns}	3939311.99**	333018.58^{ns}
S	2	1411.16**	22.68**	2260124.12**	1422430.3**	9670855.09**	1571590.84**
W×S	2	82.12^{ns}	0.07^{ns}	31744.87^{ns}	7218.28^{ns}	217608^{ns}	18963.73^{ns}
Error	10	39.52	0.95	74381.68	44985.32	282337.96	186657.68

ns: is not statistically significant, **: significant at the one percent level, *: significant at the five percent level

Table 2: Comparison of the mean of the evaluated traits

Treatment	Stem height (cm)	Stem diameter (mm)	wet weight of ($kg.ha^{-1}$)Stem	dry weight of ($kg.ha^{-1}$) Stem	wet weight of leaf($kg.ha^{-1}$)	dry weight of Leaf($kg.ha^{-1}$)
W1	187.51 a	22.22 a	4387 a	3776 a	5336 a	4544 a
W2	172.81 b	20.78 b	4095 b	3595 a	4400 b	4272 a
S1	191.8 a	23.2 a	4761 a	4076 a	6068 a	4897 a
S2	185.9 a	21.9 b	4398 b	3840 a	4996 b	4450 a
S3	162.78 b	19.38 c	3564 c	3140 b	3540 c	3876 b

The columns with common letters do not differ significantly from the Duncan test at the 5% level.

Stem diameter

According to the results of the analysis of variance table, it can be seen that the type of water and salinity had a significant effect on the diameter of the stem at 1% level. However, the interaction between type of water and salinity on stem diameter was not significant (Table 1). Sunflower stem diameter in irrigated water was larger than the control plants (irrigation with non-magnetic water) (Table 2). Irrigation with magnetic water caused a 6.6% increase in diameter of the plant than irrigation with non-magnetic water. Nikbakht et al. (2013) stated that the use of magnetic water in corn increased by 16.26% stem diameter.

Comparison of mean stem diameter in saline treatments showed that the highest stem diameter (23.2 mm) was related to S1 treatment and the lowest stem diameter (19.38 mm) was related to S3 treatment. Increasing salinity of S2 and S3 reduced the stem diameter by 5.6 and 16.48%, respectively, compared to control (S1). The results showed that there was a significant difference between stem diameter in S1, S2 and S3 treatments and in different statistical groups (a, b and c) (Table 2). The decrease in stem diameter seems to be due to the increased transfer of stock material from the stem and petiole to other parts of the plant, in order to reduce the photosynthesis activity. Dehghani et al. (2014) reported that applying salt stress, with 5, 8 and 11 dS/m salinity, decreased 3.5, 7.7 and 12.3 percent, respectively, and compared to control treatment.

Wet and dry stem weight

According to the results of the analysis of variance table, the effect of water type on stem fresh weight was significant at 5% level but did not have a significant effect on stem dry weight. It is also observed that salinity has a significant effect on the fresh and dry weight of the shoot at 1% level. However, the interaction between type of water and salinity on fresh and dry weight of stem were not significant (Table 1).

According to the results of Table 2, irrigation with magnetic water causes the fresh weight and stem shoots increase compared to irrigation with non-magnetic water. Average fresh and dry weights of irrigated water were 4387 and 3776 kg ha-1, respectively, which is expected to increase 6.6% of stem fresh weight and 4.8% of stem dry weight. The ratio of control treatment (non-magnetic water) has been. Probably, irrigation with magnetic water causes the plant to get more nutrients from the soil and to get better in the plant system of the cell, and therefore the product yields. Mohammadian et al. (2015) reported that irrigation with magnetic water had a significant effect on fresh weight of green pepper plant stem, but not significant on stem dry weight. Also, according to Table 2, fresh and dry weight of the stem decreases with increasing salinity. So that the weight of the dry weight of the stem was reduced from 4761 and 4076 kg/ha in S1 to 3564 and 3140 kg/ha in S3 treatment. It seems that salinity stress reduces the dry weight of the organs by reducing vegetative growth and reducing photosynthesis. Decreasing vegetative growth and dry weight due to decreased stem cell inflammation in the salinity layer and affected by osmotic processes. Another reason for the decrease in plant growth and yield by salinity is the increase in energy consumption in the plant for the release of aggressive sodium ions, which are abundant in the environment. As a result, it consumes a lot of cellular energy to adapt and deal with salinity stress, which ultimately reduces the growth and yield of the plant.

Wet and dry leaf weight

According to the results of the analysis of variance table, the effect of water type on leaf fresh weight was significant at 1% level but did not have a significant effect on leaf dry weight. It is also observed that salinity has a significant effect on fresh and dry leaf weight at 1% level. However, the interaction between type of water and salinity on leaf fresh and dry weight was not significant (Table 1).

According to Table 2, sunflower plants that were irrigated with magnetic water compared to non-magnetized water irrigated with fresh and dry weight of leaves were more so that the use of magnetic water for irrigation, the amount of leaf fresh weight 17.5% and dry leaves of 6% increase compared to control treatment. According to the results of the comparison table, the control treatment (S1) had the highest fresh and dry weight (Table 2). The application of salinity of 4 and 6 dS/m (S2, S3) decreased 17.7 and 41.7% in fresh leaf weight and 9.1 and 20.8% in leaf dry weight compared to control treatment. One of the most effective indicators of salinity tolerance is cellular inflammation, and osmotic regulation is done by absorbing salt and making organic matter. Plants consume a lot of energy to make organic matter, which, with high energy to regulate osmotic resistance to salinity, reduces the root efficacy of supplying nutrients and water to other organs, and the growth of the airways decreases and as a result of salinity reduces plant organs and produces plant dry matter.

4. Conclusion

According to the results of this study, irrigation water flow from the magnetic field can facilitate the absorption of plant nutrients by roots and increase the yield components of the plant. Therefore, the effect of salinity stress on the plant is reduced.

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