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# Salinity Effect of Stress on Germination of Wheat Cultivars

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**Summary**

Salinity is one of the main problems in cereal production especially in arid and semiarid regions which severely limit their production. This study was conducted to assess the effect of salinity on germination of wheat (*Triticum aestivum*) cultivars in the laboratory of Gonbad Kavoos University by using NaCl to simulate salinity and tap water as a control. The laboratory experiment was a factorial base on a completely randomized design with four replications. Treatments included wheat cultivars (Morvarid , 17 Line, Koohdosht and Daria) and four levels of salinity (0, 5, 10 and 15 ds/m). We measured germination vigor index, mean germination time, germination rate, length of plumule (shoot) and radical (root) and dry weight oh shoot and radical. The results of experiment showed that the concentrations of salt and cultivars had significant effect on all measured characteristics. Based on means comparison there were significant effect between cultivars in all traits. This result shows that there are genetic differences between cultivars and it effect on their resistance to salinity. There was no significant effect in some traits between 10 and 15 salinities. This result indicates that we can apply more salinity in future studies.

**Keywords**: wheat, germination, salinity, vigor, shoots.

## 1. Introduction

Wheat is a major cereal crop in the world. Salinity can affect any process in the plant's life cycle, so that tolerance will involve a complex interplay of characters. Soil

Stalinization is one of the major factors of soil dehydration. It has reached 19.5% of the irrigated land and 2.1% of dry – land agriculture existing on the globe [1]. Salt stress affects germination percentage, germination rate and Seedling in different ways depending on plant species [4].

The study of salinity on germination percentage germination rate, shoot and root in much crop has showed that is acceptable examine to evaluate the tolerance of plants to salinity in due to decreasing of germination, shoot length and root length [2]. The salinity decreases germination rate and it injures seedlings at the result, plant density will be decreased [5].

Abiotic stresses such as drought and salinity stresses are the main factors of crops yield reduction over the world, specially, in arid and semi arid regions [6]. Salinity stress resulted in yield reduction due to germination declining and seedling damage followed by plant reduction per unit area [5]. Study of salinity effect on rate and percent of germination showed that salinity stress in the germination stage is reliable test for salinity tolerance assessment of many species [2].

## 2. Materials and methods

Seeds were provided from Gonbad kavoos research station (Iran). The study was carried out in laboratory Gonbad kavoos University – Iran in 2012. The experiment was a factorial based on complete randomized design. Treatments were included factorial wheat cultivars (Morvarid , Line17, Koohdosht and Daria ) and salinity levels (0, 5, 10 and 15 ds/m). Seeds were sterilized by 5% Hypcrite for two minutes and then washed by distilled water. Germination trials were carried out in sterilized pertridishes containing a sheet of soaked paper and moistened with distilled water (control) or saline water (5, 10, and 15 ds/m). Each petridish was containing 20 seeds. Each treatment was carried out for 8 days. Seeds were considering germination with the emergence of radical. The parameters of germination were determined by counting seed germination in every day. In last day root length, soot length fresh weight and dry weight were measured. Statistical analysis was done by SAS. Duncan's multiple rang test was performer to compare means.

## 3. Results and Discussion

Analysis of variance results showed that there are highly significant differences among cultivars in view of germination rate, germination index, germination mean time and germination rate index (table 1).

The cultivar and salinity had significant effects on all measured characteristics but interaction salt and cultivars had significant effect on some traits (shoot length, dry weight of shoot and germination rate) (table 1). Mean comparison showed that cultivar had significant differences, for example there was 20% and 50 % differences between minimum and maximum shoot length and germination vigor, respectively. Maximum germination vigor obtained from Lin 17, that significant difference with other

cultivars; also Lin 17 had maximum fresh weight (Table 2). Germination vigor decreased with increasing salt but it was interesting that the rate of decreasing from 10 ds/m to 15 ms/m was much lower than 5 to 10 ds/m (Table 3). In term of seed germination cultivar Koohdash was the highest and significantly differed from others. Cultivar Morvarid in view of germination mean showed the highest value and grouped separately. Totally, cultivar kohhdast was the best, because of the germination rate and germination index rate. Salinity treatment did not affect the germination rate and germination index rate. The characteristics of germination index vigor and mean of germination time showed different reaction to salinity levels. Salinity values of 5, 10 and 15 mm dm-1 caused significant reduction on germination mean time. Generally cultivar Koohdash showed good adaptability under salinity stress. Cultivars Lin 17 and Morvarid had lower adaptability than Kohhdasht.

**Table 1**: Analysis of Shoot length (cm), Root length (cm), Dry weight of shoot (gr), Fresh weight (gr), Dry weight of root (gr), Root fresh weight (gr), Vigor index, mean Germination Time and Germination rate.

| **Resource of variance** | **Df** | **Shoot length** | **Root length** | **Dry weight of shoot** | **Fresh weight** | **Dry weight of root** | **Root fresh weight** | **Vigor index** | **Mean Germination Time** | **Germination rate** |
|---|---|---|---|---|---|---|---|---|---|---|
| Cultivar | 3 | 10.13$^{*}$ | 9.58$^{*}$ | 0.0137$^{*}$ | 1.248$^{**}$ | 0.0101$^{*}$ | 3.190$^{*}$ | 5923.37$^{*}$ | 1.04$^{*}$ | 0.03* |
| Salinity | 3 | 43.96$^{*}$ | 83.61$^{*}$ | 0.0092$^{*}$ | 0.899$^{*}$ | 0.0029$^{*}$ | 1.195$^{*}$ | 1287.68$^{*}$ | 0.30$^{*}$ | 0.009$^{*}$ |
| Cultivar x Salinity | 9 | 4.513$^{*}$ | 1.55$^{ns}$ | 0.0004$^{**}$ | 0.03$^{ns}$ | 0.0002$^{ns}$ | 0.07$^{ns}$ | 107.78$^{ns}$ | 0.088ns | 0.002$^{**}$ |
| Error | 48 | 0.957 | 1.966 | 0.0002 | 0.0181 | 0.00014 | 0.0451 | 70.09 | 0.052 | 0.001 |
| Cv | | 10.35 | 11.42 | 11.65 | 11.56 | 12.68 | 14.92 | 13.34 | 10.23 | 7.17 |

ns = not significant *and8** significant at the 0.05 and 0.01 probability levels respectively.

**Table 2**: Mean comparisons of Shoot length (cm), Root length (cm), Dry weight of shoot (gr), Fresh weight (gr), Dry weight of root (gr), Root fresh weight (gr), Vigor index, mean Germination Time and Germination rate between cultivars.

| Cultivar | Shoot length (cm) | Root length (cm) | Dry weight of shoot (gr) | Fresh weight (gr) | Dry weight of root (gr) | Root fresh weight (gr) | Vigor index | Mean Germination Time | Germination rate |
|---|---|---|---|---|---|---|---|---|---|
| Morvarid | 8.36c | 11.92cb | 0.09c | 0.81d | 0.06c | 0.83c | 38.24c | 2.61a | 0.39b |
| Line 17 | 10.09ab | 11.44c | 0.16a | 1.48a | 0.12a | 1.914a | 84.974a | 2.147a | 0.46a |
| Koohdasht | 9.99ab | 13.23a | 0.13b | 1.25b | 0.09b | 1.541b | 66.486b | 2.062b | 0.48a |
| Daria | 9.35b | 12.50ab | 0.12b | 1.119c | 0.1b | 1.39b | 61.268b | 2.10b | 0.47a |

Mean followed by different letters are significantly different at $p<0.05$ according to a least significant difference test.

**Table 3**: Mean comparisons of Shoot length (cm), Root length (cm), Dry weight of shoot (gr), Fresh weight (gr), Dry weight of root (gr), Root fresh weight (gr), Vigor index, and mean Germination Time and Germination rate between salt levels.

| **Salinity** | **Shoot length (cm)** | **Root length (cm)** | **Dry weight of shoot (gr)** | **Fresh weight (gr)** | **Dry weight of root (gr)** | **Root fresh weight (gr)** | **Vigor index** | **Mean Germination Time** | **Germination rate** |
|---|---|---|---|---|---|---|---|---|---|
| control | 11.46a | 14.79a | 0.16a | 1.46a | 0.11a | 1.66a | 73.27a | 2.09a | 0.48a |
| 5 | 9.93b | 13.59b | 0.13b | 1.24b | 0.1b | 1.65a | 67.05b | 2.25b | 0.45b |
| 10 | 7.54d | 10.05c | 0.1c | 0.94c | 0.08c | 1.15b | 56.27c | 2.41b | 0.42c |
| 15 | 8.86c | 10.64c | 0.121b | 1.02c | 0.08c | 1.23b | 54.38c | 2.18b | 0.46ba |

Mean followed by different letters are significantly different at $p<0.05$ according to a least significant difference test

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