Effect of salinity (sodium chloride) on germination and seedling growth of barley (Hordeum Vulgare L.) cultivars

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ABSTRACT: Salinity is one of the most widespread environmental stresses heavily on the crop affects fertility. In order to study the effect of salinity on germination and seedling growth of three barley cultivars, an experiment was conducted as factorial with completely randomized design with three replications in lab of seed department. Experimental factors including: cultivar (Sahra, Mahor and Nimrooz) and salinity (0, 3, 6, 9, 12 and 15 ds/m). The results showed that cultivar had significant affect on germination percentage, germination rate, index of germination, primary root length and root wet weight. Sahra cultivar had the highest percentage of germination (96%), seed of germination (6 days), index of germination (75), primary root length (8.8 cm) and root wet weight (38 g) other then cultivars. Salinity had significant affect on percentage of germination, seed of germination, index of germination, primary root length and root wet weight. The highest and lowest percentage of germination, seed of germination, index of germination, primary root length and root wet weight were obtained from check treatment and 15 ds/m respectively. But between 9 and 12 ds/m had not significant difference on percentage of germination percentage, germination rate and index of germination.

Key words: Salinity, Barley, Germination, Seedling

INTRODUCTION

One of The most practical ways to deal with the salinity of is the salt-resistant plants. At the beginning of the growing season, water stress and salinity, vegetative growth and reduced the number of leaves. Studies show that synthesized salinity reduces photosynthesis, good capability of women, the percentage of seed germination, leaf number, and leaf area and is ultimately reduced leaf area (Sadeghi, 2010). Sensitive to salinity during germination stage is one of the plants. Planting the seeds of salt accumulation due to evaporation from the soil surface and upward movement of salt, it may make it difficult for seed germination. Shown that the effect of salinity on germination of sodium chloride is mainly a result of osmotic effects (Salehifar et al. 2010). Parida et al. (2005) have shown that salinity can be reduced fresh weight and dry weight. GarciaRubio et al. (2003) to test the germination rate, root and shoot length and germination rate of the increase in salt concentration are shown. This increases the effect of NaCl salinity on germination and seedling growth of barley cultivars has been carried out in Ilam.

MATERIAL AND METHODS

In order to study the effect of salinity on germination and seedling growth of three barley cultivars, an experiment was conducted as factorial with completely randomized design with three replications in lab of seed department. Experimental factors including: cultivar (Sahra, Mahor and Nimrooz) and salinity (0, 3, 6, 9, 12 and 15 ds/m). Seed disinfection with sodium hypochlorite solution was performed, and after that was washed with distilled water. Petri dishes in a disinfectant solution of sodium hypo chloride, 10% were for half an hour and afterwards were washed with water. Filter paper and placed in a Petri dish, 10 seeds were placed within it. Root length was measured by a ruler. Root weight was calculated by digital scale with an accuracy of 0.001 g. The formula for
calculating percentage germination \( G_p = \frac{100(NG/NT)}{\text{in the Formula}} \) \( GP \) \( NG \) number of seeds germinated total number of seeds germinated \( NT \). Formula to calculate the germination rate \( GR = \sum_{i=1}^{n} \frac{S_i}{D_i} \) in which \( GR = \) germination rate (number of seeds per day) \( S_i = \) number of germinated seeds in each count, and \( D_i \) days to count my days in which germinated seeds nd2 and nd7 is second to seventh. That furnishing statistical software Mstat-c Round is use. Treatments were compared with Duncan's test a few skirt.

RESULTS AND DISCUSSION

Results of analysis of variance showed. Between cultivars and salinity of germination, germination rate, germination index, root length, shoot length, with significant differences exist. Between cultivars was in the Sahra cultivar has the highest percentage of germination. And the lowest percentage of germination of the Nimrooz cultivar with less than 5 percent is the cultivar (Fig 1).

Salt treatment increased the rate of seed germination was significantly reduced and this reduction at higher salinity. The highest percentage of germination in control treatments (no stress) and 3 ds/m and the lowest percentage of germination at 15 ds/m is observed. Between 9 and 12 ds/m statistically significant difference was observed in both treatment groups were statistically similar (Fig 2). Hag ghani et al. (2008) in safflower showed that the germination speed index decreased with increasing salinity.
Akhtar and Hussain (2009) tests showed that the percentage of germination, seedling growth, root length, shoot weight, root and shoot in concentrations of 10 and 15 ds/m significantly reduced to be found. Among cultivars in the Sahra has the highest rate of germination and germination rate of less than about Nimrooz of the Sahra cultivar is a reduction of 30% (Fig 3).

Seed germination decreased with increasing salinity, and this decrease was significant at higher salinity. Germination rate in control and 3 ds/m and the lowest percentage of germination was observed in 12 and 15 ds/m. Between 9 and 12 ds/m statistically significant difference was observed in both treatment groups were statistically similar (Fig 4).

Activities essential for seed germination and need to have enough water. If the water absorption is impaired should be done slowly. Kennedy also takes up the seed and roots out what time of seed germination
increases and decreases (Mashi and Galeshi, 2007). Among cultivars, Sahra cultivar had the highest index of germination and the lowest index of germination belonged to the Nimrooz cultivar (Fig 5).

![Figure 5. Effect of cultivar on index of germination](image)

Increasing salinity of the seed sown and this reduction were significant at higher salinity. The highest index of germination in control (no salt) and the lowest index of germination was observed at 15 ds/m. Between 3 and 6 ds/m statistically significant difference was observed in both treatment groups were statistically similar (Fig 6).

![Figure 6. Effect of Sodium chloride on index of germination](image)

Between cultivars in the Sahra has the highest primary root length and the lowest primary root length cultivar of about Nimrooz cultivar that the cultivar has dropped 25 percent is Sahra cultivar (Fig 7).
The advantage of this more resistant than other cultivars in the field of salinity can be calculated. Seed and root length decreased with increasing salinity of this reduction was significant at higher salinity. Maximum primary root length in control treatment and 3 ds/m and the lowest index of germination was observed in 12 and 15 ds/m. Between 6 and 9 ds/m statistically significant difference was observed in both treatment groups were similar (Fig 8).

Among cultivars, Sahra had the highest root fresh weight and the lowest root fresh weight belonged to the Nimrooz cultivar (Fig 9). Decreased with increasing salinity of the invigorated weight of roots, seeds, and this reduction was important at higher salinity. Maximum revived weight of roots in control treatment (no salt) and the lowest root weight were observed in 12 and 15 ds/m. Between 6 and 9 ds/m statistically consequential differences were observed. And these two treatments in a group were statistically similar (Fig 10). Ashraf and Rasul (1988) also observed that the salinity was reduced root fresh weight.
Figure 9. Effect of cultivar on root fresh weight

Figure 10. Effect of Sodium chloride on root fresh weight

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REFERENCES

Sadeghi H. 2010. The effects of different salinity levels on some important physiological characteristics of two wheat cultivars. 11th Iranian Crop Science Congress. 3704p.