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# The effect of different salt concentrations on germination characteristics of Mint

**Sepideh shayghan*** **and samira sedghi**

Department of Agronomy and Plant Breeding, Ardabil Branch, Islamic Azad University, Ardabil, Iran

**Corresponding author:** Sepideh shayghan

**ABSTRACT:** salinity is very important to evaluate changes in plant a major problem of arid and semi-arid regions is environmental stresses like salinity. To study the effect of salinity on germination characteristics of Mint, a completely randomized experiment was conducted under controlled conditions (germinator) with three replications in Department of Agronomy, Birjand Branch of Islamic Azad University, ardebil, Iran in 2012. The experimental treatments included different salinity levels (0, 2, 4, 6 and 8 ds m-1). The studied traits included seedling length and dry weight, germination percentage and rate and seed viability index. It was found that salinity significantly decreased germination rate and percentage and seed viability index of Mint, but its effect on seedling length and weight was not different in levele of 0, 2, 4 and 6 ds m-1. In total, it can be concluded that salinity stress mainly decreased germination percentage and rate and seed viability index of Mint.

***Keywords*****:** salt, germination, Mint.

## INTRODUCTION

The use salinity land and planting salt-tolerant plants To improve efficiency This is a good solution. Nowadays, medicinal herbs are regarded as economically important crops which are used in raw or processed forms in traditional and modern industrial medicine. Since WHO prohibited the use of synthetic stains and essences due to the side effects of chemical medications, the cultivation of medicinal herbs has been boosted recently (Mollafilabi, 2000). On the other hand, soil or water salinity is one of the environmental stress inducing factors which complicates the nourishment and metabolic processes of medicinal herbs in addition to interrupting and reducing water absorption capacity by plants (Levitte, 1980). The prevalence of irrigated agriculture in most parts of Iran has made the water and soil resources prone to salinity. In arid and semi-arid regions, the salts accumulated in root zone bring about salinity owing to the inadequate annual precipitation for leaching. Fifteen percent of total arable lands of Iran, i.e. 25 million ha, are affected by salinity to the varied extents (Jafari, 2000). So, besides selecting methods for recovering saline soils, the introduction of salinity-tolerant species and cultivars and breeding the crops for salinity tolerance can be an economical and useful method for overcoming salinity (Poustini, 1995; Levitte, 1980). Two main characteristics of saline media, i.e. low osmotic potential and high mineral concentration, are potentially poisonous for crops. The minerals of soil reduce the water potential of the root zone limiting water uptake by roots and inducing a kind of physiological drought to the crop. On the other hand, high minerals concentration in soil and the following uptake of such ions as Na and Cl causes toxicity in crop (Edward and Bison, 1996; Niu *et al*., 1995). In other words, salinity injures the crops by osmotic effect, specific toxicity effect of ions and interruption in nutrients uptake (Huang and Redmann, 1995; Niu *et al*., 1995). Germination is a critical stage in the lifecycle of crops and salinity tolerance at this stage is crucially important for the establishment of the plants growing in such environments. Germination stage is very important for determining plant density per unit area and adequate density is obtained if the sown seeds germinate completely and with adequate rate (Bagheri Kazemabad *et al*., 1988). On the other hand, the uniformity of emergence depends on germination percentage and rate, both of them being impacted by salinity, water potential, nutrients, perimeter temperature and their interactions. Such factors as the occurrence of insoluble salts and their balance and the toxicities induced by them disorder the germination of the seeds of most crops and result in the loss of field green area and finally, the yield (Datta and

Dayal, 1991; Frncois *et al*., 1984). In a study on the effect of salinity stress on the germination of Limonium stocksii, Zia and Khan (2004) stated that the highest germination was observed in no-salinity treatment and it decreased with the salinity. Maghtooli and Chaeichi (1999) found that the type of the salt significantly affected the germination of sorghum and that NaCl had the highest effect on the loss of germination percentage and radicle and plumule length. Also, Kayani et al. (1990) observed that the increase in salinity from 0 to 15 ds m-1 resulted in the reduction of the germination of the jojoba seeds by from 82.6 to 42%. In a study on the effect of five salinity levels of 0, 100, 150 and 200 mg.l-1 NaCl on germination, Rezaee and Alinejad (2004) found significant differences among different salinity levels, so that as salinity level was increased, stem length, radicle dry weight and germination percentage were decreased. Although extensive research has been carried out on the effect of salinity stress on germination of most crops, little studies have been focused on the effect of environmental stresses like salinity on the germination of medicinal herbs. Therefore, the objective of the current study was to examine the responses of the seeds of Mint to different salinity levels at germination stage.

## MATERIALS AND METHODS

In order to study the effect of different salinity levels (NaCl) on germination of the seeds of Mint (Ocimum Minticum L.). The experiment was a completely randomized one with three replications. The experimental treatments were composed of five salinity levels with EC's of 0 (distilled water), 2, 4, 6 and 8 ds m-1. The solutions of the treatments were prepared by solving NaCI in distilled water. Each experimental unit included a sterilized petri dish with the diameter of 12 cm in which cultivation medium was of the kind of filter paper. The seeds were disinfected by alcohol 70% (for 10 seconds), sodium hypochlorite 10% (for 60 seconds) and benomyl 2:1000 (for one minute) (Seghatoleslami, 2010). Afterwards, the seeds were rinsed with distilled water twice. To apply the salinity treatments, the seeds were soaked in 10 ml prepared solutions in each petri dish and then, the petri dishes were put in germinator with 80% relative humidity and 25/15°C day (16 hr)/night (8 hr) temperature. The germinated seeds were daily counted and recorded. The criterion for the germination was the exit of 1-mm radicle (Barzgar, 2009).. The seeds were irrigated with enough distilled water (if required) to prevent the accumulation of salts and the increase in their concentrations in petri dishes (so much that the seeds did not float). The experiment lasted for 12 days. At the last day, 10 seedlings were randomly selected from each petri dish and their average length was measured. Then, they were oven-dried at 65°C for 24 hours to acquire their mean dry weight (Seghatoleslami, 2010). Total number of germinated seeds in each petri dish until the 12th day was regarded as the germination percentage. Germination rate was determined by the following equation (Sarmadnia, 1996).

## RESULTS AND DISCUSSION

Analysis of variance revealed that seedling length and weight, germination percentage, germination rate and seed viability index of Mint was significantly affected by salinity level (Table 1).

Table 1. Results of analysis of variance for the effect of salinity stress on germination and growth parameters of medicinal herb of Mint

| Sources of variation | df | Seedling length (mm) | Seedling weight (mg) | Germination percentage | Germination rate (seed/day) | Seed viability index |
|---|---|---|---|---|---|---|
| Salinity | 4 | 81.36* | 0.047* | 154.90** | 20.14** | 33.52* |
| Error | 10 | 22.95 | 0.012 | 21.93 | 2.024 | 76.7 |

ns, * and ** show non-significance and significance at 5 and 1% level, respectively

Means comparison for seedling weight of Mint indicated that distilled water treatment resulted in the highest seedling weight of 0.83 mg which was 55% higher than that of 8 ds m-1 salinity treatment which was 0.5 mg on average. The highest germination percentage was also obtained from distilled water treatment and the lowest one from 8 ds m-1 salinity treatment, so that as salinity was increased from 0 to 8 ds m-1, germination percentage of Evening star decreased from 71.33 to 53% (Table 2).

Table 2. Means comparison of the effect of salinity stress on germination and growth parameters of medicinal herb of Mint

| Salinity levels (ds m-1) | Seedling length (mm) | Seedling weight (mg) | Germination percentage | Germination rate | Seed viability index |
|---|---|---|---|---|---|
| 0 | 30.40 a | 0.83 a | 71.33 a | 21.60 a | 21.68 a |
| 2 | 23.97 ab | 0.63 ab | 66.00 ab | 17.73 bc | 15.84 b |

| | | | | | |
|---|---|---|---|---|---|
| 4 | 24.97 ab | 0.63 ab | 57.33 bc | 18.77 b | 14.29 b |
| 6 | 24.07 ab | 0.73 a | 61.00 bc | 15.80 c | 14.58 b |
| 8 | 15.83 b | 0.50 b | 53.00 c | 15.07 c | 8.36 c |

Means of traits at each column with similar letter(s) were not significant at 5% level

Germination rate of Mint seeds was significantly decreased with salinity, too. The increase in salinity up to 8 ds m-1 resulted in 30.2% loss of germination rate as compared to control (distilled water treatment). The highest seed viability index (on average, 21.68) was obtained from control which was ranked in the superior statistical group over other salinity levels. But, there was no statistically significant difference among salinity levels of 2, 4 and 6 ds m-1 and they were ranked in the same group. However, 8 ds m-1 salinity treatment produced the lowest seed viability index of 8.36 and was ranked in the third statistical group (Table 2).

***Discussion:***

The loss of seed germination percentage under various salinity stress levels as compared to control has been reported in Carum copticum Heirn (Saffari and Gavahi, 2006), Nigella sativa (Gavahi et al., 2006) and Isabgol (Hosseini and Rezvani Moghadam, 2006) which is in agreement with the results of the current study. Also in a study on the effect of salinity on germination of roselle, artichoke, Hyssopus officinalis and Mint seeds, Khammari et al. (2007) found the loss of their seed germination percentage and rate with the increase in salinity stress. In addition to the osmotic effect which reduces the uptake due to the specific toxicity effect of ions, the loss of germination percentage is caused by the interruption of nutrients uptake which has been confirmed by Safarnejad et al. (1996), Penuelas et al. (1997) and Shalhevet (1993), too. It has been shown that the increase in salinity increases the uptake of Na, K and P and decreases the uptake of N which can be the reason for the loss of germination percentage (Tarzi, 1995). Salinity may inactivate the germination-affecting enzymes, especially by increasing the uptake of K which brings about a secondary peak which as a result, inhibits the activation and/or synthesis of germination-affecting enzymes and the uptake of Ca increases in a confrontation with Na. Salinity stress can retard germination and decrease germination percentage and seedling growth by limiting absorbable water by seeds. Germination is impacted by osmotic pressure and salt toxicity in saline environment. As stress level was increased, growth indices of cumin decreased owing to the adverse effects of salinity like ion toxicity, physiological drought effect and the accumulation of minerals in plant (Rajabi, 2001). Nabizadeh (2002) stated that the adverse effect of salinity on plants can be caused by the loss of osmotic potential of root medium, specific ion toxicity and the lack of nutritional ions. The extent of the loss of growth and yield depended on salt concentration, so that the higher the salt concentration was, the more tangible the loss of the growth would be (Shannon and Grieve, 1999). In total, it can be concluded that salinity stress mainly decreased germination percentage and rate and seed viability index of Mint.

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