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Study on Various Level of Salinity on Some Morphological and Physiological Characteristics of *Rosa hybrida*

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Abstract

Crisis due to global warming and its associated damaging consequences, including salinity, it is essential to develop plant resistance to salinity level. In this study, an experiment was conducted using different levels of salinity (0.05, 0.1, 0.15 and 0.2% sodium chloride) had on *Rosa hybrida*, as the most important cut flowers in the world. Results showed that by increasing of salinity, sodium increased in the tissues and root dry/fresh weight declined. Salinity stress influenced significantly shoot growth and declined it. It seems this cultivar is resistant to salinity. However, further studies must be done to clarify the amount of resistance this cultivar against salinity in comparison to other cultivars.

Keywords: Dry weight, Fresh weight, Rose, Salt, Sodium chloride.

INTRODUCTION

According to estimates, about one-third of irrigated land on earth are affected by salinity. To achieve effective methods to dissolve salinity problems in agriculture and horticulture, understand the physiology of salt toleration in plants is important. (Wahome *et al*., 2000). Salinity occurs when salt concentration in the environment of plant roots accelerated. General characteristics of soil salinity are caused by high concentrations of dissolved salt. High osmotic potential and less water availability lead to salinity stress in the plant. On the other hand, excess concentration of ions, especially Na^+ and Cl^- not only cause to lose ionic balance, but also lead to occurring ion toxicity in the plant (Wahome *et al.,* 2000). Increasing concentration of sodium ions (Na^+) in plant caused to reduce in absorption of potassium ions (K^+). Reduced absorption of cations such as calcium (Ca^{2+}) and magnesium (Mg^{2+}) occurs with increased uptake of sodium ions (Na^+) by the plant. With absorption decrease of these important cations, significant effects of salinity stress, such as reduced activity of some enzymes and amount of chlorophyll will be appears (Poonia *et al.,* 1972).

Reduce absorbing anions such as phosphate or increased of chlorine absorption (Cl^-) by the plant due to the important role of this anion in the structure of many organic molecules such as ATP, the harmful effects of salinity on plant growth will be appears. (Taiz and Zeiger, 2006). Lessened growth under salinity in plants normally causes to necrosis of leaves which result in their reduced level of active photosynthesis in plants (El-Siddig and Ludders, 1994). Prevent of activity of many effective enzymes such as Rubisco and phosphoenol pyruvate carboxilase and malate dehydrogenase leads to disorder in metabolic cycle and important processes such as photosynthesis. These disorders ultimately reduce essential carbohydrates of plant (Taiz and Zeiger, 2006). Stewart et al. reported quoting Fugel *et al*., (1973) in halophyte plants; proline comprised 70% of free amino acids in plant. In these plants proline are being gathered in the vacuole of leave cells and in some cases chloroplast and cytoplasm of leave cells.

Some factors such as size and the appearance of plant are the important criteria to determine the extent of salinity in these plants (Fogel *et al.,* 1973). Limit absorption of sodium and chloride ions in roots and accumulating of these ions in the stems and leaves are the most important mechanism for salinity tolerance in plants. These cases depend on ability of roots to choice over dose ions during the uptake. This trait influenced by different genetic characteristics (Marschner, 1993). Salinity tolerance is as the plant ability to maintain growth and metabolism when salinity occurred (Yeo, 1993). Chloride ion transport in plants generally occurs during the transpiration stream (Marschner, 1993). This justifies the high concentration of chlorine in the leaves that eventually cause to damage the leaves (Wahome *et al.,* 2000). Sodium ion absorption in plants actively is done through the ion pump in the roots while the passive absorption occurs rarely.

Passive absorption of sodium increases under conditions of salinity which the agent eventually causes to reduced potassium uptake (Wahome *et al.,* 2000). Effect of different levels of salinity on different genotype of valerian and cumin were investigated and the results showed that increasing salinity caused to reduced germination, percent root length, stem length, root dry weight, shoot dry weight, biomass and shoot to root ratio (Salami *et al.,* 2004). Emdad and Fardad (2000) observed that salinity reduced leaf area, dry weight, plant height of corn. Salinity stress significantly caused to reduce the growth of some grass varieties (Jingbo *et al.,* 2009). Salinity stress on the roses grown in vitro showed after 14 days from the start of the stress, salinity caused to plant damaging and leaf wilting (Wahome *et al.,* 2000). Salinity also caused changes in plant morphology, nutrient and chlorophyll levels, and gas exchange (Jimenez *et al.,* 1997).

Because of crisis due to global warming and its associated damaging consequences, including salinity resistance of plants against salinity stress seems to be necessary. In this study, an experiment use of different levels of salinity caused by sodium chloride in order to evaluate the tolerance of ornamental plant roses.

MATERIALS AND METHODS

The trial carried out on the rose flowers (*Rosa hybrida*) in the Faculty of Agriculture of Islamic Azad University, Jahrom branch. Treatments include 500, 1000, 1500 and 2000 mg/l sodium chloride which was determined associated with irrigation water to the pot containing the usual soil area with the identified interval. Table 1 and 2 indicate the properties of the used irrigation water and soil, respectively. This experiment lasted about two months and plant irrigation was done under temperature and humidity controlled site.

Measuring plant height and leaf number was performed as a weekly and stem diameter performed once every two weeks. At the end of the experiment dry and fresh weight of leaves and roots were measured. To obtain dry and fresh weight in aerial and underground organ, the plant cut from the crown and then roots and leaves. First fresh weight measured and then dry weight obtained by placing samples in oven temperature 72°C for 48 hours. Also to study the effect of salinity on plant growth conditions, Na^+ and K^+ accumulation in shoots, roots and leaves were examined and Na^+/K^+ ratio was obtained. For this purpose, after the preparation of extracts from the ash samples, amounts of sodium and potassium were obtained by flame photometry method. This experiment carried out in randomized complete block design with four replications. Data analyzed using statistical software MSTAT-C and mean comparing had done via Duncan test at 5%.

RESULTS AND DISCUSSION

Statistical analysis of data showed that salinity had significant effect on height and growth (Figure 1). Results of other research on crops including; wheat, barley, cumin, citrus, and valerian have shown that because of the effect of salinity, stem and shoot growth has declined (Salami *et al.,* 2006, Pessarakli *et al.,* 1997). In this study the effect of salinity on stem diameter in roses, salinity had not significant effect on stem diameter and even the highest stem diameter was observed in the final week of testing in the treatment of 2000 mg/l. About the impact of salinity on fresh and dry weight of different plant organs, significant differences were not observed in the treatments, but in the root with increasing levels of salinity, in the fresh and dry weight of roots levels decreased which indicating the increased osmotic pressure and water absorption by the inability of this limb (Figure 3). This reports agreed with the results of Fogel and Munns (1973) and Aboutalebi *et al* (2008). Effect of salinity on fresh and dry weight of the leaves showed no significant difference.

Increasing salinity levels caused to fresh and dry weight of leaves greater than before. This maybe occurs due to sodium accumulation in leaves and higher osmotic pressure and thereby increases the water absorption in this organ (Figure 2). Salinity levels also result in no significant difference in stem fresh weight and the highest fresh weight was observed in treatment 500 mg/l (control). Dry weight also had been not affected by salinity. The highest stem dry weight was observed under treatment 1000 mg/l (data not shown).

Comparison of the root sodium content in control treatment (500 mg) and other treatments showed significant differences. But differences between 1000, 1500 and 2000 mg treatments are not significant. Various researches on various citrus indicate that concentration of sodium had been increased in various organs, especially roots under increasing salinity (Aboutalebi et al. 2008, Mongi and Lowrence, 1992). On the other hand, no significant differences in measured K^+ values were observed between different treatments and the highest K^+ was seen in the control treatment. This result disagrees with the results Aboutalebi et al. (2008) in different citrus varieties.

The results showed that the lowest concentration of potassium was obtained under control treatment and potassium accumulation in the other treatments was also significant. (Aboutalebi *et al.,* 2008). It is reported that some cultivars of citrus root in a certain salinity level operated more selective to potassium than sodium (Zid & Grignon, 1987), that it would be due to excessive potassium accumulation in shoots of citrus.

Salinity stress uniformly increased compared with the Na^+/K^+ ratio in the examined organs. Ratio of Na^+/K^+ also was affected by various treatments of root salinity. All salinity levels in 1000, 1500 and 2000 mg/l had significant effect.

CONCLUSION

In general, crisis due to global warming and its associated damaging consequences such as salinity, the study of plants resistance against salinity needs more studies. Based on results, this variety is resistance to lower levels of salinity; therefore it needs to investigate effect of higher levels of salinity on the plant.

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Tables

Table 1. Properties of water used for irrigation

pH	Electric conductivity EC (μs/cm)	Salt rate (mgl⁻)
7.8	900±10	500
7.7	1930±15	1000
7.5	2740±10	1500
7.4	3920±15	2000s

Table 2. Some physical and chemical properties of soil

Organic carbon (%)	Total N (%)	Soil texture	Sand (%)	Silt (%)	Clay (%)	Total acidity	Electric conductivity
0.55	0.06	Sandy Loam	54	30	16	7.56	3.39

Figures

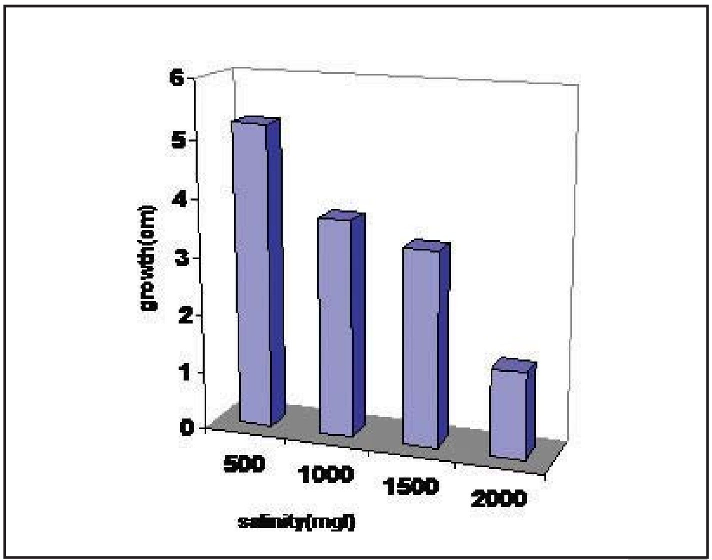

Fig. 1. The effect of different levels of salinity stress on stem growth.
Values followed by the same letters in each row are not significantly different at the 0.05 level (Duncan,s Multiple Range Test).

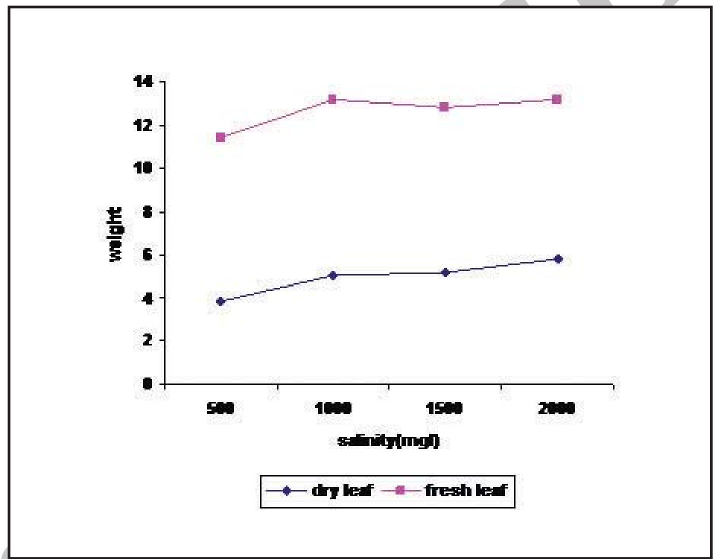

Fig. 2. The effect of different levels of salinity stress on leaf dry and fresh weight (gr).

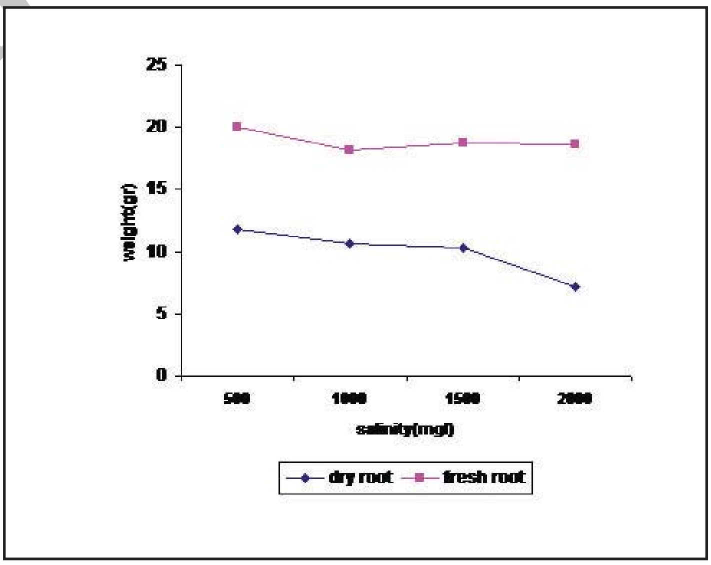

Fig. 3. The effect of different levels of salinity stress on root dry and fresh weight (gr).

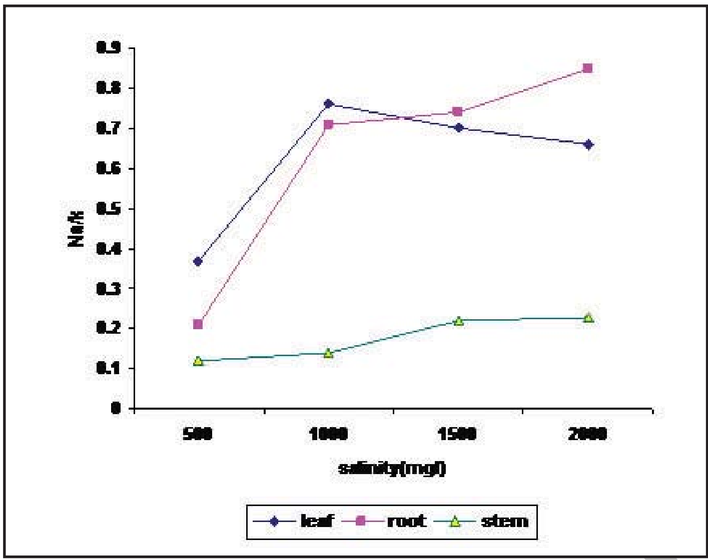

Fig. 4. The effect of different levels of salinity stress on Na/K ratio in plant organs.