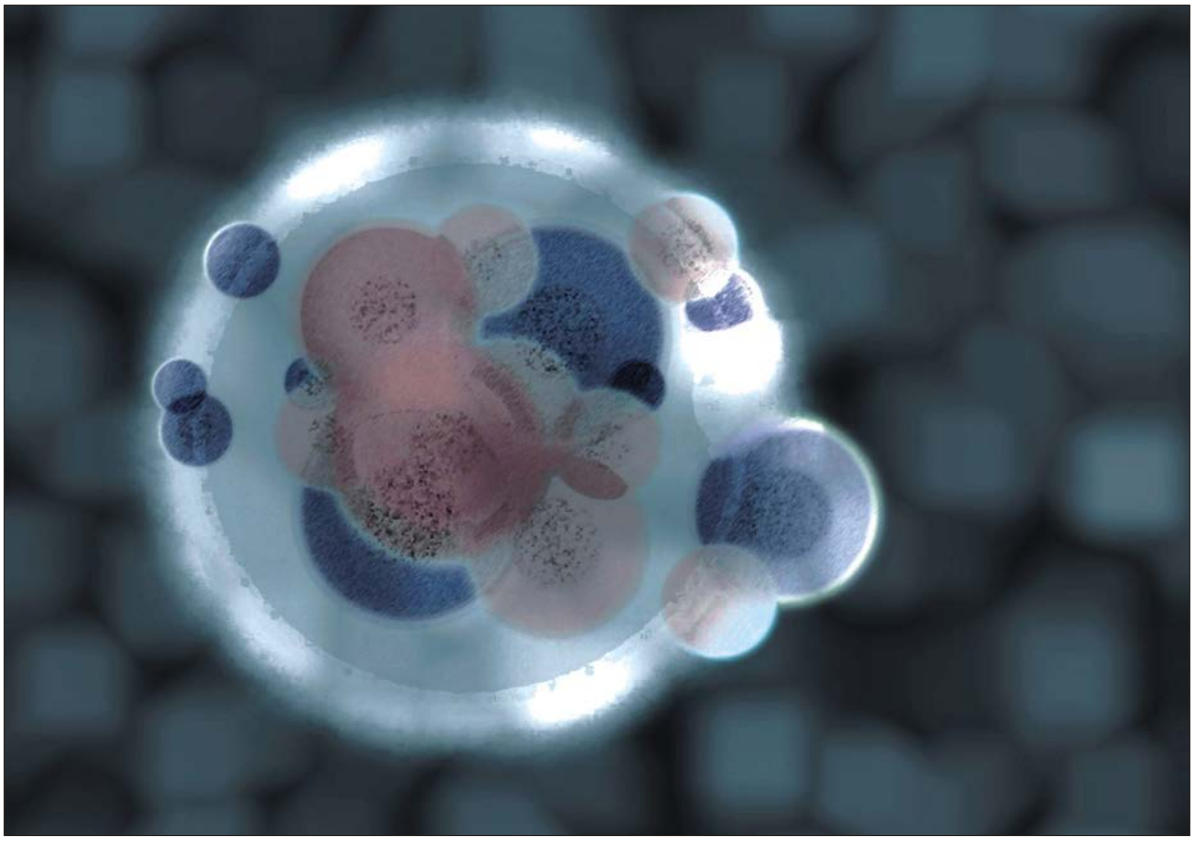

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Effect of Different Sodium Chloride Concentrations on Early Seedlings Growth of Wheat Cultivar (*Triticum aestivum L.*)

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Abstract: This study conducted in order to determine how application of seedlings with NaCl increases the long-term salinity resistance of wheat (*Triticum aestivum* L.) and whether the adaptive response to salinity accompanied by physiological changes throughout the plant-growth cycle at seedling stage. In this experiment the effects of 10, 50, 75, 100 and 200 mM NaCl on total weight, radicle weight, leaf weight and leaf length of 6 days Sardari cultivar seedlings was evaluated. Results indicated that among total weight, radicle weight, leaf weight and leaf length of 6 days Sardari cultivar seedlings, leaf length is more influenced by salinity condition and radicle weight show the lowest difference among the groups. By using of growth physiological parameters in compare with using biochemical parameters instrument and methodic errors significantly decrease and results evaluation is very tangible.

Key words: Salinity, seedling, wheat, growth parameters

INTRODUCTION

The salinity of soils and water is one of the major problems inhibiting their effective utilization in agriculture, especially in arid and semiarid regions. Soil salinity is known to suppress the growth of most crop species, but considerable differences in salinity tolerance exist between species. About 25% of world's total area (including 15% of Iran's land) is saline. This area contains about 33% of the worlds and 50% of Iran's irrigated lands, respectively (Heidari and Heidarizadeh, 2003). The level of salinity in the water supply can be highly variable in some regions of Iran, even over short distances and can range between semi desirable through non desirable. Earlier studies on different crops, for instance corn, cowpea and triticale indicated that sensitivity to salinity changes during growing season. Other studies also showed that the sensitivity of vegetables changes during growth stages. By characterizing the sensitivity to salt stress of different developmental periods of wheat (*Triticum aestivum*) the quality of the water could be better matched to the stage of development, which may allow improved management of irrigated crops (Kaydan and Yagmur, 2008).

Soil salinity/sodicity directly affects plant growth through osmotic stress and nutrient disorders. Subsoil salinity/sodicity generally restricts root growth and reduces water and nutrient extraction from subsoil resulting in poorer plant growth and lower crop yields. Decreases in rooting depth and water extraction by cereal crops have been commonly attributed to high levels of salts and exchangeable sodium in subsoil. Exploitation of subsoil water and nutrients to attain potential yields is particularly imperative for dry land cropping regions. Therefore, it is imperative to investigate strategies to manage subsoil salinity/sodicity (Atak *et al*., 2006). Identifying genotypes that are tolerant to saline and/or sodic subsoils is a practical and relatively simple way of improving crop yield and profitability on these difficult soils. Growing tolerant cultivars on soils with subsoil salinity/sodicity reflects the shift to a strategy of tailoring the plants to fit the soil' in contrast to the older strategy of tailoring the soil to fit the plant (Heidari and Heidarizadeh, 2002). Wheat is the major cereals crop in Iran it is cultivated over a wide range of environments because of wide adaptation to diverse environmental condition. It is a moderately salt tolerant crop. When the salinity increased to 100 mM NaCl wheat performance is decreased marginally compare to other crop like rice. Therefore it is promising crop for cultivation in moderate salty soils of semi arid regions. A collection of bread wheat cultivars were recommended for cultivation in saline soil condition (Maghsoudi and Maghsoudi, 2008). Kurdistan Province is one of the major centers of dry region agriculture in the country and introducing the resistance cultivar is a research preference in the province. The aim of this research is evaluation of physiological response of wheat cultivars to salinity in

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seedling stage. The present study initiated to investigate the influence of salinity on early seedling growth of wheat and also find relationship between salt stress and growth.

MATERIALS AND METHODS

Experiments were conducted in the laboratories of the University of Kurdistan, Faculty of Science, Department of Biology, during the Feb., 2006. Seed of wheat cultivar sardari was used. The seed was obtained from Faculty of Agriculture.

In this research, the effect of different sodium chloride concentrations was studied on physiological growth parameters of sardari wheat cultivar seedlings. At first with sodium chloride as showed in Table 1 six level of salinity treatment prepared.

Sardari certificated seed prepared from faculty of agriculture in university of Kurdistan. Seeds with same weigh 0.050±0.002 separated. Three seeds were leaved in each Petri dish with 8 cm diagonal. Temperature of 18°C and photoperiod of 8 h light and 16 h darkness applied in this experiment. Five cc of each solution of NaCl added to the same petri dish and seed allowed to grow for six days. After 3 days from the beginning of the experiment 5 mL of each solution of NaCl added to the same petri dish. At the end of period samples were removed and total weight, radicle weight, leaf weight and leaf length as physiological parameters were measured (Table 2).

Table 1: Six level of salinity treatment prepared with sodium chloride

Treatment	Method of preparation	Molarities (mM)
Control 1	Distilled water	0
2	0.146 g/250 mL	10
3	0.730 g/250 mL	50
4	1.095 g/250 mL	75
5	1.462 g/250 mL	100
6	2.924 g/250 mL	200

Table 2: Result of different sodium chloride concentrations on growth parameters of sardari cultivar seedlings

Treatment	Replication	Total weight (g)	Leaf weight (g)	Radicle weight (g)	Leaf length (cm)
Control	1	0.208	0.095	0.025	13.3
	2	0.190	0.086	0.017	12.5
	3	0.195	0.090	0.020	13.0
10 mM NaCl	1	0.237	0.087	0.056	15.5
	2	0.200	0.108	0.053	14.5
	3	0.251	0.110	0.050	14.0
50 mM NaCl	1	0.160	0.061	0.028	6.8
	2	0.153	0.057	0.025	7.2
	3	0.174	0.070	0.020	7.5
75 mM NaCl	1	0,146	0.052	0.024	4.7
	2	0.148	0.055	0.028	5.5
	3	0.150	0.060	0.020	6.0
100 mM NaCl	1	0.130	0.044	0.021	4.5
	2	0.132	0.041	0.019	4.3
	3	0.135	0.050	0.016	3.5
200 mM NaCl	1	0.105	0.015	0.008	1.8
	2	0.103	0.010	0.007	1.0
	3	0.100	0.080	0.008	0.09

Statistics: This research wants to evaluate effect of different sodium chloride concentrations on physiological growth parameters of sardari wheat cultivar seedlings. In order to pin point sodium chloride concentrations in sardari wheat cultivar seedlings when changes in sodium chloride concentrations are occur, sodium chloride concentrations considered as a factor and 4 physiological growth parameters considered as a variable in completely randomized design and analyzed with the statistical software program SPSS. Data subjected to analysis of variance (ANOVA) procedures.

RESULTS AND DISCUSSION

The data presented in Table 2 shows result of different sodium chloride concentrations on growth parameters of sardari cultivar seedlings. Figure 1-4 show

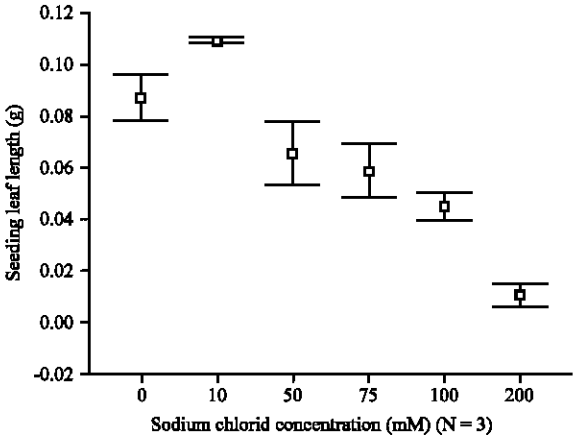

Fig. 1: The effect of different sodium chloride concentrations on leaf weight of sardari cultivar seedlings (Mean±2SE)

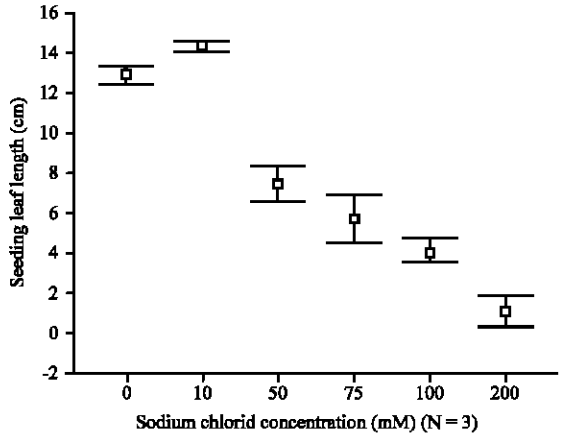

Fig. 2: The effect of different sodium chloride concentrations on leaf length of sardari cultivar seedlings (Mean±2SE)

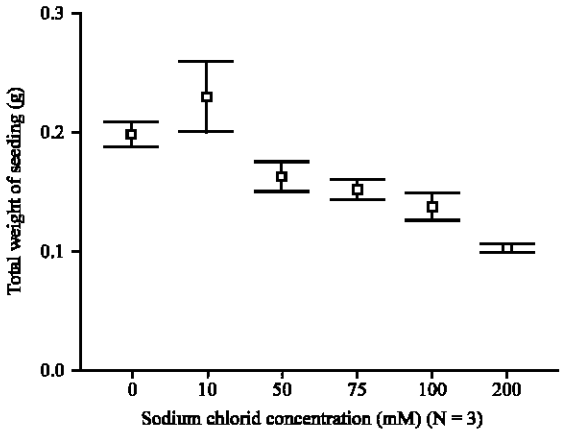

Fig. 3: The effect of different sodium chloride concentrations on total weight of sardari cultivar seedlings (Mean±2SE)

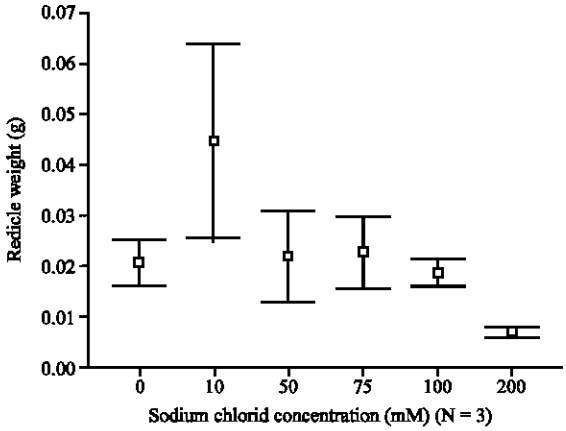

Fig. 4: The effect of different sodium chloride concentrations on radicle weight of sardari cultivar seedlings (Mean±2SE)

changes in growth factor of sardari seedlings in different sodium chloride concentrations. In 10 mM concentration of sodium chloride all of growth factors namely total weight, radicle weight, leaf weight and leaf length shows significant increase than control treatment.

The data presented in Table 3 show analysis of variance for the effect of different sodium chloride concentrations on growth parameters of sardari cultivar seedlings. Analysis of variance of leaf weight changes shows significant difference (F = 68.878) between groups. Duncan test in five subset homogenized groups. Its mean is that sodium chloride concentrations have significant effect on sardari seedlings leaf weight. Analysis of variance of leaf length changes shows significant difference (F = 175.559) between groups. Duncan test in six subset homogenized groups. Its mean is sodium

Table 3: Analysis of variance (ANOVA) for the effect of different sodium chloride concentrations on growth parameters of sardari cultivar seedlings

Variable	Sum of squares	df	Mean square	F-value	Sig.
Leaf weight	0.017	5	0.003	68.878	0.000
Leaf length	390.132	5	78.026	175.559	0.000
Total weight	0.030	5	0.006	34.334	0.000
Radicle weight	0.002	5	0.001	6.484	0.004

chloride concentrations have significant effect on sardari seedlings leaf length. Analysis of variance of total weight changes shows significant difference (F = 34.334) between groups. Duncan test in five subset homogenized groups. Its mean is sodium chloride concentrations have significant effect on sardari seedlings total weight. Analysis of variance of radicle weight changes shows significant difference (F = 6.484) between groups. Duncan test in five subset homogenized groups. Its mean is sodium chloride concentrations have significant effect on sardari seedlings radicle weight. The limits of salt tolerance of varied grass species have been reported to vary not only among population but also between species of glycophytic grasses. Rahman and Unigar (1990) reported that germination of triticum aestivum was little affected by soil salinity up to 0.25 but at 0.5% and above germination was significantly delayed and the final germination percentage was markedly reduced. The inhibitory effect of salinity was demonstrated by the reduction of mean seedling length for seed collected at the low, medium and high salinity field sites. Increasing soil salinity caused a decrease in the height of seedling from all sources (Rahman and and Unigar, 1990). Jamil and Lee (2006), who studied the effects of salt stress on growth and nitrogen fixation by pea faba bean, common bean and soy bean plants indicated that pea was the most sensitive legume among them. Root and shoot length and seedling fresh and dry weight were decreased by increasing NaCl and PEG concentration, consequently, seedling and early seedling growth was inhibited in pea. The result of this study confirmed the finding of Jamil and Lee (2006).

In conclusion, in the germination and early seedling growth stages the investigated cultivars showed different responses to water and salt stress (Okcu *et al*., 2005). Sadat Noori and McNeilly (2000) examined variability in response to salinity in 29 *Triticum durum* desf. Accessions or cultivars based upon relative root and shoot lengths of 14-day-old seedlings grown in control and 100 mM NaCl solutions. NaCl caused a significant reduction of root and shoot growth for all accessions/cultivars, but the degree of reduction differed between them. Some cultivars had significantly greater relative root and shoot lengths than others, suggesting that there may be potentially useful variability in salinity

tolerance within the durum wheat. Wheat is the most important and widely adapted food cereal in Iran. Although, Iran recently has been caused to supply all of its annual domestic demand for wheat, but salinity of soil and water resources especially in arid and semi arid regions such as central part of Iran effectively decreased wheat productivity. Most researchers reported the adverse effects of salinity of irrigation water and soil on wheat yield and yield components (Feizi *et al*., 2007).

Although several studies has been conducted for determination of wheat genotype salt tolerance, but these results are different for various weather conditions. Plant breeding is a complementary and a more permanent approach for minimizing the deleterious effects of salinity, with the development of cultivars that can grow and produce economic yield under moderately saline conditions.

Whatever selection of tolerant wheat genotype is effective for decrease of salt deleterious effect, but long term application of saline water caused soil degradation and in this condition tolerant genotype couldn't have satisfactory yield. Application of leaching levels is suitable for soil salinity reduction, but the quality and quantity of leaching on soil desalinization and crop improvement should be site specific. While some researchers found that the best estimation for leaching level for soil desalinization can be made based on soil depth but other believe that appropriate leaching level is related to salinity of drainage water (Ghiyasi *et al*., 2008).

These results indicated that sodium chloride concentrations have highest significant effect on leaf length parameter and lowest significant effect on radicle weight parameter of sardari seedlings.

This investigation shows that growth of wheat seedlings totally restrict in 200 mM sodium chloride concentration. In concentration below of this rate growth of seedlings continued relatively. About 10 mM sodium chloride concentration show increasing effect on growth of wheat seedlings.

The aim of this study is to identify the salinity tolerance of sardari wheat cultivar that is the meager used cultivar in Kurdistan province in Iran. This study indicates that using of dry weight compare of wet weight in moduling of growth factor is accurate and reduces miscues of experiment. By using of growth physiological parameters in compare with using biochemical parameters instrument and methodic errors significantly decrease and results evaluation is very tangible.

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