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Evaluation of almond' cultivars growth characteristics under salinity stress

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ABSTRACT: Soil salinity is one of the main factors which reduce crop production in both arid and semiarid areas all around the world, the experiment was carried out to study the effect of NaCl stress on growth characteristics of almond cultivars. This study was designed as completely randomized in a factorial design. The treatments consisted of 9 cultivars (Tuono, Sahand, 1-25, 13-40, mamaee, Shekufeh, 1-16, A200, Supernova and Francis) and 3 salinity levels (0 (control), 40, and 80 mm L) with three replications. At the end of experiment, some traits were studied such as shoot diameter, shoot branches, number of leafs, height and Collar diameter. The analysis of variance showed that the difference between the cultivars is statistically significant at 5 or 1%. According to the results, it was found that stress was reduced all traits. The cultivars showed different responses to stress treatments. Among cultivars Sahand, A200 and sh12 had higher resistance than other varieties.

***Keywords*:** Cultivars, Growth, Stress.

INTRODUCTION

Soil salinity is one of the main factorswhich reduce crop production in both arid and semiarid areas all around the world; also salinity is one of the problems in Iran's agriculture (Zare and Pakniyat, 2012). More specifically in Iran, 55% of the currently arable land are saline and according to the FAO estimation, the salt-affected land in Iran by low to moderate and high salinity are about 25.5 and 8.5 million hectares, respectively (Aliasgarzad et al., 2005). Therefore, salinity or in other word, salt accumulation can be a threat to plant growth in nearly every arable area of Iran. The effect of high salinity on plant can be observed at the whole plant level in terms of plant death and/or decrease in production (Parid et al., 2004). Woody plants are usually relatively salt-tolerant during the seed germination stage but much more sensitive during the young seedling stage and progressively more tolerant with increasing age through the reproductive stage (Najafian et al., 2008). Also, most of the stone fruit trees and almond are sensitive to salt stresses and their productivity gradually reduces at salt concen-trations above 1.5 dSm-1 and down to 50% of normal yield at the salt concentration of 4 dSm-1 (Hassan and El-Azayem, 1990). The reduction in growth and yield is related in part to the total concentration of soluble salts and osmotic potential of the soil solution (Dejampour et al., 2012). So, at this study, we performed to evaluation of almond cultivars growth characteristics under salinity stress.

MATERIALS AND METHODS

This study was conducted as completely randomized design at Seed and Plant Improvement Institute. Factors examined include 9 cultivars (Tuono, Sahand, 25-1, 13-40, Mamaie, Shekufeh, 1-16, A200, N.P and Sh-12) and 3 salinity levels (0, 40 and 80 mmol/ l) that each treatment was with 3 replications. To conduct this study, GN15 was selected as rootstock of all cultivars. Salinity treatments were performed in plastic pots containing a mixture of 50% soil and 30% sand and 20% peat moss, In order to prevent sudden shock and plasmolysis, adding salt was gradually. At the end of experiment, some traits were studied such as shoot diameter, shoot branches, number of leafs, height and Collar diameter.

RESULTS AND DISCUSSION

Shoot diameter: According to ANOVA, it was founded that cultivars, salinity and them interaction had significant effect on shoot diameter at 5% statistical level (table 1). The highest average (9 mm) by 13-40 had a significant difference with the lowest average (6.9 mm) that it was dedicated to the figure 9-7 (table 2) Mean compare of salinity treatments with Duncan test at level 5% showed that there was statistically significant difference between levels of salinity and salinity leading to a reduction in the branch, Applying of 40 and 80 mmol per liter resulting reduction of 7 and 19 percent in compared to the control, respectively (table 2).

Shoot branches: According to ANOVA, it was founded that, cultivars, salinity and them interaction had significant effect on shoot branches at 5, 1 and 1% statistical level, respectively (table 1). Highest (22) and lowest (5) means ware observed in 9-7 and 1-25 cultivars, respectively (table 2). Number of branches decreased by increasing the stress levels and Applying of 40 and 80 mmol per liter resulting reduction of 18 and 34 percent in compared to the control, respectively (table 2).

Number of leafs: ANOVA showed that, cultivars, salinity and them interaction had significant effect on number of leafs at 5, 1 and 1% statistical level, respectively (table 1). According to result, sh12 cultivar showed highest value also 1-16 and Mamaee cultivars had lowest means, table 2 show value of cultivars and it show Duncan test at 5% level. Applying of 40 and 80 mmol per liter resulting reduction of 14 and 29 percent in compared to the control, respectively (table 2). Under saline conditions it is known that the reduction in total leaf can be explained by a decrease in leaf turgor, changes in cell wall properties or a decreased photosynthesis rate (Franco et al., 1997). In our conditions, it could be due to cell wall changes and/or a decrease in the photosynthesis rate.

Plant height: According to ANOVA, it was founded that cultivars and salinity had significant effect on RWC at 5 and 1% statistical level, respectively. Also them interaction showed significant effect at 5% statistical level (table 1). Comparison of studied traits in response to salinity in cultivars showed that Supernova and 1-16 had highest and lowest value, respectively. Also stress had negative effect on plant height, So that applying of 40 and 80 mmol per liter resulting reduction of 10 and 22 percent in compared to the control, respectively (table 2).

Collar diameter: According to ANOVA, it was founded that cultivars and salinity had significant effect on collar diameter at 5 and 1% statistical level and them interaction showed significant effect at 1% statistical level (table 1). A200, Sahand, Mamaee and 13-40 showed highest collar diameter (12mm) and salinity had negative effect on collar diameter. So that applying of 40 and 80 mmol per liter resulting reduction of 19 and 37 percent in compared to the control, respectively (table 2). Also Rodrıguez et al (2005) showed same result in related to salinity stress. Plant growth responds to salinity in two phases: a rapid, osmotic phase that inhibits growth of young leaves, and a slower, ionic phase that accelerates senescence of mature leaves. Plant adaptations to salinity are of three distinct types: osmotic stress tolerance, Na+ or Cl− exclusion, and the tolerance of tissue to accumulated Na+ or Cl− (Munne and Tester, 2008). The decreased rate of leaf growth after an increase in soil salinity is primarily due to the osmotic effect of the salt around the roots. An increase in soil salinity causes leaf cells to lose water, but this loss of cell volume and turgor is transient. Within hours, cells regain their original volume and turgor owing to osmotic adjustment, but despite this, cell elongation rates are reduced (Rodrıguez et al., 2005) . Over days, reductions in cell elongation and also cell division lead to slower leaf appearance and smaller final size. Cell dimensions change, with more reduction in area than depth, so leaves are smaller and thicker. For a moderate salinity stress, an inhibition of lateral shoot development becomes apparent over weeks, and over months there are effects on reproductive development, such as early flowering or a reduced number of florets. During this time, a number of older leaves may die. However, production of younger leaves continues. All these changes in plant growth are responses to the osmotic effect of the salt, and are similar to drought responses. According to the results, it was found that stress was reduced all traits. The cultivars showed different responses to stress treatments. Among cultivars Sahand, A200 and sh12 had higher resistance than other varieties.

Table 1. means of square for studied treats

Source of variation	d.f	Shoot diameter	Shoot branches	Number of leafs	Plant height	Collar diameter
cultivars	8	3.45*	20.4*	34.32*	46.23*	12.19*
salinity	2	5.1*	50.15**	98.67**	166.83**	28.62**
Cultivar*salinity	16	3.15*	24.82**	42.757**	46.23*	15.37**
error	56	1.5	8.5	14.3	20.1	5.3

Table 2. comparison of studied traits in response to salinity in cultivars

	Shoot diameter		Shoot branches		Number of leafs		Plant height		Collar diameter	
A200	8	ab	11	ef	52	bc	66	f	12	a
1-25,	8	ab	5	h	46	d	76	cd	11	b
9-7,	7	b	22	a	50	c	69	ef	10	c
1-16,	7	b	15	c	36	e	57	g	11	b
Sh12,	7	b	21	a	56	a	76	cd	11	b
Sahand	8	ab	10	fg	51	c	88	b	12	a
Supernova	8	ab	9	g	55	ab	92	a	10	c
Mamaei	7	b	12	de	36	e	67	ef	12	a
13-40	9	a	18	b	43	d	73	d	12	a
control	8.4	a	16.8	a	55.6	a	83.1	a	13.9	a
40	7.8	b	13.7	b	47.3	b	74.1	b	11.2	b
80	6.8	c	10.9	c	39.3	c	64.0	c	8.7	c

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