South Western Journal of Horticulture, Biology and Environment *Vol.5 , No.1, 2014*
P-Issn: 2067- 9874, E-Issn: 2068-7958 *pp. 19-42*

ENHANCING STAND ESTABLISHMENT OF TOMATO CULTIVARS UNDER SALT STRESS CONDITION

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ABSTRACT. *Soil salinity affect the germination of seeds either by creating osmotic potential external to the seeds preventing water uptake or through the toxic effects of Na+ and Cl¯ ions on germinating seed. The objective of present study was to determine the effects of different seed priming chemicals on germination and seedling growth of tomato cultivars under difference levels of salinity conditions. The experiment was a factorial with three factors including three priming ($CaCl_2$, KNO_3 and non-priming as control), three salinity (NaCl) levels (50, 100 and 150 mMol) and two tomato cultivars (Orient F1 and Rebelion F1) on the basis of a completely randomized design. The results demonstrated that tomato germination characteristics and seedling growth are affected by high potential value of primed with $CaCl_2$ and KNO_3 solution in levels of salinity and that increased salinity levels resulted in a significant decreases in germination indices and seedlings growth in studied tomato cultivars.*

KEYWORDS: *Germination, interaction effect, osmotic stress, seed priming, seedling growth.*

INTRODUCTION

Tomato is a major vegetable crop that is grown in every country around the world, in outdoor fields and greenhouses (Demirkaya 2014). The tomato fruit is consumed in fresh, cooked or after processed forms such as canning, juice, pulp, paste, or as a variety of sauces. Being a rich source of phytochemicals such as lycopene, β-carotene, flavonoids, vitamin C and essential nutrients, the tomato has health benefit as well (Nawaz et al. 2012).

Among various environmental stresses, soil salinity has become a critical problem worldwide due to its dramatic effects on plant physiology and performance. It has been estimated that salinity affects ~7% of the world's land area and is responsible for >35% decrease in agricultural productivity world over (Cha-um et al. 2012). In semi-arid tropics, crops, often fail to establish quickly and uniformly, leading to decreased yields. Constraints to good establishment include poor seed bed preparation, low quality seed, lack of soil moisture, high temperature (Khan et al. 2014). Tomato is a major food plant, and it is moderately sensitive to salinity (Al-Busaidi et al. 2010). Salinity tolerance in tomato plants is of major importance in semi-arid tropics, where plants are often subjected to high levels of salinity in the soil from soluble salts in irrigation water and fertilizers (Al-Karaki 2000). There is a negative correlation between excess salinity and yield (Al-Karaki et al. 2001). Soil salinity may affect the germination of seeds either by creating osmotic potential external to the seeds preventing water uptake or through the toxic effects of Na+ and Cl^- ions on germinating seed (Janmohammadi et al. 2008). Seedling emergence is one of the stages of growth that is sensitive to water deficit. Therefore, seeds germination, are prerequisites for the success of stand establishment of crop plants. Under semiarid regions, low moisture is limiting factor during germination. Crop establishment depends on an interaction between seedbed environment and seed quality (Ahmadizadeh et al. 2011).

Seed priming is defined as pre-sowing treatments in water or in an osmotic solution that allows seed to imbibe water to proceed to the first stage of germination, but prevents radicle protrusion through the seed coat. The most important priming treatments include halopriming (soaking seeds in inorganic salt solutions), solid matrix priming (treatment of seeds with solid matrices), osmopriming (soaking seeds in solutions of different organic osmotica), biopriming (hydration using biological compounds) and hydropriming (soaking seeds in water) (Janmohammadi et al. 2008, Shabbir et al. 2013).

Rapid and uniform field emergence is an essential pre-requisite to reach the yield potential, quality and ultimately profit in annual crops (Shehzad et al. 2012). Primed seeds produced higher germination rate, greater germination percentage and uniformity (Farooq et al. 2006, Qadir et al. 2011). Higher seed germination rate and uniformity in emergence have been attributed to the metabolic repair during imbibition, a buildup of germination-increasing metabolites, priming repairs damage of aged seeds, in addition, seeds exposed to abiotic stresses such as salinity, which enhances germination and seedling emergence consistently (Qadir et al. 2011, Shabbir et al. 2013, Rostami-Ajirloo et al. 2013, Esmaeili & Farahmanfar 2013). Increase in various free radical scavenging enzymes, such as superoxide dismutase, catalase and peroxidase have also been demonstrated to influence the germination (Nawaz et al. 2012). The primed seeds increased the total sugars and α-amylase activity and exhibited earlier initiation of protein, RNA and DNA synthesis. Consequently, when the seed is set out for germination, cellular events are much advanced (Soughir et al. 2013, Tilahun-Tadesse et al. 2013).

Optimum enhancement of primed seeds would occur just below the osmotic potential threshold for their germination, with enhancement at or above this threshold causing premature radicle protrusion (Khan et al. 2014). One of the advantages of osmo-priming is that it makes the treated seeds less sensitive to temperature and oxygen deprivation. Furthermore, the use of calcium chloride, potassium nitrate, sodium chloride and polyethylene glycol-8000 have been proved to lessen mean germination time (Kareem & Ismail 2013). Also, it has been showed that the types of substances with same osmotic potential had different effect on seedling vigor (Rehman et al. 2013). For exemple, in rice, osmopriming with $CaCl_2$ was more effective than KCl and hydropriming. In tomato, the primed seeds with KNO_3 produced seedling with better growth than the seeds primed with NaCl (Takhti & Shekafandeh 2012).

Maher et al. (2013) indicated that seed priming increased final germination percentage, germination speed and radicle length over the non-primed treatment. Tzortzakis (2009) expressed that priming with KNO_3 improved rate of germination and seedling emergence, and stated that priming is a practical method with economic benefit for producers. Beside, some studies reported that KNO_3 primed seeds excelled over all other priming agents including NaCl (Amjad et al. 2007, Abdollahi & Jafari 2012). According to the ecological condition of agricultural land which a large percentage of the lands under cultivation are faced with the problem of salinity (Pitman & Läuchli 2002, Munns & Tester 2008). Since, saline soils emendation is very difficult. Therefore, the objective of present study was to determine the effects of different seed priming on germination and seedling growth of tomato cultivars at difference levels of salinity conditions.

MATERIAL AND METHODS

The experiment was conducted at the laboratory of faculty of agriculture Islamic Azad University, Jiroft Branch, Iran, in 2013. The tomato cultivars used were Orient F1 and Rebelion F1. Twenty five healthy seed of each cultivars were selected and then sterilized with 5% sodium hypochlorite solution. These surface sterilized seeds were primed in aerated solution of $CaCl_2$ and KNO_3 (Demir Kaya et al. 2006). After respective priming treatments, seeds were washed with distilled water. Before the seeds were put in covered sterilized petri dishes containing germination paper moistened with 8 ml of the different solutions of NaCl. The petri dishes were kept in an incubator for 10 days at 20 ± 0.5 °C. The experiment was a factorial with three factors including three priming ($CaCl_2$, KNO_3 and non-priming as control), three salinity (NaCl) levels (50, 100 and 150 mMol) and two tomato cultivars on the basis of a completely randomized design.

The numbers of seeds germinated were counted daily. In this experiment, Coefficient of Velocity of Germination (CVG), Germination Rate Index (GRI), Final Germination Percent (FGP) and Germination Index (GI) were calculated (AL-Mudaris 1998).

1.) $CVG = 100 \times \dfrac{\sum Ni}{\sum NiTi}$

Ni = the number of germinated seeds in every day

Ti = the number of day

2.) $GI = (24 \times N_1) + (23 \times N_2) + ... + (1 \times N_{24})$

N1, N2 = the number of germinated seeds in first day, second day and . . .

3.) $GRI = \frac{G_1}{1} + \frac{G_2}{2} + ... + \frac{G_x}{x}$

G1= germination percent in first day

G2= germination percent in second day to tenth day of experiment

4.) $FGP = \frac{Ng}{Nt} \times 100$

Where Ng is the number of germinated seed at each enumeration interval, and Nt is the number of seeds in each experimental unit.

Median Germination Time (MGT) was calculated to assess the rate of germination (Ellis & Roberts 1980) as follows :

5.) MGT = (fx) / f

f = the number of newly germinated seeds on each day and x is the day of counting.

At the end of ten days, 5 seedlings were selected randomly and also measured the seedling length, root weight, shoot weight, root length, shoot length and dry shoot weight. The data were statistically analyzed by Minitab software.

RESULTS AND DISCUSSION

Germination is an important index affecting the stand establishment, survival and population dynamics of a crop. The analysis of variance revealed highly significant ($P < 0.01$) difference between control treatment and seeds primed with $CaCl_2$ and KNO_3 solution in terms of all germination indices and seedling growth traits except GRI. Also, analysis of variance showed highly significant difference between levels of salinity (Table 1). Esmaeili & Farahmanfar (2013) with studied on barley reported that the analysis of variance indicated that osmopriming solutions significantly

Table 1. Analysis of variance of the evaluated traits.

S.O.V	D.F.	Means Square						
		CVG	MGT	FGP	GRI	GI	GR	Seedling Length
Priming (P)	2	0.003**	0.34**	1912**	24.77ns	168.01**	0.45**	6.87**
Salinity (S)	2	0.006**	0.94**	27207**	361.6**	5345**	8.65**	620.07**
Cultivar (C)	1	1.38×10^{-4}ns	0.016ns	1350**	0.64ns	160.1**	0.304**	1.26ns
P × S	4	0.003**	0.36**	1082**	17.03ns	176.7**	0.28**	21.04**
P × C	2	0.001*	0.12*	72.22ns	0.378ns	13.72ns	0.024ns	5.46**
S × C	2	2.22×10^{-4}ns	0.019ns	22.22ns	48.22ns	77.16**	0.055*	24.44**
P × S × C	4	0.001*	0.11*	152.7*	2.91ns	38.30*	0.065**	3.98**
Error	36	3.4×10^{-4}	0.035	64.81	16.04	11.92	0.015	0.41

ns: non-significant differences; *: significant at p<0.05;** : significant at p<0.01
Coefficient of Velocity of Germination (CVG), Median Germination Time (MGT), Final Germination Percent (FGP), Germination Rate Index (GRI) and Germination Index (GI)

S.O.V	D.F.	Means Square				
		Shoot Length	Root Length	Root Weight	Shoot Weight	Dry Shoot Weight
Priming (P)	2	3.21**	3.80**	5.886×10^{-6} **	0.0001**	2.121×10^{-5}*
Salinity (S)	2	194.9**	115.06**	0.000235**	0.01**	0.001**
Cultivar (C)	1	0.19ns	0.94*	2.508×10^{-5}**	2.745×10^{-5}ns	6.841×10^{-6}ns
P × S	4	8.35**	3.21**	3.756×10^{-5}**	0.001**	3.790×10^{-5}**
P × C	2	1.14**	1.69**	3.730×10^{-5}**	6.666×10^{-5}*	4.221×10^{-6}ns
S × C	2	10.55**	3.15**	1.368×10^{-5}**	0.0001**	7.938×10^{-6}ns
P × S × C	4	0.726**	2.95**	1.634×10^{-5}**	0.0002**	1.108×10^{-5}ns
Error	36	0.15	0.264	6.691×10^{-7}	1.323×10^{-5}	7.107×10^{-6}

ns: non-significant differences; *: significant at p<0.05;** : significant at p<0.01

affected seed germination quality and seedling establishment. In addition, the cultivars under study responded differently to the osmopriming solutions.

Priming × salinity effect was significant for all studied traits except GRI

(Table 1). The highest CVG was in primed with KNO_3 in 50mMol level of salinity was not significantly different with control and seed primed with $CaCl_2$ in 50mMol and 100mMol levels of salinity conditions (Fig. 1A). Median Germination Time in all of priming × salinity conditions had highest amount, except under primed with $CaCl_2$ and KNO_3 in 150mMol level of salinity (Fig. 1B). The highest FGP was in primed with KNO_3 and $CaCl_2$ in 50mMol level of salinity that there was no statistically significant difference with unprimed condition under 50mMol and 100mMol levels of salinity conditions (Fig. 1C). The reduction in final germination percentage can be explained by the increase of external osmotic pressure which affects the absorption of water by the seed and can be also due to the accumulation of Na+ and Cl^- in the embryo which may lead to an alteration of the metabolic processes of germination and subsequently causing cells death in the embryo (Maher et al. 2013). Afkari (2010) indicated that by increasing of levels of salinity reduced final emergence in both non-primed and primed seeds, but, negative effects of salinity stress on primed seeds were less than unprimed seeds. The most GI was in primed with KNO_3 in 50mMol level of salinity condition (Fig. 1D). Beside, similar result have been observed in terms of GR (Fig. 1E). The highest shoot length were in primed with KNO_3 in 50mMol level of salinity, as compared to the least shoot length recorded with seed priming with $CaCl_2$ and KNO_3 in 150mMol level of salinity (Fig. 2A). All priming in 50mMol level of salinity had highest root length (Fig. 1F). The highest root weight was in primed with $CaCl_2$ and KNO_3 in 50mMol and 100mMol levels of salinity, respectively (Figs. 2B). The highest shoot weight was in primed with KNO_3 in 50mMol level of salinity (Figs. 2C). The highest dry shoot weight were in primed with $CaCl_2$ and KNO_3 in 50mMol and 100mMol levels of salinity (Fig. 2D). Salinity reduced the fresh and dry shoot and root weight of tomato. Increased salinity over 4000 ppm led to reduction in dry weight, leaf area, plant stem, and roots of tomatoes (Al-Busaidi et al. 2010). Abdollahi & Jafari (2012) showed that in saline conditions KNO_3 3% increased radicle to primary shoot (R/S) ratio more than NaCl 1%. This may in turn have the advantage of increasing water up take by seedlings, which is useful for saline conditions (Abdollahi & Jafari 2012). This can be attributed to the

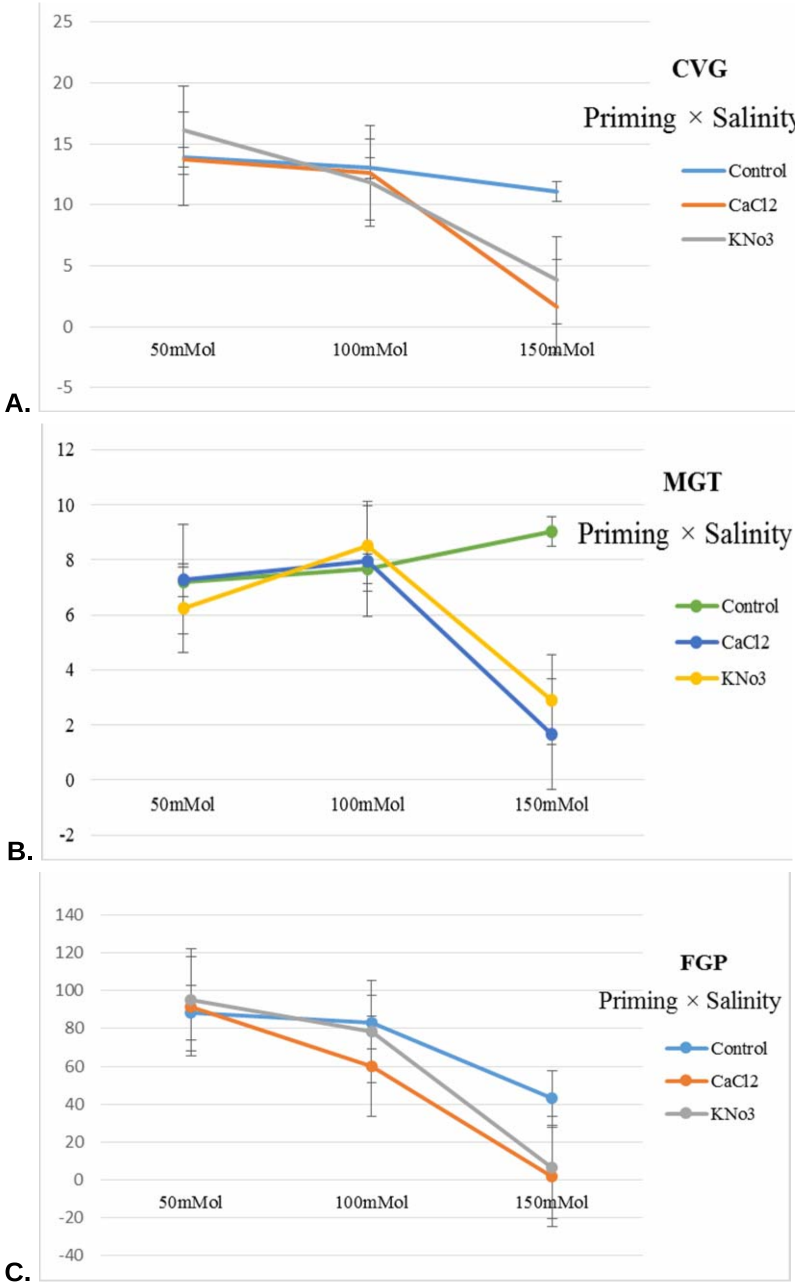
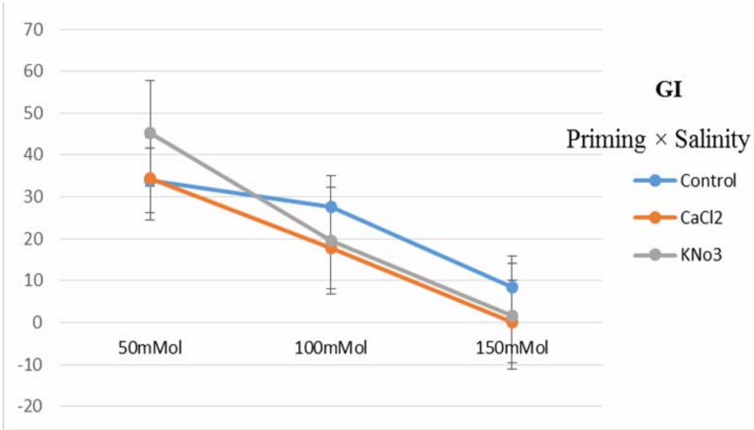


Figure 1(A-C). Interaction effect of different priming treatments and levels of salinity on germination and seedling traits.



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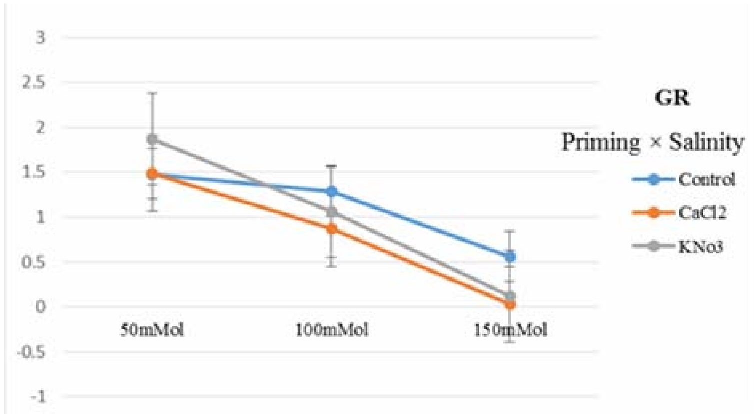

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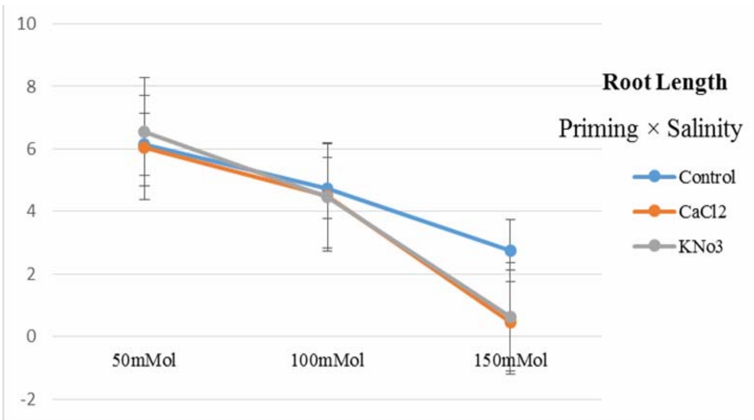
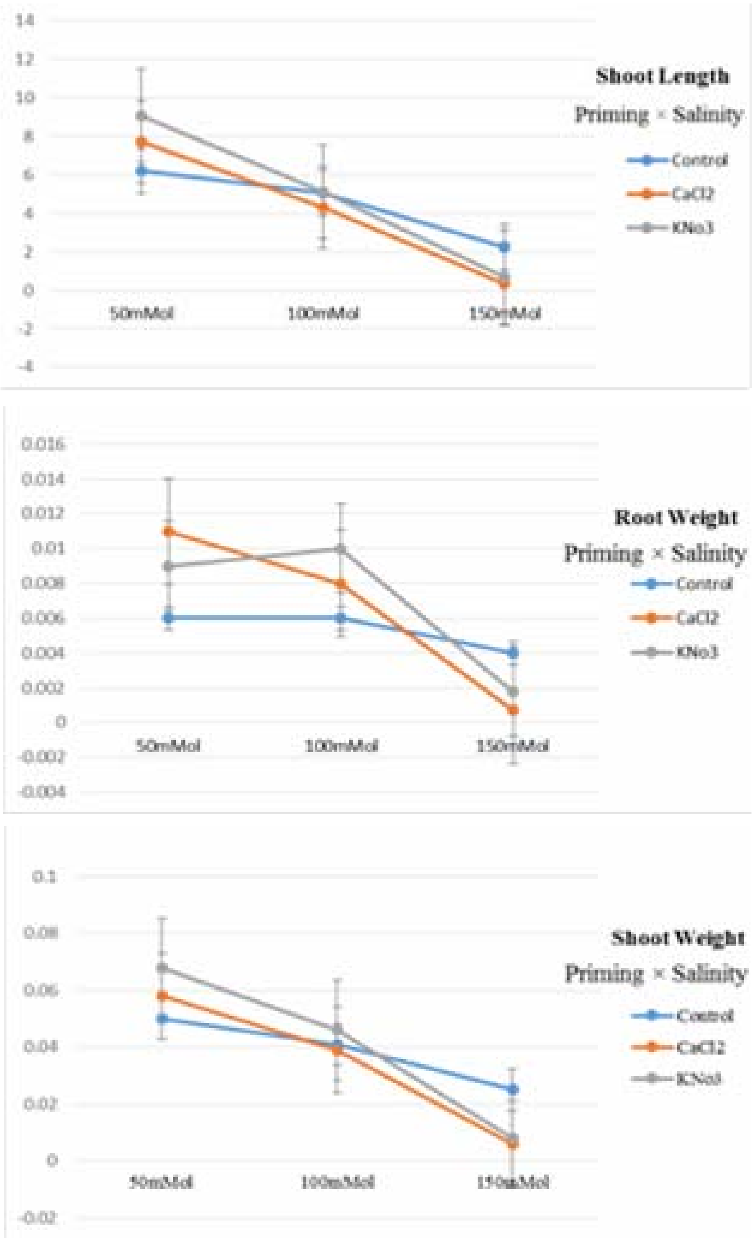


F.

Figure 1(D-F). Interaction effect of different priming treatments and levels of salinity on germination and seedling traits.



A.

B.

C.

Figure 2(A-C). Interaction effect of different priming treatments and levels of salinity on seedling traits.

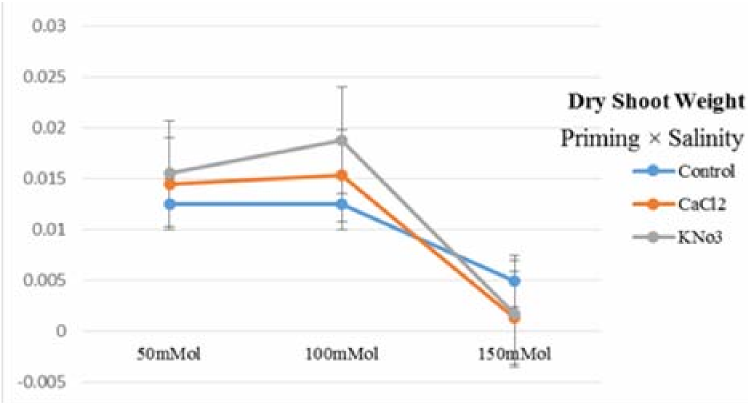


Figure 2(D). Interaction effect of different priming treatments and levels of salinity on seedling traits.

prevention of water uptake due saline condition. The salinity stress results in an imabalance in Na+ and K+ characterized by increased Na+ accumulation in the cells (Ali et al. 2011), leading to Na+ and Cl^- ions toxicity that adversely affects the germination process (Khajeh-Hosseini et al. 2003). Ahmadvand et al. (2012) indicated that at the salinity stress, mean germination and emergence time of primed seeds were less than non-primed seeds, significantly. At the salinity stress, specific highest salinity level, final germination percentage, radicle and plumule length and plant dry weight of primed seeds were more than non-primed seeds. These results indicated that priming treatments significantly improved seed performance under salinity conditions (Shah et al. 2011).

Priming × cultivar effect was significant for CVG, MGT, seedling length, shoot length, root length, root weight and shoot weight (Table 1). Two studied cultivars had highest CVG and MGT in control condition (Fig. 3A & B). These results are similar with the findings of Farooq et al. (2006) and Qadir et al. (2011) who reported decreased MGT by $CaCl_2$ primed seeds. The reasons for this reduced mean germination time may be the vigorous and earlier start taken by the $CaCl_2$ primed seeds. The highest seedling length of Rebelion F1 and Orient F1 cultivars were in primed with KNO_3 and control conditions, respectively (Fig. 3C). The highest shoot length of Orient

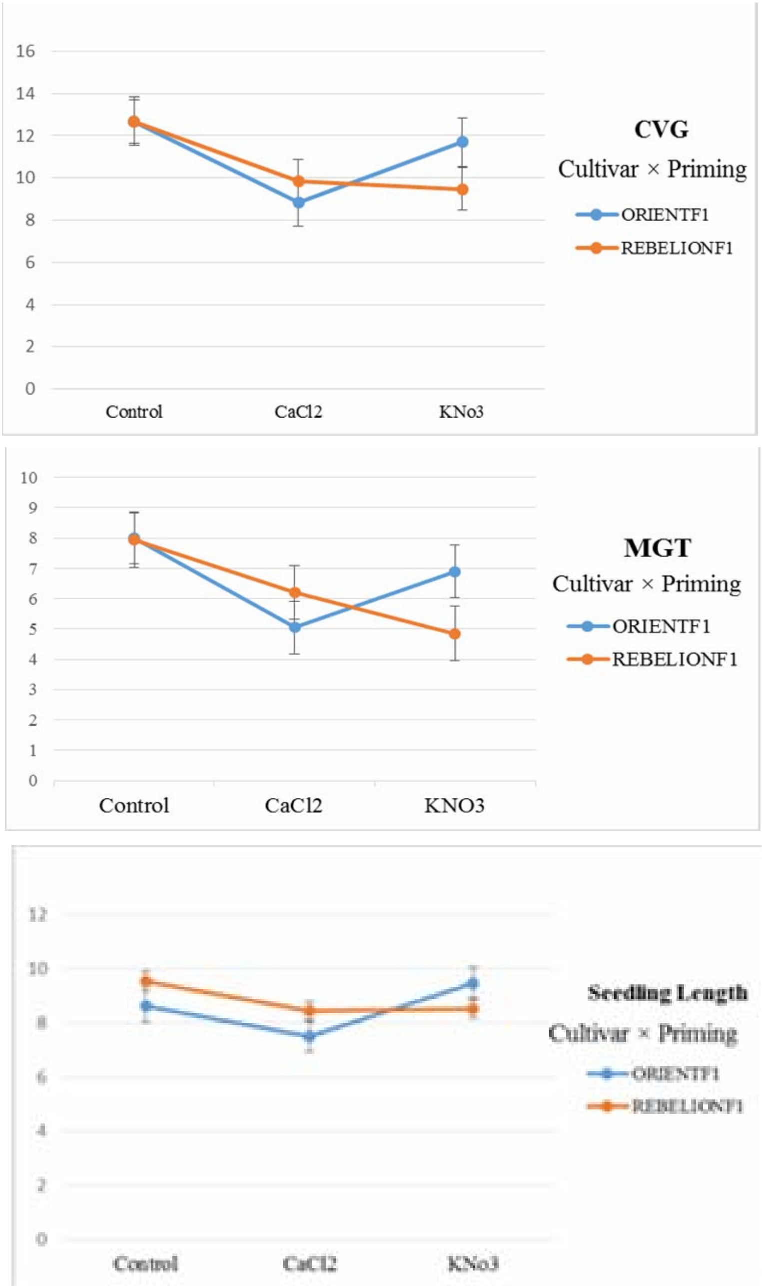
A.
B.
C.


Figure 3(A-C). Interaction effect of cultivars and different priming treatments on germination and seedling traits.

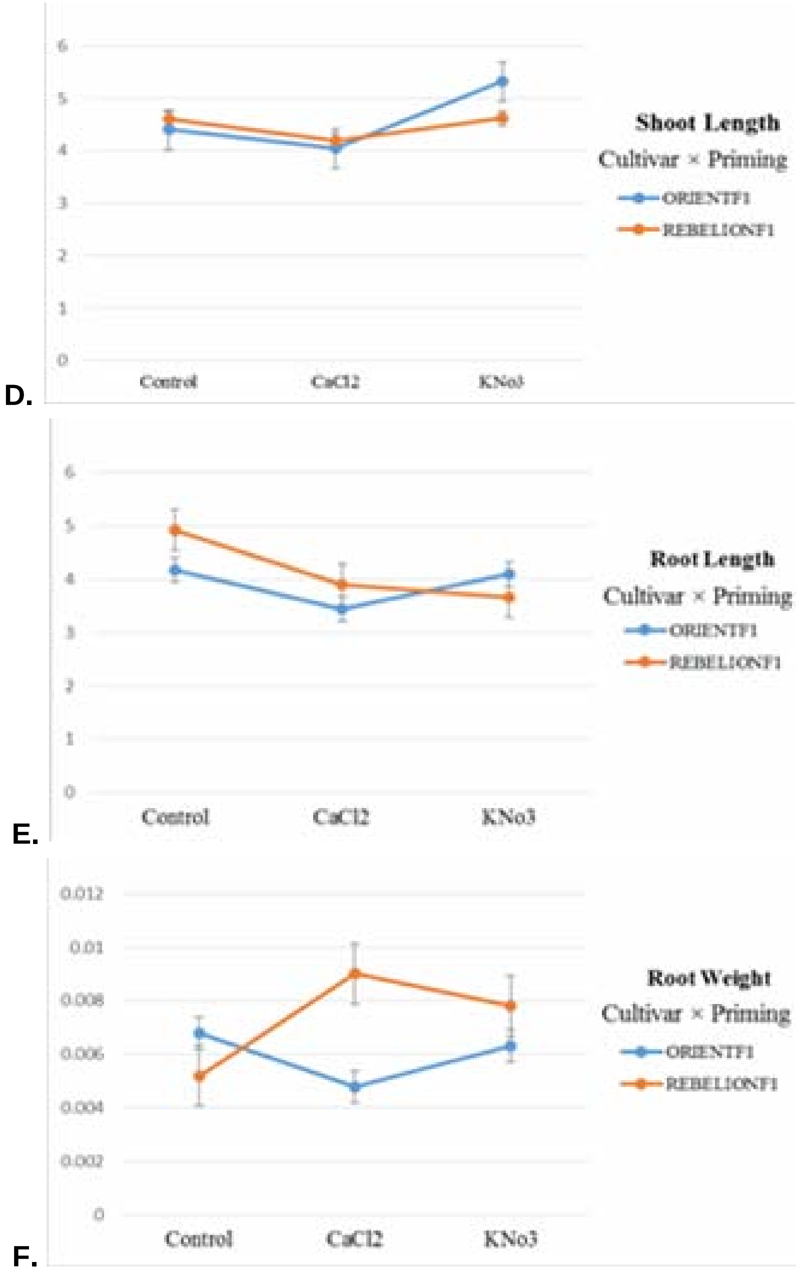


Figure 3(D-F). Interaction effect of cultivars and different priming treatments on germination and seedling traits.

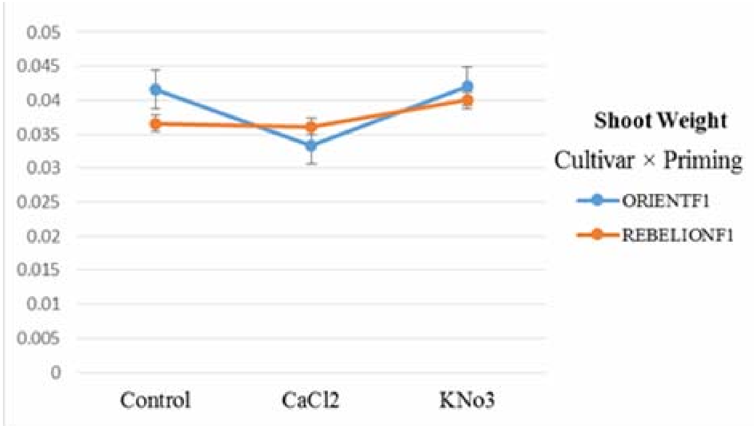
G. 

Figure 3(G). Interaction effect of cultivars and different priming treatments on germination and seedling traits.

F1 cultivar was in primed with KNO_3 (Fig. 3D). The highest root length and root weight of Rebelion F1 cultivar was in control condition and primed with $CaCl_2$, respectively (Fig. 3E & F). Two studied cultivars had highest shoot weight in primed with KNO_3 condition (Fig. 3G). Hydroprimed seeds produced the largest roots, shoots and seedlings, compared to the other seed treatments. This means that during priming, seeds would be simultaneously subjected to processes of repair and deterioration and force between the two determined the success or failure of the treatment (Ghassemi-Golezani et al. 2008). Some researcher also showed that use of KNO_3 as priming agent enhanced the germination percentage of season grasses (Bush et al. 2000, Qian et al. 2006, Qadir et al. 2011). Seed priming with KNO_3 has also been shown to cause significant increase in germination and emergence percentage, radicle and plumule length, seedling dry weight and plant dry weight (Ahmadvand et al. 2012).

Salinity effects includes different patterns in proteins synthetize, delay in emergence and decrease in germination percentage and rate (Askari Nejad & Farahmand 2012). Salinity × cultivar effect was significant for GI, GR, seedling length, shoot length, root length, root weight and shoot weight (Table 1). There is considerable differences in all the traits among the three conditions indicated there was decreasing in germination indices and seedling growth with increasing in concentration of NaCl (Fig. 4). The Orient F1 cultivar had the highest GI, GR, seedling length, shoot length and shoot weight in 50mMol level of salinity condition (Fig. 4). Also, the highest root lengths of two cultivars were in 50mMol level of salinity condition (Fig. 4D). The efficiency of soil water uptake by the root system, therefore, is a key factor in determining the rate of transpiration and tolerance to water deficient. Water uptake by the root is a complex parameter that depends on root structure, root anatomy, and the pattern by which different parts of the root contribute to overall water transport (Ahmadizadeh 2013). The Rebelion F1 cultivar had the highest root weight in 50mMol and 100mMol levels of salinity conditions (Fig. 4E). The difference in germination is due to the physical damage and toxic effect of some salts on seed radical and plumule. Priming solution influences germination by the effect of more water uptake by seed (Khan et al. 2014). Datta et al. (2009) reported that different levels of salinity significantly affected on seedling traits by reducing root and shoot length for salinity below 125 mMol. In the primed seeds, metabolic activities related to seed germination process commence much earlier than radicle and plumule appearance, i.e. emergence. Beneficial effects of hydropriming under normal and stress conditions could be due to earlier metabolic activities, faster and imbibition, lesser mechanical restriction of seed coat as a result of softening of seed coat (Askari Nejad & Farahmand 2012).

Three way interaction between priming and salinity with cultivar (P × S × C) were significant for all measured traits except GRI and dry shoot weight (Table 1). The highest CVG of cultivars were in all priming and levels of salinity conditions, except under primed with KNO_3 and $CaCl_2$ in 150mMol level of salinity conditions. Similar results have also been observed in terms of MGT and FGT. The most GI and GR were for Orient F1 under all priming conditions in 50mMol level of salinity, beside for Rebelion F1 under primed with KNO_3 in 50mMol level of salinity. Orient F1 under primed with KNO_3 in 50mMol level of salinity had highest seedling length and shoot length (Table 2). Bocian & Holubowicz (2008) reported that seed priming with KNO_3, improved seed germination of tomato. In other studies the positive

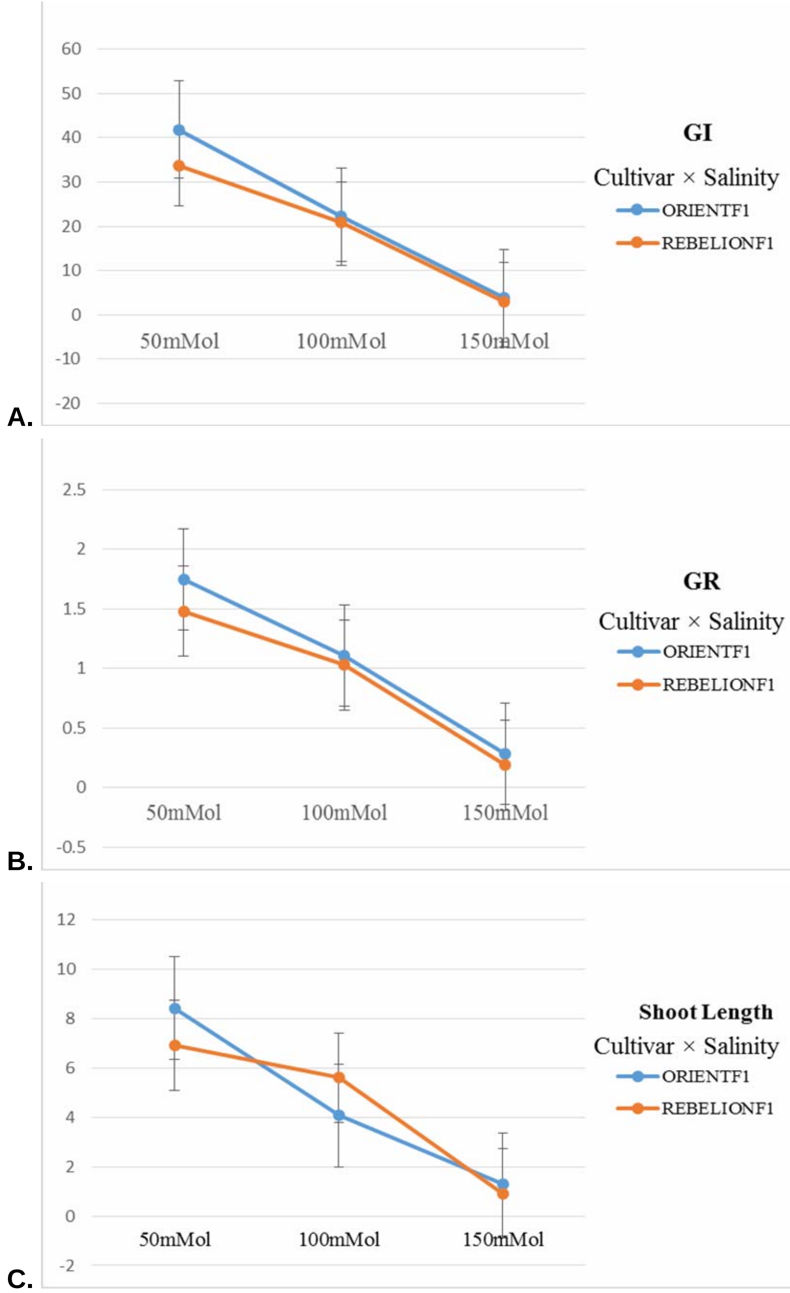
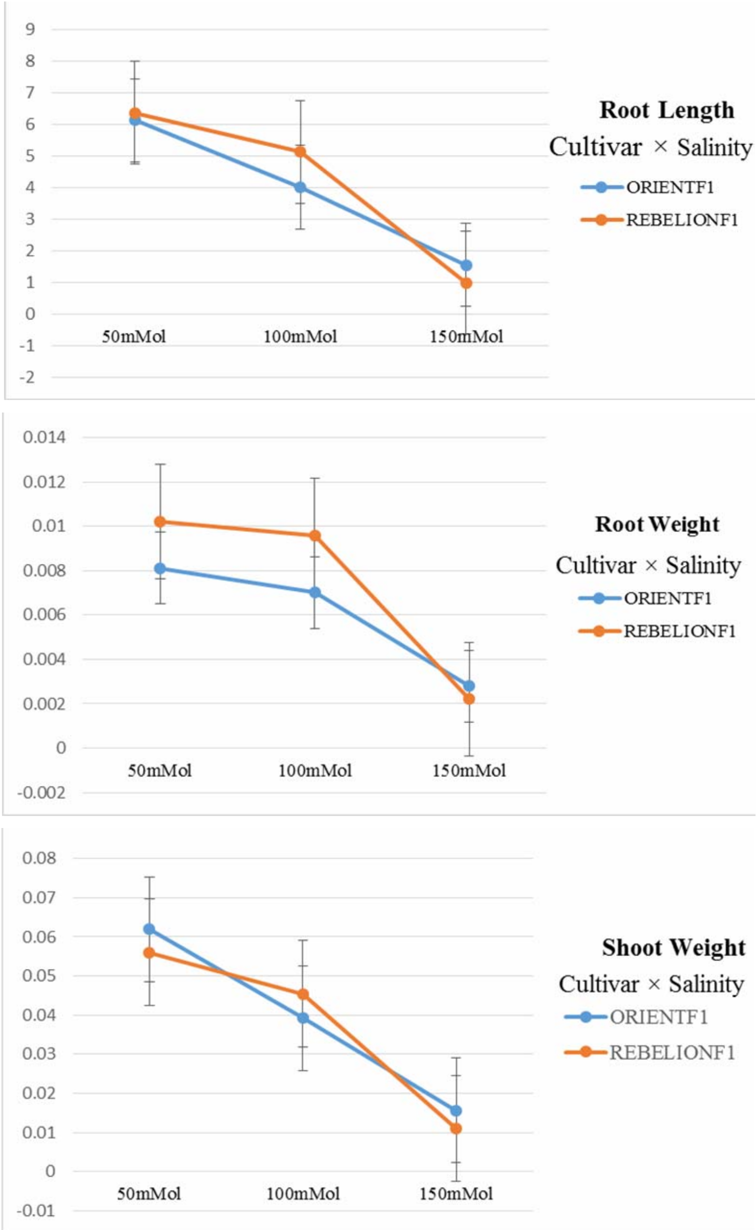


Figure 4(A-C). Interaction effect of cultivars and different levels of salinity on germination and seedling traits.



D. E. F.

Figure 4(D-F). Interaction effect of cultivars and different levels of salinity on germination and seedling traits.

effects of priming on seed germination has been confirmed (Tzortzakis 2009, Ahmadvand et al. 2012, Rostami-Ajirloo et al. 2013). During priming, the embryo expands and compresses the endosperm. The compression force of the embryo and hydrolytic activities on the endosperm cell walls may deform the tissues that have lost their flexibility upon dehydration, producing free space and facilitating root protrusion after rehydration (Ghassemi-Golezani et al. 2008). Increase in germination of KNO_3 primed seeds recorded compared with control. This increase in germination may be due to the activity of α-amylase due to osmopriming. Amylases are key enzymes that play a vital role in hydrolyzing the seed starch reserve, thereby supplying sugars to the developing embryo (Ghobadi et al. 2012). Qadir et al. (2011) reported that osmopriming with 10 mM 50 mM KNO_3 can be successfully employed to improve the germination and seedling vigor in bufffel grass. The highest root length of cultivars were under all priming in 50mMol level of salinity conditions. The most root weight observed in Rebelion F1 cultivar under primed with $CaCl_2$ and KNO_3 in 50mMol and 150mMol levels of salinity conditions, respectively. The most shoot weight were observed in Orient F1 cultivar under primed with $CaCl_2$ and KNO_3 in 50mMol level of salinity conditions and in Rebelion F1cultivar under primed with KNO_3 in 50mMol level of salinity condition (Table 2). Improved seedling fresh weight might be due to increased cell division within the apical meristem of seedling roots, which cause an increase in plant growth (Shehzad et al. 2012). These results are in accordance with Rostami-Ajirloo et al. (2013), Soughir et al. (2013) and Askari Nejad (2013), who reported that priming treatment increased seedling size. It has been reported that, although priming improve the rate of germination, synchronous seedling emergence and growth, the effectiveness of different priming agents varies with different concentration of priming solution and crop species (Takhti & Shekafandeh 2012). Faster emergence rate after priming may be due to increased rate of cell division in the root tips of seedlings from primed seeds as reported tomato (Farooq et al. 2005). Shahi-Gharahlar et al. (2010) reported that increasing NaCl concentration showed decreasing in germination percentage in Cumin (*Cuminum cyminum* L.).

Askari Nejad & Farahmand (2012) showed that different seed priming

Table 2. Three way interaction effect between cultivars, different levels of salinity and priming treatments on germination and seedling traits.

Cultivar	Salinity	Priming	CVG	MGT	FGP	GI	GR	Seedling Length	Shoot Length	Root Length	Root Weight	Shoot Weight
		Control	14.73^{a}	6.78^{ab}	96.66^{a}	40.66^{a}	1.73^{a}	11.96^{cd}	6.90^{de}	5.00^{bcd}	0.0087^{cd}	0.054^{cde}
	50mMol	$CaCl_2$	14.57^{a}	6.86^{ab}	96.66^{a}	40.00^{a}	1.66^{ab}	14.66^{b}	8.33^{b}	6.33^{ab}	0.0081^{de}	0.061^{abc}
		KNo_3	15.41^{a}	6.50^{ab}	100.00^{a}	45.00^{a}	1.87^{a}	17.10^{a}	10.03^{a}	7.06^{a}	0.0074^{def}	0.070^{a}
		Control	12.60^{ab}	7.93^{ab}	90.00^{ab}	27.66^{b}	1.33^{bc}	8.00^{f}	3.90^{i}	4.10^{cd}	0.0068^{defg}	0.039^{fg}
Orient F1	100mMol	$CaCl_2$	12.03^{ab}	8.31^{ab}	70.00^{bc}	18.66^{bcd}	0.96^{cde}	7.83^{fg}	3.83^{i}	4.00^{cd}	0.0063^{defg}	0.039^{fg}
		KNo_3	12.03^{ab}	8.36^{ab}	76.66^{ab}	20.33^{bc}	1.05^{cd}	8.66^{ef}	4.50^{hi}	3.96^{cd}	0.0078^{de}	0.038^{fg}
		Control	10.74^{ab}	9.31^{a}	50.00^{cd}	8.33^{de}	0.61^{efg}	5.90^{gh}	2.43^{j}	3.43^{de}	0.0047^{gh}	0.0307^{gh}
	150mMol	$CaCl_2$	0.000^{d}	0.000^{c}	0.000^{f}	0.000^{e}	0.000^{h}	0.000^{k}	0.000^{l}	0.000^{g}	0.000^{j}	0.000^{j}
		KNo_3	7.62^{bc}	5.83^{ab}	13.33^{ef}	3.00^{e}	0.25^{gh}	2.70^{ij}	1.43^{jk}	1.26^{fg}	0.0037^{hi}	0.0165^{i}
		Control	13.12^{ab}	7.62^{ab}	80.00^{ab}	27.00^{bc}	1.24^{c}	12.83^{bc}	5.50^{fgh}	7.33^{a}	0.0049^{gh}	0.046^{def}
	50mMol	$CaCl_2$	13.00^{ab}	7.71^{ab}	86.66^{ab}	28.66^{b}	1.32^{bc}	13.26^{bc}	7.10^{cd}	5.76^{ab}	0.0147^{a}	0.056^{bcd}
		KNo_3	16.84^{a}	5.96^{ab}	90.00^{ab}	45.33^{a}	1.88^{a}	14.23^{b}	8.13^{bc}	6.03^{ab}	0.011^{bc}	0.066^{ab}
		Control	13.47^{ab}	7.42^{ab}	76.66^{ab}	27.33^{bc}	1.25^{c}	11.65^{cd}	6.23^{def}	5.40^{bc}	0.0056^{efgh}	0.043^{ef}
Rebelion F1	100mMol	$CaCl_2$	13.23^{ab}	7.60^{ab}	50.00^{cd}	17.00^{cd}	0.79^{def}	10.50^{de}	4.83^{ghi}	5.00^{bcd}	0.0108^{bc}	0.038^{fg}
		KNo_3	11.62^{ab}	8.61^{ab}	80.00^{ab}	18.66b^{cd}	1.06^{cd}	11.33^{cd}	5.73^{efg}	5.00^{bcd}	0.0123^{ab}	0.053^{cde}
		Control	11.43^{ab}	8.75^{ab}	36.66^{de}	8.33^{de}	0.51^{fg}	4.16^{hi}	2.10^{j}	2.06^{ef}	0.005^{fgh}	0.0201^{hi}
	150mMol	$CaCl_2$	3.33^{cd}	3.33^{bc}	3.33^{f}	0.333^{e}	0.073^{h}	1.60^{jk}	0.66^{kl}	0.94^{fg}	0.0015^{ij}	0.0129^{i}
		KNo_3	0.000^{d}	0.000^{c}	0.000^{f}	0.000^{e}	0.000^{h}	0.000^{k}	0.000^{l}	0.000^{g}	0.000^{j}	0.000^{j}

Means that do not share a letter are significantly different at $p<0.05$.
Coefficient of Velocity of Germination (CVG), Median Germination Time (MGT), Final Germination Percent (FGP), Germination Rate Index (GRI) and Germination Index (GI).

treatments improved shoot and radicle length, germination percentage and speed of germination of *Aeluropus Macrostachys* specie. Ahmadizadeh et al. (2011) reported that increasing osmotic potential from -6 to -8 had negative effects on different traits of durum wheat landraces such as germination and seedling early growth. Leopold (1983) reported that soybean seed volume increases in $CaCl_2$ and KNO_3 solutions were less than distilled water, however swelling of soybean seeds in KNO_3 was more than $CaCl_2$. This case may be a reason for more KNO_3 uptake and probably its toxicity in sainfoin seed in compare with $CaCl_2$. Positive effect of KNO_3 on germination in saline condition has also been documented in halophytes like Suaeda salsa (Li et al. 2005) and *Crithmum maritimum* (Atia et al. 2009).

CONCLUSION

Priming is a pre-sowing soaking of seeds in different solutions, which enhances germination and seedling emergence uniformity under adverse environmental conditions. Our results are demonstrated that tomato germination characteristics and seedling growth may be affected by high potential value of priming with $CaCl_2$ and KNO_3 solution in levels of salinity. The Orient F1 cultivar had highest germination indices under all priming in 50mMol level of salinity conditions. Moreover, Orient F1 cultivar had highest seedling length and shoot length under primed with KNO3 in 50mMol level of salinity conditions. But, the most root weight and root length observed in Rebelion F1 cultivar under priming in salinity conditions. Also, our study indicated that increased salinity levels results in a significant decreases in germination indices and seedlings growth in studied tomato cultivars. The main reason of difference in reported work may be due to water potential level and temperature degree maintained during hydropriming. It is, therefore, concluded that priming is a simple, low cost and environmentally friendly technique for improving seed and seedling vigor of tomato under salinity stress. These results are also useful to predict sowing rates depending upon saline conditions.

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