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ORIGINAL ARTICLE

Effect of Different Levels of Drought Stress (PEG 6000 Concentrations) On Seed Germination and Inorganic Elements Content in Purslane (*Portulaca oleraceae* L.) Leaves

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One of the most important environmental stresses is drought that great effect on plant grow and metabolism. In this study, drought stress effect on germination and inorganic elements content in leaves of medical plant Purslane (*Portulaca oleraceae* L.) were study. This plant as an Antiseptic, Antispasmodic, Diuretic, and Blood Filtering has medical application. Drought stress imposed by polyethylene glycol 6000 on seedlings and experiments in completely random model framework and with 3 replications performed. Drought levels imposed consist of Blank (distilled water), -0/1 -0/2 ,-0/4 ,-0/6, -0/8 and -1 MPa. In relation with germination, observed that with increasing of drought level, germination percent was decreased, but this decrement was not meaningful in statistical level of 0/01, which indication of high resistant Purslane than to drought stress in germination stage. But in relation with inorganic elements in Purslane leaves, meaningful increase of Sodium, and meaningful decrement of Potassium, Calcium, Magnesium, Manganese, and Iron content with increase of drought level, was observed (P>0/01). In relation to sodium concentration, the highest content in level of -1 MPa and the least concentration in blank level, was observed.The highest concentration of potassium in -0/2 MPa and the least concentration in -1 MPa, observed. Also, the highest and least concentration of calcium, magnesium, manganese and iron observed in blank level and -1 MPa level, orderly.

Key words: Purslane(Portulaca oleracea L.) / Drought / Polyethylene glycol / Germination / Inorganic Elements

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Key words: Purslane(Portulaca oleracea L.) / Drought / Polyethylene glycol / Germination / Inorganic Elements

Plant growth, development and production are affected by natural stresses in the form of biotic and abiotic stresses such as drought, salinity and freezing, inversely. Drought or water deficit is the one most important of environmental stresses that influences on plant production (Abdalla and El-khoshiban, 2007). Plants are resistance on stress with two form that are tolerance stress and reject stress. Drought is relative term that occurs in mild regions in 15 days without any rain. In semi-arid region, there are two sessions: dry and damp, and dryness is a state where no remarkable rain occurs (Saxena, 2001). Cramer (1983) defines drought stress as shortage of rain in plant environment, whose effect causes damage to plants and the rate of this damage depends on the type of plant species, maintaining of water capacity and atmosphere conditions in evaporation and gutation. Using of drought resistant plants is one of important ways for good cultivation in drought condition (Ennajeh, 2010). Purslane is annual plant, resists on drought, and it is from the Portulacaceae family, its current name is Purslane which has the highest rates of Omega-3 fatty acids and antioxidant vitamins. Hence, it is one of the valuable medical plants. Purslane as a weed, has global distribution and taxonomy by 8 current plants groups in the world (Liu et al, 2000). It was a main weed for 45 cultivating types in 81 countries of the worlds (Holm et al, 1977). The life cycle of this plant during of 2 to 4 months will complete (Chauhan and Johnson, 2007). Purslane can grow in salty and dry soil easily. As a result in Haloph data, it is known as halophyte or salty plant (Aronson, 1989). It used as an antiseptic, antispasmodic, diuretic, antipyretic, muscle loose, antioxidant, reinforcing of safety system, blood filtering and for removing of thirsty has medical application (Schuman, 2001). In comparing the highest cultivated plants whose growth was decreasing and sensitive to drought, purslane has natural distribution in drought environments and is compatible with desert low-rain regions. It seems that photosynthesis mechanism of this plant is from c_4 mechanism and it can convert to CAM photosynthesis mechanism that the resistant reason and compatibility of this plant to environmental stresses such as drought (Koch and Kennedy, 1981). With respect to important of purslane as a medicinal and valuable plant and because of low information regarding its physiological reactions under environmental stresses condition, doing this project is necessary.

MATERIALS AND METHODS

For studying of drought stress effect on germination and inorganic elements content in Purslane (*Portulaca oleraceae* L.) leaves, seeds were prepared in Iran Jungle and Pasture Research Institute. The study was done under controlled condition and in Botany Laboratory located in Islamic Azad University of Tonekabon Branch since 2010. Seeds was put in sodium hypo chlorite 5% solution for 1 minute and then by distilled water washed for antiseptic it (Falahati, 2006). After of prepared seeds, experiments was performed in 2 stages. In primary stage for studying of drought stress effect on Purslane germination, number of 15 seeds was cultivated in Petri dish and related of stress levels on seeds was imposed. But in secondary stage for studying of drought stress effect on inorganic element in Purslane leaves, after of cultivation and germination of seeds, and leaving them to grow to 3 leaves stage, seedling were transported to washed sand pot and stress levels on seedlings was imposed. In this research, drought stress by Poly ethylene glycol (PEG 6000) was in seven levels, which included of Blank (distilled water), -0/1, -0/2, -0/4, -0/6, -0/8 and -1 MPa that these levels resulted of resolving with 0, 8/1, 11/4, 15/8, 18/9, 21/2 and 24/2 Gram of PEG 6000 in 100 m/Lit of distilled water (Asadi-Kavan et al, 2009). After of stress period, for measurement of inorganic elements in Purslane leaves, Potassium and sodium content with used of Flame Photometr and Calcium, Magnesium, Iron and Manganese concentration with used of Atomic Absorption, was performed. Experiments in completely random framework, with 3 replications were performed. Data analysis, variance and comparison of means were done by Danken experiment and SPSS software and for drawing of diagrams was used from Excel software.

RESULTS

In relation with germination percent, synchronized with increasing stress level, its decrease was observed which was not meaningful in statistical level of 0/01. The greatest percent of germination in potential of -0/2 MPa was observed that it was more than of Blank level. Also it seems that the germination percent in potential -0/4 MPa exists when it is lower than potential level of -0/8 and -1 MPa (Figure 1). Caused decreasing of germination percent in Blank level than -0/2 MPa level, was high absorption of water in blank level. In relation with inorganic elements concentration in Purslane leaves, synchronized with increasing of drought stress, Calcium, Magnesium, Manganese, Potassium and Iron contents was decreased, but sodium concentration was increased. The highest of sodium concentration in potential level of -1 MPa and the least content in Blank level was observed that was meaningful difference in statistical level of 0/01 (Figure 2). Potassium concentration synchronized with increasing of stress level, was meaningful decrement and the highest concentration of potassium in potential level of -0/2 MPa and the least content of potassium in potential level of -1 MPa, was observed that in statistical level of 0/01 were meaningful difference (Figure 3). Also Calcium, Magnesium, Manganese and Iron concentration, was meaningful decreased synchronized with increasing of stress that in the all of this elements, the highest content in Blank level and the least content in potential level of -1 MPa was observed (Figure 4, 5, 6, 7).

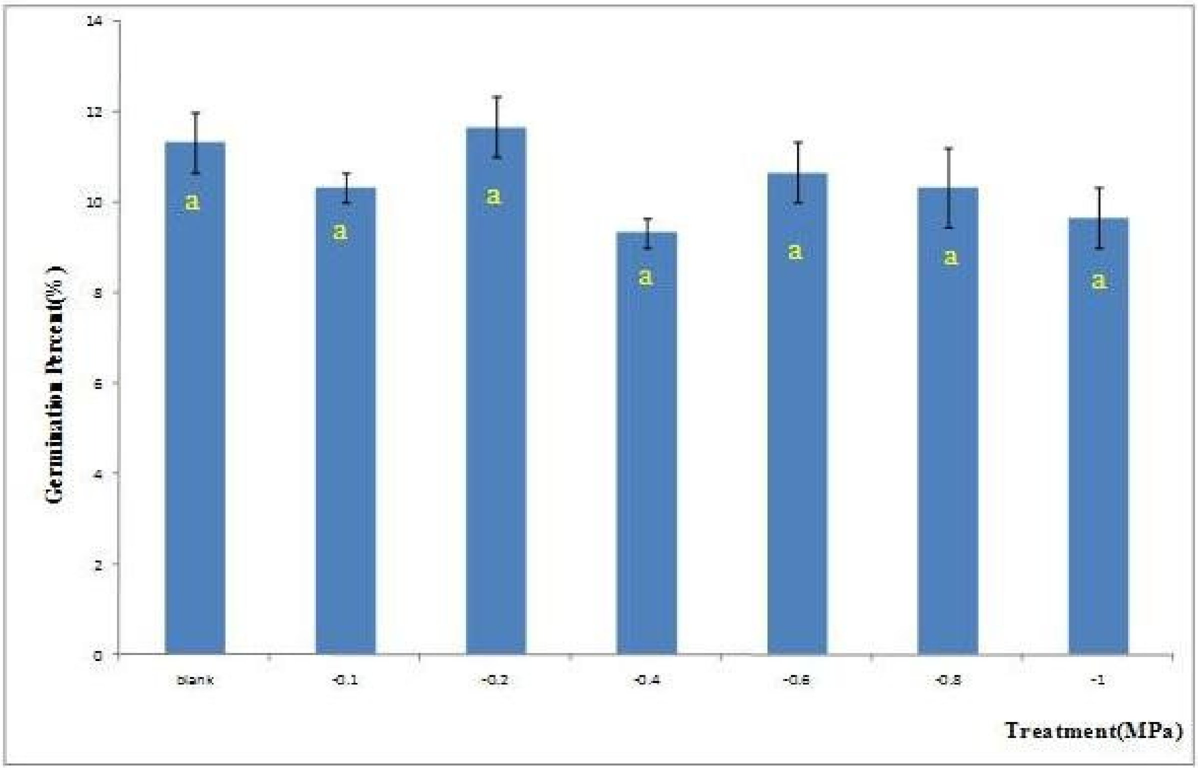

Figure 1. Effect of drought stress on germination percent.

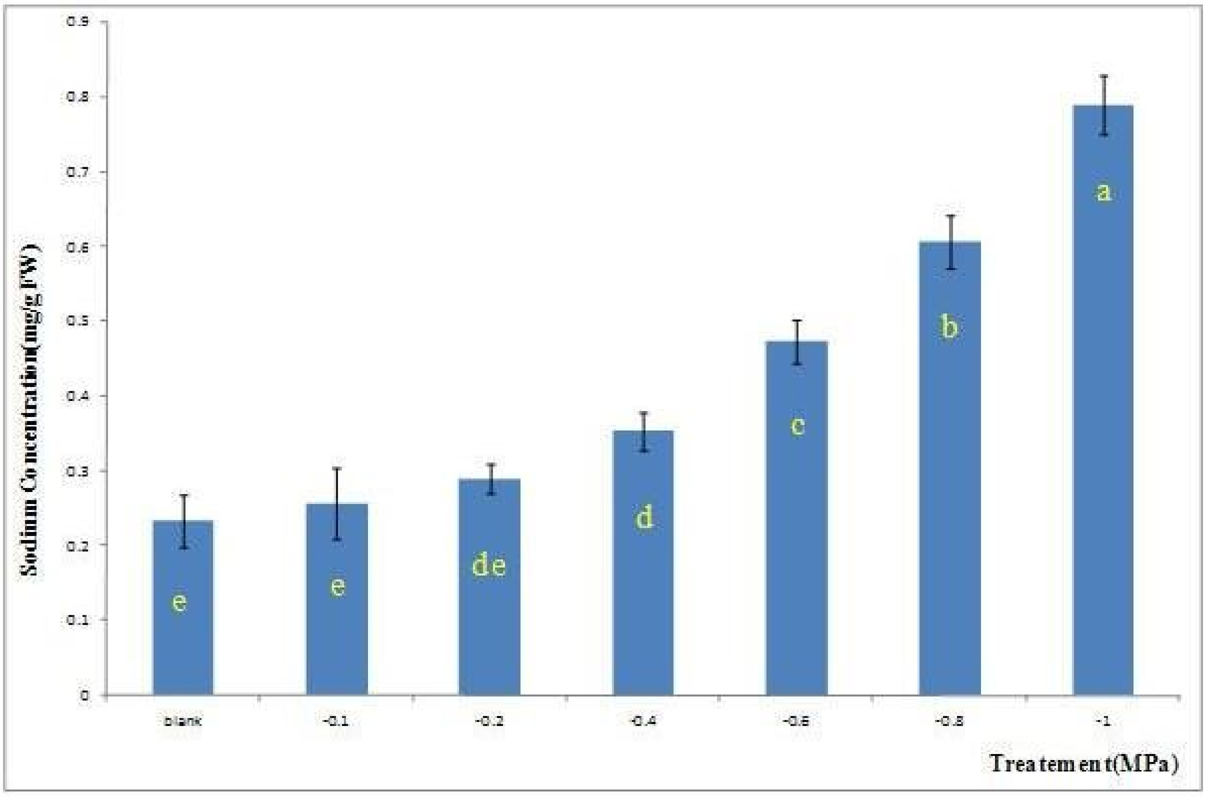

Figure 2. Effect of drought stress on sodium concentration

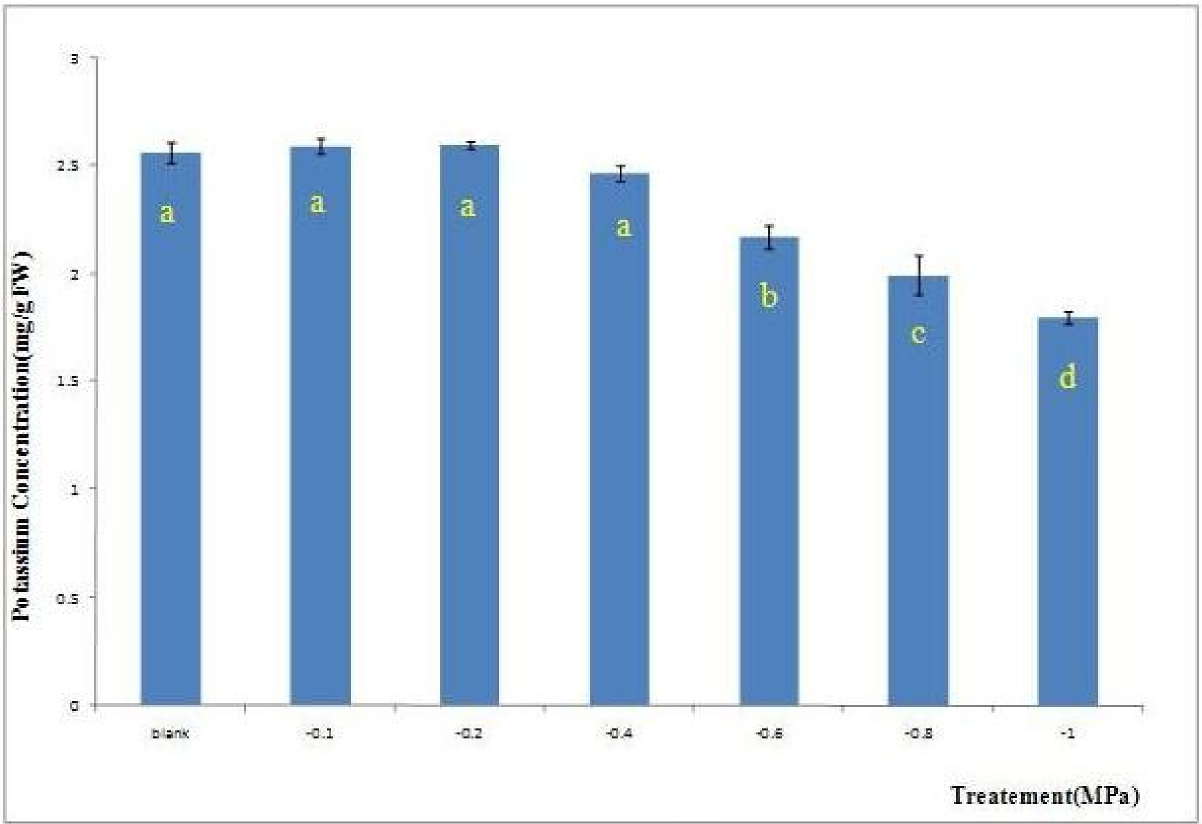

Figure 3. Effect of drought stress on potassium concentration

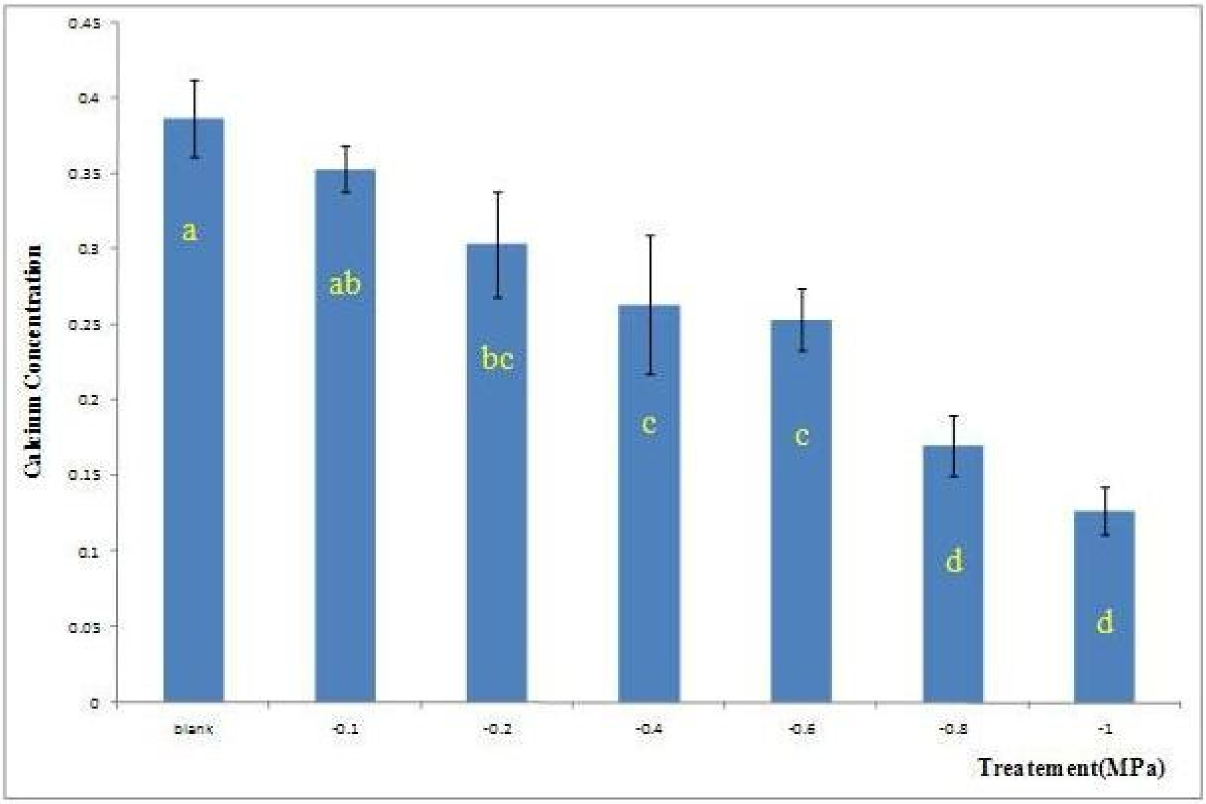

Figure 4. Effect of drought stress on calcium concentration

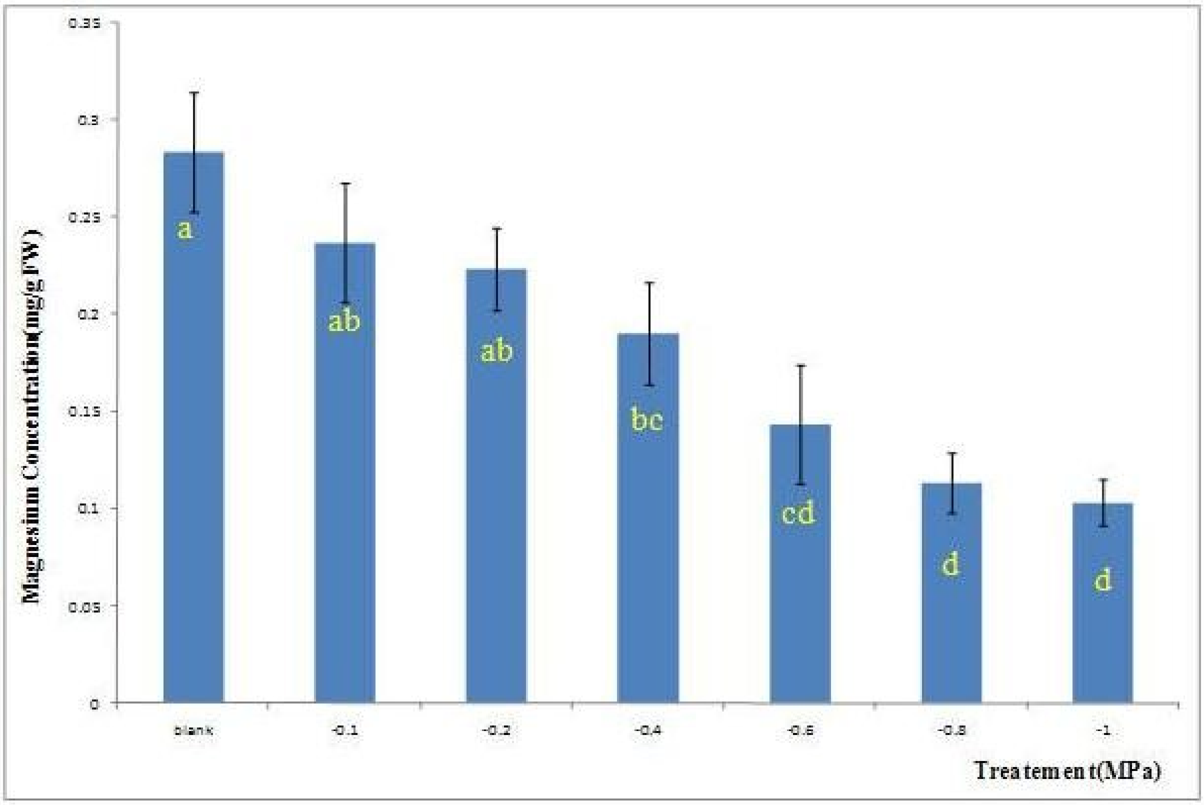

Figure 5. Effect of drought stress on magnesium concentration

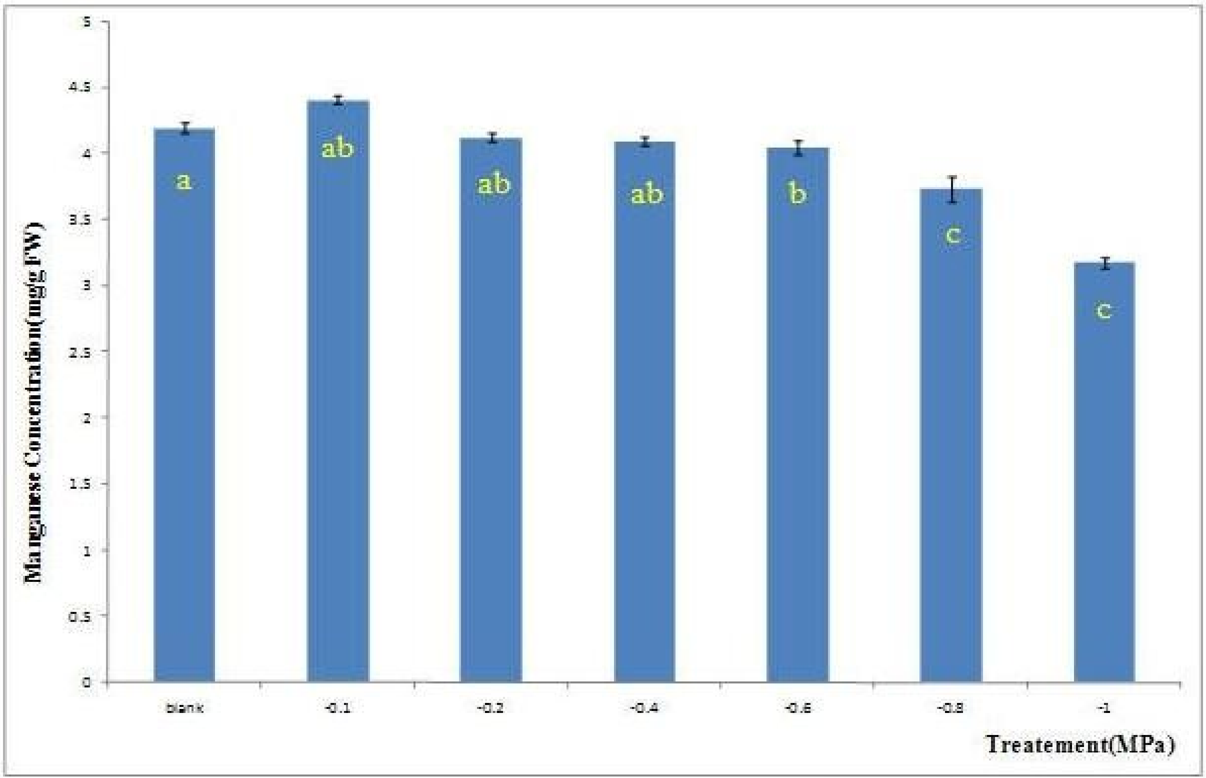

Figure 6. Effect of drought stress on manganese concentration

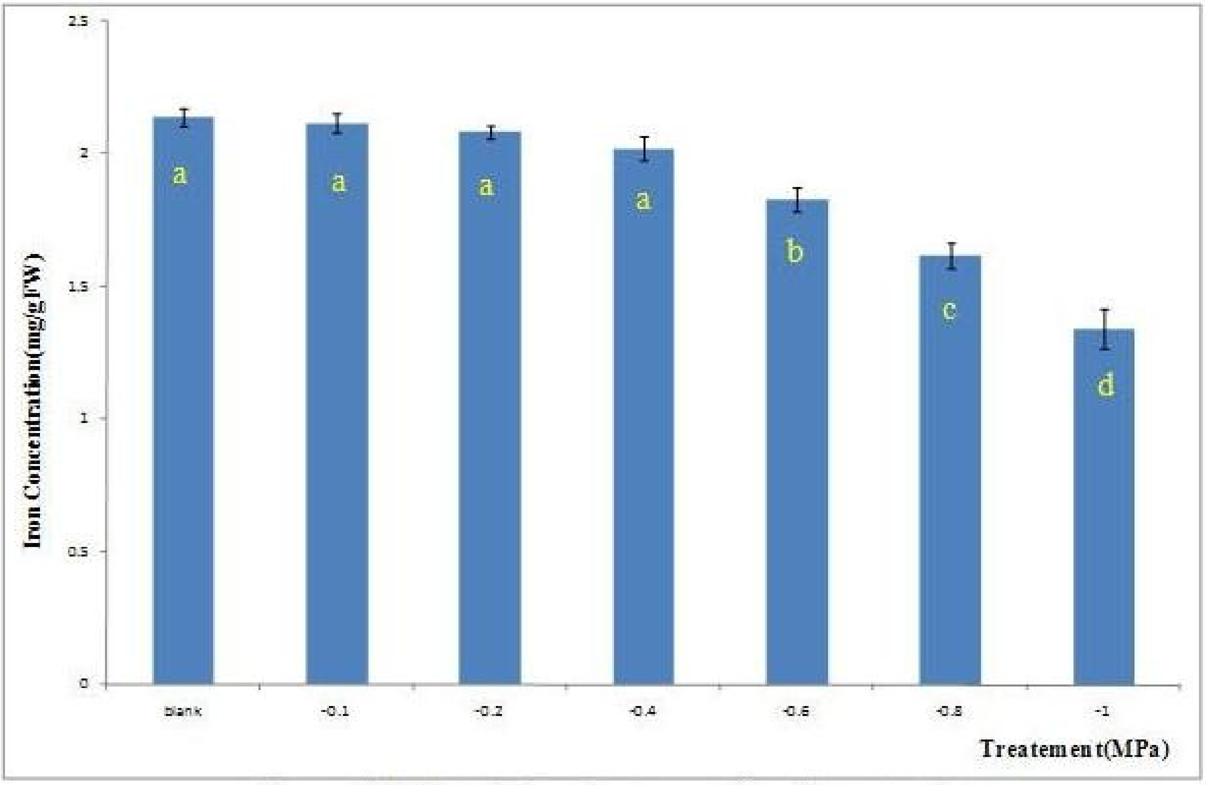

Figure 7. Effect of drought stress on iron concentration

Table 1. Variance analysis of factors studying

	Change Value (cv)	Experiment Error	Treatment	Factors
		13	6	Degree Free (df)
**	96/7%	34157/0	12844127/0	Sodium (mg/g FW)
**	37/10%	027516/0	2618730/0	Calcium (mg/g FW)
**	29/1%	050850/0	40086349/0	Manganese (mg/g FW)
**	4/13%	024785/0	01368730/0	Magnesium (mg/g FW)
**	4/2%	046547/0	27328254/0	Iron (mg/g FW)
ns	4/10%	091089/1	09523810/2	Germination Percent(%)
**	96/4%	024157/0	2416842/0	Potassium (mg/g FW)

* : Meaningful in statistical level of 0/05
** : Meaningful in statistical level of 0/01
ns: non meaningful

Table 2. Data comparison means by Toki experiment

Drought (MPa)	Blank	1/0-	2/0-	4/0-	6/0-	8/0-	1-
Sodium (mg/g FW)	2333/0 c	2566/0 e	2900/0 de	3533/0 d	4733/0 c	6066/0 b	7900/0 a
Potassium (mg/g FW)	5600/2 a	5900/2 a	5966/2 a	4666/2 a	1700/2 b	9933/1 c	7966/1 d
Calcium (mg/g FW)	3866/0 a	3533/0 ab	3033/0 bc	2633/0 c	2533/0 c	1700/0 d	1266/0 d
Manganese (mg/g FW)	1966/4 a	1400/4 ab	1266/4 ab	0966/4 ab	0533/4 b	7366/3 c	1766/3 c
Magnesium (mg/g FW)	2833/0 a	2366/0 ab	2233/0 ab	1900/0 bc	1433/0 cd	1133/0 d	1033/0 d
Iron (mg/g FW)	1366/2 a	1166/2 a	0833/2 a	0200/2 a	8266/1 b	6166/1 b	3400/1 d
Germination Percent (%)	333/11 a	333/10 a	666/11 a	333/9 a	666/10 a	333/10 a	666/9 a

DISCUSSION

Responses of different plants species to drought stress could related to different factors such as water absorption and seed size (Erdei and Taleisnik, 1993). Reduction of water entrance to seed increases drought stress due to hydraulic reduction, and as a result, physiological and metabolic germination process is being influenced and rate of their speed decreases (Masoumi et al, 2007). In studying on Mungbean (*Vigna radiata*) seeds was reported that drought stress caused of meaningful decrement of germination percent (Kazerouni et al, 2005). This result in other studying by De and Kar in 1995 was reported, also. Rahimi and Kafi (2009) in studying of different levels drought stress imposed by PEG 6000 on Purslane (*Portulaca oleraceae* L.) was reported that germination percent not showed meaningful difference up to potential level of -0/75 MPa but after that its had meaningful reduction in statistical level of 0/05. In this research on Purslane, also, was observed that drought stress up to potential level of -1 MPa had not meaningful effect on germination percent. This results display resistance of Purslane on drought stress in germination stage. In relation with drought stress effect on inorganic element in plants different studies was performed. Reported that drought stress on root plants caused changes in absorption and transport of inorganic elements in plants that caused changes in pH and effect on phytohormones secretion (Niakan and Ghorbanli, 2007). Absorption and distribution ions is important in plants natural growth in drought condition because drought caused disorder in ions distribution. In drought stress, sodium concentration increase in plant that for inhibition of toxicity ionic, its transport to vacuole by plants (Bohnert et al, 1999). Increment of sodium level synchronized with increase of drought level in Maize (*Zea mays* L.) and Bean was reported (Hu et al, 2007) that in this research on Purslane (*Portulaca oleracea* L.) leaves, sodium content was increased synchronized with drought stress increment, also. Niakan and Ghorbanli (2007) in studied effect of drought stress on ionic contents in Soybean shoot was reported that sodium level in shoot increment by stress than blank level, but potassium concentration was decreased. They expression that reason of decrease potassium content in shoot is decrement of water potential that was caused decrement of potassium transport of root to shoot in plant. In researches on Sorghum and Maize, increment of sodium and potassium level in root and shoot plants by imposed of drought stress was reported (Erdei and Taleisnik, 1993). In other study on Wheat (*Triticum aestivum*) was reported that with increase of drought stress level and period, sodium and iron concentration was increased in shoot, but potassium, calcium and magnesium contents was decreased (Abdalla and El-Khoshiban, 2007). Increase of sodium level in plants at stress condition is a defensive mechanism that plants in stress condition by its could controlled of osmotic pressure in cells, and water and nutrient solute absorption of soil. In the other hand, increased of iron concentration related to increment of Peroxidase activity in plants (Abdalla and El-khoshiban, 2007). In this research on Purslane leaves, also, was showed that iron concentration, not meaningful decrement to potential level of -0/4 MPa, but with increase of drought level, iron concentration in Purslane leaves was meaningful decreased. Also, drought stress cause decrease of calcium content in shoot of plants (Akhondi et al, 2006). In other researches on plants such as Rice (*Oriza sativa*) (Razi and Sen, 1996) and Sorghum (Eck et al, 1979) decreased of potassium, calcium and magnesium in shoot was reported, also. Hu et al (2007) in study of drought stress on Maize (*Zea mays* L.) seedlings, decrement of calcium, magnesium and manganese levels in leaves than blank level was reported that in this research on Purslane leaves, this results was discovered, also. Reason decrement of this elements in stress condition could due to decreased of absorption cations by root and decreased of cation transport to leaves in plants. Water level decrement in soil caused of decreased in elements mobility in soils, elements absorption by roots, and its transport on organs in stress condition that this states caused of disorders in respiration, photosynthesis and lipid, nucleic acid and enzymes biosynthesis (Abdalla and El-Khoshiban, 2007). In the final, death of plant cells was imposed in the stress condition (Saxenna and Nautiyal, 2001).

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