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Investigation of polyethylene glycol on some elements and proline of monogrem genotypes leaf of sugar beet in greenhouse conditions

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Abstract

Drought stress was one of the major problems to produce farms plants in Iran and the world, as well as a serious threat to the successful production of crops around the world. In other hand, drought stress was main factor to decrease sugar beet performance. According to this issue, an examination was done on 2011 at greenhouse in order to Investigate Polyethylene Glycol on some elements and proline of monogerm genotypes leaf of sugar beet. Examination was done in two-factor factorial frame in a randomized complete block design with three replications. In Factor a (drought level: 1 normal irrigation, 2: Polyethylene glycol 6000 with 30% concentration) and factor b (genotype) was performed. In this study, sodium, potassium, phosphorus and leaf proline were evaluated. The results showed that there was significant difference at 1% probable level between interaction of × genotype in term of sodium, potassium and phosphorus characteristics and there was no significant difference at proline leaf genotypes at 1% probable level. Polyethylene glycol caused to reduce 3.84 % sodium, 42.99 % potassium as well as caused to increase 40.68 % proline and 54.47 % phosphorus. Sodium and potassium among elements had 30908 and phosphorus had 30906 values. . Comparing effects mean sodium, potassium and phosphorus showed that highest values was respectively (normal × genotype 30,906), (normal × genotype 30,906) and (PEG 6000 × genotype 30906) combinations.

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Introduction

Sugar beet is one of strategic products in the country and has high feed efficiency. This product supply part of human needs directly through producing sugar and indirectly through providing animal feeds. In addition, molasses is byproduct of the sugar beet and is obtained at alcohol industry and is used at pharmaceutical. Sugar is a political and economic product and Due to severe dumping since World War II has seen the highest volatility which continues until now (Hosseini and Pour Ebrahim, 2006).

Drought stress was one of the major problems to produce farms plants in Iran and the world, as well as a serious threat to the successful production of crops around the world (Ober, 2001). significantly about one -third of the arable lands are faced to water shortages (Clover *et al.,* 1998) and is reported drought stress as a major factor to decrease sugar beet performance (Ober, 2001).

In many studies, PEG has been used as a drought stress factor (Tsveltkov and Weele, 2000). Polyethylene Glycol is a macromolecules mixture (molecular weight 8000-6000), which cannot enter to the seed and don't not cause to side effects at salts (Michel and Kaufman, 1973).PEG was used in most of plants in order to create osmotic stress which resulting of flexibility, chemical and biological interaction deny, Immobility, non-toxic and non-ionic of PEG characteristic used (Al-Bahrany, 2002).

Different crops may have different reactions against water deficits tsar increased concentrations of someone and show their passion creates. This is no different from beet sugar beet why breeders are looking indicators and characteristics are able to use them in selected cultivars tolerant to drought and salinity (Firouzabadi Brothers, 2002).Low Na/K means low sodium toxicity or tolerance of plant species is high (Kafi and Damghani , 2002). Sodium to potassium ratio can serve as a good indicator of the contradictory effects of sodium to potassium in the plant is proposed. The ratios in plant tissue as an indicator of sodium toxicity are used. Because the researchers believe that the presence of sodium, K would require disrupting enzymes. Breeding programs will be selected based on a number of agricultural industries that may exist between the positive and negative correlations

The purpose of this study was to evaluate the levels of Polyethylene Glycol on some elements and proline of monogrem genotypes leaf of sugar beet in greenhouse.

Material and method

Location of testing

in order to prepare seeds, modification institute of seeds at Karaj was visited and after receiving seeds table 1) Bracteole was done. This study was done in 2011 at greenhouse as two-factor factorial experiments. Factor a (drought level: 1 normal irrigation, 2: Polyethylene glycol 6000 with 30% concentration) and factor b (genotype) was performed. Experiment was done as Factorial in completely randomized design frame with three replications in this study, sodium, potassium, phosphorus and leaf proline were evaluated.

Table 1. Genotypes used in this study.

Number	Name of genotype
3	30906
4	30908
5	30915-88

Mode of test implementation

Experiment dry osmotic first treatment (normal water) and a second treatment of dry osmotic using polyethylene glycol 6000 concentration was 30% and in pots with a diameter of 30 cm and a height of 40 cm that have drainage was 20 seeds each digit in depth 2.5 cm using forceps straight perlite medium diameter of 4 mm were grown. Varieties that were less than 30 seeds were planted viability. Immediately after planting, the pots were irrigated with water under each potwa spliced in containers with a capacity of 500 cc. And every 3 days by municipal

water volume was 500 cc. In the first month according to the needs of low concentrations of plant nutrients in half Hoagland solution (Table 1), the experimentally and a detailed comparison table was properly used and the subsequent months of full concentration Hoagland solution was used. After 30 days of sowing (stage 3 or 4 true leaves), so meperlite were added to the pots. To help establish appropriate plants and after 60 days of implantation stage (5 to 6 leaf stage) plants in each pot were thinned to 8 plants remained low after 70 days of treatment was begun planting treatments using Overall solution were carried out under the pots. Hoagland solution was used in all solutions to environmental elements required for plant growth and lack of any tension or toxic elements into the plant will be, and the results affect. Measurement of Sodium, Potassium dry digestion was performed according to the method.

Table 2. Compounds and their levels in Hoagland solution.

Chemical name	Stock solution amount(g/1lit)	Amount of 100 liters(ml)
$NH_4H_2PO_4$	115	100
KNO_3	101	600
$Ca(NO_3)_24H_2O$	236	400
$MgSO_47H_2O$	246	200
Fe-EDTA	5	150
H_3BO_3	0.38	150
$ZnSO_47H_2O$	0.22	150
$MnSO_44H_2O$	1.02	1000
$CUSO_45H_2O$	0.08	100
$(NH_4)6MO_7O_244H_2O$	0.02	100

Statistical analysis

Before data analysis, establish the assumption of normal distribution of deviations, homogeneity of variance was examined. The mean yield using Duncan test at 5% probability level by SPSS-18 software and graph drawing was done by Excel.

Table 3. Analysis of variance.

S.O.V	df	Mean Square			
		Sodium	potassium	Phosphorus	Prolin
Replication	2	0.002**	6.555**	0.029	1.141
Stress level	1	0.016**	68.367**	776.311**	28.753**
Genotype	2	0.003**	36.593**	119.45**	0.437
Stress level × Genotype	2	0.011**	69.345**	56.378**	2.743
Error	10	0.0001	0.053	0.706	1.631
Coefficient of Variation (%)		0.62%	3.24%	4.79%	26%

* and ** Significantly at $p < 0.05$ and < 0.01, respectively.

Table 4. Comparison of evaluated elements mean by Duncan method at 5% probable level.

Genotypes	Traits					
	Phosphorus		potassium		Sodium	
30906	22.70	a	6.69	b	1.54	a
30908	15.04	b	9.78	a	1.54	a
88-30915	14.92	b	4.90	c	1.50	b

Results and discussion

Analysis of variance at (Table 3) in terms of stress levels, genotypes and the interaction of stress level and × genotype showed that there was significant difference at 1% probable level between interaction of × genotype in term of sodium, potassium and phosphorus characteristics and there was no significant difference at proline leaf genotypes at 1% probable level. Average levels of drought stress (Fig. 2) showed that normal sodium is allocated normal level 1.56 and sodium in normal condition decreased 3.84%. Potassium in normal level is allocated 9.07 an in normal condition rather to stress decreased 42.99% (Fig. 3). Phosphorus in stress level is allocated 24.12 for the highest value and the amount of potassium than the normal amount increased 54.47 % in the (Fig. 4). Also, the leaf proline is allocated 6.07 amen of highest valued and leaf proline decrease to 40.68% in normal condition compared to stress condition (Fig. 5). Comparing results of genotypes

showed that (Fig. 4), sodium and potassium genotypes, respectively 1.54 and 9.78 were allocated highest level and phosphorus with 3096 genotype and 22.7 mean were placed at superior statistical group. Results of interaction of x genotype of sodium (Fig. 6) showed that combination (normal x genotype 30906) with 1.6 averages was allocated highest value and combination (EPG 6000 x genotype 88-30915) with 1.46 average was allocated lowest rate and placed in d statistical group. Interaction of stress level of x potassium genotypes (Fig. 7) showed that combination (normal x genotype 30906) with 12.41 mean was highest level and combination (PEG 6000 x genotype 30906) with 0.96 average were lowest average and placed in f statistical group. Also, interaction of stress level of x genotype of phosphorus (Fig. 8) showed that combination (PEG 6000 x genotype 3096) with 30.81 averages was highest level and combination (normal x genotype 88-30915) wigh 10.09 average was lowest level and placed in d statistical group. Abdolahian Noghabi *et al.* (1999) that under drought stress (irrigation after 80% depletion of available water) cause to reduce dry material of sugar beet. Potassium and sodium reduced with increasing drought stress treatment 11 to 14.

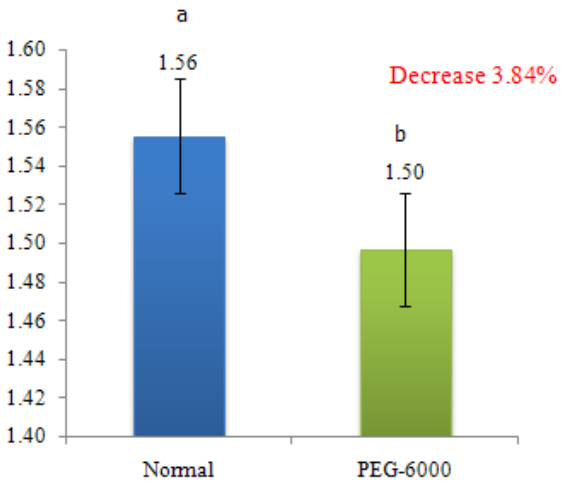

Fig. 1. Average of Sodium at polyethylene glycol levels and sodium reduction.

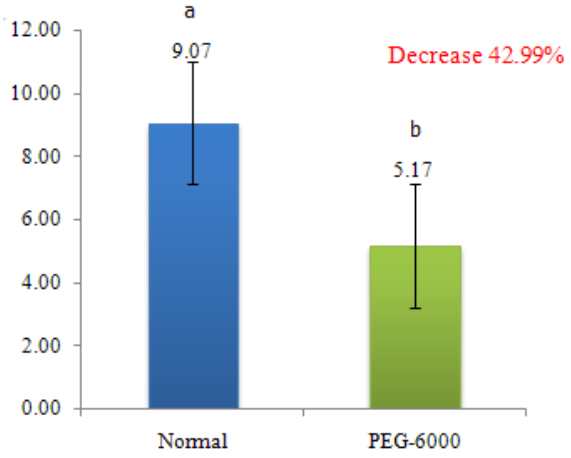

Fig. 2. Average of potassium at polyethylene glycol levels and potassium increasing.

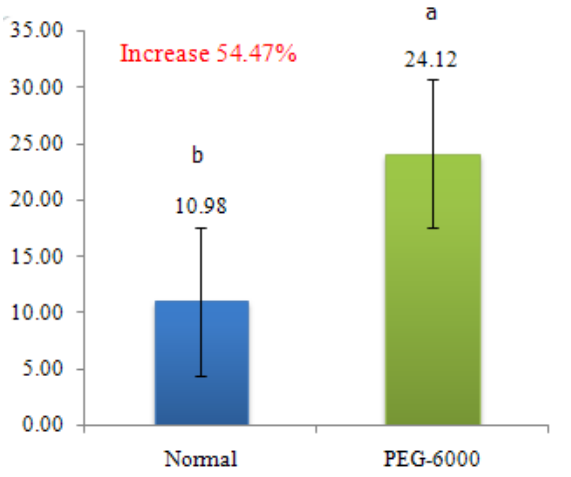

Fig. 3. Average of phosphorus at polyethylene glycol levels and phosphorus reduction.

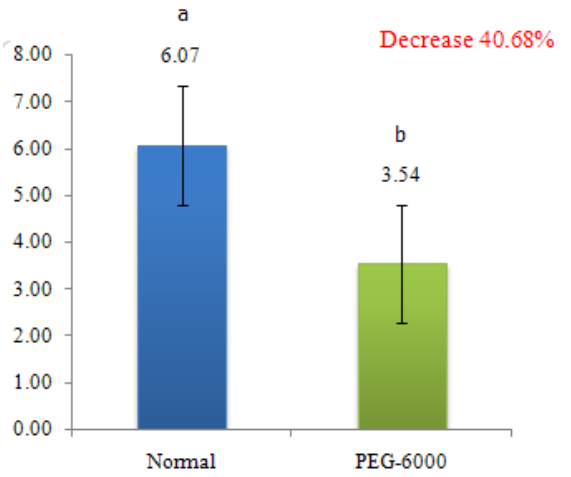

Fig. 4. Average of proline at Polyethylene Glycol levels and proline reduction.

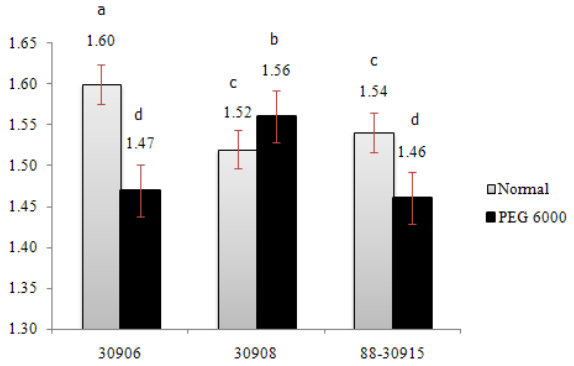

Fig. 5. Interaction drought stress × genotype for Sodium.

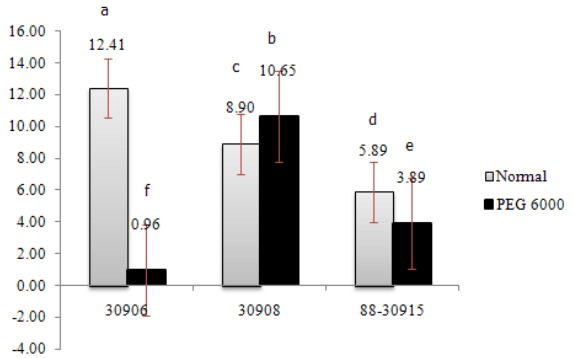

Fig. 6. Interaction drought stress × genotype for potassium.

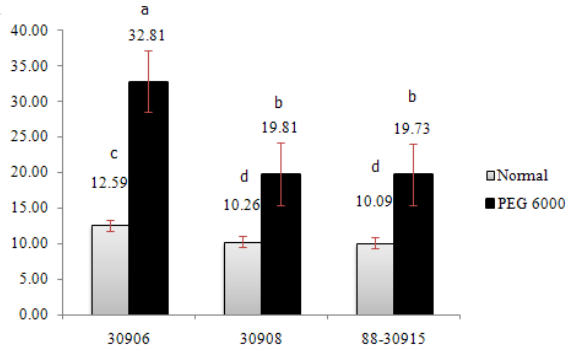

Fig. 7. Interaction drought stress × genotype for phosphorus.

In all irrigation treatments sodium roots was lower than potassium. This indicates that the potassium - is more likely to be absorbed compared to sodium. Nasri and Seyed sharifi (2007) in a study about effect of nutrients on resistance to drought Reported that germination of 91% of osmotic potential became 16.53% from zero at drought stress – eight times and became 86.81 % to 33.61 at iron nutrients.

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