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Effect of polyethylene glycol on proline of 20 monogerm and polygerm genotypes of sugar beet under greenhouse condition

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Abstract

Proline accumulation is one of parameters which have been studied associated with stress. This experiment was conducted to investigate the Effect of polyethylene glycol on proline of 20 monogerm and polygerm genotypes of sugar beet under greenhouse condition. Experiment was done in Two-factor factorial from in a randomized complete block design with three replications Factor a (stress level: 1: normal irrigation, 2: Polyethylene glycol 6000 with 30% concentration) and factor b (genotypes) was performed. Results showed that level of a and b factors were significant at 5 and 1% probable level but interaction of a × b level were not significant. Normal with mean 5.76 had highest levels of proline and proline reduced 33.33% in stress conditions compared to normal condition. Genotype 30922 with 6.44 mean had highest levels of proline and placed in superior statistical group and 19 and 20 genotypes had lowest level of proline.

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Introduction

Population growth and the need for crops and water resources cause to increase water scarcity risk. In addition to the drought problem, country is facing with spatial and temporal distribution of rainfall which adds to complexity of the problem (Davani *et al*, 2008).

Drought is one of the most important natural factors which effects on plant growth and is one of most common obstacle to produce crops in Iran and in the world successfully. (Vinkel, 1989 and Tari Nejad *et al*, 1998). Iran with an average rainfall of 240 mm has been categorized as arid regions of the world. About 45 percent of land under cultivation of wheat has less than 350 mm of rainfall. Generally, drought is a Meteorological term and refers to the period in which rainfall is less than potential evapotranspiration. Drought stress term is applied for some case that stress caused by lack of good rainfall (Hasan Panah, 1996).

If the plant exposed to water scarcity stress artificially, so water stress coefficient IS used (Donald, 1979 and Rezai and Soltani, 1998). Polyethylene glycol is used at osmotic prime. PEG is a flexible polymer which cause to negative osmotic pressure. Also doesn't tend to react with the chemical and biological material and this character cause to be PEG as one of useful molecules to create osmotic pressure at biochemical conversion (Balbi, 2008).of the PEG molecule to one of the most useful ¬ To create osmotic pressure is the biochemical conversion (Balbi, 2008). Since plant doesn't absorb PEG and concentration is constant during stress, so is best treat to osmotic stress compared to other osmotic like monitol, sugar and salt and plays important role at seed osmotic priming (Creelman *et al*, 1995). These waves are known to play a role in priming the osmotic seeds. Proline is an amino acid that is involved in the formation of protein and also is an osmosis which set plant osmic pressure during stress. It can be considered a non-enzymatic antioxidants that eliminate free radicals of oxygen (Bradford, 1976). Proline accumulation is one of the parameters that has been studied in many issues related to stress (Rahimian and Banaeiyan, 1998). So, we can say that the overall accumulation of free proline may be a sign of a stress coping mechanism.

The purpose of this study, Effect of polyethylene glycol on proline of 20 monogerm and polygerm genotypes of sugar beet under greenhouse condition.

Material and methods

Location of test implementation

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.

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.

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.

Results

Results showed that level of a and b factors were significant at 5 and 1% probable level but interaction of a × b level were not significant (table 3). Normal with mean 5.76 had highest levels of proline and proline reduced 33.33% in stress conditions compared to normal condition (figure 2). Genotype 30922 with 6.44 mean had highest levels of proline and placed in superior statistical group and 19 and 20 genotypes had lowest level of proline.

Table 1. genotypes used in this study.

Number	Germ type	Name of genotype	Number	Germ type	Name of genotype
1	Poly Germ	30881-88	11	Poly Germ	31270
2	Poly Germ	30883-88	12	Poly Germ	31267
3	Mono Germ	30906	13	Mono Germ	31290
4	Mono Germ	30908	14	Mono Germ	31291
5	Mono Germ	30915-88	15	Mono Germ	31262
6	Poly Germ	30919-88	16	Mono Germ	31266
7	Poly Germ	30920-88	17	Poly Germ	30923-89
8	Poly Germ	30922	18	Poly Germ	Jolge
9	Poly Germ	86213-89	19	Poly Germ	MSC2*7233-P29
10	Poly Germ	31269	20	Poly Germ	7233-P29

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

Discussion

Increasing proline accumulation under stress conditions intensity is dependent on plant species and stress tension. Environmental stresses, especially drought stress also alters the nature of protein. Maintaining functional proteins and preventing ineffective protein aggregation is essential for cell survival under stress conditions. In mild stress, usually amount of total protein is decreased but during intensive stress due to producing new proteins

namely tension proteins this amount is increased (Kafi and Damghani, 2000). Proline plays important role to adjustment osmotic pressure under soil salinity, drought, low temperature, lack of food As a matter proline in osmotic pressure adjustment of the cell under stresses such as salinity, drought, low temperature, exposure to heavy metals and acidity. Increasing this material during osmotic stress is observed in other organisms such as bacteria, plants, yeasts, algae and marine (deloneri and verma, 1993).

Table 3. Analysis of variance.

S.O.V	df	Prolin			
		Sum of Squares	Mean Square	F	Prob.
Replication	2	14.973	7.487	3.599	0.032
Stress level	1	109.749	109.749	52.760	0.000
Genotype	2	66.873	3.52	1.692	0.05
Stress level × Genotype	2	57.23	3.012	1.448	0.13
Error	10	162.253	2.08		
Coefficient of Variation (%)					8.23%

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

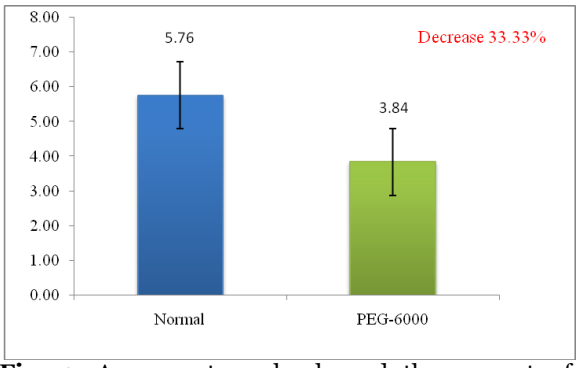

Fig. 1. Average stress levels and the amount of proline reduction.

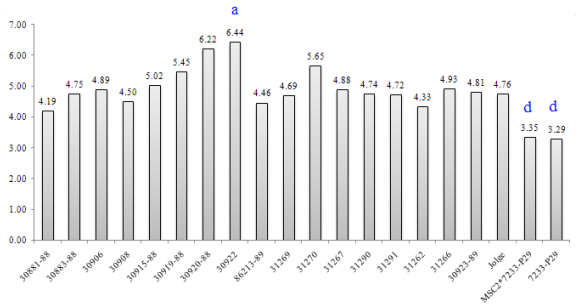

Fig. 2. Comparison of genotype of proline traits of with Duncan's multiple tests.

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