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Study of PEG Stress Effects on Wheat (*Triticum aestivum* L.) Cultivars at Germination Stage

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Abstract: In order to study the effects of drought stress on germination indices in wheat cultivars, an experiment was conducted in factorial form, using a completely randomized design of four replications. In this experiment, five wheat genotypes were evaluated in five levels of drought treatment (distilled water, -2,-4,-8 and -8 bars). The principal aim of current study was to compare the five genotypes of wheat in relative to the stress conditions. Results indicated that significant decrease was observed in percentage of germination, germination rate, length of radical and plumule and radical and plumule dry matter. On the basis of the results, the Seimareh genotype was the most resistant cultivar in stress condition that they have highest level of all traits in this study.

Key words: Wheat · Germination and PEG

INTRODUCTION

Abiotic stresses, such as drought, salinity, extreme temperatures, chemical toxicity and oxidative stress are serious threats to agriculture and result in the deterioration of the environment. Abiotic stress is the primary cause of crop loss worldwide, reducing average yields for most major crop plants by more than 50% [1]. One of the most important abiotic factors limiting plant germination and early seedling stages is water stress brought about by drought and salinity [2], which are widespread problems around the world [3]. Salinity and drought affect the plants in a similar way [4]. Reduced water potential is a common consequence of both salinity and drought [5]. Water stress acts by decreasing the percentage and rate of germination and seedling growth [6]. Germination of seeds, one of the most critical phases of plant life, is greatly influenced by salinity [7]. Polyethylene glycol (PEG) compounds have been used to simulate osmotic stress effects in Petri dish (*in vitro*) for plants to maintain uniform water potential throughout the experimental period [8]. The principal aim of present study was to compare the effects of drought stress induced on germination of five wheat genotypes at germination stage.

MATERIALS AND METHODS

This study was carried out with seeds of five wheat (*Triticum aestivum* L.) genotypes names: MV17, Seimareh, Kaspard, Sardari and Cascogne in 2011 at laboratory condition with 4 corn cultivar as factorial experiment under Randomized Complete Design (CRD) with three replications. In two separated experiments, effect of drought and salt Stresses induced by different osmotic potential levels [0(control), -2, -4, -6 and -8 bar] of polyethylene glycol 6000 (PEG 6000) treatments on Germination of corn were studied.

In each experiment and each level of stress, twenty seeds of any cultivar were selected and sterilized in sodium hypochlorite (1%) and then washed in water for two times. The seeds of all cultivars were germinated in Petri dishes on 2 layers of filter paper in an incubator maintained at 25°C.

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For 10 days Germinated seeds were counted and need have added the PEG soluble were performed. After 10 days, percentage of germination was measured by ISTA (International Seed Testing Association) standard method.

Rate of germination was calculated using the following formulas:

$$\text{Rate of germination} = \delta A/\delta Tt$$

Coefficient of velocity of germination:

$$\frac{A_1 + A_2 + ... + A_x}{A_1T_1 + A_2T_2 + ... + A_xT_x} \times 100$$

(Pollock and Ross 1972)

RESULTS

Germination Percent: The results showed that the highest germination percent Reserved to Seimareh genotype and the lowest Reserved to Cascogne. The highest of this trait was in 0 level of PEG. The Seimareh showed highest germination percent on -6 bars. Also the genotypes didn't show any germinated seed in -8 bars (Fig.1).

Germination Rate: The highest germination percent Reserved to Seimareh genotype and the lowest Reserved to Mv17. Also the highest of this trait was in 0 level of PEG. The Seimareh highest germination percent was on 0 and -2 bar and don't Observed any sprouts Seed (Fig. 2).

Length of Radical: On the basis of ANOVA results, the effects of variety and stress levels on length of radical and plumule were significant but interaction between genotypes and stress level in length of plumule had significant difference and on length of radical not significant. Mean comparison results revealed that the highest length of radical and plumule was for Seimareh genotypes (Fig. 3).

Weight of Plumule: On the basis of results, the effect of variety and stress levels and their interaction on radical dry matter was significant but plumule dry matter only on stress levels shown significant difference and with cultivar and their interaction not significant. Results showed that the highest rate of radical dry matter in Seimareh genotypes (Fig. 4).

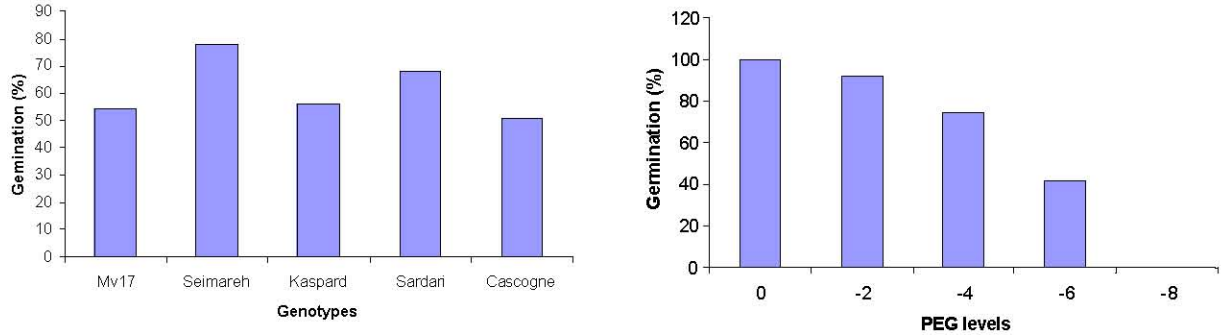

Fig. 1: Effect of drought stress on germination percentage

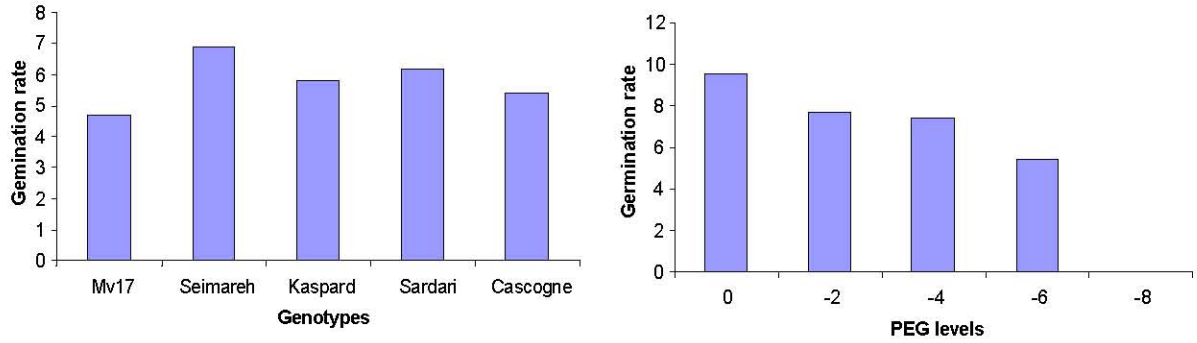

Fig. 2: Effect of drought stress on germination rate

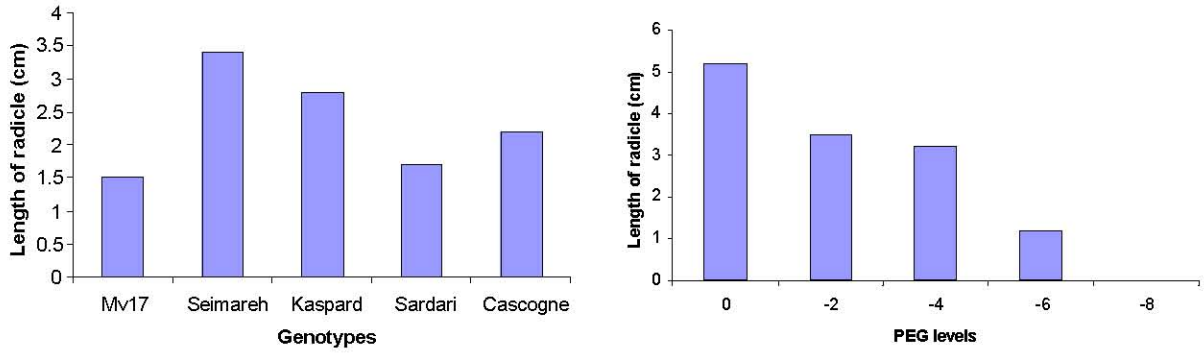

Fig. 3: Effect of drought stress on radical length.

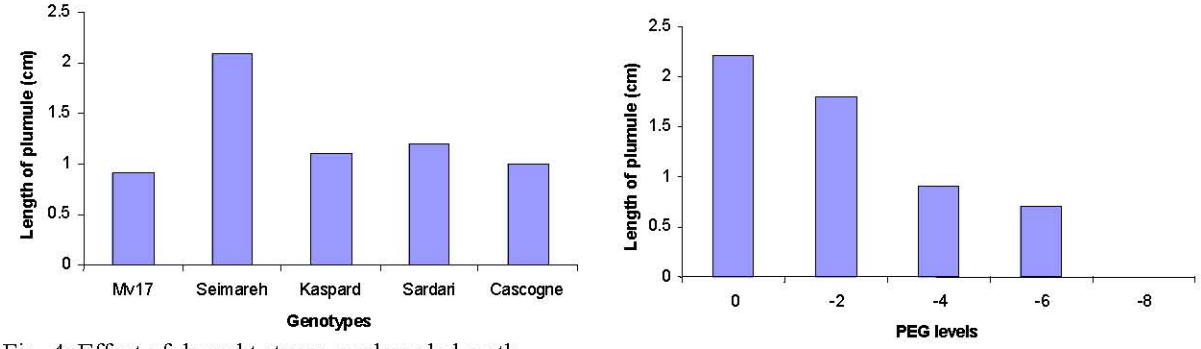

Fig. 4: Effect of drought stress on plumule length.

DISCUSSION

Water stress due to drought is probably the most significant abiotic factor limiting plant and also crop growth and development [9]. Drought stresses is physiologically related, because induce osmotic stress and most of the metabolic responses of the affected plants are similar to some extent [10]. Water deficit affects the germination of seed and the growth of seedlings negatively [11]. Because of germination is one of the most important traits in early stage of growth in most plants, it seems that Seimareh in drought stress condition had more resistant than other genotypes and had more yield potential. In according to results of the present study, it suggested that more experiments were carried out on the similar cultivars and further investigation be done on golden west. Results of the current study were in agreement with other experiments in different plants including Kalefetoglu *et al.* [12] in chickpea, Almansouri *et al.* [2] and Soltani *et al*, [13].

REFERENCES

1. Boyer, J.S., 1982. Plant productivity and environment. Sci., 218: 443-448.
2. Almansouri, M., J. M. Kinet and S. Lutts, 2001. Effect of salt and osmotic stresses on germination in durum wheat (*Triticum durum* Desf.). Plant Soil, 231: 243-254.
3. Soltani, A., M. Gholipoor and E. Zeinali, 2006. Seed reserve utilization and seedling growth of wheat as affected by drought and salinity. Environ. Exp. Bot., 55: 195-200.
4. Katerji, N., J.W. Van Hoorn, A. Hamdy and M. Mastrorilli, 2004. Comparison of corn yield response to plant water stress caused by salinity and by drought, Agric. Water Manage, 65: 95-101.
5. Legocka, J. and A. Kluk, 2005. Effect of salt and osmotic stress on changes in polyamine content and arginine decarboxylase activity in *Lupinus luteus* seedlings. Plant Physiol., 162: 662-668.
6. Delachiave, M.E.A. and S.Z. De Pinho, 2003. Germination of Senna occidentalis link: seed at different osmotic potential levels, Braz. Arch. Techn., 46: 163 166.
7. Misra, N. and U.N. Dwivedi, 2004. Genotypic differences in salinity tolerance of green gram cultivars. Plant Sci., 166: 1135-1142.

8. Kulkarni, M. and U. Deshpande, 2007. *In vitro* screening of tomato genotypes for drought resistance using polyethylene glycol, Afr. J Biotechnology, 6(6): 691-696.
9. Hartmann, T., M. College and P. Lumsden, 2005. Responses of different varieties of *Lolium perenne* to salinity. Annual Conference of the Society for Experimental Biology, Lancashire.
10. Djibril, S., O.K. Mohamed, D. Diaga, D. Diégane, B.F. Abaye, S. Maurice and B. Alain, 2005. Growth and development of date palm (*Phoenix dactylifera* L.) seedlings under drought and salinity stresses. Afr J. Biotechnol., 4(9): 968-972.
11. Van den Berg, L. and Y.J. Zeng, 2006. Response of South African indigenous grass species to drought stress induced by polyethylene glycol (PEG) 6000 Afr. J. Bot, 72: 284-286.
12. Kalefetogllu Macar, T., O. Turan and Y. Ekmekci, 2009. Effect of water deficit induced by PEG and NaCl on Chickpea (*Cicer arieitinum* L.) cultivar and lines at early seedling stage. G. U. J. Sci., 22(1): 5-14.
13. Soltani, G.E., S.O.I. Fang-Gong-Sui., B.A.I.L.I. Ping, L.U. Yingyan and Zh. Guang-sheng, 2006. Effect of water stress on the protective enzymes and lipid per oxidation in roots and leaves of summer maize" Agric. Sci. China, 5: 291-228.