

## Effects of Peg Stress on Corn Cultivars (*Zea mays L.*) At Germination Stage

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**Abstract:** Germination of each seed is considered as one of the first and most fundamental life stages of a plant so that, the success in growth and yield production is also depending on this stage. In order to study the effects of drought stress on germination indices in wheat cultivars, an experiment was conducted as factorial form, using a completely randomized design arrangement, with four replications. In this experiment, four corn cultivars were evaluated at five levels of drought treatment (distilled water (0), -2, -4 and -8 bars). Results indicated significant differences among the cultivars and drought stress levels. The principal aim of current study was to compare the four varieties of maize under the stress conditions. Results indicated that significant decrease was observed in percentage of germination, germination rate, length of radicle and plumule and radicle and plumule dry matter. Based on the results, the golden west cultivar was the most resistant one in stress conditions that possessed the highest levels of all traits in this study.

**Key words:** Corn • Germination and PEG

### INTRODUCTION

Maize crop plays an important role in the world economy and is valuable ingredient in manufactured items that affect a large proportion of the world population [1]. 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% [2]. One of the most important Abiotic factors limiting plant germination and early seedling stages is water stress brought about by drought and salinity [3], which are widespread problems around the world [4]. Salinity and drought affect the plants in a similar way [5]. Reduced water potential is a common consequence of both salinity and drought [6]. Water stress acts by decreasing the percentage and rate of germination and seedling growth [7]. Germination of seeds, one of the most critical phases of plant life, is greatly influenced by salinity [8]. 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 [9]. The principal aim of present study was to compare the effects of drought and salt stress induced on germination of four cultivars of maize.

### MATERIALS AND METHODS

This study was performed in 2009 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. The names of cultivars are in Table 1.

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 both cultivars were germinated in Petri dishes on 2 layers of filter paper in an incubator maintained at 25°C. For 10 days Germinated seeds were counted and need have added the PEG soluble were performed. After 10 days, percentage of germination was

Table 1: Names of cultivar study

NO.	Cultivar name
1	OS499
2	ZP434
3	Golden west
4	Single cross

measured by ISTA (International Seed Testing Association) standard method. At end of the tenth day, the percentage of germination, germination rate, the length of radicle and plumule of seeds and dry matter weight of radicle and plumule were also measured.

Rate of germination was calculated using the following formulas:

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

Coefficient of velocity of germination:

$$\frac{A_1 + A_2 + \dots + A_x}{A_1 + T_1 + A_2 + T_2 + \dots + A_x T_x} \times 100$$

(Pollock and Ross 1972)

Osmotic potentials of PEG 6000 were calculated as described by Michael and Kaufman [10].

## RESULTS

The results of analysis variance showed significant difference for percentage of germination and germination rate at 0.01 levels. But interaction between cultivars and stress level in of germination and germination rate was significant on 0.05 levels.

**Germination Percent:** The results showed that the highest germination percent Reserved to golden west cultivar and the lowest Reserved to OS499. Also the highest of this trait was in 0 level of PEG. The Golden west heist germination percent was on 0 and -4 bar.

Table 1: Comparison of means simple effect of cultivar and stress levels on germination

Treats						
Genotypes	Germination (%)	Germination rate	Length of radicle (cm)	Length of plumule (cm)	Radicle weight (g)	Plumule weight (g)
OS499	46.5d	5.87b	2.8c	1.1b	0.02b	0.024b
ZP434	53.8c	5.95b	3.2ab	1.2b	0.03b	0.022b
Golden west	77.4a	6.78a	3.6a	1.5a	0.06a	0.034a
Single cross	61.2b	5.51b	3.1b	0.9c	0.02b	0.016c
Stress levels (bar)						
0	91.68a	10.54a	5.67a	3.2a	0.05a	0.056a
-2	83.56b	10.16b	4.91b	2.1b	0.043b	0.049b
-4	66.54c	7.54c	3.54c	1.2c	0.032c	0.021c
-6	43.21d	3.5d	2.1d	.8d	0.017d	0.001d
-8	0e	0e	0e	0e	0.000	0e

The variability trend of germination is more severe and in primary levels of stress, Decrease amount is significant.

**Germination Rate:** The highest germination percent Reserved to golden west cultivar and the lowest Reserved to ZP434. Also the highest of this trait was in 0 level of PEG. The Golden west highest germination percent was on 0 and -2 bar and don't Observed any sprouts Seed.

**Length of Radicle and Plumule:** On the basis of ANOVA results, the effects of variety and stress levels on length of radicle and plumule were significant but interaction between cultivars and stress level in length of plumule had significant difference and on length of radicle not significant. Mean comparison results revealed that the highest length of radicle and plumule was for Golden west cultivar.

**Weight of Radicle and Plumule:** On the basis of results, the effect of variety and stress levels and their interaction on radicle dry matter were 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 radicle dry matter in golden west cultivar.

## DISCUSSIONS

Water stress due to drought is probably the most significant abiotic factor limiting plant and also crop growth and development [11]. Drought stresses is physiologically related, because induce osmotic stress

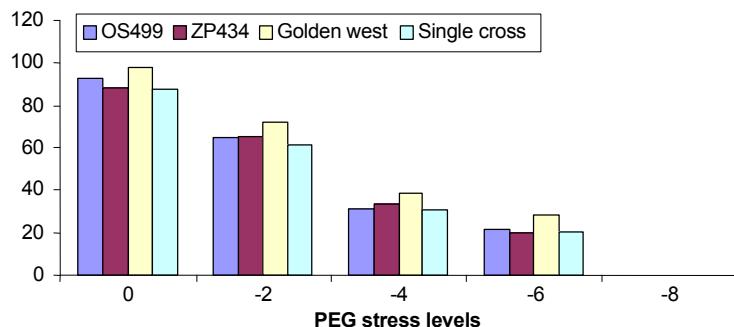


Fig. 1: Percentage of germination affected by PEG

and most of the metabolic responses of the affected plants are similar to some extent [12]. Water deficit affects the germination of seed and the growth of seedlings negatively [13]. Because of germination is one of the most important traits in early stage of growth in most plants, it seems that golden west in drought stress condition had more resistant than other cultivars and had more yield potential (Fig. 1). 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.* [14] in chickpea, Almansouri *et al.* [3] in wheat and Soltani *et al.* [15] in wheat.

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