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Influence of Different Osmopriming Treatments on Emergency and Yield of Maize (*Zea mays* L.)

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Abstract: Poor crop establishment can be major constrain to produce crop yield in marginal soils. The present study, was designed to investigate the effect of osmopriming on emergence and yield of maize (*Zea mays* L.). For osmopriming seeds were treated in aerated solutions of KNO_3, KH_2PO_4 and polyethylene glycol 8000 (PEG_{8000}) for 24 under room condition. Osmotic potential of the solutions were 0 (control), -0.5, -1.0 and -1.5 MPa. Control seeds were not treated. After osmopriming operation seeds were given 3 surfaces washing with distilled water then re-dried to near original weight under shad. Results showed grain and biological yields and some yield components affected by osmopriming treatments. Our results indicated solution kind and osmotic potential effected above characters. We obtain osmopriming of maize (*Zea mays* L.) seeds with polyethylene glycol 8000 (PEG_{8000}) at -0.5 MPa osmotic potential improved emergency, grain and biological yields compared with other treatments.

Key words: Osmopriming, yield, emergency, maize

INTRODUCTION

Fields with out a reasonable number of well-spaced, vigorous plant cannot be expected to produce good yields. Poor germination and low seed viability are the serious problems in the production in marginal soils. Good seedling establishment is an important constraint to crop production (Harris *et al*., 1999). This is particularly true for crops such as maize (*Zea mays* L.), which do not have the capacity to adjust to incomplete stand by tillering finch (Savage *et al*., 2004). Constrains to good establishment include poor seedbed, low quality seed, environmental stresses such as high and low temperature, salinity and others (Weaich *et al*., 1992; Towned *et al*., 1996). Good seedling establishment increase competitiveness against weeds, increases tolerance to environmental stresses and maximizes biological and grain yields (Ghiyasi *et al*., 2008). Several methods have been used to precondition seeds in an attempt to improve germination and seedling growth of many field crops. These include hardening, seed priming, seed soaking, seed coating and others. Many seed priming treatments such as osmopriming, hydro-priming, matrico-priming, hormonal-priming and others have been used to accelerate the germination, seedling growth and yield in most of the crops under normal and stress conditions (Basra *et al*., 2003). Osmopriming is most widely used type of seed priming in which seeds are soaked in aerated low water potential solution (Farooq *et al*., 2005). Although, the mechanism of seed priming treatments in not fully under stood, it has been observed that physiological and biochemical changes take place during the seed treatments. Witch could allow seeds to begin the germination sequences before sowing (Basra *et al*., 2005; Ghiyasi *et al*., 2008).

The objective of this study was to explore the effects of different osmopriming treatments on emergence and yield of corn (*Zea mays* L.).

MATERIALS AND METHODS

An experiment was conducted in research field of Urmia University, Faculty of Agriculture, Department of Agronomy and plant breeding, West Azerbaijan province during 2007-growth season. The experiment was laid out in RCBD base of factorial experiments with 3 replications with a net plot size of 2×6.6. All agronomic managements and plant protection treatments were kept normal and uniform. The seed was obtained from Agriculture and

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Natural Sources Research Center of West Azerbaijan, Urmia, Iran. The initial seed moisture was 11.6% (dry weight basis) and the original germination was 98%.

Seed treatments: The seeds were osmoprimed with KNO_3, KH_2PO_4 and polyethylene glycol 8000 (PEG_{8000}). Osmotic potential of the all solutions were 0 (control), -0.5, -1.0 and -1.5 MPa. Seeds were primed in aerated solutions under room condition for 24 h. The ratio of seed weight to solution volume was 1:5 (gm L^{-1}) (Ruan *et al.*, 2002).

Post priming operation: After treating, seeds were given three surfaces washing with distilled water and redride to original weight with forced air under shade (Khan, 1992).

Observations

Emergence: The number of seedlings emerged counted daily until complete emergence.

Yield and yield components: From each plot 10 plants were randomly selected at the time of harvest. The data regarding number of grain row $^{-1}$, number of grain ear $^{-1}$, number of row ear $^{-1}$ were recorded. Grain yield and total biomass were recorded after harvesting from central 5 rows from each plot.

Statical analyses were done using MSTAT-C and significant groups were separated according to Duncan's multiple range test.

RESULTS AND DISCUSSION

Emergence: Rapid seedling emergency was obtained in osmoprimed seeds (-0.5 and -1.0 MPa) as compared to control (Fig. 1-3). Highest emergence was measured from seed osmoprimed with PEG 8000 solutions (Fig. 3), while the lowest daily emergency was recorded from seed treated with KNO_3 solutions (Fig. 2). -0.5 MPa osmotic potential resulted in highest emergency than other osmopriming treatments in all solutions (Fig. 1-3).

The increase in emergency with osmopriming treatments might be due to initiating metabolic events in primed seeds (Shahzad *et al.*, 2003).

Yield and yield components: Result showed that the effect of solution kind (A) and osmotic potential (B) on all measuring characters (expect No. seed row $^{-1}$) were significant. In addition to, interaction of these factors were significant (Table 1). The effect of osmotic potential on No. seed row $^{-1}$ was found significant (Table 1 and Fig. 4).

The effect of the osmopriming treatments on grain yield was found significant p≤0.01 (Table 1). The effect of

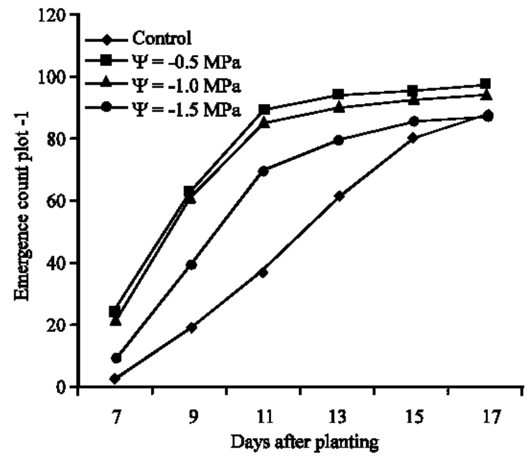

Fig. 1: Effect of osmopriming with KH2 PO4 on emergency of maize seeds

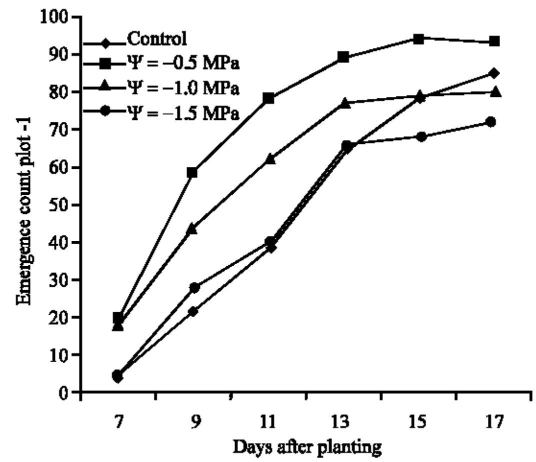

Fig. 2: Effect of osmopriming with KNO3 on emergency of maize seeds

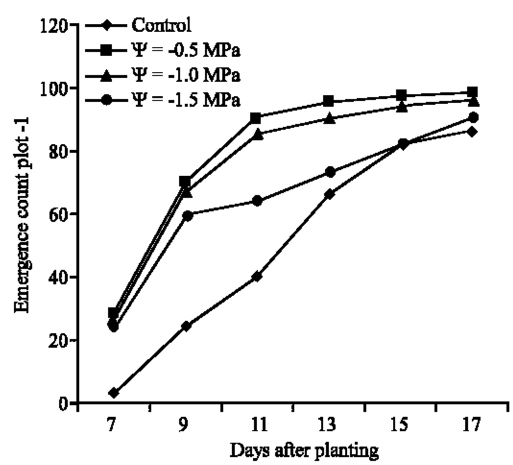

Fig. 3: Effect of osmopriming with PEG 8000 on emergency of maize seeds

Table 1: Variance analysis of the effect of different osmopriming treatments on some yield characters of maize

Sours of variation	DF	Grain yield	Biological yield	No. seed row^{-1}	No. seed ear^{-1}	Seed dry weight
Replication	2	0.36 ^{ns}	0.31 ^{ns}	0.21^{ns}	0.77^{ns}	10.6^{ns}
Solution Kind (A)	2	0.14**	19.89**	12.52*	2909.78 ^{ns}	386.44*
Osmotic potential (B)	3	5.00**	47.37**	89.32**	8866.99**	982.72**
Interaction (A×B)	6	0.31**	2.63**	4.43*	576.30*	110.37**
Error	22	0.04	1.47	2.40	178.81	24.57
CV (%)	-	15.29	13.71	11.19	14.58	11.90

*,**significance at the 0.01 and 0.05 level of probability, respectively; ns = not significant

Table 2: Effects of different osmopriming treatments on grain and biological yield of maize (*Zea mays* L.)

Treatment	Grain yield (Ton ha^{-1})	Biological yield (Ton ha^{-1})	HI (%)	No. seed ear^{-1}	Seed dry weight ear^{-1} (g)
KH2PO4					
Control	10.92cd	72.30de	15.15ab	540.0cde	141.5bc
-0.5 Mpa	11.40b	75.52ab	15.09ab	569.7bc	125.3ab
- 1.0 Mpa	10.87cd	73.40cd	14.80abc	534.0def	144.4b
-1.5 Map	9.84f	70.37f	14.06c	503.3fg	131.1c
KNO3					
Control	10.86cd	72.20de	15.04ab	538.7cde	144.9b
-0.5 Mpa	11.13bcd	74.37bc	14.69ab	583.0ab	150.8b
- 1.0 Mpa	10.72de	70.0f	15.31ab	517.3efg	142.2bc
-1.5 Map	8.87g	67.97g	13.04d	489.3c	142.6d
PEG 8000					
Control	10.86cd	72.60de	11.96ab	536.1cde	141.2bc
-0.5 Mpa	10.87a	76.37a	15.52a	604.7a	163.6a
- 1.0 Mpa	11.85bc	74.53bc	15.00ab	566.3bcd	152.4b
-1.5 Map	10.38e	71.07ef	14.60bc	537.3cde	142.6bc

Means were compared by Duncan's multiple range. Figures not sharing the same letters in a column differ significantly at p<0.01. HI= Harvest Index

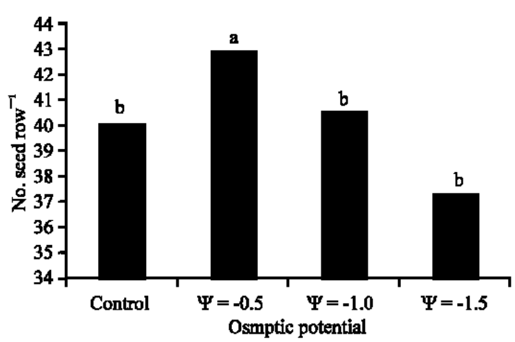

Fig. 4: Effect of different osmotic potential on No. seed row^{-1} of maize. Bars with the same letter are not significantly different at p<0.1

different osmopriming treatments on yield and yield parameters (p≤0.01) are presented in Table 2.

Our results confirm the findings of Shazad *et al.* (2003) and Zheng *et al.* (1994) who reported improvement in the yield and yield parameters of the osmoprimed seeds than non-treated seeds. Osmopriming that have shown good potential to enhance emergency, grain and biological yields Dell'. Maximum grain yield, biological yield, No seed ear^{-1}, were recorded in case of osmopriming with PEG 8000 at -0.5 osmotic potential (Table 2).

The duration and osmotic potential of the solution are the most important factors, which determine the degree of benefits harvested from osmopriming (McDonald, 2000). Also, Ghiyasi *et al.* (2008) and Tajbakhsh *et al.* (2004) showed that different osmopriming solutions affected differently germination, emergency and yield.

The increased grain and biological yields might be due to synchronized germination and early stand establishment in osmoprimed seeds (Khan, 1992). Moreover, the earlier and synchronized emergency might be attributed to increased metabolic activities in the osmoprimed seeds. In addition to, faster emergency rate after osmopriming operation may also be explained by an increased rate of cell division in the root tip.

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