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Effect of Seed Priming on Germination and Seedling Growth of Wheat (*Triticum aestivum* L.)

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Abstract: The present study was conducted to enhance the germination and seedling growth of wheat (*Triticum aestivum* L.) CV. Zarin seeds using different osmopriming treatments. Seeds were osmoprimed with Polyethylene Glycol (PEG 8000), KNO_3 solutions for 12 h. The osmotic potential of the all solutions were -0.3, -0.6 and -0.9 MPa. During osmopriming operation all solutions aerated with aquarium pump. The control seeds were not treated. Osmopriming treatments improved germination and seedling vigor than that control.

Key words: Osmopriming, germination, seedling growth, seed priming, treatments,

INTRODUCTION

Good seed germination behavior is important for horticulture and agriculture. Uneven or poor germination and subsequently inhomogeneous seedling growth can lead to great financial losses, by e.g., reduced possibilities for mechanization, or lower prices of inhomogeneous plant batches (Ghiyasi *et al*., 2008a) seed priming can increase speed and uniformity of germination (Ghiyasi *et al*., 2008b). Seed priming treatments can lead to better germination and establishment in many crops such as maize, wheat, rice, canola (Basra *et al*., 2005; Ghiyasi *et al*., 2008a, b). Seed priming treatments include non- controlled water uptake systems and controlled systems (Ashraf *et al*., 2003).

Pre-sowing seed treatments (seed priming) include hydropriming, biopriming, seed soaking, hormonal-priming, magneto-priming. Osmopriming is special type of seed priming that has been used to describe tha soaking of seeds in aerated low water potential solutions. Osmoprimed in polyethylene glycol, KNO_3, KH_2PO_4, NaCl, K_3PO_4, $CaCl_2$ solutions are usually performed at water potential ranging from -0.2 to -2.0 MPa depending plant and species (Hsu *et al*., 2003; Duman, 2006; Ghiyasi *et al*., 2008a, b). Many resent researches suggested that seed priming of crop seeds might be a useful way for better germination, seedling growth, establishment and yield (Ghiyasi *et al*., 2008a, b; Tajbakhsh *et al*., 2004; Sharafzadeh *et al*., 2006).

MATERIALS AND METHODS

Experiments were conducted in the laboratories and greenhouse of the Urmia University, Faculty of Agriculture, Department of Agronomy, during the 2006. Seed of wheat, cultivar Zarin, was used. The seed was obtained from Agriculture Research Station, West Azerbaijan, Urmia, Iran. Moisture content was determined by grinding the seeds and then drying at 130°C for 4 h and was found to be 11.7% on a fresh weight basis.

The seeds were surface sterilized with 5% NaOCl (sodium hypochloride) for 5 min to avoid fungal invasion, followed by washing with distilled water. The seeds were primed by solutions of Polyethylene Glycol (PEG 8000), KNO_3 and KH_2PO_4. During osmopriming operation, the solutions were aerated continuously. The osmotic potential levels of the all solutions were 0, -0.3, -0.6 and -0.9 Mpa.

Seeds were primed for 12 h at 25±2°C. After osmopriming seeds were given three surfaces washing with distilled water then redried to near original weight under shade.

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Germination test: Germination experiment was conducted in germinator at 25°C in 9 cm Petri dishes (20 in each) between the layers of moist filter paper. A seed was considered germinated when the radical pierced the coats up to 2 mm. Time to reach 50% germination (T_{50}) was calculated according to the following equation as:

$$T_{50} = t_i + [(N/2-n_i)(t_j-t_i)]/(n_j-n_i)$$

where:

N = The final number of germination

n_i, n_j = Cumulative number of seeds germinated by adjacent counts at times when $n_i<N/2<n_j$

Mean Germination Time (MGT) was calculated to the following equation as:

$$MGT = \Sigma Dn/\Sigma n$$

where:

n = The number of seeds, which were germinated on day D

D = The number of days counted from the beginning of germination

Germination Index (GI) was calculated according to the following equation:

GI = No. germinated seeds/days of first count
+. . .+ No. germinated seeds/
Days of final count

Seedling emergence: Treated and control seeds were sown in 35×35 cm plastic trayes (40 in each) having moist sand replicated 3 times and were placed chamber. A factorial experiment was design and conducted in the base of completely randomized design. Root and shoot length and seedling fresh and dry weights were recorded 7 days after sowing. The data analyzed by MSTATC and Excel software and means comparisons was done by Duncan's test.

RESULTS AND DISCUSSION

Osmopriming treatments improved germination and seedling growth of wheat (Table 1 and 2). The osmopriming effects on final Germination percentage (GR%) was not significant (Table 1). Maximum time to 50% germination (T_{50}) was obtained of control (Table 1). In addition to, minimum time to 50% germination (T_{50}) was recorded in case of osmopriming with PEG 8000 at -0.6 MPa osmotic potential. The increase seedling dry weight might be due to synchronized germination and improved DNA, RNA synthesis during seed treatments. The

Table 1: Effect of osmopriming treatments on germination of wheat

	Treatments			
PEG 8000	GR (%)	T_{50}	GI	MGT
Control	93.0	4.89a	18.0c	5.3a
-0.3 MPa	94.1	2.98b	38.5a	3.0c
-0.6 MPa	93.3	2.00c	40.2a	4.3b
-0.9 MPa	93.8	2.95b	39.2a	4.6b
KH_2PO_4				
Control	94.1	4.49a	18.7c	5.4a
-0.3 MPa	94.0	2.92b	37.6a	3.7c
-0.6 MPa	94.4	2.25ab	39.2a	4.0b
-0.9 MPa	93.8	3.04b	29.7b	4.2b
KNO_3				
Control	92.8	4.21a	18.4c	5.2a
-0.3 MPa	93.0	2.88b	37.0a	3.7c
-0.6 MPa	93.7	2.37ab	28.7b	4.5b
-0.9 MPa	93.6	2.91b	27.3b	4.1b

GR% = Final Germination percentage, T_{50} = Time to 50% germination, GI = Germination Index, MGT = Mean Germination Time. Figures not sharing the same letters differ significantly at $p<0.1$

Table 2: Effect of osmopriming treatments on seedling growth of wheat

	Treatments			
PEG 8000	MET (day)	Shoot length (cm)	Root length (cm)	Seedling dry weght (g)
Control	6.6a	13.1c	6.2b	0.71b
-0.3 MPa	3.9b	20.5a	9.1a	0.92a
-0.6 MPa	4.0b	19.9a	8.8a	0.89a
-0.9 MPa	4.8ab	17.1ab	8.6a	0.88a
KH_2PO_4				
Control	6.4a	13.3c	5.9b	0.73b
-0.3 MPa	4.1b	21.0a	8.9a	0.93a
-0.6 MPa	4.9ab	19.5a	8.4a	0.91a
-0.9 MPa	5.0ab	19.2a	8.5a	0.89a
KNO_3				
Control	6.1a	13.0c	6.3b	0.69b
-0.3 MPa	3.5b	19.7a	8.6a	0.9a
-0.6 MPa	4.6ab	16.5b	8.4a	0.81ab
-0.9 MPa	5.1ab	16.3b	8.3a	0.7ab

MGT = Mean Emergency Time. Figures not sharing the same letters differ significantly at $p<0.1$

increased shoot and root length with osmopriming treatments may be due to the fact that, osmopriming increased nuclear replication in root and shoot. Generally, these results indicated osmopriming improved germination and seedling vigor of wheat seeds. Our resultes confirm the findings of Duman (2006), Ghiyasi *et al.* (2008a, b) and Tajbakhsh *et al.* (2004).

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