

ORIGINAL ARTICLES

Hydropriming influence on seedling vigour in rosemary (*Rosmarinus officinalis* L.)

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ABSTRACT

Primed rosemary germinates faster and more uniformly than raw seeds, meaning less wasted space in greenhouse trays. In order to the hydropriming influence on seedling vigour index (SVI) in rosemary (*Rosmarinus officinalis* L.), this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0, 5, 10 and 15 hours). The results showed that the effect of hydropriming was significant on germination percentage and seedling vigour and wasn't significant effect on seedling length and seedling dry weight in rosemary. Mean comparison showed that the highest germination percentage and seedling vigour were achieved under hydropriming after 15 h but the highest the seedling length and seedling dry weight were achieved under hydropriming after 10 h. The results showed that germination rates were good in our tests, compared with native seeds.

Key words: Hydropriming, seedling vigour, rosemary (*Rosmarinus officinalis* L.).

Introduction

Early emergence and stand establishment of cowpea are considered to be the most important yield-contributing factors in rainfed areas. Laboratory tests and a field experiment were conducted in RCB design in 2011 at a research farm in Ramhormoz, Iran, to evaluate the effects of hydropriming (8, 12 and 16 hours duration) and halo priming (solutions of 1.5% KNO₃ and 0.8% NaCl) on seedling vigor and field establishment of cowpea. Analysis of variance of laboratory data showed that hydropriming significantly improved germination rate, seed vigor index, and seedling dry weights. However, germination percentage for seeds primed with KNO₃ and non-primed seeds were statistically similar, but higher than those for NaCl priming. Overall, hydropriming treatment was comparatively superior in the laboratory tests. Invigoration of cowpea seeds by hydropriming and NaCl priming resulted in higher seedling emergence and establishment in the field, compared to control and seed priming with KNO₃. Seedling emergence rate was also enhanced by priming seeds with water, suggesting that hydropriming is a simple, low cost and environmentally friendly technique for improving seed and seedling vigor of cowpea (Eskandari and Kazemi, 2011). It has been estimated that about nine million square kilometers of the world's arid rangelands have been turned into man-made deserts over the past half century. *B. inermis* was introduced as a livestock improvement crop, it has since invaded natural prairies and grasslands, outcompeting native grasses and decreasing biodiversity. The increasing frequency of dry periods in many regions of the world and the problems associated with salinity in irrigated areas frequently result in the consecutive occurrence of drought and salinity on cultivated land. The objective of a study was to determine the effect of seed priming on germination characteristics of *Bromus* species under stressful conditions. For osmopriming treatment, *Bromus* seeds were immersed in -0.6 MPa of PEG solutions at 25°C for 12 hours under dark conditions and seed were soaked for 12h in distilled water for hydropriming treatment. Drought condition was simulated by using PEG6000 according to Kuffman formula. Our results showed that *Bromus* could be categorized as a salt tolerant plant and its more tolerate to salinity than drought stress. Seed priming is a good seed enhancement technique for improving seed germination and faster seed germination of *Bromus* seeds (Tavili *et al.*, 2011). The objectives of a study were to evaluate effects of hydropriming and osmopriming techniques on improvement of the germination characteristics of four grass species under simulated drought stress by PEG. Germination in primed and non-primed seeds was delayed through drought stress. Then the increased osmotic potential measurements for, percentage of seeds that germinated, germination rate, seedling length and seedling dry weight were shown to decrease in all of the investigated species. Seeds were able to germinate in 0, -0.4 and -0.8 MPa concentrations of PEG and scant seed germination was observed at -1.2 MPa of PEG. It was concluded that inhibited germination was a result of osmotic effect and varied according to the different species tested. Osmopriming, rather than hydropriming treatment increased germination parameters under drought stress. For its ability to withstand drought conditions,

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it was observed that the grass species *Agropyron elongatum* had better responses than the other species to both priming treatments on conditions for germination especially at lower osmotic potentials (-1.2 MPa) (Rouhi *et al.*, 2011). The effects of osmo- and hydropriming on partially aged seeds of the mustard variety Vardan were studied. Seeds were osmoconditioned in PEG solution of strength -0.75 MPa and hydroprimed by (a) immersing in water for 3 hours; (b) allowing slow absorption of water from moist muslin for 36 hours; (c) humidifying over a water saturated atmosphere in an air-tight desiccator for 48 hours. The treated seeds were then equilibrated at 20°C and 45% RH for 48 hours to 6% moisture and packed in aluminium foil packets. Primed seeds were assessed immediately and after 10 months of storage at ambient conditions for their germination, mean germination time, leachate parameters, protein content and activities of amylase, acid phosphatase, peroxidase and catalase. Osmoconditioning and slow hydration treatments resulted in significant improvement in germination and vigour parameters in contrast to direct soaking of seeds in water. These observations are supported by decreased leakiness of electrolytes and UV absorbing materials and increased activity of free radical scavenging and reserve mobilising enzymes (Srinivasan *et al.*, 1999). The effects of different priming treatments and priming durations on germination percentage at different temperatures in parsley seeds were studied. The seeds were treated for 2, 4, 6 and 8 days with the PEG 6000 (-0.5 MPa, -1.0 MPa and -1.5 MPa), KNO₃ (0.30 mol/L and 0.35 mol/L), Mannitol (0.50 mol/L and 0.60 mol/L) and hy-dropriming (12h, 24h, 36h and 48h) and un-primed (control). Germination studies were made at 5, 10, 15, 20 and 25°C. Percentage of germination at different temperatures was significantly affected by priming treatments. Hy-dropriming (12h, 24h and 36 h) and mannitol 0.60 mol/L at 2 day generally had the highest germination percentages. In general, the high-est germination percentage with priming was determined at 10°C. It may be said that seed priming treatments increased seed germination percentage at both low and high temperatures. The highest germination percentages were observed in both hydropriming and mannitol treatments as compared with PEG and KNO₃ treatments. The PEG and KNO₃ (2 and 4 days) treatments were better than unprimed treatment in all of the temperatures (Atilla and Ekinçi, 2010). Therefore, the objective of this study was to evaluate the hydropriming influence on seedling vigour in rosemary (*Rosmarinus officinalis* L.).

Materials and Methods

In order to the hydropriming influence on seedling vigour in rosemary (*Rosmarinus officinalis* L.), this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0, 5, 10 and 15 hours) and then in the laboratory at each Petri dish 100 seeds were placed between two layers of paper culture and Petri dishes were placed in Germinator for 14 days at 23 to 25°C. After 14 days, 10 seedlings were selected and was determined seedling length and then placed on electrical Owen for 48h at 75°C and determined seedling weight by electrical scale. Finally, germination percentage determined for rosemary by following formula:

$$(\text{Number of Seeds Germinated} / \text{Total Number of Seeds on Petri Dish}) * 100$$

Data were subjected to analysis of variance (ANOVA) using Statistical Analysis System [SAS, 1988] and followed by Duncan's multiple range tests. Terms were considered significant at $P < 0.05$.

Results and Discussion

The results showed that the effect of hydropriming was significant on germination percentage and seedling vigour and wasn't significant effect on seedling length and seedling dry weight in rosemary. Mean comparison showed that the highest germination percentage and seedling vigour were achieved under hydropriming after 15 h but highest the seedling length and seedling dry weight were achieved under hydropriming after 10 h.

The results showed that germination rates were good in our tests, compared with native seeds. In production of medicinal plants, seed germination is very important problem. Seed priming is an efficient method for increasing of seed vigour and improvement of germination and seedling growth. This experiment was carried out at the Plant Physiology Laboratory in Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran in 2011. The present study was conducted to examine the effect of priming (non-priming and 12h hydropriming) treatment on seed parameters of rapeseed (*Brassica napus* L.) cultivars (Opera, Modena, and SLM046). The results showed that the effect of hydropriming was significant on seedling vigour, germination percentage and seedling dry weight in $P \# 0.05$. Mean comparison showed that the highest seedling vigour (4.1), germination percentage (100 %) and seedling dry weight (0.041 gr) were achieved by opera cul. under priming condition. Nevertheless, priming after 12h failed to improve germination all of the cultivars. Moreover, hydropriming treatment can be successfully applied on rapeseed cultivars seeds to improve germination performance (Aliabadi Farahani *et al.*, 2011). In order to evaluate the effect of seed priming on seedling emergence, grain yield and

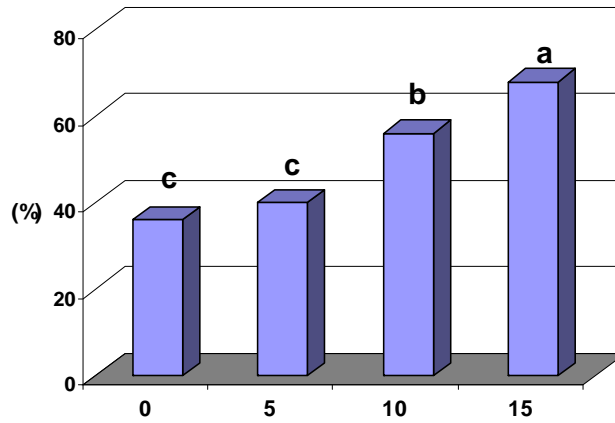


Fig. 1: Germination percentage under different levels of hydropriming.

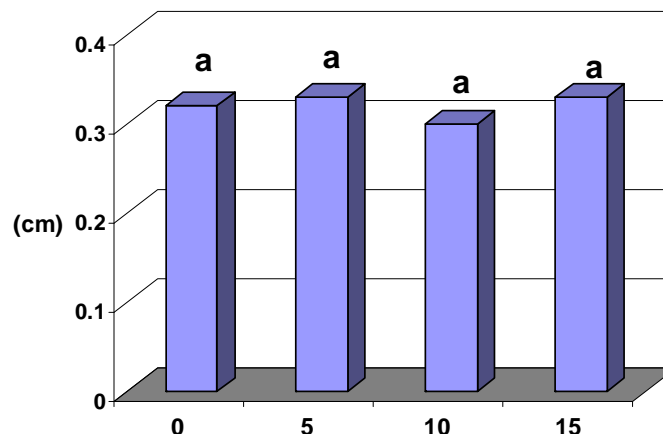


Fig. 2: Seedling length under different levels of hydropriming.

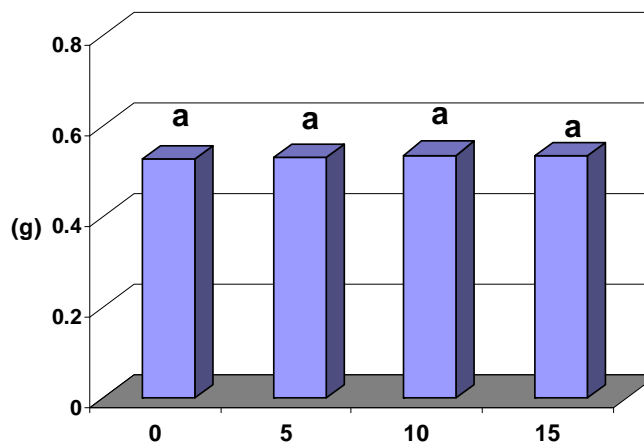


Fig. 3: Seedling weight under different levels of hydropriming.

yield components of wheat, a 2-year experiment was conducted at Seed and Plant Certification & Registration Institute (SPCRI) in Karaj, Iran, from 2008-2010. Two cultivars (Azar-2, Sardare-101) \times four priming media and control (unsoaked) were used in this experiment in field. Seeds were primed for 12 hour and 20°C in four priming media (PEG 10%, KCl 2%, KH_2PO_4 0.5%, distilled water) and control. Results of comparing means showed that osmotic priming with PEG10% had positive significant effects on emergence percentage, straw, grain and biological yield compared to other seed priming treatments (KCl 2%, KH_2PO_4 0.5% and distilled

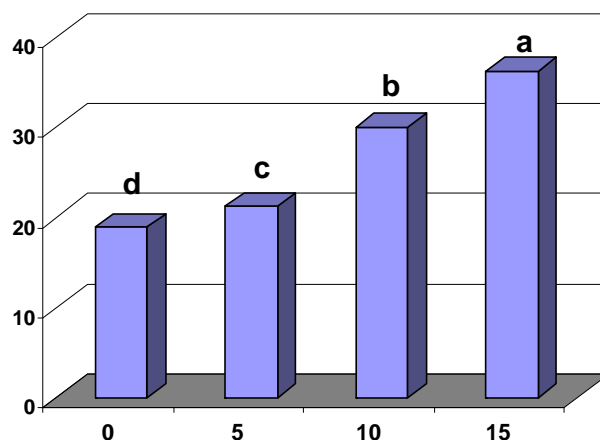


Fig. 4: Seedling vigour under different levels of hydropriming.

water). It was recognized that the maximum straw, biological yield, kernel weight, number of spikes per m^2 was obtained from Sardari-101 meanwhile the highest number of kernels per spike was achieved from Azar-2. Results of interaction between year \times seed priming treatment showed that maximum seed yield was obtained from PEG 10% and Sardari-101 (with average of 420 gr/m^2) (Yari *et al.*, 2011). In order to study of hydropriming and haloprimering on germination and early growth stage of wheat (*Triticum aestivum* L.) an experiment was carried out in laboratory of the Department of AgroNomy and Plant breeding (Shahrood University of Technology). Seed treatments consisted of T1: control (untreated seeds) (T2: soaking in distilled water for 18 h (hydropriming). T3: soaking in -1.2 MPa solution of $CaSO_4$ for 36 h (haloprimering). Germination and early seedling growth were studied using distilled water (control) and under osmotic potentials of -0.4, -0.8 and -1.2 MPa for NaCl and polyethylene glycol (PEG 6000), respectively. Results showed that Hydroprimed seeds achieved maximum germination seedling dry weight (especially during the higher osmotic potentials). Minimum germination was recorded at untreated seeds (control) followed by haloprimering. Under high osmotic potentials (hydroprimed seeds had higher GI (germination index) as compared to haloprimered or untreated seeds. Interaction effect of seed treatment and osmotic potential significantly affected the seedling vigour index (SVI) (Abbasdokht, 2011).

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