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ORIGINAL ARTICLES

Effect of hydropriming treatment on germination percentage in caraway (*Carum carvi* L.)

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ABSTRACT

Seed priming is a simple and cheap method but is acceptable in different areas. In order to the effect of hydropriming treatment on germination percentage in caraway (*Carum carvi* L.), this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0(T1), 6(T2), 12(T3) and 18(T4) hours). The results showed that the effect of hydropriming was significant on germination percentage, seedling length, seedling dry weight and seedling vigour in *Carum carvi*. Mean comparison showed that the highest germination percentage, seedling length were achieved by T4 and also the highest seedling dry weight and seedling vigour were achieved by T3 and lowest germination percentage, seedling length, seedling dry weight and seedling vigour were achieved by T1. The results of this experiment showed that hydropriming method can improve the emergence percentage in field at the arid and semi arid conditions.

Key words: Hydropriming, germination percentage, caraway (*Carum carvi* L.).

Introduction

In dry land areas of the western half of Iran, chickpea due to exposure to rotation with wheat and barley play an important role in maintaining survival of agriculture in these regions. In this study, effects of different times of hydropriming on yield, yield components, phenological characteristics and percentage of protein of chickpea (*Cicer arietinum* L.) were examined in a randomized complete block design with three replicates in 2010. Seeds of chickpea were exposed at six different hydropriming times (2 h, 4 h, 6 h, 8 h, 10 h and control). The results of this experiment showed that the effect of hydropriming treatments for main branch and lateral branch number, number of pod per plant, biological yield, grain yield, time from planting to emergence, emergence to flowering, flowering to bloom and pod forming and growth length was significant. However, there was no significant difference between treatments in terms of plant height, number of seed per pod, number of empty pod, seed thousand weight, harvesting index, pod forming to seed pods and blooming to maturity, and percentage of seed protein (Zarei *et al*., 2011). Pregermination techniques of osmotic priming and hydropriming have been used to enhance seed performance on planting Osmotic priming and hydropriming method were compared on the basis of germination performance O_2, N_2 and air were supplied to 500 ml vessels containing seeds with distilled water or -1.31 MPa PEG solution for 10 days On removing seeds from vessels, seeds were dried back to original water content. There were no differences in total germination between osmotic priming and hydropriming treatments t50 was reduced dramatically from 112 to 32 hours, using hydropriming with air and N_2supply for 1 day, compared to 70 hours of osmotic priming. Solute leakage from O_2supply of both methods was higher than air or N treatment, Indicating the loss of membrane integrity Hydropriming with O_2induced radicle emergence and loss of desiccation tolerance around 28 hours after treatment LEA protein levels were not changed in both treatments except for hydropriming with O_2. The timing of desiccation tolerance loss was correlated with that of degradation of LEA protein. O_2supply caused the adverse effects on seed performance from both methods 1 day after treatment (Yeoung and Wilson, 1994). To facilitate restoration of the lava field forests surrounding Mexico City, we developed methods to improve the germination and field seedling performance of *Quercus rugosa* using hydropriming (regulated hydration of seeds in water), and used special watering regimes to improve seedling acclimation. The size, dry mass, fresh mass and water content of seeds were measured, and curves were generated to evaluate acorn hydration and dehydration. The effects of stratification (5°C), heat shock (50°C) and scarification on germination were tested. All treated seeds and controls were germinated in control chambers at 21°C. One hydropriming cycle (PC) consisted of two hydration days followed by two dehydration days; treatments of 1, 2 and 3 PCs were tested. Seedlings from 1PC to 2PC

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were acclimated in a shade house under high and low watering regimes (400 and 200 mL week−1, respectively). In the shade house and field, the effects of hydropriming and watering treatments were evaluated by measuring length, basal diameter, crown cover, number of leaves and branches and leaf area of seedlings. Dry and fresh mass were used to calculate acorn water content. Dehydration and hydration curves displayed hysteresis. Acorns exhibited physiological dormancy, which could be overcome by stratification or by 1 month of storage. 1PC led to increased germination rates and final germination. In both the shade house and field, 1PC showed a positive effect on all seedling growth parameters except branch number. Field survival was not affected. Generally, 1PC favoured efficient seed germination, seedling vigour and homogenous plant production (Castro-Colina *et al*., 2011). The objective of this study was to evaluate the effects of ascorbic acid and salicylic acid pretreatment in addition to hydropriming on enhancement of seed germination of *Agropyron elongatum* under salt stress. The experimental design was two factors factorial based on a completely randomized design. Treatments were the combination of four levels of salt stress (0, -0.3, -0.6 and -0.9 MPa) in three concentrations of ascorbic acid and salicylic acid separately (100, 200 and 300 mg L^{-1}) and three levels of hydropriming (0 as a control, 12 and 18 h) with four replications. Results indicated that an increase in salt stress decreased germination components such as germination percentage and rate, coleoptile, radicle and seedling length and vigor index. Salicylic acid pretreatment and hydropriming did not significantly affect germination, but ascorbic acid spatially it's 300 mg L^{-1} concentration alleviated the adverse effects of salinity in all germination characteristics. Totally, it is concluded that ascorbic acid pretreatment results in improvement germination properties of *A. elongatum* under salt stress condition which in turn increases the resistance of *A. elongatum* against salt stress in germination phase (Tavili *et al*., 2009). Seeds of pinto bean (*Phaseolus vulgaris* L.) cultivars ('Talash', 'COS16' and 'Khomain') were divided into four sub-samples, one of which was kept as control (non-primed, P1) and three other samples were soaked in distilled water at 20oC for 7 (P2), 14 (P3) and 21 (P4) hours and then dried back to initial moisture content. In the laboratory, the lowest mean germination time and the highest germination percentage and seedling dry weight were achieved with P2, which was not significantly different from P3. The mean time of seed germination for 'Khomain' was significantly higher than that for 'Talash' and 'COS16'. In the field, 1000 grain weight of 'Khomain' was significantly higher than that of other cultivars, but mean grains/plant, grains/m2, grain yield/plant and grain yield/m2 of 'COS16' and 'Talash' were significantly higher than those of 'Khomain'. Therefore, grains/plant was the most important yield component affecting grain yield of pinto bean cultivars. Hydro-priming for 7 and 14 hours resulted in lower mean emergence time and higher seedling emergence percentage, grains/m2 and grain yield/m2, compared with P1 and P4. Grains/plant, 1000 grain weight and grain yield per plant were not significantly affected by hydro-priming. However, hydro-priming for 7 and 14 hours improved grain yield per unit area indirectly through enhancing seedling establishment and grains/m2. The extended priming duration negatively affected laboratory and field performance of pinto bean cultivars (Ghasemi-Golezani *et al*., 2010). Therefore, the objective of this study was to evaluate the effect of hydropriming treatment on germination percentage in caraway (*Carum carvi* L.).

Materials and Methods

In order to the effect of hydropriming treatment on germination percentage in caraway (*Carum carvi* L.), this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0(T1), 6(T2), 12(T3) and 18(T4) 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 21 days at 21 to 23C. After 21 days, 10 seedlings were selected and was determined seedling length and then placed on electrical Owen for 48h at 75ºC and determined seedling weight by electrical scale. Finally, germination percentage determined for caraway by following formula:

(Number of Seeds Germinated / 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, seedling length, seedling dry weight and seedling vigour in *Carum carvi*. Mean comparison showed that the highest germination percentage, seedling length were achieved by T4 and also the highest seedling dry weight and seedling vigour were achieved by T3 and lowest germination percentage, seedling length, seedling dry weight and seedling vigour were achieved by T1.

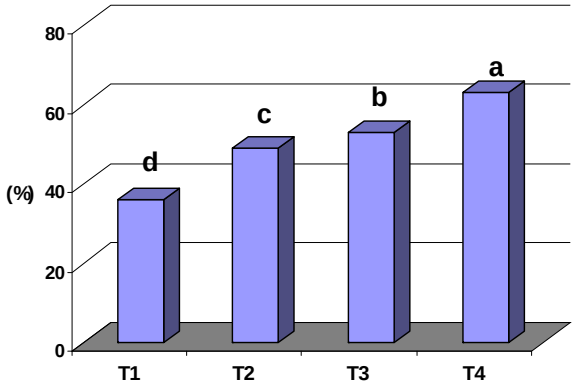

Fig. 1: Germination percentage under different levels of hydropriming.

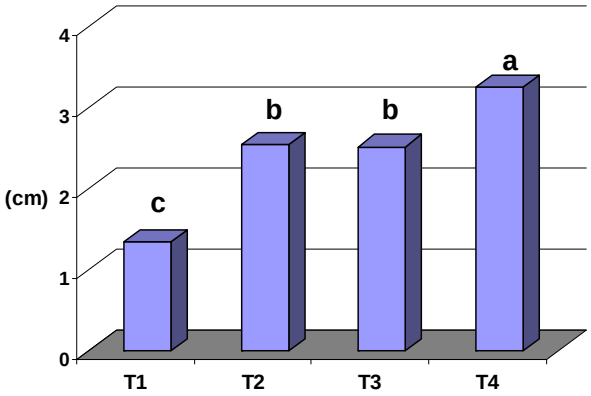

Fig. 2: Seedling length under different levels of hydropriming.

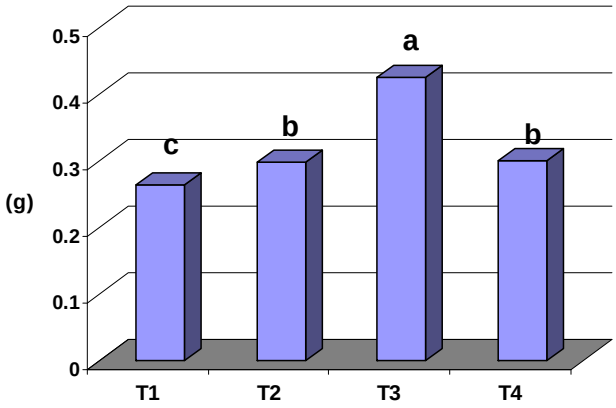

Fig. 3: Seedling weight under different levels of hydropriming.

The results of this experiment showed that hydropriming method can improve the emergence percentage in field at the arid and semi arid conditions. The influence of priming treatments and subsequent accelerated aging on seed parameters of grain sorghum was investigated. Seeds of sorghum were treated by osmo-priming (polyethylene glycol 6000 solution with osmotic potential -1.5 MPa) and hydro-priming for different time (12, 24 and 36 hours). Both osmo- and hydro-priming improved the percentage and mean emergence time (MET) of seeds at sub- optimal temperature of 15 C. Seed t ° reatment for 12 and 24 hours had a positive statistically significant effect on percentage and speed emergence. Nevertheless priming for 36 hours failed to improve emergence percentage and mean emergence time (MET). After receiving accelerated aging, osmo- and hydro - primed seeds showed a lower emergence percentage and longer mean emergence time (MET) than their non –

aged counterparts. Moreover, treated seeds subjected to accelerated aging showed lower emergence responses than aged control seeds, which was particularly clear for hydro - primed seeds (Moradi and Younesi, 2009).

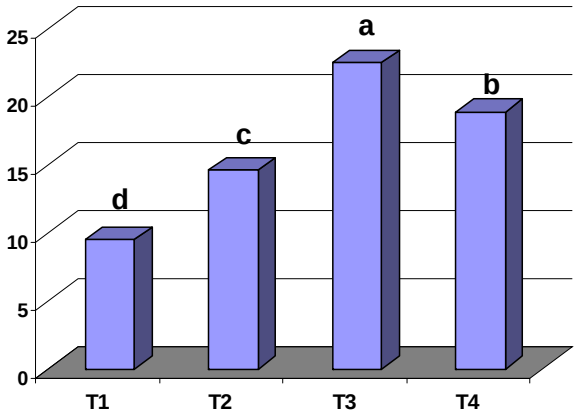

Fig. 4: Seedling vigour under different levels of hydropriming.

In production of medicinal plants, seed germination is very important problem. The treated seeds (control, hydro priming and ZnSO4) of Cumin (*Cuminum cyminum* L.) were evaluated at germination and seedling growth for tolerance to salt (NaCl and Na2SO4) conditions at the same water potentials of 0.0, -0.3, -0.6, -0.9 and -1.2MPa. Electrical conductivity (EC) values of the NaCl solutions were 0.0, 6.5, 12.7, 18.4 and 23.5 dSm-1, respectively. The objective of the study was to determine factors responsible for germination and early seedling growth due to salt toxicity or osmotic effect and to optimize the best priming treatment for these stress conditions. Results revealed that germination delayed in both solutions, having variable germination with different priming treatments. Germination, shoot and weight, root and shoot length were higher but mean germination time and abnormal germination percentage were lower in NaCl than Na2SO4 at the same water potential. The root / shoot weight and R/S length increased with increase in osmotic potential in both NaCl and Na2SO4 solutions. NaCl had less inhibitor effect on seedling growth than the germination. It was concluded that inhibition of germination at the same water potential of NaCl and Na2SO4 resulted from salt toxicity rather than osmotic effect. Hydro priming increased germination and seedling growth under salt stress. This protocol has practical importance and could be recommended to farmers to achieve higher germination and uniform emergence under field conditions (Neamatollahi, *et al*., 2009). In order to study of hydropriming and halopriming 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 CaSO4 for 36 h (halopriming). 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 halopriming. Under high osmotic potentials, hydroprimed seeds had higher GI (germination index) as compared to haloprimed or untreated seeds. Interaction effect of seed treatment and osmotic potential significantly affected the seedling vigour index (Abbasdokht, 2011).

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