Research Journal of Fisheries and Hydrobiology, 6(4): 486-490, 2011
ISSN 1816-9112
This is a refereed journal and all articles are professionally screened and reviewed

ORIGINAL ARTICLES

Seedling production in ajowan (*Carum copticum* L.) under hydropriming method

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ABSTRACT

Ajowan seed is also known as Ajwain seed and Carom. It has a flavor reminiscent of thyme; a similarity due to the presence of the essential oil thymol in both. In order to the seedling production in ajowan (*Carum copticum* L.) under hydropriming method, this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0, 10, 20 and 30 hours). The results showed that the effect of hydropriming was significant on germination percentage, seedling dry weight and seedling vigour and wasn't significant effect on seedling length, in ajowan. Mean comparison showed that the highest germination percentage, seedling length, seedling dry weight and seedling vigour were achieved under hydropriming after 20 h. The results of this experiment showed that highest seedling vigour index (SVI) was achieved under hydropriming after 20 h and lowest seedling vigour index (SVI) was achieved under no-hydropriming level.

Key words: Hydropriming, seedling production, ajowan (*Carum copticum* L.).

Introduction

Fresh seeds of lentil cultivars 'Pul 11', 'Sultan 1' and 'Meyveci 2001' were subjected to hydropriming with an objective to improve germination and seedling vigor under water stress induced by PEG-6000 at the water potentials of 0.0 (distilled water), -0.3 and-0.6 MPa. Results revealed that germination delayed in increasing water stress with variable germination among cultivars. Root, shoot length and germination were higher but mean germination time were lower in the primed seeds. Seeds were able to germinate at all concentrations of PEG but higher germination and improved seedling growth was observed in primed seeds. Cultivars showed variable response to water stress and cv. 'Pul 11' with the lightest seed weight gave better performance. Whereas, cv. 'Sultan 1' enhanced germination percentage with hydropriming under increased water stress. It was concluded that inhibition of germination due to water stress should be overcome by using primed lentil seeds (Saglam *et al*., 2010). In order to improve seed and seedling quality indices of two carrot cultivars (Nantes and Forto), a hormonal priming technique was used. A factorial experiment was carried out on the basis of randomized complete block design (RCBD) with 3 replications and 16 hormonal priming treatments such as gibberellin and salicylic acid in four concentrations including 0, 50, 100 and 150 ppm. The interaction of cultivar × hormone × concentration was significant for emergence percentage. The results showed that emergence rate, vigor index and root and shoot length were affected by treatments. The fastest and slowest emergence were observed in N□0 (Nantes hydro□primed seed) and F□GA50 (Forto primed with Gibberellin 50 ppm) respectively. The highest vigor index was N□0 (Nantes primed with distilled water) and least vigor index was N□GA50 (Nantes primed with Gibberellin 50 ppm). In both cultivars, emergence rate, vigor index and root and shoot length of hydro□priming were more than hormonal priming. Comparison of the two cultivars suggests that Forto has a more positive response to priming than Nantes (Eisvand *et al*., 2010). Two triploid watermelon cultivars 'Gold Prince' and 'Guangxi 5' were subjected to hydropriming by soaking in deionized water for 2 hrs with aeration following 24 and 48 hrs incubated at saturated relative humidity. Hydropriming had a promotive effect on germination performance in both cultivars but the overall seed germination percentages did not increase in 'Gold Prince'. Furthermore, hydrated seeds were redried under different conditions to low down the seed moisture content to 6-7 % and the two cultivars responded differently. The highest germination percentages and lowest mean germination time were obtained from medium drying (40%RH, 20□C) for 'Gold Prince' and quick drying (20%RH, 20□C) for 'Guangxi 5' (Huang *et al*., 2002). A study was conducted to determine the effect of priming of chickpea seeds, with either 4% mannitol or water for 24 h, on the performance of the crop in the field and compare with crop raised from non-primed seeds to ascertain the practical use of low-cost technology of seed priming on the yield parameters of chickpea crop. Ten plants from each plot were taken at 50, 60, 70, 85, 100, 115 and 130 days after sowing (DAS). Shoot length and

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shoot biomass of water- and mannitol-primed plants were greater compared to those from non-primed plants. At 130 DAS, the increase in length of shoots due to priming with water and mannitol was ~17% whereas increase in shoot biomass was two-fold compared to non-primed plants. At 100 DAS, the number of flowers per plant was 8 in non-primed, 12 in water-primed and 11 in mannitol-primed plants, while at 115 DAS, the corresponding values were 46, 69 and 74. At 130 DAS, the number of pods per plant was 17 in non-primed, 39 in water-primed and 38 in mannitol-primed plants. At maturity, at 160 DAS, all the plants from each field were taken out and the number of seeds per plant and remaining biomass of each plant after removing pods were noted. In non-primed crop, the average seed yield per plant was 3.61 g. With water and mannitol priming, the average seed yields per plant were 5.05 and 5.94 g, respectively, showing corresponding increase of 39 and 64% (Kaur *et al*., 2002). Laboratory tests and a field experiment were carried out to evaluate the effects of hydro priming (P2, P3 and P4: hydropriming of 8, 12 and 16 hours, respectively) on seed invigoration and field performance of three sesame cultivars (TS3, TN238 and Yellow white). The field experiment was arranged as factorial based on RCB design in three replicates. Hydropriming increased germination percentage, germination rate and seedling size, compared with non-primed seeds. Although response to hydropriming varied among sesame cultivars, seed priming generally increased grain yield per unit area through enhancing rate and percentage of seedling establishment and grains per plant. The highest improvement in grain yield per unit area was observed for primed seeds of TS3 (32%) followed by Yellow white. The highest yield increase was obtained with 16 h hydropriming. Thus, it is conceivable to suggest that this priming duration is the best treatment for invigoration of sesame seeds (Eskandari, 2011). Therefore, the objective of this study was to evaluate the seedling production in ajowan (*Carum copticum* L.) under hydropriming method.

Materials and Methods

In order to the seedling production in ajowan (*Carum copticum* L.) under hydropriming method, this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0, 10, 20 and 30 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 18 days at 18 to 20C. After 18 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 ajowan 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 dry weight and seedling vigour and wasn't significant effect on seedling length, in ajowan. Mean comparison showed that the highest germination percentage, seedling length, seedling dry weight and seedling vigour were achieved under hydropriming after 20 h.

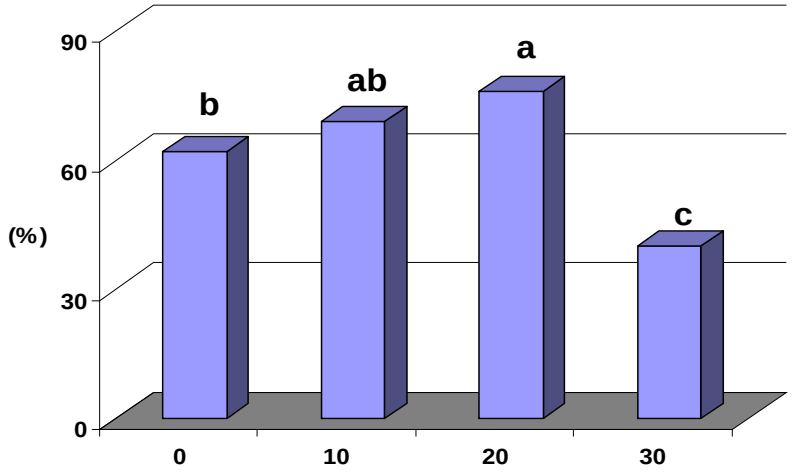

Fig. 1: Germination percentage under different levels of hydropriming.

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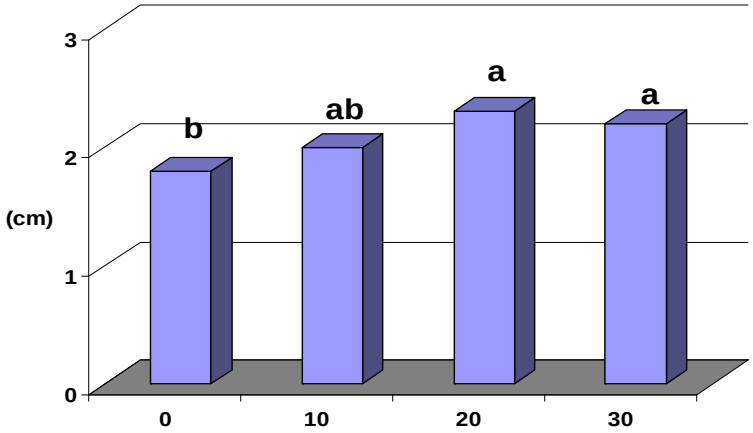

Fig. 2: Seedling length under different levels of hydropriming.

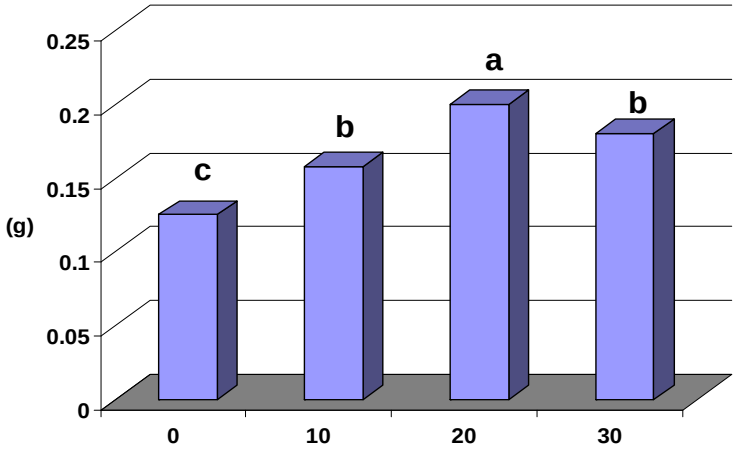

Fig. 3: Seedling weight under different levels of hydropriming.

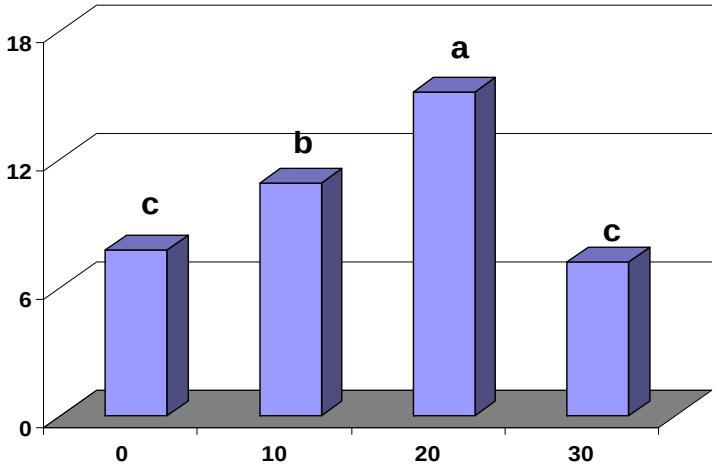

Fig. 4: Seedling vigour under different levels of hydropriming.

The results of this experiment showed that highest seedling vigour index (SVI) was achieved under hydropriming after 20 h and lowest seedling vigour index (SVI) was achieved under no-hydropriming level. Hydropriming is one of the seed germination enhancing techniques which is simple, safe, nonchemical and

harmless to the environment. The aim of the present study was to investigate the effect of hydropriming on the germination and vigor of aged coriander (*Coriandrum sativum* L.) seeds. Seeds were aged at 42°C and 100% relative humidity for 0, 24, 48, 72 and 96 h and then primed by soaking in distilled water for 8 h and incubated at 20°C for 24 h, compared to non-primed seeds as control. Results obtained showed that primed seeds resulted in earlier germination and higher first count, germination percentage than those of non-primed seeds, irrespective of aging duration. Seeds aged for 0, 24 and 48 h with subsequent priming or nonpriming showed high germination percentages but these were not significant difference among treatments. Increased aging duration to 72 h resulted in decreased germination percentages and primed seeds revealed higher germination percentages than those of non-primed seeds. However, the lowest germination percentage occurred in 96 h aged seeds, with priming or nonpriming (Rithichai *et al*., 2009). Priming effects may be different among impatiens seed lots with different seed sizes. To investigate this relationship, six seed size classes of 'Expo Wine' impatiens seeds were hydroprimed for different durations followed by slow dehydration using saturated salt solutions. Germination results showed that 24, 36 and 42h of hydropriming reduced speed of germination, while 4 and 8h of hydropriming promoted speed of germination and 1h hydropriming showed no significant difference compared to nonprimed seeds. Statistical analysis indicated that seed size effects existed, with larger seeds germinating faster than smaller seeds following hydropriming. These results indicate that seed lots subjected to hydropriming must be sized to obtain a uniform priming response (Li *et al*., 2005). Poor germination and seedling establishment are major problems in arid and semi-arid environments, and these characteristics are considered to be important factors in later plant growth and yield. Laboratory experiments were conducted on freshly harvested pyrethrum (*Tanacetum cinerariifolium*) seeds to investigate the effects of light (influenced by the seeding method) and seed hydropriming on germination, and shoot and root growth at 25 °C. Exposure to light could reduce germination from 52% to 22% and increase the mean germination time (MGT) from 7 to 12 days. The responses of hydroprimed and unprimed seeds to salt and drought stress were determined at osmotic potentials of 0 (distilled water), −0.3, −0.6, −0.9, −1.2 MPa in NaCl and PEG6000. Seed germination and seedling growth were inhibited by increasing salt and drought stress. The germination percentage of unprimed seeds was reduced from 52% to 16% in −1.2 MPa NaCl, and no seeds germinated at osmotic potentials ≤−0.9 MPa PEG. Both shoot and root growth were inhibited at osmotic potentials ≤−0.9 MPa NaCl and ≤−0.6 MPa PEG. Hydropriming shortened the delay of MGT at all osmotic potentials, and improved the germination percentage in distilled water (from 52% to 59%) and resistance to salt stress with nearly double germination (from 16% to 29%) at the highest salt concentration. When non-germinated seeds were transferred to distilled water after 20 days of incubation in total up to 12–15% of NaCl and 25–27% of PEG stressed seeds did not recover. These results show that the inhibition of the germination and seedling growth at the same osmotic potential of NaCl and PEG resulted from drought stress rather than salt toxicity, and that hydropriming is an effective tool to improve the quality of pyrethrum seeds (Li *et al*., 2011). A factorial experiment (using RCB design) with 3 replications was conducted in 2008, in order to evaluate the effects of hydro-priming duration (P1, P2, P3 and P4: 0, 7, 14 and 21 h, respectively) on field performance of three pinto bean (*Phaseolus vulgaris* L.) cultivars (Talash, COS16 and Khomain). The highest seedling establishment, ground cover, plant biomass and grain yield per unit area were recorded for P2 followed by P3. Mean chlorophyll content index of Talash was significantly higher than that of COS16 and Khomain. Ground cover, plant biomass, pods per plant, grains per plant and grain yield per unit area of COS16 and Talash were significantly higher than those of Khomain, but 1000 grain weight of Khomain was higher than that of other cultivars. Ground cover positively correlated with plant biomass, pods per plant, grains per pod, grains per plant, harvest index and grain yield per unit area. Thus, it can be used as a reliable index to estimate the yield potential of pinto bean cultivars. No significant interaction of priming duration × cultivar indicated that optimal time of hydro-priming for all pinto bean cultivars is 7 h (Ghassemi-Golezani *et al*., 2010).

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