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ORIGINAL ARTICLES

Determination of germination percentage in balm (*Melissa officinalis* L.) under hydropriming

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ABSTRACT

Balm (*Melissa officinalis*), *Monarda* species, is a perennial herb in the mint family Lamiaceae, native to southern Europe and the Mediterranean region. In order to the determination of germination percentage in balm (*Melissa officinalis* L.) under hydropriming, this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0, 7, 14 and 21 hours). The results showed that the effect of hydropriming was significant on germination percentage, seedling vigour, seedling length and seedling dry weight in balm. Mean comparison showed that the highest germination percentage and seedling vigour were achieved under hydropriming after 21 h but highest the seedling length and seedling dry weight were achieved under hydropriming after 14 h.

Key words: Hydropriming, germination percentage, balm (*Melissa officinalis* L.).

Introduction

Knowledge and prediction of seasonal weed seedling emergence patterns is useful in weed management programs. Seed dormancy is a major factor influencing the timing of seedling emergence, and once dormancy is broken, environmental conditions determine the rate of germination and seedling emergence. Seed dormancy is a population-based phenomenon, because individual seeds are independently sensing their environment and responding physiologically to the signals they perceive. Mathematical models based on characterizing the variation that occurs in germination times among individual seeds in a population can describe and quantity environmental and after-ripening effects on seed dormancy. In particular, the hydrothermal time model can describe and quantify the effects of temperature and water potential on seed germination. This model states that the time to germination of a given seed fraction is inversely proportional to the amount by which a given germination factor (e.g., temperature or water potential) exceeds a threshold level for that factor. The hydrothermal time model provides a robust method for understanding how environmental factors interact to result in the germination phenotype (i.e., germination pattern over time) of a seed population. In addition, other factors that influence seed dormancy and germination act by causing the water potential thresholds of the seed population to shift to higher or lower values. This relatively simple model can describe and quantify the germination behavior of seeds across a wide array of environmental conditions and dormancy states, and can be used as an input to more general models of seed germination and seedling emergence in the field (Bradford, 2002). A laboratory experiment was conducted to evaluate the effects of hydropriming (3 and 6 h) and osmopriming (3 and 6 h KNO_3, and 1 h polyethylene glycol [PEG] 6000 at −0.2 MPa) on the germination of seeds from the safflower cultivar Kuseh. Hydropriming significantly improved the germination, germination rate, germination uniformity and shoot/root ratio, and decreased the time to 50% germination, compared to the control. Hydropriming for 3h and 6 h KNO_3 also significantly improved most of the germination parameters, but overall, the 6 h hydropriming treatment achieved the best results and therefore, this treatment was used to evaluate the effect of priming in a field experiment with a single seed lot from each of three cultivars (Kuseh, PI and ILIII). Hydropriming resulted in higher seedling emergence and an increase in seedling emergence rate for all three cultivars, although there was a significant priming × cultivar interaction. The greatest improvement in field emergence after priming was seen in PI, which also had the lowest initial germination. Hydropriming for 6 h may be used to improve field establishment of safflower. In addition, this treatment is simple, cheap and does not need expensive chemicals and sophisticated equipment (Ashrafi and Razmjoo, 2010). The objectives of a study were to evaluate the effect of hydro-priming and hydration media on the germination of dry bean cultivars. Seed performance was evaluated based on germination test**,** seed moisture content**,** electrical conductivity and water uptake. The study constituted two set of experiments. The result of the first experiment revealed that seed priming, cultivars, and their interaction were significant for percent germination at the 2nd,

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4th and 8th day and normal seedlings percentage at the 8th day. Seeds failed to produce normal seedlings for both 4 and 8 h seed priming treatments, while the control (no priming treatment) produced large percentage of normal seedlings. The second experiment was designed to examine the cause for the failure of germination in the primed seed in the first experiment. There was significant difference between cultivars for germination percent at the 2nd day, while only the media of hydration was significant at the 8th day count. None of the factors were significant at the 4th day. There was significant difference among hydration media and cultivars for normal seedlings at the 8th day, while the interaction was non-significant. Completely immersing the seed in water-filled flask did not cause the failure of germination in the first experiment; rather hydration followed by dehydration treatment was the possible cause. The better performance of the control in both experiments indicated that hydro-priming seems unnecessary in dry bean (Abebe and Modi, 2009). A laboratory study was conducted to evaluate the benefits (if any) associated with the incorporation of polyamines in the priming media for hybrid sunflower achene priming. Achenes were subjected to hydropriming for 24 h and in the solutions containing 10 mg L-1 spermidine and putrescine for 24 h. All the achene priming treatments resulted in improved germination and early seedling growth. Priming in spermidine solution resulted in lower time to start emergence, time taken 50% emergence and mean emergence time and energy of emergence, emergence index, root and shoot length and seedling fresh and dry weight than all other treatments including control. However, hydroprimed achenes resulted in maximum final emergence and leaf score; while priming in putrescine solution resulted in maximum number of roots (Farooq *et al*., 2007). Therefore, the objective of this study was to evaluate the determination of germination percentage in balm (*Melissa officinalis* L.).

Materials and Methods

In order to the determination of germination percentage in balm (*Melissa officinalis* L.) under hydropriming, this experiment was conducted in 2011 by a completely randomized design with four replications. The factor was including hydropriming (0, 7, 14 and 21 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 20 days at 21 to 23C. After 20 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 balm 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 vigour, seedling length and seedling dry weight in balm. Mean comparison showed that the highest germination percentage and seedling vigour were achieved under hydropriming after 21 h but highest the seedling length and seedling dry weight were achieved under hydropriming after 14 h.

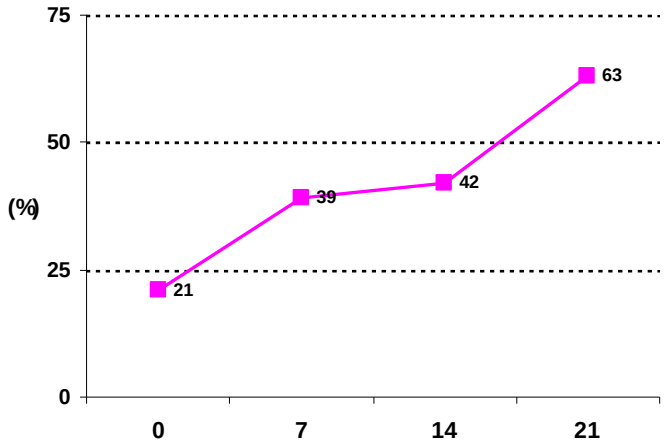

Fig. 1: Germination percentage in balm under hydropriming.

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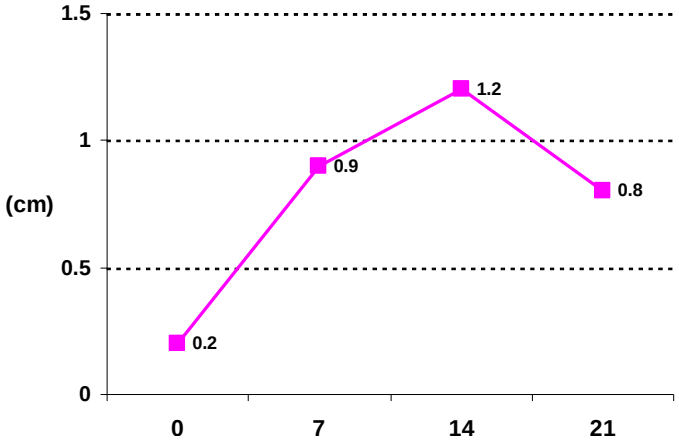

Fig. 2: Seedling length in balm under hydropriming.

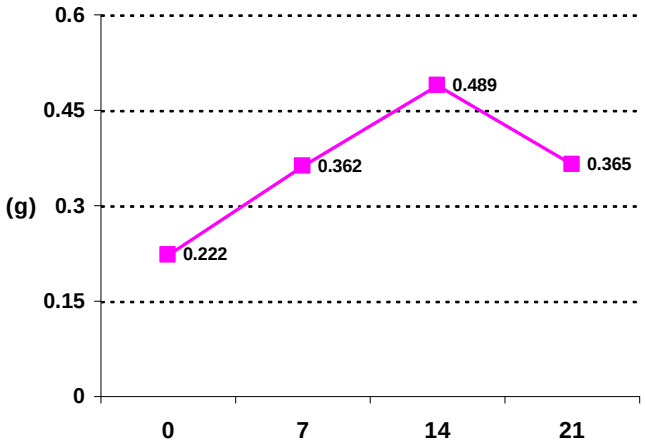

Fig. 3: Seedling weight in balm under hydropriming.

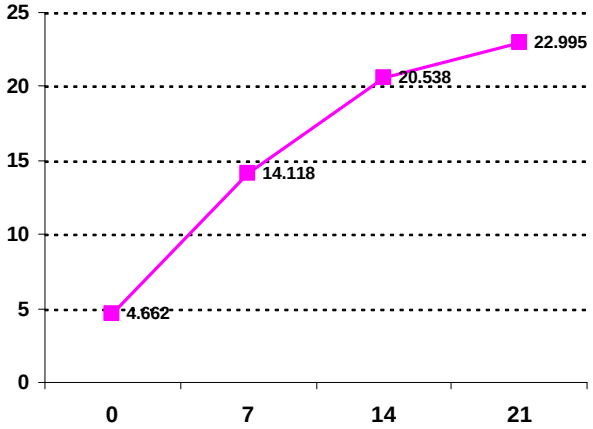

Fig. 4: Seedling vigour in balm under hydropriming.

The results showed that the highest germination percentage and seedling vigour were achieved under hydropriming after 21 h but highest the seedling length and seedling dry weight were achieved under hydropriming after 14 h. 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).

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