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ORIGINAL ARTICLES

The Nano & Hydropriming influences on seedling vigour index (SVI) in alfalfa (*Medicago sativa* L.)

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ABSTRACT

In order to the Nano & Hydropriming influences on seedling vigour index (SVI) in alfalfa (*Medicago sativa* L.), this experiment was conducted in 2011 by a factorial design with four replications. The factors were including hydropriming (0(H1), 8(H2), 16(H3) and 24(H4) hours) and use of TiO_2 nano-particle (0(N1), 0.01(N2), 0.02(N3) and 0.03(N4) percentage). The results showed that the effects of Nano & hydropriming were significant on germination percentage, seedling vigour, seedling length and seedling dry weight in alfalfa. Means comparisons showed that the highest germination percentage, seedling vigour, seedling length and seedling dry weight were achieved under H4 & N3. The results showed that use of Nano & hydropriming can improve seedling vigour index (SVI) in alfalfa sorely.

Key words: Nano & Hydropriming, seedling vigour index (SVI), alfalfa (*Medicago sativa* L.).

Introduction

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). 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). Cactus seeds on the soil surface in the desert are subjected to periods of drought that last for up to a few months, and thus they are typically under discontinuous hydration (or discontinuous dehydration) Apparently, they can tolerate long periods of dehydration after single or multiple hydration events and subsequently germinate in accordance with the previous hydration experience. This was verified in three cactus species from the Sonoran Desert Seeds of *Stenocereus thurberi* hydrated for 72 or 80 h followed by a dehydration period lasting for 4, 14, 70, 120 or 181 d germinated 2-3 d earlier and had 1 4-2 times shorter mean germination time (MGT) than untreated seeds. Seeds given shorter hydration periods also began to germinate sooner than the controls MGT was shorter only when the hydration period was 48 h or longer. Final germination percentages were not affected by these treatments, only the MGT Except for differences in germination percentages, similar results were found for *Pachycereus pecten-aboriginum* and *Ferocactus peninsulae*. When the cycle of 24 h hydration followed by 4 d dehydration was repeated one or two times, the effect was cumulative: MGT was equal to 48 and 72 h hydration, respectively These results suggest a phenomenon of "seed hydration memory," the ability of seeds to retain during dehydration periods those physiological changes that result from seed hydration Thus, treated seeds subsequently germinated earlier then

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untreated seeds, regardless of the duration of dehydration period This led to a greater biomass accumulation and thus to higher survival in seedlings from treated than from untreated seeds (Dubrovsky, 1996). 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). 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, 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). Insufficient seedling stand establishment is one of the major obstacles to achievement of winter wheat (*Triticum aestivum*) potential yield. In the present study, seeds of eleven wheat cultivars differing in drought resistance were subjected to hydropriming with distilled water and osmopriming with PEG 6000 for 12 h. Speed of emergence, vigor index and seedling dry weight were studied under two temperature conditions at 11 and 18 degrees C in plant growth incubators. Water stress started 15 Days After Sowing (DAS). As compared with osmopriming, hydropriming clearly improved speed of emergence, vigor index and seedling dry weight. The results were more evident at 11 degrees C indicating that hydropriming is more efficient for cold rather than temperate area. At both temperatures, PEG treatment severely diminished above mentioned traits. At 11 degrees C, drought resistant cultivars i.e., Sardari, Agosta-Sefid, Azar 2 and Sabalan had higher seedlings dry weight as compared with susceptible ones. Therefore, it is proposed that measurement of seedling dry weight may be a proper approach for early screening of wheat drought resistant genotypes (Ahmadi *et al*., 2007). Therefore, the objective of this study was to evaluate the Nano & Hydropriming influences on seedling vigour index (SVI) in alfalfa (*Medicago sativa* L.).

Materials and Methods

In order to the Nano & Hydropriming influences on seedling vigour index (SVI) in alfalfa (*Medicago sativa* L.), this experiment was conducted in 2011 by a factorial design with four replications. The factors were including hydropriming (0(H1), 8(H2), 16(H3) and 24(H4) hours) and use of TiO_2 nano-particle (0(N1), 0.01(N2), 0.02(N3) and 0.03(N4) percentage) 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 8 days at 20 to 21ºC. After 8 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 alfalfa 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 effects of Nano & hydropriming were significant on germination percentage, seedling vigour, seedling length and seedling dry weight in alfalfa. Means comparisons showed that the highest

germination percentage, seedling vigour, seedling length and seedling dry weight were achieved under H4 & N3.

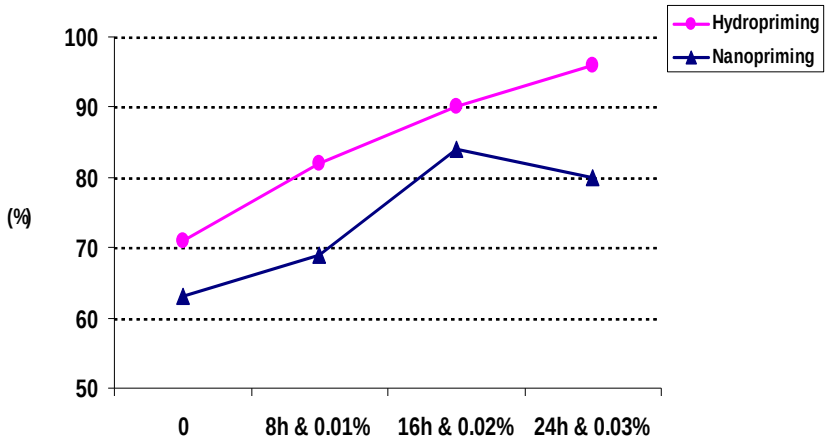

Fig. 1: Germination percentage in alfalfa under Nano & hydropriming.

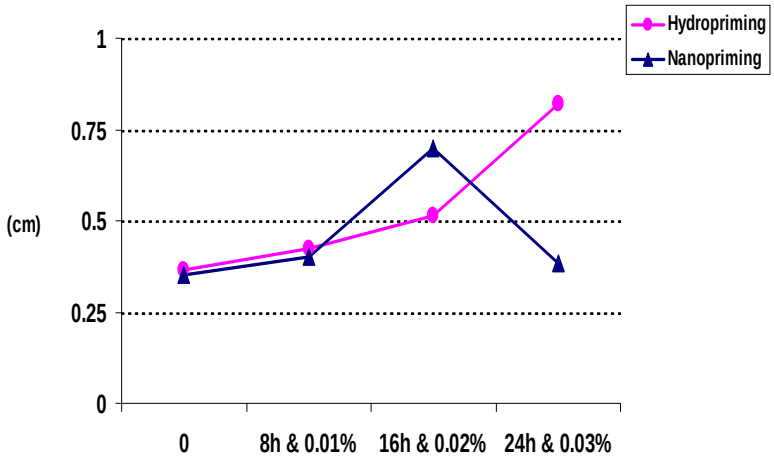

Fig. 2: Seedling length in alfalfa under Nano & hydropriming.

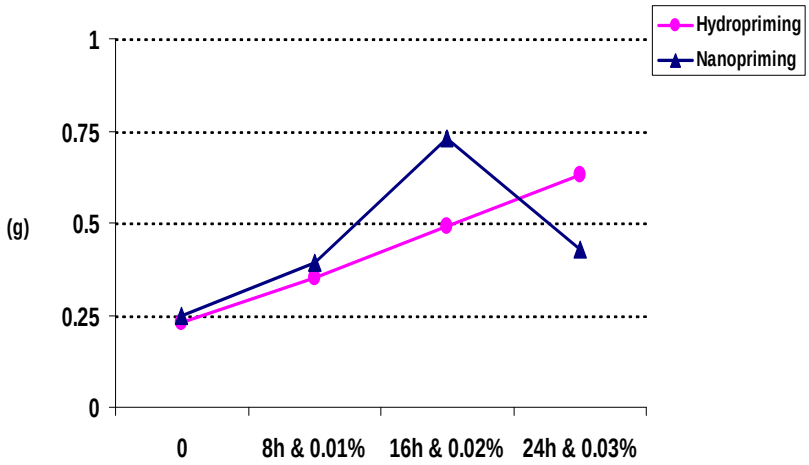

Fig. 3: Seedling weight in alfalfa under Nano & hydropriming.

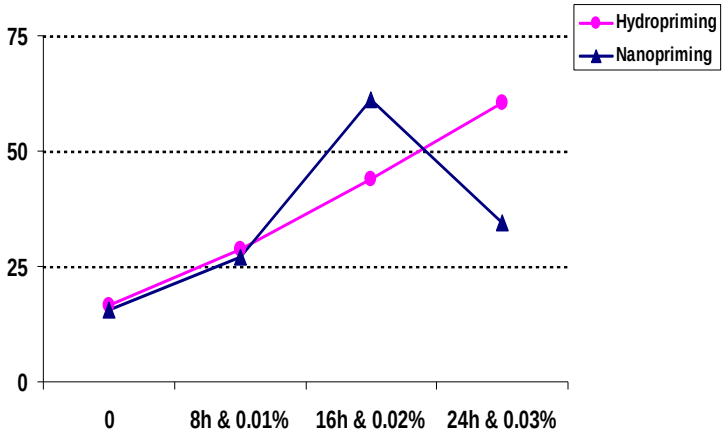

Fig. 4: Seedling vigour in alfalfa under Nano & hydropriming.

The results showed that use of Nano & hydropriming can improve seedling vigour index (SVI) in alfalfa sorely. An experiment was conducted to study the germination, emergence and seedling establishment of wheat (*Triticum aestivum* L.) cv. Auqab-2000. Wheat seeds were subjected to hydropriming for 24h or hardening for 12h (one cycle) or matriconditioning with pressmud for 24h or halopriming with 100 mol m-3 CaCl2, 50 mol m-3 NaCl, 25 mol m-3 Ca(NO3)2 for 24h. Both primed and unprimed seeds were subjected to germination, emergence and electrical conductivity test. In germination test hydropriming, hardening and matriconditioning were found better as expressed by all the invigoration parameters. But no significant effect of Ca(NO3)2 and NaCl treatments was noted in final germination percentage, T50 and mean germination time. In case of seedling evaluation in emergence test, hydropriming and hardening treatment were the most effective treatments as expressed by final emergence percentage, root and shoot dry weight, root and shoot length and root / shoot ratio. While seed priming with NaCl resulted in minimum final emergence percentage, seedling dry weight and minimum fresh weight of seedling, root and shoot length, root / shoot ratio and shoot fresh weight except control. All the treatments showed maximum seed invigoration than the control. Higher electrical conductivity of seeds treated with CaCl2 non-primed seeds and Ca(NO3)2 were recorded as compared to seeds treated with NaCl, matriconditioning, hydropriming, and hardening treatments. These results support the hypothesis that wheat seed vigor can be enhanced when treated with distilled water for 24 h or hardening for 12h (one cycle) (Basra *et al*., 2005). A study was carried out for improving yield and biological nitrogen fixation capacity of mung bean through priming techniques. The seeds were invigorated by traditional soaking (hydropriming), osmo-conditioning (soaking of seeds in aerated, low-water-potential solutions) with potassium di-hydrogen phosphate (KH_2PO_4), mannitol ($C_6H_{14}O_6$), polyethylene glycol (PEG_{6000}), sodium molybdate dihydrate ($Na_2MoO_4.2H_2O$) and salicylic acid ($C_7H_6O_3$) while untreated seeds were kept as control. The experiment was carried out at two locations under different climatic conditions during the year 2007 to 2008. All the priming treatments significantly improved the dry matter yield (4001 to 5262 kg ha^{-1}) and seed yield (713 to 948 kg ha^{-1}) compared to the control. The highest biological nitrogen fixation (46.39 kg ha^{-1}) was observed in phosphorous primed plants compared to the control. In conclusion, overall, priming of mung bean seed with phosphorous (P at 0.6%) was found very effective for improved germination and vigour of mung bean seeds under field conditions. It is easy and cost effective technology for resource poor farmers of the region (Umair *et al*., 2011).

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