Effect of Hydropriming on Germination Percentage in Sunflower (*Helianthus Annuus* L.) Cultivars

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**ABSTRACT**

In production of medicinal plants, seed germination is a 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 12 h hydropriming) treatment on seed parameters of sunflower (*Helianthus annuus* L.) cultivars (Alstar, Azargol and Golshid). 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 (8.43), germination percentage (90.66%) and seedling dry weight (0.093 g) were achieved by Alstar cultivar under priming condition. Nevertheless, priming after 12 h failed to improve germination of all the cultivars. Moreover, hydropriming treatment can be successfully applied on rapeseed cultivar seeds to improve germination performance.

**Key words:** Hydropriming, germination percentage, seedling vigour and rapeseed cultivars.

**Introduction**

Sunflower (*Helianthus annuus* L.) is a high yielding oilseed crop, but under scarce conditions, the yield is very lower than its real potential. Suboptimum plant population generally results from poor and erratic germination. In the semi-arid regions, crops often fail to establish quickly and uniformly, leading to decreased yields because of low plant populations. Constraints to good establishment include poor seedbed preparation[15], low quality seed and lack of soil moisture [10] high temperature [30] and crust formation [27]. Rapid and uniform field emergence is an essential prerequisite to reach the yield potential, quality and ultimately profit in annual crops [21]. Out of many constraints regarding low production of oilseeds, seed quality is of prime importance.Oilseeds are deteriorated more rapidly during storage, which reduces the quality of seeds [1]. Seed germination is mostly an issue in medicinal plant seeds emergence [8]. Good seedling establishment is an important constraint to such crop production [11]. Poor seedbed, low quality seed, environmental stresses such as high and low temperature and salinity constrains to good establishment include [30]. A robust seedling establishment enhances competitiveness against weeds, improves tolerance to environmental stresses and maximizes biological and grain yields [9]. Several approaches including, hardening, seed priming, seed soaking and seed coating have been employed to precondition seeds to improve germination and seedling growth of various crops [4]. Seed priming treatments such as osmopriming, hydropriming, matrico-priming, hormonal-priming have been employed to accelerate the germination,
seedling growth and yield in most of the crops under normal and stress conditions [4]. Although, the mechanism of seed priming treatments is not fully understood, it has been observed that physiological and biochemical changes take place during the seed treatments which could allow seeds to begin the germination sequences before sowing. Seed priming accelerates seed germination and seedling establishment under both normal and stressful environments [2]. Priming is one of the physiological methods, which improves seed performance and provides faster and synchronised germination [22]. Hydropriming is the simplest approach to hydrate seeds and minimize the use of chemicals. However, if the seeds are not accurately hydrated, hydration rate cannot be exactly controlled. It was observed that hydropriming practically ensured rapid and uniform germination accompanied with low abnormal seedling percentage [25,24].

Materials and methods

In order to determine the effect of hydropriming on seedling sunflower cultivar seeds, an experiment was conducted in 2011 at Laboratory Sciences, Islamic Azad University Shahr-e-Qods Branch by a completely randomized design with three replications and the first, seed viability was determined by Tetrazolium test method. After disinfecting, seeds were put in disinfected Petri dish. Each Petri dish contained 100 seeds. Three replicates of 100 seeds were put between double layered rolled. The rolled paper with seeds was put into sealed plastic bags to avoid moisture loss. Seeds were allowed to germinate at 25 ± 1°C for 7 days. Germination percentage was recorded after the 7th day. Germination percentage was calculated with the following formula:

Germination percentage (%) = Number of germinated seeds / Number of total seeds × 100

Also, seedling vigor index was calculated by the following formula:

Seedling vigor index = Germination percentage × Seedling dry weight

Statistical analysis:

Data analyses were performed using the SPSS statistical software (version 15). Mean separations were performed by Duncan’s multiple range test (DMRT) at 5% level.

Results and discussion

The results showed that, measured components of sunflower cultivars were significantly affected by hydropriming condition (Table 1). At different cultivars Alstar and Golshid, had the highest and lowest germination percentage as 90.66 and 76% respectively. Priming may improve germination by accelerating imbibitions, which in turn would facilitate the emergence phase and the multiplication of radical cells [18]. This process is important because it allows the subsequent development of the embryo, especially in seeds characterized by a morphological dormancy (Immature embryo), like Chamaecyparis nootkatensis seeds. In tomato, priming improved the germination capacity by increasing endosperm volume [7]. The technique of seed priming is becoming familiar to farmers in several parts of the world, and has now been promoted there on a range of crops, for example wheat maize [11], and mung bean, where similar responses to those reported here have been found. Equally encouraging results have been found for these crops in other countries and for other crops, such as chickpea in India and Bangladesh [11,19] upland rice in India [11] and finger millet in India [16]. In many coated seeds, germination and subsequent seedling growth can be inhibited by mechanical restriction exerted by the seed coat [6]. Priming may be helpful in reducing the risk of poor stand establishment, under filed conditions. The priming improved seed performance might be attributable in part to the decreased lipid peroxidation and increased antioxidative activities during seed imbibitions. These results are in accordance with the results of other researchers who reported either improvement of germination percentage [17]. Also, [29] reported that, both hydroprimed seeds showed significant increase in germination performance. The resultant effect of priming depends on the used method and time of treatment. Hydropriming is a simple method of priming treatment. It does not require any special technical equipment and owing to the use of distilled water as a priming medium. It is probably the cheapest priming method. Similarly, [8] presented hydropriming as a simple and inexpensive method of seed priming. Accelerated aging also resulted in increased lipid peroxidation, decreased levels of anti-oxidants and reduced activity of several enzymes involved in scavenging of free radicals and peroxides [6][14][3]. Thus, reduced antioxidative activities, along with other mechanisms, may contribute to the increased susceptibility to deterioration of primed seeds. [28] hypothesized that, the reduced longevity of primed seeds is caused by a decrease in DNA repair activity due to progression in the cell cycle during hydration. Thus, in order to maintain a high viability, it is important to store the pretreated basil seeds under more favorable conditions than untreated seeds. reported that, for impatient (Impatient walleriana Hook), pansy (Viola×wittrockiana) and pepper (Capsicum annuum L.) seeds, the desired longevity were obtained by keeping the seeds after a priming treatment, under a mild water or temperature stress for a period of
several hours to days. Perhaps this recommendation can also be considered for primed sorghum seeds. Therefore, the seeds receiving these pre-sowing treatments should be stored under favorable conditions to maintain a high viability during long term storage.

<table>
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<th>Table 1: Means Comparison.</th>
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Means within the same column and factors, followed by the same letter are not significantly different.

Fig. 1: Effect of hydro priming on germination percentage in sunflower cultivars.

Fig. 2: Effect of hydro priming on seedling dry weight in sunflower cultivars.

Fig. 3: Effect of hydro priming seedling vigour in sunflower cultivars.
References


