Ultrasonic irradiation could increase germination and seedling vigor of common yarrow (Achillea millefolium), as a medicinal plant

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Abstract: Several different priming methods have been reported to be used commercially in agriculture. In order to study effects of physical priming techniques on germination characteristics of common yarrow two experiments were conducted at the Islamic Azad University, Tabriz, Iran, based on completely randomized design with three replications on common yarrow (Achillea millefolium), during 2013. Yarrow dry seeds were treated by ultrasonication, laser irradiation and magnetic field for 5 and 10 minutes and a hydro-priming treatment for 36 hours as control. Results revealed that highest seed germination percentage of common yarrow was obtained from ultrasonic irradiation for 5 minutes (80.3%), lowest from magnetic field treatment of seeds for 5 minutes (56.5%). Effects of laser radiation for 10 minutes and magnetic field in both durations on seedling length were not significantly different with control. Seedling dry weight of yarrow ranged from 7.41 g in ultrasonic irradiation for 5 minutes up to 5 g in magnetic fields. When seeds were primed with ultrasonic irradiation for 5 minutes, seedling dry weight of yarrow increased by 70% more than those primed with distilled water. Seedling dry weight value experienced significant reduction when seeds treated with magnetic field for 5 minutes. It can be concluded that treating common yarrow seeds with ultrasonic irradiation increases its germination and primary growth. [Bahram M, Farhad F, Amirhoushang H.M, Alireza S.K. **Ultrasonic irradiation could increase germination and seedling vigor of common yarrow (Achillea millefolium), as a medicinal plant**. *Life Sci J* 2013;10(5s):302-305] (ISSN:1097-8135). http://www.lifesciencesite.com. 55

Key words: Germination percentage, Irradiation, Physical priming, Primary growth.

1. Introduction

Medicinal plants have been identified and used throughout human history. Achillea millefolium, known commonly as yarrow or common yarrow, is a flowering plant in the family Asteraceae. It is native to temperate regions of the Northern Hemisphere in Asia, Europe and North America. A. millefolium has seen historical use as a medicine, often because of its astringent effects (Dodson, 2007). In antiquity, yarrow was known as herbal militaries, for its use in staunching the flow of blood from wounds (Simonetti, 1990). Yarrow has also been used as a food, and was very popular as a vegetable. The younger leaves are said to be a pleasant leaf vegetable when cooked. Yarrow is sweet with a slight bitter taste. The leaves can also be dried and used as a herb in cooking (Dodson, 2007).

Priming could be defined as controlling the hydration level within seeds so that the metabolic activity necessary for germination can occur. Several different priming methods have been reported to be used commercially. Among them, ultrasonic irradiation of carrots (Daucus carota L.) (Aladjadjiyan, 2002), led in the early emergence and therefore early ripening of grain and vegetable crops by 5–10 days. Reports on the intriguing possibility that the use of ultrasound may enhance stimulation and germination of some seeds led several researchers to examine the feasibility of these priming methods on percent of germination in crop plants. There is little information about physical methods of seed treatment. In recent years, interest concerning the use of physical methods of seed priming due to their effects plant grow in has increased (Carbonell et al., 2000; Dinoev, 2006; Hernandez et al., 2010; Vasilevski, 2003). The main object of this research was to evaluate the effects of physical priming techniques on germination characteristics of common yarrow.

2. Material and Methods

Two experiments were conducted at the Islamic Azad University, Tabriz, Iran, based on completely randomized design with three replications on common yarrow (Achillea millefolium), during 2013. Yarrow dry seeds were treated by ultrasonication, laser irradiation and magnetic field for 5 and 10 minutes and a hydro-priming treatment for 36 hours as control. Petri dishes and filter papers were also disinfected by NaOCL and UV radiation for 36 hours in a sterile hood before their incubations. For each treatment, Twenty five primed seeds for each replicate were placed in germinator at 25±1 °C for a

germination test in a Petri dish containing Whatman filter paper No. 1 that had been thoroughly moistened with water and germination was checked once a day for 14 d. A pot experiment was also conducted with the same treatments for 40 days. The recorded data in the laboratory were final germination percentage and germination speed, and seedling length, dry weight, and seedling vigor indexes in the greenhouse conditions. Analysis of variance of data was made by the software MSTAT-C, and means were compared by using LSD test at 5% probability level.

The recorded data were final germination percentage, seedling biomass and seedling vigor index. Final germination percentage (GP) was calculated as the cumulative number of germinated seeds with normal radicles by using below equation, as described by Larsen and Andreasen (2004).

$GP = \Sigma n / N \times 100$

Where, n is number of germinated seeds at each counting and N is total seeds in each treatment.

Seedling vigor index (SVI) was calculated according to Abdul-Baki and Anderson (1973) by using below equation.

$SVI = SDW \text{ (or } SL) \times GP$

Where, SDW and SL are seedling dry weight and seedling length, respectively.

3. Results and Discussion

3.1. Variance analysis

Analysis of variance of the studied traits studied has been shown in Table 1. Effect of physical priming methods on germination percentage was significant at 1%, and on seedling length, seedling dry weight and seedling vigor index was significant at 5% probability levels.

Table 1. Variance analysis of effects of physical priming techniques on germination characteristics of common yarrow.

SV	df	Germination percentage	Germination speed	Seedling length	Seedling dry weight	Vigor index (seedling dry weight)
Treatment	6	1.23**	3.89	33.50*	0.26*	2.89*
Error	11	0.22	6.03	10.03	0.06	0.84
CV (%)	-	20.10	18.77	10.09	11.29	8.84

*, ** mean significant at 5% and 1% probability levels.

2.1. Mean comparisons

Highest seed germination percentage (GP) of common yarrow was obtained from ultrasonic irradiation for 5 minutes (80.3%), lowest from magnetic field treatment of seeds for 5 minutes (56.5%) (Fig. 1). GP in those seeds treated with magnetic field for 10 minutes was statistically same as control (64.5%). Ultrasonic irradiation treatment of seeds resulted in 16% more seed germination than control. It could be said that higher percentage of seed germination may result in higher flower yield. These results are in good agreement with those reported by Vasilevski (2003) who stated that higher speed and percent of seed germination, due to biophysical seed primings would result in yield increase in several crop plants. Moon and Sook (2000) have been reported increased seed germination percentage due to seed priming of tomato by electrical field.

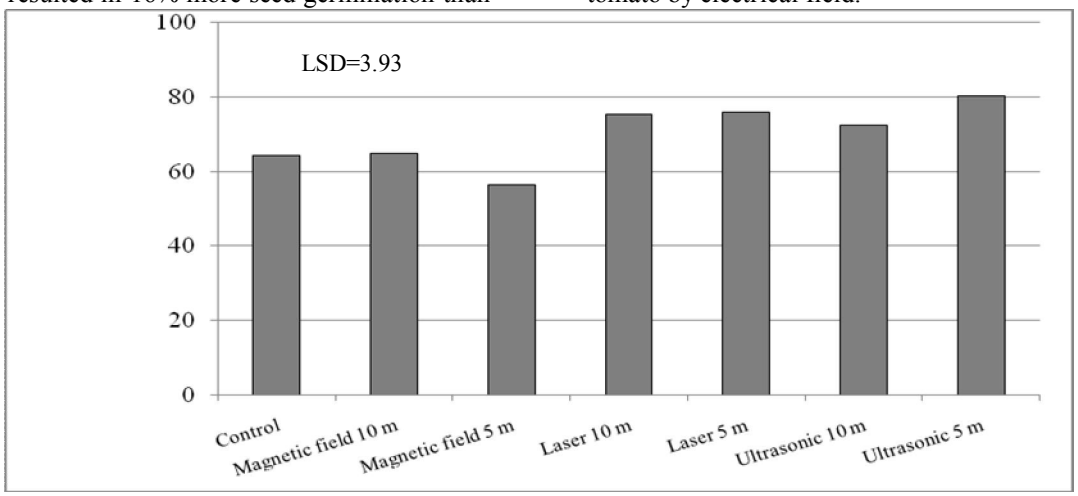

Fig. 1. Effect of priming techniques on seed germination percantage common yarrow.

Seedling length of yarrow significantly affected by seed priming treatments. Higher seedling length with ultrasonication was measured to be about 33 and 30 cm, in 5 and 10 minutes treatment durations, respectively, and 30.2 cm in laser radiation for 5 minutes, which are 15%, 5% and 6% longer as compared to the control treatment. However, the effects of laser radiation for 10 minutes and magnetic field in both durations on seedling length were not significantly different with control (Fig. 2). A preliminary study by Norfadzrin et al. (2007) showed that higher gamma ray doses, particularly 600 and 800 doses had negative effect on the morphological characteristics of tomato and okra seedlings produced from irradiated seeds. Florez et al., (2007) and Racuciu et al., (2008) also noticed increased germination rate, seedling length and plant fresh weight of corn by using physical priming treatments.

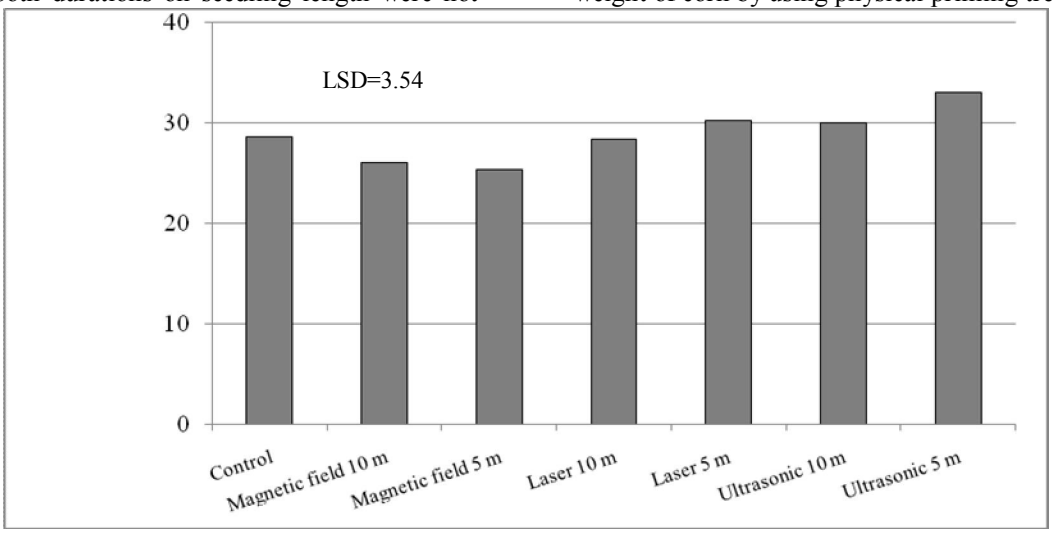

Fig. 2. Effect of priming techniques on seedling length of common yarrow.

Seedling dry weight of yarrow ranged from 7.41 g in ultrasonic irradiation for 5 minutes up to 5 g in magnetic fields. Seedling dry weight in control was more than those seeds treated with magnetic fields (Fig. 3). Treating seeds with electrical irradiation may result in significant increase in seedling length and its vigor index, fruit number, fruit yield and higher growth of above ground part of the tomato plant.

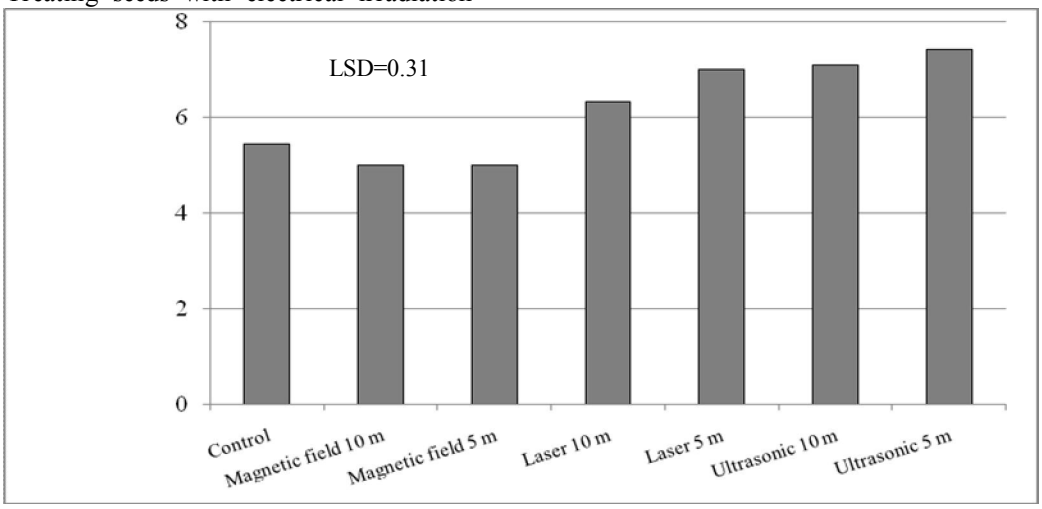

Fig. 3. Effect of priming techniques on seedling dry weight of common yarrow.

The results indicate that some of studied treatments did have positive effect on crop SVI. As we expected, when seeds were primed with ultrasonic irradiation for 5 minutes, SVI of common yarrow increased by 70% more than those primed with distilled water. Also, SVI in those seeds treated with laser irradiation for 5 minutes was statistically same as ultrasonic one. But SVI value experienced significant reduction when seeds treated with magnetic field for 5 minutes.

SVI of plants primed with distilled water was found to be 349.9, but only 282.5 from magnetic field for 5 minutes (Fig. 4). Similarly, Florez et al. (2007) and Vashista and Nagarajan (2010) noted a considerable enhancement in germination characteristics of seed such as seedling vigor, shoot and root growth in maize, chickpea and sunflower seeds when treated electrically.

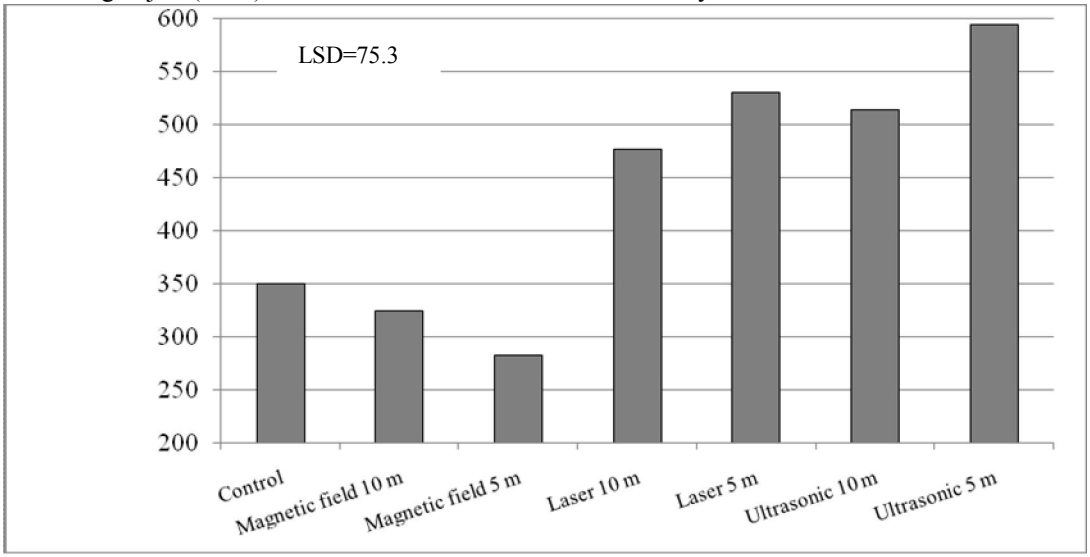

Fig. 4. Effect of priming techniques on seedling vigor index of common yarrow.

4. Conclusion

Based on the results obtained from this study in general it can be concluded that treating common yarrow seeds with ultrasonic irradiation increases its germination and primary growth.

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