Advances in Environmental Biology, 5(7): 1691-1695, 2011
ISSN 1995-0756

This is a refereed journal and all articles are professionally screened and reviewed

ORIGINAL ARTICLE

Effect of Hydropriming on Germination Percentige in Rapeseed (*Brassica Napus* L.) Cultivars

[1]Hossein Aliabadi Farahani, [2]Sayed Alireza Valadabadi, [3]Payam Moaveni and [1]Kasra Maroufi

[1]*Member of Young Researchers Club, Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran.*
[2]*Associate Professor, Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran.*
[3]*Assistant Professor, Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran.*

Hossein Aliabadi Farahani, Sayed Alireza Valadabadi, Payam Moaveni and Kasra Maroufi: Effect of Hydropriming on Germination Percentige in Rapeseed (Brassica Napus L.) Cultivars

ABSTACT

In production of medicinal plants, seed germination is 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 12h hydropriming) treatment on seed parameters of rapeseed (*Brassica napus* L.) cultivars (Opera, Modena, and SLM046). The results showed that the effect of hydropriming was significant on seedling vigour, germination percentage and seedling dry weight in $P \leq 0.05$. Mean comparison showed that the highest seedling vigour (4.1), germination percentage (100 %) and seedling dry weight (0.041 gr) were achieved by opera cul. under priming condition. Nevertheless, priming after 12h failed to improve germination all of the cultivars. Moreover, hydropriming treatment can be successfully applied on rapeseed cultivars seeds to improve germination performance.

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

Introduction

Rapeseed (*Brassica napus* L.) has some good characteristics such as suitable placement in crop rotation, desirable quality, high value of oil (40 – 45 %) and protein (39%) that has changed it to an important crop. 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 the 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 [20]. 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].

Corresponding Author
Kasra Maroufi, Member of Young Researchers Club, Islamic Azad University, Shahr-e-Qods Branch, Tehran, Iran.
Email: kasramaroufi@yahoo.com

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 [9] 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 rapeseed cultivars 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 rape seed cultivars were significantly affected by hydropriming condition (Table 1). At different cultivars opera and SLM046 had the highest and lowest germination percentage as 99 and 88.6% 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 allows the subsequent development of the embryo, especially in seeds characterized by a morphological dormancy (immature embryo), like *Chamaecyparis nootkatensis* seeds [23]. 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 [13] maize [13] and mung bean (Rashid *et al.*, 2004), 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 [26]. 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 Wang *et al.*, [29] reported that, both hydroprimied seeds showed significant increase in germination performance. The resultant effect of priming depends on the used method and time of treatment. Hydro priming 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 Fujikura *et al.* [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 subceptibility to deterioration of primed seeds. Van Pijlenet *et al.*, [28] hypothesized that the reduced longevity of primid 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.

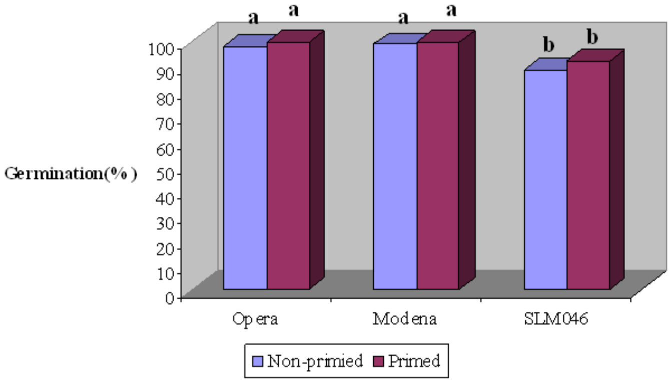

Fig. 1: Effect of hydropriming on germination percentage in basil.

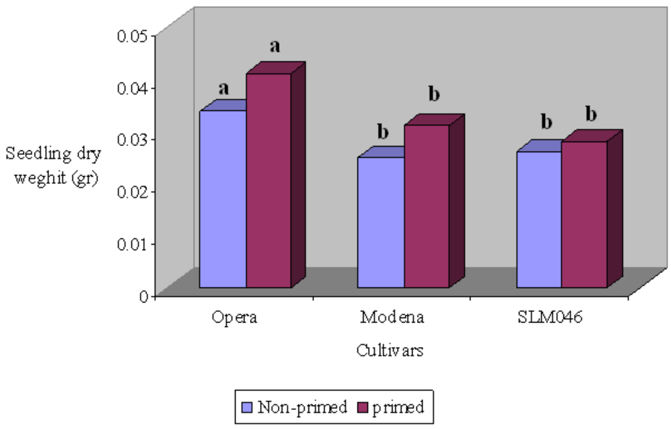

Fig. 2: Effect of hydropriming on seedling dry weigh in basil.

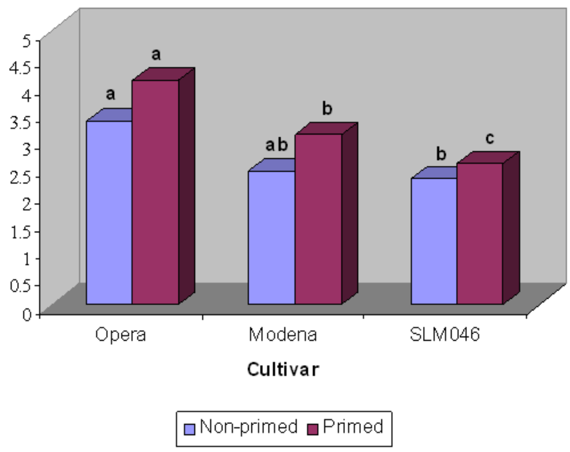

Fig. 3: Effect of hydropriming on seedling vigour in basil.

Table1: Means Comparison.

Treatment		Germination (%)	Seedling dry weight	Seedling vigour
Opera	Primed	100a	0.041a	4.1a
	Non-Primed	99a	0.034a	3.36a
Modena	Primed	100a	0.031b	3.1b
	Non-Primed	98a	0.025b	2.45ab
Slm046	Primed	92.3b	0.028b	2.58c
	Non-Primed	88.6b	0.026b	2.30b

Means within the same column and factors, followed by the same letter are not significantly difference.

Bruggink *et al.*, [5] 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 and 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.

Reference

1. Afzal, I., N. Aslam, F. Mahmood, A. Hameed, S. Irfan, G. Ahmad, 2004. Enhancement of germination and emergence of canola seeds by different priming techniques. Caderno de Pesquisa Ser. Bio. Santa Cruz do Sul., 16: 19-34.
2. Ashraf, M., M.R. Foolad, 2005. Pre-sowing seed treatment a shotgun approach to improve germination, plant growth and crop yield under saline and non-saline conditions. Adv. Agron. 88: 223-271.
3. Bailly, C., A. Benamar, F. Corbineau, D. Come, 1998. Free radical scavenging as affected by accelerated aging and subsequent priming in sunflower seeds. Physiol. Plant., 104: 646-652.
4. Basra, S.M.A., N. Zia, T. Mahmood, A. Afzal, A. Khaliq, 2003. Comparison of different in vigoration techniques in wheat (Triricum aestivum L.) seeds. Pak. J. Arid. Agric., 5: 11-16.
5. Bruggink, G.T., J.J. Ooms, Van der P. Toom, 1999. Induction of longevity in primed seeds. Seed Sci. Res., 9: 49-53.
6. Chiu, K.Y., C.S. Wang, J.M. Sung, 1995. Lipid peroxidation and peroxide –scavenging enzymes associated with accelerated aging and hydration of watermelon seeds differing in ploidy. Physiol Plant., 94: 441-446.
7. Dahal, P., K.J. Bradford, R.A. Jones, 1990. Effects of priming and endosperm integrity on seed germination rates of tomato genotypes germination at suboptimal temperatures. J. Exp. Bot., 41: 1431-1439.
8. Fujikura, Y., C.M. Karssen, 1995. Molecular studies on osmoprimed seeds of cauliflower: a partial amino acid sequnence of a vigoure -related protein and osmopriming-enhanced expression of putative aspartic protease. Seed Sci. Res., 5: 177-181.
9. Ghiyasi, M., A.S. Abbasi, M. Tajbakhsh, R. Amirnia, H. Salehzade, 2008. Effect of osmopriming with poly ethylene glycol 8000 (PEG8000) on germination and seedling growth of wheat (Triticum aestivum L.) seeds under salt stress. Res. J. Biol. Sci., 3(10): 1249-1251.
10. Gurmu, M., R.E.L. Naylor, 1991. Effects of low water potential on germination of two sorghum cultivars. Seed Sci. Technol., 19: 373-383.
11. Harris, D., A. Joshi, P.A. Khan, P. Gothkar, P.S. Sodhi, 1999. On-farm seed priming in semi-arid agriculture: development and evaluation in maize, rice and chikpea in India using participatory methods. Exp. Agric., 35:15-29.
12. Harris, D., B.S. Raghuwanshi, J.S. Gangwar, S.C. Singh, K.D. Joshi, A. Rashid, P.A. Hollington, 2001. Participatory evaluation by farmers of ‘on-farm' seed priming in wheat in India, Nepal and Pakistan. Exp. Agric., 37: 403-415.
13. Harris, D., A. Rashid, P.A. Hollington, L. Jasi, C. Riches, 2002. Prospects of improving maize yields with ‘on-farm' seed priming, pp: 180-185. In: N. P. Rajbhandari, J. K. Ransom, K. Adikhari, R. A. F. E. Palme (Eds.). Sustainable Maize Production Systems for Nepal: Proceedings of aMaize Symposium held, Kathmandu, Nepal, 3-5, 2001. Narc and Cimmyt.
14. Hsu, J.L., J.M. Sung, 1997. Antioxidant role of glutathione associated with accelerated aging and hydration of triploid watermelon seeds. Physiol., Plant., 91: 703-707.
15. Joshi, N.L., 1987. Seedling emergence and yield of pearl millet on naturally crusted arid soils in relation to sowing and cultural methods. Soil and Tillage Res., 10: 103-112.
16. Kumar, A., J.S. Gangwar, S.C. Prasad, D. Harris, 2002. ‘On-farm' seed priming increases yield of direct-sown finger millet (Eleusine coracana) in India. Int. Sorghum Millets Newslett. 43: 90-92.
17. Mauromicale, G., V. Cavallaro, 1995. Effects of seed osmopriming on germination of tomato at different water potential. Seed Sci. Technol., 23: 393-403.
18. McDonald, M.B., 1999. Seed deterioration: physiology, repair and assessment. Seed Sci., Technol., 27: 177-237.
19. Musa, A.M., D. Harris, C. Johansen, J. Kumar, 2001. Short duration chickpea to replace fallow after aman rice: the role of on-farm seed priming in the High Barind Tract of Bangladesh. Exp. Agric., 37: 509-521.
20. Nadjafi, F., M. Bannayan, L. Tabrizi, M. Rastgoo, 2006. Seed germination and dormancy breaking techniques for Ferula gummosa and Teucrium polium. J. Arid Environments. 64: 542-547.
21. Parera, C.A., D.J. Cantliffe, 1994. Pre-sowing seed priming. Hort. Reu., 16: 109-41.
22. Sivritepe, H.O. and A.M. Dourado, 1995. The effect of priming treatments on the viability and accumulation of chromosomal damage in aged pea seeds. Ann. Bot., 75: 165-171.

23. Schimtz, N., J.H. Xia, A.R. Kermode, 2001. Dormancy of yellow cedar seeds is terminated by gibberellic acid in combination with fluridone or with osmotic priming and moist chilling. Seed Sci. Technol., 29: 331-346.
24. Shivankar, R.S., D.B. Deore, N.G. Zode, 2003. Effect of pre-sowing seed treatment on establishment and seed yield of sunflower. J. Oilseeds Res., 20: 299-300.
25. Singh, B.G., 1995. Effect of hydration-dehydration seed treatments on vigour and yield of sunflower. Indian. J. Plant physiol., 38: 66-68.
26. Sung, J.M., K.Y. Chiu, 1995. Hydration effects on seedling emergence strength of watermelon seed differing in ploidy. Plant Sci., 110: 21-26.
27. Townend, J., P.W. Mtakwa, C.E. Mullins, L.P. Simmonds, 1996. Soil physical factors limiting establishment of sorghum and cowpea in two contrasting soil types in the semi arid tropics. Soil and Tillage Res., 40: 89-106.
28. Van pijlen, J.G., S.P.C. Groot, H.L. Kraak, R.J. Bino, 1996. Effect of pre-storage hydration treatments on germination performance, moisture content, DNA synthesis and controlled deterioration tolerance of tomato (Lycopersicon esculentum Mill) seeds. Seed Sci. Res., 6: 57-63.
29. Wang, H.Y., C.L. Chen, J.M. Sung, 2003. Both warm water soaking and soild priming treatments enhance anti - oxidation of bitter gourd seeds germinated at sub–optimal temperature. Seed Sci. Technol., 31: 47-56.
30. Weaich, K., K.L. Bristow, A. Gass, 1992. Pre-emergent shoot growth of maize under different drying conditions. Soil Sci. Soc. Amer. J., 56: 1272-1278.