INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 4, No. 3, p. 61-65, 2014

RESEARCH PAPER OPEN ACCESS

Impact of hydropriming and KNO_3 on emergence, yield and yield components of two rapeseed cultivars

Ali Alishavandi[1], Shahram Sharafzadeh[1*], Omid Alizadeh[2]

[1]*Department of Agriculture, Firoozabad Branch, Islamic Azad University, Firoozabad, Iran*

[2]*Department of Agricultural Sciences, College of Agriculture, Shiraz Branch, Islamic Azad University, Shiraz, Iran*

Key words: Seed preplanting treatment, osmopriming, *Brassica napus*.

http://dx.doi.org/10.12692/ijb/4.3.61-68 Article published on February 05, 2014

Abstract

Rapeseed is one of the most important annual oil and protein crops. It has high value of oil (40 - 45%) and protein (39%). Seed priming accelerates seed germination and seedling establishment under both normal and stressful environments. This experiment was conducted using seed priming (water for 4 hr, water for 8 hr, 1% KNO_3 for 4 hr and control) of two cultivars of rapeseed (Talayeh and Hyola 401) in a factorial experiment based on randomized complete block design with three replications. The priming treatments altered emergence values, yield and yield components of rapeseed. The maximum grain yield was achieved on priming with water for 8 hours and KNO_3. The grain yield was not significantly different among two cultivars.

* **Corresponding Author:** Shahram Sharafzadeh ✉ shahramsharafzadeh@hotmail.com

Introduction

In ranking, rapeseed (*Brassica napus* L.) oil is third behind soybean (*Glycine max* L.) and oil palm (*Guineensis elaeis*) showing the importance of this product. It is one of the most important annual oil and protein crops in temperate climates. Apart from direct human and animal consumption, industrial uses include the manufacture of rapeseed oil or use as a source of bio-diesel fuel production have been developed in the recent years in world (Ofori and Becker, 2008; Kandil *et al*., 2012). Its production has been notably extended during recent years in Iran (Mohammadi and Amiri, 2010). Rapeseed has high value of oil (40 - 45%) and protein (39%) (Eskandari and Kazemi, 2012).

An important problem for farmers is the heterogenecity and lack of suitable conditions in soil which causes decreasing in germination percent, heterogeneous emergence, unbalanced seedling growth and competition for environmental resources which results in different biomass of a species of plant and seed priming (seed preplanting treatments) can overcome to this problem. In this method the seeds absorb water to start germination steps and then dry in order to prevent germination (Sedghi *et al*., 2010). Seed priming accelerates seed germination and seedling establishment under both normal and stressful environments (Ashraf and Foolad, 2005). The popular methods of seed priming such as hydropriming (soaking in water), sand matric priming (use of sand as water holding medium), halopriming (soaking in KNo_3 or NaCl solution) and osmopriming (soaking in polyethylene glycol solution) should compare for each crop species, by evaluating different durations of priming (Selvarani and Umarani, 2011).

Mohammadi and Amiri (2010) revealed that seed priming especially with KNO_3 improved canola seed performance under drought stress condition. A laboratory experiment by different hydropriming treatments (8-24 hours) showed that the germination percentage, plumule dry weight and seedling dry weight of rapeseed were significantly affected by seed priming (Eskandari and Kazemi, 2012). Singh and Rao (1993) reported that potassium nitrate can enhance germination, seedling growth and seedling vigor index of the seeds of sunflower varieties with low germination. Farooq *et al.* (2006) revealed that priming of rice with $CaCl_2$ resulted in the best values of time to start germination, and higher values of final germination and emergence and seedling fresh and dry weight. Mohammadi *et al.* (2012) reported that laser priming had a positive effect on yield and yield components of canola and caused yield increase under saline conditions.

Seed viability and vigor affect on the establishment and the yield of crops (Aliabadi *et al*., 2011). Germination of the seeds, seedling emergence and crop establishment are the main components of seedling vigor of rapeseed (Devaiah *et al*., 2007).

The aim of this experiment was evaluation of hydropriming and priming with KNO_3 on emergence, yield and yield components of two cultivars of rapeseed.

Materials and methods

Plant materials and experimental conditions

This experiment was carried out using seed priming (water for 4 hr, water for 8 hr, 1% KNO_3 for 4 hr and control) of two cultivars of rapeseed (Talayeh and Hyola 401) in a factorial experiment based on randomized complete block design (RCBD) with three replications in autumn at a field in Firoozabad, State of Fars, Iran. Each plot (3×2 m) contained rows with spacing of 4 cm between plants within row and 25 cm between rows. Before planting, the seeds were primed and then dried back to the original moisture level. The soil of the field was tested before planting and showed PH=7.8, N=0.13%, available P=7.7 mg/kg, available K=63 mg/kg, organic C=1.52 and EC=0.48 ds/m. Emergence percentage and mean emergence time of each plot were calculated. The number of established plants at autumn and at beginning of spring was used in order to calculate the winter survival percentage. Finally, the plants of 1 m^2 of each plot were harvested for measurement of yield and

yield components.

Statistical analysis

Data from the experiment were subjected to analysis of variance (ANOVA) using SAS computer software and the means compared with Duncan's new multiple range test (DNMRT) at $P < 0.05$.

Results and discussion

The priming treatments altered emergence values, yield and yield components of rapeseed (Table 1). The maximum values of emergence percentage, mean emergence time, number of lateral shoots, pods per plant and grain yield were achieved on priming with water for 8 hours and KNO_3 (1%) which were significantly different when compared to control and water for 4 hours.

Table 1. Effect of seed priming on emergence, yield and yield components of rapeseed.

priming treatment	EP	MET	WSP	Number of Lateral shoots	Pods per plant	seeds per pod	1000-seed Weight (g)	Grain yield (g/m^2)
control	48.21b	6.18a	96.65a	4.78b	78.98b	23.25a	4.23a	334.4b
water (4 hr)	51.43b	5.96b	97.04a	4.98b	79.88b	24.43a	4.56a	341.7b
water (8 hr)	60.22a	5.65c	96.87a	6.36a	83.65a	24.76a	4.65a	395.7a
KNO_3 (1%)	61.74a	5.30c	97.65a	6.56a	84.32a	23.98a	4.34a	405.7a

Abbreviations: EP, emergence percentage; MET, mean emergence time; WSP, winter survival percentage. In each column, means with the same letters are not significantly different at 5% level of Duncan's new multiple range test.

The cultivar Hyola 401 showed higher emergence percentage, winter survival percentage, number of lateral shoots, pods per plant and seeds per pod than Talayeh, whereas 1000-seed weight was higher in Talayeh. The grain yield was not significantly different among two cultivars (Table 2).

Table 2. Effect of cultivar on emergence, yield and yield components of rapeseed.

cultivar	EP	MET	WSP	Number of lateral shoots	Pods per plant	Seeds per pod	1000-seed Weight (g)	Grain yield (g/m^2)
Talayeh	50.46b	6.19a	94.46b	4.21b	78.26b	21.34b	4.78a	385.4a
Hyola 401	63.56a	5.48a	98.56a	6.34a	83.43a	24.35a	4.04b	395.5a

Abbreviations: EP, emergence percentage; MET, mean emergence time; WSP, winter survival percentage. In each column, means with the same letters are not significantly different at 5% level of Duncan's new multiple range test.

There are several evidence shows physiological mechanisms are involved in seed priming for repairing of the age (Bray, 1995; Burgass and Powell, 1984) and advancement of metabolic events that repairs the radicle protrusion (Dell' Aquilla and Beweley, 1989). Jabbarpour *et al.* (2012) showed that seed priming improved biological and grain yields of winter rapeseed per unit area through enhancing rate and percentage of seedling establishment. The highest value of grain and biological yield per unit area was observed for seeds primed with KNO_3. Farhoudi and Sharifzadeh (2006) revealed that total emergence and dry weight of the canola seedlings were higher by NaCl priming under salinity stress. NaCl priming enhanced proline. Some changes can occur in the primed seeds which help the growth of the embryo such as endosperm hydrolyzing during priming that enhances growth of the embryo (Burgass and Powell, 1984). Aboutalebian *et al.*, 2012 investigated the influence of hydropriming on germination

characteristics of canola under drought and salinity stresses at a laboratory experiment. Hydropriming increased germination percentage especially under drought stress. The Hyola 401 illustrated the highest increase in germination percentage by hydropriming when compared with noprimed seeds. A report indicated that seed priming permits DNA replication, increases RNA and protein synthesis and reduces leakage of metabolites (McDonald, 2000). During the pre planting treatments, several processes including storage, material handling, activation and synthesis of a number of enzymes and nucleic acids, repair and build up, ATP synthesis, and the cytoplasmic membrane repair in treated seeds will begin to develop (Asgharipour and Rafiei, 2011).

Conclusion

Seed priming with 1% KNO_3 and water (8 hours) improved seed performance significantly. There wasn't significant difference between 1% KNO_3 and water (8 hours) regarding the emergence values and grain yield. Therefore, hydropriming for 8 hours can be recommended and be used as an efficient method to improve seed performance and yield of rapeseed.

References

Aboutalebian MA, Mohagheghi A, Azimi Niaz SH, Rouhi HR. 2012. Influence of hydropriming on seed germination behavior of canola cultivars as affected by saline and drought stresses. Annals of Biological Research **3,** 5216-5222.

Aliabadi H, Moaveni P, Maroufi K. 2011. Effect of Hydropriming on Seedling Growth of Basil (*Ocimum basilicum* L.). Advances in Environmental Biology **5,** 2258-2263.

Asgharipour MR, Rafiei M. 2011. The effect of different concentrations of humic acid on seed germination behavior and vigor of barley. Australian Journal of Basic and Applied Science **5,** 610-613.

Ashraf M, Foolad MR. 2005. Pre-Sowing Seed Treatment-A Shotgun Approach to Improve Germination, Plant Growth, and Crop Yield Under Saline and Non-Saline Conditions. Advances in Agronomy **88,** 223-271.

Bray CM. 1995. Biochemical processes during the osmopriming of seeds. In: Kigel J and Galili D, eds. Seed development and germination, New York, Basel, HongKong, Maceldekker, 767-789.

Burgass RW, Powell AA. 1984. Evidence for repair processes in invigoration of seeds. Annals of Botany **53,** 753-757.

Dell' Aquilla A, Beweley JD. 1989. Protein synthesis in the axes of polyethylene glycol treated pea seed and during subsequent germination. Journal of Experimental Botany **40,** 1001-1007.

Deviah SP, Pan X, Hong Y, Roth M, Welti R, Wang X. 2007. Enhancing seed quality and viability by suppressing phospholipase D in Arabidopsis. The Plant Journal **50,** 950-957.

Eskandari H, Kazemi K. 2012. Changes in germination properties of rape (*Brassica napus* L.) as affected by hydropriming of seeds. Journal of Basic and Applied Scientific Research **2,** 3285-3288.

Farhoudi R, Sharifzadeh F. 2006. The effects of NaCl priming on salt tolerance in canola (*Brassica napus* L.) seedlings grown under saline conditions. Indian Journal of Crop Science **1,** 74-78.

Farooq M, Basra SMA, Hafeez K. 2006. Seed invigoration by osmohardening in coarse and fine rice. Seed Science and Technology **34,** 181-187.

Jabbarpour S, Ghassemi-Golezani K, Zehtab-Salmasi S, Mohammadi A. 2012. Effects of salt priming and water limitation on field performance of winter rapeseed cultivars. International Journal of Agriculture: Research and Review **2,** 872-878.

Kandil AA, Sharief AE, Abido WAE, Ibrahim MMO. 2012. Response of some canola cultivars (*Brassica napus* L.) to salinity stress and its effect on

germination and seedling properties. Journal of Crop Science **3,** 95-103.

McDonald MB. 2000. Seed priming. In: Black M and Bewley JD, eds. Seed Technology and Biological Basis, Sheffield Academic Press, England, Chapter **9,** 287-325.

Mohammadi GR, Amiri F. 2010. The Effect of Priming on Seed Performance of Canola (*Brassica napus* L.) Under Drought Stress. American-Eurasian Journal of Agricultural & Environmental Science **9,** 202-207.

Mohammadi SK, Shekari F, Fotovat R, Darudi A. 2012. Effect of laser priming on canola yield and its components under salt stress. International Agrophysic **26,** 45-51.
http://dx.doi.org/10.2478/v10247-012-0007-9

Ofori A, Becker HC. 2008. Breeding of brassica rapa for biogas production: heterosis and combining ability of biomass yield. Bioenergy Research **1,** 98-104.

Sedghi M, Nemati A, Esmaielpour B. 2010. Effect of seed priming on germination and seedling growth of two medicinal plants under salinity. Emirates Journal of Food and Agriculture **22,** 130-139.

Selvarani K, Umarani R. 2011. Evaluation of seed priming methods to improve seed vigour of onion (*Allium cepa cv. aggregatum*) and carrot (*Daucus carota*). Journal of Agricultural Technology **7,** 857-867.

Singh BG, Rao G. 1993. Effect of chemical soaking of sunflower (*Helianthus annuus* L.) seed on vigour index. Indian Journal of Agricultural Science **63,** 232-233.