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Changes in Germination Properties of Rape (*Brassica napus* L.) as Affected by Hydropriming of Seeds

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ABSTRACT

A laboratory experiment was designed to evaluate the effects of different hydropriming treatments (P_1= untreated, P_2= 8 hours of hydropriming, P_3= 12 hours of hydropriming, P_4= 16 hours of hydropriming, P_5= 20 hours of hydropriming and P_6= 24 hours of hydropriming) on germination properties of rape. The experiment was conducted as CR design with three replications. Analysis of variance of the data showed that the traits of percentage of germination, plumule dry weight and seedling dry weight were significantly affected by seed priming. Germination rate and radical dry weight were not significantly affected by hydropriming. Affected traits were improved by hydropriming comparing with untreated rapeseeds. The highest seed germination percentage was observed for P_5 which was not significantly different with P_4 hydropriming treatment. The recent hydropriming treatments had also the highest value of plumule and seedling dry weight. Hydropriming of 24 hours (P_6) had negative effect on germination and seedling growth of rapeseeds comparing with the other hydropriming treatments where germination properties of rapeseeds under P6 treatment had lower values comparing with untreated treatment. Generally, P_4 and P_5 of hydropriming treatments are the best hydropriming treatments for rapeseeds to improve germination vigor of this important oil crop.

KEY WORDS: Hydropriming, rapeseed, seed germination, seedling growth.

INTRODUCTION

Rapeseed (*Brassica napus* L.) in one of the most important oil crops which has high value of oil (40 - 45%) and protein (39%). Rape growth is characterized by six main growth stages and understanding the growth and development of a rape plant helps the producer make more effective management decisions. Rape is a very poor competitor with weeds. A uniform stand of a competitive rape is the best weed control tool. Rape is not very competitive early but becomes more competitive as it approaches the late-rosette and bolting stage. The competitive ability of rape may allow a grower to reduce costs by spraying only once or, in some cases, not at all. On the other hand, rape needs to have minimum of 8 leaves before reaching rosette stage to maximize its resistance to cold of winter. Thus, good stand establishment is extremely important for this important oil crop (Kandel and Knodel, 2011).

Without uniform field emergence, yield losses may occur in annual crops. Seed quality – which affects field emergence and establishment of crop- has important role in producing high yields. Seed priming is a pre-sowing strategy for improving seedling establishment by modulating pre germination metabolic activity prior to emergence of the radicle and generally enhances germination rate and plant performance (Bradford, 1986; Taylor and Harman, 1990). The general purpose of seed priming is to partially hydrate the seed to a point where germination processes are begun, but not completed. Treated seeds are usually re-dried to primary moisture before use, but they would exhibit rapid germination when re-imbibed under normal or stress conditions (Ashraf and foolad 2005).

Hydropriming is a very simple type of seed priming which seeds are soaked in water for a certain time and dried before sowing (Thornton and Powell, 1992). Hydropriming generally enhances seed germination and seedling emergence (Harris et al., 2001; Rajpar et al., 2006).

Since the effects of hydropriming on germination properties of rapeseeds are not sufficiently documented, this research was carried out to examine the effects of hydropriming on germination and seedling growth of rapeseeds.

MATERIALS AND METHODS

Seeds of rape were divided into 6 sub-samples. A sub-sample was kept as control (unprimed) and each of other 5 sub-samples was subjected to a priming treatment in distilled water for 8, 12, 16, 20 and 24 hours as hydropriming treatments. Primed seeds dried back to primary moisture. Laboratory tests were conducted with CR design to determine percentage of germination, germination rate, and

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radicle and plumule dry weight and seedling dry weight for each primed sample. Twenty five seeds from each priming treatment were placed on wet filter paper and germinated in incubator at 10°C for 8 days, using three replications. Germination (protrusion of radicle by 2 mm) was recorded in daily intervals.

Germination rate was calculated based on the following equation of Ellis and Roberts (1980):

$MGT= \Sigma (D. n) / \Sigma n$

Where n is the number of seeds germinated on day D and D is the number of days counted from the beginning of the test.

At the end of germination test, radicles and shoots of 25 seeds were cut from the cotyledons and then dried in an oven at 75±2°C for 24 hours. The dried radicles and shoots were weighted to the nearest milligram and the mean radicle and shoot dry weight and consequently mean seedling dry weight were determined.

Data were subjected to analysis of variance and Duncan's Multiple Range Test for comparison of means was performed, using MSTATC software.

RESULTS AND DISCUSSION

The analyses of variance showed that the hydropriming significantly affected germination percentage, plumule dry weight and seedling dry weight but germination rate and radical dry weight were not significantly affected by hydropriming (Table 1).

Table 1: Analysis of variance of hydropriming effects on germination properties of rapeseeds.

S.V	df	Mean Squares				
		Germination (%)	Germination rate (day)	Plumule dry weight (mg)	Radicle dry weight (mg)	Seedling dry weight (mg)
Hydropriming	5	242.49*	0.130ns	1460.12*	43.35ns	570.05**
Error	12	74.67	0.045	1176.97	18.5	90.6
CV (%)		11.44	12.4	16.97	24.0	21.45

*: significant at 0.05 probability level; **: significant at 0.01 probability level; ns: not significant

The highest germination percentage was observed for P_5 (20 hours of hydropriming) which was not significantly different with P_4 (16 hours of hydropriming). Seeds treated with P_6 (24 hours of hydropriming) had the lowest germination percentage, plumule dry weight and seedling dry weight (Table 2). With increasing hydropriming duration to 20 hours, germination percentage, plumule dry weight and seedling dry weight increased, after that these traits decreased (Figure 1).

Table 2: Mean values of germination percentage, plumule and seedling dry weight (mg).

Treatment	Germination percentage	Plumule dry weight (mg)	Seedling dry weight (mg)
P_1	75 c	33.8 c	35.6 d
P_2	80 b	30.2 c	37.0 d
P_3	80 b	37.4 c	46.3 c
P_4	84 a	52.13 a	66.0 a
P_5	84 a	42.7 b	53.3 b
P_6	61 e	23.9 d	28.0 e

P_1, P_2, P_3, P_4, P_5 and P_6 are untreated and 8, 12, 16, 20 and 24 hours of hydropriming, respectively. Different letters in each column show significant difference.

Hydro-priming improved seed germination and seedling growth of rapeseeds as indicated by high germination and high seedling dry weight in the laboratory (Table 1). Variations in seedling dry weight among hydropriming treatments (Table 2 and figure 1) are closely associated with differences in initial quality of seeds (Table 2). Better germination percentage and plumule growth of P_4 and P_5 resulted in the highest seedling dry weight, compared with other hydropriming treatments. It has been reported that other priming techniques had also positive effects on germination of rapeseeds. Ghassemi-Golezani et al (2010) working on salt priming effects on germination of rapeseed reported that salt priming, particularly KNO_3 priming, decreased mean germination time and increased seedling size, compared with non-primed seeds. Primed seeds can rapidly imbibe and revive the seed metabolism, enhancing germination (Mcdonald, 2000). Enhancement in seedling size due to hydropriming was more evident in P_4 and P_5, compared with the other hydropriming treatments. The highest benefit of priming was observed for seeds primed with P_4 (16 hours) (Table 2). Therefore, hydro priming can ensure satisfactory germination which it could be resulted in good stand establishment of rapeseed in the field. However, positive effects of seed priming on seed invigoration depends on priming duration (Ashraf and Foolad, 2005; Ghassemi-Golezani et al., 2008). Increasing

hydropriming to 20 hours had a positive effect, while extended priming duration more than this time, had negative effects on germination of rapeseeds

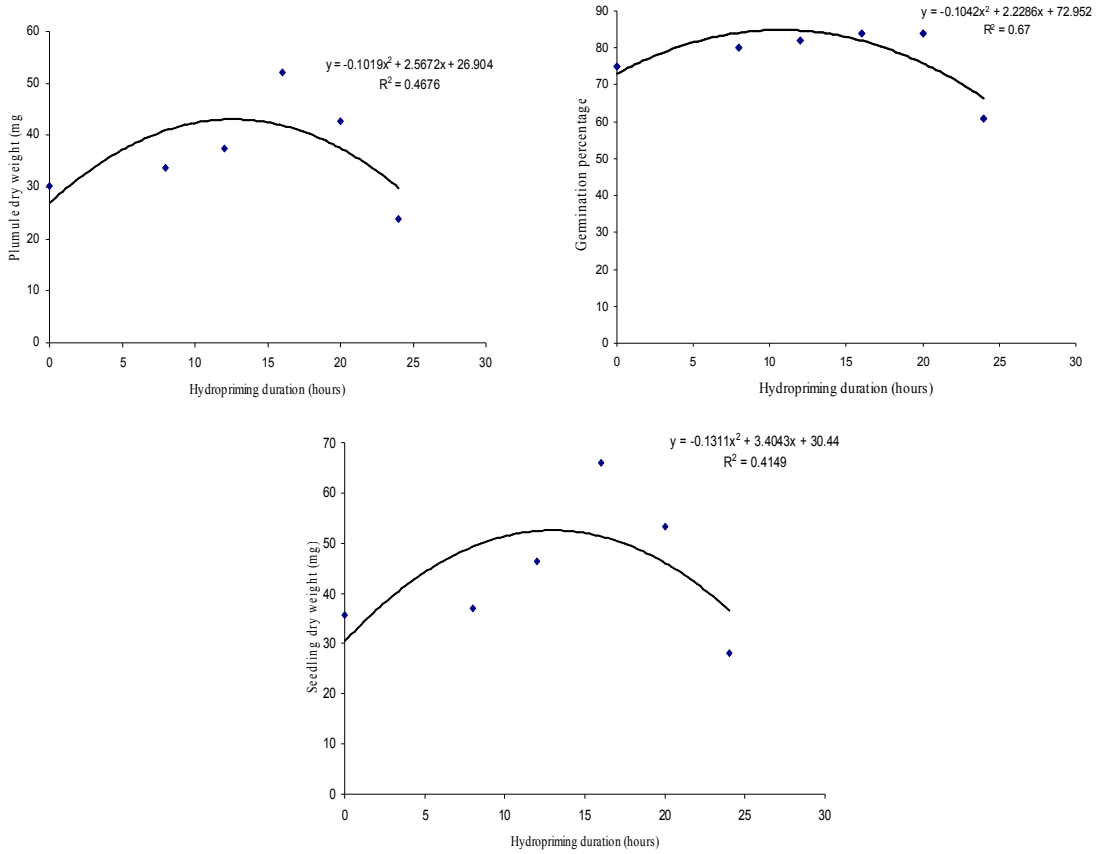

Figure 1. Changes in germination percentage, plumule and seedling dry weight as affected by hydropriming duration.

CONCLUSION

Generally, hydropriming improved germination properties of rapeseeds including germination percentage, plumule and seedling dry weight. Hydro-priming for 16 and 20 hours can be successfully applied to enhance seed and seedling vigour of rapeseeds. Treating rapeseeds with water for more than 20 hours resulted in lower germination and decreased seed vigour.

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