The Pharma Innovation Journal 2021; 10(4): 332-335

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(4): 332-335

www.thepharmajournal.com
Received: 08-01-2021
Accepted: 19-03-2021

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Standardization of hydro-priming for enhancing seed quality parameter in wheat (*Triticum aestivum* L.)

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DOI: https://doi.org/10.22271/tpi.2021.v10.i4e.5957

Abstract
Dry (moisture 13%) and the uniform seed of two varieties (Kharchiya-65 and KRL-210) of wheat were hydro-primed for 8, 16, and 24 hrs and subjected for examining the seed quality parameters namely germination percentage, root length, shoot length, seedling length, seedling dry weight, speed of germination, seedling vigour index, and conducted in Factorial Complete Randomize Design (FCRD) with three replications during Rabi season of 2017-18 and 2018-19. The maximum germination% (86.50%), root length (17.99 cm), shoot length (18.36 cm), seedling length (35.23 cm), seedling dry weight (0.15 g), speed of germination (15.12) were obtained with 16 hrs hydropriming and seedling vigour index (2371) with 8 hrs in case Kharchiya-65 whereas the maximum germination (86.33), root length (13.89 cm), shoot length (13.9 cm), seedling length (28.50 cm), seedling dry weight (0.15 g), seedling vigour index (3045) was obtained with same 16 hrs and speed of germination (13.88) with 24 hrs showed the highest result in case KRL-210. The influence of hydropriming was more pronounced in KRL-210 as compared to Kharchiya-65. Thus, the seed quality parameters will be enhanced significantly by 16 hrs hydropriming in wheat.

Keywords: wheat, hydro priming, KRL-210, Kharchiya-65.

Introduction
Wheat is the world's number one cereal in the area. The Cultivation of wheat is as old as civilization. It is the first-mentioned crop in Bible. Wheat is eaten in various forms by more than 1000 million people in the world. In India, it is second the important staple food crop next to rice. Wheat is the most important cereal in the world, giving about one-third of the total production, followed closely by rice. In temperate regions, it is the major source of food. The chief use of wheat is flour for making bread. This crop is a widely cultivated cereal, spread from 57ºN to 47ºS latitude. Hence, wheat is cultivated and harvested throughout the year in one country or other. China, India, Russian federation, USA, France, Canada, Germany, Pakistan, Australia, and Turkey are the most important wheat-growing countries. In India, UP, Punjab, Haryana, MP, Rajasthan, Bihar, Gujarat, Maharashtra, Uttaranchal and West Bengal are the important wheat cultivating states.
Seed priming is the soaking of seeds in a solution of any priming agent followed by drying of seeds that initiates germination-related processes without radical emergence (McDonald, 2000) [13]. Seed priming is seen as a viable technology to enhance rapid and uniform emergence, high vigor, and better yields in some field crops (Basra *et al.*, 2002; Chiu *et al.*, 2002; Harris *et al.*, 1999; Murungu *et al.*, 2004) [1, 3, 14]. Olouch and Welbaum (1996) [15] suggested that priming can be a valuable process for improving germination and uniformity of heterogeneously matured seed lots. (Rao *et al.*, 1987) [19] also reported that primed Brassica seeds may reduce the risk of poor stand establishment under unfavorable conditions. Good seed germination and stand establishment are maximizing factors in crop production, and their importance is well recognized by farmers and researchers (Dell-Aquila and Tritto, 1990; Chivas *et al.*, 1998; Farooq *et al.*, 2008; Yari *et al.*, 2011) [4, 6, 7, 20]. Seed priming is increasingly considered a better approach to enhancing rapid and uniform emergence and to achieving high seedling vigor and better yields in vegetables, floriculture, and some field crops (Dearman *et al.*, 1987; Parera and Cantliffe, 1994; Bruggink *et al.*, 1999) [5, 17, 2]. In the present study, hydropriming was used as a method of seed priming. Hydropriming of seeds is done by soaking seeds in water cold, hot or normal for differents duration before sowing in the field. Thick seed coat enclosing embryo Affect germination by imposing mechanical restriction on embryo growth. This problem of poor or slow seed germination can be solved through many techniques and one of them is seed priming (Pandita and Nagarajan, 2007) [16]. Seed priming reduces the germination time,

Increases germination percentage, seedling emergence and increases uniformity under adverse environmental conditions.

Material and Methods

The experiment was conducted at Seed Testing Laboratory of the Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya-224229 (U.P.) during rabi 2017-18 and 2018-19. Varieties Kharchiya-65, and KRL-210 obtained from ANDUAT, Ayodhya, and CSSIR Lucknow, were used in this experiment. Both varieties were primed with distilled water for three different duration 8, 16 and 24 hrs. Thereafter that treated seeds were dried in shade. An Experiment was laid down in a Factorial Completely Randomized Design (FCRD), with three replications. Observations were recorded on seed quality parameters like, germination, shoot length, root length, seedling length and its dry weight to bring out around original moisture content as per ISTA (2011).

Seed Germination (%)

The germinated seed were evaluated into normal and abnormal seedlings and hard and dead seeds. Germination percentage was recorded on the basis of normal seedling only. Germination percentage was calculated following ISTA (2011) protocol.

$$\text{Germination percentage} = \frac{\text{Total number of seed germinated}}{\text{Total number of seed planted}} \text{x100}$$

Root length (cm)

On the day of final count of the germination test, twenty normal seedlings were selected from each treatment and in each replication. Root length was mean was measured by using scale from collor point to tip of the root and finally averaged.

Shoot length (cm)

Twenty normal seedlings used for root length measurement were also used for the measurement of shoot length. The shoot length was measured from collor point to tip of upper first leaf and mean shoot length is expressed in centimeter.

Seedling Length (cm)

Twenty normal seedlings used for root length and shoot length measurement were used for the measurement of seedling length. The seedling length was measured from the tip of the primary root to tip of the primary leaf and mean length is expressed in centimeters.

Seedling-dry weight (g)

Twenty normal seedling used for measuring the seedling length were put in the butter paper bag and dried in hot air oven maintained at 80 ^{0}C+1 ^{0}C for 12 hours. The dry weights of such seedlings were measured by electronic weighing balance in milligram.

Results and Discussion

The results obtained during the present course of investigation were carried out to visualize the most significant influence of hydropriming on wheat cvs Kharchiya-65 and KRL-210 which are developed for alkaline/ sodic soil condition.

The variety KRL-210 showed higher germination (85.78%) in comparison to Kharchia-65 (85.44%). The maximum germination (86.50%) was notice with 16 hrs of hydropriming (Fig.1). The stimulatory effect of hydropriming on early stage of germination process could be the cause of positive effect (Varrier *et al*., 2010) [18]. Maximum root length was recorded in (15.75cm) KRL-210. Duration 16 hrs (15.16 cm) had shown the highest performance in root length while minimum root length (12.49 cm) recorded with 24 hour. Significantly higher Shoot length (17.08) reported in KRL- 210 followed by 16 hrs (15.26 cm) primed with distil water. Minimum shoot length percent recorded by hrs 24 (14.08 cm) compared other duration (Fig.3). Maximum seedling length (32.54 cm) was recorded in KRL-210 followed by hrs 16 (31.18 cm). Primed seeds are better able to complete the process of germination in short time and cope with the environmental stress including low temperature (Kant *et al*., 2006) [12]. Minimum seedling length recorded by hrs 24 (26.38 cm) with primed with hrs 24 (Fig.4).

Maximum seedling dry weight (0.14 g) was recorded in KRL-210 followed by hrs 24 and 16 hrs (0.15g) primed hydropriming (Fig.5). The maximum speed of germination (13.16) was recorded in KRL-210 followed by 24 hr (13.88) primed with hydropriming (Fig.6). The highest seedling vigour index (2775) recorded in case of KRL-210. Each crop cultivar requires a critical soaking duration and it should be less than the safe limit (Harris *et al*., 2000) [9].

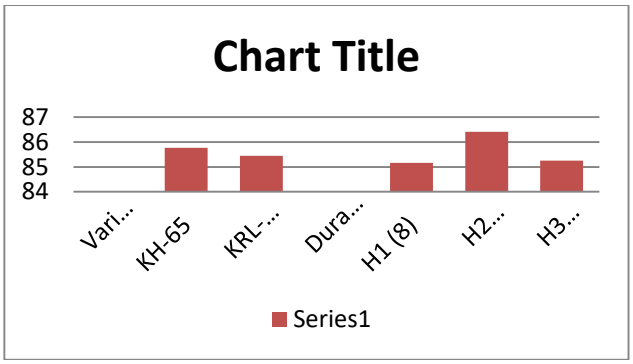

Fig 1: Effect of hydro-priming on germination (%) in wheat.

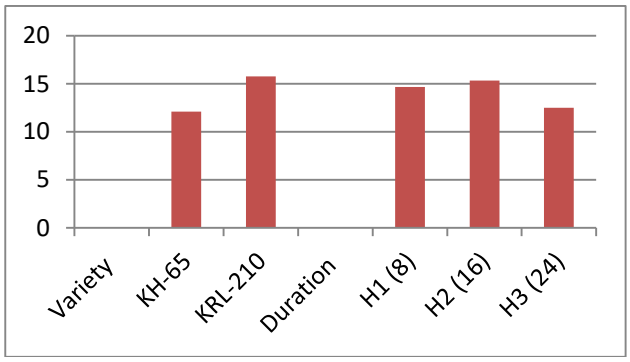

Fig 2: Effect of hydro-priming on Root length (cm) in wheat

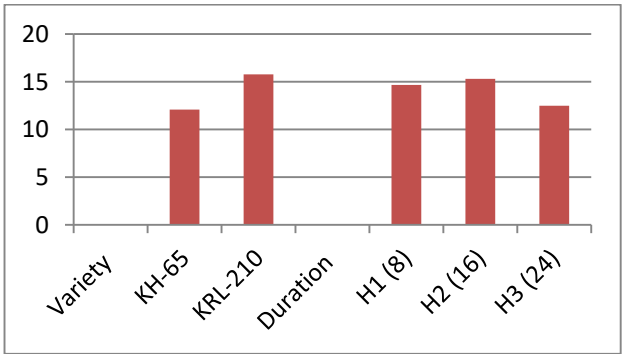

Fig 3: Effect of hydro-priming on Shoot length (cm) in wheat varieties.

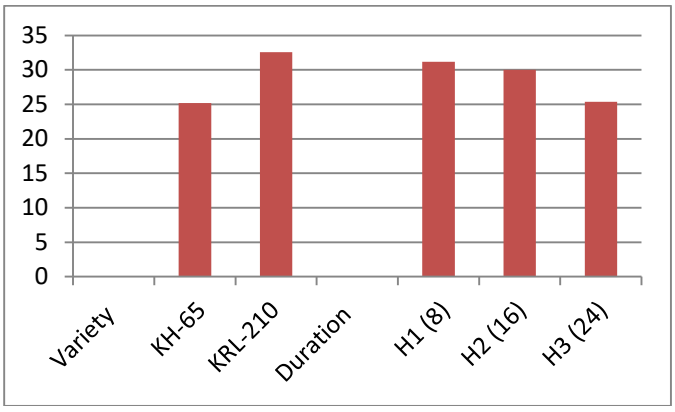

Fig 4: Effect of hydro-priming on Seedling length (cm) in wheat varieties.

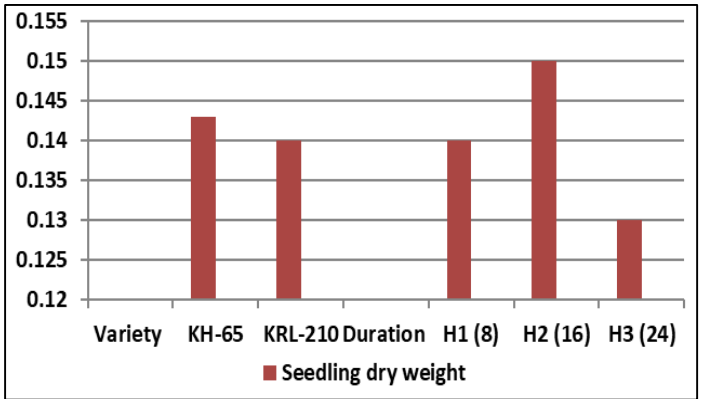

Fig 5: Effect of hydro-priming on Seedling dry weight in wheat.

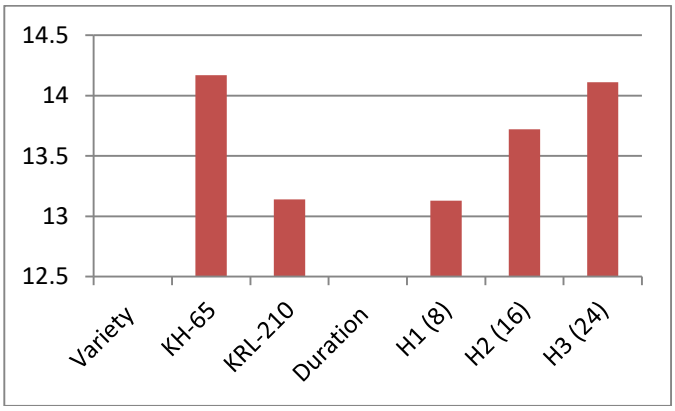

Fig 6: Effect of hydro-priming on Speed of germination in wheat

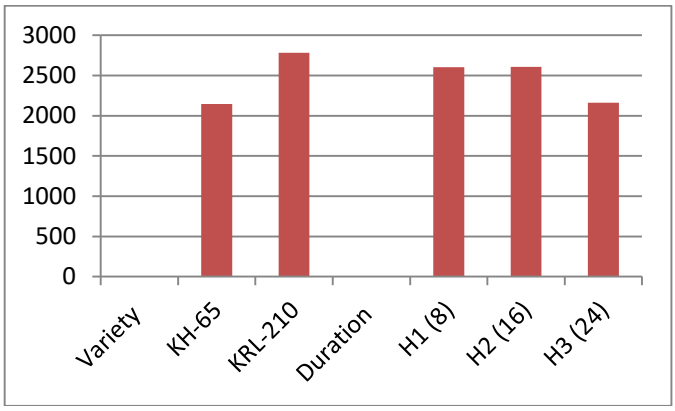

Fig 7: Effect of hydro-priming on seedling vigour index in wheat

Table 1 Showed that the interaction effect of variety, duration, and treatment showed that the highest germination (86.50%) was obtain in KRL 210 with hydropriming applied for 16 hrs where as in the case of Kharchiya-65 the maximum seed germination (86.33%) also notice with hydropriming also primed for 16 hrs. In root length the interaction effect of variety, duration, and treatment showed that the highest (17.99 cm) was obtain in KRL 210 with hydropriming applied for 16 hrs where as in the case of Kharchiya-65 the maximum (13.89 cm) notice with hydropriming primed for 8hrs. The interaction effect of variety, duration, and treatment showed that the highest Shoot length (18.36 cm) was obtain in KRL 210 with hydropriming applied for 16 hrs where as in the case of Kharchiya-65 the maximum shoot length (13.9 cm) notice with hydropriming also primed for 8 hrs. The interaction effect of variety, duration, and treatment showed that the highest Seedling length (35.23 cm) was obtain in KRL 210 with hydropriming applied for 16 hrs where as in the case of Kharchiya-65 the maximum seedling length (28.50 cm) notice with hydropriming also primed for 8 hrs.

Table 1: Interaction effect between verities and duration on Germination (%), Root length (cm) and Shoot length (cm) in wheat

	Germination(%)			Root length(cm)			Shoot length(cm)			Seedlinglength(cm)		
Interaction (V X H)	**2017-18**	**2018-19**	**mean**	**2017-18**	**2018-19**	**mean**	**2017-18**	**2018-19**	**mean**	**2017-18**	**2018-19**	**mean**
V1xH1	85.33	85.67	85.50	13.40	14.37	13.89	13.40	14.39	13.9	28.24	28.77	28.50
V1xH2	86.00	87.00	86.33	11.77	13.51	12.64	11.77	12.55	12.16	23.53	26.06	24.79
V1xH3	85.33	85.33	85.33	11.09	11.22	11.15	11.09	12.17	11.63	21.05	23.39	22.22
V2xH1	83.67	86.00	84.83	15.23	15.66	15.45	15.23	17.41	16.32	34.66	33.08	33.87
V2xH2	85.67	87.00	86.50	18.53	17.45	17.99	18.53	18.20	18.37	34.80	35.65	35.23
V2xH3	85.00	85.33	85.17	15.68	11.99	13.83	15.68	17.38	16.53	27.70	29.37	28.53
Mean	85.17	86.06	85.61	14.28	14.03	14.16	14.28	15.35	14.82	28.33	29.39	28.86
CD 5%	1.56	1.97	1.77	1.44	1.028	1.234	2.056	2.05	2.05	1.78	1.9	1.84

According to Table 2 that the interaction effect of variety, duration, and treatment showed that the highest seedling dry weight (0.15 g) was obtain in KRL 210 with hydropriming applied for 16 hrs where as in the case of KH-65 the maximum seedling dry weight (0.15 g) notice with hydropriming also primed for16 hrs. Hydropriming is a very simple, economic and environmental friendly type of seed priming (Jamil *et al.*, 2016)[11]. The interaction effect of variety, duration, and treatment showed that the highest speed of germination (13.88) was obtain in KRL 210 with hydropriming applied for 24 hrs where as in the case of Kharchiya-65 the maximum speed of germination (15.12) notice with hydropriming also primed for16 hrs. The interaction effect of variety, duration, and treatment showed that the highest seedling vigour index (3045) was obtain in KRL 210 with hydropriming applied for 16 hrs where as in the case of Kharchiya-65 the maximum seedling vigour index (2371) notice with hydropriming also primed for 8 hrs.

Table 2: Interaction effect between verities and duration on seedling length (cm) and seedling dry weight (g) in wheat

	Seedling dry weight (cm)			Speed of germination			Seedling vigour index		
Interaction (V X H)	**2017-18**	**2018-19**	**mean**	**2017-18**	**2018-19**	**mean**	**2017-18**	**2018-19**	**mean**
V1xH1	0.14	0.15	0.14	13.90	12.19	13.04	2278	2465	2371
V1xH2	0.15	0.14	0.15	14.21	16.02	15.12	2083	2268	2175
V1xH3	0.15	0.13	0.14	14.23	14.49	14.36	1795	1997	1896
V2xH1	0.13	0.17	0.15	13.93	12.54	13.23	2855	2845	2850
V2xH2	0.15	0.16	0.16	12.39	12.36	12.38	2987	3102	3045
V2xH3	0.12	0.12	0.12	13.32	14.43	13.88	2352	2506	2429
Mean	0.14	0.15	0.14	13.66	13.67	13.67	2392	2531	2461
CD 5%	0.022	0.027	0.025	1.55	1.54	1.55	238	174	206

Conclusion

Based on present investigation it is concluded that seed quality parameters viz. germination, Root length, shoot length, seedling length, seedling dry weight, speed of germination and seedling vigour index of wheat cvs Kharchia-65 and KRL 210 and still be enhance with 16 hydro-priming which could be exploited for successful wheat cultivation under normal and stress condition. .

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