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Short Communication

Use of different seed priming tools to enhance the planting value and seed quality in barley

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Good seed quality is important for successful seed production. Seed priming treatments can improve the seed quality by enhancing the germination and establishment in many crops like maize, wheat, rice and canola (Basra *et al.*,2005). Seed priming include hydro-priming, osmo-priming, thermo-priming, halo-priming, magnetic-priming and nano-priming. It is a simple way to improve germination and establishment of seeds. It is an age-old technique for enhancing rapid and uniform emergence, leading to better stand establishment and yield (Dutta, 2018).Several advantages of priming have been reported including rapid and uniform germination, increased nutrient uptake, relieved phytochrome-induced photo – and thermo-dormancy, and increased range of germination temperature, improved water use efficiency and synchronous maturity of crop (Hill *et al.*, 2008). Seed priming ensures uniform germination by reducing the imbibitions time (Brocklehurst*et al.,* 2008), increasing the metabolite production and pre-germinative enzyme activation (Hussain *et al.*, 2016). There are many research articles on seed priming towards improving seed germination, stand establishment, crop growth in various crops like rice, wheat, okra, pulses and melons (Marthandan *et al.*, 2020). This research was also conducted to study the effect if different seed priming treatments viz., thermo-priming, hydro-priming and pre-chilling on seed quality parameters in barley.

This study was conducted at the seed laboratory of Department of Seed Science and Technology, CSKHPKV Palampur, India during 2021-2022 seasons. Experimental material was two varieties of barley i.e. BHS 380 and BHS 400 (fresh andone-year-old seed lots.) These were procured from IARI, Regional station Karnal, India. The experiment was conducted under a completely randomized design (CRD) factorial and each treatment was replicated three times. Seeds were primed with three treatments viz: thermo-priming, hydro-priming and pre-chilling. Thermo-priming of seeds was done at 30 °C and 35°C for different periods (6, 12, 24, 36 and 48 hrs.). Seeds were hydro-primed at 20°C for seven duration viz., 4,6,8,10,12 and 14 hrs. Pre-chilling was done at 5°C for 7 days. Untreated seeds were use as control.

Data were recorded for various seed quality parameters like germination (%), seedling vigour (I and II), field emergence (%), and moisture content (%) and 2 mm radical emergence (mm). Germination test was conducted using 100-seeds in three replications by adopting the blotter paper method (Anonymous 1999). Seeds were incubated in germinator at a temperature 25 ± 1°C and RH of 90 %. Normal germinated seeds were counted on 4th and 7th

day after incubation and total germination percentage was calculated using the following formula –

% Germination = (Number of normal germinated seeds/ Total number of seeds) ×100

The seedling vigour index - I and II were calculated by adopting the method suggested by Abdul Baki and Anderson (1973).

Field emergence count was taken on the 8thday after sowing and the emergence percentage was calculated taking into account the number of seedlings emerging above the soil surface. Moisture content of seeds was recorded in percentage using a moisture meter, before and after the treatment.

2 mm radical emergence was recorded after 42 hours using randomly taken 10 seed from 300 kept in three replications of 100 seeds each for germination test. Then time taken for the emergence of 2 mm radical was calculated in hours.

The data were statistically analyzed using software OPSTAT (Sheoran *et al.* 1998). The data on germination (%) and field emergence (%) were transformed into arc sine root percentage and transformed data was used for statistical analysis.

Hydro-priming

Different treatments showed significant differences for moisture content (%) before and after hydro-priming treatments (Table3.1). Among the old seed and fresh seed lot, fresh lot had shown significantly higher germination percentage in both the varieties. Fresh seed lot of BHS 380 showed higher germination percentage ($V_1L_2H_3$ - 98.00%) as compared to old seed lot ($V_1L_2H_2$ - 89.33%). Both the lots have shown significantly superior germination as compared to control ($C_1V_1L1_2$- 92.33% & $C_1V_1L1_1$- 84.67 %). Similar results are reported in BHS 400 variety where fresh seed lot ($V_2L_4H_2$- 97.67%) recorded higher germination in comparison to old lot ($V_2L_3H_2$- 95.33%) and both the varieties had significantly higher germination in comparison to control ($C_1V_2L_4$ – 95.33% & $C_1V_2L_3$ – 90.67%). Among the different hydro-priming treatments, hydro-priming for 6 hrs. recorded higher germination among all treatments in both the varieties. Ashraf and Razmjoo (2010) have also reported that 6 hrs. hydro-priming showed maximum germination in safflower seeds. Similar results are reported in other seed quality parameters. Fresh seed lot seed lots hydro-primed for 6 hrs. recorded higher vigour (3008.60, 1652.93 &2975.60, 1780.80) in both varieties (BHS 380 & BHS 400) as compared to control (2403.73, 1338.86 & 2736.06, 1506.26). Field emergence and 2 mm radical emergence had also showed the similar results (Table 3.1)

Thermo-priming

Thermo-priming had shown significant differences for moisture content (%) before and after the treatment (Table 3.2). Thermo-priming for 12 hrs. at 30^{0}C had recorded significantly superior seed quality parameters among all the thermo- treatments. Among fresh and old seed lots, fresh lot had significantly superior germination in comparison to old seed lot in both the varieties (BHS 380 and BHS 400). BHS 380 fresh lot ($V_1L_2T_1D_2$) showed significantly higher germination (96.33%) in comparison old seed lot ($V_1L_1T_1D_2$- 87.00%). Both the lots had significantly superior germination as compare to control ($C_1V_1L_2$– 92.33%, $C_1V_1L_1$– 84.67%). Similar results are reported in the seed lots of variety BHS 400. Wang *et al.* (2015) in bitter-gourd also reported the increase in germination performance by thermo-priming at 20 and 25^{0}C. Other seed quality parametersi.e. vigour index I&II, field emergence (%) and 2 mm radical emergence had also been superior in thermo-primed treatment for 12 hrs. at 30**° C** (Table 3.2). Sani & Jodaeian (2015) and Maroufi *et al* (2011) reported the higher germination & vigour after thermo-priming of soybean and wheat seeds for 10 minutes.

Pre-chilling

None of the pre-chilled treatment recorded superiority in seed quality parameters in comparison to control. BHS 400 fresh seed lot (Control) recorded higher germination percentage (97.67%) in comparison to pre-chilled treatments. Similar pattern was recorded in other seed quality parameter of this variety and BHS 380 seed lots (Table 3.3). Mattana *et al.* (2009) in *Rhamnus persicifolia* and Ogunrotimi and kayoed (2018) in *Solanum macrocarpon* reported non-significant effect of pre-chilling on seed germination.

Table 3.1 Effect of different Hydro-priming treatment on seed quality parameters in barley

Variety	Treatment	MC (%) before treatment	MC (%) after treatment	Germination (%)	V –I	V-II	FE (%)	2 mm radical emergence
BHS 380	$V_1L_1H_1$	11.60	11.70	88.33(70.31)	2611.53	1384.73	83.33 (65.88)	3.73
Old seed lot	$V_1L_1H_2$	11.40	11.53	89.33 (70.92)	2680.73	1445.33	84.67(66.92)	3.70
	$V_1L_1H_3$	11.80	11.86	81.00(64.13)	2170.83	1093.53	72.33(58.24)	3.90
	$V_1L_1H_4$	11.60	11.76	78.00(62.00)	2122.76	1049.66	74.33(59.53)	3.80
	$V_1L_1H_5$	11.06	11.30	85.00(67.19)	2252.53	1232.46	78.00(62.00)	4.63
	$V_1L_1H_6$	11.30	11.50	87.00(68.84)	2592.56	1394.86	79.00(62.70)	4.21
	$V_1L_1H_7$	11.50	11.60	88.00(69.71)	2331.96	1258.36	84.33(66.65)	4.41
Fresh seed lot	$V_1L_2H_1$	11.40	11.46	96.33(78.95)	2825.80	1512.40	93.33(75.04)	3.77
	$V_1L_2H_2$	11.30	11.50	98.00(81.83)	3008.60	1652.93	93.67(75.4)	3.69
	$V_1L_2H_3$	10.40	10.60	90.33(71.86)	1913.56	1201.56	84.33(66.65)	3.89
	$V_1L_2H_4$	10.46	10.70	92.33(73.90)	2557.56	1528.33	87.00(68.84)	4.39
	$V_1L_2H_5$	10.80	10.86	90.67(72.20)	2478.20	1226.86	86.00(68.00)	4.23
	$V_1L_2H_6$	10.40	10.56	88.33(70.00)	2205.40	1475.20	85.67(67.72)	5.00
	$V_1L_2H_7$	10.70	10.83	91.00(72.53)	2366.76	1216.46	87.00(68.84)	4.69
Old seed lot (Control)	$C_1V_1L_1$	-	-	84.67(66.92)	2040.46	1216.40	77.67(61.77)	5.93
Fresh seed lot (Control)	$C_1V_1L_2$	-	-	92.33(73.90)	2403.73	1338.86	89.67(71.22)	5.03
BHS 400	$V_2L_3H_1$	11.03	11.30	94.00(75.82)	2776.53	1543.93	88.00(69.71)	4.17
Old seed lot	$V_2L_3H_2$	11.16	11.40	95.33(77.55)	2907.73	1744.53	89.33(70.92)	3.89
	$V_2L_3H_3$	11.50	11.70	88.00(69.71)	2349.63	1275.96	86.00(68.00)	4.40
	$V_2L_3H_4$	11.20	11.40	91.33(72.86)	2677.16	1352.36	85.33(67.45)	4.05
	$V_2L_3H_5$	11.50	11.63	89.00(70.61)	2503.86	1367.66	87.33(69.12)	4.16
	$V_2L_3H_6$	12.13	12.30	87.33(69.12)	2314.33	1248.86	85.00(67.19)	4.27
	$V_2L_3H_7$	12.20	12.40	89.00(70.61)	2474.23	1424.06	87.33(69.12)	4.16
Fresh seed lot	$V_2L_4H_1$	10.30	10.56	96.67(79.47)	2755.00	1517.70	93.33(75.01)	4.24
	$V_2L_4H_2$	10.30	10.50	97.67(81.22)	2975.60	1780.80	94.33(76.21)	3.69
	$V_2L_4H_3$	10.80	10.93	95.67(77.97)	2764.80	1454.66	93.33(75.01)	4.14
	$V_2L_4H_4$	11.50	11.73	93.67(75.40)	2628.90	1483.03	92.33(73.90)	3.70
	$V_2L_4H_5$	11.80	11.86	94.33(76.21)	2726.33	1290.60	89.67(71.22)	4.19

	$V_2L_4H_6$	12.23	12.53	94.00(75.82)	2852.06	1613.06	93.33(75.01)	3.90
	$V_2L_4H_7$	12.50	12.70	94.67(76.67)	2669.53	1328.46	91.67(73.19)	3.70
Old seed lot (Control)	$C_1V_2L_3$	-	-	90.67(72.18)	2429.83	1242.17	87.00(68.84)	5.11
Fresh seed lot (Control)	$C_1V_2L_4$	-	-	95.33(77.50)	2736.06	1506.26	91.67(73.19)	4.82
SEm±CD		0.06	0.05	0.52	15.02	9.05	0.43	0.01
(P=0.5) 0.16		0.14	1.47	42.44	25.58	0.43	0.03	

V1L1H1 – BHS 380 old seed lot hydro-primed for 4 hrs, V1L1H2 – BHS 380 old seed lot hydro-primed for 6 hrs, V1L1H3 – BHS 380 old seed lot hydro-primed for 8 hrs, V1L1H4 – BHS 380 old lot hydro-primed for 10 hrs, V1L1H5 – BHS 380 old seed lot hydro-primed for 12 hrs, V1L1H6 – BHS 380 old seed lot hydro-primed for 14 hrs, V1L1H7 –BHS 380 lot hydro-primed for 16 hrs, V1L2H1 – BHS 380 fresh seed lot hydro-primed for 4 hrs, V1L2H2 - BHS 380 fresh seed lot hydro-primed for 6 hrs, V1L2H3 – BHS 380 fresh seed lot hydro-primed for 8 hrs, V1L2H4 – BHS 380 fresh seed lot hydro-primed for 10 hrs, V1L2H5- BHS 380 fresh seed lot hydro-primed for 12 hrs, V1L2H6 - BHS 380 fresh seed lot hydro-primed for 14 hrs, V1L2H7 – BHS 380 fresh seed lot hydro-primed for 16 hrs, C1V1L1 - BHS 380 old seed lot, C1V1L2 - BHS 380 fresh seed lot

$V_2L_3H_1$ - BHS 400 old lot hydro-primed for 4 hrs, $V_2L_3H_2$ - BHS 400 old lot hydro-primed for 6 hrs, $V_2L_3H_3$ - BHS 400 old lot hydro-primed for 8 hrs, $V_2L_3H_4$ - BHS 400 old lot hydro-primed for 10 hrs, $V_2L_3H_5$ - BHS 400 old lot hydro-primed for 12 hrs, $V_2L_3H_6$ - BHS 400 old lot hydro-primed for 14 hrs, $V_2L_3H_7$ - BHS 400 old lot hydro-primed for 16 hrs, $V_2L_4H_1$ - BHS 400 fresh lot hydro-primed for 4 hrs, $V_2L_4H_2$ - BHS 400 fresh lot hydro-primed for 6 hrs, $V_2L_4H_3$ - BHS 400 fresh lot hydro-primed for 8 hrs, $V_2L_4H_4$ - BHS 400 fresh lot hydro-primed for 10 hrs, $V_2L_4H_5$ - BHS 400 fresh lot hydro-primed for 12 hrs, $V_2L_4H_6$ - BHS 400 fresh lot hydro-primed for 14 hrs, $V_2L_4H_7$ - BHS 400 fresh lot hydro-primed for 16 hrs, $C_1V_2L_3$ - BHS 400 old seed lot, $C_1V_2L_4$ - BHS 400 fresh seed lot

Table 3.2 Effect of thermo-priming treatment on seed quality parameters in barley

Variety	Treatment	MC (%) before treatment	MC (%) after treatment	Germination (%)	V –I	V-II	FE (%)	2 mm radical emergence
BHS 380 Old seed lot	$V_1L_1T_1D_1$	11.26	11.23	82.00(64.87)	2192.06	1262.73	70.00(56.76)	4.13
	$V_1L_1T_1D_2$	11.33	11.36	87.00(68.84)	2468.26	1255.63	74.67(59.75)	3.96
	$V_1L_1T_1D_3$	11.36	11.43	86.00(68.00)	2459.23	1241.16	69.00(56.14)	4.03
	$V_1L_1T_1D_4$	11.26	11.26	84.33(66.65)	2462.56	1231.33	68.33(55.73)	4.13
	$V_1L_1T_1D_5$	11.23	11.26	82.00(64.87)	2435.43	1038.66	72.33(58.24)	4.20
	$V_1L_1T_2D_1$	11.60	11.70	80.33(63.65)	2150.30	1255.83	73.33(58.88)	4.26
	$V_1L_1T_2D_2$	11.50	11.53	85.67(67.73)	2435.76	1173.56	73.67(59.10)	4.16
	$V_1L_1T_2D_3$	11.70	11.73	85.00(67.19)	2456.53	1209.93	74.33(59.53)	4.23
	$V_1L_1T_2D_4$	11.63	11.66	83.33(65.88)	2436.16	1250.03	70.67(57.18)	4.30
	$V_1L_1T_2D_5$	11.63	11.66	80.33(63.65)	2102.06	1044.33	70.33(56.98)	4.70
Fresh seed lot	$V_1L_2T_1D_1$	11.26	11.33	95.33(77.50)	2559.30	1287.73	93.00(74.65)	3.67
	$V_1L_2T_1D_2$	11.23	11.26	96.33(78.95)	2856.83	1401.50	91.67(73.19)	3.66
	$V_1L_2T_1D_3$	11.20	11.20	94.67(76.62)	2426.63	1158.10	90.33(71.86)	3.83
	$V_1L_2T_1D_4$	11.20	11.23	92.00(73.56)	2563.70	1299.70	86.33(68.27)	3.90
	$V_1L_2T_1D_5$	11.23	11.26	92.33(73.90)	2665.40	1308.00	87.33(69.12)	3.86

	$V_1L_2T_2D_1$	11.40	11.46	95.00(77.09)	2644.23	1406.03	90.00(71.55)	4.50
	$V_1L_2T_2D_2$	11.53	11.60	93.00(74.65)	2659.76	1236.93	91.00(72.53)	4.56
	$V_1L_2T_2D_3$	11.50	11.53	91.33(72.85)	2721.73	1251.26	90.00(71.55)	4.40
	$V_1L_2T_2D_4$	11.53	11.63	88.67(70.31)	2624.60	1380.20	87.67(69.41)	4.23
	$V_1L_2T_2D_5$	11.50	11.53	90.67(72.18)	2738.13	1299.60	89.67(71.22)	4.03
Old seed lot (Control)	$C_1V_1L_1$	-	-	84.67(66.92)	2040.46	1216.40	77.67(61.77)	5.93
Fresh seed lot (control)	$C_1V_1L_2$			92.33(73.90	2403.73	1338.86	89.67(71.22)	5.03
BHS 400	$V_2L_3T_1D_1$	10.26	10.33	90.00(71.55)	2394.03	1119.03	88.33(70.00)	4.16
Old seed lot	$V_2L_3T_1D_2$	10.36	10.43	92.00(73.56)	2715.70	1402.50	90.33(71.86)	4.03
	$V_2L_3T_1D_3$	10.50	10.53	91.67(73.19)	2630.83	1414.76	85.00(67.19)	4.06
	$V_2L_3T_1D_4$	10.33	10.36	88.67(70.30)	2651.10	1344.83	86.33(68.27)	4.23
	$V_2L_3T_1D_5$	10.33	10.36	90.00(71.55)	2388.03	1071.03	86.67(68.56)	4.16
	$V_2L_3T_2D_1$	10.43	10.46	89.00(70.61)	2607.66	1168.90	78.33(62.24)	4.13
	$V_2L_3T_2D_2$	10.40	10.43	89.67(71.22)	2651.10	1237.33	79.00(62.70)	4.36
	$V_2L_3T_2D_3$	10.60	10.66	89.33(70.91)	2563.80	1174.60	78.33(62.23)	4.36
	$V_2L_3T_2D_4$	10.73	10.76	87.67(69.41)	2495.80	1282.90	69.00(56.14)	4.36
	$V_2L_3T_2D_5$	10.80	10.90	90.33(71.86)	2544.40	1234.60	75.00(59.97)	4.43
Fresh seed lot	$V_2L_4T_1D_1$	10.50	10.53	97.00(80.08)	2858.23	1341.93	86.67(68.55)	3.86
	$V_2L_4T_1D_2$	10.46	10.53	97.67(81.22)	2793.23	1370.60	93.67(75.40)	3.83
	$V_2L_4T_1D_3$	10.46	10.53	96.33(78.95)	2726.26	1486.70	92.33(73.90)	4.00
	$V_2L_4T_1D_4$	10.40	10.46	97.00(80.08)	2706.33	1312.73	92.67(74.26)	3.86
	$V_2L_4T_1D_5$	10.46	10.53	96.00(78.49)	2796.73	1196.80	85.00(67.19)	4.00
	$V_2L_4T_2D_1$	11.30	11.33	95.33(77.50)	2720.13	1267.96	90.33(71.89)	4.33
	$V_2L_4T_2D_2$	11.33	11.36	93.33(75.01)	2579.10	1176.03	90.33(71.86)	4.36
	$V_2L_4T_2D_3$	11.20	11.23	94.33(76.21)	2776.60	1490.46	91.67(73.19)	4.33
	$V_2L_4T_2D_4$	11.20	11.26	96.67(79.56)	2668.50	1271.63	92.67(74.26)	4.40
Old lot (Control)	$C_1V_2L_3$	-	-	90.67 (72.18)	2429.83	1242.17	87.00 (68.84)	5.11

Fresh lot (Control)	$C_1V_2L_4$	-	-	95.33 (77.50)	2736.06	1506.26	91.67 (73.19)	4.82
SEm±		0.04	0.04	0.50	16.18	10.47	0.42	0.04
CD (P=0.5)		0.13	0.11	1.42	45.49	29.44	1.19	0.10

V1L1T1 D1 - BHS 380 old lot thermo-primed for 6 hrs at 300C, V1L1T1 D2 - BHS 380 old lot thermo-primed for 12 hrs at 300C, V1L1T1 D3 - BHS 380 old lot thermo-primed for 24 hrs at 300C, V1L1T1 D4 - BHS 380 old lot thermo-primed for 36 hrs at 300C, V1L1T1 D5 - BHS 380 old lot thermo-primed for 48 hrs at 300C, V1L1T2 D1- BHS 380 old lot thermo-primed for 6 hrs at 350C, V1L1T2 D2 - BHS 380 old lot thermo-primed for 12 hrs at 350C, V1L1T2 D3 - BHS 380 old lot thermo-primed for 24 hrs at 350C, V1L1T2 D4 - BHS 380 old lot thermo-primed for 36 hrs at 350C, V1L1T2 D5 - BHS 380 old lot thermo-primed for 48 hrs at 350C, V1L2T1 D1 - BHS 380 fresh lot thermo-primed for 6 hrs at 300C, V1L2T1 D2 - BHS 380 fresh lot thermo-primed for 12 hrs at 300C, V1L2T1 D3 - BHS 380 fresh lot thermo-primed for 24 hrs at 300C, V1L2T1 D4 - BHS 380 fresh lot thermo-primed for 36 hrs at 300C, V1L2T1 D5 - BHS 380 fresh lot thermo-primed for 48 hrs at 300C, V1L2T2 D1 - BHS 380 fresh lot thermo-primed for 6 hrs at 350C, V1L2T2 D2 - BHS 380 fresh lot thermo-primed for 12 hrs at 350C, V1L2T2 D3 - BHS 380 fresh lot thermo-primed for 24 hrs at 350C, V1L2T2 D4 - BHS 380 fresh lot thermo-primed for 36 hrs at 350C, V1L2T2 D5 - BHS 380 fresh lot thermo-primed for 48 hrs at 350C, C1V1L1 - BHS 380 old seed lot, C1V1L2 - BHS 380 fresh seed lot

$V_2L_3T_1D_1$ - BHS 400 old lot thermo-primed for 6 hrs at 30°C, $V_2L_3T_1D_2$ - BHS 400 old lot thermo-primed for 12 hrs at 30°C, $V_2L_3T_1$ D_3 - BHS 400 old lot thermo-primed for 24 hrs at 30°C, $V_2L_3T_1$ D_4 - BHS 400 old lot thermo-primed for 36 hrs at 30°C, $V_2L_3T_1$ D_5 - BHS 400 old lot thermo-primed for 48 hrs at 30°C, $V_2L_3T_2$ D_1 - BHS 400 old lot thermo-primed for 6 hrs at 35°C, $V_2L_3T_2$ D_2 - BHS 400 old lot thermo-primed for 12 hrs at 35°C, $V_2L_3T_2$ D_3 - BHS 400 old lot thermo-primed for 24 hrs at 35°C, $V_2L_3T_2$ D_4 - BHS 400 old lot thermo-primed for 36 hrs at 35°C, $V_2L_3T_2$ D_5 - BHS 400 old lot thermo-primed for 48 hrs at 35°C, $V_2L_4T_1$ D_1 - BHS 400 fresh lot thermo-primed for 6 hrs at 30°C, $V_2L_4T_1$ D_2 - BHS 400 fresh lot thermo-primed for 12 hrs at 30°C, $V_2L_4T_1$ D_3 - BHS 400 fresh lot thermo-primed for 24 hrs at 30°C, $V_2L_4T_1$ D_4 - BHS 400 fresh lot thermo-primed for 36 hrs at 30°C, $V_2L_4T_1$ D_5 - BHS 400 fresh lot thermo-primed for 48 hrs at 30°C, $V_2L_4T_2$ D_1 - BHS 400 fresh lot thermo-primed for 6 hrs at 35°C, $V_2L_4T_2$ D_2 - BHS 400 fresh lot thermo-primed for 12 hrs at 35°C, $V_2L_4T_2$ D_3 - BHS 400 fresh lot thermo-primed for 24 hrs at 35°C, $V_2L_4T_2$ D_4 - BHS 400 fresh lot thermo-primed for 36 hrs at 35°C, $V_2L_4T_2$ D_5 - BHS 400 fresh lot thermo-primed for 48 hrs at 35°C, $C_1V_2L_3$ - BHS 400 old seed lot, $C_1V_2L_4$ - BHS 400 fresh seed lot

Table 3.3 Effect of pre-chilling on seed quality parameters in barley

S. No.	Treatment		MC (%) before treatment	MC (%) after treatment	2mm radical emergence (hrs.)	Germination %	FE (%)	VI-I	VI-II
1	BHS 380 old lot prechilled at 5°C for 7 days	$V_1L_1P_1D_1$	10.90	11.03	4.09	86.67(68.55)	79.33(62.93)	2389.16	1222.03
2	BHS 380 fresh lot prechilled at 5°C for 7 days	$V_1L_2P_1D_1$	10.40	10.50	4.36	95.33(77.50)	87.00(68.84)	2809.20	1477.70
3	BHS 400 old lot prechilled at 5°C for 7 days	$V_2L_3P_1D_1$	10.83	11.00	4.20	89.67(71.22)	82.00(64.87)	2489.70	1291.16
4	BHS 400 fresh lot prechilled at 5°C for 7 days	$V_2L_4P_1D_1$	10.40	10.70	4.23	96.33(78.95)	90.00(71.55)	2816.03	1512.46
5	BHS 380 old seed lot	$C_1V_1L_1$	-	-	5.93	84.67(66.92)	77.67(61.77)	2040.46	1216.40
6	BHS 380 fresh seed lot	$C_1V_1L_2$	-	-	5.03	92.33(73.90)	89.67(71.22)	2403.73	1338.86
7	BHS 400 old seed lot	$C_1V_2L_3$	-	-	5.11	90.67(72.18)	87.00(68.84)	2429.83	1242.17
8	BHS 400 fresh seed lot	$C_1V_2L_4$	-	-	4.82	95.33(77.50)	91.67(73.19)	2736.06	1506.26
SEm±			0.05	0.05	0.01	0.40	0.47	11.10	8.35
CD (P=0.05)			0.17	0.18	0.03	1.17	1.37	32.59	24.53

Conclusion

This study showed that different seed priming treatments can significantly increase the seed quality of barley seed. Hydro-priming and thermo-priming had significantly increased the germination, vigour (I&II) and field emergence. Hydro priming for 6 hrs. is superior treatment among all the treatments for both varieties and seed lots. Fresh lots have shown significantly higher germination than old seed lot. Similar results were reported by Noorhosseini *et al.* (2017) in basil, Patel *et al.* (2017) in tomato, Adhkari *et al.* (2021) in bitter gourd, Barupal *et al.* (2022) in okra. High germination in primed seeds is due to metabolic repair which increased production of metabolites, including nucleic acids, required for germination during imbibition process thus strengthening the metabolic machinery of seed (Burgrass and Powell, 1984). Priming also amplifies the activities of anti-oxidative enzymes (Mcdonald, 1999, Wang et al., 2003).

Thermo-priming for 12 hrs. at 30**°C** was superior treatment among the all other treatments for both varieties and seed lots. Fresh seed lot of both the varieties have shown significantly superiority in all other parameters as compare to old lots. On the other hand, none of the pre-chilling treatments were significantly superior in comparison to control.

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Conflict of Interest

Authors declare that they have no conflict of interests.

Author's Contributions

Conceptualization of Research (KCD, RK, RK); Designing of the experiments (KCD, RK, RK); Contribution of experimental materials (KCD, RK, RK); Execution of lab/ lab experiments and data collection (KCD, RK, RK AT); Analysis of data and interpretation (KCD,RK,RK,AT); Preparation of manuscript (AT, RK, KCD, RK)

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