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Seed Priming and Priming Duration Influence on Growth and Yield of Wheat (*Triticum aestivum* L.) under Rainfed Condition of Hilly Uttarakhand

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Abstract

Insufficient stand establishment of winter wheat is a major problem in the rainfed region of the Uttarakhand hills. In order to increase germination and early establishment in the field under rainfed condition of hilly tracts this study was conducted at college of forestry VCSG University of Horticulture and Forestry, Ranichauri, Tehri Garhwal, Uttarakhand, India. The ten treatments were laid out in randomized block design with three replications in field. The treatments were VL 892 primed for 12 hrs with normal water, VL 892 primed for 24 hrs with normal water, VL 892 primed for 12 hrs with lemon water, VL 892 primed for 24 hrs with lemon water, VL 829 primed for 12 hrs with normal water, VL 829 primed for 24 hrs with normal water, VL 829 primed for 12 hrs with lemon water, VL 829 primed for 24 hrs with lemon water, VL 892 with no priming, and VL 829 with no priming. Significantly higher grain Yield of wheat was recorded in VL 829 primed with normal water for 24 hours which was statistically on par with VL 829 primed for 12 hrs with normal water, VL 892 primed for 24 hrs with normal water and VL 892 primed for 12 hrs with normal water. Significantly higher grain yield was recorded in case of priming with normal water than the priming with lime water.

Keywords: Wheat, priming, priming duration

1. Introduction

Wheat (*Triticum aestivum* L.) is important staple food for the 40% of world's populations (Peng et al., 2011). Wheat provides 21% of the food calories and 20% of the protein for more than 4.5 billion people in 94 countries (Braun et al., 2010). In India wheat is the second most important cereal crop after rice and plays a key role in food and nutritional security (Anonymous, 2015).

In Uttarakhand 39.97% area of wheat was under rainfed during 2015-16. The hill districts of Uttarakhand had 80% area of wheat under rainfed whereas in plains only 2.17% area of wheat under rainfed. The wheat productivity of hilly area (10.29 q ha^{-1}) was 3.4 times lower than the productivity of plains (35.13 q ha^{-1}) (Anonymous, 2017). Moisture stress is a major problem in lower productivity of wheat in Uttarakhand. Rapid germination is important for satisfactory stands whereas late germination may lead to a lower yield. Moisture stress can have drastic effects on wheat during various periods of plant development, particularly at germination. Low moisture content in the field after the harvest of finger

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millet in the hilly tracts adversely affects the germination of wheat seed and early establishment. Thus, screening of wheat varieties, that are more moisture stress tolerant, determining the higher rate of germination and emergence under rainfed are essential. In order to improve crop growth and yield under rainfed conditions seed soaking is a procedure that partially hydrates seed to initiate the germination process which are known to seed priming that leads to better germination rate, growth and seed yield (Eskridge et al., 2014). Therefore to find economically viable solution for the resource poor farmer of Uttarakhand hills, this experiment was conducted.

2. Materials and Methods

An experiment was conducted during *rabi,* 2016 at Crop Improvement Research Block and Seed Testing Laboratory at Department of Seed Science and Technology, V.C.S.G. Uttarakhand University of Horticulture and Forestry, College of Forestry, Ranichauri into determine the effect of seed priming and priming duration on growth and seed yield of wheat (*Triticum aestivum* L.). Ten treatments *viz.* T_1: VL 892 primed for 12 hrs with normal water, T_2: VL 892 primed for 24 hrs with normal water, T_3: VL 892 primed for 12 hrs with lemon water, T_4: VL 892 primed for 24 hrs with lemon water, T_5: VL 829 primed for 12 hrs with normal water,T_6: VL 829 primed for 24 hrs with normal water, T_7: VL 829 primed for 12 hrs with lemon water, T_8: VL 829 primed for 24 hrs with lemon water, T_9: VL 892 with no priming, and T_{10}: VL 829 with no priming were laid out in randomized complete block design with three replication in field. The crop was sown in lines 20 cm apart with plant to plant distance 7.5 cm on 17.11.2016 and harvested on 27.05.2017. The soil was silty clay loam of medium depth with acidic pH (5.4) having 0.76% organic carbon, 208 kg ha^{-1} available N, 16.24 kg ha^{-1} available P and 418 kg ha^{-1} available K. The climate of College of Forestry is humid and temperate type with chilled winter. The total precipitation during the crop season was recorded 349.8 mm in 25 rainy days during *rabi* 2016-17, whereas the maximum temperature varied between 2.6 to 28.8°C in *rabi* 2016-17 during cropping season. Similarly minimum temperature varied between -1.6to 16.3°C during *rabi* season of 2016-17. The crop was raised using standard package and practices recommended for the region. The crop was fertilized with NPK @ 100:60:40 kg ha^{-1} using Urea, DAP and MOP. Data on yield attributes and yield were recorded using standard procedure. The data was statistically analyzed using STPR-1 designed by Department of Mathematics and Statistics of GBPUA&T, Pantnagar.

3. Results and Discussion

3.1. Growth

The results showed that the highest field germination percent was recorded in VL 829 primed for 24 hrs with normal water followed by VL 892 primed for 24 hrs with normal water and VL 829 primed for 12 hrs with normal water and lowest germination percent were recorded in treatments without priming (Table 1). Similar result was found by Meena et al. (2013) in wheat and Moghanibashi et al. (2012) in sunflower. VL 829 gave higher germination percent than VL 892. The germination percent was higher in VL 829 as it recorded higher test weight (Table 2) than the VL 892. Ahirwar et al. (2012) also reported that large sized *Alangium lamarckii* seed gave maximum germination than medium sized grain. There was significant improvement in germination under primed treatments than non-primed treatments in field condition (Table 1). The significantly higher plant height and dry matter accumulation at 60 DAS was recorded in all primed treatments

Table1: Effect of priming and priming duration on growth and plant establishment of wheat

Sl. No.	Treat-ments	Germination (%) (20 DAS)	Plant Height (cm) (60 DAS)	Dry Matter accumulation (g)(60 DAS)	No.of leaves $plant^{-1}$ (60 DAS)	Stem diameter (mm) (60 DAS)	No of productive tillers (at harvest)	Plant population / meter row length (at harvest)
1.	T_1	90.33	14.67	1.40	5.83	4.40	5.00	32.33
2.	T_2	93.00	16.43	1.43	5.93	4.63	5.13	34.33
3.	T_3	87.00	14.13	1.36	5.77	4.17	4.83	30.33
4.	T_4	85.33	12.80	1.27	5.63	4.10	4.53	29.67
5.	T_5	90.67	15.03	1.40	5.87	4.60	5.07	34.00
6.	T_6	94.33	16.80	1.47	6.03	4.90	5.27	34.67
7.	T_7	88.33	14.23	1.37	5.80	4.33	4.87	32.67
8.	T_8	85.67	13.97	1.30	5.70	4.20	4.70	29.33
9.	T_9	76.33	9.66	1.00	4.87	4.13	3.20	21.00
10.	T_{10}	77.33	10.27	1.03	5.13	3.97	3.50	22.33
SEm±		5.17	1.27	0.94	0.40	0.33	0.33	1.94
CD (*p*=0.05)		15.36	3.79	0.27	NS	NS	0.99	5.76

Table 2: Effect of priming and priming duration on yield components and yield of wheat

Sl. No.	Treatments	Yield components					Yield			
		No of spike per meter row length	No of spikelet spike^{-1}	Filled grain spike^{-1}	Length of spike (cm)	Weight of 1000 grains (g)	Seed yield (q ha^{-1})	Straw yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest Index (%)
1.	T_1	31.33	58.47	53.80	10.43	31.65	19.90	24.08	43.98	45.17
2.	T_2	33.33	59.00	57.17	11.30	32.58	21.00	26.68	47.68	45.68
3.	T_3	30.33	54.93	54.26	10.03	31.09	15.57	19.41	34.98	44.51
4.	T_4	28.33	53.73	51.31	10.00	31.21	14.54	19.26	33.80	42.94
5.	T_5	33.00	55.40	51.76	11.30	37.64	21.00	25.28	46.30	45.27
6.	T_6	33.67	59.80	58.47	11.47	37.75	22.02	26.13	48.15	45.75
7.	T_7	30.67	54.60	54.16	10.13	37.18	17.63	21.73	39.35	44.86
8.	T_8	29.33	54.10	52.10	10.00	36.91	15.57	20.07	35.65	43.74
9.	T_9	20.00	47.86	43.03	9.70	30.39	13.42	15.26	28.68	42.01
10.	T_{10}	20.67	47.50	44.63	9.77	37.09	13.78	18.93	32.71	42.17
SEm±		1.85	2.38	3.05	0.77	1.66	0.98	1.43	2.28	2.60
CD (*p*=0.05)		5.51	7.08	9.06	NS	4.91	2.93	4.25	6.80	NS

except VL 892 and VL 829 with no priming. The effect of priming and priming duration on plant height and dry matter accumulation at 60 DAS were more on VL 829 than VL 892. Patra et al. (2016) also reported that 16 hours of hydropriming resulted highest number of wheat tiller than none primed.

3.2. Yield attributes and yield

All yield attributing characters except length of spike were improved in priming treatments than the non-priming treatments. The yield attributing characters i.e. number of spike per meter row length, number of spikelet per spike and filled grain per spike were recorded significantly higher in VL 829 primed for 24 hours with normal water than the non primed VL 892 and VL 829. The similar results were also reported by Meena et al. (2018) in wheat. All primed treatments recorded statistically at par number of spike per meter row length, number of spikelet per spike and filled grain per spike (Table 2). The test weight of VL 892 was recorded significantly higher than the VL 829. The test weight of VL 829 primed for 24 hours with normal water was recorded significantly higher than the VL 892.The priming for 24 hour with normal water gave higher yield than priming for 12 hours and was statistically on par. Mohamed et al., 2019 also reported that 24 hours priming duration is better than other duration in wheat. Ali and Sajed, 2009 also reported similar results in case of chickpea. Significantly higher grain yield of wheat recoded in VL 829 primed for 24 hrs with normal water which was statistically on par with VL 829 primed for 12 hrs with normal water, VL 892 primed for 24 hrs with normal water and VL 892 primed for 12 hrs with normal water. Significantly higher grain yield was recorded in case of priming with normal water than the priming with lime water. Hydropriming for 8 hours provided higher seed yield of faba bean was reported by Damalas et al. (2019).Similar results were also recorded in straw yield and biological yield of wheat. The harvest index was not affected by the priming treatments. Mehri et al. (2015) and Muzaffar et al., 2019 also reported seed priming by H_2O increased yield and yield components.

4. Conclusion

Seed priming with normal water for 24 hour in VL 829 increase germination, plant establishment, plant growth, yield of wheat under rainfed condition of Uttarakhand.

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