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Short Communication

Optimization of Hydro Priming Technique for Delinted and Fuzzy Seeds of Cotton

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Cotton known as "White gold" and "King of fibers" belongs to *Malvaceae* family and is native to tropical and subtropical region of world, including America, Africa, Egypt and India. It is an important commercial crop which is grown in about 70 countries and is considered to be an industrial commodity of worldwide importance. It is grown worldwide with a cultivation area of about 31.8 million hectares annually and production of over 24,963 million kg during the year 2017 and India commands highest share globally (36%) in terms of area under cultivation. In Haryana, it is cultivated in 6.39 lakh hectares with the production of 16.26 lakh bales of 170 kg with the productivity of 413 kg/ha [1]. Main reason for low productivity of cotton in India attributed to low germination percentage of seeds and incidence of insect pest and diseases or both ultimately cause significant loss in cotton seed yield. According to Indian Minimum Seed Certification Standards [2], the minimum germination requirement in cotton seeds is 65%. Due to inclement weather condition, fluctuations in minimum and maximum temperature and relatively higher humidity levels (more than 65%) there is deterioration in the quality and viability of seed. High humidity causes the attack of fungus on cotton seed leading in reduction in the viability of seed, loses the weight of seed and finally turns it to dead.

Deterioration of seeds during storage is an irreversible process which leads to various changes at different levels *viz.*, impairment or shift in metabolic activity, compositional changes, decline or change in enzyme activities, phenotypic, cytological changes apart from quantitative losses. Due to high moisture content and environmental weathering, ageing of seeds start right from physiological maturity. As seeds aged, they come to germinate more slowly than fresh seeds, respire slower and become more susceptible to diseases; chromosomal abnormalities and increased proportion of morphologically abnormal seedlings are produced. It is one of the most intriguing and challenging scientific problems of universal concern. Germination percentage and storability of seeds can be enhanced with different seed treatments like priming, hardening, humidification, growth regulators and dry heat treatments. The term priming often refers to a number of different approaches to seed improvement, all involving controlled seed hydration. Seed priming is controlled hydration of seeds to a level which allow pre-germinative metabolic activity to continue but interrupts radicle emergence. Hydro-priming is a special type of seed priming in which seeds are soaked in water and dried before sowing to accomplish seed hydration [3]. Soaking by submerging seeds in water can be performed with or without aeration [4]. In an earlier study, hydro priming for 24 h in wheat resulted in increased grain yield compared with sowing untreated seeds [5]. In a field experiment hydro-priming in maize increased the speed of seedling emergence and improved the field stand and plant growth [6]. In contrast, Pill and Necker [7] found that hydro-priming failed to improve germination in common Kentucky bluegrass seeds but Basra *et al.* [8] found that wheat seeds responded to different pre-sowing seed treatments with hydro-priming for 48 h showing the maximum invigoration followed by hydro-priming for 24 h. Change in seed water content, cell cycle regulation, modification of seed ultra structure, management of oxidative stress and reserve mobilization are the major physiological and biochemical changes takes places during seed priming [9]. Although, a lot of studies have been conducted on hydro-priming, reports on the benefits associated with hydro-priming techniques in cotton are missing and no comprehensive study has been made so far to find the most optimum technique for vigour enhancement in cotton. Hydro-priming technique is very

simple, economical and environmental friendly technique because simple water is used. Although priming is used since decades by the farmers but this technique is influenced by number of factors such as duration of priming, volume of water, temperature of priming environment, type of seeds and priming method etc. If these factors will not be favorable, this technique may adversely affect the seed quality. Hence, the present study was therefore, executed to optimize the hydro-priming treatments for enhancement of germination in delinted and fuzzy cotton seeds.

Present study was conducted on seeds of two *Desi* (HD 324 and HD 432) and two American cotton varieties (H1300 and H1098i). The acid delinted and fuzzy seed of these four varieties (Produced during in kharif 2018) was procured from Department of Genetics and Plant Breeding (Cotton Section) and the study was conducted in the laboratory of Department of Seed Science & Technology, CCS HAU and Hisar during 2019.

The seed (100g) of all four varieties was soaked in double volume of distilled water (200ml) for 4, 6, 8, 10 and 12h duration under ambient conditions (Temperature 32^{o}C and Relative Humidity 62%). The initial seed moisture contents of all varieties were estimated and the seeds were dried to same original moisture contents after hydration. The observations on germination were taken as per ISTA [10]. One hundred seeds of each variety in three replicates were placed in between sufficient moistened rolled towel papers (BP) and kept at 25^{o}C in seed germinator. The final count was taken on 12th day and only normal seedlings were considered for percent germination. Ten normal seedlings were selected randomly at the time of final count of standard germination for measurement of seedling lengths which was recorded in centimeters. The same ten seedlings after measurement of seedling length were kept into oven at 80°C for 24 hours and seedling dry weight was recorded in milligrams. Seedling vigour indices were calculated according to the method suggested by Abdul-Baki and Anderson [11]:

Seedling Vigour index–I = Standard Germination (%) X Average seedling length (cm)

Seedling Vigour index–II = Standard Germination (%) X Average seedling dry weight (mg)

The factorial experiment in completely randomized design (CRD) was conducted in three replications. The data recorded were analyzed as per standard method suggested by Panse and Sukhatme [12] and using the online statistical tool (OPSTAT).

The results revealed that enhancement in seed quality parameters was observed as the hydro-priming duration increased up to 10h, thereafter decrease in seed quality was recorded. Maximum germination (69.3%), seedling length (28.5cm), seedling dry weight (29.9 mg), seedling vigour index–I (1975) and seedling vigour index-II (2071) was observed after 10 h hydro-priming duration in both fuzzy as well as delinted seeds of all cotton varieties except H 1098i where enhancement in seed quality parameters was recorded even at 12 h priming, which might be due to soaking injury in seeds of other varieties. The seed quality of unprimed delinted seeds was found superior than unprimed fuzzy seeds. The inferior seed quality of fuzzy seeds may be due to presence of insect damaged or injured seeds. But maximum enhancement in germination was recorded in fuzzy seeds as compared to delinted seeds. The enhancement in seed quality of fuzzy seeds might be due to slow imbibitions due to presence of fuzz on the seed coat. Among the varieties, HD 432 showed superiority over the other varieties by registering maximum germination (69.1%), seedling length (29.0cm) and seedling vigour index–I (2004) in delinted seeds while maximum seedling dry weight (31.4mg) was recorded in fuzzy seeds and seedling vigour index-II (2087) was recorded in delinted in variety H 1098i, which might be due to difference in genetic makeup of these varieties. These findings support the earlier work; where improved germination rate and percentage were observed following after hydro-priming in wheat [7], maize [13] and gourd seeds [3]. The higher germination percentage in hydro-primed seeds might be the consequence of breakdown of dormancy as fresh seeds were used during the investigations. The earlier and synchronized germination might be attributed to increased metabolic activities in the hydro-primed seeds [3, 8]. Hydro-priming treatments not only improved the germination percentage but also enhanced the seedling vigour as indicated by more seedling length and seedling dry weights (Table 1). Enhanced replication in root tips has also been reported by hydro-priming [14]. Delayed and poor germination and emergence in seeds subjected to hydro-priming for 60 h is probably due over priming, as was reported by Lee and Kim [15, 16] for rice. Maximum enhancement in germination (from 55.7 to 69.3%) was recorded in fuzzy seeds of H 1098i variety which was 24.4% higher as compared to unprimed seeds while minimum enhancement (from 67.7 to 71.7%) i.e.

Table 1. Effect of hydro-priming on standard germination and seedling length of delinted and fuzzy seeds of cotton

Varieties	Duration of Hydration (h)													
	0	4	6	8	10	12	Mean	0	4	6	8	10	12	Mean
	Germination (%)							**Seedling vigour index- I**						
HD 324 (D)	65.7	66.7	68.0	70.7	72.7	70.3	69.0	1724	1783	1834	1942	2030	1919	1872
HD 324 (F)	59.0	60.0	61.3	63.3	66.7	65.7	62.7	1508	1566	1605	1700	1802	1775	1659
HD 432 (D)	67.7	67.7	68.0	69.3	71.7	70.0	69.1	1906	1912	1971	2036	2163	2036	2004
HD 432 (F)	60.0	60.7	62.3	64.0	66.3	65.7	63.2	1657	1689	1724	1792	1896	1865	1771
H1300 (D)	65.3	65.7	67.0	68.7	72.3	71.3	68.4	1826	1836	1885	1970	2106	2055	1946
H1300 (F)	58.7	59.0	60.7	62.3	67.3	67.0	62.5	1578	1609	1657	1723	1907	1889	1727
H1098i (D)	62.3	64.0	66.0	67.7	70.3	73.7	67.3	1633	1707	1775	1832	2003	2104	1842
H1098i (F)	55.7	57.0	61.0	64.0	67.3	69.3	62.4	1365	1471	1586	1687	1891	2049	1675
Mean	61.8	62.6	64.3	66.3	69.3	69.1		1650	1697	1755	1835	1975	1962	
CD (p=0.05)	4.58	4.95	3.60	NS	4.13	4.05		123.6	188.9	124.1	185.8	152.3	145.9	
	Seedling length (cm)							**Seedling vigour index- II**						
HD 324 (D)	26.2	26.7	27.0	27.5	27.9	27.3	27.1	1642	1703	1738	1814	1978	1965	1807
HD 324 (F)	25.5	26.1	26.2	26.9	27.1	27.0	26.5	1373	1476	1552	1617	1782	1726	1588
HD 432 (D)	28.2	28.2	29.0	29.5	30.2	29.1	29.0	1698	1785	1796	1852	2007	1915	1842
HD 432 (F)	27.6	27.7	27.7	28.1	28.6	28.4	28.0	1387	1480	1558	1701	1823	1823	1629
H1300 (D)	28.0	28.0	28.1	28.7	29.2	28.8	28.5	1843	1870	1981	2147	2307	2221	2062
H1300 (F)	26.9	27.2	27.3	27.6	28.3	28.2	27.6	1620	1653	1754	1869	2088	2115	1850
H1098i (D)	26.3	26.7	26.9	27.0	28.5	28.6	27.3	1946	2004	2074	2134	2354	2011	2087
H1098i (F)	24.6	25.8	26.0	26.4	28.0	29.5	26.7	1677	1745	1878	1982	2225	2270	1963
Mean	26.7	27.1	27.3	27.7	28.5	28.4		1648	1715	1791	1890	2071	2006	
CD (p=0.05)	1.23	1.17	0.89	1.00	NS	1.33		205.5	160.9	153.2	219.9	138.4	167.1	
	Seedling dry weight (mg)													
HD 324 (D)	25.0	25.5	25.6	25.7	27.2	27.9	26.2							
HD 324 (F)	23.3	24.6	25.3	25.6	26.8	26.3	25.3							
HD 432 (D)	25.1	26.3	26.4	26.8	28.0	27.4	26.7							
HD 432 (F)	23.1	24.3	25.1	26.6	27.5	27.7	25.7							
H1300 (D)	28.2	28.5	29.5	31.3	31.9	31.1	30.1							
H1300 (F)	27.6	28.0	28.9	30.0	31.0	31.6	29.5							
H1098i (D)	31.3	31.4	31.4	31.5	33.4	27.3	31.1							
H1098i (F)	30.1	30.6	30.8	31.0	33.1	32.7	31.4							
Mean	26.7	27.4	27.9	28.6	29.9	29.0								
CD (p=0.05)	2.38	1.6	1.76	1.12	1.36	1.47								

D= Delinted, F= Fuzzy

5.9% higher than control was recorded in delinted seeds of variety HD 432. This might be due to already more vigour potential of this variety and hence less opportunity to enhance germination. With this hydro-priming technique, germination was enhanced from 61.8 to 69.3% which was 12.1% higher than control. It is concluded from present study that seed hydro-priming is a cost effective vigour enhancement tool in cotton seeds and 10h priming duration in double quantity of water is optimum to enhance the seed quality parameters in both fuzzy and delinted seeds of cotton under ambient conditions (Temperature 32^{o}C and Relative Humidity 62%).

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