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EFFECT OF HYDROPRIMING ON FIELD ESTABLISHMENT OF SEEDLINGS OBTAINED FROM PRIMED SEEDS OF BORO RICE cv. BRRI dhan29

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Abstract

An experiment was conducted at the Seed Laboratory of the Department of Agronomy, Bangladesh Agricultural University, Mymensingh during the period from January to April 2012 to study the effect of hydropriming on field establishment of seedlings obtained from primed seeds of *Boro* rice cv. BRRI dhan29. Seeds were soaked in water for 0, 24, 30, 36, 42, 48, 54 and 60 hours. The incubation period was 30 hours at 35^0C temperature. Seed quality viz. percent germination, mean germination time, vigor index, shoot length, root length, shoot dry weight and root dry weight of rice seedlings were measured. Plant population m^{-2} was also recorded to understand the field establishment of primed seeds. It was observed that priming treatments had significant effect on germination and other growth parameters of rice seedlings. The highest germination, vigor index, population m^{-2}, length of shoot and root and their weights were found at 15 and 30 DAS. The lowest mean germination time was observed from hydropriming of seeds with 30 hours soaking. On the contrary, no priming treatment showed the lowest germination, vigor index, population m^{-2}, and the highest mean germination time. The study concludes that BRRI dhan29 rice seed could be primed for 30 hours as hydropriming improves germination and field establishment of rice seedlings of *Boro* rice cv. BRRI dhan29.

Key words: Rice, Hydropriming, Germination, Vigor, Seedling establishment.

Introduction

Rice (*Oryza sativa L.*) is the most important staple food for a large part of the world's human population, especially in Asia and the West Indies. It is the staple food and extensively cultivated cereal crop in Bangladesh. About 80% of the total cultivated lands in Bangladesh are used for rice cultivation and its total production is 31.98 million metric tons (BBS, 2011). About 92% of the world rice is produced and consumed in Asia (Maclean *et al.,* 2002). World rice demand is projected to increase by 25% from 2001 to 2025 (Maclean *et al.,* 2002). Bangladesh, China, India, Indonesia, Myanmar, the Philippines, Thailand and Vietnam are producing more than 90% of total Asian rice production (Food Out Look, 2007).

Moisture is the basic requirement for seed germination and essential for enzyme activity. Seedlings that germinate faster and grow rapidly are able to produce sufficient deep root system before the seed bed dries out and harden and these seedlings have enough competitive ability against weeds and seedling diseases. When seeds are sown, they have to absorb water from the soil which takes long time before they germinate. If this time could be reduced by soaking the seed before they are sown, germination happens more quickly resulting in healthier crop. Seeds sown at low moisture condition will not germinate unless sufficient moisture is available. At this situation seed priming can be a simple solution towards stand establishment (Harris *et al.,* 2002). Priming in the semi- arid tropics has been reported to increase emergence, more vigorous plants, better drought tolerance, earlier maturing and higher grain yield (Harris *et al*., 1999, 2000, 2002).

Seed priming techniques are being used in many parts of the world to reduce the germination time, to get synchronized germination, improve germination rate and better seedling establishment in many field crops viz. rice (Lee and Kim, 1999, 2000; Basra *et al.*, 2003, 2004; Farooq *et al*., 2004), wheat, maize (Dell Aquilla and Tritoo, 1990; Basra *et al.,* 2002). Hydropriming practically ensured rapid and uniform germination and it had high potential in improving field emergence and ensured early flowering and harvesting under stress condition, especially in dry areas (Singh, 1995 and Shivankar *et al.,* 2003). In many cases, synchronized germination and uniform seedling establishment of this crop is not possible due to insufficient soil moisture. As a result, yield of those crops reduced seriously and farmers fail to achieve their targeted yield.

So, priming is an effective tool for rapid and uniform seedling emergence. However, methods for priming of rice have not yet been developed in Bangladesh. Hence, the present study was undertaken to investigate the effects of seed priming on germination and seedling establishment of rice to select the best seed soaking time for improving seedling establishment of *Boro* rice under dry bed direct seeded (DBDS) system; and to see the effects of hydropriming on the establishment potential of seedlings.

Materials and Methods

The experiment was conducted at the seed testing laboratory of the Department of Agronomy, Bangladesh Agricultural University, Mymensingh during the period from January to April 2012. Seeds of BRRI dhan29 were used as the test material. Treatments of this experiment were 0, 24, 30, 36, 42, 48, 54 and 60 hours soaking followed by 30 hours incubation at 35^0C temperature. The experiment was laid out in a Completely Randomized Design with three replications. Seed quality parameters viz. germination percentage, mean germination time, vigor index, seedlings shoot and root length were measured at 15 and 30 days after days after sowing(DAS), seedlings shoot and root dry matter at 15 and 30 DAS and population m^{-2}. The daily record of germinated seed was taken 14 days from setting up of the test. The germination test was conducted at 25^oC temperature in germination room of Seed Laboratory. Daily count of germination of seed was taken on the basis on emergence from the media to calculate data on mean germination time and it was calculated as follows (Goodchild and Walker, 1971): Mean germination time (MGT) $=\frac{\sum tn}{\sum n}$ where, t= days to germination, n = number of seedlings germination on day t. Daily count of germination of seed was taken to calculate data on vigor index.

It was calculated by the following formula (Maguire, 1962), vigor index (VI) = $\frac{X_1}{N_1}+\frac{X_2}{N_2}+..................+\frac{Xn}{Nn}$ where, X_1 = number of seedlings at first count, N_1 = number of days at first count, X_2 = number of seedlings at second count, N_2 = number of days at second count, X_n = number of seedlings at final count, N_n = number of days at final count. Seedling shoot and root lengths were recorded at 15 and 30 DAS.Ten seedlings were carefully uprooted randomly all pots of each treatment with the help of *khurpi*, and their fresh shoot and root weights were recorded. Then their shoot and root dry weights were recorded after drying in an electric oven at 72^0C temperature for 48 hours and weighing with an electronic balance. For the measurement of population m^{-2}, seedlings were grown in plastic pots filled with BAU farm soil. Primed seeds were sown in pots in the dry bed direct seeded system (DBDS) system. In one square meter area there were 26 hills whereas three seeds were sown in each hill. Population m^{-2} was calculated accordingly with the germination percentage of rice seeds.

Results and Discussion

The hydropriming treatments had significant effect on germination percentage, mean germination time (days), vigor index, shoot length and root length of rice seedlings. The germination of seed for different treatments ranged between 81% and 95.67%. The highest germination percentage (95.67%) was found in 30 hours priming followed by 36, 42, 48, 24, 54 and 60 hours whereas the lowest germination percentage (81%) was observed in no priming (Table 1). This result is in agreement with that of Lee *et al.* (1998) and Basra *et al.* (2005). Under all conditions, the highest mean germination time was noted in no priming (9.473 days). However, the rest of the treatments resulted in lower mean germination time than no priming treatment and minimum mean germination time (8.1 days) was noted in seeds hydroprimed for 30 hrs and it was followed by 36 hours (Table 2). Similar results were also found by Harris *et al.* (2002) and Lee *et al.* (1998). The highest vigor index (11.21) was obtained from 30 hours followed by 36 hours priming. The lowest vigor index was obtained in no priming treatments (Table 2). These results were similar to those of Harris *et al*. (2000), Lee and Kim (2000) and Basra *et al*. (2003). The highest shoot length at 15 days after sowing (DAS) (18.32cm) and at 30 DAS (32.06 cm) was found with seeds primed for 30 hours followed by 48 hours and 36 hours and 36 hours and 48 hours, respectively. On the other hand, the lowest shoot length (16.71 cm) was found with seed primed for 54 hours (Table 2). Similar results were also found by Tongma *et al*. (2001) and Farooq *et al.* (2006). The highest root length at 15 DAS (6.48 cm) and at 30 DAS (12.47 cm) was obtained from seeds hydroprimed for 30 hours. The lowest root length at 15 DAS (4.71 cm) was recorded from 60 hours seed hydropriming and at 30 DAS (10.45 cm) was recorded from 36 hours hydropriming (Table 2). These results are similar to those of Harris *et al*. (2000), Lee and Kim (2000) and Basra *et al*. (2003).

Table 1: Effect of hydropriming on percent germination of BRRI dhan29

Hydro-priming (hrs)	Germination (%)												
	Days after setting for germination												
	3	4	5	6	7	8	9	10	11	12	13	14	15
0 (control)	0.333f	1.667 f	12.00 e	40.00c	50.33c	62.67b	72.67b	75.67b	77.00c	78.67b	80.67b	81.00b	81.00b
24	24.33e	49.67e	73.00cd	82.00ab	83.00ab	85.67a	87.67a	88.67a	90.33ab	90.67a	91.67a	91.67a	91.67 a
30	59.33a	82.33a	86.00a	88.33a	89.33a	90.33a	92.67a	93.00a	94.00a	94.67a	95.67a	95.67a	95.67a
36	46.33b	74.33b	83.67ab	86.00ab	87.67ab	89.00a	90.67a	91.33a	92.00ab	92.67a	93.67a	94.33a	94.33a
42	34.33d	51.67e	68.00d	74.00 b	77.67b	80.33a	85.67a	88.00a	89.67ab	91.33a	92.00a	93.33a	93.33a
48	40.33c	67.33c	84.33a	84.33ab	84.00ab	86.67a	88.00a	88.33a	88.67ab	89.00a	90.33a	91.67a	91.67a
54	42.33bc	67.00cd	77.33bc	82.67ab	85.67ab	87.67a	88.33a	90.00a	91.00ab	91.33a	91.67a	91.67a	91.67a
60	34.33d	61.33d	82.67ab	83.67ab	85.00ab	85.67a	87.00a	87.33a	88.00b	89.67a	90.00a	90.33a	91.00a
Level of sign.	**	**	**	**	**	**	**	**	**	**	**	**	*
CV(%)	7.49	5.71	4.98	8.77	6.73	6.30	4.93	4.38	3.31	3.27	3.34	3.86	4.77

The figures in a column having the same letter do not differ significantly whereas figures with dissimilar letter differ significantly as per DMRT.
** = Significant at 1% level of probability

Table 2: Effect of hydropriming on shoot length, root length, shoot weight, root weight, population m^{-2}, mean germination time, and vigor index of BRRI dhan29

Treatment	At 15 days				At 30 days				Population m^{-2} (no.)	Mean germination time (days)	Vigor index
	Shoot length (cm)	Root length (cm)	Root dry weight (g)	Shoot dry weight (g)	Shoot length (cm)	Root length (cm)	Shoot dry weight (g)	Root dry weight (g)			
0 hr (control)	17.97a	5.85 b	0.007	0.036	24.01d	11.69b	0.763d	0.390abc	63.18b	9.473a	6.203c
24hr	17.92a	5.220cd	0.010	0.039	26.98bcd	10.65d	0.907bcd	0.3667abc	71.50a	8.677abcd	9.613b
30hr	18.32a	6.480a	0.013	0.043	32.06a	12.47a	1.173a	0.4267a	74.62a	8.100d	11.21a
36hr	18.25a	5.573bc	0.009	0.033	30.08ab	10.45d	1.097ab	0.4067abc	73.58a	8.557bcd	10.42ab
42hr	17.88a	5.630bc	0.005	0.037	25.51cd	11.53b	0.857cd	0.4167ab	72.80a	9.027abc	9.180b
48hr	18.29a	4.95de	0.007	0.037	29.70ab	11.05c	1.017abc	0.4233ab	71.48a	8.923abc	9.653b
54hr	16.71b	5.79 b	0.009	0.035	29.05abc	10.62d	0.860cd	0.3633bc	71.50a	8.253cd	10.38ab
60hr	17.87a	4.710e	0.008	0.038	26.73bcd	10.71d	0.940bcd	0.3500c	70.98a	9.173ab	9.287b
Level of significance	**	**	NS	NS	**	**	**	**	**	**	**
CV(%)	2.57	4.62	-	-	6.80	1.48	11.44	6.25	4.50	4.72	7.15

The figures in a column having the same letter and no letter do not differ significantly whereas figures with dissimilar letter differ significantly as per DMRT.
NS= Not significantly different at $p \leq 0.05$
** = Significant at 1% level of probability

The shoot and root dry weights of rice seedlings did not differ significantly due to seed priming treatments. However, apparently, the highest shoot dry matter accumulation at 15 DAS (0.043g) and at 30 DAS (1.173g) per seedling was measured in 30 hours followed by 24 hours of hydro-priming. The lowest shoot dry matter accumulation at 15 DAS (0.033 g) and at 30 DAS (0.763 g) per seedling were found in 36 hours and no priming treatments, respectively (Table 2). Apparently, the highest root dry weight at 15 DAS (0.013) was found with seed primed for 30 hours and the lowest root dry weight at 15 DAS (0.005 g) was found with 42 hours seed priming. The highest root dry weight at 30 DAS (0.4267 g) was found with seed primed in 30 hours and the lowest root dry weight at 30 DAS (0.3500 g) value was found in 60 hours hydropriming (Table 2). Similar results were also found by Tongma *et al.* (2001) and Farooq *et al.* (2006).

Hydropriming treatments had significant effect on seedling population m^{-2}. The highest population m^{-2} of rice seedlings (74.62) was obtained in 30 hours priming whereas the lowest population m^{-2} of rice seedlings (63.18) was found with no priming treatments.

In conclusion, the *Boro* rice (cv. BRRI dhan29) seed could be hydroprimed for 30 hours followed by incubation at 35^0C temperature for 30 hours to enhance germination percentage and field establishment of seedlings.

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