

Performance of *Boro* rice cv. BRRI dhan28 as Influenced by Different Plant Establishment Methods and Weeding Regimes

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Abstract:

At present time food safety is a precedence issues in Bangladesh. It is essential to increase the production level of rice to address this mission. Suitable plant establishment method is necessary to get higher yield. Indifferent of the method of establishment, weeds are a prime barrier to rice production. Enormity of weed infestation, types of weed species and types of associated crop causes yield loss of rice. The study was undertaken to evaluate the yield performance of *Boro* rice cv. BRRI dhan28 under different plant establishment methods and weeding regimes. The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during December 2017 to June 2018. It was a two factor experiment that comprehended three plant establishment methods viz. sprouted seeds in line, sprouted seeds in broadcasting and transplanting of seedlings in line; five weeding regimes viz. no weeding, one hand weeding at 20 Day after planting (DAP), two hand weeding at 20 and 40 DAP, three hand weeding at 20, 40 and 60 DAP, and application of herbicide. The experiment was observed in a randomized complete block design with three replications. Yield contributing characters and yield of *Boro* rice were exerted significantly by plant establishment methods and the highest results were recorded in transplanting of seedlings in line method in which the number of total tiller hill⁻¹ (6.39), number of effective tiller hill⁻¹ (5.93), grains panicle⁻¹ (99.28), 1000 grain weight (24.16 g) and grain yield (4.19 t ha⁻¹). And the lowest results were found in sprouted seeds in broadcasting method. Considering weeding regimes, the highest number of total tillers hill⁻¹ (6.03), effective tillers hill⁻¹ (5.28), grains panicle⁻¹ (101.4), grain yield (4.12 t ha⁻¹) and straw yield (5.74 t ha⁻¹) were recorded with application of herbicide method. Contrariwise, no weeding showed the lowest values. In interaction effect, maximum grain yield (4.48 t ha⁻¹) was obtained in transplanting of seedlings in line method with application of herbicide and Sprouted seeds in broadcasting method with no weeding was performed the lowest grain yield (2.86 t ha⁻¹). In the overall results the growers can be recommended to cultivate *Boro* rice cv. BRRI dhan28 in transplanting of seedlings in line method with application of herbicide at different Agro-ecological zones of Bangladesh.

Key word: *Boro* rice; Plant establishment method; Weeding regime; Yield; BRRI dhan28

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I. Introduction

Rice (*Oryza sativa* L.) is the most important semi-aquatic annual grass plants under Gramineae family. About 135 million people of Bangladesh consume rice as their staple food. Bangladesh as an agro-based developing country is striving hard for its rapid development of economy. The economic development of this country is mainly depended on agriculture. The contribution of this sector in GDP is 14.32% (BBS, 2017). This sector plays significant impact on poverty alleviation, human resource development and food security. In Bangladesh, rice is main food crop and about 84.67% of cropped area is used for rice production with annual production of 34.42 million tons (BBS, 2017). However, the area and production of *Boro* rice in the country were 4.14 million hectares and 15.89 million tons gradually in 2016-2017 (BBS, 2017). For the last few years, the production in agricultural sector was startling and the most momentous role was played by rice. So, it is necessary to accept further steps to increase the production level of rice.

Transplanting is the most common and elaborative plant establishment technique in irrigated situation across Bangladesh. But in dry condition and deep water culture direct-seeded practice is widely used (Alim, 1982). Pre-germinated seedlings are used to transfer the wet field from seedbed. It requires less seed and enables the crop to be planted right time in the field as nurseries raised in advanced. It is an effective method to control weeds and other intercultural operations. The seedlings are shown at the time of transplanting are able to

compete with weeds that propagated. That's why weed infestation is generally much lower in transplanted rice compare to direct-seeded rice which increase crop yield. Mechanical power or manual labor is used to transplant rice seedling in the main field. It is troublesome and cost intensive practice because considerable amount of labor that is required to transplant (Islam *et al.*, 2016). However, compare to direct-seeded rice the growth duration of transplanted rice is somewhat longer because of the stress procured by transplantation. In *Boro* season, a large amount of seedlings are damaged due to dense fog and cold weather and the availability of seedlings become shortage. Farmers are now switching over to direct seedling method under puddle conditions as wet seeding reduces the amount of labor needed for growing rice crop. Wet seeding also helps to harvest earlier by 8-10 days than transplanted rice. It can eliminate the operations such as nursery bed preparation, care of seedling, pulling, transporting and transplanting to the main filed (Chandrapala, 2009 and Sreelatha, 2011). However, in direct-seeded rice crop weed infestation becomes higher which reduce yield. So, to get maximum yield by avoiding weed infestation appropriate plant establishment method should be selected.

In rice cultivation weed creates serious yield reduction problems. Weed infestation is an innate phenomenon in rice field. Improperly controlled weeds compete for soil nutrition with more rapidly in growth and cause reduction of yield and grain quality. A large number of noxious weed species are grown in rice field as the climatic condition of Bangladesh is favorable for weeds. Weed acts as a barrier for rice plants that compete for nutrients, space, water, air and light (Miah *et al.*, 1990). Each kilogram weed infestation reduce approximately 0.75 kg yield in rice crop. In rice production weeds are major biotic constraints (Yeasmin and Ye 2008) and weed management is a serious challenge for farmers and researcher as well (Anwer *et al.*, 2011). Weed management requires a large number of labors which increase the production cost. From the economic point of view lower cost of weeding is preferable. Choosing the suitable weeding regime depends on weed flora, weed dynamics, weed intensity, time of weeding and soil moisture. The cost of production of rice can be reduced by adopting of alternative methods of weed control which includes mechanical, biological and chemical weed control in combination with manual weeding. Herbicides and mechanical weeding are the alternative to hand weeding. However, herbicides are getting popularity at present time because it saves labor and regarded as cost effective. In controlling weeds numerous pre-emergence herbicides are used together with hand weeding (Ahmed *et al.*, 2003). So, the selection of the effective weeding regime plays an important role to get higher yield by reducing the weed infestation.

Choosing a suitable plant establishment method and weed management practice is an imperative for rice production in a sustainable way. Hence, the present study was undertaken to find out the yield performance of *Boro* rice cv. BRRI dhan28 under different plant establishment methods and weeding regimes.

II. Materials and Methods

The experiment was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period in December 2017 to June 2018. The experiment consisted three plant establishment method *viz* Sprouted seeds in line, Sprouted seeds in broadcast, Transplanting of seedlings in line; five weeding regimes *viz*. no weeding, one hand weeding at 20 DAP, two hand weeding at 20 and 40 DAP, three hand weeding at 20, 40 and 60 DAP, and application of herbicide (Sathi 10WP @ 185 g ha⁻¹). The experiment was placed in a randomized complete block design (RCBD) with three replications. Thus total numbers of unit plot was 45. The space between blocks and between unit plots was 1.0 m and 0.75 m. The size of the unit plot was 10m² (4.0 x 2.5 m). Seeds of BRRI dhan28 were collected in the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh. After soaking in water for 48 hours the sprouted seeds were sown in 30 plots for direct seeding, 15 plots of them were placed with sprouted seeds in line and 15 plots of them were sprouted seeds in broadcast. Sprouted seeds were sown in 25 cm individual lines successively and for the broadcast, sprouted seeds were randomly broadcasted on 12 December 2017. For transplanting of seedlings in line method, seedlings were raised on nursery bed. Sprouted seeds were broadcasted on prepared nursery bed on 12 December 2017. Fourteen five days old seedlings were then transplanted on 27 January 2018 with 25 cm x 15 cm spacing at two seedlings per hill⁻¹. Weeding was done as per experimental treatments. In case of no weeding treatment, weeds were allowed to grow in the plots in sowing to harvesting of the crop. Others intercultural operations were done for ensuring and maintaining the normal growth of the crop. Harvesting was done when 90% of grains turned yellow. The plants in one square meter area in the centre of the plot were harvested at ground level. The direct seeded plots were mature earlier than the transplanted plots. The direct seeded mature plots were harvested on 25 May, 2018. And the transplanted plots were harvest on 5 June, 2018. The crop was then separately threshed, grain and straws were sun dried thoroughly and weights were recorded. Prior to the harvest, five hills were randomly selected in each unit plot to collect data on yield components. While it was completed to collect the data then the grains and straws in five sampling hill were added to the total grain and straw yield. All the recorded data were compiled

and tabulated for statistical analysis. The mean differences of the treatments were analyzed by the Duncan's Multiple Range Test (Gomez and Gomez, 1984).

III. Results and Discussion

Effect of plant establishment method:

Plant establishment methods affected significantly to yield contributing characters and yield of *Boro* rice cv. BRRI dhan28 (Table 1). Tallest plant (85.26 cm) was obtained in transplanting of seedling in line method and shortest plant (76.62 cm) was recorded in sprouted seeds in broadcasting method. Maximum spacing and more availability of nutrients ensure highest growth in transplanted rice crop. Chandrapala (2009) and Mahapatra *et al.* (1985) found the similar results. The highest number of total tiller hill⁻¹ (6.39) was obtained in transplanting of seedlings in line method and the lowest tiller hill⁻¹ (4.58) was found in sprouted seeds in broadcasting method. Biswas and Salokhe (2005) reported similar results. The highest number of effective tillers hill⁻¹ (5.93) was found in transplanting of seedlings in line method and lowest number of effective tillers hill⁻¹ (3.74) was found with sprouted seeds in broadcasting method. It may be the fact that transplanting method provides enough nutrients, lights and air which helped in producing maximum effective tillers hill⁻¹. The findings of Mridha *et al.* (1991) were same. Highest number of non-effective tillers hill⁻¹ (0.85) was found in sprouted seeds in broadcasting method and lowest number of non-effective tillers hill⁻¹ (0.46) was found in transplanting of seedlings in line method. Akbar (2004) found the highest number of non-effective tillers hill⁻¹ in direct seeded method in rice. Numerically the longest panicle (21.62 cm) was obtained in transplanting of seedlings in line method and shortest panicle (21.20 cm) was obtained in sprouted seeds in broadcasting method. Goel and Verma (2000) found longest panicle length in the transplanting. Transplanting of seedling in line method showed highest number of grains panicle⁻¹ (99.28) and lowest grains panicle⁻¹ (96.97) was in sprouted seeds in broadcasting method. Reddy and Ghosh (1987) were reported the same observations who stated that transplanting method produced highest number of grains panicle⁻¹. Transplanting of seedling in line method showed lowest number of sterile spikelet panicle⁻¹ (11.65) and the highest (11.78) was in sprouted seeds in broadcasting method. Ang *et al.* (2002) reported similar result. The highest weight of 1000 grain (24.16 g) was observed in transplanting of seedlings in line method and the lowest weight of 1000-grain (23.23 g) was observed in sprouted seeds in broadcast method. Xiang *et al.* (1999) found higher 1000-grains weight in transplanting seedlings than sprouted seeds. It was found that the highest grain yield (4.19 t ha⁻¹) and straw yield (6.19 t ha⁻¹) were obtained in transplanting of seedling in line method and the lowest grain yield (3.33 t ha⁻¹) and straw yield (4.15 t ha⁻¹) were obtained in sprouted seeds in broadcasting method. Roy *et al.* (1990) and Chowdhury *et al.* (1993) reported same observations and stated that yield depends on some contributing characters. Highest harvest index (44.51 %) was produced by sprouted seeds in broadcasting method and lowest harvest index (40.36%) was found in transplanting of seedlings in line method. Sarkar *et al.* (2003) reported highest harvest index in direct seeded crops than the nursery seedlings.

Effect of weeding:

Yield components and yield of *Boro* rice cv. BRRI dhan28 were significantly affected by weeding regimes (Table 2). The tallest plant (81.77 cm) was obtained in application of herbicide and the shortest plant height (79.33 cm) was obtained in no weeding. The highest number of total tillers hill⁻¹ (6.03) was obtained in application of herbicide and no weeding showed the lowest number of total tillers hill⁻¹ (4.38). Competition between rice plants and weeds for nutrients and water was lowest in case of application of herbicide compared to no weeding. It may be the fact that favored rice plants to produce more tillers reported by Walia *et al.* (2009). The highest number of effective tillers hill⁻¹ (5.28) was obtained in application of herbicide and the lowest number of effective tillers hill⁻¹ (3.83) was recorded in no weeding. Lowest competition between rice plants and weeds in case of herbicide application might have resulted in highest number of effective tillers hill⁻¹. Smith (1981) was supported this results. The highest number of non-effective tillers hill⁻¹ (0.76) was obtained in no weeding and the lowest number of non-effective tillers hill⁻¹ (0.55) was obtained in application of herbicide. Similar observations were also made by Singh and Ghosh (2007). Lowest number of non-effective tillers hill⁻¹ found where there were highest weed competition. The longest panicle (21.80 cm) was obtained in application of herbicide. The shortest panicle (21.14 cm) was obtained in no weeding. These results are in conformity with the findings of Sharma *et al.*, (1994). The highest number of grains panicle⁻¹ (101.4) was recorded in application of herbicide and the lowest number of grains panicle⁻¹ (90.84) was showed by no weeding. Less competition among rice plants and weeds might have encouraged the distribution of assimilates towards grains resulting in highest number of grains panicle⁻¹. This observation was similar to Mukhupadhyay and Ghosh (1981). The highest number of sterile spikelets panicle⁻¹ (13.45) was obtained in no weeding and the lowest number of sterile spikelets panicle⁻¹ (11.15) was obtained in application of herbicide. The highest number of sterile spikelets in no weeding might be due to severe competition between weeds and rice plants. Sreelatha (2011) reported that less weed competition resulted in lowest sterility in rice. The highest weight of 1000-grain (23.69 g) was obtained in

application of herbicide and the lowest weight of 1000-grain (23.51 g) was obtained in no weeding. The results are in conformity with the findings of Rekha *et al.* (2002) and Shan *et al.* (2012). The highest grain yield (4.12 t ha⁻¹) and straw yield (5.76 t ha⁻¹) were found in application of herbicide method. On the contrary the lowest grain yield (3.42 t ha⁻¹) and straw yield (4.51 t ha⁻¹) were obtained in no weeding. Grain yield increases due to the contribution of number of effective tillers, number of spikelet's panicle⁻¹ and individual grain weight. And Straw yield decreased with the increase in weed infestation. Bhat *et al.* (2011) reported similar results. The highest harvest index (43.12%) was obtained in no weeding and the lowest harvest index (42.06%) was found in application of herbicide.

Table 1. Effect of plant establishment method on yield contributing characters and yield of Boro rice (cv. BRRI dhan28)

Plant establishment method	Plant height (cm)	Number of total tiller hill ⁻¹	Number of effective tiller hill ⁻¹	Number of non-effective tiller hill ⁻¹	Panicle length (cm)	Number of grains panicle ⁻¹	Number of sterile spikelet panicle ⁻¹	1000 grain weight (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Biological yield (t ha ⁻¹)	Harvest index (%)
M ₁	80.08 _b	5.20 _b	4.48 _b	0.73 _b	21.20	98.03	11.66	23.51 _b	3.95 _b	5.31 _b	9.26 _b	42.65 _b
M ₂	76.62 _c	4.58 _c	3.74 _c	0.85 _a	21.58	96.97	11.78	23.23 _c	3.33 _c	4.15 _c	7.48 _c	44.51 _a
M ₃	85.26 _a	6.39 _a	5.93 _a	0.46 _c	21.62	99.28	11.65	24.16 _a	4.19 _a	6.19 _a	10.38 _a	40.36 _c
LSD _(0.05)	1.81	0.29	0.25	0.21	0.37	3.64	0.97	0.26	0.12	0.12	0.21	0.81
SX [—]	0.62	0.10	0.08	0.07	0.13	1.25	0.33	0.08	0.04	0.04	0.07	0.28
Level of Significance	**	**	**	**	NS	NS	NS	**	**	**	**	**
CV (%)	3.01	7.41	7.18	42.34	2.36	4.97	11.15	1.47	4.49	3.32	3.14	2.55

In a column, figures having dissimilar letter (s) differ significantly as per DMRT

**=Significant at 1% level of probability,

NS=Not significant

LSD = Least Significant Difference

Where,

M₁= Sprouted seeds in line, M₂= Sprouted seeds in broadcasting,

M₃= Transplanting of seedlings in line

Table 2. Effect of weeding regimes on yield contributing characters and yield of Boro rice (cv. BRRI dhan28)

Weeding Regimes	Plant height (cm)	Number of total tiller hill ⁻¹	Number of effective tiller hill ⁻¹	Number of non-effective tiller hill ⁻¹	Panicle length (cm)	Number of grains panicle ⁻¹	Number of sterile spikelet panicle ⁻¹	1000 grain weight (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Biological yield (t ha ⁻¹)	Harvest index (%)
W ₀	79.33	4.38 _c	3.83 _c	0.76	21.14 _{ab}	90.84 _b	13.45 _a	23.51	3.42 _c	4.51 _d	7.93 _d	43.12 _a
W ₁	79.96	5.27 _b	4.65 _b	0.73	21.27 _b	98.85 _a	10.92 _b	23.63	3.69 _b	4.99 _c	8.68 _c	42.51 _b
W ₂	80.99	5.45 _b	4.75 _b	0.70	21.40 _b	99.64 _a	11.58 _b	23.66	3.82 _b	5.18 _b	9.00 _b	42.44 _b
W ₃	81.23	5.85 _a	5.09 _a	0.61	21.39 _a	99.76 _a	11.39 _b	23.68	4.06 _a	5.66 _a	9.72 _a	41.76 _c
W ₄	81.77	6.03 _a	5.28 _a	0.55	21.80 _{ab}	101.4 _a	11.15 _b	23.69	4.12 _a	5.74 _a	9.86 _a	41.78 _c

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LSD _(0.05)	2.34	0.38	0.32	0.27	0.48	4.71	1.26	0.33	0.16	0.16	0.27	1.04	
SX	—	0.80	0.13	0.11	0.095	0.16	1.62	0.43	0.11	0.05	0.05	0.09	0.36
Level of Significance	NS	**	**	NS	*	**	**	NS	**	**	**	NS	
CV (%)	3.01	7.41	7.18	42.34	2.36	4.97	11.15	1.47	4.49	3.32	3.14	2.55	

In a column, figures having dissimilar letter (s) differ significantly as per DMRT

**=Significant at 1% level of probability

NS=Not significant

LSD = Least Significant Difference

DAP = Day after planting

Where,

W₀= No weeding

W₁= One hand weeding at 20 DAP

W₂= Two hand weeding at 20 and 40 DAP

W₃= Three hand weeding at 20, 40 and 60 DAP

W₄= Application of herbicide (Sathi 10WP @ 185 g ha⁻¹)

Interaction effect between plant establishment method and weeding regimes:

The interaction effect of plant establishment method and weeding exposed significant influence on yield components and yield of *Boro* rice cv. BRRI dhan28 (Table 3). Transplanting of seedling in line method with application of herbicide produced the tallest plant (87.20 cm) and the shortest plant (72.33cm) was obtained in sprouted seeds in broadcasting method with no weeding. Lowest crop- weed competition ensures favorable environment for crop growth. The results are in accordance with the findings of Ahmed *et al.* (2012). The highest number of total tillers hill⁻¹ (7.70) was enumerated in transplanting of seedling in line method with application of herbicide. Elsewhere the lowest number of total tillers hill⁻¹ (3.70) was found in sprouted seeds in broadcasting method with no weeding. Similar observation was reported by Subramanian *et al.* (2006). The highest number of effective tillers hill⁻¹ (7.70) was listed in transplanting of seedling in line method with application of herbicide. Besides the lowest number of effective tillers hill⁻¹ (3.27) was found in sprouted seeds in broadcasting method with no weeding. Hugar *et al.* (2009) and Sinha and Talati (2006) also opined similarly. It was found that the highest non-effective tillers hill⁻¹ (1.13) was obtained in sprouted seeds in broadcasting method with no weeding and the lowest number of non effective tillers hill⁻¹ (0.26) was obtained in transplanting of seedling in line method with application of herbicide. The longest panicle (22.31cm) was obtained in transplanting of seedlings in line method with application of herbicide. The shortest panicle (20.74 cm) was obtained in sprouted seeds in line method with no weeding. Paul (1999) found the longest panicle in transplanted of seedlings with weed management practice compared to the clonally propagated tillers. It was observed that numerically the highest number of grains panicle⁻¹ (105.5) was computed in transplanting of seedlings in line method with application of herbicide and sprouted of seeds in line method with no weeding showed the lowest number of grains panicle⁻¹ (94.15). Dwivedi *et al.* (1996) found highest total grains panicle⁻¹ in transplanting of seedling in weed controlled condition. Xiang *et al.* (1999) found the similar result. The highest number of sterile spikelet panicle⁻¹ (13.73) was obtained in sprouted seeds in line method with no weeding and the lowest number of sterile spikelet panicle⁻¹ (10.03) was obtained in transplanting of seedlings in line method with application of herbicide. Nagalakshmi 2002 recorded lowest sterile spikelet in transplanted seedlings in weed maintained condition. The highest weight of 1000-grain was observed (24.54 g) in transplanting of seedlings in line method with application of herbicide and the lowest 1000-grain weight (22.66g) was obtained in sprouted of seeds in broadcasting method with no weeding. Rahman (1992) found highest 1000-grains weight in the combination of transplanted of seedling and controlled weed practice. The highest grain yield (4.48 t ha⁻¹) and straw yield (6.84t ha⁻¹) were counted in transplanting of seedlings in line method with application of herbicide. As opposed to the lowest grain yield (2.86 t ha⁻¹) was counted in sprouted seeds in line method with no weeding. Ang *et al.* (2002) reported that the grain yield of the line transplanted of seedling in rice with weeding increased compared to others conventional methods. Chandrapala (2009) also reported similar results. The highest harvest index (47.20 %) was obtained in sprouted of seeds in line with application of herbicide and the lowest harvest index (39.34%) was obtained in transplanting of seedlings in line method with three hand weeding. Sreenivas (1992) also reported similar observations.

Table 3: Interaction effect of plant establishment method and weeding regimes on yield contributing characters and yield of *Boro rice* (cv. BRRI dhan28)

Interaction (Method × Weeding)	Plant height (cm)	Number of total tiller hill ⁻¹	Number of effective tiller hill ⁻¹	Number of non-effective tiller hill ⁻¹	Panicle length (cm)	Number of grains panicle ⁻¹	Number of sterile spikelet panicle ⁻¹	1000 grain weight (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	Biological yield (t ha ⁻¹)	Harvest index (%)
M ₁ W ₀	73.0f	4.30fg	3.34g	1.10a	20.74	94.15	13.73	23.40cde	2.86d	4.08hi	6.94h	41.21cd
M ₁ W ₁	81.00cd	4.43ef	3.50fg	1.00ab	21.04	97.35	11.39	23.40cde	2.95d	3.97i	6.92gh	42.63cd
M ₁ W ₂	81.80bcd	4.67def	3.80fg	0.80abcd	21.31	97.23	12.03	23.44cde	3.32c	4.06hi	7.38gh	44.98ab
M ₁ W ₃	82.00bcd	4.73def	4.08ef	0.66abcd	21.24	97.02	11.72	23.58bcd	3.54c	4.34gh	7.88f	44.92ab
M ₁ W ₄	83.27abc	4.80def	4.00ef	0.66abcd	21.65	99.11	10.34	23.73cde	3.98b	4.46g	8.44e	47.15a
M ₂ W ₀	72.33f	3.70g	3.27g	1.13a	21.44	89.63	12.66	22.66f	3.37c	3.90i	7.27fg	46.35ab
M ₂ W ₁	74.96ef	4.89cdef	4.43de	0.83abc	21.47	97.67	11.53	22.92ef	3.98b	4.93f	8.91d	44.66ab
M ₂ W ₂	78.08de	5.27cd	4.57de	0.70abcd	21.48	99.72	11.79	23.32de	4.07b	5.48e	9.55d	42.61cd
M ₂ W ₃	78.47de	5.60c	4.77d	0.47bcd	21.62	101.6	11.30	23.60bcd	4.10b	5.81d	9.91c	41.37cd
M ₂ W ₄	78.60de	6.53b	5.40c	0.43cd	21.86	101.6	11.04	23.63bcd	4.19ab	6.26bc	10.45bc	40.09de
M ₃ W ₀	83.61abc	5.14cde	4.71d	0.71abcd	21.02	88.74	13.96	23.98abcd	4.02b	5.46e	9.48d	42.40cd
M ₃ W ₁	84.74abc	6.29b	5.83bc	0.50bcd	21.13	97.75	11.90	24.00abc	4.05b	5.98cd	10.03c	40.37de
M ₃ W ₂	85.07abc	6.33b	5.88bc	0.43cd	21.20	100.5	10.91	24.05abc	4.15ab	6.17c	10.32bc	40.21de
M ₃ W ₃	85.71ab	6.47b	6.20b	0.41cd	21.44	103.9	11.15	24.20ab	4.30ab	6.50b	10.80b	39.81e
M ₃ W ₄	87.20a	7.70a	7.70a	0.26d	22.31	105.5	10.03	24.54a	4.48a	6.84a	10.96a	40.87de
LSD _(0.05)	4.05	0.66	0.56	0.47	0.84	8.15	2.18	0.58	0.28	0.28	0.47	1.81
SX [—]	1.40	0.23	0.19	0.16	0.29	2.81	0.75	0.20	0.09	0.10	0.16	0.62
Level of Significance	**	**	**	*	NS	NS	NS	**	**	**	**	**
CV (%)	3.01	7.41	7.18	42.34	2.36	4.97	11.15	1.47	4.49	3.32	3.14	2.55

In a column, figures having dissimilar letter (s) differ significantly as per DMRT

**=Significant at 1% level of probability

LSD =Least Significant Difference

NS = Not significant

DAP = Day after planting

Where,

M₁= Sprouted seeds in line, M₂= Sprouted seeds in broadcasting

M₃= Transplanting of seedlings in line

W₀= No weeding, W₁= One hand weeding at 20 DAP

W₂= Two hand weeding at 20 and 40 DAP

W₃= Three hand weeding at 20, 40 and 60 DAP

W₄= Application of herbicide (Sathi 10WP @ 185 g ha⁻¹)

IV. Conclusions

Results of the experiment concluded that the best performance was showed in transplanting of seedlings in line method with application of herbicide among the others for cultivation of *Boro rice cv. BRRI dhan28*. It was recorded the highest grain yield. Therefore, our results suggest that BRRI dhan28 in transplanting of seedlings in line method with application of herbicide may be recommended to get higher yield.

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