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EFFECTS OF DETILLERING AND ROW SPACING ON GROWTH AND YIELD ATTRIBUTES OF BRRI dhan28

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ABSTRACT

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from 25 November 2005 to 13 April 2006 to study the effect of detillering and row spacing on growth, yield and yield attributes of BRRI dhan28. The experiment consisted of four detillering treatments viz., 6 tillers kept hill^{-1} (T_1), 9 tillers kept hill^{-1} (T_2), 12 tillers kept hill^{-1} (T_3) and intact hills (T_4) and four row spacing were 25 cm x 15 cm (S_1), 20 cm x 15 cm (S_2), 15 cm x 15 cm (S_3) and 10 cm x 15 cm (S_4). The experiment was laid out in a randomized complete block design with three replications. The effect of detillering was found to be significant in all the characters under study except 1000-grain weight. The plant height, panicle length, number of grains panicle', grain yield and straw yield were observed statistically significant and also found identical both in the case of 9 and 12 tillers kept hill^{-1}. The maximum number of effective tillers (10.04) was found in 12 tillers kept hill^{-1} than that of other treatments. The spacing 20 cm x 15 cm showed better performance in general, although most the parameters were statistically similar with that of spacing 25 cm x 15 cm. The highest grain yield of 5.04 t ha^{-1} was recorded in case of 20 cm x 15 cm spacing. Interaction effects between detillering and row spacing were significant for most of the growth characters and yield components under study except 1000-grain weight. The treatments 9 tillers kept hill spaced with 20 cm x 15 cm and 12 tillers kept hill^{-1} with the same spacing were found to be significantly superior in the case of number of grains panicle', grain yield and straw yield, although they were found identical with some other interaction treatments under the same parameters. The detillering with retaining of 9 tillers hill^{-1} at 20 cm x 15 cm spacing was the best possible combination for achieving optimum grain yield of BRRI dhan28.

Key words: Detillering, spacing, BRRI dhan28.

Introduction

The rapid population growth is continuously diminishing the productive rice areas from the existing 10.27 million hectares (BBS, 1997). Moreover, Bangladesh is in continual annual shortage of about 1.5 million tons of food grains (Karim, 1999), and this shortage will be severe if the present level of population growth continues. Recent projection shows that rice demand in Bangladesh will reach over 40 million tons in 2020. Rice yield may be influenced by such factors as row and plant spacing and number of tillers hill^{-1}. Improper spacing and tillers hill^{-1} may affect the physiological activities of rice plant and account for yield reduction to a great extent. Row spacing and number of tillers hill^{-1}are the key factors that determine the availability of sunlight, nutrient, water and the rate of photosynthesis and ultimately the yield. To enhance this physiological process of growth tiller separation is sometimes practiced in Bangladesh (Hossain *et al.*, 1988), especially in post flood situation. So, it is important to know the performance of BRRI dhan28 as a boro rice as affected by detillering from which information about optimum number of tillers hill^{-1} can be determined for having better growth and development of mother plant. On the other hand, distance between row to row is also an important factor that needs to be considered during cultivation of BRRI dhan28 as a boro rice crop. In case of closer spacing, more competition arises among the plants for nutrient, air and light as a result plants become weaker and thinner and reduction of yield occurs. In wider row spacing, farmers may not get desired number of hills which also ultimately may reduce yield per unit area. Thus proper row spacing ensures optimum plant population which allows the plants to grow properly after even detillering both in their aerial and underground parts resulting in efficient utilization of solar radiation and nutrients (Miah *et al.*,1990). That is why, it may be important to know the effect of row spacing and the number of tillers hill^{-1} on the growth and yield of BRRI dhan28 after detillering from the mother plant. The

present study was, therefore, under taken with the objectives: i) to find out the effect of detillering on growth, yield and yield attributes of BRRI dhan28, ii) to find out the effect of row spacing on BRRI dhan28 and iii) to find out interaction between detillering and row spacing on the growth, yield and yield attributes of BRRI dhan28.

Materials and Methods

The experiment was conducted at the Agronomy field laboratory, Bangladesh Agricultural University, Mymensingh during the period from 25 November 2005 to 13 April 2006 to study the effect of detillering and row spacing on growth and yield attributes of BRRI dhan 28. The experiment consisted of four detillering treatments viz., 6 tillers kept hill (T_1), 9 tillers kept hill^{-1}(T_2), 12 tillers kept hill^{-1}(T_3), intact hills (T_4) and four row spacings were 25 cm x 15 cm (S_1), 20 cm x 15 cm (S_2), 15 cm x 15 cm ($_{S3)}$ and 10 cm x 15 cm (S_4). The experiment was laid out in a randomized complete block design with three replications. The size of unit plot was 5m² (2.5 m x 2.0 m). The land was fertilized with 90 kg, 70 kg, 50 kg, 25 kg and 6 kg ha^{-1} of N, P_2 O_5, $K_2$0, S and Zn in the form of urea, triple super phosphate, muriate of potash, gypsum and zinc sulphate respectively. The entire amount of triple super phosphate, muriate of potash, gypsum and zinc sulphate was applied as basal dose. One-third of urea was top dressed at 15 DAT. The rest of urea was top dressed in two equal splits at 30 DAT and at the panicle initiation stage (50 DAT). Forty day old seedlings were transplanted on 7 January 2006 with 3 seedlings hill where spacings were maintained as per experimental specification. The first detillering was practiced on 7 February 2006 at 30 DAT. The mother plants were detillered at 2-3 days intervals and this practice was performed upto 7 days before panicle initiation. Tillers were separated out keeping 6, 9, 12 tillers hill^{-1} on according to experimental specification and tillers were not separated out from intact hills. Intercultural operations were done as and when necessary. Five hills (excluding border hills) were randomly selected and uprooted from each unit plot prior to harvest for collecting data on different crop characters after sampling. The rest of crops were harvested at maturity when 90% of the spikelets become golden yellow in colour on 13 April 2006. The grain and straw yields were recorded from the harvesting materials of the whole plot. Data were analyzed statistically using "Analysis of Variance" (ANOVA) technique and the differences among treatments were adjudged by Duncan's New Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

Results and Discussion

Effect of detllering

Effects of detillering on the growth and yield attributes of boro rice (cv. BRRI dhan28) have been presented and discussed in this section. The results have been presented through Table 1 and Figs. 1-2. The analysis of variance for crop characters studied is also illustrated. Effect of detillering on growth and most of the yield attributes on BRRI dhan28 were significant except 1000-grain weight (Table 1).

Table 1. Effect of detillering on growth and yield attributes of BRRI dhan28

Detillering (Factor A)	Plant height (cm)	Effective tillers hill^{-1} (no.)	Panicle length (cm)	Grains panical^{-1} (no.)	1000-grain weight (g)
T_1 (6 tillers kept hill-1)	86.71b	5.30d	21.94a	122.9a	23.87
T_2 (9 tillers kept hill-1)	87.39ab	7.26b	22.37a	121.9a	23.64
T_3 (12 tillers kept hill-1)	89.12a	10.04a	21.60a	120.0a	23.46
T_4 (Intact hills)	89.39a	6.11c	20.27b	110.7b	23.10
Level of significance	**	**	**	**	NS
S $\overline{X}$	0.5205	0.12	0.2658	1.304	.3333
CV (%)	3.04	5.79	4.20	3.80	4.72

In a column, the means having similar letter (s) or without letter (s) do not differ significantly and those having dissimilar letter (s) differ significantly as per DMRT, S $\overline{X}$ = Standard error of means
** = Significant at 1% level of probability, NS = Not significant.

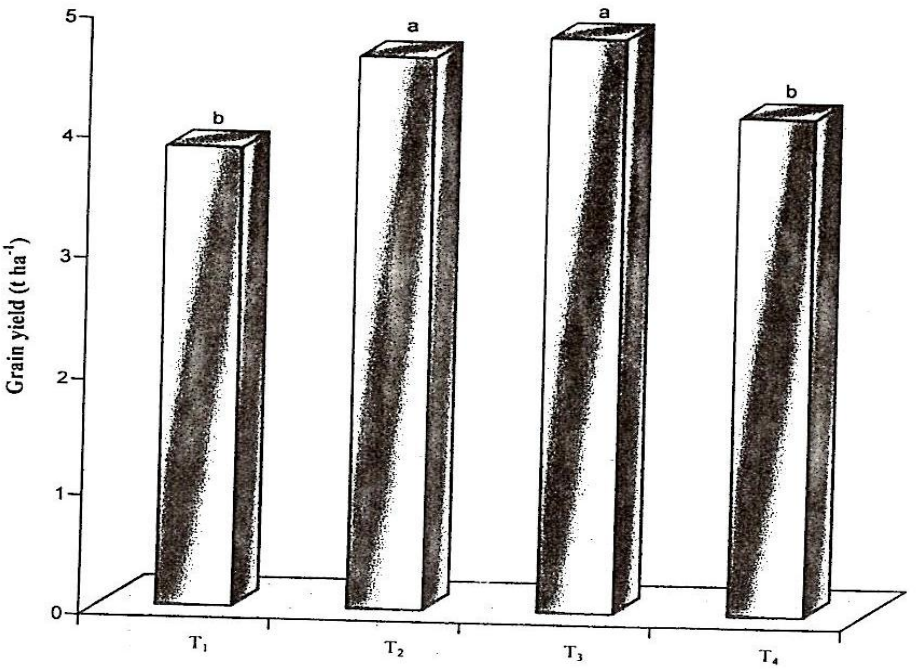

Fig. 1. Effect of detillering on grain yield of BRRI dhan28

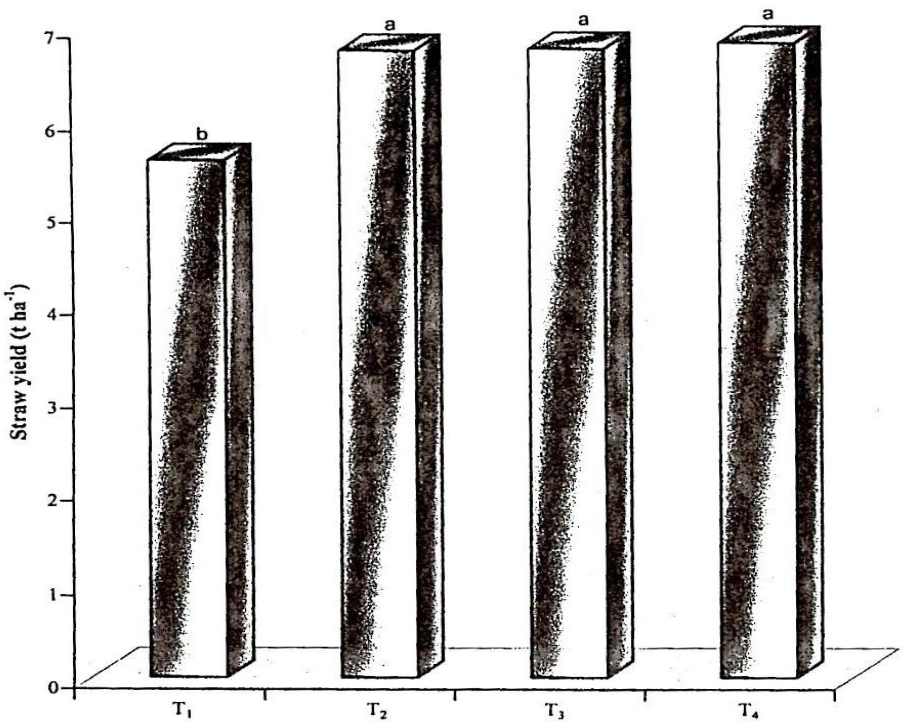

Fig. 2. Effect of detillering on straw yield of BRRI dhan28

The highest plant height 89.39 cm and 89.12 cm were recorded both in intact hills and 12 tillers kept hill^{-1} respectively. The lowest plant height (86.71 cm) was found when 6 tillers were kept hill^{-1} which was statistically identical with the results obtained from 9 tillers kept hill^{-1}. The highest number of effective tillers hill^{-1} (10.04) was found when 12 tillers were kept hill^{-1} followed by 9 tillers kept hill^{-1}, intact hills and 6 tillers kept hill^{-1} respectively. The probable reason of getting highest number of effective tillers might be due highest number of total tillers hill^{-1} kept. The highest panicle length was obtained from detillered hills compared to intact hills and those were statistically identical. Panicle length was highest (22.37 cm) when 9 tillers were kept hill^{-1} immediately followed by the results produced by 6 and 12 tillers kept hill^{-1}. On the other hand panicle length was lowest (20.27 cm) in case of the intact hills. Detillered hills were fixed with lower number of tillers hill^{-1} facilitating more nutrient uptake from soil which might be the probable reason of producing higher panicle length. The highest number of grains panicle^{-1} (122.9) was found when 6 tillers were kept hill^{-1} which was statistically similar with 9 and 12 tillers kept hill and was significantly higher than that of intact hills. The lowest number of grains panicle^{-1} (110.7) was obtained in intact hills because plant population was higher than those of 6, 9 and 12 tillers kept hill^{-1}. The detillered hills keeping different number of tillers hill^{-1} showed less number of unfilled grains panicle^{-1} than that of intact hills. The highest number of unfilled grains panicle^{-1}(15.40) was obtained in intact hills and the lowest number of unfilled grains panicle^{-1} (4.98) was found where 6 tillers were kept hill^{-1}(Table 1). The effect of detillering on 1000-grain weight on BRRI dhan28 was not significant (Table 1). Similar findings were also reported by Mollah (1990). The highest grain yield (4.80 t ha^{-1}) was obtained when 12 tillers were kept hill^{-1} which was found statistically similar with that of the results produced by 9 tillers kept hill^{-1}. The lowest grain yield (3.84 t ha^{-1}) was found when 6 tillers were kept hill^{-1} which was found identical with intact hills. On the other hand, improvement of yield component e.g. number of effective tillers hill^{-1}, panicle length and number of grains panicle^{-1} might be mainly responsible for the increased grain yield when 12 tillers were kept hill^{-1}. The highest straw yield of 6.82 t ha^{-1}, 6.76 t ha^{-1} and 6.74 t ha^{-1} were obtained from intact hills, 12 and 9 tillers kept hill respectively.

Effect of row spacing

Effect of row spacing on growth and yield components was significant except growth duration and 1000-grain weight. Plant height was influenced by the row spacing have been presented in Table 2. There was a consistent trend in decreasing plant height with lower row spacing to higher row spacing. The plant height was observed highest in 25 cm x 15 cm spacing (89.31 cm) which was significantly higher than those in 20 cm x 15 cm, 15 cm x 15 cm and 10 cm x 15 cm spacing. Significantly lowest plant height (86.81 cm) was recorded with 10 cm x 15 cm spacing.

Table 2. Effect of row spacing on growth and yield attributes of BRRI dhan28

Spacing (Factor B)	Plant height (cm)	Effective tillers hill^{-1} (no.)	Panicle length (cm)	Grains panical^{-1} (no.)	1000-grain weight (g)
S_1 (25 cm X 15 cm)	89.31a	8.00a	22.64a	123.4b	23.87
S_2 (20 cm X 15 cm)	88.83a	7.67a	22.35a	130.9a	23.77
S_3 (15 cm X 15 cm)	88.13ab	6.64b	20.90b	115.2c	23.24
S_4 (10 cm X 15 cm)	86.81b	6.39b	20.31b	105.9d	23.20
Level of significance	*	**	**	**	NS
S $\overline{X}$	0.5205	0.1201	0.2658	1.304	0.3333
CV (%)	3.040	5.79	4.27	3.80	4.72

In a column, the means having similar letter (s) or without letter (s) do not differ significantly and those having dissimilar letter (s) differ significantly as per DMRT, S $\overline{X}$ = Standard error of means
** = Significant at 1% level of probability, NS = Not significant.

The reason for increase in plant height probably due to the total population per unit area in wider spacing was lower than that of closer spacing which was resulted efficient use of fertilizer, less competition for space, air and finally with sunlight which may enhanced the plant to grow upwards and thus the height is

increased. These results were in agreement with the results of Haque (2002) and Mia, (2001). The highest number of effective tillers hill^{-1}(8.00) was observed in 25 cm x 15 cm spacing which was statistically similar in spacing 20 cm x 15 cm and significantly higher than those in 15 cm x 15 cm and 10 cm x 15 cm spacings (Table 2). The probable reason behind increase in effective tillers hill in wider spacing might be due to lower number of plant population. The similar result was observed by Verma *et al.* (2002). The highest (3.86) number of non-effective tillers hill^{-1} was found on closer spacing 10 cm x 15 cm followed by wider spacing of 15 cm x 15 cm, 25 cm x 15 cm and 20 cm x 15 cm. Highest panicle length (22.64 cm) was observed at wider spacing of 25 cm x 15 cm which was identical (22.35 cm) at 20 cm x 15 cm spacing (Table 2). The lowest panicle length was found (20.31 cm) at 10cm x 15 cmand (20.90 cm) at 15 cm x 15 cm spacing. So, as population density decreased there was an increasing trend of panicle length. The highest number of grains panicle (130.9) was found in spacing 20 cm x 15 cm and lowest in spacing 10 cm x 15 cm (105.9). This might be due to the fact that from wider spacing plant got more nutrients and moisture which eventually led to develop of more grains comparing to closer spacing. The results were agreement with that of Karim *et al.* (1992). The highest grain yield (5.04 t ha^{-1}) was found in 20 cm x 15 cm spacing which was significantly higher than those in other spacing treatments. The lowest grain yield of 3.43 t ha^{-1} was observed in 10 cm x 15 cm spacing. A decreasing trend in yield was observed towards closer spacing. The probable reasons behind significant increase in grain yield in wider spacing might be due to having significantly increased number of effective tillers hill^{-1}, panicle length, grains panicle^{-1}. Grain yield of BRRI dhan28 as influenced by spacing has been presented in (Fig. 3). Therefore, there was a trend in increasing grain yield as the plant population decreased. Ramakrishna *et al.* (1992), Kandade and Karla (1986) also expressed similar views regarding the effects of plant spacing on grain yield of rice.

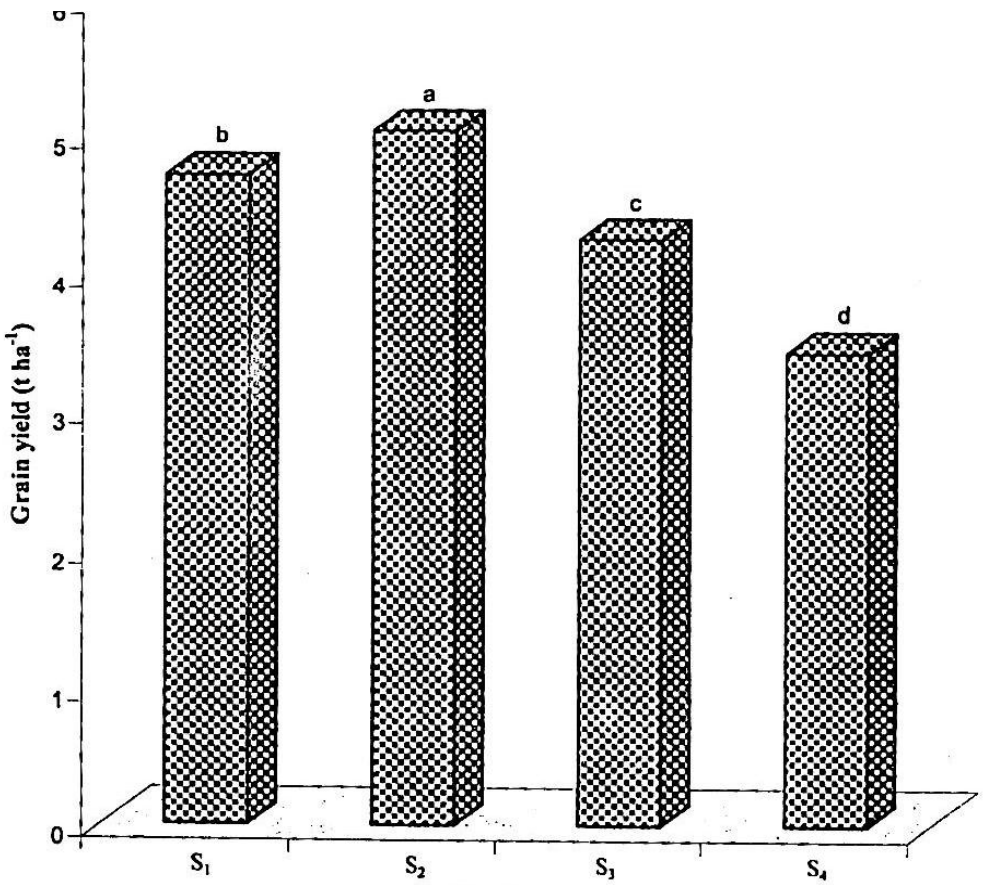

Fig. 3. Effect of row spacing on grain yield of BRRI dhan28

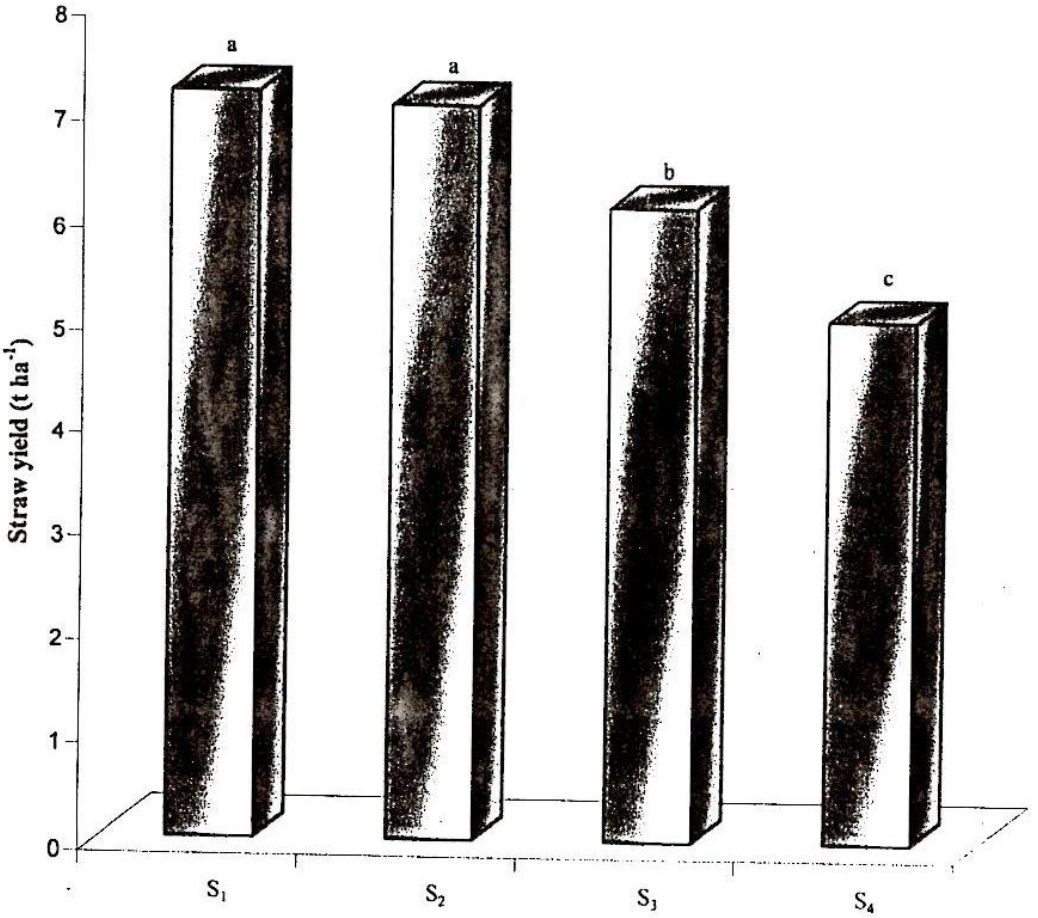

Fig. 4. Effect of row spacing on straw yield of BRRI dhan28

The highest straw yield (7.15 t ha^{-1}) was found at 25 cm x 15 cm spacing which was statistically similar to 20 cm x 15 cm spacing while the lowest straw yield (5.01 t ha^{-1}) was found at 10 cm x 15 cm spacing. The probable reason might be due to lower plant height of the both spacing (Fig. 4).

Effect of interaction between detillering and row spacing

The interaction effect of detillering and row spacing was significant on growth and most of the yield components except 1000-grain weight and growth duration (Table 3). The highest plant height (90.78 cm) was obtained with intact hills at spacing 25 cm x 15 cm which was found to be statistically identical with maximum interaction treatments. The lowest (83.73 cm) was found when 9 tillers were kept hill with spacing 10 cm x 15 cm. Although plant height varied significantly for the above interaction, the data did not follow any definite trend (Table 3). The higher number of effective tillers $hill^{-1}$(10.91) was obtained in 12 tillerskept $hill^{-1}$ with spacing 20 cm x 15 cm (T_3 x S_2) and 10.80 with 12 tillers kept $hill^{-1}$ at spacing 25 cm x 15 cm (T_3 x S_1), while the lowest (5.01) was observed with spacing 15 cm x 15 cm at intact plants $hill^{-1}$ where found statically indentical with the results that produced by T_4 x S_4, T_2 x S_4, T_1xS_2 and T_1 x S_1. The interaction treatments T_1 x S_1 and T_2 x S_2 showed comparatively higher panicle length of 24.32 cm and 23.90 cm respectively then those of other treatments. The treatments T_3 x S_2, T_1 x S_1 and T_2 x S_2 showed comparatively higher number of grains panicle 144.5, 139.3 and 138.7 respectively than that of other treatments. The lowest number of grains $panicle^{-1}$ (104.3) in plots having spacing of 10 cm x 15 cm with

intact hills (T_4 x S_4) which was statistically identical with T_3 x S_4, T_2 x S_4, T_1 x S_4, T_4 x S_3, T_2 x S_3, T_4 x S_2 and T_3 x S_1 treatments. The highest 1000-grain weight (24.43 g) was found when 6 tillers kept hill spaced with 25 cm x 15 cm and the lowest 1000- grain weight (23.03 g) was obtained in case of intact plants spaced with 10 cm x 15 cm.

Table 3. Interaction effect of detillering and row spacing on growth and yield attributes of BRRI dhan28

Interactions	Plant height (cm)	Effective tillers hill^{-1} (no.)	Panicle length (cm)	Grains panical^{-1} (no.)	1000-grain weight g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Growth duration (day)
T_1 S_1	88.34abc	5.60f	24.32a	139.3a	24.43	4.50ab	6.70a	146.5
T_1 S_2	87.11bc	5.45f	22.04bcd	129.3b	23.96	4.81ab	7.01a	146.2
T_1 S_3	85.69cd	5.04f	21.24def	117.6cd	23.45	3.24cd	4.24b	145.9
T_1 S_4	85.71cd	5.09f	20.17ef	105.4e	23.65	2.79d	4.28b	146.7
T_2S_1	90.02ab	8.0cd	23.49ab	127.3b	24.04	4.88ab	7.36a	145.9
T_2 S_2	88.11abc	7.91cd	23.90a	138.7a	24.01	5.19a	7.28a	143.9
T_2 S_3	89.62ab	6.62e	21.04def	112.2de	23.42	4.72ab	7.28a	143.0
T_2 S_4	83.73d	6.50e	21.06def	109.4de	23.09	3.69c	5.04b	142.8
T_3S_1	88.11abc	10.80a	21.69cde	109.7de	23.56	4.70ab	7.53a	141.0
T_3 S_2	90.23ab	10.91a	23.01abc	144.50a	24.19	5.21a	6.60a	140.9
T_3 S_3	90.01ab	9.88b	21.21def	122.20bc	23.04	4.62ab	6.33a	142.0
T_3 S_4	89.20ab	8.56bc	20.49def	105.3e	23.05	4.66ab	6.59a	142.0
T_4S_1	90.78a	7.60d	21.05def	117.6cd	23.05	4.75ab	7.01a	139.0
T_4 S_2	89.89ab	6.41e	20.45def	111.1de	23.29	4.94ab	7.21a	138.9
T_4 S_3	87.19bc	5.01g	20.09ef	108.7e	23.05	4.40b	6.50a	140.9
T_4 S_4	88.61abc	5.40f	19.51f	104.3e	23.03	2.56d	4.14b	140.9
Level of significance	*	**	*	**	NS	**	**	NS
Sx	1.041	0.240	0.5317	2.608	0.6660	0.2273	0.4286	2.158
CV (%)	3.04	5.79	4.27	3.80	4.91	9.05	11.75	4.62

In a column, the means having similar letter (s) or without letter (s) do not differ significantly and those having dissimilar letter (s) differ significantly as per DMRT, S $\overline{X}$ = Standard error of means
** = Significant at 1% level of probability, NS = Not significant.

The higher grain yield of 5.21 t ha^{-1} and 5.19 t ha^{-1} were obtained when 12 tiller kept hill''' with spacing 20 cm x 15 cm (T_3 x S_2) and T_2 x S_2 treatments which were statistically similar to most of the interaction treatments except T_4 X S_3, T_1 x S_4, T_2 x S_4 and T_4 x S_4 (Table 3). The lowest grain yield was found from the treatment intact hill with closer spacing of 15 cm x 10 cm (T_4 x S_4) which was identical to 6 tillers kept hill with the similar closer spacing of (T_1 x S_4) interaction treatment. The highest straw yield (7.53 t ha^{-1}) was observed when 12 tillers fixed hill^{-1} and spaced with 25 cm x 15 cm (T_3 x S_1) (Table 3). The lowest straw yield (4.14 t ha^{-1}) was observed in case of intact hills spaced with 10 cm x 15 cm which was statistically identical with T_1 x S_3, T_1 x S_4 and T_2 x S_4 treatment combinations. The highest days of growth duration was observed (146.5) with interaction treatment T_1 x S_1 whereas the lowest duration of 138.9 days was found at T_4 x S_2 treatment. From the above discussion, it can be concluded that detillering retaining 9 tillers hill^{-1} spaced with 20 cm x 15 cm could probably be the best possible arrangement for achieving the higher yield in boro rice cv. BRRI dhan28.

Conclusion

The detillering with retaining of 9 tillers hill^{-1} at 20 cm x 15 cm spacing was the best possible combination for achieving optimum grain yield of BRRI dhan28.

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