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EFFECT OF SPACING AND NUMBER OF SEEDLINGS HILL^{-1} ON THE YIELD OF BRRI dhan29

N. AKTER[1] M.S.U. BHUIYA[1], M.A. SALAM[1], M.S. ISLAM[1] AND H. KATO-NOGUCHI[2]

[1]Department of Agronomy, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; [2]Department of Applied Biological Science, Faculty of Agriculture, Kagawa University, Miki, Kagawa 761-0795, Japan.

Corresponding author & address: Md. Shafiqul Islam, E-mail: shafiqagron@bau.edu.bd
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ABSTRACT

Akter N, Bhuiya MSU, Salam MA, Islam MS, Kato-Noguchi H (2014) Effect of spacing and number of seedlings hill^{-1} on the yield of brri dhan29. *Int. J. Expt. Agric.* 4(1), 7-10.

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from November 2011 to July 2012 to study the effect of spacing and number of seedlings hill^{-1} on the yield of BRRI dhan29. Three spacings viz. 20 cm × 15 cm, 20 cm × 20 cm, 20 cm × 25 cm and three numbers of seedlings hill^{-1} *viz.* 2, 3 and 4 seedlings hill^{-1} were included as experimental treatment. The experiment was carried out in a randomized complete block design with four replications. The effect of spacing showed significant variation in respect of plant height, total tillers hill^{-1}, number of effective tillers hill^{-1}, number of non-effective tillers hill^{-1}, panicle length, grains panicle^{-1}, sterile spikelets panicle^{-1}, grain yield, straw yield, biological yield and harvest index. The highest plant height (97.69 cm), the number of total tillers hill^{-1} (17.45), effective tillers hill^{-1} (13.41) and grains panicle^{-1} (158.15) were found with 20 cm × 25 cm spacing. The highest panicle length (23.94 cm) was obtained from 20 cm × 15 cm spacing. The highest grain yield of 5.02 t ha^{-1} was also obtained from the spacing 20 cm × 25 cm. Number of seedlings hill^{-1} showed significant effect on all the parameters except 1000-grain weight. The highest grain yield of 5.03 t ha^{-1} was obtained from 4 seedlings hill^{-1} while the lowest grain yield of 3.43 t ha^{-1} was found from 2 seedlings hill^{-1}. The highest grain yield of 5.61 t ha^{-1} was obtained from interaction between 20 cm x 25 cm spacing with 4 seedlings hill^{-1} while the lowest grain yield of 2.51 t ha^{-1} were found from the interaction between 20 cm x 15 cm spacing with 2 seedlings hill^{-1}. Results of the present study reveals that 20 cm x 25 cm spacing with 4 seedlings hill^{-1} was found to be the best for obtaining maximum grain yield of BRRI dhan29.

Key words: *spacing, number of seedlings hill^{-1}, BRRI dhan29*

INTRODUCTION

Rice (*Oryza sativa* L.) is the staple food for nearly half of the world's population. It is cultivated both in the tropical and sub-tropical regions extending from 45°N to 40°S latitude. Rice is extensively grown in Bangladesh in three seasons namely, *Aus*, *Aman* and *Boro*, which covers 80% of the total cultivable area of the country (AIS 2011). Rice is the major food crop of the people of Bangladesh. It constitutes 95% of the cereals consumed and supplies 68% of the calorie and 54% of the protein in the diet of the people of Bangladesh. In Bangladesh, about 77% of total cultivable land is used for rice cultivation. Among the growing countries, Bangladesh occupies fourth position in rice production (BRRI 2000). The soil and climates are favorable for rice cultivation and it is extensively cultivated throughout the year. The total area, production and average yield of rice in Bangladesh are 11.53 million hectares, 33.7 million tons and 2.92 t ha^{-1}, respectively (BBS 2012). Besides these the annual production of *Aus*, *Aman* and *Boro* rice were 2.30, 12.7 and 18.7 million t ha^{-1}, respectively and *Boro rice* shares about 49% of the total rice production (BBS 2012).

The growth, development, yield and yield components of rice are greatly influenced by plant spacing. Optimum plant spacing ensures plant to grow properly utilizing more solar radiation and nutrients. When the planting densities exceed optimum level, competition among plants for light and nutrients become severe. Consequently, the growth slows down and the grain yield decreases. Wider spacing can produce more tillers when soil, water and nutrients are sufficiently available that produced higher yield. Again in wider spacing low yield would result due to low plant population (Uddin 1989).

The number of tillers and their growth is greatly affected both qualitatively and quantitatively by number of seedlings hill^{-1}. Optimum number of seedlings hill^{-1} may enable the plant to grow properly both in its aerial and underground parts by utilizing maximum radiant energy, nutrient, space and water and also could reduce seedlings cost of farmers. Excessive numbers of seedlings hill^{-1} may produce higher number of tiller hill^{-1} resulting mutual shading and lodging and thus favours the production of more straw instead of grain. Chowdhury *et al.* (1993) reported that number of seedlings hill^{-1} was an important factor as it influenced the plant population unit^{-1} area, availability of sunlight, competition for nutrients, photosynthesis and respiration which ultimately influenced the yield contributing characters of rice. So, the study was undertaken to determine the effect of spacing and number of seedlings hill^{-1} on the yield of BRRI dhan29.

MATERIALS AND METHODS

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from November 2011 to July 2012 to study the effect of spacing and number of seedlings hill-1 on the yield of BRRI dhan29. The soil of the experimental land belongs to the Sonatala series of dark grey flood plain soil type under AEZ9. The land was medium high silty loam soil having pH 6.5. The climate of the experimental location was sub-tropical which was characterized by high temperature, high humidity and heavy precipitation during the month from April to October and scanty precipitation associated with moderately low

temperature during the period of October to March. The experiment included two treatment(A)three spacings viz. 20 cm × 15 cm, 20 cm × 20 cm, 20 cm × 25 cm and (B) three number of seedlings hill-1 viz. 2, 3 and 4 seedlings hill-1. The experiment was laid out in a randomized complete block design with four replications. Healthy and vigorous seeds of BRRI dhan29 were collected from the Agronomy Field Laboratory, BAU, Mymensingh. Nursery bed was prepared by puddling the soil with country plough, cleaned and levelled with ladder on 10 December 2011. Finally, the sprouted seeds were sown by broadcasting in the wet nursery bed on 10 December, 2011. Experimental land was first opened with a tractor drawn disc plough. The land was then puddled thoroughly by ploughing and cross ploughing with a country plough and subsequently leveled by laddering. Immediately after final field preparation, the field layout was made on 29 January 2012 as per the design. Individual plots were cleaned by removing weeds and stubble and finally levelled by ladder. The experimental area was fertilized with 130-60-96-72-12 g plot-1 of urea, triple super phosphate, muriate of potash (MoP), gypsum and zinc oxide, respectively. The entire amount of triple super phosphate, muriate of potash and gypsum and zinc oxide were broadcast and incorporated into the soil at final land preparation, one-third of urea was applied at the time of final land preparation. One-third amount of urea was applied as first top dressing at 20 DAT and the rest one-third was applied at second top dressing at 45 DAT. Seedlings were transplanted in the main field as per experimental treatments at the rate of 2, 3 and 4 seedlings hill-1 with 20 cm spacing between hills and 15, 20 and 25 spacing between lines in respective treatment on 31 January 2012. Crop management practices such as drainage, plant protection measures were done as per requirement and two hand weeding were done in order to keep the crop weed free at 20 and 45 DAT. Individual plots were harvested at maturity on 27 May 2012. Five hills were selected each unit plot excluding central 5.0 m^2 and boarder rows to record the data on yield contributing characters. The harvested crop of each plot (5 m^2 central area) was separately bundled; properly tagged and then brought to the threshing floor. The harvested crops were threshed by pedal thresher. The grains were cleaned and sun dried and adjusted to 14% moisture content. Straw were sun dried to record the straw yield. Grain yield and straw yield were then converted to t ha^{-1}. Collected data were analyzed statistically using MSTAT-C programme and the means were compared by Duncan's Multiple Range Test(Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect of spacing

Plant height, number of total tillers $hill^{-1}$, number of effective tillers $hill^{-1}$, number of non-effective tillers $hill^{-1}$, panicle length, number of grains $panicle^{-1}$, number of sterile spikelet's $panicle^{-1}$, grain yield, straw yield, biological yield and harvest index were significantly influenced by plant spacing. (Table1). The highest number of effective tillers $hill^{-1}$ (13.41) was obtained from 20 cm × 25 cm spacing and the lowest one (10.38) from the spacing of 20 cm × 15 cm. The result revealed that 20 cm × 25 cm spacing had the greatest opportunity to produce more number of effective tillers $hill^{-1}$. It might be due to the fact that the spacing 20 cm × 25 cm provided enough nutrients, light and air which played vital role in producing more effective tillers $hill^{-1}$. The results are in agreement with the findings of Muhammad *et al.* (1987) and Haque (2002). The highest grain yield (5.02 t ha^{-1}) was obtained from 20 cm × 25 cm spacing, which was similar to 20 cm × 20 cm spacing and the lowest one (3.65 t ha^{-1}) was obtained from the spacing of 20 cm × 15 cm. The highest number of effective tiller m^{-2} and the highest number of grains $panicle^{-1}$ were mainly responsible for this highest grain yield.

Effect of number of seedlings $hill^{-1}$

Plant height, number of total tillers $hill^{-1}$, number of effective tillers $hill^{-1}$, number of non-effective tillers $hill^{-1}$, grains $panicle^{-1}$, number of sterile spikelets $panicle^{-1}$, grain yield, straw yield, biological yield and harvest index were significantly affected by number of seedling $hill^{-1}$(Table 1). The highest number of grains $panicle^{-1}$ (158.62) was found in 4 seedlings $hill^{-1}$ and the lowest number of grains $panicle^{-1}$ (131.70) was found in 2 seedlings $hill^{-1}$. It may be due to the sharing of nutrients, light, temperature etc. among the plants.The highest grain yield (5.03 t ha^{-1}) was found in 4 seedlings $hill^{-1}$. The highest grains $panicle^{-1}$ was mainly responsible for this highest grain yield. The highest straw yield (5.68 t ha^{-1}) obtained from 3 seedlings $hill^{-1}$ and the lowest one (4.80 t ha^{-1}) was obtained from 2 seedlings $hill^{-1}$. The highest biological yield (10.65 t ha^{-1}) and the highest harvest index (47.18 %) were found in 4 seedlings $hill^{-1}$.

Table 1. Effect of spacing on the yield and yield components of BRRI dhan29

Treatments	Plant height (cm)	Total tillers hill^{-1} (no)	Effective tillers hill^{-1} (no)	Non-effective tillers hill^{-1} (no)	Panicle length (cm)	No. of grains panicle^{-1}	No. of sterile spikelets panicle^{-1}	1000-grain wt (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
Spacing												
20 cm × 15 cm	93.91b	13.82c	10.38c	3.44b	23.94a	132.01c	32.42a	22.84	3.65c	5.00c	8.65b	41.65c
20 cm × 20 cm	92.18b	14.62b	11.09b	3.54b	23.46b	142.88b	29.87b	23.09	4.43b	5.76a	10.19a	43.20b
20 cm × 25 cm	97.69a	17.45a	13.41a	4.04a	23.42b	158.15a	25.64c	22.37	5.02a	5.33b	10.35a	48.42a
CV (%)	3.11	3.55	3.46	16.21	3.42	3.73	8.51	3.88	3.46	3.94	4.07	3.94
Level of significance	**	**	**	**	**	**	**	NS	**	**	**	**
Number of seedlings hill^{-1}												
2	98.09a	17.33a	12.98a	4.35a	23.29	131.70c	36.91a	22.59	3.43c	4.80b	8.23b	41.20c
3	94.09b	14.87b	11.54b	3.32b	23.66	142.71b	27.77b	22.85	4.63b	5.68a	10.31a	44.89b
4	91.60c	13.69c	10.35c	3.35b	23.86	158.62a	23.25c	22.86	5.03a	5.62a	10.65a	47.18a
CV (%)	3.11	3.55	3.46	16.21	3.42	3.73	8.51	3.88	3.46	3.94	4.07	3.94
Level of significance	**	**	**	**	NS	**	*	NS	**	**	**	**

In a column, figure(s) with same letter or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.
**= Significant at 1% level of probability, * = Significant at 5% level of probability, NS = Not significant

Table 2. Interaction effect of spacing and number of seedlings hill^{-1} on the yield and yield components of BRRI dhan29

Interaction	Plant height (cm)	Total tillers hill^{-1} (no)	Effective tillers hill^{-1} (no)	Non-effective tillers hill^{-1} (no)	Panicle length (cm)	No. of grains panicle^{-1}	No. of sterile spikelets panicle^{-1}	1000-grain wt. (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
$L_1 \times S_1$	100.74a	15.72d	11.90c	3.82bc	22.77e	124.00f	42.72a	22.41	2.51g	4.50f	7.01f	35.87f
$L_1 \times S_2$	95.09bc	13.58f	10.27de	3.32c	24.36ab	130.16e	29.68c	22.80	4.09e	5.40c	9.48c	43.10d
$L_1 \times S_3$	85.90e	12.17h	8.98f	3.19c	24.68a	141.87c	24.87d	23.29	4.35d	5.11d	9.46c	45.98c
$L_2 \times S_1$	95.18bc	16.36c	12.35c	4.02bc	23.28cde	130.55e	37.12b	22.77	3.46f	5.11d	8.57e	40.33e
$L_2 \times S_2$	91.59cd	12.80g	10.85d	1.95d	23.17cde	134.27d	30.94c	23.21	4.68c	6.15a	10.83b	43.22d
$L_2 \times S_3$	89.76de	14.71e	10.07e	4.64ab	23.93abc	163.82b	21.54d	23.30	5.14b	6.03a	11.17a	46.05c
$L_3 \times S_1$	98.34ab	19.92a	14.71a	5.21a	23.83a-d	140.56c	30.89c	22.60	4.32d	4.79e	9.10d	47.41b
$L_3 \times S_2$	95.60bc	18.22b	13.52b	4.71ab	23.47b-e	163.70b	22.69d	22.53	5.14b	5.49bc	10.62b	48.34ab
$L_3 \times S_3$	99.15ab	14.21e	12.00c	2.21d	22.96de	170.18a	23.33d	21.97	5.61a	5.72b	11.32a	49.51a
CV (%)	3.11	3.55	3.46	16.21	3.42	3.73	8.51	3.88	3.46	3.94	4.07	3.94
Level of significance	**	**	**	**	**	**	*	NS	**	*	**	**

In a column, figure (s) with same letter or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT
*= Significant at 5% level of probability L_1= 20 cm × 15 cm S_1= 2 seedlings hill^{-1}
**= Significant at 1% level of probability L_2= 20 cm × 20 cm S_2= 3 seedlings hill^{-1}
NS=Not significant L_3= 20 cm × 25 cm S_3= 4 seedlings hill^{-1}

Interaction effect of spacing and Number of total tillers hill^{-1}

Interaction between spacing and number of seedlings hill^{-1} had significant effect in respect of yield and yield contributing characters except plant 1000-grain weight. The highest plant height (100.74 cm) was obtained from the spacing 20 cm × 15 cm by transplanting 2 seedlings hill^{-1}. The highest total tillers hill^{-1} (19.92) and effective tillers hill^{-1} (14.71) were obtained from 20 cm × 25 cm spacing with by transplanting 2 seedlings hill^{-1}. The highest length of panicle (24.36 cm) was obtained from 20 cm × 15 cm spacing by transplanting 3 seedlings hill^{-1}. The highest number of grains panicle^{-1} (170.18), grain yield (5.61 t ha^{-1}), biological yield (11.32 t ha^{-1}) and harvest index (49.51%) were obtained from 20 cm × 25 cm spacing by transplanting 4 seedlings hill^{-1}.

CONCLUSION

From the present study it could be concluded that the BRRI dhan29 grown under 20 cm × 25 cm spacing by transplanting 4 seedlings hill^{-1} emerged out as a promising practice in order to get the optimum grain yield.

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