EFFECT OF NUMBER OF SEEDLING HILL^{-1} AND NITROGEN LEVEL ON GROWTH AND YIELD OF BRRI dhan32

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ABSTRACT

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An experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh during, T. a*man* season 2002, to investigate the effect of number of seedling hill^{-1} and nitrogen level on growth and yield component of BRRI dhan32.The treatments were the variation numbers of seedling hill^{-1} viz., 1, 2, 3 and 4 seedling hill^{-1} and four levels of nitrogen viz; 0, 60, 80 and 100 kg N ha^{-1}. Number of seedlings hill^{-1} significantly influenced growth and yield components except 1000-grain weight. It was found that the highest number of grains panicle^{-1} (100.92) and grain yield (5.37 t ha^{-1}) were resulted from transplanting of 3 seedlings hill^{-1} and the lowest grain yield (4.38 t ha^{-1}) was obtain from the transplanting of 1 seedling hill^{-1}. The highest straw yield (7.02 t ha^{-1}) was obtain from the transplanting of 4 seedlings hill^{-1} and the lowest one (5.64 t ha^{-1}) from the transplanting of 1 seedling hill^{-1}. Nitrogen level significantly influenced growth and yield components. The maximum grains panicle^{-1} (100.80) and highest grain yield (5.34 t ha^{-1}) were obtained with 80 kg N ha^{-1}. The highest straw yield (6.98 t ha^{-1}) was obtained at the highest nitrogen level (100 kg N ha^{-1}). Result showed that 3 seedlings hill^{-1} and 80 kg N ha^{-1} was optimum to produced maximum yield of BRRI dhan32.

Key words: Nitrogen level, Growth, Yield, BBRI dhan32

INTRODUCTION

Bangladesh is favorable of rice cultivation throughout the year but per hectare yield of this crop is much below the potential level. The reasons are modern high yielding varieties require higher prices for seeds, fertilizer, irrigation and pesticides. Our farmers are poor, so they can not always afford their costs. Hence, special attention should be given for increasing the yield per unit area through effective management practices. Among different management practices, use of appropriate number of seedlings hill^{-1} and optimum nitrogen fertilizer application are important. Chowdhury *et al.* (1993) reported that number of seedlings hill^{-1} is an important factor as it influences the plant population unit^{-1} area, availability of sunlight, competition for nutrients, photosynthesis and respiration which ultimately influence the yield and yield contributing characters of rice. Rice plant requires great amount of nitrogen throughout its life cycle and it is one of the most important and widely used fertilizer in rice cultivation. At present, the farmers of Bangladesh use increased amount of nitrogen fertilizer to get higher yield. It is evident that high yielding varieties show very good response to nitrogen and the yield is affect very much if correct dose is not applied. Nitrogen is the key element in the production of rice and gives by far the largest response. It is also a fact that improper use of nitrogenous fertilizer, instead of giving yield advantage, may reduce the same. Again different varieties may have varying responses to N-fertilizer depending on their agronomic traits. Many workers have reported a significant response of rice to nitrogen in different soils in Bangladesh (Bhuiya *et al*., 1989, Hossain *et al*., 1989 and Islam, 1990). Considering the above facts the experiment objective was to find out the effect between number of seedling hill^{-1} and nitrogen level on growth and yield of BRRI dhan32.

MATERIALS AND METHOD

An experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during T. a*man* season (June to December) 2002. The soil of the experimental unit belongs to the Sonatola Series of Old Brahmaputra Floodplain (AEZ-9), a non-calcareous dark grey floodplain soil and sandy loam in texture. Soil P^H value ranges from 5.9 to 6.5. The treatments were the variation numbers of seedling hill^{-1} viz., 1, 2, 3 and 4 seedling hill^{-1} and four levels of nitrogen viz; 0, 60, 80 and 100 kg N ha^{-1}. The experiment at plots was a randomized Complete Block Design (RCBD) with three replications. The plot size was 4.0m X 2.5m. Phosphorus, Potassium, Sulphur and Zinc fertilizer were applied as per recommendation of BRRI (1991). All the phosphatic, Potassic, Sulphur, Zinc and one third of Urea fertilizer were applied in each plot at the time of final land preparation and were mixed thoroughly with soil. The rest of the urea was top dressed in two equal splits. One at active tillering stage and the other at panicle initiation stage at 30 and 50 DAT respectively. The control plots received no nitrogen fertilizer. Weeding was done twice by hand pulling on

15 and 30 days after transplanting (DAT). Dimacron 100 EC @ 0.839 Litre 0.1 ha^{-1} was applied to control rice stem borer at tillering stage (30 DAT). Thirty day old seedlings were transplanted on 22 July, 2002. The crop was harvested when 90% of the seeds became golden yellow in color. Grains were sun dried and moisture content of 14%. Moisture was adjusted to estimate in grain yield.
Leaf Area Index (LAI) was measured by using the following formula:

$$LAI = \frac{\text{Sum of leaf area hill}^{-1} \text{ sampled hills}}{\text{Area of land covered by the sampled hills}} \times 100$$

Total Dry Matter (TDM)
Five hills plot^{-1} were taken randomly on 30, 45, 60, 75 and 90 DAT. The roots were washed thoroughly and discarded. The panicles were then separated from the shoot (after heading) and dried in an oven at 70^{0}c for 48 hours. After oven drying, the sample were weighed by using an electric balance which gave total dry matter and finally, it was expressed in g/m^{-2}

The data were analyzed following the ANOVA technique and the mean differences were adjudged by the Duncan's Multiple Range Test (Gomez and Gomez, 1984) using a statistical computer package MSTAT.

RESULTS AND DISCUSSION

Plant height
Plant height was significantly affected by number of seedling hill^{-1} and nitrogen level. The highest plant height (119.71cm) was found with 4 seedlings hill^{-1} which was similar to 3 seedlings hill^{-1} (118 cm) and the lowest plant height (112.07 cm) was recorded from the treatment with 1 seedling hill^{-1} at harvest stages. It was clear that the plant height increased with increase in the number of seedling hill^{-1}. This might be due to more competition in the plants that were planted with more seedlings hill^{-1} (Table 1). These results are similar to that the reported by Pataniswamy and Gomez (1976). The tallest plant (122.06 cm) was observed from 100 kg N ha^{-1} application which was statistically similar to 80 kg N ha^{-1} (120.69 cm) and the shortest one (108.05 cm) from control. Plant height increased with increasing nitrogen level. These results are similar to those obtained by Reddy *et al*. (1988) who recorded a positive effect of nitrogen on plant height. The increase in plant height due to application of increased level of nitrogen might be due associated with stimulating effect of nitrogen on various physiological process including cell division and cell elongation of the plant.

Table 1. Effect of seedling hill^{-1} and nitrogen Level on plant height, panicle length, grains panicle^{-1}, 1000 grain weight, grain and straw yield of BRRI dhan32.

Treatments	Plant height (cm)	Panicle length (cm)	Grains panicle^{-1}	Weight of 1000-grains (g)	Grain Yield (t ha^{-1})	Straw Yield (t ha^{-1})
Number of seedling hill^{-1}						
1	112.07b	19.97a	94.63c	21.48	4.38c	5.64d
2	117.28ab	19.79a	96.33bc	21.57	4.75b	6.05c
3	118.00a	19.56ab	100.92a	21.69	5.37a	6.63b
4	119.72a	19.07b	99.95ab	21.49	4.80b	7.02a
SE (±)	1.877	0.197	1.323	0.301	0.096	0.095
Level of significance	0.05	0.05	0.01	NS	0.01	0.01
Nitrogen level (kg ha^{-1})						
0	108.05c	19.00c	93.66b	20.87b	4.11c	5.52d
60	116.27b	19.34bc	98.05a	21.45ab	4.37b	6.20c
80	120.69ab	20.24a	100.80a	21.97a	5.34a	6.64b
100	122.06a	19.81ab	99.31a	21.94a	5.12a	6.98a
SE (±)	1.877	0.197	1.323	0.301	0.096	
Level of significance	0.01	0.01	0.01	0.05	0.01	0.01

Same letter in a column implies the statistical insignificant level; NS= not significantly different at p ≤0.05. SE= Standard Error of Means

Leaf area index (LAI)

The effect of number of seedling (s) hill^{-1} and nitrogen level on LAI was significant as observed at all sampling dates. The highest LAI (4.31) was observed with 4 seedlings hill^{-1} at 75 DAT. The lowest LAI was obtained from 1 seedling hill^{-1} at all sampling dates (Table 3). In the present experiment, a increasing trend of LAI was found up to 75 DAT and decreased after words (90 DAT) in case of all number of seedling hill^{-1}. LAI increased with growth duration at flowering and then decreased. Reduction of LAI after flowering was mainly because of leaf drying and senescence. The highest LAI value (4.46) was observed from 100 kg N ha^{-1} at 75 DAT (Table 3). The lowest LAI value was obtained from control (0 kg N ha^{-1}) at all sampling dates and the interaction effect it was found that 4 seedlings hill^{-1} and nitrogen level 100 kg ha^{-1} gave the maximum LAI (4.68) at 75 DAT (Table 4).

Total dry matter (TDM)

The effect of number of seedling (s) hill^{-1} and nitrogen level on TDM was significant as observed at all sampling dates. The maximum dry matter (683.03gm^{-2}) was found with 4 seedlings hill^{-1} at 90 DAT. The minimum dry matter was found with 1 seedling hill^{-1} (Table 3). Total dry matter production increased with the increase of life span of plants and it was also increased gradually with increasing number of seedling hill^{-1}. The highest dry matter at 90 DAT was obtained (711.65 gm^{-1}) with 100 kg N ha^{-1} (Table 3). Total dry matter production increased due to nitrogen application at active tillering stage and panicle initiation stage. There are many reports on the increased of total dry matter due to increased nitrogen fertilizer application (Prasad, 1981; Park, 1987) and the interaction effect we found that, when 4 seedlings hill^{-1} and nitrogen level at 100 kg ha^{-1}, it produced the highest dry matter (760.99 gm-2) at 90 DAT (Table 4).

Panicle length

Panicle length was significantly influenced by number of seedlings hill^{-1} and nitrogen level. Table 1 shows that panicle length was higher (19.97 cm) when 1 seedling hill^{-1} which was statistically similar to that observed in 2 seedlings hill^{-1} (19.73) than 4 seedlings hill^{-1} (19.07 cm). Karmakar *et al* (2002) reported that panicle length reduced gradually with increasing number of seedling hill^{-1} (Table 1). The plant received no additional nitrogen fertilizer produced shortest panicle. The longest panicle (20.24cm) was found from 80 kg N ha^{-1} which was statistically similar to 100 kg N ha^{-1} (19.81cm) and the shortest panicle (19.00cm) was recorded from control (Table 1) and the interaction effect the longest panicle (20.51 cm) recorded from 1 seedling hill^{-1} with 80 kg N ha^{-1} and the shortest one (18.22 cm) was produced from 4 seedlings hill^{-1} with control (Table 2).

Number of grains panicle^{-1}

Number of grains panicle^{-1} was significantly influenced by number of seedlings hill^{-1} and nitrogen level. The number of grains panicle^{-1} was the highest (100.92) in 3 seedlings was transplanted hill^{-1} which was statistically similar of 4 seedlings hill^{-1} (99.95) and the lowest (94.63) in 1 seedling was transplanted hill^{-1} (Table 1). Reduction in vegetative growth due to decrease number of seedlings hill^{-1}was perhaps, the reason for this reduction in the number of grains panicle^{-1}. This result was in agreement with Islam (1989) who stated that 3 seedlings hill^{-1} well as 4 seedlings hill^{-1}. The highest number of grains panicle^{-1} (100.80) was obtained from 80 kg N ha^{-1} which was statistically similar to 100 kg N ha^{-1} (99.31) and 60 kg N ha^{-1} (98.05). The lowest number of grains panicle^{-1}(93.66) was obtained from control (Table 1). The highest nitrogen level 100 kg N ha^{-1} produced lower number of grains panicle^{-1} than 80 kg N ha^{-1}. Adequate supply of nitrogen contributed to grain formation which probably increased number of grains panicle^{-1} with increasing nitrogen level. Interaction effect between number of seedling hill^{-1} and nitrogen level was not found significantly influenced number of grains panicle^{-1} (Table 2). The highest number of grains panicle^{-1} (105.12) was recorded from 3 seedlings hill^{-1} with 80 kg N ha^{-1} and the lowest one (88.46) was produced from the combination of 2 seedlings hill^{-1} with control (Table 2).

Weight of 1000-grains

Weight of 1000-grains was not significantly affected by number of seedlings hill^{-1} but significant effect on nitrogen level. The maximum weight of 1000-grains (21.69g) was observed from 3 seedlings hill^{-1} and minimum (21.48g) from 1 seedling hill^{-1} (Table 1). Result showed that the number of seedlings hill^{-1} is not a factor for increasing or decreasing of weight of 1000-grains. The maximum weight of 1000-grains (21.97 g) was obtained from 80 kg N ha^{-1} but was statistically similar to 100 kg N ha^{-1} (21.94 g) and the minimum (20.87 g) from control (0 kg N ha^{-1}) (Table 1). It is a genetically character and genetically fixed by an individual variety but interaction effect had no significant effect on Weight of 1000-grains (Table 2). However, the maximum

weight of 1000-grains (22.51 g) was obtained from 3 seedlings hill^{-1} with 100 kg N ha^{-1} and the minimum (20.42 g) from 3 seedlings hill^{-1} with control (Table 2).

Table2: Interaction effect between number of seedling hill^{-1} and nitrogen level on plant height, panicle length, grains panicle^{-1}, 1000 grain weight, grain and straw yield of BRRI dhan32.

Number of seedling hill^{-1}	Nitrogen level (kg ha^{-1})	Plant height (cm)	Panicle length (cm)	Grains panicle^{-1}	Weight of 1000-grains (g)	Grain Yield (t ha^{-1})	Straw Yield (t ha^{-1})
1	0	102.48	19.04	88.84	20.76	3.27g	4.47
	60	112.47	19.96	94.74	21.99	4.05f	5.28
	80	116.23	20.51	97.91	21.70	5.20b-d	6.23
	100	117.10	20.36	97.02	21.47	5.00cd	6.58
2	0	103.50	19.61	88.46	21.43	4.17ef	5.40
	60	119.11	19.64	98.72	21.40	4.67de	6.01
	80	122.24	20.19	99.09	21.74	5.35a-c	6.08
	100	124.26	19.73	99.04	21.72	4.83cd	6.71
3	0	114.74	19.14	98.82	20.42	4.83cd	5.82
	60	115.06	19.46	99.14	21.43	5.17b-d	6.52
	80	120.30	20.09	105.12	22.42	5.83a	7.04
	100	121.91	19.53	100.58	22.51	5.65ab	7.16
4	0	111.47	18.22	98.53	20.87	4.17ef	6.40
	60	118.45	18.29	99.61	20.99	5.03cd	7.00
	80	124.00	20.17	101.08	22.02	5.00cd	7.20
	100	124.97	19.61	100.59	22.07	5.00cd	7.48
SE (±)		3.755	0.394	2.650	0.602	0.191	0.191
Level of significance		NS	NS	NS	NS	0.05	NS

Same letter in a column implies the statistical insignificant level; NS= not significantly different at p ≤0.05. SE= Standard Error of Means

Grain yield

Grain yield was significantly influenced by number of seedlings hill^{-1} and nitrogen level (Table 1). The highest grain yield (5.37 t ha^{-1}) was observed from 3 seedlings hill^{-1} which was statistically dissimilar from other seedling hill^{-1}. The lowest grain yield (4.38 t ha^{-1}) was recorded with 1 seedling hill^{-1} (Table 1). The largest number of grains panicle^{-1} and the highest 1000 grain weight contribute to higher grain yield. Grain yield increased due to increase the number of seedling hill^{-1} and therefore, proved to be better significant which was in agreement with the findings of Prasad and Sheer (1992), BINA (1993) and Ahmed and Fiaz (1972) reported similar results. The highest grain yield (5.34 t ha^{-1}) was obtained from 80 kg N ha^{-1} which was statistically similar to 100 kg N ha^{-1} (5.12 t ha^{-1}) and the lowest one (4.11 t ha^{-1}) was obtained from control. The application of nitrogen up to 80 kg N ha^{-1} registered an increased grain yield. But, further increment of nitrogen level had no positive influence on grain yield. Increase in grain yield due to application of nitrogen was mainly due to improvement of yield contributing characters like number of effective tillers hill^{-1}, panicle length and number of grains panicle^{-1} (Table 1), and the interaction effect the highest grain yield (5.83 t ha^{-1}) was found from 3 seedlings hill-1 with 80 kg N ha-1 (5.65 t ha^{-1}) and the lowest one (3.27 t ha^{-1}) was obtained from 1 seedling hill^{-1} with control (Table 2).

Table 3: Effect of seedling hill^{-1} and nitrogen Level on Leaf Area index (LAI) and Total Dry Matter (TDM) of BRRI dhan32 at different days after transplanting (DAT).

Treatment	Leaf Area Index at DAT					Total Dry Matter (g m^{-2}) at DAT				
Number of seedling hill^{-1}	30	45	60	75	90	30	45	60	75	90
1	2.71c	3.07d	3.73d	3.87d	3.74b	106.16d	153.99d	277.18d	455.43c	570.22d
2	2.75c	3.24c	3.86c	3.99c	3.77b	111.40c	160.25c	188.51c	508.41b	647.99c
3	2.82b	3.37b	4.01b	4.17b	4.02a	117.96b	170.87b	299.18b	514.04ab	660.34b
4	2.93a	3.55a	4.11a	4.31a	4.04a	132.34a	185.59a	317.30a	522.73a	683.03a
SE (±)	0.022	0.034	0.030	0.035	0.024	1.409	1.698	2.511	4.434	4.097
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Nitrogen level (kg ha^{-1})										
0	2.64c	2.80d	3.34d	3.42d	3.25d	99.94d	146.11d	257.63d	430.32d	551.82d
60	2.71b	3.02c	3.84c	4.11c	3.93c	113.50c	161.85c	287.46c	485.94c	626.62c
80	2.90a	3.59b	4.17b	4.35b	4.16b	121.78b	174.25b	307.99b	526.42b	671.50b
100	2.96a	3.82a	4.37a	4.46a	4.23a	132.65a	188.50a	329.10a	557.94a	711.65a
SE (±)	0.022	0.034	0.030	0.035	0.024	1.409	1.698	2.511	4.343	4.097
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Same letter in a column implies the statistical insignificant level; NS= not significantly different at p ≤0.05. SE= Standard Error of Means

Straw yield

Straw yield was significantly influenced by number of seedlings hill^{-1} and nitrogen level (Table 1). Maximum Straw yield (7.02 t ha^{-1}) was observed from 4 seedlings hill^{-1}. Minimum straw yield (5.64 t ha^{-1}) was observed from 1 seedling hill^{-1} (Table 1). The highest number of total tillers hill^{-1} produced with 4 seedlings hill^{-1} resulting in mutual shading which hampered translocation and enough food materials were not translocated from body to growing panicles and thus favour the production of more straw instead of grain. In case of 1 seedling hill^{-1}, lower number of total tillers hill^{-1} were produced and as a result straw yield was also lower. These results are in agreement with the findings of Mian and Gaffer (1970) who reported that straw yield increased with the increasing number of seedling hill^{-1}. The straw yield (6.98 t ha^{-1}) was obtained from 100 kg N ha^{-1}. The lowest straw yield (5.52 t ha^{-1}) was produced in control treatment. Nitrogen influenced vegetative growth in terms of plant height and number of tiller hill^{-1} which resulted in increase straw yield (Table 1). Similar trend of straw yield was also reported by Srivastava *et al*. (1987), Kanda and Dixit (1996). Straw yield was not significantly affected by the interaction between number of seedlings hill^{-1} and nitrogen level. It was observed that apparently the highest straw yield (7.48 t ha^{-1}) was obtained from 4 seedlings hill^{-1} with 100 kg N ha^{-1} and the lowest one (4.47 t ha^{-1}) from 1 seedling hill^{-1} with control (Table 2).

Table 4: Interaction effect between number of seedling hill^{-1} and nitrogen level on Leaf Area index and Total Dry Matter of BRRI dhan32.

Treatment		LAI					TDM (g m^{-2})				
Number of seedling hill^{-1}	Nitrogen level (kg ha^{-1})	30	45	60	75	90	30	45	60	75	90
1	0	2.39g	2.69	3.22	3.32	3.21ef	93.89	140.39	248.70	375.23h	485.39
	60	2.54f	2.81	3.70	3.82	3.79d	102.79	149.79	265.99	425.11g	540.37
	80	3.00b	3.22	3.90	4.10	3.94c	108.07	155.77	285.38	485.39e	600.33
	100	2.90bc	3.55	4.11	4.23	4.01bc	119.89	170.00	308.66	535.99cd	654.80
2	0	2.77c-e	2.71	3.32	3.40	3.13f	96.37	142.49	250.66	430.00g	560.99
	60	2.70e	2.97	3.79	3.98	3.72d	104.96	152.39	281.36	508.00e	645.39
	80	2.72e	3.56	4.10	4.20	4.11b	116.30	165.78	301.72	540.25bc	680.00
	100	2.81c-e	3.72	4.23	4.39	4.13b	127.96	180.35	320.31	555.38a-c	705.59
3	0	2.69e	2.81	3.40	3.42	3.32e	100.99	145.79	258.78	455.72f	575.36
	60	2.73de	3.01	3.88	4.21	4.10b	112.87	164.32	290.66	500.31e	650.39
	80	2.87b-d	3.67	4.27	4.50	4.28a	124.92	180.05	312.66	535.01cd	690.39
	100	3.00ab	3.89	4.51	4.56	4.36a	133.05	193.31	335.11	565.10ab	725.23
4	0	2.78e	2.98	3.41	3.53	3.33e	108.49	155.77	272.39	460.31f	585.53
	60	2.88bc	3.21	4.00	4.42	4.12b	133.38	180.88	312.30	510.32de	670.32
	80	3.00ab	3.89	4.41	4.61	4.30a	137.81	195.38	332.18	545.01bc	715.26
	100	3.13a	4.12	4.63	4.68	4.42a	149.69	210.32	352.33	575.29a	760.99
SE (±)		0.044	0.07	0.06	0.07	0.047	2.818	3.396	2.022	8.686	8.193
Level of significance		0.01	NS	NS	NS	0.05	NS	0.05	NS	0.05	NS

Same letter in a column implies the statistical insignificant level; NS= not significantly different at p ≤0.05. SE= Standard Error of Means

The results of the study it could be concluded that the transplant *aman* rice (cv. BBRI dhan32) gown under 3 seedlings hill^{-1} with 80 kg N ha^{-1} showed better performance in respect of higher grain yield, because of corresponding of effective tillers, filled grain and 1000-grains weight proved to be better significant. Therefore, it may be concluded that BBRI dhan32 should be transplanted with 3 seedlings hill^{-1} and fertilized with 80 kg N ha^{-1} for higher grain yield.

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