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Effect of seedlings per hill and nitrogen rate on the yield performance of fine rice cv. kalizira

M. R. Islam, M. A. H. Khan, M. S. Rahman[1], M. S. Alam[2] and M. S. Rahman[3]
Department of Agronomy and [2]Germplasm Centre, Bangladesh Agricultural University, Mymensingh, [1]Department of Agricultural Extension, Khamarbari, Dhaka, [3]Regional Agricultural Research Station, BARI, Akborpur, Moulivibazar

Abstract: An experiment was conducted at the Agronomy Farm of Bangladesh Agricultural University, Mymensingh from July to December 2010 to investigate the effect of number of seedlings hill^{-1} and nitrogen rate on the yield performance of fine rice (cv. Kalizira). The two factor experiment consisted of two levels of number of seedlings hill^{-1} viz., 2 and 4 and four levels of nitrogen rates viz., 0, 20, 40, 60 kg ha^{-1}.Nitrogen was applied in the form of urea. The experiment was layout in randomized compete block design with three replications. Regarding the effect of number of seedlings hill^{-1}, 2 seedlings hill^{-1} produced the tallest plant, the maximum total tillers, effective tillers, length of panicle, grains per panicle, weight of 1000 grain, except non effective tillers hill^{-1} biological yield and harvest index, grain yield, straw yield and the minimum values were found in 4 seedlings per hill^{-1} except non effective tillers. Regarding the effect of nitrogen rates, the tallest plant, the maximum total tillers, effective tillers, length of panicle, grains per panicle, sterile spikelets, weight of 1000 grain, biological yield, harvest index, grain yield, straw yield and the lowest values of non effective tillers hill^{-1}were found in 60 kg N ha^{-1} and the minimum values were found in 0 kg N ha^{-1} except non effective tillers hill^{-1}. Interaction effect between number of seedlings hill^{-1} and nitrogen rates did not show any significant effect on all the studied parameters. So the variety Kalizira should preferably be transplanted in 60 kg N ha^{-1} with 4 seedlings hill^{-1} to obtain the desired grain yield.

Key words: Seedlings, nitrogen, yield, fine rice, Kalizira.

Introduction

Among various factors, improper number of seedlings hill^{-1} and nitrogen rate in soil are now considered as the major reasons for low yield of rice in Bangladesh. Of the nutrient elements derived from soils, the rice plant requires nitrogen in the major amount (Thenababu, 1972). However, nitrogen is found deficit in almost all soils of Bangladesh (Portch and Islam, 1984). The low level of organic matter content and deficiency of nitrogen in Bangladesh soils have been attributed primarily due to warm climate accompanied by year round cultivation of same piece of land. Many workers have reported a significant response of rice to nitrogen in different soils of Bangladesh (Eaqub and Mian, 1981; Bhuiyan *et al.*, 1989; Hussain *et al.*, 1991 and Islam *et al.*, 1990). Nitrogen is the key element in the production of rice and gives by far the largest response. Most of the rice varieties are highly responsive to added nitrogen and they are not expected to produce their full yield potential without adequate fertilization especially with nitrogen fertilizers.

Improper number of seedlings hill^{-1} may affect the physiological activity of rice plant and account for yield reduction. Like number of seedlings hill^{-1} also influences the uptake of nutrients, availability of radiant energy, and other physiological phenomena and ultimately affects the growth and development of rice plant. Therefore, the present study was conducted with the following objectives- i) to determine the appropriate rate of nitrogen fertilizer for successful cultivation of fine rice; ii) to determine the optimum number of seedlings hill^{-1} ; and iii) to find out the interaction, if any, among rates of nitrogen and number of seedlings hill-1.

Materials and Methods

An experiment was conducted at the Agronomy Farm of Bangladesh Agricultural University, Mymensingh from July to December 2010 to investigate the effect of number of seedlings hill^{-1} and nitrogen rate on the yield performance of fine rice (cv. Kalizira). The two factor experiment consisted of two levels of number of seedlings hill^{-1} viz., 2 and 4 and four levels of nitrogen rates viz., 0, 20, 40, 60 kg ha^{-1}. Nitrogen was applied in the form of urea. The experiment was layout in randomized compete block design with three replications. There were 8 plots in each replication. The size of the unit plot was 4.0 m×2.5 m. Total plots in the experimental field were 24. The seeds were collected from the Bangladesh Agricultural University Farm, Mymensingh. Manuring was done with cowdung at the rate of 5 t ha^{-1} during the land preparation. In addition, the crop was fertilized with P_2O_5, K_2O, S and Zn at the rate of 60-40-60-5 kg ha^{-1} at final land preparation in the form of triple supper-phosphate, muriate of potash, gypsum and $ZnSO_4$, respectively. One-third of N was applied at final land preparation and the rest of N was top dressed in three equal splits on 10, 25 and 45 days after transplanting (DAT).Forty days old seedlings were transplanted in the puddled field on 23 August 2010. Intercultural operation was done as and when necessary. The crop was harvested plot wise on 18 December 2010 at full maturity and the yields of both grain and straw were recorded after thoroughly during in the sun. Data pertaining to plant characteristics were taken from randomly selected hills harvested and collected from each plot. The-1000 grains weight was taken from dried grain samples of each unit plot. In respect of yield and yield contributing characters of the fine rice under study, the following data were collected. i) plant height (cm) ii) total number of tillers hill^{-1} iii) number of effective tillers hill^{-1}, iv) number of non-effective tillers hill^{-1}, v) length of panicle (cm), vi) number of grains panicle^{-1}N, vii) number of sterile spikelets panicle^{-1}, viii) weight of 1000 grains (g), ix) grain yield (t ha^{-1}), x) straw yield (t ha^{-1}), xi) biological yield (t ha^{-1}) and xii) harvest index. The collected data were analyzed using "Analysis of Variance" technique with the help of a computer package (MSTAT) and the mean differences were adjudged with Duncan's Multiple Range Test (Gomez and Gomez, 1983).

Results and Discussion

Main effect of number of seedlings hill^{-1}: Yield and yield contributing characters were no significantly affected by number of seedlings hill^{-1} ·2 seedlings hill^{-1} produced the tallest plant (145.43 cm), the maximum effective tillers (8.66), length of panicle (21.76 cm), no. of grains per panicle (112.82), weight of 1000 grain (11.33 g), except total tillers, non effective tillers hill^{-1}, sterile spikelets per panicle , grain yield, straw yield, biological yield and harvest index. The maximum total tillers (8.96), non effective tillers (1.97) hill^{-1} ,

no. of sterile spikelets per panicle (16.43) , grain yield (2.32 t/ha), straw yield 4.33 (t/ha), biological yield (6.63 t/ha) and harvest index (33.58 %) were obtained in 4 seedling hill^{-1}.and the minimum values were found in 4 seedlings per hill^{-1} in case of plant hieght (144.53 cm), effective tillers (8.34), length of panicle (21.24 cm), no. of grains per panicle (111.33), weight of 1000 grain (11.26 g), and the lowest values were found on non effective tillers (1.797) hill^{-1}, no. of sterile spikelets per panicle (15.33) , grain yield (2.27 t/ha), straw yield (4.12 t/ha), biological yield (6.43 t/ha) and harvest index (32.66 %) were obtained in 2 seedling hill^{-1} (Table 1).This finding agreed with Choudhury *et al.(1993),*and Singh *et al.* (1992).They observed that 4 seedlings hill^{-1} were better for grain yield of rice. BRRI (1992) reported that grain yield increased with the increase of plant population hill^{-1}.

Table 1. Effect of seedling hill^{-1} on yield and yield contributing characters of fine rice cv. Kalizira in aman season

Number of seedlings hill^{-1}	Plant height (cm)	Total tillers hill^{-1}	Effective tillers hill^{-1}	Non-effective tillers hill^{-1}	Length of panicle (cm)	Grains panicle^{-1}	Sterile spikelets panicle^{-1}	Wt. of 1000-grain (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
2	145.43	8.08	8.66	1.79	21.76	112.82	15.33	11.33	2.27	4.12	6.43	32.66
4	144.53	8.96	8.34	1.97	21.24	111.33	16.43	11.26	2.32	4.33	6.63	33.58
Level of sig.	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	3.03	12.30	13.46	30.84	6.42	14.34	13.50	3.36	2..44	5.33	12.33	14.51

NS = Not significant

Table 2. Effect of nitrogen rates on yield and yield contributing characters of fine rice cv. Kalizira in aman season

Nitrogen rates (kg ha^{-1})	Plant height (cm)	Total tillers hill^{-1}	Effective tillers hill^{-1}	Non-effective tillers hill^{-1}	Length of panicle (cm)	Grains panicle^{-1}	Sterile spikelets panicle^{-1}	Wt. of 1000-grain (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
0	140.63	9.40	7.69	1.86	20.02	91.52	19.41	10.45	1.94	3.76b*	5.70c	31.28
20	141.92	9.62	8.26	1.40	20.94	101.26	21.05	10.43	2.26	4.27ab	6.52ab	32.79
40	143.82	10.10	8.51	1.59	20.88	99.35	21.80	10.30	2.01	4.56a	6.47ab	33.42
60	145.31	10.47	8.61	1.32	21.66	102.28	22.72	10.66	2.27	4.72a	7.02a	34.70
S $\bar{x}$	-	0.2908	0.2459	-	-	-	-	-	-	0.1680	0.2258	-
Level of sig.	NS	NS	NS	NS	NS	0.01	0.01	NS	NS	0.01	0.01	NS
CV (%)	4.04	14.40	14.57	37.95	5.51	15.53	14.60	3.48	21.35	16.57	14.90	14.51

*In a column figures having similar letter (s) do not differ significantly as per DMRT. NS = Not significant

Table 3. Effect of interaction of seedlings hill^{-1} and N rates on yield performance of fine rice cv. Kalizira in aman season

Interaction (Number of seedlings hill^{-1} x Nitrogen rare)	Plant height (cm)	Total tillers hill^{-1}	Effective tillers hill^{-1}	Non-effective tillers hill^{-1}	Length of panicle (cm)	Grains panicle^{-1}	Sterile spikelets panicle^{-1}	Wt. of 1000-grain (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
S_1N_0	142.41	9.56	7.74	2.22a*	20.09	92.31	19.54	10.24	1.92	3.59	5.51	33.48
S_1N_1	140.88	9.88	8.38	1.17c	21.10	104.38	20.70	10.42	2.32	4.36	6.68	34.09
S_1N_2	144.04	10.04	8.02	1.16c	21.17	103.69	21.39	10.46	2.14	4.69	6.83	31.61
S_1N_3	146.20	9.96	9.04	1.93ab	21.24	105.86	20.38	10.48	2.32	4.69	7.11	32.19
S_2N_0	138.84	9.24	7.33	1.01ab	19.96	90.72	14.29	10.00	1.90	3.42	5.40	30.22
S_2N_1	142.97	9.36	8.13	1.47bc	20.58	98.13	21.41	10.45	2.19	4.19	6.38	33.49
S_2N_2	143.59	10.16	8.18	1.18c	20.68	95.01	21.07	10.37	1.87	4.22	6.11	31.24
S_2N_3	144.42	10.98	9.00	1.78abc	20.28	91.30	22.22	10.24	2.41	4.74	6.93	35.08
S $\bar{x}$	-	-	-	0.2044	-	-	-	-	-	-	-	-
Level of sig.	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV (%)	4.04	14.40	14.57	37.95	5.51	15.53	14.60	3.48	21.35	16.57	14.90	14.51

*In a column figures having similar letter (s) do not differ significantly as per DMRT. NS = Not significant. S_1= 2 seeding hill^{-1}, S_2 = 4 seeding hill^{-1}, N_0 = 0 kg Nha^{-1}, N_1 = 20 kg Nha^{-1}, N_2 = 40 kg Nha^{-1}, N_3 = 60 kg Nha^{-1}

Main effect of Nitrogen rate: Yield and yield contributing characters were significantly affected by nitrogen rate on grain and sterile spikelets per panicle as well as straw and biological yield. 60 kg N ha^{-1} produced the tallest plant (145.31 cm), the maximum total (10.47) and effective tillers (8.61), length of panicle (21.66 cm), no. of grains per panicle (102.28), no. of sterile spikelets per panicle (22.72), weight of 1000 grain (10.66 g), grain yield (2.27 t/ha), straw yield (4.72 t/ha), biological yield (7.02 t/ha) and harvest index (34.28 %) except non effective tillers hill^{-1}. The maximum

non effective tillers (1.86) hill^{-1} was obtained in 0 kg N ha^{-1} where no nitrogen was applied .and the minimum values were found in 0 kg N ha^{-1} on all the mentioned parameters except non effective tillers hill^{-1}.The lowest non effective tillers hill^{-1} was obtained in 60 kg N ha^{-1} (Table 2).This finding agreed with Kumar *et al.*(1986), and Singh *et al* .(1992). They reported that increasing rates of N from 0 to 60 Kg ha^{-1} increased yields.

Interaction effect of number of seedlings hill^{-1} and nitrogen rate: Yield and yield contributing characters did not differ significantly due to number of seedlings hill^{-1} and nitrogen rate. ·2 seedlings hill^{-1} with 60 kg N ha^{-1} produced the tallest plant (146.20 cm), the maximum effective tillers (9.04), length of panicle (21.24 cm), no. of grains per panicle (105.86), weight of 1000 grain (10.48 g), except non effective tillers hill^{-1}, sterile spikelets per panicle , grain yield, straw yield, biological yield and harvest index. The maximum total tillers hill^{-1} (10.98), non effective tillers (10.98) hill^{-1} , no. of sterile spikelets per panicle (22.22) , grain yield (2.41 t/ha), straw yield (4.74 t/ha), biological yield (6.93 t/ha) and harvest index (35.08 %) were obtained in 4 seedling hill^{-1}.with 60 kg N ha^{-1}. and the minimum values were found in 4 seedlings per hill^{-1} with 0 kg N ha^{-1} in case of plant height (138.84 cm), effective tillers (7.33), length of panicle (19.96 cm), no. of grains per panicle (9072), weight of 1000 grain (10.00 g), and the lowest values were found on non effective tillers (1.01) hill^{-1} , no. of sterile spikelets per panicle (14.33) , grain yield (1.90 t/ha), straw yield (4.42 t/ha), biological yield (5.40 t/ha) and harvest index (30.22 %) were obtained in 2 seedling hill^{-1} (Table 3).

Yield and yield contributing characters did not differ significantly due to number of seedlings hill^{-1} and nitrogen rate. ·2 seedlings hill^{-1} with 60 kg N ha^{-1} produced the tallest plant, the maximum effective tillers ,length of panicle , no. of grains per panicle, weight of 1000 grain, except non effective tillers hill^{-1}, sterile spikelets per panicle , grain yield, straw yield, biological yield and harvest index. The maximum total tillers hill^{-1}, non effective tillers hill^{-1} no. of sterile spikelets per panicle , grain yield, straw yield, biological yield and harvest index were obtained in 4 seedling hill^{-1}.with 60 kg N ha^{-1}. and the minimum values were found in 4 seedlings per hill^{-1} with 0 kg N ha^{-1} in case of plant height, effective tillers, length of panicle, no. of grains per panicle, weight of 1000 grain, and the lowest values were found on non effective tillers hill^{-1}, no. of sterile spikelets per panicle ,grain yield, straw yield, biological yield and harvest index were obtained in 2 seedling hill^{-1}.

From the results, it can be concluded that the Kalizira variety of fine rice can be cultivated in 60Kg N ha^{-1} with 4-seedlings hill^{-1}. This conclusion has been made based on the results of the study, conducted only in one season. Detailed studies are necessary to arrive at a definite conclusion.

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