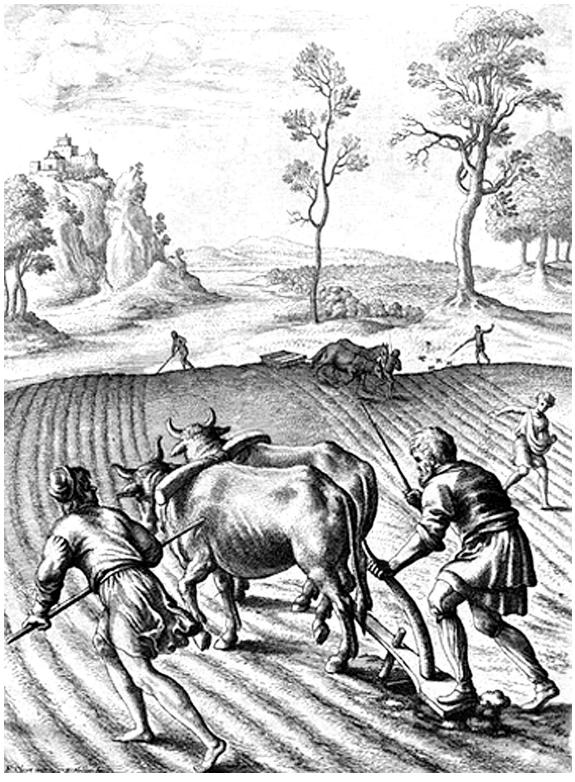
ISSN : 1812-5379 (Print)
ISSN : 1812-5417 (Online)
http://ansijournals.com/ja

JOURNAL OF AGRONOMY



ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Agronomy 1(1): 9-11, 2002 January - March 2002

Effect of Row Arrangement and Tiller Separation on the Yield and Yield Components of Transplant Aman Rice

S. K. Paul, M. A. R. Sarkar and M. Ahmed
Department of Agronomy, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

Abstract: The effect of row arrangement, time of tiller separation and number of tillers kept hill^{-1} was studied on the yield of transplant aman rice (cv. BR23). The highest number of total tillers hill^{-1}, effective tillers hill^{-1} and harvest index were found in single row. The highest harvest index was found in single row. The highest grain yield was obtained in double row arrangement. Plant height and panicle length were higher when the tillers were separated at 25 DAT but number of total tillers hill^{-1} was maximum when the tillers were separated at 35 DAT. The highest number of effective tillers hill^{-1}, number of grains panicle^{-1} and grain yield were obtained when 2 tillers were kept hill^{-1}. The highest number of effective tillers hill^{-1} was obtained when tillers were separated at 35 DAT and 4 tillers kept hill^{-1} which was similar to tiller separation at 25 DAT keeping 2 tillers hill^{-1}. Growing transplant aman rice in double row arrangements appears as the promising practice. Cultivar BR23 of transplant aman rice appears to be resistant to tiller separation leaving behind only 2 tillers hill^{-1}. Tillers can be separated at 25 or 35 DAT without hampering the grain yield.

Key words: Row arrangement, tiller separation time, tillers kept hill^{-1}, yield, yield components and transplant aman rice

Introduction

Transplant aman rice grown during June to December is the main rice crop in Bangladesh. But devastating flood sometimes damages this crop completely. When flood water recedes in the early or mid-September farmers can not retransplant their aman rice due to unavailability of seedlings. Retransplanting of separated tillers of transplant aman rice not affected by flood and subsequent proper management practices may rehabilitate the damaged rice. Tolerance of mother plants to tiller separation needs to be tested so that their yields are not adversely affected. Row arrangement, time of tiller separation and number of tillers to be kept with mother plant may be important management practices for proper recovery in growth of mother plants.

Rice and the other cereals have unique ability to tiller profusely as each leaf axil has the potential to produce tillers (Langer, 1979). In rice, many of the late tillers do not produce panicles due to higher population (Nishikawa and Hanada, 1951; Hanada, 1979). Removal of some tillers from the mother hill can help better development of remaining tillers. Therefore, tiller separation from the mother plant may be an important aspect of research regarding vegetative propagation and use of separated tillers as seedlings for transplant aman rice production.

So, the present experiment was undertaken to study the effect of row arrangement, time of tiller separation and number of tillers kept with mother hill on the yield and yield components of transplant aman rice.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from June to December 1998. The land was medium high with sandy loam texture having pH 5.9-6.5.

BR23 (Dishari), a modern variety of transplant aman rice, was used as the test crop in experiment. The experiment consisted of three levels of row arrangements viz., a) single row (row spacing 25 cm), b) double row (row spacing 25-10-25 cm), c) triple row (row spacing 25-10-10-25 cm); two times of tiller separation viz., a) 25 days after transplanting (DAT). b) 35 days after transplanting (DAT) and three levels of number of tillers kept hill^{-1} a) 2 tillers hill^{-1}, b) 4 tillers hill^{-1} and c) intact hills.

The experiment was laid out in a split-plot design with row arrangements in the main plots and combination of time of tiller separation and number of tillers kept hill^{-1} in the sub-plots. The treatments were replicated thrice. Area of each unit plot was 4.0 m x 2.5 m. Forty days old seedlings were uprooted from the nursery bed and were transplanted on 1st August 1998 with two seedlings hill^{-1}.

The land was fertilized with 90-70-50-25-6 kg ha^{-1} of N-P_2O_5-K_2O-S-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 were applied at final land preparation. Urea was top dressed in three equal instalments at 10, 30 and 50 DAT (panicle initiation stage).

The crop was properly weeded and irrigated whenever necessary. Sumithion @ 400 ml acre^{-1} was applied to control green leaf hopper. At maximum tillering stage sheath blight was successfully controlled by proper drainage and applying Tilt (25 EC) @ 400 ml acre^{-1} at 10 day intervals.

Five hills were randomly selected in each unit plot excluding border rows to record the data on plant characters and yield components. Harvesting was done on 20 December 1998. The harvested crop was then threshed, cleaned and sun dried to record the grain yield plot^{-1}, which was finally converted to ha^{-1} at 14% moisture basis.

Results and Discussion

Row arrangements: Row arrangements significantly influenced the crop characters. The highest number of total tillers hill^{-1} and effective tillers hill^{-1} were found in single row due to wider space (Table 1 and 2). Thompstone (1953) reported that wider space produced more tillers hill^{-1}. Available literature suggest that tillering ability of individual plants is reduced due to increase in plant density, resulting in poor growth and development of plant (Yamada, 1961; Vachhani, 1961; Golingai and Mabbayed, 1969). Plant competition was more in double and triple row arrangements due to high plant population which caused a reduction in the production of total tillers and effective tillers hill^{-1}. Maximum grain yield was obtained in double row arrangement followed in order by single row and triple row arrangements (Table 2). Reduction in the production of effective tillers hill^{-1}, in triple row system probably due to higher plant population density might have resulted in decreased grain yield. Although the higher number of effective tillers hill^{-1} was observed in single row system but the number of effective tillers might be less compared to double row system for relatively wide spacing which was the probable reason of lower yields. The findings of this study that double row system produced the highest grain yield are in agreement with the findings of many authors (BRRI, 1981, Singh *et al.*, 1986; Hossain *et al.*, 1990). The highest harvest index was recorded in single row which was statistically identical to double row, where as lowest one found in triple rows (Table 2).

Time of tiller separation: Crop characters are significantly influenced by time of tiller separation. The highest plant height and the highest panicle length were found when tillers hill^{-1} were separated at 25 DAT (Tables 1 and 2). Late tiller separation reduced plant height was obtained by Mollah *et al.* (1992) and Mamin *et al.*

Table 1: Effect of row arrangements, time of tiller separation and number of tillers kept hill^{-1} on the vegetative characters

Treatments	Plant height (cm)	Number of non bearing tillers hill^{-1}	Number of total tillers hill^{-1}	Straw yield (t ha^{-1})
Row arrangements				
Single row	120.41	2.12	10.56 a	6.05
Double row	118.78	1.87	9.06 ab	6.77
Triple row	118.80	1.69	7.95 b	6.81
Time of tiller separation				
25 DAT	120.36 a	1.68 b	8.93 a	6.54
35 DAT	118.30 b	2.10 a	9.45 a	6.55
Number of tillers kept hill^{-1}				
2 tillers	118.30	1.37 b	8.87 b	6.20 b
4 tillers	119.14	1.50 b	9.04 b	6.21 b
Intact hills	120.55	2.81 a	9.66 a	7.22 a

Figures in a column under each treatment having the same letter or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.

Table 2: Effect of row arrangements, time of tiller separation and number of tillers kept hill^{-1} on the yield and yield components

Treatments	Number of Effective tillers hill^{-1}	Panicle length (cm)	Number of grains panicle^{-1}	Number of sterile spikelets panicle^{-1}	Number of total spikelets panicle^{-1}	Weight of 1000 grains	Grain yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
Row arrangements									
Single row	8.44 a	28.05	104.87	29.79	134.63	25.40	3.88 b	9.93	39.65 a
Double row	7.19 b	27.73	102.55	27.73	130.20	25.76	4.24 a	10.99	38.60 a
Triple row	6.35 b	27.35	95.21	29.59	126.21	25.65	3.50 c	10.31	34.17b
Time of tiller separation									
25 DAT	7.26	28.10 a	101.40	30.40	131.81	25.73	3.86	1.39	37.34
35 DAT	7.40	27.33 b	100.35	27.67	128.90	25.47	3.88	10.43	37.62
Number of tillers kept hill^{-1}									
2 tillers	7.82 a	27.39 b	106.64 a	24.24 b	130.86	25.66	4.39 a	10.58	41.62 a
4 tillers	7.68 a	27.35 b	102.18 a	25.70 b	129.42	25.76	3.83 b	10.04	38.66 a
Intact hills	6.79 b	28.40 a	93.81 b	37.17 a	103.78	25.38	3.39	10.61	32.15 b

Figures in a column under each treatment having the same letter or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.

Table 3: Interaction between row arrangement and time of tiller separation on the vegetative characters

Row arrangement	Time tiller separation (Days after transplanting)	Plant height (cm)	Number of total tillers hill^{-1}	Number of non-bearing tillers hill^{-1}	Straw yield (t ha^{-1})
Single row	25	120.98	10.40	2.18 a	5.72
	35	119.84	10.71	2.07 a	6.38
Double row	25	120.60	8.72	1.53 b	6.97
	35	116.97	9.40	2.20 a	6.56
Triple row	25	119.53	7.67	1.33 b	6.92
	35	118.09	8.23	2.04 a	6.70

Figures in a column having the same letter or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.

Table 4: Interaction effect of row arrangement, time of tiller separation and number of tillers kept hill^{-1} on the reproductive characters, yield and yield components

Row arrange-ment	Time of tiller separation (Days after transplanting)	Number of tillers kept hill^{-1}	Number of effective tillers hill^{-1}	Panicle length (cm)	Number of grains panicle^{-1}	Number of sterile spikelets panicle^{-1}	Number of total spikelets panicle^{-1}	Weight of 1000 grains (g)	Grains yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
	25	2	8.67 b	27.88	112.99	24.24	137.23	25.15	4.42	10.14	43.68
		4	8.13 bc	27.91	102.57	27.06	129.63	25.72	3.67	8.73	42.04
Single		Intact hills	7.93 bcd	29.32	103.02	40.99	143.90	25.39	3.33	9.71	34.60
row	35	2	8.53 b	27.73	114.51	26.31	140.82	25.29	4.37	10.17	42.99
		4	10.00 a	26.98	106.30	21.47	127.77	25.70	4.07	10.24	42.07
		Intact hills	7.40 cdef	28.47	89.80	38.66	128.46	25.11	3.40	10.57	32.51
		2	7.63 bcde	27.62	108.52	22.28	130.79	26.33	4.93	11.88	41.52
	25	4	7.40 cdef	28.19	105.63	29.63	135.26	25.88	4.35	10.91	40.22
Double		Intact hills	6.53 efg	28.44	93.23	29.93	123.17	25.59	3.60	10.91	33.10
row		2	7.40 cdef	27.03	104.92	20.17	125.08	25.70	4.57	10.63	42.86
	35	4	7.27 cdef	26.62	103.02	23.20	125.94	25.85	4.33	10.74	40.28
		Intact hills	6.93 def	28.51	100.00	41.16	140.97	25.19	3.66	10.87	33.67
		2	6.40 fg	27.39	96.35	30.48	126.83	25.90	4.07	10.60	38.70
	25	4	6.27 fg	27.44	100.60	33.09	133.72	25.64	3.22	9.94	32.66
Triple		Intact hills	6.33 fg	28.69	89.71	35.92	125.62	25.96	3.14	10.65	29.49
row		2	6.50 fg	26.68	102.56	21.95	124.37	25.62	4.00	10.04	39.96
	35	4	7.00 def	26.96	94.98	19.74	124.16	25.78	3.35	9.70	34.69
		Intact hills	5.60 g	26.97	87.06	36.37	122.57	25.01	3.22	10.93	29.51

Figures in a column under each treatment having the same letter or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.

(1999). Maximum number of total tillers and non bearing tillers were found when the tillers were separated at 35 DAT.

Number of tillers kept hill^{-1}: Yield components are significantly influenced by number of tillers kept hill^{-1} at separation. The highest number of effective tillers hill^{-1}, number of grains panicle^{-1} and grain yield were found when 2 tillers were kept hill^{-1} at separation (Table 2). Improvement of yield components e.g. number of effective tillers hill^{-1} and number of grains panicle^{-1} were mainly responsible for increased grain yield when 2 tillers were kept with mother plant. On the other hand yield components were relatively inferior in intact hills and thus grain yield was reduced.

Straw yield was reduced in the crop subjected to tiller separation leaving behind 2 and 4 tillers hill^{-1} compared to intact hills (Table 1). Keeping 2 and 4 tillers with mother plants during tiller separation produced similar straw yields. The probable reasons of increased straw yield in the intact hill might be due to higher

number of total tillers hill^{-1} and taller plants and undisturbed vegetative growth. A similar finding of an increased straw yield have been reported by Mollah *et al.* (1992) and Roy *et al.* (1990). The highest harvest index was found where two tillers were kept hill^{-1} that was statistically identical to four tillers kept hill^{-1} during tiller separation, lowest one in intact hills (Table 2).

Interaction: The highest number of effective tillers were found in single row when tillers were separated at 35 DAT and 4 tillers were kept hill^{-1} (Tables 3 and 4). On the other hand, maximum non bearing tillers were recorded in double row arrangement where tillers were separated at 35 DAT.

From the results of the present study it can be concluded that transplant aman rice should preferably be grown in double row arrangement to obtain the highest grain yield. The crop appears to be tolerant to tiller separation leaving behind only 2 tillers hill^{-1}. Tillers can be separated either at 25 or 35 days after transplanting without any adverse effect on grain yield.

References

BRRI (Bangladesh Rice Research Institute), 1981. Annual Report for 1976-77. BRRI Pub. No. 39. Joydebpur, Gazipur, Bangladesh, pp: 2, 8-11, 42.

Golingai, S.A. and B.B. Mabbayad, 1969. Plant arrangement and spacing study on C4-63 and IR-8 (68) rice varieties. Phil. Agric. 52: 556-577.

Hanada, K., 1979. Differentiation and development of tiller buds in rice plants. J.A.R.Q., 16: 79-86.

Hossain, S.M.A., M.U. Salam and M.S. Islam, 1990. Effect of alternate row spacing on rice yield in relation to rice-fish culture. Int. J. Trop. Agric., 6: 1-5.

Langer, R.H.M., 1979. Tillering In: How Grasses Grow (2nd edn). studies in Biology. No.34, Edward Annold, London, pp: 67.

Mamin, M.S.I., M.Z. Alam, A.U. Ahmed., M.A. Rashid and F. Jameel, 1999. Effect of splitting tillers on the yield and yield components of transplanted aman rice. Ann. Bangla Agric., 9: 1-9.

Mollah, M.I.U., S.M.A. Hossain, N. Islam and M.N.I. Miah, 1992. Some aspects of tiller separation in transplant aman rice. Bangla. Agron. J., 4: 45-49.

Nishikawa, G. and K. Hanada, 1951. Studies in branching habit in crop plants. I. On the differentiation and development of tillering buds in low land rice seedling grown under different seeding space. Proc. Crop Sci. Soc. Japan, 28: 191-193.

Roy, S.K., P.K. Biswas and A. Quasem, 1990. Effects of tiller removal and replant tillers on the yield of the main and the subsequent rice crops. Bangla. J. Agric., 15: 11-18.

Singh, R.S., D.C Ghosh, A. Kumar and U.K. Verma, 1986. Studies on growth and yield with different planting patterns. Indian J. Agron., 31: 16-20.

Thompstone, 1953. Effect of spacing on the yield component of rice. Agric. J. India, 10: 26-53.

Vachhani, M.V., 1961. Influence of spacing on plant characters and yield of transplant rice. Rice News Lett, 9: 15-16.

Yamada, N., 1961. On the relationship between yield and spacing in rice. Agric. Hort., 36: 13-18.