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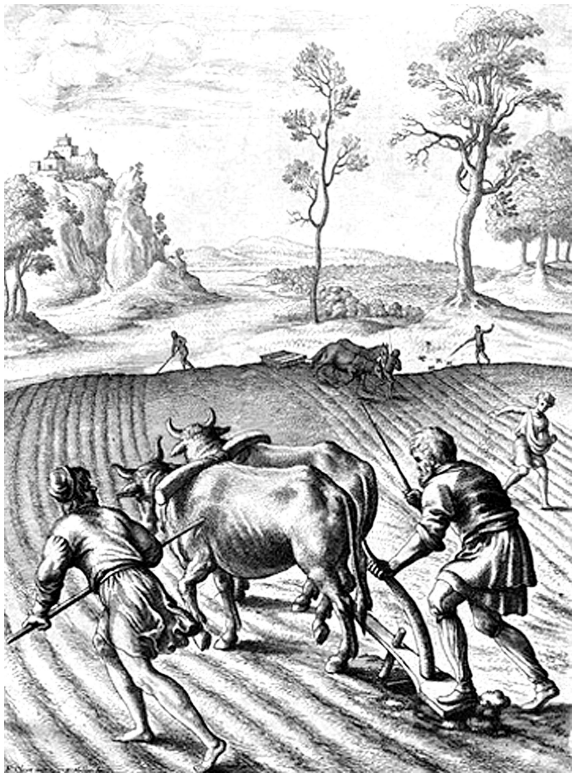

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A Comparative Study of Direct Seeding Versus Transplanting Method on the Yield of Aus Rice

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Abstract: An experiment was conducted to evaluate the performance of three modern rice varieties viz., BR1, BR14 and BR26 along with a local variety, namely, Hashikalmi grown under direct seeded and transplanted method. High yielding varieties produced significantly higher grain yield compared with local variety. A higher spikelet sterility was recorded for the local variety compared with modern varieties especially when grown under direct-seeded method. Methods of planting exerted a significant influence on the yield and yield attributes of aus rice. Transplanted rice gave higher yield than direct seeded rice for both local and high yielding varieties.

Key words: Direct seeding, transplanting, aus rice, yield components HYV

Introduction

Bangladesh grows three rice crops in a year, namely, aus (summer rice), aman (autumn rice) and boro (winter rice). Among the rice crops of the country aus rice occupies 15.24% of the total acreage (Anonymous, 1998). The yield of aus rice is the lowest among all the three rice crops. It is therefore, important to know the best method along with cultural practices to get the optimum yield of aus rice.

Rice is grown throughout the world in different ways. For the cultivation of all high yielding varieties (HYV), improved cultural methods are recommended for optimum yield. Transplantation of seedlings is always recommended as planting method for HYV. On the other hand, direct seeding is also recommended for some local varieties due to the lack of irrigation facilities and short duration. In Bangladesh, upland aman and boro rice is more productive and it is one of the surest methods of obtaining good yield. Direct seeded rice seems more suitable in multiple cropping programme due to early maturation. The climate and edaphic conditions of Bangladesh prevailing during the planting period of aus rice compel the farmers to adopt the direct seeding of the crop. The method of transplanting can be practiced where adequate irrigation facilities are available. Timely sowing may also be possible by irrigating the soil. The challenge to researchers is to develop technologies which will increase and sustain rice production in the major rice growing countries to meet their food needs. The adverse climatic conditions like water stress and other environmental factors may affect the crop during early establishment, vegetative and reproductive stages of rice cause significant yield reduction.

Aus rice is generally sown in Bangladesh during 15th March to 15th April under rainfed condition as a direct seeded crop. Under adverse climatic conditions when there is a shortage of enough stored soil moisture and also when the land is occupied by some other crop, direct seeding of aus rice is not possible. To overcome this situation aus rice is grown as a transplanted crop in the month of May after a shower of rain. Transplanting method of aus rice cultivation thus enables the farmers to obtain a rice crop before planting of transplanted aman rice, the main rice crop of Bangladesh. Moreover, yield of transplanted aman rice may be more than that of direct seeded one due to suppression of weed growth and favourable agroecosystem (Shen, 1934).

The present piece of research work was, therefore, undertaken to evaluate the comparative yield performance of some aus rice varieties grown under direct-seeded and transplanted conditions and to see the effective method of planting.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory of Bangladesh Agricultural University, Mymensingh during the period from March to August 1998 to study the yield performance of aus rice under two different methods of cultivation i.e., direct seeding and transplanting. The soils of the experimental plots belong to Sonatola series of non-calcareous dark grey floodplain under the old Brahmaputra agroecological Zone (AEZ 9). The soil was silt loam with pH 6.7 (Anonymous, 1988). The experiment consisted of four rice varieties viz., Hashikalmi, BR1, BR14 and BR26, and two planting methods viz., direct seeding under rainfed conditions and seedling transplanting. The experiment was laid out in split plot design with four replications assigning method of planting in the main plots and varieties in the sub plots.

The land was thoroughly ploughed on 12th March 1998 with a tractor drawn disc plough followed by harrowing. Then it was prepared by ploughing four times with country plough followed by laddering in order to level the soil. The weeds and stubble were removed from the field as much as possible. The land was brought into fine tilth condition at final land preparation on 22nd March 1997. The lay out of the experiment was done according to the design adopted. At last the individual plots were prepared by laddering before direct seeding. For transplanting the open land was irrigated and puddled with spade before transplanting of seedlings in the prepared specified sub plots. The experimental plots were fertilized with N, P_2O_5 and K_2O in the forms of urea, triple super phosphate (TSP) and muriate of potash (MP). For direct seeded rice the rates of fertilizer were 32, 34 and 21 kg N, P_2O_5 and K_2O, respectively, for Hashikalmi and 60, 36 and 24 kg N, P_2O_5 and K_2O, respectively, for BR1, BR11 and BR26 (Anonymous, 1996). For Hashikalmi, total amount of TSP and MP and half amount of urea was applied as basal dose and the rest half amount of urea was top dresses 20 days after sowing (DAS) and for HYV whole amount of TSP and MP and one-third amount of urea was top dressed in two equal splits at 20 and 45 DAS. For transplanted rice rates of fertilizer were 36, 34 and 21 kg N, P_2O_5 and K_2O, respectively, for Hashikalmi and 63, 45 and 24 kg N, P_2O_5 and K_2O, respectively, for BR1, BR14 and BR26. The whole amount of TSP and MP was applied as basal dose and the N was applied as 3 equal splits at 15, 30 and 45 days after transplanting (Anonymous, 1996). On 23rd March 1998 sowing was started. In the specified 16 plots dry seeds were sown in furrows at the seed rate of 60 kg ha^{-1} at spacing of 25 cm × 15 cm^2. Thirty days old seedlings were uprooted carefully and then transplanted in the specified 16 experimental plots at a spacing of 25 cm apart lines maintaining 15 cm hill to hill distance and 3 seedlings hill^{-1} were transplanted. Weeding was done thrice on 16th April, 1st May and 11th May 1998 for direct seeded rice. At the time of second weeding, excess plants were also thinned out to maintain the plant population equal to that of transplanted method. For transplanting method, weeding was done twice at 7 and 25 days after transplanting. The experimental crops were infested with rice stem borer at the early growth stages. The pest was effectively controlled by spraying Diazinon 60 EC at the rate of 1.7 kg ha^{-1} with a sprayer.

Depending upon varieties and methods of planting crops matured at different dates. After harvesting the crop of the unique plot, the grains were threshed, cleaned and sun dried to record the grain yield plot^{-1}. Straws were sun dried to record its yield plot^{-1}.

Data on crop characters and yield components were recorded from 10 randomly selected hills in each plot. Recorded data were analyzed statistically following the ANOVA technique and the mean differences were compared with Duncan's multiple range test (Gomez and Gomez, 1984).

Results and Discussion

Effect of variety: Different yield and yield contributing characters of aus rice differed significantly due to varietal differences (Table 1). Plant height was the highest (103.25 cm) in Hashikalmi variety and the lowest (83.13 cm) in BR1 variety. Total tillers and effective tillers hill^{-1} were the highest (13.49 and 11.99, respectively) in BR26 variety and the lowest in BR14. Panicle length was the highest (21.91 cm) in BR1 which was statistically similar to BR26 (21.82 cm). Spikelets panicle^{-1} was maximum (92.14) in BR1 and it was minimum (63.82) in Hashikalmi. Number of sterile spikelets panicle^{-1} was the highest (33.64) in Hashikalmi variety and the lowest (21.16) in BR14 variety. Grains panicle^{-1} was the highest (66.88) in BR1 which was statistically identical with BR14 (66.13). Thousand-grains weight was the highest (23.43 g) in BR14 and it was the lowest (20.05 g) in BR26. Grain yield was the highest (3.35 t ha^{-1}) in BR1 variety which was statistically identical with BR14 (3.27 t ha^{-1}) and BR26 (3.11 t ha^{-1}). Of the yield component studied, sterile spikelets panicle^{-1} were significantly higher (33.64) in local variety Hashikalmi compared to high yielding varieties (HYV). The other yield contributing characters like effective tillers hill^{-1}, panicle length and grains panicle^{-1} were highest in high yielding varieties. These improved parameters were mainly responsible for the higher grain yield of modern varieties. Hashikalmi produced the lowest grain yield (1.35 t ha^{-1}). This might be due to the lodging characteristics, higher spikelets sterility and inferior yield contributing characters compared to HYV rice. Straw yield was the highest (4.60 t ha^{-1}) in BR26 variety which was statistically similar to that of Hashikalmi (4.35 t ha^{-1}) and the lowest straw yield (3.97 t ha^{-1}) was recorded in BR1 variety.

Effect of method of planting: Planting method exerted significant influence on yield and yield attributes of aus rice (Table 1). Taller plant (98.57 cm) was recorded from transplanting method and the shorter plant (96.91 cm) from direct seeding. Total tillers and effective tillers hill^{-1} (11.22 and 9.65, respectively) were higher in transplanting method. Similar findings were also reported by Gupta *et al.* (1976). Longer panicles (21.21 cm) were observed in transplanting method than that of direct seeding (20.03 cm). Similar tendency of influencing panicle length due to the method of planting also observed by Gupta *et al.* (1976). Total number of spikelets panicle^{-1} was higher (83.91) in transplanting method than that of direct seeding method (75.56) Number of grains panicle^{-1} was higher (58.39) in transplanting than that of direct seeding (47.40) method. This result is in agreement with that of Rao *et al.* (1981). Direct seeded rice produced higher number (27.98) of sterile spikelets panicle^{-1} and lower (25.22) was in transplanting method. Thousand-grains weight was also higher (22.14) in transplanting method than that of direct seeding (21.23). Grain yield was higher (3.23 t ha^{-1}) in transplanting method than that of direct seeded one (2.32 t ha^{-1}) (Table 1). These results are in agreement with the findings of Ghosh *et al.* (1960), Jana *et al.* (1981) and Shamsuddin *et al.* (1988). This might be due to the cumulative effect of more number of effective tillers hill^{-1}, longer panicles, higher number of grains panicle^{-1} and lower number of sterile spikelets panicle^{-1}. Transplanted rice suffered less from soil moisture stress than that of direct seeded rice. Direct seeded rice produced the lower grain yield because of inadequate soil moisture prevailing during the growth period of the crop. These results are in partial agreement with that of Gupta *et al.* (1976), Thakur (1993) and Panda *et al.* (1994) who reported that yield obtained from transplanted rice was higher than that of direct seeded rice.

Interaction effect of variety and method of planting: Interaction of variety and method of planting had no significant effect on plant height, total tillers hill^{-1}, effective tillers hill^{-1}, panicle length, grains panicle^{-1} and grain and straw yields (Table 1). Number of spikelets panicle^{-1}, sterile spikelets panicle^{-1} and 1000 grains weight varied significantly due to the interaction effect of variety and method of planting (Table 1). The highest number of spikelets panicle^{-1} (97.56) was obtained from BR1 × seedling transplanting and the lowest in BR26 × direct seeding (60.63). The highest number of sterile spikelets panicle^{-1} (35.10) was recorded from BR26 × direct seeding which was statistically identical with BR26 × seedling transplanting. The lowest number of sterile spikelets panicle^{-1} was (23.63) in BR14 × seedling transplanting.

Table 1: Effect of variety, planting method and their interaction on the yield and yield attributes of aus rice

Treatments	Plant height (cm)	No. of total tillers hill^{-1}	No. of effective tiller hill^{-1}	Panicle length (cm)	No. of total spikelets panicle^{-1}	No. of grains panicle^{-1}	No. of sterile spikelets panicle^{-1}	1000 grains weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
Variety										
BR1	83.13c*	9.84bc	8.68b	21.91a	92.14a	66.68a	24.70c	21.94b	3.35a	3.97c
BR14	101.71b	9.09bc	8.02b	19.44b	86.72b	66.13a	21.16d	23.43a	3.27a	4.07bc
BR26	102.87ab	13.49a	11.99a	21.82a	76.28c	48.79b	26.91b	20.05c	3.11a	4.60a
Hashikalmi	103.25a	10.12b	7.92b	18.80c	63.82d	29.78c	33.64a	21.34b	1.35b	4.35ab
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.05	0.05	0.01
S$\bar{x}$	0.42	0.21	0.22	0.24	0.96	1.61	0.54	0.18	0.09	0.07
Method of planting										
Direct seeding	96.91b	10.05b	8.66b	20.03b	75.56b	47.40b	27.98a	21.23b	2.32b	4.01b
Transplanting	98.57a	11.22a	9.65a	21.21a	83.91a	58.39a	25.22b	22.14a	3.23a	4.48a
Level of significance	0.05	0.05	0.01	0.01	0.05	0.01	0.01	0.01	0.01	0.01
S$\bar{x}$	0.31	0.24	0.06	0.21	1.58	0.97	0.19	0.09	0.04	0.05
Variety × Planting method										
BR1 × Direct seeding	82.35	9.30	8.24	21.38	86.72c*	61.70	24.1c	21.69c	2.90	3.69
BR1 × Transplanting	83.91	10.39	9.12	22.44	97.56a	72.07	25.10c	22.19bc	3.81	4.25
BR14 × Direct seeding	101.70	8.41	7.25	18.99	80.69d	58.21	23.63c	22.72b	2.65	3.77
BR14 × Transplanting	101.72	9.78	8.79	20.90	92.76b	74.05	18.89c	24.15a	3.90	4.37
BR26 × Direct seeding	101.92	9.58	7.32	18.20	60.63g	22.05	35.10a	20.56d	1.01	4.19
BR26 × Transplanting	104.57	10.66	8.52	19.41	67.21f	34.51	32.19a	22.12bc	1.70	4.51
Hashikalmi × Direct seeding	101.68	12.91	11.84	21.55	74.40e	44.64	28.92b	19.97d	2.72	4.40
Hashikalmi × Transplanting	104.10	14.10	12.16	22.10	78.16de	52.95	24.90c	20.15d	3.51	4.81
Level of significance	NS	NS	NS	NS	0.05	NS	0.01	0.05	NS	NS

*Figures in a column having common letter(s) do not differ significantly as per DMRT

Thousand grains weight was the highest (24.15 g) in BR14 × seedling transplanting interaction and the lowest in Hashikalmi × direct seeding interaction (19.97 g). Though grain and straw yields did not vary significantly due to variety × seedling transplanting interaction, numerically the highest grain yield (3.90 t ha^{-1}) was obtained from BR14 × seedling transplanting and the lowest (1.01 t ha^{-1}) in BR26 × direct seeding interaction. Numerically the highest straw yield (4.81 t ha^{-1}) was obtained from Hashikalmi × seedling transplanting and the lowest (3.69 t ha^{-1}) in BR1 × direct seeding. From the results of the experiment it can be concluded that high yielding varieties of aus rice should be cultivated during aus season in order to obtain higher grain yield. Transplanting method appeared as the better method than direct seeding of aus rice in terms of grain and straw yields.

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