

DEVELOPMENT OF THREE LINE RICE HYBRIDS USING NEW PLANT TYPE INTER-SUB SPECIFIC (*indica/japonica*) DERIVATIVE LINES

Md. Sarowar Hossain¹

Extended Summary

A two years project approved by SAURES (Sher-e-Bangla Agricultural University Research System) where first experiment entitled "Identification of potential maintainers and restorers from *indica/japonica* derivatives" was conducted in Aman season, 2005 and second experiment entitled "Conversion of selected maintainers possessing desirable plant type into CMS line" was conducted in Rabi season 2005-06. The extended summary of these two experiments was already published in SAURES Biennial Report 2004-05. The third experiment entitled "Development of new plant type based hybrids" and "Conversion of selected maintainers lines into new CMS lines" was conducted in Aman season 2006 and fourth experiment entitled "Evaluation of hybrids" was conducted in Boro season, 2006-07.

Seven top ranking maintainer lines identified following various scoring parameters and overall ranking were chosen for conversion into new CMS lines. These were identified from test cross population at SAU farm in Aman season 2006 (Kharif-2) and Rabi 2006-07. During Aman season 2006, all of seven selected maintainer lines were evaluated for pollen sterility and spikelet fertility using bagged panicles and it was found that one maintainer line (TC-53) showed 97.44% pollen sterility and 6.09% spikelet fertility. This one maintainer line was eliminated because of unstable sterility behavior (Table 1). The remaining six F₁ maintainer lines showing perfect and stable sterility were back crossed and BC₂F₁ was evaluated during Rabi 2006-07 which showed complete pollen sterility in the BC₁F₁ progenies as was observed at Kharif-2 2006.

Observation on morphological characters favoring out-crossing and increased seed production were recorded on selected BC₂F₁ plants and their respective pollen parents during Rabi 2006-07 (Table-2).

Based on plant height, all six BC₂F₁ progenies were categorized as semidwarf (height less than 110 cm). The plant height of PP was slightly higher than the BC₂F₁ progenies in all cases.

¹Principal Investigator & Associate Professor, Dept. of Genetics & Plant Breeding, Sher-e-Bangla Agricultural University, Dhaka.

Table 1. Pollen sterility and spikelet fertility study of selected hybrids of maintainer lines and subsequent backcross generations

Sl. No.	Test cross No.	Rabi (2005-06)		Kharif-2 (2006)		Rabi (2006-07)	
		F ₁		BC ₁ F ₁		BC ₂ F ₁	
		Pollen sterility (%)	Spikelet fertility (%)	Pollen sterility (%)	Spikelet fertility (%)	Pollen sterility (%)	Spikelet fertility (%)
1.	TC - 44	100	0	100	0	100	0
2.	TC - 53	100	0	97.44	6.01	-	-
3.	TC - 87	100	0	100	0	100	0
4.	TC - 63	100	0	100	0	100	0
5.	TC - 23	100	0	100	0	100	0
6.	TC - 58	100	0	100	0	100	0
7.	TC - 91	100	0	100	0	100	0

TC= Test Cross

Except TC-58 and TC-91, all were categorized as good tillering group (20-25 tillers/plant). In case of pollen parents, the range of this trait varied from 8.00 (PP-63) to 16.40 (PP-23). The number of productive tillers per plant of pollen parents was less than BC₂F₁ genotypes in all cases. The panicle length of BC₂F₁ was slightly higher than the all PP (pollen parent) except PP-58. The panicle exertion rate from 79.86% in TC-58 to 89.14% in TC-44. All the pollen parents (maintainer lines) showed 100% panicle exertion rate. It was found that, out of 6 selected BC₂F₁ generations, 5 showed full stigma exertion (stigma exertion in both side) and only one TC-91 which showed partial stigma exertion (stigma exertion in one side). Three back cross lines namely TC-44, TC-87 and TC-23 showed 45, 48 and 47 seeds per panicle in respective order. TC-63 had 36 seeds per panicle and the other two namely TC-58 and TC-91 had only 31 seeds. Total grains per panicle ranged from 215.20 in TC-58 to 380.00 in TC-44 in case of BC₂F₁ lines. But in case of PP (pollen parent), it ranged from 176.00 in PP 23 to 281.40 in PP-58. The total grains per panicle of BC₂F₁ were higher than the PP except TC-58. It was observed that the spikelet fertility of pollen parents was normal and ranged from 73.92% in PP-58 to 93.86% in PP-87.

Table 2. Mean performance of selected backcross generation (BC₂F₁) and their respective maintainer lines (B line) during Rabi 2006-07

Sl. No.	Test cross/ Pollen parent No. (TC/PP)	Plant height (cm)		Productive tillers / plant		Panicle length (cm)		Panicle exertion rate (%)		Stigma exertio n	Filled spikelets / panicle		Total spikelets / panicle		Spikelet fertility (%)	1000- grain weight (g)
		BC ₂ F ₁	PP	BC ₂ F ₁	PP	BC ₂ F ₁	PP	BC ₂ F ₁	PP		BC ₂ F ₁	PP	BC ₂ F ₁	PP		
1.	TC - 44	99.75	103.40	21.20	10.60	23.75	21.70	89.14	100	F	45	214.20	380.00	230.40	92.97	24.27
2.	TC - 87	94.50	97.20	21.67	9.25	23.70	17.60	82.59	100	F	48	217.00	328.50	231.40	93.86	17.24
3.	TC - 63	99.88	108.20	19.50	8.00	24.83	22.60	81.26	100	F	36	179.00	297.32	241.14	82.52	21.06
4.	TC - 23	77.20	105.13	20.00	16.40	24.50	24.20	81.51	100	F	47	180.60	300.67	178.60	83.76	23.44
5.	TC - 58	99.95	118.20	18.53	9.00	25.00	28.20	79.86	100	F	31	208.00	215.20	281.40	73.92	20.80
6.	TC - 91	99.90	117.25	19.00	9.80	22.00	19.00	87.56	100	P	30	197.80	302.00	244.00	81.07	16.52

TC = Test cross, PP = Pollen parent, F = Full (stigma exertion in both side), P = Partial (stigma exertion in one side)

PP-44 also showed 92.97% of spikelet fertility. Thousand grains weight of PP gives us preliminary idea about the grain density and size of CMS lines. Therefore, thousand grain weight of PP were also recorded which ranged from 16.52g (PP-91) to 24.27 g (PP-44).

After evaluation of all possible characters, three pollen parents namely PP-44, PP-87 and PP-23 were selected for further back crossing and use in regular hybrid breeding program of Genetics and Plant Breeding Department, SAU.

The objective of 'Development and evaluation of new plant type based hybrids' was accomplished in two steps. In the first step large number of crosses was made using selected CMS lines and large number of newly developed new plant type lines as pollen parents for identification of cross combinations which produced fully fertile and vigorous F_1 plants. This step was entitled "Development and identification of new plant type based promising hybrids". In the second step seeds of selected promising hybrids of combinations will be produced and evaluated in field plot trail in the next season. This step has been entitled as "Evaluation of selected new plant type based hybrids".

Out of 102 testcross combination, 51 test crosses were categorized as fertile with respective pollen parent as restorer on the basis of pollen fertility study. Out of these restored lines, 31 uniform lines were selected for analyzing the yield and yield components for identification of potential restorers and hybrid combinations. Finally, on the basis of overall performance, 14 combinations were identified in the preliminary stage (Table 3) as potential hybrids for further evaluation on the basis of yield performance in Augmented design.

As revealed by the Table 3 the range for adjusted grain yield per plant was from 28.23 g in TC-10 to 53.06 g in TC-42, with a mean of 37.15 g. Among the checks, BRR1 dhan 28 showed the lowest yield (25.54 g) and BRR1 dhan 29 showed the highest yield (27.33 g) per plant.

Based on DMRT test of adjusted mean for yield per plant, all the selected hybrids along with checks were ranked. As a result, a total of 9 groups were formed on the basis of rankings (Table 3). Among the hybrids, two hybrids (TC-76 and TC-42) were ranked in group I (49.56g to 53.06g), two (TC-51 and TC-96) in group II (45.03g to 44.25g), one (TC-74) in group III (43.58g), two (TC-35 and TC-68) in group IV (40.55g to 41.20g), one (TC-32) in group V (39.60g), one (TC-41) in group VI (37.22g), one (TC-70) in group VII (37.02g), one (TC-15) in group VIII (32.15g) and three (TC-47, TC-71 and TC-10) in group IX (29.76g to 28.86g). In case of checks, BRR1 dhan 28 and BRR1 dhan 29 also ranked in the lowest group (25.54g and 27.33g, respectively). Finally the 11 hybrids having the ranks I to VIII were considered for further evaluation in replicated yield trial. The hybrids having the rank IX (yield < 30g/plant) were not considered for evaluation.

Table 3. Adjusted yields/plant of test cross hybrids in observation yield trial (OYT) using Augmented design (Rabi 2006-07)

Sl. No.	Test cross No.	Adjusted yield/plant (g)	Rank (on the basis of DMRT)
1.	TC-76	49.56	I
2.	TC-35	40.55	IV
3.	TC-15	32.15	VIII
4.	TC-51	45.03	II
5.	TC-74	43.58	III
6.	TC-32	39.60	V
7.	TC-47	29.76	IX*
8.	TC-68	41.20	IV
9.	TC-70	35.02	VII
10.	TC-71	28.86	IX*
11.	TC-10	28.23	IX*
12.	TC-41	37.22	VI
13.	TC-42	53.06	I
14.	TC-96	44.25	II
	Grand Mean	37.15	
	SEt	3.11	
	CD (5%)	6.80	
Check			
1.	BRRI dhan 28	25.54	IX
2.	BRRI dhan 29	27.33	IX
	Grand Mean	26.44	

Due to time limitation of this project, the selected 11 hybrids, 11 parental lines and 2 commercial checks will be evaluated for yield and different yield component characters in replicated trial in coming season under regular breeding program of the Department of Genetics and Plant Breeding, SAU.