International Journal of Bioresource Science
Citation: IJBS: 5(2): 91-94, December 2018
DOI: 10.30954/2347-9655.02.2018.1
©2018 New Delhi Publishers. All rights reserved

Breeding Hybrid Rice for Better Cooking Quality and Tolerance to Biotic and Abiotic Stresses

Mosiur Rahaman

Nuziveedu Seeds Limited, Regional Research Station, Barrackpore, Kolkata-700121, India

Corresponding author: dr.rahaman.m@nuziveeduseeds.com

ABSTRACT

A total of 10 photoperiod sensitive and late aman rice varieties were utilized as restore parent for hybrid seed production, in combination with widely used CMS line IR58025A, utilizing their unique and positive flowering behavior under *rabi/boro* cultivation. Hybrid seeds (F1) were produced in *rabi/boro* season where seed yield ranges from 715 kg /ha to 1410 kg /ha. Out of 10 hybrids produced, there yielded more than 10% than the check hybrid DRRH 1. In the present study details of field data along with economic heterosis and inferences were drown.

Keywords: Hybrid rice, photosensitive restorer lines, economic heterosis

The rice varieties like Sabita, Lunishree, Badsabhog, Swarnadhan, Chawanmoni, Gayatri, Sitasal, Dharitri, PSR 101, Nagra etc. are cultivated in only *kharif* season for their unique physiological and agronomical characteristics like duration,cooking quality, adaptability in a specific agro-ecological niche and tolerance to biotic and abiotic stresses. According to Shinjyo (1972) photosensitive and late (145-165 days) rice cultivars of Indian subcontinent generally show good fertility restoration making them available for utilization in hybrid rice breeding programme as restorer parents. On the other hand, Virmani (1994) opined that IR 58025A, developed at IRRI, is the extensively used CMS line with wide adaptability. This line has been mostly used in developing commercial rice hybrids in India, Philippines and Vietnam. It is photoperiod insensitive with shorter duration (115 days in kharif). Therefore, the utilization of this CMS line in combination with the above group of photosensitive late rice varieties as potential restorer line was a big challenge from the point of synchronization in flowering and good seed set.

But the findings of Rahaman (2001a, 2001b,2002a) have indicated that the photosensitive rice varieties are also agro-ecologically responsive to boro season cultivation. Not only that, their positive heading behavior in *boro* season is quite encouraging in utilization of these varieties as restorer parents in combination with the CMS line IR 58025A. The synchronization in heading of both pollen and seed parent don't create much problem for hybrid seed production. Keeping the above studies and observations in mind, attempt was made for development of medium to late duration rice hybrids having specific physiological and agronomic characteristics for the vast potential low lying areas of eastern India.

MATERIALS AND METHODS

Experiments were conducted at Regional Research Station, Nuziveedu Seeds Ltd., Barrackpore, Kolkata 700121, West Bengal during November 2015 to December 2017. Hybrid seeds were produced in boro 2015-2016 utilizing all 10 photosensitive varieties (viz. Sabita, Lunishree, Badsabhog, Swarnadhan, Chawanmoni, Gayatri, Sitasal, Dharitri, PSR 101 and Nagra) as pollen parent and IR 58025A as seed parent in each combination. The pollen parents were raised as per techniques developed by Rahaman (2002b, 2003, 2004a, 2004b). F1 seeds were produced following Virmani and Sharma (1993). Yield

potentials of the hybrids were assessed in *kharif* 2016 & 2017 by adopting recommendations made by Indian Institute of Rice Research(IIRR), Hyderabad, India (anonymous, 1994). Plot sizes were 150 and 12 m sq for production of hybrid rice in isolation and for assessment of yield of the hybrids respectively following completely randomized block design with two replications and mean values of two replications were put in the tables in each case.

RESULTS AND DISCUSSION

Table 1 shows that the photo-insensitive parents like IR58025A and IR 40750R had taken 26 days more for heading in *boro* than in *kharif*, whereas photosensitive genotypes had taken either less or a few days more for heading in *boro* than that of *kharif* season. This very contrasting but positive behavior in heading in *boro* culture of these photosensitive late varieties helped in meaningful synchronization in flowering of pollen and seed parents under study. Being short day plats (SDP), all the 10 photosensitive parents under study attained heading during the shorter days of 2nd to 4th week of October under *kharif* condition. Therefore, when the same quantum of photoperiod became once again available in the period between 4th weeks of March to 1st week of April under *boro* condition, they responded with normal behavior of heading (Rahaman, 2001a, 2002b).

Table 2 Shows that in some of the combinations F1 seed yields were quite encouraging. The low seed set and seed yield in most of the combinations may be due lack of cross compatibility between pollen and seed parents in spite of their synchronous flowering. Anyway, further study is required to identify if any genetic barrier related to cross pollination/fertilization in between pollen and seed parents is present or not. If the answer is in assertive, then suitable techniques need to be developed to increase seed yield especially in the high heterotic combinations. Interestingly, none of the F1 seeds showed longer period of dormancy though the seed of the pollen parents would be dormant for a period of 75-90 days under *kharif* production.

Table 3 shows yield potential of all 10 experimental hybrids along with popular checks under *kharif* season (*kharif* 2016 & 2017). Out of 10 hybrid combinations evaluated, three namely IR 58025A/ Swarnadhan, IR 58025A / Dharitri and IR 58025A/ PSR 101 recorded more than 5% higher yield as compared to popular check hybrid DRRH 1. The amounts of economic heterosis registered under these three combinations were 8.7%, 7.4% and 11.9% respectively.

Table 1: Days to heading (50%) of restorer and CMS lines in *kharif* and boro seasons

Variety/Parental line	Days taken for heading in *kharif* season (avg. of kh 2015 & 16)	Days taken for heading in boro season (avg. of boro 2015- 16 & 2016-17)	Extra days taken in boro
IR 58025A	84	110	+26
Sabita (R)	128	120	-8
Lunishree (R)	127	117	-10
Badshbhog (R)	125	118	-7
Swarnadhan (R)	121	127	06
Chawanmoni (R)	126	117	-9
Gayatri (R)	130	131	+1
Sitasal (R)	125	117	-8
Dharitri (R)	130	131	+1
PSR 101(R)	115	118	+3
Nagra (R)	125	130	+5
IR 40750R (R –Check)	96	122	+26
C.D. (P=0.05)	3.2	4.1	-

IR 40750R is the Restorer parent of the hybrid DRRH 1 in combination with IR 58025A;

Sowing date: In kharif 20th June & in boro 20th November.

Table 2: Production of F1 seeds in boro under different combinations

	Hybrid combinations (A/R)	Seed set (%) (avg. of boro 2015-16 & 2016-17)	Seed yield (Kg/ha) (avg. of boro 2015-16 & 2016-17)	Dormancy of F1 seeds(Day) (avg. of boro 2015-16 & 2016-17)
1.	IR58025A/Sabita	14.9	970	11
2.	IR 58025A/Lunishree	15.0	812	09
3.	IR 58025A/Badshbhog	18.6	1010	15
4.	IR 58025A/Swarnadhan	22.4	1136	10
5.	IR 58025A/Chawanmoni	09.0	906	09
6.	IR 58025A/Gayatri	19.0	1200	10
7.	IR 58025A/Sitasal	11.4	715	11
8.	IR 58025A/Dharitri	18.7	1275	10
9.	IR 58025A/PSR 101	19.5	1410	12
10.	IR58025A/Nagra	08.3	715	13
11.	IR58025A/IR 40750R©	21.2	1350	08
	C.D.(P=0.05)	2.3	112	0.2

(IR58025A/IR40750R=DRRH 1).

Table 3: Evaluation of F1 hybrids along with check (i.e. DRRH 1) in *kharif* 2016 & 2017

	Genotypes	Crop duration (Days) (avg. of *kharif* 2016& 17)	Grain yield (Kg/ha) (avg. of *kharif* 2016& 17	Economic * heterosis (%)
1.	IR58025A/Sabita	140	3015	-
2.	IR 58025A/Lunishree	140	3650	-
3.	IR 58025A/Badshbhog	125	3615	-
4.	IR 58025A/Swarnadhan	135	6372	8.7%
5.	IR 58025A/Chawanmoni	123	2916	-
6.	IR 58025A/Gayatri	144	6115	4.4%
7.	IR 58025A/Sitasal	115	2562	-
8.	IR 58025A/Dharitri	142	6295	7.4%
9.	IR 58025A/PSR 101	128	6562	11.9%
10.	IR58025A/Nagra	140	2815	-
11.	IR58025A/IR 40750R©	126	5860	-
	C.D.(P=0.05)	2.1	205	-

**DRRH 1 (IR58025A/IR 40750R) was taken into consideration for calculation of economic hetersis.*

CONCLUSION

The results clearly indicate justification of utilization of photoperiod sensitive late rice varieties as restorer parents for F1 seed production in *boro* season and their commercial cultivation in following *kharif* season. The observation also establishes the importance of working with large number of locally adapted traditional cultivars having specific physiological and agronomic characters for development of diverse rice hybrids that would satisfy specific needs of growers as well as consumers as regard to land situations, stresses (biotic/abiotic) problems, cooking and other quality related parameters.

REFERENCES

Anonymous 1994. Development and Use of Hybrid Rice Technology. Annual report 1993-94. Work Plan 1994-95. Directorate of Rice Research, Hyderabad (Presently IIRR).

Rahamn, Mosiur 2001a. Agro-botanical approach to rice production: certain aspects reconsidered. *Indian Biologist,* **33**(2): 35-41.

Rahamn, Mosiur 2001b. Seed production and hybrid rice: a fresh look, *Indian Biologist,* **33**(2): 43-47.

Rahamn, M. 2002a. Development of heterotic rice hybrids for shallow low lying areas. *Indian Biologist*, **34**(2): 27-30.

Rahaman, Mosiur 2002b. Optimum sowing time for higher yield and seed quality of some photosensitive rice varieties under *boro* culture. *Indian Biologist,* **34**(1): 21-28.

Rahaman, M. 2003. Optimum sowing time for higher seed yield and quality in rice. *Seed Research*, **31**(2): 137-140.

Rahamn, M. 2004a. Optimum age of seedling for higher seed yield and seed quality in rice. *Seed Research*, **33**(2): 136-139.

Rahaman, M. 2004b. Response of photosensitive rice varieties to nitrogen levels in boro season, *Oryza*, **41**(3&4): 101-104.

Shinjyo, C. 1972. Distribution of male sterility inducing cytoplasms and fertility restoring genes in rice, II. Varieties introduced from sixteen countries. *Jpn. Jr. Breed,* **22**: 329-333.

Virmani, S.S. and Sharma, H.L. 1993. Manual for hybrid rice seed production, IRRI, Manila, Philippines.

Virmani, S.S. 1994. Hybrid Rice Technology: New Development and Future Prospects (Edited by S.S. Virmani). IRRI, Manila, Philippines: 7-9.