

PRESENT STATUS OF HYBRID RICE RESEARCH IN SRI LANKA

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ABSTRACT

The performance of five cytoplasmic male sterile lines (cms) from China and 5 cms lines from the International Rice Research Institute, Philippines, are being examined at the Central Rice Breeding Station, Batalagoda, Sri Lanka, with the objective of transferring the cms character to popular Bg cultivars in a back-crossing programme where the local pollinators were used as recurrent parents. Results over five consecutive seasons suggest that the Bg cms lines are superior and could be further improved for their adaptability and development of hybrid rice.

INTRODUCTION

With the development and introduction of short, stiff-stemmed fertilizer-responsive rice varieties in the 1970s the main emphasis of Sri Lanka's rice varietal improvement programme had been to stabilize the yield potential of varieties by incorporating genetic capabilities to withstand environmental stresses. In recent years, however, a further increase in the existing yield potential of rice varieties was the target set by rice breeders to meet the demand imposed by population increase. Therefore, attention has been directed towards exploring the locally adaptable innovative breeding techniques that could be exploited to achieve this end.

In 1977, the rice breeders were surprised to learn the success of hybrid rice varieties that led to subsequent commercial cultivation in China giving 20—30% higher yields than conventionally bred varieties. The success of Chinese scientists encouraged the International Rice Research Institute (IRRI) to review research on hybrid rice and to explore its potential outside China (Virmani *et al*, 1981). Subsequently IRRI collaborated with the rice breeders in tropical Asia to initiate national programmes on hybrid rice. Along with this, Sri Lanka too initiated a programme of research on hybrid rice at the Central Rice Breeding Station, Batalagoda and at the Regional

Agricultural Research Station, Bombuwela to explore the possibilities of developing hybrid rices suitable for local conditions. The present paper deals only with the advances made at the Central Rice Breeding Station, Batalagoda (Bg) to date.

The term "hybrid variety" is used to designate a F_1 population (1st filial generation) which is used for commercial planting. Rice, being naturally a self pollinated crop, the development of ' F_1 hybrids' was made possible by a system composed of 'three-lines': The cytoplasmic male sterile line (cms) (A line), male sterility maintainer (B-line) and Fertility restorer (R-line) (Lu-Yung-Ken, 1982). Among these three components of hybrid rice, primary attention is given to the identification and development of cms lines adaptable to local conditions.

The objective is to examine the performances of the 5 cms systems (Yar Ai Zhao, V 20, MS 577, P 203 and WU 10) and the 5 cms lines developed at IRRI under local conditions, and to transfer the cms character of these systems to local cultivars with the intention of developing cms systems, adapted to local conditions.

MATERIALS AND METHODS

The five cms systems introduced were used with 16 popularly grown new-improved varieties to transfer cms character through a back-cross breeding programme. This was commenced in Yala (dry season) 1983, with the local pollinators as the recurrent parents.

The back-crossing was continued by selecting at each step only those back-crossed progenies with desired levels of cms character (by studying seed setting and pollen fertility) and other agronomic features for 5 consecutive seasons. The lines that had very high level of cms character and other desired features were planted in the field as 3-meter long 3-row progenies (15 cm within rows and 40 cm between rows), along with the 5 cms systems and the 5 cms lines developed at IRRI.

The growth period, plant height, panicle number, flag-leaf size, pollen fertility, seed setting and stigma size were measured and compared.

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Seed setting was measured by covering panicles before flowering and counting the number of grains and empties at harvest in three different panicles at the rate of one panicle per plant for each cms line.

At maturity samples of spiklets were fixed in 70% alcohol, and later randomly selected 5 spiklets were crushed on glass slides and stained in 1% I₂ in KI, to count the percent fertile pollen grains under the microscope. (This was replicated 9 times per cms lines). Stigma size and anther size were measured under the microscope using a micro-scale.

RESULTS AND DISCUSSION

There was no observable difference in the seedling vigour, duration to 50% flowering and flag-leaf size among the cms systems, IRRI lines and Bg cms lines. However, the Batalagoda cms lines were taller than their cms parents (V 20 A and MS 577 A). Among other agronomic features noted there was a high variation in the tiller number at flowering and total panicle number at harvesting, this however was minimal only in the Batalagoda cms lines (in IRRI lines tillering continued even after flowering). This character, therefore, is an indication of the effective tillering of Bg cms lines compared to other cms systems studied.

The pollen fertility ranged from 18.86 in IR 46 — 828 A to 1.30 in WU 10 A, the stigma size varied from 2.08 in V 20 A to 1.30 in WU 10 A; and anther size from 2.48 in IR 46 — 829 A to 2.19 in MS 577 A.

The stigma exsertion was superior only in the Bg cms lines. Seed setting (when covered) ranged from 0 to 19.4 (in WU 10 A). All Bg cms lines had very low seed setting.

These observations suggest that the Bg cms lines were superior in many agronomic and cms character and could be further improved for their adaptability and development of Hybrid rices.

REFERENCES

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<i>cms line</i>	<i>Seedling vigour*</i>	<i>Sowing to 50% flowering (days)</i>	<i>Flagleaf size cm</i>	<i>Plant height cm</i>	<i>Panicle No at 50% flowering</i>	<i>Panicle No at maturity</i>	<i>%pollen fertility</i>	<i>Stigma size mm</i>	<i>Anther size mm</i>	<i>Stigma Exser- tion</i>	<i>Panicle Exser- tion*</i>	<i>%Seed setting (when covered)</i>
V 20 A	3	71	45.4, 1.4	48.0	19	29.3	1.87	2.08	2.38	V. good	7	0.0
MS 577 A	3	68	32.6, 1.4	61.6	18	23.0	8.59	1.57	2.09	normal	3	0.45
YA 2 A	3	72	31.0, 1.8	55.6	17	24.3	5.96	1.94	2.34	good	5	0
P 203 A	3	75	38.1, 1.1	114.3	17	17.0	4.86	1.40	2.29	poor	1	12.3
WU 10 A	5	74	19.7, 1.3	47.6	23	35.0	14.86	1.30	2.06	poor	7	19.4
IR 46—826 A	1	66	39.9, 1.4	57.5	34	52.0	18.86	1.45	2.25	poor	3	0.0
IR 46—828 A	1	66	27.1, 1.0	54.4	26	40.0	5.42	1.71	2.27	good	1	0
IR 46—829 A	1	68	27.7, 1.4	59.7	31	46.6	7.71	1.49	2.48	normal	1	2.5
IR 46—830 A	1	71	21.7, 1.3	61.3	30	44.3	3.70	1.57	2.39	normal	5	0
IR 46—831 A	1	73	28.5, 1.3	55.5	25	30.6	6.52	1.45	2.28	normal	5	5.5
V 20 A/*3 Bg 379.2	3	75	32.2, 1.3	73.7	16	18.6	2.69	1.56	2.14	normal	5	0
MS 577 A/*3 Bg 12—1	1	76	30.6, 1.6	87.1	13	13.3	5.56	1.94	2.39	V. good	3	0
MS 577 A/*3 Bg 380	3	76	36.6, 1.3	72.8	15	15.0	9.92	1.57	2.23	normal	3	0.18

* Standard evaluation system for rice IRRI.