

## COMS 13 A – A new male sterile line in rice

S. Manonmani\*, K. Thiyagarajan, D. Malarvizhi and P. Deepa Shankar

Department of Rice, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, COIMBATORE (T.N.) INDIA

### ABSTRACT

Promising lines with high yield potential were selected and crossed with the CMS line IR 58025 A and their hybrid combinations were studied for pollen fertility. Among all, 100 per cent sterility was observed in the cross IR 58025 A / AC 10/91. The line AC 10/91 was identified as a recurrent parent for the development of new CMS line. After BC<sub>5</sub>F<sub>1</sub> generation plants attained homozygosity for all the characters and a new CMS line was developed, designated as COMS 13 A. It was tested along with its parents for all the floral traits. Plant height was almost similar to IR 58025 A (72.7 cm). Number of productive tillers and panicle exertion was higher than its female parent. Panicle exertion and stigma exertion play an important role in enhancing out crossing rate in rice. COMS 13 A recorded 55.5 % stigma exertion compared with 42.4 % in IR 58025 A. Glume opening duration was similar to that of IR 58025 A. COMS 13 A was crossed with selected number of restorer lines to identify its combining ability. The hybrid combinations viz., COMS 13 A/IR 65515-14-1-2-19 R, COMS 13 A/ Gui 99 showed their superiority over the hybrid check CORH 2. Hence, the newly developed CMS line COMS 13 A is having better restoration ability along with better floral traits and can be used for its relative advantage over other CMS lines for exploitation in hybrid rice breeding.

**Key words :** Rice, Male, Sterile Line, Coms 13A

### INTRODUCTION

Hybrid varieties developed by making use of the WA (Wild abortive) type of CMS (Cytoplasmic male sterility) accounted for approximately 90% of the hybrid rice produced in China in the past. These hybrids have significantly out-yielded conventional pure line cultivars. The WA cytoplasm has been found to be the most stable and hence about 95% of the rice hybrids adapted world – over are based on this single source of cyto sterility. Hence, this programme was undertaken to develop the new CMS line under the nuclear background of locally adopted line which can be utilized for development of new rice hybrid combinations. In the last several years, this system has also been used extensively in hybrid rice breeding programmes in other countries to produce CMS types of hybrids under various genetic back grounds (Virmani, 1994).

### MATERIALS AND METHODS

Promising lines with high yield potential were crossed with the CMS line IR 58025 A in the source nursery during kharif 99 season and their 400 hybrid combinations were studied for pollen fertility in test cross nursery during rabi 99-2000 season. Among all, 100 per cent sterility was observed in the cross IR 58025 A / AC 10/91. The sterility was examined using potassium iodide stain. The sterile plants were tagged and back crossed with their male parent AC 10/91 as recurrent parent. Subsequently in every season backcrossing was done after examining 100% pollen sterility. Backcrossing was continued for both seasons in 2001, 2002 and 2003. In each nursery twenty days old plants were transplanted with a spacing of 20x15 cm in 2m<sup>2</sup> plot. All the plants were observed for pollen sterility. After BC<sub>5</sub>F<sub>1</sub> generation plants attained homozygosity for all the characters studied. The observations were recorded on five plants from the central row in three replications for nine characters viz., Days to fifty percent flowering, Plant height, Number of productive tillers, Panicle exertion percentage, Panicle length, Stigma exertion percentage, Number of spikelets, Pollen sterility percentage and Glume opening duration. At the time of flowering, these lines were crossed with promising restorers. Crossed seeds were collected and raised along with their male parents and check hybrid CORH 2 in RBD with three replications. Biometrical observations viz., Plant height, Days to fifty percent flowering, Plant height, Number of productive tillers, Panicle length, Number of spikelets, Pollen sterility percentage and Grain yield were observed for five randomly selected plants from hybrids and parents.

### RESULTS AND DISCUSSION

In test cross nursery, the cross IR 58025 A / AC 10/91 was identified as 100 % sterile with good floral traits. The line AC 10/91 was used as a recurrent parent for the development of new CMS line. New aromatic CMS lines were developed after 5 back cross generations. Newly developed line was designated as COMS 13 A. It was evaluated along with its parents for all the floral traits viz., panicle exertion, stigma exertion, glume opening, grain type, outcrossing rate, aroma etc. Days to 50% flowering showed that the new CMS line COMS 13 A was found to be intermediate between its

Table 1 : Characteristics of new CMS line COMS 13A and their parents

Characters	IR 58025 A	COMS 13 A
Days to 50% flowering	98	100
Plant height	73.2	72.7
No. of productive tillers	10.4	13.0
Panicle exertion (%)	66.9	77.8
Panicle length (cm)	24.3	25.5
Number of spikelets	260	286.6
Stigma exertion (%)	42.4 %	55.5
Pollen sterility (%)	100 %	100 %
Glume opening duration	2.00 hrs	2.0 hrs

parents. Plant height was almost similar to IR 58025 A (72.7 cm). A good CMS line should have short stature over their restorer or maintainer for effective transfer of pollen grains. The CMS lines having 16-29 cm shorter height than their respective maintainer and restorers found to be effective for transfer of pollen grains and seed set (Azzini and Rutzer 1982). Number of productive tillers and number of spikelets were higher than its female parent. The maximum productive tillers per plant and spikelets per panicle in different CMS lines were reported over their respective maintainer. (Mishra and Pandey 1993). COMS 14 A recorded a panicle length of 25.5 cm. The panicle length reported from 18.5 to 22.5cm in different rice CMS lines by Rangaswami *et al.*, 1987. Panicle exertion and stigma exertion play important role in enhancing out crossing rate in rice. The panicle exertion directly influences natural out crossing and ultimately resulting into good seed setting. (Ramesha *et al.*, 1999). COMS 13 A recorded 77.8 percent panicle exertion and 55.5 % stigma exertion where as IR 58025A recorded only 66.9 % Panicle exertion and 42.4 % stigma exertion. Ingale *et al.*, 2004 recorded the panicle

\*Author for correspondence

Table 2 : Restoration ability of COMS13A in Rice.

Hybrids/ Male parents	Plant Height (cm)	Productive tillers	Panicle length (cm)	Pollen fertility (%)	Spikelet fertility (%)	Single plant yield (g)	Standard Heerosis (%)
COMS 14A/Gui 99	64.0	13.0	24.2	98.0	74.4	25.00	4.00
COMS 14A/IR 65515	64.5	20.0	25.3	95.0	70.4	35.30	47.00
COMS 14A/IR 21567	62.0	13.0	19.2	95.0	81.3	16.80	-
COMS 14A/NDR 359	71.5	15.5	19.5	96.0	84.1	24.25	1.04
Gui 99	67.0	12.0	21.5	-	82.0	19.40	-
IR 65515	56.0	8.5	20.6	-	91.6	14.40	-
IR 21567	69.3	12.0	21.7	-	94.1	23.80	-
NDR 359	66.0	9.5	23.4	-	90.1	22.90	-
CORH 2	66.1	9.3	19.8	-	91.5	24.00	-

exertion percentage of 73.67 to 93.09 % in the CMS lines. Quite good range of stigma exertion from 0.2 to 87.8 % was observed in cultivated Indica rice (Virmani and Athwal, 1973). Male sterile spikelets with better stigma exertion, had significantly higher seed set than that of spikelets without exerted stigma. Glume opening duration was similar to IR 58025 A. The floral glume remains open for relatively longer period in CMS lines possibly due to the delayed or ineffective pollination (Grist 1953). COMS 13 A was crossed with selected number of restorer lines to identify its combining ability. Fertility level was evaluated. Spikelet fertility level ranged from 70.4 % to 84.1% (Table 2). This line produced very good heterotic hybrid combinations. Grain yield of these hybrids were compared with the check hybrid CORH 2. All the hybrids produced superior yield over their corresponding male parents. The hybrid combinations viz., COMS 13 A / IR 65515-14-1-2-19 R, COMS 13 A / Gui 99 produced 35 g/plant and 25g plant respectively and showed their superiority over the hybrid check CORH 2 (24 g/plant). Standard heterosis of rice hybrids ranged from 25.13 to 111.23 for grain yield per plant was reported by Singh and Lal 2005. Hence, the newly developed CMS line COMS 13 A is having better restoration ability along with better floral traits than its female parent. It showed very good restoration with good floral traits. New CMS lines developed through substitution backcrossing have been reported by Zaman *et al.*, (1996), Abraham *et al.*, (1998), Jayamani *et al.*, (1998) and Ingale *et al.*, 2004. The newly developed COMS 13 A showed over all phenotypic acceptability with better restoration ability and thus it can be exploited for development of new rice hybrid combinations.

#### REFERENCES

- Abraham, M.J., Zaman, F.U., Natarajan, U.S., Anju Mahendru and Faiz Mohammad. (1998). Development of Pusa 5A-A stable indica CMS line with high out crossing potential. *IRRN*, 23:5.
- Azzini L.E. and Rudger N. (1982). Amount of out crossing on different CMS lines of Rice. *Crop Science* 22: 905-906.
- Grist D.H. (1953). Variation in flowering behaviour in Rice. Rice Longman green, London, p 23-31.
- Ingale, B.V., Waghmode, B.D., Sawant D.S and Shinde D.B. (2004). Evaluation of newly developed CMS lines of Rice (*Oryza sativa* L.) for their agronomical and floral traits. *Indian J. Genet.* 64 ; 286-290.
- Mishra M. and Pandey M.P. (1993). Identification of stable Cytoplasmic male sterile CMS lines for hybrid rice breeding in sub humid tropics. *Int. Rice. Res. Newsl.*, 18:7-8.
- Ramesha M.A., Viraktamath B.C., Ahmad M. Ilyas and Vijayakumar C.H.M. (1999). New CMS sources with stable male sterility and better out crossing traits in rice. *Indian J. Genetics.*, 59 : 403-409.
- Rangaswami M., Rangaswamy, S. R. S., Nataraja Moorthy K. and Sivasubramaniun. V. (1987). Morphological characters, seed setting and dry matter production of Aand Blines. *Int. Ric Res. Newsl.*, 12:22
- Singh, R.K. and Lal, J.P. (2005). Exploitation of heterosis in aromatic rices for different physicochemical traits. *Indian J. Genet.*, 65 : 47-48.
- Virmani S. S. and Athwal D.S. (1973). Genetic variability for floral characters influencing out crossing in *Oryza sativa* (L), *Crop Sci.*, 13 : 66-69.
- Zaman, F.U. Abraham, M.J., Natarajan U.S., Anju Mahendru and Faiz Mohammed. (1996). Development of Pusa 3A- Basmati CMS line. Abstracts: Proc. 3<sup>rd</sup> Int. Symp. on hybrid rice p. 59.

Received : August, 2005; Accepted : February, 2006