

Studies on relative stability of cytoplasmic male sterile lines and their floral traits influencing out-crossing in rice (*Oryza sativa* L.)

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SUMMARY

Pollen shedding in male sterile lines is one of the problem in hybrid breeding of rice, under certain environment; hence, relative stability for sterility, agronomic characters and floral traits influencing out-crossing of CMS lines were under taken. Twenty CMS lines were evaluated over two seasons. The CMS lines IR 58025A, IR 68886A, IR 68901A, IR 69628 A, PMS 2 A, IR 54755 A, G 46 A, D 297 A and IR 66707 A were completely pollen sterile and had zero spikelet fertility and hence highly stable while IR 68897 A, IR 68899 A, IR 70907 A, IR 71564 A, IR 68885 A were stable. Remaining CMS lines were unstable. All CMS lines were dwarf in height. The CMS lines IR 58025 A, IR 68886 A, IR 68901 A, IR 69628 A, PMS 2 A, G 46 A and IR 68899 A had comparatively longer stigma and Style, higher number of productive tiller and spikelets per panicle with good panicle exertion favourable for out-crossing during seed production of A x B and A x R combinations. The differential response of CMS lines possessing one kind of Cytosterile source "Wild abortive" observed was due to primarily to differences in nuclear background of CMS lines and interactions of cytoplasm with nuclear genes.

Key words : Rice, CMS line, Pollen sterility, Hybrid rice, Stability.

Cytoplasmic genetic male sterility (CMS) system is a potent genetic tool in development of rice hybrids as evidenced in China. The first CMS line was developed by Shinjyo and Omura (1966) and the first CMS line used in commercial rice hybrid was developed in China in 1973 from wild rice population (Yuan, 1977). Since then a large number of CMS lines have been developed in China, IRRI and rice growing countries from different cytosterile sources. As per Virmani and Wan (1988) CMS lines to be used in hybrid breeding programme should possess (i) complete and stable pollen sterility over environments to avoid self fertilization during seed multiplication (ii) good adaptability to ecological and cultural conditions for which hybrids are to be developed (iii) combine ability and (iv) useful agronomic floral traits to allow significant cross pollination in seed production plots. In the present study, twenty CMS lines developed from different sources were evaluated for their sterility behaviour, floral traits and agronomic traits across two season at Agricultural Research Station, Shirgaon (Ratnagiri) Maharashtra State with the objective to identify stable CMS line possessing good agronomic traits and floral structure for out-crossing for utilization in hybrid breeding programme.

MATERIALS AND METHODS

A group of CMS lines on listed in Table 2 constituted the materials for this experiment. The twenty three days old single seedling of twenty CMS lines were transplanted in Randomized Block Design with two replications during 2001 and 2002 *Kharif* season. Plot size consisted of four rows of three meter long with inter and intra row spacing of 20 cm.

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Appropriate field management and cultural practices were undertaken. CMS line plots were isolated by erecting high polythene Sheets all around the experimental field to avoid cross contamination from foreign pollen.

To estimate pollen sterility, spikelet from lower, middle and top portion of the panicles per plants were randomly selected. Ten spikelets were collected at the time of flowering and fixed in a vial containing 70% alcohol. Anthers of each spikelet were smeared in 1% iodine potassium iodide solution and pollen grains were observed under light microscope. Count of completely unstained shriveled pollen grains indicating sterility was taken and expressed in percentage. At the time of panicle emergence, one panicle in each of the ten randomly chosen plants was bagged with butter paper bag. Spikelet fertility estimates were taken from number of fertile and total spikelets from bagged panicles per plant. Spikelet fertility in percentage was calculated as

$$\text{Spikelet fertility percentage} = \frac{\text{Number of fertile spikelets}}{\text{Total number of spikelet}} \times 100$$

Data on five randomly selected plants per CMS lines were recorded for agronomical and floral characteristics viz. productive tillers, plant height (cm), days to 50 % flowering, panicle exertion, spikelet per panicle, stigma and style length (mm). Statistical analysis was done using RBD model.

RESULTS AND DISCUSSION

Analysis of variance (Table 1) exhibited highly significant differences among CMS lines for all