

## Cytoplasmic Male Sterile Lines for Hybrid Rice Production

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**Abstract:** Diversification of cms lines form an important step towards the development of superior hybrids with preferable qualitative characters. Experiment of various Rice cms lines and their maintainer lines for stability of pollen and spikelet fertility. A total of thirty five cms lines and twenty four maintainer lines of Divergent origin were included in the study. About 16 lines were found to be completely pollen sterile while others showed spike let fertility ranging from 0.50 percent to 6.50 percent. The cms lines DRR 6A, DRR 7A, PMS 17A, COMS 14A, COMS 15A, RTN 2A, RTN 3A, RTN 6A, RTN 18A, IR68888A were found promising for the character of pollen sterility, panicle exertion, stigma exertion and natural out crossing. These cms lines may be further studied and utilized for three line hybrids Rice production technology.

**Key words:** Rice, cytoplasmic male sterility, cms lines

### INTRODUCTION

Rice (*oryza sativa*) is the principal food crop of India but the over growing population, stresses the need to increase the productivity of rice crop. Among the different improved technologies to increase the productivity of rice, the exploitation of hybrid Technology appears to be promising. Chinese rice scientists developed rice hybrids utilizing cms, which increased yield by about 20 percent over semi dwarf varieties (yuan,<sup>[4]</sup> and yuan *et al.*<sup>[5]</sup>) The three line breeding method adopted in hybrid production technology involves the use of cytoplasmic male sterile line (A line) its maintainer (B line) and restorer (R) line. Improvement of parental lines A, B and R are congenial for the successful development of hybrid rice. Most of the hybrids released through out the world are based on a single sterile cytoplasmic source ie WA or wild Abortive. Intensive use of single source of male sterile cytoplasm in developing hybrids may be disastrous due to various reasons such as sterility breakdown, susceptibility to pest, diseases etc. Only limited efforts have been made to improve the grain quality of hybrid rice<sup>[3]</sup> Hence search for Alternative sources of cytoplasm and evaluation of cms lines and their maintainer lines for adaptability, stability of pollen and spikelet fertility, other agronomic characteristics was taken for into consideration while conducting the present study.

### MATERIALS AND METHODS

Thirty five cms lines and maintainer lines of diverse sources formed the materials for the present study. Three pairs of each cms and maintainer lines were planted in single row plots having 12 hills per row with a spacing of 20 x 20 cm apart. Observations were recorded for days to fifty percent flowering, plant height, panicle number, panicle length (cms), pollen sterility % panicle exertion %, stigma exertion%, natural seed set % and spikelet fertility %. Pollen sterility was observed by routine procedure, with 1% iodene potassium iodide solution. Five panicles each were evaluated for natural seed set percent after bagging them with butter paper bags prior to anthesis to prevent cross pollination.

Cms lines and maintainer lines were of medium to long duration and were free from serious pests and diseases.

### RESULTS AND DISCUSSION

The result showed that out of Thirty five lines evaluated, thirty two had pollen sterility about 95 percent. Sixteen cms lines namely DRR 6A, DRR 7A, APMS 6A, PMS 17A, COMS 14A, COMS 15A, KCMS 13A, RTN 2A, RTN 3A, RTN 6A, RTN 11A, RTN 13A, RTN 14A, RTN 17A, RTN 18A and IR 68888A were completely pollen sterile. It was found that these lines has reduced anthers and did not set

**Table 1:** Performance of cms lines for various Traits

| S. No | CMS Lines  | Days of Flowering | Plant height (cm) | Panicle Number | Panicle length (cm) | Pollen Sterility (Percent) | Panicle exertion (per cent) | Stigma exertion (per cent) | Natural out crossing (per cent) | Spikelet fertility (per cent) |
|-------|------------|-------------------|-------------------|----------------|---------------------|----------------------------|-----------------------------|----------------------------|---------------------------------|-------------------------------|
| 1     | DRR 3A     | 97                | 53.6              | 10.6           | 16.6                | 99.25                      | 72.0                        | 32.0                       | 27                              | 0.8                           |
| 2     | DRR 4A     | 88                | 41.5              | 7.6            | 18.8                | 98.00                      | 68.9                        | 29.0                       | 28                              | 1.2                           |
| 3     | DRR 5A     | 87                | 46.0              | 9.4            | 18.6                | 92.50                      | 63.9                        | 30.0                       | 18                              | 6.5                           |
| 4     | DRR 6A     | 93                | 41.4              | 10.1           | 14.5                | 100.00                     | 77.0                        | 37.5                       | 50                              | 0.0                           |
| 5     | DRR 7A     | 90                | 47.1              | 12.1           | 16.5                | 100.00                     | 70.5                        | 38.8                       | 42                              | 0.0                           |
| 6     | DRR 8A     | 94                | 64.3              | 11.2           | 18.8                | 94.80                      | 54.2                        | 19.0                       | 27                              | 5.5                           |
| 7     | APMS 6A    | 100               | 64.6              | 11.5           | 20.6                | 100.00                     | 63.2                        | 17.3                       | 40                              | 0.0                           |
| 8     | PMS 17A    | 96                | 58.2              | 11.6           | 17.5                | 100.00                     | 80.8                        | 35.3                       | 52                              | 0.0                           |
| 9     | COMS 14A   | 94                | 47.3              | 10.4           | 16.1                | 100.00                     | 73.9                        | 32.5                       | 47                              | 0.0                           |
| 10    | COMS 15A   | 98                | 53.6              | 10.6           | 17.9                | 100.00                     | 76.9                        | 32.0                       | 42                              | 0.0                           |
| 11    | CRMS 45A   | 92                | 46.5              | 7.3            | 18.9                | 99.00                      | 52.6                        | 19.6                       | 35                              | 0.6                           |
| 12    | Pusa 3A    | 110               | 50.7              | 8.3            | 18.8                | 99.25                      | 55.6                        | 36.1                       | 36                              | 0.8                           |
| 13    | Pusa 6A    | 113               | 52.4              | 11.0           | 20.7                | 98.00                      | 58.5                        | 11.2                       | 26                              | 1.6                           |
| 14    | KCMS 13A   | 113               | 53.3              | 12.0           | 20.6                | 100.00                     | 78.1                        | 35.3                       | 26                              | 0.0                           |
| 15    | IR 73318A  | 110               | 48.6              | 8.6            | 20.0                | 94.30                      | 59.0                        | 18.3                       | 18                              | 3.8                           |
| 16    | IR 73323A  | 110               | 50.0              | 11.0           | 17.6                | 98.25                      | 59.7                        | 17.5                       | 38                              | 2.2                           |
| 17    | IR 73328A  | 115               | 57.0              | 9.6            | 15.2                | 98.30                      | 56.0                        | 19.1                       | 18                              | 2.4                           |
| 18    | IR 75594A  | 112               | 38.3              | 5.4            | 21.1                | 96.50                      | 63.0                        | 19.1                       | 38                              | 3.6                           |
| 19    | IR 75601A  | 104               | 42.3              | 11.6           | 20.3                | 99.25                      | 52.0                        | 36.4                       | 35                              | 0.4                           |
| 20    | IR 75603A  | 105               | 36.6              | 5.2            | 22.0                | 98.00                      | 67.0                        | 18.8                       | 35                              | 1.0                           |
| 21    | IR 7560 8A | 113               | 49.3              | 9.1            | 20.2                | 96.55                      | 67.6                        | 18.6                       | 39                              | 2.6                           |
| 22    | RTN 2A     | 90                | 52.0              | 16.3           | 20.1                | 100.00                     | 79.9                        | 33.7                       | 42                              | 0.0                           |
| 23    | RTN 3A     | 95                | 53.0              | 18.6           | 21.5                | 100.00                     | 79.2                        | 32.3                       | 38                              | 0.0                           |
| 24    | RTN 4A     | 115               | 52.1              | 11.6           | 19.3                | 99.00                      | 60.5                        | 17.1                       | 18                              | 0.7                           |
| 25    | RTN 5A     | 111               | 51.4              | 13.2           | 19.3                | 99.00                      | 68.0                        | 18.3                       | 38                              | 0.5                           |
| 26    | RTN 6A     | 95                | 54.4              | 14.7           | 18.6                | 100.00                     | 80.5                        | 33.8                       | 48                              | 0.0                           |
| 27    | RTN 10A    | 100               | 55.1              | 15.2           | 20.6                | 99.00                      | 50.0                        | 15.3                       | 18                              | 0.0                           |
| 28    | RTN 11A    | 114               | 55.0              | 13.6           | 18.5                | 100.00                     | 53.0                        | 23.9                       | 21                              | 1.0                           |
| 29    | RTN 13A    | 110               | 54.3              | 13.3           | 18.0                | 100.00                     | 78.0                        | 26.8                       | 39                              | 0.0                           |
| 30    | RTN 14A    | 116               | 56.0              | 11.0           | 18.5                | 100.00                     | 68.5                        | 22.0                       | 35                              | 0.0                           |
| 31    | RTN 17A    | 113               | 55.6              | 13.8           | 20.1                | 100.00                     | 60.7                        | 49.3                       | 19                              | 0.0                           |
| 32    | RTN 18A    | 89                | 54.4              | 15.6           | 20.1                | 100.00                     | 79.2                        | 32.0                       | 37                              | 0.0                           |

**Table 1:** Continue

|    |           |     |      |      |      |        |      |      |    |     |
|----|-----------|-----|------|------|------|--------|------|------|----|-----|
| 33 | IR 58025A | 111 | 54.4 | 14.2 | 18.0 | 98.25  | 74.8 | 23.2 | 36 | 1.8 |
| 34 | IR 68897a | 93  | 44.4 | 9.0  | 20.0 | 98.25  | 67.1 | 28.6 | 13 | 2.6 |
| 35 | IR 68888A | 93  | 48.8 | 13.1 | 20.0 | 100.00 | 77.0 | 33.2 | 48 | 0.0 |

seeds in bagged panicles. High pollen sterility was observed for cms lines DRR 3A, CRMS 45A, PUSA 3A, IR 75601A, RTN 4A, RTN 5A and RTN 10A. Out crossing of 35 percent or more was observed for about 22cms lines. Out crossing percentage was maximum for the sterile cms line, PMS 17A (52%) followed by DRR 6A (50%), IR68888A (48%), RTN 6A (48 %) and COMS 14A (47%). Higher panicle exertion is favourable for high outcrossing. Panicle exertion of 70 percent or more was observed in cms lines DRR 3A, DRR 6A, DRR 7A, PMS 17A, COMS 14A, COMS 15A, KCMS 13A, RTN 2A, RTN 3A, RTN 6A, RTN 13A, RTN 18A, IR 58028A and IR68888A. Stigma exertion of above 30 percent was observed for the cms lines DRR3A, DRR 5A, DRR 6A, DRR 7A, COMS 14A, COMS 15A, PMS 17A, KCMS 13A, PUSA 3A, IR 7560 1A, IR 68888A, RTN 2A, RTN 3A, RTN 6A, RTN 17A and RTN 18A. These results are in according with Abraham *et al.*<sup>[1]</sup> Azzini and Rudger<sup>[2]</sup>.

The cms lines Viz, RTN 2A, RTN 3A, RTN 6A, RTN 10A, IR58025A, RTN 17A showed higher number of panicles per plant, some of the cms lines that were completely pollen steriles in nature, either showed poor stigma exertion or had poor out crossing. Thus KCMS 13A and DRR 3A had poor out crossing and APMS 6A had poor stigma exertion or had poor out crossing and APMS 6A had poor stigma exertion. IR 75601A exhibited less than 70 percent panicle exertion for these cms lines the poorly expressed chacters are to the stabilized.

From the experiment conducted it may be found that cms lines, VI3, DRR 6A, DRR 7A, COMS 14A, COMS 15A, PMS 17A, RTN 2A, RTN 3A, RTN 6A, IR68888A and RTN 18A. were promising for the character for pollen sterility, panicle exertion, stigma exertion and natural out crossing and may be utilized for the development of three line hybrids with superior yield and quality.

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