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# Evaluation of Floral and Morphological Traits in CMS Lines of Hybrid Rice

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**Twenty one CMS lines and their respective maintainer lines were evaluated for floral and morphological characters. All the genotypes showed significant variation for the traits studied. The CMS lines *viz.,* IR 58025A, IR 80559A, IR 79156A, DRR 5A, COMS 14A, COMS 15A, TNAU CMS 2A, CRMS 32A and IR 68897A were found promising for the characters *viz.,* pollen sterility (%), glume angle, panicle exsertion (%), stigma exsertion (%), natural out crossing (%), which would favour good out-crossing during seed production of A x B and A x R combinations.**

**Key words:** Rice, CMS lines, floral traits, pollen sterility.

Rice is strictly self pollinated crop and natural out crossing rate is extremely low. Higher yields in hybrid seed production depends on out crossing rate of CMS lines and it is influenced by various morphological and floral traits. Successful development of hybrid rice depends on improvement of parental lines A, B and R. Among the different improved technologies to increase the productivity of rice, the exploitation of hybrid technology appears to be promising (Yuan *et al.,* 1994). The cytoplasmic genetic male sterility system is controlled by the interaction of cytoplasmic and nuclear genes. Presence of homozygous recessive nuclear gene for fertility restoration in association with sterility inducing genetic factor(s) in cytoplasm makes a genotype male sterile. In hybrid rice breeding more than 90 per cent of the hybrids released throughout the world are based on a single sterile cytoplasm, wild abortive (WA) and some of the drawbacks of the WA system are poor panicle exsertion and undesirable flowering behavior to low seed yield in seed production plots, which underscores the need for diversification of male sterile lines and also to improve the floral traits which would enhance the seed set percentage. The desirable floral traits for divorcified male sterile lines studied were days to 50% flowering, glume angle, panicle exertion percentage, stigma exertion percentage, pollen sterility percentage and out crossing percentage. Therefore, the present study was conducted with an objective to evaluate different CGMS lines for floral characters at Department of Rice, Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore.

## Material and Methods

Twenty one CMS lines and their maintainer lines were raised at Paddy Breeding Station, Tamil Nadu Agricultural University, Coimbatore, India during Kharif 2010. All the lines were grown in three replications in randomized block design and a spacing of 20 x 20 cm was adopted. Observations were recorded for five florets of different plants for floral traits in all the genotypes. The traits namely days to 50 % flowering, glume angle, panicle exertion percentage, stigma exertion percentage, pollen sterility percentage, awning, spikelet fertility percentage, out crossing percentage, plant height, number of productive tillers per plant, panicle length, total number of spikelet per panicle, number of filled grains per panicle, 100 grain weight, aroma, grain type, pest and disease and acceptability of the genotype was studied by following standard protocol. About 10-15 spikelets from the freshly emerged panicles of all the plants were collected and examined under microscope with 1% Iodine Potassium Iodide (I-KI) solution for pollen sterility assessment. Five panicles per plant were evaluated for natural seed set per cent. Panicles emerging from the sheath were bagged with butter paper bags prior to anthesis to prevent cross-pollination. Bagged panicles were harvested to assess seed setting per cent.

## Results and Discussion

The natural out crossing in cultivated rice varied from 0 to 68 per cent. Male sterile lines of cultivated rice have shown an outcrossing of 0 to 44 per cent (Athwal and Virmani, 1972). Variability in extent of natural out crossing in rice can be attributed to variations in flowering behaviour, floral characteristics of varieties or species and environmental factors. Breeders practically use the *per se* performance of genotypes for choosing parents. The genotypes IR 58025A, IR 80559A, IR

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**Table 1. Mean performance of 21CMS lines of rice for floral and biometrical traits**

| Entries | DFF | GA | PE % | PS% | OCR % | SE % | SB | Stigma colour |
|---|---|---|---|---|---|---|---|---|
| IR 68897A | 96 | 30 | 79.50 | 100.00 | 48.06 | 78.00 | 67.52 | White and TSE |
| IR 58025A | 109 | 20 | 73.33 | 100.00 | 42.77 | 82.00 | 73.02 | White and TSE |
| IR 80559A | 108 | 35 | 75.81 | 99.00 | 56.93 | 80.00 | 63.94 | White and TSE |
| IR 79156A | 94 | 30 | 78.04 | 100.00 | 60.71 | 85.00 | 75.00 | White and OSE |
| IR 80555A | 106 | 30 | 75.59 | 98.00 | 42.76 | 62.00 | 64.14 | White and TSE |
| DRR 4A | 110 | 30 | 63.00 | 100.00 | 44.91 | 65.00 | 51.32 | White and TSE |
| DRR 5A | 113 | 20 | 69.75 | 98.00 | 51.80 | 72.00 | 74.89 | Purple and TSE |
| DRR 6A | 114 | 30 | 76.08 | 97.00 | 50.00 | 75.00 | 67.69 | White and TSE |
| COMS15A | 108 | 30 | 79.43 | 100.00 | 46.75 | 72.00 | 73.12 | Purple and TSE |
| COMS16A | 116 | 25 | 80.76 | 99.00 | 49.64 | 68.00 | 74.67 | White and TSE |
| COMS18A | 114 | 30 | 76.59 | 100.00 | 42.24 | 80.00 | 64.53 | White and TSE |
| CNMS 2A | 93 | 25 | 76.08 | 98.00 | 59.50 | 82.00 | 74.30 | White and TSE |
| APMS6A | 112 | 25 | 75.00 | 100.00 | 42.39 | 78.00 | 65.22 | White and TSE |
| Pusa 6A | 112 | 20 | 82.00 | 99.00 | 43.84 | 82.00 | 74.93 | White and TSE |
| COMS 29A | 98 | 21 | 71.65 | 100.00 | 42.50 | 62.80 | 65.45 | White and TSE |
| COMS 14A | 95 | 24 | 75.00 | 100.00 | 45.28 | 75.40 | 72.50 | White and TSE |
| COMS 19A | 102 | 25 | 68.50 | 95.50 | 46.50 | 72.50 | 65.92 | White and TSE |
| TNAU CMS 2A | 85 | 20 | 70.50 | 100.00 | 49.85 | 80.50 | 55.85 | White and TSE |
| IR 73328A | 109 | 20 | 65.50 | 99.50 | 42.75 | 65.50 | 72.65 | White and TSE |
| CRMS 31A | 100 | 25 | 68.50 | 100.00 | 48.25 | 75.50 | 55.45 | White and TSE |
| CRMS 32A | 104 | 30 | 79.80 | 100.00 | 50.00 | 79.80 | 58.65 | White and TSE |
| Mean | 104.67 | 25.95 | 74.31 | 99.19 | 47.97 | 74.90 | 67.18 | - |

DFF: Days to 50 % flowering GA : Glume angle PE %: Panicle exsertion percentage
PS% : Pollen sterility percentage OCR %: Out crossing Rate in percentage
SE %: Stigma exsertion percentage SB : Seed set on bag

79156A, DRR 5A, DRR 6A, COMS 23A, COMS 14A, COMS 15A COMS 19A and IR 68897A registered highest mean value for glume angle, panicle exertion percentage, stigma exertion percentage, pollen sterility and natural out crossing rate (Table 1). Angle of glume / floret opening for these lines varied from 20° to 35°. In the present study maximum glume angle was observed in IR 80559A, IR 68897A,

**Table 2. Mean performance of 21CMS lines of rice for biometrical traits**

| Entries | HT | PN | PL | TS | FG | 100 GW | Grain type | Aroma | ACP | DIS-INS |
|---|---|---|---|---|---|---|---|---|---|---|
| IR 68897A | 94.30 | 9 | 22 | 129 | 100 | 2.39 | MS | Absent | A | Nil |
| IR 58025A | 85.60 | 8 | 25 | 159 | 132 | 2.71 | MS | Slight aroma | A | Nil |
| IR 80559A | 91.30 | 10 | 22 | 137 | 115 | 3.03 | MS | Absent | A | Nil |
| IR 79156A | 76.30 | 7 | 23 | 140 | 119 | 3.04 | MS | Absent | A | Nil |
| IR 80555A | 75.00 | 11 | 21 | 145 | 93 | 2.6 | MS | Absent | A | Nil |
| DRR 4A | 73.60 | 11 | 20 | 167 | 69 | 2.45 | MS | Absent | A | Nil |
| DRR 5A | 73.60 | 8 | 21 | 139 | 118 | 2.71 | MS | Absent | A | Nil |
| DRR 6A | 83.00 | 9 | 20 | 130 | 101 | 2.95 | MS | Absent | A | Nil |
| COMS15A | 96.00 | 9 | 24 | 154 | 128 | 3.07 | MS | Absent | A | Nil |
| COMS16A | 89.60 | 8 | 23 | 137 | 116 | 2.8 | MS | Absent | B | Nil |
| COMS18A | 84.60 | 8 | 24 | 161 | 120 | 3.04 | MS | Absent | A | Nil |
| CNMS2A | 83.60 | 10 | 21 | 121 | 102 | 2.78 | MS | Absent | A | Nil |
| APMS6A | 88.30 | 8 | 22 | 184 | 120 | 2.56 | MS | Absent | B | Nil |
| Pusa 6A | 92.00 | 10 | 23 | 146 | 124 | 2.48 | LS | Slight aroma | B | Nil |
| COMS 29A | 85.00 | 9 | 22 | 125 | 112 | 2.38 | MS | Absent | B | Nil |
| COMS 14A | 92.00 | 11 | 20 | 132 | 128 | 2.56 | MS | Absent | A | Nil |
| COMS 19A | 88.00 | 10 | 21 | 140 | 132 | 2.45 | MS | Absent | B | Nil |
| TNAU CMS 2A | 91.00 | 9 | 22 | 128 | 100 | 2.32 | MS | Absent | A | Nil |
| IR 73328A | 88.00 | 8 | 23 | 115 | 98 | 2.18 | MS | Absent | A | Nil |
| CRMS 31A | 92.00 | 9 | 20 | 125 | 102 | 2.28 | MS | Absent | A | Nil |
| CRMS 32A | 89.00 | 12 | 23 | 138 | 134 | 2.35 | MS | Absent | A | Nil |
| Mean | 86.28 | 9.24 | 22.00 | 140.57 | 112.52 | 2.63 | - | - | - | - |

HT: Plant height (cm) PN: Number of panicle/plant PL: Panicle length TS: Total spikelets per panicle
FG: Number of grains per panicle 100 GW: 100 grain weight (g)ACP: Acceptability of the genotype DIS-INS: Pest and Disease incidence

IR 79156A, IR 80555A, DRR 4A, DRR 6A, COMS15A, CRMS 32A and COMS18A. Ravneet S. Behta *et al.*(2007) reported the range of 23° to 30°. Days to 50% flowering also showed significant variation in all the CGMS lines studied. The minimum days to 50% flowering was 86 in CNMS 2A, where as it was maximum in COMS16A (116 days). Panicle exsertion ranged from 63° to 82° % for DRR 4A and PUSA 6 A respectively. Stigma exsertion ranged from 62 (IR 80555A) to 85 (IR 79156A). Out of twenty one CGMS lines evaluated twelve CMS lines *viz*., IR 68897A, IR 58025A, IR 79156A, DRR 4A, COMS15A, COMS18A, APMS6A, COMS 29A, COMS 14A, TNAU CMS 2A, CRMS 31A and CRMS 32A were completely pollen sterile. Out crossing percentage was maximum for the sterile CMS lines, IR 79156A followed by CNMS 2A, IR 80559A, DRR 5A, DRR 6A and CRMS 32A.

From this experiment, it was found that CMS lines, IR 58025A, IR 80559A, IR 79156A, DRR 5A, COMS 14A, COMS 15A, TNAU CMS 2A, CRMS 32A and IR 68897A were found promising for the characters *viz.,* pollen sterility (%), glume angle, panicle exsertion (%), stigma exsertion (%) and natural out crossing (%), (Table 2). Thus confirming their superiority for the synthesis of good rice hybrids with high seed production potential.

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