

Evaluation of cytoplasmic male sterile lines of rice for temperate region

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ABSTRACT

Various agronomical, floral and out-crossing traits of two cytoplasmic male sterile lines, SKAU-7A and SKAU-11A were studied against the more popular exotic CMS lines under temperate conditions of Kashmir. The locally developed male sterile lines exhibited greater plant height, more number of tillers plant⁻¹, spikelets panicle⁻¹ and were early maturing. The two A-lines had greater stigma length, short and narrow flag leaves, better stigma exertion, wider angle and longer duration of open floret, therefore, showed high percentage of out-crossing. The CMS lines developed are in temperate genotypic background and have performed well in comparison to exotic lines mostly used in sub-tropical parts of India.

Key words: rice, cytoplasmic male sterile lines, evaluation, temperate climate

Hybrid rice programme has not received a major breakthrough in Kashmir because of non-adaptability of most of the exotic CMS lines under cold temperate agro-climatic conditions which rules out their direct use as A-lines and secondly lack of restorers available for them. Preliminary study was aimed at characterizing two locally developed and adapted temperate CMS lines SKAU-7A and SKAU-11A vis-à-vis more popular exotic cyto-sterile lines procured from International Rice Research Institute, Philippines.

Materials comprised of six CMS lines viz., SKAU-7A, SKAU-11A, IR 58025A, IR 62829A, IR 68888A and IR 68897A. Both SKAU-7A and SKAU-11A have been developed by recurrent backcrossing with Baderwah-I (a temperate cold tolerant genotype), with IR 69628 and IR 68888, respectively as cytoplasm donors. CMS lines were evaluated for various morphological/agronomical traits, pollen sterility and the traits favoring out-crossing. The experiment was laid in RBD with three replications at Rice Research and Regional Station Khudwani during wet season 2007. The study was carried out for the traits plant height, panicle length, flag leaf length, flag leaf angle, number of tillers plant⁻¹, number of panicles plant⁻¹, spikelets panicle⁻¹, 1000-grain weight, days to 50% flowering, days to maturity, duration of open floret,

angle of floret opening, ovary length, style length, stigma length, pollen sterility, anther length, panicle exertion, stigma exertion and outcrossing. Apart from characterizing the two local CMS lines, this investigation was undertaken to confirm the suitability of exotic CMS lines for direct use under temperate climatic conditions of Kashmir.

The two CMS lines showed significantly greater plant height, number of tillers plant⁻¹ and more number of spikelets panicle⁻¹ as compared to exotic CMS lines evaluated under similar conditions (Table 1). SKAU-7A and SKAU-11A flowered in 98 and 97 days, respectively, while others especially, IR 62829 A showed delayed flowering and maturity of 117 and 152 DAS, respectively. SKAU-7A and SKAU-11A had shorter and narrow flag leaves which help in efficient reception of foreign pollen (Nghia *et al*, 1994). Both the lines, besides highest number of spikelets panicle⁻¹ had more productive tillers, and thus suitable for commercial hybrid seed production.

SKAU-7A and SKAU-11A, recorded 100 percent spikelet sterility and exhibited a pollen sterility of 98.44 and 97.30 percent, respectively. Highest pollen sterility was in IR 58025A. Pistil length of these two CMS lines was significantly greater than all the IRRI CMS lines except IR 62829A which is the trait related

Table 1. Agronomical characteristics, floral and out-crossing traits of the cytoplasmic male sterile lines of rice.

CMS line	No of productive tillers plant ⁻¹	No of Plant tillers plant ⁻¹	Plant height (cm)	Panicle length (cm)	Flag leaf length (cm)	Flag leaf width (cm)	Flag leaf angle (°)	Days to 50% flowering	Spikelets/ panicle ⁻¹ (gm)	Seed weight (gm)	Days to maturity	Duration of open floret (min)	Angle of open floret (Degree)	Ovary length (mm)	Style length (mm)	Pistil length (mm)	Anther length (mm)	Pollen sterility (%)	Panicle exsertion (%)	Stigma exsertion (%)	Out- crossing (%)	
IR-58025A	11.21	24.35	79.56	25.52	29.00	1.5	14.62	110	127.32	26.12	145	101.32	35.13	0.56	0.51	1.82	2.61	1.83	99.34	77.86	30.87	23.13
IR-62829A	12.40	29.68	60.88	22.73	25.41	1.0	12.20	117	120.90	25.34	152	95.50	32.49	0.59	0.54	1.54	2.95	2.10	98.10	82.81	37.98	26.46
IR-68888A	8.38	20.41	57.21	23.12	22.32	1.1	12.74	115	111.00	24.00	150	91.67	25.15	0.50	0.45	1.31	2.26	1.79	96.44	70.33	25.80	19.06
IR68897A	9.52	21.00	49.28	20.43	25.10	1.2	13.00	112	119.19	26.83	145	89.33	30.00	0.52	0.48	1.50	2.50	2.12	95.59	73.49	26.18	21.64
SKAU-7A	13.68	32.24	94.30	24.50	25.45	1.2	16.92	98	151.62	24.77	137	97.58	39.88	0.54	0.53	1.65	2.72	1.94	98.44	70.93	32.85	25.77
SKAU-11A	10.59	28.30	92.52	24.21	24.19	1.1	20.76	97	142.43	25.06	140	88.23	35.10	0.58	0.51	1.56	2.65	1.82	97.30	66.28	28.22	20.47
CD(P=0.05)	2.06	5.24	21.05	1.97	2.51	0.19	3.62	5.47	16.75	1.10	4.28	5.32	2.33	0.04	0.04	0.10	0.17	0.16	1.51	6.50	2.10	2.30

to stigma exsertion and out-crossing potential. SKAU-7A had comparably good stigma length (1.65 mm) and stigma exsertion (32.85 %) against SKAU-11A. Angle of open floret has direct relation to out-crossing potential which was highest for SKAU-7A (40°) followed by SKAU-11A (35°) and IR 58025A (35°). Usually medium and short grained genotypes have wider angle of open floret than long grained types (Parmar *et al*, 1979) which have been observed in the present investigation also. SKAU-7A showed longer duration (97 min) of open floret which was *at par* with IR 62829A and significantly greater than SKAU-11A with 88 minutes duration. Highest out-crossing percentage was noted for IR 62829A (26.46%) followed by SKAU-7A (25.77%). SKAU-7A had stigma length greater than the much improved and advanced CMS lines 62829A, IR 68897A and IR 68888A which according to Ali *et al*. (2007) is a useful trait favoring good extrusion of stigma out of lemma palea for high seed setting.

The results indicated that SKAU-7A had better floral/ out-crossing traits than SKAU-11A, though, both the CMS lines were cold tolerant, stable and adapted to temperate climate of Kashmir. Usually exotic male sterile lines tend to be late under Kashmir conditions and hence, are hardly of any direct use in hybrid breeding programme. Therefore, much impetus and thrust may be given for development of more male sterile lines under local temperate climate for their potential use in the development of hybrid rice.

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