SHORT COMMUNICATION

Evaluation of new rice lines derived through induced mutation of traditional variety: Suduru samba

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ABSTRACT

Suduru samba is a traditional rice variety popular among most of the rice consumers in Sri Lanka. This cultivar produces white color, short round (samba) grain with higher rice grain cooking quality, good taste and aroma. However, susceptibility to lodging, neck blast and photosensitivity are major disadvantages of this variety. With the objective of developing shorter plants with desirable characters, seeds of Suduru samba were mutated using gamma irradiation. After the phenotypic selection and advancement of selfing generations two mutants SSR 26 and SSR 8 were evaluated on yield trials with standard checks Bg 357, Bg 360 and parent Suduru samba. The grain yield was recorded as 2.27, 2.90, and 1.01 t ha^{-1} for SSR 26, SSR 8 and Suduru samba, respectively. Further SSR 8 and SSR 26 having intermediate plant height and strong culm, showed resistance to lodging compared to the parent variety, Suduru samba,

***Keywords**: Suduru samba, photosensitivity, gamma irradiation, mutation*

INTRODUCTION

Hybridisation is the basic method for creating genetic variability that breeders need for selections. Spontaneous and induced mutations can make valuable additions to such variability and give the breeder an additional "raw material" for his selection (Mikaelsan,1980). Moreover, induced mutation can shorten the breeding process compared with conventional methods. Induction of mutations with radiation has been the most frequently used method to directly develop mutant varieties. During the past decades, worldwide more than 3222 varieties, which were developed by induced mutation, have been officially released. Out of which 827 varieties were rice mutants (IAEA, 2015).

Mutation breeding is primarily used to improve characters such as semi-dwarf height, early maturity, improved grain yield, disease and cold tolerance and improved grain quality (Ahloowalia *et al.*, 2004). In terms of plant characters, change in plant height has been one of the most common mutant traits. The most important ones are those with shorter culms (dwarfs, semi dwarfs). A large number of such short-statured mutants has been produced from local varieties in many countries. Little attention has been paid in using mutation techniques in the rice variety improvement in Sri Lanka. MI 273 is the only available mutant variety that has been officially released in Sri Lanka (Bentota *et al.*, 2008). Therefore, with the objective of developing new rice lines with strong culm,

shorter plant height and desirable grain characters, seeds of Suduru samba was mutated using gamma irradiation in the present study.

MATERIALS AND METHODS

A 500 g of seeds of Suduru samba was irradiated with gamma irradiation doses of 250 Gy at gamma irradiation unit at Horticultural Crops Research Institute (HORDI), Gannoruwa whereas the field experiment was carried out at the Rice Research and Development Institute (RRDI), Batalagoda. Irradiated seeds were germinated and planted as bulk population to raise the M1 generation. Visual selection was carried out over M1 to M8 generation based on plant height, panicle length, seed size, seed shape and days to maturity. Five promising lines were selected after M8 generation from the previous evaluations (Hemachandra *et al.*, 2010). Among the five lines, SSR 08 and SSR 26 have shown good phenotypic characters at progeny level. Therefore, those two lines were selected to evaluate the yield trials in *Maha* 2010/11 and *Yala* 2011. The lines were tested with standard checks of Bg 357, Bg 360 and parent Suduru samba. The field trial was established as Randomised Complete Block Design (RCBD) with three replications. The plot size was 3 x 6 m^2 and each plot was transplanted with sixteen days old seedlings as three seedlings per hill with 15 x 15 cm spacing. All the cultural practices were maintained according to the Department of Agriculture (DOA) recommendations. Days to 50% flowering, days to maturity, agronomic characters, yield parameters and lodging assessment at the stage of maturity were recorded.

Statistical analysis

Analysis of Variance (ANOVA) was carried out using SAS computer software package version 9.1.3.

RESULTS AND DISCUSSION

Tiller number, Panicle number, culm length, panicle length, days to 50% flowering and days to maturity of mutants are presented in Table 1 along with that of the parent variety Suduru samba, standard checks Bg 357 and Bg 360 of 3 ½ months varieties.

Tiller number and panicle number

Tiller number and panicle number of tested lines were not consistent in both *Yala* and *Maha* seasons. The tested lines of SW 25 and SSR 26 recorded significantly (P<0.05) higher number of tillers and panicles per plant compared to the parental variety, Suduru samba.

Culm length

The SSR 26 and SSR 8 mutant lines had significantly (P<0.05) shorter culms, which lies between 67 to 76 cm. The tallest culm was observed from Suduru

Table 1: Agronomic characteristics, days to 50% flowering and days to maturity of the mutant lines, parent variety, standard checks Bg 357 and Bg 360 in *Maha* 2010/11 and *Yala* 2011.

Mutant line/ variety	Agronomic characteristics								Days to 50% flowering		Days to maturity	
	Tiller number/ plant		Panicle number/ plant		Culm length (cm)		Panicle length (cm)					
	2010/11 *Maha*	2011 *Yala*	2010/11 *Maha*	2011 *Yala*	2010/11 *Maha*	2011 *Yala*	2010/11 *Maha*	2011 *Yala*	2010/11 *Maha*	2011 *Yala*	2010/11 *Maha*	2011 *Yala*
SW 25	11.73ab	12.73ab	9.8a	12.33ab	64.76cd	69.06c	18.96d	21.19c	76c	78c	106c	112c
SSR 26	11.86a	12.67ab	10a	11.6ab	69.46b	74.23b	22.36bc	25.41ab	75d	72e	105d	106e
SSR 8	10.4c	11.4b	7.5c	10.6bc	67.5bc	76.36b	23.5ab	25.9a	79a	86a	109a	120a
Suduru samba (Parent)	10.8bc	10.83b	8.3bc	8.33c	110.23a	111a	24.36a	24.16b	76c	82b	106c	116a
Bg357 (Standard)	8.13d	11.47b	8.26bc	10.93bc	62.8d	68.7c	20.53dc	22c	73e	76d	103e	110d
Bg 360 (Standard)	10.06c	14a	8.93ab	13.8a	64.53cd	65.9c	22.53ab	22.1c	78b	75d	108b	109d
CV	5.49	10.77	8.71	13.31	2.9	2.81	4.65	3.47	0.45	0.5	0.32	0.35
LSD	1.05	2.38	1.39	2.73	3.86	3.97	1.86	1.48	0.63	0.71	0.63	0.71

Means followed by the same letter within each column are not significantly different at $P<0.05$.

samba, which was 110 cm in height. The results revealed that induced mutation was positively affected on semi-dwarf nature of mutant lines.

Panicle length

Variation in panicle length showed different trends in *Maha* 2010/11 and *Yala* 2011. Panicle length of two mutant lines (SSR 8 and SSR 26) were within the range of 22 to 26 cm. All the tested lines recorded higher panicle lengths in *Yala* 2011 while the highest panicle length recorded was 25.9 cm in SSR 8.

Days to 50% flowering and maturity

Significance variation on days to 50% flowering was observed among selected mutant lines in both *Yala* and *Maha* seasons. All the tested lines have taken more days to 50% flowering in *Yala* season than in *Maha* season, except SSR 26. Days to maturity of all the lines were not consistent in both seasons. The mutant line SSR 26 was well fitted to 3½ months age group based on *Maha* 2010/11 and *Yala* 2011 results. Further, the results revealed that SSR 8 has mild photoperiod sensitivity similar to the parent variety.

Panicle characteristics, physical grain characteristics, grain yield and lodging assessment of tested lines along with parent and standard checks are presented in Table 2.

Panicle characteristics

All tested lines were not significantly (P<0.05) different for number of seeds per panicle and filled grain percentage. Though number of seeds per panicle varies from 115 to 143. Bg 357 recorded highest number of seeds per panicle. Filled grain percentage of tested lines was varied from 74.4 to 84.5 while highest filled grain percentage was recorded by Bg 360.

Grain physical characteristics

Pericarp color of all six tested lines were white while SW 25, SSR 26, Bg 360 and Suduru samba had short round grains. SSR 8, Bg 357 had long slender, intermediate bold/long medium grains, respectively. The smallest 1000 seed weight of 9.8 g was recorded from SSR 26. The 1000 seed weight of SSR 8 was significantly (P<0.05) higher than the parental variety Suduru samba, which was similar to 1000 seed weight of Bg 357.

Grain Yield

Tested mutant lines showed significant grain yield differences compared to Suduru samba. Though SSR 8 was recorded higher yield than SSR 26 in both seasons. The lowest yield of 0.88 to 1.15 t ha^{-1} was recorded by Suduru samba while Bg 357 was recorded the highest yield as 4.76 t ha^{-1}. The results revealed that gamma irradiation as an induced mutation technique had a significant effect on yield advancement of derived mutant lines.

Table 2: Panicle characteristics, physical grain characteristics and grain yield of mutant lines, parent variety, standard checks Bg 357 and Bg 360 in *Maha* 2010/11 and *Yala* 2011.

Mutant line /variety	Panicle characteristics		Physical grain characteristics			Grain Yield (t ha^{-1})		Lodging assessment***
	Number of Seeds/panicle	Filled grain %	Pericarp color*	Grain shape**	1000 seed weight (g)	2010/11 *Maha*	2011 *Yala*	
SW 25	117a	80.1a	W	SR	12.5bc	2.85a	3.11bc	NL
SSR 26	131.3a	80.1a	W	SR	9.8d	1.92b	2.63c	NL
SSR 8	133.3a	74.4a	W	LS	16.9a	2.85a	2.95bc	NL
Suduru samba (Parent)	136.6a	79a	W	SR	10cd	0.88c	1.15d	L
Bg357 (Standard)	143.3a	80.1a	W	IB/LM	16.73a	3.45a	4.76a	NL
Bg 360 (Standard)	115.3a	84.5a	W	SR	13.56b	3.27a	3.8b	NL
CV	21.5	12.7			10.34	14.7	16.3	
LSD	50.65	18.43			2.49	0.68	0.91	

Means followed by the same letter within each column are not significantly different at $P<0.05$.

*W – White **SR – Short round, LS – Long slender, IB – Intermediate bold, LM – Long medium, ***NL – Non-lodged, L – Lodged

Lodging assessment

All the tested lines were resistant to lodging, except Suduru samba. It was observed that Suduru samba was started to lodging from the time of milking stage. It may be due to taller plant height (<110 cm) and thin culm. SSR 8 and SSR 26 were resistant to lodging due to changing plant architecture by mutation induction.

CONCLUSIONS

It is possible to change the characters such as plant height, flowering time and days to maturity, grain characters, yield and lodging tolerance by induced mutations. The mutant lines SSR 26, SSR 8 are significantly different from the parent variety and performed better. Moreover, these two lines are adequately uniform in plant height, seed characters and maturity time. These materials could be used to enrich the rice breeding germplasm. Also this study confirms that induced mutation provided favorable and heritable genetic variation for further improvement of rice varieties in the country.

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