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Evaluation of Basmati derivatives in gangetic alluvial soil of West Bengal

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ABSTRACT

An attempt was made to develop dwarf high yielding scented varieties with long slender grains. Crossing was made between high yielding lines and Basmati rice varieties. Desirable lines were identified from the segregating generations of IR30 x Basmati 370 cross only. Fifty two F_4 lines, selected from sixteen F_3 families, were evaluated for nine biometrical characters viz. panicle number plant^{-1}, panicle weight, panicle length, grain number panicle^{-1}, grain length (L), grain breadth (B), grain L:B ratio, 1000 grain weight and grain yield plant^{-1}. The analysis of variance revealed significant differences among the lines for all the Parameters studied. Four lines showed significantly superior performance in respect of grain yield and some other yield related characters. Mean grain length of the selected lines was 7.45 mm and nine lines showed significantly superior performance in respect of grain yield and some other yield related characters. Mean grain length. More than sixty percent lines had>4.0 grain L:B ratio. High genotypic coefficient variability(GCV) and Phenotypic coefficient variability (PCV) were observed for grain yield plant^{-1}, grain number panicle^{-1}, panicle weight and panicle number plant^{-1}. High heritability was observed for panicle weight, grain number panicle-1, grain length, grain L:B ratio, 1000 grain weight and grain yield plant^{-1} while panicle number plant^{-1}, panicle length and grain breadth and moderate heritability. Grain yield plant^{-1}showed maximum genetic advance as percentage of mean followed by panicle weight, grain number panicle^{-1}, 1000 grain weight and panicle number plant^{-1}, respectively.

Key words: *Basmati derivatives, grain yield, heritability, genetic advance*

Though rice production in India has been trebled during the last fifty years but low yielding aromatic rices have been the major casualty in green revolution. In the context of changing agricultural scenario, there has been increasing demand for quality scented rices throughout the world. India produces some of the best quality rices. Among them, Basmati rice is renowned for its quality characteristics. But, yield of traditional Basmati varieties is as low as 1/3rd of the semi-dwarf high yielding non-Basmati varieties (Sarial *et al.,* 2006). Physical properties like shape and size mainly determine the market acceptability of rice and appearance of milled rice is important to the consumer. Thus, grain size and shape were the prime criteria for quality improvement in rice. In this context, an attempt was made in the present study to develop semi-dwarf high yielding quality rice through the blending of quality characters of Basmati rice and high yielding capacity of modern varieties. In the present investigation, 52 F_4 lines derived from the segregating generations of IR 30 and Basmati 370 cross were evaluated for nine biometrical characters to identify high yielding lines with long slender grain and their selection in F_4 generation based on the *per se* performance and estimation of variability parameters that may give an idea about the efficiency of selection in advance generations.

Hybridization between IR30 and Basmati 370 was carried out during wet season 2001. Selection for desirable plant, based mainly on grain yield and grain shape i.e. grain length(L), grain breadth(B) and grain length/breadth(L:B) ratio, was carried out upto F4 generation. Fifty two F4 lines were selected from F3 population during wet season 2004. They were evaluated in randomized block design with two replications. Twenty five days age old seedlings were transplanted in six rowed plot of 5 m length at 20 x 20 cm spacing during 1st week of August, 2005. Normal agronomic practices were followed to obtain a good harvest. The observation were recorded on five randomly taken competitive plants for nine biometrical characters viz. panicle number plant^{-1}, panicle weight , panicle length, grain number panicle^{-1}, 1000 grain weight, grain length, grain breadth, grain L/B ratio, and grain yield plant^{-1}. The mean data were statistically analysed following Panse and Sukhatme (1967) for analysis of variance. Co-efficient of variation, heritability (broad sense) and genetic advance were estimated using the formula by Johnson *et al.* (1955) and Hansen *et al.* (1956), respectively.

The analysis of variance was highly significant against all the characters. This indicated that selected lines were significantly different for the tested characters. The highest grain yield plant^{-1} was recorded in S_1 (33.09 g) followed by S_{12} (27.34 g), S_{24} (26.49 g), S_{49} (25.25 g) and S_{32} (21.45 g) respectively (Table 1). All the selected lines, excepting 550 was recorded >6.5 mm grain length among them S_1, S_2, S_{29}, S_{31}, S_{34}, S_{35}, S_{36}, S_{37} and S_{43} were in the high ranking group. Grain breadth, the another important grain character, showed lesser degree of variation (1.40 to 2.35 mm) compared to other characters. Here, lesser grain breadth is more desirable than higher grain breadth. Therefore, S_{30} having minimum grain breadth, was the best performer followed by S_{26}, S_{27}, S_{20} and S_{22} respectively against the trait concerned. Excepting nine lines viz. S_{11}, S_{12}, S_{18}, S_{37}, S_{42}, S_{45}, S_{46}, S_{49} and S_{50}, all the selected lines possessed <2mm grain breadth in this regard. The grain L:B ratio, another important criterion, used for determining the grain shape was varied from 2.85 to 5.60. More than sixty percent lines showed above 4.0 L:B ratio. Among them, maximum L:B ratio was observed in S_{30} followed by S_{29}, S_{28}, S_{35} and S_{52} respectively. Maximum 1000 grain weight was recorded in S_{49} followed by S_{51}, S_9, S_{46} and S_{43} respectively. Grain number panicle^{-1} showed a wide variation of which minimum number (43.80) was observed in S_{35} and S_{39} had maximum number (135.40) followed by S_{49}, S_{24}, S_{33} and S_{12}, respectively. S_1 recorded maximum panicle number plant-l followed by S_{40}, S_6, S_{26}, S_{42} and S_{27} and maximum panicle weight was observed in S_{49} followed by S_{12}, S_{51}, S_1 and S_{24} respectively in this regard.

The highest PCV was observed for grain yield plant^{-1} (39.70) followed by panicle number plant-l (30.53), panicle weight (29.37) and grain number panicle^{-1} (25.69) (Table 2). Grain length had lowest PCV (8.62) and GCV (7.34) in this regard. The GCV, which provide a more precise measure of variability, was ranged from 7.34 to 34.75, the highest being for grain yield plant^{-1} (34.75) followed by panicle weight (25.52) and panicle number plant^{-1} (22.80). The high magnitude of GCV for grain yield plant^{-1}, panicle weight, panicle number and grain number panicle^{-1} revealed the great extent of variability for these characters there by suggesting good scope for improvement of these characters simply through selection.

The heritability estimates were quite high for all the characters studied excepting panicle number plant^{-1}, panicle length and grain breadth that indicated the effectiveness with which the selection of lines can be made based on phenotypic performance (Johnson *et al.,* 1956). High heritability coupled with high genetic advance as percentage of mean was recorded in 1000 grain weight, grain yield plant^{-1}, panicle weight and grain number panicle^{-1}. This suggested the preponderance of additive gene action in the controlling of these characters. Therefore, simple selection would be effective against these characters. High heritability with low genetic advance observed in grain L : B ratio, panicle weight and grain length suggested the possible role of non-additive genes for the expression of these characters, thereby showing little scope for improvement simply through selection.

The present investigation highlighted the differential performance of the selected F_4 lines of Basmati derivatives. *Per se* performance revealed that lines S_1, S_{12}, S_{24} and S_{49} were significantly superior in respect of grain yield and some other yield related characters. Hence, these most promising lines should be carried forward to the next generations to obtain desirable lines in succeeding generations, in addition to these lines, S_{34}, S_{41} and S_{48} should also be considered for future generation for their extra long slender grain with moderate grain yield. GCV, PCV, heritability and genetic advance revealed the effectiveness of panicle number plant^{-1}, grain number panicle^{-1}, 1000 grain weight and grain yield plant^{-1} for rice improvement programme. Therefore, above mentioned characters should be considered during selection in succeeding

Table 1. Mean performance of 52 F4 lines of Basmati derivatives for yield parameters and grain quality

Selection number	Panicle number plant^{-1}	Panicle weight (g)	Panicle length (cm)	Grain number panicle^{-1}	Grain length (mm)	Grain breadth (mm)	L:B ratio	1000 grain weight (g)	Grain yield plant (g)
S_1	15.70	2.74	28.23	120.40	8.10	1.95	4.15	22.31	33.09
S_2	13.20	1.66	23.63	79.40	8.55	1.85	4.60	21.25	17.87
S_3	11.60	1.63	26.53	83.30	7.45	1.90	3.90	21.03	17.00
S_4	11.20	1.96	25.43	89.50	7.40	1.80	4.10	20.63	18.83
S_5	9.55	1.84	26.99	88.20	7.10	1.80	3.95	22.18	14.63
S_6	14.60	2.12	23.39	86.00	6.95	1.85	3.75	19.77	19.50
S_7	12.55	1.55	22.77	83.80	7.25	1.85	3.90	20.88	16.90
S_8	9.70	1.55	23.73	91.10	7.60	1.95	3.90	14.89	11.65
S_9	7.70	2.37	22.53	87.80	7.25	1.95	3.75	24.92	14.20
S_{10}	4.60	2.29	23.71	93.90	6.75	1.80	3.75	20.88	7.61
S_{11}	8.90	2.42	24.84	104.40	7.55	2.35	3.20	23.66	16.69
S_{12}	11.30	2.97	23.75	126.50	7.25	2.15	3.40	24.26	27.34
S_{13}	4.70	1.41	19.90	51.60	7.50	1.75	4.25	19.80	4.14
S_{14}	9.10	1.79	25.82	62.65	7.35	1.95	3.80	22.90	11.51
S_{15}	10.00	1.18	21.24	85.60	6.80	1.95	3.50	12.95	9.90
S_{16}	13.70	1.46	25.76	78.00	7.30	1.80	4.05	13.95	11.31
S_{17}	14.10	0.80	23.80	59.00	7.38	1.70	4.35	12.60	9.63
S_{18}	9.80	1.88	22.18	103.40	6.30	2.20	2.85	21.00	15.50
S_{19}	12.90	1.82	25.89	67.30	7.75	1.95	4.00	23.02	16.56
S_{20}	9.20	1.75	27.12	99.40	6.95	1.60	4.35	16.83	11.72
S_{21}	11.70	2.15	30.37	125.20	6.90	1.70	4.10	17.29	20.06
S_{22}	8.20	1.52	28.92	121.00	6.55	1.60	4.15	15.97	11.81
S_{23}	8.30	2.20	29.36	112.60	7.25	1.95	3.70	20.11	15.40
S_{24}	13.40	2.60	27.30	128.20	6.55	1.75	3.80	19.55	26.49
S_{25}	11.50	1.34	27.06	89.70	7.55	1.65	4.55	12.81	11.51
S_{26}	14.60	1.59	27.85	107.05	7.60	1.50	5.10	14.42	17.25
S_{27}	11.60	1.49	26.75	101.80	7.85	1.55	5.10	14.88	14.15
S_{28}	9.20	1.36	22.41	87.10	7.80	1.65	4.75	14.85	9.43
S_{29}	10.70	1.31	28.60	75.25	8.05	1.70	4.80	14.66	9.91
S_{30}	7.90	1.66	26.29	93.60	7.85	1.40	5.60	14.94	10.11
S_{31}	13.50	1.82	22.63	80.30	8.30	1.95	4.25	20.11	18.78
S_{32}	11.40	2.08	29.74	104.05	7.25	1.80	4.05	23.75	21.45
S_{33}	9.30	2.16	8.87	126.80	6.65	1.75	3.85	13.90	14.30
S_{34}	9.10	2.56	27.25	126.00	8.35	1.85	4.55	20.69	20.86
S_{35}	7.70	0.98	22.00	43.80	8.25	1.75	4.75	22.37	5.81
S_{36}	13.30	1.26	22.98	65.40	8.00	1.95	4.15	22.71	14.65
S_{37}	11.60	1.75	22.45	77.30	9.00	2.00	4.55	22.32	16.29
S_{38}	9.60	2.31	27.00	105.00	7.85	1.95	4.05	21.02	16.88
S_{39}	9.80	2.52	28.33	135.40	6.75	11.90	3.55	21.94	18.40
S_{40}	15.10	1.41	24.29	90.20	7.85	1.95	4.05	18.12	17.82
S_{41}	10.70	2.35	27.66	94.95	7.80	1.90	4.15	23.59	20.05
S_{42}	14.30	1.73	25.11	91.50	7.50	2.05	3.65	23.81	20.35
S_{43}	10.60	1.86	29.81	82.40	8.00	1.95	4.10	24.35	16.02
S_{44}	4.30	1.59	14.32	74.00	7.65	1.80	4.25	16.25	4.50
S_{45}	4.10	1.30	17.51	44.50	7.10	2.00	3.60	23.08	3.86
S_{46}	8.60	2.00	26.89	100.10	7.35	2.10	3.50	24.66	14.75
S_{47}	9.20	2.40	25.61	121.50	7.75	1.85	4.25	20.52	17.46
S_{48}	14.70	1.80	28.15	100.85	7.80	1.90	4.10	17.86	20.61
S_{49}	9.20	3.08	27.75	131.30	6.75	2.25	3.05	28.80	25.25
S_{50}	8.30	2.57	27.05	125.75	5.90	2.25	2.60	20.43	16.39
S_{51}	7.50	2.94	23.30	83.20	7.20	1.70	4.25	26.44	14.18
S_{52}	12.50	1.50	30.48	76.30	7.95	1.70	4.70	19.11	14.53
Mean	10.49	1.89	25.25	93.43	7.45	1.86	4.06	19.90	15.48
CD (P=0.05)	4.27	0.55	4.84	24.19	0.69	0.28	0.66	2.37	5.93

generations for improvement of Basmati derivatives.

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