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Short Communication

Exploitation of heterosis in aromatic rices for different physico-chemical traits

R. K. Singh[1] and J. P. Lal

Department of Genetics & Plant Breeding, Institute of Agricultural Sciences, BHU, Varanasi 221 005

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Hybrid technology has successfully been used to increase the yields. Many high yielding rice hybrids have been developed in India but in most cases quality is not to the desirable extent and therefore, lacked acceptability by consumers and millers. The increasing demand of quality rices in the local and international markets has paid attention on quality breeding. Improving rice quality has now become prime objective of most of breeding programmes. The quality characteristics of rice includes the total head rice recovery, physical attributes of kernel like size, shape and appearance, cooking and eating quality, and aroma. In rice, heterosis for grain yield and its components have been reported by various workers, but little information is available on quality characters. Therefore, it is essential to develop quality rice hybrids by using CMS lines and aromatic restorers that will be expected to aromatic if aroma is governed by a dominant gene as reported Bijral & Gupta [1]. In view of above considerations, the present study has been planned to develop basmati rice hybrids as well as non-aromatic ones with better quality, and to estimate the heterosis for various quality characters and yield.

Twenty five aromatic varieties / mutants and three CMS lines (IR68888A, IR68891A & IR58025A) were crossed to generate 41 F_1 hybrids with normal fertility. These F_1s along with parents and Pusa Basmati-1 as the standard control were evaluated at the Agricultural Research Farm of the Banaras Hindu University, Varanasi, in a randomized block design with three replications. Each entry was planted in a single row of 3 m length with a spacing of 20 × 1 5 cm at one seedling per hill. The recommended agronomic practices were adopted to raise a good crop. Observations on various quality character *viz.*, head rice recovery, kernel length, Kernel breadth, l/b ratio, kernel elongation, amylose content, gel consistency, alkali digestion value, water uptake number and volume expansion were recorded from a composite seed sample of ten randomly selected plants from each replication and grain yield was taken from randomly selected plants. The head rice recovery were computed as per method of Ghosh *et al.* [2]. Kernel length, breadth were measured from milled kernel with Mitutoya dial micrometer and L:B ratio derived from individual kernel length and breadth. Kernel elongation was measured from cooked kernels with the help of graph paper and aroma was detected from the leaves as well as ripened kernels by using method of Nagaraju *et al.* [3]. The cooking quality parameters like, alkali digestion value, water uptake number, volume expansion, gel consistency and amylose content were measured by standard methods [4-6, 7 & 8], respectively, in quality testing laboratory of G.B. Pant University of Agriculture & Technology, Pant Nagar. The standard heterosis were estimated as percent increase or decrease of F_1 values over standard check. The data on standard heterosis for various quality character and yield per plant of fourteen promising hybrids are presented in Table 1.

The hybrids exhibited significant positive as well as negative standard heterosis for head rice recovery. The hybrids IR68888A × PB-5-14-50-1, IR58025A × Basmati Sathi and IR58025 A × Gopal Bhog showed significant positive standard heterosis for head rice recovery. The usable standard heterosis for kernel length, kernel breadth, l/b ratio and kernel elongation ratio were not observed in hybrids, whereas significant positive as well as negative standard heterosis for amylose content were recorded in hybrids. The hybrids IR68888A × PB-6-12-24-4, IR68888A × Basmati-397, IR68888A × PB-3-17-57-1 and IR68891 A × Hawm Kikwai exhibited significant positive standard heterosis for amylose content. These results are in accordance

[1]Present Address : Department of Agricultural Botany, Amar Singh (PG.) College, Lakhaoti, Bulandshahr 245 407

Table 1. Estimates of standard heterosis over Pusa Basmati-1 for different physico-chemical characters and grain yield per plant

S.No.	Hybrids	HRR	KL	KB	L:B	KE	AC	GC	AKD	WUP	VE	GYP
1.	IR68888A× PB-6-12-24-4	23.64**	–2.85	12.28*	–13.72**	–5.15	10.41	–2.44	–27.14**	–9.07	60.0**	111.23**
2.	IR68888A × KCN80152	24.24**	–12.31**	3.51	–15.49**	–5.67	–5.54	11.21	–25.7**	–35.17**	11.42**	25.13**
3.	IR68888A × PB-5-14-50-1	33.66**	–13.86**	19.28**	–28.10**	–7.21*	–12.12*	73.13**	–15.71*	–11.45**	54.28**	75.20**
4.	IR68888A × Basmati-397	16.83**	–5.05	16.39**	–18.58**	–4.12	14.58**	–31.70**	–35.71**	–29.89**	–2.85	95.77**
5.	IR68888A × PB-3-17-57-1	18.03**	–3.88	11.72*	–14.82	1.54	10.41*	38.65**	–22.85**	–8.73	48.57**	66.55**
6.	IR68888 A × Hawm Kikwai	18.03**	2.97	10.53*	–7.09*	–2.57	–7.70	33.17**	–35.71**	–12.95*	25.71**	74.79**
7.	IR68888A × Gopal Bhog	9.93**	–0.97	21.64**	–18.81**	1.54	2.50	43.41**	–24.28**	–8.49	31.42**	39.57**
8.	IR68888A × AC25419	7.81*	–8.42*	20.47**	–24.12**	2.06	6.66	55.56**	–20.0**	–6.96	5.71	69.34**
9.	IR68891A × Hawm Kikwai	17.63**	–15.16**	24.56**	–32.08**	–3.09	9.58*	–13.17*	–31.41**	–25.14**	31.42**	22.75**
10.	IR58025A × Khao Dawk Mali 105	14.82**	0.0	21.64**	–17.91**	–2.57	18.66**	33.41**	–25.71**	–28.60**	2.85	105.10**
11.	IR58025A × PB-4-18-57-6	–11.97*	–3.5	4.68	–7.96*	–0.51	–14.33**	46.34	–24.28**	–13.74**	54.28**	50.68**
12.	IR58025A × Basmati Sathi	29.25**	–9.59*	14.04**	–21.02**	–6.18	–12.12*	119.51**	–28.57*	–24.61**	5.71	41.48**
13.	IR58025A × PB-6-12-55-5	16.02**	5.05	8.19	–3.10	0.00	3.16	131.70**	25.42**	–5.01	60.0**	84.40**
14.	IR58025A × Gopal Bhog	28.05**	–4.79	21.03**	–21.46**	1.03	3.87	53.41**	–18.57**	–10.13	57.14**	76.22**
SE(±)		2.668	0.310	0.082	0.145	0.116	1.475	2.08	0.183	18.72	0.302	2.48

* and ** significant at P = 0.05 and 0.01, respectively; HRR = Head rice recovery, KL = Kernel length, KB = Kernel breadth, L:B = Length : breadth ratio, KE = Kernel elongation, AC = Amylose content, GC = Gel consistency, AKD = Alkali digestion value, WUP = Water uptake number, VE = Volume expansion, GYP = Grain yield per plant.

with the findings of Yolanda and Das [9]. Aroma was not expressed in leaves of hybrids showed a recessive gene which would be expected to segregate in F_2 seed with one-fourth of aromatic grains. Individual seed of each F_1 plant should be tested for aroma to determine its segregation, whereas in the present study, composite seed samples were used to detect aroma. Therefore, it is suggested that aroma should be further confirmed in hybrids before utilization. For gel consistency hybrids showed significant positive as well as negative standard heterosis. Hybrids with significant positive standard heterosis were included IR58025A × PB-6-12-55-5, IR58025A × Basmati Sathi, IR68888A × Pusa Basmati-1 and IR68888A × PB-5-14-50-1. The alkali digestion value and water uptake number were not also recorded in positive direction, whereas significant positive standard heterosis for volume expansion were observed in hybrids, some of the superior hybrids for volume expansion were IR68888A × PB-6-12-24-4, IR58025A × PB-6-12-55-5, IR68888A × PB-5-14-50-1 and IR58025A × PB-4-18-57-6. Most of the hybrids exhibited significant positive standard heterosis ranged from 25.13 to 111.23% for grain yield per plant; whereas objective of this study is to identify best hybrids on the basis of quality characterstics. Yogeshan and Mahadevappa [10] also reported high standard heterosis for grain yield per plant. The present study showed the higher magnitude of all the physicochemical characters were not expressed in a single hybrid combination which was vary from cross to cross due to genetic background of their diverce parents. Overall two hybrids IR68888 A × PB-3-17-57-1 and IR58025A × PB-6-12-55-5 were identified superior over Pusa Basmati-1 for most of the quality characters as well as grain yield per plant, which could be utilized commercially for exploitation of heterosis to these characters.

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