VARIABILITY AND GENETIC PARAMETERS FOR GRAIN YEILD AND ITS QUALITY ATTRIBUTES IN CMS BASED RICE HYBRIDS (*ORYZA SATIVA* L.)

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Abstract: The present investigation is carried out to the genetic parameters for yield and its quality attributes in eighteen rice hybrids. Analysis of variance revealed significant differences for all traits under study. The characters *viz.* biological yield per plant(g), grain yield per plant(g), number of unfilled spikelet/plant, number of filled spikelet/plant, productive tiller/plant, spikelet fertility%, pollen fertility %, kernel length breadth ratio and harvest index. High GCV and PCV were recorded for traits *viz.*, followed by biological yield/plant, grain yield/plant, number of unfilled spikelet/plant, number of filled spikelet/plant, productive tiller/plant, spikelet fertility%, pollen fertility%, kernel length breadth ratio and harvest index. High heritability coupled with high genetic advance as percent of mean was registered for grain yield/plant(g), number of unfilled spikelet/panicle, number of filled spikelet/panicle, productive tiller/plant, tiller/plant, spikelet fertility %, pollen fertility %, kernel length breadth ratio, harvest index, brown rice length breadth ratio, flag leaf area(cm^2), hundred seed weight(g), plant height(cm), head rice recovery percentage, flag leaf length(cm), kernel length(cm), brown rice(cm), leaf area index, paddy length breadth ratio, paddy breadth(cm) suggesting preponderance of additive gene action in the expression of these characters.

Keywords: Variability, Heritability, Genetic advance, Hybrid rice

INTRODUCTION

Rice is one of the most important cereal crops of the world meeting the dietary requirements of the people living in the tropics and sub-tropics. Quantum jumped in yield improvement has been achieved in rice with the development of high yielding heterotic hybrids under commercial cultivation. However, being the staple food of the population in india, improving its productivity has become a crucial importance. Knowledge on the nature and magnitude of genetic variation governing the inheritance of quantitative characters like yield and its components is essential for effecting genetic improvement. A critical analysis of genetic variability is a prerequisite for initiating any crop improvement programme and for adopting of appropriate selection techniques.(Ravindra *et al.*,2012).

A paradigm shift in the rice (*Oryza sativa* L.) breeding strategies from quantity centered approach to quality oriented effort was inevitable, since India has not only become self sufficient in food grain production but also is the second largest exporter of quality rice in the world (Sreedhar *et al*.,2005). Improvement in grain quality that does not lower yield is the need of hour at present context in order to benefit all rice grower and consumers. Like grain yield, quality is not easily amenable to selection due to its complex nature. Lack of clear cut perception regarding the component traits of good quality rice is one of the important reasons for the tardy progress in breeding for quality rice varieties. For the development of high yielding varieties with good quality the information on variability and genetic parameters of grain quality attributes and their association with each other including grain yield is necessary to formutate suitable breeding strategies for grain quality improvement. In the present investigation, an attempt has been made to elucidate information on nature and magnitude of genetic variation observed for yield and yield component and quality attributes in certain parents and rice hybrids.(Venkata Subbaiah *et al*., 2011).

MATERIAL AND METHOD

The experimental material used in the study consisted of nine parents and 18 F_1 hybrid combinations of rice grown in a completely randomized block design with two replications at Research Farm, Department of Genetics and Plant Breeding, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. About 21 days old seedling of each genotype were transplanted in single row a standard spacing 20 × 20 cm was adapted for planting and ten plants were planted. Single plant per hill was planted. Recommended package of practices were followed during the crop growth period.

The treatment means for all the characters were subjected to analysis of variance technique on the basis of model proposed by Panse and Sukhatme(1961).The genotypic (GCV) and Phenotypic (PCV) coefficient of variation was calculated by the formulae given by Burton (1952).Heritability in broad sense[$h^2_{(b)}$] was calculated by the formula given by Lush (1940) as suggested by Johnson *et al.*(1955). From the heritability estimates, the genetic advance (GA) was estimated by the following formula given by Johnson *et al*. (1955).

RESULT AND DISCUSSION

Analysis of variance revealed the significant differences among the genotypes for all the traits

indicating the sufficient scope for further improvement (Table 1 and 2).The range of mean variation observed among yield components and kernel quality characters in parents revealed that highest range of mean variation was noticed for biological yield per plant and head recovery rice%, whereas the range was found to least for hundred seed weight and elongation ratio, respectively(Table 1 and 2).

The PCV estimates were higher than GCV for all the traits, indicating the influence of environment for the expression of these traits. The difference between PCV and GCV estimates were relatively low for traits viz., days of 50% flowering, panicle length(cm), hulling %, milling %, paddy length(cm), brown rice length(cm), brown rice breadth(cm), kernel length(cm), elongation ratio(cm) indicating less environmental influence on these traits. The characters viz., tiller per plant, productive tiller per plant, no. of filled spikelet per panicle, no. of unfilled spikelet per panicle, spikelet fertility %, pollen fertility %, biological yield per plant(g), grain yield per plant(g), harvest index, kernel length breadth ratio, showed higher estimates of GCV and PCV therefore, simple selection can be practiced for further improvement of these characters. This was in conformity with the finding of Sharma *et al.*(2006) for total number of productive tillers per plant and Singh *et al.*(2000) for harvest index in rice. Moderate estimates of PCV and GCV values were recorded for plant height(cm), flag leaf length(cm), flag leaf area(cm^2), leaf area index, hundred seed weight(g), head recovery rice %, paddy length(cm), paddy breadth(cm), brown rice length breadth ratio, kernel breadth(cm). These results were in consonance with the findings of Kundu *et al.*(2008) for hundred seed weight.

High heritability values were recorded for all the characters except elongation ratio(cm) in the generation indicating the least influence of environment on expression of kernel quality characters. These findings were in consonance with the reports made earlier in rice by Kundu *et al.* (2008) and Deepa Sarkar *et al.* (2006). High heritability coupled with high genetic advance as per cent of mean were recorded for plant height(cm), tiller per plant, productive tiller per plant, flag leaf length(cm), flag leaf area (cm^2), leaf area index, number of filled spikelet per panicle, number of unfilled spikelet per panicle, spikelet fertility %, pollen fertility %, hundred seed weight(g), biological yield per plant(g), grain yield per plant (g), harvest index, head recovery rice %, paddy breadth(cm), paddy length breadth ratio, brown rice breadth(cm), brown rice length breadth ratio, kernel breadth(cm), kernel length breadth ratio, in case of hybrids indicating the additive gene effects in the genetic control of these traits and can be improved by simple selection in the present breeding material. Similar kind of observations were reported by Kundu *et al.*(2008) for number of grains per panicle, Deepa Sankar *et al.*(2006) for plant height, total number of productive tillers per plant, number of grains per panicle, test weight and grain yield per plant. The present study revealed that, days of 50% flowering, panicle length(cm), hulling %, milling %, paddy length(cm), brown rice length(cm), brown rice breadth(cm), kernel length(cm), elongation ratio(cm) were less influenced by environment and high heritability coupled with high genetic advance indicating that most likely the heritability is due to additive gene effects and selection may be effective for these characters based on phenotypic values in order to obtain maximum genetic gain for yield improvement in rice by simple selection process.

Table 1: Analysis of variance for grain yield and its contributing characters in rice

Source of variation	df	DF	PH	TP	PTP	FLL	FLA	LAI	PL
R eplications	**1**	0.19	0.35	1.89	3.63	5.76	2.76	0.004	1.01
Genotypes	**26**	24.01**	449.41**	26.78**	26.94**	31.34**	70.54**	1.420**	7.62**
Error	**26**	0.68	1.86	1.70	1.28	0.90	1.38	0.042	1.12

*****Significant at P= 0.05 level;**Significant at 0.01 level

DF:Days of 50%Flowering; PH:Plant height; TP:Tiller per plant; PTP:Productive tiller per plant; FLL:Flag leaf length; FLA:Flag leaf area; LAI:Leaf area index; PL:Panicle length

Source of variation	df	NFP	NUP	PF%	SF%	HW	BY	GY	HI
Replications	**1**	322.63	263.88	1.27	0.79	0.000062	0.1	0.7	0.594
Genotypes	**26**	7479.67**	3525.33**	631.59**	619.90**	0.33**	12023.1**	1049.5**	138.150**
Error	**26**	69.01	84.68	5.15	4.63	0.02	1.4	0.5	0.60

*Significant at P=0.05 level;**Significant at 0.01 level.

NFP:no.of filled spikelet per panicle; NUP:no. of unfilled spikelet per panicle; PF%:Pollen fertility %; SF%:Spikelet fertility %; HW:Hundred seed weight; BY: Biological yield per plant; GY:Grain yield per plant; HI:Harvest index.

Table 2: Analysis of variance for kernel quality characters in rice

Source of variation	df	H%	M%	HRR%	PL	PB	PLBR	BL	BB
Replications	**1**	2.85	4.54	3.54	0.0025	0.00080	0.0060	0.00074	0.00017
Genotypes	**26**	7.65**	18.99**	192.39**	0.5480**	0.13498**	0.3249**	0.77322**	0.13438**
Error	**26**	1.07	3.74	14.07	0.0019	0.00036	0.0004	0.00060	0.00019

*Significant at P=0.05 level;**Significant at 0.01 level.

H%:Hulling %; M%: Milling %; HRR%:Head recovery rice%; PL:Paddy length;
PB:Paddy breadth; PLBR:Paddy length breadth ratio; BL:Brown rice length; BB:Brown rice breadth.

Source of variation	df	BLBR	KL	KB	KLBR	ER
Replications	**1**	0.00025	0.0048	0.0008	0.00055	0.00857
Genotypes	**26**	0.78951**	0.4016**	0.1400**	1.060**	0.03172**
Error	**26**	0.00084	0.0012	0.0016	0.00657	0.00998

*Significant at P=0.05 level;**Significant at 0.01 level.

BLBR:Brown rice length breadth ratio; KL:Kernel length; KB: Kernel breadth; KLBR:Kernel length breadth ratio; ER: Elongation ratio.

Table 3: Estimation of genetic variability and genetic parameters for different charcters

Character	GCV %	PCV %	h^2	GA
Days of 50% flowering	3.61	3.71	94.5	7.23
Plant height (cm)	15.85	15.92	99.2	32.52
Tiller per plant	31.01	33.03	88.1	59.57
Productive tiller per plant	34.73	36.42	90.9	67.70
Flag leaf length (cm)	15.20	15.63	94.5	30.39
Flag leaf area (cm^2)	18.84	19.21	96.2	37.96
Leaf area index	11.95	12.30	94.3	23.72
Panicle length (cm)	7.34	8.50	74.5	13.05
No. of filled spikelet per panicle	41.35	41.73	98.2	84.39
No. of unfilled spikelet per panicle	46.24	47.37	95.3	92.99
Spikelet fertility %	28.68	28.92	98.4	58.52
Pollen fertility %	24.34	24.52	98.5	49.74
Hundred seed weight (g)	18.74	19.82	89.4	36.20
Biological yield per plant (g)	69.66	69.66	100.0	143.35
Grain yield per plant (g)	54.25	54.27	99.9	111.71
Harvest index	21.07	21.16	99.1	43.21
Hulling %	2.28	2.62	75.5	4.08
Milling %	3.98	4.86	67.1	6.72
Head recovery rice %	16.21	17.44	86.4	31.02
Paddy length (cm)	5.93	5.95	99.3	12.03
Paddy breadth (cm)	10.82	10.79	99.5	21.20
Paddy length breadth ratio	10.97	10.84	97.6	22.17
Brown rice length (cm)	9.39	9.38	99.8	19.11
Brown rice breadth (cm)	12.81	12.80	99.7	25.24
Brown rice length breadth ratio	18.82	18.80	99.8	37.95
Kernel length (cm)	7.58	7.56	99.4	15.34
Kernel breadth (cm)	14.51	14.35	97.9	28.43
Kernel length breadth ratio	22.01	21.87	98.8	43.83
Elongation ratio (cm)	9.54	6.89	52.1	9.38

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