GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE FOR GRAIN YIELD AND ITS COMPONENTS IN RICE (*Oryza sativa* L.)

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ABSTRACT

The experiment was conducted to study the variability, heritability and genetic advance in fifty one genotypes of rice during kharif 2015. The observations were recorded on twelve different traits viz., days to 50 per cent flowering, plant height (cm), panicle length (cm), effective tillers per plant, test weight (g), grain yield per plant (g), grain length (mm), grain breadth (mm), grain length: breadth ratio, hulling percentage, milling percentage and head rice recovery percentage. Analysis of variance revealed significant differences among genotypes for all the characters indicated the presence of considerable genetic variability for all the traits studied. GCV and PCV were moderate for the characters days to 50 per cent flowering, plant height, effective tillers per plant, test weight, grain yield per plant, grain breadth and grain length: breadth ratio. The remaining characters exhibited shy variability. The narrow differences between GCV and PCV for all the characters except effective tillers per plant, grain breadth and head rice recovery percentage, suggested little influence of environment on the expression of these traits. The estimates of heritability coupled with high genetic advance as per cent of mean were higher for plant height, grain yield per plant, grain breadth and grain length: breadth ratio, suggested that there is good scope for improvement of these characters by selection alone, as additive gene action played pivotal role for the inheritance of these traits.

KEY WORDS: GCV, genetic advance, heritability, PCV, rice

INTRODUCTION

Rice has been cultivated under a wide range of climatic conditions. Almost 90 per cent of the World's rice is grown and consumed in Asia, where 50 per cent of the population depends on rice for food. It contributes 43 per cent of caloric requirement and 20-25 per cent of agricultural income. In India, rice is grown in an area of 43.5 million ha (23% of gross cropped area) with an annual production of 90 million tons. The population growth in most of the Asian countries, except China, continues to be around 2 per cent per year. Hence, it is very pertinent to critically consider whether the rice production can be further increased to keep pace with population growth. With the current green

revolution technologies, it is estimated that by 2020 at least 115-120 million tonnes of milled rice is to be produced in India to maintain the present level of self-sufficiency. Yield is a complex character, which is highly influenced by the environment, hence direct selection for yield alone limit the selection efficiency and ultimately results in limited success in yield improvement.

Genetic variability studies are important in selection of parents for hybridization (Chauhan and Singh, 1982) because crop improvement depends upon magnitude of genetic variability in base population (Adebisi *et al.*, 2001). Once genetic variability has been ascertained, crop improvement is possible through the use of appropriate selection method and increasing total yield would be made easier by selecting for yield components, because they are more often easily inherited than total yield itself. An attempt was made in the present investigation to assess the variability, heritability and genetic advance of some quantitative characters in rice.

Genetic variability forms the basis for crop improvement genotypic and phenotypic coefficients of variation are useful in detecting the amount of variability present in available genotypes. The main purpose of estimating heritability and genetic parameters that compose heritability estimates is to compare the expected gains from selection based on alternative selection strategies (Dhankhar and Dhankhar, 2002). Therefore, the information on variability, heritability and genetic advance of plant characters are of vital important in plant breeding programme. An attempt was made in the present investigation to assess the variability, heritability and genetic advance of some quantitative characters in rice.

MATERIALS AND METHODS

Fifty one genotypes along with checks (GAR 13, Gurjari and GR 11) were evaluated in Randomized Block Design with three replications in *kharif* 2015 at Main Rice Research Station, Anand Agricultural University, Nawagam (Gujarat). Each plot consisted of twenty plants in a row keeping 20 and 15 cm inter and intra row spacing, respectively. The recommended packages of practices were adopted to raise a good crop. The observations were recorded on five randomly selected competitive plants from each genotype for twelve different characters *viz*., days to 50 per cent flowering, plant height (cm), panicle length (cm), effective tillers per plant, test weight (g), grain yield per plant (g), grain length (mm), grain breadth (mm), grain length: breadth ratio, hulling percentage, milling percentage and head rice recovery percentage. Days to 50 per cent flowering data was recorded on per plot basis. The mean value of these plants was computed and used for statistical analysis. Analysis of variance to test the significant difference among accessions for each character was carried out as per methodology advocated by Panse and Sukhatme (1985). Similarly, GCV (Genetic coefficient of variation) and PCV (Phenotypic coefficient of variation) were calculated by the formula given by Panse and Sukhatme (1985), heritability in broad sense (h^2) was worked out by using the formula suggested by Burton and De Vane (1953) and genetic advance *i.e*., the expected genetic advance were calculated by using the procedure given by Johnson *et al*. (1955).

RESULTS AND DISCUSSION

The analysis of variance revealed highly significant mean squares due to genotypes for all the characters, which indicated the presence of enough genetic variability in the material under study (Table 1). The wide range of variation noticed in all the characters would offer scope of selection for improvement of desirable types. The genotypic coefficient of variation provides a

measure to compare of genetic variability present in twelve parameters (Table 2). In general, phenotypic coefficient of variation was higher than GCV. These findings are in agreement with those of Sarvan *et al.* (2012), Sheth *et al.* (2012) and Patel *et al.* (2014).

High phenotypic coefficient of variation and genotypic coefficient of variation was recorded for grain length : breadth ratio. Similar findings were reported by Fiyaz *et al.* (2011), Prajapati *et al*. (2011) and Sharma and Kumar (2011). GCV and PCV were moderate for the characters, days to 50 per cent flowering, plant height, effective tillers per plant, test weight, grain yield per plant, grain breath and grain length: breadth ratio; whereas the remaining characters *viz.,* panicle length, grain length, hulling percentage, milling percentage and head rice recovery percentage, exhibited shy variability. These results are in agreement with Pal and Sabesan (2010). The narrow differences between GCV and PCV for all the characters, except effective tillers per plant, grain breadth and head rice recovery percentage suggested little influence of environment on the expression of these traits. The estimates of PCV were higher than their GCV indicating effect of environment on all the characters under study.

The heritability estimates help the breeders in selection based on the phenotypic performance. In the present study, the estimation of heritability ranged from 12.89 per cent (Effective tillers per plant) to 94.50 per cent (Plant height) (Table 2). The very high heritability was observed for traits, plant height, test weight, grain length, grain breadth and grain L: B ratio. Thus, these traits were less influenced by environmental factors. The high estimates of heritability was recorded for the characters days to 50 percent flowering, grain yield per plant and milling percentage, while remaining traits showed moderate to low heritability. These results are in line with those of Parikh *et al.* (2011) and Prajapati *et al.* (2011).

The genetic advance was calculated as percentage of mean for all the twelve characters. The high estimates of heritability coupled with high genetic advance as per cent of mean were observed for plant height, grain yield per plant, grain breadth and grain length: breadth ratio suggested that there is good scope for the improvement of these characters by selection alone, as additive gene action involved for inheritance of these traits. Johnson *et al.* (1955) and Arya and Saini (1977) also suggested that characters with high heritability coupled with high genetic advance would respond better to selection than those with high heritability and low genetic advance. This results are in accordance with the results of Bharadwaj *et al.* (2007), Chaudhary (2007) and Seyoum *et al.* (2012).

CONCLUSION

From the present study, it is evident that genotypes studied may provide good source of material for further breeding programme. Therefore, information on the genetic parameters such as coefficient of variation, heritability, genetic advance can help the breeder to evolve suitable cultivars within a short time. On the basis of results as summarized above, it is concluded that the great deal of variability for the important characters studied even in highly selected lines under the present investigation. High heritability with high genetic advance for plant height, grain yield per plant, grain breadth and grain length: breadth ratio indicated their due importance as the indicator characters and their manipulation through selection. These characters can be utilized as selection criteria for the development of high yielding rice varieties.

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Table 1: Analysis of variance (mean sum of squares) for twelve different characters in rice

Sr. No.	Characters	Mean Sum of Squares		
		Replications	Genotypes	Error
	d.f.	2	53	106
1	Days to 50 per cent flowering	80.22**	218.92**	3.47
2	Plant height (cm)	10.49**	913.39**	16.86
3	Panicle length (cm)	1.67	9.95**	1.87
4	Effective tillers per plant	8.90**	2.51**	1.65
5	Test weight (g)	21.16**	26.06**	0.75
6	Grain yield per plant (g)	1.26**	11.88**	1.09
7	Grain length (mm)	13.08**	2.10**	0.05
8	Grain breadth (mm)	0.16**	0.69**	0.03
9	Grain L:B ratio	1.46**	1.83**	0.06
10	Hulling (%)	78.99**	3.55**	1.64
11	Milling (%)	72.72**	3.61**	0.58
12	Head rice recovery (%)	62.25**	29.25**	6.01

, ** Significant at 5 per cent and 1 per cent levels of significance, respectively

Table 2: Variability parameters of twelve different characters in rice

Sr. No.	Characters	GCV %	PCV %	Heritability %	Genetic Advance	Genetic Advance Expressed As Per Cent of Mean
1	Days to 50 per cent flowering	10.05	12.66	63.10	13.38	16.44
2	Plant height (cm)	14.17	14.56	94.60	34.65	28.40
3	Panicle length (cm)	6.48	8.37	60.00	2.63	10.35
4	Effective tillers per plant	6.45	18.00	12.80	0.37	4.77
5	Test weight (g)	10.38	11.20	85.80	4.78	19.79
6	Grain yield per plant (g)	17.46	19.94	76.70	3.42	31.52
7	Grain length (mm)	8.73	9.00	94.00	1.61	17.39
8	Grain breadth (mm)	17.90	19.13	87.60	0.90	34.48
9	Grain L:B ratio	20.70	21.86	89.70	1.48	40.33
10	Hulling (%)	1.01	1.91	27.90	0.87	1.10
11	Milling (%)	1.45	1.82	63.30	1.64	2.36
12	Head rice recovery (%)	4.90	6.52	56.60	4.34	7.60

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