Genetic variation among rice (*Oryza sativa* L) genotypes for yield and yield related traits

MOHIT SAHU*, PRABHARANI CHAUDHARI, PRADEEP KUMAR SAO and SHEIK JAVID

Department of Genetics and Plant Breeding
Indira Gandhi Krishi Vishwavidyalaya, Raipur 492012 Chhattisgarh, India
*Email for correspondence: sahumohit7869@gmail.com

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ABSTRACT

The present investigations were carried out on fifty three rice genotypes to select the better lines for yield traits in randomized block design with three replications during kharif 2023. The variance studies showed significant variations among all the genotypes, suggesting significant genetic variation in the material. The phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the traits. The yield traits which showed high values for genetic advance as per cent of mean along with high heritability were number of unfilled grains per panicle followed by number of filled grains per panicle, number of total grains per panicle, grain yield per plant, number of panicles per plant, number of total tillers per plant, harvest index, test weight, plant height, biological yield per plant and panicle length, revealing the prevalence of additive gene action, thus providing scope for further improvement through selection.

Keywords: Rice; variation; yield; PCV; GCV; traits

INTRODUCTION

Rice (*Oryza sativa* L) is one of the most important grain crops in the world, accounting for 27 per cent of the global grain yield (Huang et al 2011). India's total area under rice cultivation in 2020-21 was 45.77 million hectares with a production of 124.37 million tonnes and a yield of 2,717 kg per hectare (Anon 2023). Genetic variability is the basis of plant breeding because any crop improvement depends on the amount and direction of genetic association of the traits in the base population (Tuhina-Khatun et al 2015, Aditya and Bhartiya 2013). It provides a wide range of genotypes that can be selected to develop new varieties (Pandey et al 2009). Therefore, the present study was conducted with the objective of assessing the variation among 53 rice genotypes for yield and yield related traits.

MATERIAL and METHODS

The experiment was conducted on fifty three genotypes including checks namely MTU 1010, IR 64 and Swarna. The experiment was set up in a randomized block design with three replications during kharif season 2023. The observations were recorded on five randomly selected plants selected at optimum stage of plant growth from each line in all the three replications for the evaluation of yield and related traits except for days to 50 per cent flowering, which were taken on plot basis. The mean values from selected plants were statistically analysed.

RESULTS and DISCUSSION

Analysis of variance revealed presence of highly significant differences for all the characters under study. Variance analysis indicated that the mean sum of squares was found highly significant for all the traits due to genotypes (Table 1).

Bagudam et al (2023) carried out investigations to know the extent of genetic variability present in forty six genotypes of rice. Analysis of variance revealed highly significant differences for all the 12 characters, indicating the presence of genetic variability among the genotypes. The magnitude of phenotypic coefficient of variation (PCV) was slightly higher than genotypic

Table 1. Genetic parameters of variation for yield and yield attributing characters in rice genotypes

Character	Mean	Range		Coefficient of variance		h^2 (bs) (%)	GA as per cent of mean
		Min	Max	PCV%	GCV%		
Days to 50% flowering	89.78	74.67	110.67	10.02	9.76	94.72	19.57
Plant height (cm)	132.97	71.33	179	18.68	18.31	96.1	36.98
Number of tillers/plant	9.18	4.67	15.33	31.69	27.49	75.23	49.11
Panicle length (cm)	24.45	15.43	31.8	14.17	12.69	80.23	23.42
Number of panicles/plant	7.44	3.33	13.67	33.59	28.88	73.93	51.16
Number of filled grains/panicle	90.47	41.67	191	37.97	36.03	90.06	70.45
Number of unfilled grains/panicle	9.83	2.67	31.33	60.33	56.97	89.17	110.83
Number of total grains/panicle	100.3	47.33	199.33	36.89	35.43	92.22	70.1
Spikelet fertility (%)	90.09	72.86	95.88	5.4	4.69	75.53	8.4
Biological yield/plant (g)	43.37	22.33	61.33	21.39	19.17	80.33	35.41
Test weight (g)	24.26	11.41	35.17	18.69	18.37	96.68	37.22
Grain yield /plant (g)	14.5	3.78	28.88	38.61	36.18	87.8	69.85
Harvest index (%)	33.04	10.55	48.98	27.55	24.34	78.06	44.3

GCV = Genotypic coefficient of variation, PCV = Phenotypic coefficient of variation, h^2 (bs) = Heritability in broad sense, GA = Genetic advance, Min = Minimum, Max = Maximum

coefficient of variation (GCV) for the traits viz plant height, number of tillers per plant, number of panicles, panicle weight, grain number, test weight, single plant yield, plot yield and biomass, indicating less influence of environmental factors on the expression of traits and the possibility for genetic improvement through direct selection for these traits. The estimates of PCV and GCV were moderate for the traits viz days to 50 per cent flowering, panicle length and harvest index, indicating the influence of environment rather than the genotype alone.

Study on genetic parameters that number of unfilled grains per panicle, grain yield per plant, number of filled grains per panicle, number of total grains per panicle, number of panicles per plant, number of total tillers per plant and harvest index showed high PCV and GCV. This indicated that genotypic variance was smaller than phenotypic variance, that showed that environment had masking effect on the expression of genetic variability.

Srujana et al (2017) experimented on 29 rice genotypes including one check for 13 quantitative characters to study genetic variability, heritability and genetic advance. Analysis of variance revealed that there was considerable variability among the genotypes. The variability coefficients revealed that the differences between PCV and GCV were small indicating little influence of environment on the expression of the characters studied. High to moderate estimates of GCV and PCV were recorded for grain yield per hill, harvest index, spikelets per panicle, tillers per hill, flag leaf length and panicles per hill. High estimates of heritability were observed for spikelets per panicle, days to maturity, biological yield, grain yield per hill, panicles per hill and tillers per hill. High estimates of heritability along with moderate to low estimates of genetic advance were observed for spikelets per panicle, seed yield per plant, tillers per plant, panicles per plant and biological yield per hill.

For all thirteen yield traits under analysis, higher amount of heritability (>60%) was reported for test weight, plant height, plant length, days to 50 per cent flowering, number of total grains per panicle, number of filled grains per panicle, number of unfilled grains per panicle, grain yield per plant, biological yield per plant, panicle length, harvest index, number of total tillers per plant and number of panicles per plant.

Prakash et al (2018) investigated genetic variability, heritability and genetic advance in rice under salt affected soil comprising 7 lines and 3 testers

recommended for sodic soil. High value of PCV and GCV was found for grain yield per plant and biological yield per plant indicating existence of wide spectrum of variability for these traits and greater opportunities for desired gain through phenotypic selection. Heritability in broad sense was observed >75 per cent for majority of traits. High value of heritability in narrow sense (>30%) was recorded for all the traits with genetic advance indicating preponderance of additive gene effects.

Higher estimates of heritability coupled with high genetic advance as a mean per cent were found for number of unfilled grains per panicle followed by number of filled grains per panicle, number of total grains per panicle, grain yield per plant, number of panicles per plant, number of total tillers per plant, harvest index, test weight, plant height, biological yield per plant and panicle length. These characters are governed by additive gene action and selection will be useful in further genetic programmes.

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