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Variability, Heritability and Genetic Advance for Yield and Grain Quality Characters in Rice

Key words : Rice, Variability, Quality, Yield

The development of fertilizer responsive, high yielding, semi- dwarf varieties was an important land mark in the history research on tropical rice. This resulted in achievement of quantum jump in rice yield in 1960's through cultivation of these varieties in large scale in almost all rice growing areas of the world. However subsequent release of new varieties could not improve varietal yields significantly. Therefore to raise this yield ceiling, research efforts were further intensified to critically analyze the basis of yield potential and to establish the characteristics of functional ideotype for irrigated rice. One important constraint is less adoptability of newly introduced varieties. In the light if this, existence of sufficient variability specially in locally developed lines to evolve location specific varieties is considered as prime requirement. The development of high yielding long duration rice varieties using javanicas shows great potential still remaining unutilized in germplasm (Siddiq, 1989). Keeping in view the importance of variability in breeding programmes, the present study was undertaken to determine the extent of variability in yield and quality traits of rice under irrigated ecosystem.

The experimental material consisted of 84 rice genotypes. The experiment was carried out at Agricultural college farm, Bapatla in randomized block design with three replications during *kharif* 2009. Thirty days old seedlings were transplanted at the rate of one seedling per hill with a spacing of 20 × 15 cm. Recommended package of practices were followed to raise the crop. Observations were recorded on 22 different characters *viz.*, plant height, total number of tillers per plant, ear bearing tillers per plant, panicle length, days to 50% flowering, filled grains per panicle, grain length, grain width, flag leaf length, test weight, kernal length, kernal breadth, kernal length after cooking, water uptake, alkali spreading value, amylose content, protein percentage, gel consistency, hulling percentage, milling percentage, head rice recovery percentage and grain yield per plot. Finally, genotypic and phenotypic coefficients of variation (Burton., 1952), heritability and genetic advance as per cent of mean (Johnson *et al* ., 1955) were estimated.

Analysis of variance revealed significant genotypic differences for all the characters studied. In general, phenotypic coefficient of variation (PCV) values were higher than genotypic coefficient of variation (GCV) values (Table 1). High variability was observed for filled grains per panicle, test weight, grain yield per plot, alkali spreading value and gel consistency. Where as variability was low for days to 50% flowering, grain length, amylose content, hulling percentage, milling percentage and head rice recovery percentage. The remaining characters possessed moderate variability.

High heritability coupled with high genetic advance as per cent of mean was observed for plant height, total number of tillers per plant, ear bearing tillers per plant, filled grains per panicle, flag leaf length, test weight, grain yield per plot, kernal length, kernal length after cooking, water uptake, alkali spreading value, protein percentage and gel consistency indicating that these traits are largely influenced by additive gene action, which is in conformity with the findings of Sharma and Sharma (2007) for plant height, number of ear bearing tillers per plant, number of filled grains per panicle, test weight, grain yield per plot; Asish Binodh *et al*. (2007) for kernal length, kernal length after cooking, alkali spreading value and gel consistency. Hence, yield and quality improvement is simple and strait through directed selection of higher ear bearing tillers per plant, filled grains per panicle and optimizing the quality characters which have high heritability and genetic advance. Thus the genetic parameters are useful to know the nature of inheritance (additive and non additive gene action) and expected quantum of genetic improvement in a particular trait. Present study revealed that there was good amount of variability in the traits *i.e.,* filled grains per panicle, test weight, grain yield per plot and selection towards these traits would be effective to develop high yielding genotypes, as these traits exhibited high heritability and high genetic advance as per cent of mean.

Table 1. Estimates of mean, variability, heritability and genetic advance as % of mean for 22 characters in rice (*Oryza sativa* L.)

S. No.	Character	Mean	Range	GCV (%)	PCV (%)	Heritability (h^2)	Genetic advance as % of mean
1	Plant height (cm)	99.13	75.24- 151.70	14.73	15.73	87.60	28.39
2	Total number of tillers per plant	8.52	6.60- 12.90	15.87	17.80	79.42	29.13
3	Ear bearing tillers per plant	7.50	5.53- 11.60	18.00	19.90	81.82	33.53
4	Panicle length (cm)	23.18	18.54- 30.07	8.50	11.06	59.04	13.45
5	Days to 50% flowering	113.77	96.67- 137.00	8.12	8.29	95.77	16.36
6	Filled grains/ panicle	112.90	52.44- 190.21	27.30	28.62	90.96	53.63
7	Grain length (mm)	8.47	6.94- 10.40	9.73	9.94	95.65	19.60
8	Grain width (mm)	2.04	1.62- 2.63	9.77	10.80	81.82	18.20
9	Flag leaf length (cm)	29.75	20.95- 44.85	13.93	15.58	79.96	25.66
10	Test weight (g)	20.77	13.46- 31.27	20.27	21.22	91.21	39.87
11	Grain yield per plot (kg)	5.55	2.25- 7.97	23.05	25.70	80.43	42.59
12	Kernel length (mm)	5.67	4.05- 7.43	12.47	12.63	97.40	25.35
13	Kernel breadth (mm)	1.74	1.32- 2.28	9.51	10.43	83.08	17.85
14	Kernal length after cooking (mm)	8.76	6.37- 11.29	12.94	13.00	99.06	26.54
15	Water uptake (ml)	285.30	198.33- 340.00	10.64	11.03	93.00	21.13
16	Alkali spreading value	4.18	2.00- 7.00	37.81	37.95	99.26	77.59
17	Amylose content	23.57	20.53- 26.50	5.61	6.08	85.11	10.66
18	Protein percentage	8.81	6.24- 12.94	12.58	12.84	95.96	25.38
19	Gel consistency	35.92	21.17- 81.50	40.20	40.35	99.26	82.50
20	Hulling percentage	80.07	74.66- 85.28	2.53	3.75	45.30	3.50
21	Milling percentage	69.34	61.21- 74.30	3.39	4.52	56.18	5.23
22	Head rice recovery percentage	62.34	48.70- 71.57	8.68	9.10	91.01	17.06

GCV= Genotypic coefficient of variation PCV= Phenotypic coefficient of variation

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