Quantitative Analysis of Rice (*Oryza sativa* L.) in Allahabad Agro Climate Zone

Priyanka Yadav, N. R. Rangare*, P. John Anurag and A. K. Chaurasia

Department of Genetics and Plant Breeding and Seed Science and Technology, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Allahabad- 211007, UP

Abstract

Analysis of variance among 20 genotypes showed significant differences for yield and quality contributing traits *viz.*, plant height, days to 50% flowering, days to maturity, flag leaf length, flag leaf width, number of tillers per hill, number of spikelets per panicle, 1000 grain weight and yield per plant. This indicated the presence of substantial amount of genetic variability in the study material and there is scope for selection. The results showed that PCV (Phenotypic Coefficient of Variation) in general was higher than GCV (Genotypic Coefficient of Variation) for various characters. Highest PCV and GCV was observed for number of tillers per hill and number of spikelets per panicle. However, difference between GCV and PCV was low in most of the character studied. High estimate of heritability were observed for plant height and number of spikelets per panicle. High genetic advance were observed for number of spikelets per panicle and plant height.

'Rice is life' was the theme of International year of rice 2004 denoting its overwhelming importance as an item of food and commerce. It is the most important staple food among the cereals, consumed by more than half of the world's population. Development of high yielding genotypes requires a thorough knowledge of genetic variation in yield contributing characters. Observed variability is a combined estimate of genetic and environmental causes whereas genetic variability alone is heritable. Moreover, estimates of genetic variability across different environments helps to exploit complete genetic variability to exercise selection for development of yield contributing traits. An estimate of heritability alone does not give an idea of expected genetic gain in the next generation but also be considered in the conjunction with genetic advance. Therefore, the present investigation was made with an objective to estimate genetic variability of yield and its components.

* Corresponding author: nrrangare@yahoo.co.in

Materials and Methods

The experiment consisted of 20 high yielding rice genotypes collected from IGKV, Raipur, NDAUT, Faizabad, and SHIATS, Allahabad represented at experimental centre of the Department of Genetics and Plant Breeding. Trials were laid out in a Randomized Block Design with two replications with the spacing of 20 x 15 cm and the recommended cultural practices were followed. Plant height, days to 50% flowering, days to maturity, flag leaf length, flag leaf width, days to maturity, number of tillers per hill, number of spikelets per panicle, 1000 grain weight and yield per plant were recorded. The data were analyzed by using ANOVA (Panse and Sukhatme, 1967) and the genetic parameters such as PCV and GCV were calculated by the formula given by Burton (1952), heritability broad sense (h^2) by Burton and De Vane (1953), and genetic advance in percent of mean (genetic gain) were work out as suggested by Johnson *et.al.* (1955).

Result and Discussion

Analysis of variance revealed highly significant differences among the genotypes for all the characters, indicating presence of high variability among the varieties. Thus, there is ample scope for selection of different quantitative and qualitative characters for rice improvement. The Phenotypic (Vp) and genotypic (Vg) variation were obtained for different characters and they

are presented in Table 1. The maximum genotypic and phenotypic variation were obtained for spikelet no. per panicle, plant height, days to 50% flowering, while moderate variation was observed for number of tillers per hill, and days to maturity. This indicated that the environment did not influence these characters much. Values of phenotypic and genotypic variance were very close for flag leaf width and flag leaf length. The character with almost equal value of phenotypic and genotypic variance can be considered stable. Low level of genotypic variance for flag leaf width and 1000 grain weight is indicative of stable nature of these characters. Similar findings were reported by Ganesan *et al.* (1994) and Rao *et al.* (1996).

The Genotypic Coefficient of Variation provides a measure to compare genetic variability present in various quantitative characters. The highest value of Genotypic Coefficient of Variation was recorded for number of tillers per hill, number of spikelets per panicle, plant height, flag leaf length and yield per plant and low estimate for days to maturity, 1000 grain weight and flag leaf width. The higher value clearly indicated high degree of genotypic variability in these quantitative characters in rice.

Phenotypic Coefficient of Variation which measure total relative variation was highest for number of tillers per hill, number of spikelets per panicle and plant height, while, lowest for days to maturity and flag leaf width.. Similar findings were reported by Nayak *et al.* (2002) and Vivek *et al.* (2004).

Heritability is a measure of extent of phenotypic variation caused by the action of genes. In the present study high heritability was observed for traits *viz.*, plant height, number of spikelets per panicle, days to 50% flowering, flag leaf length, yield per plant, flag leaf width and days to maturity. Whereas, 1000 grain weight had lowest heritability. High heritability of the above characters indicated that influence of environment on these characters is negligible

Table 1: Phenotypic and genotypic variation for different plant growth parameters

S.No.	Characters	Variance			GCV	PCV	h^2 (bs) (%)	GA	GA as % of mean
		Vg	Vp	Ve					
1	Plant height	718.96	721.59	2.63	25.36	25.40	99.6	70.66	66.82
2	Days to 50% flowering	173.34	174.73	1.39	12.27	12.32	99.2	34.62	32.26
3	Days to maturity	18.54	19.62	1.08	3.03	3.12	94.5	11.05	7.78
4	Flag leaf length	55.44	56.35	0.91	23.47	23.66	98.4	19.50	61.46
5	Flag leaf width	0.03	0.03	0.002	10.01	10.29	94.7	0.43	25.71
6	Number of Tillers /hill	34.80	38.37	3.57	29.39	30.86	90.7	14.83	73.88
7	Number of spikelets/panicle	1536.58	1542.92	6.34	26.54	26.59	99.6	103.27	69.92
8	1000 grain weight	5.05	8.52	3.47	9.52	12.36	59.3	4.57	19.35
9	Yield per plant	22.63	23.67	1.03	20.62	21.08	95.6	12.28	53.22

or low. Hence plant breeder may use these characters in their rice improvement programme. The estimate of heritability alone is not very much useful on predicting resultant effect for selecting the best individual because it includes the effect of both additive gene as well as non-additive gene. High genetic advance only occurs due to additive gene action (Panse, 1957). So heritability coupled with genetic advance would be more useful than heritability alone. On examining the estimate of genetic advance for different characters, it was observed that number of tillers per hill had highest genetic advance as percent of mean and was followed by number of spikelets per panicle, plant height and flag leaf length. Rest of the characters showed appreciable values. When both heritability and genetic advance are considered, it is observed that number of spikelets per panicle, plant height and days to 50% flowering showed high heritability coupled with high genetic advance as reported earlier by Rema Bai *et al* . (1992) for plant height, flag leaf area, panicle length and grain yield per plant

References

Burton, G. W. 1952. Quantitative inheritance of grasses. *Proc. 6th int. Grassland congress*, 1 : 277-283.

Burton, G.W. and De Vane, E.H. 1953. Estimating heritability in tall fescue (*Festuca arundinacea*) from replicated clonal material. Agronomy Journal. 45: 478-481.

Ganesan, K. 1994. Genetic studies in F_2 and F_3 of tall x dwarf rice crosses. *Madras Agricultural Journal* 81: 30-32.

Johnson, H. W., Robinson, A. E. and Comstock, R. E. 1955. Estimates of genetic and environmental variability in soyabeans. *Agron omy Journal* 47: 314-318.

Kishor C., Prasad Y., Zaider Z. A., Kumar R. and Kumar K. 2008. Quantitative analysis of upland rice. *Oryza* 45: 268-272.

Nayak, A.R., Chaudhary, D. and Reddy, J.N. 2002. Genetic variability, heritability and genetic advance in scented rice. *Indian Agriculturist* 46: 45-47.

Panse, V. G. and Sukhatme, P. V. 1967. Statistical methods for agricultural workers. ICAR New Delhi., *2nd Edn.* pp.381.

Rao T.P., Gomathinayagam P. and Soundrapandian S. 1996. Genetic variability and character association studies in semi-dry rice. *Madras Agricultural Journal* 83(3): 185-188.

Rema Bai N., Ahmed R., Devika R. and Joseph C. A. 1992. Genetic variability and association of characters in meadium duration rice genotype. *Oryza* 29(1): 19-22.

Vivek, S., Surendra, S., Singh, S.K., Shukla, V. and Singh, S. 2004. Analysis of variability and heritability in new plant type tropical japonica rice (*Oryza sativa* L.). *Environment and Ecology* 22: 43-45.