Analysis of Genetic Variability, Heritability and Genetic Advance for Yield and Yield Components in Low Land Rice

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Estimates of genetic variability, heritability and genetic advance were studied in 65 low land rice genotypes. Phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the 12 studied characters indicating the influence of environment on the characters. Grains per panicle had maximum GCV followed by plot yield, grain yield per plant, harvest index, panicle number, plant height and 1000-seed weight. A moderate to high degree of heritability estimates and genetic advance was for days to 50% flowering, plant height and grains per panicle. Moderate heritability values with low genetic advance was observed for panicle length, plot yield, 1000-grain weight, grain weight per plant and harvest index.

Key Words: Genetic Variability, Heritability, Genetic Advance, Low Land Rice

Importance of genetic variability in any breeding material is a pre-requisite as it provides not only a basis for selection but also some valuable information regarding selection of diverse parents for use in a hybridization programme. The most important function of heritability estimates in the improvement of yield is by utilizing heritable components of variation. Possible advance through selection based on phenotypic values can be predicted only from knowledge of the degree of correspondence between phenotypic and genotypic values. Burton (1952) has suggested that the genetic components of variation together with heritability estimates would give the best picture of the amount of advance to be expected from selection. Many reports on estimates of genetic variability are available in rice but information on low land rice is limited. Hence, the present study has been undertaken to determine the estimates of variability, heritability and genetic advance for grain yield and its components from 65 low land rice genotype.

Meterials and Methods

The present experiment material consisted of 65 low land rice genotypes collected from different sources. These were grown in a randomized complete block design with two replications during wet season of 2000 in low land with water depth varying from 30-50cm. Thirty days old single seedling per hill was transplanted with five rows per entry having 29 hills per row in 20x15cm spacing. Observations for quantitative traits viz., days to 50% flowering, plant height, number of panicles/plant, panicle length, number of spikelets/panicle, spikelet fertility%, grain weight per panicle, L/B ratio of grain, grain yield /plant and 1000-grain weight were recorded from five competitive plants of the middle row of each entry while days to 50% flowering, straw yield and plot yield were on the plot basis. Biological yield per plot was recorded by harvesting all plants of the plot from the ground level excluding roots. All the harvested plants were kept for sun drying and weight was recorded. The genotypic and phenotypic coefficients of variations were computed as suggested by Burton, 1952. Heritability and genetic advance were worked out as per the method outlined by Hanson *et al.* (1955).

Results and Discussion

Highly significant differences were observed among the cultivars for all the characters studied (Table 1). The estimates of genetic parameters are presented in Table 2. It is observed that phenotypic coefficient of variation was higher than the genotypic coefficient of variation, indicating the greater influence of environment on the expression of characters. Bhattacharya and Mishra (1981) and Gomathinayagam *et al.* (1990) have made similar observation in rice.

It is observed that considerable range of variation exhibited by the genotypes for all the traits. The maximum range of variation was observed for grains per panicle followed by grain weight per plant, plot yield, panicle number and 1000-grain weight. There is scope for further improvement of these characters. The extent of coefficient of variations indicated that grains per panicle had maximum gcv (41.70) followed by plot yield, grain yield per plant, harvest index, panicle number, plant height and 1000-grain weight. High genotypic coefficient of variance for characters could be ascribed to genotypes. These traits thus offer scope for selection. These observations are in conformity with those of Rahangdale and Khorgade (1988). However, the coefficients of variation (cv) were low for traits like days to 50% flowering, L/B ratio, panicle

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Table 1. Analysis of variance for 12 characters of 65 low land rice genotypes (Mean sum of square)

Characters	Sources of variation (d.f)		
	Replication (1)	Genotypes (64)	Error (64)
Days to 50% flowering	1.5	345.38**	1.85
Plant height (cm)	662.13**	954.30**	65.99
Panicles per plant	7.05	7.53**	2.45
Panicle length (cm)	9.87*	13.93**	1.46
Number of grains/panicle	7525.25**	6071.16**	409.80
Fertility %	234.0*	318.04**	53.47
Grain weight/plant	94.23**	50.05**	9.13
L/B ratio	0.05**	0.42**	0.002
Straw weight (kg/ha)	518518.51**	706172.83**	222222.22
Plot yield (kg/ha)	217.78	271.11**	20.00
1000-grain weight	0.41	31.21**	0.55
Harvest index	19.28	107.25**	12.71

*and ** significant at 5% and 1% levels of probability, respectively

Table 2. Estimates of mean, range, CV, GCV, PCV, heritability and genetic advance of 12 characters

Characters	Mean	Range	CV %	GCV%	PCV%	h^2	GA%
Days to 50% flowering	113.75	77.50-137.50	1.20	11.52	11.58	98.85	26.85
Plant height (cm)	109.88	63.43-146.65	7.39	19.18	20.56	87.10	40.51
Panicle number	8.16	5.30-15.60	19.16	19.53	27.36	51.00	2.35
Panicle length (cm)	25.78	14.85-30.43	4.69	9.69	10.76	81.00	4.63
Grains per panicle	127.59	25.35-275.80	15.87	41.70	44.61	87.40	102.44
Fertility %	72.69	42.86-89.52	10.06	15.82	18.75	71.20	19.99
Grain weight per plant (gm)	12.90	2.64-21.63	23.40	35.04	42.14	69.20	7.75
L/B ratio of grain	3.49	2.40-4.85	1.41	13.03	13.10	98.80	0.93
Straw yield (kg/ha)	2932.89	1466.67-4466.67	16.10	16.80	23.27	52.10	0.33
Plot yield (kg/ha)	1480.89	333.33-2711.11	14.99	35.44	38.48	84.80	0.45
1000-grain weight (gm)	21.86	13.24-34.42	3.39	17.91	18.23	96.50	7.93
Harvest index (%)	32.63	17.20-46.35	10.93	21.07	23.73	78.80	12.57

length, plant height and 1000-grain weight. On the other hand, the higher coefficients of variation estimates in number of panicles/plant, grains/panicle, grain yield/plot, fertility %, straw yield/plot and harvest index provide clue about the highly vulnerable nature of the characters under handicapped low land ecosystem.

The heritability estimates for all the 12 characters ranged from 51 % for number of panicles/plant to 98.85% for days to 50% flowering. The genetic advance expressed as percentage of mean varied from 0.33% in straw yield to 102.44% in number of grains/panicle. A moderate to high degree of heritability estimates associated with moderate to high genetic advance was for days to 50% flowering, plant height and grains per panicle. This indicates the presence of additive gene effects and hence selection on the basis of phenotypic performance would be effective (Panse, 1957). The characters like panicle length, plot yield, L/B ratio of grain, 1000-grain weight and harvest index which showed moderate to high heritability values in conjunction with low genetic advance might be under the control of non-additive gene effects. A similar observation was made by Singh *et al.* (1990) for length of panicle; Gomathinayagam *et al.* (1990) for grains per panicle and for grain yield by Shukla *et al.* (1972) and Chaudhury *et al.* (1973). Thus information regarding the genetic coefficient of variation, heritability and genetic advance would be useful in developing reliable selection indices.

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