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Research article

GENETIC VARIABILITY AND ASSOCIATION ANALYSIS IN RICE

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ABSTRACT: Genetic variability, character association and path analysis between yield and its contributing traits were studied in 49 Rice cultures. Analysis of variance revealed the existence of significant differences among genotypes for all characters studied. The magnitude of PCV and GCV was moderate to high for number of grains per panicle, test weight and grain yield. High heritability coupled with high genetic advance as per cent of mean was observed for test weight and grain yield indicating the role of additive gene in expressing these traits. Grain yield was significant positively correlated with number of grains per panicle, panicle length and test weight. Path coefficient analysis indicated that number of grains per panicle, test weight and productive tillers per square meter were essential traits to be considered for realizing the improvement in yield.

Key words: Correlation, genetic variability, path analysis and Rice

INTRODUCTION

Rice is one of the principle food crops and one third of the world population and two thirds of the Indian population is utilizing rice as staple food. It contributes 43 per cent of caloric requirement and 20-25% 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 (Viraktamath and Sundaram, 2010). 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 (Chaudhary 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. Knowledge of interrelationship of the phenotypic traits among each other and their influence on yield as well as direct and indirect contribution of various traits towards yield is important in a breeding programme and in selecting suitable lines for subsequent release as new varieties. An attempt was made in the present investigation to assess the variability, heritability and genetic advance of some quantitative characters and understand the relationship between these characters and their contribution to yield in a set of genotypes.

MATERIALS AND METHODS

Field experiment was conducted at Acharya N.G Ranga Agricultural University, Regional Agricultural Research Station, Jagtial during *kharif* 2009. The experimental material comprised of fourty nine entries including checks were sown in randomized complete block design (RCBD) with three replications with a spacing of 15 cm between the rows and 15cm between the plants. Observations were recorded on five randomly selected plants in each replication. The characters studied were days to 50% flowering, plant height (cm), productive tillers per square meter, panicle length (cm), number of grains per pancle, test weight (g) and grain yield per plant (g). The data were recorded on five randomly selected plants in each entry in each replication. The mean values were used for analysis of variance. The coefficient of variation was calculated as per Burton (1952). Heritability in broad sense and genetic advance were calculated as per Johnson *et al.*, (1955). The correlation coefficients and path analysis were carried out following the methods of Al-Jibouri *et al.*, (1958) and Dewey and Lu (1959) respectively.

RESULTS AND DISCUSSION

The success of any breeding programme depends upon the extent of genetic variability in base population and relationship of various characters towards yield. In the present study the analysis of variation shown highly significant differences among the genotypes for all the characters studied *viz.*, days to 50% flowering, plant height (cm), productive tillers per plant, panicle length (cm), number of grains per panicle, test weight (g) and grain yield per plant (g) indicating the existence of considerable genetic variation in the experimental material.

Perusal the components of variance revealed that the phenotypic coefficient of variation (PCV) were higher than Genotypic coefficient of variation (GCV) for all the characters studied indicating the role of environmental variance in the total variance (Table 1). The magnitude of PCV and GCV was moderate to high for number of grains per panicle, test weight (g) and grain yield per plant (g). (Roy *et al.*, 2001; Rao and Shrivastava, 1994 and Tripathi *et al.*, 1999).Heritability in broad sense was higher in most of the characters *viz.*, days to 50% flowering, grain yield per plant (g) and plant height (cm). Johnson *et al.*, (1955) had pointed out that in a selection programme, heritability values as well as genetic advance were more useful than heritability alone. High heritability coupled with high genetic advance as percent of mean was observed in test weight (g) and grain yield per plant (g) indicating the role of additive gene in expressing these traits and revealed better scope for improvement of these traits through direct selection.

Grain yield is a complex character governed by several contributing traits. Hence, it is important to understand the association of different characters with Grain yield for enhancing the usefulness of selection criterion to be followed while developing varieties. In the present investigation the genotypic and phenotypic correlations are on par with each other suggesting the less influence of environment. Hence, in this paper the genotypic correlations only discussed (Table 2). Invariably Grain yield was significant positively correlated with number of grains per panicle, panicle length and test weight. Similarly, significant positive association of grain yield with 1000 seed weight (Ravindra Babu,1996 and Raju *et al.*, 2004) and panicle length (Rajeshwari and Nadarajan, 2004 and Patil *et al.*, 1993) were noticed in their respective experiments.

Path coefficient analysis (Table 3) revealed that the highest direct positive effect of number of grains per panicle, test weight and productive tillers per square meter was revealed on Grain yield. Similar results were reported by Rajeshwari and Nadarajan, (2004) and Suman *et al*. (2006). Hence, a direct selection criterion should be followed for traits *viz.*, no of grains per panicle and test weight to improve the Grain yield.

Table.1 Estimates of variability, heritability and genetic advance in Rice

Character	Mean	Range	GCV (%)	PCV (%)	Heritability in Broadsence (H^2)	Genetic advance	GA as percent of mean
Days to 50% flowering (DF)	97.9728	90.6-104.3	3.387	3.563	90.4	8.327	8.499
Plant height (PH)	118.2327	98.6-145.8	9.181	9.854	86.8	26.699	22.581
Productive Tillers/m^2(PT/m^2)	356.3061	284.3-444.3	6.921	13.784	25.2	32.688	9.174
Panicle Length(PL)	25.7878	20.5-29.4	7.598	9.165	68.7	4.289	16.63
Number of grains per panicle (NG/P)	151.8775	91.6-231.3	18.682	27.145	47.4	51.556	33.946
1000 seed weight (TW)	21.5309	13.5-29.5	17.289	21.21	66.4	8.011	37.207
Grain yield (GY)	4.8574	2.8-6.4	14.809	15.785	88	1.782	36.677

Table 2: Genotypic correlation coefficients between different traits in Rice

Character	DF	PH	PT/m^2	PL	NG/P	TW	GY
Days to 50% flowering(DF)	1.0000	-0.1099	0.2934*	-0.2165	0.0428	-0.0520	0.1271
Plant height(PH)		1.0000	-0.1166	0.4420**	0.2180	0.1133	-0.0153
Productive Tillers/m2(PT/m2)			1.0000	-0.0084	-0.1363	-0.1755	0.2532
Panicle Length(PL)				1.0000	0.1702	0.3787**	0.4671**
Number of grains per panicle(NG/P)					1.0000	-0.4164**	0.5651**
1000 seed weight(TW)						1.0000	0.4348**

*, ** Significant at P=0.05 and P = 0.01 level respectively

Table 3. Direct (diagnol) and indirect effects of yield contributing characters in Rice

Character	DF	PH	PT/m2	PL	NG/P	TW	GY
Days to 50% flowering(DF)	**-0.0709**	0.0078	-0.0208	0.0154	-0.003	0.0037	0.1271
Plant height(PH)	0.0363	**-0.3301**	0.0385	-0.1459	-0.072	-0.0374	-0.0153
Productive Tillers/m2(PT/m2)	0.1691	-0.0672	**0.5762**	-0.0048	-0.0786	-0.1011	0.2532
Panicle Length(PL)	-0.0023	0.0046	-0.0001	**0.0105**	0.0018	0.004	0.4671
Number of grains per panicle(NG/P)	0.0493	0.2511	-0.1571	0.1961	**1.1521**	-0.4797	0.5651
1000 seed weight(TW)	-0.0544	0.1184	-0.1835	0.3959	-0.4352	**1.0453**	0.4348

Residual effect (G) = 0.0316 G = Genotypic

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