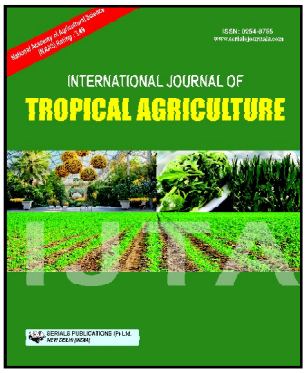

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Genetic Variability and Character Association in Lowland Rice

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Abstract : The nature and magnitude of genetic variability and their inter-relationship were studied for grain yield and its eight component traits in 35 lowland genotypes of rice. High estimates of genotypic coefficients of variation, heritability and genetic advance were observed for flag leaf area, effective tillers/plant and fertile grains/panicle indicating their reliability for effecting selections for high grain yield. These three component traits were also the best contributors to grain yield and further, days to 50 % flowering, along with these three traits showed high significant positive association with grain yield both at genotypic and phenotypic levels. Hence, the studies revealed the importance of flag leaf area, effective tillers/plant and fertile grains/panicle as selection criteria for improvement of grain yield in lowland rice.

Key words: Genetic variability, character association, grain yield, rice

INTRODUCTION

Rice (*Oryza sativa* L.) is the principal food crop and India accounts for about a quarter of total rice production of the world being the highest rice producer only next to China. It is estimated that India will require 120 m tonnes of rice to feed its projected population of one and half billion by 2030 (Hota *et al.*, 2018). Therefore, the enhancement of production potential of the crop is essentially required to meet the growing food demand for which, the present study aims to assess the genetic variability and degree of association of grain yield with its component traits for effective selection of elite genotypes under lowland situation in rice.

MATERIALS AND METHODS

The study was carried out during kharif season on 35 lowland genotypes of rice including checks at the Rice Research Station, OUAT, Bhubaneswar in randomized block design with two replications.

Observations were recorded on 9 different quantitative traits (Table 1) on five random plants per treatment in each replication and the mean data were used for analysis of variance and covariance (Panse and Sukhatme, 1967). From the variance and covariance components, coefficients of variation at phenotypic (PCV) and genotypic (GCV) levels (Burton, 1952), heritability in broad sense (H) (Lush, 1940) and expected genetic advance (GA) (Johnson *et al.*, 1955) were computed. The genotypic and phenotypic correlation coefficients were estimated (Miller *et al.*, 1958) and used for path coefficient analysis at phenotypic level (Dewey and Lu, 1959).

RESULTS AND DISCUSSION

Studies on variation and genetic parameters revealed that all the characters exhibited significant differences (Table 1), indicating the presence of sufficient genetic variability in the material. The results further revealed that effective tillers/plant, flag leaf area, fertile grains/panicle and grain yield had high H, high GA and high GCV, hence these characters have maximum scope for further improvement through selection. However, high H with moderate GA and moderate GCV for panicle length and 100-grain weight indicated that simultaneous improvement for these traits could also be achieved. The remaining traits were unsuitable for improvement by direct selection alone. The narrow range of difference between PCV and GCV in traits like days to 50 % flowering, plant height, panicle length, flag leaf area and fertility % indicated that these characters were least influenced by environment.

Correlation studies (Table 2) showed that for most character pairs, genotypic and phenotypic associations were in the same direction and a high significant positive association of number of effective tillers/plant, number of fertile grains/panicle and flag leaf area with grain yield was observed both at genotypic and phenotypic levels indicating an increase in tillers and flag leaf area had direct bearing on grain yield. The negative correlation of 100-grain weight with plant height, effective tillers and fertile grains/panicle indicated that an increase in number of tillers and fertile grains/panicle resulted in reduction of grain size.

The direct and indirect effects of different traits on grain yield at phenotypic level (Table 3) revealed that the highest direct effect (0.47) of flag leaf area was intensified further with marginal indirect effects

Table 1
Genetic variability parameters in low land rice

Character	*Mean*	*Range*	*Variance*	*PCV (%)*	*GCV (%)*	*H (%)*	*GA (as % of mean)*
Days to 50 % flowering	121.06	111.00-131.00	73.52**	5.01	4.83	93.10	8.21
Plant height (cm)	101.49	84.46-119.58	123.03**	7.73	6.71	75.49	10.27
Panicle length (cm)	22.04	18.75-26.89	6.60**	8.24	7.95	92.96	13.48
Effective tillers/plant	6.50	4.50-9.00	2.91**	18.56	14.99	65.17	21.29
Flag leaf area (cm^2)	24.34	15.34-36.81	62.09**	22.89	22.76	98.87	39.83
Number of fertile grains/panicle	131.24	91.00-177.00	946.66**	16.58	13.14	62.86	18.34
Fertility (%)	90.60	83.68-95.16	19.39*	3.44	2.54	54.56	3.30
100-grain weight (g)	2.27	1.80-2.69	0.09**	9.22	8.00	75.22	12.21
Grain yield (q/ha)	33.77	15.87-52.91	161.26**	26.59	24.92	87.80	41.09

*, ** Significant at 5 % and 1 % levels, respectively

Table 2
Genotypic (G) and phenotypic (P) correlation coefficients in rice

Character		*Days to 50 % flowering*	*Plant height (cm)*	*Panicle length (cm)*	*No. of Effective tillers/plant*	*Flag leaf area (cm^2)*	*Number of fertile grains/panicle*	*Fertility (%)*	*100-grain weight (g)*
Plant height (cm)	G	-0.02							
	P	-0.05							
Panicle length (cm)	G	-0.49**	0.12						
	P	-0.48	0.15						
Effective tillers/plant	G	0.41	-0.11	0.35*					
	P	0.36	-0.01	0.24					
Flag leaf area (cm^2)	G	-0.04	0.47**	0.55**	0.28				
	P	-0.03	0.41	0.54**	0.22				
Number of fertile grains/panicle	G	-0.16	0.69**	0.11	0.23	0.41*			
	P	-0.14	0.49**	0.09	0.08	0.32			
Fertility (%)	G	0.41*	-0.22	-0.36*	0.13	-0.10	-0.30		
	P	0.27	-0.11	-0.24	0.11	-0.07	-0.12		
100-grain weight (g)	G	-0.40*	-0.40*	0.23	-0.22	0.10	-0.12	0.13	
	P	-0.36	-0.19	0.22	-0.13	0.09	-0.04	0.08	
Grain yield (q/ha)	G	0.53**	0.35*	-0.14	0.43**	0.48**	0.57**	0.11	-0.19
	P	0.49**	0.32	-0.14	0.38*	0.45**	0.40**	0.03	-0.13

*, ** Significant at 5 % and 1 % levels, respectively

Table 3
Direct (diagonal) and indirect effects of component traits on grain yield of rice at phenotypic level

Character	*Days to 50 % flowering*	*Plant height (cm)*	*Panicle length (cm)*	*Effective tillers/plant*	*Flag leaf area (cm^2)*	*Number of fertile grains/ panicle*	*Fertility (%)*	*100-grain weight (g)*	*Grain yield (q/ha)*
Days to 50 % flowering	**0.341**	-0.004	0.176	0.089	-0.016	-0.036	-0.030	-0.031	0.490**
Plant height (cm)	-0.019	**0.077**	-0.055	-0.002	0.191	0.128	0.013	-0.017	0.317
Panicle length (cm)	-0.163	0.012	**-0.369**	0.059	0.253	0.024	0.027	0.019	-0.139
Effective tillers/plant	0.123	-0.001	-0.089	**0.247**	0.104	0.021	-0.012	-0.011	0.383*
Flag leaf area (cm^2)	-0.011	0.031	-0.197	0.055	**0.472**	0.083	0.008	0.008	0.449**
Number of fertile grains /panicle	-0.046	0.038	-0.034	0.020	0.150	**0.261**	0.013	-0.003	0.399*
Fertility (%)	0.093	-0.009	0.089	0.027	-0.035	-0.031	**-0.110**	0.007	0.032
100-grain weight (g)	-0.121	-0.015	-0.080	-0.031	0.043	-0.010	-0.009	**0.089**	-0.134
Residual effect (P_R) = 0.601									

*, ** Significant at 5 % and 1 % levels, respectively

via. tillers/plant, panicle length and number of grains/panicle. Further, the fertile grains/panicle had also a high direct effect (0.26) on yield and considerable negative indirect effects via panicle length and grain weight.

This study on variability and character associations in rice under lowland situation suggested that among the nine traits studied, flag leaf area followed by effective tillers/plant and fertile grains/panicle were the most important components of grain yield and can be used effectively as selection criteria for improvement of yield in rice.

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