

Character association and component analysis in rice

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ABSTRACT

Correlation and component analysis were performed for 12 characters in 20 genotypes of rice to find out the character association and their direct and indirect effects on seed yield. A positive and significant correlation was found for the characters, panicle length, number of spikelets panicle⁻¹, flag leaf length, flag leaf width, biological yield and harvest index with grain yield plant⁻¹ at genotypic level. Highly significant and positive correlation was observed between number of tillers and number of panicles plant⁻¹. Component analysis revealed higher direct effects of harvest index, biological yield, number of tillers and flag width, suggesting that these characters may be given prime attention further improve the genetic yield potential of rice.

Key words: *Correlation, character association, component analysis, direct effect, indirect effect*

At present level of production growth, India would require to add annually not less than 25 million tones of rice to sustain the present level of self-sufficiency. Yield is the end product of multiplicative interaction between various yield components (Grafius, 1959) and this necessitates a thorough understanding of character association and direct and indirect effects contributed by each character on grain yield before launching any breeding programme. Therefore, an attempt was made to study the nature of character association by computing correlation coefficients and their effects by component analysis.

The experimental material of the present study comprised 20 diverse genotypes of rice collected from different sources namely, Narendra 359, Savitri, Nati Mahsuri, Ratna, Pant Dhan 12, Sarju 52, Sona Mahsuri, BPT 5204, MTU 1010, MTU 7029, MTU 2067, RGL 1808, Tata Mahsuri, AAI R 1 (Selection), AAI R 2 (Selection), AAI R 3 (Selection), Swarna, Pant Dhan 4, Jaya and Vandana. The experiment was conducted at the Field Experimentation Centre, Department of Genetics and Plant Breeding, Allahabad Agricultural Institute-Deemed University, Allahabad in randomized complete block design laid in three replications with inter and intra-row spacing of 20 x 15 cm respectively,

during wet season 2002. Five plants from each replication were selected at random and observations were recorded on 12 characters viz., plant height (cm), tillers plant⁻¹, panicle length (cm), panicles plant⁻¹, spikelets panicle⁻¹, flag leaf length (cm), flag leaf width (cm), days to maturity, biological yield (g), test weight (g), harvest index and yield plant⁻¹ (g). Genotypic and phenotypic correlation coefficients were estimated adopting the procedure of Singh and Choudhary (1985) and the component analysis was carried out as per the procedure of Wright (1921) which was illustrated by Dewey and Lu (1957).

The genotypic correlation among various yield and yield contributing traits revealed that grain yield plant⁻¹ was significantly and positively correlated with flag leaf width (0.805**), harvest index (0.649**), spikelets panicle⁻¹ (0.560**), flag leaf length (0.462*), panicle length (0.449*) and biological yield (0.415*) (Table 1). It suggests that top priority should be given to these traits while making selection for yield improvement. Roy *et al.* (1995) also reported that grain yield was positively correlated with spikelets panicle⁻¹, number of tillers, test weight, harvest index and biological yield. All the characters under study were positively correlated with grain yield plant⁻¹ except tillers plant⁻¹

(-0.045) and days to maturity (-0.024). The negative correlation of these characters with the yield plant⁻¹, suggest its use in breeding programme for productive tillers and earliness in rice.

Among the other characters, tillers plant⁻¹ with panicles plant⁻¹ (0.985**), flag leaf width with biological yield (0.665**) and plant height with days to maturity (0.503*) were positively and significantly correlated with each other, suggesting the inter-dependency of these characters and should be given due consideration in selection programme. Identification of important yield components and information about the association with yield and also with each other are necessary in developing efficient breeding strategy for evolving improved genotypes.

Component analysis is a tool to partition the observed correlation coefficient into direct and indirect effects of yield components on the grain yield to provide more clear understanding of character association for formulating effective selection strategy. Results obtained from component analysis revealed that the characters, harvest index (0.788), biological yield (0.578), tillers plant⁻¹ (0.337), flag leaf width (0.223),

test weight (0.578) and spikelets panicle⁻¹ (0.141) exhibited high positive direct effect on grain yield plant⁻¹ (Table 2). This provides an indication of inter-relationship of these traits with the yield plant⁻¹ and direct selection of these traits may be rewarding for yield improvement. These results were in consonance with Chaubey and Singh (1994) and Kumari *et al.* (1999). High positive genotypic correlation between flag leaf width and grain yield plant⁻¹ was due to its direct effect and positive indirect effects of biological yield and harvest index. Likewise, highly significant positive correlation of harvest index with yield plant⁻¹ was due to its direct effect.

The genetic architecture of grain yield is based on the balance or overall net effect produced by various yield components interacting with one another. Based on the studies on correlation and path analysis, it may be concluded that flag leaf width, tillers plant⁻¹, spikelets panicle⁻¹ and plant height being easily observable characters at field level and others characters like harvest index and days to maturity appeared to be primary yield contributing characters and could be relied upon these characters for selection of genotypes to improve the genetic yield potential of rice.

Table 1. Estimates of genotypic correlation coefficient among 12 characters in 20 genotypes of rice

Character	No. of tillers	Panicle length (cm)	Panicles plant ⁻¹	Spikelets panicle ⁻¹	Flag leaf length (cm)	Flag leaf width (cm)	Days to maturity	Biological yield (g)	Test weight (g)	Harvest index	Grain yield plant ⁻¹ (g)
Plant height (cm)	-0.495*	0.286	-0.442*	0.420*	0.117	0.126	0.503*	0.190	0.160	0.024	0.240
No. of tillers	1.000	0.003	0.985**	-0.136	-0.117	0.037	-0.282	0.119	-0.272	-0.096	-0.045
Panicle length (cm)		1.000	0.024	0.095	0.423*	0.250	0.064	0.162	0.265	0.335	0.449*
Panicles plant ⁻¹			1.000	-0.064	-0.111	0.057	-0.244	0.136	-0.219	0.011	0.064
Spikelets panicle ⁻¹				1.000	0.323	0.521*	-0.106	0.219	0.114	0.264	0.560**
Flag leaf length (cm)					1.000	0.390*	-0.262	0.345	0.284	0.236	0.462*
Flag leaf width (cm)						1.000	-0.394*	0.665**	0.082	0.196	0.805**
Days to maturity							1.000	-0.328	0.016	0.290	-0.024
Biological yield (g)								1.000	-0.119	-0.363	0.415*
Test weight (g)									1.000	0.242	0.271
Harvest Index										1.000	0.649**

* and ** significant at 5% and 1% level of significance, respectively

Table 2. Direct (Diagonal) and indirect effects of component traits attributing to yield at genotypic level

Character	Plant height (cm)	No. of tillers	Panicle length (cm)	Panicles plant ⁻¹	Spikelets panicle ⁻¹	Flag leaf length (cm)	Flag leaf width (cm)	Days to maturity	Biological yield (g)	Test weight (g)	Harvest index	Grain yield plant ⁻¹ (g)
Plant height (cm)	0.020	-0.167	0.008	0.144	0.059	-0.012	0.028	0.007	0.110	0.025	0.019	0.241
No. of tillers	-0.018	0.337	0.000	-0.327	-0.019	0.012	0.008	-0.004	-0.069	-0.042	0.076	-0.044
Panicle length (cm)	0.006	0.001	0.027	-0.008	0.013	-0.045	0.056	0.001	0.093	0.041	0.264	0.449
Panicles plant ⁻¹	-0.009	0.331	0.001	-0.326	-0.009	0.012	0.013	-0.003	0.079	-0.034	0.009	0.066
Spikelets panicle ⁻¹	0.005	-0.046	0.003	0.021	0.141	-0.034	0.116	-0.001	0.126	0.018	0.209	0.558
Flag leaf length (cm)	0.002	-0.039	0.011	0.036	0.045	-0.106	0.087	-0.004	0.199	0.044	0.186	0.461
Flag leaf width (cm)	0.002	-0.012	0.007	-0.019	0.073	-0.041	0.223	-0.005	0.385	0.013	0.155	0.805
Days to maturity	0.010	-0.095	0.002	0.080	-0.015	0.028	-0.088	0.013	-0.190	0.002	0.228	-0.025
Biological yield (g)	0.004	0.040	0.004	-0.044	0.031	-0.037	0.149	-0.004	0.578	-0.018	-0.286	0.417
Test weight (g)	0.003	-0.092	0.007	0.071	0.016	-0.030	0.018	0.000	-0.069	0.154	0.191	0.269
Harvest Index	0.000	-0.038	0.009	-0.119	0.037	-0.138	0.044	0.004	-0.315	0.377	0.788	0.649

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