



Character Association and Interrelationship of Yield and Quality Attributes in Rice (*Oryza sativa* L.)

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ABSTRACT

Forty eight genotypes of rice were evaluated for fourteen yield and quality attributes to assess character association among themselves. The correlation analysis indicated that grain yield was significantly associated with number of grains per panicle, days to 50 per cent flowering, days to maturity, number of effective tillers per plant, harvest index, panicle length and 1000-grain weight. Path coefficient analysis revealed that days to 50 per cent flowering, number of effective tillers per plant, number of grains per panicle, plant height, harvest index and 1000-grain weight had positive direct effect on grain yield. Hence, selection on these traits could be suggested to bring simultaneous improvement of yield and quality.

Key words : Character Association, Path Analysis, Quality, Rice, Yield

Grain yield and quality are complex characters and are associated with number of component characters which are themselves interrelated. Such interdependence often affects their relationship with yield, there by making correlation ineffective. So, there is a need to partition the correlations into direct and indirect effects to get the information on actual contribution of each character to yield. Therefore, the present study was undertaken to study the association and interrelationships of different yield and quality attributes in the selected lines of rice.

MATERIAL AND METHODS

The experimental material consisted of 48 diverse genotypes of rice, which were grown at wetland farm, S.V. Agricultural College, Tirupati in *Kharif* season 2006, in randomized block design with three replications. Thirty days old seedlings were transplanted at the rate of one seedling per hill with inter-and intra-row spacing of 20 x 15 cm. Recommended package of practices was followed to raise the crop. Observations were recorded on 14 quantitative and qualitative characters viz., days to 50% flowering, days to maturity, number of effective tillers per plant, plant height, panicle length, number of grains per panicle, 1000-grain weight, harvest index, kernel length, kernel breadth, kernel length/breadth ratio, kernel length after cooking, kernel elongation ratio and grain yield per plant. The genotypic and phenotypic correlations were determined as per Johnson *et al.* (1955). Path coefficient analysis was done as suggested by Wright (1921) and as described by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The data in respect of correlation coefficient analysis between important characters, both phenotypic and genotypic are presented in Table 1. In general, the genotypic correlation coefficients were higher than phenotypic correlations. This indicated that low phenotypic correlation might be due to the masking effect of environment in genetic association between the characters (Johnson *et al.*, 1955). The correlation of yield and yield contributing characters indicated that grain yield per plant was positive and significantly influenced by days to 50% flowering, days to maturity, number of effective tillers per plant, number of grains per panicle, panicle length and 1000-grains weight. Swain and Reddy (2006) reported similar findings for days to 50% flowering, number of effective tillers per plant; Krishna Naik *et al.* (2005) for days to maturity, panicle length, number of grains per panicle and Krishnaveni and Shobha Rani (2006) for 1000-grain weight. It is desirable to select genotypes with more productive tillers per plant with more panicle length and grains per panicle coupled with minimum L/B ratio of kernel to develop a high yielding fine grain quality rice.

Path coefficient analysis (Table 2) revealed that the number of grains per panicle, number of effective tillers per plant and days to 50% flowering exhibited high positive direct effect and significant positive correlation with grain yield. Similar findings were reported by Chitra *et al.* (2005) for number of effective tillers per plant and Vinothini and Ananda Kumar (2005) for number of grains per panicle. Even though, panicle length had positive correlation with

Table 1. Phenotypic (r_p) and genotypic (r_g) correlation coefficients among grain yield per plant and its components in rice.

Characters	r_p	r_g	Days to maturity	No. of effective tillers / plant	Plant height	Panicle length	No. of grains panicle ⁻¹	Harvest index	Kernel length	Kernel breadth	Kernel length / breadth ratio	kernel length after cooking	Kernel elongation ratio	1000 grain weight	Grain yield plant ⁻¹	
Days to 50% flowering			0.92**	0.06	-0.00	0.13	0.45	0.15	-0.03	-0.14	0.10	-0.26	-0.10	0.07	0.50**	
Days to maturity			0.95	0.06	0.00	0.13	0.48	0.17	-0.04	-0.15	0.10	-0.28	-0.10	0.07	0.54	
No. of effective tillers / plant				0.00	-0.04	-0.00	0.43**	0.11	-0.01	-0.14	0.11	-0.23	-0.11	-0.03	0.43**	
Plant height				0.01	-0.04	-0.00	0.45	0.13	-0.01	-0.18	0.14	-0.26	-0.12	-0.03	0.46	
Panicle length					-0.05	0.09	0.01	0.21	-0.31*	-0.12	-0.07	-0.26	0.24	0.01	0.39**	
No. of grains / panicle					-0.05	0.11	0.02	0.22	-0.33	-0.16	-0.06	-0.29	0.27	0.00	0.46	
Harvest index						0.43**	0.27	0.01	-0.12	0.39**	-0.35*	-0.04	0.12	0.24	0.22	
Kernel length						0.44	0.29	0.01	-0.12	0.46	-0.41	-0.04	0.13	0.24	0.23	
Kernel breadth							0.35*	0.28*	0.06	0.13	-0.04	-0.01	-0.09	0.35*	0.34*	
Kernel length / breadth ratio							0.37	0.32	0.07	0.15	-0.05	-0.01	-0.10	0.38	0.36	
Kernel length after cooking								0.16	-0.25	0.08	-0.19	-0.43**	0.05	-0.00	0.56**	
Kernel elongation ratio								0.18	-0.28	0.08	-0.21	-0.46	0.06	0.00	0.62	
1000 grain weight									-0.05	0.00	-0.02	0.01	0.08	0.28	0.35*	
									-0.05	0.01	-0.03	0.01	0.09	0.33	0.40	
										-0.01	0.64**	0.67**	-0.85**	0.24	-0.15	
										0.00	0.68	0.71	-0.87	0.26	-0.17	
											-0.75**	-0.11	-0.09	0.34*	0.00	
											-0.72	-0.12	-0.12	0.41	0.00	
												0.49**	-0.48**	-0.11	-0.06	
												0.55	-0.52	-0.14	-0.07	
													-0.22	0.21	-0.27	
													-0.28	0.24	-0.28	
														-0.17	0.04	
														-0.18	0.05	
															0.31*	
																0.34

* significant at 5% level ** significant at 1% level.

Table 2. Phenotypic (P) and genotypic (G) path coefficients for grain yield per plant and its components in rice

Characters	Days to 50% flowering	Days to effective maturity	No. of effective tillers/plant	Plant height	Panicle length	No. of grains/panicle	Harvest index	Kernel length	Kernel breadth	Kernel length/breadth ratio	kernel length after cooking	Kernel elongation ratio	1000 grain weight	Correlation with grain yield/plant
Days to 50% flowering	P 0.1902	0.0541	0.0229	-0.0001	-0.0037	0.1865	0.0156	0.0073	-0.0214	0.0329	0.0019	0.0015	0.0202	0.5080**
	G 0.7458	-0.7004	0.0464	0.0002	-0.0530	0.4201	0.0384	-0.3950	0.4659	-0.4223	0.8089	-0.4193	0.0043	0.5400
Days to maturity	P 0.1765	0.0583	0.0029	-0.0043	0.0001	0.1766	0.0114	0.0027	-0.0210	0.0366	0.0017	0.0017	-0.0093	0.4340**
	G 0.7151	-0.7305	0.0113	-0.0097	0.0026	0.3934	0.0286	-0.1128	0.5326	-0.6007	0.7350	-0.4989	-0.0017	0.4643
No. of effective tillers / plant	P 0.0127	0.0005	0.3434	-0.0059	-0.0026	0.0050	0.0221	0.0610	-0.0178	-0.0230	0.0019	-0.0037	0.0036	0.3972**
	G 0.0518	-0.0123	0.6673	-0.0137	-0.0456	0.0184	0.0500	-2.9387	0.4951	0.2759	0.8179	1.1003	0.0005	0.4669
Plant height	P -0.0002	-0.0024	-0.0192	0.1049	-0.0118	0.1144	0.0015	0.0237	0.0569	-0.1130	0.0003	-0.0019	0.0682	0.2216
	G 0.0007	0.0305	-0.0393	0.2329	-0.1694	0.2568	0.0036	-1.1011	-1.3594	1.7059	0.1221	0.5350	0.0138	0.2320
Plant length	P 0.0256	-0.0002	0.0331	0.0454	-0.0273	0.1473	0.0288	-0.0136	0.0187	-0.0136	0.0001	0.0014	0.1016	0.3474*
	G 0.1038	0.0051	0.0799	0.1036	-0.3806	0.3299	0.0718	0.6425	-0.4544	0.2108	0.0454	-0.4156	0.0213	0.3635
Number of grains/panicle	P 0.0864	0.0251	0.0042	0.0292	-0.0098	0.4105	0.0162	0.0496	0.0122	-0.0612	0.0032	-0.0008	-0.0011	0.5638**
	G 0.3607	-0.3308	0.0142	0.0688	-0.1445	0.8688	0.0406	-2.4452	-0.2493	0.8878	1.2948	0.2601	0.0002	0.6261
Harvest index	P 0.0296	0.0066	0.0754	0.0016	-0.0078	0.0662	0.1006	0.0104	0.0009	-0.0070	-0.0001	-0.0013	0.0803	0.3554*
	G 0.1312	-0.0956	0.1529	0.0038	-0.1251	0.1617	0.2183	-0.5049	-0.0571	0.1514	-0.0437	0.3959	0.0188	0.4078
Kernel length	P -0.0071	-0.0008	-0.1080	-0.0128	-0.0019	-0.1048	-0.0054	-0.1941	-0.0014	0.2019	-0.0049	0.0131	0.0692	-0.1571
	G -0.0339	0.0095	-0.2258	-0.0295	-0.0282	-0.2446	-0.0127	8.6861	0.0225	-2.8123	-1.9960	-3.4810	0.0146	-0.1762
Kernel breadth	P -0.0285	-0.0086	-0.0429	0.0418	-0.0036	0.0350	0.0006	0.0019	0.1430	-0.2371	0.0008	0.0015	0.0986	0.0027
	G -0.1178	0.1319	-0.1120	0.1073	-0.0586	0.0734	0.0042	0.0662	-2.9491	2.9855	0.3372	-0.4906	0.0230	0.0007
Kernel length / breadth ratio	P 0.0199	0.0068	-0.0252	-0.0378	0.0012	-0.0800	-0.0022	-0.1248	-0.1080	0.3140	-0.0036	0.0075	-0.0316	-0.0638
	G 0.0762	-0.1062	-0.0445	-0.0961	0.0194	-0.1866	-0.0080	5.9098	2.1300	-4.1335	-1.5473	-2.0788	-0.0079	-0.0735
kernel length after cooking	P -0.0498	-0.0138	-0.0907	-0.0045	0.0004	-0.1787	0.0014	-0.1313	-0.0159	0.1548	-0.0073	0.0034	0.0617	-0.2703
	G -0.2153	0.1917	-0.1948	-0.0101	0.0062	-0.4015	0.0034	6.1889	0.3550	-2.2831	-2.8014	-1.1414	0.0137	-0.2888*
Kernel elongation ratio	P -0.0190	-0.0066	0.0832	0.0128	0.0025	0.0222	0.0087	0.1660	-0.0135	-0.1529	0.0016	-0.0154	-0.0482	0.0414
	G -0.0785	0.0914	0.1842	0.0313	0.0397	0.0567	0.0217	-7.5858	0.3630	2.1558	0.8022	3.3859	-0.0103	0.0573
1000 grain weight	P 0.0135	-0.0019	0.0044	0.0253	-0.0098	-0.0016	0.0285	-0.0474	0.0498	-0.0350	-0.0016	0.0026	0.2834	0.3102*
	G 0.0574	0.0220	0.0061	0.0579	-0.1461	0.0025	0.0738	2.2755	-1.2198	0.5866	-0.6908	-0.7374	0.0556	0.3433

Residual effect (phenotypic) = 0.5911

Residual effect (genotypic) = 0.4353

* = Significant at 5% level

** = Significant at 1% level.

Bold: Direct effects

Normal: Indirect effects

yield its direct effect on yield was negative. It is due to the maximum indirect effect of number of grains per panicle which is nullifying its negative direct effect on yield. Hence, for improvement of this trait selection efforts would be more effective *via* number of grains per panicle instead of selection based on panicle length alone.

It could be suggested that more emphasis should be given on number of grains per panicle, number of effective tillers per plant, days to 50% flowering, harvest index and 1000-grain weight to bring simultaneous improvement of yield and quality in rice as they showed high correlation in addition to maximum direct effects on yield.

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