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Correlation and path analysis for grain yield and its component traits in rice

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ABSTRACT

Correlation and path analysis were carried out using forty rice genotypes including three checks for grain yield and its components and analyzed during wet season 2009 to know the association among different traits and causes of association. In general, genotypic correlation was higher in magnitude than the phenotypic correlation coefficient indicating the genetic association among various traits. At phenotypic and genotypic level, grain yield has positive and significant correlation with grains panicle^{-1}, fertility per cent, 1000-grain weight and grain breadth. Improvement in grain yield plant^{-1} can be obtained by improving above characters. Grain yield plant^{-1} was negatively and significantly correlated with panicle length at genotypic level. Path analysis revealed the highest positive direct effect of grains panicle^{-1} followed by tillers plant^{-1}, grain breadth, 1000-grain weight and panicle length on yield plant^{-1} at genotypic level.

Key words: *rice, genotypic correlation, phenotypic correlation, path analysis*

In Asia, 90 per cent of the world's rice is grown and consumed, nearly 2.8 million people derive 35-60 per cent of calories from rice. India has the largest area under rice producing about 141.13 million tones of paddy and productivity 32.08q ha^{-1} (Anonymous, 2007). In Himachal Pradesh rice is major wet season crop, next to maize. The average yield of milled rice in HP is lower than the national average. As a result of the great diversity of agro-climatic conditions under which rice is cultivated in HP, there is a great variability in the land races present in this crop.

The success of any breeding programme depends on the nature and magnitude of genetic variability present in the genotypes. The presence of sufficient variability, the knowledge of nature of association among different characters and relative contribution of different characters to yield is a prerequisite to any breeding programme. For improvement in yield, it would be desirable to understand the nature and magnitude of associations among yield and its components traits. Better understanding of the contribution of components traits in building the genetic make-up of the crop can be obtained through correlation. Based upon genotypic and phenotypic correlation, the breeder would be able to decide the breeding methods to be used to exploit desirable and break the undesirable associations.

Forty elite rice genotypes including three checks (14 released varieties and 26 improved rice genotypes) adapted to various agro ecological zones of HP were transplanted in RBD with 3 replications at the Experimental Farm of RWRC (CSK HPKV), Malan during wet season 2009. Each plot consisted of 3 rows of 3 meter row length each in which 20 plants per row were transplanted with row to row and plant to plant spacing of 20 cm and 15 cm respectively. All the recommended cultural practices were followed to raise the crop. The observations were recorded on five randomly tagged plants per replication on 12 agro morphological traits except for days to flowering, which were recorded on plot basis. The phenotypic and genotypic coefficients of correlation were computed as per method suggested by Al-Jibour *et al.* (1958). The Path coefficients were calculated by the method suggested by Dewey and Lu (1959).

Estimation of phenotypic and genotypic correlation coefficient calculated for different characters (Table 1). The values of genotypic correlation

coefficient were generally higher than the corresponding phenotypic one for most of the characters studied suggesting strong relationship between various characters. The observations were in accordance with the results Reddy *et al.* (1997), Monalisa *et al.* (2006) and Sood, R. (2008). At the phenotypic level, the grain yield had significant positive correlation with 1000-grain weight, fertility per cent, grains panicle^{-1} and grain breadth and showed no correlation with days to 50% flowering, plant height, tillers plant^{-1}, panicle length, spikelet panicle^{-1}, grain length and L:B ratio. So to increase grain yield, stress should be on those traits with which yield is positively correlated. Similar results were obtained by Nayak (2007) and Adil *et al.* (2007). At genotypic level, grain yield had significant positive correlation with 1000-grain weight, fertility per cent, grains panicle^{-1}, grain breadth and negative with panicle length, days to 50% flowering, L: B ratio and plant height. Similar results were observed by Bai *et al.* (1992), Sawant *et al.* (1996) who revealed significant positive correlation of grain yield with tillers plant^{-1} at maturity, spikelets panicle^{-1}, grains panicle^{-1} and L:B ratio. Thus improvement in grain yield can be achieved by direct selection based on 1000-grain weight, fertility %, grains panicle^{-1} and grain breadth.

Path analysis (Table 2) revealed the highest positive direct effect of grains panicle^{-1} followed by tillers plant^{-1}, grain breadth, 1000-grain weight and panicle length on yield plant^{-1} at genotypic level.

However, at phenotypic level, 1000-grain weight had maximum direct contribution towards grain yield plant^{-1} followed by grains panicle^{-1}, tillers plant^{-1} and fertility per cent. Concurrently, grains panicle^{-1} had indirect effect on yield via days to 50 % flowering and spikelets panicle^{-1} at phenotypic level. Grain panicle^{-1}

Table 1. Phenotypic (P) and Genotypic (G) correlation coefficient among various yield and morpho-physiological traits

Traits	Variation	Plant height (cm)	Tillers plant^{-1} (No.)	Panicle length (cm)	Spl panicle^{-1} (No.)	Grains pan^{-1} (No.)	Fertility (%)	1000 grain wt.(g)	Grain length (mm)	Grain w. (mm)	L:B ratio	Yield plant^{-1} (g)
Days to 50% flowering (No.)	P	0.276**	-0.031	0.467**	0.551**	0.329**	-0.589**	-0.364**	0.369**	-0.460**	0.409**	-0.156
	G	0.338**	-0.069	0.646**	0.595**	0.391**	-0.809**	-0.396**	0.403**	-0.485**	0.454**	-0.228**
Plant height (cm)	P		-0.008	0.452**	0.102	0.080	-0.071	-0.069	0.209**	-0.159	0.170	-0.086
	G		-0.029	0.542**	0.123	0.103	-0.136	-0.087	0.213**	-0.187**	0.194**	-0.206**
Tillers plant^{-1} (No.)	P			0.108	-0.321**	-0.378**	-0.017	-0.226**	0.309**	-0.351**	0.311**	0.153
	G			0.013	-0.388**	-0.543**	-0.082	-0.280**	0.411**	-0.435**	0.392**	-0.024
Panicle length (cm)	P				0.114	0.018	-0.336**	-0.205**	0.584**	-0.453**	0.523**	0.154
	G				0.146	-0.024	-0.470	-0.262**	0.763**	-0.605**	0.726**	-0.371**
Spikelets panicle^{-1} (No.)	P					0.827**	-0.526**	-0.392**	-0.043	-0.266**	0.142	0.037
	G					0.891**	-0.669**	-0.405**	-0.047	-0.290**	0.156	0.106
Grains panicle^{-1} (No.)	P						-0.163	-0.172	-0.152	-0.072	-0.030	0.269**
	G						-0.253**	-0.203**	-0.204**	-0.090	-0.035	0.346**
Fertility%	P							0.482**	-0.271**	0.451**	-0.398**	0.324**
	G							0.609**	-0.433**	0.619**	-0.583**	0.401**
1000 grain wt.(g)	P								-0.028	0.678**	-0.421**	0.363**
	G								-0.062	0.729**	-0.489**	0.425**
Grain length(mm)	P									-0.611**	0.768**	-0.025
	G									-0.667**	0.879**	-0.043
Grain breadth(mm)	P										-0.851**	0.191**
	G										-0.934**	0.274**
L:B ratio	P											-0.126
	G											-0.226**

** Significant at 5% level of significance

Table 2. Phenotypic and Genotypic (G) path coefficients of grain yield with different characters

Traits		Days to 50% flowering (No.)	Plant ht. (cm)	Tillers Plant^{-1} (No.)	Panicle length (cm)	Spikelets panicle^{-1} (No.)	Grains panicle^{-1} (No.)	Fertility %	1000 gr. wt. (g)	Grain Length (mm)	Grain Breadth (mm)	Length: Breadth Ratio	Correlation with yield
Days to 50% flowering (No.)	P	-0.049	-0.014	0.002	-0.023	-0.027	-0.016	0.029	0.018	-0.018	0.023	-0.020	-0.156
	G	-0.206	-0.070	0.014	-0.133	-0.123	-0.080	0.167	0.082	-0.083	0.100	-0.094	-0.228**
Plant ht.(cm)	P	-0.019	-0.067	0.001	-0.030	-0.007	-0.005	0.005	0.005	-0.014	0.011	-0.011	-0.086
	G	-0.075	-0.222	0.007	-0.120	-0.027	-0.023	0.030	0.019	-0.047	0.042	-0.043	-0.206**
Tillers Plant^{-1}(No.)	P	-0.015	-0.004	0.482	0.052	-0.155	-0.182	-0.008	-0.109	0.149	-0.169	0.150	0.153
	G	-0.055	-0.023	0.788	0.011	-0.306	-0.428	-0.065	-0.220	0.324	-0.341	0.309	-0.024
Panicle length (cm)	P	-0.007	-0.007	-0.002	-0.016	-0.002	0.000	0.005	0.003	-0.009	0.007	-0.008	-0.158
	G	0.103	0.086	0.002	0.016	0.023	-0.004	-0.075	-0.042	0.121	-0.096	0.116	-0.371**
Spikelets panicle^{-1} (No.)	P	0.060	0.011	-0.035	0.013	0.109	0.090	-0.057	-0.043	-0.005	-0.029	0.016	0.037
	G	-0.211	-0.044	0.138	-0.052	-0.354	-0.316	0.237	0.144	0.017	0.103	-0.055	0.106
Grains panicle^{-1} (No.)	P	0.164	0.040	-0.188	0.009	0.411	0.497	-0.081	-0.085	-0.076	-0.036	-0.015	0.269**
	G	0.540	0.143	-0.752	-0.033	1.232	1.384	-0.351	-0.281	-0.282	-0.125	-0.048	0.346**
Fertility %	P	-0.122	-0.015	-0.004	-0.069	-0.108	-0.034	0.206	0.099	-0.056	0.093	-0.082	0.324**
	G	-0.052	-0.009	-0.005	-0.030	-0.043	-0.016	0.065	0.039	-0.028	0.040	-0.038	0.401**
1000 gr. wt.(g)	P	-0.199	-0.038	-0.123	-0.112	-0.214	-0.094	0.263	0.546	-0.016	0.370	-0.230	0.363**
	G	-0.138	-0.030	-0.098	-0.092	-0.141	-0.071	0.213	0.349	-0.022	0.254	-0.171	0.425**
Grain Length (mm)	P	-0.033	-0.019	-0.027	-0.052	0.004	0.014	0.024	0.003	-0.089	0.054	0.068	-0.025
	G	0.050	0.027	0.051	0.095	-0.006	-0.025	-0.054	-0.008	0.125	-0.083	0.110	-0.043
Grain Breadth (mm)	P	0.019	0.007	0.015	0.019	0.011	0.003	-0.019	-0.029	0.026	-0.042	0.036	0.191**
	G	-0.338	-0.130	-0.301	-0.421	-0.202	-0.063	0.431	0.508	-0.465	0.696	-0.650	0.274**
Length: Breadth Ratio	P	0.044	0.018	0.033	0.056	0.015	-0.003	-0.043	-0.045	0.082	-0.092	0.108	-0.126
	G	0.154	0.066	0.133	0.246	0.053	-0.012	-0.197	-0.165	0.297	-0.316	0.338	-0.226**

** Significant at 5% level of significance

Residual effect	Phenotypic	Genotypic
	0.726	0.511

had direct effect on grain yield at phenotypic and genotypic level coupled with high positive correlation. Correlation analysis and selection indices suggested that the improvement in grain yield can be obtained by improving total tillers plant^{-1}, grains panicle^{-1}, fertility per cent and 1000-grain weight. Moderate to high value of residual effect obtained in the study showed that some of the important characters have not been included in the present study. Similar results were reported by Sood R. (2008). Similar results for the indirect effect of days to 50 per cent flowering at phenotypic and genotypic level were observed by Babu *et al.* (2002). The results obtained by Deway and Lu (1959) were in accordance with the results of the present investigation for direct effect of the spikelets panicle^{-1} at both genotypic and phenotypic level. The overall results obtained from path analysis are more or less in contingency with earlier findings of Madharvilatha *et al.* (2005).

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