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Research Note

Correlation and path analysis of yield and yield attributes in local rice cultivars (*Oryza sativa* L.)

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Abstract:
An investigation was carried out in 100 local rice cultivars to understand the association among yield components and their direct and indirect influence on the grain yield. The correlation analysis indicated that grain yield was significantly associated with panicle length, test weight, number of tiller per plant, number of productive tiller per plant, number of spikelet per panicle, per cent spikelet fertility and amylase per cent. Path coefficient analysis revealed that days to 50 % flowering, plant height, panicle length, panicle number, number of productive tiller per plant, per cent spikelet fertility and amylase per cent had positive direct effect on grain yield. Hence, selection based on these traits could help to bring simultaneous improvement of yield and yield attributes.

Key words: Correlation, Path Analysis, Rice, Yield

Grain yield and quality are complex characters and are associated with number of component characters which are themselves interrelated. Such dependence often affects their relationship with yield, thereby making correlation ineffective. So, there is a need to path analysis that permits the partitioning of the correlation coefficient into its components, one component being the path coefficient that measures the direct effect of a predictor variable upon its response variable; the second component being the indirect effect(s) of a predictor variable on the response variable through another predictor variable (Dewey and Lu, 1959).Partition the correlation into direct and indirect effects to get the information on actual contribution of each character to yield. Therefore, the present investigation was undertaken to study the association and interrelationships of different yield and quality attributes in the selected lines of rice.

The experimental material consisted of 100 diverse local genotypes of rice, which were grown at Agricultural college Farm, Navile, Shimoga, during *Kharif* 2010, in a 10 x 10 Simple Lattice Design with two replications. Observations were recorded on 13 yield and its attribute characters. 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).
In general, the genotypic correlation coefficients were higher than phenotypic correlation coefficients which is due to the masking effect of environment in genetic association between the characters (Johnson *et al*., 1955). Grain yield per plant was significantly associated with panicle length, test weight, number of tillers per plant, number of productive tillers per plant, number of spikelets per panicle, per cent spikelet fertility and amylase per cent. Eradasappa *et al*. (2007) reported similar findings for plant height, productive tillers per plant, panicle length, number of filled grains per panicle; Siva Kumar and Kannan Bapu (2005) for total number of tillers per plant and panicle length. It is desirable to select genotypes with more productive tillers per plant with more panicle length and per cent spikelet fertility coupled with optimum amylase content to develop high yielding quality rice.

Path coefficient analysis (Table 2) revealed that days to 50 % flowering, panicle length, panicle number, number of productive tiller per plant, per cent spikelet fertility and amylase per cent exhibited high positive direct effect and significant positive association with grain yield. Similar findings were reported by Siva Kumar and Kannan Bapu (2005) for total number of tillers per plant; Panwar and Mashiat Ali (2007) for number of productive tillers per plant and Panwar (2006) for number of filled grains per panicle. Among all these seven characters Days to 50 per cent flowering exhibited highest direct effect on grain yield followed by number of productive tiller per plant, panicle number and panicle length. This indicates that, if other factors are held constant, an increase in Days to 50 per cent flowering individually will reflect in an increased yield. Even number of spikelet per panicle had positive significant correlation with grain yield and its direct effect on grain yield was negative. It is due to the maximum indirect effect of days to 50% flowering which is nullifying its negative direct effect on grain yield. Hence, for improvement of this trait selection efforts would be more effective via days to 50 % flowering instead of selection based on number of spikelet per panicle alone. The residual effect (0.0854) was very low, indicating that much of the variation in yield has been accounted by the characters studied and that the choice of characters was appropriate.

It could be concluded that more emphasis should be given on days to 50 % flowering, panicle length, panicle number, number of productive tiller per plant, per cent spikelet fertility and amylase per cent to bring simultaneous improvement of yield and it's attributes in local rice genotypes as they showed high correlation in addition to maximum direct effects on yield. Based on the above traits twelve local rice lines were selected for further yield evaluation

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Table 1. Estimates of genotypic (above diagonal) and phenotypic (below diagonal) correlation coefficients for 13 characters in local rice genotypes

Traits	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13
X1	1.000	0.001	0.441**	0.110*	-1.111	-0.171	0.115*	-0.003	0.102*	0.075	0.057	0.125*	0.073
X2	0.000**	1.000	0.443**	0.109*	-1.103	-0.172	0.118*	-0.002	0.103*	0.075	0.059	0.125*	0.075
X3	0.105*	0.105*	1.000	0.172**	0.861**	-0.006	-0.092	-0.318	0.231**	0.017	0.001	-0.067	-0.019
X4	0.066	0.066	0.074	1.000	0.401**	-0.006	0.038	0.517**	0.113*	-0.306	-0.081	0.159**	0.422**
X5	-0.196	-0.195	-0.010	0.030	1.000	-1.071	-0.225	0.697**	-1.062	0.312**	-0.333	-0.555	-0.555
X6	-0.115	-0.115	0.014	-0.069	-0.048	1.000	0.051	0.443**	-0.076	0.130*	0.036	0.014	0.116*
X7	0.090	0.091	0.038	0.129*	-0.042	0.030	1.000	0.792**	0.171**	-0.083	0.111*	-0.039	0.124*
X8	-0.053	-0.053	0.069	0.062	-0.015	0.170**	0.641**	1.000	0.273**	-0.006	-0.138	0.098	0.409**
X9	0.088	0.089	0.154 **	0.080	0.103*	-0.072	0.129*	0.129*	1.000	0.002	-0.079	0.101*	0.163**
X10	0.040	0.039	0.034	-0.120	-0.082	0.110*	-0.016	0.001	0.003	1.000	-0.164	0.097	0.206**
X11	0.056	0.057	-0.000	-0.043	-0.008	0.029	0.071	-0.066	-0.080	-0.165	1.000	0.098	-0.229
X12	0.089	0.089	-0.041	0.094	-0.038	0.015	-0.021	0.046	0.097	0.095	0.098	1.000	0.168**
X13	0.076	0.077	-0.032	0.018	0.036	0.076	0.053	0.208**	0.116*	0.155**	-0.171	0.117*	1.000

** Significance at 1 %, * Significance at 5 %

Where,

X_1 - Days to 50 per cent flowering
X_2 - Days to maturity
X_3 - Plant height (cm)
X_4 - Panicle Length(cm)
X_5 - Panicle No.
X_6 - Test weight (g)
X_7 - No. of tiller per plant
X_8 - No. of Productive tiller per plant
X_9 - No. of spikelet per panicle
X_{10} - per cent of spikelet fertility
X_{11} - protein %
X_{12} - Amylase%
X_{13} - Grain yield (g)

Table 2. Estimates of direct and indirect effects of yield components on grain yield at genotypic level in local rice cultivars

Traits	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	‘ r’ value
X1	**12.567**	-12.337	0.002	0.005	-0.145	0.010	-0.043	-0.002	-0.011	0.022	-0.004	0.009	0.073
X2	12.568	**-12.337**	0.002	0.005	-0.144	0.011	-0.044	-0.002	-0.011	0.022	-0.005	0.009	0.075
X3	5.541	-5.459	**0.005**	0.008	0.112	0.000	0.034	0.237	-0.024	0.005	-0.000	-0.005	-0.019
X4	5.541	-1.350	0.001	**0.049**	0.052	0.008	-0.014	0.385	-0.012	-0.090	0.006	0.012	0.422**
X5	-13.964	13.611	0.004	0.020	**0.131**	0.065	0.084	-0.070	-0.073	-0.314	-0.024	-0.024	-0.555
X6	-2.154	2.122	-0.000	-0.006	-0.140	**-0.061**	-0.019	0.329	0.008	0.038	-0.003	0.001	0.116*
X7	1.450	-1.456	-0.000	0.002	-0.029	-0.003	**-0.374**	0.589	-0.018	-0.025	-0.009	-0.003	0.124*
X8	-0.039	0.029	0.001	0.025	-0.012	-0.027	-0.297	**0.744**	-0.028	-0.002	0.011	0.007	0.409**
X9	1.281	-1.269	-0.001	0.006	0.091	0.005	-0.064	0.203	**-0.104**	0.001	0.006	0.007	0.163**
X10	0.946	-0.920	-0.000	-0.015	-0.139	-0.008	0.031	-0.004	-0.000	**0.295**	0.013	0.007	0.206**
X11	0.716	-0.725	-0.000	-0.004	0.041	-0.002	-0.042	-0.103	0.008	-0.048	**-0.077**	0.007	-0.229
X12	1.574	-1.540	-0.000	0.008	-0.043	-0.001	0.015	0.073	-0.011	0.029	-0.008	**0.072**	0.168**

Residual effect= 0.087

Where,

X_1 - Days to 50 per cent flowering
X_2 - Days to maturity
X_3 - Plant height (cm)
X_4 - Panicle Length(cm)
X_5 - Panicle No.
X_6 - Test weight (g)
X_7 - No. of tiller per plant
X_8 - No. of Productive tiller per plant
X_9 - No. of spikelet per panicle
X_{10} - per cent of spikelet fertility
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X_{13} - Grain yield (g)