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RESEARCH ARTICLE

Correlation and path analysis for yield and yield attributes in rice (*Oryza sativa* L.) genotypes

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SUMMARY

The present study was undertaken with the objective to determine the nature and degree of association between yield and it's component characters and their direct, indirect effects on grain yield in rice (*Oryza sativa* L.). Thirty three genotypes were evaluated for identifying their efficiency with respect to yield and yield components. The correlation studies revealed strong positive association of yield with biological yield per hill, number of spikelets per panicle, flag leaf width, flag leaf length and plant height. The result of path analysis indicated that the biological yield per hill had maximum direct effect on grain yield per plant followed by harvest index, number of tillers per hill, flag leaf width and panicle length.

Key Words : Rice, Correlation, Path analysis

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Rice is one of the most important cereal crop and is central to lives of billions of people around the world. Possibly the oldest domesticated grain (10,000 years), rice is staple food for more than 60 per cent of the world's population, especially in Asia and West indies. Rice is predominantly staple food for 17 countries in Asia and pacific, nine countries in North and South America and eight countries in Africa. India has the largest area and ranks second in production after China. Grain yield, being a quantitative trait is a complex character of any crop. Various morphological and physiological plant characters contribute to yield. These yield contributing components are interrelated with each other showing a complex chain of relationship and also highly influenced by the environmental conditions. Breeding strategy in rice mainly depends upon the degree of associated characters as well as its magnitude and nature of variation. For selection in rice, information on correlation co-efficient always has been helpful as a basis for selection in a breeding programme. Path co-efficient analysis partitions into direct and indirect matrix presenting correlation in a more meaningful way. The present research study was conducted to find out the genetic variability among different plant traits, direct and indirect contribution of these parameters towards paddy yield and to identify better combinations as selection criteria for developing high yielding rice genotypes.

MATERIAL AND METHODS

The experimental material comprised of 33 rice including onecheck NDR-359 were grown at Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad. The experiment was laid out in a Randomized Block Design with three replications during *Kharif* 2011. Plant to plant and row to row spacing was maintained at 15 and 20 cm, respectively. The crop was raised as per recommended package of practices. Five competitive plants were selected randomly from each genotype in each replication and observations were recorded on days to 50 per cent flowering,

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plant height, flag leaf length, flag leaf width, panicle number per plant, panicle length,total number of spikelets per panicle, 1000-grain weight and grain yield per plant. The genotypic and phenotypic correlation co-efficients were estimated as suggested by AI-Jibouri *et al.* (1958) and path-co-efficient analysis was done following Dewey and Lu (1959).

RESULTS AND DISCUSSION

The analysis of variance revealed highly significant differences among the genotypes for all the characters studied. The genotypic and phenotypic correlation co-efficients between grain yield and it component characters are presented in Table . Correlation analysis among yield and its contributing character revealed that the genotypic correlation co-efficients in most cases were higher than their phenotypic correlation co-efficients indicating the association is largely due to genetic reason. In some cases phenotypic correlation co-efficients were higher than genotypic correlation indicating suppressing effect of the environment which modified the expression of the characters at phenotypic level.The grain yield showed significant positive correlation with plant height, panicle number per plant, panicle length, total number of spikelets per panicle, flag leaf length and flag leaf width at both genotypic and phenotypic levels. The observed positive correlation of grain yield with various traits was supported by earlier workers *viz.,* Seyed *et al.* (2011) for number of panicles per plant; Kayvan *et al*. (2007) for flag leaf length; Nandan *et al.* (2010) for plant height (Kole *et al.* (2008) for harvest index) Panwar and Ali (2006) for biological yield per hill.This indicates the relative utility of all these traits for selection with respect to grain yield. Selection of any of these characters will have adirect response on grain yield of rice breeding where multiple selection criteria are essential. The days to 50 per cent flowering had positive and significant correlation with flag leaf width, total number of spikelets per panicle, biological yield per hill, days to maturity whereas with plant height and harvest index, it showed significant negative association.

Table 1: Phenotypic(P) and genotypic(G) correlation co-efficient among yield and contributing traits of rice genotypes

No.	Character		Days to 50% flowering	Plant height cm	Flag leaf length cm	Flag leaf width cm	Tillers/ hill	Panicles/ hill	Panicle length cm	Spikelets/ panicle	Biological yield/ hill	Days to maturity	Test weight	harvest index	Economic yield / hill
1.	Days to 50%	G	1.0000	-0.2544*	0.1132	0.2896**	-0.0131	0.0150	0.0732	0.3511***	0.3345**	1.0010***	-0.0938	-0.3159*	0.2131
	flowering	P	1.0000	-0.2536*	0.1136	0.2874**	-0.0105	0.0179	0.0663	0.3456***	0.3038**	0.9779***	-0.0948	-0.2483*	0.1881
2.	Plant height	G		1.0000	0.5470***	0.3681***	0.1400	0.1864	0.5821***	0.4390***	0.4049***	-0.2841**	-0.0566	-0.0585	0.4192***
	cm	P		1.0000	0.5306***	0.3667***	0.1355	0.1860	0.5732***	0.4401***	0.3957***	-0.2759**	-0.0482	-0.0482	0.4052***
3.	Flag leaf	G			1.0000	0.4686***	0.1184	0.1532	0.5280***	0.4169***	0.4208***	0.0847	-0.1507	0.0473	0.5065***
	length cm	P			1.0000	0.4551***	0.1029	0.1460	0.5037***	0.4033***	0.3742***	0.0666	-0.1274	0.0677	0.4574***
4.	Flag leaf	G				1.0000	0.3787***	0.3490***	0.4375***	0.6265***	0.3822***	0.2612*	-0.1273	0.1791	0.5409***
	width cm	P				1.0000	0.3528***	0.3400***	0.4325***	0.6216***	0.3720***	0.2578*	-0.1115	0.1440	0.5171***
5.	Tillers/	G					1.0000	0.9643***	0.0367	0.1124	0.3530**	-0.0114	-0.2855**	-0.0762	0.3997***
	hill	P					1.0000	0.9300***	0.0422	0.1067	0.3149**	-0.0078	-0.2678**	-0.0301	0.3687***
6.	Panicles/	G						1.0000	0.1278	0.1471	0.4527***	0.0159	-0.2932**	-0.0762	0.4520***
	hill	P						1.0000	0.1306	0.1451	0.4234***	0.0185	-0.2762**	-0.0745	0.4349***
7.	Panicle	G							1.0000	0.2602 *	0.3164 **	0.0312	0.1969*	-0.1373	0.3494***
	length cm	P							1.0000	0.2588*	0.3233**	0.0341	0.2141*	-0.0910	0.3587***
8.	Spikelets/	G								1.0000	0.5706 ***	0.3417***	-0.2831**	-0.2453	0.5257***
	panicle	P								1.0000	0.5527***	0.3406***	-0.2674**	-0.1960	0.5050***
9.	Biological	G									1.0000	0.3201 **	-0.4502***	-0.3384*	0.9034***
	yield/ hill	P									1.0000	0.3258**	-0.3800***	-0.2448*	0.8648***
10.	Days to	G										1.0000	-0.0937	-0.3160*	0.1972
	maturity	P										1.0000	-0.0852	-0.2574*	0.2032
11.	Test	G											1.0000	0.0019	-0.4066***
	weight	P											1.0000	0.0097	-0.3388***
12.	harvest	G												1.0000	0.1558
	index	P												1.0000	0.1168
13.	Economic	G													1.0000
	yield/ hill	P													1.0000

*, ** and *** Indicate significance of value at P=0.05, 0.01 and 0.1, respectively

Table 2 : Partitioning of genotypic correlation with grain yield into direct (bold) and indirect effect of yield contributing traits in 33 rice genotypes

No.	Character	Days to 50% flowering	Plant height cm	Flag leaf length cm	Flag leaf width cm	Tillers/ hill	Panicles/ hill	Panicle length cm	Spikelets/ panicle	Biological yield/ hill	Days to maturity	Test weight	harvest index
1.	Days to 50% flowering	0.2811	-0.0715	0.0318	0.0814	-0.0037	0.0042	0.0206	0.0987	0.0941	0.2814	-0.0264	-0.0888
2.	Plant height cm	0.0254	-0.1000	-0.0547	-0.0368	-0.0140	-0.0186	-0.0382	-0.0439	-0.0405	0.0284	0.0057	0.0058
3.	Flag leaf length cm	-0.0002	-0.0011	-0.0021	-0.0010	-0.0002	-0.0003	-0.0011	-0.0009	-0.0009	-0.0002	0.0003	-0.0001
4.	Flag leaf width cm	-0.0398	-0.0506	-0.0644	-0.1375	-0.0521	-0.0480	-0.0602	-0.0862	-0.0526	-0.0359	0.0175	-0.0246
5.	Tillers/ hill	-0.0044	0.0468	0.0396	0.1266	0.3343	0.3223	0.0123	0.0376	0.1180	-0.0038	-0.0954	0.0055
6.	Panicles/ hill	-0.0041	-0.0507	-0.0416	-0.0949	-0.2622	-0.2719	-0.0348	-0.0400	-0.1231	-0.0043	0.0797	0.0207
7.	Panicle length cm	0.0110	0.0877	0.0796	0.0659	0.0055	0.0193	0.1507	0.0392	0.0477	0.0047	0.0297	-0.0207
8.	Spikelets/ panicle	0.0565	0.0707	0.0671	0.1008	0.0181	0.0237	0.0419	0.1610	0.0918	0.0550	-0.0456	-0.0395
9.	Biological yield/ hill	0.3678	0.4452	0.4627	0.4202	0.3882	0.4977	0.3479	0.6274	1.0995	0.3520	-0.4950	-0.3721
10.	Days to maturity	-0.2888	0.0820	-0.0244	-0.0754	0.0033	-0.0046	-0.0090	-0.0986	-0.0924	-0.2885	0.0270	0.0912
11.	Test weight	-0.0089	-0.0054	-0.0143	-0.0121	-0.0270	-0.0278	0.0186	-0.0268	-0.0426	-0.0089	0.0947	0.0002
12.	harvest index	-0.1827	-0.0338	0.0273	0.1035	0.0096	-0.0441	-0.0794	-0.1418	-0.1957	-0.1827	0.0011	0.5782
13.	Economic yield/ hill	0.2131	0.4192	0.5065	0.5409	0.3997	0.4520	0.3494	0.6257	0.9034	0.1972	-0.4066	0.1558

Table 3 : Partitioning of phenotypic correlation with grain yield into direct (bold) and indirect effect of yield contributing traits in 33 rice genotypes

No	Character	Days to 50% flowering	Plant height cm	Flag leaf length cm	Flag leaf width cm	Tillers/ hill	Panicles/ hill	Panicle length cm	Spikelets/ panicle	Biological yield/ hill	Days to maturity	Test weight	harvest index
1.	Days to 50% flowering	-0.1329	0.0337	-0.0151	-0.0382	0.0014	-0.0024	-0.0088	-0.0459	-0.0404	-0.1299	0.0126	0.0330
2.	Plant height cm	0.0169	-0.0665	-0.0353	-0.0244	-0.0090	-0.0124	-0.0381	-0.0293	-0.0263	0.0184	0.0032	0.0032
3.	Flag leaf length cm	0.0071	0.0330	0.0621	0.0283	0.0064	0.0091	0.0313	0.0251	0.0232	0.0041	-0.0079	0.0042
4.	Flag leaf width cm	0.0259	0.0331	0.0410	0.0902	0.0318	0.0307	0.0390	0.0561	0.0335	0.0232	-0.0101	0.0130
5.	Tillers/ hill	-0.0018	0.0231	0.0176	0.0603	0.1708	0.1588	0.0072	0.0182	0.0538	-0.0013	-0.0457	-0.0051
6.	Panicles/ hill	-0.0020	-0.0211	-0.0166	-0.0385	-0.1055	-0.1134	-0.0148	-0.0165	-0.0480	-0.0021	0.0313	0.0085
7.	Panicle length cm	0.0048	0.0419	0.0368	0.0316	0.0031	0.0095	0.0730	0.0189	0.0236	0.0025	0.0156	-0.0066
8.	Spikelets/ panicle	0.0095	0.0121	0.0111	0.0171	0.0029	0.0040	0.0071	0.0275	0.0152	0.0094	-0.0073	-0.0054
9.	Biological yield/ hill	0.2691	0.3506	0.3315	0.3295	0.2790	0.3750	0.2854	0.4896	0.8858	0.2886	-0.3366	-0.2168
10.	Days to maturity	0.0686	-0.0193	0.0047	0.0181	-0.0005	0.0013	0.0024	0.0239	0.0228	0.0701	-0.0060	-0.0180
11.	Test weight	-0.0009	-0.0004	-0.0011	-0.0010	-0.0024	-0.0025	0.0019	-0.0024	-0.0034	-0.0008	0.0090	0.0001
12.	harvest index	-0.0762	-0.0148	0.0208	0.0442	-0.0092	-0.0229	-0.0279	-0.0602	-0.0751	-0.0790	0.0030	0.3070
	Economic yield/ hill	0.1881	0.4052	0.4574	0.5171	0.3687	0.4349	0.3537	0.5050	0.8648	0.2032	-0.3388	0.1168

The plant height had significant positive correlation with flag leaf length, flag leaf width, panicle length, total number of spikelets per panicle and biological yield per hill which is supported by Nayak *et al*. (2001). Panicle length had similar association with flag leaf length, flag leaf width and total number of spikelets per panicle. The biological yield per hill showed negative and significant correlation with 1000 grain weight. Similar findings were observed by Halil and Necmi (2003). The panicle length exhibited positive non-significant correlation with number of panicles per hill, but Shakthivel *et al.* (2001) observed positive and significant correlation between these two characters.

A number of variables are included in correlation studies, the indirect association become complex and important. Hence, path co-efficient analysis has been found useful in finding out direct and indirect causes of correlation and permits a detailed analysis of forces acting to produce a given correlation. The direct and indirect effects of yield components on yield are presented in Table 2 and 3. Among the yield components biological yield per hill showed maximum direct effect followed by harvest index and total number of tillers per hill exhibited significant positive correlation with grain yield, indicating a true relationship among these traits. This may indicate that the direct selection for biological yield per hill, harvest index and number of tillers per hill would likely to be effective in increasing grain yield.Positive direct effects of various characters on grain yield observed in the present study are in accordance with the findings of Shweta *et al.* (2011) for biological yield per hill, Madhavilatha *et al.* (2005) and Kumar (2011)for harvest index and Basavaraja *et al.* (1997) for number of tillers per hill. Days to 50 per cent flowering showed the highest direct negative effect on yield followed by number of panicles per hill. Abarshahr *et al.* (2011) also reported negative direct effect of days to 50 per cent flowering on grain yield. Though flag leaf length and total number of spikelets per panicle exhibited positive significant correlation but their direct contribution towards grain yield was very low.Though test weight showed positive direct effect on yield but its correlation with yield is negative due to negative indirect effect through biological yield per hill and number of tillers per hill. Plant height and total number of panicles per hill had negative direct effect on yield. Number of panicles per hill showed negative direct effect on yield but has positive phenotypic correlation due to positive indirect effect through biological yield per hill and number of tillers per hill. The effect of residual factor on yield was negligible thereby suggesting that no other major yield component was left over in the present study.

The present findings revealed that more emphasis should be given while selection on biological yield per hill, total number of spikelets per panicle and flag leaf width to increase grain yield in rice.

REFERENCES

Abarshahr, M., Rabiei, B. and Habibollah, S.L.(2011).Genetic variability, correlation and path analysis in rice under optimum and stress irrigation regimes. *Not.Sci.Biol.*, **3**(4):134-142.

Al Jibouri, H.A., Miller, P.A. and Robinson, H.F. (1958). Genotypic and environmental variation and covariation in upland rice crop of inter specific origin. *Agron. J.*, **50**:626-636.

Basvaraja, P., Rudradhaya, M. and Kulkarni, R.S. (1997). Genetic variability, correlation and path analysis of yield components in two F4 populaion of fine grained rice. *Mysore J. Agric. Sci.*, **13**(1):95-98.

Dewey, D.R. and Lu, K.H. (1959). Genetic variability, correlation and path co-efficient analysi of components of crested wheat grass seed production. *Agron J.*, **51**:515-518.

Halil, S.R. and Necmi, B. (2003). Correlation and path co-efficient analysis for some yield-related traits in rice (*Oryza sativa* L.) under thrace conditions *Turk. J. Agric.*, **27**: 77-83.

Kayvan, A., Mohammad, H.F. and Ezatollah, F. (2007). Correlation and path co-efficient analysis for some yield related traits in rice genotypes. *Asian J. Pl. Sci*., **6**(3): 513-517.

Kole, P.C.,Chakraborty, N.R. and Bhat, J.S.(2008). Analysis of variability, correlation and path co-efficient in induced mutants of aromatic non-basmati rice.*Trop.Agric.Res.& Ext.*, **11**:60-64.

Madhavilatha, L., Sekhar, M.R., Suneetha, Y. and Srinivas, T. (2005). Genetic variability, correlation and path analysis for yield and quality traits in rice. (*Oryza sativa* L.) *Res.Crops*, **6** (3):527-534.

Nandan, R., Sweta and Singh, S.K.(2010). Character association and analysis in rice(*Oryza sativa* L.) genotypes. *World J. Agric. Sci*., **6**(2): 201-206.

Nayak, A.R., Chaudhary, D. and Reddy, J.N. (2001). Correlation and path analysis in scented rice (*Oryza sativa* L.). *Indian J. Agric. Res*., **35**(3): 185-189.

Panwar, L.L. and Ali (2006).Genetic variability, heritability and genetic advance for panicle characters in transplanted rice. *Crop Res.*, **19** (3): 250-258.

Sarawgi, A.K., Rastogi, N.K. and Sani, D.K. (2000). Studies on some quality parameters of indigenous rice in Madhya Pradesh. *Ann. Agric. Res*., **21** (2): 258-261.

Seyed, M.S. (2011). Heritability, phenotypic correlation and path co-efficient studies for some agronomic characters in land race Rice varieties. *World Appl. Sci. J.*,**13**(5):1229-1233.

Shweta, T., Verma, O.P., Dwived, D.K., Yadavendra, Kumar, Singh, P.K. and Verma, G.P. (2011). Association studies in rice hybrids under saline alkaline environment. *Environ. & Eco.*, **29** (3B):1557-1560.

Singh,Yadavendra, Kumar, B.N.,Verma,O.P., Shweta, T. and Dwivedi, D.K. (2011). Correlation and path co-efficient analysis in scented rice under sodicity. *Environ.& Eco.*, **29** (3B):1550-1556.