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Research Note

Path coefficient analysis studies in rice (*Oryza sativa* L.) for quantitative and qualitative traits

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Abstract
Path coefficient studies were carried out for yield and quality traits in 74 rice genotypes involving hybrids and their parental lines. Grains per panicle, productive tillers per plant and amylose content were significant and positive direct effects on yield at genotypic level. Grains per panicle, productive tillers per plant and amylose content contributed maximum to higher grain yield compared to other characters, thus, selection for these characters helps in selection of superior cross combinations for improvement of yield.

Key words
Path coefficient, direct effect, Indirect effect

"Rice is life" was the theme of International Year of Rice 2006 signifies its devastating importance on global food system. It is the staple food for two thirds of the Indian population. It contributes 43 per cent of caloric requirement and 20-25% of agricultural income. Grain yield is a complex character which is highly influenced by the environment, hence direct selection for yield alone limits the selection efficiency and ultimately results in limited success in yield improvement. Thus, effective improvement in yield may be brought about through selection of quantitative traits *viz*., number of productive tillers per plant, panicle length, number of grains per panicle and 1000 grain weight. Yield component characters show association among themselves and also with yield. Therefore, selection based on *per se* performance is not effective thus; consideration of other yield components at the same time more proficient. Resourceful crop improvement scheme refers to the collection of superior alleles into a single targeted genotype.

The nature and extent of genetic variation governing the inheritance of characters and association will facilitate effective genetic improvement. Plant Breeder has to find significant association among yield and yield component traits, and effect of yield component traits on grain yield to predict the superior cross combinations and to select ideal plant type with increased yield. The present study was undertaken to derive information on correlation among yield and yield component traits and to estimate the direct and indirect effects of yield component traits on grain yield. This helps in selection of superior cross combinations for yield improvement.

The experimental material comprising seventy four rice genotypes were evaluated in randomized block design with 3 replications during (Rabi) season of 2011-2012 in at AC & RI, Killikulam. Twenty-five days old seedlings were transplanted in the main field in three -meter row length with a spacing of 20 × 20 cm with single seedling per hill. Standard agronomic practices compatible to this ago-ecological zone were adopted to ensure good crop growth. Path coefficient was worked out as method suggested by Al-Jibouri *et al*. (1958) and Dewey and Lu (1959), respectively. The utility of the correlation estimates considerably increased by partitioning into genotypic, phenotypic and environmental components (Burton 1952). The path coefficient analysis therefore specifies the causes and measures the relative contribution of each variable to yield (Lenka and Misra, 1973).

The estimates of correlation coefficients revealed only the relationship between yield and yield associated characters, but did not show the direct and indirect effects of different traits on yield *per se*. This is because the attributes which are in association do not exist by themselves, but are linked to other components. The path coefficient analysis suggested by Dewey and Lu (1959) specified the effective measure of direct and indirect causes of association and also depicts the relative importance of each factor involved in contributing to the final product that is, yield. In

order to find out the cause and effect relationship between grain yield and its related characters, path analysis was taken up in the present investigation.

The results from path analysis depict clearly that number of grains per panicle exerted positive and very high direct effect on single plant yield as reported by Deepa Sankar *et al.* (2006) followed by number of productive tillers per plant, whereas days to fifty per cent flowering, plant height, panicle length, thousand grain weight had negative direct effect on yield which was in concordance with the results of Sabesan *et al*. (2009). Except breadth wise expansion and amylose content, other three quality traits recorded negative indirect effect (Fig.1. & Table1). Nandan *et al.* (2010) reported that selection based grains per panicle was a desirable trait to improve single plant yield.

Days to 50% flowering had negative indirect effects through grains per panicle, plant height, indirect effect through days to 50% flowering, panicle length, breadth wise expansion ratio, volume expansion ratio and amylose content. Grains per panicle had positive indirect effect on yield through days to 50% flowering, productive tillers per plant, L/B ratio, linear elongation ratio, breadth wise expansion ratio and amylose content negative indirect effect through plant height, panicle length, 1000 grain weight.

The indirect effect of thousand grain weight on yield was positive for days to 50% flowering, plant height, grains per panicle, L/B ratio and amylose content similar results were reported by Yogameenakshi *et al.* (2004). L/B ratio had positive indirect effect on yield through days to 50 % flowering, plant height, productive tillers per plant, thousand grain weight, breadth wise expansion ratio and volume expansion. Negative indirect effects were exhibited by panicle length, grains per panicle, linear elongation ratio and amylose content. Whereas, Linear elongation ratio had positive indirect effect through days to 50 % flowering, plant height, breadth wise expansion ratio. Negative indirect effect through panicle length, productive tillers per plant, grains per panicle, thousand grain weight, L/B ratio. Breadth wise expansion ratio had positive indirect effect through plant height, productive tillers per plant, grains per panicle, thousand grain weight and amylose content. Volume expansion ratio had positive indirect effect on yield through days to 50 % flowering, productive tillers per plant, grains per panicle, L/B ratio, linear elongation ratio and Breadth wise expansion ratio. Amylose content had positive indirect effect on yield through days to 50 % flowering, plant height, grains per panicle, L/B ratio and Breadth wise expansion ratio.

Arumugachamy *et al.* (1993) reported panicles per plant had positive indirect effect on yield through days to flowering, panicle length through grains per panicle, straw yield and days to flowering. Sarma and Roy (1993) observed panicle length had positive indirect effect on yield through grains per panicle. Reports of Nandan *et al.* (2010) indicated that number of grains per panicle enchanced yield. Kishore *et al.* (2008) reported same for enchancing yield through for number of productive tillers.

Path coefficient analysis permits the partition of correlation coefficients into direct and indirect effects and gives a more realistic relationship of the characters and helps in identifying the effective components. Therefore in this study, path analysis reveals that grains per panicles and number of productive tillers per plant were reliable for selection programme.

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Table 1. Direct and Indirect effects of different quantitative and qualitative characters on grain yield

Characters	DF	PH	NPT	PL	GP	GW	L/B ratio	LER	BER	VER	AC
DF	**-0.097**	-0.003	-0.093	0.002	-0.143	0.002	0.036	0.000	0.023	0.003	-0.001
PH	-0.010	**-0.031**	0.098	-0.001	0.001	0.002	0.010	0.003	-0.004	-0.007	-0.000
NPT	0.027	-0.009	**0.334**	-0.002	0.156	0.001	-0.000	0.027	0.008	-0.012	-0.009
PL	0.026	-0.004	0.080	**-0.007**	0.150	-0.010	-0.017	-0.012	0.008	-0.010	0.029
GP	0.024	-0.000	0.092	-0.002	**0.567**	-0.004	0.024	0.014	0.000	-0.021	0.027
GW	0.005	0.002	-0.008	-0.002	0.076	**-0.033**	0.051	-0.014	-0.016	-0.021	0.016
L/B	0.013	0.001	0.001	-0.000	-0.050	0.006	**-0.273**	-0.018	0.088	0.046	-0.010
LER	0.000	0.001	-0.089	-0.001	-0.076	-0.005	-0.046	**-0.104**	0.014	0.015	0.028
BER	-0.011	0.001	0.013	-0.000	0.000	0.003	-0.120	-0.008	**0.200**	-0.006	0.007
VER	0.003	-0.003	0.052	-0.001	0.153	-0.009	0.159	0.020	0.016	**-0.079**	0.026
AC	0.001	0.000	-0.031	-0.002	0.155	-0.005	0.028	-0.030	0.013	-0.021	**0.099**

Diagonal values represent direct effects Residual effect = 0.553926

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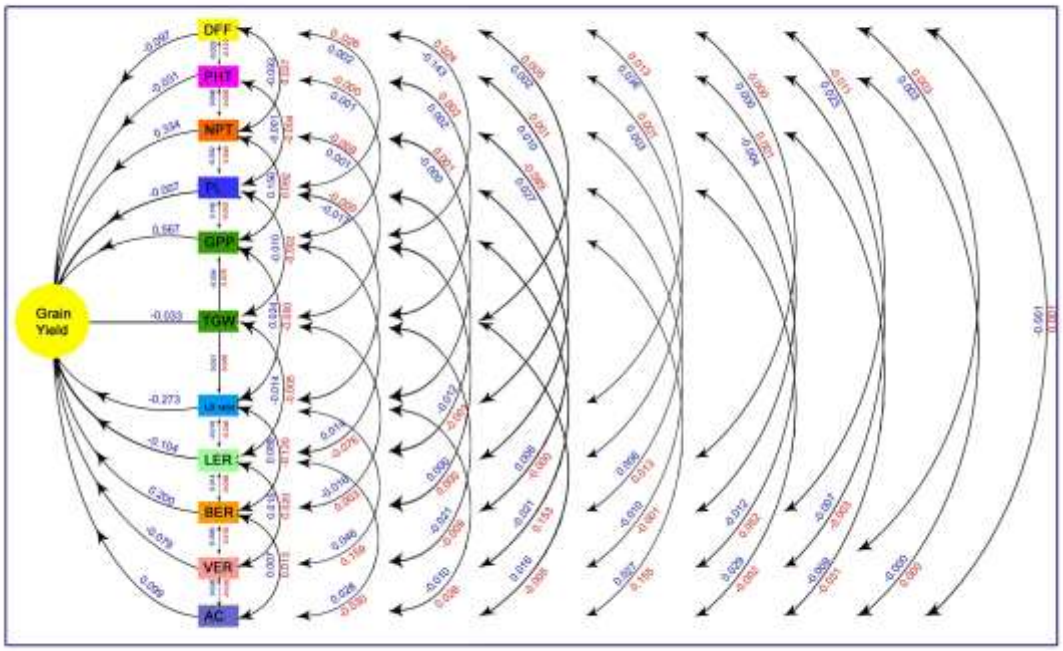

Fig. 1. Path diagram for Direct and Indirect effects of different quantitative and qualitative characters on grain yield


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