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Character Association and Path Analysisstudies for Quantitative Traits in Hybrid Rice (*Oryza sativa* L.)

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ABSTRACT

Forty eight rice hybrids of different parents were studied for correlation and path analysis at IIRR, Hyderabad.A critical analysis of both correlation coefficients and path analysis together for grain yield and its components indicated that, panicle weight, number of productive tillers per plant, numbers of filled grains per panicle and 1000 grain weight were more important in rice productivity. Other important traits to be considered for high grain yield was panicle length, number of total tillers per plant, as there always existed a significant desirable association between this trait and number of grains per panicle. Apart from these, spikelet fertility (%) and 1000 grain weight also exhibited positive direct effects on grain yield per plant.

Key words: *Correlation, Pathanalysis, Hybridrice.*

INTRODUCTION

India has made notable technological progress in rice cultivation over the last decades, which has contributed to achieving food security despite doubling of population and a reduction in arable land since its independence. The hybrid rice is being the new answer to the growing hunger of world population; by the way of its elevated yield potential, agronomic performance and disease resistance. Correlation and path coefficients are pre-requisites for improvement of any crop including rice in any trait by selection of superior genotypes. Yield component directly or indirectly increasing grain yield if the components are highly heritable and genetically independent or positively correlated with grain yield. Knowledge of correlation between yield and its contributing characters are basic and fore most endeavour to find out guidelines for plant selection.

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Partitioning of total correlation into direct and indirect effect by path analysis helps in making the selection more effective. Keeping in view the above facts, the present investigation was undertaken to know variability and correlation among yield and its contributing characters using 48 rice hybrids.

MATERIALS AND METHODS

The experiment was conducted at Indian Institute of Rice Research, Rajendranagar during *rabi* season, 2017. The research was conducted with forty eight rice hybrids generated with 16 parents. The research was set in a randomized block design with two replications. In this experiment, Water management; weeding and insects & pest control was done when it is required. Data was collected from five randomly selected plants from each row on observations viz., days to fifty per cent flowering, plant height, panicle length, panicle weight, number of total tillers per plant, number of productive tillers per plant, number of filled grains per panicle, spikelet fertility percentage, 1000 grain weight and grain yield per plant were recorded for the study. The analysis of variance was done using WINDOSTAT software. Normal Pearson's correlation was calculated using WINDOSTAT software. Genotypic and phenotypic correlation coefficients were calculated following snedechor et al.[9] Path coefficient analysis was estimated according to the method suggested by Dewey and Lu [3].

RESULTS AND DISCUSSION

The analysis of variance revealed highly significant variation among the hybrids for all the characters studied. Simple correlation analysis among yield and itscontributingcharactersareshowninTable1.An analysis on character association, to assess the relationship among yield and its components and to have an insight into the causes for higher yield in hybrids based on the data recorded on 48 hybrids was done. The grain yield per plant had significant positive association with panicle length, panicle weight, and number of total tillers per plant, number of productive tillers per plant, number of filled grains per panicle, spikelet fertility (%) and 1000 grain weight. Similar kind of observation were reported by Abdul Fiyaz et al[1]and Rafii et al.[6] for plant height; Ravindra Babu et al.[8] for number of productive tillers per plant; Zulqarnain et al.[12] for number of filled grains per panicle. Hence, these traits could be considered as criteria for selection for higher yield as they were mostly inter related positively in addition to a positive association with grain yield.

The character days to 50 % flowering and days to maturity expressed significant negative significant association with grain yield per plant, panicle length, panicle weight, number of total tillers per plant, number of productive tillers per plant, number of filled grains per panicle and 1000 grain weight as reported by Venkanna et al.[11] .Decreased flowering duration resulted in increase of panicle length and number of filled grains per panicle, which intern helped to realize higher grain yield per plant. Positive and significant correlation was observed for plant height with panicle length, panicle weight and also with number of total tillers per plant. It indicated that plant height plays important role in enhancement of yield potential in rice. Thus, breeding for semi tall varieties with sturdy culm rather than dwarf varieties would be a perspective approach. Krishna et al.[4] reported a positive correlation between grain yield and plant height.

It was observed that number of productive tillers per plant exhibited significant positive association with panicle length, number of filled grains per panicle and grain yield per plant. Bhadru et al.[2] and Ravindra Babu et al.[8] reported a strong association between productive tillers per plant and grain yield per plant. Panicle length showed significant positive correlation with number of filled grains per panicle, spikelet fertility (%) and grain yield per plant. Earlier researchers, Rajamadhan et al.[7] and Bhadru et al.[2] reported similar results. The trait number of filled grains per panicle is considered as an important component for realizing high yield, because it exhibited significant and positive association with days to 50% flowering, plant height, number of productive tillers per plant

and panicle length while it registered negative significant relationship with 1000 grain weight Nandan et al.[5]. The trait, spikelet fertility (%) was found to possess positive and significant association with grain yield per plant. It also expressed positive relationship with panicle length and number of filled grains per panicle. No significant association was observed between 1000 grain weight and grain yield per plant and also with days to 50% flowering and number of filled grains per panicle. From the study it was concluded that there is change in the association between different yield components, number of productive tillers per plant and number of filled grains per panicle are very crucial for higher yields, as they exhibited significant positive correlations with grain yield per plant. The other important traits to be considered are plant height and panicle length. Many times, in rice, semi tall plant types (110-115 cm) with sturdy culm (non-lodging) would yield better than the dwarf ones.

Based on the data recorded on 48 hybrids were estimated the direct and indirect effects of yield attributing traits over locations and results are presented in Table 2 & Fig.1&2.

Days to 50% flowering had negative direct effect on grain yield at both phenotypic (-4.9587) and genotypic levels (-6.6793). Positive but low level of indirect effects were exhibited on grain yield per plant by days to 50% flowering by this trait via plant height, panicle length, panicle weight, number of tillers per plant, number of productive tillers per plant, number of filled grains per panicle and 1000 grain weight at both phenotypic and genotypic levels.

Plant height had positive direct effect at genotypic level (0.0061) on grain yield as was reported by Rajendra Kumar (2012). The indirect effect of this trait on grain yield through plant height, panicle length, panicle weight, number of tillers per plant, number of productive tillers per plant, number of filled grains per panicle and 1000 grain weight at genotypic level were also positive.

Number of productive tillers per plant exhibited positive direct effect (0.2828 and 0.6264 at phenotypic and genotypic level respectively) on grain yield per plant. Similar results were reported by Ravindra Babu et al.[8] and Thirumala Rao et al.[10]. It is interesting to note that productive tillers had positive indirect effects through all the other yield components except days to 50% flowering and days to maturity. Positive indirect effect was observed on grain yield by plant height, panicle length, panicle weight, number of tillers per plant, number of filled grains per panicle, spikelet fertility and 1000 grain weight.

Positive direct effect was exerted by number of filled grains per panicle on grain yield per plant at both phenotypic (0.3526) and genotypic (0.2528) level which indicated its greater role in higher yield. Earlier Thirumala Rao et al[10] and Venkanna et al[10]. also reported that productive tillers were very important among yield components. This trait also displayed desirable effects through all the traits studied except days to 50% flowering and days to maturity. Another important yield contributing trait is spikelet fertility (%), as evident from positive direct effect of 0.0681 and 0.0474 on grain yield at phenotypic and genotypic level respectively. Indirect positive influence of spikelet fertility on grain yield was observed through days to 50% flowering, panicle weight, number of tillers per plant, number of productive tillers per plant, number of filled grains per panicle, 1000 grain weight and days to maturity while it showed negative influence through plant height and panicle length,

The trait, 1000 grain weight exerted positive direct effect (0.2157 and 0.2940) at phenotypic and genotypic level on grain yield per plant. Indirect positive influence of 1000 grain weight on grain yield was observed through panicle length, panicle weight, number of tillers per plant, number of productive tillers per plant, number of filled grains per panicle and spikelet fertility[8,10]. Whereas negative indirect effect was observed on grain yield through days to 50 % flowering, plant height and days to maturity

Path coefficient analysis revealed that number of filled grains per panicle exerted highest positive direct effect on grain yield followed by number of productive tillers per

plant, 1000 grain weight, spikelet fertility (%), panicle length, panicle weight and days to maturity at both phenotypic and genotypic level. The negative direct effect was noticed on grain yield by days to 50% flowering and plant height at phenotypic and genotypic level. The results were in conformity with Ravindra Babu et al [8] number of productive tillers per plant and panicle length, for number of filled grains per panicle. A critical analysis of both character association and path analysis indicated that among the yield components investigated, number of productive tillers per plant number of filled grains per panicle, spikelet fertility and 1000 grain weight were determined as most critical ones as both the correlation coefficients as well the direct effects were high with grain yield per plant. Other important traits for high grain yield were panicle length, panicle weight and number of total tillers per plant.

Table 1: Simple correlation coefficients for grain yield and yield components

	Days to 50% flowering	Plant Height (cm)	Panicle length (cm)	Panicle weight	Total tillers/plant	Productive tillers/plant	Filled grains/panicle	Spikelet fertility	1000 grain weight	Days to maturity	Grain yield per plant
Days to 50% flowering	1.0000	-0.0412	-0.4153**	-0.2655*	-0.3004*	-0.4151**	-0.3341**	0.0331	-0.2551*	0.9992**	-0.4033**
Plant Height (cm)		1.0000	0.4791**	0.1835	0.2183*	0.0208	0.1075	-0.1512	-0.0350	-0.0358	0.0314
Panicle length (cm)			1.0000	0.3346**	0.2681*	0.2593*	0.2735*	-0.0638	0.2425*	-0.4101**	0.3598**
Panicle weight(g)				1.0000	0.4756**	0.4577**	0.3782**	0.2945*	0.2644*	-0.2586*	0.4473**
Total tillers/plant					1.0000	0.8353**	0.6758**	0.1020	0.5181**	-0.2961*	0.5678**
Productive tillers/plant						1.0000	0.7913**	0.1714	0.4697**	-0.4071**	0.7349**
Filled grains/panicle							1.0000	0.1672	0.4025**	-0.3276**	0.7219**
Spikelet fertility								1.0000	0.2747*	0.0394	0.2956*
1000 grain weight									1.0000	-0.2529*	0.5549**
Days to maturity										1.0000	-0.3889**
Grain yield per plant											1.0000

*Significant at 5% level - 0.24 **Significant at 1% level – 0.31

Table 2: Phenotypic (P) and Genotypic (G) Path coefficient analysis of yield and yield contributing characters in hybrid rice

Character		Days to 50% Flowering	Plant Height (cm)	Panicle Length (cm)	Panicle weight	No. of tillers/ plant	No of prod. Tillers / Plant	No.of filled grains/ Panicle	Spikelet fertility	1000 Grain Weight (g)	Days to maturity	Grain Yield/ Plant (g)
Days to 50% flowerin	**P**	**-4.9587**	0.192	1.9407	1.2801	1.4241	1.9956	1.6407	-0.1375	1.1953	-4.9541	-0.4142**
	G	**-6.6793**	0.2949	2.9688	1.8075	2.1059	2.8580	2.2541	-0.2622	1.8056	-6.6756	-0.4219**
Plant Height (cm)	**P**	0.0027	**-0.0702**	-0.0325	-0.012	-0.0143	-0.0012	-0.007	0.0086	0.0025	0.0023	0.0297
	G	-0.0003	**0.0061**	0.0030	0.0012	0.0014	0.0001	0.0007	-0.0011	-0.0002	-0.0002	0.0368
Panicle Length (cm)	**P**	-0.0459	0.0544	**0.1173**	0.0354	0.0285	0.028	0.0298	-0.0072	0.0263	-0.0453	0.3466**
	G	-0.0438	0.0492	**0.0986**	0.0367	0.0295	0.0277	0.0287	-0.0071	0.0262	-0.0433	0.3928**
Panicle weight	P	-0.0209	0.0139	0.0245	**0.0811**	0.0358	0.0357	0.0301	0.0231	0.0198	-0.0204	0.4408**
	G	-0.0269	0.0197	0.0371	**0.0995**	0.0511	0.0472	0.0382	0.0306	0.0286	-0.0263	0.4695**
Number of tillers / plant	**P**	0.0328	-0.0233	-0.0278	-0.0503	**-0.1142**	-0.0912	-0.0726	-0.0115	-0.0551	0.0324	0.5433**
	G	0.1342	-0.1008	-0.1275	-0.2185	**-0.4256**	-0.3745	-0.3078	-0.0446	-0.2383	0.1321	0.6082**
Number of prod. tillers /	**P**	-0.1138	0.005	0.0675	0.1245	0.2259	**0.2828**	0.2145	0.0455	0.123	-0.1118	0.6998**
	G	-0.2680	0.0152	0.1761	0.2969	0.5511	**0.6264**	0.5182	0.1150	0.3186	-0.2625	0.7741**
Number of filled grains/p	**P**	-0.1167	0.0352	0.0896	0.1309	0.2241	0.2674	**0.3526**	0.0544	0.1348	-0.1145	0.7034**
	G	-0.0853	0.0293	0.0736	0.0971	0.1828	0.2092	**0.2528**	0.0461	0.1074	-0.0836	0.7256**
Spikelet fertility	**P**	0.0019	-0.0084	-0.0042	0.0194	0.0068	0.011	0.0105	**0.0681**	0.0175	0.0023	0.2663**
	G	0.0019	-0.0088	-0.0034	0.0145	0.0050	0.0087	0.0086	**0.0474**	0.0141	0.0021	0.3103**
1000 Grain Weight	**P**	-0.052	-0.0078	0.0484	0.0527	0.1041	0.0938	0.0825	0.0554	**0.2157**	-0.0515	0.5196**
	G	-0.0795	-0.0102	0.0783	0.0844	0.1646	0.1495	0.1248	0.0873	**0.2940**	-0.0789	0.5765**
Days to maturit y	P	4.8564	-0.1612	-1.8769	-1.221	-1.3777	-1.9222	-1.5777	0.1675	-1.1603	**4.8610**	-0.3995**
	G	6.6252	-0.2579	-2.9117	-1.7497	-2.0576	-2.7781	-2.1928	0.2990	-1.7793	**6.6289**	-0.4073**
Genotypic residual effect = 0.45 Phenotypic residual effect = 0.54 BOLD values are direct effects												

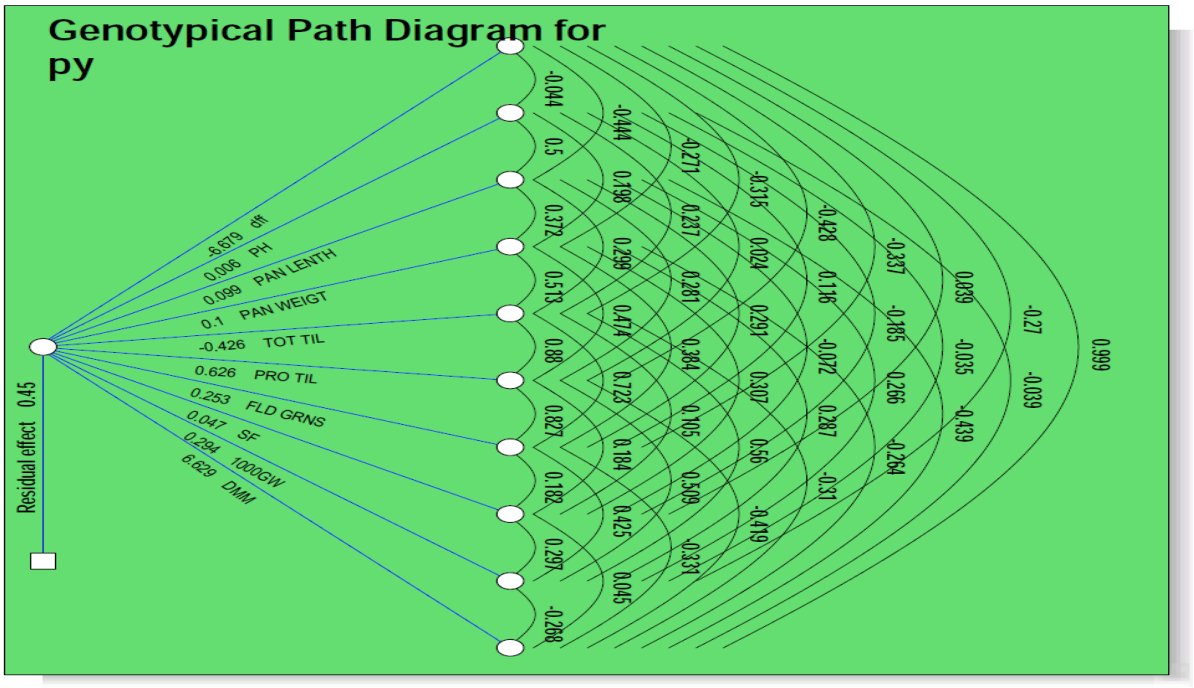

Fig. 1: Genotypical path diagram for grain yield per plant (g)

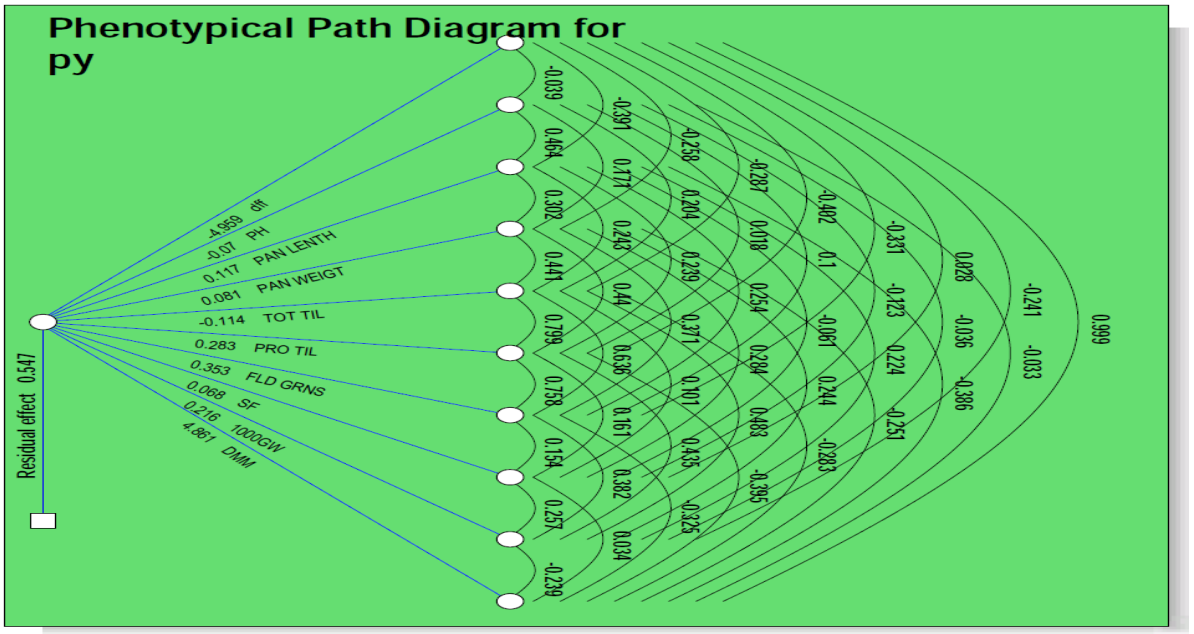

Fig. 2: Phenotypical path diagram for grain yield per plant (g)

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