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CHARACTER ASSOCIATION AND PATH COEFFICIENT ANALYSIS OF GRAIN YIELD AND YIELD RELATED TRAITS IN SOME PROMISING EARLY TO MEDIUM DURATION RICE ADVANCED LINES

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ABSTRACT

Islam MA, Raffi SA, Hossain MA, Hasan AK (2015) Character association and path coefficient analysis of grain yield and yield related traits in some promising early to medium duration rice advanced lines. *Int. J. Expt. Agric.* 5(1), 8-12.

Evaluation of advanced lines is an important step in any crop improvement program. A field experiment was conducted using twenty three rice genotypes including three check varieties during the period from June to December 2013 at the Agronomy Field Laboratory, Department of Agronomy, Bangladesh Agricultural University, Mymensingh to investigate the association among eight morpho-physiological traits including yield. The experiment was laid out in a randomized complete block design with three replications. Grain yield was found to be positively and significantly correlated with filled grain per panicle, plant height, days to 50% flowering and days to maturity both at genotypic and phenotypic levels, indicating the importance of these traits for yield improvement in rice. From the path coefficient analysis, it was revealed that days to maturity, days to 50% flowering, plant height, number of filled grain per panicle and grain length had direct positive effect on yield, indicating these are the main contributors to yield. Eventually, it was recommended that, for obtaining increased rice yield, a genotype should possess more number of filled grains per panicle.

Key words: *correlation coefficients, path coefficient, grain yield, yield related traits, rice*

INTRODUCTION

Rice (*Oryza sativa* L.) is an important crop which supplies staple food for nearly 50% of the global population (FAO 2011; Garris *et al.* 2005). Among the most cultivated cereals in the world, rice ranks as second to wheat (Abodolereza and Racionzer, 2009). Bangladesh is the fourth largest producer and consumer of rice in the world (FAO 2011), with annual production of 25 million tons from 10.5 million hectares of land (BBS 2010). Agricultural production of Bangladesh is dominated by rice. But the country is not self-sufficient in rice (the yearly requirement of rice in Bangladesh is 31 million tons and the yearly production is only 25 million tons, BBS 2010). In order to meet the fastest growing demand for rice grain, development of high yielding genotypes with desirable agronomic traits for diverse ecosystem is therefore a necessity. Breeding and adoption of rice cultivars with enhanced yield potential and short growth duration is a common objective of the breeders. However, grain yield is a complex trait, controlled by many genes, as well as environmentally influenced and determined by the magnitude and nature of their genetic variability in which they grow (Singh *et al*. 2000). In addition, grain yield is related with other characters such as plant types, growth duration and yield components (Yoshida 1981). These traits are also correlated among themselves. The associations among different traits can be evaluated by correlation analysis (Akhtar *et al.* 2011). Sadeghi (2011) observed positive significant association of grain yield with grains per panicle, days to maturity, number of productive tillers and days to flowering. Ullah *et al*. (2011) noted that grain yield was positively and significantly associated with panicle length and grains per panicle. Hairmansis *et al*. (2010) also recorded a positive and significant association of grain yield with filled grains per panicle, spikelets per panicle and spikelets fertility. Furthermore, path coefficient analysis partitions the genetic correlation between yield and its component traits into direct and indirect effects and hence has effectively been used in identifying useful traits as selection criteria to improve grain yield in rice (Mustafa and Elsheikh, 2007; Kole *et al.* 2008; Akinwale *et al*. 2011; Sadeghi 2011). Grain yield has been reported to be influenced by high direct positive effects of productive tillers, days to flowering and grains per panicle (Sadeghi 2011), filled grains per panicle (Hairmansis *et al*. 2010), panicles per plant and grains per panicle (Mustafa and Elsheikh, 2007; Akinwale *et al*. 2011), panicles per plant, grains per panicle, plant height and days to flowering (Kole *et al*. 2008). In this study, the correlation among different traits at genotypic and phenotypic levels and their direct and indirect effects in terms of path coefficient analysis on grain yield were studied.

MATERIALS AND METHODS

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University (BAU), Mymensingh, during the period from July' 2013 to December' 2013. Twenty advanced lines (collected from Field Laboratory of Dept. of Genetics and Plant Breeding, BAU) and three check varieties *viz*. BR 11, BRRI dhan49, BRRI dhan57 were used in the present study. The experiment was laid out in a randomized complete block design (RCBD) with three replications. Each replication was consisted of twenty three plots and each of the plot was 5.0 m^2. The seeds were soaked into water on 11th July 2013 for 24 hours and incubated in moist cloth sacks for 48 hours for quick germination. The pre-germinated seeds were sown in seedbed on 14th July

2013. One seedling per hill was transplanted to the main plot on the 04th August, 2013 when they were 21 days old. Row to row and plant to plant distance were 20 cm and 15 cm, respectively. Fertilizers were applied at the rate of Urea 170 kg, TSP 70 kg, MP 100 kg, Zypsum 80 kg and Cowdung 2 tons/ha. Gap filling was done within seven days after transplanting with the seedlings from the same sources to obtain uniform plant population. Irrigation, drainage, and weeding were done as and when required. Insecticides and fungicides were sprayed only once. Ten sample plants were randomly chosen from each plot for recording observations on some morpho-physiological traits *viz.* plant height (cm), filled grain per panicle, days to 50% flowering, days to maturity, grain length (mm), grain width (mm), thousand grain weight (g) and grain yield (t/ha). Genotypic and phenotypic correlation coefficients were calculated according to the formula given by Miller *et al*. (1958) and path coefficient analysis was computed following the method suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Correlation coefficient

Relationships among morphological and yield contributing traits were studied through analysis of correlation among them. Phenotypic and genotypic correlation co-efficient among eight traits of 23 rice genotypes are presented in Table 1. Genotypic correlation coefficients were of higher in magnitude than the corresponding phenotypic correlation coefficients in most of the associations which might be due to masking or modifying effect of environment (Singh 1980). These findings are corroborating the observations of Meenakshi *et al.* (1999) and Bhattacharyya *et al.* (2007). Grain yield was found to be positively and significantly associated with filled grain per panicle, plant height, days to 50% flowering and days to maturity both at genotypic and phenotypic levels, indicating the importance of these traits for yield improvement in rice. The results are supported by Rokonuzzman *et al*. (2008) and Khan *et al*. (2009) for filled grains per panicle and by Rasheed *et al.* (2002) and Girish *et al.* (2006) for plant height. Grain yield had negative and significant correlation with thousand grain weight which also reported by Ullah *et al*. (2011). The overall results indicated that the selection of higher number of filled grain per panicle with a reasonable balance for moderate days to maturity, higher grain width, moderate grain length and moderate plant height would particularly encourage the agronomist to achieve higher yield. These results were in conformity with the findings Hasib and Kole (2004) and Khedikar *et al.* (2004).

Table 1. Genotypic and Phenotypic correlation coefficient between yield and yield contributing traits

Traits		FG	DF	DM	TGW	GL	GW	GY
PH	r_g	49.31**	24.17**	25.49**	-5.97**	-0.42*	0.12	4.13**
	r_p	86.67**	23.48**	24.12**	-5.82**	0.01	0.10	5.52**
FG	r_g		80.64**	95.65**	-0.52**	-2.44**	1.15**	9.36**
	r_p		83.63**	83.23**	-1.76**	-2.32**	1.25**	9.52**
DF	r_g			39.44**	-4.27**	-1.68**	0.55**	4.24**
	r_p			42.45**	4.62**	-1.65**	0.56**	4.12**
DM	r_g				-4.68**	-1.72**	0.62**	3.96**
	r_p				-4.94**	-1.83**	0.62**	4.50**
TGW	r_g					-0.03	-0.09	-0.74**
	r_p					-0.04	-0.09	-0.72**
GL	r_g						-0.03	-0.09
	r_p						-0.04	-0.08
GW	r_g							0.05
	r_p							0.05

Note: PH = Plant height, FG = Filled grain, DF = Days to 50% flowering, DM = Days to maturity, TGW = Thousand grain weight, GL = Grain length, GW = Grain width, GY = Grain yield (t/ha), $\mathbf{r_g}$ = Genotypic correlation co-efficient, $\mathbf{r_p}$ = Phenotypic correlation co-efficient. ****** indicates significant at 0.01 probability, ***** indicates significant at 0.05 probability

Path coefficient analysis

Genotypic correlation coefficients were partitioned by using method of path analysis to find out the direct and indirect effects of yield contributing traits towards the grain yield. From the path coefficient analysis (Table 2, Fig. 1), it was revealed that days to maturity (5.592), days to 50% flowering (4.156), plant height (1.717), number of filled grain per panicle (1.182) and grain length (0.105) had direct positive effect on yield, indicating these are the main contributors to yield. Yolanda and Das (1995) and Zahid *et al*. (2006) reported that days to maturity has highest positive direct effect on yield. Akter *et al*. (2010) also reported that days to maturity has highest positive direct effect on yield followed by plant height and days to 50% flowering.

Table 2. Path coefficient of yield contributing traits on grain yield of twenty three rice genotypes

Traits	PH	FG	DF	DM	TGW	GL	GW	Correlation With GY
PH	**1.717**	0.583	1.004	1.425	1.148	-4.418	-4.481	4.13
FG	0.846	**1.182**	3.351	5.349	0.100	-0.256	-4.295	9.36
DF	0.415	0.953	**4.156**	2.205	0.821	-0.176	-2.054	4.24
DM	0.437	1.131	1.639	**5.592**	0.900	-0.180	-2.315	3.96
TGW	-0.102	-6.149	-0.177	-0.261	**-0.192**	-3.155	3.361	-0.74
GL	-7.212	-2.885	-6.982	-9.619	5.769	**0.105**	1.120	-0.09
GW	2.060	1.359	2.285	3.467	1.730	-3.155	**-3.734**	0.05
Residual effect					0.538			

Note: Bold diagonal figures indicate the direct effect.

Here, PH = Plant height, FG = Filled grain, DF = Days to 50% flowering, DM = Days to maturity, TGW = Thousand grain weight, GL = Grain length, GW = Grain width, GY = Yield (t/ha)

The residual effect was 0.538 indicated that the contribution of component traits on grain yield was 46.2%, by the eight traits studied in path analysis, the rest 53.8% was the contribution of other factors, such as traits not studied.

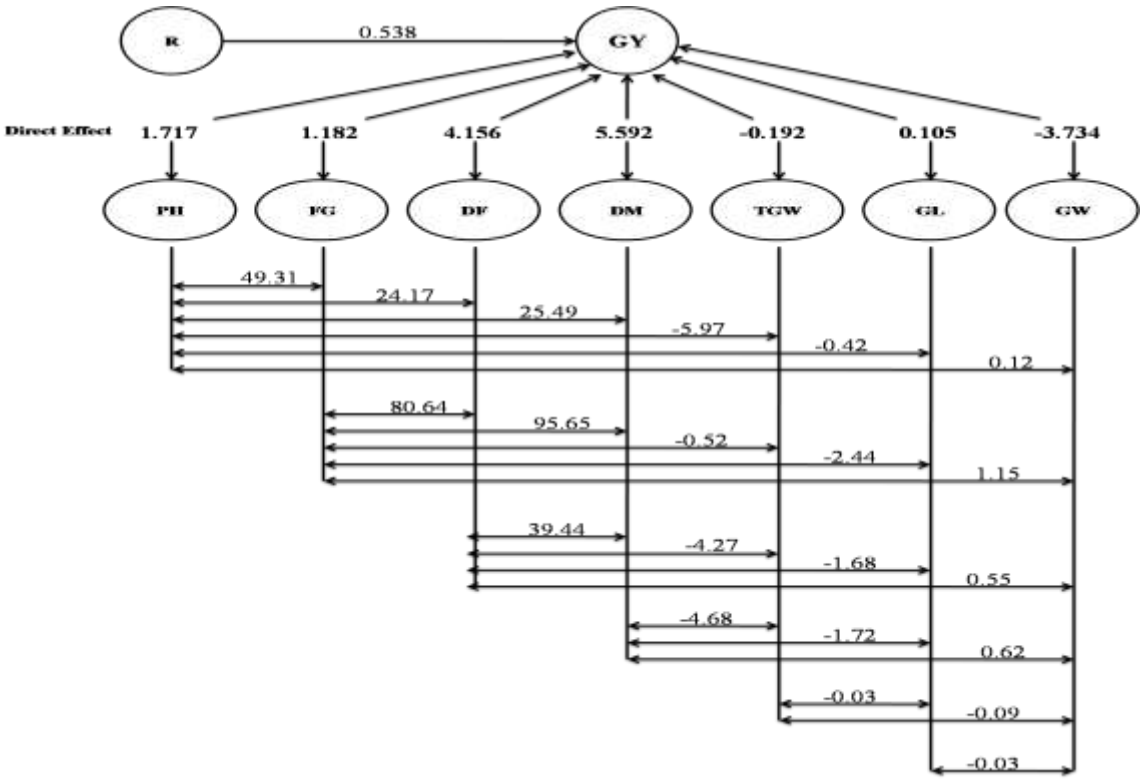

Fig. 1. Path diagram of yield contributing traits on yield

Note: Single arrow lines indicate path coefficients and double arrow lines indicate correlation coefficients. PH = Plant height, FG = Number of filled grain per panicle, DF = Days to 50% flowering, DM = Days to maturity, TGW = Thousand grain weight, GL = Grain length, GW = Grain width, GY = Grain yield (t/ha)

Finally, the present study results indicated that filled grains per panicle had the highest correlation coefficient with grain yield and days to maturity had the highest positive direct effect on grain yield. Therefore, it can be forwarded that for increasing grain yield, a genotype should possess more number of filled grains per panicle.

CONCLUSION

A clear understanding on the inter-relationship between the important traits related to yield is a must for designing an effective breeding program. The necessity of improving yield potential of existing rice genotypes hence, therefore, might be done based on the findings of the present study. It is therefore, concluded that, while yield and maturity length are concerned, trait like number of filled grain per panicle should be given prime importance.

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