CORRELATION AND PATH COEFFICIENT ANALYSIS FOR QUANTITATIVE CHARACTERS IN T. AMAN RICE

MJ Karim[1] F Jesmin[2] MH Ali[3] MN Islam[4*] and E Mahmud[5]

Present address
[1]Upazila Agriculture Officer DAE [2]Upazila Rural Development Officer, BRDB. Scientific Officer [3]IWM Division and [4]Soil Science Division, BRRI, Gazipur [5]BARI, Gazipur.

Correspondence
nazrulag@gmail.com

Accepted: 21 November, 2016

Abstract

An experiment was conducted at the experimental field laboratory of the department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh, during the period from July to December, 2008. Correlation and path coefficients analyses among twelve morphological characters were studied in twenty-five traditional and HYV Aman rice to investigate interrelationship between yield and yield contributing characters and their direct and indirect effect on yield. The experiment revealed that days to 50% flowering, effective tillers, panicle length, weight of grain per panicle, filled grain, days to maturity, leaf area and 1000 grain weight showed significant positive correlation with grain yield whereas unfilled grain per panicle showed significant negative correlation with grain yield. Path coefficient analysis revealed highest positive direct effect of days to maturity on grain yield but unfilled grain per panicle had negative direct effect on grain.

Key words: Phenotypic correlation, residual effect, yield and yield contributing characters

Introduction

Rice (*Oryza sativa* L.) is the staple food for nearly half D MD D MD both the tropical and sub-tropical regions. This crop is widely distributed around the world, in as broad range as 50^o N to 40^o S and from the sea level to altitudes of more than 2500m. Rice and agriculture are still fundamental to the economic development of the most Asian countries. In Bangladesh, rice is the most dominant cereal crop, which occupies about 77% of the total cropped area of 13.9 million hectare (BBS, 2010). At present rice alone constitutes about 92% of the food grains produced annually in the country. It provides about 75% of the calories and 66% of the protein in the average daily diet of the people (Bhuiyan *et al*., 2002). Rice is grown in Bangladesh under diverse ecosystem of irrigated, rain fed and deep-water conditions in three distinct seasons namely Aus, Aman, and Boro (Rashid, 1994). But the average yield of T. Aman rice production per hectare is very low as compared to Boro. It is notable that the area coverage of Aman is the largest as a single crop and Boro remains the second (BBS, 2016). The production of Aman depends on the weather condition of the country. Under the situation breeder have to develop more high yielding Aman varieties for upland rainfed area which would enhance the yield potential thereby rice production in Aman season. Yield of rice is a contribution of various component characters such as number of panicle/hill, number of filled grains/panicle, 1000-grain weights, etc. So, information on correlation coefficients between grain yield and its component characters is essential for yield improvement, since grain yield in rice is a complex entity and is highly influenced by several component characters. Studies on path co-efficient also provide useful information regarding the direct and indirect effects of different yield component characters on grain yield and thus aid in the identification of effective selection criteria for effective yield improvement. Therefore, it is necessary to know the relationship between and among component characters with yield and others. The traits usually show a complex chain of interacting relationship (Akanda *et al*., 1995). Therefore, the present study was undertaken to study the interrelationship between yield and yield contributing characters and their direct and indirect effect on yield.

Methods and Materials

The experiment was conducted at the experimental field laboratory of the department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh, during the period from July to December, 2008. The land was medium high belonging to the Sonatola Soil series of non-calcareous dark grey flood plain soil type under the Old Brahmaputra Flood plain of Agro-ecological Zone-9, (UNDP and FAO, 1988; Islam *et al*., 2013a; Islam *et al*., 2013b; Islam *et al*., 2014 and Islam *et al.*, 2016;). The pH value of the soil is around 6.5 and non-flooded with Sandy loam in texture. The experimental area has sub-tropical climate. Usually the rainfall is heavy in Kharif and scanty in Rabi season. There was heavy rain with high temperature during the vegetative, the flowering and maturity stage of the crop.

The experimental materials included twenty-five rice varieties of both local and high yielding varieties. These are Jhinga Sail DA-15, Laxmi Bilash, Bajal,

Purbachi, Basmati-D, Madhu Sail, Lakhi, Debamoni, BR25/Nayapajam, Nirbhoe, Bailam/Kumra, BR5/Dulhabhog, BR10/Progati, BRRI dhan33, BRRI dhan41, Beti, BR22/Kiron, BRRI dhan31, BRRI dhan34, Boron dhan, Lakkhi Nata, BRRI dhan39, Digha-2, Lati Sail and BR4/Brrisail. All the materials were collected from Genetic and Finger Printing laboratory, Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh.

The experimental plot was prepared by ploughing with power tiller followed by laddering. The land was mudded and leveled well before transplanting. At the final land preparation chemical fertilizers such as Triple Super Phosphate (T. S. P), Muriate of Potash (MP) and Gypsum were applied. Two seedlings per hill were transplanted to the main plot when they were twenty seven days old. The experiment was done in a randomized block design with three replications. Standard production package of intercultural practices was followed; Insects and fungal attacks were negligible. Date of harvesting was confined when 90% of the grain attained golden yellow color.

Data were recorded from three randomly selected hills. Among the characters, days to 50% flowering was recorded from the field and flag leaf area (LAI) was determined at its green state in the Central Laboratory of Bangladesh Agricultural University and the remaining characters were recorded in the field laboratory after harvesting.

The phenotypic correlation coefficient among different characters was carried out as per procedure suggested by Searle (1961). The path coefficient analysis was done as suggested by Dewey and Lu (1959).

Results and Discussion

Correlation study

The correlation co-efficient between yield and yield contributing characters in rice are presented in Table 1. Days to 50% flowering were positively and significantly correlated with effective tiller per hill, panicle length, filled grain per panicle, plant height, days to maturity, 1000 grain weight, and grain yield per plot. It was negatively and significantly correlated with unfilled grain per panicle, and gain length breadth ratio. Rao and Shrivastava (1999) reported positive correlation between days to flowering and days to maturity. The findings are similar to the present study.

Numbers of effective tillers per hill were positively and significantly correlated with panicle length, weight of grain per panicle, filled grain per panicle, days to maturity, 1000 grain weight, and grain yield per plot. It was negatively and significantly correlated with unfilled grain per panicle.

Panicle length showed positively and significantly correlation with weight of grain per panicle, filled grain per panicle, days to maturity, 1000 grain weight, and grain yield per plot. It was negatively and significantly correlated with unfilled grain per panicle.

Weight of grain per panicle showed positively and significantly correlation with filled grain per panicle, plant height, days to maturity, Leaf area, 1000 grain weight, and grain yield per plot. It was negatively and significantly correlated with unfilled grain per panicle.

Filled grain per panicle showed positively and significantly correlation with days to maturity, plant height, Leaf area, 1000 grain weight, and grain yield per plot. It was negatively and significantly correlated with unfilled grain per panicle.

Unfilled grain per panicle showed negatively and significantly correlation with days to maturity, 1000 grain weight, and grain yield per plot.

Days to maturity showed positively and significantly correlation with leaf area, 1000 grain weight, and grain yield per plot.

Leaf area showed positively and significantly correlation with 1000 grain weight and grain yield per plot.

1000 grain weight showed positively and significantly correlation with grain yield per plot. The result was supported by Ramalingam *et al.* (1994), Chaudhary and Das (1998) and Sangeeta *et al. (*2000).

Path co-efficient study

Contribution of direct and indirect effect of some presumed yield contributing characters towards yield per plot, a path coefficient analysis was done and presented in the table-2. Among the characters panicle length, number filled grain, days to maturity, leaf area, and 1000-grain weight showed positive direct effect indicating that among the independent variables, these five contributed maximum for yield per plot.

Days to 50% flowering, unfilled grain and plant height exerted negative direct effects towards yield per plot. The maximum positive direct effect was exerted by days to maturity. Therefore, days to maturity and 1000-grain weight are the best contributors for increasing grain yield for rice. Maximum direct effect of days to maturity was also reported by Chaudhary and Das (1998).

Days to flowering had negative direct effect with grain yield per plot. Borbora *et al.* (2005) reported negative direct effect of days to flowering on grain yield. Plant height showed negative direct effect on grain yield per plot and the correlation co-efficient was non-significant negative. Saha *et al.* (1989) reported negative direct effect of plant height on grain yield.

Table 1 Correlation of Coefficients

Character	DF	ET	PL	FG	UFG	L/B	PH	DM	LA	GW
ET	0.734**									
PL	0.728**	0.666**								
FG	0.839**	0.766**	0.589**							
UFG	-0.773**	-0.771**	-0.661**	-0.599**						
L/B	-0.403*	-0.201	-0.098	-0.331	0.074					
PH	0.499*	0.184	0.311	0.305	-0.184	-0.322				
DM	0.910**	0.861**	0.753**	0.897**	-0.769**	-0.308	0.315			
LA	0.317	0.343	0.098	0.456*	-0.236	-0.302	0.007	0.476*		
GW	0.818**	0.879**	0.713**	0.774**	-0.827**	-0.124	0.236	0.901**	0.487*	
Y	0.788**	0.842**	0.669**	0.844**	-0.674**	-0.292	0.205	0.924**	0.537**	0.866**

NB. DF= Days to 50% flowering, ET= Effective tillers, PL=Panicle length, FG= Filled grain, UFG= Unfilled grain, L/B= Grain length breadth ratio, PH= Plant height, DM= Days to maturity, LA= Leaf area, GW= 1000 grain weight, Y= Grain yield per plot

Table 2 Partitioning of phenotypic correlations into direct (bold faced) and indirect effects of eight important yield contributing traits out of 12 by path analysis

Character	DF	PL	FG	UFG	PH	DM	LA	GW	Y
DF	-0.077	0.02	0.05	-0.01	-0.03	0.7	0.01	0.2	0.79
PL	-0.05	0.028	0.03	-0.1	-0.02	0.5	0.05	0.2	0.67
FG	-0.06	1.6	0.067	-0.09	-0.02	0.7	0.02	0.3	0.84
UFG	0.05	-0.01	-0.04	-0.17	0.01	-0.5	-0.01	-0.2	-0.67
PH	-0.03	0.008	0.02	-0.03	-0.067	0.2	0.0006	0.07	0.21
DM	-0.06	0.02	0.06	-0.1	-0.02	0.74	0.02	0.2	0.92
LA	-0.02	0.002	0.03	-0.06	-0.0006	0.3	0.059	0.1	0.54
GW	-0.06	0.01	0.05	-0.1	-0.01	0.7	0.02	0.31	0.87

NB. DF= Days to 50% flowering, PL=Panicle length, FG= Filled grain, UFG= Unfilled grain, PH= Plant height, DM= Days to maturity, LA= Leaf area, GW= 1000 grain weight, Y= Grain yield per plot

Panicle length showed moderate positive direct on grain yield per plot and also showed positive significant correlation with yield per plot. Which reveals true relationships between them and direct selection for this trait will be rewarding for yield improvement. Chaudhary and Das (1998) also reported positive effect for this trait.

The residual effect was 0.11 indicating that the eight characters contributed 89 percent of variability in yield per plot studied in path analysis. The residual effects towards grain yield in this study may be due to several of reason such as causal factors (characters) not included in the analysis and sampling errors. Das (1992) observed a residual effect of 0.36 indicating 64 percent of the variability in yield per ha contributed by 8 characters in path analysis.

Conclusion

The correlation and path co-efficient studies revealed that 1000-grain weight, panicle length, and days to maturity are the most important yield components. Recent breeding research has also emphasized the importance of these characters.

References

Akanda MAL, Alam MS and Shamsuddin AKM 1995. Genetic variability, correlation and path coefficient of yield and its components in groundnut. Bangladesh. J. Pl. Breed. Genet. 8(1& 2):39.

BBS 2010. Agriculture Wing. Bangladesh Bureau of statistics, Ministry of planning, Government of D MD ngladesh, Dhaka.

BBS 2016. Estimates of Aman Rice (Husked), 2014-15. Agriculture Wing, Bangladesh Bureau of statistics, Ministry of planning, Government of D MD D

Bhuiyan NI, Paul NR and Jabber MA 2002. Feeding the extra millions by 2025- challenges for rice research and extension 2002. Annual workshop held on 29-31 January, 2002 at BRRI, Gazipur, P. 09

Borbora TK, Hazarika CN and Medhi AK 2005. Correlation and path analysis for plant and panicle characters in rice (*Oryza sativa*). Crop Res. Hisar. 30(2): 215-220.

Chaudhary PKD and Das PK 1998. Genetic variability, correlation and path co-efficient analysis in deep-water rice. Amm. Agril. Res. 19(2): 120-124.

Das LK 1992. Correlation studies of growth and yield attributing characters with grain yield of hybrid rice. J. Inter. 8(4): 627-629.

Dewey DR and Lu KH 1959. A correlation and path analysis of components of crested wheat grass seed production. Agron. J. 57: 515-518.

Islam MN, Rahman MM, Mian MJA and Ali MH 2016. Effect of fertilizer management on NPKS leaching loss from sandy loam soil under alternate wetting and drying condition. Bangladesh Rice J. 20(1): 59-64.

Islam MN, Rahman MM, Mian MJA, Barua R and Kamal AM 2013a. Leaching loss of NPKS in the Old Brahmaputra Floodplain soil under continuous standing water condition. Eco-friendly Agril. J. 6(04): 63-66.

Islam MN, Rahman MM, Mian MJA, Barua R and Kamal AM 2013b. Leaching loss of NPKS in silty soil under alternate wetting and drying condition. Eco-friendly Agril. J. 6(04): 67-71.

Islam MN, Rahman MM, Mian MJA, Khan MH and Barua R 2014. Leaching losses of nitrogen, phosphorus and potassium from the sandy loam soil of Old Brahmaputra Floodplain (AEZ-9) under continuous standing water condition. Bangladesh J. Agric. Res. 39(3): 437-446.

Ramalingam L, Nadarajan N, Variarajan C, Rangasams Y and Arumugapillai M. 1994. Character association and component analysis for panicle architecture in rice (*Oryza sativa* L.). Agril. Sic. Digest Kamal. 14(2): 136-140.

Rao SS and Shrivastava MM. 1999. Genetic variation and correlation studies in rain fed upland rice. *Oryza*. 31: 288-291.

Rashid MM 1994. Rice production in Bangladesh: Programmed achievements, potentials and challenges, IRCN, 43: pp. 9-18. Rice in Assam. Intl. Rice Res. Notes. 14(1): 21.

Saha AKE, Haque B, Quader TZ, Hussain and Miah NM. 1989. Correlation and path analysis of some yield contributing characters in some high yielding and local varieties of irrigated rice. Bang. J. Pl. Breed. Genet. 2(1&2): 19-22.

Sangeeta-Mahitkar, Girl DG, Jahagirdar SW, Giri MD and Mahitkar S 2000. Correlation studies in upland rice. Annals of plant physiology. 14(2): 195-197.

Searle S 1961. Phenotypic, genotypic and environmental correlations. Biometrics. 17: 474-480.

UNDP and FAO 1988. Land resources appraisal of Bangladesh for agricultural development report No. 2. Agro-ecological regions of Bangladesh. United Nations Dev. Prog. and Food and Agric. Org. pp. 212-221.