

Correlation and Path Coefficient Studies for Grain Yield and other Yield Attributing Traits in Slender Grain Rice Genotypes

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Received 10 July 2017; Accepted 13 August 2017; Published online 2 September 2017

Abstract A correlation coefficient and path analysis study was conducted in forty-nine elite slender grain rice genotypes for thirteen component characters including grain yield to establish the nature of relation between grain yield and yield components. In medium slender rice highest estimate of positive correlation at genotypic level was between yield and kernel breadth followed by 100 seed weight, harvest index, flag leaf area, fertile grains per panicle, plant height

and kernel length. This revealed that selection on the basis of these characters bears relevance to grain yield. It was observed from the path coefficient analysis that traits like harvest index followed by days to 50% flowering, plant height, kernel length, fertile grains per panicle and 100 seed weight exhibited higher positive effect on grain yield and should be considered as important selection criteria for realization of higher productivity.

Keywords Correlation, Direct effects, Path analysis, Yield components.

Introduction

Rice is the staple food for two thirds of the Indian population. It contributes 43% of caloric requirement and 20–25% of agricultural income. Now-a-days emphasis has been given not only for higher yield but also for different quality traits such as texture, aroma, appearance. As standard of living of people are increasing day by day people showing more interest towards slender grain for consumption due to its flavor and palatability. But most of the rice varieties are having medium bold grain. So development of slender grain rice varieties is need of the hour. Slender grain rice varieties collected from different parts of the country will help to identify varieties suitable for

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Table 1. Analysis of variance for various characters (mean sum of squares) for 49 medium slender rice genotypes. *Significant at 5% level, **Significant at 1%.

Sl. No.	Characters	Mean sum of squares (df)		
		Replication (I)	Genotype (48)	Error (48)
1.	Days to 50% flowering	2.276	280.875**	1.838
2.	Plant height (cm)	0.797	149.451**	9.131
3.	Panicle length (cm)	0.285	8.910**	0.529
4.	No. of effective tillers/plant	0.850	3.303**	1.564
5.	Flag leaf area (cm ²)	26.992	116.157**	1.237
6.	Fertile grains/panicle	58.939	1777.219**	14.194
7.	Fertility percentage	35.985	263.487**	22.206
8.	Kernel length (mm)	0.193	0.342	0.072
9.	Kernel breadth (mm)	0.009	0.057	0.024
10.	L/B ratio	0.009	0.202	0.042
11.	100 seed wt (g)	0.003	0.108	0.011
12.	Harvest index	0.004	0.008	0.003
13.	Grain yield/plant (g)	12.864	26.474**	1.664

cultivation in this region as well as for selecting promising varieties for use as parent material in future breeding program. Hence the present study was un-

dertaken to evaluate forty-nine elite slender grain rice genotypes to find out important characters contributing to grain yield, to assess the direct and indirect effects of different component traits on yield through path coefficient analysis.

Materials and Methods

The experimental material used in the present investigation consisted of forty-nine elite slender grain rice genotypes. The test genotypes were evaluated under normal situations at Rice Research Station, Orissa University of Agriculture and Technology, Bhubaneswar during *kharif*, 2015. Trials were laid out in a randomized block design with two replications with the spacing of 15 × 20 cm and the recommended cultural practices were followed. Observations were recorded on the following thirteen characters Days to 50% flowering, Plant height, Panicle length, Number of effective tillers per plant, Flag leaf area, Fertile grain number, Fertility percentage, Kernel length, Kernel breadth, L/B ratio, 100-seed weight, Harvest index,

Table 2. Estimates of phenotypic and genotypic correlation co-efficient among various characters for 49 medium slender rice genotypes. *Significant at 5% level, **Significant at 1% level.

Characters		Days to 50% flowering	Plant height	Panicle length	No. of effective tiler per plant	Flag leaf area	Fertile grain per panicle
Plant height	r_p	0.113					
	r_g	0.119					
Panicle length	r_p	0.021	0.622**				
	r_g	0.028	0.649**				
No. of effective tiller per plant	r_p	-0.023	-0.184	-0.250			
	r_g	-0.046	-0.258	-0.392**			
Flag leaf area	r_p	0.208	0.521**	0.464**	-0.197		
	r_g	0.210	0.538**	0.486**	-0.278		
Fertile grain per panicle	r_p	0.037	0.237	0.109	-0.211	0.432**	
	r_g	0.035	0.241	0.111	-0.280	0.439**	
Fertility percentage	r_p	-0.623**	-0.106	-0.129	0.165	-0.164	0.192
	r_g	-0.653**	-0.109	-0.134	0.309*	-0.167	0.197
Kernel length	r_p	-0.160	0.100	0.415**	-0.110	0.004	-0.175
	r_g	-0.182	0.132	0.485**	-0.129	0.010	-0.193
Kernel breadth	r_p	0.145	0.090	0.252	-0.181	0.164	-0.070
	r_g	0.220	0.081	0.317	-0.116	0.223	-0.098
L/B ratio	r_p	-0.226	-0.106	0.049	0.195	-0.314*	-0.162
	r_g	-0.304*	-0.115	0.082	0.321*	-0.350*	-0.169
100 seed weight	r_p	-0.169	0.197	0.331*	-0.069	0.105	-0.193
	r_g	-0.174	0.216	0.335*	-0.029	0.107	-0.205
Harvest index	r_p	-0.568**	-0.097	-0.045	0.049	0.027	0.318*
	r_g	-0.687**	-0.149	-0.085	0.195	0.059	0.374**
Grain yield per plant	r_p	0.259	0.362*	0.259	-0.020	0.422**	0.413**
	r_g	0.263	0.365**	-0.268	-0.028	0.438**	0.429**

Table 2. Continued.

Characters		Fertility percentage	Kernel length	Kernel breadth	10 L/B ratio	100 seed weight	Harvest index
Plant height	r_p						
	r_g						
Panicle length	r_p						
	r_g						
No. of effective tiller per plant	r_p						
	r_g						
Flag leaf area	r_p						
	r_g						
Fertile grain per panicle	r_p						
	r_g						
Fertility percentage	r_p						
	r_g						
Kernel length	r_p	-0.129					
	r_g	-0.128					
Kernel breadth	r_p	-0.292*	0.364*				
	r_g	-0.430**	0.492**				
L/B ratio	r_p	0.160	0.424**	-0.536**			
	r_g	0.189	0.431**	-0.668**			
100 seed weight	r_p	-0.041	0.706**	0.673**	-0.118		
	r_g	-0.043	0.789**	0.838**	-0.149		
Harvest index	r_p	0.469**	0.196	0.144	-0.070	0.358*	
	r_g	0.569**	0.270	0.177	-0.098	0.440**	
Grain yield per plant	r_p	-0.104	0.284*	0.385**	-0.268	0.440**	0.439**
	r_g	-0.112	0.353*	0.557**	-0.324*	0.499**	0.475**

Grain yield per plant were recorded. The data recorded were subjected to statistical analysis based on the sample mean of the various characters under observation.

Results and Discussion

The analysis of variance (Table 1) revealed the existence of significant differences among the genotypes for all the traits, indicating the existence of sufficient variation in the material studied. Hence, the data was further subjected to correlation and path coefficient analysis to estimates the association existing between yield and yield contributing components and direct and indirect effects of yield related traits, respectively.

Selection of yield *per se* is not reliable as it is much influenced by the environment. Therefore, indirect selections through component characters becomes important in breeding for yield improvement.

Hence, studies on character associations not only help to understand physical linkage but also provide information on nature and direction of selection. The correlation coefficients between characters are given in Table 2. The present investigation indicated that, the genotypic correlation coefficients in general were higher than the phenotypic correlation coefficients demonstrated that the observed relationships among the various traits were due to genetic causes. This is also in confirmation with earlier findings [1—3]. In medium slender rice highest estimate of positive correlation at genotypic level was between yield and kernel breadth followed by 100 seed weight, Harvest index, flag leaf area, fertile grain per panicle, plant height and kernel length. These results are in accordance with [4—6].

As simple correlation does not provide the true contribution of the characters towards the yield, so correlations were partitioned into direct and indirect effects through path coefficient analysis. It allows

Table 3. Direct and indirect effects of component traits on yield at phenotypic level for 49 medium slender rice genotypes.

Characters	Days to 50% flowering	Plant height (cm)	Panicle length (cm)	No. of effective tillers/plant	Flag leaf area (cm ²)	Fertile grains/panicle	Fertility percentage	Kernel length (mm)	Kernel breadth (mm)	L/B ratio	100 seed wt (g)	Harvest index	Grain yield per plant
Days to 50% flowering	0.636	0.031	-0.001	-0.002	0.013	0.006	-0.008	-0.038	-0.004	0.024	-0.025	-0.374	0.259
Plant height (cm)	0.072	0.274	-0.033	-0.017	0.032	0.039	-0.001	0.024	-0.002	0.010	0.029	-0.064	0.362
Panicle length (cm)	0.013	0.170	-0.052	-0.023	0.029	0.018	-0.002	0.098	-0.006	-0.004	0.049	-0.030	0.259
No. of effective tillers / plant	-0.015	-0.050	0.013	0.094	-0.012	-0.035	0.002	-0.026	0.005	-0.018	-0.010	0.032	-0.020
Flag leaf area (cm ²)	0.132	0.143	-0.024	-0.018	0.062	0.071	-0.002	0.001	-0.004	0.029	0.016	0.018	0.422
Fertile grains/panicle	0.024	0.065	-0.006	-0.020	0.027	0.165	0.002	-0.041	0.002	0.015	-0.029	0.209	0.413
Fertility percentage	-0.396	-0.029	0.007	0.015	-0.010	0.032	0.012	-0.030	0.007	-0.015	-0.006	0.309	-0.104
Kernel length (mm)	-0.102	0.027	-0.022	-0.010	.000	-0.029	-0.002	0.235	-0.009	-0.039	0.104	0.29	0.284
Kernel breadth (mm)	0.092	0.025	-0.013	-0.017	0.010	-0.012	-0.004	0.086	-0.025	0.049	0.100	0.095	0.385
L/B ratio	-0.016	-0.029	-0.003	0.018	-0.019	-0.027	0.002	0.100	0.014	-0.091	-0.017	-0.046	-0.268
100 seed wt (g)	-0.107	0.054	-0.017	-0.006	0.007	-0.032	-0.001	0.166	-0.017	0.011	0.148	0.236	0.440
Harvest index	-0.361	-0.027	0.002	0.005	0.002	0.052	0.006	0.046	-0.004	0.006	0.053	0.658	0.439

separating the direct effect and their indirect effects through other attributes by apportioning the correlations for better interpretation of cause and effect relationship. It was observed from the path coefficient analysis (Table 3) that medium slender rice that high direct positive effect on grain yield was manifested by harvest index (0.658) followed by days to 50% flowering (0.636) and moderate direct effect by plant height (0.274), kernel length (0.235), fertile grains per panicle (0.165) and 100 seed weight (0.148) thus, indicating the importance of such traits as criteria for selection in that order for realization of higher productivity. The other traits like panicle length, kernel breadth and L/B ratio, exhibited negative direct effect on grain yield. Out of different characters under study flag leaf area, kernel breadth, fertile grain per panicle exerted greatest indirect effect on yield via other traits. Thus from the foregoing observations on direct and indirect effects, the traits, like harvest index, days to 50% flowering, plant height, kernel length may be considered as important selection criteria for realization of high and stable yields in slender grain rice. These findings in relation to different component traits were

in agreement with published report on path analysis [7—10].

Conclusion

The present investigation indicated that, the genotypic correlation coefficients in general were higher than the phenotypic correlation coefficients demonstrated that the observed relationships among the various traits were due to genetic causes. In medium slender rice highest estimate of positive correlation at genotypic level was between yield and kernel breadth followed by 100 seed weight, Harvest index, flag leaf area, fertile grain per panicle, plant height and kernel length. It was observed from the path coefficient analysis that high direct positive effect on grain yield was manifested by harvest index followed by days to 50% flowering and moderate direct effect by plant height, kernel length, fertile grains per panicle and 100 seed weight thus, indicating the importance of such traits as criteria for selection in that order for realization of higher productivity.

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