STUDIES ON CORRELATION AMONG YIELD AND YIELD ATTRIBUTING CHARACTERS IN RICE (*ORYZA SATIVA* L.)

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Abstract

Rice (*Oryza sativa*, 2n=2x=24) belongs to family graminae is the major food crop of the world. The study revealed that correlation co-efficient revealed that grain yield per plant had positive significant association with hundred grain weight and number of tillers per plant at both genotypic and phenotypic level. The cause and effect of relationship indicated very high direct effect on grain yield per plant was through grain L/B ratio and days to 50 per cent flowering and high direct effect through number of productive tillers per plan leaf breadth. This suggests that these characters deserve greater weightage while formulating selection indices in rice.
Keywords : Path analysis, Direct and indirect effect, Phenotypic and genotypic correlation.

Introduction

Rice (*Oryza sativa*, 2n=2x=24) belongs to family graminae is the major food crop of the world for more than half of the global production. In India rice is grown in 43.86 million hectares, the production level is 104.80 million tonnes and the productivity is about 2390 kg/ha (Agricultural statistics at a glance-2015). The genetic improvement through plant breeding has been an effective mechanism to improve the yield potential of this crop. *per se* performance largely governs the yield of the crop. Hence it should be improved through genetic manipulation.

Materials and Methods

The present investigation was conducted at the Plant Breeding Farm, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai Univenity, Annamalai Nagar, Tamil Nadu, India during the year 2017 to 2018. The experimental materials for this genetic divergence study comprised of 40 rice genotypes collected from various places. Seeds of the forty rice genotypes were sown in raised nursery beds during January 2017. In each genotype, one seedling per hill was transplanted in the main field after 25 days with the spacing of 20 cm between rows and 15 cm between plants in 3 m long rows. The experiment was carried out in randomized block design with three replications. An uniform population of 20 plants in a row was maintained. Fourteen productive and quality characters were recorded on single plant basis in five randomly selected plants of the each genotype per replication. The following were the economic and quality characters studied. They are, days to first flowering, days to 50 per cent flowering, plant height, number of tillers per plant, number of productive tillers per plant, boot leaf length, boot leaf breadth, number of grains per panicle, panicle length, grain length, grain breadth, grain L/B ratio, 100 grain weight and grain yield per plant.

Results and Discussion

Correlation studies

Estimation of correlation between yield and yield component characters in rice genotypes are presented. Days to first flowering had significant positive association with days to 50 per cent flowering and boot leaf length at both genotypic and phenotypic levels. Days to 50 per cent flowering had significant positive association with boot leaf length at both genotypic and phenotypic level. Plant height had non-significant association with all the characters except grain yield per plant. Plant height had negative significant association with grain yield per plant at both phenotypic and genotypic level. Number of tillers per plant had significant positive association with number of productive tillers per plant and number of grains per panicle at both genotypic and phenotypic level.

Number of productive tillers per plant had positive significant association with grain yield per plant at both genotypic and phenotypic levels. Boot leaf length had significant positive association with boot leaf breadth, number of grain per panicle and panicle length at both genotypic and phenotypic level. Boot leaf breadth for genotypic and phenotypic level all the characters observed non significant. Number of grain per panicle for genotypic and phenotypic level all the characters observed non significant.

Panicle length had no significant positive association with all the characters. It had no significant negative association with grain yield per plant. Grain length had significant positive correlation at both genotypic and phenotypic level with grain L/B ratio. Grain breadth has no significant positive association with all the characters.

Grain L/B ratio for both genotypic and phenotypic levels all the fourteen characters observed non significant. Hundred grain weight had significant positive correlation with grain yield per plant for genotypic and phenotypic

level. It had observed non significant correlation with all other characters.

Grain yield per plant had significant positive association with hundred grain weight and number of productive tillers per plant at both genotypic and phenotypic level. It had significant negative association with plant height and panicle length at both phenotypic and genotypic level. It had non-significant association with all other characters

The ultimate aim of any crop improvement program is yield improvement. Since yield is a complex trait, knowledge of association of different yield components with yield and inter correlations among themselves are important. A study of phenotypic correlation is inadequate while correlation coefficients based on the heritable part of the values (genotypic correlation) provide a dependable basis for selection. Estimation of phenotypic and genotypic correlations between the response variable (yield) and the predictor variables (yield components) and among the yield components themselves, may provide information for the breeding program when selection is based on two or more characters simultaneously.

A positive value of correlation shows that the changes of two variables are in same direction, that is high value of one variable are associated with high value of the other and vice-versa, The breeder always concerned for the selection of superior genotypes on the basis of phenotypic expression. However, for the qualitative characters, genotypes are influenced by environment, consequently affecting the phenotypic expression. Information regarding the nature and extend of association of morphological characters would be helpful in developing suitable plant type, in addition to the improvement of yield a complex character for which direct selection is not effective.

In this study, grain yield per plant expressed significant positive correlation with hundred grain weight at genotypic level. This positive association of these yield attributing characters with grain yield per plant was also reported by Anees Salma (2006). From the foregoing discussion, it may be seen that hundred grain weight can be appropriately used as selection criteria for the improvement of grain yield per plant in rice.

The character days to first flowering expressed the positive significant association with days to 50 per cent flowering and boot leaf length at both genotypic and phenotypic levels. Similar results were observed by Saravanan and Sabesan (2009) while days to 50 per cent flowering showed positive significant association with boot leaf length at both genotypic and phenotypic level.

Number of tillers per plant had positive significant association with number of productive tillers and number of grains per panicle at both genotypic and phenotypic level. Similar findings were reported by Suresh (2009) and Yadav *et al.* (2011). Number of productive tillers per plant had positive significant association with grain yield per plant at both genotypic and phenotypic level. Similar results were reported by Venkatramana *et al.* (1999). Boot

leaf length had positive significant association with boot leaf breadth, number of grain per panicle and hundred grain weight at both genotypic and phenotypic level. The character grain length had positive significant association with grain L/B ratio at both genotypic and phenotypic level.

Path coefficient analysis

Direct effect

The traits grain L/B ratio, grain breadth and days to 50 per cent flowering had very high positive direct effect on grain yield per plant. The characters number of productive tillers per plant and boot leaf breadth registered high positive direct effect on grain yield per plant. The character hundred grain weight recorded low direct effect with grain yield per plant. The direct effect of the characters days to first flowering, grain length and number of productive tillers per plant was found to be negatively very high on grain yield per plant. The characters plant height and panicle length had negatively high direct effect on grain yield per plant. The character boot leaf length was found to be negatively moderate to grain yield per plant. While the character number of grain per panicle recorded negative negligible direct effect.

Indirect effect

Days to first flowering

This character had very high positive indirect on grain yield per plant through days to 50 per cent flowering.

Days to 50 per cent flowering

Days to 50 per cent floweringhad low positive indirect effect on grain yield per plant *via.,* grain length, grain breadth, number of productive tillers per plant and boot leaf breadth While it had negligible positive indirect effect via, number of grains per panicle on grain yield per plant

Plant height

Plant height had low positive indirect effect on grain yield per plant through boot leaf breadth and days to 50 per cent flowering. While it had negligible positive indirect effect via, grain length, grain LB ratio and panicle length. It had low negative indirect effect through days to first flowering.

Number of tillers per plant

Number of tillers per plant had high positive indirect effect via, grain L/B ratio, days to first flowering. While it had moderate positive indirect effect on grain yield per plant via, boot leaf breadth. It had negligible positive indirect effect via, boot leaf length, plant height and 100 grain weight

Number of productive tillers per plant

Number of productive tillers per plant had high positive indirect effect on grain yield per plant via number of tillers per plant and grain L/B ratio, while it had moderate positive indirect effect via, days to first

flowering. It had negligible positive indirect effect via boot leaf length and panicle length

Boot leaf length

Boot leaf length had high positive indirect effect on grain yield per plant through days to 50 per cent flowering and grain length. While it had moderate positive indirect effect through grain breadth, number of productive tillers per plant and number of tillers per plant. It had low positive indirect effect *via.,* boot leaf breadth.

Boot leaf breadth

Boot leaf breadth had high positive indirect effect via, days to 50 per cent flowering. It had moderate positive indirect effect on grain yield per plant via, number of productive tillers per plant. While it had negligible positive indirect effect *via.,* grain length, number of productive tillers per plant. It had negligible positive indirect effect *via.,* grain breadth and hundred grain weight.

Number of grain per panicle

Number of grain per panicle had moderate positive indirect effect through number of tillers per plant. While it had negligible positive indirect effect via, grain length, days to first flowering, boot leaf breadth, 100 grain weight and grain L/B ratio. It had low negative indirect effect through number of productive tillers per plant.

Panicle length

Panicle length had high positive indirect effect on grain yield per plant *via.,* days to 50 per cent flowering. It had moderate positive indirect effect on grain yield per plant *via.,* grain length. It had low positive in direct effect via., Boot leaf breadth. It had negligible positive indirect effect *via.*, grain breadth, plant height, number of tillers per plant, number of productive tillers per plant.

Grain length

Grain length had very high positive indirect effect on grain yield per plant through grain L/B ratio. It had moderate positive indirect effect via, days to first flowering. While it had negligible positive indirect effect through boot leaf breadth, boot leaf length, panicle length, number of tillers per plant, plant height and number of grain per panicle.

Grain breadth

Grain breadth had more moderate positive indirect effect on grain yield per plant via., number of productive tillers per plant and grain length. It had low positive indirect effect on grain yield per plant *via.,* days to 50 per cent flowering. While it had negligible positive indirect effect via, boot leaf breadth, 100 grain weight and plant height.

Grain L/B ratio

Grain L/B ratio had low positive indirect effect on grain yield per plant *via.,* days to first flowering. While it had moderate positive indirect effect *via.,* number of tillers per plant. It had negligible positive indirect effect on grain

yield per plant via panicle length, boot leaf length and boot leaf breadth.

100 grain weight

100 grain weight had low positive indirect effect on grain yield per plant via grain breadth and boot leaf breadth. It had negligible positive indirect effect on grain yield per plant *via.,* number of tillers per plant, plant height, number of productive tillers per plant, days to first flowering and panicle length.

While studying the association of more number of independent variables with a particular dependent variable, it needs the study of inter dependence of each component by partitioning them into direct and indirect effects, exerted through other characters resulting inevitably as an integral part of the growth pattern. Under such complex situations, the total correlations are insufficient to explain the true associations for effective manipulation of the characters. Path analysis furnishes a method of partitioning the correlation coefficient into direct and indirect effects and measures the relative importance of the causal factors involved. Yield is a complex character dependent upon a number of contributory factors. These factors also exhibit different degrees of association between themselves. A change in one character results in a corresponding change in its relationship with the other characters and finally is reflected on yield. In order to get an insight into these chain relating the cause and effect between grain yield per plant and eleven component characters were investigated by path analysis.

In the present investigation, the estimated residual was 00.701. Among the yield components characters grain L/B ratio, grain breadth and days to 50 per cent flowering recorded very high positive direct effect on grain yield per plant. Almost similar results were reported by Ramesh Babu and Raghava Reddy (2006).

In addition to its direct effect, indirect effect of days to first flowering had very high positive in direct via, days to 50 per cent flowering, while it had low positive indirect effect *via.*, grain length, grain breadth, number of productive tillers per plant and boot leaf breadth on grain yield per plant. For days to 50 per cent flowering, grain length, grain breadth, number of productive tillers per plant and boot leaf breadth had low positive indirect effect on grain yield per plant. Plant height had low positive indirect effect on grain yield per plant via, boot leaf breadth and days to 50 per cent flowering.

Number of tillers per plant had high positive indirect effect on grain yield per plant *via.,* grain L/B ratio and days to first flowering, while it had moderate positive indirect effect *via.,* Boot leaf breadth. Number of productive tillers per plant had high positive indirect effect on grain yield per plant *via.,* number of tillers per plant and grain L/B ratio, while it had moderate positive indirect effect *via.,* days to first flowering. Boot leaf length had high positive indirect effect on grain yield per plant via, days to 50 per cent flowering and grain length, while it had moderate positive in direct effect *via.,* grain breadth,

number of productive tillers per plant and number of tillers per plant. It had low positive indirect effect on grain yield per plant via, boot leaf breadth.

Boot leaf breadth had high positive indirect effect via, days to 50 per cent flowering, while it had moderate positive indirect effect via, number of productive tillers per plant. Number of grain per plant had moderate positive indirect effect on grain yield per plant via, number of tillers per plant. Panicle length had high positive indirect effect on grain yield per plant *via.,* days to 50 percent flowering, while it had moderate positive indirect effect via, grain length. It had low positive indirect effect *via.,* boot leaf breadth.

Among the grain quality traits grain length had very high positive indirect effect *via., g*rain L/B ratio and days to first flowering, while it had moderate positive indirect effect via, days to first flowering. Grain breadth had moderate positive indirect effect *via.,* number of productive tillers per plant and grain length, while it had low positive indirect effect via, days to 50 per cent flowering. Grain L/B ratio had moderate positive indirect effect via, number of tillers per plant, while it had low positive indirect effect *via.,* days to first flowering on grain yield per plant. Hundred grain weight had low

positive indirect effect on grain yield per plant via, grain breadth and boot leaf breadth.

From the above discussion, it is inferred that the pattern of path coefficient observed in the present study is in agreement with the correlation obtained. In general, the characters hundred grain weight and number of productive tillers per plant exhibited positive significant correlation and moderate indirect effect with grain yield per plant, and therefore these trait should be given prime importance for selecting high yielding genotypes.

The results obtained are summarized in the text to follow. The analysis of variance revealed the presence of significant variability among the genotype for all the 14 characters studied. The correlation co-efficient revealed that grain yield per plant had positive significant association with hundred grain weight and number of tillers per plant at both genotypic and phenotypic level. The cause and effect of relationship indicated very high direct effect on grain yield per plant was through grain L/B ratio and days to 50 per cent flowering and high direct effect through number of productive tillers per plant and boot leaf breadth. This suggests that these characters deserve greater weightage while formulating selection indices in rice.

Table 1 : Genotype correlation among various morphological characters in rice genotypes

	Days to first flowering	Days to 50% flowering	Plant height	No of tillers per plant	No of productive tillers per plant	Boot leaf length	Boot leaf breadth	No. of Grains per panicle	Panicle length	Grain Length	Grain breadth	Grain L/B ratio	100 Grain weight	Grain yield per plant
Days to first flowering	1.000	0.995**	0.093	-0.259*	-0.154	0.327*	0.190	-0.047	0.239	-0.121	0.083	-0.099	-0.015	-0.105
Days to 50% flowering		1.000	0.076	-0.257*	-0.146	0.312*	0.196	-0.017	0.228	-0.105	0.086	-0.094	-0.006	-0.088
Plant height			1.000	-0.022	0.002	0.120	0.207	0.203	-0.115	-0.053	-0.018	0.018	-0.118	-0.254*
No of tillers per plant				1.000	0.869**	-0.231	-0.328*	0.272*	0.014	0.039	-0.285*	0.217	0.050	-0.132
No of productive tillers per plant					1.000	-0.258*	-0.225	0.148	-0.001	0.010	-0.254*	0.194	-0.040	0.267*
Boot leaf length						1.000	0.457**	0.263	0.654**	-0.236	0.017	-0.108	0.199	-0.060
Boot leaf breadth							1.000	0.098	0.162	0.132	0.051	-0.031	0.224	0.149
No of grains per panicle								1.000	0.101	-0.062	-0.050	0.001	0.038	-0.018
Panicle length									1,000	-0.142	0.039	-0.102	-0.071	-0.310*
Grain length										1.000	-0.165	0.647**	0.084	-0.041
Grain breadth											1.000	-0.838**	0.100	0.053
Grain L/B ratio												1.000	-0.060	-0.070
100 grain weight													1.000	0.277*
Grain yield per plant														1.000

Table 2 : Phenotype correlation among various morphological characters in rice genotypes.

	Days to first flowering	Days to 50% flowering	Plant height	No of tillers per plant	No of productive tillers per plant	Boot leaf length	Boot leaf breadth	No. of Grains per panicle	Panicle length	Grain Length	Grain breadth	Grain L/B ratio	100 Grain weight	Grain yield per plant
Days to first flowering	1.000	0.991**	0.093	-0.242	-0.138	0.324*	0.179	-0.046	0.227	-0.098	0.081	-0.099	-0.015	-0.106
Days to 50% flowering		1.000	0.076	-0.242	-0.132	0.311*	0.186	-0.018	0.214	-0.084	-0.083	-0.093	-0.006	-0.090
Plant height			1.000	-0.021	0.002	0.120	0.197	0.201	-0.110	-0/047	0.018	0.018	-0.118	-0.255*
No of tillers per plant				1.000	0.828**	-0.221	-0.304*	0.257*	0.008	0.024	-0.265*	0.205	0.049	0.115
No of productive tillers per plant					1.000	-0.236	-0.202	0.132	-0.009	-0.001	-0.230	0.175	-0.035	0.259*
Boot leaf length						1.000	0.424**	0.261*	0.622**	-0.207	0.017	-0.108	0.198	-0.057
Boot leaf breadth							1.000	0.085	0.147	0.104	0.045	-0.031	0.215	0.136
No of grains per panicle								1.000	0.094	-0.050	-0.047	0.001	0.038	-0.017
Panicle length									1.000	-0.112	0.033	-0.095	-0.067	-0.300*
Grain length										1.000	-0.141	0.565**	0.071	-0.044
Grain breadth											1.000	-0.815**	0.097	0.042
Grain L/B ratio												1.000	-0.061	-0.065
100 grain weight													1.000	0.266*
Grain yield per plant														1.000

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