

Correlation Studies on Grain Yield and its Component Traits in Rice (*Oryza sativa* L.)



Agriculture

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R. ARULMOZHI

Department of Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore

Dr. A. MUTHUSWAMY

Department of Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore

ABSTRACT

Correlation coefficient is one of the important biometrical tools for formulating a selection index as it reveals the strength of relationship among the group of characters. Correlation analysis was carried out for yield and quality components in 74 rice genotypes involving hybrids and their parental lines. Grains per panicle, productive tillers per plant and amylose content had significant positive association with yield at genotypic levels. These traits contributed maximum to higher grain yield compared to other characters, thus, selection for these characters helps in selection of superior cross combinations for improvement of yield.

INTRODUCTION

Rice (*Oryza sativa* L.) is the second largest produced cereal in the world. Asia is the biggest rice producer, accounting for 90 % of the world's production and consumption of rice. China and India, which account for more than one-third of global population supply over half of the world's rice. Today, rice has special position as a source of food providing over 75 % of Asian population and more than three billion of world population meal which represents 50 to 80 % of their daily calorie intake. This population will increase to over 4.6 billion by 2050, and this demands more than 50 % of production than what is produced at present to cope with the growing population (Srividya *et al.*, 2010). Hence ensuring food and nutritional security is a challenging task. The Indian population is about 1.21 billion people according to 2011 census and still expected to grow at a higher rate (1.7% per year).

Grain yield is a complex character which is highly influenced by the environment, hence direct selection for yield alone limit the selection efficiency and ultimately results in limited success in yield improvement (Majumder *et al.*, 2008; Selvaraj *et al.*, 2011). Thus, effective improvement in yield may be brought about through selection of yield component characters *viz*; number of productive tillers per plant, panicle length, number of grains per panicle and 1000 grain weight. Yield component characters show association among themselves and also with yield.

The nature and extent of **genetic variation** governing the inheritance of characters and association will facilitate effective genetic improvement. Plant Breeder has to find significant correlations among yield and yield component traits, and effect of yield component traits on grain yield to predict the superior cross combinations and to select ideal plant type with increased yield. The present study was undertaken to derive information on correlation among yield and yield component traits and to estimate the direct and indirect effects of yield component traits on grain yield. This helps in selection of superior cross combinations for yield improvement.

MATERIALS AND METHODS

Experimental design:

The experimental material comprising seventy four rice genotypes were evaluated in randomized block design with 3 replications during pishnam season of 2011-2012 in at AC & RI Killikulam. Twenty-five days old seedlings were transplanted in the main field in three -meter row length with a spacing of 20 × 20 cm with single seedling per hill. Standard agronomic practices compatible to this ago-ecological zone were adopted to ensure good crop growth. **Correlation coefficient** was worked out as method suggested by Al-Jibouri *et al.* (1958) and Dewey and Lu (1959), respectively. The estimated values were compared with table values of correlation coefficient to test the significance of correlation coefficient.

RESULTS

Complete knowledge on interrelationship of grain yield with other characters is of paramount importance to the breeder for making improvement in complex quantitative character like grain yield for which direct selection is not much effective. Hence, association analysis was undertaken to determine the direction of selection and number of characters to be considered in improving grain yield.

Positive Association of quantitative and qualitative traits on grain yield

The grain yield exhibited the highest significant and positive association with grains per panicle (0.720), followed by number of productive tillers per plant (0.520), Volume expansion ratio (0.339), panicle length (0.233) and Amylose content (0.208).

Negative Association of quantitative and qualitative traits on grain yield

Days to fifty per cent flowering

(-0.271), L/B ratio (-0.197) and linear elongation ratio (-0.260) showed significant and negative association with yield at genotypic level.

Inter- correlation among yield components and quality components

Days to flowering exhibited significant and negative association with grains per panicle (-0.252), panicle length (-0.271) and number of productive tillers per plant (-0.277) at genotypic levels. Plant height showed significant and positive association with number of productive tillers per plant (0.293). Panicle length recorded positive and significant association with number of productive tillers per plant (0.240), grains per panicle (0.265), amylose content (0.288) and grain weight (0.297). Panicles per plant exhibited significant and positive association with grains per panicle (0.275) and had recorded negatively significant association with linear elongation ratio (-0.265). Grains per panicle had significant and positive association with volume expansion ratio (0.270) and amylose content (0.273). Grain weight exhibited significant positive association with volume expansion ratio (0.269). L/B ratio exhibited positive and significant association with breadth wise expansion ratio (0.439) and had negative significance with volume expansion ratio (-0.584). Linear elongation ratio showed significant and positive association with amylose content (0.287) and also had significant negative association with volume expansion ratio (-0.195). Volume expansion had significant and positive association with amylose content (0.264). Estimation of genotypic correlation coefficient between yield, yield and quality component traits is given in Table 1.

Table 1. Estimates of genotypic correlation coefficient between yield, yield and quality component traits

Traits	DF	PH	NPT	PL	GP	GW	L/B ratio	LER	BER	VER	AC	SPY
DF	1.000	0.108	-0.277*	-0.271*	-0.252*	-0.050	-0.133	-0.004	0.115	-0.035	-0.013	-0.271*
PH		1.000	0.293*	0.119	0.002	-0.050	-0.037	-0.028	-0.018	0.084	-0.001	0.061
NPT			1.000	0.240*	0.275*	-0.023	0.001	-0.265*	0.039	0.155	-0.094	0.520**
PL				1.000	0.265*	0.297*	0.061	0.113	0.038	0.127	0.288*	0.233*
GPP					1.000	0.135	-0.088	-0.133	0.000	0.270*	0.273	0.720**
GW						1.000	-0.187	0.136	-0.081	0.269*	0.159	0.055
L/B ratio							1.000	0.170	0.439**	-0.584**	-0.104	-0.197*
LER								1.000	0.072	-0.195*	0.287*	-0.260*
BER									1.000	0.081	0.066	0.077
VER										1.000	0.264*	0.339**
AC											1.000	0.208*
SPY												1.000

* Significance at 5% level

** Significance at 1% level

DISCUSSION

Genotypic correlation coefficients was assessed among the twelve characters (seven quantitative and five qualitative) viz., days to fifty per cent flowering, plant height, number of productive tillers per plant, panicle length, grains per panicle, thousand grain weight, grain yield, L/B ratio, linear elongation, breadth wise expansion, volume expansion and amylose content.

Direct correlation

The traits number of grains per panicle, number of productive tillers per plant, volume expansion, panicle length and amylose content had significant positive association with grain yield at genotypic level. A strong correlation of these traits with grain yield indicated that, simultaneous improvement of all the characters is possible. Days to 50% flowering, kernel length / breadth ratio and linear elongation ratio had significant and negative association with grain yield.

Intercorrelation

Days to 50 % flowering recorded significant and negative correlation with grains per panicle and productive tillers per plant and also showed positively significant correlation with plant

height which was in concordance with the results of Sabesan *et al.* (2009). Plant height exhibited significant and positive correlation with productive tillers per plant, panicle length and grains per panicle. This was in accordance with the findings of Khan *et al.* (2009) for productive tillers per plant and Sabesan *et al.* (2009) for panicle length and grains per panicle. The inter relationship of panicle length was positive and significant with productive tillers per plant, number of grains per panicle, thousand grain weight and amylose content indicating that increase in panicle length thereby increases these yield through these component traits. Similar views were earlier reported by Yogameenakshi *et al.* (2004) for grains per panicle and 1000 grain weight.

Number of productive tillers per plant had positive significant correlation with grains per panicle. L/B ratio recorded negative significance with volume expansion ratio and amylose content. Linear elongation ratio had positive association with volume expansion ratio and amylose content. This result was in accordance with findings of Manomani *et al.* (2010). Breadth wise expansion ratio had positive association with L/B ratio, volume expansion ratio and amylose content and this was similar to the results of Binodh *et al.* (2007). Volume expansion recorded positive significant association with amylose content. Similar results were reported earlier by Manonmani *et al.* (2010).

CONCLUSION

Correlation studies revealed that the characters grains per panicle, number of productive tillers per plant, volume expansion ratio, panicle length and amylose content, had significant positive association with grain yield. Days to fifty per cent flowering, L/B ratio and linear elongation ratio showed significant and negative association with yield at genotypic level. Hence these characters can be used as a selection index for improving the grain yield.

REFERENCE

- Al-Jibouri, H.A., P.A. Miller and H.F. Robinson. 1958. Genotypic and environmental variances and covariance in upland cotton cross of inter-specific origin. *Agron. J.*, 50: 633-637.
- Binodh, A.K., R. Kalaiyarasi, Thiyagarajan. K. 2007. Genetic parameter studies on quality traits in rice. *Madras Agric. J.* 94 (1-6): 109-113.
- Dewey, D.R. and K.H. Lu. 1959. A correlation and path co-efficient analysis of components of crested wheat grass seed production. *Agron. J.*, 51(9): 515-518.
- Khan, A.S., M.Imran and M.Ashfaq. 2009. Estimation of Genetic Variability and Correlation for Grain Yield Components in Rice (*Oryza sativa* L.). *Am.Eurasian J. Agric. Environ.sci.*, 6: 585 - 590.
- Manonmani, S., D. Malarvizhi, S. Robin, M. Umadevi, M.Ameen, R.Pushpam, K. Mohana Sundaram and K.Thiyagarajan. 2010. Breeding three line rice hybrids with good grain quality. *Electr. J. Pl. Br.*, 1(4): 1265- 1269.
- Srividya, A., L.R. Vemireddy, A.S. Hariprasad, M. Jayaprada and S. Sridhar *et al.*, 2010. Identification and mapping of landrace derived QTL associated with yield and its components in rice under different nitrogen levels and environments. *Int. J. Plant Breed. Genet.*, 4: 210-227.
- Sabesan, T., R. Suresh and K. Saravanan. 2009. Genetic variability and correlation for yield and grain quality characters of rice grown in coastal saline low land of Tamilnadu. *Electr. J. Pl. Br.*, 1: 56-59.
- Selvaraj, C.I., P. Nagarajan, K. Thiyagarajan, M. Bharathi and R. Rabindran. 2011. Studies on Heterosis and Combining Ability of Well Known Blast Resistant Rice Genotypes with High Yielding Varieties of Rice (*Oryza sativa* L.) *Int. J. Plant Breed. Genet.*, 5: 111-129.
- Yogameenakshi, P., N. Nadarajan and J. Anbumalarnathi. 2004. Correlation and path analysis on yield and drought tolerant attribution in rice (*Oryza sativa* L.) under drought stress. *Oryza*, 41(3&4): 68-70.