CORRELATION AND PATH COEFFICIENT ANALYSIS FOR GRAIN YIELD IN AEROBIC RICE (Oryza sativa L.) GENOTYPES

Article · December 2018

CITATIONS
0

6 authors, including:

Srijan Ambati
Professor Jayashankar Telangana State Agricultural University
27 PUBLICATIONS **10** CITATIONS
SEE PROFILE

Darshanoju Srinivasa Chary
Professor Jayashankar Telangana State Agricultural University
7 PUBLICATIONS **0** CITATIONS
SEE PROFILE

Research Note
The J. Res. PJTSAU 46(4) 64-68, 2018

CORRELATION AND PATH COEFFICIENT ANALYSIS FOR GRAIN YIELD IN AEROBIC RICE (*Oryza sativa* L.) GENOTYPES

A. SRIJAN, KULDEEP SINGH DANGI, P. SENGUTTUVEL, R. M. SUNDARAM, D. SRINIVASA CHARY and S. SUDHEER KUMAR

Department of Genetics and Plant Breeding, College of Agriculture
Professor Jayashankar Telangana State Agricultural University
Rajendranagar, Hyderabad-500 030

Date of Receipt : 28-11-2018 Date of Acceptance : 11-12-2018

As rice is the staple food in most parts of India, to feed the increasing population there is a great need to increase production of rice and productivity of land under rice cultivation. In Asia, about 17 million ha of irrigated rice area may experience "Physical water scarcity" and 22 million ha may have "Economic water scarcity" by 2025 (Tuong and Bouman, 2003). Therefore, efficient use of water is required in rice production. Aerobic rice is one such new concept to decrease water requirement in rice production (Vijayakumar, 2006). However, crop yield is the end product of the interaction of a number of other interrelated attributes. The efficiency of selection for yield mainly depends on the direction and magnitude of association between yield and its component characters and also among themselves. Correlation gives only the relation between two variables whereas path coefficient analysis allows separation of the direct effect and their indirect effects through other attributes by partitioning the correlations (Wright, 1921). In this study an attempt was made to identify the major contributing characters for grain yield, their direct and indirect effects.

The material for this study, consisted of 52 rice genotypes and were evaluated at Indian Institute of Rice Research (ICAR-IIRR), Rajendranagar, during *Kharif* 2016. The experiment was laid out in Randomized Block Design (RBD) with three replications. The crop was cultivated purely as aerobic rice, which does not require any puddling and flooding. The soil condition (moisture status) was maintained at below saturation level and throughout the crop growth it was maintained as irrigated dry crop. A plot size of two rows of 2m length for each entry with a spacing of 20 x 15 cm was maintained and later thinning was done retaining one seedling per hill after one week. The recommended package of practices and plant protection measures of IIRR was followed for raising a healthy crop. Data was recorded on eleven characters *viz.,* days to fifty per cent flowering, plant height, panicle length, number of productive tillers per plant, number of filled grains per panicle, spikelet fertility percentage, 1000 grain weight, productivity per day, biomass per plant, harvest index and grain yield per plant from each replication and the mean data were subjected to statistical analysis as per Singh and Chaudhary (1985) for Correlation coefficients and Dewey and Lu (1959) for path analysis.

In the present study, phenotypic and genotypic correlations between yield and yield components were estimated. In general, genotypic correlations were found to be higher than phenotypic correlations, which indicated that though there is strong inherent association between characters studied, its expression is lessened due to influence of environment on the association of characters at genic level.

Phenotypic and genotypic correlation coefficients between yield and yield components are presented in Table 1. Days to 50 per cent flowering had a significant positive phenotypic correlation with grain yield per plant, panicle length, number of productive tillers per plant, number of filled grains per panicle and harvest index. The plant height showed a significant positive phenotypic correlation with, grain yield per plant, number of filled grains per panicle, 1000 seed weight and biomass per plant, while negative and significant correlation of plant height was observed with number of productive tillers/ plant and harvest index. Panicle length exhibited a significant positive phenotypic correlation with number of filled grains per panicle, spikelet fertility and 1000 seed

email:srijan.ambati1@gmail.com

Table 1. Estimates of phenotypic and genotypic correlation coefficients for yield and its attributing characters

Character		Days to 50% flowering	Plant height	Panicle length	No. of Productive tillers per plant	No. of filled grains per panicle	Spikelet fertility	1000-seed weight	Productivity per day	Biomass per plant	Harvest Index	Grain yield per plant
Days to 50%	P	**1.0000**	0.1223	0.3431**	0.1594*	0.5331**	0.1150	-0.0195	0.0049	-0.0536	0.2191**	0.2472**
flowering	G	**1.0000**	0.1181	0.3730**	0.1691*	0.5421**	0.1149	-0.0229	0.0073	-0.0657	0.2280**	0.2570**
Plant height	P		**1.0000**	0.5653**	-0.4414**	0.3795**	0.1272	0.5292 **	0.1470	0.4604**	-0.2536**	0.1630*
	G		**1.0000**	0.6145**	-0.5199**	0.3892**	0.1301	0.5412**	0.1454	0.4798	-0.2621**	0.1605*
Panicle length	P			**1.0000**	-0.0258	0.3811**	0.2527**	0.1930 *	0.0041	-0.0205	0.0637	0.0774
	G			**1.0000**	0.0038	0.4071**	0.2706**	0.2060*	0.0242	0.0073	0.0654	0.1048
No. of Productive	P				**1.0000**	-0.0043	0.2021*	-0.3806 **	0.2308**	-0.3316**	0.4903**	0.2561**
tillers per plant	G				**1.0000**	-0.0029	0.2298**	-0.4340	0.2296**	-0.4530**	0.5749**	0.2585**
No. of filled grains	P					**1.0000**	0.5067**	0.0868	0.5112**	0.3200**	0.2694**	0.6261**
per panicle	G					**1.0000**	0.5088**	0.0874	0.5348**	0.3406**	0.2736**	0.6535**
Spikelet fertility (%)	P						**1.0000**	0.0613	0.4997**	0.0490	0.4247**	0.5043**
	G						**1.0000**	0.0615	0.5270**	0.0519	0.4359**	0.5301**
1000 seed weight	P							**1.0000**	0.1600*	0.2852**	-0.0689	0.1470
	G							**1.0000**	0.1656*	0.2999	-0.0697	0.1513
Productivity per day	P								**1.0000**	0.2902**	0.5785**	0.9681**
	G								**1.0000**	0.2391**	0.6147**	0.9662**
Biomass per plant	P									**1.0000**	-0.5619**	0.2585**
	G									**1.0000**	-0.5711**	0.2047*
Harvest index (%)	P										**1.0000**	0.6174**
	G										**1.0000**	0.6549**

P- Phenotypic correlation coefficient, G- Genotypic correlation coefficient ; ** Significant at 1%, * Significant at 5 %

weight. Number of productive tillers per plant exhibited significant positive phenotypic correlation with grain yield per plant, spikelet fertility, productivity/ day and harvest index while significant negative correlation with 1000 seed weight and biomass per plant. The significant positive phenotypic correlation of days to 50 percent flowering, plant height and number of productive tillers per plant with grain yield per plant was also reported earlier by Patel *et al* (2014) and Srijan *et al* (2016).

Number of filled grains per panicle and , spikelet fertility % exhibited a significant positive phenotypic correlation with grain yield per plant, productivity/ day and harvest index. 1000 grain weight has positive significant correlation with productivity/ day and biomass/ plant. Productivity per day exhibited a significant positive phenotypic correlation with grain yield per plant, biomass/ plant and harvest index. Bhadru *et al.* (2011) and Srijan *et al.* (2016) also reported significant positive phenotypic correlation of productivity per day with, grain yield per plant. Biomass per plant and harvest index showed significant positive correlation with grain yield per plant whereas biomass per plant showed significant negative correlation with harvest index.

As simple correlation cannot provide the true contribution of the characters towards the yield, these genotypic correlations were partitioned into direct and indirect effects through path coefficient analysis. The estimates of path coefficient analysis are provided for yield and yield component characters in Table 2. Among all the characters productivity/ day was the major contributor for grain yield followed by days to 50 per cent flowering, number of filled grains per panicle and 1000 seed weight. These characters showed direct positive effects on grain yield per plant. On the other hand characters that had negative direct effect include, spikelet fertility, panicle length, number of productive tillers per plant, plant height, harvest index and biomass per plant. The positive indirect effects of various characters with grain yield include Days to 50 per cent flowering through number of filled grains per panicle, productivity/ day and biomass per plant; plant height through days to 50 per cent flowering, number of productive tillers/ plant, number of filled grains per panicle, 1000 seed weight, productivity/ day and harvest index. Panicle length through days to 50 per cent flowering, number of productive tillers per plant, number of filled grains per panicle, productivity/ day, 1000 grain weight and biomass per plant; Number of productive tillers per plant through days to 50 per cent flowering, plant height, panicle length, productivity/ day and biomass per plant; Number of filled grains per panicle through days to 50 per cent flowering, number of productive tillers per plant, 1000 grain weight and productivity/ day; Spikelet fertility through days to 50 per cent flowering, number of filled grains per panicle, productivity/ day and 1000 grain weight; 1000 grain weight through number of productive tillers per plant, number of filled grains per panicle, productivity/ day and harvest index; Productivity per day through days to 50 per cent flowering, panicle length, number of filled grains per panicle and 1000 - grain weight; Biomass per plant through panicle length, number of productive tillers per plant, number of filled grains per panicle and 1000 grain weight; and Harvest index through days to 50 per cent flowering, plant height, number of filled grains per panicle, productivity/ day and biomass per plant. Bhadru *et al.* (2011) and Srijan *et al.* (2016) reported the positive direct effects of productivity/ day, days to 50 per cent flowering, number of productive tillers per plant, number of filled grains per panicle, 1000 grain weight and negative direct effects of spikelet fertility percent on grain yield per plant.

The study of phenotypic correlation studies revealed that selection of plants with more number of productive tillers per plant, higher number of filled grains per panicle, more 1000 grain weight, high productivity per day, more biomass per plant, tall plants with long duration would result in improvement of yield. Path analysis revealed that productivity/ day, days to 50 per cent flowering, number of filled grains per panicle and 1000 grain weight are the most important characters which could be used as selection criteria for effective improvement in grain yield. Therefore, it is suggested that preference should be given to these characters in selection programmes, so as to isolate superior lines with high genetic potential in rice.

Acknowledgement:

Authors are highly thankful to DST-INSPIRE for providing financial support for carrying out research

Table 2. Direct and indirect effects of various component characters on yield in rice

Character		Days to 50% flowering	Plant height	Panicle length	No. of Productive tillers per plant	No. of filled grains per panicle	Spikelet fertility	1000-seed weight	Productivity per day	Biomass per plant	Harvest Index	Grain yield per plant
Days to 50%	P	**0.2451**	-0.0015	-0.0035	-0.0018	0.0132	-0.0012	-0.0001	0.0049	0.0030	-0.0110	0.2472**
flowering	G	**0.2522**	-0.0018	-0.0040	-0.0023	0.0157	-0.0011	-0.0002	0.0073	0.0041	-0.0128	0.2570**
Plant height	P	0.0300	**-0.0123**	-0.0058	0.0048	0.0094	-0.0013	0.0031	0.1482	-0.0260	0.0128	0.1630*
	G	0.0298	**-0.0153**	-0.0066	0.0072	0.0112	-0.0012	0.0041	0.1465	-0.0298	0.0147	0.1605*
Panicle length	P	0.0841	-0.0069	**-0.0102**	0.0003	0.0094	-0.0025	0.0011	0.0042	0.0012	-0.0032	0.0774
	G	0.0941	-0.0094	**-0.0108**	-0.0001	0.0118	-0.0025	0.0015	0.0243	-0.0005	-0.0037	0.1048
No. of Productive	P	0.0391	0.0054	0.0003	**-0.0110**	-0.0001	-0.0020	-0.0022	0.2327	0.0187	-0.0247	0.2561**
tillers per plant	G	0.0426	0.0080	0.0000	**-0.0138**	-0.0001	-0.0022	-0.0033	0.2314	0.0282	-0.0323	0.2585**
No. of filled grains	P	0.1307	-0.0047	-0.0039	0.0000	**0.0247**	-0.0051	0.0005	0.5154	-0.0181	-0.0136	0.6261**
per panicle	G	0.1367	-0.0060	-0.0044	0.0000	**0.0289**	-0.0048	0.0007	0.5389	-0.0212	-0.0154	0.6535**
Spikelet fertility (%)	P	0.0282	-0.0016	-0.0026	-0.0022	0.0125	**-0.0100**	0.0004	0.5038	-0.0028	-0.0214	0.5043**
	G	0.0290	-0.0020	-0.0029	-0.0032	0.0147	**-0.0094**	0.0005	0.5311	-0.0032	-0.0245	0.5301**
1000 seed weight	P	-0.0048	-0.0065	-0.0020	0.0042	0.0021	-0.0006	**0.0058**	0.1613	-0.0161	0.0035	0.1470
	G	-0.0058	-0.0083	-0.0022	0.0060	0.0025	-0.0006	**0.0075**	0.1669	-0.0186	0.0039	0.1513
Productivity per day	P	0.0012	-0.0018	0.0000	-0.0025	0.0126	-0.0050	0.0009	**1.0082**	-0.0164	-0.0291	0.9681**
	G	0.0018	-0.0022	-0.0003	-0.0032	0.0154	-0.0049	0.0012	**1.0077**	-0.0149	-0.0345	0.9662**
Biomass per plant	P	-0.0131	-0.0056	0.0002	0.0036	0.0079	-0.0005	0.0017	0.2926	**-0.0564**	0.0283	0.2585**
	G	-0.0166	-0.0074	-0.0001	0.0062	0.0098	-0.0005	0.0022	0.2410	**-0.0621**	0.0321	0.2047*
Harvest index (%)	P	0.0537	0.0031	-0.0006	-0.0054	0.0066	-0.0043	-0.0004	0.5832	0.0317	**-0.0503**	0.6174**
	G	0.0575	0.0040	-0.0007	-0.0079	0.0079	-0.0041	-0.0005	0.6194	0.0355	**-0.0561**	0.6549**

Phenotypic residual effect = 0.0578, Genotypic residual effect = 0.0560 ; P- Phenotypic level, G- Genotypic level ; Bold values - Direct effects, Normal Values - Indirect effects;

**** Significant at 1%, * Significant at 5 %**

REFERENCES

Bhadru, D., Lokanadha Reddy, D and Ramesha, M.S. 2011. Correlation and path coefficient analysis of yield and yield contributing traits in rice hybrids and their parental lines. Electronic Journal of Plant Breeding. 2(1): 112-116.

Dewey, J.R and Lu, K.H. 1959. Correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal. 51: 515-518.

Patel, J.R., Saiyad, M.R., Prajapati, K.N., Patel, R.A and Bhavani R.T. 2014. Genetic variability and character association studies in rainfed upland rice (*Oryza sativa* L.). Electronic Journal of Plant Breeding. 5(3): 531-537.

Singh, R.K. and Chaudhary, B.D. 1985. Biometrical methods in quantitative genetic analysis. Kalyani Publishers, New Delhi, Ludhiana, India: 205-215.

Srijan, A., Sudheer Kumar, S., Damodar Raju, Ch and Jagadeeshwar, R. 2016. Character association and path coefficient analysis for grain yield of parents and hybrids in rice (*Oryza sativa* L.). Journal of Applied and Natural Science. 8 (1): 167 –172.

Tuong, T.P and Bouman, B.A.M. 2003. Water productivity in Agriculture: Limits and opportunities for improvement. CABI Publishing, pp. 55-67 .

Vijaykumar, C.H.M., Shobha, R.N., Subbarao, L.V., Mahender, K.R., Voleti, S.R., Viraktamath, B.C and Mishra, B. 2006. Breeding for high yielding rice (*Oryza sativa* L.) varieties and hybrids adapted to aerobic (non-flooded irrigated) conditions II. Evaluation of released varieties. Indian Journal of Genetics. 66(3): 182-186.

Wright, S. 1921. Correlation and causation. Journal of Agricultural Research. 20: 57-585.