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ASSESSMENT OF ASSOCIATION ANALYSIS FOR GRAIN YIELD AND ITS ATTRIBUTING TRAITS IN RICE (*ORYZA SATIVA* L.)

C. Praveen Sampath Kumar[1], Bukke Mahesh Naik[1] and *Darling B. Suji[2]

[1]Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University, Annamalainagar-608002 (Tamilnadu) India.

[2*]Department of Agricultural Extension, Faculty of Agriculture, Annamalai University, Annamalainagar-608002 (Tamilnadu) India.

Abstract

Thirty five rice genotypes were subjected to study the association among the grain yield and yield attributing traits. Eleven characters *viz*., days to first flowering (X1), plant height at maturity (X2), number of tillers per plant (X3), number of panicles per plant (X4), panicle length (X5), number of grains per panicle (X6), 1000 grain weight (X7), grain length (X8), grain breadth (X9), grain L/B ratio (X10) and grain yield per plant (X11) were studied. The genetic correlations revealed that grain yield per plant had positive significant association with number of tillers per plant, number of panicles per plant and number of grains per panicles while the significant positive association was observed between number of tillers per plant and number of panicles per plant. The cause and effect of relationship indicated maximum direct effect on grain yield per plant was through number of tillers per plant, number of grains per panicle, 1000 grain weight, grain breadth and grain L/B ratio.

***Key words*:** Rice, correlation and causation.

Introduction

Rice (*Oryza sativa* L.) is the essential staple food for more than 65% of the people, also plays a key role in food security and it provides employment and livelihood security to 70% of Indian population. Rice grain is consumed by nearly half of the world population. It is grown in countries and many people are engaged in rice cultivation around the world.

In India, it is grown in diverse conditions starting from below sea levels to hill as greater than 2000 meters. India is the second largest producer of rice in the world after China. It has an area of 43 million hectares with the production of 99 million tonnes and 3.45 tonnes per hectare productivity (Anon, 2012). In Tamilnadu, rice is grown predominantly among the state in India which is cultivated in an area of 2.2 million hectares and the production of 8.65 million tones with the productivity of tonnes per hectare.

In any selection programme, it may not be always possible to select on the basis of yield alone for evolving superior yielding genotypes because yield is a complex character and is collectively influenced by many component characters. Correlation co-efficient illustrate relationships among independent variables and the degree of linear relation between the traits. Such association studies provide information on nature of extent and direction of selection, but it does not adequately predict the success of selection. Knowledge of association between yield and yield contributing characters would be of immense aid in plant breeding programme where simultaneous improvement in two or more characters is desired to be achieved.

However path–coefficient analysis that is developed by Wright (1929) is the most worthy tool to estimate the exact correlation in terms of cause and effect, it allows one to identify the direct, indirect and total causal effect as well as to remove any unrealistic effect that may be present. Path-coefficient can be defined as the ratio of standard deviation of the effect due to a given cause to the total standard deviation of the effect (Singh and Chouadhary, 1985).

Materials and Methods

The present investigation was carried out in the Plant Breeding farm, Department of Genetics and Plant

Table 1: List of genotypes selected for the study.

S. No.	Name of the Genotype	Origin	Genotype Code
1	ADT 36	TRRI, TN, India	G1
2	ADT 37	TRRI, TN, India	G2
3	ADT 39	TRRI, TN, India	G3
4	ADT 41	TRRI, TN, India	G4
5	ADT 42	TRRI, TN, India	G5
6	ADT 43	TRRI, TN, India	G6
7	ADT 45	TRRI, TN, India	G7
8	ADT 46	TRRI, TN, India	G8
9	ADT 47	TRRI, TN, India	G9
10	ADT 48	TRRI, TN, India	G10
11	ADT 49	TRRI, TN, India	G11
12	ADT 50	TRRI, TN, India	G12
13	TKM 9	RRS, Tirur, TN, India	G13
14	PMK 3	ARS, Paramkudi, TN, India	G14
15	AD 06207	TRRI, Aduthurai, TN, India	G15
16	TPS 5	ARS, Paramkudi, India	G16
17	ANNA 4	ARS,Paramkudi,India	G17
18	MDU 4	Agricultural college, Madurai,TN, India	G18
19	NLR 34449	A.N.G.R.A.U Research station, AP, India	G19
20	RNR 1446	A.N.G.R.A.U Research station, AP, India	G20
21	BPT 5204	Agricultural college, Bapatla, AP, India	G21
22	MTU 1001	A.N.G.R.A.U Research station, AP, India	G22
23	MTU 1010	A.N.G.R.A.U Research station, AP, India	G23
24	STBN 1	DRR, Hyderabad, India	G24
25	STBN 2	DRR, Hyderabad, India	G25
26	STBN 3	DRR, Hyderabad, India	G26
27	Ranjith	CRRI, Cuttack, India	G27
28	Gayathri	CRRI, Cuttack, India	G28
29	Jaya	DRR, Hyderabad, India	G29
30	PY 1	RRS, Paiyur, TN, India	G30
31	Bora	Landrace, Assam, India	G31
32	Shali	Landrace, Assam, India	G32
33	Porimol	Landrace, Assam, India	G33
34	Sampada	Landrace, Assam, India	G34
35	Chatoki	Landrace, Assam, India	G35

Breeding, Faculty of Agriculture, Annamalai University during samba season. The experimental material comprised of 35 rice genotypes collected from various places (Table 1).

Seeds of the thirty five rice genotypes were sown in raised nursery beds. In each genotype, one seeding 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 3m long rows. The experiment was carried out in randomized block design (RBD) with three replications. A uniform population of 10 plants in a row was maintained. Recommended agronomic practices and need based plant protection measures were adopted.

Five randomly selected plants of the each genotype per replication were chosen and labelled for recording observations and the mean of five plants were used for statistical analysis. The data on the following yield and yield components and quality parameters were recorded. The characters *viz.*, days to first flowering (X1), plant height at maturity (X2), number of tillers per plant (X3), number of panicles per plant (X4), panicle length (X5), number of grains per panicle (X6), 1000 grain weight (X7), grain length (X8), grain breadth (X9), grain L/B ratio (X10) and grain yield per plant (X11) were studied. The genotypic and phenotypic correlation coefficients were calculated from the mean of the three replications of each genotype by adopting the method suggested by Al-Jibouri *et al*., (1958). Path-coefficient analysis was also done as per the method suggested by Wright (1921) and elaborated by Dewey and Lu (1959).

Results and Discussion

Breeding high yielding varieties in most of the crops needs information on the extent of inter relationship among yield components. The efficiency of selection for yield mainly depends on the direction and magnitude of the association of the components traits with yield. correlation studies which provide estimates of degree of association of grain yield with its components help in planning effective selection strategies Johnson *et al*., (1955) pointed out that characters with no values in themselves and are not normally measured in the selection programme are not worthy of inclusion in the selection scheme. Correlation between yield and yield attributing characters in rice genotypes are estimated and are presented in table 2. The estimates of phenotypic and genotypic correlations coefficients among the 11 traits are discussed below.

In the present study, correlation analysis indicated that grain yield per plant had exhibited significant positive correlation with number of tillers per plant, number of panicles per plant and number of grains per panicle both at genotypic and phenotypic level. Similar results were reported by Anees salma (2006) for number of panicles per plant and panicle length and Rajamani *et al*., (2004) for plant height at maturity. This indicated that association between these traits could be utilized for increasing grain yield. This corroborates with the findings of Rajamani *et*

Table 2: Genotypic and phenotypic correlation analysis for eleven characters in 35 rice genotypes

S. No.	Characters		Days of first flower -ing	Plant hight	Number of tillers per plant	Number of panicles per plant	Panicles length	Number of grain per panicles	1000 grain weight	Grain length	Grain breadth	Grain L/B ratio	Grain yield per plant
1	Days to first flowering	G	1.00	0.05	0.26	0.23	0.05	0.03	-0.07	0.13	0.11	-0.07	0.19
		p	1.00	0.01	0.15	0.11	-0.00	0.02	-0.10	0.10	0.07	-0.04	0.13
2	Plant height at maturity	G		1.00	0.06	-0.01	0.24	-0.13	-0.08	-0.07	-0.10	0.05	-0.12
		P		1.00	0.05	-0.02	0.19	-0.11	-0.06	-0.06	-0.10	0.05	-0.12
3	Number of tillers per plant	G			1.00	0.98**	-0.01	-0.09	-0.24	-0.26	-0.29	0.01	0.61**
		P			1.00	0.91**	-0.01	-0.07	-0.20	-0.22	-.025	0.02	0.58**
4	Number of panicles per plant	G				1.00	-0.02	-0.10	-0.18	-0.28	-0.16	-0.09	0.65**
		P				1.00	-0.06	-0.10	-0.15	-0.24	-0.16	-0.05	0.61**
5	Panicle length	G					1.00	0.13	-0.12	0.03	0.13	-0.05	0.03
		P					1.00	0.13	-0.08	0.02	0.13	-0.07	0.05
6	Number of grains per panicle	G						1.00	-0.21	0.02	-0.13	0.13	0.48**
		P						1.00	-0.21	0.02	-0.12	0.12	0.44**
7	1000 grain weight	G							1.00	0.04	0.37*	-0.23	0.21
		P							1.00	0.04	0.35*	-0.21	0.21
8	Grain length	G								1.00	0.07	0.57**	-0.16
		P								1.00	0.07	0.56**	-0.16
9	Grain breadth	G									1.00	-0.75**	0.01
		P									1.00	-0.75**	0.01
10	Grain L/B ratio	G										1.00	-0.12
		P										1.00	-0.12
11	Grain yield per plant	G											1.00
		P											1.00

*Significant at 5 per cent level **Significant at 1 per cent level G : Genotypic P : Phenotypic

al., (2004). Thus suggesting that selection pressure applied for increasing the characters will eventually increase the grain yield per plant.

The significant positive association was observed between number of tillers per plant and number of panicles per plant. This is akin to the earlier reports of Latha *et al*., (2003) and Raju *et al*., (2003). 1000 grain weight had significant positive association with grain breadth (Chakraborty *et al*., 2001), while grain length and grain breadth had significant positive association with grain L/B ratio at both genotypic and phenotypic levels.

However, association of yield and its components alone are not adequate in any selection programme. The interrelationship among the individual character may ultimate influence the yield. These results are in conformity with the findings of Raju *et al*., (2001) for plant height at maturity, Ganapathy *et al*., (2006) for number of panicles per plant, Malarvizhi *et al*., (2006) and Saravanan and Sabesan (2009) for panicle length with grain yield per plant.

The correlation coefficients alone are insufficient to explain the relationship for effective manipulation of the characters, but path analysis furnishes a method for partitioning the correlation coefficient into direct and indirect effect and measures the relative importance of the casual factor involved. The direct and indirect contribution of various characters on grain yield in rice genotypes are measured and are presented in table 3. The results of such analysis are discussed below.

The estimated residual was 0.1519. This indicated that all characters studied was amply controls free expression of grain yield in rice. Among the yield component character number of tillers per plant recorded very high positive direct effect on grain yield per plant. Similar results were reported by Kavitha and Sree Rama Reddi (2001) and Raju *et al*., (2003). With the exception of days to first flowering, plant height at maturity, number of panicles per plant, panicle length and grain length all

Table 3: Path coefficient analysis showing direct and indirect effects of yield attributing characters on grain yield per plant in rice genotypes

S. No.	Characters	Days of first flower -ing	Plant hight	Number of tillers per plant	Number of panicles per plant	Panicles length	Number of grain per panicles	1000 grain weight	Grain length	Grain breadth	Grain L/B ratio	Grain yield per plant
1	**Days to first flowering**	**-0.0333**	-0.0022	0.2865	-0.0451	-0.0005	0.0203	-0.0363	-0.0246	0.0516	-0.0231	0.193
2	**Plant height at maturity**	-0.0017	**-0.0431**	0.0664	0.0024	-0.0022	-0.0897	-0.0399	0.0127	-0.0482	0.0163	-0.127
3	**Number of tillers per plant**	-0.0088	-0.0026	**1.0748**	-0.1859	0.0001	-0.0647	-0.1172	0.0487	-0.1308	0.0054	0.619
4	**Number of panicles per plant**	-0.0079	0.0005	1.0585	**-0.1887**	0.0001	-0.0694	-0.0878	0.0518	-0.0733	-0.0301	0.654
5	**Panicle length**	-0.0018	-0.0106	-0.0191	0.0038	**-0.0092**	0.0952	-0.0630	-0.0065	0.0621	-0.0150	0.036
6	**Number of grains per panicle**	-0.0009	0.0056	-0.1011	0.0190	-0.0012	**0.6877**	-0.1023	-0.0052	-0.0589	0.0408	0.483
7	**1000 grain weight**	0.0024	0.0035	-0.2580	0.0339	0.0011	-0.1441	**0.4882**	-0.0076	0.1687	-0.0719	0.216
8	**Grain length**	-0.0044	0.0030	-0.2858	0.0535	-0.0003	0.0197	0.0204	**-0.1830**	0.0333	0.1758	-0.168
9	**Grain breadth**	-0.0038	0.0046	-0.3139	0.0309	-0.0012	-0.0904	0.1838	-0.0136	**0.4479**	-0.2308	0.013
10	**Grain L/B ratio**	0.0025	-0.0023	0.0191	0.0187	0.0004	0.0923	-0.1154	-0.1058	-0.3399	**0.3042**	-0.126

Residual effect = 0.1519081

other remaining traits recorded positive direct effect on grain yield per plant. Similar results by Sathish *et al*., (2003) was recorded for 1000 grain weight, Ezhilmaran and Thirumeni (2006) for number of panicles per plant, Amudha *et al*., (2006) for number of grains per panicle, Kavitha and Sree Rama Reddi (2001) for grain breadth.

In addition to its direct effect, indirect effect of number of panicle per plant via number of tillers per plant was very high positive indirect effect on grain yield per plant. Similar results were reported by Kavitha and Sree Rama Reddi (2001). Among the grain quality traits grain breadth and grain L/B ratio had high negative indirect effect *via* number of tillers per plant and grain breadth respectively.

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, number of panicles per plant, number of tillers per plant, grain L/B ratio and grain breadth exhibited positive significant correlation and high direct effect with grain yield per plant. Hence, these traits should be given prime importance while selection for high yielding genotypes.

The character such as number of tillers per plant, number of grains per panicles and 1000 grain weight recorded variable performance for direct and indirect effect and more similarly for correlation coefficient. Hence, selection for such characters could be postponed to later generation until there is favourable and constant association of genes controlled the characters.

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