Plant Archives Vol. 19, Supplement 1, 2019 pp. 1023-1026 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

COMPONENT ANALYSIS FOR GRAIN YIELD IN RICE (*ORYZA SATIVA* L.) UNDER NATURAL SALINE CONDITION

M. Venkatesan, P. Karthikeyan and T. Thilagavathi
Department of Genetic and Plant Breeding, Faculty of Agriculture,
Annamalai University, Annamalai Nagar – 608002, Tamil Nadu, India.

Abstract

Study was carried out to explore correlation and path coefficient analysis in 40 rice genotypes for eleven characters. The genotype correlation coefficients showed higher magnitude than phenotypic correlation coefficients which indicated masking or modifying effect of environment. The genetic correlation revolved that grain yield per plant had strong negative and significant association with days to first flower at both genotypic and phenotypic levels. So it could be referred that grain yield and days to first flower could be used as selection criteria for the improvement of yield per plant. The path analysis indicated that maximum direct effect on grain yield was exhibited by number of tillers per plant. Hence the trait should be taken up for breeding programme to develop the maximum of threshold yield obtaining new rice varieties of hybrids.

Key words: Genotypic, Phenotypic, Correlation, Coefficient and Path analysis

Introduction

Rice (*Oryza Sativa L.* 2n:2x:24) is the world's largest food crop, providing the above needs of millions of people daily and cultivated widely in many parts of the world. The genes Oryza belongs to the family Poaceae and subfamily Oryzoidia. There are two different types of domesticated rice *Oryza Sativa* or Asian Rice and *Oryza glaberrima*, African rice. The genus Oryza contains 21 wild relatives of the domesticated rice. The genus is divided into four species complexes: The *Oryza sativa, Oryza officinalis, Oryza ridelyi* and Oryza *granulate* species complexes.

Around 3 billion people in the world use rice as a basic food, which can provide 50 to 80 percent of the daily calorie. Globally rice is cultivated on 154 million hectares with annual production of around 600 million tons and average productivity of 3.9 tons/hectares more than 90 percent of the rice is produced and consumed in Asian countries.

Correlation coefficient analysis measures the mutual relationships between various plant characters on which selection can be based for genetic improvement in yield. Grain yield is a complex character and is the end. Product of various trails. Therefore knowledge regarding the correlation of grain yield with other component characteristics is valuable for understanding the correlated response to selection of yield. Path coefficient analysis is helpful to recognize direct and indirect causes of correlation and also enables us to compare the casual factors on the genetic basis of their relative contributions. Hence the present study of correlations and path analysis would serve path for future breeding programmes.

Materials and Methods

The experimental material for the study comprised of 40 genotypes laid in Randomized Block Design (RBD) with three replication at experimental farm of plant breeding (11^{o}24$^{'}$N latitude and 79^{o}44$^{'}$E longitude, + 5.79MSL), Annamalai University, Tamil Nadu, India. In each genotype, one seedling per hill was transplanted in the main field after 25 days with spacing of 20cm×20cm. These genotypes were grown in saline soil with electrical conductivity (EC) of 2.83 dSm^{-1}.

Standard agronomic practices and plant protection measures were taken as per schedule observations were recorded on fire randomly selected plants per replication for days to first flower, (days) plant height (cm), number of tillers per plant, number of panicles per plant, number of grains per panicle, panicle length (cm), hundred grain weight (g), kernel length (mm), kernel breadth(mm), kernel L/B ratio and grain yield per plant. The analysis of genetic divergence was done using Mahalanobis (1936) D^2 statistics. The genotypes were grouped into different clusters, inter and intra clusters distances and mean performances for characters were also computed.

Results and Discussion

The grain yield was a complex and highly variable character and was a result of cumulative effects of its component characteristics and therefore, direct selection for it may not be effective. These component characters were independent in their action but are inter linked and in this inter linked complex genetic system selection practiced for one individual character might subsequently bring about a simultaneous change in the other. Thus, an understanding of the association between the component characters and their relative contribution of yield is essential to effect of rational improvement in desirable trails.

The genotypic and phenotypic correlation coefficient was studied for different trails along with grain yield to understand interrelationship among them. Estimates of correlation in rice genotypes are presented in Table 2.

A positive value of correlations shows that the changes of two variables are in the same direction i.e. high value of one variable are associated with high values of the other and vice-versa. The breeder is always concerned for the selection of superior genotypes on the basis of phenotypic expression. However, for the quantitative characters, genotypes are influenced by environment, thereby affecting the phenotypic expression. Information regarding the nature and extent 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 general, the genotypic and the phenotypic correlation coefficients showed similar trend but genotypic correlation coefficients were of higher in magnitude than the correlation phenotypic correlation coefficients which might be due to marking or modifying effect of environment (Singh, 1980).

In present investigation, there was strong negative and significant correlation between grain yield per plant and days to first flower at both genotypic and phenotypic levels (Table 3). Thus negative correlation between grain yield and days to first flower indicated that grain yield per plant would be reduced when the genotypes had late flowering nature. Contrary findings were reported by Mohan *et al.* (2015) and Thippeswamy *et al.* (2016) in which they reported positive significant correlation between grain yield per plant and days to first flower at both levels .Similar findings reported by C.A. Sowmiya and M. Venkatesan (2017)

Also, days to first flower had positive significant correlation with plant height and negative significant correlation with grain yield per plant at genotypic and phenotypic levels. The results clearly indicated that long duration genotypes would be tall yet contribute less grain yield.

Number of tillers per plant had the maximum correlations among all the characters studied for correlation coefficients. It had positive and significant correlation with the number of panicles per plant, number of grains per panicle, panicle length, hundred grain weight, kernel length, kernel L/B ratio and grain yield per plant.

From the investigation, plant height showed significant positive correlation with kernel length at both genotypic and phenotypic levels.

Panicle length showed significant positive correlation with hundred grain weight, kernel length, grain yield per plant at both phenotypic and genotypic level, kernel L/B ratio at genotypic level. From the above discussion, it may be seen that selection of these characters would ultimately help in identifying genotypes with high yield potential.

Path coefficient analysis allows separating the direct and indirect effects through other contributes by apportioning the correlations (Wright, 1921) for better interpretation of cause and effect relationship. The results clearly showed significant difference in genotypic and phenotypic direct and indirect effects, indicating the predominance of environmental influence in expression of the traits.

In the present investigation, the residual effect was 0.1620 (Table 4). Perusal of results obtained in path analysis revealed that high direct effect on grain yield was exhibited by number of panicles per plant. Contrary reports were given by Thippeswamy *et al.* (2016), Mohan *et al.* (2015), Yadav *et al.* (2011) and Akhtar *et al.* (2011).

Panicle length recorded low positive direct effect on grain yield per plant.

The trait, number of panicles per plant and kernel breadth had high negative direct effect on grain yield per plant. In addition to the direct effect, indirect effect of number of tillers per plant via hundred grain weight was high and positive on grain yield per plant was observed.

High positive indirect effect was observed by plant height through number of panicle per plant on grain yield per plant. But Ravindra Babu *et al.* (2012) and Yadav *et al.* (2011) reported positive low indirect effect on grain yield by the same.

Plant height also had high and positive indirect effect on grain yield through number of tillers per plant. Also, panicle length was detected to have very high negative indirect effect through number of panicles per plant on grain yield. Kernel L/B ratio has also observed very high positive indirect effect through number of tillers per plant on grain yield. From the above discussion, it was inferred that the pattern of path coefficient observed in the present study was in agreement with the correlation attained. In general, the character days to first flower recorded negative grain yield per plant. Hence it could be used as selection criteria in breeding programme to develop high yielding new plant type rice varieties.

Table 1: List of genotypes selected for D^2 analysis, The following genotypes were collected from IIRR, Hyderabad

SL. No	Name of Genotype	SL. No	Name of Genotype
1.	AURC 1	21.	AURC 21
2.	AURC 2	22.	AURC 22
3.	AURC 3	23.	AURC 23
4.	AURC 4	24.	AURC 24
5.	AURC 5	25.	AURC 25
6.	AURC 6	26.	AURC 26
7.	AURC 7	27.	AURC 27
8.	AURC 8	28.	AURC 28
9.	AURC 9	29.	AURC 29
10.	AURC 10	30.	AURC 30
11.	AURC 11	31.	AURC 31
12.	AURC 12	32.	AURC 32
13.	AURC 13	33.	AURC 33
14.	AURC 14	34.	AURC 34
15.	AURC 15	35.	AURC 35
16.	AURC 16	36.	AURC 36
17.	AURC 17	37.	AURC 37
18.	AURC 18	38.	AURC 38
19.	AURC 19	39.	AURC 39
20.	AURC 20	40.	AURC 40

Table 2 : Phenotypic and genotypic correlation coefficients among yield attributing characters in rice genotypes

S. No	Characters		Days to first flower	Plant Height	No of tillers per plant	No. of Productive tillers per plant	No. of Grains per Panicle	Panicle length	100 seed weight	Kernel length	Kernel Breadth	Kernel L/B ratio	Grain yield per plant
1	Days to first flower	P	1.00	-0.34*	-0.33*	-0.35*	-0.28	-0.43**	-0.31*	-0.37*	0.15	-0.31*	-0.28
		G	1.00	-0.39**	-0.41**	-0.43**	-0.35*	-0.48**	-0.38**	-0.44**	0.19	-0.41**	-0.36*
2	Plant Height	P		1.00	0.27	0.26	0.04	0.10	0.13	0.31*	0.01	0.21	0.10
		G		1.00	0.30	0.29	0.04	0.12	0.17	0.34*	0.03	0.21	0.12
3	No of tillers per plant	P			1.00	0.97**	0.43**	0.42**	0.34	0.75**	-0.31*	0.67**	0.32*
		G			1.00	1.00**	0.61**	0.47**	0.45**	0.90**	-0.37*	0.87**	0.43**
4	No. of Productive tillers per plant	P				1.00	0.46**	0.43**	0.36	0.74**	-0.31*	0.41**	0.34*
		G				1.00	0.63**	0.48**	0.48**	0.91**	-0.37*	0.86**	0.47**
5	No. of Grains per Panicle	P					1.00	0.50**	0.61**	0.40**	-0.37*	0.36*	0.31*
		G					1.00	0.69**	0.50**	0.55**	-0.49**	0.59**	0.44**
6	Panicle length	P						1.00	1.00**	0.37*	-0.24	0.26	0.54**
		G						1.00	0.71**	0.43**	-0.26	0.41**	0.68**
7	100 seed weight	P							1.00	0.35*	-0.00	0.32*	0.75**
		G							1.00	0.46**	-0.03	0.37*	0.91**
8	Kernel length	P								1.00	-0.48**	-0.75	0.37*
		G								1.00	-0.47**	0.90**	0.44**
9	Kernel Breadth	P									1.00	1.00**	-0.08
		G									1.00	-0.72**	-0.12
10	Kernel L/B ratio	P										1.00	0.87**
		G										1.00	0.42**
11	Grain yield	P											1.00
		G											1.00

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 to first flower	Plant Height	No of tillers per plant	No. of Productive tillers per plant	No. of Grains per Panicle	Panicle length	100 seed weight	Kernel length	Kernel Breadth	Kernel L/B ratio	Grain yield per plant
1	Days to first flower	**-0.12**	0.03	-1.27	1.24	0.04	0.09	-0.46	0.02	-0.06	0.13	-0.36
2	Plant Height	0.046	**-0.09**	0.93	-0.85	-0.00	-0.02	0.20	-0.02	-0.01	-0.07	0.12
3	No of tillers per plant	0.048	-0.03	**3.09**	-2.88	-0.06	-0.08	0.53	-0.04	0.12	-0.27	0.43
4	No. of Productive tillers per plant	0.05	-0.03	3.09	**-2.88**	-0.06	-0.08	0.57	-0.04	0.12	-0.27	0.47
5	No. of Grains per Panicle	0.04	-0.00	1.88	-1.81	**-0.10**	-0.12	0.60	-0.02	0.16	-0.18	0.44
6	Panicle length	0.06	-0.01	1.44	-1.36	-0.07	**-0.17**	0.86	-0.02	0.08	-0.13	0.68
7	100 seed weight	0.04	-0.1	1.38	-1.39	-0.05	-0.13	**1.20**	-0.02	0.00	-0.11	0.91
8	Kernel length	0.05	-0.03	2.79	-2.62	-0.05	-0.08	0.55	**-0.04**	0.16	-0.28	0.44
9	Kernel Breadth	-0.02	-0.00	-1.15	1.07	0.05	0.05	-0.03	0.02	**-0.33**	0.23	-0.12
10	Kernel L/B ratio	0.05	-0.02	2.67	-2.47	-0.06	-0.07	0.44	-0.04	0.24	**-0.31**	0.42

Residual effect =0.2606737 Direct effect – diagonal bold values Indirect effect-unbold values

Reference

Singh, R.P. (1980). Association of grain yield and its component in F_1 and F_2 population of rice. *Oryza,* 17: 200-204.

Mohan, Y.C.; Thippeswamy, S.; Bhoomeshwar, K.; Madhavilatha, B. and Jameema, S. (2015). Diversity analysis for yield and gall midge resistance in rice (*Oryza sativa* L.) in Northern Telangana zone, India. *SABRAO J. of Breed. and Genet.,* 47(2): 160-171.

Thippeswamy, S.; Chandramohan, Y.; Srinivas, B. and Padmaja, D. (2016). Selection of diverse parental lines for heterotic hybrid development in rice (*Oryza sativa* L.). *SABRAO J. of Breed. and Genet.,* 48(3): 285-294.

Sowmiya C.A. and Venkatesan, M. (2017). Studies on genetic diversity in rice (*Orya sativa* L.). *Int. J. Curr. Microbiol. App. Sci.,* 6(9): 1749-1756.

Wright, S. (1921). Correlation and association. *J. Agric. Res.,* 20: 550-587

Ravindra, B.V.; Shreya, K.; Kuldeep, S.D.; Usharani, G. and Shankar, A.S. (2012). Correlation and Path Analysis Studies in Popular Rice hybrids in India. *Intl. J. of Scientific and Res. Publications,* 2(3): 1-5.

Yadav, S.K.; Pandey, P.; Kumar, B. and Suresh, B.G. (2011). Genetic Architecture, Inter-relationship and selection criteria for yield improvement in rice (*Oryza sativa* L.). *Pakistan J. of Biological Sci.,* 14(9): 540-545.

Akhtar, N.; Nazir, M.F.; Rabnawaz, A.; Mahmood, T.; Safdar, M.E.; Asif, M. and Rehman, A. (2011). Estimation of Heritability, Correlation and Path Coefficient Analysis in fine grain Rice (*Oryza sativa* L.). *The Journal of Animal & Plant Sciences,* 21(4): 660-664.

Rajamadhan, R.; Eswaran, R. and Anandan, A. (2011). Investigation of correlation between traits and path analysis of rice (*Oryza sativa* L.) grain yield under coastal salinity. Electronic J. of Plant Breed., 2(4): 538-542.