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Research Article

Character Association And Path Analysis in Inter-Racial Hybrids in Rice (*Oryza Sativa* L.)

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Abstract:

The studies on the correlation of the traits and their relative direct and indirect effects on yield are important, as they are helpful to adopt suitable selection procedure for yield improvement in inter-racial breeding programmes. In the present study, 15 wide compatible genotypes (11 tropical *japonicas* and four *indicas*) were crossed with six non-wide compatible genotypes (three each of *indicas* and *japonicas*) and 90 hybrids were obtained. With an emphasis on inter sub-specific hybrids, the 90 hybrids obtained as above were classified into four types *viz*., i) tropical *japonica* (11) x *indica* (3) type hybrids (33), ii) tropical *japonica* (11) x *japonica* (3) type hybrids (33), iii) *indica* (4) x *indica* (3) type hybrids (12) and iv) *indica* (4) x *japonica* (3) type hybrids (12). All the four types of hybrids were evaluated separately in Randomized Complete Block Design with two replications. The findings, in general for all the four types of cross combinations, suggested that productive tillers followed by filled grains per panicle and 100 grain weight are the important characters to bring about the improvement in yield potential of rice. The productive tillers attains importance as it is easier to record and simultaneously will increase filled grains thereby the grain yield.

Key words: inter-racial hybrids, correlation, path analysis, yield traits

Introduction

The exploitation of yield potential through inter sub-specific (inter-racial) hybridization become a challenging task for rice breeders. Grain yield is a complex quantitative dependent trait which is greatly influenced by many independent traits and environment. Hence, selection of superior genotypes based on yield as such may not be effective. For an effective approach towards the enhancement of yield, selection has to be made
for the components of yield as well. Association of yield and yield components thus assumes an unique prominence as the basis for selecting desirable genotypes with high grain yield potential. Also, knowledge of the presence of association among the supplementary characters reveals that some of the latter are useful as indicators of yield. In reality, correlation values between yield and its components are equivocal due to inter relationships existing among the components. As a result, the direct contribution of each component trait on yield and the indirect effect it has through its association with other component traits, cannot be discerned entirely from correlation studies. Hence, in the present investigation, path analysis was also given due importance.. The correlation of the traits and their relative direct and indirect effects on yield are important, as they are helpful to adopt suitable selection procedure for yield improvement in inter-racial breeding programmes.

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Materials and Methods

In the present study, 15 wide compatible genotypes (11 tropical *japonicas* and four *indicas*) were crossed with six non-wide compatible genotypes (three each of *indicas* and *japonicas*) and 90 hybrids were obtained. With an emphasis on inter sub-specific hybrids, the 90 hybrids obtained as above were classified into four types *viz*., i) tropical *japonica* (11) x *indica* (3) type hybrids (33), ii) tropical *japonica* (11) x *japonica* (3) type hybrids (33), iii) *indica* (4) x *indica* (3) type hybrids (12) and iv) *indica* (4) x *japonica* (3) type hybrids (12). All the four types of hybrids were evaluated separately in Randomized Complete Block Design with two replications.

Twenty five days old seedlings were transplanted in the mainfield with single seedling per hill adopting a spacing of 20 cm between rows and 15 cm between plants. Each genotype in a replication was accommodated in a single row of 3 m length. Ten competitive plants were selected randomly from each genotype and from each replication to measure biometrical traits. Normal agronomical practices were followed throughout the crop period. The eight biometrical observations made on all the hybrids were used for association analysis. The genotypic correlation coefficients between yield and yield components as well as among the yield components were worked out for hybrids. From the analysis of variance and covariance tables, the corresponding genotypic variances and covariances were calculated by using the mean square values and mean sum of products as suggested by AI-Jibouri *et al.*(1958). The correlation coefficients were calculated by using the formula suggested by Falconer (1964). The relative influence of seven components on yield by themselves (direct effects) and through other traits (indirect effects) were evaluated by the method of path coefficient analysis as suggested by Dewey and Lu (1959). The simple genotypic correlation coefficients already estimated were utilized for this purpose. The direct and indirect effects were classified based on the scale given by Lenka and Misra (1973).

Results and Discussion

The genotypic correlation coefficients of yield *vis-a-vis* its component characters and interrelationship among the component characters for all the quartet combinations of hybrids are presented in Table 1. The path coefficients of different yield attributes on grain yield based on genotypic coefficients of correlation for all the hybrids studied are furnished in Table 2. Grain yield per plant in tropical *japonica* / *indica* combination showed significant positive association with productive tillers(r_g = 0.726). Similar association of productive tillers with yield was earlier reported by Annadurai (2001) and Kavita and Sree Rama Reddy (2001). Path analysis revealed that productive tillers and filled grains per panicle had very high (1.13) and high(0.57) direct effects, respectively, with negligible indirect effects. Thus, selection for the improvement of grain yield can be efficient if it is based on productive tillers and filled grains per panicle. The results are in agreement with Shanthi and Singh (2000).

With regard to tropical *japonica* / *japonica* combination, single plant yield was positively and significantly correlated with all its component characters, except days to 50 % flowering. Furthermore, plant height and panicle length(r_g = 0.67);panicle length and 100 grain weight(r_g = 0.51); filled grains and spikelet fertility per cent (r_g = 0.40) were correlated between themselves. Similar inter-correlations were also reported by Shanthi and Singh (2000) and Hari Ramakrishnan *et al.*(2006). Path analysis projected high direct effects for productive tillers(0.83), filled grains per panicle(0.55) and 100 grain weight(0.43). Two other characters *viz*., spikelet fertility per cent and panicle length exhibited high indirect effects on yield through filled grains per panicle and 100 grain weight, respectively. Therefore, it is imperative that productive tillers, filled grains per panicle and 100 grain weight should be given consideration while improving grain yield.

Similarly, in case of *indica* / *indica* cross combination also, positive significant association of productive tillers(r_g = 0.62), panicle length(r_g = 0.49) and filled grains per panicle(r_g = 0.70) with grain yield per plant was noticed. Notable inter-correlation was between panicle length and filled grains per panicle. The results of path coefficient analysis revealed that the characters *viz*., filled grains per panicle(0.90), productive tillers(0.51) and 100 grain weight(0.35) exhibited high positive direct effects. Most of the characters exhibited their indirect effects through filled grains per panicle and productive tillers thus signifies the responsibility of these two characters for manipulation of grain yield. Grain yield per plant in *indica* / *japonica* showed positive significant correlation with days to 50 % flowering(r_g = 0.60), productive tillers(r_g = 0.63), panicle length(r_g = 0.68) and filled grains per panicle(r_g = 0.58) indicating the importance of these traits in increasing grain yield. Significant inter-correlations were observed between days to 50 % flowering and productive tillers, days to 50 % flowering and panicle length, panicle length and filled grains per panicle. High direct effects were realized by productive tillers(0.86), filled grains per panicle(0.83) and 100 grain weight(0.53). High positive indirect effects of days to 50 % flowering, panicle length and plant height were manifested through productive tillers, filled grains and 100 grain weight, respectively. Hence, selection for the traits *viz*., productive tillers, filled grains per panicle and 100 grain weight would be effective in improving grain yield per plant. Surek *et al*.(1998) and Shanthi and Singh (2000) also

emphasized the importance of selection for productive tillers, filled grains and 100 grain weight in improving grain yield.

The findings, in general for all the four types of cross combinations, suggested that productive tillers followed by filled grains per panicle and 100 grain weight are the important characters to bring about the improvement in yield potential of rice. Recording all the above parameters, except productive tillers, was laborious and time consuming and hence selection for productive tillers attains importance as it is easier to record and simultaneously will increase filled grains thereby the grain yield.

References

Al-Jibouri, H.R., Miller, P.A. and Robinson, H.F. 1958. Genotypic and environmental variances and covariance in an upland cotton cross of inter-specific origin. *Agron. J.,50* : 633 – 636.

Annadurai, A. 2001. Association analysis in hybrid rice. *Ann. Agric. Res. New series*, *22* : 420 – 422.

Dewey, D.R. and Lu, K.H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J., 51* : 515 – 518.

Falconer, D.S. 1964. Introduction to quantitative genetics. Longmann. London and New York. *pp.* 294 – 300.

Hari Ramakrishnan, S., Anandakumar, C.R., Saravanan, S., Malini, M. 2006. Association Analysis of some yield traits un rice *(Oryza sativa L.)* Journal of Applied Sciences Research, 2: 402-404

Kavitha, S. and Sree Rama Reddi, N. 2001. Correlation and path analysis of yield components in Rice (*Oryza sativa* L.). *Andhra Agric. J., 48*: 311 – 314.

Lenka, D. and Misra, B. 1973. Path coefficient analysis of yield in rice varieties. *Indian J. Agric. Sci., 43* : 376 – 379.

Shanthi, P. and Singh, J. 2000. Correlation and path analysis in Induced Mutants of Mahsuri Rice (*Oryza sativa* L.). *Andhra Agric. J., 47*: 43 – 45.

Surek, H., Korkut, Z.K. and Bilgin, O. 1998. Correlation and path analysis for yield and yield components in rice in an 8-parent half diallel set of crosses. *Oryza, 35* : 15 – 18.

Table 1. Genotypic correlation coefficients in inter-racial rice crosses.

Character	Cross	Plant height	Prod. Tillers	Panicle length	Filled grains per panicle	Spikelet fertility %	100 grain weight	Grain yield
Days to 50% flowering	TJ / I	0.29*	-0.48*	0.30*	0.20	0.18	0.58*	-0.18
	TJ / J	0.41*	-0.05	0.40*	0.04	-0.01	0.26	0.05
	I / I	- 0.47*	0.61*	0.41*	0.08	-0.05	-0.54*	0.26
	I / J	-0.03	0.73*	0.57*	0.22	0.08	-0.40	0.60*
Plant height	TJ / I		-0.13	0.59*	0.22	-0.32*	0.21	0.15
	TJ / J		0.19	0.67*	0.06	-0.20	0.26	0.40*
	I / I		-2.03	-0.49*	-0.59*	0.12	0.77*	-0.29
	I / J		0.17	-0.04	-0.36	0.06	0.59*	0.09
Productive tillers	TJ / I			-0.02	-0.44*	-0.17	-0.50*	0.73*
	TJ / J			0.11	-0.35*	0.01	-0.29*	0.57*
	I / I			0.13	0.04	0.36	-0.05	0.62*
	I / J			0.32	-0.12	-0.01	-0.24	0.63*
Panicle length	TJ / I				0.27	-0.20	0.13	0.28
	TJ / J				0.21	0.08	0.51*	0.52*
	I / I				0.53*	0.21	-0.15	0.49*
	I / J				0.58*	-0.27	-0.04	0.68*
Filled grains per panicle	TJ / I					0.22	0.13	0.14
	TJ / J					0.40*	0.19	0.39*
	I / I					-0.17	-0.29	0.70*
	I / J					0.08	-0.27	0.58*
Spikelet fertility %	TJ / I						0.27	0.01
	TJ / J						0.13	0.36*
	I / I						0.37	0.30
	I / J						-0.26	0.02
100 grain weight	TJ / I							-0.16
	TJ / J							0.33*
	I / I							0.13
	I / J							0.01

*** Significant at 5 per cent level**

TJ = Tropical Japonica

I = Indica

J = Japonica

Table 2. Path coefficients among eight characters in inter-racial crosses.

Character	Cross	Days to 50% flowering	Plant height	Prod. Tillers	Panicle length	Filled grains per panicle	Spikelet fertility %	100 grain weight	Correlation with grain yield
Days to 50% flowering	TJ / I	**0.07**	0.03	-0.54	0.01	0.11	-0.01	0.16	-0.18
	TJ / J	**-0.11**	0.06	-0.04	0.02	0.02	0.00	0.11	0.05
	I / I	**0.15**	-0.10	0.35	0.00	0.08	-0.01	-0.19	0.26
	I / J	**0.01**	0.00	0.64	-0.06	0.18	0.03	-0.21	0.60*
Plant height	TJ / I	0.02	**0.09**	-0.15	0.01	0.12	0.02	0.05	0.15
	TJ / J	-0.04	**0.15**	0.16	0.03	0.03	-0.02	0.10	0.40*
	I / I	-0.06	**0.20**	-0.13	0.00	-0.50	0.02	0.27	-0.29
	I / J	0.00	**-0.07**	0.14	0.00	-0.30	0.01	0.31	0.09
Productive tillers	TJ / I	-0.03	-0.01	**1.13**	0.00	-0.25	0.02	-0.14	0.73*
	TJ / J	0.01	0.03	**0.83**	0.01	-0.19	0.00	-0.13	0.57*
	I / I	0.09	-0.05	**0.51**	0.00	0.04	0.06	-0.02	0.62*
	I / J	-0.01	-0.01	**0.86**	-0.03	-0.10	0.00	-0.10	0.63*
Panicle length	TJ / I	0.02	0.06	-0.02	**0.02**	0.15	0.01	0.04	0.28
	TJ / J	-0.04	0.10	0.09	**0.05**	0.12	0.01	0.22	0.52*
	I / I	0.06	-0.10	0.08	**0.01**	0.48	0.03	-0.05	0.49*
	I / J	-0.00	0.00	0.27	**-0.08**	0.48	-0.04	-0.02	0.68*
Filled grains per panicle	TJ / I	0.01	0.02	-0.50	0.01	**0.57**	-0.02	0.04	0.14
	TJ / J	-0.00	0.01	-0.29	0.01	**0.55**	0.04	0.08	0.38*
	I / I	0.01	-0.12	0.02	0.00	**0.90**	-0.03	-0.10	0.70*
	I / J	-0.00	0.02	-0.10	-0.05	**0.83**	0.01	-0.14	0.58*
Spikelet fertility %	TJ / I	0.01	-0.03	-0.20	-0.00	0.13	**-0.07**	0.08	0.01
	TJ / J	0.00	-0.03	0.00	0.00	0.22	**0.10**	0.06	0.36*
	I / I	-0.01	0.02	0.21	0.00	-0.16	**0.15**	0.13	0.30
	I / J	0.00	-0.00	-0.01	0.02	0.07	**0.13**	-0.14	0.02
100 grain weight	TJ / I	0.04	0.02	-0.57	0.00	0.07	-0.02	**0.28**	-0.16
	TJ / J	-0.03	0.04	-0.24	0.02	0.10	0.01	**0.43**	0.33*
	I / I	-0.08	0.15	-0.03	-0.00	-0.26	0.06	**0.35**	0.13
	I / J	0.00	-0.04	-0.20	0.00	-0.22	-0.03	**0.53**	0.01

*** Significant at 5 per cent level** **Bold values are direct effects**

TJ = Tropical Japonica
I = Indica
J = Japonica

Residual effects : TJ / I = 0.08
TJ / J = 0.05
I / I = 0.01
I / J = 0.00