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Character Association and Path Coefficient Analysis in Rice (*Oryza sativa* L.)

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ABSTRACT

Twenty F_1 crosses along with their parents were used to study the rice grain yield and its component traits by correlation and path coefficients. Character association of the yield attributing traits revealed significant positive association of grain yield per plant with no.of ear bearing tillers per plant. Path coefficient analysis revealed that no.of ear bearing tillers per plant, test weight, panicle length and days to 50 % flowering exhibited positive direct effect on grain yield per plant. On other hand plant height showed negative direct effect on grain yield per plant. Among these characters no.of ear bearing tillers per plant possessed both positive association and high direct effect. Hence, selection for this trait could bring improvement in yield.

Key words : Character association, Path Analysis, Riceand.

Rice (*Oryza sativa* L.) is one of the important cereal food crops of India and World. Rice is the staple food for 2.5 billion people and growing rice is the largest single use of land for producing food, covering nine per cent of the earth's arable land (Khan *et al*., 2009). In India population is increasing at an alarming rate but food production is almost stagnated so there is a need to improve the yield to meet the growing population demand. Grain yield in any crop depends on many component characters which influence yield either jointly or singly and either directly or indirectly through other related characters. Selection for yield on the basis of *per se* performance alone may not be effective as that based on component characters associated with it, which is biometrically determined by correlation coefficients and path analysis.

Knowledge of interrelationship between yield and its components is obvious for efficient selection of desirable segregants in plant breeding. Unlike the correlation coefficient values which measure the extent of relationship, path coefficient analysis (Wright, 1921 and Dewey and Lu, 1959) measures the magnitude of direct and indirect effects of characters on complex dependent characters like yield and thus enables the breeders to judge best about the important component characters during selection. Hence, the present investigation was carried out with the objective of studying the character association and path coefficient analysis in rice for yield improvement.

MATERIAL AND METHODS

In the present study twenty F_1 crosses were generated through line × tester mating by using four lines and five testers. The experiment was laid out in Randomised Block Design (RBD) with three replications. One month old seedlings were transplanted 20 cm apart between rows and 15 cm within the row. All necessary precautions were taken to maintain uniform plant population in each treatment per replication. The data was recorded on days to 50 % flowering, plant height, no.of ear bearing tillers per plant, panicle length, test weight and grain yield per plant from five randomly selected plants from each treatment. The recorded data was subjected to statistical analysis as per Singh and Chaudary (1995) for correlation coefficients and Dewey and Lu (1959) for path analysis.

RESULTS AND DISCUSSION

Selection based on the detailed knowledge of magnitude and direction of association between yield and its component attributes is very important in identifying the key characters, which can be

Table 1. Estimates of phenotypic and genotypic correlation coefficients between yield and yield components characters in rice.

Character	Days to 50 % flowering	Plant height (cm)	No. of ear bearing tillers per plant	Panicle length (cm)	Test weight (g)	Grainyield per plant (g)
Days to 50 % flowering	1.0000 (1.0000)	-0.652 (-0.0608)	-0.0431 (-0.0104)	-0.0557 (-0.0749)	-0.1273 (-0.1280)	0.0089 (0.0269)
Plant height (cm)		1.0000 (1.0000)	-0.0724 (-0.0761)	0.2423* (0.3295**)	0.5103** (0.5604**)	-0.4049** (-0.4378**)
No. of ear bearing tillers per plant			1.0000 (1.0000)	0.1515 (0.2184*)	-0.0003 (-0.0015)	0.3608** (0.4493*)
Panicle length (cm)				1.0000 (1.0000)	0.0622 (0.0627)	-0.0293 (-0.0541)
Test weight (g)					1.000 (1.000)	-0.1469 (-0.1966)
Grain yield per plant (g)						1.0000 (1.000)

** Significant at 1% level * Significant at 5% level

Figures in the parenthesis are genotypic correlation coefficients

Table 2. Estimates of direct and indirect effects between yield and yield components in rice.

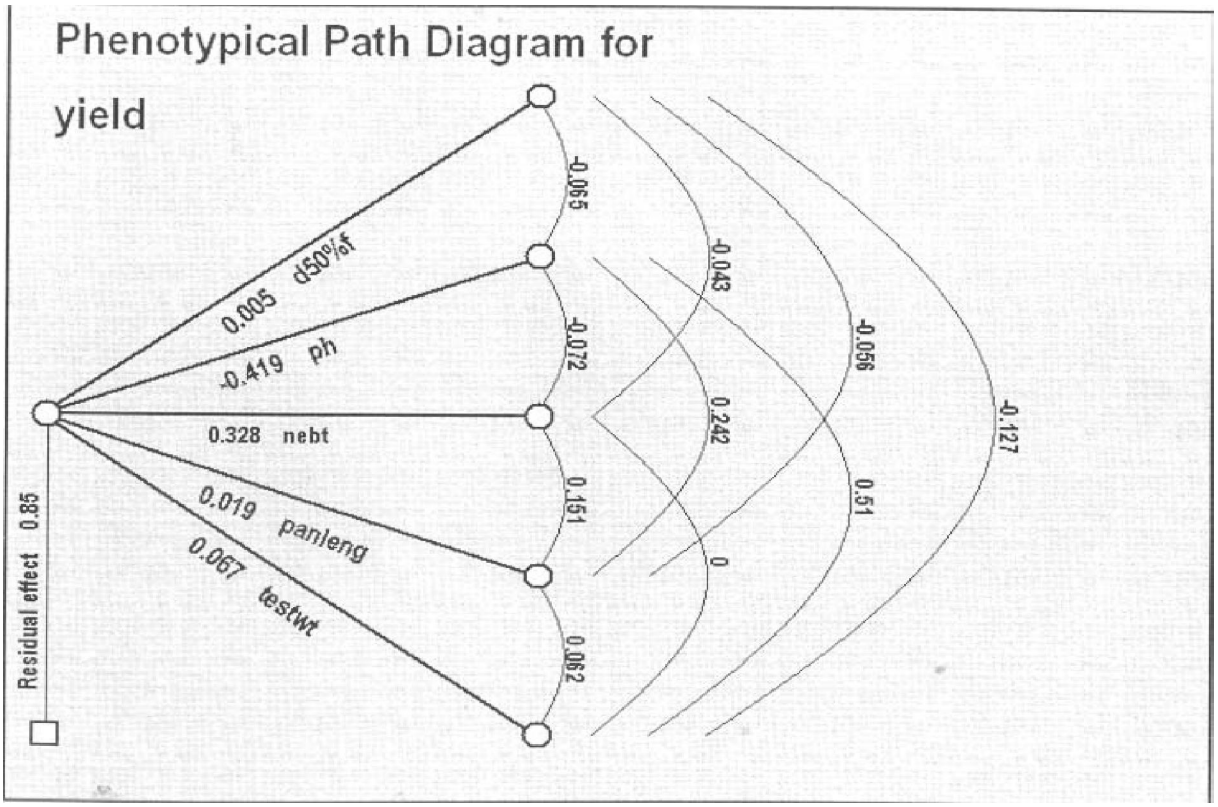
Character	Days to 50 % flowering	Plant height (cm)	No. of ear bearing tillers per plant	Panicle length (cm)	Test weight (g)	Grainyield per plant (g)
Days to 50 % flowering	**0.0052** **(0.0106)**	-0.0003 (-0.0006)	-0.0002 (-0.0001)	-0.0003 (-0.0008)	-0.0007 (-0.0014)	0.0089 (0.0269)
Plant height (cm)	0.0274 (0.0261)	**-0.4194** **(-0.4292)**	0.0304 (0.0327)	-0.1016 (-0.1414)	-0.2140 (-0.2405)	-0.4049 (-0.4378)
No. of ear bearing tillers per plant	-0.0141 (-0.0043)	-0.0237 (-0.0318)	**0.3279** **(0.4182)**	0.0497 (0.0913)	-0.0001 (-0.0006)	0.3608 (0.4493)
Panicle length (cm)	-0.0010 (0.0005)	0.0046 (-0.0020)	0.0028 (-0.0013)	**0.0188** **(-0.0061)**	0.0012 (-0.0004)	-0.0293 (-0.0541)
Test weight (g)	-0.0085 (-0.0059)	0.0340 (0.0259)	0.0000 (-0.0001)	0.0042 (0.0029)	**0.0667** **(0.0463)**	-0.1469 (-0.1966)

Residual effect (Phenotypic) =0.8498

Residual effect (Genotypic) =0.7954

Figures in the parenthesis are genotypic effects

Figure 1. Phenotypic path diagram for yield in rice.



exploited for crop improvement through suitable breeding programme. Phenotypic and genotypic correlations between yield and yield components *viz*., days to 50 % flowering, plant height, no.of ear bearing tillers per plant, test weight and grain yield per plant were computed separately for all the genotypes. The results are presented in Table 1. The results revealed that the estimates of genotypic correlation coefficients were higher than phenotypic correlation coefficients for most of the characters under study which indicated strong inherent association between the characters which might be due to masking or modifying effects of environment.

Days to 50 % flowering showed positive and non-significant correlation with grain yield per plant, while negative and non-significant association with plant height, no.of ear bearing tillers per plant, panicle length and test weight both at phenotypic and genotypic levels. Plant height exhibited positive and significant association with panicle length and test weight while negative and significant association with grain yield per plant both at genotypic and phenotypic levels. Panicle length exhibited positive and non-significant association with test weight and negative and non-significant association with grain yield per plant. Test weight showed negative and non-significant association with grain yield per plant. These results for plant height were in accordance with Ravindra Babu *et al*. (2012) and Kavitha and Reddi (2001). No.of ear bearing tillers registered positive and significant association with grain yield per plant at both genotypic and phenotypic levels and showed positive and significant association with panicle length at genotypic level. Similar results were also reported by Ravindra Babu *et al*. (2012) and Reddy *et al*. (1997). It indicated that grain yield can be increased whenever there is an increase in characters that showed positive and significant association with grain yield. Hence, these characters can be considered as criteria for selection for higher yield as these were mutually and directly associated with yield.

As simple correlations do not provide the true contribution of the characters towards the yield,

these genotypic correlations were portioned into direct and indirect effects through path coefficient analysis. It allows separating the direct effect and their indirect effects through other attributes by portioning the correlations (Wright, 1921) for better interpretation of cause and effect relationship. The estimates of path coefficient analysis are furnished for yield and yield component characters in Table 2.

Among all the characters, the no.of ear bearing tillers per plant had the highest positive direct effect on grain yield followed by test weight, panicle length and days to 50 % flowering. Positive direct effect of no.of ear bearing tillers per plant, panicle length and test weight on grain yield per plant was also reported by Ravindra Babu *et al*. (2012). These findings for days to 50 % flowering were in accordance with Laxuman *et al*. (2011). No.of ear bearing tillers per plant exhibited high direct effects and significant association with yield indicates that direct selection through this trait would be much effective for the improvement of grain yield per plant. On the other hand, negative direct effect on grain yield was recorded by plant height. These results were in accordance with the results of Ravindra Babu *et al*. (2012). Phenotypic path diagram for yield per plant is shown in Fig.1.

The residual effect in the present study is very high indicating the need to add some more traits for better partitioning of the association effects.

Based on critical analysis of results obtained from character association and path coefficient analysis indicated that the number of ear bearing tillers per plant showed both positive association and positive high direct effects. Hence, selection for this trait could bring improvement in yield and yield components.

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