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# Correlation and Path Coefficient Analysis for Yield Contributing Characters in Rice (*Oryza sativa* L.) Cultivars

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**A B S T R A C T**

The study was conducted among the thirty two rice varieties of the Breeders Seed Production chain of Tamil Nadu during Kharif 2016-17. Days to 50 per cent flowering, plant height, leaf length, number of panicles per plant, panicle length, number of grains per panicle, 1000 grain weight, time to maturity and single plant yield showed significant difference between varieties. Correlation study showed significant positive correlation on single plant yield by leaf length, leaf width, number of panicles per plant, number of grains per panicle, 1000 grain weight and time to maturity. Path analysis for direct and indirect effects on yield revealed significant high direct effects for number of panicles per plant, number of grains per panicle, 1000 grain weight, days to 50 percent flowering and time to maturity. Number of grains per panicle via number of panicles per plant showed significant high association on single plant yield.

## Introduction

The importance of food grain production stems from the fact that the world has around 7.3 billion people to be fed every day. One of the most important crops among them is rice which is the staple food for 2.7 billion people.

Thus rice production should necessarily increase to meet the rising demand and the crop improvement programmes should be well ahead of the expected 1 billion increase estimated for 2050 (UN, 2015). Thus the main objective of breeding in rice becomes yield improvement. In varietal improvement through selection or breeding of diverse parents, identification of superior genotypes is inevitable. Yield being a complex quantitative character, information about the contributing characters is also important. Selection of superior genotypes for yield can be effective only if the association of yield with attributing traits are known and considered during the process. The correlation studies estimates the degree and direction of relationship between two or more variables and provides information about yield contributing characters. In breeding it can be used to identify the component characters that can be used for selection for improvement of yield and can also aid in selecting elite genotypes from diverse populations (Johnson *et al*,

1955). Path coefficient analysis was developed by Wright in 1921 and was used for plant selection for first time by Dewey and Lu. It splits the correlation coefficient into direct and indirect effects. The independent characters that show direct influence on yield is given by direct effects and characters which has effects on yield through other independent traits is given by indirect effect.

## Materials and Methods

The present investigation was conducted at the Paddy Breeding Station of Tamil Nadu Agricultural University, Coimbatore during Kharif 2016-17 among the thirty two rice varieties of the Breeder's Seed Production chain. Observations were recorded on twelve yield contributing characters for ten randomly selected plants in each replication. The varieties, ASD16, ASD18, ASD19, MDU6, TRY1, TRY3, TPS5, Anna(R)4, IR20, IR36, IR50, TKM9, TKM13, TKM14, ADT36, ADT37, ADT38, ADT39, ADT42, ADT43, ADT(R)45, ADT(R)46, ADT(R)47, ADT(R)49, ADT(R)50, CO43, CO(R)48, Co49, Co50, Co51, CR1009, CR1009 Sub1 were subjected to Analysis of Variance in Randomized Block Design for three replications. Correlation and Path coefficient Analysis for yield was carried out using TNAUSTAT software.

## Results and Discussion

## Correlation analysis

The varieties showed significant variability for days to 50 per cent flowering, plant height, leaf length, number of panicles per plant, panicle length, number of grains per panicle, 1000 grain weight, time to maturity and single plant yield (Table 1). Association analysis measures the interrelationship between various characters and also finds the component traits which can be selected to improve yield. The correlation coefficients of yield attributing traits on yield are presented in Table 2. Single plant yield showed positive and significant correlation with leaf length, leaf width, number of panicles per plant, number of grains per panicle, 1000 grain weight and time to maturity. So, in-order to improve yield, which is a complex character, selection for the above yield attributing characters can be done. Dhurai *et al*. (2016), Namita *et al*. (2016), Nikhil *et al*. (2014) and Sathisha *et al*. (2015) furnished reports in accordance with the present study. Contradictory results showing negative association between flag leaf length and yield was reported by Devendra *et al*. (2016). Nikhil *et al*. (2014) also reported negative association of number of grains per panicle on yield.

Leaf length showed significant positive correlation with leaf width, plant height, panicle length and time to maturity. Similar results for correlation between leaf length and width was published by Rabara *et al*. (2014). Leaf width exhibited significant positive correlation with plant height, thousand grain weight and time to maturity. Plant height is significantly and positively correlated with panicle length and grain width. Panicle length showed significant positive correlation with grain width and thousand grain weight. Number of panicles per plant exhibited significant positive correlation with number of grains per panicle, days to fifty per cent flowering and time to maturity. Days to fifty per cent flowering showed significant positive correlation with time to maturity indicating longer duration for varieties with higher days to 50 per cent flowering. Dhurai *et al*. (2016) furnished reports supporting this finding for fifty percent flowering. Number of grains per panicle showed significant positive correlation with days to fifty per cent flowering. Negative significant correlation with grain width and thousand grain weight was also exhibited by number of grains per panicle. Grain length

showed significant negative correlation with days to fifty per cent flowering and time to maturity. Information regarding the interrelationship between different characters can tell about the direction in which selection should be done.

**Table.1** ANOVA for twelve quantitative characters

| Source of variation | d. f. | Days to 5 per cent flowering | Plant height | Leaf length | Leaf width | No. of panicles per plant | Panicle length | No. Of grains per panicle | Grain length | Grain width | 000 grain weight | Time to maturity | Single plant yield |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment | 31 | 469.46** | 260.02** | 71.44** | 0.04 | 11.16** | 12.53** | 311.85** | 1.45 | 0.22 | 21.66** | 591.48** | 120.48** |
| Replication | 2 | 3.56* | 2.31 | 2.22 | 0.01 | 0.23 | 2.66 | 16.09** | 0.02 | 0.01 | 1.00 | 2.62 | 1.17 |
| Error | 62 | 16.92 | 11.25 | 8.54 | 0.01 | 0.41 | 1.89 | 77.21 | 0.01 | 0.01 | 1.019 | 2.3 | 11.14 |

**Table.2** Simple correlation coefficient for yield and its component characters

| | DFF | PH | LL | LW | NPP | PL | NGP | GL | GW | TW | TM | SPY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DFF | 1 | | | | | | | | | | | |
| PH | -0.02 | 1 | | | | | | | | | | |
| LL | 0.09 | 0.23* | 1 | | | | | | | | | |
| LW | 0.14 | 0.33** | 0.26* | 1 | | | | | | | | |
| NPP | 0.23* | 0.04 | 0.18 | 0.19 | 1 | | | | | | | |
| PL | -0.08 | 0.56** | 0.42** | 0.15 | 0.01 | 1 | | | | | | |
| NGP | 0.26* | -0.09 | 0.10 | 0.11 | 0.52** | -0.06 | 1 | | | | | |
| GL | -0.23* | 0.00 | -0.03 | -0.19 | 0.15 | 0.14 | -0.05 | 1 | | | | |
| GW | -0.09 | 0.29** | 0.12 | -0.07 | -0.15 | 0.27** | -0.35** | 0.16 | 1 | | | |
| TW | -0.17 | 0.16 | 0.11 | 0.23* | -0.20 | 0.31** | -0.21 | 0.10 | 0.10 | 1 | | |
| TM | 0.83** | 0.16 | 0.22* | 0.25* | 0.22* | 0.17 | 0.19 | -0.29** | -0.03 | -0.02 | 1 | |
| SPY | 0.19 | 0.07 | 0.24* | 0.30** | 0.66** | 0.15 | 0.70** | 0.09 | -0.20 | 0.36** | 0.27** | 1 |

*significance at 5% level **significance at 1% level

LL: Leaf Length, GL : Grain Length, LW: Leaf Width, GW:Grain Width, PH: Plant Height, TW: Thousand grain Weight, PL: Panicle Length, DFF : Days to 50 per cent flowering, PL: Panicle Length, DFF : Days to 50 per cent flowering, NPP: Number of Panicles per Plant, TM :Time to Maturity, NGP: Number of Grains per Panicle, SPY : Single Plant Yield

**Table.3** Path analysis with dependent variable

| | DFF | PH | LL | LW | NPP | PL | NGP | GL | GW | TW | TM | Correlation coefficient of SPY with other traits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DFF | **-0.101** | 0.000 | 0.003 | -0.001 | 0.105 | 0.003 | 0.153 | -0.004 | -0.002 | -0.098 | 0.129 | 0.189 |
| PH | 0.002 | **-0.004** | 0.008 | -0.002 | 0.017 | -0.022 | -0.051 | 0.000 | 0.005 | 0.087 | 0.025 | 0.066 |
| LL | -0.009 | -0.001 | **0.034** | -0.001 | 0.083 | -0.017 | 0.056 | -0.001 | 0.002 | 0.062 | 0.034 | 0.241* |
| LW | -0.014 | -0.001 | 0.009 | **-0.005** | 0.087 | -0.006 | 0.066 | -0.003 | -0.001 | 0.130 | 0.040 | 0.301** |
| NPP | -0.023 | 0.000 | 0.006 | -0.001 | **0.459** | -0.001 | 0.299 | 0.002 | -0.002 | -0.110 | 0.035 | 0.665 ** |
| PL | 0.008 | -0.002 | 0.014 | -0.001 | 0.006 | **-0.040** | -0.036 | 0.002 | 0.005 | 0.173 | 0.026 | 0.154 |
| NGP | -0.027 | 0.000 | 0.003 | -0.001 | 0.237 | 0.003 | **0.579** | -0.001 | -0.006 | -0.119 | 0.030 | 0.699 ** |
| GL | 0.023 | 0.000 | -0.001 | 0.001 | 0.071 | -0.006 | -0.028 | **0.015** | 0.003 | 0.056 | -0.046 | 0.088 |
| GW | 0.009 | -0.001 | 0.004 | 0.000 | -0.068 | -0.011 | -0.204 | 0.002 | **0.017** | 0.057 | -0.004 | -0.198 |
| TW | 0.018 | -0.001 | 0.004 | -0.001 | -0.090 | -0.012 | -0.123 | 0.002 | 0.002 | **0.562** | -0.004 | 0.356 ** |
| TM | -0.084 | -0.001 | 0.007 | -0.001 | 0.102 | -0.007 | 0.112 | -0.004 | 0.000 | -0.013 | **0.156** | 0.267** |

Residue = 0.2631; LL : Leaf Length, GL : Grain Length, LW: Leaf Width, GW:Grain Width, PH: Plant Height, TW: Thousand grain Weight, PL: Panicle Length, DFF : Days to 50 per cent flowering, PL: Panicle Length, DFF : Days to 50 per cent flowering, NPP: Number of Panicles per Plant, TM :Time to Maturity, NGP: Number of Grains per Panicle, SPY : Single Plant Yield

## Path analysis

The direct and indirect effects of yield and yield attributing traits were estimated by path analysis and are presented in Table 3. A residual effect of 0.26 indicates high contribution towards variability in single plant yield by the characters chosen for study. Number of panicles per plant, number of grains per panicle, thousand grain weight, days to fifty percent flowering and time to maturity showed significant direct effect on yield. These traits should be taken into consideration in selecting for yield among the cultivars studied. The direct effects of number of grains per panicle (0.58), number of panicles per plant (0.46), and 1000 grain weight (0.56) were positive and high. Akhi *et al*. (2016) and Sathisha (2015) reported similar findings for number of grains per panicle and thousand grain weight respectively. Negative but low direct effect was contributed by days to fifty per cent flowering and positive low direct effect by time to maturity. Negative direct effect on yield for the same trait has been reported by Devendra *et al*. (2016) which is in accordance with the findings of present study.

Number of panicles per plant via number of grains per panicle showed moderate indirect effect on single plant yield. Contrary results were furnished by Menaka and Ibrahim (2015) where negative indirect effect was reported. The indirect effect of days to 50 per cent flowering (0.10) and time to maturity (0.10) through number of panicles per plant was positive and low. Similar, indirect but high effect has been reported by Akhi *et al*. (2016). Days to fifty percent flowering (0.15) and time to maturity (0.11) through number of grains per panicle also showed low positive indirect effect on single plant yield. Similarly, days to fifty per cent flowering (0.13) through time to maturity exhibited positive low indirect effect on single plant yield.

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