Correlation and path analysis in rice germplasm

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ABSTRACT

Correlation and path analysis studies for eleven characters on one hundred and fifty rice genotypes including five check varieties revealed that the genotypic correlations were higher than phenotypic correlations. Single plant yield showed maximum significant correlation with 100 seed weight and productive tillers plant^{-1} followed by spikelet fertility, total tillers plant^{-1}, grains panicle^{-1} and panicle length.

Key words: rice, yield, correlation, path analysis

Yield being a complex character is governed by or the result of interaction of many variables. A knowledge of the association between yield and its component characters themselves can prove the efficiency of selection and studies on character association prove to be an effective tool for partitioning the correlation coefficient into direct and indirect effects of component characters. Information on direct and indirect effects contributed by each character towards yield will be an added advantage in aiding the selection process.

Hence, the present investigation was carried out to determine the interrelationship between yield and its contributing characters as well as to identify the characters to be considered for selecting better genotypes suitable for use as parents in the development of high yielding varieties.

A field experiment was conducted with one hundred and forty five genotypes of rice collected from Chattisgarh along with five check varieties viz., Jaya, Mandya Vijaya, Prasanna, Rasi and Vasumathi in a randomized block design with three replications. Thirty days old seedlings were transplanted with a spacing of 20 cm and 15 cm between rows and plants, respectively. Observations were recorded on five randomly selected plants for eleven agro-morphological characters *viz.*, plant height, leaf length, leaf width, total tillers per plant, productive tillers plant^{-1}, panicle length, grains panicle^{-1}, spikelet fertility and single plant yield. Days to 50% flowering were computed on plot basis. Seed weight was recorded by weighing 100-grains of each cultivar. Statistical analyses for the above eleven characters were done following Singh and Choudhary (1995) for correlation coefficient and Dewey and Lu (1959) for path analysis.

High genotypic correlations, in general, as compared to their phenotypic counterparts (Table 1) indicated strong inherent association between the characters, which might be due to masking or modifying effects of environment. All the yield attributing characters under study showed significantly positive correlations with grain yield both at genotypic and phenotypic levels. Single plant yield showed positive significant correlation with 100-seed weight, productive tillers plant^{-1}, spikelet fertility, total tillers plant^{-1}, grains panicle^{-1} and panicle length. This indicated that all these characters are important for yield improvement. These results are in conformity with earlier reports of Suman *et al.* (2006). Plant height showed significant and positive correlation with leaf length and leaf width while negative correlation with total tillers plant^{-1}, productive tillers plant^{-1}, panicle length, spikelet fertility and 100-seed weight. Days to 50 per cent flowering exhibited positive significant association with productive tillers plant^{-1}, leaf width and leaf length.

Total number of tillers plant^{-1} had a positive and significant correlation with productive tillers plant^{-1}, panicle length and single plant yield. From the results it was evident that an increase in number of tillers plant^{-1} would further help in increasing the

Table 1.: Estimates of phenotypic and genotypic correlation coefficients

	Days to 50% flowering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Total tillers plant⁻¹	Productive tillers plant⁻¹	Panicle length (cm)	Grains panicle⁻¹	Spikelet fertility (%)	100-seed weight (g)	Single plant yield (g)
Days to 50% flowering	1.0000	-0.1074 * (-0.1081)	0.1305** (0.1342)	0.0958 (0.1222)	0.0623 (0.0707)	0.1015 * (0.1141)	-0.0482 (-0.0494)	0.1840 ** (0.1866)	0.1237** (0.1243)	-0.0563 (-0.0608)	0.0372 (0.0374)
Plant height(cm)		1.0000	0.0926 (0.0980)	0.1802** (0.2258)	-0.2272** (-0.2602)	-0.1438** (-0.1608)	-0.0413 (-0.0459)	0.0661 (0.0678)	-0.0967* (-0.0969)	-0.0591 (-0.0654)	-0.0248 (-0.0654)
Leaf length (cm)			1.0000	-0.1355 ** (-0.1599)	-0.0995 * (-0.1186)	-0.0545 (-0.0712)	-0.1566** (-0.1885)	0.0447 (0.0428)	-0.001 (0.0002)	-0.0186 (-0.0257)	-0.1227** (-0.1313)
Leaf width (cm)				1.0000	-0.0878 (-0.1011)	-0.0784 (-0.1432)	0.1491** (0.2103)	0.0277 (0.0333)	0.0951* (0.1187)	-0.0014 (-0.0066)	0.0005 (0.0077)
Total tillers per plant					1.0000	0.7184 ** (0.8241)	0.0939 * (0.0457)	0.0557 (0.0587)	-0.0280 (-0.0257)	-0.1970** (-0.2073)	0.1267** (0.1732)
Productive tillers / plant						1.0000	0.1283 ** (0.0504)	-0.0075 (-0.0195)	0.0040 (0.0143)	-0.1890 ** (-0.1859)	0.2063** (0.2780)
Panicle length (cm)							1.0000	0.1181 *(0.1181)	0.0610 (0.0780)	0.2411 ** (0.3330)	0.1178* (0.1729)
Grains per panicle								1.0000	-0.0417 (-0.0403)	0.0014 (0.0074)	0.1229** (0.1305)
Spikelet fertility %									1.0000	0.0194 (0.0052)	0.1414** (0.1365)
100-seed weight (g)										1.0000	0.2549** (0.2243)

Figures in parenthesis are genotypic correlation coefficients
* Significant at 5% level
** Significant at 1% level

single plant yield due to production of more panicles and grains. The results are in accordance with the findings of Allahgholipour and Salehi (2003) and Suman *et al* (2006). Productive tillers per plant showed positive and significant correlation with days to 50% flowering, panicle length and single plant yield but it exhibited negative and significant correlation with 100-seed weight. These results are in conformity with the findings of Mahto *et al* (2003) and Kuldeep *et al* (2004). Panicle length had a positive and significant association with the number of grains per panicle and there by having a prominent role in increasing the grain yield. Panicle length had a positive and nonsignificant association with spikelet fertility, which is in agreement with the findings of Madhavilatha (2005). Number of grains per panicle registered positive and significant association with single plant yield and it had a negative correlation with spikelet fertility, which confirms the findings of

Allahgholipour *et al* (2003) and Monalisa *et al* (2006).

Spikelet fertility had positive and significant association with single plant yield and positive association with 100-grain weight. Borkakati *et al*. (2005) also obtained similar results. 100 grain weight exhibited positive and significant association with single plant yield. The correlation values for the characters under study were partitioned into direct and indirect effects (Table 2) 100-grain weight exhibited maximum positive direct effect as against its highest positive significant correlation value with single plant yield. This was due to high positive indirect effects of 100-seed weight via panicle length, spikelet fertility and grains per panicle, which confirms the findings of Khedikar *et al*.(2004). Other characters with positive direct effects were productive tillers per plant, spikelet fertility, grains panicle^{-1}, plant height and days to 50%

Table 2. Direct and indirect effects between yield and its component traits in rice

	Days to 50% flowering	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	Total tillers plant^{-1}	Productive tiller plant^{-1}	Panicle length (cm)	Grains panicle^{-1}	Spikelet fertility %	100-seed weight (g)	Single plant yield (g)
Days to 50% flowering	0.0052 (-0.0149)	-0.0006 (0.0016)	0.0007 (-0.0020)	0.0005 (-0.0018)	0.0003 (-0.0011)	0.0005 (-0.0017)	-0.0003 (0.0007)	0.0010 (-0.0028)	0.0006 (-0.0019)	-0.0003 (0.0009)	0.0372 (0.0374)
Plant height(cm)	-0.0052 (-0.0035)	0.0488 (0.0325)	0.0045 (0.0032)	0.0088 (0.0073)	-0.0111 (-0.0085)	-0.007 (-0.0052)	-0.0020 (-0.0015)	0.0032 (0.0022)	-0.0047 (-0.0032)	-0.0029 (-0.0021)	-0.0248 (-0.0275)
Leaf length (cm)	-0.0159 (-0.0153)	-0.0113 (-0.0111)	-0.1217 (0.1137)	0.0165 (0.0182)	0.0121 (0.0135)	0.0066 (0.0081)	0.0191 (0.0214)	-0.0054 (-0.0049)	0.0001 (0.0000)	0.0023 (0.0029)	-0.1227 (-0.1313)
Leaf width (cm)	-0.0017 (0.0014)	-0.0032 (0.0025)	0.0024 (-0.0018)	-0.0177 (0.0111)	0.0015 (-0.0011)	0.0014 (-0.0016)	-0.0026 (0.0023)	-0.0005 (0.0004)	-0.0017 (0.0013)	0 (-0.0001)	0.0005 (0.0077)
Total tillers plant^{-1}	-0.0010 (-0.0113)	0.0038 (0.0416)	0.0017 (0.0190)	0.0015 (0.0162)	-0.0167 (0.1598)	-0.012 (-0.1317)	-0.0016 (-0.0073)	-0.0009 (-0.0094)	0.0005 (0.0041)	0.0033 (0.0331)	0.1267 (0.1732)
Productive tillers plant^{-1}	0.0284 (0.0525)	-0.0402 (-0.0740)	-0.0153 (-0.0328)	-0.0219 (-0.0659)	0.2009 (0.3793)	0.2796 (0.4602)	0.0359 (0.0232)	-0.0021 (-0.0090)	0.0011 (0.0066)	-0.0528 (-0.0856)	0.2063 (0.2780)
Panicle length (cm)	0.0015 (-0.0008)	0.0013 (0.0016)	0.0048 (-0.0030)	-0.0045 (0.0034)	-0.0029 (0.0007)	-0.0039 (0.0008)	-0.0305 (0.0160)	-0.0036 (0.0019)	-0.0019 (0.0012)	-0.0073 (0.0053)	0.1178 (0.1729)
Grains panicle^{-1}	0.0252 (0.0290)	0.0091 (0.0105)	0.0061 (0.0067)	0.0038 (0.0052)	0.0076 (0.0091)	-0.001 (-0.0030)	0.0162 (0.0184)	0.1370 (0.1555)	-0.0057 (-0.0063)	0.0002 (0.0011)	0.1229 (0.1305)
Spikelet fertility%	0.0182 (0.0166)	-0.0142 (-0.0129)	-0.0001 (0.0000)	0.014 (0.0158)	-0.0041 (-0.0034)	0.0006 (0.0019)	0.0090 (0.0104)	-0.0061 (-0.0054)	0.1470 (0.1332)	0.0029 (0.0007)	0.1414 (0.1365)
100seed weight(g)	-0.0174 (-0.0163)	-0.0183 (-0.0175)	-0.0058 (-0.0069)	-0.0004 (-0.0018)	-0.061 (-0.0556)	-0.0585 (-0.0498)	0.0747 (0.0892)	0.0004 (0.0020)	0.0060 (0.0014)	0.3097 (0.2679)	0.2549 (0.2243)

Bold values are direct effects and all other values are indirect effects. Figures in parenthesis indicate genotypic estimates.

flowering.These findings were also corroborated by Borkakati *et al*.(2005), Madhavilatha *et al*.(2005), Monalisa *et al*.(2006),Paramesha *et al*.(2005), Patil and Sarawgi (2005). Negative direct effect was found in total tillers per plant, panicle length.These results are in agreement with the findings of Madhavilatha *et al*.(2005) and Suman *et al*.(2005). Negative direct effect was found in leaf length leaf width.

Partitioning of correlation values showed that some of the characters could not produce significant correlation with single plant yield which might be either due to very high negative direct effect such as total tillers per plant, leaf width, panicle length and leaf length. These results are in unison with the findings of De *et al*., (2005). Results of path analysis indicated that 100- seed weight, productive tillers plant^{-1}, panicle length, spikelet fertility and grains panicle^{-1} were important as they contributed directly towards high single plant yield. Hence these characters need to be considered while designing a selection strategy for yield improvement in rice.

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