Research Article

CORRELATION AND PATH COEFFICIENT STUDIES FOR GRAIN YIELD AND OTHER YIELD ATTRIBUTES ON AROMATIC SHORT GRAIN RICE (*Oryza sativa* L.) GENOTYPES

**Abstract-** The present study was carried out on Aromatic short grain rice genotypes tested under Advance Varietal Trial-Two (AVT-2) consisting of total 11 entries along with three checks. The trial was conducted at Thakur Chhedilal Barrister College of Agriculture and Research Station, Sarkanda (IGKV Raipur), Bilaspur, and Chhattisgarh during *kharif* 2013. Thirty days old seedlings were transplanted by maintaining 20 cm plant-to-plant and row-to-row spacing. Analysis of variance reflected significant differences among the genotypes for all the traits studied. Association analysis suggested that days to 50% flowering and days to maturity exhibited highly significant negative genetic association with number of productive tillers per plant, 1000 grain weight and grain yield per plant. Plant height and panicle length exhibited highly significant positive genetic association with tillers per plant and 1000 grain weight but grain yield shown negative association with plant height. Plant height exhibited highly significant positive genetic association for panicle length and flag leaf length. Flag leaf length correlates negatively with tillers per plant suggest that few tillers increases flag leaf length. Tillers per plant and 1000 grain weight height exhibited highly significant positive genetic association for grain yield. Path analysis had portioned the direct and indirect effects and concludes that flag leaf length has high direct effect followed by days to maturity, tillers per plant and panicle length. Association and path analysis suggested that productive tillers per hill, days to maturity, panicle length and 1000 grain weight may be considered important for the improvement of grain yield in the aromatic rice.

**Keywords**- Genotypic correlation, Path coefficient analysis Aromatic short grain.

# Introduction

Rice (*Oryza sativa*) belongs to family Gramineae. It is the most important crop of Chhattisgarh and is also the staple food of Chhattisgarh. Morphologically, rice is an annual grass and one of the most important grain crops. Globally it is grown extensively in tropical and sub-tropical regions of the world. More than half of the people on the globe depend on rice as their basic diet and generally extensively consumed in the producing countries. The continuous increasing population of world can only be satisfied with rice. It is expected that the world population increase by about 2 billion in the next two decades and half of this increase will in Asia where rice is the staple food. The chief rice production countries are; China, India, Indonesia, Bangladesh, Vietnam, Thailand, Myanmar, Philippine, Brazil, Japan, U.S.A and Pakistan. China is the prime producer of rice. India is an important rice growing and exporting country. In 2011-12 status of rice in India confirms that it was grown on 44.00 mha. area with the production of 105 MT with the average productivity of 24 q/ha. [12]. In the state of Chhattisgarh the status of rice on Kharif 2012 it was grown on 3.79 mha area with the production of 7.34 MT with the average productivity of 20 q/ha . [5]. It clarifies the fact that being the tag of rice bowl state of Chhattisgarh, but its average productivity is lower than national average productivity. The present studies were undertaken to describe the character association (genotypic and phenotypic) and contribution of various yield-influencing traits to establish appropriate plant attributes for selection to improve the yield in aromatic short grain genotypes.

# Materials and Methods

The material consist of 11 entries along check was grown at the research farm of Thakur Chhedilal Barrister College of Agriculture and Research Station ,Sarkanda (IGKV Raipur),Bilaspur ,Chhattisgarh, India in a Randomized Block Design (RBD) with three replications during the year Kharif 2013. Each genotypes were grown in a plot size of 3x5 m2 with 20 cm plant to plant and row-to-row spacing. Thirty day old seedlings were transplanted by maintaining one seedling per hill. To get a good crop, standard agronomic practices were followed. Five plants per replication per entry were harvested randomly to collect the data on Plant Height, Panicle Length, Tillers Per Plant, Flag Leaf Length, 1000-Grain Weight, and Grain Yield Per Plant. The analysis of variance was done using MSTATC software. Genotypic and phenotypic coefficients of variation were estimated as per [10]. Genotypic and phenotypic correlation coefficients were calculated using Windostat software ver.

9.1. Path coefficient analysis was estimated according to the method suggested by [3].

# Results and Discussion

Selection based on the basis of correlation studies gives the ideal methods of selection for genotypes with high yield traits, which can be exploited for crop improvement through suitable breeding program. Phenotypic and genotypic correlations between yield and yield components *viz.,* days to 50 percent flowering, days to maturity, plant height, panicle length, flag leaf length, tillers per plant, 1000 grain weight and grain yield were computed separately for rice

genotypes. The results are presented in [Table-2]. The results revealed that the estimates of genotypic 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 per cent flowering registered positive and significant correlation with

days to maturity, plant height, flag leaf length while negative and significant association with number of productive tillers per plant, 1000 grain weight and grain yield per plant. The result for positive association is in accordance with [4,6,7,9] for days to maturity and plant height while negative association is in accordance with [4,6] for tillers and grain yield. [2,7,9] recorded for negative association for 1000 grain weight.

**Table-1** *Yield and Ancillary data of Advance Variety Trial-2 Aromatic Short Grain of AVT-2 (ASG) trial sown on Kharif -2013*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **S no.** | **Entry No.** | **Designation** | **Days to 50%**  **flowering** | **Days to maturity** | **Plant height (cm)** | **Panicle length (cm)** | **Flag leaf length (cm)** | **Tillers plant -1** | **1000**  **Grain weight (Gm)** | **Yield (q/ha)** | **Rank s** |
| 4 | 2504 | PNR 546 | 070 | 107 | 114 | 27.93 | 74.33 | 12 | 23.36 | 48.22 | 1 |
| 7 | 2507 | CN 1646-6-11-9 | 075 | 114 | 119 | 22.80 | 65.66 | 10 | 25.35 | 47.78 | 2 |
| 8 | 2508 RC) | (RC)Kalanamak | 089 | 121 | 188 | 26.53 | 52.33 | 10 | 16.40 | 32.44 |  |
| 10 | 2510(LC) | (LC)Vishnubhog | 094 | 126 | 165 | 29.06 | 33.33 | 16 | 16.70 | 28.67 |  |
| 11 | 2511 | HUR-917 | 090 | 125 | 099 | 26.53 | 61.33 | 10 | 11.73 | 22.00 |  |
| 9 | 2509 | R 1536-136-1-77-1 | 089 | 125 | 109 | 26.73 | 55.33 | 11 | 13.98 | 21.78 |  |
| 3 | 2503 | CR 2713-11 | 089 | 125 | 119 | 28.86 | 51.33 | 16 | 12.58 | 21.56 |  |
| 6 | 2506 | CN 1268-5-7 | 089 | 125 | 132 | 29.93 | 87.00 | 14 | 19.21 | 21.11 |  |
| 5 | 2505 | R 1521-950-6-843-1 | 089 | 116 | 122 | 23.33 | 57.33 | 10 | 15.59 | 20.67 |  |
| 2 | 2502 | NDR 6330 | 087 | 124 | 145 | 23.26 | 40.33 | 10 | 15.21 | 20.22 |  |
| 1 | 2501 NC) | (NC)Badshabhog | 102 | 125 | 188 | 20.10 | 53.66 | 11 | 29.38 | 20.00 |  |
|  | **C D at 5%= 5.99** | | | | | | | | | |  |
|  | **C.V. (%) = 12.06** | | | | | | | | | |  |

**Table-2** *Estimates of Genotypic and Phenotypic correlations coefficients between Yield and Yield component*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Characters** |  | **Days to 50%**  **flowering** | **Days to**  **Maturity** | **Plant**  **height(cm)** | **Panicle**  **length (cm)** | **Flag leaf**  **Length(cm)** | **Tillers plant -1** | **1000 Grain**  **Weight** | **Grain**  **yield(q/ha)** |
| **Days to 50% flowering** | **G P** | 1.000 | (0.817\*\*\*) 0.806\*\*\* | (0.476\*\*) 0.460\*\* | (-0.182)  -0.135 | (0.775\*\*\*) 0.746\*\*\* | (-0.602\*\*\*)  -0.563\*\*\* | (-0.471\*\*)  -0.457\*\* | (-0.809\*\*\*)  -0.785\*\*\* |
| **Days to Maturity** | **G**  **P** |  | 1.000 | (0.317)  0.313 | (-0.419\*)  -0.370\* | (0.442\*)  0.430\* | (-0.707\*\*\*)  -0.657\*\*\* | (-0.375\*)  -0.372\* | (-0.783\*\*\*)  -0.772\*\*\* |
| **Plant height(cm)** | **G**  **P** |  |  | 1.000 | (0.550\*\*)  0.521\*\* | (0.825\*\*\*)  0.810\*\*\* | (0.214)  0.197 | (0.210)  0.210 | (-0.066)  -0.065 |
| **Panicle length**  **(cm)** | **G**  **P** |  |  |  | 1.000 | (0.221)  0.196 | (0.723\*\*\*)  0.622\*\*\* | (0.657\*\*\*)  0.618\*\*\* | (0.558\*\*\*)  0.529\*\* |
| **Flag leaf**  **Length(cm)** | **G**  **P** |  |  |  |  | 1.000 | (-0.132)  -0.123 | (-0.223)  -0.212 | (-0.406\*)  -0.399\* |
| **Tillers plant -1** | **G**  **P** |  |  |  |  |  | 1.000 | (0.732\*\*\*)  0.668\*\*\* | (0.959\*\*\*)  0.889\*\*\* |
| **1000 Grain Weight** | **G**  **P** |  |  |  |  |  |  | 1.000 | (0.700\*\*\*)  0.698\*\*\* |
| **Grain yield(q/ha)** | **G**  **P** |  |  |  |  |  |  |  | 1.000 |
| **Significance levels 0.05 0.01 0.005 0.001**  **Star allocations \* \*\* \*\* \*\*\* If correlation r = > 0.344 0.442 0.477 0.546**  **Figures in parenthesis are genotypic correlation coefficients** | | | | | | | | | |

Days to maturity registered positive and significant correlation with flag leaf length while negative and significant association with number of productive tillers per plant, 1000 grain weight and grain yield per plant. The result for positive association is in accordance with [6] for flag leaf length while negative association is in accordance with [4,6,9] for tillers, 1000 Grain Weight and Grain yield.

Plant height exhibited positive and significant correlation with panicle length, flag leaf length, number of tillers per plant, 1000 grain weight, while negative and significant association with grain yield per plant. The result for positive association is in accordance with [4,6,9] for panicle length, flag leaf length, tillers per plant 1000 grain weight while negative accordance for Grain yield had been in tune with [2].

Panicle length exhibited positive and significant association with number of tillers per plant, 1000 grain weight and grain yield per plant. The result for positive association is in accordance with [2,4,6,9] for tillers per plant ,1000 grain weight and grain yield.

Flag leaf length exhibited negative and significant association with grain yield however non-significant association with tillers and 1000 grain weight. The result for negative non significant association is in accordance [6].

Tillers per plant exhibited positive and significant association with 1000 grain weight and grain yield per plant. The result for positive association is in accordance with [4,9] for 1000 grain weight and grain yield.

1000 grain weight exhibited positive and significant association with grain yield per plant. The result for positive association is in accordance with [4,11]. 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. Character association revealed significantly positive association of grain yield per plant with number of productive tillers per plant. Hence, selection for these traits can improve yield.

As simple correlation does not always provide the true contribution of the characters towards the yield, hence path coefficient analysis must be done to partition the effects on direct and in direct parts, these genotypic and phenotypic correlations were partitioned into direct and indirect effects through path coefficient analysis. It allows separating the direct effect and their indirect effects through other attributes by apportioning the correlations for better interpretation of cause and effect relationship. The estimates of path coefficient analysis are

furnished for yield and yield component characters in [Table-3]. Among all the characters, flag leaf length, has maximum direct positive effect followed by days to maturity, panicle length and tillers per plant ,whereas days to 50 % flowering has high negative direct effect followed by plant height and 1000 grain weight on

genotypic path values. These findings were in line with [8] for flowering, panicle length and tillers per plant [6] for maturity,[2] for plant height, panicle length and tillers per plant, while at last [1] for plant height and 1000 grain weight.

**Table-3** *Path coefficient analysis showing direct and indirect effect of various characters on Grain yield at Phenotypic level & genotypic level*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Characters** |  | **Correlation with grain yield** | **Direct effect** | ***Indirect effect via*** | | | | | | |
| **Days to 50% flowering** | **Days to Maturity** | **Plant height (cm)** | **Panicle length**  **(cm)** | **Flag leaf Length**  **(cm)** | **Tillers plant -1** | **1000 Grain Weight** |
| **Days to 50% flowering** | G P | (-0.809\*\*\*)  -0.785\*\*\* | (-1.433)  -0.542 | --- | (-1.170)  -0.437 | (-0.682)  -0.249 | (0.261)0.07  3 | (-1.111)  -0.404 | (0.862)  0.305 | (0.675)  0.248 |
| **Days to Maturity** | G P | (-0.783\*\*\*)  -0.772\*\*\* | (1.157)  0.128 | (0.946)  0.103 | --- | (0.367)  0.040 | (-0.485)  -0.047 | (0.512)  0.055 | (-0.818)  -0.084 | (-0.434)  -0.0477 |
| **Plant height(cm)** | G P | (-0.066)  -0.065 | (-1.129)  -0.273 | (-0.580)  -0.126 | (-0.386)  -0.0856 | --- | (-0.670)  -0.142 | (-1.006)  -0.221 | (-0.261)  -0.054 | (-0.256)  -0.057 |
| **Panicle length (cm)** | G P | (0.558\*\*\*) 0.529\*\* | (0.492)  0.175 | (-0.090)  -0.024 | (-0.206)  -0.0649 | (0.271)  0.091 | --- | (0.109)  0.034 | (0.356)  0.109 | (0.324)  0.108 |
| **Flag leaf Length(cm)** | G P | (-0.406\*)  -0.399\* | (1.205)  0.233 | (0.934)  0.174 | (0.532)  0.100 | (0.994)  0.189 | (0.266)  0.046 | --- | (-0.159)  -0.029 | (-0.268)  -0.052 |
| **Tillers plant -1** | G P | (0.959\*\*\*) 0.889\*\*\* | (1.070)  0.558 | (-0.643)  -0.314 | (-0.756)  -0.366 | (0.229)  0.110 | (0.774)  0.347 | (-0.141)  -0.068 | --- | (0.783)  0.373 |
| **1000 Grain Weight** | G P | (0.700\*\*\*) 0.698\*\*\* | (-0.124)  0.126 | (0.058)  -0.058 | (0.046)  -0.047 | (-0.026)  0.026 | (-0.081)  0.078 | (0.028)  -0.028 | (-0.090)  0.084 | --- |
| **Residual effects(Genotypic)= -0.058**  **Residual effects(Phenotypic)= 0.268 Figures in parenthesis are genotypic effects** | | | | | | | | | | |

# References

1. Babu V. R., Shreya K., Dangi K.S., Usharani G. and Siva Shankar A. (2012) *International J. of Scientific and Research Pub*., 2(3),1-4.
2. Bhadru D., Chandra Mohan Y., Rao V.T., Bharathi D. and Krishna L.(2012)

*International J. of Applied Biology and Pharmaceutical Tech*., 3(2), 137-140

1. Dewey D. R. and Lu. K. I. (1959) *Agronomy Journal*, 515-518.
2. Hasan M. J., Kulsum M. U., Akter A., Masuduzzaman A. S. M. and Ramesha M. S., (2010) *Bangladesh J. Pl. Breed. Genet*, 24(1), 45-51
3. <http://agridept.cg.gov.in/agriculture/Crop> \_Detail/Kharif\_ 2012\_13. html.Access and downloaded dated 16/05/2016
4. Khan A.S., Imran M. and Ashfaq M. *(*2009) *American-Eurasian J. Agric. & Sci*., 6(5), 585-590
5. Mugemangango C. and Kumar V. (2011) *Journal of Reliability and Statistical Studies*, 4(2), 119-131.
6. Qamar Z.U., Cheema A.A, Ashraf M., Rashid M. and Tahir G.R. *(*2005)

*Pak. J. Bot*., 37(3), 613-627

1. Selvaraj I., Nagarajan P., Thiyagarajan K., Bharathi M. and Rabindran R. (2011) *African Journal of Biotechnology,* 10(17), 3322-3334
2. Singh R.K. and Chaudhary B.D. (1979) *Biometrical methods in quantitative genetic analysis*. Kalyani publication, New Delhi, 120 p.
3. Soni S.K., Yadav V.K., Pratap N., Bhadana V.P. and Ram T. (2013)

*SAARC J. Agri*., 11(2), 17-32 (2013)

1. State *of Indian Agriculture* (2012-13) Directorate of Economics and Statistics New Delhi pp.191-200.
2. Parihar R, Sharma DJ, Agrawal AP, Minz MG. Genetic variability, heritability and genetic advance studies in aromatic short grain rice (*Oryza Sativa* L.) genotypes. Journal of Pharmacognosy and phytochemistry. 2017;6(6S):649-51.