# ESTIMATION OF GENETIC PARAMETERS FOR QUALITY TRAITS IN RICE (*ORYZA SATIVA* L.) UNDER RAINFED CONDITION

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## ABSTRACT

Twenty four genotypes of Rice were evaluated which consisting of advanced breeding materials, parent lines, land races and standard checks revealed considerable amount of variability for all the quality characters under rainfed condition. The GCV and PCV for quality characters range from low to moderate under rainfed condition. High heritability coupled with high genetic advance was observed in L/B ratio and elongation index under rainfed which may be probably due to additive gene effects indicate a good scope for improvement of these traits. High heritability with moderate genetic advance was recorded in rainfed condition for breadth of paddy, L/B ratio of paddy, L/B ratio of brown rice and Kernel length after cooking. These results were indicating that the characters are less influenced by environment but governed by both additive and non additive gene action hence, simple selection is suggested for further improvement in the later generation.

**Key words :** *Rice, quality parameters, variability, rainfed*

Rice is the most important staple food crop in the world, and is grown under a broad range of environmental conditions. About 80% of the rice area of eastern India is rainfed. Rainfed rice production environment is very diverse, and subjected to high risk of crop loss due to environmental stresses mainly drought stress. Developing drought tolerant varieties is one of the most important objectives of current breeding program.

With increase in yield there is also a need to look into the quality aspects to have better consumer acceptance. Rice quality is of great importance for all people involved in producing, processing and consuming rice, because it affects the nutritional and commercial value of grains. The most important quality components, common to all users, include appearance, milling quality, cooking and processing quality and nutritional quality (1). Improvement of genetic architecture of any crop depends upon not only the nature and extent of variability existing but also on the magnitude and inter- relationship of heritable and non-heritable variations for these characteristics.

## MATERIALS AND METHODS

Twenty four genotypes of Rice were evaluated which consisting of advanced breeding materials, parent lines, land races and standard checks, grown in Randomized Completely Block Design (RCBD) with two replications under rainfed situation. at Research Farm, Department of Genetics and Plant Breeding, IGKV, Raipur. Twenty one days seedling of each genotype was planted in five rows of three meter length with 20 cm row spacing keeping single seedling per hill. Recommended package of practices were followed to a raise a good crop. The observations of quality attributing characters were recorded for length of paddy, breadth of paddy, L/B ratio of paddy, length of brown rice, breadth of brown rice, L/B ratio of brown rice, length of milled rice , breadth of milled rice, L/B ratio of milled rice, kernel length after cooking, kernel breadth after cooking, L/B ratio of cooked rice, elongation ratio and elongation index as per standard procedure. The data were subjected to statistical analysis to workout GCV, PCV, heritability, correlation as per standard methods.

## RESULTS AND DISCUSSION

Highly significant differences exhibited among the genotypes for length of paddy, breadth of paddy, L/B ratio of paddy, length of brown rice, breadth of brown rice, L/B ratio of brown rice, length of milled rice, breadth of milled rice, L/B ratio of milled rice, kernel length after cooking, kernel breadth after cooking, L/B ratio of cooked rice, elongation ratio and elongation index under rainfed condition. These results were expected as the presence of substantial variability among the genotypes. This was also expected as the genotypes involved in the evaluation had entirely different expressions for most of the quality traits. Similar results for these traits has also been reported by (2, 3). The mean and variability parameters for different quality characters, under present study are presented in table-1.

The GCV and PCV of quality characters ranged from low to moderate under rainfed condition. Moderate estimates of GCV and PCV was observed for breadth of paddy, L/B ratio of paddy, breadth of brown rice, L/B ratio of brown rice, breadth of milled rice, L/B ratio of milled rice, kernel length after cooking, kernel breadth after cooking, elongation index and L/B ratio of cooked rice. Low estimates of GCV and PCV was observed for length of paddy, length of brown rice, length of milled rice and elongation ratio. The genotypes showed high heritability

**Table-1 :** Genetic Variability of Quality characters for different genotypes under Rainfed.

| Characters | Mean | GCV | PCV | Heritability | Genetic advance | Genetic advance as percentage of mean | Maximum | Minimum | Range |
|---|---|---|---|---|---|---|---|---|---|
| Length of Paddy (mm) | 9.0 | 6.7 | 6.7 | 98.5 | 1.2 | 13.5 | 9.7 | 7.6 | 2.1 |
| Breadth of Paddy (mm) | 2.5 | 10.9 | 11.1 | 96.2 | 0.6 | 21.9 | 3.1 | 1.8 | 1.3 |
| L/B ratio of Paddy | 3.6 | 12.2 | 12.3 | 97.4 | 0.9 | 24.6 | 4.4 | 2.6 | 1.8 |
| Length of Brown Rice (mm) | 6.8 | 6.3 | 6.4 | 96.1 | 0.9 | 12.6 | 7.3 | 5.6 | 1.7 |
| Breadth of  Brown Rice | 2.1 | 11.2 | 11.6 | 93.6 | 0.5 | 22.1 | 2.8 | 1.7 | 1.1 |
| L/B ratio of Brown Rice | 3.2 | 12.1 | 12.6 | 92.7 | 0.8 | 23.7 | 3.8 | 2.1 | 1.7 |
| Length of Milled Rice (mm) | 6.2 | 6.7 | 7.0 | 93.0 | 0.8 | 13.2 | 6.9 | 5.3 | 1.6 |
| Breadth of Milled Rice (mm) | 2.0 | 15.3 | 15.6 | 96.5 | 0.6 | 30.7 | 2.7 | 1.1 | 1.6 |
| L/B ratio of Milled Rice | 3.2 | 17.7 | 18.1 | 96.0 | 1.1 | 35.4 | 4.9 | 2.1 | 2.8 |
| Kernel length after cooking (mm) | 9.4 | 11.0 | 11.1 | 97.7 | 2.1 | 22.1 | 10.9 | 6.4 | 4.5 |
| Kernel breadth after cooking (mm) | 3.2 | 8.6 | 9.1 | 88.3 | 0.5 | 16.4 | 3.8 | 2.8 | 1.0 |
| L/B ratio of cooked Rice | 2.9 | 10.3 | 11.1 | 85.7 | 0.6 | 19.4 | 3.4 | 2.3 | 1.1 |
| Elongation Ratio | 1.5 | 8.3 | 8.9 | 86.4 | 0.2 | 15.7 | 1.8 | 1.2 | 0.6 |
| Elongation Index | 1.0 | 15.6 | 16.6 | 89.2 | 0.3 | 30.1 | 1.2 | 0.5 | 0.7 |
| Hulling percent | 79.7 | - | - | - | - | - | 88.5 | 76.5 | 12.0 |
| Milling percent | 73.0 | - | - | - | - | - | 88.5 | 66.1 | 22.4 |
| Head rice recovery percent | 64.4 | - | - | - | - | - | 98.3 | 43.1 | 55.2 |
| Alkali spreading value | 2.7 | - | - | - | - | - | 6.0 | 1.0 | 5.0 |

**Table-2 :** Summary of estimates of heritability and genetic advance as percentage of mean for different quality characters under rainfed condition.

| S. No. | Quality characters | Rainfed | |
|---|---|---|---|
| | | Heitability | Genetic Advance |
| 1. | Length of paddy (mm) | H | L |
| 2. | Breadth of paddy (mm) | H | M |
| 3. | L/B ratio of paddy | H | M |
| 4. | Length of brown rice (mm) | H | L |
| 5. | Breadth of brown rice (mm) | H | M |
| 6. | L/B ratio of brown rice | H | M |
| 7. | Length of milled rice (mm) | H | L |
| 8. | Breadth of milled rice (mm) | H | H |
| 9. | L/B ratio of milled rice | H | H |
| 10. | Kernel length after cooking (mm) | H | M |
| 11. | Kernel breadth after cooking (mm) | H | L |
| 12. | L/B ratio of cooked rice | H | L |
| 13. | Elongation ratio | H | L |
| 14. | Elongation index | H | H |

**Table-3.1 :** Correlation of grain yield with different quality characters under rainfed.

| S. No. | Quality Characters | Rainfed |
|---|---|---|
| 1. | Length of paddy (mm) | -0.29 |
| 2. | Breadth of paddy (mm) | 0.17 |
| 3. | L/B ratio of paddy | -0.32 |
| 4. | Length of brown rice (mm) | -0.25 |
| 5. | Breadth of brown rice (mm) | 0.23 |
| 6. | L/B ratio of brown rice | -0.34 |
| 7. | Length of milled rice (mm) | -0.24 |
| 8. | Breadth of milled rice (mm) | 0.26 |
| 9. | L/B ratio of milled rice | -0.34 |
| 10. | Kernel length after cooking (mm) | -0.03 |
| 11. | Kernel breadth after cooking (mm) | 0.03 |
| 12. | L/B ratio of cooked rice | -0.07 |
| 13. | Hulling percent (%) | 0.16 |
| 14. | Milling percent (%) | 0.40* |
| 15. | Head rice recovery percent (%) | 0.16 |
| 16. | Elongation ratio | 0.15 |
| 17. | Elongation index | 0.30 |
| 18. | Alkali spreading value | 0.10 |

*, Significant at 5% level

**Table-3.2 :** Correlation between different quality characters under rainfed condition.

| Characters | Kernel length after cooking | Kernel breadth after cooking | L/B ratio of cooked rice | Hulling % | Milling % | Head rice recovery % | Elongation Ratio | Elongation Index |
|---|---|---|---|---|---|---|---|---|
| Kernel length after cooking | 1.00 | | | | | | | |
| Kernel breadth after cooking | 0.48* | 1.00 | | | | | | |
| L/B ratio of cooked rice | 0.68** | -0.31 | 1.00 | | | | | |
| Hulling % | 0.04 | -0.17 | 0.18 | 1.00 | | | | |
| Milling % | -0.19 | -0.23 | 0.00 | 0.75** | 1.00 | | | |
| Head rice recovery % | -0.22 | -0.25 | -0.01 | 0.44* | 0.46* | 1.00 | | |
| Elongation Ratio | 0.79** | 0.52** | 0.44* | 0.04 | -0.18 | -0.04 | 1.00 | |
| Elongation Index | 0.48* | 0.24 | 0.36 | 0.27 | 0.20 | 0.27 | 0.69** | 1.00 |

*, **, Significant at 5 and 1 % levels, respectively.

**Table-4 :** Quality characters of best five genotypes under rainfed condition compared to checks.

| Genotypes | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R-1033-968-2-1 | 8.9 | 2.4 | 3.8 | 6.8 | 2.0 | 3.4 | 5.8 | 1.9 | 3.1 | 8.6 | 3.2 | 2.7 | 77.9 | 72.3 | 74.2 | 1.5 | 0.9 | 1.0 |
| R-RF-29 | 9.2 | 2.4 | 3.9 | 6.9 | 2.0 | 3.5 | 6.3 | 1.9 | 3.4 | 9.8 | 3.1 | 3.2 | 79.6 | 75.3 | 60.1 | 1.6 | 1.0 | 2.0 |
| R-RF-25 | 8.7 | 2.8 | 3.1 | 6.8 | 2.5 | 2.8 | 6.2 | 2.3 | 2.7 | 10.9 | 3.4 | 3.3 | 80.6 | 76.8 | 58.3 | 1.8 | 1.2 | 3.0 |
| R 1027 | 7.6 | 2.6 | 2.9 | 6.2 | 2.2 | 2.8 | 5.7 | 2.1 | 2.8 | 7.7 | 3.0 | 2.6 | 75.6 | 72.6 | 73.7 | 1.4 | 0.9 | 5.0 |
| R-RF-21 | 9.2 | 2.4 | 3.9 | 6.6 | 2.0 | 3.4 | 6.5 | 1.9 | 3.4 | 9.7 | 3.4 | 2.9 | 78.3 | 72.3 | 54.2 | 1.5 | 0.8 | 2.0 |
| Poornima | 9.4 | 2.4 | 4.0 | 7.2 | 2.1 | 3.5 | 6.8 | 1.8 | 3.8 | 10.2 | 3.4 | 3.0 | 79.9 | 72.3 | 47.1 | 1.5 | 0.8 | 5.0 |
| MTU 1010 | 9.1 | 2.4 | 3.9 | 6.8 | 2.1 | 3.2 | 6.2 | 2.0 | 3.2 | 10.1 | 3.4 | 3.0 | 78.1 | 70.7 | 76.6 | 1.6 | 1.0 | 2.0 |
| IR- 64 | 9.4 | 2.5 | 3.8 | 6.8 | 2.1 | 3.3 | 6.6 | 2.0 | 3.4 | 10.0 | 3.5 | 2.9 | 79.5 | 72.9 | 81.9 | 1.5 | 0.9 | 2.0 |

Note : 1 = Length of Paddy (mm), 2 = Breadth of Paddy (mm), 3 = L/B ratio of Paddy, 4 = Length of Brown Rice (mm), 5 = Breadth of Brown Rice (mm), 6 = L/B ratio of Brown Rice, 7 = Length of Milled Rice (mm), 8 = Breadth of Milled Rice (mm), 9 = L/B ratio of Milled Rice, 10 = Kernel length after cooking (mm), 11 = Kernel breadth after cooking (mm), 12 = L/B ratio of cooked rice, 13 = Hulling %, 14 = Milling %, 15 = Head rice recovery % , 16 = Elongation Ratio, 17 = Elongation Index, 18 = Alkali spreading value.

estimates of more than 80% for all the quality characters under rainfed condition while variation was found for the estimates of genetic advance as percentage of mean. High estimates of heritability for kernel breadth after cooking and elongation ratio by (4).

High heritability coupled with high genetic advance was observed in L/B ratio and elongation index under rainfed Which may be probably due to additive gene effects indicate a good scope for improvement of these traits.

High heritability with moderate genetic advance was recorded in rainfed condition for breadth of paddy, L/B ratio of paddy, L/B ratio of brown rice and Kernel length after cooking. These results were indicating that the characters are less influenced by environment but governed by both additive and non additive gene action. Hence, simple selection is suggested for further improvement in the later generation.

High heritability with low genetic advance was recorded in rainfed condition for Length of paddy, Length

of brown rice, Length of milled rice, Kernel breadth after cooking and Kernel breadth after cooking and elongation ratio. These results were indicating non additive gene action. The high heritability is being exhibited due to favourable influence of environment rather than genotype and selection for such traits may not be rewarding. Summary of heritability and genetic advance for quality characters are presented in table-2

In quality characters recorded in the present study under rainfed condition did not exhibited significant correlation with yield. The data of correlation between some important quality characters is presented in table-3 for rainfed condition. Among quality characters significant and positive correlation was observed between kernel length after cooking and elongation index under rainfed condition which is in accordance with the result of (5). Positive correlation was also observed between hulling %, milling % and head rice recovery percent under rainfed condition indicating that genotypes with higher hulling % also recorded higher estimates for milled rice and head

rice. Similar results for these traits have also been reported by (5). Elongation index was positively correlated with kernel length after cooking, L/B ratio of cooked rice and negatively with kernel breadth after cooking under rainfed condition. A similar result has been reported by (2). Highly significant and positive correlation was also observed between elongation ratio and elongation index under rainfed condition. In conclusion best five genotypes R1033-968-2-1, R-RF-29, R-RF-25, R 1027 and R-RF-21 identified over their checks for quality traits in rice under rainfed condition in table-4.

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