Environment & Ecology 35 (3B) : 2119—2122, July—September 2017
Website : environmentandecology.com ISSN 0970-0420

# Genetic Variablity Studies in $F_2$ Segregating Generation for Grain Yield and its Components InvolvingTraditional Variety of Rice (*Oryza sativa* L.)

**K. Mamata, M. P. Rajanna, S. K. Savita**

Received 10 October 2016; Accepted 4 November 2016; Published online 23 November 2016

**Abstract** Rice (*Oryza sativa* L.) is the most important staple food crop among the cereals consumed by more than half of the world's human population. In this study five hundred $F_2$ segregating population developed involving traditional variety Rajamudi and semi-dwarf high yielding variety BR-2655 were evaluated for their performance and genetic variability for grain yield and yield related parameters. High to moderate genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) values were observed for grain yield per plant, production tillers per plant, panicle weight, filled grains per panicle, straw yield per plant spikelet fertility and harvest index suggested that presence of considerable variation. Hence, individual plant selection can be practiced for the above mentioned characters to get higher grain yield. High heritability coupled with high genetic advance as per cent of mean was observed for characters like plant height, productive tillers per plant, straw yield per plant, spikelet fertility, grain yield per plant and harvest index indicates the involvement of additive gene action and less environment influence on expression of these characters. The superior segregants with high grain yield were identified in F generation, can advanced to further generations for selection of superior segregants.

**Keywords** Rice, Genetic advance, GCV, PCV, Heritability.

## Introduction

Rice (*Oryza sativa* L.) is one of the world's most important cereal crop and primary calorie source for one-third of the world's population Shim et al. [1]. More than 90% of the world's rice is grown and consumed in developing countries. It occupies almost one-fifth of the total land area covered under cereals and grown under diverse cultural and over wide geographical range. India is largest rice growing country accounting for about one third of the world acre-

---

K. Mamata*
PhD Scholar,
Dept of Genetics and Plant Breeding, College of Agriculture,
UAS Bangalore, Karnataka, India
e mail : mamatakhandappagol@gmail.com

M. P. Rajanna
Professor and Head,
AICRP on Rice Zonal Agriculture Research Station,
VC Farm, Mandya, Karnataka, India
e mail : mprajanna@rocketmail.com

S. K. Savita
PhD Scholar,
Dept of Genetics and Plant Breeding, College of Agriculture,
UAS Bangalore, Karnataka, India
e mail : agricosavita@gmail.com
*Correspondence

age under the crop. Rice crop occupies about 43.97 m ha$^{-1}$ in the country with a production of 106.57 mt and productivity of 2424 kg ha$^{-1}$ during 2015-16 Anon [2]. The aim of most rice breeding progrm is to increase the grain yield, milling properties and enhance the quality of end use products.

For effective selection for high grain yield genotypes, knowledge on genetic parameters such as genetic variability, heritability, genetic advance is essential. Genetic variability for trait of interest in any breeding material is a prerequisite as it provides basis for selection. Heritability estimates helps in improvement of traits by utilizing heritable components of variation. Possible advance through selection based on phenotypic values can be predicted only from knowledge of the degree of correspondence between phenotypic and genotypic values. Genetic components of variation together with heritability estimates would give the best picture of the amount of advance to be expected from selection. The present study has been undertaken to determine the estimates of variability, heritability and genetic advance as per cent of mean for grain yield and its component traits in $F_2$ population of cross Rajamudi × BR-2655 in rice.

## Materials and Methods

The present investigation was carried out during *rabi*/ summer 2015 at Zonal Agricultural Research Station, Mandya Karnataka. Experimental material consisted of Five hundred $F_2$ population developed involving traditional variety Rajamudi is high yielder with superior nutritional grain qualities but they are photo sensitive and susceptible to lodging because of their tall growing nature and other parent BR-2655 improved semi-dwarf high yielding variety were evaluated in an augmented design landraces. $F_2$ population were evaluated in an augment design with spacing 20 ×10 cm, recommended cultural practices and plant protection measures were taken up as per the packages of practices recommended by university of Agricultural Sciences Bangalore Anon [3].

Observations were recorded on grain yield and yield attributing traits viz., days to 50% flowering, plant height (cm), productive tillers per plant, panicle weight (g), panicle length (cm), filled grains per paniple, total Spikelets per panicle, straw yield per plant (g), 1000-grain weight (g), spikelet fertility (%), harvest index (%) and grain yield per plant (g). The mean data for each character individually was subjected to statistical analysis. Standard statistical procedures were used for the genotypic and phenotypic coefficients of variation Burton and De Vane [4], heritability and genetic advance Johnson et al. [5].

## Results and Discussion

The analysis of variance in $F_2$ population of cross Rajamudi × BR 2655 revealed significant differences among the lines for grain yield and yield related characters studied viz. days to 50% flowering, plant height (cm), productive tillers per plant, panicle weight (g), panicle length (cm), filled grains per panicle, total spikelets per panicle, straw yield per plant (g), 1000-grain weight (g), spikelet fertility (%), harvest index (%) and grain yield per plant (g) indicating presence of high genetic variability in the experimental material. The range of variation was quite high in $F_2$ population suggesting that these traits may be improved by individual plant selection and provide clues about the occurrence of genotypes with extreme expression.

The potentiality of a cross is measured not only by mean performance but also on the extent of variability. Knowledge on nature and magnitude of genotypic ad phenotypic variability present in any crop species plays an important role in formulating successful breeding program Allard [6]. Sivasubramanian and Mathava menon [7] also highlighted the importance of variability in early segregating generations and suggested that magnitude of genotypic coefficient of variability and phenotypic coefficient of variability should be given importance.

High phenotypic coefficient of variation and moderate genotypic coefficient of variation estimates were observed for grain yield per plant, productive tillers per plant, panicle weight, filled grains per panicle, spikelets per panicle, productive tillers per plant and straw yield per plant suggested that presence of considerable variation (Table 1). These findings are in accordance with the reports of Madhu-

**Table 1.** Estimation of mean and genetic parameters for yield and yield attributing traits in $F_2$ generation of the cross Rajamudi × BR-2655 in rice (*Oryza sativa* L.).

| | | Range | | PCV | GCV | H | |
|---|---|---|---|---|---|---|---|
| Characters | Mean | Minimum | Maximum | (%) | (%) | (%) | GAM |
| Days to 50% flowering | 87.45 | 73.00 | 106.00 | 11.44 | 10.65 | 84.37 | 19.88 |
| Plant height (cm) | 117.51 | 63.00 | 185.00 | 15.11 | 14.72 | 97.44 | 30.33 |
| Productive tillers per plant | 8.41 | 2.00 | 22.00 | 34.44 | 18.94 | 54.99 | 39.01 |
| Panicle weight (g) | 3.53 | 0.80 | 6.93 | 29.05 | 13.21 | 45.47 | 27.21 |
| Panicle length (cm) | 24.58 | 13.00 | 31.97 | 12.36 | 8.05 | 65.13 | 16.58 |
| Filled grains per panicle | 134.15 | 36.00 | 250.00 | 28.14 | 15.33 | 54.49 | 31.59 |
| Total spikelets per panicle | 134.28 | 36.00 | 296.00 | 28.4 | 11.37 | 40.02 | 23.41 |
| Straw yield per plant (g0 | 15.90 | 9.20 | 36.10 | 25.67 | 16.69 | 65.04 | 34.39 |
| 1000-grain weight (g) | 25.23 | 15.01 | 34.97 | 9.85 | 8.41 | 68.31 | 12.97 |
| Spikelet fertility (%) | 84.04 | 17.97 | 98.55 | 17.16 | 13.46 | 78.43 | 27.73 |
| Harvest index (%) | 0.33 | 0.20 | 0.50 | 19.78 | 17.83 | 90.14 | 36.72 |
| Grain yield per plant (g) | 24.44 | 5.00 | 54.40 | 36.88 | 22.26 | 60.37 | 45.86 |

sudhan [8] and Sharma et al. [9]. Lingaiah et al. [10] reported magnitude of phenotypic coefficient of variation and genotypic coefficient of variation was moderate to high for the traits number of grains/ panicle, test weight and yield.

Moderate PCV and GCV were recorded for days to fifty per cent flowering, plant height, spikelet fertility and harvest index. Kumar et al. [11] reported high to moderate GCV and PCV for above characters. This result are in contradiction with the earlier report of Thirumala et al. [12] and Sinha et al. [13]reported low variability for this trait. Panicle length and 1000-grain weight exhibited low GCV and PCV indicate less variability with respect to these traits. The high magnitude of genotypic coefficient of variation further revealed greater extent of variability present in these characters, thereby suggesting good scope for improvement through selection. Low values of genotypic coefficient of variation indicated the need to create variability either by hybridization or mutation followed by selection.

Heritability is a measure of the gnetic relationship between parents and progeny and widely used in determining the degree to which a character may be transmitted from parents to off-springs. Heritability value alone cannot provide information on the amount of genetic progress that would result from selection of best individuals. Johnson et al. [5] reported that heritability estimates along with genetic gain would be more useful than the former alone in predicting the effectiveness of selecting the best individuals. Therefore, it is essential to consider the predicted genetic advance along with heritability estimate as a tool in the selection progrm for better efficiency in the selection.

High heritability estimates and genetic advance as per cent of mean were obtained for plant height, straw yield per plant, spikelet fertility, harvest index and grain yield per plant indicated the presence of lesser environmental influence and prevalence of additive gene actions in their expression. High heritability coupled with moderate genetic advance as per cent of mean were observed for days to fifty per cent flowering, panicle length and hundred grain weight (Fig. 1). This moderate value may be due to moderate values for phenotypic standard deviation as the heritability is high for these characters and selection differential is always constant. Moderate heritability coupled with moderate genetic advance as per cent of mean were observed for the characters productive tillers per plant, panicle weight, filled grains per panicle and spikelets per panicle in the present study, which indicated considerable influence of environment apart from non-additive gene action.

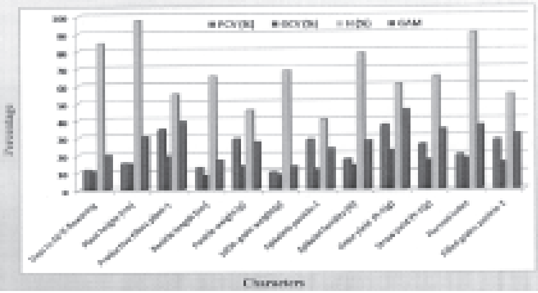

**Fig. 1.** Estimation of mean and genetic parameters for yield and yield attributing traits in $F_2$ generation of the cross Rajamudi × BR-2655 in rice (*Oryza sativa* L.).

Higher heritability coupled with high genetic advance revealed the presence of lesser enviromental influence and prevalence of additive gene action in their expression. But lower values of genetic advance indicated the prevalence of narrow range of variability, high G × E interaction or non-additive gene action. For moderate values of genetic advance, both additive and non-additive gene action might be responsible for the expresssion. High estimates of heritability along with high genetic advance provides good scope for further improvement in advance generations if these characters subjected to selection.

## References

1. Shim KS, Cho SK, Jeung JU (2004) Identification of fungal (*M. grisea*) stress-induced genes in wild rice (*Oryza minuta*). Pl Cell Rep 22 : 599—607.
2. Anonymous (2015) Agri statistics at a glance-2015. Directorate of Economics and Statistic, Department of Agricultural and Cooperation.
3. Anonymous (2014) Adika iluvarige adhunika besaya paddhathigalu package of practices for field crops. Univ Agric Sci, Bangalore.
4. Burton GW, De Vane (1952) Estimating heritability in tall tissue (*Festula arundnacea* L.) from replicated clonal material. Agron J 45 : 478—488.
5. Johnson HW, Robinson HF, Comstock RE (1955) Genotypic and phenotypic correlations in soybean and their applcation in selection. Agron J 47 : 477—483.
6. Allard RW (1960) Principles of plant breeding. John Wiley and Sons. Inc USA, pp 485.
7. Sivasubramanian P, Menon PM (1973) Genotypic and phenotypic variability in rice. Madras Agric J 60 : 1093—1096.
8. Madhusudhan (2001) Development of trait differential lines and detection of near isogenic lines by phenotypic and molecular characterization in early segregating generation in rice (*Oryza sativa* L.). MSc (Agric) thesis. Univ Agric Sci Bangalore, pp 96.
9. Sharma AK, Sharma RN (2007) Genetic variability and character association in early maturing rice. Oryza 44 : 300—303.
10. Lingaiah N, Venkanna V, Cheralu G (2014) Genetic variability analysis in rice (*Oryza sativa* L.). Int J Pure App Biosci 2 : 203—204.
11. Kumar Vikas, Nidhi K, Neha S, Kouta GK (2014) Genetic evaluation of RIL's population for yield and quality attributing traits in rice. J Agric Technol 1 : 43—51.
12. Thirumala Rao V, Mohan VC, Bhadru D, Bharathi D, Venkanna V (2014) Genetic variability and association analysis in rice. Int J Appl Biol & Pharmaceutical Technol 5 : 63—65.
13. Sinha SK, Tripathi AK, Bisen UK (2004) Study of genetic variability and correlation co-efficient analysis in midland landraces of rice. Ann Agric Res 25 : 1—3.