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GENETIC VARIABILITY STUDIES FOR YIELD AND ITS ATTRIBUTES, QUALITY AND NUTRITIONAL TRAITS IN MEDIUM DURATION RICE GENOTYPES (*Oryza sativa* L.)

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ABSTRACT

The experiment was conducted during *kharif*, 2024 at Regional Agricultural Research Station, Maruteru. Sixty-four genotypes of medium duration rice (*Oryza sativa* L.) were evaluated for genetic variability, heritability and genetic advance as per cent of mean for 15 quantitative traits. Analysis of variance revealed significant differences for all the characters under study. High genotypic coefficient of variation (GCV) 21.000% and phenotypic coefficient of variation (PCV) 20.642% were observed for the character *viz.,*grains per panicle. High heritability coupled with high genetic advance as percent mean was observed for grains per panicle, no of grains per cm panicle, grain density, test weight, grain yield per plant and high protein content indicating the effectiveness of simple selection in improvement of these traits.

Key words: GCV, Genetic variability, Genetic advance, Heritability, PCV and Rice

INTRODUCTION

Rice (*Oryza sativa* L., 2n=24) is a self-pollinating cereal crop that belongs to the Poaceae family and the Cyperales order. Rice is widely cultivated in tropical and subtropical regions worldwide. Over half of the global population relies on rice as a staple food, and it is typically consumed in large quantities in the countries where it is produced. China is the leading producer of rice and India is second largest producer of rice. Rice is a primary staple food in South and Southeast Asia, where 90% of the world's rice is both produced and consumed. In India, rice is cultivated in 514.23 lakh hectares yielding 1490.70 lakh tons with an average productivity of 2899 kg per hectare (www.Indiastat.com, 2024-25). In Andhra Pradesh, rice is grown on 20.75 lakh hectares, producing 80.16 lakh tons, with a productivity of 3863 kg per hectare (www.Indiastat.com, 2024-25).

Adequate genetic variability is considered a critical requirement for any crop improvement program. The extent of variation in quantitative traits is often assessed using genetic parameters like the genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV).These measures also help indicate how much environmental factors influence the expression of these traits.In some cases, phenotypic selection based on performance may not be effective, as genotypes may perform poorly in subsequent segregating generations. The genotypic coefficient of variation indicates the extent of genetic variability and represents the

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heritable portion of the variability. Therefore, selecting genotypes based on heritability and genetic advance is crucial. By assessing genetic variability along with heritability estimates, it becomes possible to predict the genetic gain that can be expected through selection (Burton and Devane, 1953). Hence, evaluating variability in grain yield, its attributes, quality, and nutritional parameters in rice genotypes is vital for developing selection criteria to enhance yield through breeding.

MATERIAL AND METHODS

The present study was conducted during *kharif*, 2024 at Regional Agricultural Research Station, Maruteru, Andhra Pradesh.The experimental material used in the present study comprised of 64 genotypes (*Oryza sativa* L.) developed by ANGRAU with different genetic backgrounds. Among the 64 genotypes, BPT 3082 was obtained from ARS, Bapatla while remaining genotypes from RARS, Maruteru. The experiment was laid in Simple lattice design with two replications adopting 20cm x15cm spacing. To ensure healthy crop stand recommended agronomic practices and integrated plant protection measures were diligently implemented all through the evaluation time. Data was recorded for 15 characters *viz.,* days to 50% flowering, days to maturity, plant height (cm), ear bearing tillers per plant, panicle length (cm), grains per panicle (cm), no of grains per cm panicle, grain density (g/cm^{-3}), test weight (g) and grain yield per plant (g). Quality parameters are head rice recovery (%), kernel length (mm), kernel breadth (mm), kernel L/B ratio and nutritional parameter protein content (%).The data was statistically analysed to estimate Phenotypic Coefficient of Variation (PCV) and Genotypic Coefficient of Variation (GCV) as indicated by Burton and Devane(1953). Heritability in broad sense was computed as the ratio of genetic variance to the total phenotypic variance and narrow sense heritability was the ratio of additive genetic variance to the total phenotypic variance as suggested by Lush(1949) and genetic advance as percent of mean was calculated based on the formula Genetic Advance (GA)= Kx ópxh^2 which was given by Jhonson *et al.* (1955).The statistical analysis was done using INDOSTAT version 9.50.

RESULTS AND DISCUSSION

Analysis of Variance

Analysis of variance indicated significant differences among the genotypes for all the characters under study indicating the existence of sufficient amount of variability in the genotypes studied (Table 1). The phenotypic coefficient of variation (PCV) was slightly higher in magnitude than genotypic coefficient of variation (GCV) for all the characters (Table 2) indicating that the apparent variation was not only due to genotypes but also due to influence of environment.

Phenotypic and Genotypic Coefficients of Variation

The phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were high for grain per panicle similar results were obtained by Singh *et al.* (2020a). The phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were low for daysto 50 percent flowering, days to maturity, plant height, panicle length, head rice recovery, kernel length, kernel breadth and kernel L/B ratio.The results are in agreement with Anusha *et al.* (2024) for days to 50 percent flowering, Harsharaj *et al.* (2024) for days to Maturity, Devi *et al.* (2022) for plant height, Gnaneswari *et al.* (2023) for panicle length, Lingaiah *et al.*(2018) for head rice recovery, Usha *et al.* (2024) for kernel length,

Table 1. Analysis of variance for grain yield, yield components, quality and nutritional traitsin medium duration rice genotypes in rice (*Oryza sativa* L.)

Source	Df	Days to 50 per cent flowering	Days to maturity	Plant height	Ear bearing tillers per plant	Panicle length	Grains per panicle	No of grains per cm panicle	Grain density
Replication	1	7.508	7.508	2.915	4.133	0.003	56.445	0.125	0.000
Genotypes (Unadjusted)	63	46.387**	46.715**	141.992**	1.622**	6.380**	9420.199**	11.087**	0.026**
Blocks within Replication adjusted	14	2.722	2.722	2.885	0.731	0.210	60.285	0.232	0.000
Intra block Error	49	2.324	2.324	2.142	0.595	0.283	72.991	0.156	0.000

**** Significant at 1 per cent level of probability**

Source	Df	Test weight	Grain yield per plant	Head rice recovery	Kernel length	Kernel breadth	Kernel L/B ratio	Protein content
Replication	1	0.051	2.349	2.055	0.003	0.002	0.003	-0.002
Genotypes (Unadjusted)	63	16.653**	50.137**	37.779**	0.247**	0.036**	0.137**	2.240**
Blocks within Replication adjusted	14	0.008	2.562	0.147	0.001	0.000	0.001	0.000
Intra block Error	49	0.006	2.917	0.134	0.001	0.000	0.001	0.001

**** Significant at 1 per cent level of probability**

Table 2. Estimates of genetic parameters for yield attributing, quality and nutritional traits in 64 medium duration rice genotypes

S.No.	Characters	Mean	Range		Coefficient of variation		Herit ability (%)	Genetic advance as per cent of mean
			Minimum	Maximum	PCV (%)	GCV (%)		
1.	Days to 50 % flowering	106	96	119	3.849	5.169	55.451	5.905
2.	Days to maturity	136	126	149	3.077	3.990	59.467	4.887
3	Plant height (cm)	134.35	108.6	146.7	6.067	6.470	87.909	11.717
4	Ear bearing tillers per plant	10	8	14	6.599	10.093	42.749	8.889
5	Panicle length (cm)	27.25	22.8	31.22	6.415	6.689	91.953	12.671
6	Grains per panicle	330	175	477	20.642	21.000	96.621	41.797
7	No of grains per cm panicle	12.11	6.07	16.7	19.277	19.486	97.872	39.286
8	Grain density (gm/cm^3)	0.6	0.38	0.89	18.958	19.115	98.356	38.731
9	Test weight (g)	16.18	11.16	21.29	16.908	18.705	81.708	31.484
10	Grain yield per plant (g))	29.3	18.4	36	16.002	21.000	96.621	29.135
11	Head rice recovery (%)	60.14	49.3	68.65	6.851	7.583	81.631	12.752
12	Kernel length (mm)	5.34	4.52	6.19	6.440	6.729	91.596	12.697
13	Kernel breadth (mm)	1.83	1.61	2.15	7.153	7.499	90.979	14.054
14	Kernel L/B ratio	2.93	2.32	3.38	8.824	9.050	95.066	17.724
15	Protein content (%)	7.56	5.4	9.94	13.825	14.174	95.126	27.776

PCV: Phenotypic coefficient of variation
GCV: Genotypic coefficient of variation

Devi *et al.* (2019) for kernel breadth and Bandi *et al*. (2018) for kernel L/B ratio. The phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were moderate to moderate for no of grains per cm panicle, grain density, test weight and protein content. The results are conformity with Lakshmi *et al.* (2020) for test weight. Moderate phenotypic and low genotypic co variance were characterized for ear bearing tillers per plant. The similar results were observed for Devi *et al.*(2022) and high phenotypic and moderate genotypic co variance reported for grain yield per plant by Nagajyothi (2001).

Heritability and Genetic Advance

Heritability estimates along with genetic advance as percent of mean would be more useful in predicting yield under phenotypic selection than heritability estimates alone as suggested by Johnson *et al.* (1955). High heritability coupled with high genetic advance as per cent of mean was observed for grains per panicle, no of grains per cm panicle, grain density, test weight, grain yield per plant and protein content. Similar results are conformity with Harsharaj *et al*. (2024) for grains per panicle, Suhana *et al.* (2023) for test weight, Bhargavi *et al*. (2021) for grain yield per plant and Rao *et al*. (2020) for protein content indicating the preponderance of additive gene action. High heritability coupled with moderate genetic advance as per cent of mean was observed for plant height, panicle length, head rice recovery, kernel length, kernel breadth and kernel L/B ratio. The results are in agreement with Sao *et al*. (2024) for plant height, Deepthi *et al*. (2022) for panicle length, Singh *et al.*(2020a) for head rice recovery, Priyanka (2021) for kernel length, Manivelan *et al.* (2022) for kernel L/B ratio indicating the preponderance of additive and non-additive gene action. Moderate heritability coupled with low genetic advance as per cent of mean for days to 50 percent flowering, days to maturity and ear bearing tillers per plant. The above results are in conformity with Lingaiah *et al.* (2018) for days to 50 percent flowering, Singh *et al.* (2020a) for days to maturity and Devi *et al.* (2020) for ear bearing tillers per plant wereindicating the role of both additive and non-additive gene action in governing thetraits.

CONCLUSION

The present study revealed that the trait grains per panicle exhibited high phenotypic and genotypic coefficient of variation along with high heritability and high genetic advance, suggesting the presence of additive gene action. This trait can be effectively improved through direct phenotypic selection.High PCV and GCV values for no of grains per panicle reflected substantial variability, suggesting good scope for improvement through selection. High heritabilitycoupled with high genetic advance as per cent mean was observed grains per panicle, no of grains per cm panicle, grain density, test weight, grain yield per plant and high protein content indicating the effectiveness of simple selection in improvement of these traits.

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