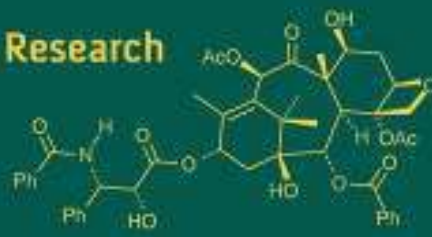
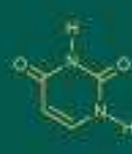


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; 8(9): 1112-1114
www.biochemjournal.com
Received: 13-07-2024
Accepted: 16-08-2024

Anjali
Department of Genetics and Plant
Breeding, Sardar Vallabhbhai Patel
University of Agriculture and
Technology, Meerut, Uttar Pradesh,
India

Pooran Chand
Department of Genetics and Plant
Breeding, Sardar Vallabhbhai Patel
University of Agriculture and
Technology, Meerut, Uttar Pradesh,
India

Lokesh Kumar Gangwar
Department of Genetics and Plant
Breeding, Sardar Vallabhbhai Patel
University of Agriculture and
Technology, Meerut, Uttar Pradesh,
India

Mukesh Kumar
Department of Genetics and Plant
Breeding, Sardar Vallabhbhai Patel
University of Agriculture and
Technology, Meerut, Uttar Pradesh,
India

Atar Singh
Department of Genetics and Plant
Breeding, Sardar Vallabhbhai Patel
University of Agriculture and
Technology, Meerut, Uttar Pradesh,
India

Vaishali
Department of Agriculture
Biotechnology, Sardar Vallabhbhai
Patel University of Agriculture and
Technology, Meerut, Uttar Pradesh,
India

Corresponding Author:
Anjali
Department of Genetics and Plant
Breeding, Sardar Vallabhbhai Patel
University of Agriculture and
Technology, Meerut, Uttar Pradesh,
India

Evaluation of variability, heritability and genetic advance in relation to seed yield and its attributing traits in rice (*Oryza sativa* L.)

Anjali, Pooran Chand, Lokesh Kumar Gangwar, Mukesh Kumar, Atar Singh and Vaishali

DOI: <https://doi.org/10.33545/26174693.2024.v8.i9n.2351>

Abstract

The present study was distributed for analyses the genetic heritability, variability and genetic advance for 10 quantitative traits. Use Randomized Block Design (RBD) with three replications for grown the 58 genotypes. Recorded the observations on five randomly selected plants from each genotype in each replication for the 10 characters viz. days to 50% flowering, days to maturity, plant height, no. of productive tillers, panicle length, grain per panicle, 1000 seed weight, biological yield, harvest index and grain yield per plant. The high genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) was observed for harvest index, grain yield per plant and grain per panicle. There was least influence of environment within the expression of those traits. High heritability as well as high genetic advance recorded for harvest index, grain yield/ plant, biological yield and grain per panicle. As a result, genotypes selection will be done directly through these characters for further improvement of genotypes of *Oryza sativa*. Based on the findings of the preceding research, it will be concluded that due weightage should incline to harvest index, grain yield/plant and biological yield and grain per panicle while enforcing genetic improvement through selection in rice.

Keywords: Variability, heritability, genetic advance, rice

Introduction

Rice (*Oryza sativa* L., $2n=24$), belongs to the family Poaceae (Graminae) is the most important food crop of the developing world. Rice is the staple food of more than half of the world's population. It is especially important crop of Asia, where more than 90% of world rice is grown and consumed, where more than half of world's people live. Rice is regarded as important cereal crop for its potential to provide food security to the increasing world population (Kaur *et al.*, 2016) [5]. Among the rice growing countries in the world, India has the largest area under rice crop and ranks second in production next to China. The total global area under rice cultivation in 2020-21 is Area: 164.19 m ha, production is 756 mt and productivity: 32.89 q/ha and in India Area: 45.07 mha, production: 122.27 mt and productivity: 27.13 q/ha. In UP it is cultivated with an area of 5.68 million hectares with annual production of 15.52 million tonnes. It is widely grown in South-East Asia where largest population resides. Rice farming is about 10,000 year old and largest single use of land for producing food. Rice fields covers 11% of Earth's entire arable land. Two rice species are important cereals for human nutrition. The grain is a caryopsis in which the single seed is fused with the wall which is the pericarp of the ripened ovary forming the grain which is the seed. Rice is rich in nutrients and contains a number of vitamins and minerals. Genetic variability serves as the fundamental asset for plant breeders seeking to enhance plant performance. This variability within a population arises from genetic diversity, environmental influences, and the interaction between genetics and the environment. The presence of genetic variability in crop germplasm assists in efficiently selecting high-yielding, well adapted crop plants which can be utilized either by directly introducing it as a new variety or by incorporating it as one of the parents in breeding programs aimed at developing improved crop varieties. An insight into the magnitude of genetic variability present in the gene pool of a crop species is of utmost importance to a plant breeder for starting a judicious plant-breeding program.

Materials and Methods

The materials were collected for the present investigation consisted of 58 diverse strains of Rice (*Oryza sativa* L., 2n=24) from the Department of Genetics and Plant Breeding, SVPUAT, Meerut and Pantnagar University. Randomized Block Design (RBD) with three replications were used to grown all the 58 genotypes. The length of the rows was kept 3.0 meter and spacing between R × R 30 cm and P × P 10 cm. five competitive plants were selected randomly from each entry in each replication and were tagged for recording detailed field observations later on the data on yield and its components were recorded on these randomly selected plants except days to 50% flowering and days to maturity which were recorded on the plot basis. The experimental data were subjected to statistical analysis as following standard statistical procedure described Panse and Sukhatme (1969) [7] to assess component of variance and coefficient of variation. Heritability – Allard (1960) [1] and genetic advance - Johnson *et al.* (1955) [4].

Results and Discussion

The importance of variance was investigated using the analysis of variance across 58 distinct *Oryza sativa* germplasm. The data was displayed in Table 1. For all 10 traits studied, including days to 50% flowering, days to maturity, plant height, no. of productive tillers, panicle length, grain per panicle, 1000 seed weight, biological yield, harvest index and grain yield per plant the RBD analysis of variance revealed extremely significant differences between the materials used in this study. For these qualities, the phenotypic coefficient of variance was higher than the genotypic coefficient of variation Harvest index ((24.27%) and (25.58%), grain yield/plant (21.92%) and (19.80%), and grain per panicle (20.15%) and (17.20%) all had significant GCV and PCV. Nayak *et al.* (2016) [6] Moderate GCV and PCV observed in no. of productive tillers (18.00%) and (14.97%), biological yield (16.90%) and (15.17%), 1000 seed weight (12.01%) and (6.67%). These observations are

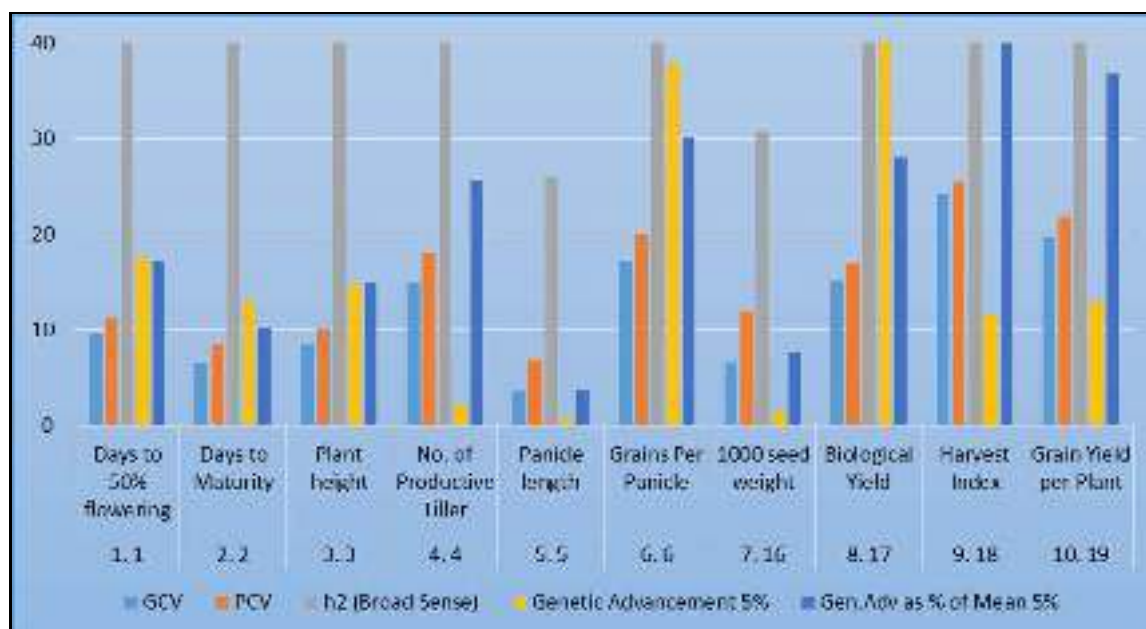
in accordance with Chandra *et al.* (2009) [3], Sravan *et al.* (2012) [13], Shankar *et al.* (2016) [11], PCV and GCV levels that are high and moderate suggest that these features can yet improve genotypes. It's worth noting that, for all of the qualities tested, PCV estimations were often not significantly higher than their corresponding GCV indicating that, in the manifestation of these traits, environment affect not much and additive gene effects, implying that genotypes can be improved and chosen for these characteristics. The findings on heredity in general for seed yield and attributing factors found that heritability estimates ranged from 26.08% (panicle length) to 89.98% (harvest index). The character number of harvest index 89.98%) had the highest heritability in the broad sense, followed by grain yield/plant (81.58%), biological yield (80.56%). Moderate heritability in the broad sense is observed in days to 50% flowering (74.35%) followed by grain per panicle (72.85%) and plant height (72.85%) panicle length was estimated to have a low heritability in a wide sense (26.08%). It is in confirmation with the results of earlier workers Prasad *et al.* (2011) [8], Babu *et al.* (2012) [2], Nayak *et al.* (2016) [6], Reddy *et al.* (2013) [9]. The genetic advance was arbitrarily divided into three categories: high GA (more than 20%), moderate GA (10-20%), and low GA (less than 10%). (below 10 percent). harvest index (47.42%), grain yield/plant (36.84%), grain per panicle (30.24%), biological yield (28.04%), no. of productive tiller (25.65%) all had high expected GA (>20%) days to 50% flowering (17.22%) followed by plant height (10.19%) and days to maturity (10.19%) had a moderate GA (10-20%), although 1000 seed weight (7.63%) and panicle length (3.74%) estimation had a low GA in percent age of mean (10). For harvest index, grain yield/plant, biological yield there was a high heritability combined with a high GA. As a result, for future enhancement of *Oryza sativa* genotypes, direct selection of germplasm can be done using these features. Prasad *et al.* (2011) [8] Sharma *et al.* (2013) [12] have all reported similar findings.

Table 1: Analysis of variance (ANOVA) for 10 traits in (*Oryza sativa* L.).

Source	Degrees of freedom	Days to 50% flowering	Days to Maturity	Plant height	No. of Productive Tiller	Panicle length	Grains Per Panicle	1000 seed weight	Biological Yield	Harvest Index	Grain Yield per Plant
Replication	2	10.7590	38.5230	82.4560	10	5.3860	482.4380	9.8550	369.7150	7.840	22.0120
Treatment	57	328.734**	262.644**	239.78**	4.853**	3.942**	1563.875**	8.329**	1656.615**	109.756**	157.801**
Error	114	33.899	51.821	26.992	0.628	1.915	172.815	3.563	123.36	3.929	11.044

Table 2: Heritability, Coefficient of variation, GA and GA mean for 10 characters in Rice

Sl. No.	Characters	GCV	PCV	h ² (Broad Sense)	Genetic Advancement 5%	Gen. Adv as% of Mean 5%
1	Days to 50% flowering	9.70	11.25	74.35	17.61	17.22
2	Days to Maturity	6.52	8.60	57.56	13.10	10.19
3	Plant height	8.59	10.09	72.44	14.77	15.05
4	No. of Productive Tiller	14.97	18.00	69.16	2.03	25.65
5	Panicle length	3.56	6.96	26.08	0.87	3.74
6	Grains Per Panicle	17.20	20.15	72.85	37.86	30.24
7	1000 seed weight	6.67	12.01	30.84	1.44	7.63
8	Biological Yield	15.17	16.90	80.56	41.80	28.04
9	Harvest Index	24.27	25.58	89.98	11.61	47.42
10	Grain Yield per Plant	19.80	21.92	81.58	13.01	36.84



Graph of Heritability, Coefficient of variation GA and GA Mean

Conclusion

Variance analysis demonstrated that the current set of breeding material had considerable genetic variance, and research into genetic factors using these genotypes worth valuable results. The current research into variability, heritability, and genetic advance suggested that to improve the grain yield per plant these traits could be used directly.

References

- Allard RW. Principles of Plant Breeding. New York: John Wiley and Sons Inc; c1960.
- Babu RV, Shrey K, Dangi KS, Usharani G, Nagesh P. Genetic variability studies for qualitative and quantitative traits in popular rice (*Oryza sativa* L.) hybrids of India. International Journal of Applied Biology and Pharmaceutical Technology. 2012;2:1-5.
- Chandra BS, Reddy TD, Kumar SS. Variability parameters for yield, its components and quality traits in rice. Crop Research. 2009;30(1):46-49.
- Johnson HW, Robinson HF, Comstock RE. Estimates of genetics and environmental variability in soybean. Agronomy Journal. 1955;47:314-318.
- Kaur N, Dhawan M, Sharma I, Pati PK. Interdependency of reactive oxygen species generating and scavenging system in salt-sensitive and salt-tolerant cultivars of rice. BMC Plant Biology. 2016;16(1):131.
- Nayak R, Singh VK, Singh AK, Singh PK. Genetic variability, character association, and path analysis of rice genotypes. Annals of Plant and Soil Research. 2016;18(2):161-164.
- Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. New Delhi: Indian Council of Agricultural Research; c1969. p. 282-301.
- Prasad SG, Sujatha M, Chaitanya U, Rao LVS. Studies on variability, heritability, genetic advance, correlation, and path analysis for quantitative characters in rice (*Oryza sativa* L.). Journal of Research ANGRAU. 2011;39(4):104-109.
- Reddy GE, Suresh BG, Sravan T. Correlation and path analysis for yield and yield attributes in rice (*Oryza sativa* L.) genotypes. International Journal of Plant Sciences. 2013;8:391-394.
- Robinson HF, Comstock RE, Harvey PH. Estimates of heritability and degree of dominance in corn. Agronomy Journal. 1949;41:353-359.
- Shankar HPP, Krishnaveni B, Babu JDP, Rao V. Assessment of genetic variability and association studies in dry direct sown rice (*Oryza sativa* L.). Journal of Rice Research. 2016;9(2):11-16.
- Sharma CL, Singh NK, Mall AK, Kumar K, Singh ON. Combining ability for yield and yield attributes in rice (*Oryza sativa* L.) genotypes using CMS system. SAARC Journal of Agriculture. 2013;11(1):23-33.
- Sravan T, Rangare NR, Suresh BG, Kumar SR. Genetic variability and character association in rainfed upland rice (*Oryza sativa* L.). Journal of Rice Research. 2012;5(1-2):24-29.