

Genetic Variability, Heritability and Genetic Advance for Yield and its Related Traits and Screening for Blast in Rice (*Oryza sativa* L.) genotypes

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Abstract: The present study consists of 49 rice genotypes that were evaluated at Agricultural and Horticultural Research station, Ponnampet, Karnataka to study genetic variability, heritability and genetic advance for grain yield and four yield associated traits. The experiment was conducted using 7 × 7 simple lattice design with two replications during the 2013 kharif main cropping season. The analysis of variance revealed statistically significant differences ($p < 0.05$) indicating the existence of genetic variability among the 49 genotypes for all the traits studied. Significant differences were observed for grain yield that ranged from 2016.00 to 6170.00 kg/ha with overall mean value of 4409.00 kg/ha. Higher PCV and GCV values were exhibited by yield kg/ha which suggests the possibility of improving this trait through selection. The highest heritability was recorded for panicles per square metre followed by days to fifty percent flowering, yield kg/ha and plant height. High to medium heritability coupled with high GCV and high genetic advance as percentage of means were exhibited for plant height, panicles per square metre. High genetic advances as percent of means were recorded by yield kg per hectare, panicles per square metre, plant height (cm) and days to fifty per cent flowering. Scored for leaf blast of rice and found four genotypes were resistant to blast disease.

Keywords: Variability, Heritability, Genetic advance, Blast

1. Introduction

Rice is a self-pollinated cereal crop belonging to the family Gramineae (synonym-Poaceae) under the order Cyperales and class Monocotyledon having chromosome number $2n=24$ [1]. The genus *Oryza* includes a total of 25 recognized species out of which 23 are wild species and two, *Oryza sativa* and *Oryza glaberrima* are cultivated [2]. It can survive as a perennial crop and can produce a ratoon crop for up to 30 years but cultivated as annual crop and grown in tropical and temperate countries over a wide range of soil and climatic condition.

For any crop improvement it depends on magnitude of genetic variability present in base population. Environmental effects influence the total observable variations of quantitative traits. Therefore, partitioning of overall variance due to genetic and non-genetic causes becomes necessary for effective breeding programme. The genotypic coefficient of variation estimates the heritable variability, whereas phenotypic component measures the role of environment on the genotype. High PCV and low GCV for a character indicated high influence of environment in its expression. The phenomenon of transmission of characters from parents to offspring is usually measured in terms of heritability. Therefore the estimates of heritability and genetic advance would help to formulate the advanced breeding programme.

2. Material and Methods

The experiment was carried out during kharif, 2013 at AICRP on rice, Agricultural and Horticultural Research

Station, Ponnampet. The material comprised of 49 elite genotypes (Table 1) sown in a simple lattice design with two replications with spacing of 20 X 15 cm. Data were recorded on five randomly selected plants in each entry in each replication for the traits days to 50% flowering, Plant height (cm), number of panicles per square metre, except yield which recorded in kg/plot converted into kg/ha. The data subjected to INDOSTAT software to estimate Genetic coefficient of variation (%), phenotypic coefficient of variation (%), Heritability (%) (Broad sense), Genetic Advance and Genetic Advance as percent of mean. The estimates for variability treated as per the categorization proposed by Siva Subramanian and Madhavamenon (4), heritability and genetic advance as percent of mean estimates according to criteria proposed by Johnson *et al.* (2). Blast disease was scored according to standard blast scale (0-9).

3. Results and Discussion

In the present study analysis of variance revealed the existence of significant differences among genotypes for all traits studied. The mean, variability estimates *i.e.*, Genetic coefficient of variation (%), phenotypic coefficient of variation (%), Heritability (%) (Broad sense), Genetic Advance as percent of mean are presented in Table 2. All traits under studied have higher phenotypic coefficient of variation than genotypic coefficient of variation. The magnitude of phenotypic coefficient of variation and genotypic coefficient of variation was moderate to high for the traits panicles per square metre and yield [3, 5]. The high PCV observed for yield per hectare [5]. The high GCV obtained for number of panicles per square metre indicating the improvement is possible through selection. Genotypic

coefficient of variation measures the extent of genetic variability percent for a trait but does not assess the amount of genetic variation which is heritable. Heritability estimates were high for all the characters. The heritability estimates along with genetic advance can be useful to predict effect of selection in selection programmes. The traits like days to fifty percent flowering, yield [7] and plant height exhibited high magnitude of genetic advance as percent of mean. The traits plant height, days to fifty percent flowering, panicles per square metre and yield have high heritability along with genetic advance as percent of mean indicate that these characters attributable to additive gene effects which are fixable revealing that improvement in these characters would be possible through direct selection.

4. Conclusion

Forty nine rice genotypes along with one standard check were evaluated for four yield and yield attributing traits. Results of the present investigation on variability, heritability and genetic advance as well as observation on blast indicated a scope for improvement of grain yield through selection.

References

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Table 1: The different rice genotypes, Blast score and grain types of material used in experiment

Genotypes	Blast score	Grain type	Genotypes	Blast score	Grain type
IET 23150	2	MS	IET 23569	3	MB
IET 23171	3	LB	IET 23570	2	MS
IET 23139	3	SB	IET 23571	3	LS
IET 23148	2	SB	IET 23572	3	MS
IET 23175	1	MS	IET 23573	1	MS
IET 23550	6	MB	IET 23574	1	MS
IET 23551	3	MS	IET 23575	3	SB
IET 23552	4	SB	IET 23576	2	MS
IET 23553	4	MS	IET 23577	3	MB
IET 23554	2	SB	IET 23578	3	MS
IET 23555	2	MS	IET 23579	7	MS
IET 23556	5	MS	IET 23580	2	MS
IET 23557	2	MS	IET 23581	6	MB
IET 23558	3	MS	IET 23582	3	MS
IET 23559	4	LS	Dhanarasi	4	MS
IET 23560	2	MS	IET 23583	3	MB
IET 23561	2	SB	IET 23584	2	MS
IET 23562	4	MS	IET 23585	4	MS
IET 23563	3	MS	thunga	2	SB
IET 23564	3	LB	IET 23586	3	LS
Swarna	2	MS	IET 23587	4	MS
IET 23565	3	MB	IET 23588	5	SB
IET 23566	5	MB	IET 23589	7	LS
IET 23567	4	LB	IET 23590	8	MS
IET 23568	4	MB			

Table 2: Standard screening scale (0-9 grade for disease rating) was used for blast disease of Indica rice (Source-IRRI, 1996; Ghazanfaret *al.*, 2009)

Grade	Disease severity	Host response
0	Lesion are not present	Highly resistant (HR)
1	Small brown specksof pin point size on lower leaves	Resistant (R)
2	Small roundish to slightly elongated, necrotic gray spots, about 1-2mm in diameter, with a distinct brown margin. Lesions are mostly found on the lower leaves	Moderately resistant (MR)
3	Lesion type same as in 2, but significant number of lesions on the upper leaves	Moderately resistant (MR)
4	Typical susceptible blast lesions, 3mm or longer infecting less than 4% of leaf area	Moderately susceptible (MS)
5	Typical susceptible blast lesions of 3mm or longer infecting 4-10% of the leaf area	Moderately susceptible (MS)
6	Typical susceptible blast lesions of 3mm or longer infecting 11-25% of the leaf area	Susceptible (S)
7	Typical susceptible blast lesions of 3mm or longer infecting 26-50% of the leaf area	Susceptible (S)
8	Typical susceptible blast lesions of 3mm or longer infecting 51-75% of the leaf area many leaves are dead	Highly susceptible (HS)
9	Typical susceptible blast lesions of 3mm or longer infecting more than 75% leaf area affected	Highly Susceptible (HS)

Table 3: Variability, Heritability and genetic advance for quantitative traits in rice

Characters	Mean	Range	Genetic coefficient of variation (%)	Phenotypic coefficient of variation (%)	Heritability (%)	Genetic advance (%)	Genetic advance as percent mean
Days to fifty percent flowering	122.33	103-135	6.97	7.02	0.98	17.53	14.29
Plant height (cm)	76.37	53-100	13.94	14.26	0.95	21.45	28.08
Panicles per m ²	300.00	176-515	24.11	24.18	0.99	148.77	49.52
Yield kg/ha	4409.4	2016-6170	27.23	27.45	0.99	2471.00	56.05