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Selection Criteria and Genetic Variability Studies in Early Maturing Rice (*Oryza sativa* L.) Genotypes

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ABSTRACT: The present study was undertaken to determine the extent of variability and heritability for yield contributing characters with involvement of early group (duration 120-125 days) genotypes. The analysis of variance revealed significant genotypic difference for all the traits studied indicating that a large amount of variability present in germplasm and there is a scope for selecting promising genotypes. The results on genetic variability revealed that phenotypic coefficient of variation were higher than genotypic coefficient of variation. The values of genotypic and phenotypic coefficients of variation (GCV and PCV) were moderate for plant height, number of effective tillers per plant and number of grains per panicle and low for days to 50% flowering test weight and yield per plant. Selection for these traits would offer better scope for development. High heritability coupled with high genetic advance as percent of mean was observed for plant height indicating the preponderance of additive type of gene action for the expression of this characters and selection may be effective for improving this character. High heritability accompanied with low genetic advance as percent of mean for the trait days to 50% flowering reflected preponderance of non-additive gene action and selection for this trait may not be worthwhile. Simple correlation indicated that selection would be towards the improvement of number of grains/panicle and test weight for overall grain yield.

Keywords: Rice, GCV, PCV, Heritability, Genetic advance as percent of mean.

INTRODUCTION

The knowledge of genetic variability present in a given crop species for the character under improvement is of paramount importance for the success of any plant breeding program. The primary consideration to bring about genetic improvement of a crop is the study of genetic variability. Assessment of variability for any trait is pre - requisite for a plant breeder to planning effective breeding programmes. The presence of genetic variability for morphological and yield components is most importance for identification and development of desirable genotypes as improvement in any trait is depend on the amount of genetic variability present in the material. Genetic parameters like genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) are useful in detecting the amount of variability present in the germplasm. The genotypic coefficient of variation indicates the range of variability present in different characters, while the phenotypic coefficient of variation measures the role of environment on the genotypes. Heritability and genetic advance are important selection parameters. Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone. Selection for yield *per se* is not reliable and indirect selection for yield component traits play an important role. Hence studies on character association not only help to understand the nature of physical linkage but also provide information on the nature and direction of association existing between the traits. Keeping in view the above perspectives, the present study was undertaken to determine the extent of variability, heritability and selection criteria for yield contributing

characters present in germplasm for grain yield improvement in early (120-125 days) rice genotypes.

MATERIALS AND METHOD

The present investigation was carried out during *Rabi,* 2022 at Agricultural Research Station, Kampasagar, Telangana state, India. The experimental material comprised of 22 rice genotypes and experiment was laid out in randomized complete block design with two replications. The recommended packages of practices were followed for raising a healthy crop. Five randomly competitive plants were selected from each replication to record observations on yield components like plant height (cm), effective tillers per plant, panicle length (cm), number of grains per panicle, test weight (g), yield/plant (g) except days to 50% flowering which was computed on plot basis.

Estimates of phenotypic and genotypic coefficients of variation according to Burton & De Vane (1952) heritability estimates in broad sense according to Lush (1940) and genetic advance as per suggested by Johanson *et al.* (1955) and correlation coefficient according to Robinson *et al.* (1951) were calculated following standard statistical procedures.

RESULTS AND DISCUSSION

Analysis of variance was carried out as per standard procedure by Panse and Sukhatme, (1985). The range, mean, variability estimates *i.e.* genotypic coefficient of variation (GCV), phenotypic coefficient of variation (PCV), heritability, genetic advance and genetic advance as percentage of mean were estimated for yield, its components presented in Table 1. The analysis of variance revealed significant genotypic difference for all the traits studied indicating that a large amount of variability was present in the material.

Variability of a character is measured by its coefficient of variation. The genotypic and phenotypic coefficients of variation are classified (low: less than 10%, moderate: 10-20% and high: more than 20%) as suggested by Sivasubramanian and Madhava Menon (1973). Heritability estimates are categorized (low: less than 30%, moderate: 30-60% and high: more than 60%) as recommended by Johnson *et al*. (1955). The range of genetic advance as percent of mean is classified (low: less than 10%, moderate: 10-20% and high: more than 20%) as suggested by Johnson *et al.* (1955).

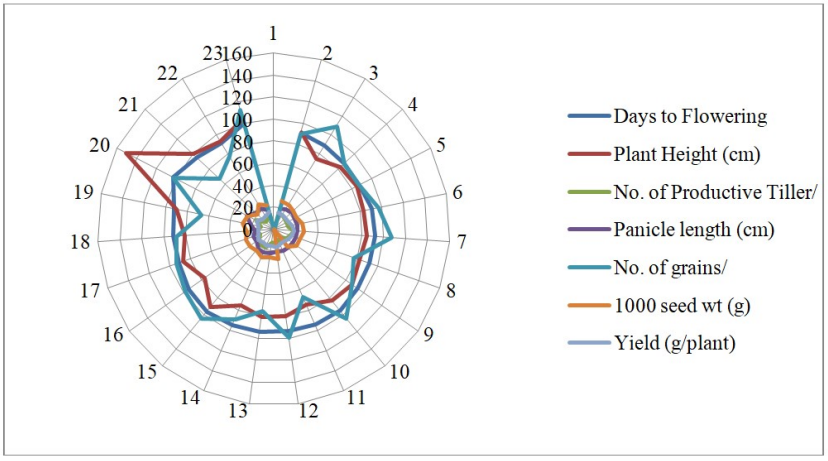

Fig. 1. Radar diagram showing the variability present in experimental material.

Table 1: Estimates of variability and genetic parameters of seven yield traits in early maturing rice genotypes.

Character	Range	Mean ± SE	Mean sum of squares	GCV (%)	PCV (%)	Heritability (bs) (%)	Genetic advance	Genetic advance as % of mean
Days to 50% flowering	87-103	93.00 ± 1.03	28.06**	3.86	4.17	85.83	6.87	7.38
Plant height (cm)	74.20 - 151.60	88.31 ± 2.32	518.86**	18.06	18.41	96.26	32.24	36.50
No. of effective tillers/plant	10 - 18	13.00 ± 0.79	10.28**	16.18	18.32	78.02	3.86	29.45
Panicle length (cm)	17.40 – 27.70	21.32 ± 0.66	7.81**	8.72	9.77	79.75	3.42	16.05
No. of grains/panicle	67-113	89.35 ± 1.95	335.63**	14.33	14.66	95.55	25.78	28.86
Test weight (g)	18.62-29.2	25.61 ± 0.36	9.87**	8.56	8.78	94.87	4.40	17.17
Yield (g/plant)	13.7-18.1	15.45 ± 0.54	3.12*	7.27	8.83	67.90	1.91	12.34

Table 2: Estimates of simple correlation coefficients for yield characters in early maturing rice genotypes.

Character	Days to 50% flowering	Plant height (cm)	No. of effective tillers/plant	Panicle length (cm)	No. of grains/panicle	Test weight (g)	Yield (g/plant)
Days to 50% flowering	**1.00**	0.665**	0.357	0.326	0.211	-0.068	0.258
Plant height (cm)		**1.00**	0.229	0.621**	0.173	0.166	0.221
No. of effective tillers/plant			**1.00**	0.022	0.589**	0.362	0.732**
Panicle length (cm)				**1.00**	-0.061	0.038	0.155
No. of grains/panicle					**1.00**	0.349	0.580**
Test weight (g)						**1.00**	0.387
Yield (g/plant)							**1.00**

* Significant at p< 0.05; **Significant at p<0.01

The results on genetic variability revealed that phenotypic coefficient of variation were higher than genotypic coefficient of variation. The difference between PCV and GCV was minimum for all the characters studied. The apparent variation is not only due to influence of genotype but also due to environment. A close difference between phenotypic and genotypic coefficient of variation revealed that there was a little influence of environment on the expression of the character studied.

The values of genotypic and phenotypic coefficients of variation (GCV and PCV) were moderate for plant height, number of effective tillers per plant and number of grains per panicle and low for days to 50% flowering (Manjunath *et al.,* 2017) panicle length (Rukmini Devi *et al.,* 2017), test weight and yield per plant. Selection for these traits would offer better scope for genotypes under study and there is a need for creation of variability either by hybridization or mutation followed by selection.

High heritability (broad sense) estimates (>60%) were observed for all the traits *viz*., days to 50% flowering (85.83%), plant height (96.26), number of effective tillers per plant (78.02), panicle length (79.75), number of grains per panicle (95.55), test weight (94.87) and yield (67.90) Present results were in accordance with the findings of (Saha, 2019; Shivani *et al.,* 2018; Lingaiah *et al.,* 2018; Rukmini Devi *et al.,* 2017; Srujana *et al.,* 2017; Dhanwani *et al.,* 2013) indicating that the variation observed was mainly under genetic control and less influenced by environment and hence selection will be effective for these traits.

Since the estimates of heritability alone sometimes misleads interpretation hence estimates of genetic advance as percent of mean is used for better prediction of characters under study. The values of genetic advance as percent of mean were moderate for number of grains per panicle low for all the remaining characters under study. Similar results were reported by Kole *et al*. (2008). Heritability alone fails to indicate the response to selection and a character having high heritability may not necessary give high genetic advance. Therefore, heritability should be always considered along with genetic advance as percent of mean to arrive at a more reliable conclusion. High heritability coupled with high genetic advance as percent of mean was observed for plant height (Dhurai *et al.,* 2013; Anjaneyulu *et al.*, 2010.) indicating the preponderance of additive type of gene action for the expression of this characters and selection may be effective for improving this character. High heritability accompanied with low genetic advance as percent of mean for the trait days to 50% flowering (Singh and Verma 2018; Bhukya Rambabu *et al.,* 2022) reflected preponderance of non-additive gene action and selection for this trait may not be worthwhile. High heritability coupled with moderate genetic advance recorded for effective tillers per plant, panicle length (Akinola *et al.,* 2019) number of grains per panicle, test weight and yield.

The efficiency of selection for yield mainly depends on the direction and magnitude of association between yield and its component characters and also among themselves. Character association provides information on the nature and extent of association between pairs of metric traits and helps in selection for the improvement of the character. The knowledge regarding relative contribution of individual traits to yield may be accomplished by correlation studies. Further, the component characters of yield exhibit different associations among themselves and also with yield. Unfavorable associations between the desired attributes under selection may limit genetic advance. Therefore, knowledge on the magnitude of association between the yield and its attributing characters is essential for planning sound breeding programme.

In the present investigation, simple correlation studies were estimated for yield and its components. The character days to 50% flowering, plant height, panicle lengthy and test weight showed the non-significant positive correlation with grain yield, where as effective tillers per plant (Edukondalu *et al.* 2017; Manjunatha *et al*., 2017; Srikanth Thippani *et al.,* 2017**;** Rukmini devi *et al.,* 2017) and number of grains per panicle (Vinoth et *al.,* 2016; Chandrashekhar Haradari and Shailaja Hittalmani 2017) recorded significant positive correlation with yield. The study of simple correlation in the present investigation suggested that selection of plants with more number of productive tillers per plant, number of grains per panicle and test weight which had significant positive association with yield may be taken

in to account in rice breeding program for yield improvement.

CONCLUSION

Present study revealed that there was good amount of genetic variability in the traits number of effective tillers per plant and grains/panicle, selection would be more effective for developing these traits.

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Conflicts of Interest. None.

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