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Assessment of Genetic Variability Studies among the Backcross Populations in Rice [*Oryza sativa* (L.)]

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ABSTRACT

An Experiment was carried out to estimate the variability parameters for yield and its important contributing characters in four BC_1F_2 backcrossing populations of rice cultures. The range of all the six characters in four crosses shows high variations. The genotypic (GCV) and phenotypic coefficient of variation (PCV) was high for grain yield per plant in all the four crosses and also in number of grains per panicle for the cross (BPT 5204 X JGL 1798) X BPT 5204 & (BPT 5204 X JGL 1798) X JGL 1798 and Number of productive tillers in (BPT 5204 X ADT 45) X ADT 45. High heritability coupled with moderate genetic advance was observed for number of productive tillers per plant and grain yield per plant for all the four crosses. Among the four different populations, (BPT 5204 X ADT 45) X ADT 45 recorded high mean yield coupled with earliness.

Key words: *PCV, GCV. Heritability, Genetic advance, BC_1F_2.*

INTRODUCTION

Rice (*Oryza sativa* L.), one of the three most important food crops in the world, forms the staple diet of 2.7 billion people. Around 32-59% of the dietary energy and 25-44% of the dietary protein in 39 countries was obtained from rice. In India it's being the staple food for more than 64% of the people, India's national food security relies on its growth and stability of its production. India is the largest producer of rice grain among worldwide. The global human population continues to grow and it is estimated that rice production will need to increase 40% by 2030 to meet the food demand. To confront the challenge of producing more rice from limited area of arable land, we need rice varieties with higher yield potential and greater yield stability[3]. The performance of the crosses is estimated not only by using mean performance but also on the extent of variability. Knowledge on nature and magnitude of genotypic and phenotypic variability present in any crop species plays an important role in formulating successful breeding programmes[1]. It is very difficult to evaluate whether observed variability is highly heritable or not.

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Crop improvement in rice depends on the magnitude of genetic variability and the extent to which the desirable genes are heritable. Moreover, knowledge of heritability is essential for selection based improvement as it indicates the extent of transmissibility of a character into future generations.

MATERIALS AND METHODS

The present experiment was carried out at Rasi Seeds (P) Ltd., Attur, Salem, located at 22^0 57' N latitude and 72^0 54' E longitudes at an altitude of 11.98 m above the mean sea level. The soil of the experimental site is heavy black and fine textured with pH ranges from 7. 5 to 8.0. It receives an average annual rainfall of 760 mm. The materials comprised of three parental lines *viz*., BPT 5204, ADT45, JGL 1798 obtained from Germplasm divisions of Rasi Seeds (P) Ltd. By using these three lines two different crosses (BPT 5204 X ADT 45 & BPT 5204 X JGL 1798) were made during *rabi'13*. The F_1 seeds from the above two crosses were raised during *kharif'14.* The F_1 were backcrossed with both the parents *viz*., (BPT 5204 X ADT 45) X BPT 5204, (BPT 5204 X ADT 45) X ADT 45, (BPT 5204 X JGL 1798) X BPT 5204 & (BPT 5204 X JGL 1798) X JGL 1798 during the same season to obtain seeds of parental lines and BC_1F_1'' s. All the four BC_1F_1 populations were raised during *rabi'14* and selfing was done to obtained BC_1F_2. The four different BC_1F_2 populations along with three checks were raised during *kharif'15* by adopting a spacing of 15 X 10 cm with single seedling per hills in non-replicated plots. All the recommended package of practices was followed along with necessary prophylactic plant protection measures to raise a good crop. *Per se* performance for biometrical traits in BC_1F_2 generations for six economic characters including yield among the four backcrosses (BPT 5204 X ADT 45) X BPT 5204, (BPT 5204 X ADT 45) X ADT 45, (BPT 5204 X JGL 1798) X BPT 5204 & (BPT 5204 X JGL 1798) X JGL 1798 was observed. Data were recorded for 200 plants in BC_1F_2's respectively for days to 50 percent flowering (days), number of productive tillers per plant, panicle length (cm), number of grains per panicle, 1000 grain weight(g) and Grain yield per plant in single plant observation. These data were subjected to statistical analysis. Standard statistical procedure was used for the analysis of genotypic and phenotypic coefficients of variation[2], heritability[5] and genetic advance.

RESULT AND DISCUSSION

The range of variations along with *per se* performance for all the six characters of four crosses were given in the table 1. The wide range of variations were observed for all the characters included in these studies showed the presence of variability over four populations. The character days to 50% flowering showed higher range of variation (64 days to 115 days with mean 88.85 days) in the cross (BPT 5204 X ADT 45) X BPT 5204. Higher *per se* performance for the character number of productive tillers was recorded in the cross (BPT 5204 X ADT 45) X ADT 45 as 16.09 with ranges from 9.00 to 28.00. The mean panicle length was more or less equal in all the four crosses but high range of variations (9.00 cm - 23.00 cm) was recorded in the cross (BPT 5204 X JGL 1798) X JGL 1798. The *per se* performance for the character number of grains per panicle was recorded very high

(289.45 grains) in the cross (BPT 5204 X JGL 1798) X BPT 5204. The 1000 seed weight recorded high variation in the cross (BPT 5204 X ADT 45) X BPT 5204 as it ranged from 18.20 gms to 12.00 gms with mean 15.39gms.

The cross (BPT 5204 X ADT 45) X BPT 5204 recorded the highest *per se* performance for grain yield per plant (26.30 gms) with wider range of variation (6.50gms – 45gms). Among the four crosses, (BPT 5204 X ADT 45) X BPT 5204 showed high grain yield in association with earliness in nature.

In these study, all the six characters from the four crosses depicted high PCV over GCV. This indicated the presence of environmental effects. High PCV coupled with High GCV was observed for Grain yield per plant in all the four crosses and also in number of grains per panicle for the cross (BPT 5204 X JGL 1798) X BPT 5204 & (BPT 5204 X JGL 1798) X JGL 1798 and Number of productive tillers in the cross (BPT 5204 X ADT 45) X ADT 45. This showed that the variations observed in these characters contributed markedly to the total variability. This results were in accordance with Ukaoma *et al*[11]. (2013). High PCV and moderate GCV were observed for number of grains per panicle in (BPT 5204 X ADT 45) X BPT 5204 and (BPT 5204 X ADT 45) X ADT 45 and number of productive tillers for the cross (BPT 5204 X ADT 45) X ADT 45. Selection will be effective based on the heritable nature of these characters. Moderate PCV and GCV were noticed in number of productive tillers per plant in the cross (BPT 5204 X JGL 1798) X JGL 1798. Low PCV and GCV were observed for days to 50% flowering, 1000 grain weight in all the four crosses and panicle length in the crosses (BPT 5204 X JGL 1798) X BPT 5204 & (BPT 5204 X JGL 1798) X JGL 1798, which showed that the variability for these characters among these genotypes was meagre. These results were in accordance with Shiva Prasad *et al*[9]., Paikhomba *et al*., and Seyoum *et al*[8]. To achieve gains in a selection programme, in addition to the magnitude of variation existing in the population the extent of heritable variation assumes greater importance. Genetic advance is another parameter which indicates the amount of genetic change that would occur due to selection. Expected genetic advance for particular character denotes a measure of genetic gain that could be achieved by further selection. A character with high heritability and genetic advance is very useful in plant breeding programme. Heritability in conjugation with genetic advance is more effective and reliable in predicting the resultant effect of selection and based on which, selection procedure can be evaluated. According to Panse[7] such characters are found to be governed by additive gene action. High heritability joined with moderate genetic advance was observed for number of productive tillers per plant and grain yield per plant for all the four crosses. This result was in accordance with Mohan lal and Chauhan[6] for grain yield per plant. The remaining characters such as days to 50% flowering, panicle length, number of grains per panicle and 1000 grain weight shows high heritability coupled with low genetic advance. It is an indicative for the presence of non-additive gene action for the above mentioned characters. High heritability was due to conducive environment, rather than genotypic and selection for such characters may not be rewarding. Similar results were previously reported by Lingaiah *et al*[4]., for days to 50% flowering; Singh *et al*[10]., for Panicle length.

Table 1: Range, Mean, Genetic variability, Heritability and Genetic advance for Yield and Yield contributing characters in BC_1F_2 Populations

Cross	Range	Mean	PCV	GCV	h^2	GAM
Days to 50% flowering (Days)						
(BPT 5204 X ADT 45) X BPT 5204	64 – 115	88.85	9.68	9.64	99.3	1.98
(BPT 5204 X ADT 45) X ADT 45	64 – 114	89.94	9.25	9.21	99.2	1.95
(BPT 5204 X JGL 1798) X BPT 5204	68 – 112	90.89	9.02	8.98	99.2	1.93
(BPT 5204 X JGL 1798) X JGL 1798	69 – 109	92.74	8.47	8.43	99.1	1.89
Number of productive tillers per plant						
(BPT 5204 X ADT 45) X BPT 5204	5 – 25	14.45	19.89	17.78	79.95	12.93
(BPT 5204 X ADT 45) X ADT 45	9 – 28	16.09	22.44	20.96	87.31	12.68
(BPT 5204 X JGL 1798) X BPT 5204	10 – 26	15.65	21.07	19.40	84.78	12.66
(BPT 5204 X JGL 1798) X JGL 1798	9 – 23	15.04	18.38	16.26	78.35	12.17
Panicle Length (Cm)						
(BPT 5204 X ADT 45) X BPT 5204	16.2 – 26.5	22.30	10.03	9.50	89.31	7.00
(BPT 5204 X ADT 45) X ADT 45	15.8 – 26.0	21.30	10.07	9.49	88.97	7.27
(BPT 5204 X JGL 1798) X BPT 5204	17.5 – 26.3	22.92	8.17	9.55	85.38	6.49
(BPT 5204 X JGL 1798) X JGL 1798	16.9 – 26.5	21.79	9.75	9.18	88.66	7.09
Number of grains per panicle						
(BPT 5204 X ADT 45) X BPT 5204	142 – 543	278.55	21.69	18.09	69.59	2.97
(BPT 5204 X ADT 45) X ADT 45	111 – 404	249.87	21.92	17.40	63.01	3.00
(BPT 5204 X JGL 1798) X BPT 5204	152 – 510	289.45	23.20	20.14	75.38	3.10
(BPT 5204 X JGL 1798) X JGL 1798	135 – 462	264.51	23.65	20.01	71.64	3.22
1000 grain weight (gm.)						
(BPT 5204 X ADT 45) X BPT 5204	12.0 – 18.2	15.39	8.30	8.29	99.73	3.45
(BPT 5204 X ADT 45) X ADT 45	12.5 – 18.0	15.27	6.11	6.09	99.49	3.46
(BPT 5204 X JGL 1798) X BPT 5204	13.5 – 18.0	15.32	5.19	5.17	99.30	3.45
(BPT 5204 X JGL 1798) X JGL 1798	12.5 – 17.1	15.65	5.82	5.80	99.42	3.51
Grain Yield per Plant (gm.)						
(BPT 5204 X ADT 45) X BPT 5204	6.5 – 45.0	26.30	32.32	29.07	80.91	12.21
(BPT 5204 X ADT 45) X ADT 45	7.5 – 43.8	26.11	30.68	27.19	78.52	11.94
(BPT 5204 X JGL 1798) X BPT 5204	5.5 – 42.5	25.24	36.17	33.04	83.46	13.12
(BPT 5204 X JGL 1798) X JGL 1798	4.2 – 42.6	23.34	38.14	34.67	82.61	14.05

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