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COMPARATIVE STUDY OF HERETABILITY, GENETIC ADVANCE AND ASSOCIATION OF CHARACTERS IN CONVENTIONALLY BRED AND DOUBLED HAPLOID LINES OF RICE (*Oryza sativa* L)

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ABSTRACT

Field experiment was conducted during wet season of 1999-2000 at Lamphelpat, Imphal, Manipur including doubled haploid (DH) and conventionally bred (CB) rice genotypes. The variability study revealed the wider range, higher heritability, phenotypic and genotypic co-efficient of variation in CB lines than DH lines which indicated the possibility of further selection in CB lines and attainment of uniformity in DH lines. While CB lines exhibited correlation of yield with ear bearing tillers and 100-grain weight, DH lines showed close relation of yield with plant height, panicle length and bold grains.

INTRODUCTION

Knowledge of genetic parameters such as genotypic (GCV) and phenotypic coefficient of variation (PCV), heritability and genetic advance is a prerequisite in the genetic improvement of crop, which imparts knowledge about the variability for different characters present in the genotypes. The genetic variability in crop is important in selecting the best genotypes for making rapid improvement in desirable traits and also in selecting the most potential parent for making sound hybridization program. The knowledge of correlation between yield and other yield contributing characters and among themselves would provide a way for fixing suitable criteria to enhance yield. Even though there is no dearth of information on variability and asssociation characters in rice it is important for the breeders to know the variability present in the traits and relationship of these traits with yield in the germplasm they handle. Furthermore, literature available on comparative study on lines developed through different plant-breeding techniques is meagre. Hence in the present study doubled haploid lines were compared with conventionally bred genotypes of rice for genetic variability and correlation.

MATERIALS AND METHODS

The experiment was conducted in the Lamphelpat farm of ICAR Research Complex for NEH Region during rainy season of 1999-2000. Ten advanced lines of cross Prasad

/ IR 24 along with four checks viz., RCM 9, Prasad, RCM 10 and Leimaphou and nine DH lines developed through anther culture and four checks viz., IET 13459, IET 13783, IET 15046 and Bali received from ICAR Research complex for NEH Region, Umiam formed the materials of the present study. The genotypes were grown in RBD with three replications adopting a plot size of 4.34 M^2. Standard agronomic practices recommended for rain fed lowlands of Manipur were followed. Observations were recorded on days to 50% flowering (DFF), plant height (PH), panicle length (PL), ear-bearing tillers (EBT), and total number of grains/panicle (TG), spikelet fertility (SPF), 100 grain weight (100 GW) and plot yield. Analysis of variance and correlation co-efficient were worked out adopting standard statistical procedures.

RESULTS AND DISCUSSION

The performance and genetic parameters of CB and DH lines are given in Table1. Even though DH lines recorded higher mean for the characters viz., DFF, PL, SPF and 100 GW, the plot yield of these lines were found less than that of CB lines. The difference in yield was due to lengthier panicles having more grains in CB lines than that in DH lines. Girija Rani and Sreerama Reddy (2001) reported comparatively higher yield of hybrids over varieties. Overall range of different characters was found wider for CB lines, which explained possibilities of further selection in CB lines, the narrow range of traits in DH lines indicated the attainment of uniformity in DH lines.

Other genetic variability parameters for these charactrs revealed that in both CB and DH lines PCV was higher in magnitude than GCV that depicted the indifferent influence of environment on the genotypes developed through both the techniques. Similar report of relatively higher PCV in Lin seed was reported by Singh (2001). Except for 100 GW, CB lines recorded higher values of PCV and GCV than DH lines. While the highest difference in magnitude of PCV and GCV was observed in TG, lowest difference was found in 100 GW, which showed varying influence of environment on the different characters. Pandey et al., (2000) also reported similar findings in walnut collection. Higher heritability (broad sense) was observed from DFF, TG, 100 GW and plot yield in CB lines. With respect to DH lines higher heritability was observed for TG, SPF, 100 GW and plot yield. The characters showing moderate heritability were PL in CB lines and PL and PH in DH lines. However, Johnson et al., (1955) suggested that heritability and genetic advance when calculated together would be more useful in predicting the effectiveness of the character for improvement. In the presnet study, both CB and DH lines showed high heritability and genetic advance for DFF, SPF and TG. Hence these characters are controlled by additive gene action it would be possible to effect direct selection in improving them. Association of high heritability with genetic advance for the traits 100 GW may be due to dominance or epistatic gene action, which warrant selection after adequate progeny testing for the improvement of these traits.

Phenotypic and genotypic correlation coefficients of CB and DH lines were presented in Table 2. In DH lines grain yields was positively and significant correlated with TG and 100 GW at phenotypic and genotypic levels. This result was in conformity with earlier reports of Anna Durai (2001) in hybrid rice. At genotypic level yield was correlated with PH and PL. In CB lines grain yield exhibited positive correlationwith

EBT, TG, SPF and 100 GW. Among them significant correlation was found only between 100 GW and grain yield. In contrary to this, Gupta et al., (1999) reported insignificant positive and also negative correlation between 100-grain weight and grain yield in segregating population in basmati rice. In DH lines intercorrelation was found between DFF and SPF and also among PL, EBT and TG. Negative and significant inter correlation was found among PH, 100GW and plot yield. Negative intercorrelation was also found between TG and PL in CB lines indicating the sparse grain arrangement in CB lines. In contrary to this significant positive correlation between these traits was recorded in DH lines. However positive intercorrelation at genotypic level was found among PL, EBT and SPF in CB lines. The same was the case in DH lines. Prashanth *et al.*, (1999) reported the similar results in indica / japonica doubled haploid population.

Results revealed that selection of plant with more number of ear bearing tillers with bold grains would boost the yield of CB lines. In case of DH lines yield advancement could be achieved by selecting taller plants having lengthy panicle with more of bold grains.

REFERENCES

Anna Durai, A. (2001). Association analysis in hybrid rice. *Ann. Agric. Res.* 22: 137-139

Girija Rani, M and Sreerama Reddy. (2001). Comparative study of Association of characters between hybrids and varieties of rice among yield and yield contributing characters and physiological characters. In: *Proceedings of the eighty eighth session of the Indian science congress, New Delhi. 2001.*

Gupta, K.R. Panwar, D.V.S. and Rakeshkumar. (1999). Character association in segregating population in Basmati rice. *Oryza.*, 36: 16-19.

Johnson, H.W. Robinson, J.E. and Camstock, R.F. (1955). Estimates of genetic and environmental variability in soybeans. *Agron. J.* 47:314-348.

Pandey, G, Joshi B.P. and Mandal. S. (2000). Genetic variability, character association and path analysis in walnut collection. *Indian J. Hill Farmg.* 13:87-90.

Prashanth, G, Bagali, Shailaja Hittalamani and H.E. Shashidhar. (1999). Character association and path coefficient analysis in *indica X japonica* doubled haploid population of rice. *Oryza.* 36:10-12.

Singh, D.N. 2001. Heritability and Genetic advance in Lin seed (*Linum usitatissimum L.) Journal of Research (BAU).* 13:73-74.

Table 1. Performance and genetic parameters of conventionally bred (CB) and doubled haploid (DH) lines of rice

Characters	Range	Mean	GCV	PCV	Heritability (Broad sense)	GA at 5% selection intensity
Days to 50%	109.33-115.33	112.82	5.90	6.62	0.89	4.73
Flowering	**104.66-128.33**	**111.71**	**29.74**	**30.36**	**0.97**	**11.12**
Plant height	113.25-125.97	117.80	7.76	12.69	0.61	4.49
	82.8-93.7	**88.47**	**10.15**	**11.43**	**0.88**	**6.19**
Panicle length	21.60-23.99	22.88	0.14	0.45	0.31	0.43
	19.90-28.90	**24.45**	**2.80**	**3.66**	**0.76**	**3.01**
Total no. of	95.40–147.73	121.85	224.37	242.50	0.93	29.68
grains / panicle	**138.47-229.20**	**169.70**	**713.35**	**738.40**	**0.97**	**54.02**
Spikelet fertility	71.26-91.80	88.92	32.47	34.49	0.94	1i.39
	57.16-86.29	**70.28**	**56.45**	**65.35**	**0.86**	**14.39**
100 grain weight	2.72-3.61	3.23	0.057	0.059	0.96	0.48
	2.07-2.84	**2.44**	**0.058**	**0.058**	**0.99**	**0.49**
Plot yield	0.47-1.17	0.84	0.05	0.053	0.91	0.43
	0.47-1.99	**1.37**	**201.422**	**204.49**	**0.98.**	**0.92**

Values in normal letters represent DH lines and those in bold letters represent CB lines

Table 2. Genotypic and phenotypic correlation coefficients in CB and DH lines

Characters	DFF	PH	PL	EBT	TG	SPF	100GW	Plot yield
DFF		0.2546	0.0099	0.0712	0.5028	0.6849**	0.3219	0.2992
		0.1628	**0.0706**	**0.0549**	**0.4824**	**0.6085***	**0.2939**	**0.2801**
PH	0.2237		0.0045	0.1952	0.2643	0.2297	-0.0315	0.5567*
	0.2066		**-0.0402**	**0.1444**	**0.1876**	**0.2061**	**-0.0136**	**0.3898**
PL	-0.0060	0.5133		0.8103**	0.9724**	0.1877	0.4855	0.6283
	-0.0153	**0.4261**		**0.3725**	**0.6273****	**0.0289**	**0.2502**	**0.2414**
EBT	-0.0801	-0.1700	0.6866**		0.2696	0.4689	-0.2861	-0.0727
	-0.0667	**0.1285**	**0.5015**		**0.2536**	**0.4286**	-0.2632	**-0.0402**
TG	0.1738	-0.2327	-0.6688**	-0.3454		0.2987	0.4189	0.6839**
	0.1754	**-0.2057**	**-0.5863****	**-0.0311**		**0.2484**	**0.4093**	**0.6242****
SPF	0.0306	-0.1873	0.5280**	0.3085	-0.0365		0.3112	0.2727
	0.0479	**-0.1999**	**0.4567**	**0.2564**	**-0.0558**		**0.3007**	**0.2617**
100GW	-0.2262	-0.7706**	-0.1222	0.1760	0.2140	0.3972		0.7328**
	-0.2184	**-0.7251**	**-0.1213**	**0.1584**	**0.2209**	**0.3501**		**0.6825****
Plot yield	-0.2513	-0.5331*	-0.0576	0.2179	0.3294	0.3151	0.6256*	
	-0.2446	**-0.5045**	**-0.0585**	**0.1902**	**0.3075**	**0.3031**	**0.6375***	

Values in normal letters are genotypic correlations; values in bold letters represnt phenotypic correlation; values above diagonal represent DH lines; values below diagonal represent CB lines; DFF = Days to 50% flowering, PH = Plant height; PL = Panicle length; EBT = Ear bearing tillers; TG = Total number of grains per panicle; SPF = Spikelet fertility; 100GW = 100 grain weight