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Identification of selection parameters for evaluating superior rice hybrids

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ABSTRACT

Forty eight popular rice hybrids were studied to find out suitable genetic parameters for evaluation of an elite rice hybrid. The experiment was conducted during kharif 2012 and 2013 at Zonal Research Station, Chianki (Birsa Agricultural University, Ranchi), Palamau. A wide spectrum of variability was observed for all the characters in both the years. High genotypic coefficient of variation was observed for grains/panicle followed by test weight, grain yield and tillers/ plant both for the years. High heritability percent was observed for days to 50% flowering, test weight and grain yield during kharif, 2012 and 2013. Days to 50% flowering days to maturity, grains/ panicle and test weight had high positive significant association with grain yield whereas plant height, panicles/ sq. m and tillers/ plant showed positive significant correlation with grain yield at genotypic level. High positive direct effect was noted for test weight followed by grains/panicle, days to 50% flowering, days to maturity and plant height. Based on the results of the present study on correlation and path analysis, the characters i.e. grains/ panicle, test weight, days to 50% flowering and days to maturity influenced the grain yield either directly or indirectly in hybrid rice for improving the grain yield.

Key words: *Correlation, path analysis, direct effect, hybrid rice*

Rice is one of the staple food and feed crop not only in India but also in the world. Most of the characters of interest to breeders are complex and they are result of the interaction of a number of components (Sarawgi et al., 1997). The information on certain genetic parameters of variability for different characters of economic significance is important for plant breeders before releasing any variety. Estimation of heritability and genetic advance play an important role in exploiting future research projections of rice improvement. The information on extent of variability, heritability and genetic advance has been reported by Sharma & Dubey (1997) and Barbora & Hazarica (1998) for panicle characters and Ganesan & Subramanhian (1994) for plant height. Selection for yield per se may not be much rewarding unless other yield attributing traits are taken into consideration. Correlation coefficient is a statistical measure which is used to find out the degree and diversion of relationship between two or more characters. Correlation coefficient analysis measures the nature and relationship between various plant characters and determines the component characters of economically importance. Hence, the present investigation was undertaken with a view to establish relationship between yield and yield attributing traits and to estimate the direct and indirect effects of yield component traits on grain yield in hybrid rice genotypes.

The experimental material consisted of forty eight popular hybrids and they were grown in randomized complete block design in three replications during *kharif*, 2012 and 2013. The experiment was conducted at Zonal Research Station, Chianki (Birsa Agricultural University, Ranchi), Palamau. Each entry was transplanted in ten rows plot of 7.5 meter length with 20 cm inter row spacing. Ten plants from each replication were selected at random from all the genotypes. The standard package and of practices were followed in each year. The observations were recorded on nine characters *viz.,* days to 50% flowering, days to maturity, plant height (cm), panicles/ sq. meter, tillers/ plant, panicle length (cm), grains/ panicle, test weight

Table 1. Range, mean, genotypic and phenotypic coefficients of variation (GCV, PCV%), heritability (%) and genetic advance (GA) % of mean, for grain yield and associated character in hybrid rice.

Character	Year	Range	Mean	GCV	PCV	h2%	G.A
Days to 50 % flowering	2012	75.3 to 94.0	86.44	3.54	3.68	93	7.03
	2013	74.0 to 102.0	88.56	5.04	5.33	89	9.81
Days to maturity	2012	112.0 to 128.0	120.65	2.73	2.92	87	5.23
	2013	107.0 to 133.3	121.96	3.53	3.81	86	6.72
Plant height (cm)	2012	65.4 to 100.4	80.05	9.50	7.97	89	14.55
	2013	67.4 to 103.4	82.23	9.13	10.05	83	17.10
Panicles/sq. meter	2012	214.6 to 437.0	270.46	8.52	10.93	61	13.69
	2013	204.6 to 400.6	316.55	6.06	13.52	30	9.56
Tillers/plant	2012	7.1to 12.1	7.41	10.43	13.31	31	8.54
	2013	6.0 to 12.0	8.76	9.21	18.17	36	9.62
Panicle length (cm)	2012	21.7 to 27.7	24.81	5.45	6.67	67	9.17
	2013	20.6 to 26.2	24.12	3.04	4.73	41	4.03
Grains / panicles	2012	155.3 to 276.3	186.66	17.30	19.60	78	9.48
	2013	165.3 to 253.0	196.84	16.93	13.61	86	7.27
Test weight (g)	2012	17.1 to 30.3	22.47	11.55	12.05	91	22.81
	2013	16.6 to 29.4	23.06	11.13	11.86	88	21.50
Grain yield (q/ha.)	2012	56.64 to 84.08	75.69	12.73	13.40	90	24.90
	2013	49.9 to 84.0	69.28	11.99	11.02	86	15.11

(g), yield (q/ha). The genetic parameters *viz.,* genotypic and phenotypic coefficient of variation (Burton 1953), heritability in broad sense and genetic advance as percent of mean (Johnson et al., 1955), correlation (Al-Jibouri et al., 1958) and path coefficient analysis as per method given by Dewey and Lu (1959) were carried out using mean value observed for all the characters. The data of each year *i.e., kharif*, 2012 and 2013 were analyzed.

Analysis of variance for grain yield and eight other yield contributing characters revealed that all the genotypes differed significantly which clearly indicated the presence of enormous variability among the genotypes for all the characters studied in both the years (Table 1). A wide variability was observed for all the characters which may offer scope for selection for evolving promising genotypes. Days to 50% flowering ranged from 75.3-94.0 cm in the year 2012 and in 2013 it was 74-102. Days to maturity ranged from 102-128 in 2012 where as in 2013 it was 107-133.3. The plant height ranged from 67.4-103.4 in the year 2012 to 65.4-100.4 in 2013, panicles per sq.m in 2012 ranged from 214 to 437 where as in 2013 it ranged from 204 to 400.6, tillers per plants 7.1-12.1 in 2012 where as in 2013 it ranged from 6.0 to 12.0. The genotype exhibited significant variation for grains/ panicle (155.3 to 276.3) in 2012 and for the year 2013 it was (165.3 to 253.0). Whereas the character test weight in 2012 ranged from (17.1 - 30.4) and for 2013 (16.6-29.4). Grain yield q/ha had appreciable range of variation (56.64 to 84.08) in 2012 and (49.9 to 84.0) in the year 2013. Mani et al. (1997), Barbora and Hazarika (1998) also reported the wide range of variation for most of the characters studied. The panicle length varied from (21.7 to 27.7 cm.) in the year 2012 and (20.6 to 26.2 cm.) in 2013 which clearly showed that there is lesser genotypic and phenotypic coefficient of variation. The GCV was high in grains per panicle 17.30 and 16.93 followed by grain yield 12.73 and 11.93 and test weight 11.55 and 11.93 for the year 2012 and 2013 respectively. Whereas low to moderate estimates of GCV were exhibited by remaining characters (Table 1). A narrow margin of estimates between GCV and PCV were observed in the characters like days to 50% flowering, days to maturity, panicle/ sq.m and panicle length which clearly suggested that these characters may be less influenced by the environmental factors. The findings where in close agreement with those of Chauhan and Tondon (1984) and Chauhan et al. (1993).

The heritability estimates ranged from 30 to 93%. The panicle/ sq. m in 2013 showed lowest (30%) and days 50% flowering (93%) in 2012 highest heritability estimates. The grain / panicle, plant height and grain yield showed high GCV alongwith high heritability indicating effectiveness of selection based on their traits. Although days to maturity and days to 50% flowering exhibited high heritability but low GCV

Table 2. Phenotypic (rp) and genotypic (rg) correlation between grain yield and other agronomic traits in hybrid rice.

Character		Days to 50 % flowering	Days to maturity	Plant height	Panicles /sq. meter	Tillers/ plant	Panicle length	Grains/ panicles	Test weight	Grain yield / ha
Days to 50 % flowering	G	1.000	0.769**	-0.118	0.315**	0.284**	-0.066	0.251**	-0.091	0.571**
	P	1.000	0.689**	-0.124	0.251**	0.154*	-0.075	0.206*	-0.082	0.527**
Days to maturity	G		1.000	0.046	0.296**	0.325**	-0.095	0.424**	-0.216*	0.656**
	P		1.000	0.041	0.226*	0.119*	-0.097	0.353**	-0.191*	0.580**
Plant height	G			1.000	-0.040	-0.565**	0.324**	0.126*	-0.001	0.188*
	P			1.000	-0.013	-0.268**	0.237*	0.174*	-0.010	0.179*
Panicles/sq. meter	G				1.000	0.516**	-0.081	-0.258**	-0.248*	-0.146*
	P				1.000	0.252**	-0.071	-0.151*	-0.171*	-0.110*
Tillers/plant	G					1.000	-0.129*	0.031	-0.345**	0.113*
	P					1.000	-0.015	0.029	-0.194*	0122*
Panicle length	G						1.000	-0.497**	0.626**	0.037
	P						1.000	-0.342**	0.497**	0.004
Grains / panicles	G							1.000	-0.690**	0.420**
	P							1.000	-0.588**	0.393**
Test weight	G								1.000	0.265**
	P								1.000	0.252**

*, **: Significant at 5% and 1% levels of significance respectively.

as reported by Singh et al., 2005. The character test weight, grain yield panicle m-2 and plant height showed high heritability with high genetic advance. Johnson et al. (1955) had shown that high heritability accompanied by high genetic advances was essential for selection programme.

The genotypic and phonotypic correlation coefficients were studied for different traits alongwith grain yield for both sowing years for understanding the correlation among themselves. The estimates of genotypic and phonotypic correlation coefficients between grain yield and its components are presented in Table 2. The genotypic correlation coefficients were found to be higher than the corresponding phonotypic correlation coefficients in both the years. This clearly indicated that there is strong inherent association between yield and its component traits. The days to 50 % flowering, day to maturity, grains/ panicle and test weight had very high positive significant association with grain yield in both the years. Bhadra et al. (2011); Chaturvedi et al., 2008; Tomar et al., 2000; Shivani and Rama Reddy 2000 and Reddy et al., 2008 also reported similar type of results. Further, path coefficient analysis results indicated that high positive direct effects on grain yield were observed for days to 50% flowering, day to maturity, grains/ panicle, test weight and plant height (Table 3). Similar findings were also reported by Chaturvedi et al., 2008; Shivani and Rama Reddy, 2000 and Chakrabarty and Chakrabarty, 2010. The direct contribution of tillers/plant in 2012 and panicles/ sq. m and panicle length was positive but low in magnitude. Based on the results of present study on correlation

Table 3. Path Coefficient analysis showing direct (diagonal) and indirect effects of yield and other agronomic traits at phenotypic level.

Character	Days to 50 % flowering	Days to maturity	Plant height	Panicles /sq. meter	Tillers/ plant	Panicle length	Grains/ panicles	Test weight	Grain yield
Days to 50 % flowering	0.303	0.209	-0.038	0.077	0.047	-0.023	0.062	-0.025	0.527
Days to maturity	0.229	0.332	0.014	0.075	0.039	-0.032	0.117	-0.063	0.580
Plant height	-0.023	0.007	0.181	-0.002	-0.049	0.043	0.031	-0.001	0.179
Panicles/sq. meter	-0.043	-0.038	0.002	-0.169	-0.043	0.011	0.026	0.028	-0.110
Tillers/plant	0.014	0.010	-0.024	0.022	0.089	-0.001	0.002	-0.017	0.022
Panicle length	0.004	0.005	-0.014	0.004	0.001	-0.058	0.020	-0.028	0.005
Grains / panicles	0.073	0.125	0.061	-0.053	0.010	-0.120	0.353	-0.027	0.393
Test weight	-0.031	-0.071	-0.004	-0.064	-0.072	0.186	-0.220	0.373	0.059

RESIDUAL EFFECT = 0.659

and path analysis, the characters namely grains/panicle, test weight, days to 50% flowering, days to maturity, panicles/sq. m and tillers/ plant had influenced the grain yield either directly or indirectly. These characters should be included in the breeding programme for improving the grain yield of hybrid rice.

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