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CHARACTER ASSOCIATION IN F_4 GENERATION OF RICE (*Oryza sativa* L.)

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ABSTRACT

Twenty five rice genotypes were used to study the genetic components, correlation and path coefficients during Aman season of 2011. Thirteen characters were studied to find out the suitable traits for the improvement of rice yield. Among these characters considerable correlation were observed. Correlation values of grain yield per square meter with plant height, number of tillers per hill, number of panicles per hill, panicle length, number of primary branches, number of filled grain per panicle, spikelet sterility (%), 1000 grain weight and days to flowering revealed that selection based on this traits could significantly be improved the grain yield of rice. Number of tillers per hill, number of panicles per hill, panicle length, number of filled grains per panicle, 1000-grain weight exhibited high direct effect coupled with significant positive correlation on grain yield indicating selection on the basis of these traits would enhanced yield potentiality of rice. The residual effect was found 0.179 which indicated that 82.10% of the variability was accounted for 13 yield and yield contributing traits included in the present study. Rest 17.90% variability might be controlled by other yield contributed traits that was not included in the present investigation. So direct selection based on these traits would be effective for improvement of these F_4 materials.

Keywords: Correlation; path analysis; selection indices; rice; *Oryza sativa* L.

INTRODUCTION

The quantitative characters are the best indicators of yield. Yield is a complex character, which is effected by a number of its component characters and the environment, where it is grown. Thus selection for grain yield becomes difficult unless the associations between the yield contributory characters are known. So, measurement of correlation coefficient helps to identify the relative contribution of component characters towards yield (Panse, 1957). The correlation between grain yield and a component character may sometimes be misleading due to an over estimation or underestimation for its association with other characters. Thus yield components have influence on ultimate yield both directly and indirectly (Tukey, 1954). Splitting of total correlation into direct and indirect effects, therefore, would provide a more meaningful interpretation of such association. Path coefficient, which is a standard partial regression coefficient, specifies the cause and effect relationship and measures the relative importance of each variable (Wright, 1921). Therefore, correlation in combination with path coefficient analysis would be an important tool to find out the association and quantify the direct and indirect influence of one character upon another (Dewey and Lu, 1959). Considering the above facts the present study, has, therefore, been undertaken to assess the character association and contribution of the characters towards grain yield in F_4 generation of rice and to find out

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the direct and indirect effect of component characters on grain yield in F_4 generation of rice.

MATERIALS AND METHODS

Twenty five F_4 generation materials (Table 1) developed previously from 8 × 8 diallel cross were grown in randomized complete block design (RCBD) with three replications during T. Aman 2011. Plot size was 1m x 2m. Plant to plant and row to row distance was 20cm respectively. Urea, TSP, MP and gypsum were applied @ 150-100-70-60 kg/ha, respectively recommended for rice cultivation. Thirty days old seedlings were transplanted in the experimental units. Normal intercultural practices and plant protection measures were followed to raise the crop successfully. Crop was successfully harvested. One square meter area was harvested for measuring grain yield. Data were collected from 10 randomly selected hills of each genotype. Data were recorded on plant height at maturity (cm), number of tillers per hill, number of panicles per hill, panicle length (cm), panicle weight (g), number of primary branches per panicle, number of secondary branches per panicle, number of filled grains per panicle, spikelet sterility (%), 1000-grain weight (g), days to flowering, days to maturity, grain yield per square meter (g). All data obtained from each trait were statistically analyzed. For calculating the genotypic and phenotypic correlation coefficient for all possible combinations the formula suggested by Miller *et al.* (1958), Hanson *et at.* (1956), Johnson *et al.* (1955) were adopted. Path coefficient analysis was calculated according to the formula given by Dewey and Lu (1959).

Table 1. List of 25 F_4 generation of T. Aman rice

Sl. No.	Pedigree	Sl. No.	Pedigree
01	Rajashail × Pokkali	14.	BR 10 × BRRI dhan33
02.	Pokkali × BR 10	15.	BRRI dhan33 × BRRI dhan32
03.	Pokkali × BRRI dhan33	16.	BRRI dhan44 × BR 10
04.	BRRI dhan44 × Pokkali	17.	Rajashail × BRRI dhan30
05.	BRRI dhan39 × Pokkali	18.	BRRI dhan33 × BR 10
06.	Pokkali × BR 11	19.	BRRI dhan39 × BRRI dhan32
07.	Rajashail × BRRI dhan39	20.	BRRI dhan32 × BRRI dhan44
08.	Rajashail × BRRI dhan44	21.	BRRI dhan33 × BRRI dhan39
09.	BR 11 × Rajashail	22.	BRRI dhan39 × BR 11
10.	BR 11 × BRRI dhan33	23.	BRRI dhan44 × BRRI dhan39
11.	BR 11 × BRRI dhan32	24.	BRRI dhan39 × BR 10
12.	BR 10 × Rajashail	25.	BR10 × BRRI dhan32
13.	Rajashail × BRRI dhan33		

RESULTS AND DISCUSSION

Yield is a complex product being influence by several inter dependable quantitative characters. Association of character with yield and among themselves provides guideline to the plant breeder for making improvement through selection in relation to a clear understanding about the contribution in respect of establishing the association by genetic and non-genetic factors. Here grain yield per square meter was significantly and positively correlated with number of tillers per hill, number of panicles per hill, panicle length, number of filled grain per panicle and 1000 grain weight both at genotypic and phenotypic levels. Significant positive association was observed for days to maturity at phenotypic level only. Plant height, spikelet sterility (%) and days to flowering showed significant negative correlation coefficient with grain yield at both genotypic and phenotypic level. Plant height showed significant negative correlation with panicle length, panicle weight, number of primary branches per panicle, number of filled grains per panicle and significant positive correlation with spikelet sterility at genotypic and phenotypic level. Gomathinayagam *et al.* (1998) found that Grain yield had negative significant genotypic correlation with plant height. Number of primary branches per panicle, number of filled grains per panicle, 1000 grain weight and number of panicles per hill also showed positive correlation with numbers of tillers per hill. On the other hand, this trait had significant and considerable negative association with panicle length, spikelet sterility, days to flowering and days to maturity. Number of primary branches per panicle, number of filled grains per panicle, panicle length and spikelet sterility also showed positive correlation with number of panicles per hill. Ray *et al.* (1993) and Balan *et al.* (1999) also reported similar types of observations. Panicle weight showed negative association with number of panicles per hill. Panicle length was negatively and significantly correlated with spikelet sterility (%) and days to flowering and this trait had significant positive correlation with panicle weight, number of primary branches per panicle, filled grain per panicle 1000-grain weight and grain yield per hill. Panicle weight exhibited significant positive correlation with number of filled grain per panicle and number of secondary branches per panicle at genotypic level and 1000-grain weight at phenotypic level. Positive correlation between panicle weight and grain yield per square meter was also observed by Chaubey and Singh (1994). However, panicle weight showed significant negative correlation with days to flowering and days to maturity at phenotypic level only. Number of primary branches per panicle showed significant positive correlation with number of filled grains per panicle, spikelet sterility (%), 1000-grain weight and significant negative association with days to flowering. Number of filled grains per panicle and 1000 grain weight were negatively correlated with number of secondary branches per panicle. Number of filled grains per panicle had highly significant negative correlation with days to flowering and spikelet sterility (%) and significant and positive association with 1000-grain weight at phenotypic and genotypic level. Correlation with 1000-grain weight, and days to flowering with spikelet sterility was negatively significant at genotypic level. 1000-grain weight showed positive association with days to flowering and days to maturity.

Correlation values of grain yield per square meter with plant height, number of tillers per hill, number of panicles per hill, panicle length, number of primary branches, number of filled grain per panicle, spikelet sterility (%), 1000 grain weight and days to flowering revealed that selection based on these traits could significantly improve the grain yield of rice. Ray *et al.* (1993), Paul and Sharma (1997) and Balan *et al.* (1999) reported highly significant positive correlation between 1000-grain weight and grain yield per hill. The results of path coefficient analysis revealed that number of filled grains per panicle had the highest positive direct (0.901) effect on grain yield followed by panicle length (0.672), number of tillers per hill (0.521), spikelet sterility (%) (0.441), 1000 grain weight (0.368), number of panicles per hill (0.368). Such results indicated that direct selection based on these characters would be effective for yield improvement of rice yield. Plant height (0.264) showed positive and negligible direct effect on grain yield. The negative indirect effect of plant height on grain yield via panicle length (-0.447), number of primary branches per panicle (-0.435), number of panicles per hill (-0.328), 1000 grain weight (g) (-0.328), number of tillers per hill (-0.311), number of filled grain per panicles (-0.214) made the total correlation negative and significant between plant height and grain yield (-0.604*). Kumar (1992), Ray *et al.* (1993) and Choudhury and Das (1998) also reported positive direct effect of plant height on grain yield of rice.

Table 2. Phenotypic correlation coefficient (r_p) and genotypic correlation coefficient (r_g) among thirteen yield and yield contributing traits in F_4 generation of rice

Characters		No. of tillers per hill	No. of panicles per hill	Panicle length (cm)	Panicle weight (g)	No. of primary branches /panicle	No. of secondary branches /panicle	No. of filled grains /panicle	Spikelet sterility (%)	1000 grain weight (g)	Days to flowering	Days to maturity	Grain yield/ meter square (g)
Plant height (cm)	r_p	-0.318	-0.391	-0.532*	-0.525*	-0.517*	0.231	-0.625**	0.542*	-0.391	0.379	0.270	-0.683*
	r_g	-0.554*	-0.328	-0.447*	-0.450*	-0.435*	0.194	-0.525	0.456*	-0.328	0.318	0.227	-0.604*
No. of tillers per hill	r_p		0.327	-0.316	-0.195	0.419*	-0.178	0.417*	-0.179	0.411*	-0.511*	-0.321	0.511*
	r_g		0.417*	-0.454*	-0.318	0.425*	-0.354	0.451*	-0.414*	0.415*	-0.352	-0.435*	0.854**
No. of panicles per hill	r_p			0.478*	-0.412*	0.465*	-0.207	0.562*	0.487*	0.351	-0.341	-0.243	0.614*
	r_g			0.402	-0.348	0.390	-0.174	0.472*	0.409	0.295	-0.286	-0.204	0.543*
Panicle length (cm)	r_p				0.316	0.633**	0.283	0.765**	-0.664**	0.478*	-0.464*	0.331	0.836**
	r_g				0.419*	0.532*	0.238	0.643**	-0.558*	0.402	-0.390	0.278	0.740**
Panicle weight (g)	r_p					0.144	0.318	0.381	-0.319	0.411*	-0.413*	-0.428*	0.217
	r_g					0.166	0.416*	0.411*	-0.313	0.391	-0.315	-0.317	0.428
No. of primary branches/panicle	r_p						-0.275	0.444**	0.445**	0.465*	-0.451*	-0.322	0.412**
	r_g						-0.231	0.425**	0.442*	0.390	-0.379	-0.270	0.419**
No. of secondary branches/panicle	r_p							-0.332	0.288	-0.207	0.201	0.144	0.363
	r_g							-0.279	0.242	-0.174	0.169	0.121	0.321
Number of filled grains/panicle	r_p								-0.480**	0.562*	-0.545*	0.389	0.982**
	r_g								-0.455**	0.572*	-0.458*	0.327	0.869**
Spikelet sterility (%)	r_p									-0.487*	-0.473*	-0.337	-0.852**
	r_g									-0.409	-0.397	-0.284	-0.754**
1000 grain weight (g)	r_p										0.341	0.243	0.614*
	r_g										0.286	0.204	0.543*
Days to flowering	r_p											0.243	-0.596*
	r_g											0.204	-0.527*
Days to maturity	r_p												0.425*
	r_g												0.367

*= Significant at 5% level of significance, **= Significant at 1% level of significance

Table 3. Partitioning of genotypic correlation into direct (bold phase) and indirect components to grain yield in F_4 generation of rice

Characters	Plant height	No. of tillers/ hill	No. of panicles/ hill	Panicle length (cm)	Panicle weight (g)	No. of primary branches/ panicle	No. of secondary branches / panicle	Number of filled grains/ panicle	Spikelet sterility (%)	1000 grain weight (g)	Days to flowering	Days to maturity	Genotypic correlation with grain yield
Plant height	**0.264**	-0.311	-0.328	-0.447	0.042	-0.435	0.194	-0.214	0.414	-0.328	0.318	0.227	-0.604*
Number of tillers per hill	-0.554	**0.521**	0.417	-0.454	0.318	0.425	-0.354	0.451	-0.414	0.415	-0.352	0.435	0.854**
Number of panicles per hill	-0.117	0.151	**0.386**	0.402	-0.211	0.390	-0.174	0.321	-0.409	0.295	-0.286	-0.204	0.543*
Panicle length (cm)	-0.447	-0.214	0.402	**0.672**	0.221	0.532	-0.238	0.422	-0.344	0.402	-0.390	-0.278	0.740**
Panicle weight (g)	-0.450	-0.218	0.348	0.419	**0.217**	0.166	0.416	0.411	-0.313	0.391	-0.315	-0.317	0.428
No. of primary branches Per panicle	-0.435	-0.012	0.390	0.532	0.144	**0.338**	-0.231	0.481	-0.530	0.390	-0.379	-0.270	0.419
No. of secondary branches Per panicle	0.294	0.331	-0.174	-0.221	-0.049	-0.231	**0.159**	-0.279	0.111	-0.174	2.169	0.221	0.321
Number of filled grains per panicle	-0.525	0.014	0.472	0.412	0.231	0.611	-0.279	**0.901**	-0.655	0.472	-0.458	-0.327	0.869**
Spikelet sterility (%)	0.456	-0.316	-0.409	-0.242	-0.214	-0.542	0.242	-0.441	**0.441**	-0.409	0.397	0.284	-0.754**
1000 grain weight (g)	-0.117	0.251	0.295	0.402	-0.211	0.390	-0.174	0.221	-0.409	**0.386**	-0.286	-0.204	0.543*
Days to flowering	0.318	0.137	-0.286	-0.390	-0.157	-0.379	0.169	-0.301	0.260	-0.286	**0.189**	0.198	-0.527*
Days to maturity	0.327	0.212	0.204	-0.278	-0.311	-0.270	0.221	-0.173	0.272	-0.204	0.298	**0.078**	0.367

*= Significant at 5% level of significance, **= Significant at 1% level of significance

Residual effect 0.17

Spikelet sterility (%) showed positive direct effect (0.441) on grain yield but the indirect effect of this character via number of panicles per hill (-0.409), panicle length (-0.242), panicle weight (-0.214), number of tillers per hill (-0.316), number of primary branches per panicle (-0.542), number of filled grains per panicle (-0.441) and 1000-grain weight (-0.409) effect contributed the total correlation highly negative and significant (-0.754**) on yield. Kumar *et al.* (1998) also reported positive direct effect of spikelet sterility (%) and strong negative correlation with grain yield of rice, which showed agreement to these findings. Direct effect of days to flowering on grain yield was positive and negligible (0.189) whereas it's negative indirect effect via panicle length (-0.390), primary branches per panicle (-0.379), number of panicles per hill (-0.286), and panicle weight (-0.157) constituted the total correlation on grain yield significant and negative (-0.527*). Number of tillers per hill, number of panicles per hill, panicle length, number of filled grains per panicle, 1000-grain weight exhibited high direct effect coupled with significant positive correlation on grain yield indicating selection performed by these traits would enhance yield potentiality of rice. The residual effect was found 0.179 which indicated that 82.10% of the variability was accounted for 13 yield and yield contributing traits included in the present study. Rest 17.90% variability might be controlled by other yield contributed traits that was not included in the present investigation.

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