Himachal Journal of Agricultural Research Vol. 32(1) : 22-26, 2006

Correlation and path co-efficient analysis among various grain quality, yield and yield attributing traits in segregating generation (F_2) of rice (*Oryza sativa* L.) at mid hills of Himachal Pradesh

Sanjeev Kumar, H.B. Singh and J.K. Sharma
Department of Plant Breeding and Genetics
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur -176 062.

Abstract

Thirty six populations derived from 9 x 9 diallel mating system (excluding reciprocals) of Indica rice (*Oryza sativa* L.) were studied for correlation and path co-efficient analysis for grain yield, its components and some grain quality traits. Grain yield was positively correlated with biological yield (0.61*) and harvest index (0.35*). Except days to maturity, leaf area index, dry matter, grain length, grain breadth, 100 grain weight and protein content, all other characters registered positive direct effect on grain yield. The highest positive direct effect on grain yield was recorded by biological yield (1.07) and lowest by grain length (-0.46). Thus, improvement in grain yield per plant could be achieved by exercising selection simultaneously for biological yield per plant, dry matter and harvest index due to their positive association and high direct effect with grain yield.

Introduction

Rice (*Oryza sativa* L.) is one of the leading cereal crops of India. It was cultivated on 45MH with production of 92MT during 2004 in the country (Anonymous, 2004). Population of India increases at the rate of 1.45% per year, for feeding such a huge population we require145MT rice by 2025. For that we require more genetic diversity among the cultivated as well as in their wild relatives, which means if there is no genetic diversity, no variation then selection for the desirable traits is not possible ultimately we cannot increase the yield of rice, so genetic diversity is prerequisite for enhancing the yield potential of the concerned crops. Yield being a complex character, is composed of several components, some of which effect the yield directly while, others contribute towards it indirectly. Correlation studies provide an opportunity to study the magnitude and direction of association of grain yield with its direct and indirect components and also among various components. It is essential to know the implications of the inter-relationships of various characters. Linear correlations between grain yield and various structural or growth components, because of Inter-relationships among the components themselves, can present a confusing picture. For this reason standard partial correlation or regression (path co-efficient) can give a more realistic interpretation of characters involved. Considering these points, the present study was conducted to understand inter-relationships of the morpho-physiological and some quality traits in segregating (F_2) generation of rice.

Material and Methods

The experimental material comprised of F_2 populations of thirty six cross combinations of rice obtained by 9 x 9 diallel mating system excluding reciprocals. The nine diverse parents of Indica rice used in the study were HPR 1164, HPR 2047, China 988, VL 91-1754, VL 93-3613, VL93-6052, IR 57893-08, VLDhan221 and JD-8. The parents along with their 36 F_2s were evaluated in Randomized Block Design with three replications. The row to row and plant to plant spacings were kept 20 cm and 15 cm respectively. Each replication comprised of three rows of each F_2 and a single row of each parent having 3m length accommodating 20 plants per row and 60 plants per replication at the Experimental farm of Department of Plant Breeding and Genetics of CSK Himachal Pradesh Krishi Vishvavidyalaya Palampur.

Agronomical practices were adopted as per the recommended package of practices during Kharif 2003. The observations were recorded on five randomly taken plants of parents and 50 plants of each F_2 populations in each replication for plant height (cm), days to 50% flowering, grain yield (g), biological yield (g), harvest index (%), days to maturity, leaf area index (%), dry matter (g), panicle length (cm), 100 grain weight (g), net-assimilation rate (g\cm^2\day^{-1}), grain length (mm), grain breadth (mm), amylose content (%), protein content (%) and L / B ratio. The phenotypic and genotypic coefficients of correlation were estimated as per method, suggested by Al-Jiburi *et al.* (1958). The path analysis was carried out as per procedure prescribed by Dewey and Lu (1959).

Results and Discussion

The phenotypic correlation between all possible characters is presented in (Table1). Biological yield and Harvest index were significantly and positively correlated with grain yield. Similar results were reported by Meenakshi *et al.* (1999). Correlation coefficient between grain yield and biological yield (rp=0.72) was the highest. Thus, it was concluded that biological yield was the most important trait promoting grain yield as observed by Chauhan (1996) and Panwar *et al.* (1989). An important yield component 100 grain weight was not associated with grain yield, which may be due to higher panicle length which results large number of grains causes less 100 grain weight. Similar results were reported by Chandra and Das (2000). The lack of association of 100 grain weight with grain yield offers scope to improve the character by selection. A positive and significant correlation of plant height with panicle length and 100 grain weight indicated that tall plant might be expected to produce longer and vigorous grains. Plant height correlated with grain breadth because vigorous plants produce healthy grains. Days to 50% flowering positively correlated with days to maturity and net assimilation rate, as the period for days to 50% flowering prolonged days to maturity will also be enhanced. Biological yield positively correlated with harvest index. Panicle length positively correlated 100 grain weight. Grain breadth positively correlated with 100 grain weight. Similar type of correlation was also observed at genotypic level (Table1). Thus, we find consistency in the correlations both at genotypic and phenotypic levels. Considering the economic yield as the effect and other characters are causes, the path coefficient analysis was done to find out the direct and indirect contributions of the yield contributing characters towards grain yield. The results of phenotypic path coefficient analysis in the direct and indirect effects on grain yield are presented in Table2. The value of residual path after deducting the direct and indirect effects was not very high. Break up of phenotypic correlation of grain yield into its components showed that biological yield, harvest index and LB ratio contributed maximum (directly) towards grain yield. Days to maturity, leaf area Index, dry matter, grain breadth, grain length, 100 grain weight and protein content made negative direct contribution of which grain breadth and grain length contributed the maximum. Plant height, days to 50% flowering, panicle length, net-assimilation rate and amylose content also made direct contribution towards grain yield. Path coefficient analysis at both genotypic and phenotypic levels showed that biological yield made maximum direct contribution and also exerted appreciable indirect influence towards Grain yield via days to 50% flowering, length: breadth ratio and grain length. The residual effect at the phenotypic level in the present study was 0.02 indicated that characters chosen for path analysis were adequate and appropriate. Biological yield and harvest index contributed maximum direct effect on grain yield. Similar results were reported by Yadav *et al.* (1999), Surek and Beser (2003) and Singh *et al.* (2002). The direct and indirect effects among the component traits viz., biological yield and harvest index were positive. Weightage should be given to those traits which contribute towards increasing biological yield, dry matter and harvest index which in turn seems to be most important primary yield attribute. Thus, improvement of any of these traits would simultaneously improve grain yield because of correlated response of grain yield. Thus, the present study indicated that selection based on biological yield, dry matter and harvest index may result in improvement of grain yield in rice.

Table 1.Correlation coefficients for grain yield, its components and grain quality traits in F_2 at phenotypic and genotypic levels

Traits		Days to 50% flowering	Grain yield	Biological yield	Harvest index	Days to maturity	L/B ratio	Leaf area index	Dry matter	Panicle length	Grain breadth	Grain length	100 grain weight	NAR	Amylose content	Protein content
Plant height	P 0.09		-0.20	-0.08	-0.15	-0.07	0.01	-0.09	0.003	0.50*	0.28	0.24	0.44*	0.00	0.10	-0.24
	G 0.09		-0.32	-0.13	-0.26	-0.08	0.01	-0.09	-0.02	0.64*	0.33	0.32	0.52*	0.01	0.10	-0.28
Days to 50%flowering			0.05	0.05	0.03	0.95*	0.16	-0.06	0.009	0.23	0.26	0.33*	0.12	0.46*	-0.10	-0.17
			0.14	0.11	0.07	1.00*	0.17	-0.08	-0.006	-0.05	-0.02	0.20	-0.06	-0.05	-0.12	-0.25
Grain yield				0.61*	0.35*	0.04	0.11	-0.03	0.16	0.07	0.03	0.04	-0.02	0.04	-0.02	-0.03
				0.79*	0.07	0.09	0.14	-0.02	0.22	0.21	0.06	0.27	-0.10	0.05	-0.003	-0.10
Biological yield					0.49*	0.06	0.13	-0.25	0.001	0.14	0.03	0.20	0.04	.14	-0.14	-0.24
					-0.55*	0.08	0.24	-0.30	0.007	0.21	0.01	0.33*	0.05	0.17	-0.18	-0.28
Harvest index						0.001	-0.03	0.27	0.2	-0.09	-0.03	-0.07	-0.08	-0.13	0.13	0.24
						0.04	-0.17	0.45*	0.32	-0.12	0.03	-0.17	-0.23	-0.19	0.25	0.24
Days to maturity							0.16	-0.08	0.06	0.001	-0.02	0.19	-0.06	-0.05	-0.07	-0.18
							0.17	-0.09	-0.003	-0.06	-0.02	-0.06	-0.02	0.05	-0.09	-0.26
L/B ratio								-0.02	0.05	0.007	-0.61	0.77*	-0.11	0.03	0.09	-0.005
								-0.03	0.03	-0.03	-0.65*	0.73*	-0.15	0.04	0.13	0.05
Leaf area index									0.25	-0.11	0.18	0.09	-0.08	-0.37*	0.14	0.007
									0.26	-0.13	0.19	0.11	-0.09	-0.37*	0.14	0.01
Dry matter										0.18	-0.02	0.03	-0.05	0.35*	0.25	-0.13
										0.23	-0.03	0.006	-0.03	0.37	0.29	-0.17
Panicle length											0.18	0.15	0.38*	0.21	0.28	-0.14
											0.22	0.17	0.45*	0.24	0.33*	-0.21
Grain breadth												0.01	0.40*	-0.16	-0.02	-0.004
												0.03	0.54*	0.17	-0.02	-0.04
Grain length													0.18	-0.06	0.10	-0.02
													0.31	-0.08	0.16	-0.01
100 grain weight														-0.14	0.05	-0.26
														-0.16	0.04	-0.25
NAR															-0.16	-0.17
															-0.17	-0.20
Amylose content																0.04
																0.11

NAR-net assimilation rate
P= Phenotypic
G= Genotypic

Table 2. Estimates of direct and indirect effects for grain yield, its components and grain quality traits at phenotypic and genotypic levels in F_2

Traits	Plant height	Days 50% Flowering	Biological yield	Harvest index	Days to maturity	L/B ratio	Leaf area index	Dry matter	Panicle length	Grain breadth	Grain length	100 grain	NAR	Amylose content	Protein content
Plant height	**P 0.03**	-0.00	-0.09	-0.14	0.006	0.009	0.002	0.00	0.002	0.11	-0.11	-0.01	0.00	0.003	0.00
	G 0.18	-0.01	-0.17	-0.17	0.006	0.01	0.01	0.00	-0.05	-0.33	0.30	0.007	0.00	0.008	-0.05
Days to	**0.002**	**0.06**	0.05	0.02	-0.08	0.09	0.002	0.00	0.00	-0.01	-0.08	0.002	0.00	-0.003	0.00
50%flowering	-0.02	**0.14**	0.14	0.04	-0.07	0.25	-0.01	0.00	0.004	-0.33	-0.001	-0.001	0.00	-0.009	-0.04
Biological yield	-0.002	0.003	**1.07**	-0.45	-0.05	0.08	0.006	0.00	0.001	0.01	-0.09	-0.001	0.001	-0.004	0.00
	-0.02	0.01	**1.33**	-0.36	-0.007	0.35	-0.04	0.00	-0.01	-0.01	0.32	0.001	0.003	-0.01	-0.05
Harvest index	-0.004	0.001	-0.53	**0.90**	0.00	-0.01	-.006	-0.004	0.00	-0.01	0.03	0.002	0.00	0.003	0.00
	-0.04	0.01	-0.73	**0.66**	-0.003	0.25	0.05	0.003	0.01	-0.03	-0.16	-0.003	0.004	0.02	0.04
Days to maturity	-0.002	0.06	0.07	0.001	**-0.09**	0.1	0.002	0.00	0.00	-0.009	-0.09	0.001	0.00	-0.002	0.00
	-0.01	0.14	0.11	0.02	**-0.08**	0.26	-0.01	0.00	0.005	0.02	**0.19**	**0.00**	0.001	-0.007	-0.04
L/B ratio	0.00	0.01	0.14	—0.03	-0.01	**0.59**	0.001	-0.001	0.00	-0.24	-0.40	0.003	0.00	0.002	0.00
	0.002	0.02	0.32	-0.11	-0.01	**1.47**	-.004	0.00	0.003	0.67	0.70	-0.002	0.001	0.01	0.009
Leaf area index	-0.002	-0.005	-0.27	0.25	0.007	-0.01	**-0.02**	-0.005	0.00	0.07	-0.04	0.002	-.001	003	0.00
	-0.01	-0.01	-0.40	0.30	0.007	0.04	**0.13**	0.002	0.01	-0.20	-0.10	-0.001	0.007	0.01	0.002
Dry matter	0.00	0.001	0.001	0.18	-0.001	0.03	0.006	**-0.02**	0.001	-0.01	-0.02	0.001	0.001	0.006	0.00
	-0.003	-0.001	0.01	0.21	0.00	0.04	0.03	**0.009**	-0.01	0.03	0.006	0.00	0.007	0.02	-0.03
Panicle length	0.01	0.00	-0.09	-0.09	0.00	0.004	0.003	-0.004	**0.004**	0.07	-0.07	-0.009	0.001	0.007	0.00
	0.11	-0.007	0.28	-0.08	0.005	0.05	-0.01	0.002	**0.002**	-0.03	0.17	0.006	0.004	0.02	-0.03
Grain breadth	0.007	-0.002	0.04	-0.03	0.002	-0.36	0.004	0.001	0.001	**-0.39**	-0.008	-0.01	-.001	-0.001	0.00
	0.06	-0.003	0.02	0.022	0.97	0.03	0.00	-0.01	-1.03	**0.02**	0.007	-0.003	.001	-0.008	-0.02
Grain length	0.007	0.01	0.22	-0.06	-0.02	0.45	.002	-0.001	0.001	0.007	**-0.46**	**-0.05**	0.00	0.003	**0.00**
	0.05	0.02	0.44	-0.11	-0.01	1.08	0.01	0.00	-0.01	-0.02	**0.96**	0.004	0.001	0.01	0.002
100 grain weight	0.01	-0.004	0.04	-0.07	0.005	-0.07	0.002	0.001	0.001	0.16	-0.08	**-0.03**	-0.00	0.01	0.00
	0.09	-0.009	0.07	-0.15	0.003	0.22	-0.01	0.00	-0.03	-0.55	0.29	**0.01**	0.003	0.003	-0.04
NAR	0.00	-0.003	0.16	-0.12	0.004	0.02	0.009	-0.007	0.001	0.06	0.03	0.004	**0.004**	-0.004	0.00
	0.003	-0.007	0.23	-0.13	0.004	0.05	-0.04	0.003	-0.01	0.18	-0.07	-0.002	**0.01**	-0.01	-0.03
Amylose content	0.003	-0.006	-0.16	0.12	-0.003	0.00	0.003	-0.001	-0.002	0.009	0.006	-0.001	0.001	**0.001**	-0.001
	0.01	-0.01	-0.24	0.16	0.007	-.19	0.01	0.003	-0.02	0.15	0.001	-0.003	0.07	**0.01**	0.01
Protein content	-0.007	-0.01	-0.26	0.22	0.02	-.003	0.00	0.003	-0.001	-0.002	0.009	0.006	-0.00	0.001	**-0.001**
	-0.05	-0.03	-0.37	0.16	0.02	-.07	0.001	-0.002	0.01	0.04	0.009	-0.003	-.00	008	**0.14**

NAR-net assimilation rate

P= Phenotypic

G=Genotypic

References

AlJibouri, H.A., Moller, P.A. and Robinson, H. F. 1958. Genotypic and environmental variances and covariances in an upland cotton cross of inter-specific origin. *Agronomy Journal* 50: 633-36.

Anonymous 2004. Survey of Indian Agriculture, pp 25.

Chandra, K. and Das, A.K. 2000.Correlation and intercorrelation of physiological parameters in rice (*Oryza sativa* L.) under rainfed transplanted condition. *Crop Research* 19: 251-54.

Chouhan, J. S. 1996. Genotypic and phenotypic correlations between grain yield and other associated characters in very early duration elite breeding cultivars of rice. *Oryza* 33: 26 -30.

Dewey, D. R. and Lu, K. H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal* 51: 515-18.

Meenakshi, T., Amiratha, A., Ratinam, O. and Backiyarni, S.1999. Correlation and path analysis of yield and some physiological characters in rain fed rice. *Oryza* 36:154-56.

Panwar, D.V.S., Bansal, M.P. and Madupuri, R.N.1989. Correlation and path coefficient analysis in advanced breeding lines of rice. *Oryza* 26: 296-98.

Singh, L., Singh, J.D. and Sachan, N.S. 2002. Inter character association and path analysis in paddy (*Oryza sativa* L.). *Annals of Biology* 17: 125-28.

Surek, H. and Beser, N.2003. Correlation and path coefficient analysis for some yield related traits in rice (*Oryza sativa* L.) under Turkish conditions. *Turkish Journal of Agriculture and Forestry* 27: 74-83.

Yadav, V.S., Singh, D., Yadav, S.S. and Kumar, J. 1999. Correlation and path analysis in Chickpea. *Annals of Agriculture Research*: 461-64.

VIR SOFTECH