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Correlation and path coefficient analysis in non-segregating generation (F_1) of rice (*Oryza sativa* L.)

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Abstract

The F_1 generation of 9 x 9 diallel mating system comprising of 36(F_1's) direct crosses of rice were studied for correlation and path coefficient analysis. Grain yield was significantly and positively correlated with biological yield (0.72) and dry matter (0.55). Days to 50% flowering positively correlated with days to maturity (1.20). Biological yield per plant positively correlated with dry matter at 90 days (0.49) and negatively correlated with harvest index (-0.45). Grain length negatively correlated with 100 grain weight and grain breadth positively with the same trait. L\B ratio positively correlated with grain length. The results of path analysis revealed that the direct contribution of biological yield was maximum (1.02) on grain yield followed by harvest index, days to maturity, L/B ratio, grain breadth, net-assimilation rate and 100 grain weight. The improvement in grain yield per plant could be achieved by exercising selection simultaneously for biological yield per plant, dry matter and harvest index to their positive and significant relationship and also high direct effect with grain yield.

Key words: Correlation, path coefficient analysis, F_1 generation, diallel, rice.

Introduction

Yield being a complex character, is composed of several components, some of which affect the yield directly while, others contribute towards it indirectly. Correlation studies provide an opportunity to study the magnitude and direction of association of 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 yield and various structural or growth components, because of Inter-relationships among the components themselves, can present at 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 in view, the present study was conducted to understand inter-relationships of the morpho-physiological and some quality traits in non- segregating (F_1) generation of rice.

Materials and Methods

The experimental material comprised of F_1 populations of thirty six cross combinations obtained by 9 x 9 diallel mating system in rice excluding reciprocals. The parents were HPR 1164, HPR 2047, China 988, VL91-1754, VL93-3613, VL93-6052, IR57893-08, VLDhan 221 and JD8. The 36 hybrids (F_1'S) along with parents were raised during kharif 2003 season, at the Experimental Farm of Department of Plant Breeding and Genetics. Each replication was comprised of three rows of each hybrid and single row of each parent having 3m in row length at spacing of 20 x 15 cm. The observations were recorded on twenty randomly selected plants of each replication in both parents and F_1'S for fourteen traits viz. plant height (cm), days to 50% flowering, grain yield (g), biological yield (g), harvest index (%), days to maturity, L/B ratio, leaf area index (%), dry matter (g), panicle length (cm), grain breadth (mm), grain length (mm), 100 grain weight (g) and net-assimilation rate (g\cm^2\day^1). Mean data were subjected to statistical analysis. Correlations were estimated as per method suggested by Johnson *et al.* (1955). The path analysis was carried out as per procedure prescribed by Dewey and Lu (1959).

Results and Discussion

Phenotypic correlation co-efficient between grain yield, its components and grain quality traits indicated that grain yield was positively correlated with biological yield and dry matter at 90 days after transplanting (Table1-4). Similar results were reported by Meenakshi *et al.* (1999). Plant height showed positive correlation with grain length and 100 grain weight indicated

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Table 1. Correlation coefficients for yield, yield components and grain quality traits in F_1 at genotypic level

	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
Plant height	0.28	0.18	0.24	-0.13	0.28	0.16	0.04	0.06	0.23	0.27	0.39*	0.36*	0.01
Days to 50%flowering		-0.22	-0.21	0.02	1.00*	0.10	0.22	-0.52*	0.40*	0.31	0.38*	0.13	-0.48*
Grain yield			0.72*	0.27	-0.22	0.19	0.06	0.57*	-0.10	-0.13	0.04	0.02	0.24
Biological yield				-0.45*	-0.21	0.21	0.10	0.49*	-0.12	-0.11	0.09	0.05	0.19
Harvest index					0.02	-0.11	-0.07	0.03	0.09	-0.02	-0.15	-0.05	0.02
Days to maturity						0.10	0.21	-0.52*	0.39*	0.31	0.38*	0.14	-0.48*
L/B ratio							0.19	0.17	-0.02	-0.42*	0.62*	-0.04	0.10
Leaf area index								0.009	0.03	0.18	0.34*	0.19	-0.40*
Dry matter									-0.15	-0.10	0.05	0.17	0.70
Panicle length										0.37*	0.33	0.57*	-0.15
Grain breadth											0.45*	0.68*	-0.14
Grain length												0.57*	-0.04
100 grain weight													0.03

* Significant

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Table 2. Correlation coefficients for yield, yield components and grain quality traits in F_1 at phenotypic level

	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
Plant height	0.26	0.18	0.24	-0.13	0.26	0.16	0.04	0.06	0.21	0.22	0.35*	0.34*	0.01
Days to 50%flowering		-0.21	-0.20	0.02	1.00*	0.09	0.21	-0.50*	0.23	0.26	0.33*	0.12	-0.46*
Grain yield			0.72*	0.26	-0.21	0.16	0.06	0.55*	-0.06	-0.01	0.04	0.01	0.24
Biological yield				-0.45*	-0.20	0.17	0.09	0.49*	-0.06	-0.07	0.08	0.04	0.18
Harvest index					0.02	-0.09	-0.07	0.03	0.03	-0.03	-0.13	-0.05	0.01
Days to maturity						0.09	0.21	-0.50*	0.23	0.26	0.33*	0.12	-0.47*
L/B ratio							0.14	0.14	-0.05	-0.47	0.67*	-0.08	-0.08
Leaf area index								0.008	0.01	0.16	0.29	0.17	-0.39*
Dry matter									-0.12	-0.08	0.05	0.16	0.69*
Panicle length										0.28	0.18	0.38*	-0.11
Grain breadth											0.33	0.59*	-0.12
Grain length												-0.42*	-0.03
100 grain weight													0.03

*Significant

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Table 3. Estimates of direct (diongal) and indirect (off diongal) effects for yield, its components and grain quality traits at genotypic level in F_1

	Plant height	Days to 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 weight	NAR
Plant height	0.01	**0.18**	0.23	-0.09	-0.20	0.47	0.00	-0.005	-0.004	0.66	-1.16	0.07	0.00
Days to 50%flowering	0.003	**0.66**	-0.20	0.01	-0.70	0.31	0.00	0.04	-0.006	0.66	-1.14	0.03	0.00
Biological yield	-0.02	-0.14	**0.95**	-0.30	0.15	0.65	0.00	-0.03	0.002	-0.27	-0.27	0.01	-0.003
Harvest index	-0.01	0.01	-0.43	**0.66**	-0.01	-0.35	0.00	-0.002	-0.001	-0.05	0.46	-0.01	0.00
Days to maturity	0.003	0.66	-0.20	0.01	**-0.70**	0.31	0.00	-0.01	0.00	0.45	-1.03	0.04	0.006
L/B ratio	0.002	0.07	0.20	-0.008	-0.07	**3.02**	0.00	-0.011	0.00	-1.05	-1.87	-0.008	-0.001
Leaf area index	0.00	0.14	0.09	-0.04	-0.15	0.56	**-0.001**	-0.001	0.00	0.45	-1.03	0.03	0.006
Dry matter	0.001	-0.34	0.47	0.01	0.36	0.51	0.00	**-0.07**	0.002	-0.24	-0.16	0.03	-0.01
Panicle length	0.022	0.26	-0.12	0.06	-0.28	-0.06	0.00	0.01	**-0.02**	0.93	-1.00	0.11	0.001
Grain breadth	0.003	0.20	-0.10	-0.01	-0.22	-1.27	0.00	0.008	-0.006	**2.49**	-1.34	0.13	0.002
Grain length	0.004	0.25	0.08	-0.01	-0.26	-1.87	-0.001	-0.04	-0.005	1.11	**3.02**	0.10	0.001
100 grain weight	0.004	0.09	0.05	-0.03	-0.09	-0.12	0.00	-0.01	-0.009	1.69	-1.72	**0.18**	0.00
NAR	0.00	-0.31	0.18	0.01	0.34	0.30	0.001	-0.005	0.002	-0.34	0.13	0.006	**-0.02**

Table 4. Estimates of direct (diongal) and indirect (off diongal) effects for yield, its components and grain quality traits a phenotypic level in F_1

	Plant height	Days to 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 weight	NAR
Plant height	**0.02**	0.1-7	0.24	-0.09	0.16	0.04	0.001	-0.002	-0.006	0.04	-0.08	0.01	0.001
Days to 50%flowering	0.006	**-0.65**	-0.20	0.02	0.63	0.03	0.004	0.02	-0.007	0.05	-0.07	0.004	-0.02
Biological yield	0.005	0.13	**1.02**	-0.32	-0.102	-0.04	0.002	-0.01	0.002	-0.01	-0.01	.001	0.000
Harvest index	-0.003	-0.02	-0.45	**0.72**	0.01	-0.02	-0.002	-0.001	-0.001	-0.005	0.03	-0.002	0.001
Days to maturity	0.006	-0.66	-0.21	0.01	**0.63**	0.02	0.004	0.02	-0.007	0.05	-0.07	0.003	-0.02
L/B ratio	0.004	-0.06	0.17	-0.06	0.05	**0.29**	0.003	0.005	0.002	-0.08	-0.14	-0.002	0.004
Leaf area index	0.001	-0.13	0.10	-0.05	0.13	0.04	**0.02**	0.00	0.00	0.03	-0.06	0.005	-0.01
Dry matter	0.001	0.33	0.50	0.02	-0.31	0.04	0.00-	**-0.04**	0.004	-0.01	-0.01	0.005	0.03
Panicle length	0.005	-0.15	-0.06	0.02	0.14	-0.01	0.00	0.005	**-0.03**	0.05	-0.03	0.01	-.005
Grain breadth	0.005	-0.17	-0.07	-0.01	0.16	-0.14	0.004	0.003	-0.008	**0.19**	-0.07	0.01	-.001
Grain length	0.008	-0.22	0.08	-0.09	0.20	0.20	0.006	-0.002	-0.005	0.06	**-0.22**	0.01	-.002
100 grain weight	0.008	-0.07	0.054	-0.04	0.07	-0.02	0.004	-0.006	-0.01	0.11	-0.09	**0.03**	0.001
NAR	0.00	0.31	0.18	0.01	-0.29	0.02	-0.009	-0.02	0.003	-0.02	0.008	0.001	**0.05**

tall plants would produce longer and healthy grains. These findings are in agreement with the findings of Panwar *et al.* (1989). Biological yield showed negative correlation with harvest index because harvest index is inversely proportional to biological yield. Days to maturity exhibited negative correlation with dry matter and net-assimilation rate because both these traits are directly related with days to maturity if days to maturity prolonged, more will be dry matter which lead to increase the net-assimilation rate. Days to maturity exhibited positive correlation with grain length. Grain breadth showed positive correlation with 100 grain weight; however, grain length exhibited negative correlation with 100 grain weight Similar results are in agreement with the findings of Surek and Beser (2003), Singh *et al.*(2002) and Nayak *et al.*(2001). Similar correlation was also exhibited at genotypic level. Thus, there is consistency in the correlation both at genotypic as well as phenotypic levels. The results of path analysis revealed that the direct contribution of biological yield was maximum (1.02) on grain yield followed by harvest index (0.72), days to maturity (0.63), L/B ratio (0.29), grain breadth (0.19) and (0.02) of each leaf area index and plant height. These findings are in close agreement with the result of Chauhan (1996) and Krishna *et al.* (1991). Plant height, harvest index, L/B ratio, leaf area index, grain breadth and net-assimilation rate had no significant association with grain yield but had positive direct effect on grain yield. Test weight had a non-significant association with grain yield and very low direct effect on grain yield. Days to 50% flowering had a non-significant negative association with grain yield, also had negative direct-effect on yield. Days to maturity and grain breadth had negative association with grain yield but had a positive direct effect on grain yield. Grain yield per plant showed positive but weak association with grain length breadth ratio and grain length. Non significant correlation of grain yield with L/B ratio and grain length were due to their high positive direct effects and negative indirect effects for majority of the traits. The low residual effect (0.05), in the present study indicated that the characters chosen for path analysis were adequate and appropriate. Biological yield contribute maximum direct effect on grain yield, Chauhan (1996) and Yadav *et al.* (1999) observed similar findings. The direct and indirect effects among the components viz., biological yield and harvest index was positive. Thus, improvement of any of these traits would simultaneously improve grain yield because of correlated response of grain yield by applying strong selection on these traits. The present study indicated that selection based on biological yield and harvest index would result in improvement of grain yield.

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