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Correlation and Path Analysis of Yield and Quality Attributes in Rice

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ABSTRACT

Eighty four genotypes of rice were evaluated for twenty two yield and quality attributes to assess correlation among themselves. The correlation analysis indicated that grain yield was significantly associated with plant height, total number of tillers per plant, ear bearing tillers per plant, panicle length, days to 50% flowering, filled grains per panicle and grain length. Path coefficient analysis revealed that total number of tillers per plant, ear bearing tillers per plant, filled grains per panicle, grain width, test weight, kernal length and head rice recovery percentage had positive direct effect on grain yield. Hence, selection on these traits suggested to bring simultaneous improvement of yield and quality.

Key words : Correlation, Path Analysis, Quality, Rice, Yield

Grain yield and quality are complex characters and are associated with number of component characters which are themselves interrelated. Such independence often affects their relationship with yield, there by making correlation ineffective. So, there is a need to partition the correlation into direct and indirect effects to get the information on actual contribution of each character yield. Therefore, the present investigation was undertaken to study the association and interrelationships of different yield and quality attributes in the selected lines of rice.

MATERIAL AND METHODS

The experimental material consisted of 84 diverse genotypes of rice, was grown at Agricultural college farm, Bapatla days *kharif* season 2009, in randomized block design with three replications. Thirty days old seedlings were transplanted at the rate of one seedling per hill with a spacing of 20 × 15 cm. Recommended package of practices were followed to raise the good crop. Observations were recorded on 22 qualitative and quantitative characters *viz.*, plant height, total number of tillers per plant, ear bearing tillers per plant, panicle length, days to 50% flowering, filled grains per panicle, grain length, grain width, flag leaf length, test weight, kernal length, kernal breadth, kernal length after cooking, water uptake, alkali spreading value, amylose content, protein percentage, gel consistency, hulling percentage, milling percentage, head rice recovery percentage and grain yield per plot. The genotypic and phenotypic correlations were determined as per Johnson *et al.* (1955). Path coefficient analysis was done as suggested by Wright (1921) and as described by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The data in respect of correlation coefficient analysis between important characters, both phenotypic and genotypic levels are presented in Table 1. In general, the genotypic correlation coefficients were higher than phenotypic correlation coefficients and this is due to the masking effect of environment in geneticgrpic association between the characters (Johnson *et al*., 1955). The correlation of yield and yield contributing characters indicated that grain yield per plot was positive and significantly influenced by plant height, total number of tillers per plant, ear bearing tillers per plant, panicle length, days to 50% flowering, filled grains per panicle, grain length. Eradasappa *et al.* (2007) reported similar findings for plant height, ear bearing tillers per plant and panicle length, number of filled grains per panicle; Siva Kumar and Kannan Bapu (2005) for total number of tillers per plant, panicle length. It is desirable to select genotypes with more ear bearing tillers per plant with more panicle length and filled grains per panicle coupled with optimum amylose content and gel consistency to develop a high yielding good quality rice.

Table 1. Estimates of phenotypic (above diagonal) and genotypic (below diagonal) correlations in 84 genotypes of rice

Character	Plant height (cm)	Total tillers plant^{-1}	Ear bearing tillers plant^{-1}	Panicle length (cm)	Days to 50% flowering	Filled grains panicle^{-1}	Grain length (mm)	Grain width (mm)	Flag leaf length (cm)	Test weight (g)
	1	2	3	4	5	6	7	8	9	10
1		0.0640	0.0801	0.3097**	0.1277*	0.1967**	0.1799**	0.1636**	0.4562**	0.1449*
2	0.0845		0.9704**	-0.0809	0.1410*	-0.0103	-0.1389*	-0.2635**	-0.0950	-0.1857**
3	0.0871	1.0003**		-0.0637	0.1480*	0.0047	-0.1272*	-0.2428**	-0.0886	-0.1739**
4	0.4123**	-0.1283*	-0.1084		0.1027	0.2268**	0.2297**	0.0998	0.3543**	0.0701
5	0.1342*	0.1657**	0.1656**	0.1571*		0.2534**	-0.1187	0.1759**	0.1676**	-0.2012**
6	0.2308**	-0.0110	0.0088	0.3494**	0.2715**		-0.0472	-0.0241	0.1413*	-0.5487**
7	0.2008**	-0.1539*	-0.1421*	0.2984**	-0.1267*	-0.0449	0.1563*	0.1260*	0.1008	0.3709**
8	0.2005**	-0.3060**	-0.2724**	0.1432*	0.2010**	-0.0107		0.0479	0.0369	0.2919**
9	0.5356**	-0.1093	-0.1070	0.4199**	0.1995**	0.1884**	0.1090		0.0283	0.0240
10	0.1502*	-0.2169**	-0.1966**	0.1111	-0.2172**	-0.5991**	0.4012**	0.3175**		0.4758**
11	0.1486*	-0.1459*	-0.1255*	0.2057**	-0.0847	-0.1781**	0.8597**	0.1999**	-0.0132	
12	-0.0027	-0.1906**	-0.1476*	0.0517	0.1118	-0.1490*	0.2443**	0.7693**	-0.0832	0.3852**
13	0.1167	-0.0126	-0.0100	0.1256*	-0.3019**	-0.1606*	0.6221**	0.0994	-0.1025	0.3343**
14	0.1774**	0.1791**	0.1732**	-0.1314*	-0.2954**	-0.0618	-0.0188	-0.0712	-0.0537	0.0432
15	0.0447	-0.0768	-0.0598	0.2148**	-0.2138**	0.0161	0.4106**	0.2309**	0.0294	0.1291*
16	-0.0541	-0.1087	-0.1100	-0.0265	-0.0437	-0.1047	-0.0553	-0.0013	-0.1718**	0.1908**
17	0.0149	0.1404*	0.1108	-0.1886**	-0.0842	0.0172	-0.1410*	-0.2138**	-0.0238	-0.2065**
18	0.0522	0.0655	0.0505	0.0739	0.0444	-0.0744	-0.1147	0.1301*	0.1894**	0.0050
19	0.1077	-0.0047	0.0342	0.0261	-0.3627**	-0.0257	0.1368*	0.0984	-0.0221	0.0945
20	-0.0011	0.0259	0.0516	-0.0446	-0.2810**	-0.0252	0.2265**	0.1235	-0.1299*	0.1349*
21	-0.0556	0.0962	0.1219	-0.1558*	-0.2505**	-0.0209	-0.0109	-0.0533	-0.2470**	0.0113
Grain yield plot^{-1} (kg)	0.4033**	0.5515**	0.5949**	0.3638**	0.2575**	0.5892**	0.1663**	0.0842	0.1219	0.0379

Kernel length (mm)	Kernel breadth (mm)	Kernal length after cooking (mm)	Water uptake (mm)	Alkali sprea ding value	Amylose Content	Protein %	Gel consis- tency (mm)	Hulling %	Milling %	Head rice recov- ery%	Grain yield plot^{-1}
11	12	13	14	15	16	17	18	19	20	21	22
0.1306*	-0.0274	0.1112	0.1520*	0.0402	-0.0555	0.0146	0.0479	0.0690	0.0209	-0.0511	0.3473**
-0.1218	--0.1624**	-0.0099	0.1603*	-0.0626	-0.0956	0.1138	0.0612	0.0102	0.0428	0.1077	0.4326**
0.1063	-0.1313*	-0.0080	0.1529*	-0.0478	-0.1037	0.0929	0.0476	0.0514	0.0831	0.1325*	0.4701**
0.1609*	-0.0063	0.0990	-0.0918	0.1598*	0.0121	-0.1418*	0.0627	0.0512	0.0236	-0.1059	0.2192**
-0.0795	0.0976	-0.2949**	-0.2839**	-0.2088**	-0.0364	-0.0809	0.0428	-0.2392**	-0.2084**	-0.2372**	0.2197**
-0.1689**	-0.1135	-0.1524*	-0.0566	0.0149	-0.0897	0.0230	-0.0734	-0.0207	0.0036	-0.0151	0.5141**
0.8222**	0.2267**	0.6065**	-0.0242	0.3988**	-0.0539	-0.1427*	-0.1120	0.0964	0.1654**	-0.0096	0.1428*
0.1804**	0.5909**	0.0881	-0.0627	0.2102**	0.0011	-0.1852**	0.1151	0.0716	0.0828	-0.0547	0.0702
-0.0124	-0.0619	-0.0982	-0.0598	0.0242	-0.1159	-0.0255	0.1712**	0.0323	-0.0479	-0.1895**	0.1186
0.4461**	0.3314**	0.3234**	0.0423	0.1237*	0.1588*	-0.1943**	0.0034	0.0824	0.1021	0.0186	0.0459
	0.2017**	0.6283**	-0.1285*	0.3632**	0.0113	-0.1575*	-0.1381*	0.0608	0.1110	-0.0080	0.1093
0.2237**		0.1778**	-0.0271	0.1342*	0.0171	-0.2293**	0.0361	0.0363	0.0565	0.0006	0.0655
0.6382**	0.1933**		0.0866	0.3856**	-0.0899	0.0730	-0.0125	0.1492*	0.1371**	0.1133	0.0653
-0.1424*	-0.0399	0.0912		0.2011**	-0.1722**	-0.1077	0.0151	0.0642	0.1118	-0.1333*	0.0547
0.3702**	0.1515*	0.3880**	0.2092**		-0.2404**	-0.0213	-0.0978	0.1278*	0.1103	-0.0100	0.0716
0.0160	0.0011	-0.0966	-0.1935**	-0.2593**		-0.0887	-0.1441*	0.0106	-0.1051	-0.1200	-0.0496
-0.1603*	-0.2692**	0.0756	-0.1023	-0.0213	-0.1065		0.2338**	0.0573	0.0326	0.1224	-0.0931
-0.1428*	0.0397	-0.0124	0.0135	-0.0975	-0.1518*	0.2404**		0.1332*	0.0650	-0.0413	-0.0597
0.0759	0.1053	0.2152**	0.1244*	0.1873**	-0.0205	0.0716	0.1983**		0.6368**	0.3971**	0.0574
0.1477*	0.1262*	0.1797**	0.1359**	0.1395*	-0.1111	0.0479	0.0899	0.6971**		0.5811**	0.1178
-0.0095	0.0140	0.1200	-0.1477*	-0.0116	-0.1261*	0.1329*	-0.0444	0.5035**	0.6924**		0.0849
0.1248*	0.0703	0.0716	0.0655	0.0802	-0.0791	-0.1163	-0.0662	0.0311	0.1096	0.0820	

Table 2. Phenotypic (P) and genotypic (G) path coefficients for grain yield per plot and its components in rice (Cont.......)

Char-ac-ter		Plant height (cm)	Total tillers Plant^{-1}	Ear bearing tillers plant^{-1}	Panicle length (cm)	Days to 50% flowering	Filled grains panicle^{-1}	Grain length (mm)	Grain width (mm)	Flag leaf length (cm)	Test weight (g)	Kernel length (mm)	Kernel breadth (mm)
		1	2	3	4	5	6	7	8	9	10	11	12
1	P	**0.0395**	0.0029	0.0422	0.0014	0.0035	0.1571	-0.0020	0.0068	0.0143	0.0783	0.0087	-0.0005
	G	**-0.0434**	0.0322	0.0352	-0.0106	-0.0045	0.2624	-0.0161	0.0142	-0.0002	0.1314	0.0155	0.0001
2	P	0.0025	**0.0458**	0.5115	-0.0004	0.0039	-0.0083	0.0016	-0.0110	-0.0030	-0.1004	-0.0081	-0.0027
	G	-0.0037	**0.3809**	0.4041	0.0033	-0.0056	-0.0125	0.0124	-0.0216	0.0000	-0.1899	-0.0153	0.0036
3	P	0.0032	0.0444	**0.5271**	-0.0003	0.0041	0.0037	0.0014	-0.0101	-0.0028	-0.0940	-0.0071	-0.0022
	G	-0.0038	0.3810	**0.4040**	0.0028	-0.0056	0.0100	0.0114	-0.0192	0.0000	-0.1721	-0.0131	0.0028
4	P	0.0122	-0.0037	-0.0336	**0.0044**	0.0029	0.1812	-0.0026	0.0042	0.0111	0.0379	0.0108	-0.0001
	G	-0.0179	-0.0489	-0.0438	**-0.0258**	-0.0053	0.3973	-0.0239	0.0101	-0.0002	0.0972	0.0215	-0.0010
5	P	0.0050	0.0065	0.0780	0.0005	**0.0278**	0.2024	0.0013	0.0073	0.0052	-0.1087	-0.0053	0.0016
	G	-0.0058	0.0631	0.0669	-0.0041	**-0.0336**	0.3087	0.0102	0.0142	-0.0001	-0.1901	-0.0089	-0.0021
6	P	0.0078	-0.0005	0.0025	0.0010	0.0070	**0.7989**	0.0005	-0.0010	0.0044	-0.2966	-0.0113	-0.0019
	G	-0.0100	-0.0042	0.0035	-0.0090	-0.0091	**1.1371**	0.0036	-0.0008	-0.0001	-0.5244	-0.0186	0.0028
7	P	0.0071	-0.0064	-0.0670	0.0010	-0.0033	-0.0377	**-0.0113**	0.0053	0.0032	0.2005	0.0550	0.0038
	G	-0.0087	-0.0586	-0.0574	-0.0077	0.0043	-0.0510	**-0.0802**	0.0110	0.0000	0.3512	0.0899	-0.0046
8	P	0.0065	-0.0121	-0.1280	0.0004	0.0049	-0.0193	-0.0014	**0.0418**	0.0012	0.1578	0.0121	0.0098
	G	-0.0087	-0.1165	-0.1100	-0.0037	-0.0068	-0.0121	-0.0125	**0.0706**	0.0000	0.2779	0.0209	-0.0143
9	P	0.0180	-0.0043	-0.0467	0.0016	0.0047	0.1129	-0.0011	0.0015	**0.0313**	0.0130	-0.0008	-0.0010
	G	-0.0232	-0.0416	-0.0432	-0.0108	-0.0067	0.2142	-0.0087	0.0034	**-0.0004**	0.0247	-0.0014	0.0016
10	P	0.0057	-0.0085	-0.0916	0.0003	-0.0056	-0.4384	-0.0042	0.0122	0.0007	**0.5406**	0.0299	0.0055
	G	-0.0065	-0.0826	-0.0794	-0.0029	0.0073	-0.6812	-0.0322	0.0224	0.0000	**0.8753**	0.0498	-0.0072
11	P	0.0052	-0.0056	-0.0561	0.0007	-0.0022	-0.1349	-0.0093	0.0075	-0.0004	0.2412	**0.0669**	0.0034
	G	-0.0064	-0.0556	-0.0507	-0.0053	0.0028	-0.2025	-0.0690	0.0141	0.0000	0.4165	**0.1046**	-0.0042
12	P	-0.0011	-0.0074	-0.0692	0.0000	0.0027	-0.0907	-0.0026	0.0247	-0.0019	0.1791	0.0135	**0.0166**
	G	0.0001	-0.0726	-0.0596	-0.0013	-0.0038	-0.1694	-0.0196	0.0543	0.0000	0.3372	0.0234	**-0.0187**
13	P	0.0044	-0.0005	-0.0042	0.0004	-0.0082	-0.1218	-0.0069	0.0037	-0.0031	0.1748	0.0420	0.0030
	G	-0.0051	-0.0048	-0.0040	-0.0032	0.0101	-0.1826	-0.0499	0.0070	0.0000	0.2927	0.0667	-0.0036
14	P	0.0060	0.0073	0.0806	-0.0004	-0.0079	-0.0452	0.0003	-0.0026	-0.0019	0.0228	-0.0086	-0.0005
	G	-0.0077	0.0682	0.0700	0.0034	0.0099	-0.0703	0.0015	-0.0050	0.0000	0.0378	-0.0149	0.0007
15	P	0.0016	-0.0029	-0.0252	0.0007	-0.0058	0.0119	-0.0045	0.0088	0.0008	0.0668	0.0243	0.0022
	G	-0.0019	-0.0293	-0.0242	-0.0055	0.0072	0.0183	-0.0330	0.0163	0.0000	0.1130	0.0387	-0.0028
16	P	-0.0022	-0.0044	-0.0547	0.0001	-0.0010	-0.0716	0.0006	0.0000	-0.0036	0.0858	0.0008	0.0003
	G	0.0023	-0.0414	-0.0444	0.0007	0.0015	-0.1190	0.0044	-0.0001	0.0001	0.1670	0.0017	0.0000
17	P	0.0006	0.0052	0.0490	-0.0006	-0.0022	0.0183	0.0016	-0.0077	-0.0008	-0.1050	-0.0105	-0.0038
	G	-0.0006	0.0535	0.0448	0.0049	0.0028	0.0196	0.0113	-0.0151	0.0000	-0.1807	-0.0168	0.0050
18	P	0.0019	0.0028	0.0251	0.0003	0.0012	-0.0586	0.0013	0.0048	0.0054	0.0019	-0.0092	0.0006
	G	-0.0023	0.0249	0.0204	-0.0019	-0.0015	-0.0846	0.0092	0.0092	-0.0001	0.0044	-0.0149	-0.0007
19	P	0.0027	0.0005	0.0271	0.0002	-0.0066	-0.0165	-0.0011	0.0030	0.0010	0.0446	0.0041	0.0006
	G	-0.0047	-0.0018	0.0138	-0.0007	0.0122	-0.0292	-0.0110	0.0069	0.0000	0.0827	0.0079	-0.0020
20	P	0.0008	0.0020	0.0438	0.0001	-0.0058	0.0029	-0.0019	0.0035	-0.0015	0.0552	0.0074	0.0009
	G	0.0000	0.0099	0.0208	0.0012	0.0094	-0.0287	-0.0182	0.0087	0.0001	0.1181	0.0154	-0.0024
21	P	-0.0020	0.0049	0.0699	-0.0005	-0.0066	-0.0121	0.0001	-0.0023	-0.0059	0.0100	-0.0005	0.0000
	G	0.0024	0.0366	0.0493	0.0040	0.0084	-0.0238	0.0009	-0.0038	0.0001	0.0099	-0.0010	-0.0003

Cont...........

* = significant at 5% level, ** = significant at 1% level. Residual effects = 0.5061 (P), SQRT (1- 1.1283) (G): Bold and diagonal values indicate direct effects

Table 2. Phenotypic (P) and genotypic (G) path coefficients for grain yield per plot and its components in rice

Char-ac-ter		Kernal length after cooking (mm)	Water uptake (mm)	Alkali spread-ing value	Amylose Content	Protein %	Gel consis-tency (mm)	Hulling %	Milling %	Head rice recovery %	Grain yield $plot^{-1}$
1	P	13	14	15	16	17	18	19	20	21	22
	G	-0.0021	0.0015	-0.0002	0.0002	-0.0005	-0.0013	-0.0005	-0.0001	-0.0021	**0.3473****
2	P	-0.0052	-0.0064	-0.0004	0.0040	-0.0007	-0.0012	-0.0023	0.0000	-0.0006	**0.4033****
	G	0.0002	0.0016	0.0003	0.0003	-0.0038	-0.0017	-0.0001	-0.0002	0.0045	**0.4326****
3	P	0.0006	-0.0064	0.0007	0.0080	-0.0066	-0.0016	0.0001	-0.0002	0.0010	**0.5515****
	G	0.0002	0.0015	0.0002	0.0003	-0.0031	-0.0013	-0.0004	-0.0004	0.0055	**0.4701****
4	P	0.0004	-0.0062	0.0006	0.0081	-0.0052	-0.0012	-0.0007	-0.0004	0.0013	**0.5949****
	G	-0.0019	-0.0009	-0.0007	0.0000	0.0047	-0.0017	-0.0004	-0.0001	-0.0044	**0.2192****
5	P	-0.0056	0.0047	-0.0020	0.0020	0.0089	-0.0018	-0.0006	0.0003	-0.0017	**0.3638****
	G	0.0056	-0.0029	0.0009	0.0001	0.0027	-0.0012	0.0017	0.0010	-0.0098	**0.2197****
6	P	0.0133	0.0106	0.0020	0.0032	0.0040	-0.0011	0.0078	0.0020	-0.0027	**0.2575****
	G	0.0029	-0.0006	-0.0001	0.0003	-0.0008	0.0020	0.0001	0.0000	-0.0006	**0.5141****
7	P	0.0071	0.0022	-0.0001	0.0077	-0.0008	0.0018	0.0005	0.0002	-0.0002	**0.5892****
	G	-0.0115	-0.0002	-0.0016	0.0002	0.0047	0.0031	-0.0007	-0.0008	-0.0004	**0.1428***
8	P	-0.0275	0.0007	-0.0038	0.0041	0.0066	0.0027	-0.0029	-0.0016	-0.0001	**0.1663****
	G	-0.0017	-0.0006	-0.0009	0.0000	0.0061	-0.0032	-0.0005	-0.0004	-0.0023	**0.0702**
9	P	-0.0044	0.0026	-0.0021	0.0001	0.0101	-0.0031	-0.0021	-0.0009	-0.0006	**0.0842**
	G	0.0019	-0.0006	-0.0001	0.0004	0.0008	-0.0047	-0.0002	0.0002	-0.0079	**0.1186**
10	P	0.0045	0.0019	-0.0003	0.0127	0.0011	-0.0045	0.0005	0.0009	-0.0026	**0.1219**
	G	-0.0061	0.0004	-0.0005	-0.0005	0.0064	-0.0001	-0.0006	-0.0005	0.0008	**0.0459**
11	P	-0.0148	-0.0015	-0.0012	-0.0141	0.0097	-0.0001	-0.0020	-0.0010	0.0001	**0.0379**
	G	-0.0119	-0.0013	-0.0015	0.0000	0.0052	0.0038	-0.0004	-0.0005	-0.0003	**0.1093**
12	P	-0.0282	0.0051	-0.0034	-0.0012	0.0076	0.0034	-0.0016	-0.0010	-0.0001	**0.1248***
	G	-0.0034	-0.0003	-0.0006	-0.0001	0.0076	-0.0010	-0.0003	-0.0003	0.0000	**0.0655**
13	P	-0.0085	0.0014	-0.0014	-0.0001	0.0127	-0.0009	-0.0023	-0.0009	0.0001	**0.0703**
	G	**-0.0190**	0.0009	-0.0016	0.0003	-0.0024	0.0003	-0.0011	-0.0006	0.0047	**0.0653**
14	P	**-0.0442**	-0.0033	-0.0036	0.0071	-0.0036	0.0003	-0.0046	-0.0013	0.0013	**0.0716**
	G	-0.0016	**0.0100**	-0.0008	0.0005	0.0035	-0.0004	-0.0005	-0.0005	-0.0055	**0.0547**
15	P	-0.0040	**-0.0358**	-0.0019	0.0143	0.0048	-0.0003	-0.0027	-0.0010	-0.0016	**0.0655**
	G	-0.0073	0.0020	**-0.0041**	0.0007	0.0007	0.0027	-0.0009	-0.0005	-0.0004	**0.0716**
16	P	-0.0171	-0.0075	**-0.0093**	0.0192	0.0010	0.0023	-0.0040	-0.0010	-0.0001	**0.0802**
	G	0.0017	-0.0017	0.0010	**-0.0030**	0.0029	0.0040	-0.0001	0.0005	-0.0050	**-0.0496**
17	P	0.0043	0.0069	0.0024	**-0.0739**	0.0050	0.0036	0.0004	0.0008	-0.0013	**-0.0791**
	G	-0.0014	-0.0011	0.0001	0.0003	**-0.0330**	-0.0064	-0.0004	-0.0002	0.0051	**-0.0931**
18	P	-0.0033	0.0037	0.0002	0.0079	**-0.0472**	-0.0057	-0.0015	-0.0003	0.0014	**-0.1163**
	G	0.0002	0.0002	0.0004	0.0004	-0.0077	**-0.0276**	-0.0010	-0.0003	-0.0017	**-0.0597**
19	P	0.0005	-0.0005	0.0009	0.0112	-0.0113	**-0.0239**	-0.0042	-0.0006	-0.0005	**-0.0662**
	G	-0.0028	0.0006	-0.0005	0.0000	-0.0019	-0.0037	**-0.0072**	-0.0030	0.0165	**0.0574**
20	P	-0.0095	-0.0045	-0.0017	0.0015	-0.0034	-0.0047	**-0.0214**	-0.0049	0.0054	**0.0311**
	G	-0.0026	0.0011	-0.0005	0.0003	-0.0011	-0.0018	-0.0046	**-0.0047**	0.0241	**0.1178**
21	P	-0.0079	-0.0049	-0.0013	0.0082	-0.0023	-0.0021	-0.0149	**-0.0071**	0.0074	**0.1096**
	G	-0.0022	-0.0013	0.0000	0.0004	-0.0040	0.0011	-0.0029	-0.0027	**0.0415**	**0.0849**
		-0.0053	0.0053	0.0001	0.0093	-0.0063	0.0011	-0.0108	-0.0049	**0.0107**	**0.0820**

* = significant at 5% level, ** = significant at 1% level. Residual effects = 0.5061 (P), SQRT (1- 1.1283) (G): Bold and diagonal values indicate direct effects

Path coefficient analysis (Table 2) revealed that the total number of tillers per plant, ear bearing tillers per plant and filled grains per panicle exhibited high positive direct effect and significant positive association with grain yield. Similar findings were reported by Siva Kumar and Kannan Bapu (2005) for total number of tillers per plant; Panwar and Mashiat Ali (2007) for number of ear bearing tillers per plant and Panwar (2006) for number of filled grains per panicle. Even though grain length had positive significant correlation with grain yield its direct effect on grain yield was negative. It is due to the maximum indirect effect of test weight which is nullifying its negative direct effect on grain yield. Hence, for improvement of this trait selection efforts would be more effective via test weight instead of selection based on grain length alone.

It could be suggested that more emphasis should be given on total number of tillers per plant, ear bearing tillers per plant, filled grains per panicle to bring simultaneous improvement of yield and quality in rice as they showed high correlation in addition to maximum direct effects on yield.

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