

Character Association and Path Analysis of Yield and Yield Component Traits in Rice (*Oryza sativa* L.)

M Srinivasa Rao, M Subba Rao, M Lal Ahamed, P Ramesh Babu, G Rama Rao and
V Srinivasa Rao

Department of Genetics and plant Breeding, Agricultural College, Bapatla, A. P.

ABSTRACT

An investigation was carried out in forty three rice cultivars to understand the association among yield and quality components and their direct and indirect influence on the grain yield. The correlation analysis indicated that grain yield was significantly associated with days to 50% flowering, days to maturity, plant height, productive tillers plant⁻¹, panicle length, filled grains⁻¹, total grains panicle⁻¹, hulling %, milling % and head rice recovery. Path coefficient analysis revealed that days to maturity, plant height, productive tillers plant⁻¹, total grains panicle⁻¹ and head rice recovery had positive direct effect on grain yield. Hence, selection based on these traits could help to bring simultaneous improvement of yield and yield attributes.

Key words: *Character association, Path Analysis and Rice.*

Rice is the staple food for two thirds of the Indian population. It contributes 43 percent of caloric requirement and 20-25% of agricultural income. Grain yield and quality are complex characters and are associated with number of component characters which are themselves interrelated. Such dependence often affects their relationship with yield, thereby making correlation ineffective. So, there is a need to option for path analysis that permits the partitioning of the correlation coefficient in to its components, one component being the path coefficient that measures the direct effect of a predictor variable upon its response variable; the second component being the indirect effect(s) of a predictor variable on the response variable through another predictor variable (Dewey and Lu, 1959). Portion in of the correlation coefficient into direct and indirect effects to get the information on actual contribution of each character to 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 material used in the present study consisted of 43 diverse local genotypes of rice which were grown at Agricultural Research Station, Nellore, Andhra Pradesh during Kharif 2015. The experimental material was planted in Randomized block design with two replications. Each genotype consisted of three rows of 4 m length with a spacing of 20 cm between the rows and 15 cm between the hills. Observations were recorded on 21 yield and quality characters.

RESULTS AND DISCUSSION

The genotypic and phenotypic correlations were determined as per Johnson *et al.* (1955). Path coefficient analysis was done as suggested by Wright

Table 1. Estimates of genotypic (above diagonal) and phenotypic (below diagonal) correlation coefficients among yield and yield components in rice (*Oryza sativa* L.).

Character	Days to 50% Flowering	Days to Maturity	Plant Height (cm)	Productive Tillers/Plant	Panicle Length (cm)	Filled GrainsPa nicle ⁻¹	Total GrainsPa nicle ⁻¹	Spikelet Fertility	Test Weight (g)	Hulling %	Milling %
1	1.0000	0.9894**	0.4513**	-0.0108	0.2886**	0.1319	0.3210**	-0.5920**	-0.0739	0.0870	-0.1640
2	0.9774**	1.0000	0.4029**	0.0164	0.3062**	0.1490	0.3299**	-0.5846**	-0.0724	0.0683	-0.1610
3	0.4186**	0.3710**	1.0000	0.0613	0.2724**	0.1217	0.1514	-0.2262**	0.3158**	0.3702**	0.1359
4	-0.0295	0.0135	0.0756	1.0000	0.0504	0.4134**	0.3372**	0.2766**	-0.0857	-0.0010	0.2160*
5	0.2545*	0.2639*	0.2819**	0.0778	1.0000	0.6484**	0.7046**	-0.0066	-0.3996**	0.0150	-0.1051
6	0.1031	0.1156	0.1256	0.3648**	0.5839**	1.0000	0.9481**	0.3726**	-0.3829**	0.1611	0.1388
7	0.2849**	0.2866**	0.1722	0.2939**	0.6345**	0.9308**	1.0000	0.0803	-0.4252**	0.1514	0.0703
8	-0.5082	-0.4952**	-0.2267	0.1758	-0.0432	0.3481**	0.0341	1.0000	0.0177	0.1383	0.3420**
9	-0.0763	-0.0734	0.3035**	-0.0693	-0.3532**	-0.3631**	-0.3981**	0.0017	1.0000	0.1356	0.3560**
10	0.0672	0.0557	0.2729**	0.1703	0.0473	0.1054	0.0846	0.0567	0.1025	1.0000	0.6786**
11	-0.1606	-0.1522	0.0838	0.1650	-0.0764	0.1365	0.0494	0.2984**	0.3153**	0.4847**	1.0000
12	-0.1164	-0.0784	0.0693	0.1871	0.0387	0.0645	0.0052	0.2207**	0.2852**	0.2904**	0.7614**
13	-0.0246	-0.0384	0.0990	-0.0866	-0.0119	-0.0636	-0.0195	-0.1117	0.3844**	-0.0097	0.0392
14	0.2942**	0.2871**	0.2620	0.1165	0.3301**	0.0758	0.1775	-0.3117**	0.0014	0.0883	-0.0832
15	-0.0250	-0.0009	-0.1806	-0.0002	0.1325	0.1092	0.0691	0.1066	-0.0755	-0.2066*	-0.2581**
16	0.1413	0.1292	0.1259	0.1731	0.2912**	0.2116*	0.2905**	-0.2194*	-0.0642	-0.0528	-0.1677
17	-0.1210	-0.0870	-0.1673	-0.1403	0.0085	0.0255	0.0328	0.0430	0.1566	-0.0189	-0.0208
18	0.0231	0.0169	0.1574	-0.1980	-0.0735	-0.2476*	-0.2129*	-0.1669	0.2825**	0.0985	0.0640
19	-0.0210	-0.0278	0.1503	0.1232	0.0303	0.0134	-0.0069	0.0332	-0.0728	0.0406	0.1131
20	-0.2723**	-0.2743**	-0.3494**	-0.0559	-0.3952	-0.0048	-0.0765	0.1514	-0.0122	-0.1079	0.0667
21	0.2698*	0.2539*	0.5069**	0.3460**	0.4165**	0.5043**	0.5117**	0.0705	0.2291**	0.2472*	0.3146**

Table 1. contd...

Character	Head Rice Recovery	L/B Ratio	Water Uptake	Kernel Elongation Ratio	Volume Expansion Ratio	Alkali Spreading Value	Gel Consistency	Amylose Content	Protein %	Grain yield plant ⁻¹
	12	13	14	15	16	17	18	19	20	21
1	-0.1112	-0.0204	0.2984**	-0.0331	0.1427	-0.1194	0.0171	-0.0278	-0.2792**	0.3057**
2	-0.0786	-0.0389	0.2906**	-0.0047	0.1319	-0.0853	0.0199	-0.0346	-0.2842**	0.2847**
3	0.0827	0.1002	0.2780**	-0.1836	0.1329	-0.1755	0.1608	0.1469	-0.3778**	0.5590**
4	0.2405*	-0.1082	0.1639	0.0179	0.2154*	-0.1666	-0.2612*	0.1361	-0.0611	0.4326**
5	0.0705	-0.0127	0.3753**	0.1745	0.3259**	0.0105	-0.0978	0.0317	-0.4479**	0.4412**
6	0.0323	-0.0686	0.0852	0.1253	0.2249*	0.0252	-0.2781*	0.0213	-0.0083	0.5385**
7	-0.0147	-0.0201	0.1919	0.0818	0.3071**	0.0328	-0.2423*	-0.0093	-0.0825	0.5499**
8	0.2350*	-0.1386	-0.3594	0.1042	-0.2555*	0.0551	-0.1866	0.0691	0.1737	0.0844
9	0.3215**	0.3886**	0.0021	-0.0815	-0.0667	0.1581	0.2873**	-0.0749	-0.0141	0.2464*
10	0.3929**	-0.0121	0.1313	-0.2686*	-0.0726	-0.0179	0.1160	0.0212	-0.1632	0.4277**
11	0.8457**	0.0403	-0.1016	-0.2924**	-0.1964	-0.0281	0.0825	0.1299	0.0670	0.3777**
12	1.0000	-0.1121	0.0066	-0.2575*	-0.0993	-0.0502	0.2010	0.1631	-0.1029	0.3119**
13	-0.0874	1.0000	-0.0281	0.2543*	-0.0156	0.2076*	-0.2009	-0.2439*	0.0479	0.1934
14	0.0064	-0.0293	1.0000	-0.1511	0.6704**	-0.2354*	0.1639	0.1754	-0.3025**	0.2062*
15	-0.2362*	0.2512**	-0.1462	1.0000	-0.0200	0.2617*	-0.2279*	-0.3067	0.1050	0.0712
16	-0.0893	-0.0129	0.6660**	-0.0153	1.0000	-0.0031	0.0551	-0.0639	-0.1535	0.1219
17	-0.0420	0.2068	-0.2346*	0.2540*	-0.0034	1.0000	-0.0999	-0.8967**	-0.1241	-0.1140
18	0.1720	-0.2002	0.1577	-0.2206*	0.0536	-0.1015	1.0000	0.0741	-0.0498	-0.0876
19	0.1371	-0.2390*	0.1786	-0.2946**	-0.0624	-0.8828**	0.0752	1.0000	0.0569	0.1214
20	-0.0857	0.0489	-0.2969**	0.1063	-0.1524	-0.1217	-0.0500	0.0556	1.0000	-0.2472*
21	0.2311*	0.1694	0.1925	0.0387	0.1117	-0.1062	-0.0789	0.1169	-0.2264*	1.0000

Above diagonal : Genotypic correlation Below diagonal : Phenotypic correlation

Table 2. Direct and indirect effects (genotypic) of yield and quality components on yield among 45 genotypes of rice (*Oryza sativa* L.)

Character	Days to	Days to	Plant	Productive	Panicle	Filled	Total	Spikelet	Test	Hulling
	50%	Maturity	Height	Tillers/ Plant	Length	Grains/ Panicle	Grains/ Panicle	Fertility	Weight	%
	Flowering		(cm)		(cm)				(g)	
	1	2	3	4	5	6	7	8	9	10
1	-1.2227	-1.2098	-0.5518	0.0132	-0.3529	-0.1612	-0.3925	0.7239	0.0904	-0.1064
2	0.9731	0.9835	0.3963	0.0161	0.3011	0.1465	0.3245	-0.5749	-0.0712	0.0671
3	0.2305	0.2058	0.5108	0.0313	0.1392	0.0622	0.0773	-0.1155	0.1613	0.1891
4	-0.0034	0.0052	0.0195	0.3175	0.016	0.1313	0.1071	0.0878	-0.0272	-0.0003
5	0.0604	0.0641	0.057	0.0105	0.2093	0.1357	0.1474	-0.0014	-0.0836	0.0031
6	-0.505	-0.5706	-0.4663	-1.5833	-2.4833	-3.8301	-3.6315	-1.427	1.4665	-0.6171
7	1.3318	1.3689	0.6282	1.3991	2.9234	3.9341	4.1493	0.3333	-1.7643	0.6281
8	-0.6142	-0.6064	-0.2346	0.287	-0.0068	0.3865	0.0833	1.0374	0.0184	0.1435
9	-0.0521	-0.051	0.2225	-0.0603	-0.2814	-0.2697	-0.2995	0.0125	0.7044	0.0955
10	0.0376	0.0294	0.1597	-0.0004	0.0065	0.0695	0.0653	0.0597	0.0585	0.4314
11	0.1065	0.1046	-0.0883	-0.1403	0.0683	-0.0901	-0.0456	-0.2221	-0.2312	-0.4408
12	-0.0368	-0.026	0.0273	0.0795	0.0233	0.0107	-0.0049	0.0777	0.1063	0.1299
13	0.0023	0.0043	-0.0111	0.012	0.0014	0.0076	0.0022	0.0153	-0.043	0.0013
14	-0.0343	-0.0334	-0.0319	-0.0188	-0.0431	-0.0098	-0.022	0.0413	-0.0002	-0.0151
15	-0.006	-0.0008	-0.0332	0.0032	0.0315	0.0226	0.0148	0.0188	-0.0147	-0.0485
16	-0.0177	-0.0163	-0.0164	-0.0266	-0.0403	-0.0278	-0.038	0.0316	0.0083	0.009
17	0.0863	0.0616	0.1267	0.1203	-0.0076	-0.0182	-0.0237	-0.0398	-0.1142	0.013
18	-0.0031	-0.0036	-0.0291	0.0473	0.0177	0.0504	0.0439	0.0338	-0.052	-0.021
19	0.0134	0.0167	-0.0709	-0.0657	-0.0153	-0.0103	0.0045	-0.0334	0.0362	-0.0102
20	-0.0409	-0.0416	-0.0553	-0.0089	-0.0656	-0.0012	-0.0121	0.0254	-0.0021	-0.0239
Grain Yield/ Plant (g)	0.3057**	0.2847**	0.5590**	0.4326**	0.4412**	0.5385**	0.5499**	0.0844	0.2464*	0.4277**
Partial R ²	-0.3738	0.28	0.2855	0.1373	0.0923	-2.0626	2.2817	0.0876	0.1736	0.1845

Table 2. contd....

Character	Milling %	Head Rice Recovery	L/B Ratio	Water Uptake	Kernel Elongation Ratio	Volume Expansion Ratio	Alkali Spreading Value	Gel Consistency	Amylose Content	Protein %
	11	12	13	14	15	16	17	18	19	20
1	0.2005	0.136	0.0249	-0.3648	0.0404	-0.1745	0.146	-0.0209	0.034	0.3414
2	-0.1584	-0.0773	-0.0382	0.2858	-0.0046	0.1297	-0.0839	0.0196	-0.034	-0.2795
3	0.0694	0.0423	0.0512	0.142	-0.0938	0.0679	-0.0896	0.0821	0.075	-0.193
4	0.0686	0.0764	-0.0343	0.0521	0.0057	0.0684	-0.0529	-0.0829	0.0432	-0.0194
5	-0.022	0.0147	-0.0027	0.0785	0.0365	0.0682	0.0022	-0.0205	0.0066	-0.0937
6	-0.5315	-0.1237	0.2628	-0.3262	-0.48	-0.8615	-0.0965	1.0651	-0.0817	0.0318
7	0.2916	-0.0609	-0.0832	0.7961	0.3392	1.2744	0.136	-1.0052	-0.0385	-0.3421
8	0.3548	0.2438	-0.1438	-0.3729	0.1081	-0.2651	0.0572	-0.1936	0.0717	0.1802
9	0.2507	0.2264	0.2737	0.0015	-0.0574	-0.047	0.1113	0.2024	-0.0528	-0.0099
10	0.2928	0.1695	-0.0052	0.0566	-0.1159	-0.0313	-0.0077	0.0501	0.0091	-0.0704
11	-0.6495	-0.5493	-0.0262	0.066	0.1899	0.1275	0.0183	-0.0536	-0.0844	-0.0436
12	0.2796	0.3306	-0.0371	0.0022	-0.0851	-0.0328	-0.0166	0.0665	0.0539	-0.034
13	-0.0045	0.0124	-0.1107	0.0031	-0.0282	0.0017	-0.023	0.0222	0.027	-0.0053
14	0.0117	-0.0008	0.0032	-0.1149	0.0174	-0.077	0.027	-0.0188	-0.0201	0.0348
15	-0.0528	-0.0465	0.046	-0.0273	0.1807	-0.0036	0.0473	-0.0412	-0.0554	0.019
16	0.0243	0.0123	0.0019	-0.0829	0.0025	-0.1237	0.0004	-0.0068	0.0079	0.019
17	0.0203	0.0363	-0.15	0.1701	-0.189	0.0022	-0.7224	0.0722	0.6478	0.0896
18	-0.0149	-0.0364	0.0364	-0.0297	0.0413	-0.01	0.0181	-0.1811	-0.0134	0.009
19	-0.0627	-0.0787	0.1177	-0.0847	0.1481	0.0309	0.433	-0.0358	-0.4829	-0.0275
20	0.0098	-0.0151	0.007	-0.0443	0.0154	-0.0225	-0.0182	-0.0073	0.0083	0.1465
Grain Yield/ Plant (g)	0.3777**	0.3119**	0.1934	0.2062	0.0712	0.1219	-0.114	-0.0876	0.1214	-0.2472*
Partial R ²	-0.2453	0.1031	-0.0214	-0.0237	0.0129	-0.0151	0.0823	0.0159	-0.0586	-0.0362

Table 3. Direct and indirect effects (phenotypic) of yield and quality components on yield among 45 genotypes of rice (*Oryza sativa* L.)

Character	Days to 50% Flowering	Days to Maturity	Plant Height (cm)	Productive Tillers/ Plant	Panicle Length (cm)	Filled Grains/ Panicle	Total Grains/ Panicle	Spikelet Fertility	Test Weight (g)	Hulling %
	1	2	3	4	5	6	7	8	9	10
1	0.2641	0.2582	0.1105	-0.0078	0.0672	0.0272	0.0753	-0.1342	-0.0201	0.0178
2	-0.2402	-0.2458	-0.0912	-0.0033	-0.0649	-0.0284	-0.0704	0.1217	0.018	-0.0137
3	0.0631	0.0559	0.1507	0.0114	0.0425	0.0189	0.026	-0.0342	0.0457	0.0411
4	-0.005	0.0023	0.0128	0.1698	0.0132	0.0619	0.0499	0.0298	-0.0118	0.0289
5	0.0601	0.0623	0.0665	0.0184	0.236	0.1378	0.1497	-0.0102	-0.0834	0.0112
6	-0.0253	-0.0284	-0.0308	-0.0895	-0.1432	-0.2452	-0.2283	-0.0854	0.0891	-0.0258
7	0.2018	0.203	0.122	0.2081	0.4493	0.6593	0.7082	0.0241	-0.282	0.0599
8	-0.0488	-0.0476	-0.0218	0.0169	-0.0042	0.0335	0.0033	0.0961	0.0002	0.0054
9	-0.0405	-0.039	0.161	-0.0368	-0.1874	-0.1927	-0.2113	0.0009	0.5306	0.0544
10	0.0006	0.0005	0.0024	0.0015	0.0004	0.0009	0.0007	0.0005	0.0009	0.0087
11	-0.0354	-0.0336	0.0185	0.0364	-0.0169	0.0301	0.0109	0.0659	0.0696	0.107
12	0.0123	0.0083	-0.0073	-0.0197	-0.0041	-0.0068	-0.0006	-0.0233	-0.0301	-0.0306
13	0.0016	0.0024	-0.0063	0.0055	0.0008	0.004	0.0012	0.0071	-0.0243	0.0006
14	0.0047	0.0046	0.0042	0.0019	0.0053	0.0012	0.0028	-0.005	0	0.0014
15	-0.003	-0.0001	-0.0219	0	0.016	0.0132	0.0084	0.0129	-0.0091	-0.025
16	-0.0164	-0.015	-0.0146	-0.0201	-0.0338	-0.0246	-0.0337	0.0255	0.0075	0.0061
17	0.0454	0.0327	0.0628	0.0526	-0.0032	-0.0096	-0.0123	-0.0161	-0.0588	0.0071
18	-0.0024	-0.0018	-0.0164	0.0206	0.0077	0.0258	0.0222	0.0174	-0.0294	-0.0103
19	0.0044	0.0058	-0.0315	-0.0258	-0.0064	-0.0028	0.0015	-0.007	0.0152	-0.0085
20	0.029	0.0292	0.0372	0.0059	0.042	0.0005	0.0081	-0.0161	0.0013	0.0115
Grain Yield/ Plant (g)	0.2698*	0.2539*	0.5069**	0.3460**	0.4165**	0.5043**	0.5117**	0.0705	0.2291*	0.2472*
Partial R ²	0.0713	-0.0624	0.0764	0.0588	0.0983	-0.1237	0.3624	0.0068	0.1216	0.0022

Table 3. contd...

Character	Milling %	Head Rice Recovery	L/B Ratio	Water Uptake	Kernel Elongation Ratio	Volume Expansion Ratio	Alkali Spreading Value	Gel Consistency	Amylose Content	Protein %
	11	12	13	14	15	16	17	18	19	20
1	-0.0424	-0.0307	-0.0065	0.0777	-0.0066	0.0373	-0.032	0.0061	-0.0056	-0.0719
2	0.0374	0.0193	0.0094	-0.0706	0.0002	-0.0317	0.0214	-0.0042	0.0068	0.0674
3	0.0126	0.0104	0.0149	0.0395	-0.0272	0.019	-0.0252	0.0237	0.0227	-0.0526
4	0.028	0.0318	-0.0147	0.0198	0	0.0294	-0.0238	-0.0336	0.0209	-0.0095
5	-0.018	0.0091	-0.0028	0.0779	0.0313	0.0687	0.002	-0.0173	0.0072	-0.0933
6	-0.0335	-0.0158	0.0156	-0.0186	-0.0268	-0.0519	-0.0063	0.0607	-0.0033	0.0012
7	0.035	0.0037	-0.0138	0.1257	0.0489	0.2058	0.0232	-0.1508	-0.0049	-0.0541
8	0.0287	0.0212	-0.0107	-0.03	0.0102	-0.0211	0.0041	-0.016	0.0032	0.0146
9	0.1673	0.1513	0.204	0.0007	-0.04	-0.0341	0.0831	0.1499	-0.0386	-0.0065
10	0.0042	0.0025	-0.0001	0.0008	-0.0018	-0.0005	-0.0002	0.0009	0.0004	-0.0009
11	0.2207	0.168	0.0086	-0.0184	-0.057	-0.037	-0.0046	0.0141	0.025	0.0147
12	-0.0803	-0.1054	0.0092	-0.0007	0.0249	0.0094	0.0044	-0.0181	-0.0145	0.009
13	-0.0025	0.0055	-0.0632	0.0019	-0.0159	0.0008	-0.0131	0.0127	0.0151	-0.0031
14	-0.0013	0.0001	-0.0005	0.016	-0.0023	0.0107	-0.0038	0.0025	0.0029	-0.0048
15	-0.0312	-0.0286	0.0304	-0.0177	0.121	-0.0018	0.0307	-0.0267	-0.0356	0.0129
16	0.0195	0.0104	0.0015	-0.0774	0.0018	-0.1162	0.0004	-0.0062	0.0072	0.0177
17	0.0078	0.0157	-0.0776	0.088	-0.0953	0.0013	-0.3752	0.0381	0.3313	0.0457
18	-0.0067	-0.0179	0.0209	-0.0164	0.023	-0.0056	0.0106	-0.1042	-0.0078	0.0052
19	-0.0237	-0.0287	0.05	-0.0374	0.0617	0.0131	0.1849	-0.0157	-0.2094	-0.0116
20	-0.0071	0.0091	-0.0052	0.0316	-0.0113	0.0162	0.0129	0.0053	-0.0059	-0.1063
Grain Yield/ Plant (g)	0.3146*	0.2311*	0.1694	0.1925	0.0387	0.1117	-0.1062	-0.0789	0.1169	-0.2264*
Partial R ²	0.0694	-0.0244	-0.0107	0.0031	0.0047	-0.013	0.0399	0.0082	-0.0245	0.0241

(1921) and described by Dewey and Lu (1959). In general, the genotypic correlation coefficients were higher than phenotypic correlation coefficients (Table 1) indicating a strong inherent association between the characters. Grain yield plant⁻¹ was significantly associated with days to 50% flowering, days to maturity, plant height, productive tillers plant⁻¹, panicle length, filled grains panicle⁻¹, total grains panicle⁻¹, hulling%, milling% and head rice recovery both at phenotypic and genotypic levels. The results were supported by Eradasappa *et al.*, (2007), Krishna *et al.*, (2008) and Sudharani *et al.*, (2014).

A significant negative association was observed between grain yield and protein content. (Basavaraja *et al.*, 2011). Association analysis among yield, yield attributing and quality characters revealed that days to 50% flowering had positive significant association with days to maturity, panicle length, total grains panicle⁻¹. Days to 50% flowering, plant height, panicle length, total grains panicle⁻¹, water uptake showed significant positive association with days to maturity. Plant height was positively correlated with days to 50% flowering, days to maturity, panicle length, test weight and hulling % while productive tillers plant⁻¹ showed positive correlation with filled grains panicle⁻¹, total grains panicle⁻¹ and spikelet fertility%. Panicle length had positive association with days to 50% flowering, days to maturity, plant height, filled grains panicle⁻¹ and total grains panicle⁻¹ while filled grains panicle⁻¹ showed positive association with productive tillers plant⁻¹, panicle length, total grains panicle⁻¹ and spikelet fertility. Days to 50% flowering, days to maturity, productive tillers plant⁻¹, panicle length and filled grains panicle⁻¹ and volume expansion ratio showed positive association with total grains panicle⁻¹. Spikelet fertility showed positive significant association with productive tillers plant⁻¹, filled grains panicle⁻¹ and milling per cent while test weight had

positive association with plant height, milling percent, head rice recovery, L/B ratio and gel consistency.

The correlation coefficient alone is inadequate to interpret the cause and effect relationships among the traits and ultimately with grain yield. Path analysis technique furnishes a method portioning the correlation coefficients into direct and an indirect effect, provides the information on actual contribution of a trait on the yield. The path coefficient analysis revealed that total grains panicle⁻¹, spikelet fertility and days to maturity had maximum direct effect on grain yield plant⁻¹ (Table 2). These results are in conformation with the earlier reports of Bhadru *et al.*, (2012) and Seesang *et al.*, (2013). Filled grains panicle⁻¹ and days to 50% flowering exhibited significant negative direct effect on grain yield plant⁻¹ which is conformation with earlier reports of Eradasappa *et al.* (2007), Pankaj Garg *et al.* (2010) and Swain and Reddy (2006).

All the traits except days to 50% flowering, filled grains panicle⁻¹ and panicle length showed positive significant correlation with grain yield due to high direct effect and selection through these traits will be effective for yield improvement. Days to 50% flowering, filled grains panicle⁻¹ and panicle length had direct effects but showed significant positive correlation with grain yield plant⁻¹ which may be due to indirect effects. Hence, these traits are to be considered simultaneously for selection to improve grain yield plant⁻¹.

CONCLUSION

It may be concluded that, days to maturity, plant height, productive tillers plant⁻¹, total grains panicle⁻¹, spikelet fertility and test weight had a significant positive association with grain yield and also had a positive direct effect on yield at genotypic level. Hence, these traits may be given due weightage while practicing the selection for grain yield improvement.

LITERATURE CITED

- Basavaraja T Ganga Prasad S, Dhusyantha Kumar B M and Shilaja Hittlamani 2011** Correlation and path analysis of yield and yield attributes in local rice cultivars (*Oryza sativa* L.). *Electronic Journal of Plant Breeding*. 2(4):523-526.
- Bhadru D, Rao V T, Mohan Y C and Bharathi D 2012** Genetic variability and diversity studies in yield and its component traits in rice (*Oryza sativa* L.). *SABRAO Journal of Breeding and Genetics*. 44(1): 129-137.
- 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(9): 515-518.
- Eradasappa E, Ganapathy K N, Satish R G, Shanthala J and Nadarajan N 2007** Heterosis studies for yield and yield components using CMS lines in rice (*Oryza sativa* L.). *Crop Research*. 34 (1, 2 & 3): 152-155.
- Johnson H W, Robinson H F and Comstock R E 1955** Estimates of genetic and environmental variability in soybean. *Agronomy Journal*. 47 (7): 314-318.
- Krishna L, Raju Ch D and Raju Ch S 2008** Genetic variability and correlation in yield and grain quality characters of rice germplasm. *The Andhra Agricultural Journal*. 55 (3): 276-279.
- Pankaj Garg, Pandey D P and Dharendra Singh 2010** Correlation and path analysis for yield and its components in rice (*Oryza sativa* L.). *Crop Improvement*. 37(1): 46-51.
- Seesang J, Sripicchitt, P, Somchit P and Sreewongchai T 2013** Genotypic Correlation and Path Coefficient for Some Agronomic Traits of Hybrid and Inbred Rice (*Oryza sativa* L.) Cultivars. *Asian Journal of Crop Science*. 5: 319-324.
- Sudharani M, Reddy P R, Reddy G H and Raju C S 2013** Correlation and path coefficient analysis for yield and physiological attributes in rice (*Oryza sativa* L.) hybrids under saline soil conditions. *Journal of Research, ANGRAU*. 41(1): 105-108.
- Swain B and Reddy J N 2006** Correlation and path analysis of yield and its components in rainfed lowland rice genotypes under normal and delayed planting conditions. *Oryza*. 43(1): 58-61.
- Wright S 1921** Correlation and causation. *Journal of Agricultural Research*. 20: 557-585.

Received on 11.08.2016 and revised on 22.11.2016