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Character Association and Path Analysis for Yield and its Component Characters in Rice

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Abstract The present investigation is carried out to study the correlation and path analysis in 42 rice varieties and 18 rice genotypes in Jagtial. Telangana during *kharif,* 2014. The correlation analysis revealed that the seed yield / plant showed significant positive correlation with total number of tillers/plant, number of productive tillers/plant, total no. grains / panicle, number of filled grains/panicle, spikelet fertility (%) and 100-seed weight (g) and negative correlation with days to 50% flowering. Hence, selection for these traits can improve yield. Path coefficient analysis revealed that highest positive direct effect of number of filled grains/panicle on grain yield at genotypic level followed by 100-seed weight (g), total number of tillers / plant, number of productive tillers / plant was observed, whereas total no.grains / panicle and days to 50% flowering had a negative direct effect.

Keywords Character association, Path analysis, Yield, Genotypes, Rice

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Indroduction

Rice (*Oryza sativa* L.) occupies a pivotal place in the Indian agriculture. Rice is also called as the Grain of Life, because it is not only staple food for more than 70% of the Indians but also a source of liveli-

hood for about 120-150 million rural households. At the current rate of population growth accelerating at 1.8%, rice requirement by the year 2020 would be around 140 million tons (Anonymous 2004). Rice is the second most widely consumed in the world next to wheat. From poorest to richest person in this world consume rice in one or other form. To increase production of rice plays a very important role in food security and poverty alleviation. In view of the growing population, the basic objective of the plant breeders would always be towards yield improvement in staple food crops. For improvement in yield, it would be desirable to understand the nature and magnitude of associations amongst yield and its component traits. Information on association of characters, direct and indirect effects contributed by each character towards yield will be an added advantage in aiding the selection process. Correlation and path analysis establish the extent of association between yield and its components and also bring out relative importance of their direct and indirect effects, thus giving an obvious understanding of their association with grain yield.

Materials and Methods

Field experiment was conducted at Regional Agricultural Research Station, Jagtial, Telangana state, India, during *kharif* 2014 season. The experiment was laid out in a randomized complete block design with three replications. In each replication, single seedling was transplanted per hill in 3 rows with 20 ×15 cm spacing. Five plants per treatment were randomly selected for each replication in middle of the two rows. The outer rows were rejected; since, it may be have some border effect. Observations were recorded for 10 quantitative characters viz., days to 50% flowering, plant height, panicle length, total number of tillers / plant, number of productive tillers / plant, total number of grains / panicle,number of filled grains / panicle, spikelet fertility, 100-seed weight and seed yield / plant. Correlation coefficients were calculated at genotypic and phenotypic level using the formulae suggested by Falconer (1981). The direct and indirect effects both at genotypic and phenotypic level were estimated by taking seed yield as dependent variable, using path coefficient analysis suggested by Wright (1921) and Dewey and Lu (1959).

Results and Discussion

Character association studies primary importance is to know the suitability of various characters for selection, since selection of a particular trait may bring about desirable or undesirable changes in the associated characters. Generally, direct selection for yield was not aimed at, as it is a most complex trait which is the result of the interaction of a number of component traits and is highly influenced by environment. Based on correlation the breeder would be able to decide the breeding method to be used to exploit the desirable associations and to break the undesirable associations.

The analysis of variance revealed significant differences among the genotypes for all the character studied. In general the genotypic correlation coefficients were higher than the phenotypic correlation cofficients for all the traits under study.This might be due to relative stability of genotypes as majority of them have been subjected to certain amount of selection (Johnson et al. 1955). At phenotypic level, the seed yield / plant exhibited highly significant positive association with total number of tillers / plant and number of productive tillers / plant, total number of grains / panicle, number of filled grains / panicle, spikelet fertility and 100-seed weight. Similar observations were earlier recorded by Padmaja et al. (2011) for total number of tillers / plant, number of productive tillers / plant, number of filled grains / panicle and 100 seed weight and Nagaraju et al. (2013) for number of productive tillers / plant, Yadav et al. (2010) and Sravan et al. (2012) for total number of grains / panicle and number of filled grains / panicle. This trait had highly significant negative correlation with days to 50% flowering. Sravan et al. (2012) got similar result for days to 50% flowering. At genotypic level, the seed yield / plant exhibited highly significant positive association with total number of grains / panicle and number of filled grains / panicle followed by total number of tillers /

Table 1. Estimates of phenotypic, genotypic correlation coefficients between yield and its contributing characters. * Significant at 5% level of significance, ** significant at 1% level of significance.

Characters		Days to flowering	Plant height (cm)	Panicle length (cm)	Total number of tillers/ plant	Number of productive tillers/ plant	Total no. grains / panicle	Number of filled grains/ panicle	Spikelet fertility (%)	100-Seed weight (g)	Seed yield / plant (g)
Days to 50% flowering	P	**1.0000**	-0.1407	0.0034	0.0375	-0.0328	-0.0630	-0.0908	-0.1393	-0.3013**	-0.2617**
	G	**1.0000**	-0.1413	-0.0204	-0.0993	0.0260	-0.0795	-0.1051	-0.1463	-0.3602**	-0.3031**
Plant height (cm)	P		**1.0000**	0.2108**	-0.1950**	-0.0837	0.0596	0.1275	0.2380**	0.2160**	0.0980
	J		**1.0000**	0.3104**	-0.3212**	-0.1738*	0.0592	0.1292	0.2467**	0.2447**	0.1249
Panicle length (cm)	G			**1.0000**	-0.0794	-0.0804	-0.0874	-0.0620	0.0908	0.1671*	0.0202
	J			**1.0000**	-0.2192**	0.0304	-0.1036	-0.0750	0.1028	0.2647**	0.0047
Total number of tillers plant	P				**1.0000**	0.4414**	-0.0848	-0.0773	0.0108	0.0184	0.2856**
	G				**1.0000**	1.1572**	-0.1636*	-0.1347	0.0502	0.0515	0.1923**
Number of productive tillers/ plant	P					**1.0000**	-0.0632	-0.0443	0.0725	0.0459	0.2247**
	G					**1.0000**	-0.1867*	-0.1208	0.2504**	0.1911*	0.3657**
Total no. grains / panicle	P						**1.0000**	0.9538**	-0.1262	-0.3729**	0.5820**
	G						**1.0000**	0.9569**	-0.1112	-0.4096**	0.6554**
Number of filled grains panicle	P							**1.0000**	0.1597*	-03639**	0.6574**
	G							**1.0000**	0.1692*	-0.3992**	0.7291**
Spikelet fertility (%)	P								**1.0000**	0.0149	0.2177**
	G								**1.0000**	-0.0020	0.2400**
100-Seed weight (g)	P									**1.0000**	0.2063**
	G									**1.0000**	0.1674*
Seed yield / plant (g)	P										**1.0000**
	G										**1.0000**

plant and number of productive tillers / plant, spikelet fertility and 100-seed weight (Table 1). These results are in support with the findings of Malini et al. (2007), Yadav et al. (2010) and Sravan et al. (2012) for total number of grains/ panicle and Rao et al. (2014) and Ekka et al. (2011) for number of filled grains/panicle, Yadav et al. (2010) for total number of tillers / plant, Sravan et al. (2012) for number of productive tillers / plant and spikelet fertility. Highly significant negative association of this trait was noticed with days to 50% flowering. Sravan et al. (2012) for days to 50% flowering earlier obtained similar results.

Path coefficient analysis allows the separation of direct effect and their indirect effects through other attributes by partitioning the correlations (Wright 1921). Path analysis indicated that number of filled grains/panicle had the maximum direct contribution towards seed yield / plant, followed by 100-seed weight, total number of tillers / plant, number of productive tillers / plant, at phenotypic level. These results are in agreement with the findings of Padmaja et al. (2011) for number of filled grains / panicle, 100-seed weight and number of productive tillers / plant and Aditya and Bhartia (2013) for total number of tillers / plant. On the other hand, negative direct effect on seed yield / plant were recorded by total number of grains / panicle, spikelet fertility (%), days to 50% flowering at phenotypic level which is in

Table 2. Estimates of phenotypic, genotypic path coefficients between yield and its contributing characters. * significant at 5% level of significance, **significant at 1% level of significance.

Characters		Days to 50% flowering	Plant height (cm)	Panicle length (cm)	Total number of tillers/ plant	Number of productive tillers/ plant	Total no. grains/ panicle	Number of filled grains/ panicle	Spikelet fertility (%)	100-Seed weight (g)	Seed yield/ plant (g)
Days to 50% flowering	P	**-0.0522**	0.0125	0.0001	0.0104	-0.0035	0.0578	-0.1617	0.0264	-0.1515	-0.2617
	G	**-0.0297**	0.0094	-0.0005	0.0354	-0.0017	-0.0038	-0.0983	-0.0141	-0.1998	-0.3031**
Plant height (cm)	P	0.0074	**-0.0889**	0.0070	-0.0543	-0.0089	-0.0546	0.2270	-0.0452	0.1086	0.0980
	G	0.0042	**-0.0668**	0.0072	-0.1146	0.0116	0.0028	0.1209	0.0238	0.1357	0.1249
Panicle length (cm)	P	-0.0002	-0.0187	**0.0332**	-0.0221	-0.0086	0.0802	-0.1103	-0.0172	0.0840	0.0202
	G	0.0006	-0.0207	**0.0233**	-0.0782	-0.0020	-0.0050	-0.0701	0.0099	0.1468	0.0047
Total number of tillers / plant	P	-0.0020	0.0173	-0.0026	**0.2785**	0.0471	0.0778	-0.1377	-0.0020	0.0092	0.2856
	G	-0.0029	0.0215	-0.0051	**0.3567**	-0.0774	-0.0078	-0.1261	0.0049	0.0286	0.1923**
Number of productive tillers / plant	P	0.0017	0.0074	-0.0027	0.1229	**0.1068**	0.0580	-0.0788	-0.0138	0.0231	0.2247
	G	-0.0008	0.0116	0.0007	0.4128	**-0.0669**	-0.0089	-0.1130	0.0242	0.1060	0.3657**
Total no. grains / panicle	P	0.0033	-0.0053	-0.0029	-0.0236	-0.0067	**-0.9175**	1.6984	0.0240	-0.1875	0.5820
	G	0.0024	-0.0040	-0.0024	-0.0584	0.0125	**0.0478**	0.8954	-0.0107	-0.2272	0.6554**
Number of filled grains / panicle	P	0.0047	-0.0113	-0.0021	-0.0215	-0.0047	-0.8751	**1.7807**	-0.0303	-0.1830	0.6574
	G	0.0031	-0.0086	-0.0017	-0.0481	0.0081	0.0457	**0.9357**	0.0164	-0.2214	0.7291**
Spikelet fertility (%)	P	0.0073	-0.0212	0.0030	0.0030	0.0077	0.1158	0.2843	**-0.1898**	0.0075	0.2177
	G	0.0043	-0.0165	0.0024	0.0179	-0.0167	-0.0053	0.1583	**0.0967**	-0.0011	0.2400**
100-Seed weight (g)	P	0.0157	-0.0192	0.0055	0.0051	0.0049	0.3421	-0.6480	-0.0028	**0.5029**	0.2063
	G	0.0107	-0.0163	0.0062	0.0184	-0.0128	-0.0196	-0.3736	-0.0002	**0.5546**	0.1674*

trend with the results of Garg et al. (2010) for total number of grains / panicle and days to 50 flowering and Ekka et al. (2011) for spikelet fertility. At genotypic level (Table 2), high positive direct effect of number of filled grains / panicle, 100-seed weight, total number of tillers / plant, spikelet fertility, total number of grains / panicle on seed yield / plant. Padmaja et al. (2011) for number of filled grains / panicle, 100-seed weight and spikelet fertility, Yadav et al. (2010) for total number of tillers / plant and total number of grains / panicle got similar results earlier. However number of productive tillers / plant, days to 50% flowering had negative direct effect on seed yield / plant which is in accordance with the findings of Nagesh et al. (2013) and Aditya and Bhartia (2013) for number of productive tillers / plant, days to 50% flowering. Hence it is revealed that selection of traits with significant positive association as well as positive direct effect on seed yield / plant viz., total number of tillers / plant, number of filled grains / panicle and 100-seed weight can be considered as the most reliable indicators of yield improvement in rice.

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