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CORRELATION AND PATH COEFFICIENT ANALYSIS OF SOME LOW LAND RICE CULTIVARS

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Abstract

Yield is mostly the prominent objective in most breeding programs. As a quantitative character, it is typically influenced by the environment. Phenotypic expressions which include yield, is also a product of the environment and the genotype. So, association studies and genetic analysis is important in any selection program of a population. This present study therefore sought to analyze the genetic contribution to the yield, determine the association of some yield components and establish the most prominent parameters for selection in some lowland rice varieties. The investigation involved fifty cultivars in α- lattice design with three replications, conducted at National Cereals Research Institute stations at Badeggi and Edozhigi in 2017. The result indicated that there exists significant variability amongst the genotypes. A national released variety FARO 15 recorded the highest yield across the two lowland ecologies. Association study revealed that some yield components correlated positively with the yield and none of them were significant. Plant height had the highest (2.12) correlation with yield while panicle exertion recorded the highest (3.19) direct contribution to the yield, the implication therefore is that these parameters may be selected for in improvement of yield in the lowland rice cultivars. Though the residual effect for the path analysis was a negative value, three of the parameters demonstrated strong direct association with grain yield.

Keyword: Rice, Correlation, Cultivar, Path analysis, FARO

INTRODUCTION

Rice, *Oryza sativa* (2n = 24) belong to the family *poaceae* and subfamily *Oryzoidae*. Rice is the most important human food crop, providing staple food for nearly half of the global population, especially in Asia, Africa, and Latin America (FAO, 2004). India has the largest area under rice cultivation in the world and ranks second in production. Rice is one of the significant cereal commodities for the world's population (Lopez and Joseph, 2008). It has shaped the culture, diets and economy of of millions of people. For more than half of the humanity, "rice is life". Considering its important position, the United Nation designated year 2004 as the "International year of rice. More than 430 million metric tons of rice were consumed worldwide (USDA, 2008). Rice is a nutritional staple food providing 20 % of the calories and 15 % of proteins consumed by the world's population (Muhammad *et al.*, 2015). Yield is known to be a complex quantitative character controlled by many genes. Hence, it is a product of multiple interaction among its components and highly sensitive to environmental fluctuation (Vernier and Dansi, 2000; Obiokoro, 2005). Yield is the major objective in most selection programs, and direct selection as such could be misleading. The knowledge of direct and indirect effects of yield components is necessary to reveal which effect is important (Isong *et al.*, 2013). Correlation coefficient is known to determine the relationship between components necessary for selection, however when more characters are involved, the indirect association between characters become more complex. Path coefficient analysis is found to be useful in revealing the relationship among traits whereby suitable for effective selection of complex traits in rice (Liaqat *et al.*, 2015, Iqbal *et al.*, 2006). Therefore, the study of direct and indirect association will help in understanding the yield components and form the basis for selection to improve yield.

Globally, improving quantity and quality of rice grain have been approached to solve several problems among the world population such as decreasing the number of hidden hunger and malnutrition (Burchi *et al.*, 2011). However, a wide variation of grain morphological characteristics will be required as source of genetic materials in breeding for some specific traits as it would have effect on consumer's acceptance in the end.

MATERIALS AND METHODS

The experiment was conducted at National Cereals Research Institute Badeggi (latitude 9°45'N and, longitude 6°07'E) and Edozhigi (longitude 5° 50 E and latitude 9°45N). Nursery was raised three weeks prior to the transplanting. The local rice varieties used for this experiment were collected from farmers in Niger State rice growing villages and the improved varieties were collected from National Cereals Research Institute, Badeggi (NCRI). rice breeding unit.

The experiment was laid out in Alpha lattice design in 3 replications with plot size of 4m x 5m. Transplanting was done 21 days after seedling emergence at spacing of 20 by 20 cm inter and intra row spacing. Manual weeding was carried out regularly at 21 and 42 days after transplanting.

The equivalent of 40 kg each of N, P2O5 and K_2O per hectare was applied at transplanting using NPK 15-15-15. Top dressing of 46% N fertilizer, was applied in 2 split application by 1st top dressing at 21 days after transplanting, 2nd top dressing at panicle initiation.

Data were recorded from five selected plants in each entry for eight characters : panicle exertion (PX). number of panicles (NP), panicle weight (PW), grain yield (GY), panicle length (PL), plant height (PH), number of tillers (NT), days to 50% flowering (DFF).

The means for all the observed parameters were worked out and subjected to Analysis of variance (ANOVA) according to Johnson *et al*. (1955) and Falconer (1967) and further subjected to correlation and path analysis.

RESULTS AND DISCUSSION

The estimates of genotypic and phenotypic correlation coefficients among all the traits studied are presented in Table 1. The genotypic correlation coefficients were higher than the phenotypic correlation coefficients for most of the traits. In this study, plant height has high positive correlation with panicle length, panicle number and yield but, correlated negatively with other parameters. Panicle length recorded high positive correlation coefficient with panicle weight but low with panicle number. Panicle number has very low correlation with days to 50 % flowering, panicle weight has negative correlation with 50 % flowering and yield which is in contrast with the report of Abbasi *et al.* (1995) who reported highly significant ($P < 0.001$) variation within the accessions studied for panicle weight. But, tiller number correlated negatively with yield in contrast with the findings of Rahman *et al.* (2011). Tiller number per plant correlates positively with grain yield. Panicle exertions correlated positively with panicle weight and days to 50 % flowering. Also, days to 50 % flowering was positively correlated with yield at both phenotypic and genotypic levels. Similar results were recorded by Selvarani and Rangasamy (2008) for days to flowering, Choudhary and Das (2008) for panicle number and Gupta *et al* (200[illegible]) for panicle weight.

The contributions of each of the components to yield are indicated in Table 2. The highlighted diagonal values indicate the direct effect of each of the components to yield, the indirect contribution to the rice yield per plant by each component are the horizontal and vertical values in Table 2. Consequently path analysis is employed to identify the basic index for selection. According to Table 2, all the direct effects were less than 1. Plant height shows the highest direct and positive contribution to yield. On the contrary, number of tillers, panicle length, number of panicle, panicle exertion and panicle weight were negative. Days to 50 % flowering shows low positive direct effect on yield.

The positive correlation with the grain yield by most of the parameters as revealed by path analysis was mainly due to their indirect effects through other components. Similar results had been obtained by Rather *et al* (2008) for panicles number, days to flowering and panicle weight.

Analysis of variance in table 1 shows that significant difference existed in panicle number and grain yield among the genotypes.

Table 1. ANOVA of some grain yield and yield components in 50 rice genotypes

	PH(cm)	NT	PL (cm)	NP	PX (cm)	PW (g)	DFF	GY
GE	221.76	3016.88	9.09	1856.05	5.24	18.94	96.92	10961.06
Error								
total	150.26	1685.04	7.58	1056.63	3.02	17.59	42.09	8158.03

Table 2. Genotypic and Phenotypic correlation coefficients of 50 rice genotypes

	PH	NT	PL	NP	PX	PW	DFF	GY
PH	1	-0.37	0.62	0.31	-0.09	-0.15	-0.01	0.32
	1	-0.14	0.02	0.06	-0.06	-0.12	0.02	-0.01
NT		1	-0.23	0.001	-0.04	-1.09	-0.13	-0.12
		1	-0.14	-0.05	-0.12	-0.18	-0.09	0.01
PL			1	0.24	-0.29	0.71	-0.03	-0.12
			1	0.09	-0.05	0.018	-0.009	-0.07
NP				1	-0.14	-0.29	0.03	-0.36
				1	0.003	0.001	0.03	-0.10
PX					1	0.48	0.16	-0.26
					1	0.04	0.06	-0.12
PW						1	-0.13	-0.37
						1	0.03	-0.06
DFF							1	0.22
							1	0.11
GY								1
								1

Table 3. Path analysis of yield and yield components in 50 rice genotypes

	PH	NT	PL	NP	PX	PW	DFF	R^2
1	**0.5934**	0.0607	-0.2137	-0.1748	0.0295	0.0276	-0.0023	**0.3203**
2	-0.2167	**-0.1663**	[illegible]	-0.0009	0.0149	0.2	-0.0313	-0.1225
3	0.3659	0.0373	**-0.3466**	-0.1375	0.0993	-0.1315	-0.0068	-0.12
4	0.1842	-0.0003	-0.0847	**-0.563**	0.0467	0.0538	0.0075	-0.3559
5	-0.0509	0.0072	0.0999	0.0763	**-0.3445**	-0.089	0.0408	-0.2602
6	-0.0888	0.1806	-0.2475	0.1644	-0.1665	**-0.1841**	-0.0317	-0.3737
7	-0.0056	0.0209	0.0095	-0.0169	-0.0566	0.0235	**0.2486**	0.2233

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