IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 17, Issue 10 Ser. 1 (October. 2024), PP 67-70
www.iosrjournals.org

Association Analysis among Morpho-physiological Traits of Rice (*Oryza sativa* L.) Lines under Rainfed and Irrigated Conditions.

V.N. Pathak*
**Department of Genetics & Plant Breeding, S.M.M. Town Post Graduate College, Ballia*

Abstract
The present investigation was conducted during Kharif 2023 at the Agricultural Research Farm, S.M.M. Town PG. College, Ballia. 132 genotypes of rice were studied to assess character association and path analysis. The grain yield/plant in almost all the crops is referred to as a character, which results from the multiplicative interaction of several other traits that are termed as yield components. Therefore, identification of important yield components and information about their association with yield and also with each other is very useful for developing an efficient breeding strategy for evolving high-yielding varieties. The high positive direct contribution towards grain yield per plant was exhibited by spikelet fertility, kernel length, days to panicle initiation, number of unfilled grains per panicle, test weight, days to 50 per cent flowering, panicle length, number of grains per panicle and number of effective tillers per plant.
Key words*: Rice, Oryza sativa, correlation, path analysis.*

I. Introduction

Rice (*Oryza sativa* L.) is a member of the Poaceae (Gramineae) family and the most important stable food crop of the world and feeding over 60% of the world population. Rice is grown throughout the world due to high stability, sustainability and productivity in varying environmental conditions such as humid tropical and subtropical regions of the world. Rice is cultivated in 114 countries, over an area of 161.4 mha, with the production of 466.7 m tonnes (on a milled basis). About 90% of the world's rice is grown in South East Asia. India is the world's second-largest producer of rice after China, accounting for 20% of the world's rice production. During 2023-24, the global rice production was 520.65 million Metric Tons. However, India ranked second in rice production after China by producing 137 Million Metric Tons.

Rice is a self-pollinated crop species and rich source of Carbohydrates, good source of protein, Calcium, Phosphorus, Iron and minerals, which are concentrated in outer brown layer known as husk and germ. Brown rice a type of rice from which only husk has been removed is the most nutritious type of rice. Rice contains less protein 6-8 % in white rice and 8-10 % in brown rice and contains 2 to 2.5% fats, which is lost during milling and polishing.

Grain yield, being a complex trait, depends upon component variables and their interaction degree and direction of relationship between two or more variables that lead to the estimation of correlation. Correlation studies provide a better understanding of the yield component, which helps the plant breeder during selection (Robinson *et al*. 1951 and Johnson *et al*., 1955). Path coefficient analysis measures the direct and indirect contribution of independent variables on dependent variables and thus helps breeders in determining the yield components and understanding the cause of association between two variables

II. Materials and Methods

The experiment was carried out at the Agricultural Research Farm, S.M.M. Town PG. College, Ballia. during *Kharif* season, 2023. The soil was rich in potash and low in organic carbon, nitrogen, phosphorus and balanced in micronutrients required for a good & healthy crop. The experimental materials comprising of 128 genotypes along with four check varieties *viz*., Rajendra Sweta, BPT-5204, Tetep and MTU-7029, were grown in these genotypes exhibiting a wide spectrum of variability and diversity for various morphological and quantitative characters.

The experimental material was planted in an augmented block design along with four check varieties *viz*, Tetep, Rajendra Sweta, BPT-5204 and MTU-7029 in irrigated conditions in clay loam soil. The experimental field was divided into 8 blocks of equal size, with 3 meters length and each block had 20 plots. Out of 16 plots in a block the test germplasm which were not replicated, while the remaining four checks were distributed *viz*., Tetep, Rajendra Sweta, BPT-5204 and MTU-7029. The four checks were randomly placed along with the test genotype in a block.

The simple correlations between different characters at genotypic (g) and phenotypic (p) levels were estimated according to Searle (1961). Path coefficient analysis was done according to the formula given by Dewey and Lu (1959).

III. Result and Discussion

The grain yield per plant showed highly significant and positive correlation with the spikelet fertility, number of effective tillers per plant, panicles length, days to maturity, day to 50 per cent flowering, days to panicle initiation, kernel length, kernel breadth, test weight, number of grains per panicle, plant height, number of unfilled grains per panicle, kernel length and breadth ratio, disease rating scale and disease lesion length showed significant positive correlation. Thus, these characters emerged as important trait associated with grain yield. An increase/improvement in the above characters followed by the selection effect, positively affects grain yield. The available literature also identified positive association on above characters with grain yield in rice Patel *et al*. (2014), Ogunbayo *et al.* (2014), Kalyan *et al*. (2017), Bhati *et al.*(2015), Solomon and Wegary (2016), Kafi *et al.,* 2021), Kayastha *et al.* (2022).

Test weight showed highly significant positive correlation with spikelet fertility, panicle length, number of effective tillers per plant, days to maturity, days to 50 per cent flowering, days to panicle initiation, plant height, number of unfilled grains per panicle and the number of grains per panicle. Sivasankar *et al* (2018). Number of grains per panicle showed a positive, highly significant correlation with number of effective tillers per plant, days to maturity, days to 50% flowering, days to panicle initiation. Number of unfilled grains per panicle showed a highly significant positive correlation with panicle length, number of effective tillers per plant, number of grains per panicle, days to maturity. Number of unfilled grains per panicle and a positive significant correlation with and plant height. Singh *et al.* (2022).

Spikelet fertility showed highly significant positive correlation with number of effective tillers per plant, panicle length, days to maturity, days to 50 per cent flowering, days to panicle initiation, plant height, number of grain per panicle and number of unfilled grain per panicle. Panicles length showed highly significant positive association with number of effective tillers per plant, days to maturity, days to 50 per cent flowering and days to panicle initiation and plant height. Number of effective tillers per plant showed highly significant positive correlation with days to maturity, days to 50 per cent flowering and days to panicle initiation and plant height. Plant height showed highly significant positive correlation with days to maturity, days to 50 per cent flowering and days to panicle initiation. Parimala *et al.* (2020).

The high positive direct contribution towards grain yield per plant was exhibited by spikelet fertility, kernel length, days to panicle initiation. Days to maturity, number of unfilled grains per panicle, test weight, days to 50 per cent flowering, panicle length, number of grains per panicle, number of effective tillers per plant. These characters have also been identified as major direct contributors towards grain yield in rice by earlier workers, Singh *et al*. (2019), Parimala *et al.* (2020), Saran *et al.* (2023).

The direct effect of length and breadth ratio, days to maturity, kernel breadth and plant height was substantial in a negative direction on grain yield per plant. The high positive indirect contribution towards grain yield per plant was exhibited by the number of effective tillers per plant, panicle length, days to maturity, days to 50 per cent flowering, test weight, and number of grains per panicle exerted substantial positive indirect effects on grain yield per plant via spikelet fertility. The indirect contribution of days to panicle initiation, kernel length, length and breadth ratio, panicle length, number of effective tillers per plant, day to maturity, days to 50 per cent flowering, plant height, on grain yield per plant per plant via kernel length was also high-order positive. Days to maturity, days to 50% flowering, spikelet fertility, panicle length, number of effective tillers, test weight, and number of grains per panicle had a considerable negative indirect effect on grain yield per plant via days to maturity. The remaining estimates of the indirect effects in the analysis were too high to be considered important. Sivasankar *et al* (2018), Kalyan *et al*. (2017), Kafi *et al.* (2021).

References

[1]. Bhati P. K., Singh S. K., Singh R., Dhurai S. Y., Sharma A. and Kumar V. (2015) Correlation and path analysis for yield and quality characters in rice (*Oryza sativa* L.). *Res. Environ. Life Sci.*8(2) 153- 156.

[2]. Dewey, D.R. and K.N. Lu (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal*, 51: 515-518.

[3]. Johnson, H.W., Robinson, H.F. and Comstock, R. E. (1955). Estimation of genetic and environmental variability in soybean. *Agro. J.,* 47: 314-318

[4]. Kalyan B., Radha Krishna K.V. and Rao L.V.S. (2017). Correlation Coefficient Analysis for Yield and its Components in Rice (*Oryza sativa* L.) Genotypes. *Int. J. Curr. Microbiol. App. Sci* 6(7): 2425-2430.

[5]. Kafi S. H., Abiodun E. A., Bunmi O., Kyung-Ho K. (2021) Correlation coefficient and path analyses of yield and yield-related traits of Korean double Haploid Rice for germplasm Improvement in Nigeria. *American Journal of Agriculture and Forestry* 9(3): 114- 121.

[6]. Kayastha P., Chand H, Barsha KC, Pandey B, Magar B. R, Bhandari J, Lamichhane P, Baduwa P. and Poudel M. R. (2022). Correlation coefficient and path analysis of yield and yield attributing characters of rice (*Oryza sativa* L.) genotypes under reproductive drought stress in the Terai region of Nepal. *Archives of Agriculture and Environmental Science* 7(4): 564-570.

[7]. Ogunbayo S. A., Sié M., Ojo D. K., Sanni K. A., Akinwale M. G., Toulou B., Shittu A., Idehen E. O., Popoola A. R., Daniel I. O. and Gregorio G. B. (2014) Genetic variation and heritability of yield and related traits in promising rice genotypes (*Oryza sativa* L.). *Journal of Plant Breeding and Crop Science.* 6(11), pp. 153-159

[8]. Patel J. R., Saiyad M. R., Prajapati K. N., Patel R. A., and Bhavani R. T. (2014). Research Note: Genetic variability and character association studies in rainfed upland rice (*Oryza sativa* L.). *Electronic Journal of Plant Breeding*, 5(3), 531- 537.

[9]. Parimala K, Raju CH S., Prasad AS H, Kumar S. S. and Reddy S. N (2020). Studies on genetic parameters, correlation and path analysis in rice (*Oryza sativa* L.). *Journal of Pharmacognosy and Phytochemistry*9(1): 414-417.

[10]. Robinson, H.F., R.E. Comstock and P.H. Harvey (1951). Genotypic and phenotypic correlations in wheat and their implications in selection. *Agronomy Journal*, 43: 282-287.

[11]. Saran D, Gauraha D, Sao A., Kumar V. and Sandilya R. K. (2023). Correlation and Path coefficient analysis for yield and yield attributing traits in Rice (*Oryza sativa* L.). *International Journal of Plant & Soil Science* 35, Page 94-101.

[12]. Searle, S. R. 1961. Phenotypic, genotypic and environmental correlations. Biometrics. 17(3): 474-480.

[13]. Singh A. K, Singh A. K, Tarkeshwar, Goldy A. and Maurya S. G. P. (2022). Analysis of Correlation and Path coefficients for Yield and its Attributes in CMS lines and Their F1's of Rice (*Oryza sativa* L.). *Biological Forum –An International Journal* 14(4): 19-23.

[14]. Singh R. K, Maurya CL, Kumar M, Lal K and Kumar A (2019) Character association and path coefficient Analysis for seed yield and quality traits in rice (*Oryza sativa* L.). *Journal of Pharmacognosy and Phytochemistry*; 8(3): 514-517.

[15]. Sivasankar R., B.G. Suresh, S. Ashish and T.R. Sudheer (2018). Correlation and Path Coefficient Analysis in Elite Germplasm of Rice (*Oryza sativa* L.) *Int. J. Curr. Microbiol. App. Sci* 7(7): 3454-3459.

[16]. Solomon, H., Dagne Wegary (2016). Phenotypic correlation and path coefficient analysis of yield and yield component in rice (*Oryza sativa L.*). *International Journal of Research & Review*.3.

Table-1: Phenotypic correlation coefficients among 16 agro-morphological, yield contributing characters and disease characters in rice (*Oryza sativa L.*)

Characters	**Days to panicle initiation (day)**	**ays to 50% owering (day)**	**Days to maturity (day)**	**Plant Height (cm)**	**Number of Effective Tillers/ plant**	**Panicles Length (cm)**	**mber of grains/ panicle (Nos)**	**Number Of unfilled grains/ panicle (Nos)**	**Spikelet fertility (%)**	**Test weight (g)**	**Kernel length (mm)**	**Kernel breadth (mm)**	**Length/ Breadth ratio**	Disease lesion length (cm)	**Disease ratting**	**Grain yield /plant**
Days to panicle initiation (days)	1.000	0.998**	0.995**	0.913**	0.938**	0.938**	0.799**	0.737**	0.948**	0.808**	0.8108**	0.900**	0.690**	0.698**	0.765**	0.867**
Days to 50% flowering (days)		1.000	0.996**	0.915**	0.945**	0.943**	0.805**	0.741**	0.955**	0.819**	0.823**	0.902**	0.7043**	0.692**	0.768**	0.873**
Days to maturity (day)			1.000	0.923**	0.957**	0.959**	0.806**	0.752**	0.968**	0.838**	0.847**	0.912**	0.729**	0.709**	0.781**	0.883**
Plant Height (cm)				1.000	0.880**	0.919**	0.712**	0.681**	0.907**	0.800**	0.807**	0.884**	0.676**	0.663**	0.745**	0.776**
Number of effective tillers/ plant					1.000	0.966**	0.819**	0.771**	0.976**	0.871**	0.894**	0.883**	0.808**	0.698**	0.779**	0.901**
Panicles length (cm)						1.000	0.799**	0.773**	0.975**	0.882**	0.914**	0.898**	0.817**	0.720**	0.802**	0.887**
Number of grains/panicle (Nos)							1.000	0.772**	0.825**	0.620**	0.678**	0.699**	0.633**	0.558**	0.628**	0.815**
Number of unfilled ins/panicle (Nos)								1.000	0.732**	0.670**	0.771**	0.680**	0.725**	0.495**	0.598**	0.758**
Spikelet fertility (%)									1.000	0.879**	0.906**	0.904**	0.811**	0.726**	0.808**	0.907**
Test weight (g)										1.000	0.910**	0.868**	0.771**	0.619**	0.716**	0.828**
Kernel length (mm)											1.000	0.815**	0.929**	0.6309**	0.740**	0.837**
Kernel breadth (mm)												1.000	0.582**	0.689**	0.767**	0.837**
Length/Breadth ratio													1.000	0.5417**	0.637**	0.735**
Disease hight(cm)														1.000	0.933**	0.632**
Disease rating scale															1.000	0.697**

Table 2: Direct and Indirect Effect among 16 agro-morphological, yield contributing characters and disease characters in rice (*Oryza sativa L.*)

Characters	**Days to panicle initiation (day)**	**ays to 50% owering (day)**	**Days to maturity (day)**	**Plant Height (cm)**	**Number of Effective Tillers/ plant**	**Panicles Length (cm)**	**mber of grains/ panicle (Nos)**	**Number Of unfilled grains/ panicle (Nos)**	**Spikelet fertility (%)**	**Test weight (g)**	**Kernel length (mm)**	**Kernel breadth (mm)**	**Length/ Breadth ratio**	Disease lesion length (cm)	**Disease rating**	**Grain yield /plant**
Days to panicle initiation (days)	**0.403**	0.402	0.401	0.368	0.378	0.378	0.322	0.297	0.382	0.326	0.327	0.363	0.278	0.282	0.309	0.867**
Days to 50% flowering (days)	0.085	**0.085**	0.085	0.078	0.080	0.080	0.068	0.063	0.081	0.070	0.070	0.077	0.060	0.059	0.065	0.873**
Days to maturity (day)	-0.543	-0.543	**-0.545**	-0.503	-0.522	-0.523	-0.44	-0.410	-0.528	-0.457	-0.462	-0.498	-0.398	-0.387	-0.425	0.883**
Plant Height (cm)	-0.283	-0.284	-0.286	**-0.310**	-0.273	-0.285	-0.220	-0.211	-0.281	-0.248	-0.250	-0.274	-0.209	-0.205	-0.231	0.7762**
Number of effective tillers/plant	0.040	0.041	0.041	0.038	**0.043**	0.042	0.035	0.033	0.042	0.038	0.039	0.038	0.035	0.030	0.034	0.901**
Panicles length (cm)	0.065	0.065	0.066	0.063	0.067	**0.069**	0.055	0.053	0.067	0.061	0.063	0.062	0.056	0.05	0.055	0.887**
Number of grains/panicle (Nos)	0.053	0.053	0.053	0.047	0.054	0.053	**0.066**	0.051	0.054	0.041	0.044	0.046	0.041	0.037	0.041	0.815**
nber of unfilled grains/panicle (Nos)	0.192	0.192	0.195	0.177	0.200	0.201	0.201	**0.260**	0.190	0.174	0.200	0.177	0.188	0.128	0.155	0.758**
Spikelet fertility (%)	1.173	1.182	1.198	1.122	1.208	1.206	1.020	0.905	**1.237**	1.087	1.120	1.118	1.003	0.898	0.999	0.907**
Test weight (g)	0.129	0.131	0.134	0.128	0.139	0.141	0.099	0.107	0.140	**0.160**	0.146	0.139	0.123	0.099	0.114	0.828**
Kernel length (mm)	0.58	0.588	0.606	0.578	0.639	0.653	0.485	0.551	0.648	0.651	**0.715**	0.583	0.665	0.451	0.529	0.837**
Kernel breadth (mm)	-0.419	-0.420	-0.425	-0.412	-0.411	-0.418	-0.325	-0.317	-0.421	-0.404	-0.380	**-0.466**	-0.271	-0.321	-0.357	0.837**
Length/Breadth ratio	-0.527	-0.538	-0.558	-0.516	-0.618	-0.624	-0.484	-0.554	-0.620	-0.590	-0.711	-0.445	**-0.764**	-0.414	-0.487	0.735**
Disease lesion length (cm)	0.113	0.112	0.115	0.107	0.113	0.116	0.090	0.080	0.117	0.100	0.102	0.111	0.087	**0.162**	0.151	0.632**
Disease rating scale	-0.195	-0.196	-0.199	-0.190	-0.199	-0.204	-0.160	-0.152	-0.206	-0.182	-0.189	-0.196	-0.162	-0.238	**-0.255**	0.697**

Residual effect: 0.3477