The Pharma Innovation Journal 2021; 10(12): 199-201

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(12): 199-201

www.thepharmajournal.com
Received: 10-10-2021
Accepted: 16-11-2021

P Ram Prabhu Naik
Agricultural College, Bapatla, Andhra Pradesh, India

BNVSR Ravi Kaumar
Regional Agricultural Research Station, Maruteru, Andhra Pradesh, India

J Dayal Prasad Babu
Agricultural College, Bapatla, Andhra Pradesh, India

V Srinivasa Rao
Agricultural College, Bapatla, Andhra Pradesh, India

Corresponding Author:
BNVSR Ravi Kaumar
Regional Agricultural Research Station, Maruteru, Andhra Pradesh, India

Genetic variability and path coefficient analysis in restorers of rice (*Oryza sativa* L.)

P Ram Prabhu Naik, BNVSR Ravi Kaumar, J Dayal Prasad Babu and V Srinivasa Rao

Abstract
A study was undertaken to find out the genetic variability, heritability, genetic advance and path coefficient analysis for grain yield and yield traits of rice restorers. High PCV and GCV were observed for number of unfilled grains per panicle (76.42% and 55.38%) and pollen sterility (52.20% and 51.29%). High heritability coupled with high genetic advance as per cent of mean was observed for plant height (91% and 22.01%), number of ear bearing tillers per plant (62% and 26.22%), pollen sterility (96% and 103.81%), number of filled grains per panicle (64% and 30.35%) and single plant yield (93% and 79.98%). The high estimates of heritability coupled with moderate genetic advance as per cent of mean was observed for days to 50% flowering (94% and 13.40%) and days to maturity (95% and 10.14%). High heritability coupled with low genetic advance was observed for traits panicle length. Path coefficient analysis revealed plant height (0.1714 and 0.1276), number of ear bearing tillers per plant (0.1585 and 0.2222) and panicle length (0.1285 and 0.0461) showed direct positive effect towards yield and positive correlation with yield at both the levels.

Keywords: Genetic variability, heritability, genetic advance, path coefficient analysis, restorers, rice

Introduction
Rice is a cereal crop belongs to genus *Oryza* of family Poaceae. The association of different characters was essential to determine their contribution towards yield. The variability in the breeding material is extremely important in the selection of superior plant types where selection is based not only on yield but also on its component traits. Genetic variability is the prime requirement for breeding programme. An understanding of the nature and magnitude of genetic variation present in the germplasm lines and cultivated varieties is necessary before initiating a breeding programme aiming to develop high yielding varieties. Plant breeders commonly select for yield components which indirectly increase yield. Genetic parameters such as Genotypic Coefficient of Variation (GCV) and Phenotypic Coefficient of Variation (PCV) are useful in detecting the amount of variability present in the germplasm Idris *et al*., (2012). Heritability (h^2) of a trait is important in determining its response to selection. It was found out earlier that genetic improvement of plants for quantitative traits requires reliable estimates of heritability in order to plan an efficient breeding program.
Path coefficient analysis partitions total correlation into direct and indirect effect by path coefficient analysis helps in making the selection more effective. Path analysis establishes the extent of association between yield and its components and also brings out relative importance of their direct and indirect effects, thus giving an obvious understanding of their association with grain yield. Keeping in view the above facts, the present investigation was undertaken to know variability and path coefficient analysis among yield and its contributing characters in 52 elite restorers for ten quantitative characters.

Material and Methods
Fifty two genotypes of rice were grown in randomized block design with two replications during *kharif*, 2016 at Regional Agricultural Research Station, Maruteru, West Godavari district of Andhra Pradesh, India.
Each genotype had 4 rows with spacing of 20×15 cm in the layout of RBD with 2 replications. Twenty five day's old seedlings were transplanted in 2 m row length. Fertilizer dose of 100 kg N +50 kg P_2O_5 + 50 kg K_2O per hectare, other recommended package of practices and plant protection measures were adopted to raise the crop healthy.

Observations on ten randomly selected plants were recorded for the characters *viz*. days to fifty per cent flowering, days to maturity, plant height (cm), number of ear bearing tillers per plant, pollen sterility (%), panicle length (cm), number of filled grains per panicle, number of unfilled grains per panicle, spikelet fertility (%) and single plant yield (g).

Analysis of variance was done by method suggested by Panse and Sukhatme (1985) [10]. Genotypic and phenotypic coefficient of variation, heritability and genetic advance were studied as per the standard procedures (Falconer, 1964, Allard, 1960 Lush, 1940 and Johnson *et al.* 1955) [3, 1, 7, 5] respectively. Path coefficient analysis was determined by Dewey and Lu (1959) [2].

Results and Discussion

Analysis of variance showed the significant difference among genotypes for all the characters studied (Table 1) indicating presence of variability in the restorers. Estimates of genetic parameters like Genetic Coefficient of Variance (GCV), Phenotypic Coefficient of Variance (PCV), heritability, genetic advance and genetic advance as per cent of mean were studied (Table 2).

High PCV and GCV were observed for number of unfilled grains per panicle (76.42% and 55.38%) and pollen sterility (52.20% and 51.29%) and single plant yield (41.66% and 40.22%) indicates high variability among the lines under study for these traits. The results are in agreement with the previous research findings of Shekawat *et al.* 2015 [11] and Sridhar *et al.* 2016 [12].

High estimates of heritability along with high genetic advance as per cent of mean were observed for plant height (91% and 22.01%), number of ear bearing tillers per plant (62% and 26.22%), pollen sterility (96% and 103.81%), number of filled grains per panicle (64% and 30.35%), and single plant yield (93% and 79.98%) which finds support from previous results (Nayak *et al.* 2016) [9]. It appeared that the above mentioned characters might exhibit predominance of additive gene effects; hence selection for these characters would be effective for the genetic improvement of yield.

The both genotypic and phenotypic correlation coefficients were partitioned using path analysis to find out the direct and indirect effects of yield contributing traits towards grain yield (Table 3) which reveals that plant height (0.2799/0.2694) has highest direct effect on yield followed by number of ear bearing tillers per plant (0.2606/0.1897), panicle length (0.1783/0.1640) and number of filled grains per panicle (0.2791/0.1960). The observed positive direct effect of various traits on grain yield was also supported by earlier workers *viz.*, Nayak *et al.* 2016 [9] and Kishore *et al.* 2015 [6]. This may indicate that direct selection of these characters is likely to be effective in increasing grain yield. The estimates of genotypic and phenotypic path coefficient values were presented in the Table. 3.

In the present study, the results also revealed that high residual effect for both phenotypic (0.88%) and genotypic (0.8217%) path coefficients was recorded, indicating that some other factors which were not been considered in the study, need to be included in the analysis to explain total variation in yield. Similar findings was found by Mojumder *et al.* 2013 [8], (R=76.6%) and Tejaswini *et al.* 2016 [13], (R=77.1%).

Table 1: Analysis of variance (mean sum of squares) for 10 characters for 52 genotypes of rice (*Oryza sativa* L.)

Source of variations	d. f.	Days to 50% flowering	Days to maturity	Number of ear bearing tillers per plant	Plant height (cm)	Panicle length (cm)	Pollen sterility (%)	No.of filled grains per panicle	No.of unfilled grains per panicle	Spikelet fertility (%)	Grain yield per plant (g)
Mean sum of squares											
Replications	1	5.08	6.50	0.77	2.10	5.08	20.16	1447.53	258.61	6.35	2.23
Genotypes	51	86.77**	83.84**	6.07**	120.52**	3.71**	220.52**	7299.86**	844.45**	55.80**	228.10**
Error	51	2.61	2.16	1.42	14.08	0.92	3.87	1576.49	262.96	22.32	8.04

*Significant at 5% level

**Significant at 1% level

Table 2: Estimates of genetic variability parameters for yield and yield components in rice (*Oryza sativa* L.)

S. No.	Character	Range		Mean	Variability parameters (%)		h^2 (bs) (%)	GAM (%)
		Min.	Max.		PCV	GCV		
1	Days to 50% flowering	84	115	96.74	6.91	6.70	94	13.40
2	Days to maturity	114	145	126.40	5.18	5.05	95	10.14
3	Plant height (cm)	87	141.5	112.69	11.63	11.15	91	22.01
4	Number of ear bearing tillers per plant	6.5	14.5	9.43	20.53	16.17	62	26.22
5	Panicle length (cm)	22.25	28.30	25.41	5.98	4.64	60	7.43
6	Pollen sterility (%)	4	39.90	20.29	52.20	51.29	96	103.81
7	Number of filled grains per panicle	187	336.00	291.50	22.85	18.35	64	30.35
8	Number of unfilled grains per panicle	8	110.5	30.78	76.42	55.38	52	82.67
9	Spikelet fertility (%)	72	97.65	90.61	6.89	4.51	42	6.09
10	Single plant yield (g)	10.4	49.6	26.07	41.66	40.22	93	79.98

Table 3: Path coefficients of yield and yield components of rice (*Oryza sativa* L.)

S. No.	Characters		Days to 50% flowering	Days to maturity	Plant height (cm)	Number of ear bearing tillers per plant	Panicle length (cm)	Pollen sterility (%)	Number of filled grains per panicle	Number of unfilled grains per panicle	Spikelet fertility (%)
1.	Days to 50% flowering	P	-0.0174	-0.0168	-0.0017	-0.0004	0.0034	-0.0021	0.0027	-0.0038	0.0041
		G	-0.6117	-0.6115	-0.0698	-0.0125	0.1677	-0.0739	0.1325	-0.1970	0.2337
2.	Days to maturity	P	0.0524	0.0542	0.0049	-0.0003	-0.0103	0.0068	-0.0079	0.0086	-0.0091
		G	0.5788	0.5790	0.0560	-0.0116	-0.1803	0.0745	-0.1374	0.1542	-0.1893
3.	Plant height (cm)	P	0.0171	0.0156	0.1714	0.0357	0.0327	-0.0176	-0.0311	0.0219	-0.0294
		G	0.0146	0.0123	0.1276	0.0279	0.0250	-0.0140	-0.0324	0.0125	-0.0245
4.	Number of ear bearing tillers per plant	P	0.0037	-0.0008	0.0330	0.1585	-0.0001	0.0117	-0.0120	-0.0126	0.0095
		G	0.0046	-0.0045	0.0486	0.2222	-0.0039	0.0173	-0.0426	-0.0247	0.0112
5.	Panicle length (cm)	P	-0.0251	-0.0244	0.0245	-0.0001	0.1285	-0.0145	0.0254	-0.0023	0.0072
		G	-0.0126	-0.0143	0.0090	-0.0008	0.0461	-0.0074	0.0077	-0.0015	0.0006
6.	Pollen sterility (%)	P	-0.0256	-0.0274	0.0222	-0.0159	0.0245	-0.2165	-0.0304	0.0072	-0.0221
		G	-0.0158	-0.0169	0.0144	-0.0102	0.0211	-0.1309	-0.0235	0.0062	-0.0209
7.	Number of filled grains per panicle	P	-0.0094	-0.0089	-0.0111	-0.0046	0.0120	0.0085	0.0609	0.0047	0.0124
		G	-0.0838	-0.0918	-0.0983	-0.0742	0.0650	0.0694	0.3869	0.0677	0.0428
8.	Number of unfilled grains per panicle	P	-0.1630	-0.1195	-0.0962	0.0599	0.0136	0.0251	-0.0583	-0.7533	0.7073
		G	-0.6396	-0.5292	-0.1945	0.2211	0.0626	0.0942	-0.3476	-1.9866	1.8755
9.	Spikelet fertility (%)	P	0.1704	0.1201	0.1224	-0.0431	-0.0402	-0.0730	-0.1453	0.6712	-0.7149
		G	0.7691	0.6583	0.3870	-0.1013	-0.0249	-0.3206	-0.2227	1.9005	-2.0132
10.	Single plant yield (g)	P	0.0030	-0.0079	0.2694	0.1897	0.1640	-0.2715	-0.1960	-0.0583	-0.0349
		G	0.0034	-0.0185	0.2799	0.2606	0.1783	-0.2914	-0.2791	-0.0686	-0.0841
	Partial R^2	P	-0.0001	-0.0004	0.0462	0.0301	0.0211	0.0588	-0.0119	0.0439	0.0250
	Partial R^2	G	-0.0021	-0.0107	0.0357	0.0579	0.0082	0.0382	-0.1080	0.1362	0.1693

Residual effect = 0.8217 (Genotypic path)
Residual effect = 0.8873 (Phenotypic path)
P: Phenotypic path coefficient
G: Genotypic path coefficient

Conclusion

Significant differences among the genotypes for all the characters studied indicating the presence of variability in the restorers. The high GCV, high heritability with high genetic advance as per cent of mean were observed for pollen sterility, number of unfilled grains per panicle and grain yield per plant. Similarly plant height (0.1714 and 0.1276), number of ear bearing tillers per plant (0.1585 and 0.2222) and panicle length (0.1285 and 0.0461) showed direct positive effect towards yield and positive correlation with yield at both the levels. Therefore, simultaneous improvement of grain yield is possible through selection of these traits.

References

1. Allard RW. *Principles of Plant Breeding*. John Wiley and Sons Inc., New York 1960, 485.
2. Dewey DR, Lu KH. A correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal 1959;51(9):515-518.
3. Falconer DS. *An Introduction to Quantitative Genetics.* Oliver and Boyd, Edinburgh, London 1964, 312-324.
4. Idris AE, Mohammed KA. Estimation of genetic variability and correlation for grain yield components in rice (*Oryza sativa* L.). Global Journal of Plant Ecophysiology 2013;3(1):1-6.
5. Johnson HW, Robinson HF, Comstock RE. Estimation of genetic and environmental variability in soybean. Agronomy Journal 1955;47:314-318.
6. Kishore NS, Srinivas T, Nagabhushanam U, Pallavi M, Sameera SK. Genetic variability, correlation and path analysis for yield and yield components in promising rice (*Oryza sativa* L.) genotypes. SAARC Journal of Agriculture 2015;13(1):99-108.
7. Lush JL. Intra-sire correlation and regression of offspring in rams as a method of estimating heritability of characters. Proceedings of American Society of Animal Production 1940;33:292-301.
8. Majumder RR, Roy RK, Kader MA, Aditya TL, Ansari A. Variability, correlation and path analysis in maintainer lines of aromatic rice for out crossing traits. Bangladesh journal of crop science 2013;25:139-14.
9. Nayak R, Singh VK, Singh AK, Singh PK. Genetic variability, character association and path analysis of rice genotypes. Annals of Plant and Soil Research 2016;18(2):161-164.
10. Panse VG, Sukhatme PV. *Statistical Methods for Agricultural Workers*. Indian Council of Agricultural Research, New Delhi 1985, 242-246.
11. Shekawat HVS, Singh RP, Yashpal. Studies on variability, heritability and genetic advance in rice (*Oryza sativa* L.) germplasm lines. Annals of Agri-Bio research 2015;20(1):22-25.
12. Sridhar TC, Dushyantha Kumar BM, Mani BR, Nishanth GK. Genetic diversity, variability and association analysis for yield traits in traditional rice *(Oryza sativa* L.*)* cultivars of southern Karnataka. *Green Farming*. 2016;7(4):774-778.
13. Tejaswini KLY, Srinivas M, Ravi Kumar BNVSR, Lal Ahamed M, Raju SK, Ramana RPV. Correation and path analysis studies of yield and its component traits in F_5 families of rice (*Oryza sativa* L.). IOSR Journal of Agriculture and Veterinary Science 2016;9(11):80-85.