International Journal of Plant & Soil Science

33(19): 113-123, 2021; Article no.IJPSS.73290
ISSN: 2320-7035

Genetic Variability Studies for Yield and Yield Related Attributes in Rice (*Oryza sativa* L.) Genotypes

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IJPSS/2021/v33i1930607
Editor(s):
(1) Dr. Muhammad Shehzad, The University of Poonch Rawalakot, Pakistan.
Reviewers:
(1) Kailash Chandra, Sri Karan Narendra Agriculture University, India.
(2) T. Raghavendra, Acharya N G Ranga Agricultural University, India.
(3) Dr. Manukonda Srinivas, Acharya N G Ranga Agricultural University, India.
Complete Peer review History: https://www.sdiarticle4.com/review-history/73290

Original Research Article

Received 27 June 2021
Accepted 07 September 2021
Published 14 September 2021

ABSTRACT

A set of twenty four rice genotypes including one check variety were grown to estimate study genetic variability, heritability, genetic advance, correlation and path coefficient for 13 quantitative characters, observation recorded to study the genetic variability parameters, correlation coefficient and path coefficient for yield and its attributing traits. High to moderate estimates of GCV and PCV were recorded for test weight followed by spikelets per panicle, grain yield per plant, flag leaf width, flag leaf length, tillers per hill, biological yield and panicles per hill. Grain yield indicated significant positive correlation with plant height followed by tillers per hill, panicles per hill, biological yield and harvest index in terms of phenotypic correlation coefficient whereas in terms of genotypic coefficient it showed positive and significant correlation with plant height, tillers per hill, panicles per hill, biological yield and harvest index. Path coefficient analysis showed positive significant direct effects on grain yield per hill were exhibited by plant height, tillers per hill and harvest index at genotypic level whereas it showed positive and significant direct effect for tillers per hill, flag leaf width, biological yield and harvest index at phenotypic level. Thus, these traits are identified as the efficient and potential for indirect selection for the improvement of rice productivity in the present experimental materials.

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Keywords: Correlation; GCV; heritability; path analysis; PCV; rice and variability.

1. INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important staple cereal food crop in the world and belongs to the genus Oryza of family Graminae (Poaceae). The genus includes 24 species out of which 22 are wild and two viz., *Oryza sativa* and *Oryza glaberimma* are cultivated. The basic chromosomes number (n) of the genus *Oryza sativa* is 12 (2n=24). The cultivated varieties of Oryza sativa grouped in to three sub species, Indica, Japonica, and Javanica. Rice (*Oryza sativa* L.) is one of the staple cereal crops of the world and it is one of the main sources of carbohydrate for nearly one half of the world population. It meets the calorie requirement of 50 percent of the population and provides livelihood to 160 million of rural poor. Santha and Karthikeyan, [1]. 'Rice is life' was the theme of International year of rice 2004 denoting its overwhelming importance as an item of food and commerce Pandey and Anurag, [2]. Globally, rice is cultivated now in 162.41 million hectares with annual production of around 728 million tones and average productivity of 4.65 tonnes/ha (USDA-2018). Asia is considered to be 'rice bowl' of the world, and it produces and consumes more than 90% of world rice. In India, rice is staple food of 65% of the total population. In India, rice is grown in 44.78 million ha, the production level is 115.65 million tonnes and the productivity is about 2.7 tonnes/ha during 2018-19. It is grown over an area of 3.7 million hectares with an average productivity of 1.3 tons per hectare in 2017. Rice is the major crop in Uttar Pradesh and is grown in about 5.91 million hectares (accounting for 13.28% of entire area).

Genetic variability is the foremost important breeding tool in order to break yield stagnation and developing high yielding varieties. Genetic variability refers to the presence of difference among the individuals of the plant population. The large spectrum of genetic variability in segregating population depends on the amount of the genetic variability among genotypes and offer better scope for selection. The magnitude of heritable variation in the traits studied has immense value in understanding the potential of the genotype for further breeding programme. Variability results due to difference either in the genetic constitution of the individuals of a population or in the environment in which they are grown.

Yield is a complex character, which is influenced by several quantitative traits and is governed by polygenes. Application of biometrical techniques in plant breeding has led to the greater understanding of genetics of quantitative characters and proved to be extremely useful to the plant breeder for systematic genetic analysis.

Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone. Hence knowledge about genetic advance coupled with heritability is most useful. Character exhibiting high heritability may not necessarily give high genetic advance. High heritability should be accompanied with high genetic advance to arrive more reliable conclusion. Expected genetic advance as per cent of mean indicates the mode of gene action in the expression of a trait, which helps in choosing an appropriate breeding method [3].

A thorough knowledge of nature and magnitude of genetic variability and association of characters in a crop species is a pre-requisite for a successful breeding programme. Information on direct and indirect effects contributed by each character towards yield will be an added advantage in aiding the selection process.

Correlation is the measure of the mutual relationship between two variables. The study of correlations may help the plant breeder to know how the improvement of one character will bring simultaneous improvement in other characters. Path coefficient analysis is a standardized regression coefficient and measures the direct influence of one variable upon the other. Direct selection for yield is not a reliable approach since it is influenced by the environment. Therefore, it is essential to identify the component characters through which yield can be improved. Selection would be more effective for the trait, which has got high genetic advance and high correlation with grain yield. The use of correlation coefficient is to establish extent of association between yield and yield component and other character, which are having decisive role in influencing the yield**.**

2. MATERIALS AND METHODS

The experimental material for present investigation consists of twenty four genotypes including one check variety **(NDR 359)** was carried out at the Field Experimentation Centre of

Department of Genetics and Plant Breeding, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, U.P. during **kharif** 2020. The soil of experimental site was clay loamy mixed with pH ranging from6 to 7. The land was prepared by two harrowing followed by puddling. The experiment was conducted in Randomized Block Design (RBD) with three replications. The genotypes were sown on nursery bed on 20th june 2020.Plant spacing between row to row and plant to plant is 20 × 15 cm^2.

In each replication and in each plot, selection of five plants are done randomly and tagged except the border plants to minimize border effects. All the 13 characters studied and recorded on five randomly selected plants except days to flowering and days to maturity. Grain weight of the rice were recorded with the help of physical balance.

3. RESULTS AND DISCUSSION

The analysis of variance for different yield related characters are presented in (Table 1). The analysis of variance revealed significant differences among all the 13 characters under study at 1% level of significance except for harvest index, which is significant at 5% level of significance. This indicates that the presence of significantly higher amount of genetic variability among the genotypes present in the investigation for all the yield related characters studied. The genotypic variance (σ 2 g) and phenotypic variance (σ 2 p) were obtained for different wide range of variance was observed for all the characters. The results revealed that magnitude of phenotypic variance was higher than genotypic variance for all the characters respectively. The highest variance (б2 g & б2 p) was recorded for spikelets per panicle, plant height, days to maturity, days to 50% flowering, flag leaf length, biological yield, test weight. While, moderate values were observed in grain yield per plant, harvest index and lowest genotypic variance and phenotypic variance was observed in panicle length, tillers per hill, panicles per hill and flag leaf width.

Indicating the existence of wide variability among the genotypes studied for these traits and the possibility of genetic improvement of these traits through selection. Further, high phenotypic variations for these traits were noticed to be composed of high genotypic variations and less of environmental variations, indicating the presence of high genotypic variability. Hence selection on the basis of phenotypic alone can be effective for improvement of these traits. The characters studied in the present investigation exhibited low, moderate and high phenotypic and genotypic coefficient of variation as proposed by Sivasubramaniam and Menon [4]. The GCV and PCV from present investigation are presented in (Table 2). Among the 13 quantitative characters, highest GCV were recorded for test weight and spikelets per panicle. Moderate GCV were recorded for grain yield per plant, flag leaf width, flag leaf length, tillers per hill, biological yield, panicles per hill and Low GCV were observed for plant height, panicle length, days to 50% flowering and days to maturity, harvest index. In genotypic coefficient variation similar results are reported by Ogunbayo et al. [5], Abdul et al. [6] for panicle length and harvest index respectively, Kishore et al. [7] for days to 50% flowering, plant height panicle length, test weight and grain yield per hill.

Among the 13 quantitative characters, highest PCV were recorded for test weight, spikelets per panicle. Moderate PCV were recorded for grain yield per plant, flag leaf width, flag leaf length, tillers per hill, biological yield, panicles per hill. Low PCV were observed for plant height, days to 50% flowering, panicle length, harvest index and days to maturity.

The highest heritability was observed for spikelets per panicle followed by, Test weight, grain yield per plant, flag leaf width, biological yield, tillers per hill, flag leaf length, panicles per hill, panicle length, plant height and days to 50% flowering respectively. Similar results are reported by Dinesh et al. [8]. Moderate heritability were observed for days to maturity. Lowest heritability were observed in harvest index. All the characters showed high to low heritability. Similar results are reported by Shiva et al. [9] for harvest index.

In the present study, high genetic advance was observed for spikelets per panicle and plant height. Moderate values of genetic advance was observed for days to 50% flowering, flag leaf length and biological yield. Lowest values of genetic advance was observed for test weight followed by, days to maturity, grain yield per plant, panicle length, tillers per hill, panicles per hill, harvest index, and flag leaf width. Highest genetic advance as per cent mean was recorded for test weight followed by, spikelets per panicle,

grain yield per plant, flag leaf width, flag leaf length, tillers per hill, biological yield and panicles per hill. Moderate genetic advance as per cent mean was recorded for plant height followed by, panicle length and days 50% flowering. Lowest genetic advance as per cent mean was observed for days to maturity and harvest index. High heritability coupled with high genetic advance as per cent mean was recorded for spikelets per panicle followed by, test weight, grain yield per plant, flag leaf width, biological yield, tillers per hill, flag leaf length, panicle per hill. High heritability coupled with moderate genetic advance as per cent mean was observed in panicle length, plant height, days to 50% flowering. High heritability coupled with lowest genetic advance as per cent mean was recorded for days to maturity followed by harvest index.

Grain yield per plant showed positive significant association with plant height, tillers per hill, panicles per hill, flag leaf length, flag leaf width, biological yield and harvest index at phenotypic level (Table 3) which indicated the strong association of these traits with the yield. Therefore, top priority should be given to these characters while making selection for yield improvement.

Table 1. Analysis of variance for 13 quantitative characters of rice

Source of Variations	Replicate	Treatments	Error	Mean	Range	CD 5%	CV
DF	2	23	46				
Days to 50% flowering	2.292	193.970 ***	27.317	94.85	76.00-111.00	8.59	5.51
Plant Height (cm)	28.862	551.393 ***	72.634	131.02	104.73-157.40	14.01	6.50
No of Tillers/ hill	0.123	7.516 ***	0.52	10.03	7.33-13.15	1.19	7.20
No of panicles/ hill	0.016	4.840 ***	0.459	9.24	6.73-12.47	1.11	7.34
Panicle Length (cm)	0.435	14.355 ***	1.63	25.65	22.08-30.29	2.10	4.98
Flag Leaf Length (cm)	1.237	127.118 ***	8.928	40.20	27.65-57.13	4.91	7.43
Flag Leaf Width (cm)	0	0.195	0.009	1.46	0.99-1.88	0.16	6.57
No of Spikelets /Panicle	77.931*	5099.034 ***	84.945	181.11	115.66-251.67	15.15	5.09
Days to maturity	2.26	193.954 ***	56.293	124.85	106.00-141.00	12.33	6.01
Biological yield (g)	13.296	110.925 ***	6.07	40.51	32.90-53.60	4.05	6.008
Harvest Index (%)	1.958	23.521 *	13.197	45.57	41.21-52.39	5.97	7.97
Test weight (g)	0.183	79.659 ***	2.56	19.97	12.93-31.02	2.63	8.01

** and ** Indicate Significant at 5% and 1% level of significance.*

Table 2. Variability and genetic parameters for 13 quantitative characters in rice germplasm

S. No	Character	Vg	Vp	GCV	PCV	$_{h}2$ (bs) (%)	GA	GA as % mean
1.	**Days To 50% Flowering**	55.55	82.86	7.858	9.59	67.00	12.57	13.25
2.	**Plant Height (Cm)**	159.58	232.22	9.64	11.63	68.70	21.57	16.46
3.	**Flag Leaf Length (Cm)**	39.39	48.32	15.61	17.29	81.50	11.67	29.04
4.	**Flag Leaf Width (Cm)**	0.062	0.071	17.047	18.26	87.10	0.47	32.76
5.	**Number of Tillers Per Hill**	2.33	2.85	15.23	16.84	81.80	2.84	28.37
6.	**Number of Panicles Per Hill**	1.46	1.91	13.08	14.99	76.10	2.17	23.50
7.	**Panicle Length**	4.24	5.87	8.03	9.44	72.20	3.60	14.06
8.	**Number of Spiklets Per Panicle**	1671.36	1756.30	22.57	23.14	95.20	82.15	45.36
9.	**Days to Maturity**	45.88	102.18	5.42	8.09	44.90	9.35	7.49
10.	**Biological Yield**	34.952	41.02	14.59	15.81	85.20	11.24	27.75
11.	**Harvest Index (%)**	3.442	16.63	4.07	8.95	20.70	1.73	3.81
12.	**Test Weight**	25.69	28.26	25.38	26.62	90.90	9.95	49.87
13.	**Grain yield per hill**	11.09	12.57	18.01	19.175	88.20	6.44	34.84

Table 3. Phenotypic correlation coefficient for yield and its related traits in rice

	DF 0%	PH (cm)	NTH	NPH	PL (cm)	FLL (cm)	FLW (cm)	NSP	DM	BY (g)	HI (%)	TW (g)	GY/hill (g)
DF 50 %	1.0000	-0.0622	0.0160	0.0744	-0.1212	-0.2346 *	-0.2067	0.3285 **	0.9866***	-0.0635	-0.0525	-0.0921	-0.0780
PH (cm)		1.0000	0.0439	-0.0605	0.0324	0.6032 ***	0.4895 ***	-0.0187	-0.0637	0.2457 *	0.0973	-0.2796 *	0.248*
NTH			1.0000	0.9474 ***	-0.2658*	0.2888 *	0.5112 ***	-0.3690 **	0.0125	0.2915 *	0.1883	-0.1222	0.335**
NPH				1.0000	-0.2711*	0.1457	0.4347 ***	-0.3606 **	0.0649	0.1976	0.1850	-0.0967	0.257*
PL (cm)					1.0000	0.2058	0.0524	-0.1441	-0.0941	-0.0430	-0.3209 **	0.1491	-0.1860
FLL (cm)						1.0000	0.6295 ***	-0.2595 *	-0.2245	0.2879 *	0.0168	-0.3794 **	0.236*
FLW (cm)							1.0000	-0.0961	-0.1956	0.3248 **	0.1097	-0.2904 *	0.321**
NSP								1.0000	0.3034 **	0.1927	0.0336	-0.0632	0.1730
DM									1.0000	-0.0608	-0.0808	-0.0742	-0.0890
BY (g)										1.0000	0.1401	0.0262	0.886**
HI (%)											1.0000	0.1476	0.581**
TW (g)												1.0000	0.0900
GY/hill (g)													1.0000

** and ** Indicate Significant at 5% and 1% level of significance.*

DF50:Days to 50% flowering, PH: Plant height (cm), NTH:Number of tillers per hill, NPH: Number of panicles per hill,PL:Panicle length (cm), FLL:Flag leaf length (cm), FLW:Flag leaf width (cm), NSP:Number of spikelets per plant, DM: Days to maturity, BY:Biological yield per plant (g), HI:Harvest index (%), TW:Test weight (g), GY/hill :Grain yield per plant (g)

Table 4. Genotypic correlation coefficient for yield and its related traits in rice

	DF 50%	PH (cm)	NTH	NPH	PL (cm)	FLL (cm)	FLW(cm)	NSP	DM	BY (g)	HI (%)	TW (g)	GY/hill (g)
DF 50 %	1.0000	-0.0525	0.0315	0.1121	-0.255*	-0.244*	-0.2170	0.376**	0.963**	-0.0597	0.1716	-0.1637	-0.0076
PH (cm)		1.0000	-0.0562	-0.1624	0.1524	0.785**	0.581**	-0.0122	-0.0507	0.326**	0.0442	-0.322**	0.268*
NTH			1.0000	0.976**	-0.384**	0.349**	0.560**	-0.426**	0.0362	0.334**	0.404**	-0.1450	0.368**
NPH				1.0000	-0.441**	0.2177	0.464**	-0.421**	0.1251	0.2279	0.466**	-0.1033	0.296*
PL (cm)					1.0000	0.235*	0.0093	-0.2178	-0.293*	-0.1144	-0.600**	0.1684	-0.235*
FLL (cm)						1.0000	0.748**	-0.321**	-0.257*	0.349**	0.0582	-0.467**	0.289*
FLW (cm)							1.0000	-0.0912	-0.2312	0.357**	0.1809	-0.306**	0.330**
NSP								1.0000	0.407**	0.2062	0.1294	-0.0778	0.1948
DM									1.0000	-0.0628	0.244*	-0.1870	0.0070
BY (g)										1.0000	0.819**	0.0277	0.991**
HI (%)											1.0000	0.376**	0.887**
TW (g												1.0000	0.1090
GY/hill(g)													1.0000

** and ** Indicate Significant at 5% and 1% level of significance*

DF50:Days to 50% flowering, PH: Plant height (cm), NTH:Number of tillers per hill, NPH: Number of panicles per hill,PL:Panicle length (cm), FLL:Flag leaf length (cm), FLW:Flag leaf width (cm), NSP:Number of spikelets per plant, DM: Days to maturity, BY:Biological yield per plant (g), HI:Harvest index (%), TW:Test weight (g), GY/hill :Grain yield per plant (g),

Table 5. Direct and indirect effects of yield related traits on grain yield in 24 rice genotypes at phenotypic level.

	DF 50%	PH (cm)	NTH	NPH	PL (cm)	FLL(cm)	FLW (cm)	NSP	DM	BY (g)	HI (%)	TW (g)	GY/hill (g)
DF 50 %	**-0.0900**	0.0057	-0.0012	-0.0076	0.0139	0.0192	0.0177	-0.0276	-0.0752	0.0044	0.0027	0.0084	-0.0616
PH (cm)	0.0024	**-0.0383**	-0.0006	0.0027	-0.0034	-0.0221	-0.0182	-0.0002	0.0021	-0.0098	-0.0034	0.0097	0.2110
NTH	0.0017	0.0018	**0.1236**	0.1114	-0.0348	0.0341	0.0592	-0.0437	0.0012	0.0342	0.0226	-0.0137	0.326**
NPH	-0.0110	0.0092	-0.1179	**-0.1309**	0.0378	-0.0182	-0.0529	0.0465	-0.0126	-0.0270	-0.0187	0.0125	0.234*
PL (cm)	0.0012	-0.0007	0.0022	0.0023	**-0.0080**	-0.0017	-0.0004	0.0012	0.0009	0.0005	0.0024	-0.0011	-0.1723
FLL (cm)	0.0009	-0.0023	-0.0011	-0.0006	-0.0008	**-0.0040**	-0.0025	0.0011	0.0008	-0.0012	-0.0001	0.0015	0.240*
FLW (cm)	-0.0054	0.0131	0.0132	0.0112	0.0012	0.0174	**0.0277**	-0.0027	-0.0054	0.0088	0.0023	-0.0078	0.306**
NSP	-0.0005	0.0000	0.0006	0.0006	0.0002	0.0004	0.0002	**-0.0016**	-0.0005	-0.0003	0.0000	0.0001	0.1646
DM	0.0903	-0.0059	0.0011	0.0104	-0.0129	-0.0215	-0.0212	0.0306	**0.1081**	-0.0055	-0.0071	-0.0110	-0.0287
BY (g)	-0.0165	0.0869	0.0940	0.0701	-0.0193	0.0974	0.1077	0.0613	-0.0172	**0.3400**	0.0685	0.0044	0.869**
HI (%)	-0.0051	0.0148	0.0308	0.0242	-0.0499	0.0031	0.0143	0.0038	-0.0110	0.0340	**0.1688**	0.0298	0.527**
TW(g)	-0.0002	-0.0007	-0.0003	-0.0003	0.0004	-0.0010	-0.0007	-0.0002	-0.0003	0.0000	0.0005	**0.0027**	0.0848
GY/hill (g)	-0.0616	0.2110	0.326**	0.234*	-0.1723	0.240*	0.306**	0.1646	-0.0287	0.869**	0.527**	0.0848	**1.0000**

** and ** Indicate Significant at 5% and 1% level of significance.*

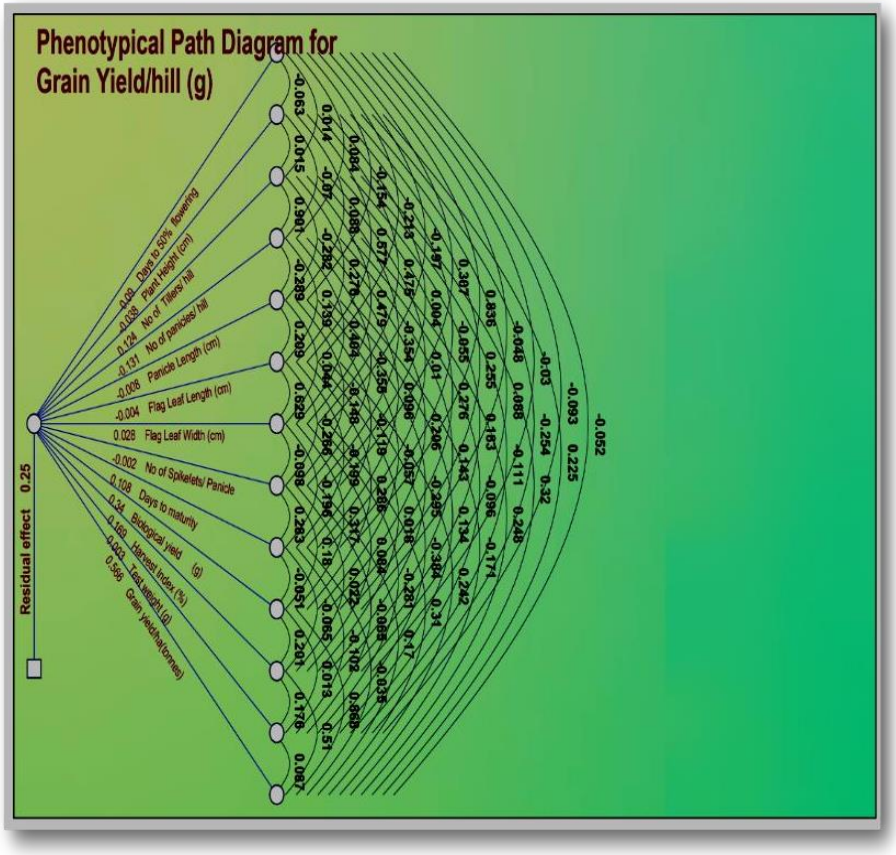
DF50:Days to 50% flowering, PH: Plant height (cm), NTH:Number of tillers per hill, NPH: Number of panicles per hill,PL:Panicle length (cm), FLL:Flag leaf length (cm), FLW:Flag leaf width (cm), NSP:Number of spikelets per plant, DM: Days to maturity, BY:Biological yield per plant (g), HI:Harvest index (%), TW:Test weight (g), GY/hill :Grain yield per plant (g),

Table 6. Direct and indirect effects of yield component traits on grain yield for 24 rice genotypes at Genotypic level.

	DF50%	PH(cm)	NTH	NPH	PL (cm)	FLL(cm)	FLW(cm)	NSP	DM	BY (g)	HI (%)	TW (g)	GY/hill(g)
DF 50 %	**-0.1839**	0.0101	-0.0052	-0.0184	0.0389	0.0454	0.0399	-0.0678	-0.1940	0.0119	-0.0127	0.0269	-0.0286
PH (cm)	-0.0111	**0.2027**	-0.0049	-0.0272	0.0216	0.1513	0.1140	-0.0039	-0.0116	0.0616	0.0134	-0.0644	0.272*
NTH	0.0443	-0.0377	**1.5684**	1.5386	-0.5519	0.5301	0.8727	-0.6541	0.0468	0.5137	0.4784	-0.2234	0.363**
NPH	-0.1249	0.1677	-1.2254	**-1.2492**	0.4943	-0.2528	-0.5806	0.5101	-0.1213	-0.2732	-0.4407	0.1275	0.292*
PL (cm)	-0.0531	0.0268	-0.0883	-0.0993	**0.2509**	0.0571	0.0053	-0.0503	-0.0565	-0.0237	-0.1193	0.0421	-0.2273
FLL (cm)	0.0791	-0.2392	-0.1083	-0.0648	-0.0729	**-0.3204**	-0.2311	0.0979	0.0811	-0.1074	-0.0126	0.1430	0.276*
FLW (cm)	0.0373	-0.0967	-0.0956	-0.0799	-0.0037	-0.1239	**-0.1718**	0.0158	0.0375	-0.0604	-0.0263	0.0523	0.331**
NSP	0.0504	-0.0026	-0.0570	-0.0558	-0.0274	-0.0418	-0.0126	**0.1367**	0.0519	0.0282	0.0125	-0.0102	0.1921
DM	0.1069	-0.0058	0.0030	0.0098	-0.0228	-0.0256	-0.0221	0.0385	**0.1014**	-0.0065	0.0089	-0.0148	-0.0373
BY (g)	0.0158	-0.0745	-0.0803	-0.0536	0.0232	-0.0822	-0.0863	-0.0505	0.0158	**-0.2452**	-0.1245	-0.0074	0.972**
HI (%)	0.0197	0.0188	0.0869	0.1005	-0.1354	0.0112	0.0436	0.0261	0.0249	0.1446	**0.2848**	0.0749	0.742**
TW(g)	0.0207	0.0450	0.0202	0.0144	-0.0238	0.0632	0.0431	0.0105	0.0206	-0.0043	-0.0372	**-0.1416**	0.1060
GY/hill (g)	-0.0286	0.272*	0.363**	0.292*	-0.2273	0.276*	0.331**	0.1921	-0.0373	0.972**	0.742**	0.1060	**1.0000**

** and ** Indicate Significant at 5% and 1% level of significance*

DF50:Days to 50% flowering, PH: Plant height (cm), NTH:Number of tillers per hill, NPH: Number of panicles per hill,PL:Panicle length (cm), FLL:Flag leaf length (cm), FLW:Flag leaf width (cm), NSP:Number of spikelets per plant, DM: Days to maturity, BY:Biological yield per plant (g), HI:Harvest index (%), TW:Test weight (g), GY/hill :Grain yield per plant (g).



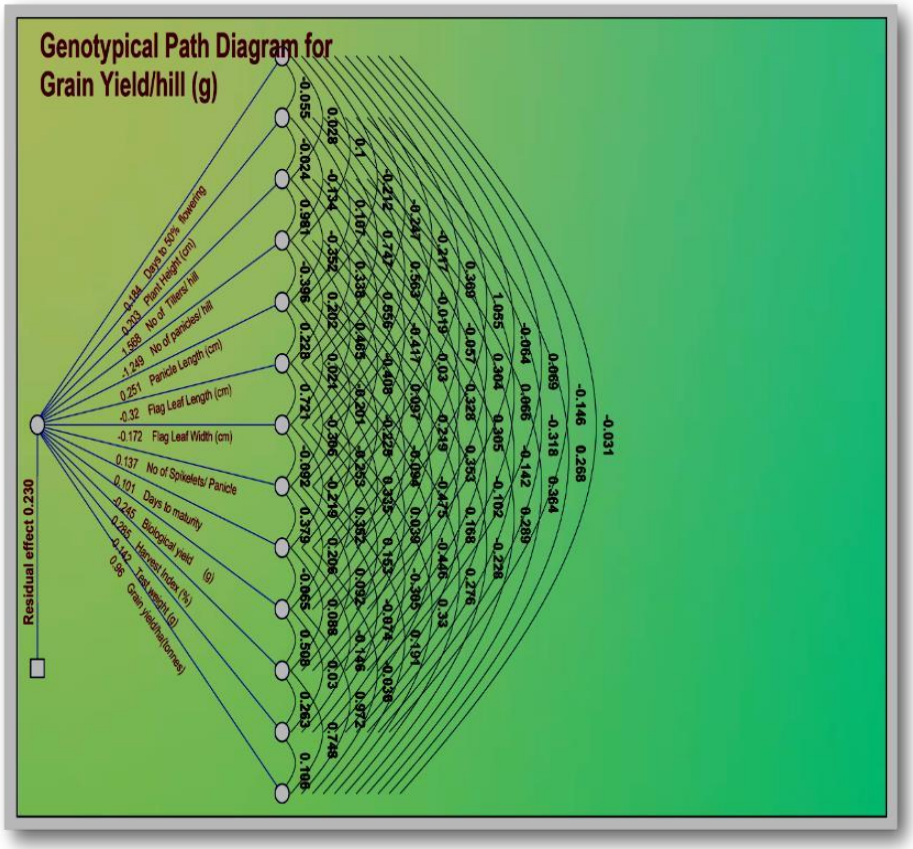


Fig. 1. Phenotypical Path Diagram for Grain Yield/hill (g)

Fig. 2. Genotypical Path Diagram for Grain Yield/hill (g)

The correlation among the yield and yield attributing characters revealed grain yield per plant was positive significantly associated with that plant height, tillers per hill, panicles per hill, flag leaf length, flag leaf width, biological yield and harvest index at genotypic level (Table 4).The genotypic correlations were also higher than phenotypic correlation values for almost all the characters indicating masking effect of environment on these traits. The character grain yield per plant showing highly significant positive correlation with plant height, tillers per hill, panicles per hill, flag leaf length, flag leaf width, biological yield and harvest index at both phenotypic and genotypic level. Correlations among the yield, yield attributing characters revealed phenotypic and genotypic correlations of similar directions and significance, in general. Indicating an increase in grain yield with an increase in these characters.

The maximum positive direct effect on tillers per hill, flag leaf width, days to maturity, biological yield, harvest index and test weight with grain yield per plant at phenotypic level (Table 5) and maximum positive direct effect of tillers per hill, spikelets per panicle, days to maturity, plant height, panicle length, and harvest index with grain yield per plant at genotypic level (Table 6). Path analysis revealed positive direct effect of tillers per hill, days to maturity and harvest index with grain yield per plant at both genotypic and phenotypic levels (Figs. 1 & 2). These characters may be given due importance during selection.

4. CONCLUSION

By considering the nature and extent of correlation coefficients and their direct and indirect effects, it can be concluded that improvement of rice crop for yield and its contributing traits could be brought through simultaneous selection for harvest index, days to maturity, plant height showed highest differences between GCV and PCV. High heritability coupled with high genetic advance as per cent mean was recorded for spikelets per panicle followed by, test weight, grain yield per plant, flag leaf width, biological yield, tillers per hill, flag leaf length, panicle per hill. Thus, these traits might be ranked as the most important component trait for seed yield per plant in breeding programme in rice.

ACKNOWLEDGEMENT

The author is very thankful to the advisor (Dr. G. M. Lal).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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