International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(2): 2327-2331

Received: 16-01-2018
Accepted: 19-02-2018

HR Patel
PG Scholar, Regional Rice Research Station, Navsari Agricultural University Vyara, Gujarat, India

VP Patel
Associate Research Scientist, Regional Rice Research Station, Navsari Agricultural University Vyara, Gujarat, India

PB Patel
Associate Research Scientist, Regional Rice Research Station, Navsari Agricultural University Vyara, Gujarat, India

AJ Rathod
PG Scholar, Regional Rice Research Station, Navsari Agricultural University Vyara, Gujarat, India

AG Pampaniya
PG Scholar, Regional Rice Research Station, Navsari Agricultural University Vyara, Gujarat, India

Correspondence
HR Patel
PG Scholar, Regional Rice Research Station, Navsari Agricultural University Vyara, Gujarat, India

Genetic variability, correlation and path analysis for grain yield and component traits in f_3 segregating population of rice (*Oryza sativa* L.)

HR Patel, VP Patel, PB Patel, AJ Rathod and AG Pampaniya

Abstract
The present study comprised of F_3 segregating progenies of two cross of one traditional landraces (Lalkada) and two high yielding varieties (IR-28 and Jaya) *viz.*, Cross I (IR-28 x Lalkada) and Cross II (Jaya x Lalkada) of rice were evaluated to assess the genetic variability, heritability and genetic advance, correlation and direct and indirect effects among yield and yield components. The progenies were evaluated during Summer-2016. The results corresponding to analysis of variance showed significant progeny mean square values for all the traits for all the F_3 progenies studied. The progenies of the both crosses had higher values of GCV and PCV for grain yield per plant and straw yield per plant indicating that there is great scope for improvement by applying selection on these traits in desirable direction. The progenies of both the crosses had high heritability coupled with high genetic advance as percent mean for grain yield per plant and straw yield per plant was observed. The correlation studies revealed that in both crosses panicle length, straw yield per plant and harvest index showed significant positive correlation with grain yield per plant. Path analysis revealed that straw yield per plant and harvest index had high positive direct effect on grain yield per plant.

Keywords: rice (*oryza sativa* l.), genetic variability, heritability and genetic advance, correlation and path coefficient

Introduction
Rice, the world's most important cereal crop, is the primary source of food and calories for about half of the mankind (Khush, 2005) [5]. Rice (*Oryza sativa* L., 2n=24) belongs to family Poaceae and subfamily Oryzoidae. It is believed to be originated in South East Asia. "Rice is life" was the famous theme of International Year of Rice, 2004 denoting it's over whelming importance as an item of food and commerce. Besides being the chief source of carbohydrate and protein, it also provides minerals and dietary fiber (Verma *et al*. 2006) [14]. It is also a good source of thiamine, riboflavin and niacin. Asia is considered to be "rice bowl" of the world, and it produces and consumes more than 90 per cent of world rice. India is the largest rice growing country, while China is the largest producer of rice. Chhattisgarh is known as "rice bowl" of India. Rice constitutes about 42 per cent of the total food grain production and 45 per cent of total cereal production of our country. In India, it is grown in 44.10 million hectares in diverse ecological conditions with an annual production of 105.5 million tonnes and productivity of 2391 kg/ha (Anonymous, 2016) [1]. In Gujarat, rice is cultivated on an area of 7.88 lakh hectares with total production of 16.36 lakh tonnes and productivity about 2076 kg/ha.

Genetic variability for economic traits is pre-requisite for any successful breeding programme. Rice is a self pollinated crop, the efforts of the breeder to evolve better yielding genotypes is mainly aimed at exercising selection in segregating generation. The selection within a segregating generation partly may fulfill the objective in improving polygenic character like yield. Generally direct selection for yield is not effective due to its low heritability; hence it is desirable to adopt indirect selection of component traits for yield improvements. The estimates of variability, heritabi1ity and genetic advance for the yield components and their correlations with yield have been considered to be of great importance. The genetic variability could be determined with the help of genetical parameters such as Genetic Coefficient of Variation (GCV), heritability estimates and genetic advance (GA). GCV indicates the relative degree of genetic variability existing for different characters in a population of genotypes. The heritability expresses the relative amount of heritable portion of the variation. However, the

heritability estimates along with genetic gain is more useful in selecting the best population individual. Furthermore, the study of character correlations is important to design appropriate selection strategy for genetic improvement in yield and other characters. Though these correlations provide information on the components on yield, they do not provide an exact picture of the cause and effect relationship. Thus, relative importance of direct and indirect effects of each of the component traits towards yield has to be understood to decide effective selection indices. In this context, the path co-efficient analysis technique (Wright, 1921; Dewey and Lu, 1959) [15, 3] is an important tool in the hands of plant breeder in partitioning the correlation coefficients into direct and indirect effects of the independent variables on dependent variable.

Material and Methods

The material for the present study consisted of two crosses of rice *viz.*, Cross I (IR-28 x Lalkada) and Cross II (Jaya x Lalkada). The 30 F_3 progenies each of the two crosses of rice were grown during Summer-2016. Thirty days old seedlings were transplanted in randomized block design replicated tries. Distances between hills and between rows were 20 cm and 15 cm respectively. Normal agronomic practices were followed throughout the crop growth period to obtain a good harvest. The observations were recorded on five randomly selected plants from each progeny row for the following thirteen characters *viz.*, days to 50% flowering, days to maturity, plant height(cm), panicle length(cm),productive tillers per plant, no. of gains per panicle, 100 grain weight (g), kernel length (mm), kernel breadth (mm), kernel L/B ratio, grain yield per plant (g), straw yield per plant (g) and harvest index (%). The Phenotypic and Genotypic Coefficients of Variability (PCV & GCV) were computed as per the methods of Burton and De vane (1953) [2]. For the estimation of broad sense heritability and Genetic advance as percent of mean, the method of Johnson *et al*. (1955) [4] was followed. The Phenotypic correlation coefficients and Path analysis were performed using the software INDOSTAT.

Result and Discussion

Analysis of variance revealed significant differences among F_3 progenies each of two crosses for all the traits studied (Table- 1 & 2). Genetic variability in both F_3 Populations (Table 3 & 4) indicated that, range of variation, a simple measure of variability was quite high for all the characters. Values of Phenotypic Coefficient of Variation (PCV) in both F_3 generations were higher than the Genotypic Coefficient of Variation (GCV) for the traits studied. The narrow difference between PCV and GCV observed for most traits was an indication of low environmental influence for traits under study. GCV and PCV estimates were classified as low (0-10%), moderate (10-20%) and high (>20%) as per Johnson *et al.* (1955) [4]. Accordingly, days to maturity, days to 50% flowering, panicle length, 100 grain weight, kernel length, kernel breadth, kernel L/B ratio in both crosses excluding moderate PCV observed for 100 grain weight, kernel L/B ratio in Cross II. Plant height, productive tillers per plant, no. of grains per panicle and harvest index showed moderate PCV and GCV for both the crosses except low GCV for plant height and harvest index in Cross I and low GCV and PCV for plant height in Cross II. High GCV and PCV were observed for grain yield per plant and straw yield per plant in Cross II excluding GCV for grain yield per plant. These results are in agreement with Shet *et al.* (2012) [13]. As per Robinson *et al.* (1949) [12], broad sense heritability estimates were categorized into low (0-30%), moderate (30-60%) and High (>60%). In both crosses, plant height, grain yield per plant, straw yield per plant and harvest index showed high heritability whereas days to maturity, productive tillers per plant, no. of grains per panicle and kernel L/B ratio showed moderate heritability in both populations. The estimates of Genetic advance as per cent of mean were classified as low (<10%), moderate (10-20%) & high (>20%) as suggested by Johnson *et al.* (1955) [4]. Except days to 50% flowering, days to maturity, kernel length and kernel breadth (Cross II) all the remaining traits *viz.*, plant height, panicle length, productive tillers per plant, no. of gains per panicle, 100 grain weight, kernel L/B ratio, grain yield per plant, straw yield per plant and harvest index depicted moderate to high genetic advance as per cent mean. Grain yield improvement being the primary concern in the present study, presence of high variability for the trait in both crosses is an indication of scope for selection. Also, high heritability coupled with highest genetic advance as per cent mean was shown by the trait suggests additive gene effect of the trait and effectiveness of selection. The results of the present study closely agree with the earlier reports in rice by Ramalingam *et al*. (1994) [11], Panwar *et al.* (2007) [9] and Shet *et al.* (2012) [13]. In order to understand the nature and magnitude of association between different quantitative traits, genotypic correlation was studied in both F_3 populations (Table 5 & 6). In both crosses, association of panicle length, no. of grains per panicle, kernel length, L/B ratio, straw yield per plant and harvest index showed significant positive correlation with grain yield per plant excluding no. of grains per panicle, kernel length, L/B ratio in Cross I. This is in agreement with the results of Shet *et al.* (2012) [13], Kiran *et al.* (2014) [6], Rajeshwari & Nadarajan (1994) [11], Krishna veni and Shobha Rani (2005) [7]. Path analysis (Table 7 & 8) indicated that in both F_3 populations of crosses IR-28 x Lalkada and Jaya x Lalkada, plant height, kernel length, straw yield per plant and harvest index had high positive direct effect on grain yield per plant. This is in accordance with the report of Rajeshwari and Nadarajan (2004) [10], Shet *et al.* (2012) [13], Nandeshwar *et al.* (2010) [8] about high positive direct effect of straw yield per plant and harvest index on grain yield. In both the crosses, kernel breadth and L/B ratio had negative direct effect on grain yield per plant. This is in accordance with the report of Nandeshwar *et al.* (2010) [8] and Shet *et al.* (2012) [13]. Hence selection based on straw yield per plant and harvest index would be most effective for grain yield improvement in these two populations of rice as these traits exerted highest direct effect and also indirect effect on grain yield.

Table 1: Analysis of variance for various characters in F_3 progenies of the cross IR28 X Lalkada

Sr. No.	Character	Mean square		
		Replication	Progenies	Error
	Degree of freedom	2	29	58
1	Days to 50% flowering	5.071	29.161**	7.429
2	Days to Maturity	8.510	36.881**	7.932
3	Plant height (cm)	38.658	257.434**	39.291

4	Panicle length (cm)	1.678	3.373**	1.390
5	Productive tillers per plant	1.794	5.512**	1.586
6	No. of grains per panicle	67.253	259.587**	49.591
7	100 grain weight (g)	0.013	0.031**	0.013
8	Kernel length (mm)	0.033	0.150**	0.079
9	Kernel breadth (mm)	0.004	0.036**	0.018
10	Kernel L/B ratio	0.021	0.107**	0.037
11	Grain yield per plant (g)	0.680	22.416**	1.747
12	Straw yield per plant (g)	5.496	32.571**	3.581
13	Harvest index (%)	6.088	54.531**	4.323

**- Significant at 1.0 per cent level of probability,
*- Significant at 5.0 per cent level of probability

Table 2: Analysis of variance for various characters in F_3 progenies of the cross Jaya x Lalkada

Sr. No.	Character	Mean square		
		Replication	Progenies	Error
	Degree of freedom	2	29	58
1	Days to 50% flowering	1.704	38.307**	6.611
2	Days to Maturity	7.550	32.562**	7.010
3	Plant height (cm)	70.851	397.854**	44.650
4	Panicle length (cm)	0.267	6.653**	0.456
5	Productive tillers per plant	0.746	4.166**	0.798
6	No. of grains per panicle	99.884	314.923**	71.557
7	100 grain weight (g)	0.010	0.176**	0.012
8	Kernel length (mm)	0.105	0.367**	0.080
9	Kernel breadth (mm)	0.021	0.087**	0.024
10	Kernel L/B ratio	0.001	0.279**	0.054
11	Grain yield per plant (g)	0.116	25.105**	1.428
12	Straw yield per plant (g)	0.100	59.712**	3.033
13	Harvest index (%)	0.551	61.938**	5.891

**- Significant at 1.0 per cent level of probability,
*- Significant at 5.0 per cent level of probability

Table 3: Estimation of genetic variability parameters for thirteen quantitative characters in F_3 progenies of cross IR-28 X Lalkada

Characters	Range	σ^2g	σ^2p	GCV (%)	PCV (%)	h^2 (b)	GAM
Days to 50% flowering	88.80-101.76	7.24	14.67	2.82	4.02	49.37	4.08
Days to Maturity	115.43-130	9.64	17.58	2.52	3.40	54.89	3.85
Plant height (cm)	76.24-105.16	72.71	112.00	9.41	11.68	64.92	15.63
Panicle length (cm)	18.74-23	0.66	2.05	3.94	6.95	32.23	4.61
Productive tillers per plant	8.50-15.50	1.30	2.89	10.06	14.97	45.20	13.94
No. of grains per panicle	59.37-103.10	69.99	119.58	10.26	13.42	58.53	16.18
100 grain weight (g)	2.15-2.51	0.0061	0.019	3.38	5.97	32.17	3.95
Kernel length (mm)	6.11-6.94	0.023	0.10	2.34	4.89	23.05	2.32
Kernel breadth (mm)	2.10-2.57	0.0061	0.023	3.42	6.77	25.49	3.55
Kernel L/B ratio	2.40-3.22	0.023	0.060	5.29	8.48	38.93	6.80
Grain yield per plant (g)	8.84-22.14	6.88	8.63	19.41	21.74	79.77	35.72
Straw yield per plant (g)	15.50-27.66	9.66	13.24	16.31	19.09	72.96	28.69
Harvest index (%)	32.82-51.83	16.73	21.05	9.87	11.07	79.47	18.12

σ^2g = Genotypic variance, σ^2p = Phenotypic variance, GCV = Genotypic Coefficient of Variance, PCV = Phenotypic Coefficient of Variance, h^2 (b) = Heritability (Broad sense), GAM = Genetic advance as per cent mean.

Table 4: Estimation of genetic variability parameters for thirteen quantitative characters in F_3 progenies of cross Jaya x Lalkada

Characters	Range	σ^2g	σ^2p	GCV (%)	PCV (%)	h^2 (b)	GAM
Days to 50% flowering	93.01-105.87	10.57	17.18	3.29	4.20	61.51	5.32
Days to Maturity	122.10-134.57	8.51	15.52	2.30	3.11	54.86	3.52
Plant height (cm)	74.37-115.63	117.73	162.38	11.29	13.26	72.50	19.80
Panicle length (cm)	18.76-25.19	2.06	2.52	6.57	7.26	81.90	12.26
Productive tillers per plant	7.63-11.83	1.12	1.92	11.14	14.58	58.45	17.55
No. of grains per panicle	68.54-114.07	81.12	152.67	9.23	12.66	53.13	13.86
100 grain weight (g)	1.77-2.91	0.05	0.07	9.85	10.87	82.10	18.40
Kernel length (mm)	5.84-7.31	0.095	0.17	4.72	6.40	54.46	7.18
Kernel breadth (mm)	2.09-2.77	0.020	0.044	6.10	8.92	46.76	8.59
Kernel L/B ratio	2.31-3.37	0.074	0.12	9.82	12.90	58.02	15.42
Grain yield per plant (g)	8.39-18.68	7.89	9.32	19.22	20.88	84.68	36.43
Straw yield per plant (g)	13.27-32.36	18.89	21.92	20.17	21.73	86.17	38.57
Harvest index (%)	37.71-50.94	18.68	24.57	10.67	12.24	76.03	19.17

σ^2g = Genotypic variance, σ^2p = Phenotypic variance, GCV = Genotypic Coefficient of Variance, PCV = Phenotypic Coefficient of Variance, h^2 (b) = Heritability (Broad sense), GAM = Genetic advance as per cent mean.

Table 5: Inter character correlation in F_3 progenies of the cross IR-28 x Lalkada in rice

Characters	DFF	DM	PH	PL	PTP	NGP	100GW	KL	KB	L/B ratio	SYP	HI	GYP
DFF	1.000	0.996**	0.172	0.534**	0.087	0.071	0.441**	-0.710**	0.367**	-0.558**	0.152	-0.437**	-0.242*
DM		1.000	0.190	0.432**	0.076	0.133	0.371**	-0.772**	0.433**	-0.621**	0.095	-0.340**	-0.201
PH			1.000	0.629**	-0.449**	0.321**	0.091	-0.453**	-0.009	-0.176	0.388**	-0.206	0.176
PL				1.000	-0.079	0.057	0.024	-0.648**	-0.348**	-0.027	0.826**	-0.470**	0.281**
PTP					1.000	-0.332**	0.366**	-0.228*	0.011	-0.116	-0.084	0.131	0.006
NGP						1.000	0.291**	-0.148	-0.165	0.051	0.069	0.070	0.148
100GW							1.000	-0.082	0.124	-0.150	0.372**	-0.214	0.130
KL								1.000	-0.806**	0.932**	0.034	0.029	0.048
KB									1.000	-0.965**	-0.236*	0.309**	0.070
L/B ratio										1.000	0.169	-0.169	-0.007
SYP											1.000	-0.339**	0.572**
HI												1.000	0.573**

DFF – Days to 50% flowering **PTP** – Productive tillers per plant **KB** – Kernel breadth (mm)
DM – Days to maturity **NGP** – No. of grains per panicle **GYP** – Grain yield per plant (g)
PH – Plant height (cm) **100GW** – 100 grain weight (g) **SYP** – Straw yield per plant (g)
PL – Panicle length (cm) **KL** – Kernel length (mm) **HI** – Harvest index (%)
**- Significant at 1.0 per cent level of probability, *- Significant at 5.0 per cent level of probability

Table 6: Inter character correlation in F_3 progenies of the cross Jaya x Lalkada in rice

Characters	DFF	DM	PH	PL	PTP	NGP	100GW	KL	KB	L/B ratio	SYP	HI	GYP
DFF	1.000	0.939**	-0.194	0.114	-0.130	0.069	-0.133	0.067	0.053	-0.017	0.106	-0.018	0.106
DM		1.000	-0.270**	0.111	-0.133	0.082	-0.118	0.152	-0.155	0.157	0.012	0.027	0.057
PH			1.000	0.376**	-0.384**	0.418**	-0.105	0.104	0.040	0.080	0.469**	-0.017	0.441**
PL				1.000	-0.224*	0.559**	-0.159	0.440**	-0.410**	0.474**	0.451**	0.037	0.495**
PTP					1.000	-0.088	-0.218*	-0.069	-0.026	-0.025	-0.147	0.045	-0.110
NGP						1.000	-0.190	0.400**	-0.509**	0.505**	0.663**	-0.052	0.619**
100GW							1.000	0.086	0.135	-0.022	0.272**	-0.383**	-0.083
KL								1.000	-0.635**	0.883**	0.306**	0.128	0.443**
KB									1.000	-0.921**	0.037	-0.387**	-0.373**
L/B ratio										1.000	0.155	0.292**	0.462**
SYP											1.000	-0.438**	0.547**
HI												1.000	0.508**

DFF – Days to 50% flowering **PTP** – Productive tillers per plant **KB** – Kernel breadth (mm)
DM – Days to maturity **NGP** – No. of grains per panicle **GYP** – Grain yield per plant (g)
PH – Plant height (cm) **100GW** – 100 grain weight (g) **SYP** – Straw yield per plant (g)
PL – Panicle length (cm) **KL** – Kernel length (mm) **HI** – Harvest index (%)
**- Significant at 1.0 per cent level of probability, *- Significant at 5.0 per cent level of probability

Table 7: A path coefficient analysis of component characters towards grain yield per plant in F_3 progenies of the cross IR-28 x Lalkada in rice

Characters	DFF	DM	PH	PL	PTP	NGP	100GW	KL	KB	L/B ratio	SYP	HI	Genotypic correlation with Grain yield per plant
DFF	-0.4306	-0.4290	-0.0742	-0.2301	-0.0376	-0.0305	-0.1900	0.3057	-0.1582	0.2405	-0.0653	0.1880	-0.242*
DM	0.4982	0.5001	0.0953	0.2163	0.0382	0.0665	0.1853	-0.3861	0.2164	-0.3106	0.0474	-0.1702	-0.201
PH	0.0098	0.0108	0.0567	0.0357	-0.0255	0.0182	0.0052	-0.0257	-0.0005	-0.0100	0.0220	-0.0117	0.176
PL	-0.0469	-0.0380	-0.0552	-0.0878	0.0069	-0.0050	-0.0021	0.0569	0.0306	0.0023	-0.0725	0.0413	0.281**
PTP	0.0035	0.0031	-0.0182	-0.0032	0.0406	-0.0135	0.0149	-0.0092	0.0005	-0.0047	-0.0034	0.0053	0.006
NGP	0.0016	0.0030	0.0072	0.0013	-0.0075	0.0225	0.0065	-0.0033	-0.0037	0.0011	0.0016	0.0016	0.148
100GW	-0.0326	-0.0274	-0.0067	-0.0017	-0.0271	-0.0215	-0.0739	0.0060	-0.0092	0.0111	-0.0275	0.0158	0.130
KL	-0.1117	-0.1214	-0.0713	-0.1019	-0.0358	-0.0233	-0.0128	0.1573	-0.1297	0.1466	0.0054	0.0046	0.048
KB	-0.0501	-0.0590	0.0013	0.0475	-0.0015	0.0225	-0.0169	0.1098	-0.1363	0.1315	0.03212	-0.0421	0.070
L/B ratio	0.1319	0.1466	0.0417	0.0063	0.0274	-0.0119	0.0355	-0.2201	0.2278	-0.2361	-0.0399	0.0400	-0.007
SYP	0.1442	0.0901	0.3687	0.7859	-0.0795	0.0660	0.3543	0.0324	-0.2247	0.1606	0.9513	-0.3226	0.572**
HI	-0.3595	-0.2803	-0.1693	-0.3572	0.1077	0.0575	-0.1762	0.0242	0.2543	-0.1394	-0.2793	0.8235	0.573**

DFF – Days to 50% flowering **PTP** – Productive tillers per plant **KB** – Kernel breadth (mm)
DM – Days to maturity **NGP** – No. of grains per panicle **GYP** – Grain yield per plant (g)
PH – Plant height (cm) **100GW** – 100 grain weight (g) **SYP** – Straw yield per plant (g)
PL – Panicle length (cm) **KL** – Kernel length (mm) **HI** – Harvest index (%)
**- Significant at 1.0 per cent level of probability, *- Significant at 5.0 per cent level of probability, Residual = 0.0357, Bold diagonal figures are the direct effects

Table 8: A path coefficient analysis of component characters towards grain yield per plant in F_3 progenies of the cross Jaya x Lalkada in rice

Characters	DFF	DM	PH	PL	PTP	NGP	100GW	KL	KB	L/B ratio	SYP	HI	Genotypic correlation with Grain yield per plant
DFF	0.1318	0.1238	-0.0256	0.0150	-0.0171	0.0091	-0.0174	0.0088	0.0069	-0.0022	0.0139	-0.0023	0.106
DM	-0.1169	-0.1245	0.0336	-0.0138	0.0166	-0.0102	0.0146	-0.0189	0.0192	-0.0195	-0.0015	-0.0033	0.057
PH	-0.0007	-0.0010	0.0038	0.0014	-0.0014	0.0016	-0.0004	0.0004	-0.0001	0.0003	0.0018	-0.00007	0.441**
PL	0.0014	0.0014	0.0048	0.0128	-0.0028	0.0071	-0.0020	0.0056	-0.0052	0.0061	0.0058	0.0004	0.495**
PTP	0.0013	0.0013	0.0039	0.0022	-0.0102	0.0009	0.0022	0.0007	0.0002	0.0002	0.0015	-0.0004	-0.110
NGP	-0.0021	-0.0025	-0.0132	-0.0176	0.0027	-0.0315	0.0060	-0.0126	0.0160	-0.0159	-0.0209	0.0016	0.619**
100GW	-0.0040	-0.0035	-0.0031	-0.0048	-0.0066	-0.0057	0.0304	0.0026	0.0041	-0.0006	0.0082	-0.0116	-0.083
KL	0.0292	0.0667	0.0454	0.1927	-0.0303	0.1751	0.0377	0.4377	-0.2781	0.3864	0.1339	0.0558	0.443**
KB	-0.0365	0.1073	0.0280	0.2848	0.0179	0.3535	-0.0938	0.4412	-0.6944	0.6394	-0.0256	0.2687	-0.373**
L/B ratio	0.0164	-0.1482	-0.0756	-0.4484	0.0234	-0.4770	0.0210	-0.8343	0.8702	-0.9451	-0.1466	-0.2757	0.462**
SYP	0.1024	0.0121	0.4548	0.4375	-0.1427	0.6433	0.2635	0.2967	0.0358	0.1504	0.9700	-0.4244	0.547**
HI	-0.0161	0.0244	-0.0154	0.0331	0.0408	-0.0472	-0.3444	0.1148	-0.3481	0.2625	-0.3937	0.8997	0.508**

DFF – Days to 50% flowering
DM – Days to maturity
PH – Plant height (cm)
PL – Panicle length (cm)
PTP – Productive tillers per plant
NGP – No. of grains per panicle
100GW – 100 grain weight (g)
KL – Kernel length (mm)
KB – Kernel breadth (mm)
GYP – Grain yield per plant (g)
SYP – Straw yield per plant (g)
HI – Harvest index (%)

**- Significant at 1.0 per cent level of probability, *- Significant at 5.0 per cent level of probability, Residual = 0.019, Bold diagonal figures are the direct effects

Conclusion

The present study revealed that characters having high GCV, PCV, heritability, coupled with high genetic advance as percent of mean that indicating presence of additive gene effects in its inheritance and such character could be improved by selection. Whereas low heritability and low genetic advance also indicates greater role of non additive gene action in their inheritance suggesting heterosis breeding could be useful for improving these traits. The traits which showing positive and significant correlation with yield per plant by improving those traits in desirable direction we can also improve yield per plant. Path analysis reveled that if the correlation between grain yield per plant and its contributing traits is due to direct effect of a traits, it reveals true relationship between them and direct selection for this trait will be rewarding for grain yield improvement.

References

1. Anonymous. Directorate of Economics and Statistics Department of Agriculture and Coopretion, 2016.
2. Burton GW, De Vane EM. Estimating heritability in tall Fescue (*Festuca arundinaceae*) from replicated clonal-material. Agron. J 1953; 51:515-518.
3. Dewey DR, Lu KH. A correlation and path analysis of components of crested wheat grass seed production. Agron. J 1959; 51:513-516.
4. Johnson HW, Robinson HE, Comstock RE. Estimation of Genetic and Environmental variability in soybean. Agron. J 1955; 47:314-318.
5. Khush GS. What it will take to feed 5.0 billion rice consumers in 2030. Plant molecular biology. 2005; 59(1):1-6.
6. Kiran KK, Gururaja rao MR, Rajanna MP, Mohan rao A, Mahadevu P, Siddegowda DK. Correlation and Path Analysis in F_2 Populations of Two Crosses of Rice (*Oryza sativa* L.). Trends in Biosciences. 2014; 7(10):896-899.
7. Krishnaveni B, Shobha Rani N. Association and path analysis for yield and components in F_2 generation of rice. The Andhra Agric. J 2005; 52:290-292.
8. Nandeshwar BC, Pal S, Senapati BK, De DK. Genetic variability and character association among biometrical traits in F_2 generation of some rice crosses. Electronic J. Pl. Breed. 2010; 1:758-763.
9. Panwar A, Dhaka RPS, Vinod Kumar. Path analysis of grain yield in rice. Adv. Plant Sci. 2007; 20:27-28.
10. Rajeswari S, Nadarajan N. Correlation between yield and yield components in rice (*Oryza sativa* L.). Agric. Sci. Digest. 2004; 24:280- 282.
11. Ramalingam J, Nadarajan N, Rangasamy P, Vanniarajan C. Genetic variability for panicle characters in rice. Oryza. 1994; 31:56-57.
12. Robinson HF, Comstock RE, Harvey VH. Estimates of heritability and degree of dominance in corn. Agron. J 1949; 41:353-359.
13. Shet RM, Rajanna MP, Ramesh S, Sheshshayee MS, Mahadevu P. Genetic variability, correlation and path coefficient studies in F2 generation of aerobic rice (*Orzya sativa* L.). Electronic J. Pl. Breed. 2012; 3(3):925-931.
14. Verma DD, Hota M, Randhawa GJ, Bhalla S, Chalam VC, Tyagi V. Document on biology of Rice (Oryza sativa L.) in India. National Bureau of Plant Genetics Resources. Indian Council of Agricultural Research, New Delhi. Alpha Lithographics Inc. 2006, 1-88.
15. Wright S. Correlation and causation. J. Agric. Res. 1921; 20:557-585.