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Genetic Variability, Correlation and Path Coefficient Study for Various Yield and Quality Traits in NPT Lines of Rice (*Oryza sativa* L.)

Naveen Surjaye, Yogendra Singh, Sanjay Kumar Singh , Shivangi Rahangdale, A. K. Mehta

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ABSTRACT

Rice (*Oryza sativa* L.) is the most important food crop and a primary food source for more than one third of the world's population. Rice feeds more than half the world's population and improving the productivity of this grain is necessary for food security. This study includes eighty NPT lines of rice were evaluated for twenty-eight morphological and quality traits. The experiment was conducted during kharif 2019 at Seed Breeding Farm, JNKVV, Jabalpur (MP), India and genotypes were planted in RCBD with three replication. The values of mean square were found significant for all the characters under study. Estimates of PCV were higher than the GCV and ECV values for all the characters, suggesting that these characters were relatively much influenced by the environment. The study revealed that high heritability accompanied with high genetic advance was observed for the traits spikelet density (%), milling percentage, thousand grain weight, hulling percentage, panicle weight/plant, panicle index (%), harvest index (%), grain yield per plant, head rice recovery (%), stem length, plant height, panicle length, total spikelets/panicle and fertile spikelets/panicle. Correlation and path coefficient analysis revealed that hulling index, panicle index and panicle weight/plant showed positive correlation with grain yield per plant and at the same time exhibited high positive direct effect towards yield. Thus, they considered to be main yield contributing traits and they can be used as direct selection in improvinggrain yield of rice.

Keywords Genetic variability, Heritability, Genetic advance, Correlation, Path.

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important food crop and a primary food source for more than one third of the world's population. It is a self-pollinated crop belonging to Poaceae family with a genome size of 430 mb and diploid (2n = 2x = 24). The genus *Oryza* (including both cultivated and wild rice species) can grow in diverse climatic conditions and locations from the wettest areas to the driest deserts in the world ranging 53° north to 40° south latitude,

Naveen Surjaye, Yogendra Singh*, Sanjay Kumar Singh, Shivangi Rahangdale, A. K. Mehta
Department of Plant Breeding and Genetics Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, 4820041
Email : yogendrasinghbt@gmail.com
*Corresponding author

Table 1. Notations : DTPI (days to panicle initiation), DTM (days to maturity), FLL (flag leaf length), FLW (flag leaf width), ST (stem thickness), SL (stem length), PH (plant height), NOT (number of tillers per plant), NOPT (number of productive tillers per plant), PL (panicle length), BYPP (biological yield per plant), PWPP (panicle weight per plant), NSPP (number of spikelet per panicle), FSPP (fertile spikelet per panicle), SF (spikelet fertility), SD (spikelet density), TGW (thousand grain weight), PI (panicle weight), HI (harvest index), GL (grain length), GB (grain breadth), DGL (decorticated grain length), DGB (decorticated grain breadth), DLBR (decorticated length breadth ratio), H% (hulling %), M% (milling %), HRR (head rice recovery), GYPP (grain yield per plant).

Sl. No.	Traits	Mean	Range		Coefficient of variation		h^2 (bs) %	Genetic advance as 5% of mean
			Min	Max	GCV (%)	PCV (%)		
1	DTPI	95.85	73.33	107.67	7.680	7.716	99.1	15.748
2	DTM	125.94	103.67	137.67	5.768	5.804	98.8	11.808
3	FLL	33.02	21.47	57.94	18.952	21.402	78.4	34.573
4	FLW	1.31	0.90	1.96	13.267	17.345	58.5	20.906
5	SL	90.92	69.26	131.03	13.600	13.880	96.0	27.450
6	ST	6.00	4.44	7.78	8.377	15.663	28.6	9.229
7	PH	115.12	88.39	161.89	12.416	12.613	96.9	25.178
8	NOT	5.73	4.22	8.22	13.880	19.990	48.2	19.854
9	NOPT	5.06	3.67	7.33	14.193	19.771	51.5	20.989
10	PL	24.20	17.91	30.91	11.972	13.156	82.8	22.442
11	TSP	210.38	93.33	345.33	29.031	29.917	94.2	58.035
12	FSP	183.79	86.33	314.67	29.406	30.514	92.9	58.377
13	GL	8.69	6.67	11.67	11.860	12.765	86.3	22.701
14	GB	2.90	2.00	4.00	14.200	15.803	80.7	26.286
15	1000 GW	24.23	13.52	34.54	21.040	21.187	98.6	43.041
16	DGL	6.50	5.00	9.00	12.602	14.029	80.7	23.318
17	DGB	2.31	1.50	3.00	17.689	18.987	86.8	33.947
18	LBR	2.92	1.67	4.44	21.770	23.662	84.6	41.260
19	SF	87.51	71.15	96.14	6.284	6.749	86.7	12.054
20	SD	8.88	4.19	15.61	33.664	34.333	96.1	67.998
21	BYPP	52.91	36.11	75.89	14.150	17.289	67.0	23.857
22	PWP	25.33	14.67	34.00	15.598	16.382	90.7	30.595
23	PI	64.64	36.11	92.11	17.657	18.224	93.9	35.243
24	HI	31.35	16.14	47.28	22.456	24.282	85.5	42.783
25	H%	78.59	54.94	90.69	10.653	10.712	98.9	21.823
26	M%	75.50	51.10	87.80	11.119	11.129	99.8	22.884
27	HRR	66.25	46.37	79.68	12.506	12.587	98.7	25.598
28	GYPP	16.57	7.00	24.12	22.229	22.529	97.4	45.182

from sea level to an altitude of 3000 m above sea level (Juliano 2004). To meet the growing demand of human population, rice varieties with higher yield potential and greater yield stability need to be developed (Khush 2005). It accounts for about 43% of food grain production in the country. At current rate of population growth, which is 1.8% rice requirement by 2020 would be around 140 million tonnes. Thus, it is desirable to develop new rice varieties with a yield advantage of about 20% over currently grown varieties.

The purpose of this study was to obtain information on genetic variability, character association, and path coefficient analysis in a set of eighty NPT rice genotypes. Heritability (h^2) is a predictor in crop breeding programs because it is an index of character transmissibility from parents to off spring (Khan and Naqvi 2011). Genetic advance is defined as an increase in the mean genotypic value of selected plants over the parental population. The level of genetic variability, heritability and selection intensity are all factors that influence the genetic progress of the traits being investigated (Allard 1960). It is not always the case that a character with high heritability also has significant genetic advancement (Johnson *et al.* 1955). Choosing parents only on the basis of yield can be deceiving. Path coefficient analysis provides

Table 2 (a). Estimates of phenotypic correlation coefficient for various yield and quality attributing traits (cont.).

Traits	DTPI	DTM	NTPP	NPPT	PH	SL	ST	FLL
DTPI	**1.0000**							
DTM	0.6960	**1.0000**						
NTPP	0.2320	0.2420	**1.0000**					
NPPT	0.1770	0.1840	0.8540	**1.0000**				
PH	-0.1600	-0.1590	-0.2610	-0.2610	**1.0000**			
SL	-0.118	-0.117	-0.2400	-0.2520	0.9830	**1.0000**		
ST	-0.0250	-0.0270	-0.2460	-0.2090	0.115	0.1260	**1.0000**	
FLL	0.0010	-0.0080	-0.2020	-0.1950	0.5530	0.5190	0.0670	**1.0000**
FLW	-0.0270	-0.0320	-0.2460	-0.2720	-0.0580	-0.0350	0.3520	0.0060
PL	-0.2650	-0.2640	-0.2460	-0.1960	0.6820	0.5360	0.0290	0.4770
PW	0.1400	0.1420	0.1260	0.1550	0.0480	0.0860	0.1470	0.0020
TSP	0.3410	0.3360	0.0510	-0.0080	-0.0950	-0.0850	-0.0070	-0.0040
FSP	0.3570	0.3520	0.0650	-0.0040	-0.1230	-0.1100	-0.0360	-0.0110
SF	0.0580	0.0610	0.0670	0.0340	-0.1200	-0.1110	-0.1660	-0.0610
SD	0.4220	0.4160	0.1550	0.0760	-0.3350	-0.2690	-0.0330	-0.1790
TGW	-0.5310	-0.5210	-0.3520	-0.2870	0.2580	0.2150	0.1280	0.0550
GL	-0.3380	-0.3400	-0.117	-0.1000	0.4040	0.3150	-0.116	0.3450
GB	-0.2560	-0.2490	-0.2340	-0.1690	0.0080	0.0070	0.2290	-0.0290
DGL	-0.2610	-0.2580	-0.0400	-0.0150	0.4790	0.4000	-0.1530	0.3450
DGB	-0.3370	-0.3260	-0.2030	-0.1450	0.0230	0.0170	0.2160	-0.0700
LBR	0.1280	0.1200	0.1700	0.1360	0.1960	0.1590	-0.2530	0.2350
H%	0.0370	0.0410	0.0900	0.0060	-0.0490	-0.0540	0.0840	-0.1090
M%	-0.0210	-0.0180	0.0670	-0.0300	-0.0550	-0.0580	0.1040	-0.1110
HRR	0.0290	0.0330	-0.0880	-0.1400	0.0290	0.0350	0.1870	-0.0280
BYPP	0.1460	0.1540	0.1560	0.2180	0.3560	0.3580	0.2940	0.2420
PI%	-0.0170	-0.0150	0.0120	0.0280	0.1800	0.1580	-0.0430	0.0150
HI%	0.0030	0.0010	-0.0360	-0.0580	-0.0840	-0.0770	-0.1250	-0.1570
GYPP	0.0680	0.0700	0.1970	0.1900	0.1690	0.1780	0.1010	0.0100

Table 2 (a). Continued.

Traits	FLW	PL	PW	TSP	FSP	SF
DTPI						
DTM						
NTPP						
NPPT						
PH						
SL						
ST						
FLL						
FLW	**1.0000**					
PL	-0.1270	**1.0000**				
PW	0.1880	-0.1220	**1.0000**			
TSP	0.0660	-0.0990	0.0650	**1.0000**		
FSP	0.0920	-0.1260	0.0440	0.9730	**1.0000**	
SF	0.0940	-0.1100	-0.0740	-0.0820	0.1420	**1.0000**
SD	0.0860	-0.4670	0.0780	0.9170	0.9090	-0.0150
TGW	0.1590	0.3300	0.1060	-0.4010	-0.4230	-0.1080
GL	-0.2500	0.6030	-0.2580	-0.2750	-0.3070	-0.1510
GB	0.1960	0.0060	0.2670	-0.0800	-0.0780	0.0000
DGL	-0.2890	0.6090	-0.1640	-0.2700	-0.2990	-0.1260
DGB	0.0610	0.0370	0.2160	-0.1730	-0.2200	-0.2140
LBR	-0.2020	0.2700	-0.2610	-0.0400	-0.0240	0.0750
H%	0.112	-0.0080	-0.0280	0.0890	0.0550	-0.1560
M%	0.1230	-0.0240	-0.0210	0.0950	0.0650	-0.1370

Table 2 (a). Continued.

	FLW	PL	PW	TSP	FSP	SF
HRR	0.2160	-0.0030	-0.0070	0.1 13	0.0670	-0.1880
BYPP	0.2120	0.2110	0.4640	0.0700	0.0340	-0.1480
PI%	-0.0620	0.2000	-0.0840	0.0840	0.0360	-0.1950
HI%	0.0620	-0.0770	0.2450	0.0580	0.0260	-0.1230
GYPP	**0.1180**	**0.0790**	**0.6200**	**0.0880**	**0.0340**	**0.2150**

Table 2 (b). Estimates of phenotypic correlation coefficient for various yield and quality attributing traits.

Traits	SD	1000 GW	GL	GB	DGL	DGB	LBR	H%	M%	HRR	BYPP	PI%
DTPI												
DTM												
NTPP												
NPPT												
PH												
SL												
ST												
FLL												
FLW												
PL												
PW												
TSP												
FSP												
SF												
SD	**1.0000**											
TGW	-0.5296	**1.0000**										
GL	-0.5082	0.3790	**1.0000**									
GB	-0.1259	0.5702	-0.1722	**1.0000**								
DGL	-0.5413	0.3318	0.8903	-0.1805	**1.0000**							
DGB	-0.1963	0.4843	0.0392	0.6248	-0.0459	**1.0000**						
LBR	-0.1459	-0.2039	0.4491	-0.6231	0.5694	-0.8255	**1.0000**					
H%	0.0639	0.0977	-0.0862	0.0882	-0.0457	0.0095	-0.0064	**1.0000**				
M%	0.0725	0.1608	-0.1000	0.1522	-0.0713	0.0443	-0.0476	0.9418	**1.0000**			
HRR	0.0779	0.2356	-0.1702	0.3063	-0.1051	0.1785	-0.1910	0.8015	0.8242	**1.0000**		
BYPP	-0.0297	0.0903	-0.1037	0.2450	0.0102	0.2849	-0.2519	-0.0329	-0.0524	0.0880	**1.0000**	
PI%	-0.0039	0.1915	0.1523	-0.0810	0.2740	-0.2106	0.3368	0.2906	0.3204	0.3098	0.0212	**1.0000**
HI%	0.0689	0.1587	-0.0388	-0.0090	0.0465	-0.1860	0.2116	0.2442	0.2847	0.2085	-0.2472	0.7805	**1.0000**
GYPP	**0.0280**	**0.2260**	**-0.0750**	**0.1880**	**0.0630**	**-0.0580**	**0.0970**	**0.2230**	**0.2500**	**0.2490**	**0.3130**	**0.7320**	**0.7190**

information on the direct and indirect effects of each contributing characteristic on yield, as well as allowing breeders to rank genetic features according to their contribution.

MATERIALS AND METHODS

This study was conducted at Seed Breeding Farm, Department of Plant Breeding and Genetics, College of Agriculture, J.N.K.V.V, Jabalpur, Madhya Pradesh during *kharif* season (2019). The experimental material of this investigation was comprised of 80 NPT rice genotypes. These genotypes were planted in randomized Complete Block design. The observations were recorded by selecting 5 random plants for twenty-eight quantitative characters. All the given eighty rice genotypes were studied for genetic variability parameters, heritability, genetic advance, character association and direct and indirect effect.

RESULTS AND DISCUSSION

Genetic variability parameters

Result of analysis of variance indicated that the mean sum of squares due to genotypes were highly

Table 3 (a). Genotypic path analysis for yield and attributing traits on grain yield/plant (cont). R square = 0.9983, Residual effect = 0.0412.

Traits	DTPI	DTM	NTPP	NPPT	PH	SL	ST	FLL	FLW	PL	PW	TSP	FSP	SF
DTPI	**0.6060**	-2.0794	-0.0885	-0.0787	0.0736	-0.0081	0.4393	-0.7273	-0.7431	0.9407	0.3116	0.4576	-0.3041	-0.2714
DTM	-0.5967	**0.7871**	0.0833	0.0813	0.0019	0.0408	-0.1944	0.2561	0.2006	-0.3768	-0.0651	-0.1313	0.0644	0.065
NTPP	0.0216	0.6209	**5.8666**	5.8676	-0.9299	-0.5554	-2.2543	-0.1044	-1.5629	-1.05	2.3312	1.886	-1.9633	-1.3194
NPPT	0.0211	-0.535	-5.1828	**-5.182**	0.8128	0.4776	2.0099	0.088	1.4135	0.9432	-2.0154	-1.6082	1.7687	1.2105
PH	-1.9893	-0.0051	0.3376	0.334	**-2.1296**	-2.0969	-1.0283	-0.1899	-1.3335	-0.5875	-0.376	0.054	-0.1885	0.0209
SL	1.9112	0.0642	-0.1172	-0.1141	1.2193	**1.2384**	0.3993	0.0784	0.7373	0.295	0.2082	-0.0623	0.0192	-0.0711
ST	0.0039	-0.49	-0.7623	-0.7694	0.9578	0.6396	**1.9837**	0.329	0.8103	0.5966	0.2261	0.2272	0.7968	0.4652
FLL	0.0004	0.2812	-0.0154	-0.0147	0.0771	0.0547	0.1434	**0.8645**	-0.0094	-0.228	0.2759	0.0996	0.1634	0.0552
FLW	-0.0057	0.645	-0.6741	-0.6902	1.5844	1.5065	1.0336	-0.0275	**2.5304**	0.8301	0.022	-0.1471	0.8733	0.5707
PL	1.0312	0.2697	0.1008	0.1026	-0.1554	-0.1342	-0.1695	0.1486	-0.1848	**-0.5634**	0.0724	-0.0032	-0.1385	-0.1681
PW	0.0587	0.3457	-1.6609	-1.6256	-0.738	-0.7027	-0.4763	-1.3337	-0.0363	0.5372	**-4.1796**	-3.2268	-0.386	-0.5989
TSP	0.0933	-0.8127	1.5668	1.5125	-0.1236	-0.245	0.5583	0.5614	-0.2833	0.0281	3.7627	**4.8737**	0.6842	1.0075
FSP	-0.1823	-0.3958	1.6185	1.6507	-0.428	-0.0751	-1.9426	-0.9141	-1.6691	-1.1887	-0.4466	-0.6789	**-4.8363**	-4.2336
SF	0.0046	-0.8022	2.1852	2.2697	0.0952	0.5575	-2.2786	-0.6203	-2.1912	-2.8991	-1.3923	-2.0086	-8.5053	**-9.716**
SD	0.1060	-0.55	1.8022	1.8031	-0.8644	-0.5301	-2.0264	-1.5267	-1.9264	0.3931	0.3284	0.309	-3.1145	-0.623
TGW	-0.0484	2.3577	-4.421	-4.5214	-0.2592	-0.8774	2.9936	2.4588	4.2345	2.9433	1.1461	1.7946	15.2393	13.9358
GL	0.0279	-0.0894	0.0175	0.0182	-0.0402	-0.0448	0.0069	-0.032	-0.0633	-0.0083	0.0067	0.0028	-0.1001	-0.0929
GB	0.0192	0.169	-0.2839	-0.2841	0.1951	0.1488	0.3112	0.1967	0.1082	-0.1654	0.0208	-0.1004	0.1197	0.0056
DGL	-0.0092	0.2611	-0.016	-0.0112	0.5544	0.5518	0.2382	0.5118	0.2292	-0.3785	0.4573	-0.6044	-0.0508	-0.1559
DGB	-0.0013	0.0247	0.0142	0.0136	0.0348	0.0431	-0.0275	-0.0295	0.0391	0.0309	-0.0362	-0.0246	0.0282	0.0253
LBR	-0.0136	0.4815	-0.201	-0.2012	0.134	0.1038	0.2054	0.2059	0.247	0.0601	-0.0337	-0.0903	0.593	0.5626
H%	-0.0017	0.1453	0.0645	0.0613	0.0025	0.0344	-0.1587	-0.1614	0.2536	0.2015	-0.1922	-0.1129	0.2912	0.3084
M%	-0.0010	-0.7369	0.5934	0.5953	-0.2883	-0.1746	-0.6869	-0.3619	-0.4103	0.1076	-0.0595	0.0664	-1.2276	-1.1299
HRR	0.0004	0.3306	-0.5241	-0.5216	0.1958	0.0567	0.7767	0.5947	-0.1242	-0.4673	0.3892	0.1805	0.4582	0.3448
BYPP	0.0269	0.2213	-0.1326	-0.1361	0.2198	0.2266	0.0549	0.1778	0.2411	-0.0272	-0.0964	-0.1115	-0.074	-0.112
PI%	-0.0087	-0.7424	0.2166	0.2176	-0.2912	-0.3318	0.0853	-0.4093	-0.5982	0.118	0.0437	-0.0745	-0.1289	0.0905
HI%	0.0005	0.0238	0.0004	0.0001	0.0145	0.0107	0.025	0.0162	0.0161	-0.0169	0.0098	0.0025	0.0138	0.0163
GYPP	**0.0680**	**-0.2102**	**0.3877**	**0.3772**	**-0.0747**	**-0.085**	**0.0213**	**0.0498**	**-0.0752**	**0.0682**	**0.7189**	**0.9689**	**0.0955**	**0.192**1

Table 3 (b). Genotypic path analysis for yield and attributing traits on grain yield/plant. R square = 0.9983, Residual effect = 0.0412. (cont.)

Traits	SD	1000 GW	GL	GB	DGL	DGB	LBR	H%	M%	HRR	BYPP	PI%	HI%
DTPI	0.2690	-0.4411	1.0203	0.4983	0.2967	0.3528	1.0275	0.446	0.6348	-0.1946	0.5464	0.739	-0.6635
DTM	-0.2599	0.1185	-0.374	-0.1667	-0.1213	-0.1108	-0.3538	-0.1201	-0.2386	0.102	-0.1733	-0.2783	0.2557
NTPP	0.0152	-1.6558	0.5447	2.0863	0.0555	-0.4751	1.1009	-0.3974	1.432	-1.2057	0.7739	0.6052	0.0282
NPPT	0.0110	1.4958	-0.5015	-1.8443	-0.0342	0.4004	-0.9735	0.3338	-1.269	1.0601	-0.7016	-0.5371	-0.0084
PH	-2.0676	0.0352	0.4548	0.5205	0.6968	0.4226	0.2664	0.0056	0.2526	-0.1636	0.4657	0.2954	-0.4223
SL	1.2622	-0.0694	-0.295	-0.2308	-0.4033	-0.3043	-0.1201	-0.0447	-0.089	0.0276	-0.2792	-0.1957	0.1811
ST	-0.0001	0.3791	0.0731	-0.7735	-0.2788	0.3102	-0.3803	0.3306	-0.5605	0.6043	-0.1084	0.0806	0.6777
FLL	-0.0140	0.1357	-0.1469	-0.213	-0.2611	0.1454	-0.1662	0.1465	-0.1287	0.2016	-0.153	-0.1685	0.1913
FLW	0.0136	0.6841	-0.8505	-0.3429	-0.3422	-0.5629	-0.5834	-0.6738	-0.4271	-0.1233	-0.607	-0.721	0.5572
PL	0.7270	-0.1059	0.0249	-0.1168	-0.1258	0.099	0.0316	0.1192	-0.0249	0.1033	-0.0153	-0.0317	0.13
PW	0.0343	-0.3058	-0.1493	0.1089	1.128	-0.8622	-0.1316	-0.8433	0.1023	-0.638	-0.4008	-0.0871	-0.5588
TSP	0.2378	0.5584	0.0732	0.6132	1.7383	0.682	0.4107	0.5777	0.1331	0.3449	0.5407	-0.1731	0.1665
FSP	-0.4396	-4.7053	2.5718	0.7255	-0.145	0.7772	2.6772	1.4784	2.4422	-0.869	-0.3562	0.2969	-0.9085
SF	-0.0026	-8.6444	4.7928	0.0678	-0.894	1.4026	5.1031	3.1462	4.5157	-1.314	-1.0825	-0.4187	-2.1586
SD	**0.2389**	-2.7971	1.5706	2.0433	0.5694	0.3036	1.3978	0.3522	1.5276	-0.948	0.5718	1.4094	-0.1962
TGW	-0.0478	**15.6633**	-9.238	-1.2394	0.8007	-3.3444	-8.867	-5.6832	-7.7499	2.1298	1.2766	-1.3787	1.9325
GL	0.0385	-0.111	**0.1883**	0.0179	-0.0039	0.102	0.1267	0.108	0.1016	-0.0077	0.0376	0.0616	-0.0323
GB	0.0085	0.0632	-0.0757	**-0.7982**	-0.4287	0.1745	-0.2112	0.1741	-0.3156	0.3541	-0.339	-0.365	0.0905
DGL	-0.0169	-0.0866	0.0347	-0.9102	**-1.6946**	0.2738	-0.1958	0.3036	-0.2892	0.3971	-0.3292	-0.1834	0.227
DGB	-0.0007	0.0375	-0.0952	0.0384	0.0284	**-0.1756**	-0.0304	-0.1419	0.0252	-0.1086	0.0014	-0.0153	0.0017

Table 3 (b). Continued.

Traits	SD	1000 GW	GL	GB	DGL	DGB	LBR	H%	M%	HRR	BYPP	PI%	HI%
LBR	0.0144	0.6064	-0.7209	-0.2834	-0.1238	-0.1857	**-1.0712**	-0.2492	-0.7587	0.3812	-0.1845	-0.3428	0.1169
H%	-0.0029	0.3456	-0.5465	0.2078	0.1706	-0.7697	-0.2216	**-0.9525**	0.0812	-0.6572	0.0228	-0.0308	0.1162
M%	0.0035	-1.2028	1.3126	0.9612	0.4148	-0.3484	1.7219	-0.2072	**2.431**	-1.8873	0.843	0.7376	-0.3171
HRR	0.0012	0.3467	-0.1044	-1.1312	-0.5975	1.5769	-0.9075	1.7595	-1.9795	**2.5498**	-0.7546	-0.5911	0.0288
BYPP	-0.0045	-0.0819	-0.2009	-0.4269	-0.1953	0.0081	-0.1731	0.024	-0.3485	0.2975	**-1.0051**	-0.7597	-0.1641
PI%	-0.0019	-0.1848	0.6866	0.96	0.2273	0.1832	0.6719	0.0678	0.637	-0.4867	1.5868	**2.0995**	0.6651
HI%	0.0230	0.009	-0.0126	-0.0083	-0.0098	-0.0007	-0.008	-0.0089	-0.0096	0.0008	0.012	0.0232	**0.0733**
GYPP	**0.0280**	**0.0865**	**0.0369**	**0.3634**	**0.4673**	**0.0747**	**0.1408**	**0.0512**	**0.1277**	**-0.0496**	**0.189**	**0.0704**	**0.0099**

significant for all the traits under study. Considerable amount of variability was observed for the entire yield and quality attributing traits. In the present investigation, the trait panicle weight per plant shown maximum variability as well as the trait that shown least variability was number of productive tillers per plant (Table 1).

The significant amount of variability among genotypes for panicle weight per plant, spikelets per panicle, stem thickness, stem length, milling%, decorticated grain breadth, decorticated grain length, length/breadth ratio of decorticated grain, hulling %, days to panicle initiation, days to maturity, head rice recovery, number of tillers, fertile spikelets per panicle, spikelet density, biological yield per plant, grain yield per plant, spikelet fertility, panicle length, grain weight per plant, flag leaf length, flag leaf width, plant height, grain breadth, panicle index, grain length and number of productive tillers per plant.This result was in partial agreement with the finding of Jha *et al.* (2014), Kumar *et al*. (2014), Srujana *et al.* (2017), Choudhary *et al.* (2018), Rahangdale *et al.* (2019).

The PCV was found higher than GCV for all the traits studied, which shows very little influence of the environmental variation. The study revealed that high heritability accompanied with high genetic advance was observed for the traits spikelet density, fertile spikelets per panicle, total spikelets per panicle, Harvest index, L/B ratio, Grain yield/plant and thousand grain weight. Whereas, Flag leaf length was reported for high PCV and moderate GCV. Selection for such traits may be rewarding. The characters with low PCV and GCV i.e., days to maturity should not be preferred in breeding programes. Based on these the genotypes selected were JNPT 805, JNPT 809, NPT 23, JNPT (s) 10-1-1B and JNPT 828.

Heritability and genetic advance

The characters viz., spikelet density%, milling percentage, thousand grain weight, hulling percentage, panicle weight/plant, panicle index %, harvest index %, grain yield per plant, head rice recovery %, stem length, plant height, panicle length, total spikelets/panicle and fertile spikelets/panicle have high heritability with high genetic advance. This was partially in consonance with the findings of Debnath *et al.* (2015), Devi *et al.* (2017), Vinoth *et al.* (2016), Rajesh *et al.* (2016), Kumar *et al.* (2018).Similar results were reported by Rahangdale *et al.* (2019) for thousand grain weight, head rice recovery, harvest index, total spikelets/panicle,biological yield /plant, spikelet density, fertile spikelets/panicle, grain yield /plant and panicle weight/plant.

Correlation coefficient analysis

In this investigation, grain yield/plant revealed significant and positive association with panicle index, followed by hulling index, panicle weight per plant, biological yield per plant, head rice recovery percentage, milling percentage, thousand grain weight and hulling percentage. Similar results were previously confirmed by Shrivastava *et al.* (2015), Yadav *et al.* (2015), Sameera *et al.* (2016), Vinoth *et al.* (2016), Kumar *et al.* (2017), Onyia *et al.* (2017), Shamim

et al. (2017), Rahangdale *et al.* (2019) for panicle weight/plant, biological yield/plant, panicle index. This show strong association of these traits with grain yield per plant and selection for such traits will be useful in improving grain yield. Negative significant correlation of grain yield/plant was observed with grain length followed by decorticated grain breadth.

Path coefficient analysis

The present investigation revealed that the highest positive direct effect towards grain yield/plant was observed for plant height, days to panicle initiation, panicle index, panicle weight, hulling index, spikelet density, spikelet per panicle and flag leaf width. Similar results were reported by Kumar *et al*. (2014), Yadav *et al.* (2015), Rahangdale *et al.* (2019) for spikelet density and panicle weight. Whereas, Kumar *et al.* (2017) confirmed the highest positive direct effect of spikelet fertility on grain yield/plant.

Based on the results from correlation and path coefficient analysis, it may be concluded that the characters showing high direct effect and positive association i.e., plant height, days to panicle initiation, panicle index, panicle weight, hulling index, spikelet density, spikelet/panicle and flag leaf width should be given emphasis for further selection.

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