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Genetic variability studies for yield and yield components in F_2 generation in rice (*Oryza sativa* L.)

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Abstract
The present experiment was conducted at Field Experimentation Centre, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture Technology and Sciences, Allahabad during *Kharif*- 2017 in Randomized Block Design (RBD) with three replications. The data were recorded for thirteen quantitative and seven quality characters to study genetic variability, heritability, genetic advance, correlation coefficient analysis and path analysis. Analysis of variance among 30 advance breeding lines in rice genotypes showed highly significant differences for all the characters indicated the presence of substantial amount of genetic variability. On the basis of mean performance highest grain yield per hill observed in genotypes SHUATS Dhan-211(ABL) (42.43 g), followed by SHUATS Dhan-224(ABL) (41.50), SHIATS DHAN-5 (40.68). High genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) was observed for flag leaf length (20.51 to 21.22), followed test weight (19.19 to 19.64), number of spikelet's per panicle (18.38 to 18.62) and number of panicles per hill, indicating that these characters could be used as selection for crop improvement. High estimates of heritability were observed for number of spikelets per panicle, days to 50 % flowering, test weight, flag leaf length, plant height and harvest index followed by seed yield per hill, biological yield per hill and number of panicles per hill. High genetic advance were for number of spikelets per panicle, plant height. Genetic advance as percent of mean was observed for test weight, number of spikelets per panicle, number of panicles per hill and plant height.

Keywords: Rice, Yield, Genetic variability, Heritability and Genetic advance

Introduction
Rice (*Oryza sativa* L.) is the most important staple cereal food crop in the world. Rice plays a vital role in Indian economy being the stable food for two third of the population. Rice is also called as the "Grain of Life" because it is not only the stable food for more than 70 per cent of the Indians but also a source of livelihood for about 120 million rural households. It accounts for about 43% of food grain production in the country. At the current rate population growth, which is 1.8%, rice requirement by 2020 would be around 140 million tones (Directorate of Rice Research, 2005) [4].

Cultivation of rice is important for the food security of Asia. India has a long history of rice cultivation. India stands first in area (43.97 m ha) and world's second largest producer (109.32 mt) of rice after china with the productivity of 2.55 tones per hectare. The year 2016-17 recorded the highest rice production (109.32 mt) still now. It is estimated that in India, the demand for rice will be 129.6 million tones by 2040 and 137.3 million tons by 2050 for internal consumption. Rice is the major crop in Uttar Pradesh and is grown in about 5.98 million hectares producing 14.63 million tones with the productivity of 2.44 tones per hectare. The cropping intensity is 153%. The state ranks 2nd in the country in production of rice. The low productivity in India is mainly due to its cultivation under rainfed situation in most of the rice growing areas. Arunachalam (1981) [2] reported that the greater chance of getting heterotic hybrids and enhanced variation in the segregating population of varietal improvement programmes. Germplasm is the core of any breeding work. 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. (Mohammad *et al.*, 2002) [8].

High heritable estimates are helpful in making selection of superior genotype on the basis of phenotypic performance of quantitative characters suggested that GCV, PCV, heritability and genetic advance will play an important role in exploiting future research projections of rice improvement. (Johnson *et al.*, 1955) [5]. 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 percent of mean indicates the mode of gene action in the expression of a trait, which helps in choosing an appropriate breeding method. Identification of effective selection criteria for effective yield improvement. The present investigation was under taken in this context to elucidate information on variability, heritability and genetic advance in rice genotypes (Ajmera *et al.,* 2017-18) [1]. Path-analysis reveals whether the association of these characters with yield is due to their effect on yield or is a consequence of their indirect effects via other component characters. Thus, it helps in determining yield contributing characters and therefore, is useful in indirect selection (Dewey and Lu, 1959) [3]. The present study was undertaken to derive information on genotypic and phenotypic correlations, direct and indirect effect on various traits. (Venkanna *et al.,* 2014) [12]. Therefore, the techniques of path coefficient analysis are utilized to have an idea of direct and indirect contribution of a trait towards the yield, the end product (Nandan *et al.,* 2010) [9]. The present investigation was undertaken to evaluate how far the genetic potential is transferred from F_2 and F_3, based on selection for single plant yield in F_2 (Kumar *et al*., 2011) [7]. Genetic parameter such as heritability offers the information of transmissibility of characters from one generation to consecutive generations following objectives:

To assess Genetic variability among segregating population of F_2 generation of some crosses in rice.

Materials and Methods

The present investigation was carried out at the Field Experimentation Centre of Department of Genetics and Plant Breeding, Allahabad Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, 211007 (U.P.) during *Kharif*-2017. The site of Experiment is located at 25.87º N latitude, 81.51 longitude and 98 meters above sea level. The genetic material for this study comprised of 30 rice genotypes for the "Genetic variability studies for yield and yield components in F_2 generation in rice (*Oryza sativa* L.)" it's grown in Randomized Block Design (RBD) with three replications during *Kharif* – 2017. The recommended doses of fertilizers at the rate of 120:60:40 kg (NPK) per hectare was applied. The full doses of phosphorous (P_2O_5) and potash (K_2O) and 50 % of nitrogen was applied in the soil at the time of land preparation. 25 % of total nitrogen was top dressed at tillering stage and the remaining 25 % nitrogen was top dressed at panicle initiation stage. An intercultural operations like manual weeding were done in the field twice at 20 days after transplanting and 50 days after transplanting.

The following observations were recorded during the evaluation of experimental material. Days to 50% flowering, Plant height (cm), Number of tillers per plant, Number of Panicles per plant, Panicle length (cm), Flag leaf length (cm), Flag leaf width (cm), Number of spikelets per panicle, Days to maturity, Biological yield per plant (g), Harvest index (%), Test weight (g) and Grain yield per plant (g).

The statistical analysis were done by using replication mean values based on the recorded data. The different statistical procedures followed were as under.

Analysis of Variance Coefficient of Variance, GCV and PCV

The analysis of variance was worked out to test the differences among genotypes by F-test. It was carried out according to the procedure of Randomized Complete Block Design for each character as per methodology advocated by Panse and Sukhatme (1967) [10]. ANOVA helps in partitioning the total variance into three components *viz.,* replication, treatment and error.

Standard error of mean was calculated by the following formula:

$$SEM = \frac{\sqrt{2EMS}}{r}$$

Critical difference was calculated by the following formula:

$$C.D. = \frac{\sqrt{2EMS}}{r} \times t$$

Mean = mean value of each character was worked out by dividing the total by the corresponding number of observations.

$$Mean = \frac{\sum X}{N}$$

The genotypic variance (VG or σ^2_g) is the variance due to the genotypes present in the population. The formula used for calculation of genotypic variance was

$$VG = \frac{V_t - EMS}{r}$$

Where,

V_t = MSS due to Treatment

EMS = Error Mean Sum of Squares

Phenotypic variance

Phenotypic variance (VP or σ^2_p) denotes the total variance present in a population for particular character and is calculated by following formula

VP = Genotypic variance (VG) + Error variance (VE)

Result and Discussion

The experimental material for the present study of was received during *Kharif*-2017 from Department of Genetics and Plant Breeding, SHUATS, Allahabad. The data was recorded on 13 quantitative characters viz., days to 50% flowering, plant height, number of tillers per hill, number of panicles per hill, panicle length, flag leaf length, flag leaf width, number of spikelets per panicle, days to maturity, biological yield per hill, harvest index, test weight and grain yield per hill. The results of the present experiments are detailed and discussed in the light of works of earlier researchers under the following heads:

Analysis of variance

Mean performance of genotypes

Quality parameters

Analysis of variance revealed significant differences for all the characters indicating sufficient variability among the genotypes. The treatment i.e., mean sum of square due to genotypes showed highly significant differences to all the 13 quantitative characters under study at 5% level of significant. This indicates that there was ample scope for selection of

promising lines from the present gene pool for yield and its components.

The findings were in accordance with findings of Vivek *et al*. (2005) [11], Kishore *et al*. (2015) [6], who also observed significant variability for yield and its components traits in rice. The results from analysis of variance among rice (*Oryza sativa* L.) genotypes for 13 quantitative characters are presented.

The mean performance of days to 50 percent flowering ranged from 84.00 to 105.00 with a grand mean of 95.81 days. The genotypes SHIATS DHAN 5 showed the earliest days to 50 percent flowering (84.00 days), followed by genotypes showed earliest flowering for SHIATS DHAN 3 (85.00 days), SHIATS DHAN 2 (86.00 days), SHUATS Dhan-211(ABL) (87.66). Among the genotypes the late days to 50 % flowering was observed for SHUATS Dhan-224(ABL) (105.00 days), followed by SHUATS Dhan-219(ABL) (104.33 days), SHUATS Dhan-220(ABL) (104.00 days).,Plant height ranged from 87.62 cm to 124.24 cm with a grand mean of 105.17 cm. Rice breeding lines SHUATS Dhan-226(ABL) (87.62 cm) was recorded with the lowest value of plant followed by SHUATS Dhan-218(ABL) (90.83 cm), SHUATS Dhan-215(ABL) (91.38 cm). Highest value of plant height recorded by SHIATS DHAN 1 (124.24 cm), followed by SHIATS DHAN 5 (120.46 cm), SHUATS Dhan-219(ABL) (119.82 cm). The mean value for Flag leaf length ranged from 24.14 cm to 48.43 cm with grand mean of 32.89 cm. Maximum flag leaf length observed in SHUATS Dhan-219(ABL) (48.43 cm) and SHIATS DHAN 4 (45.23 cm) followed by SHIATS DHAN 3(44.56 cm),SHUATS Dhan-210(ABL) (43.01 cm), SHUATS Dhan-224(ABL) (39.82 cm).While the lowest value was recorded in SHUATS Dhan-215(ABL) (24.14 cm), followed by SHUATS Dhan-218(ABL) (24.43 cm), SHUATS Dhan-212(ABL) (25.11 cm), and SHUATS Dhan-222(ABL) (25.37 cm).Flag leaf width ranged from 1.20 cm to 1.78 cm with a grand mean of 1.42 cm. Maximum flag leaf width was in SHUATS Dhan-217(ABL) (1.78 cm). Rice breeding lines SHUATS Dhan-211(ABL) (1.62 cm) exhibited highest flag leaf width among all the rice genotypes followed by SHIATS DHAN 3 (1.616 cm) and SHUATS Dhan-219(ABL) (1.613 cm) showed significantly highest than check NDR-359 (1.45 cm), while the genotypes SHUATS Dhan-214(ABL) (1.20 cm), had lowest value, followed by SHUATS Dhan-222(ABL) (1.206 cm), SHUATS Dhan-218(ABL) (1.21 cm). The mean value for Number of tillers per hill were counted and varied from 13.33 to 22.90 with a grand mean value of 17.41. The genotypes SHUATS Dhan-211(ABL) (22.90 cm) was recorded high number of tillers per hill among the genotypes, followed by SHUATS Dhan-217(ABL) (21.00), SHUATS Dhan-214(ABL) (19.86), SHUATS Dhan-223(ABL) (19.86), while the minimum number of tillers per hill was in the genotypes SHUATS Dhan-228(ABL) (13.33) followed by SHIATS DHAN 2 (14.10), SHUATS Dhan-216(ABL) (14.43), NDR-359 (14.70) check. The values for number of panicle per hill were recorded ranged from 11.20 to 20.40 with a grand mean of 15.83. The genotypes SHUATS Dhan-211(ABL) (20.40) was the best genotype for number of panicles per hill followed by SHUATS Dhan-217(ABL) (19.90), SHUATS Dhan-223(ABL) (18.86), SHUATS Dhan-218(ABL) (18.33), SHUATS Dhan-219(ABL) (18.20) and MTU-1010 (17.93) genotypes were significantly superior to the best check NDR-359, which had 13.42 number of panicles per hill. While the minimum value was observed for the rice genotypes SHUATS Dhan-228(ABL) (11.20) followed by SHUATS Dhan-216(ABL) (12.00), SHIATS DHAN 2 (12.50), NDR-359 (13.42), SHUATS Dhan-229(ABL) (14.05), SHIATS DHAN 4 (14.25). The estimates of Panicle length was measured and ranged from 21.18 cm to 28.39 cm with grand mean value of 24.31 cm. The longest panicle was observed in genotype SHUATS Dhan-219(ABL) (28.39 cm) were significantly differed by SHUATS Dhan-220(ABL) (28.28 cm), SHUATS Dhan-224(ABL) (26.86 cm) and SHUATS Dhan-216(ABL) (26.54 cm). While the lowest panicle length was observed for SHUATS Dhan-227(ABL) (21.18 cm) followed by SHUATS Dhan-226(ABL) (21.93 cm), SHUATS Dhan-210(ABL) (22.10 cm).The mean value for the number of Number of spikelets /grain is an important yield contributing trait which has direct effect on grain yield. The number of spikelets per panicle ranged from 115.76 to 252.87 with a grand mean of 183.27.The genotype SHIATS DHAN 1 (252.87) had the highest number of spikelets per panicle, followed by SHUATS Dhan-221(ABL) (233.56), SHUATS Dhan-225(ABL) (223.73), SHUATS Dhan-219(ABL) (223.23) and SHUATS Dhan-228(ABL) (218.03). The minimum number of spikelets per panicle was observed in the genotype SHUATS Dhan-223(ABL) (115.76), followed by SHUATS Dhan-214(ABL) (132.93), SHUATS Dhan-215(ABL) (135.14) MTU-1010 (145.40), SHUATS Dhan-218(ABL) (145.76). The mean value for days to maturity was 127.03 with a ranged of 115.67 days to 140.00 days. The range for maturity varied from 115.67 (SHIATS DHAN-5) to 140.00 (BPT-5204). The genotype BPT-5204 (140.00) had highest days to maturity followed by MTU-1001 (135.66), NDR-359 (134.00), SHUATS Dhan-221(ABL) (133.33) while the minimum days were taken in SHIATS DHAN 5 (115.67) followed by SHUATS Dhan-211(ABL) (116.33) SHUATS Dhan-216(ABL) (120.00) and SHUATS Dhan-229(ABL) (121.66). The mean performance for biological yield per hill ranged from 62.40 g to 93.61 g with grand mean of 75.88 g. while the rice genotypes SHUATS Dhan-224(ABL) (93.61 g) exhibited highest biological yield which was highly significant followed by SHUATS Dhan-211(ABL) (86.87 g), SHUATS Dhan-217(ABL) (83.87 g), SHIATS DHAN 5 (83.25 g) and SHUATS Dhan-229(ABL) (82.91 g). The minimum value was observed in the genotype MTU-1001 (62.40 g), followed by SHUATS Dhan-221(ABL) (66.47 g), SHUATS Dhan-214(ABL) (68.30 g), SHUATS Dhan-227(ABL) (69.66 g) and SHUATS Dhan-225(ABL) (69.86 g). The mean value for harvest index ranged from 41.17 to 54.32 percent with a grand mean of 47.16 percent. While the genotype MTU-1001 (54.32 percent) had highest harvest index which was highly significant followed by SHUATS Dhan-210(ABL) (49.74 %), SHUATS Dhan-225(ABL) (49.29 %), SHUATS Dhan-220(ABL) (49.22 %) and SHUATS Dhan-214(ABL) (48.87 %). While the minimum value was observed for the genotype BPT-2411 (41.17 %) followed by NDR-359 (41.69 %), SHIATS DHAN 1 (43.54 %), SHUATS Dhan-229(ABL) (44.19 %) and SHUATS Dhan-224(ABL) (44.33 %). The mean value for test weight ranged from 13.17 g to 28.50 g with a grand mean of 20.08 g. Rice genotypes SHUATS Dhan-211(ABL) (28.50 g) had highest test weight which was significantly and followed by SHUATS Dhan-224(ABL) (27.03 g), SHUATS Dhan-223(ABL) (25.57 g), SHIATS DHAN 2 (25.23 g) and SHUATS Dhan-215(ABL) (24.56 g).The least test weight observed in SHUATS Dhan-221(ABL) (13.17 g), followed by SHUATS Dhan-217(ABL) (14.70 g), SHUATS Dhan-222(ABL) (15.82 g), SHUATS Dhan-227(ABL) (16.49 g).The mean value for grain yield per hill varied from 30.07 g

to 42.43 g with a grand mean of 35.73 g. Rice genotypes maximum grain yield was observed in SHUATS Dhan-211(ABL) (42.43 g), followed by SHUATS Dhan-224(ABL) (41.50 g), SHIATS DHAN 5 ((40.68 g), SHUATS Dhan-210(ABL) (40.56 g) and SHUATS Dhan-217(ABL) (38.50 g). The minimum grain yield was observed in BPT-2411 (30.07 g), followed by NDR-359 (31.62 g), SHUATS Dhan-221(ABL) (32.30 g), SHUATS Dhan-228(ABL) (32.79 g) and SHUATS Dhan-214(ABL) (33.38 g).

Table 1: Mean performance of 30 advance breeding lines (ABL) of rice for 13 characters during *Kharif* -2017

S. No.	Designation	Days to 50% flowering	Plant height (cm)	No of tillers/ hill	No of panicles/ hill	Panicle length (cm)	Flag leaf length (cm)	Flag leaf width (cm)	No of spikelet's / panicle	Days to maturity	Biological yield/ hill (g)	Harvest index (%)	Test weight (g)	Seed yield/ hill (g)
1.	SHUATS Dhan-210(ABL)	92.67	108.93	18.20	17.40	22.10	43.01	1.35	214.67	122.33	81.54	49.74	16.97	40.56
2.	SHUATS Dhan-211(ABL)	87.67	118.59	22.90	20.40	25.46	39.76	1.63	214.50	116.33	86.87	48.84	28.50	42.43
3.	SHUATS Dhan-212(ABL)	91.33	94.71	18.67	16.12	23.62	25.11	1.43	152.73	122.00	74.12	48.52	23.10	36.26
4.	SHUATS Dhan-213(ABL)	95.00	104.44	16.97	14.67	25.23	34.13	1.48	183.90	124.00	73.25	47.53	19.58	34.82
5.	SHUATS Dhan-214(ABL)	93.67	95.62	19.87	17.47	22.56	25.91	1.20	132.93	122.00	68.30	48.87	23.40	33.38
6.	SHUATS Dhan-215(ABL)	96.67	91.39	18.87	16.27	24.31	24.14	1.52	135.14	126.67	72.85	47.65	24.56	34.72
7.	SHUATS Dhan-216(ABL)	91.33	105.97	14.43	12.00	26.54	36.63	1.35	206.37	120.00	77.59	45.97	18.08	35.67
8.	SHUATS Dhan-217(ABL)	94.33	119.43	21.00	19.90	23.92	29.49	1.79	203.03	123.00	83.87	45.90	14.70	38.50
9.	SHUATS Dhan-218(ABL)	97.00	90.83	19.40	18.33	22.51	24.43	1.21	145.77	124.67	79.98	46.58	23.76	37.26
10.	SHUATS Dhan-219(ABL)	104.33	119.83	19.00	18.20	28.39	48.44	1.61	223.23	133.00	72.85	48.70	18.50	35.48
11.	SHUATS Dhan-220(ABL)	104.00	104.44	19.47	17.60	28.28	33.81	1.53	184.43	132.00	74.29	49.22	18.21	36.57
12.	SHUATS Dhan-221(ABL)	98.67	97.00	16.57	14.80	23.89	30.03	1.33	233.57	133.33	66.48	48.58	13.17	32.30
13.	SHUATS Dhan-222(ABL)	100.33	99.32	16.80	15.20	25.01	25.37	1.21	181.70	128.67	70.49	48.58	15.82	34.25
14.	SHUATS Dhan-223(ABL)	102.00	96.31	19.87	18.87	24.29	28.57	1.32	115.76	129.00	71.80	46.83	25.57	33.63
15.	SHUATS Dhan-224(ABL)	105.00	112.89	18.00	16.90	26.87	39.82	1.54	165.27	133.00	93.61	44.33	27.03	41.50
16.	SHUATS Dhan-225(ABL)	95.67	101.93	14.87	15.27	25.08	31.52	1.29	223.73	126.33	69.86	49.29	16.76	34.44
17.	SHUATS Dhan-226(ABL)	98.00	87.62	15.50	14.83	21.93	31.03	1.28	153.37	129.33	75.82	48.58	16.76	36.84
18.	SHUATS Dhan-227(ABL)	99.00	108.99	18.37	16.10	21.18	28.67	1.34	148.70	132.00	69.67	48.72	16.49	33.95
19.	SHUATS Dhan-228(ABL)	91.33	99.83	13.33	11.20	22.86	27.87	1.33	218.03	124.00	70.88	46.26	17.24	32.79
20.	SHUATS Dhan-229(ABL)	91.67	105.28	15.07	14.05	24.55	28.57	1.39	213.70	121.67	82.91	44.19	20.44	36.64
21.	MTU-1010	92.67	112.44	18.27	17.93	23.76	26.65	1.33	145.40	123.67	72.39	47.92	21.17	34.69
22.	BPT-5204	105.00	107.26	18.00	16.60	23.47	31.68	1.45	175.17	140.00	77.82	45.47	17.20	35.39
23.	MTU-1001	101.00	124.25	17.87	15.50	22.25	26.34	1.38	170.59	135.67	62.40	54.32	23.50	33.90
24.	SHIATS DHAN 1	98.00	124.25	16.62	14.65	25.68	35.27	1.57	252.87	130.00	78.56	43.54	17.20	34.21
25.	SHIATS DHAN 2	86.00	110.32	14.10	12.50	24.53	38.12	1.20	198.60	124.00	76.35	46.32	25.23	35.37
26.	SHIATS DHAN 3	85.00	98.33	16.20	14.80	25.20	44.57	1.62	204.60	128.33	80.25	45.53	23.35	36.54
27.	SHIATS DHAN 4	92.00	93.37	17.35	14.25	25.52	45.23	1.50	187.45	129.33	79.46	47.28	19.46	37.57
28.	SHIATS DHAN 5	84.00	120.47	15.50	14.33	23.54	37.52	1.60	185.67	115.67	83.25	48.86	20.87	40.68
29.	BPT-2411	97.00	97.33	16.60	15.56	23.20	37.57	1.48	152.12	127.00	76.80	41.17	18.52	30.07
30.	NDR-359 ©	104.00	104.00	14.70	13.43	23.80	27.60	1.45	175.15	134.00	72.12	41.69	17.51	31.62
	Mean	95.81	105.18	17.41	15.84	24.32	32.90	1.42	183.27	127.03	75.88	47.17	20.09	35.73
	Range Lowest	84.00	87.62	13.33	11.20	21.19	24.14	1.20	115.77	115.67	62.40	41.17	13.17	30.07
	Range Highest	105.00	124.25	22.90	20.40	28.39	48.44	1.79	252.87	140.00	93.61	54.32	28.50	42.43
	C.D. 5%	1.81	5.38	2.71	2.07	1.72	2.92	0.16	8.99	1.80	5.03	1.37	1.37	1.80

Table 2: Estimation of genetic parameters for 13 quantitative characters in rice.

Characters	$\sigma^2 p$	$\sigma^2 g$	PCV	GCV	h^2 (Broad Sense)%	Genetic Advance	Gen. Adv as % of Mean 5%
Days to 50% flowering	36.36	35.14	6.29	6.19	97	12.00	12.53
Plant height (cm)	114.30	103.48	10.16	9.67	91	19.94	18.96
No of tillers/ hill	6.65	3.91	14.81	11.35	59	3.12	17.92
No of panicles/ hill	5.93	4.33	15.37	13.14	73	3.66	23.13
Panicle length (cm)	3.78	2.68	8.00	6.73	71	2.83	11.65
Flag leaf length (cm)	48.72	45.53	21.22	20.51	93	13.44	40.85
Flag leaf width (cm)	0.03	0.02	11.76	9.60	67	0.23	16.14
No of spikelet's / panicle	1165.03	1134.80	18.62	18.38	97	68.49	37.37
Days to maturity	37.53	36.31	4.84	4.76	97	12.21	9.65
Biological yield/ hill (g)	48.67	39.21	9.19	8.25	81	11.58	15.26
Harvest index (%)	7.20	6.50	5.69	5.40	90	4.99	10.57
Test weight (g)	15.56	14.86	19.64	19.19	95	7.76	38.63
Seed yield/ hill (g)	9.03	7.81	8.41	7.82	87	5.36	14.99

Table 3: Mean performance of best 05 rice genotypes for 7 quality parameters during *Kharif* – 2017

SL. No.	Characters Designation	Hulling (%)	Kernel Length Before Cooking (mm)	Kernel Breadth Before Cooking (mm)	Kernel Length After Cooking (mm)	Kernel Breadth After Cooking (mm)	L/B Ratio (mm)	Elongation Ratio (mm)
1	SHUATS Dhan-211(ABL)	73.95	6.05	1.85	3.2	8.16	3.2	2.54
2	SHUATS Dhan-217(ABL)	69.05	5.55	1.75	3.17	7.95	3.12	2.55
3	SHUATS Dhan-220(ABL)	73.85	5.85	1.65	3.54	7.82	3.1	2.52
4	SHUATS Dhan-222(ABL)	64.7	5.35	1.95	2.74	8.1	3.43	2.36
5	SHUATS Dhan-229(ABL)	74.45	5.75	1.65	3.48	7.56	2.74	2.75
	Mean	71.2	5.71	1.77	3.22	7.91	3.11	2.54
Range	Lowest	64.7	5.35	1.65	2.74	7.56	2.74	2.36
	Highest	74.45	6.05	1.95	3.54	8.16	3.43	2.75

Conclusion

It is concluded that among 30 genotypes of rice on the basis of mean performance SHUATS Dhan-211(ABL) (6.2 t/ ha) was found to be superior in grain yield number of spikelets per panicle over the check followed by SHUATS Dhan-224 (ABL) (6.1 t/ha), SHIATS DHAN 5 (6.0 t/ha) showed 1-2 t/ha increase over the check (NDR-359). Selection of plants on these traits would certainly lead to improvement in grain yield.

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