Frontiers in Crop Improvement, Vol. 8 (2) : 90-96 (2020)
Print ISSN : 2393-8234, Online ISSN : 2454-6011

ASTHA FOUNDATION
Meerut (U.P.) INDIA

GENETIC ANALYSIS OF BACKCROSS DERIVED INTERSPECIFIC POPULATION DERIVED FROM *ORYZA GLABERRIMA* STEUD. IN ELITE RICE CULTIVAR IR64 BACK-GROUND FOR AGRO-MORPHOLOGICAL TRAITS

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ABSTRACT

Oryza glaberrima Steud. (African rice) is source of many traits such as, tolerance to drought, competitive to weeds and low input responsive which are unique to rice species. However, *O. glaberrima* is not much explored for agro-morphological traits. In the present investigation, we have developed 84 lines of $BC_1F_{2:3}$ populations by interspecific cross between *Oryza glaberrima* Steud. (as donor) and *Oryza sativa* cv. IR64 (as recurrent parent), with an objective of analysing the backcross population for agro-morphological traits. The 84 introgressed lines were sown in augumented design during *Kharif*, 2019 and data is noted for nine agro-morphological traits to study correlation, heritability, genetic variability and genetic advance. Genetic variability estimates revealed GCV and PCV were higher for number of tillers/hill, spikelets/panicle, number of panicles/hill, yield/plant and spikelet fertility indicating that simple selection of these traits can be performed for further improvement. High heritability (%) broad sense along with high genetic advance as per-cent mean (GAM) was observed in number of tillers/hill, plant height, number of panicles/hill, spikelets number/panicle, spikelet fertility, yield/plant, showing the contribution of additive gene action. Three introgressed lines *viz.,* 58*-1-18, 58*-9-5, 58*-3-27 with are having higher mean performance of yield than donor *O. glaberrima* are found to be promising.

***Key words** : Correlation coefficient, genotypic coefficient of variation, genetic advance, heritability, NERICA, Oryza glaberrima, Oryza sativa, phenotypic coefficient of variation.*

Rice is one of the most important energy source for world's population. The necessity for rice is increasing in Asia and the demand is projected to 650 million tonnes by 2050 (1). Rice belongs to genus *Oryza* and species can be either diploid or tetraploid. Both cultivated species of rice, *Oryza sativa* L. and *Oryza glaberrima* stued. belongs to diploid species (2n=24) (2). In west Africa *O. glaberrima* (African rice) is being selected and cultivated for the last 3000 years (3) and is found resistant to several biotic and abiotic stresses *viz.,* drought, iron toxicity, weed competitiveness, African gall midge, nematodes, and bacterial blight (4). Several studies have reported QTLs for agronomic performance (1,17,22) using *O. glaberrima* for yield traits. However, yield level of *O. glaberrima* is lesser to that of *O. sativa* due to grain shattering and poor resistance to lodging (5). Transfer of useful genes was also constrained by sterility in the early progenies of crosses (7). Despite these interspecific barriers, many have reported and analysed the natural gene flows among *O. glaberrima* and *O. sativa* (8, 9). Rice breeders at the Africa Rice Centre developed (NERICA) New Rice for Africa using interspecific crosses between *O. glaberrima* Steud. and *O. sativa* L. (10).

In the plant breeding programme, the presence and amount of variability play the crucial part. Estimation of variation that is transferable to successive generations along with heritability is required to understand the expected genetic gain (11). So in the present study, efforts were made to phenotype *O. sativa* × *O. glaberrima* interspecific progenies for agro-morphological traits and estimated genetic variability, heritability, and genetic advance. The result of present study expected to throw light on feasibility of *O. sativa* × *O. glaberrima* interspecific progenies in rice crop improvement and widening genetic basis of rice gene pool.

MATERIALS AND METHODS

Plant material : The experiment was conducted at research farm of ICAR-Indian Institute of Rice Research, Rajendranagar, Hyderabad during *Kharif* 2019 under irrigated condition**.** The experimental materials used in the present study comprised of 84 $BC_1F_{2;3}$ introgressed lines (ILs) developed from the cross between IR64 (*Oryza sativa* L). × *Oryza glaberrima* Steud. accession (EC861812).

Development of population : Recurrent parent IR64 (as female parent) was crossed to *O. glaberrima* accession (EC861812) during *Kharif,* 2016 to produce interspecific F_1 seeds. The seed set during interspecific hybridization was very low (<20%, personnel communication). The single F_1 plant was backcrossed with recurrent parent and obtained 10 BC_1F_1 seeds. BC_1F_1 seeds were grown and selfed to produce 84 lines of $BC_1F_{2:3}$ introgression lines (ILs).

Experimental design : The experiment was laid in Augumented RCBD design (12) and experimental plot was divided in to four blocks containing 21 introgression lines along with parents as checks in each block. Each accession was sown in single row of two-meter length with spacing of 15×20 cm and recommended agronomic practices were followed.

Phenotypic evaluation : Three plants were randomly tagged and utilized to collect data on agro-morphological characters *viz*., days to 50% flowering, plant height (cm), number of tillers per hill, number of panicles per hill, panicle length (cm), number of spikelets per panicle, spikelet fertility (%), 1000 grain weight (g) and yield per plant (g).

Statistical analysis : The mean values from each replication were subjected to statistical analysis. The augmented ANOVA analysis was carried out in R studio (version 3.5.2) using *augmented RCBD* package (13). Genotypic and phenotypic coefficient of variation (6), heritability in broad sense (14), genetic advance in per cent of mean (15) were also obtained. Correlation analysis was carried out using OPSTAT (16).

RESULTS AND DISCUSSION

Analysis of variance (ANOVA) and descriptive statistics : To know the differences which are significant among introgressed lines (ILs) of developed population, descriptive statistics, and analysis of variance were performed for nine agro morphological traits and results were discussed below (Table-1). The analysis of variance showed mean sum of square of treatments were significant for spikelets/panicles, spikelet fertility and yield. Mean sum of square of checks were significant for the traits *viz.,* days to 50% flowering, number of spikelets, yield, spikelet fertility and 1000 grain weight indicating two checks are performing significantly different from each other. Mean sum of square of blocks (Eliminating treatments) were non-significant for all traits excluding days to 50% flowering indicating homogeneity of blocks in experimental site. Mean sum of square of treatment *vs* checks is significant for number of tillers/hill, number of spikelets, days to 50% flowering, yield and spikelet fertility indicating the difference in performance between treatments and checks.

Performance of introgression lines for agro-morphological traits : The performance of agro-morphological traits among introgression lines (ILs) are presented in Table 2 and discussed below.

Days to 50% flowering (DFF) : In ILs DFF ranging from 77 days (58*-1-2, 58*-7-27, 58*-8-1) to 85 days (58*-1-15, 58*-2-8, 58*-3-5, 58*-3-22, 58*-4-3, 58*-4-5, 58*-4-6) with mean value of 81.99±0.45 days. Compared to parents, IR64 (92 days) and EC861812 (98), all introgression lines had earlier heading days.

Plant height (cm) : In ILs height of the plant ranged between 67cm (58*-1-7) to 136.7cm (58*-3-22) with mean value of 101.98±2cm. The plant height of recurrent parent IR64 was 93cm and of EC861812 was 117cm. Reduction in plant height than recurrent parent is observed in ILs.

Number of tillers/hill : In ILs the values ranged from 4.5 (58*-7-27) to 55 (58*-1-15) with mean value of 17.45±1.13. Higher number is observed in ILs compared to recurrent parent producing 15.3 tillers and EC861812 producing 9.5 tillers.

Number of panicles/hill : In ILs the values varied from 3.7 (58*-9-14) to 44 (58*-1-15) and mean value of panicles was 14.3±0.96. Recurrent parent IR64 produced 14 panicles and donor parent produced 8.3 panicles. Higher number of panicles/hill is observed in ILs compared to parents.

Panicle length (cm) **:** Panicle length in ILs ranged between 17cm (58*-4-6) to 28.2cm (58*-3-18) with mean value of 23.02±0.23 cm. Panicle length of recurrent parent IR64 is 22.7cm and donor is 23.6cm.

Number of spikelets/panicle : In ILs ranges the values varied from 13.3 (58*-1-2) to 177 (58*-1-3) with mean value of 90.76±4.46. Introgressed lines are having lower spikelet number compared to parents, IR64 (244.5) and EC861812 (219.5).

Spikelet Fertility (%) : Among ILs spikelet fertility ranged from 3.7% (58*-3-12) to 81.7% (58*-3-19) with mean value of 19.83±1.9. The recurrent parent, IR64 exhibited 96.8% and the donor EC861812 94.2%. Compare to parents, all the ILs exhibited low spikelet fertility.

Grain yield/plant (g) : Grain yield ranged from 1.1g (58*-2-15, 58*-3-10, 58*-4-3, 58*-7-27, 58*-9-9) to 9.2g (58*-1-18) with the mean value of 2.7±0.21g, Grain yield of in all ILs is low compared to recurrent parent IR64 (10.4g) and donor parent (7.5g).

1000 grain seed weight (g) : The test weight of grains in introgressed lines ranged from 22.6g (58*-1-7) to 32.3g (58*-2-1), with an mean value of 29.17±0.31g. Recurrent parent IR64 recorded 32.3g and donor recorded 27.3g.

Phenotypic co-efficient of variability and Genotypic co-efficient of variability estimation : The higher values of GCV and PCV is observed in number of tillers/hill (GCV= 48.33 and PCV= 52.95%), number of panicles/hill (GCV= 49.76 and PCV= 55.76%), yield/plant (GCV= 60.84 and PCV= 63.67%), number of spikelets/panicle (GCV= 37.46 and PCV= 38.71%) and spikelet fertility (GCV= 66.35 and PCV= 66.39%). Whereas, GCV and PCV with medium values was found in plant height (GCV= 15.06 and PCV= 17.06), while lower GCV and PCV was

Table-1 : Augmented analysis of variance for yield attributing traits in BC1F2:3 derived from IR64*1/O. glaberrima.

Source of variation	Df	Mean sum of squares								
		DFF	PH	TT	PT	PL	NSP	SF	YPP	TSW
Block (ignoring Treatments)	3	4.9 *	1991.05**	782.35**	625.22**	1.72	2742.79 **	359.96 **	3.98 *	3.82
Treatment (eliminating Blocks)	85	19.87 **	252.42	59.91	42.4	3.16	2922.01 **	672.64 **	6.42 *	6.45
Check	1	55.12 **	640.82	29.02	32.19	1.62	1250 *	13.92 **	16.82**	51.66*
Test and Test vs. Check	84	19.45 **	247.8	60.28	42.52	3.18	2941.91 **	680.48 **	6.3 *	5.91
Treatment (ignoring Blocks)	85	19.31 **	304.54	86.95	64.02	3.13	3017.04 **	685.33 **	6.55 *	6.42
Treatment:	83	3.79	302.53	85.33	63.6	3.18	1234.4 *	173.27 **	2.96 *	5.92
Treatment: Test vs. Check	1	1272.02 **	134.88	279.49*	130.61	0.16	152742.87 **	43857.32 **	294.22 **	2.94
Block (eliminating Treatments)	3	20.79 **	514.32	16.32	12.65	2.6	50.33	0.57	0.44	4.54
Residuals	3	0.46	66.59	14.23	12.95	0.49	78.33	0.25	0.26	2.43

Note : ns P > 0.05; * P <= 0.05; ** P <= 0.01 DFF-Days to 50% flowering, PH-Plant height, TT-number of Tillers per hill, PT-Number of panicles per hill, PL-Panicle length, NSP-Number of spikelets per panicle, SF- Spikelet Fertility %, TSW-1000 seed weight, YPP-Grain yield per plant.

seen in days to 50% flowering (GCV= 2.23 and PCV= 2.37%), panicle length (GCV= 7.13 and PCV= 7.75%), 1000 grain weight (GCV= 6.4 and PCV= 8.34). The results are given in (Table 3; Figure 1).

Estimation of heritability (%) broad sense and genetic advance : The results were presented in (Table-3 and Figure-1). High heritability (%) broad sense is noted for DFF (87.9%), plant height (77.99%), number of tillers/hill (83.32%), Number of panicles/hill (79.64%), panicle length (84.65%), number of spikelets/panicle (93.65%), spikelet fertility (99.85%) and yield (91.32%). Whereas 1000 grain weight (58.97%) showed medium heritability. Traits such as number of panicles/hill, spikelets/panicle, number of tillers/hill, plant height, spikelet fertility and yield are showing high heritability and are also having high genetic advance. Higher heritability per-cent and low genetic advance is observed in days to 50% flowering. Panicle length is showing high heritability and medium genetic advance, while medium heritability and medium genetic advance is seen in 1000 grain weight.

Correlation coefficient : Yield is significantly correlating with DFF (0.300), spikelet fertility (0.307), number of spikelet/panicle (0.248). Whereas traits like plant height (-0.064), number of tillers/hill (-0.166), panicles/plant (-0.123), and panicle length (-0.123) showed negative correlation with yield/plant (Table 4).

Promising lines for yield : Mean yield performance of three introgression lines 58*-1-18 (9.2±0.21g), 58*-9-5 (8.2±0.21g), 58*-3-27 (7.5±0.21g) are having higher yield/plant than donor parent EC861812 (7.5±0.21g). However, they are lower than recurrent parent IR64 (10.4±0.21g) except 58*-1-18 (9.2±0.21g) which is found on par with IR64.

The *O. glaberrima* accessions have many important characters such as weed competitiveness, high light use efficiency, drought tolerance, pest, and disease resistance. Drought and weed growth limit the rice crop in getting high yield. In African rice weed competitive ability is contributed by early vigour, low extinction coefficient, high light use efficiency, and high specific leaf area. The ability of *O. glaberrima* to produce extra tillers (up to 8 tillers/hill) between 40 and 80 days after germination, can compensate for any early loss in tillering suffered due to weeds. Thus, *O. glaberrima* can be used as a vital source for improving yield of rice. Backcrossing *O. glaberrima* with *O. sativa* parents not only increased fertility but also helped in combining the features of both *O. sativa* and *O. glaberrima* (3). However, *O. glaberrima* is not much explored for agro morphological traits.

Performance of agro-morphological traits : In our study, earliness in flowering and reduction in plant height was observed in almost all introgressed lines. The observed high number tillers/hill ranging 4.5 (58*-7-27) to 55 (58*-1-15) and high number of panicle/hill ranging from 3.7 (58*-9-14) to 44 (58*-1-15) in introgressed lines is due to secondary branching. Similarly, observed earliness in flowering in certain accessions of BILs of *O. glaberrima* compared with the RP and reduced plant height in crosses with ten accessions of *Oryza glaberrima* (17). (17) also observed that though the number of primary branches were same in the two parents (about 12 per panicle), but observed higher in the four progenies, and also said the high tiller number in introgressed lines is because of secondary branching compared to the parents.

We also observed low number of spikelet/panicle with mean value of 90.76±4.46 and low spikelet fertility with mean 19.83±1.9 which is much lower compared to recurrent parent IR64 (96.8%). In support of our result of lower spikelet fertility (17) also observed severe spikelet sterility in the interspecific F_1 and backcross derivatives of *O. sativa* and´ *O. glaberrima* crosses. (18) have found that proportion of *O. glaberrima* in the genome (PGG) level is having negative effect on the percentage of grain filling. The mean of yield/plant was 2.7±0.21g, and all ILs

Table-2 : Mean performance of $BC_1F_{2:3}$ introgression lines derived from IR64*1/*O. glaberrima*.

Plant no	Generation code	DFF	PH	TT	PT	PL	NSP	SF	YPP	TSW
1	58*-1-1	80.0	78.7	11.3	10.0	21.8	30.0	33.3	3.1	26.3
2	58*-1-2	77.0	72.0	19.0	16.0	23.2	13.3	25.0	1.9	27.0
3	58*-1-3	82.0	115.5	22.5	17.0	25.8	177.0	26.6	1.8	26.3
4	58*-1-5	78.0	68.3	14.0	10.3	21.3	40.0	25.0	2.4	26.6
5	58*-1-4	83.0	116.0	21.5	15.5	25.3	44.3	15.0	1.1	24.3
6	58*-1-6	82.0	93.5	21.5	14.0	22.5	33.3	38.0	1.3	27.4
7	58*-1-7	79.0	67.0	25.0	21.5	22.5	96.7	20.7	2.4	22.6
8	58*-1-8	81.0	99.0	33.7	27.0	22.0	113.3	11.8	1.8	29.5
9	58*-1-13	84.0	100.0	27.0	27.0	24.3	96.7	13.8	6.9	31.2
10	58*-1-15	85.0	77.0	55.0	44.0	23.7	92.7	9.0	1.2	30.4
11	58*-1-18	79.0	74.0	16.0	12.0	21.7	61.7	8.1	9.2	26.6
12	58*-1-19	78.0	99.0	32.0	21.0	23.7	36.7	18.2	1.4	29.4
13	58*-1-20	80.0	75.5	33.5	27.5	22.3	124.3	13.4	1.3	30.2
14	58*-1-24	79.0	88.0	25.3	24.7	22.8	104.3	7.3	2.6	31.5
15	58*-2-1	81.0	89.0	28.0	24.3	21.7	80.0	12.5	5.4	32.3
16	58*-2-4	82.0	80.0	38.0	38.0	25.3	113.7	12.6	2.0	26.7
17	58*-2-7	83.0	88.0	17.0	15.0	18.7	107.7	4.0	2.1	30.5
18	58*-2-8	85.0	99.0	20.3	16.3	21.3	135.3	14.8	4.8	29.0
19	58*-2-9	79.0	87.0	25.7	19.3	24.8	102.7	14.3	3.1	31.2
20	58*-2-10	81.0	92.3	14.0	11.0	23.5	106.7	17.8	1.4	32.1
21	58*-2-12	80.0	110.5	33.0	28.5	23.5	74.7	8.0	1.4	30.4
22	58*-2-13	81.0	104.7	28.3	25.7	23.7	97.3	4.1	1.3	31.0
23	58*-2-14	82.0	110.0	26.0	30.0	25.0	109.3	10.4	1.4	28.8
24	58*-2-15	82.0	113.0	30.0	26.0	25.7	102.0	10.8	1.1	31.3
25	58*-3-1	83.0	106.7	21.3	16.3	22.2	105.3	7.6	2.8	24.3
26	58*-3-2	84.0	74.0	17.3	14.7	20.4	73.3	9.1	2.0	31.6
27	58*-3-3	80.0	88.7	15.0	14.0	21.2	118.0	26.0	3.2	28.0
28	58*-3-4	82.0	128.0	11.0	8.0	24.6	104.7	14.0	1.5	29.5
29	58*-3-5	85.0	108.0	11.7	12.3	20.8	88.0	24.2	1.2	31.7
30	58*-3-6	83.0	108.0	21.7	16.0	25.6	101.0	11.2	1.9	25.3
31	58*-3-7	81.0	93.8	22.1	18.4	23.9	16.0	16.7	1.4	27.5
32	58*-3-8	83.0	81.3	12.7	10.7	22.4	94.0	14.9	1.5	29.8
33	58*-3-9	84.0	111.3	22.7	17.3	24.2	92.3	44.4	1.3	29.8
34	58*-3-10	79.0	130.3	28.7	23.0	26.0	98.7	17.2	1.1	30.2
35	58*-3-11	83.0	130.3	22.0	21.3	23.6	121.7	12.3	2.4	30.5
36	58*-3-12	83.0	128.7	19.7	16.0	24.3	62.3	3.7	2.9	31.9
37	58*-3-15	82.0	83.0	11.0	13.3	23.8	87.0	19.5	4.7	30.6
38	58*-3-16	83.0	106.0	16.0	12.7	23.0	73.7	32.1	1.3	31.3
39	58*-3-17	82.0	105.7	22.0	18.0	19.2	68.7	13.1	1.9	24.4
40	58*-3-18	83.0	123.5	25.0	21.0	28.2	86.3	5.4	1.2	29.6
41	58*-3-19	81.0	89.0	7.7	6.0	21.0	93.0	81.7	2.7	24.6
42	58*-3-20	81.0	83.0	11.0	13.3	23.8	30.0	22.2	2.7	23.0
43	58*-3-21	81.0	117.0	14.7	13.3	22.8	96.3	20.4	5.5	32.0
44	58*-3-22	85.0	136.7	9.3	7.0	23.3	103.3	18.1	2.3	29.6
45	58*-3-23	79.0	105.0	14.5	12.0	23.7	85.0	16.1	1.3	31.6
46	58*-3-24	82.0	119.0	14.0	12.7	23.6	121.3	6.6	2.5	27.1
47	58*-3-25	82.0	117.0	14.7	13.3	22.8	111.3	13.5	1.5	31.4
48	58*-3-27	82.0	124.0	9.0	6.7	22.8	97.0	8.9	7.5	29.3
49	58*-3-28	83.0	104.5	28.0	18.5	22.8	115.0	7.2	2.8	30.7
50	58*-3-29	82.0	104.5	28.0	18.5	22.8	143.0	13.8	1.8	25.9
51	58*-4-1	83.0	117.3	11.3	7.3	21.6	110.0	15.8	2.1	29.7
52	58*-4-2	80.0	101.3	13.0	10.7	24.3	104.0	17.9	2.8	26.5
53	58*-4-3	85.0	103.0	10.0	8.0	22.8	99.7	5.7	1.1	27.1
54	58*-4-4	81.0	97.0	10.3	7.0	24.1	105.3	10.1	1.4	28.9
55	58*-4-5	85.0	104.5	28.0	18.5	22.8	95.7	8.4	1.4	31.9
56	58*-4-6	85.0	73.0	8.0	6.0	17.0	116.0	13.5	2.3	31.4
57	58*-4-7	82.0	104.5	28.0	18.5	22.8	117.0	7.4	1.4	28.6
58	58*-7-3	81.0	90.7	22.7	19.7	24.7	108.7	12.6	4.9	27.9
59	58*-7-4	82.0	114.7	29.7	23.3	23.6	87.3	5.7	4.1	31.6

Table-2 : Contd......

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Plant no	Generation code	DFF	PH	TT	PT	PL	NSP	SF	YPP	TSW
60	58*-7-5	83.0	80.7	6.7	5.7	21.3	80.3	10.8	1.9	30.9
61	58*-7-17	82.0	68.0	20.0	16.0	19.0	100.0	18.0	1.4	28.7
62	58*-7-18	79.0	101.7	16.0	13.7	23.1	106.3	12.9	2.1	30.2
63	58*-7-27	77.0	101.0	4.5	4.5	21.8	68.3	29.8	1.1	30.9
64	58*-8-1	77.0	91.3	8.7	8.7	21.0	146.7	47.7	1.5	31.4
65	58*-8-10	83.0	120.5	19.0	17.0	22.7	43.7	22.9	5.2	30.4
66	58*-8-11	84.0	97.7	10.3	9.3	26.3	19.3	31.0	1.2	24.4
67	58*-8-13	81.0	83.7	11.7	4.3	22.6	104.0	27.9	1.8	28.9
68	58*-9-1	81.0	85.0	10.7	8.3	22.1	95.0	24.9	4.1	31.1
69	58*-9-2	80.0	125.7	11.3	8.3	22.9	161.7	43.3	2.4	28.6
70	58*-9-3	80.0	90.3	7.0	5.7	22.3	50.3	25.2	5.8	27.9
71	58*-9-5	81.0	100.0	8.3	5.7	21.2	70.0	18.1	8.2	27.6
72	58*-9-6	82.0	127.7	7.3	5.0	25.3	28.3	23.5	2.4	31.7
73	58*-9-7	83.0	120.0	8.3	5.3	22.3	30.0	11.1	2.1	29.0
74	58*-9-8	83.0	127.0	7.3	5.7	23.8	146.0	8.4	2.2	30.8
75	58*-9-9	84.0	128.7	8.3	6.0	22.8	18.7	10.7	1.1	31.7
76	58*-9-10	84.0	117.7	7.7	6.0	24.4	93.0	8.2	4.1	31.3
77	58*-9-11	80.0	110.3	7.7	6.3	23.9	22.3	40.3	1.4	27.0
78	58*-9-12	82.0	106.0	12.7	10.3	21.9	67.0	4.0	1.7	28.8
79	58*-9-13	81.0	105.0	7.5	5.5	23.0	77.0	9.1	1.6	32.1
80	58*-9-14	82.0	116.0	6.3	3.7	23.4	70.0	17.1	5.7	28.9
81	58*-9-15	82.0	126.7	9.7	8.3	26.3	60.7	22.0	1.9	32.0
82	58*-9-16	80.0	109.0	13.7	10.7	21.0	103.3	67.7	3.0	25.0
83	58*-9-17	82.0	106.7	9.0	7.3	23.6	24.0	13.9	1.9	32.0
84	58*-9-19	83.0	118.7	8.7	7.3	23.1	131.3	13.7	1.5	30.4
85	EC86182	98	117.0	9.5	8.3	23.6	219.5	94.2	7.5	27.3
86	IR64	92	93.0	15.3	14.0	22.7	244.5	96.8	10.4	32.3
	Max	85	136.7	55.0	44.0	28.2	177.0	81.7	9.2	32.3
	Min	77	67.0	4.5	3.7	17.0	13.3	3.7	1.1	22.6
	Mean	81.99±0.45	101.98±2	17.45±1.13	14.3±0.96	23.02±0.23	90.76±4.46	19.83±1.9	2.7±0.21	29.17±0.31
	CD (0.05)	0.96	36.73	16.9	16.1	0.99	12.52	0.71	0.72	2.2
	CV %	0.82	8.02	22.12	25.64	3.03	8.85	2.02	16.32	5.33

Note : DFF-Days to 50% flowering, PH-Plant height, TT-number of Tillers per hill, PT-Number of panicles per hill, PL-Panicle length, NSP- Number of spikelets per panicle, SF-Spikelet Fertility %, TSW-1000 seed weight, YPP- Grain yield per plant.

Table-3 : Estimates of genetic variability parameters for yield and yield parameters in BC1F2:3 population derived from IR64*1/*O. glaberrima*.

Trait	Mean	Coefficient of variability		Heritability (%) broad sense	Gen. Advance as per cent of Mean (at 5%)
		GCV	PCV		
Days to 50% Flowering	81.99	2.23	2.37	87.9	4.3
Plant height (cm)	101.98	15.06	17.06	77.99	27.44
Number of tillers per hill	17.45	48.33	52.95	83.32	91.01
Number of panicles per hill	14.3	49.76	55.76	79.64	91.61
Panicle length (cm)	23.02	7.13	7.75	84.65	13.53
Number of spikelets per panicle	90.76	37.46	38.71	93.65	74.8
Spikelet fertility (%)	19.83	66.35	66.39	99.85	136.77
1000 grain weight (g)	29.17	6.4	8.34	58.97	10.15
Yield per plant (g)	2.7	60.84	63.67	91.32	119.94

exhibited much lesser than yield of recurrent parent IR64 (10.4g). The low yield level in our study is due to high sterility and persistence of shattering. (3) observed seed fertility of the progenies between 30 and 65% in the BC_2F_1 populations, suggesting a gradual elimination of heterozygotes. However, fertility increased with each generation.

Performance based on genetic variability, heritability and mean genetic advance : Genetic variability estimation revealed that simple selection can be done in the traits having high GCV and PCV. Traits which are showing low PCV and GCV indicate that traits are influenced by environmental factors. In our study we found that PCV which adds up to the total variation is higher than

Table-4 : Pearson Correlation matrix.

Trait	DFF	PH	TT	PT	PL	NSP	SF	YPP	TSW
DFF	1	0.237*	0.054NS	0.046NS	0.019NS	0.435**	0.330**	0.300**	0.104NS
PH	0.237*	1	0.173NS	0.190NS	0.452**	0.087NS	0.060NS	0.064NS	0.213*
TT	0.054NS	0.173NS	1	0.958**	0.215*	0.117NS	-0.274*	0.166NS	0.001NS
PT	0.046NS	0.190NS	0.958**	1	0.233*	0.130NS	-0.259*	0.123NS	0.018NS
PL	0.019NS	0.452**	0.215*	0.233*	1	0.058NS	0.098NS	0.123NS	0.009NS
NSP	0.435**	0.087NS	0.117NS	0.130NS	0.058NS	1	0.311**	0.248*	0.129NS
SF	0.330**	0.060NS	-0.274*	-0.259*	0.098NS	0.311**	1	0.307**	0.197NS
YPP	0.300**	0.064NS	0.166NS	0.123NS	0.123NS	0.248*	0.307**	1	0.013NS
TSW	0.104NS	0.213*	0.001NS	0.018NS	0.009NS	0.129NS	0.197NS	0.013NS	1

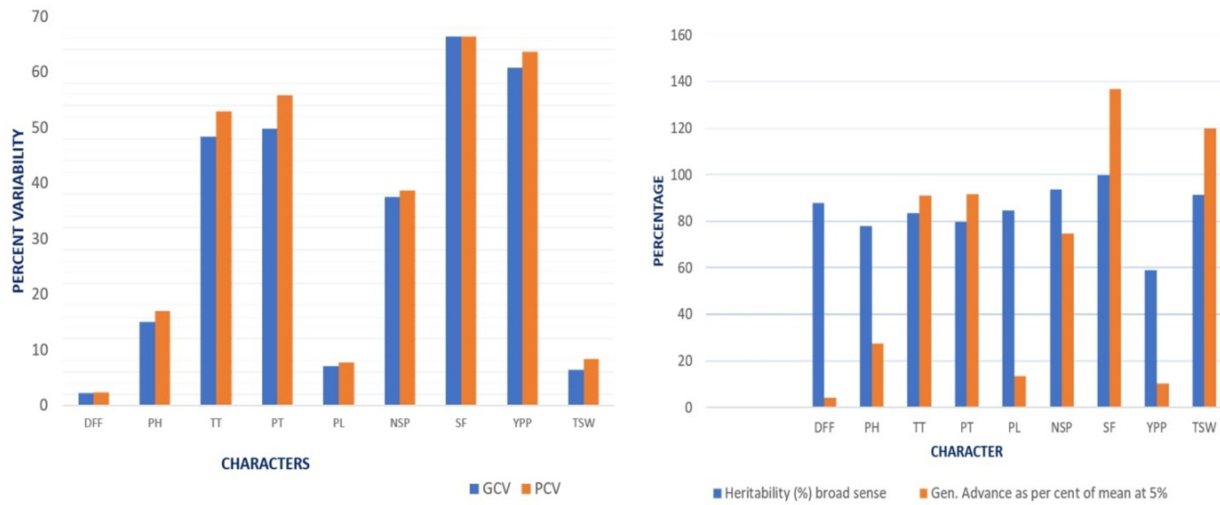

Figure-1 : Histogram of PCV, GCV, heritability in broad sense (h2) and genetic advance.

GCV in all traits revealing the influence of environmental factors on these agro-morphological traits.

Traits with high heritability (%) broad sense with high genetic advance (GAM) signifying the additive gene action. Therefore, emphasis should be given to choose these traits to increase the yield potential of rice and further improvement of these traits can be obtained by direct phenotypic selection. Heritability estimates combined with genetic advance traits will be more helpful in estimating the yield under phenotypic selection than taking only heritability values individually (15). Heterosis breeding is for the traits with high heritability (%) and low genetic advance (GAM) as there is non-additive gene action.

CONCLUSIONS

In general plants having yield component traits (tillers/plant, panicle length, spikelets/panicle) numerically higher than the RP were selected. Plants with undesirable traits like tallness, lateness, spreading, shattering, awning, and very bold grains were rejected. In our preliminary study we have found desirable plant traits like decreased DFF and plant height. To further increase the yield potential in the present cross combination importance should be given to traits which were having high heritability (%) combining with high genetic advance. There was significant increase in three introgressed lines *i.e.,* 58*-1-18, 58*-9-5, 58*-3-27 for mean yield performance, which are promising for advancement. Yield is positively correlated with DFF, spikelets/panicle and spikelet fertility indicating that the introgression is feasible.

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Received : June-2019 Revised : June-2019 Accepted : July-2020