RESEARCH ARTICLE https://doi.org/10.58297/BNWT2744

Genetic Analysis for Yield and Yield Attributing Traits in *Oryza glaberrima* Derived Introgression Line and O. *sativa* cv. Samba Mahsuri

Udaya V [1,2], Reddi Sekhar M[2], Laha GS[1], Reddy VLN[2], Sudhakar P[3] and Gireesh C[1]*

[1]ICAR-Indian Institute of Rice Research

[2]S. V. Agricultural College, Tirupati, Acharya N G Ranga Agricultural University (ANGRAU)

[3]Acharya N G Ranga Agricultural University (ANGRAU)

Corresponding author Email: giri09@gmail.com

Received: 2nd October 2022; Accepted: 5th December 2022

Abstract

Rice (*Oryza sativa* L.) is one of the most important staple food crops of the world and the yield of rice is stagnated for several decades because of a narrow genetic base. African cultivated species, *Oryza glaberrima*, is a potent source for broadening the genetic base of *O. sativa* cultivars. In this investigation, a total of 232 F_2 population derived from a cross between *O. glaberrima* derived introgression line and *O. sativa* cv. Samba Mahsuri was characterised by yield and yield-attributing traits. A great range of variability was noticed for the number of tillers, number of panicles, and yield per plant. The PCV values were on par with GCV for all yield and yield-attributing variables, indicating a low environmental influence. High heritability coupled with moderate to high GAM was recorded in all traits, indicating the presence of additive gene effect and direct selection of these characters might be effective. Panicle length (0.18**), the number of tillers (0.29**), and panicles (0.31**) found a significant positive correlation with yield per plant. The findings of the current study have demonstrated the usefulness of *O. glaberrima* germplasm and its potential for use in the genetic development of *indica* rice varieties, specifically for the yield-enhancing trait.

Keywords: *Oryza glaberrima, O. sativa*, Variability, Heritability, Hybridization

Introduction

Rice (*Oryza sativa* L.), is a major cereal crop, and roughly one-half of the world's population depends on rice. In India, 122.27 million tonnes of rice were produced in an area of 45.07 million hectares in the year 2021 (https://desagri.gov.in). It is also the most affordable source of carbohydrates and calories (Srijan *et al*., 2016; Lingaiah *et al*., 2020). The demand for rice production is rising along with the population. However, rice yield stagnated in the last several decades. In India, the yield of rice was 1901 kg/ha in 2000–21; it was 2239 kg/ha in 2010–11; and, was 2713 kg/ha in 2020–21 (https://desagri.gov.in), indicating low genetic gain over the period of time despite intensive breeding efforts. This could be mainly due to the narrow genetic base of parental lines in breeding programmes. So, it is imperative to broaden the genetic base of rice cultivars to break the yield ceiling limit in rice production to meet increasing rice demand.

African rice (*O. glaberrima*) is known to possess useful traits for the genetic enhancement of *indica* cultivars. However, *O. glaberrima* is not extensively utilised in *indica* improvement programs even after the successful story of NERICA (New Rice for Africa) in India, due to sterility barriers in interspecific hybridization, linkage drag and other challenges in interspecific crosses (Sarla and Swamy, 2005; Maji and Shaibu, 2012; Lakshmi *et al*., 2019). The *O. glaberrima* is used rarely in India to improve the genetics of indica rice. In this study, the F_2 population derived from the cross between *O. glaberrima* introgressed line and *O. sativa* cv. Samba Mahsuri was characterised by yield-enhancing traits. The study revealed selection parameters to be employed in the selection and promising plants for yield-enhancing traits.

The fundamental aim of the plant breeder is the development of a high-yielding and wide genetic base variety, in that context selection parameters play a crucial part in the introgression of useful traits during the breeding program. Key selection criteria for selecting superior varieties include genetic variability, correlation, heritability, genetic advance, and genetic advance over a mean (Ali *et al*., 2002). To maximise the utilisation of the relationships in the selection, it is essential to understand the link between yield and yield constituent qualities. (Sarawgi *et al*., 1997).

Samba Mahsuri (BPT-5204), a popular mega-variety of rice is grown extensively in India, especially in the southern belt. It is a medium-slender grain with outstanding cooking qualities. However, Samba Mahsuri yield levels plateaued (Basavaraj *et al*., 2020). The enormous genetic variability in the *Oryza* genus could aid in the improvement of rice varieties, and in this light, African rice would be a useful tool for *O. sativa* varietal improvement (Bharamappanavara *et al*., 2020). As a result, the current investigation sought to evaluate variability and identify a relationship between yield and yield constituting traits in the F_2 population of the cross between *O. glaberrima* introgressed line and *O. sativa* cv. Samba Mahsuri.

Materials and Methods

Plant material and population development

The present study was conducted at the ICAR-Indian Institute of Rice Research, Hyderabad in *Kharif* 2020, *Rabi* 2020-21, and *Kharif* 2021. Introgression line derived from IR64*1/*O. glaberrima* in BC_2F_4 was selected as the donor (male) parent and was crossed to *O. sativa* cv. Samba Mahsuri in *Kharif* 2020. *O. glaberrima* (EC861812) was used as a donor as it showed resistance to few biotic stresses over seasons and also has cross-compatibility with *O. sativa* cv. Samba Mahsuri. The true F_1 confirmed (**Figure 1**) by parental polymorphic SSR marker RM 169 (F: 5'-TGGCTGGCTCCGTGGGTAGCTG-3', R: 5'TCCCGTTGCCGTTCATCCCTCC-3'; Tm- 58^0C; positive – 130 bp; negative – 169 bp) was selfed to develop F_2 seeds during *Rabi* 2020-21. The 232 F_2 seeds and parents were sown and transplanted with a single seedling per hill in an un-replicated design, spaced 20cm × 15cm apart in *Kharif* 2021 in an irrigated ecology. All the agronomic practices were followed as recommended by ICAR – IIRR (https://www.icar-iirr.org/index.php/en/) to raise the good crop.

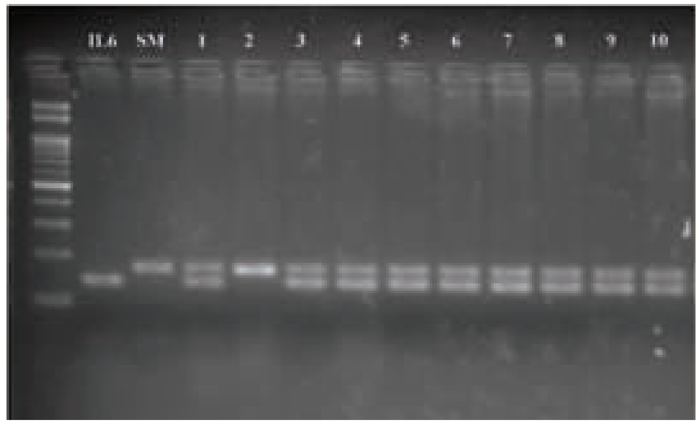

Figure 1: Hybrid confirmation of 10 F1 plants along with parents (IL6 and Samba Mahsuri) by SSR (RM169) marker

Observations and Statistical analysis

The observations were recorded at maturity stage for seven yield and yield constituent traits namely plant height (cm), panicle length (cm), number of tillers, number of panicles, flag leaf length (cm), flag leaf breadth (cm), and yield per plant (g). The collected F_2 data were subjected to different statistical analyses. The PCV and GCV were calculated according to Burton and Dewane (1953). Heritability was calculated following Falconer (1981). The genetic advance was calculated according to Johnson *et al*. (1955). Principal Component Analysis (PCA) and correlation coefficients were calculated using Past (v4.0). The transgressive index is the range of phenotypic differences between both the parents and the phenotypic range in the F_2 population. The index was calculated by the difference between the maximum and minimum values in the F_2 population by the parental (male and female) difference.

Results and Discussion

Genetic variability of yield and yield constitute traits

O. glaberrima, will serve as a donor for the identification and introgression of many economical traits for the genetic improvement of Asian cultivated species. However, utilization of *O. glaberrima*, in *O. sativa* breeding is hampered by high sterility in interspecific F_1 and could be overcome by repeated backcrosses (Bharamappanavara *et al*., 2020).

Any effective plant breeding programme depends on genetic variability. The most efficient way to create and preserve genetic variability is by crossing genetically diverse parents and selecting from the early generation. In the present experiment, the F_2 population derived from *O. glaberrima* introgression lines and popular *O. sativa* cv. Samba Mahsuri had shown high variability to yield and yield constitute traits (**Table 1** and **Figure 2**). The frequency distribution of yield and yield attributing traits that depicted the variation were presented in **Figures 3** and **4**.

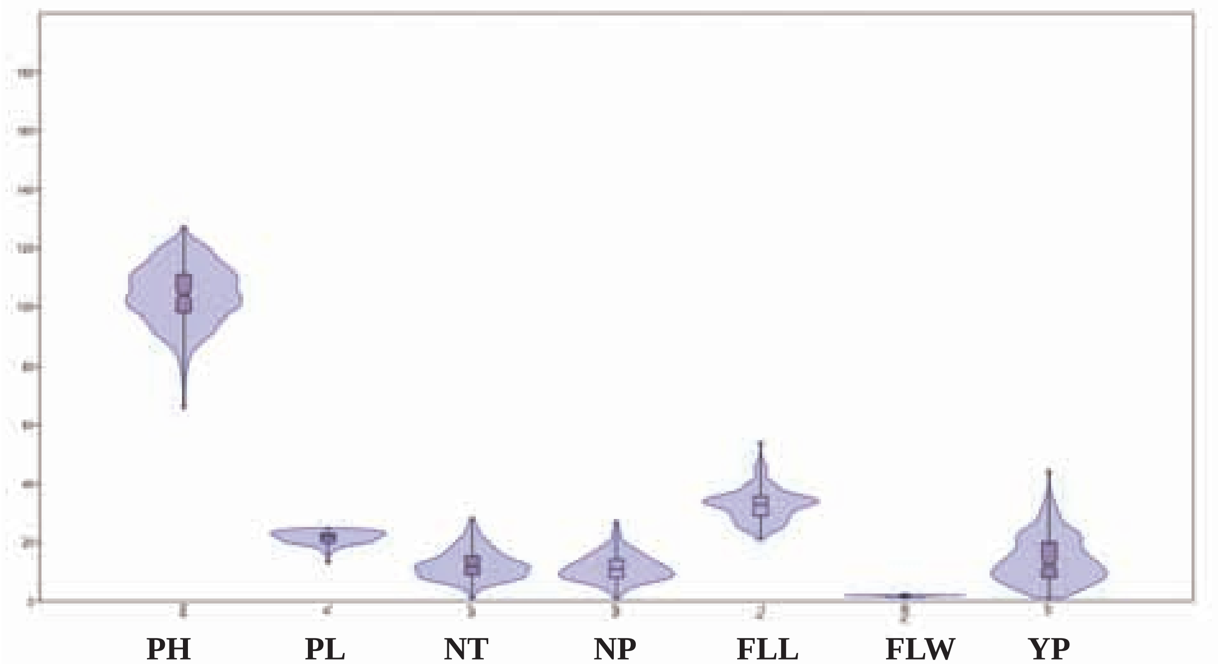

Figure 2: Violin and Box Plots for depicting genetic variability for yield and yield attributing traits in F_2 population derived from cross between IL 6 and Samba Mahsuri

PH-Plant height, PL-Panicle length (cm), NT-Number of tillers, NP-No. of panicles, FLL-Flag leaf length (cm), FLW-Flag leaf width (cm), YP- Yield Per plant (g)

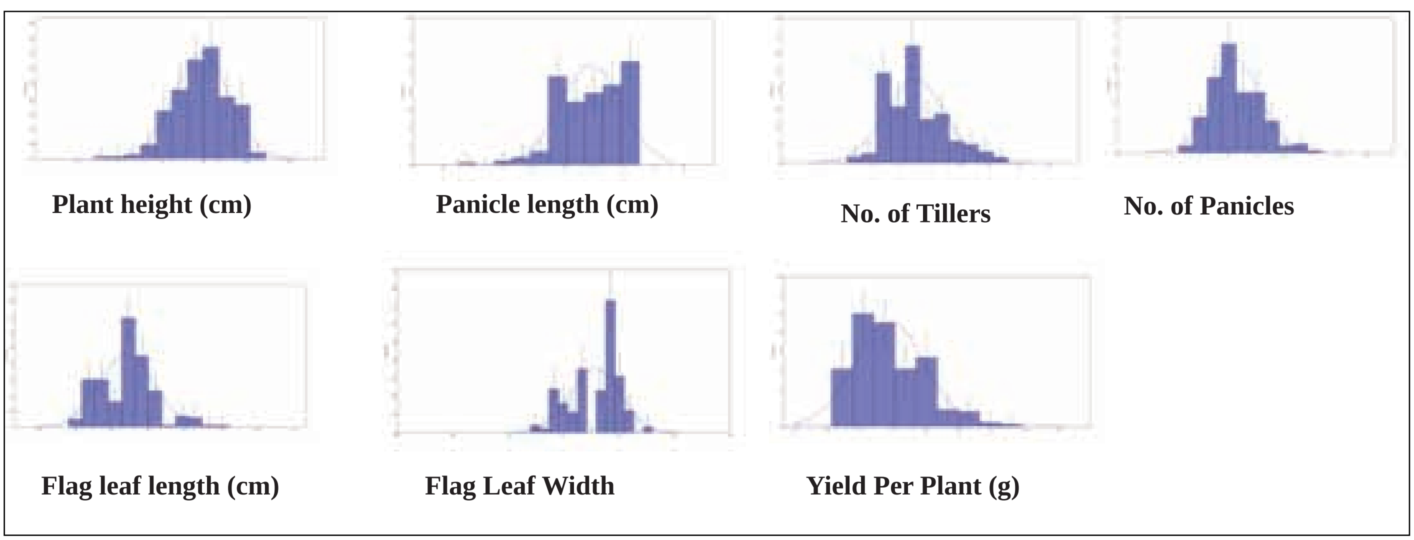

Figure 3: Frequency distribution of yield and yield attributing traits in F_2 population derived from cross between IL6 and Samba Mahsuri

Table 1. Genetic variability parameters for yield and yield attributing traits in F_2 population derived from cross between IL6 and Samba Mahsuri

Sl. No.	Trait		Range			PCV		GCV		$h^2_{(BS)}$		GA	GAM	
		Mean	Min.	Max.	SE	(%)	Category	(%)	Category	(%)	Category		(%)	Category
1	PH	103.984	66.000	127.000	0.652	9.570	Low	9.486	Low	98.20	High	20.141	19.369	Moderate
2	PL	21.796	13.000	25.000	0.135	9.458	Low	8.521	Low	81.20	High	3.447	15.814	Moderate
3	NT	12.475	1.000	28.000	0.329	40.235	High	37.958	High	89.00	High	9.203	73.767	High
4	NP	11.327	1.000	27.000	0.291	39.168	High	36.437	High	86.50	High	7.910	69.825	High
5	FLL	32.925	21.000	54.000	0.363	16.820	Moderate	16.058	Moderate	91.10	High	10.398	31.581	High
6	FLW	1.778	1.200	2.300	0.015	12.575	Moderate	12.282	Moderate	95.40	High	0.440	24.714	High
7	YP	14.232	1.000	44.250	0.526	56.375	High	55.618	High	97.30	High	16.088	113.033	High

PH-Plant height (cm), PL-Panicle length (cm), NT-Number of tillers, NP-No. of panicles, FLL-Flag leaf length (cm), FLW-Flag leaf width (cm) YP- Yield Per plant (g)

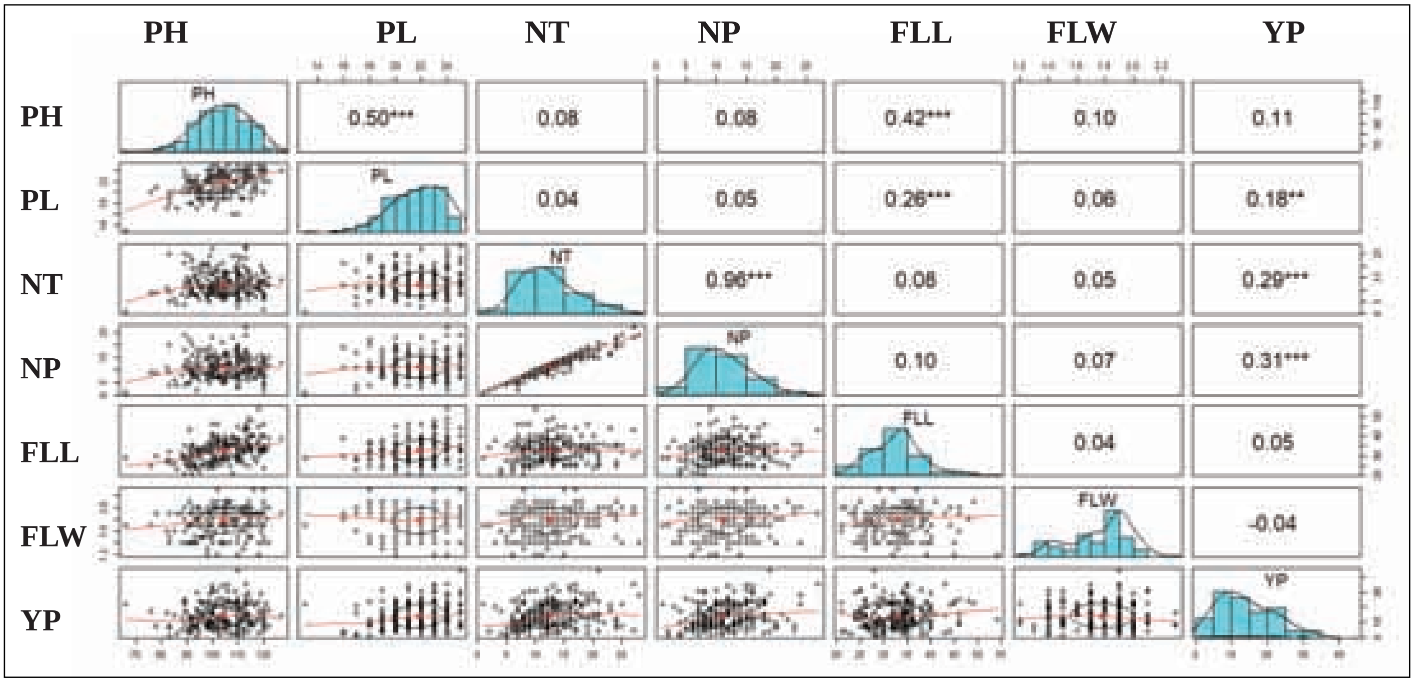

Figure 4: Frequency distribution, scatter diagram and correlation between yield and yield attributing traits in F_2 population derived from cross between IL 6 and Samba Mahsuri

PH- Plant height (cm), PL-Panicle length (cm), NT-Number of tillers, NP-No. of panicles, FLL-Flag leaf length (cm), FLW-Flag leaf width (cm) YP- Yield Per plant (g)

In the present study, plant height (cm) varied from 66.00 cm to 127.00 cm with a mean of 103.98 cm. Plant height is a significant factor influencing grain yield (Piao *et al.*, 2014). The majority of dwarf rice types are high yielding, do not lodge, and include the Dee-geo-woo-gen, semi-dwarfing gene, *sd1* (Poehlman and John, 1987). This characteristic has a modest phenotypic and genotypic variability (PCV- 9.570%, GCV- 9.486 %) indicating less variability for the trait. High broad sense heritability (98.20%) and virtually high genetic advance as a per cent of the mean (GAM -19.369%) were noticed in this case, showing the presence of additive gene activity for which selection is favourable in this case. The findings were consistent with those of Balakrishnan *et al.*, 2016 (GAM-3.18%, h^2 96.22%) and Basavaraj *et al.*, 2020 (GAM-34.50%, h^2-92.73%).

An important predictor of rice yield is panicle length. In rice, panicle length is a crucial factor in determining panicle architecture and grain yield (Liu *et al.*, 2016). The length of the panicle ranged from 13 to 25 cm with a mean value of 21.796 cm. There was less phenotypic and genotypic variability for panicle length (PCV- 9.458%, GCV-8.521%), indicating less variation for this character in the F_2 population. High heritability (81.20%) and moderate GAM (15.814%) were observed indicating additive gene action. This result was similar to the findings of Balakrishnan *et al.*, (2016) who reported GAM-2.20%, h^2 14.73% and Basavaraj *et al.*, (2020) with a GAM-32.56%, h^2-98.50%.

Because the number of tillers impacts the number of panicles, it is one of the most important features that can be exploited to obtain a high yield. Grain yield and biomass both have a strong relationship with the number of productive tillers (Basavaraj *et al.*, 2020). The number of tillers varied from 1 to 28 with a mean of 12.475. We found high phenotypic (PCV: 40.235%) and genotypic variation (GCV: 37.958%). High broad sense heritability (89.00%) was observed with high GAM (73.767%) indicating a predominance of additive gene action and advancing improvement through direct selection would be fruitful, which is in line with the conclusions of Edukondalu *et al.*, (2017; GAM-34.87%, h^2-95.00%) and Basavaraj *et al.*, (2020; GAM-67.58%, h^2-85.40%).

Grain yield is positively associated by the number of panicles (Balakrishnan *et al*., 2016). Tillers and panicles are typically numerous on *O. glaberrima* and its derived lines (Sarla and Swamy, 2005). In the current investigation, panicle counts ranged from 1 to 27, with a mean of 11.327. A high level of phenotypic (39.168%) and genotypic variability (36.437%) was noticed for this trait. For this character, high heritability (86.50%) and high GAM (69.825%) were observed which was similar to the findings of Abebe *et al*., (2017; GAM-4.10%, h^2-18.24%) and Basavaraj *et al*., (2020; GAM-67.58%, h^2-85.4).

The width and length of the flag leaf are crucial characteristics that affect rice grain output. Flag leaf breadth has a low range of variability (1.200 to 2.300 cm); however, flag leaf length has a high range of variability (21.000 to 54.000 cm), indicating the wide range of variation of this trait. Flag leaf length had high heritability (91.10%) and high GAM (31.581%) suggesting direct selection. We noticed high heritability (95.40%) and high GAM (24.714%) in flag leaf breadth as well, demonstrating the existence of additive gene action where pedigree selection can be used.

Yield per plant is a complex quantitative trait governed by multiple genes. The ultimate goal of plant breeders is high yield. The yield per plant values in the current study ranged from 1 to 44g with a mean of 14.232g and have substantial phenotypic and genotypic variation (PCV-56.375%, GCV-55.618%) along with high heritability (97.30%) and high GAM (113.033). The outcomes showed that the direct selection for this attribute would be quite successful. An identical set of results were reported by Abebe *et al*., (2017; GAM-27.77%, h^2-54.35%) and Basavaraj *et al*., (2020; GAM-89.27%, h^2-96.81).

Association study between yield and yield constitute traits

It is essential to understand the relationship between yield and its component parts in order to select the best genotype and identify the other contributing factors that influence yield. The length of the panicle (0.18**), the number of tillers (0.29**), and the number of panicles (0.31**) are all correlated with the grain yield (**Figure 4**). It was also interesting to note that flag leaf length had a significant positive association with panicle length (0.26**) and plant height (0.42**). The number of tillers has a significant positive association with the number of panicles (0.96**).

Through the selection of its yield-associated trait, which is indirectly and strongly connected, there is a chance of enhancing yield (Lakshmi *et al*., 2020, Basavaraj *et. al*., 2020). The results of the association study showed that panicle length, the number of tillers, and panicles can be used as criteria for choosing plants with higher yields as they were related to one another and showed a positive significant correlation (**Figure 4**). The current findings were in line with the findings of Thippeswamy *et al*., (2016) Priya *et al*., (2017) and Basavaraj *et. al*. (2020).

Principal component analysis

The first six main components in the current study accounted for 99.60% of the overall variability. PCA revealed PC1, PC2 and PC3 as important principal components with eigenvalues of 2.255, 1.692 and 1.020 which contributed to 71.00 per cent of the total variance for all the characters (**Table 2**) capturing important aspects of the data set. The component's Eigen-values of less than one was disregarded because they are unlikely to be of any practical significance. Based on principal component 1, no. of tillers (0.565), no. of panicles (0.574) and yield per plant (0.344) had relatively higher contributions (32.200%) to the total morphological variability. While the second major component was responsible for 24.200% of the total morphological variability. In this plant height (0.551), panicle length (0.507), and flag leaf length (0.430) contributions more to variability. Principle component 3 contributes to 14.600 % of the total variation in which flag leaf width (0.899) contributes to the highest variation.

PCA analysis was done to assess the relationship among lines for characterization using the first, second and third principal components for the F_2 population. Selection of traits *viz.,* plant height, panicle length,

Table 2. Principal component analysis of yield and yield attributing traits in F_2 population derived from cross between IL6 and Samba Mahsuri

Parameter	PC1	PC2	PC3	PC4	PC5	PC6	PC7
Eigenvalue	2.255	1.692	1.020	0.868	0.676	0.452	0.0373
Variance explained (%)	32.200	24.200	14.600	12.400	9.700	6.500	0.500
Cumulative (%)	32.200	56.400	70.900	83.400	93.000	99.500	100.000
Plant Height (cm)	0.300	0.551	0.010	0.053	-0.185	0.754	0.006
Panicle Length (cm)	0.267	0.507	-0.124	-0.308	-0.484	-0.572	-0.003
No. of Tillers	0.565	-0.353	0.075	0.172	-0.164	-0.015	-0.702
No. of Panicles	0.574	-0.344	0.079	0.148	-0.131	-0.026	0.711
Flag Leaf Length (cm)	0.252	0.430	0.013	0.547	0.599	-0.306	-0.012
Flag Leaf Width (cm)	0.087	0.091	0.899	-0.369	0.194	-0.04	-0.015
Yield Per Plant (g)	0.344	-0.057	-0.405	-0.645	0.539	0.088	-0.023

PC= Principal Component

flag leaf length and flag leaf width lying in these three principal components would **(Figure 5)** be beneficial in contributing to the total diversity. The results were in accordance with Worede *et al*., (2014) in 24 rice genotypes, with the first and second PCs accounting for 61.2% of the overall variability. In *O. glaberrima* accessions Lakshmi *et al*., (2019) described 54.752% of the total variance with the first two principal components.

Transgressive Segregants

Transgressive segregation results in phenotypes that are superior to those of the parents. As a result of segregation and recombination, such plants are created by the accumulation of favourable genes from both the parents. Extreme phenotypes brought on by transgressive segregation, in contrast to heterosis, are heritably stable. In the current study, out of 232 F_2 plants, we identified 172, 82, 65, 130, 119, and 62

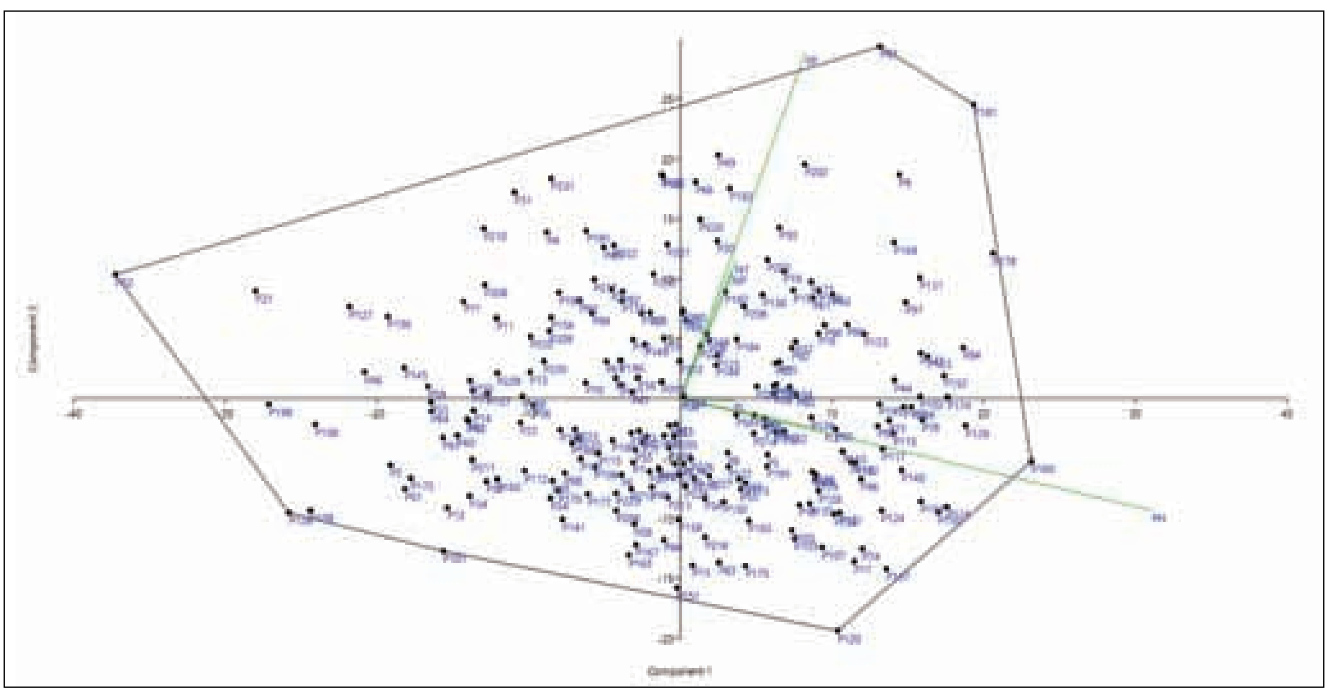

Figure 5: PCA biplot based on yield and yield attributing traits in F_2 population derived from cross between IL 6 and Samba Mahsuri

transgressive segregants for panicle length, tillers, panicles, flag leaf length, flag leaf width, and yield per plant respectively (**Table 3**). We have identified four F_2 plants (F_2-131, F_2-169, F_2-181 and F_2-231) which were transgressive segregants for all yield and yield attributing traits, which were highlighted in the **Supplementary Table 1**. Such transgressions may occur because certain F_2 populations have accumulated complimentary alleles from both parents at multiple loci (Tanksley,1993) and also unmasking of recessive deleterious genes due to inbreeding (Rick and Smith, 1953).

The transgressive index between IL6 and Samba Mahsuri for various yield and yield component traits was high, demonstrating that many plants from the F_2 generation outperformed their parents for various traits. Similar outcomes were noted by Koide *et al.,* (2019). This clearly shows that the parents had different genes governing yield and its component traits. Our study demonstrates that *O. glaberrima* contributes to yield-enhancing traits and could be employed as donor for genetic improvement of *O. sativa* cultivars for yield-enhancing traits. Hence, there is a lot of scope to introduce beneficial alleles from *O. glaberrima* into *O. sativa* cultivars through selection in later generations for yield and yield constituent traits.

Table 3. Transgressive segregants for yield and yield attributing traits in F_2 population derived from cross between IL6 and Samba Mahsuri

Sl. No.	Trait	Parents (Mean)		Range of F_2 population		Number of transgressive Segregants	Transgressive Index
		Samba Mahsuri	BRIL 6	Minimum	Maximum		
1.	Panicle Length (cm)	20.330	20.580	13.00	25.00	172.000	48.000
2	No. of Tillers	13.000	13.330	1.00	28.00	82.000	81.818
3.	No. of Panicles	13.000	12.380	1.00	27.00	65.000	41.935
4.	Flag Leaf Length (cm)	32.000	25.000	21.00	54.00	130.000	4.714
5.	Flag Leaf Width (cm)	1.700	1.800	1.20	2.30	119.000	11.000
6.	Yield Per Plant (g)	19.650	16.620	1.00	44.25	62.000	14.274

Conclusion

To break yield limitations in modern rice cultivars, related species of rice can be utilized to widen the genetic base. The present research showed that *O. glaberrima* could be utilised to genetically improve elite rice cultivars for increasing yield, and resulting transgressive segregants might be employed as pre-breeding material. The transgressive segregants can be assessed in subsequent generations, and the promising lines could be used in further breeding work. It is clear from the study that *O. glaberrima* has contributed to yield-enhancing traits and could be utilized as a donor for the genetic improvement of *O. sativa.*

Acknowledgments

The authors are thankful to the Director, ICAR-IIRR for providing the lab and field facilities for the successful conduct of this research. The first author extends his sincere thanks to the Director of Research, Associate Dean, and Head of the Genetics and Plant Breeding Department, S.V. Agricultural College, Tirupati, ANGRAU for allowing him to conduct his research at ICAR-IIRR, Hyderabad and also providing valuable suggestions during his research work.

References

Abebe T, Alamerew S and Tulu L. 2017. Genetic variability, heritability and genetic advance for yield and its related traits in rainfed lowland rice (*Oryza sativa* L.) genotypes at Fogera and Pawe, Ethiopia. *Advances in Crop Science and Technology,* 5: 272. DOI: 10.4172/2329-8863.1000272.

Agricultural Statistics at a Glance. 2021. Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Directorate of Economics & Statistics. https://desagri.gov.in

Ali Z, Khan AS and Asad MA. 2002. Salt tolerance in bread wheat: genetic variation and heritability. *Asian Journal of Plant Sciences,* 1:420-422.

Balakrishnan D, Robin S, Rabindran R and Joel AJ. 2016. Molecular and Morphological Characterisation of Back Cross Generations for Yield and Blast Resistance in Rice. *Rice Research: Open Access,* 4:169. Doi:10.4172/2375-4338.1000169.

Basavaraj PS, Gireesh C, Muralidhar B, Manoj A, Anantha MS and Raju CD. 2020. Genetic analysis of backcross derived lines of *Oryza rufipogon* in the background of Samba Mahsuri for yield-enhancing traits in rice. *Electronic Journal of Plant Breeding,* 11:1120-1127. https://doi.org/10.37992/2020.1104.181.

Bharamappanavara M, Siddaiah AM, Ponnuvel S, Ramappa L, Patil B, Appaiah M, Maganti SM, Sundaram RM, Shankarappa SK, Tuti MD and Banugu S. 2020. Mapping QTL hotspots associated with weed competitive traits in backcross population derived from *Oryza sativa* L. and *O. glaberrima* Steud. *Scientific reports,* 10: 1-13. https://doi.org/10.1038/s41598-020-78675-7.

Edukondalu B, Reddy VR, Rani TS, Kumari CA and Soundharya B. 2017. Studies on variability, heritability, correlation and path analysis for yield, yield attributes in rice (*Oryza sativa* L.). *International Journal of Current Microbiology and Applied Sciences,* 6: 2369-2376. doi: https://doi.org/10.20546/ijcmas.2017.610.279.

Falconer DS. 1981. An Introduction of Quantitative Genetics- Second edition. Oliver and Boyd, Edinburgh. 312-324.

Johnson HW, Robinson HF and Comstock RE. 1955. Estimates of genetic and environmental variability in soybeans. *Agronomy Journal,* 47:314-318.

Koide Y, Sakaguchi S, Uchiyama T, Ota Y, Tezuka A, Nagano AJ, Ishiguro S, Takamure I. and Kishima Y. 2019. Genetic properties responsible for the transgressive segregation of days to heading in rice. *G3: Genes, Genomes, Genetics,* 9:1655-1662. https://doi.org/10.1534/g3.119.201011.

Lakshmi VI, Sreedhar M, Vanisri S, Anantha MS, Rao LS and Gireesh C. 2019. Multivariate analysis and selection criteria for identification of African rice (*Oryza glaberrima*) for genetic improvement of indica rice cultivars. *Plant Genetic Resources,* 17:499-505. doi:10.1017/S1479262119000327.

Lingaiah N, Chandra BS, Venkanna V, Devi KR and Hari Y. 2020. Genetic variability and correlation studies in yield traits of elite rice (*Oryza sativa* L.) genotypes. *Indian Journal of Pure and Applied Biosciences,* 8: 359-363. doi: http://dx.doi.org/10.18782/2582-2845.8428

Liu E, Liu Y, Wu G, Zeng S, Tran, Thi TG, Liang L, Liang Y, Dong Z, She D, Wang H and Zaid IU. 2016. Identification of a candidate gene for panicle length in rice (*Oryza sativa* L.) via association and linkage analysis. *Frontiers in plant science,* 7: 596. https://doi.org/10.3389/fpls.2016.00596.

Maji AT and Shaibu AA. 2012. Application of principal component analysis for rice germplasm characterization and evaluation. *Journal of Plant Breeding and Crop Science,* 4:87-93.

Marri PR, Reddy LV and Siddiq EA. 2005. Identification and mapping of yield and yield-related QTLs from an Indian accession of *Oryza* *rufipogon*. *BMC Genetics,* 6:1-14. https://doi.org/10.1186/1471-2156-6-33.

Piao R, Chu SH, Jiang W, Yu Y, Jin Y, Woo MO, Lee J, Kim S and Koh HJ. 2014. Isolation and characterization of a dominant dwarf gene, Dh, in rice. *PLoS One,* 9(2). e86210. https://doi.org/10.1371/journal.pone.0086210.

Poehlman I and John M. 1987. Breeding Field Crops. Oxford and IBH Publishing. 2: 5-8.

Priya CS, Suneetha Y, Babu DR and Rao SV. 2017. Inter-relationship and path analysis for yield and quality characters in rice (*Oryza sativa* L.). *International Journal of Science, Environment and Technology,* 6:381-390.

Rick CM and Smith PG. 1953. Novel variation in tomato species hybrids. *The American Naturalist,* 87:359-373.

Sarawgi AK, Rastogi NK and Soni DK. 1997. Correlation and path analysis in rice accessions from Madhya Pradesh. *Field Crops Research,* 52:161-167.

Sarla N and Swamy BM. 2005. *Oryza glaberrima*: a source for the improvement of *Oryza sativa*. *Current science,* 89:955-963.

Shaikh S, Umate S, Syed AJ and Deosarkar DB. 2017. Study on genetic variability, heritability and genetic advance in rice (*Oryza sativa* L.) genotypes. *International Journal of Pure and Applied Bioscience,* 5: 511- 515.

Srijan A, Kumar SS, Raju CD and Jagadeeshwar R. 2016. Character association and path coefficient analysis for grain yield of parents and hybrids in rice (*Oryza sativa* L.). *Journal of Applied and Natural Science,* 8:167-172.

Thippeswamy S, Mohan CY, Srinivas B and Padmaja D. 2016. Selection of diverse parental lines for heterotic hybrid development in rice (*Oryza sativa* L.). *SABRAO Journal of Breeding and Genetics,* 48:285-294.

Worede F, Sreewongchai T, Phumichai C and Sripichitt P. 2014. Multivariate analysis of genetic diversity among some rice genotypes using morpho-agronomic traits. *Journal of Plant Sciences,* 9:14-24.

Supplementary Table 1. Mean values of F_2 Population (BRIL6 X SM) for yield and yield attributing characters during *Kharif*, 2021

Sl. No.	Plant Code	Plant Height (cm)	Panicle Length (cm)	No. of Tillers	No. of Panicles	Flag Leaf Length (cm)	Flag Leaf Width (cm)	Yield Per Plant (g)	BB Lesion Length (cm)
1.	F_2-1	100.00	22.00	27.00	23.00	30.00	2.00	4.57	1.52
2.	F_2-2	88.00	20.00	8.00	8.00	29.00	1.90	5.00	1.85
3.	F_2-3	99.00	23.00	11.00	11.00	26.00	1.70	23.38	2.30
4.	F_2-4	94.00	23.00	8.00	8.00	24.00	1.70	29.50	2.44
5.	F_2-5	110.00	25.00	16.00	16.00	36.00	1.70	7.70	1.90
6.	F_2-6	102.00	21.00	8.00	8.00	34.00	1.90	9.00	0.75
7.	F_2-7	104.00	21.00	8.00	8.00	29.00	2.00	10.42	4.75
8.	F_2-8	110.00	16.00	21.00	19.00	30.00	1.90	4.24	9.60
9.	F_2-9	113.00	25.00	28.00	24.00	32.00	1.40	28.31	3.70
10.	F_2-10	99.00	20.00	24.00	19.00	35.00	1.50	11.14	1.20
11.	F_2-11	92.00	22.00	19.00	16.00	26.00	1.40	13.27	2.62
12.	F_2-12	95.00	20.00	6.00	6.00	22.00	2.00	3.92	5.50
13.	F_2-13	96.00	19.00	11.00	11.00	26.00	1.50	14.20	2.92
14.	F_2-14	93.00	20.00	15.00	12.00	26.00	1.80	7.49	3.33
15.	F_2-15	110.00	22.00	9.00	9.00	30.00	2.00	1.55	2.85
16.	F_2-16	112.00	23.00	13.00	12.00	32.00	2.00	22.60	1.85
17.	F_2-17	120.00	23.00	8.00	8.00	32.00	2.00	6.10	1.00
18.	F_2-18	115.00	22.00	12.00	10.00	32.00	2.00	7.76	1.20
19.	F_2-19	109.00	22.00	9.00	8.00	30.00	1.70	30.65	0.55
20.	F_2-20	102.00	20.00	20.00	15.00	36.00	1.90	25.00	1.00
21.	F_2-21	76.00	20.00	9.00	9.00	25.00	1.70	17.19	0.75
22.	F_2-22	94.00	20.00	13.00	11.00	34.00	1.70	8.53	2.60
23.	F_2-23	102.00	21.00	13.00	13.00	27.00	1.90	20.60	2.66
24.	F_2-24	98.00	20.00	6.00	6.00	34.00	1.70	6.91	7.10
25.	F_2-25	104.00	20.00	11.00	11.00	26.00	1.90	20.15	1.50
26.	F_2-26	104.00	23.00	12.00	12.00	35.00	1.80	20.02	1.16
27.	F_2-27	100.00	22.00	9.00	9.00	46.00	2.00	9.01	1.05
28.	F_2-28	104.00	22.00	6.00	6.00	34.00	1.80	6.32	8.00
29.	F_2-29	105.00	24.00	8.00	7.00	34.00	1.70	11.46	5.25
30.	F_2-30	106.00	25.00	14.00	13.00	34.00	1.90	30.57	5.10
31.	F_2-31	89.00	21.00	21.00	18.00	30.00	2.00	23.58	8.00
32.	F_2-32	94.00	19.00	8.00	8.00	32.00	1.90	5.57	7.23

Sl. No.	Plant Code	Plant Height (cm)	Panicle Length (cm)	No. of Tillers	No. of Panicles	Flag Leaf Length (cm)	Flag Leaf Width (cm)	Yield Per Plant (g)	BB Lesion Length (cm)
33.	F_2-33	89.00	21.00	11.00	11.00	29.00	1.80	9.28	10.43
34.	F_2-34	92.00	22.00	8.00	7.00	35.00	1.70	4.15	11.54
35.	F_2-35	102.00	24.00	8.00	8.00	34.00	1.90	11.51	1.88
36.	F_2-36	102.00	22.00	14.00	13.00	32.00	1.90	8.79	7.00
37.	F_2-37	110.00	24.00	11.00	10.00	34.00	1.90	22.87	3.63
38.	F_2-38	102.00	22.00	15.00	14.00	29.00	1.90	13.19	1.00
39.	F_2-39	108.00	24.00	10.00	9.00	40.00	1.70	18.43	0.75
40.	F_2-40	96.00	21.00	18.00	18.00	31.00	1.90	21.69	1.86
41.	F_2-41	106.00	22.00	9.00	9.00	28.00	1.90	9.68	1.80
42.	F_2-42	102.00	21.00	14.00	13.00	34.00	1.90	20.80	1.70
43.	F_2-43	117.00	21.00	11.00	11.00	27.00	1.90	10.99	2.44
44.	F_2-44	116.00	21.00	11.00	10.00	40.00	1.90	21.53	3.44
45.	F_2-45	102.00	25.00	11.00	11.00	40.00	1.90	6.10	5.50
46.	F_2-46	85.00	20.00	6.00	6.00	26.00	1.60	14.47	0.47
47.	F_2-47	100.00	24.00	11.00	11.00	35.00	1.90	14.36	0.13
48.	F_2-48	104.00	21.00	9.00	8.00	34.00	1.40	14.16	0.34
49.	F_2-49	100.00	23.00	16.00	16.00	35.00	1.90	34.00	0.88
50.	F_2-50	110.00	21.00	16.00	16.00	39.00	1.80	23.81	8.08
51.	F_2-51	90.00	22.00	7.00	5.00	27.00	1.70	4.58	2.46
52.	F_2-52	92.00	18.00	11.00	10.00	30.00	2.00	8.84	2.60
53.	F_2-53	110.00	25.00	8.00	8.00	32.00	1.90	22.59	3.35
54.	F_2-54	110.00	23.00	10.00	10.00	27.00	1.90	7.09	1.88
55.	F_2-55	110.00	24.00	7.00	7.00	34.00	1.90	10.98	2.00
56.	F_2-56	95.00	21.00	11.00	10.00	32.00	1.80	11.53	1.50
57.	F_2-57	110.00	23.00	6.00	6.00	32.00	1.40	24.00	1.05
58.	F_2-58	110.00	21.00	24.00	20.00	27.00	1.80	6.17	1.62
59.	F_2-59	88.00	20.00	8.00	8.00	31.00	1.40	12.95	1.82
60.	F_2-60	91.00	18.00	10.00	10.00	32.00	1.40	7.64	2.73
61.	F_2-61	110.00	21.00	17.00	15.00	35.00	1.50	23.10	2.50
62.	F_2-62	66.00	13.00	1.00	1.00	29.00	1.70	22.00	3.00
63.	F_2-63	100.00	22.00	17.00	16.00	25.00	1.50	30.59	3.20
64.	F_2-64	91.00	20.00	8.00	5.00	24.00	1.70	11.92	5.00
65.	F_2-65	98.00	23.00	11.00	9.00	34.00	1.90	17.38	6.50
66.	F_2-66	99.00	24.00	19.00	19.00	35.00	1.70	28.73	1.00

Sl. No.	Plant Code	Plant Height (cm)	Panicle Length (cm)	No. of Tillers	No. of Panicles	Flag Leaf Length (cm)	Flag Leaf Width (cm)	Yield Per Plant (g)	BB Lesion Length (cm)
67.	F_2-67	110.00	25.00	21.00	19.00	28.00	1.90	44.25	1.72
68.	F_2-68	110.00	22.00	11.00	10.00	34.00	1.90	15.26	0.48
69.	F_2-69	104.00	22.00	7.00	5.00	29.00	1.90	26.00	0.60
70.	F_2-70	100.00	25.00	9.00	7.00	24.00	2.00	16.56	2.00
71.	F_2-71	90.00	20.00	15.00	14.00	25.00	1.40	16.49	3.38
72.	F_2-72	100.00	23.00	11.00	11.00	40.00	1.50	10.97	7.14
73.	F_2-73	104.00	24.00	12.00	11.00	34.00	1.70	12.00	1.95
74.	F_2-74	120.00	20.00	7.00	4.00	34.00	2.10	9.37	2.34
75.	F_2-75	118.00	25.00	11.00	10.00	34.00	1.80	17.68	2.76
76.	F_2-76	106.00	22.00	13.00	11.00	28.00	1.70	7.23	1.40
77.	F_2-77	104.00	19.00	9.00	8.00	30.00	1.90	12.10	1.33
78.	F_2-78	120.00	23.00	18.00	14.00	35.00	1.50	14.25	1.00
79.	F_2-79	93.00	22.00	8.00	8.00	24.00	1.40	13.52	0.85
80.	F_2-80	112.00	22.00	20.00	16.00	32.00	1.70	12.33	5.90
81.	F_2-81	93.00	21.00	16.00	10.00	25.00	1.50	6.85	2.95
82.	F_2-82	98.00	22.00	14.00	14.00	32.00	1.60	21.10	0.56
83.	F_2-83	110.00	24.00	7.00	7.00	35.00	1.40	3.80	2.25
84.	F_2-84	118.00	23.00	14.00	13.00	45.00	1.40	23.56	0.70
85.	F_2-85	98.00	23.00	6.00	6.00	32.00	1.20	8.48	1.65
86.	F_2-86	110.00	20.00	15.00	14.00	45.00	1.20	22.51	1.13
87.	F_2-87	91.00	20.00	14.00	13.00	28.00	1.40	4.39	1.33
88.	F_2-88	100.00	21.00	8.00	8.00	28.00	1.50	8.00	0.40
89.	F_2-89	96.00	20.00	20.00	18.00	34.00	1.70	14.63	0.80
90.	F_2-90	98.00	19.00	20.00	18.00	24.00	1.80	15.64	2.20
91.	F_2-91	102.00	24.00	11.00	10.00	39.00	1.20	11.42	5.85
92.	F_2-92	110.00	22.00	16.00	14.00	34.00	1.90	18.80	6.65
93.	F_2-93	117.00	22.00	16.00	15.00	36.00	1.90	13.16	7.38
94.	F_2-94	105.00	23.00	7.00	6.00	38.00	1.90	5.04	0.67
95.	F_2-95	112.00	24.00	12.00	12.00	43.00	1.90	14.55	1.13
96.	F_2-96	118.00	24.00	12.00	8.00	33.00	1.90	12.11	0.67
97.	F_2-97	113.00	25.00	23.00	17.00	44.00	2.00	21.35	0.56
98.	F_2-98	111.00	24.00	23.00	16.00	35.00	1.90	18.00	5.30
99.	F_2-99	110.00	20.00	18.00	17.00	34.00	1.90	13.34	1.36
100.	F_2-100	102.00	21.00	12.00	11.00	29.00	1.90	9.31	0.88
101.	F_2-101	94.00	17.00	7.00	2.00	29.00	2.00	1.00	2.50

Sl. No.	Plant Code	Plant Height (cm)	Panicle Length (cm)	No. of Tillers	No. of Panicles	Flag Leaf Length (cm)	Flag Leaf Width (cm)	Yield Per Plant (g)	BB Lesion Length (cm)
102.	F_2-102	120.00	25.00	17.00	15.00	32.00	2.30	16.30	2.40
103.	F_2-103	114.00	23.00	6.00	6.00	37.00	1.90	8.39	2.66
104.	F_2-104	103.00	24.00	8.00	8.00	38.00	1.70	12.36	6.83
105.	F_2-105	116.00	23.00	8.00	7.00	29.00	2.30	8.00	1.33
106.	F_2-106	99.00	22.00	9.00	9.00	37.00	1.90	8.35	0.75
107.	F_2-107	118.00	23.00	13.00	13.00	30.00	1.90	2.87	0.90
108.	F_2-108	83.00	19.00	9.00	9.00	26.00	1.90	6.36	0.57
109.	F_2-109	86.00	17.00	4.00	4.00	23.00	1.90	2.33	0.75
110.	F_2-110	99.00	19.00	10.00	8.00	32.00	1.90	10.69	3.00
111.	F_2-111	100.00	24.00	11.00	11.00	32.00	1.70	14.82	2.38
112.	F_2-112	98.00	20.00	8.00	7.00	26.00	1.30	7.76	1.75
113.	F_2-113	100.00	20.00	10.00	8.00	34.00	1.50	9.71	1.17
114.	F_2-114	118.00	24.00	10.00	9.00	54.00	1.20	11.69	0.64
115.	F_2-115	119.00	24.00	13.00	11.00	33.00	1.60	15.44	0.55
116.	F_2-116	113.00	24.00	8.00	7.00	46.00	1.60	15.32	1.00
117.	F_2-117	119.00	24.00	10.00	10.00	32.00	1.90	15.41	0.15
118.	F_2-118	100.00	22.00	16.00	13.00	26.00	1.80	19.88	2.28
119.	F_2-119	110.00	24.00	21.00	18.00	32.00	1.80	11.46	3.52
120.	F_2-120	120.00	24.00	2.00	2.00	34.00	1.70	4.00	3.50
121.	F_2-121	114.00	23.00	17.00	15.00	44.00	1.70	3.94	2.65
122.	F_2-122	115.00	24.00	15.00	14.00	40.00	1.90	10.00	2.05
123.	F_2-123	115.00	23.00	12.00	10.00	48.00	1.80	23.86	0.14
124.	F_2-124	120.00	25.00	13.00	8.00	33.00	1.40	9.25	2.38
125.	F_2-125	105.00	19.00	15.00	9.00	36.00	1.40	18.77	0.43
126.	F_2-126	83.00	18.00	5.00	4.00	28.00	1.50	1.20	0.20
127.	F_2-127	82.00	17.00	11.00	11.00	28.00	1.60	16.33	1.53
128.	F_2-128	115.00	25.00	12.00	11.00	34.00	2.00	8.95	3.50
129.	F_2-129	122.00	22.00	12.00	12.00	39.00	1.40	17.77	2.90
130.	F_2-130	111.00	24.00	6.00	6.00	28.00	2.00	10.26	4.50
131.	F_2-131	113.00	23.00	19.00	18.00	46.00	1.90	25.14	1.88
132.	F_2-132	110.00	22.00	3.00	3.00	38.00	1.40	20.00	0.77
133.	F_2-133	113.00	22.00	14.00	14.00	39.00	1.60	22.37	0.13
134.	F_2-134	113.00	23.00	10.00	10.00	34.00	1.60	16.73	0.13
135.	F_2-135	115.00	20.00	9.00	9.00	35.00	1.70	9.72	0.83
136.	F_2-136	83.00	20.00	25.00	20.00	32.00	1.40	7.21	3.30

Sl. No.	Plant Code	Plant Height (cm)	Panicle Length (cm)	No. of Tillers	No. of Panicles	Flag Leaf Length (cm)	Flag Leaf Width (cm)	Yield Per Plant (g)	BB Lesion Length (cm)
137.	F_2-137	110.00	24.00	14.00	13.00	29.00	1.80	7.78	2.40
138.	F_2-138	105.00	21.00	18.00	17.00	40.00	1.40	21.07	0.84
139.	F_2-139	120.00	23.00	6.00	5.00	24.00	1.90	11.93	2.38
140.	F_2-140	120.00	25.00	14.00	13.00	34.00	1.90	11.13	0.63
141.	F_2-141	99.00	20.00	5.00	5.00	35.00	1.90	6.02	0.35
142.	F_2-142	114.00	24.00	13.00	13.00	49.00	2.10	22.49	1.00
143.	F_2-143	114.00	24.00	9.00	9.00	40.00	1.90	15.00	0.88
144.	F_2-144	105.00	23.00	16.00	12.00	35.00	1.70	16.32	1.10
145.	F_2-145	89.00	21.00	4.00	4.00	21.00	1.60	17.27	4.50
146.	F_2-146	107.00	20.00	13.00	13.00	25.00	1.40	19.93	3.10
147.	F_2-147	120.00	22.00	7.00	7.00	40.00	1.90	6.86	5.67
148.	F_2-148	110.00	22.00	7.00	7.00	35.00	1.90	17.26	1.48
149.	F_2-149	100.00	21.00	13.00	12.00	35.00	1.90	17.93	2.06
150.	F_2-150	120.00	24.00	9.00	9.00	46.00	1.90	11.48	1.50
151.	F_2-151	110.00	24.00	5.00	4.00	28.00	1.40	2.55	1.63
152.	F_2-152	121.00	24.00	12.00	11.00	33.00	1.80	22.18	0.17
153.	F_2-153	110.00	22.00	12.00	12.00	30.00	1.50	26.43	1.00
154.	F_2-154	111.00	24.00	11.00	9.00	33.00	1.60	19.00	2.80
155.	F_2-155	91.00	22.00	12.00	9.00	29.00	1.40	12.37	3.00
156.	F_2-156	94.00	21.00	14.00	13.00	32.00	1.70	17.61	1.30
157.	F_2-157	92.00	21.00	10.00	9.00	31.00	1.90	12.38	3.10
158.	F_2-158	107.00	19.00	14.00	10.00	34.00	1.80	3.11	5.68
159.	F_2-159	105.00	20.00	11.00	9.00	37.00	1.90	8.68	6.00
160.	F_2-160	127.00	24.00	14.00	13.00	39.00	1.90	14.70	2.63
161.	F_2-161	99.00	22.00	12.00	12.00	33.00	1.90	6.50	1.50
162.	F_2-162	118.00	25.00	13.00	13.00	36.00	1.90	17.29	0.75
163.	F_2-163	103.00	23.00	9.00	7.00	38.00	1.40	1.72	0.86
164.	F_2-164	118.00	24.00	13.00	13.00	38.00	1.80	17.48	0.52
165.	F_2-165	100.00	21.00	16.00	15.00	25.00	1.40	31.49	0.64
166.	F_2-166	100.00	24.00	11.00	10.00	26.00	1.40	8.87	5.48
167.	F_2-167	105.00	24.00	6.00	5.00	32.00	1.60	4.79	5.13
168.	F_2-168	110.00	24.00	13.00	12.00	35.00	1.90	26.41	7.13
169.	F_2-169	114.00	24.00	18.00	16.00	34.00	2.00	29.02	0.23
170.	F_2-170	98.00	23.00	7.00	6.00	34.00	2.00	7.27	0.57
171.	F_2-171	109.00	22.00	19.00	18.00	36.00	1.80	22.55	1.50

Sl. No.	Plant Code	Plant Height (cm)	Panicle Length (cm)	No. of Tillers	No. of Panicles	Flag Leaf Length (cm)	Flag Leaf Width (cm)	Yield Per Plant (g)	BB Lesion Length (cm)
172.	F_2-172	92.00	21.00	8.00	8.00	21.00	1.70	4.28	1.00
173.	F_2-173	110.00	23.00	19.00	18.00	34.00	1.90	2.82	3.94
174.	F_2-174	120.00	20.00	14.00	12.00	40.00	1.50	19.20	2.88
175.	F_2-175	112.00	22.00	11.00	9.00	35.00	1.70	1.80	3.32
176.	F_2-176	105.00	20.00	10.00	9.00	37.00	2.00	10.20	2.77
177.	F_2-177	100.00	20.00	9.00	9.00	35.00	1.70	5.79	0.75
178.	F_2-178	119.00	24.00	20.00	16.00	40.00	1.70	29.30	1.50
179.	F_2-179	114.00	24.00	11.00	11.00	36.00	1.90	10.37	0.17
180.	F_2-180	91.00	21.00	13.00	11.00	43.00	1.90	2.76	1.83
181.	F_2-181	113.00	24.00	27.00	27.00	43.00	1.90	35.57	0.86
182.	F_2-182	112.00	21.00	12.00	10.00	33.00	1.90	14.16	2.50
183.	F_2-183	104.00	21.00	13.00	12.00	28.00	1.90	34.00	2.46
184.	F_2-184	106.00	22.00	8.00	8.00	35.00	1.70	23.81	1.50
185.	F_2-185	112.00	19.00	12.00	12.00	33.00	1.30	4.58	1.75
186.	F_2-186	115.00	19.00	14.00	14.00	33.00	1.50	8.84	1.25
187.	F_2-187	101.00	23.00	10.00	10.00	28.00	1.60	22.59	2.88
188.	F_2-188	94.00	20.00	19.00	15.00	32.00	1.40	7.09	0.90
189.	F_2-189	97.00	22.00	9.00	9.00	33.00	1.50	10.98	1.25
190.	F_2-190	98.00	24.00	21.00	15.00	36.00	1.90	11.53	1.63
191.	F_2-191	95.00	19.00	17.00	16.00	30.00	1.50	24.00	0.80
192.	F_2-192	112.00	23.00	15.00	14.00	26.00	1.70	6.17	9.50
193.	F_2-193	114.00	23.00	8.00	8.00	25.00	1.50	12.95	2.50
194.	F_2-194	122.00	22.00	15.00	15.00	35.00	2.00	7.64	3.00
195.	F_2-195	117.00	20.00	7.00	7.00	36.00	1.70	21.80	2.65
196.	F_2-196	111.00	19.00	16.00	14.00	29.00	2.00	11.99	1.60
197.	F_2-197	104.00	21.00	15.00	15.00	35.00	1.80	22.53	5.50
198.	F_2-198	78.00	21.00	9.00	9.00	30.00	1.90	7.10	1.80
199.	F_2-199	96.00	20.00	21.00	18.00	25.00	1.70	15.47	2.00
200.	F_2-200	104.00	23.00	21.00	21.00	26.00	1.80	15.36	2.50
201.	F_2-201	100.00	23.00	12.00	12.00	41.00	2.10	15.16	12.50
202.	F_2-202	106.00	23.00	17.00	15.00	35.00	1.70	35.00	1.95
203.	F_2-203	106.00	21.00	17.00	17.00	35.00	1.70	24.81	2.34
204.	F_2-204	102.00	23.00	8.00	8.00	35.00	2.00	5.58	10.50
205.	F_2-205	106.00	21.00	13.00	13.00	29.00	2.00	9.84	12.50
206.	F_2-206	107.00	20.00	13.00	12.00	31.00	1.80	23.59	1.30

Sl. No.	Plant Code	Plant Height (cm)	Panicle Length (cm)	No. of Tillers	No. of Panicles	Flag Leaf Length (cm)	Flag Leaf Width (cm)	Yield Per Plant (g)	BB Lesion Length (cm)
207.	F_2-207	108.00	20.00	24.00	23.00	36.00	1.90	8.09	2.50
208.	F_2-208	91.00	18.00	24.00	22.00	25.00	2.10	11.98	2.80
209.	F_2-209	94.00	19.00	19.00	18.00	33.00	1.90	12.53	0.75
210.	F_2-210	89.00	23.00	13.00	12.00	26.00	1.80	25.00	11.75
211.	F_2-211	92.00	21.00	8.00	8.00	33.00	1.90	7.17	1.33
212.	F_2-212	102.00	24.00	18.00	15.00	36.00	2.10	13.95	2.70
213.	F_2-213	102.00	21.00	7.00	7.00	46.00	1.90	8.64	6.50
214.	F_2-214	110.00	22.00	9.00	8.00	33.00	2.00	15.20	4.60
215.	F_2-215	102.00	18.00	15.00	13.00	37.00	2.30	8.49	7.50
216.	F_2-216	108.00	16.00	12.00	11.00	39.00	1.80	2.55	2.00
217.	F_2-217	96.00	18.00	12.00	11.00	33.00	1.90	23.60	4.80
218.	F_2-218	106.00	23.00	12.00	12.00	36.00	2.00	7.10	0.90
219.	F_2-219	102.00	19.00	7.00	7.00	38.00	2.00	8.76	1.40
220.	F_2-220	100.00	19.00	12.00	10.00	38.00	2.10	31.65	2.20
221.	F_2-221	102.00	23.00	10.00	7.00	25.00	2.10	30.57	2.20
222.	F_2-222	98.00	23.00	17.00	15.00	26.00	1.90	23.58	13.50
223.	F_2-223	98.00	23.00	17.00	16.00	32.00	2.00	5.57	9.20
224.	F_2-224	106.00	23.00	8.00	8.00	35.00	2.10	9.28	3.00
225.	F_2-225	102.00	21.00	12.00	12.00	34.00	2.10	4.15	1.40
226.	F_2-226	106.00	23.00	9.00	8.00	34.00	2.00	11.51	4.90
227.	F_2-227	107.00	23.00	11.00	10.00	36.00	2.10	8.79	1.80
228.	F_2-228	108.00	22.00	8.00	7.00	21.00	2.00	22.87	2.40
229.	F_2-229	91.00	23.00	12.00	10.00	34.00	2.10	13.19	2.80
230.	F_2-230	94.00	22.00	7.00	7.00	34.00	1.80	18.43	11.50
231.	F_2-231	89.00	24.00	25.00	24.00	35.50	2.00	21.69	2.50
232.	F_2-232	92.00	18.00	22.00	20.00	36.00	2.00	9.68	10.40
233.	F_2-233	101.00	17.00	18.00	17.00	29.00	2.00	20.80	2.60
234.	F_2-234	105.00	23.00	17.00	16.00	30.00	2.10	10.99	9.40
235.	SM(P_1)	73.00	20.33	13.00	13.00	32.00	1.70	19.65	9.20
236.	BRIL6(P_2)	83.25	20.58	13.33	12.38	25.00	1.80	16.62	1.50
Min		66.00	13.00	1.00	1.00	21.00	1.20	1.00	0.13
Max.		127.00	25.00	28.00	27.00	54.00	2.30	44.25	13.50