



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
Indexing: Embase
IJABR 2026; SP-10(9): 2320-2328
www.biochemjournal.com
Received: 26-06-2026
Accepted: 24-08-2026
Published: 26-09-2026

The names and affiliations of all authors are provided below, following the references.

Screening of fine grain rice (*Oryza sativa*) genotypes for morpho-physiological, biochemical and yield parameters

Mrinal V Zade¹, GR Shamkuwar², Sapana B Baviskar³, MR Wandhare⁴, Padmaja H Kausadikar⁵, PV Shende⁶, Priyanka D Kadam⁷, Subodh Purushottam Janglekar⁸

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i9Sac.10170>

ABSTRACT

A field experiment was conducted during Kharif 2025 at the Research Farm of the Agriculture Research Station, Sindewahi, District Chandrapur, Maharashtra, to screen eleven fine grain rice genotypes for morpho-physiological, biochemical, yield and quality parameters. The experiment was laid out in a Randomized Block Design with three replications, comprising nine advanced breeding lines along with two checks. Observations were recorded on plant height, days to fifty per cent flowering, days to maturity, total dry matter production, leaf area, leaf area index, flag leaf dimensions, relative growth rate, net assimilation rate, crop growth rate, total chlorophyll content, nitrogen content, yield and yield attributing traits, and grain quality parameters. Significant differences were observed among the genotypes for all the characters studied. The genotype SYE-2025-U-60 recorded the highest plant height, total dry matter production, leaf area index, total chlorophyll content, nitrogen content, effective tillers per square metre, panicle length, spikelet fertility, weight of grains per panicle, thousand grain weight, grain yield per plot, grain yield per hectare and harvest index, along with better milling and head rice recovery. This genotype produced the highest grain yield of 4673 kilograms per hectare, an increase of about seven per cent over the best check, PDKV-Tilak, which yielded 4336 kilograms per hectare. The lowest grain yield was recorded in SYE-2025-U-58. Chalkiness was absent in all the genotypes evaluated, indicating good grain appearance and cooking quality. The favourable performance of SYE-2025-U-60 for growth, physiological, biochemical and yield-contributing traits suggests its potential as a promising fine grain genotype for further evaluation, and the overall findings provide useful genetic resources for future rice improvement programmes.

Keywords: Rice, Fine grain, Genotype screening, Yield attributes, Biochemical parameters, Grain quality

Introduction

Rice (*Oryza sativa*) is one of the most important staple food crops across the world, serving as the primary source of calories for nearly half of the global population and providing livelihood to millions of rural households (Muthayya *et al.*, 2014; Erokhin *et al.*, 2021) [1]. The crop occupies nearly fifteen per cent of the world's arable land and is cultivated in around 114 countries (FAO, 2022). In India, rice plays a crucial role in ensuring national food security, with West Bengal, Uttar Pradesh and Punjab ranking among the leading states in area, production and productivity, respectively (Shaik *et al.*, 2023).

In Maharashtra, rice is an important crop of the Vidarbha region, particularly the Nagpur division, which contributes more than fifty six per cent of the state's total rice growing area. Fine grain rice varieties possessing short or long slender grains with superior cooking and eating quality fetch premium market prices and are increasingly preferred by farmers of the region. Popular fine grain varieties such as PKV HMT, Jai Shriram, PDKV Tilak, Ankur Shri 101, RNR 15048 and KJT 6 command a premium of about Rs. 3800 to 4000 per quintal in the market. However, a substantial quantity of rice is reportedly lost annually due to excessive polishing associated with the pursuit of fine grain, underscoring the need to develop and identify high yielding fine grain genotypes that can minimise such losses while retaining desirable grain quality.

Considering the growing consumer and market preference for fine grain rice, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola has accorded priority to breeding fine grain rice varieties with improved yield potential, and the Agriculture Research Station, Sindewahi holds promising breeding material for evaluation. However, a comprehensive and systematic evaluation of these genotypes for morpho-physiological, biochemical, yield and quality parameters has not been carried out so far. Therefore, the present investigation entitled "Screening of fine grain rice (*Oryza sativa*) genotypes for morpho-physiological, biochemical and yield parameters" was undertaken with the objectives of assessing the performance of different fine grain rice genotypes on the basis of morpho-physiological and biochemical parameters, and for yield, yield attributing traits and quality parameters.

Corresponding Author:
Mrinal V Zade
PG Scholar, Plant
Physiology, College of
Agriculture, Nagpur,
Maharashtra, India

Materials and Methods

The present investigation was conducted during Kharif season 2025-26 at the Research Farm of the Agriculture Research Station, Sindewahi, District Chandrapur, Maharashtra, under Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. Biochemical estimations were carried out at the Department of Agricultural Botany, College of Agriculture, Nagpur.

Experimental design and treatments

The experiment was laid out in a Randomized Block Design (RBD) with three replications and eleven treatments comprising fine grain rice genotypes, viz., SYE-2025-U-57, SYE-2025-U-58, SYE-2025-U-59, SYE-2025-U-60, SYE-2025-U-61, SYE-2025-U-62, SYE-2025-U-63, SYE-2025-U-64, SYE-2025-U-65, PDKV-Tilak (Check) and Jai Shriram (Local Check). Each treatment had a gross plot size of 3.0 m × 2.0 m and a net plot size of 2.70 m × 1.60 m. Seeds were sown at the rate of 30 kg ha⁻¹ on 5 July 2025, and transplanting was carried out on 25 July 2025 at a spacing of 20 cm × 15 cm, with a fertilizer dose of 100:50:50 kg NPK ha⁻¹.

Observations recorded

Observations were recorded on five randomly selected plants per treatment in each replication for morpho-physiological parameters, viz., plant height (cm) at 30, 60 and 90 days after transplanting (DAT) and at harvest; days to fifty per cent flowering; days to maturity; total dry matter production (g plant⁻¹); leaf area (dm²); leaf area index; and length and width of flag leaf (cm) at fifty per cent flowering. Leaf area was estimated as the product of leaf length, leaf width and a correction factor of 0.75 (Yoshida, 1981) [2], and leaf area index was computed as the ratio of total leaf area to the ground area occupied by the plant (Watson, 1947) [3].

Growth analysis was carried out for the intervals 30-60 DAT, 60-90 DAT and 90 DAT to physiological maturity by estimating relative growth rate (g g⁻¹ day⁻¹) following Fischer (1921) [4], net assimilation rate (g dm⁻² day⁻¹) following Williams (1946), and crop growth rate (g m⁻² day⁻¹) following Watson (1952) [5].

Biochemical parameters, viz., total chlorophyll content (mg g⁻¹) in flag leaves at fifty per cent flowering, were estimated by the colorimetric method of Bruinsma (1982), and nitrogen content (%) in flag leaves was determined by the Micro-Kjeldahl method (Somichi *et al.*, 1972) [6].

At harvest, yield and yield-contributing traits recorded were total number of grains per panicle, number of filled grains per panicle, panicle length (cm), spikelet fertility (%), weight of grains per panicle (g), number of effective tillers m⁻², 1000-grain weight (g), grain yield plot⁻¹ (g), grain yield (kg ha⁻¹), and harvest index (%), the last of which was calculated following Donald *et al.* (1976) [7]. Grain quality parameters recorded after harvest included milling percentage, head rice recovery percentage, length and breadth (mm) of paddy and dehusked grain along with their length-to-breadth ratio, and chalkiness.

Statistical analysis

The data recorded for the various characters were subjected to analysis of variance appropriate for Randomized Block Design, following the procedure described by Panse *et al.* (1954) [8]. The significance of differences among treatment means was tested by the *F*-test, and standard error of mean and critical difference at five per cent level of probability were used for comparing treatment means.

Results

Morpho-physiological parameters

Plant height differed significantly among the genotypes at all the growth stages studied (Table 1). At harvest, plant height ranged from 125.11 cm in SYE-2025-U-58 to 138.67 cm in SYE-2025-U-60, with a mean of 131.21 cm. All the genotypes were of mid-tall stature and none was dwarf.

Days to fifty per cent flowering and days to maturity varied significantly among the genotypes (Table 2). The mean days to fifty per cent flowering was 115.27 days, ranging from 112 days in PDKV-Tilak and SYE-2025-U-60 to 121 days in SYE-2025-U-57. Days to maturity ranged from 142 days in SYE-2025-U-60 to 152 days in SYE-2025-U-57, with a mean of 145.70 days.

Total dry matter production increased progressively from 30 DAT to harvest in all the genotypes (Table 3). At harvest, it ranged from 24.75 g plant⁻¹ in SYE-2025-U-63 to 31.77 g plant⁻¹ in SYE-2025-U-57, against a mean of 27.73 g plant⁻¹.

Leaf area and leaf area index increased progressively up to 90 DAT and declined sharply at harvest due to leaf senescence (Tables 4 and 5). At 90 DAT, leaf area ranged from 18.29 dm² in SYE-2025-U-61 to 23.34 dm² in SYE-2025-U-65, while leaf area index ranged from 5.79 in PDKV-Tilak to 7.78 in SYE-2025-U-65.

The length and width of flag leaf at fifty per cent flowering ranged from 39.69 to 44.94 cm and 1.36 to 1.52 cm, respectively, with the genotype SYE-2025-U-60 recording the maximum values for both traits (Table 6).

Growth parameters

The relative growth rate declined progressively with advancement of crop age, from a mean of 0.0224 g g⁻¹ day⁻¹ during 30-60 DAT to 0.0017 g g⁻¹ day⁻¹ during 90 DAT to physiological maturity (Table 7). The net assimilation rate similarly declined from 0.0275 g dm⁻² day⁻¹ during 30-60 DAT to 0.0071 g dm⁻² day⁻¹ during 60-90 DAT, before rising marginally to 0.0077 g dm⁻² day⁻¹ during the final growth interval (Table 8). The crop growth rate was highest during 30-60 DAT (mean 13.97 g m⁻² day⁻¹) and declined thereafter to 3.37 g m⁻² day⁻¹ during 90 DAT to physiological maturity (Table 9).

Biochemical parameters

Total chlorophyll content and nitrogen content in flag leaves at fifty per cent flowering differed significantly among the genotypes (Table 10). The genotype SYE-2025-U-60 recorded the significantly highest total chlorophyll content (3.11 mg g⁻¹) and nitrogen content (2.26%), while the lowest values were recorded in Jai Shriram (1.34 mg g⁻¹) and SYE-2025-U-61 (1.38%), respectively.

Yield and yield-contributing traits

Significant differences were recorded among the genotypes for all the yield-contributing traits studied (Table 11). The genotype SYE-2025-U-60 recorded the significantly highest total number of grains per panicle (241.33), panicle length (26.50 cm), spikelet fertility (94.95%), weight of grains per panicle (3.92 g), number of effective tillers m⁻² (416.33), 1000-grain weight (14.02 g), grain yield plot⁻¹ (2018.88 g) and harvest index (44%). Consequently, SYE-2025-U-60 recorded the highest grain yield of 4673 kg ha⁻¹, an increase of about seven per cent over the best check, PDKV-Tilak (4336 kg ha⁻¹). Among the other genotypes, SYE-2025-U-57 (4420 kg ha⁻¹), SYE-2025-U-59 (4222 kg ha⁻¹) and SYE-2025-U-65 (4154 kg ha⁻¹) ranked next in grain yield. The lowest grain yield (3100 kg ha⁻¹) was recorded in SYE-2025-U-58, which also recorded the lowest values for most of the yield-contributing traits.

Quality parameters

Milling percentage and head rice recovery differed among the genotypes, ranging from 65.00 to 69.80% and 56.83 to 63.80%, respectively, with SYE-2025-U-60 recording the highest values for both traits (Table 12). The length, breadth and length-to-breadth ratio of paddy grain ranged from 7.12 to 9.22 mm, 1.59 to 1.82 mm and 4.01 to 5.39, respectively, while the corresponding values for dehusked grain ranged from 5.10 to 6.54 mm, 1.52 to 1.71 mm and 3.15 to 4.14. The genotypes SYE-2025-U-60 and SYE-2025-U-61 possessed long slender grain type, while the remaining genotypes were of short slender type. Chalkiness was absent in all the genotypes evaluated, indicating good grain appearance and desirable milling and cooking quality.

Discussion

The variation in plant height among the rice genotypes may be attributed to differences in their genetic makeup and varietal characteristics. All the genotypes evaluated in the present study were of mid-tall stature, with plant height at harvest ranging from 125.11 to 138.67 cm. Similar variation in plant height has been reported by Anonymous (2025b) [9], who observed plant height ranging from 99 to 147 cm among rice varieties, and by Masud *et al.* (2023) [10], who reported plant height ranging from 137.3 to 162.8 cm among aromatic rice varieties.

The variation observed in days to fifty per cent flowering and days to maturity may be attributed to differences in the genetic makeup and inherent maturity duration of the genotypes. Comparable variation in days to fifty per cent flowering has been reported by Sahoo *et al.* (2022) [11], while variation in days to maturity in the present study is in agreement with the findings of Priyanka Sao and Gauraha (2020) [12] and Duraiswamy *et al.* (2025) [13].

The progressive increase in total dry matter production, leaf area and leaf area index up to ninety days after transplanting, followed by a decline at harvest due to leaf senescence, is consistent with the general pattern of rice growth reported by Shaik *et al.* (2023) and Masud *et al.* (2023) [10]. Likewise, the length and width of flag leaf recorded in the present study fall within the range reported by Sahoo *et al.* (2022) [11], Dhawne *et al.* (2023) [14] and Pooja *et al.* (2024) [15].

The relative growth rate, net assimilation rate and crop growth rate all declined progressively with advancement of crop age in the present investigation, which may be attributed to progressive leaf ageing, reduced relative increase in biomass, and increased allocation of assimilates towards reproductive development. These trends are in agreement with the findings of Dhawne *et al.* (2023) [14] and Arumugam *et al.* (2020) [16].

The variation in total chlorophyll content and nitrogen content in flag leaves among the genotypes may be attributed to differences in their genetic makeup for photosynthetic pigments and for nitrogen uptake and assimilation efficiency. The present findings are supported by Dhawne *et al.* (2023) [14] and Wang *et al.* (2021) [17], who also reported considerable genotypic variation for these biochemical traits.

The superior performance of SYE-2025-U-60 for grain yield may be attributed to its favourable expression of yield-contributing traits, particularly a higher number of effective tillers m⁻², more grains and higher spikelet fertility per panicle, and heavier grains, coupled with higher total dry matter production, leaf area index, chlorophyll content and nitrogen content. A similar association between yield-contributing traits and grain yield has been reported by Chavan *et al.* (2022) [18], Ankita *et al.* (2023) [19] and Bian *et al.* (2020) [20], who emphasised the role of panicle architecture and spikelet fertility in determining grain yield. The grain yield recorded in the present study is comparable to that reported by Ankita *et al.* (2023) [19] and lower than the maximum yield of 5500 kg ha⁻¹ reported by Singh *et al.* (2026) [21] among fine grain rice varieties.

The milling percentage and head rice recovery recorded in the present study are in agreement with the findings of Anonymous (2025b) [9] and Sokra *et al.* (2025) [22]. The absence of chalkiness in all the genotypes evaluated indicates good grain appearance and translucency, a desirable attribute for fine grain rice fetching premium market price, as also emphasised by Sultana *et al.* (2022) [23].

Tables

1. Plant height (cm) of fine grain rice genotypes at 30, 60, 90 DAT and at harvest

Sr. No.	Genotype	30 DAT	60 DAT	90 DAT	Harvest
1	SYE-2025-U-57	82.41	122.52	135.11	136.11
2	SYE-2025-U-58	71.10	90.03	110.11	125.11
3	SYE-2025-U-59	77.46	121.05	131.00	133.33
4	SYE-2025-U-60	84.81	124.04	137.45	138.67
5	SYE-2025-U-61	71.82	115.45	133.89	132.67
6	SYE-2025-U-62	71.02	115.71	127.44	129.11
7	SYE-2025-U-63	72.81	119.94	123.78	127.56
8	SYE-2025-U-64	67.73	112.32	124.22	125.89
9	SYE-2025-U-65	73.65	115.91	130.78	132.45
10	PDKV-Tilak (Check)	78.60	118.12	133.89	134.55
11	Jai Shriram (L. Check)	70.56	114.29	123.67	127.89
	Mean	74.72	115.40	128.30	131.21
	SE (m)±	2.37	2.24	3.58	3.47
	CD at 5%	5.49	3.36	4.84	4.58

1. 2. Days to 50% flowering and days to maturity of fine grain rice genotypes

Sr. No.	Genotype	Days to 50% flowering	Days to maturity
1	SYE-2025-U-57	121.00	152.00
2	SYE-2025-U-58	115.00	145.33
3	SYE-2025-U-59	115.00	145.33
4	SYE-2025-U-60	112.00	142.00
5	SYE-2025-U-61	116.33	147.00
6	SYE-2025-U-62	113.33	143.00
7	SYE-2025-U-63	114.33	145.00
8	SYE-2025-U-64	115.00	145.00
9	SYE-2025-U-65	118.00	149.00

(continued on next page)

Sr. No.	Genotype	Days to 50% flowering	Days to maturity
10	PDKV-Tilak (Check)	112.00	143.00
11	Jai Shriram (L. Check)	116.00	146.00
	Mean	115.27	145.70
	SE (m)±	0.69	0.72
	CD at 5%	2.03	2.12

1. 3. Total dry matter production (g plant⁻¹) of fine grain rice genotypes at 30, 60, 90 DAT and at harvest

Sr. No.	Genotype	30 DAT	60 DAT	90 DAT	Harvest
1	SYE-2025-U-57	3.672	15.217	27.953	31.773
2	SYE-2025-U-58	3.885	15.030	22.597	25.700
3	SYE-2025-U-59	3.377	15.442	24.947	28.653
4	SYE-2025-U-60	3.222	16.145	25.700	29.650
5	SYE-2025-U-61	3.872	16.683	24.253	27.900
6	SYE-2025-U-62	2.960	13.935	24.507	27.797
7	SYE-2025-U-63	2.310	15.963	21.187	24.747
8	SYE-2025-U-64	3.393	17.197	22.377	25.897
9	SYE-2025-U-65	4.647	16.847	24.277	28.347
10	PDKV-Tilak (Check)	4.030	18.657	24.453	28.177
11	Jai Shriram (L. Check)	3.227	15.740	23.243	26.350
	Mean	3.510	16.080	24.140	27.730
	SE (m)±	0.289	0.747	0.516	0.407
	CD at 5%	0.852	2.204	1.523	1.200

1. 4. Leaf area (dm²) of fine grain rice genotypes at 30, 60, 90 DAT and at harvest

Sr. No.	Genotype	30 DAT	60 DAT	90 DAT	At harvest
1	SYE-2025-U-57	2.717	13.777	22.653	1.020
2	SYE-2025-U-58	2.697	13.567	20.533	0.953
3	SYE-2025-U-59	3.053	11.940	22.857	1.003
4	SYE-2025-U-60	3.490	14.667	18.950	1.147
5	SYE-2025-U-61	3.397	12.313	18.290	0.977
6	SYE-2025-U-62	2.913	9.463	20.593	1.003
7	SYE-2025-U-63	2.993	14.600	19.933	0.927
8	SYE-2025-U-64	2.557	11.740	22.873	0.853
9	SYE-2025-U-65	3.067	11.763	23.343	0.887
10	PDKV-Tilak (Check)	2.960	13.037	17.363	0.920
11	Jai Shriram (L. Check)	3.110	12.467	21.833	0.803
	Mean	3.000	12.670	20.840	0.950
	SE (m)±	0.247	0.977	1.603	0.007
	CD at 5%	0.729	2.881	4.728	0.020

1. 5. Leaf area index of fine grain rice genotypes at 30, 60, 90 DAT and at harvest

Sr. No.	Genotype	30 DAT	60 DAT	90 DAT	At harvest
1	SYE-2025-U-57	0.90	4.59	7.55	0.34
2	SYE-2025-U-58	0.90	4.52	6.84	0.32
3	SYE-2025-U-59	1.02	3.98	7.62	0.33
4	SYE-2025-U-60	1.16	4.89	6.32	0.38
5	SYE-2025-U-61	1.13	4.10	6.09	0.32
6	SYE-2025-U-62	0.97	3.15	6.86	0.33
7	SYE-2025-U-63	1.00	4.87	6.64	0.31

(continued on next page)

Sr. No.	Genotype	30 DAT	60 DAT	90 DAT	At harvest
8	SYE-2025-U-64	0.85	3.91	7.62	0.28
9	SYE-2025-U-65	1.02	3.92	7.78	0.30
10	PDKV-Tilak (Check)	0.99	4.34	5.79	0.31
11	Jai Shriram (L. Check)	1.04	4.16	7.28	0.27
	Mean	1.00	4.22	6.95	0.32
	SE (m)±	0.0831	0.3264	0.5344	0.0029
	CD at 5%	0.2450	0.9628	1.5765	0.0087

1. 6. Length and width (cm) of flag leaf at 50% flowering of fine grain rice genotypes

Sr. No.	Genotype	Length (cm)	Width (cm)
1	SYE-2025-U-57	43.25	1.50
2	SYE-2025-U-58	40.70	1.41
3	SYE-2025-U-59	42.69	1.46
4	SYE-2025-U-60	44.94	1.52
5	SYE-2025-U-61	39.69	1.42
6	SYE-2025-U-62	42.10	1.39
7	SYE-2025-U-63	41.79	1.49
8	SYE-2025-U-64	41.48	1.43
9	SYE-2025-U-65	41.89	1.36
10	PDKV-Tilak (Check)	42.80	1.47
11	Jai Shriram (L. Check)	40.92	1.45
	Mean	42.02	1.45
	SE (m)±	2.75	0.05
	CD at 5%	5.74	0.10

1. 7. Relative growth rate ($\text{g g}^{-1} \text{ day}^{-1}$) of fine grain rice genotypes

Sr. No.	Genotype	30-60 DAT	60-90 DAT	90 DAT – PM
1	SYE-2025-U-57	0.02066	0.00881	0.00132
2	SYE-2025-U-58	0.02011	0.00543	0.00161
3	SYE-2025-U-59	0.02250	0.00634	0.00172
4	SYE-2025-U-60	0.02387	0.00641	0.00194
5	SYE-2025-U-61	0.02130	0.00568	0.00163
6	SYE-2025-U-62	0.02284	0.00785	0.00165
7	SYE-2025-U-63	0.02830	0.00415	0.00194
8	SYE-2025-U-64	0.02295	0.00446	0.00182
9	SYE-2025-U-65	0.01854	0.00556	0.00173
10	PDKV-Tilak (Check)	0.02251	0.00376	0.00186
11	Jai Shriram (L. Check)	0.02321	0.00554	0.00151
	Mean	0.02244	0.01000	0.00170
	SE (m)±	0.00141	0.00044	0.00009
	CD at 5%	0.00417	0.00130	0.00027

1. 8. Net assimilation rate ($\text{g dm}^{-2} \text{ day}^{-1}$) of fine grain rice genotypes

Sr. No.	Genotype	30-60 DAT	60-90 DAT	90 DAT – PM
1	SYE-2025-U-57	0.0248	0.0104	0.0072
2	SYE-2025-U-58	0.0240	0.0064	0.0068
3	SYE-2025-U-59	0.0274	0.0083	0.0076
4	SYE-2025-U-60	0.0245	0.0084	0.0088
5	SYE-2025-U-61	0.0268	0.0073	0.0083
6	SYE-2025-U-62	0.0286	0.0105	0.0070

(continued on next page)

Sr. No.	Genotype	30-60 DAT	60-90 DAT	90 DAT – PM
7	SYE-2025-U-63	0.0270	0.0046	0.0076
8	SYE-2025-U-64	0.0332	0.0044	0.0073
9	SYE-2025-U-65	0.0274	0.0065	0.0079
10	PDKV-Tilak (Check)	0.0314	0.0056	0.0095
11	Jai Shriram (L. Check)	0.0275	0.0065	0.0069
	Mean	0.0275	0.0071	0.0077
	SE (m)±	0.0022	0.00061	0.00059
	CD at 5%	0.0064	0.0018	0.0017

1. 9. Crop growth rate (g m⁻² day⁻¹) of fine grain rice genotypes

Sr. No.	Genotype	30-60 DAT	60-90 DAT	90 DAT – PM
1	SYE-2025-U-57	12.8296	14.1519	3.0317
2	SYE-2025-U-58	12.3852	8.7426	2.9272
3	SYE-2025-U-59	13.4093	10.5633	3.5327
4	SYE-2025-U-60	14.3630	10.6141	4.1122
5	SYE-2025-U-61	14.2352	8.4111	3.2842
6	SYE-2025-U-62	12.1981	11.7467	3.3211
7	SYE-2025-U-63	15.1704	5.8037	3.3917
8	SYE-2025-U-64	15.3389	5.7556	3.3535
9	SYE-2025-U-65	13.5574	8.2552	3.4792
10	PDKV-Tilak (Check)	16.2537	6.4407	3.7600
11	Jai Shriram (L. Check)	13.9037	8.3370	2.8765
	Mean	13.9700	8.9800	3.3700
	SE (m)±	0.9574	0.6792	0.2823
	CD at 5%	2.8243	2.0036	0.8327

1. 10. Total chlorophyll content (mg g⁻¹) and nitrogen content (%) in flag leaves of fine grain rice genotypes

Sr. No.	Genotype	Total chlorophyll content	Nitrogen content
1	SYE-2025-U-57	2.15	2.07
2	SYE-2025-U-58	1.83	1.56
3	SYE-2025-U-59	2.05	1.59
4	SYE-2025-U-60	3.11	2.26
5	SYE-2025-U-61	1.90	1.38
6	SYE-2025-U-62	1.65	1.51
7	SYE-2025-U-63	1.93	1.43
8	SYE-2025-U-64	1.41	1.46
9	SYE-2025-U-65	1.77	1.50
10	PDKV-Tilak (Check)	2.14	1.70
11	Jai Shriram (L. Check)	1.34	1.44
	Mean	1.93	1.63
	SE (m)±	0.05	0.03
	CD at 5%	0.14	0.09

1. 11. Yield and yield-contributing traits of fine grain rice genotypes

Sr. No.	Genotype	Total grains panicle ⁻¹	Filled grains panicle ⁻¹	Panicle length (cm)	Spikelet fertility (%)	Grain wt. panicle ⁻¹ (g)	Effective tillers m ⁻²	1000 grain wt. (g)	Grain yield plot ⁻¹ (g)	Grain yield (kg ha ⁻¹)	Harvest index (%)
1	SYE-2025-U-57	239.33	223.83	26.17	93.50	3.82	381.00	13.78	1909.44	4420	33
2	SYE-2025-U-58	168.33	135.50	21.89	80.50	2.96	257.00	12.58	1339.20	3100	25

(continued on next page)

Sr. No.	Genotype	Total grains panicle ⁻¹	Filled grains panicle ⁻¹	Panicle length (cm)	Spikelet fertility (%)	Grain wt. panicle ⁻¹ (g)	Effective tillers m ⁻²	1000 grain wt. (g)	Grain yield plot ⁻¹ (g)	Grain yield (kg ha ⁻¹)	Harvest index (%)
3	SYE-2025-U-59	216.83	191.33	24.11	88.27	3.65	348.00	13.49	1823.76	4222	37
4	SYE-2025-U-60	241.33	229.17	26.50	94.95	3.92	416.33	14.02	2018.88	4673	44
5	SYE-2025-U-61	161.17	140.00	22.72	86.80	3.60	308.00	12.81	1758.24	4070	33
6	SYE-2025-U-62	207.67	176.17	23.89	84.87	3.40	295.00	13.31	1766.88	4090	36
7	SYE-2025-U-63	197.17	168.50	22.00	85.48	2.99	299.00	13.02	1566.72	3627	30
8	SYE-2025-U-64	204.50	168.67	23.11	82.46	3.48	293.00	13.47	1679.40	3888	35
9	SYE-2025-U-65	205.50	168.83	23.11	82.15	3.44	339.00	13.27	1794.60	4154	30
10	PDKV-Tilak (Check)	224.17	203.17	24.44	90.71	3.68	355.00	13.64	1873.08	4336	41
11	Jai Shriram (L. Check)	183.00	149.17	23.00	81.76	3.09	327.00	13.05	1713.60	3967	30
	Mean	204.45	177.67	23.72	86.50	3.46	328.91	13.31	1749.00	4049.62	33.94
	SE (m)±	4.57	4.61	1.25	2.63	0.04	17.08	0.19	140.69	325.67	2.73
	CD at 5%	13.48	5.51	3.69	7.75	0.13	50.37	0.57	415.04	960.73	8.06

1. 12. Quality parameters of fine grain rice genotypes

Sr. No.	Genotype	Milling (%)	Head rice recovery (%)	Chalkiness	Paddy length (mm)	Paddy breadth (mm)	Paddy L/B	Dehusked length (mm)	Dehusked breadth (mm)	Dehusked L/B
1	SYE-2025-U-57	69.70	63.50	Absent	7.12	1.68	4.23	5.97	1.58	3.78
2	SYE-2025-U-58	65.00	56.83	Absent	7.97	1.73	4.60	5.17	1.64	3.15
3	SYE-2025-U-59	68.00	61.00	Absent	7.28	1.67	4.35	5.10	1.60	3.19
4	SYE-2025-U-60	69.80	63.80	Absent	8.02	1.62	4.95	6.09	1.59	3.83
5	SYE-2025-U-61	66.50	63.00	Absent	9.22	1.71	5.39	6.54	1.58	4.14
6	SYE-2025-U-62	66.00	60.00	Absent	7.28	1.62	4.59	5.72	1.58	3.62
7	SYE-2025-U-63	68.00	63.00	Absent	7.18	1.59	4.51	5.33	1.52	3.51
8	SYE-2025-U-64	65.00	61.00	Absent	7.36	1.82	4.04	5.63	1.71	3.29
9	SYE-2025-U-65	68.00	59.50	Absent	7.27	1.69	4.30	5.38	1.61	3.34
10	PDKV-Tilak (Check)	68.80	63.00	Absent	7.18	1.79	4.01	5.37	1.70	3.16
11	Jai Shriram (L. Check)	67.70	61.50	Absent	8.31	1.71	4.80	5.72	1.58	3.62
	Mean	67.50	61.47	-	7.65	1.69	4.52	5.64	1.61	3.51

Conclusion

Based on the results of the present investigation, it can be concluded that the fine grain rice genotype SYE-2025-U-60 recorded the highest grain yield of 4673 kg ha⁻¹, exceeding the best check, PDKV-Tilak (4336 kg ha⁻¹), by about seven per cent. The superior yield performance of SYE-2025-U-60 was associated with its favourable morpho-physiological attributes, including higher total dry matter production, leaf area, leaf area index and flag leaf dimensions, together with

significantly higher relative growth rate, net assimilation rate and crop growth rate during the later growth stages. The genotype also recorded significantly higher total chlorophyll content and nitrogen content in flag leaves, along with superior yield-contributing traits, viz., effective tillers m⁻², grain weight per panicle, grain yield plot⁻¹ and harvest index, and better milling and head rice recovery. The genotype SYE-2025-U-61 recorded the highest length-to-breadth ratio, indicating good grain slenderness. Chalkiness was absent in all the genotypes evaluated, reflecting good grain appearance and quality. The high yielding genotypes exhibiting desirable morpho-physio

logical, biochemical, yield and quality traits identified in this study may serve as valuable genetic resources for rice breeders in future crop improvement programmes and could provide useful information to researchers, plant physiologists, agronomists and students working on rice productivity.

Acknowledgments

The authors are grateful to the Associate Dean, College of Agriculture, Nagpur, and the Officer In-charge, Agriculture Research Station, Sindewahi, District Chandrapur, under Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, for providing the necessary experimental facilities. The authors also thank the field and laboratory staff for their assistance during the course of the investigation. The authors declare that they have no conflict of interest related to this work.

References

1. Muthayya S, Sugimoto JD, Montgomery S, Maberly GF. An overview of global rice production, supply, trade, and consumption. *Ann. N. Y. Acad. Sci.* 2014;1324(1):7-14.
2. Yoshida S. Fundamentals of rice crop science. International Rice Research Institute, Los Baños, Philippines. 1981.
3. Watson DJ. Comparative physiological studies in the growth of field crops. I. Variation in net assimilation rate and leaf area between species and varieties, and between years. *Ann. Bot.* 1947;11:41-76.
4. Fischer RA. Some remarks on the methods formulated in the recent article on "The quantitative analysis of plant growth". *Ann. Appl. Biol.* 1921;7:367-372.
5. Watson DJ. Leaf growth in relation to crop yield: The growth of leaves. Mithorpe (ed.). Butterworths, London. Williams, RF. 1952.
6. Somichi Y, Doughlus SY, James AP. Laboratory manual: Physiological studies in rice analysis for total nitrogen (organic N) in plant tissue. The International Rice Research Institute, Los Baños, Laguna, Philippines, II. 1972.
7. Donald CM, Hamblin J. Growth and development in physiology crop plants. 2nd Ed. Scientific publishers Jodhapur. 1976:198-199.
8. Panse VG, Sukatme PV. Statistical methods for Agricultural workers. ICAR. Publication. New Delhi. 1954:63-66.
9. Anonymous. Annual progress report on rice breeding (2024-25). Zonal Agricultural Research Station, Sindewahi. 2025a.
10. Masud TA, Roy TS, Rahman A, Mahmud MH, Hossain MD. Study on growth and yield of some aromatic rice varieties. *Bangladesh Agron.* 2023;26(1):1-8.
11. Sahoo C, Subudhi H, Panda B. Phenotypic characterization of aromatic rice (*Oryza sativa* L.) landraces of Odisha, India. *Ecol. Environ. Conserv.* 2022:S261-S270.
12. Priyanka, Sao A, Gauraha D. Genetic variability studies for yield and quality parameters in aromatic breeding lines of rice (*Oryza sativa* L.). *J. Pharmacogn. Phytochem.* 2020;9(6):1637-1640.
13. Duraiswamy A, Jebakani S, Pramitha L, Ramchander S, Natarajan D, Wilson D, Palaniappan DK, Kumar P. Evaluating the variability parameters among rice (*Oryza sativa* L.) landraces and varieties from Tamil Nadu. *Electron. J. Plant Breed.* 2025;14(2):487-495.
14. Dhawne M, Shamkuwar G, Shamkuwar S, Landge N, Sable A, Tinpayale A. Influence of foliar application of nano-urea on morpho-physiological and yield parameters in rice (*Oryza sativa* L.) *Biological Forum – An International Journal.* 2023;15:548.
15. Sahare P, Shamkuwar G, Baviskar G, Shamkuwar S, Khandare K, Landge Y. Yield and yield contributing traits of long grain aromatic rice (*Oryza sativa* L.). *Int. J. Adv. Biochem. Res.* 2024;8(10S):592-595.
16. Arumugam V, Durairaj S, Hemalatha M, Joseph M. Study on rice residue management options on growth parameters and growth indices of rice crop. *J. Exp. Agric. Int.* 2020;42(1):56-63.
17. Wang L, Chen S, Li D, Wang C, Jiang H, Zheng Q, Peng Z. Estimation of paddy rice nitrogen content and accumulation both at leaf and plant levels from UAV hyperspectral imagery. *Remote Sens.* 2021;13:2956.
18. Chavan BR, Dalvi VV, Kunkerkar RL, Mane AV, Gokhale NB. Studies on genetic variability for yield and yield contributing traits in aromatic rice (*Oryza sativa* L.). *The Pharma Innovation Journal.* 2022;11(2):1732-1735.
19. Poudel A, Chaudhary MS, Adhikari A, Shrestha J. Detection of superior rice genotypes through evaluating growth and yield parameters. *Nepal Agriculture Research J.* 2023;15:66-74.
20. Bian JL, Ren GL, Han C, Xu FF, Qiu S, Tang JH, Zhang HC, Wei HY, Gao H. Comparative analysis on grain quality and yield of different panicle weight indica-japonica hybrid rice (*Oryza sativa* L.) cultivars. *J. Integr. Agric.* 2020;19(4):999-1009.
21. Singh AP, Rai A, Singh V, Dubey AK. Comparative study of growth and yield attributes of different paddy cultivars under Tarai region of Uttar Pradesh. *Int. J. Adv. Biochem. Res.* 2026;9(12S):1867-1870.
22. Sokra I, Touch P, Chanra R, Meta H. Effect of moisture content of paddy (Phka Rumduol) on the quality of white rice (*Oryza sativa* L.). *Zenodo.* 2025.
23. Sultana S, Faruquee M, Islam MR. Rice grain quality parameters and determination tools: A review on the current developments and future prospects. *Int. J. Food Prop.* 2022;25(1):1063-1078.

How to cite this article: Zade MV, Shamkuwar G, Baviskar SB, Wandhare M, Kausadikar PH, Shende P, et al. Screening of fine grain rice (*Oryza sativa*) genotypes for morpho-physiological, biochemical and yield parameters. *International Journal of Advanced Biochemistry Research.* 2026;SP-10(9):2320-2328. doi: <https://www.doi.org/10.33545/26174693.2026.v10.i9Sac.10170>

Authors

Mrinal V Zade

PG Scholar, Plant Physiology, College of Agriculture, Nagpur, Maharashtra, India

GR Shamkuwar

Senior Research Scientist, ARS Sindewahi, Maharashtra, India

Sapana B Baviskar

Assistant Professor, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

MR Wandhare

Assistant professor, ARS Sindewahi, Maharashtra, India

Padmaja H Kausadikar

Assistant Professor, Soil Science Section, College of Agriculture, Nagpur, Maharashtra, India

PV Shende

Professor, Agricultural Botany Section, College of Agriculture, Nagpur, Maharashtra, India

Priyanka D Kadam

PG Scholar, Plant Physiology, College of Agriculture, Nagpur, Maharashtra, India

Subodh Purushottam Janglekar

PG Scholar, Genetics and Plant Breeding, College of Agriculture, Nagpur, Maharashtra, India