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Screening of Rice Genotypes for Biochemical and Yield and Yield Contributing Characters under Direct Seeded Condition

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ABSTRACT: A field experiment was conducted during *kharif* 2022, to study the evaluation of rice genotypes under direct seeded condition. The experiment was laid down in randomized block design (RBD) with eleven rice genotypes *viz*., SYE-68-15-34-31-12-35-13, SYE-930-8-25, SYE-94-32-9-17, SYE-335-4-37-9, SYE-309-39-13-18-5-23-20, SYE-1635-40-15-4-9-44-18, PKV-HMT (CH), PDKV Tilak (CH), PKV Ganesh (CH), PDKV Kisan (CH), Awishkar (CH) and three replications at research farm of Botany Section College of Agriculture, Nagpur. Observations about biochemical parameters like leaf chlorophyll, nitrogen content and amylose content were also estimated. Observations on yield and yield contributing parameters. Significantly enhance biochemical parameters like chlorophyll and Nitrogen content in leaves and amylose content in seed were also enhanced check PKV-Ganesh, PKV-HMT, PDKV Tilak, PDKV Kisan and Awishkar.

Keywords: Rice, biochemical parameters, yield.

INTRODUCTION

Rice (*Oryza sativa* L.) is the supreme cereal crop belonging to the genus of *Oryza*. Rice is the world second largest producing crop after wheat. Asia accounts for more than 90% rice production of world. Rice designated as “Global Grain” for its usage as foremost essential food supplements in various developed and developing nations around the globe (Katkani *et al*., 2023).

Rice (*Oryza sativa* L.) is the seed of monocot plants. It can be a short, medium or long grain size. It can also be waxy (sticky) or non-waxy. Some rice varieties are considered aromatic. Rice also comes in many different colors including white, brown, red, purple and black (Bele *et al*., 2021).

Rice (*Oryza sativa* L.) is the staple food for over half of the world population and it is ranked as the number one human food crop in the world. It is one of the major food crops consumed by 70 per cent of world population. It occupies 1/5th of the total land covered under the cereal crops. Rice which is mainly consumed as a whole grain supplies 20 per cent of daily calories and 15 per cent per capita protein for the world population. Eastern Vidarbha Zone is the major rice producing area of Maharashtra (52.41% of the state area). The early, midlate, late duration and aromatic rice varieties are very popular in Eastern Vidarbha Zone. In Vidarbha region the proportion of area under early, mid late, late varieties and aromatic rice varieties is about 30, 40, 25 and 5 per cent respectively (Padole *et al*., 2018).

Direct seeding of rice refers to the process of establishing a rice crop from seeds sown in the field rather than by transplanting seedlings from the nursery. Day by day there is less rainfall, uneven distribution of rains, dry spell during the month of July-August and from second fortnight of September in Vidarbha region. Sometimes farmers use 40 to 50 days old rice seedlings for transplanting which later on suffers heavily due to disease pest infestation also. Rice crop suffer due to water stress at flowering and grain filling stage which resulted into low yields. To overcome this problem now farmers are slowly shifting to rice crop cultivation by direct seeding. Different rice cultivars growing in India for direct seeding condition in many states are having different morphological and yield traits.

MATERIALS AND METHODS

The experiment was conducted during *Kharif*-2022 at research farm of Botany Section College of Agriculture, Nagpur in a Randomized Block Design (RBD) with eleven genotypes and three replications. Eleven rice genotypes *viz*., SYE-68-15-34-31-12-35-13, SYE-930-8-25, SYE-94-32-9-17, SYE-335-4-37-9, SYE-309-39-13-18-5-23-20, SYE-1635-40-15-4-9-44-18, PKV-HMT (CH), PDKV Tilak (CH), PKV Ganesh (CH), PDKV Kisan (CH), Awishkar (CH) were tested. The gross plot size was 5.10 m × 1.50 m and net plot size was 4.70 m × 1.30 m with spacing of 20 cm × 10 cm. Five plants from each plot were selected randomly and data were collected at 30, 60 and 90 DAS under direct seeded condition. Observations on total chlorophyll content in leaves, nitrogen content in leaves and amylose content after harvest. Total chlorophyll content of oven dried leaves was estimated by colorimetric method as Bruinsma (1982). Nitrogen content in leaves was estimated by micro kjeldahls method as given by Somichi *et al*. (1972). Amylose content after harvest. Test weight, panicle length, number of panicles^{-2}, spikelet fertility, number of spikelet panicle^{-1}, grain yield plot^{-1} were calculated after harvest.

RESULTS AND DISCUSSION

A. Total chlorophyll contnt in leaves (mg g^{-1})

Chlorophyll is a green pigment present in chloroplast of all green plant cells and tissues. These are essential photosynthetic pigments capable of absorbing light energy for the synthesis of carbohydrates. Chlorophyll content of the plant tissue represents the photosynthetic capacity of plant. The greenness of the leaf is generally considered to be a parameter contributing to yielding ability of cultivar. Leaves constitute most important aerial organ of the plants, playing a major role in the anabolic activities by means of the so called 'green pigments or chlorophyll' is the sole medium of the photosynthetic progress which in turn is the major synthesis pathway operatives in plants.

At 30 DAS total chlorophyll content in leaves ranged between 1.59-2.59 mg g^{-1}. Significantly highest chlorophyll content was observed in check PKV Ganesh (2.59 mg g^{-1}) followed by PKV-HMT (2.22 mg g^{-1}) however, lowest chlorophyll content in leave recorded in genotypes sye-1635-40-15-4-9-44-18 (1.59 mg g^{-1}) was recorded.

At60 DAS total chlorophyll content in leaves varied from 3.39-4.91 mg g^{-1}. The significantly maximum chlorophyll noticed in check Awishkar (4.91 mg g^{-1}) followed by SYE-1635-40-15-4-9-44-18 (4.84 mg g^{-1}), SYE-930-8-25 (4.69 mg g^{-1}). However, these genotypes found at par and significantly superior. While, lowest chlorophyll content were found in check PKV-HMT (3.39 mg g^{-1}).

At 90 DAS significantly highest total chlorophyll content in leaves was registered in genotype SYE-1635-40-15-4-9-44-18 (2.74 mg g^{-1}) followed by SYE-930-8-25 (2.59 mg g^{-1}). Next to these treatments significantly lowest chlorophyll content was also recorded in check PDKV Kisan (1.60 mg g^{-1}).

Similar results were observed by Swain *et al*. (2017) conducted an experiment on morpho-physiological traits of some rice varieties in response to shallow water depth and reported mean of 2.03 mg g^{-1} total chlorophyll content of rice varieties and range of 1.6 to 2.5 mg g^{-1} at later stage. Vanisri *et al.* (2017) conducted an experiment on evaluation of rice genotypes for chlrophyll content and scavenging enzyme activity and reported the range of total chlorophyll mg g^{-1} from 3.42 in Tulsi to 6.56 mg g^{-1} in Rasi amongst 21 rice cultivars studied.

B. Nitrogen content in leaves (%)

Nitrogen is key component in mineral fertilizers and has more influence on plant growth, appearance and fruit production or quality than any other essential elements. Nitrogen is an important constituent of protein and protoplasm and essential for the growth of plants. Its storage leads to chlorosis and stoppage of growth and its presence in moderate doses is essential for plant growth and fruiting. An abundant supply of essential nitrogenous compound is required in each plant cell for normal cell division, growth and respiration. The nitrogen present mostly as protein is constantly moving and under concentration of nitrogen is found in young, tender plant tissues like tips of shoots, buds and new leaves (Jain, 2010).

The data obtained about the nitrogen content in leaves are given in Table 1. It is observed from the data that there was significant variation in leaf nitrogen of different genotypes on various concentrations 30, 60 and 90 DAS. At 30 DAS nitrogen content is differed genotypes and ranged from 1.00-1.91%. The best and significant results were obtained in check PKV Ganesh (1.91%) followed by treatments SYE-94-32-9-17 (1.82%) had also stimulatory effect on leaf nitrogen content over genotypes. Whereas, the check Awishkar (1.00%) shows significantly lowest nitrogen content in leaves.

At 60 DAS nitrogen content in leaves ranged from 2.25-3.96%. Significantly maximum increment in nitrogen content in check PKV Ganesh (3.96%) followed by SYE-94-32-9-17 (3.82%). Genotypes SYE-1635-40-15-4-9-44-18 (3.06%) and SYE-94-32-9-17 (3.82%) were found at par. SYE-68-15-34-31-12-35-13 (2.25%) also showed significantly less nitrogen content.

At 90 DAS nitrogen content in leaves ranged from 0.56-1.31% maximum N content at 90 DAS was recorded in check PKV Ganesh (1.31%) followed by genotype SYE-94-32-9-17 (1.32%). Whereas lowest nitrogen content in leaves were found in genotype SYE-1635-40-15-4-9-44-18 (0.56%). Patni and guru (2012) reported that rice genotypes which can extract more nitrogen at early stages of growth tend to be more competitive in terms of plant biomass production. Result shows that nitrogen content was highest in the genotype Govind under free weed situation.

C. Amylose content (%)

The amylose content of milled rice is the major determinant of rice texture how soft or firm the cooked rice. After cooking, the high-amylose and intermediate-amylose rice are firm and fluffy, while low amylase and waxy rice are soft, moist and sticky in texture. The data obtained about the amylose content in grain are given in Table 1. Data showed significant variation in amylose content. The range of amylose content after harvest was 19.78-26.94%. Significantly highest amylose content in grain were found in check PDKV Kisan (26.94%) followed by SYE-930-8-25 (26.15%), SYE-94-32-9-17 (24.73%), SYE-309-39-13-18-5-23-20 (24.79%). Significantly lowest amylose content was recorded in genotypes SYE-1635-40-15-4-9-44-18 (19.78%) followed by SYE-335-4-37-9 (19.91%).

Similar results were noted by Shende *et al*. (2017) conducted that the high yielding, supper fine (short slender) good quality variety, the cross effected between Daya × SYE632003 at agriculture research station, sindewahi resulted in the development new culture SYE-503-78-34-2 (PDKV TILAK), which is late duration, high yielding (40-45 q/ha) with good cooking quality *i.e.* intermediate amylose content (22-26%). With high milling (70.97%) and good head recovery (66.47%).

D. Yield and yield parameters

1000 grain weight (g). Data pertaining to 1000 grain weight as influenced by different genotypes was tabulated in Table 1. A close perusal of data on 1000 grain weight indicated that there was significant difference due to the different genotypes.

Significant variation was observed among rice genotypes. Significantly highest 1000 grain weight was recorded in check PDKV Kisan (17.35 g) as compared to all genotypes. Genotypes SYE-309-39-13-18-5-23-20 (16.80 g) and SYE-335-4-37-9 (16.50 g) these genotypes were found at par. Whereas, significantly lowest 1000 grain weight was recorded in check PDKV Tilak (12.30 g) followed by SYE-68-15-34-31-12-35-13 (12.90 g).

Similar result were noted by Padhiary *et al*. (2017) they reported that the maximum range of 1000 grain weight (g) of rice cultivars from 18.20 to 24.58 (g) in high yielded.

Dongarwar *et al.* (2018) conducted an experiment to evaluate the effect of seed rates on yield and economic traits in bold as well as fine seeded rice variety in terms of direct seeded technique and recorded that SYE-2001, a coarse grain variety with higher 1000 grain weight was suitable direct seeded condition compared to PKV-HMT. Bele *et al*. (2021) reported the cultivar SKL-3-1-41-8-33-15 recorded highest 1000 grain weight compared with other cultivars studied. Hence, cultivar SKL-3-1-41-8-33-15 can be recommended for cultivation.

Panicle length (cm). Significantly highest panicle length was recorded in check PDKV Tilak (27.50 cm) followed by PKV Ganesh (24.25 cm), PDKV Kisan (24.25 cm), PKV-HMT (24 cm) However, SYE-930-8-25 (23.65 cm), check PDKV Tilak (27.50 cm), check PKV-Ganesh (24.25 cm), PDKV Kisan (24.25 cm) were found at par and found significantly superior. Genotype length SYE-68-15-34-31-12-35-13 (18 cm) exhibited significantly lowest panicle length among all the genotypes studied.

In present investigation panicle length of rice genotypes was ranged from 18.00 to 27.50 cm. The presents results are supported by Adigbo *et al*. (2018) they reported that panicle length of rice upland cultivars tested in anaerobic soil was ranged from 19.9 cm to 30.9 cm.

Number of panicles m^{-2}. The data pertaining to number of panicles m^{-2} of rice genotypes are presented in Table 2 indicates that mean number of panicles m^{-2} of rice genotypes was 276.86. Significantly highest number of panicles m^{-2} was recorded in genotype SYE-309-39-13-18-5-23-20 (293.50) followed by SYE-94-32-9-17 (289), check PDKV Tilak (285.50), SYE-68-15-34-31-12-35-13 (274.50), SYE-930-8-25 (263.00). Significantly lowest number of panicles m^{-2} was recorded in rice genotype SYE-1635-40-15-4-9-44-18 (237) followed by check PDKV Kisan (241.50).

In present study number of panicles m^{-2} were ranged from 237 to 293.50. Present results are in accordance with the result reported by Ali *et al*. (2007), they reported that number of panicles m^{-2} ranged from 141 to 327.

Number of spikelet panicle^{-1}. The data in respect to number of spikelet panicle^{-1} of rice genotypes presented in Table 2. Significant differences were found in respect to number spikelet panicle^{-1} of rice genotypes. Significantly highest number of spikelet panicle^{-1} was recorded in genotype SYE-309-39-13-18-23-20 (167.90) followed by SYE-94-32-9-17 (161.70). However, numerically moderate number of spikelet panicles^{-1} were recorded in check PKV-HMT (133.00) and SYE-68-15-34-31-12-35-13 (131.30). The check PDKV Kisan (121.60) and SYE-335-4-37-9 (125.20) exhibited significantly lowest number of spikelet panicle^{-1} over all other genotypes.

In present investigation number of spikelet panicle^{-1} of rice genotypes were found in the ranged from 121.60 to 161.70 under direct seeded condition. High yielding rice genotypes SYE-309-39-13-18-23-20 (167.90), SYE-93-32-9-17 (161.70) showed higher number spikelet panicle^{-1}. Presents results are supported by Bele *et al*. (2022), they reported range of number of grains panicle-1 from 78.36 to 125.48.

Spikelet fertility (%). The data pertaining to spikelet fertility of rice genotypes presented in Table 2. Numerically higher spikelet fertility was recorded in genotype SYE-94-32-9-17 (95.45%) followed by genotype SYE-309-39-13-18-5-23-20 (92.80%), check PDKV Kisan (92.40%), check PKV Ganesh (89.05%). However, the rice genotypes SYE-94-32-9-17 (95.45%), SYE-309-39-13-18-5-23-20 (92.80%), check PKV-HMT (90%), PKV Ganesh (89.05%), PDKV Kisan (92.40%) were found significantly and moderatly superior as compared to other genotypes. Genotype SYE-1635-40-15-4-9-44-18 (81.40%) recorded significantly lowest spikelet fertility.

Similar result showed that Malarwizhi *et al*. (2010) reported spikelet fertility in the range of 86.2 to 93.35 in different rice cultivars and hybrids studied.

Grain yield plot^{-1} (kg). The data pertaining to grain yield kg plot^{-1} of rice genotypes presented in Table 2 showed significant differences in respect to grain yield plot^{-1} (kg) of rice genotypes under direct seeded condition. Significantly highest grain yield plot^{-1} was recorded in genotype SYE-309-39-13-18-23-20 (2.78 kg) followed by SYE-94-32-9-17 (2.78 kg) and check PDKV Tilak (2.27 kg). Check PKV-HMT (2.08 kg), PKV Ganesh (1.59 kg) and check Awishkar (2.07 kg) were found moderate in grain yield. However, significantly lowest grain yield plot^{-1} was recorded in check PDKV Kisan (1.34 kg) and SYE-1635-40-15-4-9-44-18 (1.38 kg).

Similar results were noted by Purane *et al*. (2020), who reported that the significantly highest grain yield plot-1 was observed in genotypes PKV-Ganesh (3.52 kg), followed by PKV-Makrand (3.43 kg) but KJT-184 (2.94 kg) recorded significantly lowest grain yield plot^{-1} than all other genotypes studies.

Table 1: Total chlorophyll content, nitrogen content in leaves and amylose content of rice genotypes under direct seeded condition.

Genotypes	Total chlorophyll content (mg g^{-1})			Nitrogen content (%)			Amylose content (%)
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	After harvest
SYE-68-15-34-31-12-35-13	1.83	3.79	2.33	1.25	2.25	0.75	20.77
SYE-930-8-25	1.72	4.69	2.59	1.47	2.47	1.32	26.15
SYE-94-32-9-17	1.73	4.44	2.58	1.82	3.82	1.32	24.73
SYE-335-4-37-9	1.65	3.64	2.15	1.46	2.46	0.96	19.91
SYE-309-39-13-18-5-23-20	1.83	3.35	2.23	1.41	2.41	1.06	24.79
SYE-1635-40-15-4-9-44-18	1.59	4.84	2.74	1.06	3.06	0.56	19.78
PKV-HMT (CH)	1.22	3.39	2.22	1.80	2.30	1.25	22.75
PDKV Tilak (CH)	1.65	3.55	2.35	1.49	2.49	1.24	20.53
PKV Ganesh (CH)	2.59	3.62	2.22	1.91	3.96	1.31	21.94
PDKV Kisan (CH)	1.60	4.38	1.60	1.38	2.38	1.03	26.94
Awishkar (CH)	2.26	4.91	1.76	1.00	2.50	0.90	20.89
SE(m) ±	**0.10**	**0. 38**	**0.15**	**0.20**	**0.49**	**0.25**	**1.32**
CD at 5%	**0.30**	**1.13**	**0.44**	**0.59**	**1.44**	**0.74**	**3.88**

Table 2: Yield and yield contributing parameters of rice genotypes under direct seeded condition.

Genotypes	1000 grain weight (g)	Panicle length (cm)	Number of panicles m^{-2}	Spikelet fertility (%)	Number of spikelet panicle^{-1}	Grain yield kg plot^{-1}
SYE-68-15-34-31-12-35-13	12.90	18.00	274.50	85.73	131.30	1.80
SYE-930-8-25	15.60	23.65	263.00	84.60	137.00	1.87
SYE-94-32-9-17	14.60	21.50	289.00	95.45	161.70	2.70
SYE-335-4-37-9	16.50	22.55	249.00	83.83	125.20	1.71
SYE-309-39-13-18-5-23-20	16.80	19.00	293.50	92.80	167.90	2.78
SYE-1635-40-15-4-9-44-18	13.85	21.35	237.00	81.40	125.60	1.38
PKV-HMT (CH)	14.66	24.00	265.00	90.00	133.00	2.08
PDKV Tilak (CH)	12.30	27.50	285.50	87.98	148.70	2.27
PKV Ganesh (CH)	15.80	24.25	259.50	89.05	124.30	1.59
PDKV Kisan (CH)	17.35	24.25	241.50	92.40	121.60	1.34
Awishkar (CH)	13.90	18.75	270.00	86.16	144.90	2.07
SE(m) ±	**0.97**	**1.57**	**24.11**	**2.36**	**10.88**	**0.46**
CD at 50%	**2.86**	**4.47**	**71.12**	**6.96**	**32.10**	**1.37**

CONCLUSIONS

The check PKV Ganesh significantly showed significant enhancement in morpho-physiological parameters viz., plant height, number of tillers hill-1, days to flower initiation, days to 50% flowering, days to maturity, leaf area plant-1, leaf area index, total dry weight, RGR and NAR. Similarly biochemical parameters like chlorophyll and Nitrogen content in leaves and amylose content in seed were also enhanced check PKV-Ganesh, PKV-HMT, PDKV Tilak, PDKV Kisan and Awishkar. Yield and yield attributing parameters, grain yield kg/plot and grain yield ha-1 (kg) were also showed significant increment by genotypes SYE-309-39-13-18-5-23-20 and SYE-94-32-9-17.

FUTURE SCOPE

The future scope of studying the screening of rice genotypes for biochemical and yield-contributing characters under direct-seeded conditions is promising. It can contribute to developing resilient rice varieties, enhancing crop productivity, and adapting agriculture to evolving environmental conditions. Additionally, insights gained from this research can inform sustainable farming practices and aid in ensuring food security in the face of changing climates and agricultural practices.

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Conflict of Interest. None.

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