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SCREENING OF RICE GENOTYPES FOR MORPHO - PHYSIOLOGICAL CHARACTERS AND YIELD

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ABSTRACT

The present investigation was conducted during *kharif* season of 2019-2020 at research farm of ARS, Sakoli in Randomized Block Design (RBD) with twelve treatments (twelve rice cultivars viz., CR Dhan 311, CR Dhan 310, CR Dhan 201, Indira Arobic, Samleshwari, Rajeshwari, Indira Barani Dhan, MTU-1010, N-22, PKV Ganesh, Vandana, Sahbhagi Dhan) replicated thrice. Cultivar PKV Ganesh recorded higher plant height, number of effective tillers, total dry matter production, leaf area and leaf area index over check and other cultivars under study. But, grain yield plant^{-1} was also recorded significantly highest in Rajeshwari followed by PKV Ganesh when compared with check Sahbhagi Dhan and other cultivars.

(Key words: Rice, morpho-physiological traits, yield)

INTRODUCTION

Rice (*Oryza sativa* L.) is the seed of the 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. Globally, rice is the second most widely consumed cereal next to wheat and it has occupied an area of 160.6 million hectares, with a total production of 738.2 million tonnes (Anonymous, 2015a). In India rice occupies an area of 43.95 million hectares with an average production of 105.48 million tonnes with the productivity of 2424 kg ha^{-1} though increasing marginally, but is still well below the worlds average yield of 4360 kg ha^{-1} (Anonymous, 2015b).

Direct seeding of rice refers to the process of establishing a rice crop from seeds sown in the ûeld 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 having different morphological and yield traits. Different rice cultivars showed differences in yield under direct seeding condition. Considering the above facts present investigation was under taken on different varieties of rice under direct seeded condition.

MATERIALS AND METHODS

An experiment was carried out at research farm ARS Sakoli, during 2019-20 in RBD with three replications and twelve treatments (cultivars CR Dhan 311, CR Dhan 310, CR Dhan 201, Indira Arobic, Samleshwari, Rajeshwari, Indira Barani Dhan, MTU-1010, N-22, PKV Ganesh, Vandana, Sahbhagi Dhan). Observations on plant height and total dry matter production were recorded at 90 DAS and at harvest. Leaf area and LAI were recorded at 60 DAS and 90 DAS. Number of effective tillers plant^{-1} was recorded at harvest. Observations on days to 50% flowering and days to maturity and grain yield plant^{-1} were also recorded. Data were statistically analyze as per method suggested by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Plant height

The data presented in Table 1 indicated that mean plant height of rice cultivars at 90 DAS was 112.33 cm. Significantly lowest plant height was recorded in rice cultivar N-22 (100 cm) as compared to check Sahbhagi dhan (80 cm), while numerically more plant height was recorded in rice cultivar CR Dhan 310 (119 cm) and PKV Ganesh (119 cm). Remaining all the rice cultivars were found at par with check Sahbhagi dhan.

The data presented in Table 1 indicated that mean plant height of rice cultivars at harvest was 113 cm. Significantly lowest plant height was recorded in rice cultivar N-22 (100 cm) as compared to check Sahbhagi dhan (119 cm), while numerically more plant height was recorded in

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rice cultivar PKV Ganesh (120 cm). Remaining all the rice cultivars were found at par with check Sahbhagi dhan.

The variation in the plant height was observed due to their genetic makeup of rice cultivars. Final plant height of rice cultivars ranged from 100 to 120 cm in present investigation. Such variation in plant height was also reported by Ali *et al*. (2007). They reported variation in plant height from 84 cm to 146 cm. Yaqoob *et al.* (2012) also reported significant differences in plant height of rice genotypes ranging from 86.67 to 114.67 cm.

Number of effective tillers plant^{-1} at harvest

The data presented in Table 1 indicated that mean number of effective tillers plant^{-1} of rice cultivars at harvest was 6.48. Significantly highest number of effective tillers were recorded in rice cultivar PKV Ganesh (8.9) followed by Vandana (8), Indira aerobic (7.5) as compared to check Sahbhagi Dhan (5). Lowest number of effective tillers were noted in Sahbhagi Dhan (5).

Rice cultivar of midlate maturity recorded grain yield of 6066 kg ha^{-1} and produced consistently highest effective tillers. Differences in effective tillers in rice cultivar ranged from 5.0 to 8.9 plant^{-1}. Srilatha and Vani (2013) conducted sixty front line demonstrations on direct sown paddy with seed drill in farmer's fields of different villages in Krishna district of Andhra Pradesh over the last three seasons starting from 2012-13 to 2014-15. The DSP method showed an increase in yield in comparison to TPP. In case of DSP effective tillers hill^{-1} (16.6 nos.) were significantly higher as compared to TPP method.

Days to 50% flowering

The data presented in Table 1 indicated that mean days to 50% flowering of rice cultivars was 78.08. Significant differences were found in rice cultivars for days to 50% flowering. Significantly highest days to 50% flowering were required by rice cultivar PKV Ganesh (93) followed by Rajeshwari (83) as compared to check Sahbhagi Dhan (77). However, Significantly lowest days to 50% flowering was recorded in Vandana (65) followed by N-22 (67).

Variation in days required to 50% flowering in rice cultivars was due to their genetic makeup. The range found to be 65 to 93 days. All the cultivars showed earliness in flowering except PKV Ganesh which came in midlate. Adigbo *et al*. (2018) also observed range of 68 to 96.3 days in 50% flowering in rice cultivars tested in upland condition in anaerobic soil. Larry *et al.* (2012) recorded 58 mean days to 50% flowering in rice cultivar tested under direct seed dibble condition.

Days to maturity

The data presented in Table 1 indicated that mean days to maturity of rice cultivars was 108.08. Significant differences were found in rice cultivars for days to maturity. significantly highest days to maturity were required by rice cultivar PKV Ganesh (123) followed by Rajeshwari (113) as compared to check Sahbhagi Dhan (107). However, significantly lowest days to maturity was recorded in Vandana (95) followed by N-22 (97).

Variation in days required to maturity in rice cultivars was due to their genetic makeup. The range found to be 95 to 123 days. All the cultivars showed earliness in maturity except PKV Ganesh which came in midlate maturity. Different researchers report different maturity in different rice varieties tested under different conditions. Ali *et al.* (2007) screened 15 rice varieties suitable for direct seeding in Punjab and reported range of maturity in rice varieties from 122 to 148 days. Abade *et al.* (2016) also observed mean of 134 days and range from 105 to 144 days to maturity of rice cultivars tested in irrigated condition. Larry *et al.* (2012) recorded 91.1 mean days to maturity in rice cultivar tested under direct seed dibble condition.

Total dry matter production

The data presented in Table 1 indicated that mean total dry matter production (g plant^{-1}) of rice cultivars at 90 DAS was 18.90 g. Significant differences were found in rice cultivars for total dry matter production. Significantly higher total dry matter production was recorded in rice cultivar Rajeshwari (24.8 g), followed by PKV Ganesh (23.75 g) and MTU 1010 (22.15 g) as compared to check Sahbhagi Dhan (17.32 g). However, significantly lowest total dry matter production was recorded in N-22 (13.3 g). However, rest of all other rice cultivars were found at par with check Sahbhagi Dhan.

The data presented in Table 1 indicated that mean total dry matter production (g plant^{-1}) of rice cultivars at harvest was 23.83 g. Significant differences were found in rice cultivars for total dry matter production. Significantly higher total dry matter production was recorded in rice cultivar Rajeshwari (31.2 g), followed by PKV Ganesh (30.2 g) and MTU 1010 (28.1 g) as compared to check Sahbhagi Dhan (20.4 g). However, lowest total dry matter production was recorded in N-22 (18 g). However, rest of all other rice cultivars were found at par with check Sahbhagi Dhan.

Dry matter production is the result of balanced between photosynthetic activity and respiration loss of plant. The total dry matter production often indicates the potentiality of crop plants for yield, but its mobilization towards grain development is important for grain yield.

From the results, it was observed that total dry matter production (g plant^{-1}) progressively increased from 90 DAS to harvest. At harvest total dry matter production (g plant^{-1}) of rice cultivars was ranged from 18 to 31.2 g. The findings are in conformity to those observed by Adigbo *et al.* (2018). They observed range from 13.46 to 23.75 g amongst different upland rice varieties tested in anaerobic soil. Purane *et al.* (2020) studied on performance of rice genotypes for morpho-physiological parameters and yield in summer season on seven rice genotypes at 30, 60 and 90 DAT and reported range of total dry matter production from 0.50 to 43.02 g.

Leaf area (dm^2)

The data presented in Table 1 indicated that mean leaf area (dm^2 plant^{-1}) of rice cultivars at 60 DAS was 7.65 dm^2. Significant differences were found in rice cultivars for

leaf area (dm^2 $plant^{-1}$). Six rice cultivars recorded significantly higher Leaf area (dm^2 $plant^{-1}$) as compared to check Sahbhagi Dhan (6.05 dm^2). However, significantly highest leaf area was recorded in rice cultivar PKV Ganesh (9.06 dm^2) followed by Samleshwari (9.05 dm^2). Check Sahbhagi Dhan (6.05 dm^2) recorded lowest leaf area.

The data presented in Table 1 indicated that mean leaf area (dm^2 $plant^{-1}$) of rice cultivars at 90 DAS was 5.48 dm^2. Significant differences were found in rice cultivars for leaf area (dm^2 $plant^{-1}$). Five rice cultivars recorded significantly higher leaf area (dm^2 $plant^{-1}$) as compared to check Sahbhagi Dhan (4.29 dm^2). However, significantly highest leaf area was recorded in rice cultivar PKV Ganesh (7.66 dm^2) followed by Rajeshwari (6.96 dm^2) and Samleshwari (6.61 dm^2). Check Sahbhagi Dhan (4.29 dm^2) recorded lowest leaf area.

From the results, it was observed that leaf area (dm^2 $plant^{-1}$) of rice cultivars was progressively increased at 60 DAS and later on decreased at 90 DAS due to senescence of leaves at 90 DAS. PKV Ganesh recorded significantly highest leaf area (9.06 dm^2) at 60 DAS. Present findings are supported by Renuka Devi *et al.* (2013). They reported that leaf area $plant^{-1}$ in rice under aerobic conditions showed a gradual increase from 30 DAS to 75 DAS and then declined in all the aerobic rice cultivars. Among the tested rice cultivars NLR 3010 recorded significantly higher leaf area (6.06 dm^2). Gupta and Guhey (2011) observed the variation in flag leaf area from 0.09 to 0.17 dm^2 $plant^{-1}$ in rice grown in water stress condition.

Leaf area index

The data presented in Table 1 indicated that mean leaf area index of rice cultivars at 60 DAS was 3.82. Seven rice cultivars exhibited significantly higher leaf area index than the check Sahbhagi Dhan (3.02). Significantly highest leaf area index was recorded in rice cultivar in PKV Ganesh (4.53) followed by Samleshwari (4.52) and CR Dhan 310 (4.34), while lowest leaf area index was recorded in rice cultivar check Sahbhagi Dhan (3.02).

The data presented in Table 1 indicated that mean leaf area index of rice cultivars at 90 DAS was 2.73. Five rice cultivars exhibited significantly higher leaf area index than the check Sahbhagi Dhan (2.14). Significantly highest leaf area index was recorded in rice cultivar PKV Ganesh (3.83) followed by Rajeshwari (3.34) and Samleshwari (3.3), while lowest leaf area index was recorded in rice cultivar N-22 (2.04).

From the results, it was observed that leaf area index of rice cultivars was progressively increased at 60 DAS and later on decreased at 90 DAS due to senescence of leaves at 90 DAS. Present findings are supported by Nicknejal *et al.*(2009).They reported that LAI was higher before flowering and ranged from 3.97 to 4.90 which was observed at 60 DAS in present study. PKV Ganesh recorded significantly highest leaf area index (4.53) at 60 DAS and at 90 DAS (3.83). Present findings are also supported by Padhiary *et al*. (2017). They conducted an experiment to evaluate morpho-physiological traits of different rice varieties and showed LAI of 4.92 at 90 DAS in high yielding rice variety Varshadhan.

Grain yield $plant^{-1}$

The data in respect to grain yield $plant^{-1}$ (g) of rice cultivars are presented in Table 1 indicated that mean grain yield $plant^{-1}$ of rice cultivars was 12.40 g. Significant differences were observed in respect to grain yield $plant^{-1}$ of rice cultivars under direct seeded condition. Significantly highest grain yield $plant^{-1}$ was recorded in Rajeshwari (15.4 g) followed by PKV Ganesh (15 g), Samleshwari (14.9 g) and Indira Arobic (14.7 g) as compared to check Sahbhagi Dhan (11.6 g). However, significantly lower grain yield $plant^{-1}$ was recorded in Vandana (8.1 g) followed by N-22 (8.3 g) than the check Sahbhagi Dhan (11.6 g), while rest of the rice cultivars were at par with check Sahbhagi Dhan.

In present investigation grain yield $plant^{-1}$ (g) of rice cultivars was ranged from 8.1 g in low yielding rice cultivar Vandana to 15.4 g in top yielding rice cultivar Rajeshwari under direct seeded condition in low land. The results obtained in present study are supported by Adigbo *et al.* (2018).They reported grain yield $plant^{-1}$ (g) of rice cultivars was ranged from 1.4 g to 10.54 g under upland condition. Whereas, Malarvizhi *et al.* (2010) observed higher grain yield $plant^{-1}$ (g) and it ranged from 24.25 g to 39.10 g in different rice cultivars and hybrids.

Table 1. Plant height (cm), effective tillers, days to 50% flowering, days to maturity, total dry matter production (g), leaf area (dm^2) and leaf area index and grain yield under direct seeded condition

Genotypes	Plant height (cm)		Effective tiller $plant^{-1}$ at harvest	Days to 50% flowering	Days to maturity	Dry matter production (g)		Leaf area (dm2)		LAI		Grain yield $plant^{-1}$(g)
	90 DAS	Harvest				90 DAS	Harvest	60DAS	90 DAS	60 DAS	90 DAS	
CR Dhan 311	115	166	5,7	79	109	17.65	23.2	8.1	4.6	4.05	2.45	13.1
CR Dhan 310	119	119	6.6	80	110	15.62	23.8	8.69	5.08	4.34	2.54	11.7
CR Dhan 201	113	114	6.5	80	110	17.00	12.6	7.61	4.7	3.8	2.35	12.8
Indira Arobic	110	112	7.5	80	`110	18.02	24.6	7.47	5.3	3.73	2.65	14.7
Samleshwari	117	109	6.1	79	109	18,65	21.4	9.05	6.61	4.52	3.30	14.9
Rajeshwari	110	110	6.1	83	113	24.80	31.2	7.5	6.96	3.75	3.34	15.4
Indira Barani Dhan	117	117	4.9	75	105	18.95	20.0	7.62	5.81	3.81	2.90	10.5
MTU-1010	111	111	5.9	79	109	22.15	28.1	6.61	6.3	3.30	3.15	12.7
N-22	100	100	6.6	67	97	13.30	18.0	7.49	4.09	3.74	2.04	8.3
PKV Ganesh	119	120	8.9	93	123	23.75	30.2	9.06	7.66	4.53	3.83	15
Vandana	109	109	8.0	65	95	19.62	21.6	6.54	4.1	3.27	2.05	8.1
Sahabhagi Dhan (check)	117	119	5.0	77	107	17.32	20.4	6.05	4.29	3.02	2.42	11.6
SE (m) ±	7.18	7.23	0.74	0.53	0.58	1.25	1.58	0.49	0.36	0.25	0.18	0.83
CD at 5%	21.06	21.2	2.16	1.56	1.17	3.65	4.65	1.45	1.05	0.72	0.52	2.42

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