The Andhra Agric. J 70 (1): 050-061, 2023
10.61657/aaj.2023.8

Evaluation of Experimental Hybrids for Yield and Yield Component Traits in Rice *(Oryza sativa* L.*)*

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ABSTRACT

The study was carried out at Regional Agricultural Research Station, Maruteru with 30 experimental hybrids developed by crossing three male sterile lines (APMS 15 A, APMS 17 A and APMS 18 A) with 10 testers (RTCNP 2, RTCNP 23, RTCNP 33, RTCNP 37, RTCNP 38, RTCNP 66, RTCNP 73, RTCNP 90, RTCNP 120 and RTCNP 150) in Line × Tester mating design during *Kharif*, 2022. The resultant 30 hybrids were evaluated in Randomized Block Design with two replications along with the parents and hybrid check, HRI-174 during *Rabi*, 2022-23. Flowering behaviour studies of the CMS lines revealed maximum panicle exertion per cent for AMPS 18A (80.27%) and highest duration of floret opening for APMS 17A (153 min). Analysis of variance for yield and yield components revealed significant differences among the genotypes. In general, the hybrids had recorded higher grain yield per plant, compared to the lines. The hybrids were also observed to be early and relatively tall with more number of ear bearing tillers per plant and greater panicle length compared to the parents. The hybrids, APMS 15A × RTCNP 2, APMS 15A × RTCNP 150, APMS 17A × RTCNP 2 and APMS 17A × RTCNP 38 had recorded significantly higher grain yield per plant, compared to the hybrid check, HRI-174 and were identified as potential hybrids for commercial exploitation.

Keywords: *Rice, Hybrids, Grain Yield and Yield Components*

Rice (*Oryza sativa* L.) is a staple food crop that plays a crucial role in global food security, feeding nearly half of the world's population (Kumar *et al*., 2023). India is one of the top rice producers globally, with predominant area, production, and productivity (www.indiastat.com, 2018-19). Globally rice is being cultivated in 162.06 million hectares with a production of 500 million metric tonnes and average productivity of 5.0 t ha^{-1} (FAO, 2021). India has been the largest producer after China. In India the cultivated area of paddy is 46.3 million hectares with a production and productivity of 129.5 million tonnes and 2798 kg ha^{-1}, respectively during 2021-22 (Ministry of Agriculture & Farmer Welfare, 2022). In Andhra Pradesh, it is grown in an area of 2.6 million ha with a production of 13.1 million tonnes and the productivity of about 5130 kg ha^{-1} (Ministry of Agriculture & Farmers Welfare, 2022).

With the increasing global population, the demand for rice is expected to rise and production needs to increase by almost two million tons per year to meet this demand. To achieve this, adopting hybrid rice technology is a viable alternative (Buelah *et al*., 2021). Hybrid rice has the potential to yield significantly higher than traditional high-yielding varieties (HYVs) by exploiting the genetic expression of heterosis or hybrid vigor (Virmani, 1994). Hybrid rice was first commercialized in the late 1970s in China, and since then, countries like Vietnam, India, Philippines, Bangladesh and the United States have also begun commercial production. Hybrid rice varieties account for about 50 per cent of rice genotypes in China, producing 103.5 million tonnes of paddy annually with an average yield of 6.9 t ha^{-1}. In comparison, inbred high-yielding varieties produce 81 million tonnes with an average yield of 5.4 t ha^{-1} (Huang *et al*., 2011). Thus, on an average, hybrid rice in China yields about 27 per cent (1.5 mt ha^{-1}) more than inbred high-yielding varieties. The potential of hybrid rice technology to enhance yield and contribute to global food security has been demonstrated by its success in China (Yuan, 2003). However, the adoption of hybrid rice outside China remains relatively limited due to various factors (Peng *et al.*, 2008). Efforts to develop and promote hybrid rice technology outside China are therefore essential to address the growing food demands of the world's population (Vennela *et al.,* 2022). In this context, the present investigation was undertaken to evaluate experimental rice hybrids for their grain yield and yield component traits.

MATERIAL AND METHODS

The study was undertaken at Regional Agricultural Research Station (RARS), Maruteru, West Godavari District of Andhra Pradesh. The experimental site is situated at 26Ë%38'N latitude,81º 44'E longitude and 5 m above mean sea level with semi-humid climate with black alluvial clayey soils and falls under Godavari Zone of Andhra Pradesh. The experimental material for the present study comprised of three male sterile lines *viz.,* APMS 15A, APMS 17A and APMS 18A and 10 restorer lines *viz.*, RTCNP2, RTCNP23, RTCNP33, RTCNP37, RTCNP38, RTCNP 66, RTCNP 73, RTCNP 90, RTCNP 120 and RTCNP 150 and their 30 hybrids developed by crossing the male sterile lines with the testers in Line x Tester mating design during *Kharif*, 2022. The salient features of parents and the check are summarized in Table 1. Evaluation of the 30 hybrids along with their parents, *i.e.*, three CMS lines and 10 restorers and the hybrid check, HRI-174 was carried out in a randomized block design with two replications during *Rabi*, 2022-2023 at Regional Agricultural Research Station, Maruteru. The seedlings were transplanted into the main field 21 days after sowing in the nursery. Normal, healthy and vigorous seedlings of each genotype were selected and transplanted in two rows plot of 4.5 m length with a spacing of 20 x 15 cm. All the recommended package of practices were adopted throughout the crop growth period to raise a healthy crop. Observations were recorded for grain yield per plant and yield attributing characters, namely, plant height, ear bearing tillers per plant, panicle length and spikelet fertility by randomly choosing five plants from each entry in each replication and their means were used for the statistical analysis. The plants were selected from the middle rows to minimize the error due to border effect. However, days to 50 per cent flowering was recorded on plot basis. In contrast, observations for test weight and grain density were obtained from a random grain sample drawn from each plot in each genotype and replication using standard procedures. Further, the observations for yield and yield component traits were recorded on maintainer (B) lines of the respective male sterile lines, while panicle exertion and duration of floret opening were recorded on the male sterile lines. The data collected were subjected to standard statistical procedures (Panse and Sukhatme, 1967).

RESULTS AND DISCUSSION

The analysis of variance (ANOVA) was carried out for 44 genotypes (three lines, ten testers, 30 hybrids and one check) for thirteen characters in Randomised Block design (RBD). The results revealed significant differences among the genotypes for all the characters studied, indicating the existence of sufficient variation among the genotypes studied (Table 2) for effective selection. Similar results for yield and yield component traits were reported earlier (Prasad *et al.*, 2019 and Srilakshmi *et al.*, 2019)

Results on mean performance of the lines and testers for yield and yield attributes are presented in Table 3 and for hybrids in Table 4 and Fig. 1.

Days to 50 per cent flowering

The check, HRI-174 had recorded lesser number of mean days to 50 percent flowering (93.50days), compared to lines (99.83 days), testers (98.25 days) and hybrids (95.35 days). Further, days to 50 per cent flowering ranged from 98.50 to 102.00 with a mean of 99.83 days in lines. Among the lines, APMS17A flowered early (98.50), while, APMS18A flowered late (102.00).

In testers, it ranged from 96.00 to 102.00 days. Among the testers, RTCNP 150 flowered earliest (96.00 days) whereas, RTCNP 33 flowered late (102.00 days). Five testers were early in flowering, compared to the mean (98.25 days).

In hybrids, days to 50 per cent flowering ranged from 91.00 days to 102.50days. Among the hybrids, APMS 15A × RTCNP 38 (91.00 days) and APMS 17 A × RTCNP 38 (91.00 days) flowered early whereas, APMS 17A × RTCNP 90 flowered lately (102.50). Ten hybrids were early in flowering, compared to the mean flowering of the hybrids (95.35 days).

In general, the hybrids (95.35) were early to flower in comparison to the testers (98.25) and lines (99.83) in tune with the earlier findings of Khute *et* *al*. (2015), Saikiran *et al*. (2018) and Sari *et al*. (2020).

Plant height (cm)

The hybrid check, HRI-174 was in general taller (123.40 cm), compared to hybrids (117.62 cm), lines (113.81 cm) and testers (107.74 cm). Further, plant height for lines studied in the present investigation was observed to range from 111.05 cm (APMS 15A) to 115.75 cm (APMS 17A) with a general mean height of 113.81 cm. In testers, plant height ranged from 88.50 cm (RTCNP 33) to 119.70 cm (RTCNP 90). Five testers recorded lower plant height, compared to the mean value (107.74 cm).

Plant height for hybrids ranged from 101.00 to 133.80 cm. Among the hybrids, APMS 15A x RTCNP 33 (101.00 cm) recorded minimum plant height, whereas APMS 15A × RTCNP 38 (133.80 cm) recorded maximum plant height. Seventeen hybrids had recorded lower plant height compared to the mean value (117.62 cm).

In general, the hybrids (117.62) were relatively tall, compared to the testers (107.74) and lines (113.81). The results are in agreement with the reports of Prasad *et al*. (2019).

Ear bearing tillers per plant

In general, hybrids recorded higher number of ear bearing tillers per plant (9.77), compared to testers (9.32) lines (8.41) and the check (8.25). Among the lines, highest number of ear bearing tillers per plant was recorded by APMS18A (8.90), while the lowest number was registered by APMS 15A (7.75). Similarly, among the testers, highest number of ear bearing tillers per plant was recorded by RTCNP 33 (10.50) whereas the lowest number was registered by RTCNP 150 (7.90). Six testers had recorded more number of ear bearing tillers per plant than the mean value (9.32).

In hybrids, maximum number of ear bearing tillers per plant was recorded by the hybrids APMS 17A × RTCNP 2 (12.85) and APMS 18A × RTCNP 33 (12.50), whereas the lowest number was registered by the hybrids APMS 18A × RTCNP 150 (6.65) and APMS 15A × RTCNP 120 (7.80). Thirteen hybrids had recorded higher number of ear bearing tillers per plant, compared to the mean value (9.77).

In general, the hybrids (9.77) had maximum ear bearing tillers per plant comparison to the testers (9.32) and lines (8.41) in tune with the earlier findings of Buelah *et al*. (2021) and Vennela *et al*. (2022).

Panicle length (cm)

In general, the hybrid check, HRI-174 recorded greater panicle length (27.45 cm), compared to hybrids (25.88 cm), lines (25.80 cm) and the testers (24.90 cm). Among the lines, panicle length was found to be range from 25.30 cm to 26.15 cm with a mean of 25.80 cm. The longest panicles were produced by APMS 18A (26.15 cm), whereas the shortest panicles were recorded by APMS 17A (25.30 cm). In testers, it ranged from 21.15cm to 28.90 cm. The longest panicles were produced by RTCNP 23 (28.90 cm), whereas the shortest panicles were produced by RTCNP 37 (21.15 cm). Six testers had greater panicle length when compared to mean panicle length of testers (24.90 cm).

In hybrids, it ranged from 23.45 cm to 30.10 cm. The longest panicles were produced by APMS 18A × RTCNP 38 (30.10 cm), whereas the shortest panicles were exhibited by APMS 15A × RTCNP 33 (23.45 cm). Fourteen hybrids had greater panicle length, when compared to mean panicle length of hybrids (25.88 cm).

In general, the hybrids (25.88) relatively longer panicles comparison to the lines (25.08) and testers (24.90) in tune with the earlier findings of Buelah *et al*. (2021) and Vennela *et al*. (2022).

Spikelet fertility (%)

It ranged from 79.35 to 84.65 per cent with a mean of 82.18 per cent in lines. The genotype, APMS 17A, recorded highest spikelet fertility percentage (84.65%), whereas APMS 18A registered lowest spikelet fertility per cent (79.35%). In testers, it ranged from 85.05 to 92.45 per cent. The genotype, RTCNP 37 (92.45%) recorded highest spikelet fertility percentage, whereas RTCNP 2 (85.05%) registered lowest spikelet fertility percentage. Further, four testers had recorded higher spikelet fertility percentage than the mean value (88.94%).

In hybrids, spikelet fertility ranged from 20.50 to 91.50 per cent. Highest spikelet fertility percentage was recorded for the hybrid, APMS 17A × RTCNP 2 (91.50%), whereas lowest value was registered for the hybrid, APMS 18A × RTCNP 23 (20.50%).

Further, 18 hybrids had recorded greater spikelet fertility than the mean value (73.54%).

In general, the hybrids (73.54) relatively lower spikelet fertility comparison to the lines (82.17) and testers (88.94). These findings are similar to the earlier reports of Prasad *et al.* (2019) and Srilakshmi *et al.* (2019).

1000-grain weight (g)

The check, HRI-174 had in general recorded higher 1000-grain weight (24.80 g), compared to lines (14.31 g), testers (17.02 g) and hybrids (16.92 g). Further, the line, APMS 15A had recorded the maximum test weight (17.05 g) whereas, APMS 18A recorded the least test weight (12.90 g) with a mean test weight 14.31 g among the lines. Among testers, RTCNP 66 had recorded the maximum test weight (21.00 g) whereas, RTCNP 38 recorded the least test weight (13.35 g). Six testers registered higher test weight compared to the mean of testers (17.02 g).

Among the hybrids, APMS 15A × RTCNP 150 recorded maximum test weight (19.30 g), whereas APMS 18A × RTCNP 120 (13.45g) recorded the least test weight (1.13 g). Seventeen hybrids had registered higher test weight compared to the mean test weight of the hybrids (16.92 g).

In general, the hybrids (16.92 g) registered higher test weight compared to the mean of lines (14.31 g). These findings are similar to the earlier reports of Buelah *et al.* (2021) and Vennela *et al.* (2022).

Grain density

The lines in general recorded higher grain density (14.88), compared to the testers (9.95), hybrids (11.49) and the check (14.45). Among the lines, grain density ranged from 13.50 to 17.10 with a general mean of 14.88. Maximum grain density was recorded in APMS 17A (17.10), whereas minimum grain density was recorded for APMS15A (13.50).

In testers, it ranged from 7.60 to 12.15. The maximum grain density was recorded in the genotype RTCNP 90 (12.15), whereas minimum grain density was noticed in the genotype, RTCNP 150 (7.60). Five testers had recorded more grain density when compared to general mean of the testers (9.95).

In hybrids, it ranged from 7.55 to 15.85. The maximum grain density was recorded in APMS 17A × RTCNP 38 (15.85), whereas minimum was recorded in APMS15A × RTCNP 33 (7.55). Fourteen hybrids had recorded more grain density when compared to the mean value (11.49).

In general, the hybrids (11.49 g) recorded higher test weight compared to the mean of testers (9.95 g). These findings are similar to the earlier reports of Prasad *et al.* (2019).

Grain yield per plant (g)

The check, HRI-174 had recorded higher grain yield per plant (31.50 g), compared to the hybrids (26.61 g), lines (24.90 g) and the testers (29.16 g). Among the lines, it ranged from 21.70 g to 27.00 g. APMS 18A (27.00 g) recorded the highest grain yield per plant, whereas APMS17A registered the lowest grain yield per plant (21.70 g).

Among the testers, it ranged from 19.00 g to 38.50 g. The genotype, RTCNP 120 (38.50 g) recorded the highest grain yield per plant, whereas RTCNP 33 (19.00 g) registered the lowest grain yield per plant. Further, five testers had recorded higher yield than the mean value (29.16 g).

In general, the hybrids (26.61 g) had recorded higher grain yield per plant, compared to the lines (24.90 g). These findings are similar to the earlier reports of Prasad *et al.* (2019) and Vennela *et al.* (2022). The hybrids were also observed to be early and relatively tall with more number of ear bearing tillers per plant and greater panicle length compared to the parents. Several workers had also reported similar increased panicle length of hybrids, compared to parents (Dhanakodi and Subramanian,1994; Mishra and Pandey,1998; Pandey and Kaushik,1999 and Sathya *et al.*, 1999). Further, grain yield per plant ranged from 17.50 g to 46.50 g in the hybrids. The hybrid, APMS 17A × RTCNP 38 (46.50 g) recorded the highest grain yield per plant, whereas APMS 15A × RTCNP 33 (17.50 g) registered the lowest grain yield per plant. Ten hybrids had recorded higher yield than the mean (26.61 g).

Flowering behaviour of CMS lines

Flowering behaviour of CMS lines is important as it decides the extent of out crossing. The out crossing depends upon floral characters, *viz.*, panicle exertion per cent and duration of floret opening. Mean performance of the floral traits of CMS lines studied in the present investigation is presented in Table 5 and Fig. 2.

Panicle exertion per cent

The range of variation for this character among the CMS lines was from 75.89 (APMS 17A) to 80.27 per cent (APMS 18A) with a mean value of 77.98 per cent. Highest panicle exertion per cent was recorded for AMPS 18A (80.27%) and lowest panicle exertion was recorded for APMS 17A (75.89%). The panicle exertion directly influences natural out crossing, ultimately resulting into good seed setting. These findings are in consonance with the results of El-Shamey *et al*. (2022) and Padmavathi *et al.* (2012).

Duration of floret opening

The variation for this character ranged from 138 (APMS 18A) to 153 min (APMS 17A) with a mean of 146 min. Highest duration of floret opening was recorded for APMS 17A (153 min) and lowest duration of floret opening was recorded for APMS 18A (146 min). These results are in agreement with the reports of El-Shamey *et al*. (2022) and Padmavathi *et al.* (2012).

Swaminathan *et al*. (1971) and Virmani (1996) reported that about 20 to 30 per cent yield advantage is sufficient to offset the extra cost of hybrid seed. In the present investigation, five hybrids (APMS 15A × RTCNP 2, APMS 15A × RTCNP 38, APMS 15A × RTCNP 150, APMS 17A × RTCNP 2 and APMS 17A × RTCNP 38) recorded grain yield more than 30 per cent over the standard check, HRI-174 (31.5 g) and were significantly superior to the hybrid check. Details of these promising hybrids are presented in Table 6. Spikelet fertility of these hybrids was also noticed to be more than 85 per cent. The hybrids also possessed preferred market traits, namely, earliness, semi-tall plant height and medium slender to medium bold grain type, indicating their potential for commercial exploitation.

The crosses, APMS 17A × RTCNP 38, APMS 17A × RTCNP 2, APMS 15 A × RTCNP 150, APMS 15 A × RTCNP 2 and APMS 15 A × RTCNP 38 identified as promising heterotic combinations with potential for commercial exploitation need to be tested over locations and years for their stability in performance.

Acknowledgement

The financial support provided in the form of stipend by Acharya N G Ranga Agricultural University to the first author, for pursuing full time Masters Program in the Department of Genetics and Plant Breeding at Agricultural College, Bapatla, Acharya N G Ranga Agricultural University, Andhra Pradesh is acknwowledged.

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Table 1. Salient features of experimental material

S. No.	Genotype	Source	Salient features
Lines			
1	APMS 15A	RARS, Maruteru	Medium duration, medium slender, straw glume, moderately tolerant to BPH
2	APMS 17A	RARS, Maruteru	Medium duration, medium slender, straw glume, fine
3	APMA 18A	RARS, Maruteru	Medium duration, medium slender, straw glume, tolerant to leaf blast
Testers			
1	RTCNP 2	RARS, Maruteru	Medium duration, long slender, straw glume, moderately tolerant to leaf blast
2	RTCNP 23	RARS, Maruteru	Medium duration, medium slender, straw glume,
3	RTCNP 33	RARS, Maruteru	Medium duration, medium slender, straw glume,
4	RTCNP 37	RARS, Maruteru	Medium duration, medium bold, straw glume,
5	RTCNP 38	RARS, Maruteru	Medium duration, long slender, straw glume
6	RTCNP 66	RARS, Maruteru	Medium duration, medium bold, straw glume, moderately tolerant to leaf blast
7	RTCNP 73	RARS, Maruteru	Medium duration, medium slender, bold grain
8	RTCNP 90	RARS, Maruteru	Medium duration, long slender, straw glume, moderately tolerant to leaf blast
9	RTCNP 120	RARS, Maruteru	Medium duration, medium slender, straw glume
10	RTCNP 150	RARS, Maruteru	Early duration, medium slender, straw glume
Hybrid check			
11	HRI-174	Bayer Bioscience, Hyderabad	Early duration, long bold, straw glume

Table 2. Analysis of variance (mean squares) for yield and yield components in rice

Source of variation	Degrees of freedom	Days to 50 per cent flowering	Plant height (cm)	Ear bearing tillers per plant	Panicle length (cm)	Spikelet fertility (%)	1000-grain weight(g)	Grain density	Grain yield per plant (g)
Replications	1	1.14	0.029	0.25	0.57	10.64	0.102	0.04	0.76
Genotypes	43	18.92**	153.57**	3.66**	5.23**	482.57**	10.14**	8.87**	147.59**
Error	43	6.02	24.46	0.15	1.38	11.7	0.56	0.18	14.35

Table 3. Mean performance of parents for yield and yield component characters in rice

Parents	Days to 50 per cent flowering	Plant height (cm)	Ear bearing tillers per plant	Panicle length (cm)	Spikelet fertility (%)	1000-grain weight (g)	Grain density	Grain yield per plant (g)
Lines								
APMS15A	99	111.05	7.75	25.95	82.55	17.05	13.5	26
APMS17A	98.5	115.75	8.6	25.3	84.65	13	17.1	21.7
APMS 18A	102	114.65	8.9	26.15	79.35	12.9	14.05	27
Minimum	98.5	111.05	7.75	25.3	79.35	12.9	13.5	21.7
Maximum	102	115.75	8.9	26.15	84.65	17.05	17.1	27
Mean	**99.83**	**113.81**	**8.41**	**25.8**	**82.18**	**14.31**	**14.88**	**24.9**
Testers								
RTCNP 2	98	104.1	8.2	25.4	85.05	19.9	9.55	19.5
RTCNP 23	99	110.75	10.25	28.9	91	17.9	10.8	31
RTCNP 33	102	88.5	10.5	22.9	89.3	15.3	9.55	19
RTCNP 37	99	100.65	9.8	21.15	92.45	17.6	10.85	38
RTCNP 38	99	119.3	8	25.15	88.05	13.35	9.5	37
RTCNP 66	96.5	116.4	8.5	25.85	88.55	21	10.15	28.6
RTCNP 73	97.5	97	10.35	21.9	90.5	16.75	9	36.5
RTCNP 90	98.5	119.7	9.85	26.95	88.1	14	12.15	19.5
RTCNP 120	97	116.4	9.85	26.25	88.55	17.15	10.35	38.5
RTCNP 150	96	104.65	7.9	24.6	87.9	17.25	7.6	24
Minimum	96	88.5	7.9	21.15	85.05	13.35	7.6	19
Maximum	102	119.7	10.5	28.9	92.45	21	12.15	38.5
Mean	**98.25**	**107.74**	**9.32**	**24.9**	**88.94**	**17.02**	**9.95**	**29.16**
SEd	2.45	4.95	0.39	1.17	3.42	0.75	0.43	3.79
CD (0.05)	4.95	9.97	0.78	2.37	6.9	1.51	0.86	7.64

Table 4. Mean performance of hybrids for yield and yield component characters in rice

Hybrids	Days to 50 per cent flowering	Plant height (cm)	Ear bearing tillers per	Panicle length (cm)	Spikelet fertility (%)	1000-grain weight (g)	Grain density	Grain yield per plant (g)
APMS15A ×RTCNP2	93	118.5	10.5	26.85	87.4	18.75	11.05	42
APMS15A× RTCNP23	93.5	116.05	10.2	26.6	55	16.75	9.3	19
APMS15A RTCNP33	96	101	9.8	23.45	81.15	14.4	7.55	17.5
APMS15A × RTCNP37	94	118.55	9.5	24.95	80.1	16.35	11.85	19
APMS15A × RTCNP38	91	133.8	10.5	27.15	85.15	19.2	11.15	41.5
APMS15A × RTCNP66	96	124.5	10.4	25.7	70.65	18.25	12.05	20
APMS15A × RTCNP73	98.5	117.25	9.45	25	67.45	14.7	10.25	22.5
APMS15A × RTCNP90	97	124.35	9.3	26.95	60.45	16.95	13.95	24
APMS15A ×RTCNP120	98.5	113.05	7.8	24.65	84.4	18.25	11.15	17.5
APMS15A ×RTCNP150	92.5	115.95	8	25.2	89.25	19.3	12	42.5
APMS17A × RTCNP2	92.5	118.45	12.85	26.15	91.5	17.2	11.9	45
APMS17A × RTCNP23	93	114.7	9.4	26.2	26.05	17.55	9.45	20.5
APMS17A × RTCNP33	91.5	106.3	10.4	24.75	61.6	14.6	11.4	25
APMS17A × RTCNP37	95.5	119.7	9.3	24.25	77.3	16.45	14.05	25.5
APMS17A × RTCNP38	91	131.7	8.5	28.15	93.55	19.2	15.85	46.5
APMS17A × RTCNP66	100	120.75	9.75	26.45	76.35	16.95	10.45	26.5
APMS17A × RTCNP73	97	113.15	8.65	25.35	69.95	18	10.95	20.5
APMS17A × RTCNP90	102.5	119.5	9.6	25.4	62.4	15.85	14.4	19.5
APMS17A ×RTCNP120	98	116.2	8.5	26.3	83.3	16.3	12.65	19.5
APMS17A ×RTCNP150	94.5	111.85	8.2	24.4	77.75	17.85	10.7	27
APMS18A×RTCNP2	97.5	126.3	9.8	27.05	85.85	16.85	8.6	39

Table 4. Contd…

Hybrids	Days to 50 per cent flowering	Plant height (cm)	Ear bearing tillers per	Panicle length (cm)	Spikelet fertility (%)	1000-grain weight (g)	Grain density	Grain yield per plant (g)
APMS18A × RTCNP23	97	121.3	12.4	25.65	20.5	17.65	9.05	22.5
APMS18A × RTCNP33	92.5	109.55	12.5	25.75	88.7	17.05	10.75	38
APMS18A × RTCNP37	93.5	116.4	12.1	24.45	76.4	18.55	12.35	20.5
APMS18A × RTCNP38	98.5	129.3	9.7	30.1	87.75	18.75	10.55	28
APMS18A × RTCNP66	93	106.7	8.9	26.05	71.2	14.6	13.75	21
APMS18A × RTCNP73	94	115.25	10.4	24.6	66.9	16.15	13	21
APMS18A × RTCNP90	100.5	116.2	8.8	26.5	81.5	14.8	11.95	28
APMS18A ×RTCNP120	96	116.75	11.4	27.05	70.45	13.45	13.3	20.5
APMS18A ×RTCNP150	92.5	115.65	6.65	25.35	76.45	16.95	9.35	19
Minimum	91	101	6.65	23.45	20.5	13.45	7.55	17.5
Maximum	102.5	133.8	12.85	30.1	91.5	19.3	15.85	46.5
Mean	**95.35**	**117.62**	**9.775**	**25.88**	**73.54**	**16.92**	**11.49**	**26.61**
HRI-174 (Check)	93.5	123.4	8.25	27.45	92.05	24.8	14.45	31.5
SEd	2.45	4.95	0.39	1.17	3.42	0.75	0.43	3.79
CD (0.05)	4.95	9.97	0.78	2.37	6.9	1.51	0.86	7.64

Table 5. Mean panicle exertion (%) and duration of floret opening (min) of CMS lines

S. No.	CMS lines	Panicle exertion (%)	Duration of floret opening (min)
1	APMS 15A	77.78	146
2	APMS 17A	75.89	153
3	APMS 18A	80.27	138
	Range	75.89 – 80.27	138 - 153
	Mean	**77.98**	**145.66**

Table 6. Field performance of Promising rice hybrids identified

Hybrids	Grain yield per plant (g)	Days to maturity	Plant height (cm)	Spikelet fertility (%)	1000- grain weight (g)	Grain type
APMS17A × RTCNP38	46.5	121.5	131.7	93.55	19.2	Medium slender, Straw glume
APMS17A × RTCNP2	45	120.5	118.45	91.5	17.2	Medium slender. Straw glume
APMS15A × RTCNP150	42.5	122.5	115.95	89.25	19.3	Medium bold, Straw glume
APMS15A × RTCNP2	42	120.5	118.5	87.4	18.75	Medium slender, Straw glume
APMS15A × RTCNP38	41.5	120	133.8	85.15	19.2	Medium bold, Straw glume

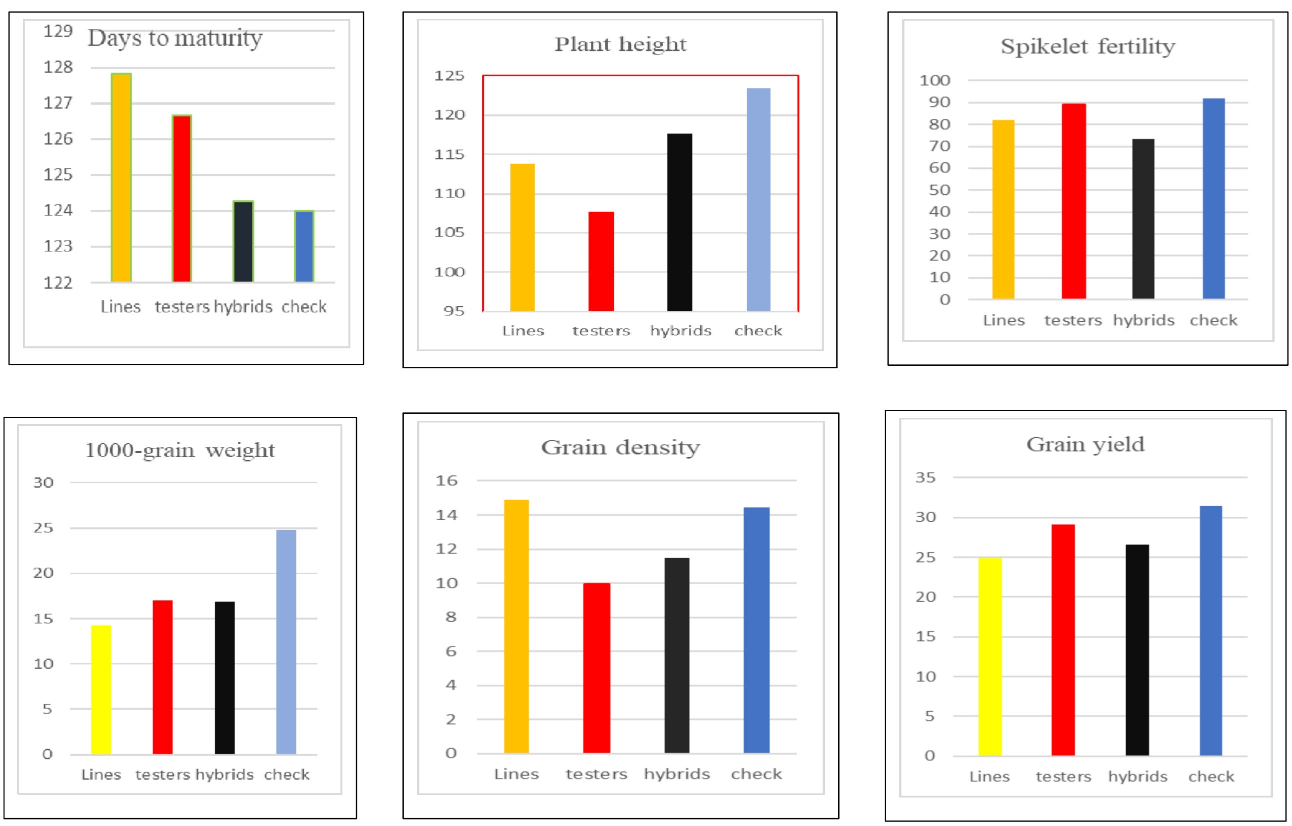

Fig. 1. Mean performance of rice hybrids and their parents for grain yield per plant and important yield attributes

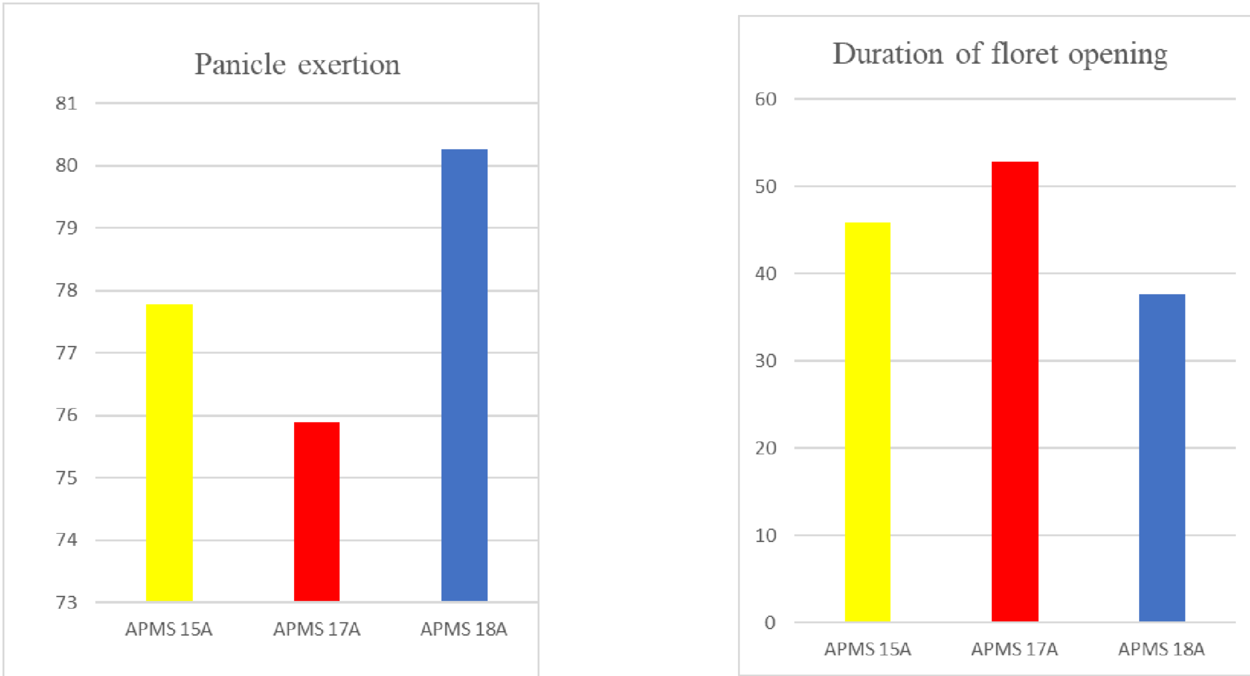

Fig. 2. Mean of panicle exertion (%) and duration of floret opening (min) of CMS lines of rice

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Received on 02.11.2022 and Accepted on 29.03.2023