



Evaluation of Different Rice Hybrids on Morphological Traits and Quality Attributes in Adaptability Yield Trial

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Authors' contributions

This work was carried out in collaboration between all authors. Author MR designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author MA managed of the study. Authors TL and NS analyzed of the study. Authors MI and AR managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/ARJA/2017/32151

Editor(s):

- (1) Peter A. Roussos, Assistant Professor, Lab. Pomology, Agricultural University of Athens, Greece.
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(3) Valentin Ivanov Kosev, Institute of Forage Crops, Bulgaria.
Complete Peer review History: <http://www.sciencedomain.org/review-history/22153>

Original Research Article

Received 10th February 2017
Accepted 28th November 2017
Published 5th December 2017

ABSTRACT

Twelve rice hybrids of different companies were evaluated for yield, yield components and quality attributes in at Rice Research Institute Kala Shah Kaku along with KSK-133 and KSK-434 as check varieties in RCBD. All the hybrids were found significantly different from each other in all aspects of morphological and quality attributes. The traits under study were maturity days, plant height (cm), no. of productive tillers, panicle length (cm), no. of grains / panicle, 1000 grain weight (gram) and paddy yield (t/ha). Quality attributes include cooked grain length, average grain length, elongation ratio, broken rice %, total milled rice % and head rice recovery%. PRIDE-1(10.2 t/ha) and DAGHA (9.7 t/ha) were found to be significantly higher in yield. On the other side paddy yield of hybrid HEV-188(5.52 t/ha) remained at the bottom. The highest value of no. of productive tillers were recorded in PRIDE-1, panical length was higher in LP-3. The no. of grains /panicle was higher in AKP-907 and 1000 grain weight was estimated maximum in Y-26, which were significantly higher relative to the checks. In case of milling recovery, WINNER-05 was found to be best hybrid with head rice recovery (68.5%) and in cooking quality the best value estimated of elongation ratio was of DAGHA (1.7). PRIDE-1 and DAGHA can be used for seed production. The seed of the following hybrids can be multiplied and produced in Sindh for cultivation.

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Keywords: Hybrid rice; yield components; quality traits.

1. INTRODUCTION

Rice (*Oryza sativa* L.) is staple food of Asia, where 90% of rice is produced. Due to decrease in land holdings and water shortage, there is decrease in yield of rice, which is insufficient to meet the food requirement of increased population. So there is a critical need to develop such rice technologies, which may boost up the yield of rice. For the sake of increase in production of rice, hybrid rice technology is the suitable option to get maximum yield [1].

After wheat, rice is an essential food commodity for masses in Pakistan. It is also valuable cause of foreign exchange earnings. In 2011-12 the production of the rice was noted as 6,160 thousand tonnes associated to 4,823 thousand tonnes for the year 2010-11. This improved routine may be accredited to 8.7% rise in area, promising weather circumstances, and healthier seed availability. Pakistan frequently exports 2/3rd of its production [2].

Rice is low in Pakistan as compared to other rice growing countries because there is steady decrease in rice cultivated area so here is need to adopt the hybrid rice technology introduced by China [3]. Hybrid rice technology has 15-20% increase in yield as compared to production of rice by conventional methods [4]. Some specific hybrids have 23% and 32.6% yield advance of hybrids (standard heterosis) over the inbreds [5,6]. In rice, the grain studies revealed that there is great variation in morphological traits of rice at different localities [7]. Yield and yield components were also evaluated on different rice hybrids by [8]. One of the most important thing about the hybrids is few of the hybrids have better grain quality with respect to check so there is a need to make efforts to improve quality attributes [9]. The objective of this study was to check the different hybrids for their yield, yield components and their quality attributes.

2. MATERIALS AND METHODS

Twelve rice hybrid varieties including RH-257, Y-26, FBS-AK907, WINNER05, PEARL-1, AKP-101, LP-3, PRIDE-1, DAGHA, HEV-188, Hi-RICE 11 and RH-777 of different companies (Guard Rice, Four Brother pvt It, Origa seed and Emkay seed) were considered for their performance on the basis of yield and quality attributes (milling and cooking quality) along with KSK434 and

KSK-133 as check varieties. These are used as checks because they are the most cultivated varieties in the area with good yield potential. Evaluation was practiced along with KSK-434 and KSK-133 used as checks at Rice Research Institute Kala Shah Kaku in 2014-15. The experiment was planted in Randomized complete block design (RCBD) with three replications. Standard cultural practices and recommended production technology was applied [10]. The data was recorded at maturity for days to maturity, plant height (cm), number of productive tillers, panicle length (cm), number of grains/panicle, 1000 grains weight (gram) and yield (t/ha). Quality analysis like milling recovery and cooking quality were also performed. For the analysis of variance the data is subjected to the statistical techniques for all the genotypes for recorded parameters. At 0.05% level of probability the means of all significant traits were compared through LSD [11].

3. RESULTS AND DISCUSSION

Yield is a very important trait for the hybrid crop (15-25%). In case of rice, hybrid rice has become an economic tool for the increasing rice production and having a lot of advantages over the inbred varieties with respect to yield [12]. It was found that there was a significant difference (Table 1) for yields (t/ha) among all the hybrids.

Under studying PRIDE-1 and DAGHA were found at maximum level for yield (t/ha) with significant values of 10.28 t/ha and 9.7 t/ha respectively (Table 2).

Maturity days of hybrids have significant difference at 5% level of probability among all the studied hybrids. Highest value for maturity days were observed in PRIDE-1 (98 days) and followed by DAGHA (97days) which were significantly higher from the check KSK-434. While the least maturity days (84 days) was observed in RH-777. [13] recommended that plant height is a very important trait in the selection of high yielding rice plants. In this study, the highest plant height value was observed in PRIDE-1 (142.7 cm) and the lowest value in RH-777 (114.7 cm). Different genotypes of rice showed that plant with maximum plant height have lengthy panicle as compared to those plants which are shorter in length which agrees with an earlier report by [14].

Table 1. Mean square and level of significance of morphological traits of rice hybrids

Sr. No.	Source of variation	D.F.	Maturity days	Plant height (cm)	No. of productive tillers	Panicle length (cm)	No. of grains/panicle	1000 grains weight (gram)	Yield(t/ha)
1	Replication	2	5.167	14.952	15.929	5.167	12.071	14.952	5.167
2	Hybrids	13	69.313 ^s	283.394 ^s	21.980 ^s	9.663 ^s	6648.7 ^s	283.394 ^s	9.663 ^{**}
3	Error	26	1.192	0.388	0.672	0.833	0.200	0.187	0.066
4	Total	41	22.98	90.83	8.17	3.84	22.98	90.83	3.844

N.S.= non-significant, S= significant, **=highly significant

Table 2. Mean performance of some economic traits of rice hybrids

Sr. No.	Designation	Maturity days	Plant height (cm)	No. of productive tillers	Panical length(cm)	No. of grains/panical	1000 grains weight (gram)	Yield(t/ha)
1	RH-257	89 ^e	102.0 ^l	12.00 ^{fg}	30.00 ^{abc}	145.0 ⁱ	25.70 ^f	5.760 ^g
2	Y-26	95 ^{bc}	128.0 ^c	12.00 ^{fg}	29.00 ^{bcd}	179.0 ^e	31.81 ^a	7.520 ^{ef}
3	FBS-AK907	87 ^f	125.0 ^d	12.67 ^{ef}	30.00 ^{abc}	280.0 ^a	28.52 ^e	7.777 ^e
4	WINNER05	93 ^c	123.0 ^e	12.33 ^{fg}	27.00 ^{ef}	215.0 ^c	29.07 ^e	7.790 ^e
5	PEARL-1	89 ^e	118.7 ^g	12.67 ^{ef}	31.33 ^a	165.0 ^f	30.14 ^{cd}	7.487 ^{ef}
6	AKP-101	88 ^{ef}	122.7 ^e	11.00 ^g	30.33 ^{ab}	155.0 ^g	31.69 ^a	8.257 ^d
7	LP-3	88 ^{ef}	120.7 ^f	16.67 ^b	31.33 ^a	208.0 ^d	28.93 ^e	7.387 ^{ef}
8	PRIDE-1	98 ^a	142.7 ^a	18.67 ^a	28.67 ^{cd}	230.0 ^b	31.09 ^{ab}	10.28 ^a
9	DAGHA	97 ^a	130.3 ^b	14.00 ^{de}	26.33 ^f	141.3 ^k	31.10 ^{ab}	9.703 ^b
10	HEV-188	91 ^d	116.0 ^{hi}	14.67 ^{cd}	28.00 ^{de}	118.0 ^l	30.79 ^{bc}	5.523 ^g
11	Hi-RICE11	97 ^a	115.0 ^{ij}	12.00 ^{fg}	30.00 ^{abc}	152.0 ^h	30.06 ^d	5.907 ^g
12	777	84 ^g	114.7 ^j	14.67 ^{cd}	30.33 ^{ab}	140.7 ^k	30.42 ^{bcd}	8.370 ^d
13	KSK434	98 ^a	110.0 ^k	20.00 ^a	31.00 ^a	143.0 ^j	31.57 ^a	8.867 ^c
14	KSK133	97 ^{ab}	117.0 ^h	15.67 ^{bc}	26.00 ^f	113.0 ^m	29.87 ^d	7.260 ^f

Level of significance/LSD=0.05. Means in the same column followed by the same letter do not differ significantly based on LSD test at $\alpha=0.05$

Number of productive tillers/plant is a very important yield attribute. The data for the number of productive tillers/plant showed that the hybrid PRIDE-1 has highest no of productive tillers/plant (18 tillers/plant) which is higher (or lower) than the values for the check KSK-434 while minimum number of productive tillers/plant was recorded in WINNER-05 (12 tillers/plant). Number of productive tillers/plant strongly correlated positively with paddy yield [15]. Panicle length is also very important trait regarding paddy yield. In case of panicle length, PEAR-1 and LP-3 were having maximum panicle length of 31.33 cm while check KSK-434 was observed with 31.00 cm. Minimum value for panicle length among the hybrid was found in DAGHA-1 and Check KSK-133 that is 26 cm. The variation in panicle length under different conditions were studied by [16].

In rice, number of grains/panicle is a major yield contributing component having significant effects on paddy yield. This study showed that there is significant difference in the number of

grain/panicle. Hybrid AK-907 and PRIDE-1 were of highest value due to their higher number of grains/panicle. Among the hybrids HEV-188 was at minimum level due to less number of grain/panicle along with check KSK-133. For the better varietal development, it was recommended that number of grains/panicle is a direct economic trait [17]. A thousand grain weight (gram) is also an important character in case of cereals. For the 1000 grain weight significant difference were found among all the hybrids. Y-26, AKP-101 and KSK-434 have ranked at the top in case of 1000 grains weight 31.81 g, 31.69 g and 31.57 g respectively. In these rice genotypes significant differences was observed for thousand grain weight by [18].

With the improved living standard of people there is needed to improve the grain qualities of rice. In rice hybrids relatively poorer grain quality is obtained which results in low head rice recovery and cooking. In this study, it was found that there were significant differences (Table 3) among the

Table 3. Mean squares and level of significance of quality traits of rice hybrids

Sr. No.	Source of variation	D.F.	CGL	AGL	E/R	BR	TMR	HR
1	Replication	2	0.060	0.032	0.010	2.667	0.470	4.006
2	Genotypes	13	0.459 ^s	0.086 ^s	0.010 ^s	1.099 ^s	5.035 ^s	213.726 ^s
3	Error	26	0.011	0.010	0.001	0.308	0.598	0.352
4	Total	41	0.15	0.03	0.003	0.67	1.99	68.18

N.S.= non-significant, S= significant, **=highly significant

Table 4. Means comparison of some quality traits

Sr. No.	Designation	CGL	AGL	E/R	BR	TMR	HR
1	RH-257	12.20 ^{cd}	7.327 ^{bc}	1.663 ^{bcd}	81.33 ^a	70.50 ^{sdef}	38.50 ^j
2	Y-26	12.20 ^{cd}	7.307 ^{bc}	1.673 ^{bcd}	81.33 ^a	71.50 ^{bcd}	64.83 ^c
3	FBS-AK907	11.60 ^f	7.400 ^b	1.567 ^g	80.67 ^{ab}	69.50 ^{fg}	51.00 ^h
4	WINNER05	11.60 ^f	7.123 ^d	1.630 ^{def}	80.67 ^{ab}	72.17 ^{abc}	68.50 ^a
5	PEARL-1	11.20 ^g	7.400 ^b	1.513 ^h	80.67 ^{ab}	70.50 ^{def}	50.83 ^h
6	AKP-101	12.30 ^{bcd}	7.300 ^{bc}	1.683 ^{abc}	81.33 ^a	70.50 ^{def}	52.83 ^g
7	LP-3	11.80 ^e	7.300 ^{bc}	1.617 ^{efg}	79.67 ^c	70.00 ^{efg}	57.50 ^e
8	PRIDE-1	12.20 ^{cd}	7.127 ^d	1.713 ^{ab}	81.33 ^a	73.17 ^a	66.67 ^b
9	DAGHA	12.43 ^b	7.200 ^{cd}	1.727 ^a	80.33 ^{bc}	71.00 ^{cde}	59.00 ^d
10	HEV-188	12.13 ^d	7.317 ^{bc}	1.657 ^{cde}	81.33 ^a	72.00 ^{abc}	48.67 ⁱ
11	HI-RICE11	12.33 ^{bc}	7.347 ^{bc}	1.680 ^{abcd}	80.33 ^{bc}	69.00 ^g	55.67 ^f
12	777	12.13 ^d	7.233 ^{bcd}	1.677 ^{abcd}	79.67 ^c	70.00 ^{efg}	48.00 ⁱ
13	KSK434	12.17 ^{cd}	7.700 ^a	1.583 ^{fg}	81.33 ^a	72.50 ^{ab}	56.17 ^f

Means in the same column followed by the same letter do not differ significantly based on LSD test at $\alpha=0.05$

milling recovery among the hybrids with WINNER-5 having the highest value of head rice recovery 68.5% while RH-257 (38.5%) had the lowest head rice recovery [19], reported that milling recovery can also be measured to attain better results for improving yield and quality. Similarly, in the cooking of the hybrids estimated that the hybrid with maximum elongation ratio was best hybrid as compared to the hybrid with less elongation ratio. In DAGHA the E/R value was 1.72 mm and PEARL-1 was with 1.5 mm elongation ratio of cooked rice (Table 4).

4. CONCLUSION

Hybrid rice development is addressed due to 15-25% rise in yield as compared to conventional varieties. To meet the feeding requirement of the increasing population of the world there is need to produce new hybrids. DHAGHA and PRIDE-1 are the hybrids with good yield. These hybrids can be developed and utilized in different countries of the world.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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