International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133; Print ISSN: 2664-7125; Impact Factor: RJIF 5.28
Received: 06-11-2020; Accepted: 20-11-2020; Published: 06-12-2020
Volume 2; Issue 4; 2020; Page No. 687-690

Yield and economics performance of rice (*Oryza sativa* L.) hybrids under middle indo-gangetic plains

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Abstract
A field experiment was conducted during kharif season of 2019 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.) to evaluate rice (*Oryza sativa* L.) hybrids under agro-climatic conditions of U.P. The experiment was carried out to find the performance of 10 hybrids, which laid out in Randomized Block Design (RBD) & replicated thrice. The experiment finding revealed that at 100DAT the significantly higher plant height was recorded in the treatment KHR-23(123.91 cm) and KHR-27 performed better than other treatment viz. tillers/m^2 (356.67), dry weight (49.91g/hill). And the minimum unfilled grains/panicle was recorded significant in KHR-24(29.33) and the significantly highest test weight was recorded in KHR-23(27.59 g). The yield parameters viz. Panicle length (31.45 cm), Filled grains/panicle (285), grain yield/hill (28.14 g), grain yield (8.16 t/ha), straw yield (11.37 t/ha) was recorded significantly higher in KHR-27. The economics of gross returns (₹159574.0/ha), net returns (₹105527.3/ha), B: C ratio (1.95) was recorded higher in KHR-27.

Keywords: hybrid rice, varietal response, yield, *Oryza sativa* L.

Introduction
Rice (*Oryza sativa* L.) is one of the most important staple cereal crops in the world and it is one of the main sources of carbohydrate for nearly one half of the world population. However, more than 90% of the rice is produced and consumed in Asia, where it is a staple for a majority of the population, including the region's 560s million hungry people. 'Rice is life' was the theme of International year 2004 denoting its over whelming importance as an item of food and commerce (Pandey *et al*., 2010) [5]. Rice is inseparable from our day-to-day life since time immemorial as evident from its use in almost all rituals of our culture. The crop is grown in a diverse geographical and climatic conditions ranging from a below sea level in kuttanad (Kerala) to high altitude in Kashmir valley. Rice is cultivated in a hydrology rang of moisture stress upland condition to water-logged ecology. Hybrid rice accounts for more than half of the area under the crop and has contributed significantly to yield and output growth even after, relocation of land to other agriculture and non-agriculture uses. With the increasing popularity of hybrid among the Indian farmers it is necessary to develop appropriate cultivation practices if the full genetic potential is to be exploited. Growing of hybrid rice is a complex process and especially agronomic management of hybrid rice differs considerable from that of conventional varieties. The present population level of rice needs to be increased in order to meet the growing population pressure on land to reach self-sufficiency in food grains production in the country. Since, there is little scope for expending the rice area, it is necessary to increase the rice productivity from unit land area. Therefore, hybrid rice is practically feasible readily adoptable genetic option to increase rice productivity. The rice hybrids perform well under managed conditions and have higher yield potential. Hybrid rice cultivation is recommended in situation. The present investigation was carried out with objective to find out superior yield and economics of hybrid varieties suitable for U. P. conditions.

Materials and Methods
The experiment was carried out during kharif season of 2019 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.) which is located at 250 24' 42" N latitude, 810 50' 56" E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Prayagraj Rewa Road about 5 km away from Prayagraj city. The region receives an average annual rainfall is 981 mm. The total rainfall of 195.2 mm was received during crop period in kharif 2019. The maximum temperature ranged in crop seasons was 29 ºC to 37.8 ºC and minimum temperatures during the same seasons was 21.3 ºC to 28.7 ºC. The soil of the experiment at site was sandy loam with a pH (7.2), EC 0.38 (ds/m^2), carbon (0.48%), available N (108.0 kg/ha) P_2O_5 (22.5 kg/ha) and K_2O (280.0 kg/ha). The experiment was laid down in randomized block design (RBD) with 10 treatments and 3 replications comprising of ten rice hybrids viz. KHR-22, KHR-23, KHR-24, KHR-25, KHR-26, KHR-27, KHR-28, KHR-29, KHR-30, KHR-31 and to evaluate the hybird rice under agro-climatic condition in Prayagraj, variety provided by UPCAR, Lucknow. Twenty two days old seedlings were transplanted to main field conventionally at a spacing of 20 x 10 cm. The crop recommended dose was fertilizer120-60-60 kg N-P-K/ha basal dose of fertilizer was applied just before last puddling on 12 July, 2019, Half dose of nitrogen and full dose of phosphorus and potassium followed by two top dressings of 1/4th

dose of nitrogen on 05/08/2019 (23 DAT) & 02/09/2019 (50 DAT), respectively. Irrigation was scheduled at 6-8 days interval; however other normal cultural practices were followed timely as; weeding at 30 DAT & 45 DAT. In the experiment biometric observation were recorded at 20 days interval up to 100 DAT. Plant height of these plants were measured from the ground level up to the collar joint of rice plant and Number of tillers/m^2 were counted tillers of plants from 1.0m^2 area of each plot. Three plants were randomly uprooted without damaging the root from each plot the samples were air dried and then kept in oven for 72 hours at 70 ^{0}C, their dry weight was determined and the average dry weight/hill was calculated. Panicle length (cm) was observed at the time of harvest randomly from five tagged hills and their averages were recorded. The ten panicles were counted separately which were obtained randomly from five tagged hills and the average of filled grains and unfilled grains was recorded. One thousand grains were randomly counted from panicles obtained from each plot and weighed and recorded as test weight (g) at 14% moisture. Five plant hills were selected randomly from each plot and tagged and the average grain yield (g) of these plant hills was recorded. Moreover, grains from harvest area (1.0 m^2) were dried in sun, cleaned and weighed separately from each plot for calculating the grain yield in tones/ha. Straw from harvest area (1.0 m^2) was dried in sun, bundled, tagged and weighed separately from each plot for calculating the straw yield in tones/ha. The data was analyzed by the method of analysis of variance as described by Gomez and Gomez (1984). The level of significance used in "F" test was given at 5%.

Results and Discussion

Plant height (cm)

Plant height during the period of growth has shown significant interaction due to various treatments is presented in Table 1. At 100 DAT the highest plant height was observed in KHR-23 (123.91 cm) which was significantly superior over rest of the treatments except KHR-26 (117.77 cm) is statistically at par. In the present study the plant height was significantly higher in KHR-23 (123.91 cm). The reason for maximum plant height may be due to genetic makeup of the variety. Similar results have also been reported by Haque *et al*. (2015) [2].

Tillers/m^2 (No.)

The results showed that tillers/m^2 was much influenced under various treatments at 100 DAT the highest tillers/$m^2$was observed in KHR-27 (356.57 tillers/m^2) and the lowest obtained in KHR-30 (284.77 tillers/m^2). There is no significant difference among treatments. In the present study the tillers/m^2 was higher in KHR-23. The propable reason for high yielding varieties have high tillering capacity. Similar findings are also reported by Yadav *et al*. (2004).

Plant dry weight (g/hill)

The results presented in Table 1 about the analysis of variance indicated that the dry weight was significantly ($P<0.05$) affected by different hybrids. At 100 DAT the highest dry weight was observed in KHR-27 (49.91 g) which was significantly superior over rest of the treatments except KHR-23 (49.33 g) and KHR-24 (43.73 g) which are statistically at par. In the present study the dry weight was significantly higher in KHR-27 (49.91 g). The propable reason for maximum dry matter accumulation depends upon the photosynthesis and respiration rate, which finally increases the plant growth with respect to increased plant height, leaf area and tillers/hill etc. Thus, the treatment which attained maximum growth, also accumulated higher dry matter similar result have also been reported by Senthil Kumar, N. (2016) [3].

Panicle length (cm)

During the period of investigation the data showed (table 1). The maximum panicle length/hill (31.45 cm) was recorded under KHR-27 which was significantly superior over rest of the treatments. The significant differences in panicle length among the hybrid rice varieties could be attributed to their genetic make-up. The results confirms the findings of Rahman *et al*. (2013) [6].

Filled grains/panicle (No.)

The results showed that filled grains/panicle was much influenced under various treatments at harvest. The highest significant number of filled grains /panicle (285.00) was recorded under KHR-27 and KHR-27 was found to be significantly superior over all other treatments. The favourable reason might be that hybrid rice produces long roots and broad leaves that enable them to take up more nutrients and produce more grains. KHR-27 is suited to existing climatic condition of the place especially during the grain-filling stage of the panicle development. Similar results have also been reported by Bhuiyan *et al*. (2014) [1].

Unfilled grains/panicle (No.)

The results showed that the lowest unfilled grains (no.) panicle (29.33) was recorded under the treatment KHR-24. Treatment KHR-24 (29.33) was found significant over rest of the treatments expect KHR-22 (30.17), KHR-23 (33.50), KHR-26 (30.67), KHR-30 (35.50) and KHR-31 (31.50) was stastically at par with KHR-24. Treatment KHR-25 (50.83) was found highest unfilled grains (No.) panicle, is unsuited to existing climatic condition of the place especially during the grain-filling stage of the panicle development. Similar results have also been reported by Bhuiyan *et al*., (2014) [1].

Test weight (g) /hill

The data showed the highest test weight was observed in KHR-23 (27.59 g) which was significantly superior over rest of the treatments except KHR-25 (27.58 g) and KHR-27 (27.30 g) which are statistically at par. The results show that the adoption of 20 x 10 cm^2 spacing for rice transplanting resulted in heavier filled and healthy grain higher test weight in hybrid (KHR-23). Similar results have been also reported by Haque *et al*. (2015) [2].

Grain yield/hill (g)

The data showed the highest grain yield/hill was observed in KHR-27 (28.14 g) which was significantly superior over rest of the treatments except KHR-23 (23.43 g), KHR-24 (27.25 g), KHR-29 (23.45 g) and KHR-31 (26.85 g), which are statistically at par. The higher grain yield/hill under variety (KHR-27) might be due to the optimum utilization of nutrient. The hybrids of short duration high yielding have the potential to give the maximum grain yield then rest of the varieties. The reason of the high yield of variety (KHR-27) is due to the better growth attribute resulting to produce higher grain yield. Similar findings were reported by Ranjitha *et al*. (2013) [7].

Grain yield (t/ha)

During the period of investigation the data showed (table 3) the highest grain yield/ha was observed in KHR-27 (8.16 t/ha) which was significantly superior over rest of the treatments except KHR-24 (8.03 t/ha) which are statistically at par. The increased yield attributes might be due to increased growth and development parameters which ultimately resulted in increased grain. These results in the conformity with the work done by Vishwakarma (2015).

Stover yield (t/ha)

The results presented in Table 2. And the highest straw yield/ha was observed in KHR-27 (11.37 t/ha) which was significantly superior over rest of the treatments except KHR-22 (11.13 t/ha), KHR-23 (11.23 t/ha), KHR-24 (11.26 t/ha) and KHR-31 (11.03 t/ha) which are statistically at par. According to the findings by (Padmavathi, 1997) [4] shows that the capability of hybrid rice to utilize more nitrogen through the expression of better growth brought by the beneficial effect on nutrient uptake and physiological growth increase the straw yield.

Cost of cultivation (₹ha-1)

The results pertaining to days to cost of cultivation as influenced by different hybrids are presented in Table 3. Cost of cultivation (₹ 54046.69/ha) was recorded in all treatments KHR-22 to KHR-31. The cost of cultivation was higher due to cost of transplanting. The results confirms the findings of Haque *et al*. (2015) [2].

Gross return (₹ ha-1)

The gross return (₹ /ha) of hybrid rice has been presented in table 3. Maximum gross return (₹ 159574.0/ha) was obtained from treatment KHR-27, which is superior over rest of the treatments due to highest grain yield and harvest index.

Net return (₹ ha-1)

The net return (₹ /ha) of hybrid rice has been presented in table 3. The treatment KHR-27 was recorded the highest net return (₹ 105527.3/ha) which is superior over rest of the treatments.

Benefit cost ratio (B: C)

Maximum benefit cost ratio of 1.95 was recorded in the treatment KHR-27 because of higher net return as also obtained by Fayez *et al*., (2015).

Table 1: Performance of Rice hybrids on growth and yield parameters.

Rice Hybrids	Plant height (cm)	Tillers/m^2 (No.)	Dry weight (g/hill)	Panicle length (cm)	filled grains/ panicle (No.)	Unfilled grains/ panicle (No.)
KHR-22	104.15	352.00	42.91	27.1	219.5	30.17
KHR-23	123.91	305.33	49.33	27.47	208.17	33.5
KHR-24	101.14	316.33	43.73	29.5	251	29.33
KHR-25	112.93	287.67	33.78	24.77	176.33	50.83
KHR-26	117.77	306.67	41.91	27.05	236.17	30.67
KHR-27	113.60	356.67	49.91	31.45	285	39.83
KHR-28	92.37	329.67	34.10	25.47	183	48.33
KHR-29	111.58	331.67	39.67	28.68	191.33	40.17
KHR-30	113.84	284.67	36.83	26.92	185.17	35.5
KHR-31	107.63	338.33	42.87	28.15	244.5	31.5
SEm(±)	3.36	28.96	2.27	0.34	3.31	2.23
CD (P=0.05)	9.98	-	6.76	1.01	9.85	6.64

Table 2: Performance of Rice hybrids on yield attributes.

Rice Hybrids	Test weight (g)	Yield/hill (g)	Grain yield (t/ha)	Straw yield (t/ha)
KHR-22	26.48	23.11	7.44	11.13
KHR-23	27.59	23.43	7.78	11.23
KHR-24	25.65	27.25	8.03	11.26
KHR-25	27.58	18.48	6.15	10.9
KHR-26	19.99	23.22	6.81	9.83
KHR-27	27.3	28.14	8.16	11.37
KHR-28	20.29	20.38	6.30	10.76
KHR-29	22.61	23.45	6.95	10.03
KHR-30	20.08	21.14	6.48	9.93
KHR-31	24.06	26.85	7.88	11.03
SEm (±)	0.2	1.59	0.09	0.12
CD (P=0.05)	0.61	4.72	0.27	0.36

Table 3: Performance of Rice hybrids on Economics.

Rice Hybrids	Cost of cultivation (₹ /ha)	Gross returns (₹ /ha)	Net returns (₹ /ha)	B:C Ratio
KHR-22	54046.69	146166.0	92119.3	1.70
KHR-23	54046.69	152437.0	98390.3	1.82
KHR-24	54046.69	156804.5	102757.8	1.90
KHR-25	54046.69	122522.5	68475.8	1.27
KHR-26	54046.69	133431.5	79384.8	1.47
KHR-27	54046.69	159574.0	105527.3	1.95
KHR-28	54046.69	125105.0	71058.3	1.31
KHR-29	54046.69	136172.5	82125.8	1.52
KHR-30	54046.69	127542.0	73495.3	1.36
KHR-31	54046.69	154052.0	100005.3	1.85

Conclusion

It may be concluded that hybrid KHR-27 was found to be the best for obtaining higher grain yield (8.16 t/ha) as well as maximum economic net returns (₹ 105527.3/ha) as compared to all other hybrids. Since the finding is based on the research done in one season further trials are needed to confirm the results.

References

1. Bhuiyan HS, Zahan A, Khatun H, Iqbal M, Alam F, Manir R, *et al*. Yield performance of newly developed test crossed hybrid rice variety, International Journal of Agronomy and Agricultural Research. 2014; 5(4):48-54.
2. Haque MD, Pervin E, Biswash MD. Identification of Potential Hybrid Rice Variety in Bangladesh by Evaluating the Yield Potential. World Journal of Agricultural Sciences. 2015; 11(1):13-18.
3. Nath S, Kumar S, Kannaujiya SK. Performance of Various Hybrids and Fertility Levels on Yield Attributes, Yield and Economics of Hybrid Rice. Indian Journal of Krishi Vigyan. 2016; 4(2):76-79.
4. Padmavathi P. Studies on relative performance of conventional hydrid rice varieties under various levels of nitrogen, plant population and planting patterns. Phd thesis, Indian agricultural research institute, New Delhi, 1997.
5. Pandey V, Singh PK, Verma OP, Pandey P. Inter-relationship and path coefficient estimation in rice under salt stress environment. International Journal of Agricultural Research. 2010; 7(4):169-184.
6. Rahman MM, Islam MT, Faruq AN, Akhtar N, Ora N, Uddin MM, *et al*. Evaluation of Some Cultivated Hybrid Boro Rice Varieties Against BLB, ShB and ALS Diseases Under Natural Epiphytic Conditions Middle-East Journal of Scientific Research. 2013; 15(1):146-151.
7. Ranjitha, Sri P, Kumar M, Jayasree G. Evaluation of rice (*Oryza sativa* L.) varieties and hybrids in relation to different nutrient management practices for yield, nutrient uptake and economics in SRI Annals of Biological Research. 2013; 4(10):25-28.
8. Vishwakarma A. Effect of date of transplanting and age of seedling on growth, yield and quality of rice (*Oryza sativa* L.) hybrids under System of Rice Intensification. Indian Journal of Agricultural Sciences. 2016; 86(5):679-85.