The Pharma Innovation Journal 2022; 11(2): 2030-2032

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 2030-2032

www.thepharmajournal.com
Received: 01-11-2021
Accepted: 10-12-2021

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Economics of rice hybrids (*Oryza sativa*) under agro-climatic conditions of Allahabad (U.P.)

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Abstract
The present study was elucidated to the "Field Evaluation of Rice Hybrids under Agro Climatic Conditions of Allahabad (UP) in *kharif* 2017". The research was conducted during *Kharif* season of 2017 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Allahabad (U.P.). The experiment was conducted to find out the best performance of 15 Rice hybrids in RBD design with three replications. In an experiment it was revealed that variety KR-25 performed better than other varieties i.e. plant height (146.56 cm), tillers per plant (17), panicle length (28.86 cm), yield per plant (56.48 g), grain yield (8.87 t ha^{-1}) was found to be significantly higher than other varieties respectively.

Keywords: Hybrid rice, growth, yield

Introduction
Rice is the most crucial cereal food crop of India, which occupies about 24% of gross cropped area of the country. It contributes 42% of total food grain production and 45% of total cereal production of the country. India (2010) yield of rice was 120.62mtn 44mha followed by China (197.21mt). During the last five decades the rice production trend has kept in pace with population growth trend. Global demand for rice is rising with the population growth, increasing affluence and changing dietary habits. The UN/FAO forecasts that global food production will need to increase by over 40% by 2030 and 70% by 2050 (FAO, 2009). Exploitation of heterosis is one of the alternatives for rising the production and productivity of rice. Heterotic hybrids hold great potential for improving economic yield in order to meet the global food needs (Hossain, 2014). Among the available genetic options to increase the productivity, adoption of hybrid rice breeding technology is one of the practically feasible and sustainable approaches. Moreover, hybrid rice normally has a yield advantage of 20 - 30% over non hybrid rice cultivars (Lokanadhan, 2010) [6]. A male sterile line is used as a female parent and grown side by side with a pollen parent in an isolated plot to produce a bulk quantity of hybrid seed ensuing from cross pollination with the adjoining fertile pollen parent (Li *et al*., 2010) [4]. Chinese rice scientists started breeding hybrid rice only after discovery of a "wild abortive" (WA) source of cytoplasmic male sterility (CMS) in a wild rice in 1970. Over the past three decades, the technology has helped China to achieve food security (Kobayashi, 2007) [3].

Materials and Methods
The experiment was carried out during *Kharif* season of 2017 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.) which is located at $25^0$24' 42" N latitude, 81^0 50' 56" E longitude and 98 m altitude above the mean sea level. Different crops grown in successive years and seasons in the experimental field were recorded for the last 5 years to get an idea about the different species grown. The experimental field was ploughed with the help of tractor drawn plough followed by two harrowing and planking. After this flooding and puddling operation was carried out with help of rotavator after that the 15 Rice hybrid seeds were first tested for germination in the laboratory of Agronomy Department, SHUATS, Allahabad. Ten seeds for each variety were taken for germination test. Germination test was done using filter paper and petridish under laboratory condition and Twenty-one to twenty four days old seedlings were taken out from the nursery and transplanting was done manually maintaining of spacing of 20 x 10 cm.
Dose of fertilizer application basal dose of fertilizer was applied just before last puddling on 08 July, 2017, Half dose of nitrogen and full dose of phosphorus and potassium followed by

two topdressings of 1/4th dose of nitrogen on 31/07/2017 (23 DAT) & 23/08/2017 (50 DAT) The experiment was conducted in Randomized block design consisting of 15 treatments combinations with 3 replications and was allocated randomly in each replication The data recorded during the course of investigation was subjected to statistical analysis by "Analysis of variance technique". The significant and non-significant treatment effects were judged with the help of 'F' (variance ratio) table. The significant differences between the means were tested against the critical difference at 5% probability level. For testing the hypothesis.

Results and Discussion

The observations on the test weight (g) of hybrid rice was statistically analysed and has been presented in table 2. The data showed the maximum test weight (29.59g) was observed in variety KR-21 (T_{11}) and minimum test weight (20.23 g) in variety KR-16 (T_6) thought significant. The results show that the adoption of 20x 10 cm^2 spacing for rice transplanting resulted in heavier filled and healthy grain higher test weight in variety (KR-21). Similar results have been also reported by Haqueet *et al.*, (2015) [2]. The observations on the grain yield (g) $hill^{-1}$ of hybrid rice was statistically analysed and has been presented in table 2. The significant and highest grain yield $hill^{-1}$ (50.70 g) was found in treatment T_{15} (KR-25). However T_1, T_2 and T_9 (KR-11, KR-12 and KR-19), was found to be at par with T_{15}. However, lowest grain yield $hill^{-1}$ (38.51 g) was found in treatment T_4 (KR-14).The higher grain yield under variety (KR-25) might be due to the optimum utilization of nutrient. The another reason of the high yield of variety (KR-25) is due to the better growth attribute resulting to produce higher grain yield. Similar findings were reported by Ranjitha *et al.*, (2013) [7]. The results obtained from the experiment are discussed here under field Evaluation of Rice Hybrids under Agro Climatic Conditions of Allahabad (U.P.) In *Kharif* season has obtained maximum benefit cost ratio (2.96) was recorded in the treatment T_{15} (variety KR-25) because of higher net return (₹ 80711.58 ha^{-1}) as also obtained by Fayez *et al.*, (2015) The net return (₹ ha^{-1}) of hybrid rice has been presented in table 3 the treatment T_{15} (varietyKR-25) recorded the highest net return (80711.58). The cost of cultivation (₹ ha^{-1}) of hybrid rice is presented in the table 4.12 Cost of cultivation (₹ 41111.75 ha^{-1}) was recorded in all treatments T_1 to $T_{15,}$ The cost. Of cultivation was higher due to cost of transplanting. The results confirm the findings of Haque *et al.*, (2015) [2]. The gross return (₹ ha^{-1}) of hybrid rice has been presented in table 3 Maximum gross return (₹ 126628.33 ha^{-1}) was obtained from treatment T_{15} (variety KR-25) due to highest grain and straw yield.

Table 1: Cost of cultivation of rice, details of operational cost

S. No.	Particulars	Cost (ha^{-1})
A.	Land Preparation	
1.	Tractor cultivation (3hrs) @ 400 ₹/hrs	1500
2.	Puddling by rotovator(4hrs)	2000
B.	Seed Rate	
1.	Variety 15 hybrid	As per price of rice variety
2.	15 kg seed	1500
C.	Sowing	
1.	Nursery sowing cost (5L)	1000
2.	Preparation of plots and irrigation channels (10 L)	2000
3.	Cost of transplanting (40 L)	8000
D.	Fertilizer Application	
1.	Nitrogen@150kg from urea (258 kg) (3L)	2146.75
2.	Phosphorus @ 80 kg from DAP (173.6 kg)	4340
3.	Potash @ 60 kg from MOP (96 kg)	1920
E.	Irrigation (12L)	2400
F.	After- Care Operations	
1	Hand weeding two times (25L)	5000
G.	Plant Protection Measures	
1.	Nominee Gold(Bispyribac Sodium) (250 ml) (1L)	1750
	Thimet (12 kg)	480
H.	Harvesting (20L)	4000
I.	Threshing and Cleaning Of Grains (12L)	2400
J.	Land Revenue	75
	Total Cost of Cultivation	
K.	Rental charge of land for 4 month	400
L.	Supervision charge for 4 month	500
	Total Common Cost (₹)	41,411.75

Note: Tractor: 500 $ha^{-1,}$ Man: Labour @ 200 per day

Table 2: Field evaluation of hybrid rice on Test weight (g) and Grain yield (g) $hill^{-1}$

Treatments	Rice hybrid	Test weight (g)	Grain yield (g) $hill^{-1}$
T_1	KR-11	26.56	48.39
T_2	KR-12	21.28	50.62
T_3	KR-13	24.36	44.60
T_4	KR-14	26.39	38.51
T_5	KR-15	24.18	43.23

T_6	KR-16	20.23	44.22
T_7	KR-17	27.39	39.73
T_8	KR-18	23.38	45.95
T_9	KR-19	20.45	47.91
T_{10}	KR-20	21.80	42.16
T_{11}	KR-21	29.59	45.33
T_{12}	KR-22	24.50	43.31
T_{13}	KR-23	20.70	45.55
T_{14}	KR-24	23.39	45.27
T_{15}	KR-25	27.54	50.70
F test		S	S
S.Ed (±)		0.14	1.99
CD (P=0.05)		0.29	4.07

Table 3: Economics of different treatments

Treatments	Rice hybrid	Gross return (₹ ha^{-1})	Cost of cultivation (₹ ha^{-1})	Net return (₹ ha^{-1})	B:C ratio
T_1	KR-11	108028.33	41111.75	66916.58	2.63
T_2	KR-12	117431.67	41111.75	76319.92	2.86
T_3	KR-13	112265.00	41111.75	71153.25	2.73
T_4	KR-14	114900.00	41111.75	73788.25	2.79
T_5	KR-15	113711.67	41111.75	72599.92	2.77
T_6	KR-16	117121.67	41111.75	76009.92	2.85
T_7	KR-17	117638.33	41111.75	76526.58	2.86
T_8	KR-18	120170.00	41111.75	79058.25	2.92
T_9	KR-19	112368.33	41111.75	71256.58	2.73
T_{10}	KR-20	113246.67	41111.75	72134.92	2.75
T_{11}	KR-21	118155.00	41111.75	77043.25	2.87
T_{12}	KR-22	114383.33	41111.75	73271.58	2.78
T_{13}	KR-23	108286.67	41111.75	67174.92	2.63
T_{14}	KR-24	116398.33	41111.75	75286.58	2.83
T_{15}	KR-25	126628.33	41111.75	80711.58	2.96

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