Original Research Article

Evaluation of Rice (*Oryza sativa* L.) Hybrids under Agro-climatic Conditions of Prayagraj in Kharif - 2022

ABSTRACT

A field experiment was conducted at Crop Research Farm, Department of Agronomy, SHUATS, Prayagraj (U.P) during *Kharif*, 2022. The soil of the experimental plot was sandy loam in texture, nearly neutral in soil reaction pH (7.1), organic carbon (0.75%), available N (269.96 kg/ha), available P (33.10 kg/ha), and available K (336 kg/ha). The experiment was laid out in Randomized Block Design with 10 hybrids each replicated thrice. Based on the objectives taken maximum plant height (112.03 cm), number of tillers (16.34), plant dry weight (50.91 g/plant), Crop Growth Rate at 80-100 DAT (32.14 $g/m^2/day$), tillers/m^2 (371.23), panicle length (29.73 cm), filled grains (245.87), grain yield/hill (31.37 g), seed yield (4.97 t/ha), straw yield (9.54 t/ha) were recorded significantly higher in hybrid R-170. And harvest index (34.41 %) were recorded significantly higher in hybrid R-151. Further, the maximum gross returns (INR 128020/ha) and net returns (INR 78974/ha) and B:C ratio was highest in 1.61 were recorded significantly higher in hybrid R-170

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

1. **Introduction:**

India is major rice growing country in world with an area of 43.79 million hectares, having production 112.91 million tonnes and productivity of 2.572 t/ha (Directorate of Economics and Statistics 2017-2018). In Uttar Pradesh 5.9 million ha and production 13.27 million tonnes with an average productivity of 2447 kg/ha and production of 14.63 million tones (Agriculture Statistics 2016). Rice is the most crucial cereal food crop of India, which occupies about 24% of gross cropped area of the country. 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) and in year 2017-18 the Area, Production, Productivity in Uttar Pradesh and India was 5.81 Million hacter, 13.21Million tones, 2283kg/ha and 43.79 Million hectare, 112.91 Million tones, 2578kg/ha respectively. 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. More than 80% of the total hybrids rice area is in eastern India states like Uttar Pradesh, Jharkhand, Bihar, Chhattisgarh, with some little area like states like M.P, Assam, Punjab, and Haryana. Hybrid rice was planted in an area of 1.3 million hectares and additional rice production of 1.5 to 2.5 million tones was recorded through this technology. Since the population increasing hence there is a urgent need to provide high yield rice varieties but yield already stagnated hence hybrid rice break the yield barriers which give 15- 20% higher yield.

Rice is grown in diverse agro-ecologies in India, and most of these have been confronting biotic and abiotic pressures, such as quantitative and qualitative deterioration of natural resources (that is, land and water), increasing frequency of extreme climatic events (for example, droughts and floods), rising input costs, declining profits, and shrinking farm sizes. India‘s land frontier appears to have reached its extensive margin of exploitation—for thepast three decades the net sown area has been stagnating at around 142 million hectares (India, MoAFW 2018). So has the acreage under rice, at around 43 million hectares. Thus, prospects for growth through area expansion are not optimistic. Growing water scarcity is another key constraint to production of rice (a water-guzzling crop). More than half of India‘s land is water-stressed.

The nutrient contents of rice are 80% carbohydrates, 7-8% protein, the amino acid profile shows that it is rich in Glutamic acid and aspartic acid, highest quality cereal protein being rich in lysine (3.8%), 3% fibre, iron 1.0 mg and Zinc 0.5 mg (Juliano *et al.*, 1971)[1].

The history of hybrid rice progress started since 1908 when Shull coined the term heterosis. Heterotic hybrids hold great potential for improving economic yield in order to meet the globalfood needs (Hossain, 2014[2].

During the first decades of the release of rice hybrids for commercial cultivation, the development and spread of the technology was not as rapid as expected due to many reasons like low level of heterosis, poor grain and cooking quality, susceptibility of hybrids to the pests and diseases and problems in seed production and delivery etc.

MATERIALS AND METHODS:

This experiment was carried out during kharif season 2022 at Crop Research Farm, Department of Agronomy, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, (U.P.) which is located at 25^0 28' 42" N latitude, 81^0 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. Organic carbon (0.87%), available Nitrogen (225 kg/ha), Phosphorus (41.8 kg/ha) and Potassium (261.2 kg/ha). The climate of the region is semi-arid subtropical. To reduce crop-weed competition one hand weeding was carried out at 35 days after sowing. Two irrigations were provided at 40 days interval. The observations pertaining to growth attributes were recorded using standard procedure at 20 days intervals, and presented at 100 DAS. Yield parameters were observed on the day of harvest, 23rd November, 2022. All the attributes were recorded and analyzed statistically by using appropriate analysis of Variance adopting Gomez and Gomez (1984) [3].

2. **Experimental design**

   The experiment was conducted in Randomized block design consisting of 10 hybrids *i.e.*, from R-127 to R-205 with 3 replications and was allocated randomly in each replication.

3. **RESULT AND DISSCUSSION:**

4.1 Growth parameters

4.1.1 Plant height (cm)

At 100 DAT the significantly tallest plant height was observed in R-170 (112.03 cm). However, R-127 (110.44 cm) was statistically at par with R-170. Genetic makeup of the variety is a huge contributing factor which has also been reported by Haque *et al.*, (2015)[4]. Increase in plant height may also be due to synchronized availability of all the essential plant nutrients especially nitrogen for a longer period during growth stages (Singh *et al.*, 2019)[5].

4.1.2 Numbers of tillers/hill

At 100 DAT the highest number of tillers was observed in R 170 (16.34). However, R 151 (15.96) and R 160 (16.02) were statistically at par with R 170. The significant differences could due to the variation in genetic make-up of the high yielding varieties that might be influenced by heredity. It could also be due to good nutrient availability.

4.1.3 Plant dry Weight (g/plant)

At 100 DAT the highest dry weight was observed in R 170 (50.91 g). However, R 127 (50.45 g/plant), and R 196 (49.32 g/plant) were statistically at par with R 170. The probable 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 Kumar (2016)[6]. The other reason of high dry matter accumulation in might be due to the significant increase in morphological parameters which responsible for the photosynthetic capacity of the plant thereby increasing the straw yield. The result conformed with Bozorgi *et al.*,(2011)[7].

4.2 Yield parameters:

4.2.1 Number of Tillers/meter^2

The Significantly highest number of tillers/m^2 was observed in R 170 (371.23 tillers/m^2). However, R 160 (359.67 tillers/m^2), R 190 (333.54) and R-205 (329.80) statistically at par with R 170. The probable reason for high yielding varieties has high tillering capacity. Similar findings are also reported by Yadav *et al.,* (2004)[8]. Wang *et al.,* (2016)[9] reported that the unequal distribution of photo- synthetically active radiation (PAR) was the source of heterogeneity in individual tiller yields, in that early emerging superior tillers pre-empted the uppermost light source, and shaded the late emerging tillers under limited light conditions. The higher tiller production was due to better inducement of root growth for anchorage. It leads to better nutrient and water uptake and ultimately leads to higher number of tillers, dry matter accumulation Bahure *et al.,* (2019)[10].

4.2.2 Panicle Length

R 170 recorded significantly higher panicle length/hill (29.73 cm). However, R 190 (27.92 cm) and R 145 (28.34 cm) were statistically at par with R 170. The nitrogen level exerted significant effect of on panicle length in hybrid rice. The significant differences in panicle length among the hybrid rice varieties could be attributed totheir genetic make-up. The results confirm the findings of Rahman *et al.* (2013)[11].

4.2.3 Grain yield (t/ha)

The data showed the significantly highest grain yield was observed in R 170 (4.97 t/ha). However, R 145 (4.20 t/ha) and R-190 (4.53 t/ha) were statistically at par with R 170. Grain yield had highly significant positive correlation with tillers/hill, panicle length and harvest index. 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 (2016)[12].

4.2.4 Straw yield (t/ha)

The data showed the significantly highest straw yield was observed in R 170 (9.54/ha). However, R 145 (9.06 t/ha) and R 190 (9.03 t/ha) were statistically at par with R 170. According to the findings by Padmavathi, 1997[13] supports that the capability of hybrid rice to utilize more nitrogen through the expression of better growth brought by the beneficialeffect on nutrient uptake and physiological growth increase the straw yield. High dry matter accumulation is might be due to the significant increase in morphological parameters which responsible for the photosynthetic capacity of the plant thereby increasing the straw yield.

4. **Economics:**

The result showed that [Table 3] the maximum gross return (128020. INR/ha), net return (78974 INR/ha) and B:C ratio (1.61) was recorded in R-170 as compared to other Hybrids.

5. **CONCLUSION:**

The concluded experiment showed that hybrid R-170 was found to be best for obtaining maximum grain yield. It also fetched the maximum gross return, net return and B:C ratio as compared to other hybrids. Since the findings are based on the research done in one season. Further trials are needed to conform more precise results. Hence hybrid R-170 can be recommended to farmers after further trails.

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Table 1. Field evaluation of different varieties on growth attributes of Rice Hybrids.

S. No.	Hybrids	Growth parameters		
		Plant height (cm)	Tillers/hill (No.)	Dry weight (g/plant)
1.	R-127	110.44	14.95	50.45
2.	R-145	108.37	14.86	48.19
3.	R-151	103.23	15.96	46.50
4.	R-160	104.53	16.02	43.91
5.	R-165	107.97	11.93	46.34
6.	R-170	112.03	16.34	50.91
7.	R-180	107.20	11.77	47.42
8.	R-190	106.30	14.49	45.89
9.	R-196	109.37	12.84	49.32
10.	R-205	102.18	12.05	46.35
	F-test	S	S	S
	SEm±	1.29	0.32	0.60
	CD (p=0.05)	3.87	1.02	1.86

Table 2. Field evaluation of different varieties on yield attributes of Rice Hybrids.

S. No.	Hybrids	Tillers/m^2	Panicle length (cm)	Grain yield (t/ha)	Straw yield (t/ha)
1.	R-127	308.33	25.32	3.87	8.03
2.	R-145	250.33	28.34	4.20	9.06
3.	R-151	258.33	25.33	3.40	6.48
4.	R-160	359.67	23.87	3.18	8.55
5.	R-165	318.67	26.26	2.84	6.62
6.	R-170	371.23	29.73	4.97	9.54
7.	R-180	299.78	27.39	3.22	6.53
8.	R-190	333.54	27.92	4.53	9.03
9.	R-196	259.67	24.56	2.68	7.86
10.	R-205	329.80	23.34	3.08	7.31
	F-test	S	S	S	S
	SEm±	15.01	1.01	0.30	0.27
	CD (p=0.05)	45.05	3.04	0.92	0.84

S. No.	Hybrids	Economics			
		Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1.	R 127	49046	101490	52444	1.07
2.	R 145	49046	111180	62134	1.27
3.	R 151	49046	87440	38394	0.78
4.	R 160	49046	89250	40204	0.82
5.	R 165	49046	76660	27614	0.56
6.	R 170	49046	128020	78974	1.61
7.	R 180	49046	83990	34944	0.71
8.	R 190	49046	117690	68644	1.40
9.	R 196	49046	77180	28134	0.57
10.	R 205	49046	83530	34484	0.70

Table 3. Field evaluation of different varieties on Economics of Rice Hybrids.