Original Research Article

Evaluation of Rice (*Oryza sativa* L.) under Agro-climatic Zone of Prayagraj

ABSTRACT

A field experiment was conducted at Crop Research Farm, Naini Agriculture Institute, Department of Agronomy, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during Kharif, 2022 on sandy loamy soil. The experiment was laid out in Randomized Block Design, replicated thrice, consisting of ten treatments *i.e*., R-205, R-210, R-212, R-218, R-242, R-248, R-256, R-300, R-305, R-311. The field experiment result revealed that R-305 has significantly increased the growth parameters *viz*., Plant height (125.87 cm), Number of tillers (16.30), Plant dry weight (47.60 g/plant), Tillers/m^2 (388.10), Panicle length (29.34 cm), Grain yield (6.95 t/ha) and Straw yield (12.80 t/ha). Maximum gross return (₹200625/ha), net return (₹151579/ha), and highest B:C ratio (3.09) was also in recorded R-305.

Keywords: *Hybrid, Rice, Growth*, *Yield, Kharif, U.P.*

1. Introduction:

“Rice is one of the most important staple food crops as it helps to sustain two thirds of the world’s population. India is an important centre of rice cultivation. It provides the bulk of daily calories for many companion animals and humans” [1]. Rice, as a complex carbohydrate, serves as the main source of energy for more than half of the world's population, particularly in Asia. It provides the body with glucose, which is essential for proper brain and bodily function. Other complex carbohydrates such as whole grains, legumes, fruits, and vegetables also play an important role in providing energy for the body, as well as supplying essential nutrients such as fiber, vitamins, and minerals that are crucial for maintaining good health and reducing the risk of chronic diseases such as heart disease. “Rice is a nutritional staple food which provides instant energy as its most important component is carbohydrate (starch), it also provides 27% of dietary energy supply, 20% of dietary protein and 3% of dietary fat” [2]. “India cultivated the rice in 44 million hectors land. Total rice production of 130.29 million tonnes in the 2021-22 which is more 3% more in pervious year 118.87 million tones. West Bengal first rank rice in production with 14.76 million tones” [3]. “It is higher by 13.85 million tonnes than the last five years’ average production of 116.44 million tonnes. It is the highest rice producing state in India with a yield of 2600 kilograms per hectare. Uttar Pradesh with 14.02 million tons of rice production, Uttar Pradesh ranks on the 2 nd position in the country” [4].

Hybrid rice offers an opportunity to boost yield potential of rice. So, expansion of hybrid rice cultivation area may be an effective and economic way to meet the future rice demands of growing population [5] . It has a yield advantage of 20-30% over conventional high yielding varieties [6] Hybrid rice plays a most important role for increase is yield in unit area. The yield advantage of 15-20% over the best pure line varieties (6.5 t/ha as against 5.4 t/ha) proved the key factor for wide adoption of the hybrid rice technology. 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. The present status of hybrids rice India, the major challenges and future outlook for this innovative technology. Presently cultivated varieties and hybrids although having high yield potential, they are erratic in their performance even under less varied conditions of cultivation [7] . Environmental changes have serious implications on genotypic yield manifestations leads to inconsistency in performance due to genotype x environment interactions [8] . In order to initiate an appropriate varietal selection program for high yielding characters is important to improve the present yield to meet the rice requirement gap to feed the ever-

increasing population of India. Thus, it is very much important to consider the identification and selection of high yielding varieties, quality characteristics in rice amongst the existing lines.

2. 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) [9] .

3. Experimental design

The experiment was conducted in Randomized block design consisting of 10 hybrids *i.e.*, from R-205 to R-311 with 3 replications and was allocated randomly in each replication.

4. RESULT AND DISSCUSSION:

4.1 Growth parameters

4.1.1 Plant height (cm)

At 100 DAS the significantly and higher plant height was observed in R-305 (125.87 cm). However, R-300 (124.52 cm) R-256 (121.70 cm) and R-248 (120.09 cm) were statistically at par with R-305. Genetic makeup of the variety is a huge contributing factor which have also been reported by [10] 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 [11]. Also, reason for maximum plant height might be due to more favorable weather

condition associated and was criticized by the higher growing degree days and hydrothermal units gained in these hybrids was found by [12].

4.1.2 Numbers of tillers/hill

At 100 DAT the highest number of tillers was observed in R-305 (16.30). However, R-300 (16.17), R-256 (15.95) and R-248 (15.77) were statistically at par with R-305. The significant differences could due to the variation in genetic make-up of the high yielding varieties that might be influenced by heredity. A comparative study of the performance of rice hybrids exhibited that R-305 recorded significantly higher tillers/hill. The differences in growth parameters between cultivars are mainly due to their genetic build up [13].

4.1.3 Plant dry Weight (g/plant)

At 100 DAT the highest dry weight was observed in R-305 (47.60 g/plant). However, R-300 (46.53 g/plant), R-256 (42.78 g/plant) and R-248 (42.33 g/plant) were statistically at par with R-305. 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 [14]. 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 [15].

4.2 Yield parameters:

4.2.1 Number of Tillers/meter^2

The highest tillers/m2 was observed in R-305 (388.10 tillers/m2). However, R-300 (380.53 tillers/m2), R-256 (373.23 tillers/m2) and R-248 (366.54 tillers/m2) was statistically at par with R-305. The probable reason for high yielding varieties have high tillering capacity. Similar findings are also reported by [16], [17]. 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 [12].

4.2.2 Panicle Length

R-305 recorded significantly higher panicle length/hill (29.34 cm). However, R-300 (28.22cm), R-256 (28.01 cm) and R-248 (27.76cm) were statistically at par with R- 305. 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 to their genetic make-up. The results confirm the findings of [18].

4.2.3 Grain yield (t/ha)

The data showed the significantly highest grain yield was observed in R-305 (6.95 t/ha). However, R-300 (6.67 t/ha) and R-256 (6.40 t/ha) were statistically at par with R-305. Grain yield per plant had highly significant positive correlation with tillers/hill, panicle length, harvest index, grain yield per plot, grain yield/meter^2 and with grain yield/hectare. These results confirm the findings of [18]. 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 [19].

4.2.4 Straw yield (t/ha)

The data showed the significantly highest straw yield was observed in R-305 (12.80 t/ha). However, R-300 (12.44 t/ha), R-256 (12.27 t/ha) and R-248 (11.97 t/ha) were statistically at par with R-305. According to the findings by Padmavathi, 1997 supports 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. 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. The result conformed with (2011) [15].

5. Economics:

The result showed that [Table 3] the maximum gross return (200625 INR/ha), net return (151579 INR/ha) and B:C ratio (3.09) was recorded in R-305 as compared to other Hybrids.

6. CONCLUSION:

The concluded experiment showed that hybrid R-305 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-305 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-205	114.44	14.24	38.19
2.	R-210	115.02	14.51	38.11
3.	R-212	115.79	14.73	35.02
4.	R-218	116.26	14.61	39.92
5.	R-242	117.00	15.48	40.72
6.	R-248	120.09	15.77	42.33
7.	R-256	121.70	15.95	42.78
8.	R-300	124.52	16.17	46.53
9.	R-305	125.87	16.30	47.60
10.	R-311	106.77	13.60	37.98
	F-test	S	S	S
	SEm±	2.87	0.49	1.96
	CD (p=0.05)	8.55	1.47	5.85

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-205	337.95	25.37	4.98	10.47
2.	R-210	344.42	25.51	5.32	10.76
3.	R-212	349.04	25.73	5.45	10.99
4.	R-218	354.54	26.01	5.68	11.43
5.	R-242	360.70	27.26	5.99	11.74
6.	R-248	366.54	27.76	6.23	11.97
7.	R-256	373.23	28.01	6.40	12.27
8.	R-300	380.53	28.22	6.67	12.44
9.	R-305	388.10	29.34	6.95	12.80
10.	R-311	249.42	22.98	4.46	9.79
	F-test	S	S	S	S
	SEm±	10.49	1.12	0.19	0.45
	CD (p=0.05)	31.18	3.33	0.57	1.35

S. No.	Hybrids	Economics			
		Cost of cultivation (INR/ha)	Gross return (INR/ha)	Net return (INR/ha)	B:C ratio
1.	R-205	49046	148305	99259	2.02
2.	R-210	49046	157420	108374	2.20
3.	R-212	49046	161135	112089	2.28
4.	R-218	49046	167840	118794	2.42
5.	R-242	49046	175745	126699	2.58
6.	R-248	49046	181825	132779	2.70
7.	R-256	49046	186680	137634	2.80
8.	R-300	49046	193165	144119	2.93
9.	R-305	49046	200625	151579	3.09
10.	R-311	49046	135050	86004	1.75

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