EVALUATION OF RICE (*Oryza sativa* L.) HYBRIDS UNDER AGRO- CLIMATIC CONDITIONS OF PRAYAGRAJ, U.P, India : An experimental Investigation

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, replicated thrice, consisting of twenty hybrids *i.e.*, R-24, R-40, R-48, R-53, R-77, R-107, R-111, R-120, R-127, R-145, R-152, R-160, R-165, R-170, R-180, R-190, R-196, R-205, R-210, R-212. Based on the objective taken maximum plant height (121.44 cm), number of tillers (15.81), plant dry weight (57.01 g/plant), tillers/m^2 (391.28), panicle length (29.28 cm), filled grains (247.04), grain yield/hill (29.13 g), seed yield (5.82 t/ha), stover yield (13.95 t/ha) and were recorded significantly higher in hybrid R-151.

Keywords: *Hybrid, rice, Growth, Yield, kharif, U.P.*

1. INTRODUCTION

The most important cereal food crop in India is rice (Oryza sativa L.), which accounts for around 24% of the nation's total cropped land. It contributes 42% of the nation's overall production of food grains and 45% of the nation's total production of cereals. After China, India is the country with the largest rice-growing area and the second-highest rice production (Yadav et al., 2010). The net planted area in India has remained constant for the previous three decades at 142 million hectares, suggesting that the country's vast land frontier has reached its limit of exploitation (India, MoAFW 2018). An average productivity of 2447 kg/ha and production of 14.63 million tonnes were recorded in Uttar Pradesh in 2016 (Agriculture Statistics). Various methodologies, including as traditional hybridization and selection techniques, ideotype breeding, hybrid breeding, wide hybridization, and genetic engineering are used to increase yield and productivity. Adopting hybrid rice breeding technique is one of the most sustainable and practicable methods among the various genetic options to boost productivity. In addition, hybrid rice typically yields 20 to 30 percent more than non-hybrid rice cultivars (Lin and Yuan, 1980; Shen, 1980). Eastern Indian states like Uttar Pradesh, Jharkhand, Bihar, and Chhattisgarh account for more than 80% of the world's hybrid rice land, whereas states like M.P., Assam, Punjab, and Haryana account for a smaller portion. A total of 1.3 million hectares of hybrid rice were planted, and this technology resulted in an additional 1.5 to 2.5 million tonnes of rice production. Because of the urgent demand for high yield rice varieties due to population growth, hybrid rice varieties break yield barriers and produce yields that are 15–20% higher. The method of growing hybrid rice is difficult, and its agronomic management is significantly different from that of traditional kinds. Many nations that produce rice have expressed interest in using the technology, despite the fact that it is still in its infancy, to increase food security. In India, 1.5 to 2.5 mt more rice was produced with this technology in 2010 thanks to the 1.7 mha of hybrid rice that was planted.

2. MATERIALS AND METHODS:

"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 20 hybrids each replicated thrice". [13] The hybrids studied were R-24, R-40, R-48, R-53, R-77, R-107, R-111, R-120, R-127, R-145, R-152, R-160, R-165, R-170, R-180, R-190, R-196, R-205, R-210, R-212. The observations were recorded on different growth parameters at harvest *viz.* plant height(cm), plant dry weight, test weight, seed yield, stover yield and harvest index. were analyzed statistically to test their significance and the experiment findings have been summarized in the light of scientific reasoning and have been discussed below under the following heading: -

3. RESULTS AND DISCUSSION

3.1 Growth parameters

3.1.1 Plant height (cm)

At 90 DAT the significantly highest plant height was observed in R-151 (121.44 cm). However, R-48 (119.83 cm), R-190 (120.58 cm) and R-160 (117.71) were statistically at par to R-151. The genetic makeup of the variety is a significant contributing component, as documented by Haque et al. (2015). Increased plant height could also be attributed to the synchronised availability of all important plant nutrients, particularly nitrogen, for a longer period of time during growth phases. Singh and colleagues (2019). Bahure et al. (2019) discovered that "the reason for maximum plant height could be attributed to more favourable weather conditions, which was criticised by the greater growing degree days and hydrothermal units achieved in these hybrids".

3.1.2 Numbers of tillers/hill

At 90 DAT the significantly higher number of tillers was observed in R-151 (15.07) which was superior over rest of the treatments except R-40 (15.14), R-77 (14.07), R-111 (15.81), R-127 (14.94), R-165 (14.07) and R-205 (15.14) were statistically at par with R-151. "Significant variances could be attributed to differences in the genetic make-up of high yielding types, which could be modified by heredity". [14] This was similar with the findings of Chowdhery et al. (1993).

3.1.3 Dry weight

At 90 DAT the significantly highest dry weight was observed in R-151 (57.01 g/plant). However, R-40 (55.12 g/plant), R-120 (53.43 g/plant) and R-205 (54.02 g/plant) and R-210 (52.99 g/plant) were statistically at par with R-151. "The most likely cause of maximal dry matter accumulation is enhanced photosynthesis and respiration rate, which ultimately promotes plant development in terms of increased plant height, leaf area, and tillers/hill, among other things. Thus, the treatment that achieved highest growth also gathered the most dry matter". [14] A similar conclusion was reported by Kumar (2016).

3.1.4 Days to 50% flowering

The data pertaining days to 50% flowering clearly shows that significantly minimum days to 50% flowering was observed in R 145 (58.33 DAT). However, R-24 (62.66 DAT), R-52 (63.66 DAT), R-77 (64.33 DAT), R-111 (59.66 DAT), R-151 (63.66 DAT) and R-180 (59.33 DAT) were statistically at par with R-145. The cause could be attributed to the variety's innate ability to flower in a short period of time. Heritability is a measure of the amount of phenotypic variation induced by gene action. Reddy et al. (2018)

similarly observed similar findings.

3.2 Yield Attributes

3.2.1 Tillers/m^2

The highest tillers/m^2 was observed in R-151 (391.28 tillers/m^2). However, R-120 (363.62 tillers/m^2), R-180 (358.27 tillers/m^2), R-190 (373.95 tillers/m^2) and R-205 (362.53 tillers/m^2) were statistically at par with R-151. High tillering capacity is the most likely reason for high producing cultivars. Yadav et al. (2004) report comparable findings.

3.2.2 Panicle length

The maximum panicle length (29.28 cm) was recorded under hybrid R- 151. However, R-40 (27.20 cm), R 48 (28.49 cm) and R-107 (27.87 cm) were statistically at par with R- 151. In hybrid rice, the nitrogen content had a substantial effect on panicle length. Thus, among the hybrids tested in the study, had considerably produced the longest panicle. The large variability in panicle length amongst hybrid rice varieties could be attributable to genetic variances. The findings support those of Rahman et al. (2013).

3.2.3 Filled grains/panicle

The highest significant number of filled grains/panicle was recorded under R-151 (247.04). However, R-40 (219.04), R-107 (215.87), R-145 (235.37) R-190 (237.51) and R-196 (245.87) were statistically at par with R-151. The beneficial reason could be that hybrid rice has long roots and broad leaves, allowing it to absorb more nutrients and produce more grains. It is well suited to the local climatic conditions, particularly during the grain-filling stage of panicle development. Similar findings have been reported by **Bhuiyan *et al*. (2014).**

3.2.4 Grain yield/hill

The data showed the highest grain yield/hill was observed in R-151 (29.13 g). However, R-48 (29.01 g), R-107 (27.90 g/hill), R-145 (27.18 g/hill) R-165 (26.86 g/hill) and R-190 (26.10 g/hill) were statistically at par with R-151. The greater grain yield/hill under variety could be attributed to optimal nutrient utilisation. Short duration high yielding hybrids have the ability to yield more grain than the other kinds. Another cause for the high production of variety is the greater growth feature, which results in higher grain yield. Ranjitha et al. (2013) observed similar findings.

3.2.5 Grain yield/ha

The data showed the significantly highest grain yield/ha was observed in R-151 (5.82 t/ha). However, R-48 (5.54 t/ha), R-77 (4.87 t/ha), R-170 (5.12 t/ha) and R-190 (5.61 t/ha) were statistically at par with R-151. Grain yield per plant correlated strongly with tillers/hill, panicle length, harvest index, grain yield per plot, grain yield/meter2, and grain yield/hectare. These findings corroborate those of Rahman et al. (2013).

3.2.6 Straw yield/ha

The data showed the significantly highest straw yield/ha was observed in R-151 (13.95 t/ha). However, R-48 (12.51 t/ha), R-145 (11.72 t/ha), R-170 (11.59 t/ha) and R-190 (13.35 t/ha) were statistically at par with R-151. According to Padmavathi's research in 1997, "hybrid rice's ability to utilise more nitrogen through the expression of improved growth caused by the beneficial influence on nutrient uptake and physiological growth increases straw yield".

3.2.7 Harvest index

The data showed the harvest index was observed significantly higher in R-305 (34.44%). However, R-315 (34.35 %), R-410 (33.69), R-458 (433.45) and R-462 (32.94%) were statistically at par with R-305. The greater harvest index could be attributed to a faster rate of photosynthate translocation to grains during the grain filling stage. The harvest index measures a crop variety's physiological ability to mobilise and translocate photosynthates to the sink. Harvest index was found to be inversely connected with plant height but positively correlated with grain number/panicle, grain number/plant, percentage spikelet fertility, and yield/plant in rice (Marri et al., 2005).

4. CONCLUSION

The present experiment well evaluated the Rice Hybrids under Agro- Climatic Conditions of Prayagraj. The results of the experiment demonstrated that hybrid R 151 was better for increasing productivity.

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Table 1. Field evaluation of rice hybrids on growth parameters

	Plant height (cm)	No. of Tillers	Dry weight	50% flowering
R-24	116.16	13.81	51.45	62.66
R-40	106.55	15.14	55.12	73.33
R-48	119.83	13.94	50.05	77.66
R-52	105.39	11.61	47.6	63.66
R-77	111.21	14.07	50.9	64.33
R-107	114.65	11.07	48.79	73.33
R-111	106.08	15.81	47.36	59.66
R-120	103.49	11.14	53.43	75.33
R-127	112.65	14.94	49.12	73.33
R-145	113.12	12.61	49.34	58.33
R-151	121.44	15.81	57.01	63.66
R-160	117.71	13.81	48.52	68.33
R-165	112.21	14.07	50.6	71.66
R-170	104.91	13.01	50.07	77.33
R-180	114.5	11.07	48.36	59.33
R-190	120.58	14.01	50.32	81.66
R-196	118.24	13.81	49.9	66.33
R-205	106.45	15.14	54.02	69.66
R-210	115.71	13.94	52.99	78.66
R-212	113.5	11.61	49.47	76.33
F-test	S	S	S	S
SEm±	1.38	0.43	1.34	1.29
CD (P=0.05)	4.19	1.76	4.03	7.89

Table 2. Field evaluation of rice hybrids on grain yield, straw yield and harvest index

	Tillers/meter^2	Panicle length	Filled grains/panicle	Grain/Hill (g/hill)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)
R-24	280.28	26.41	210.37	22.87	3.2	9.72	24.77
R-40	321.62	27.2	219.04	25.19	4.25	10.92	28.02
R-48	313.62	28.49	201.87	29.01	5.54	12.51	30.69
R-52	282.62	24.2	197.20	21.24	3.19	9.67	24.81
R-77	253.62	26.54	212.63	24.98	4.87	10.52	31.64
R-107	322.95	27.87	215.87	27.90	3.25	9.76	24.98
R-111	302.28	28.2	193.87	22.14	3.27	10.45	23.83
R-120	363.62	26.54	182.2	25.21	2.01	7.72	20.66
R-127	244.28	24.54	196.04	23.59	3.21	10.62	23.21
R-145	252.28	21.2	235.37	27.18	4.32	11.72	26.93
R-151	391.28	29.28	247.04	29.13	5.82	13.95	29.44
R-160	312.62	25.55	208.30	25.23	3.8	9.92	27.70
R-165	326.95	24.21	176.74	26.86	4.01	10.46	27.71
R-170	303.95	25.46	169.21	19.03	5.12	11.59	30.64
R-180	358.27	21.19	185.43	24.15	3.32	9.52	25.86
R-190	373.95	24.32	237.51	26.10	5.61	13.35	29.13
R-196	347.4	23.43	245.87	21.21	3.08	9.45	24.58
R-205	362.53	21.2	156.87	25.52	4.13	10.72	27.81
R-210	301.28	27.54	181.2	22.30	3.11	8.31	27.23
R-212	356.95	25.76	157.04	22.94	3.65	9.72	27.30
F-test	S	S	S	S	S	S	S
SEm±	12.09	0.73	7.16	1.01	0.35	0.76	0.83
CD (P=0.05)	36.03	2.24	21.56	3.05	1.07	2.36	2.51