

Original Research Article

EVALUATION OF RICE (*Oryza sativa* L.) HYBRIDS UNDER AGRO- CLIMATIC CONDITIONS OF PRAYAGRAJ

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/m² (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.*

INTRODUCTION

Rice (*Oryza sativa* L.) 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 has a long history of rice cultivation and stands first in rice area and second in rice production, after China (Yadav *et al.*, 2010). India's land frontier appears to have reached its extensive margin of exploitation—for the past three decades the net sown area has been stagnating at around 142 million hectares (India, MoAFW 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 tonnes (Agriculture Statistics 2016). For increasing the yield and productivity various strategies includes, conventional hybridization and selection procedures, ideotype breeding, hybrid breeding, wide hybridization and genetic engineering. 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 have a yield advantage of 20 - 30% over non hybrid rice cultivars (Lin and Yuan, 1980; Shen, 1980). 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. Growing of hybrid rice is a complex process and especially agronomic management of hybrid rice differs considerable from that of conventional varieties. Although the technology is still new, many rice-producing countries have expressed their interest in applying it to improve food security. During the year 2010, hybrid rice was planted in an area of 1.7 mha and 1.5 to 2.5 mt was added to rice production in India through this technology.

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. 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: -

RESULTS AND DISCUSSION

A. Growth Attributes:

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. Genetic makeup of the variety is a huge contributing factor which have also been reported by **Haque *et al.* (2015)**. 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. The significant differences could due to the variation in genetic make-up of the high yielding varieties that might be influenced by heredity. This was consistent with **Chowdhery *et al.* (1993)**. 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 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)**. 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 reason might be due to the inherent character of variety to take minimum days to 50% flowering Heritability is a measure of extent of phenotypic variation caused by the action of genes. Similar results have also been reported by **Reddy *et al.* (2018)**.

B. Yield Attributes

The highest tillers/m² was observed in R-151 (391.28 tillers/m²). However, R-120 (363.62 tillers/m²), R-180 (358.27 tillers/m²), R-190 (373.95 tillers/m²) and R-205 (362.53 tillers/m²) were statistically at par with R-151.

The probable reason for high yielding varieties have high tillering capacity. Similar findings are also reported by **Yadav *et al.* (2004)**. The maximum panicle length/hill (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. The nitrogen level exerted significant effect of on panicle length in hybrid rice. Thus, in the

study had significantly produced the longest panicle among the hybrids under experiment. 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 **Rahman et al. (2013)**. 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 favorable reason might be that hybrid rice produces long roots and broad leaves that enable them to take up more nutrients and produce more grains. It 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)**. 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 higher grain yield/hill under variety 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 other reason of the high yield of variety is due to the better growth attribute resulting to produce higher grain yield. Similar findings were reported by **Ranjitha et al. (2013)**

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 had highly significant positive correlation with tillers/hill, panicle length, harvest index, grain yield per plot, grain yield /meter² and with grain yield/hectare. These results confirm the findings of **Rahman et al. (2013)**. 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 the findings by **Padmavathi, 1997** it 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. 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 increase in harvest index might be due to higher rate of translocation of photosynthates to grains at grain filling stage. Harvest index reflects the physiological capacity of a crop variety to mobilize and translocate the photosynthates to the sink. (Marri et al., 2005) found that harvest index negatively correlated with plant height, but positively correlated with grain number/panicle, grain number/plant, percentage spikelet fertility and yield/plant in rice.

CONCLUSION

The concluded experiment showed that hybrid R 151 was found to be best for obtaining more productivity and was also economically feasible. Since the finding are based on the research done in one season.

Reference.

- Bhuiyan, H. S., Zahan, A., Khatun, H., Iqbal, M., Alam, F. and Manir, R. 2014. Yield performance of newly developed test crossed hybrid rice variety. *International Journal of Agronomy and Agricultural Research* **5**(4): 48-54.
- Bozorgi, H. R., Faraji, A., Danesh, R. K., Keshovarz, A., Azarpour, E. and Tarighi, F. 2011. Effect of plant density on yield and yield components of rice. *World applied Science journal* **12**(11): 2053-2057.
- Deshpande, H. H., and Devasenapathy, P. 2011. Effect of green manuring and organic manures on yield, quality and economics of rice (*Oryza sativa* L.) under lowland condition. *Karnataka Journal of Agricultural Sciences* **23**(2): 235-238.
- Haque, M. D., Pervin, E. and Biswash, M.D. 2015. Identification of Potential Hybrid Rice Variety in Bangladesh by Evaluating the Yield Potential. *World Journal of Agricultural Sciences* **11**(1): 13-18.
- Kumar, S. N. 2016. Evaluate the establishment techniques on growth and yield of rice, *Agricultural Research Communication Centre, Agriculture Science Digest* **36** (2): 110- 113.
- Marri, P. R., Sarla, N., Reddy, I. V. and Siddiq, F. A. 2005. Identification and mapping of yield and yield related QTLs from an indian accession of *Oryza rufipogon*, *BMC : genetics* **13**: 33-39.
- Padmavathi, P. 1997. Studies on relative performance of conventional hybrid rice varieties under various levels of nitrogen, plant population and planting patterns. phd thesis, Indian agricultural research institute, new delhi.
- Rahman, M. M., Islam M. T., Faruq A. N., Akhtar N., Ora N. and Uddin M. M. 2013. Evaluation of Some Cultivated Hybrid Boro Rice Varieties Against BLB, ShB and ALS Diseases Under Natural Epiphytic Conditions Middle-East. *Journal of Scientific Research* **15**(1):146-151.
- Singh, V., Rachana, Mithare, P., Kumar, S., Mishra, J. P., Singh, S. N., Tiwari D. and Sanodiya, L. K. 2019. Performance of Hybrid Rice Cultivar (*Oryza sativa* L.) on Growth and Yield Attributes under Agro-climatic Conditions of Prayagraj Uttar Pradesh in Aman Season of Planting. *International Journal of Current Microbiology and Applied Sciences* **8**(9): 2970-2982.
- Wang, Y., Ren, T., Lu, J. W., Ming, R., Li, P. F., Saddam, H., Cong, R. H. and Li, X. K. 2016. Heterogeneity in rice tillers yield associated with tillers formation and nitrogen fertilizer. *Agronomy Journal* **108**: 1717–1725.
- Yadav, P., Rangare, N. R., Anurag, J. P. and Chaurasia A. K. 2004. Quantitative Analysis of Rice

(*Oryza sativa* L.) in Prayagraj Agro Climate Zone. *Journal of Rice Research* 3(1).

UNDER PEER REVIEW

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

UNDER PEER REVIEW