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Evaluation of Rice (*Oryza sativa* L.) hybrids under Agro- climatic conditions of Sangam regionPrayagraj

Abstract

A field experiment was conducted at Crop Research Farm, Department of Agronomy, Sam Higginbottom Institute of Agriculture, Technology and Sciences (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 rice (*Oryza sativa* L.) hybrids, each replicated thrice. Based on the objectives taken maximum plant height (122.57 cm), number of tillers(15.07), plant dry weight (55.91 g/plant), Crop Growth Rate at 45-60 DAT (40.51 g/m^2/day), relative growth rate (0.026 g/g/day), tillers/m^2 (382.33), panicle length (29.00 cm), filled grains (256.17), grain yield/hill (29.13 g), test weight (26.66 g), seed yield (5.35 t/ha) and stover yield (12.77 t/ha) were recorded significantly higher in the hybrid R-504, so hybrid R- 504 was found to be best for obtaining more productivity and was economically feasible.

Keywords: Hybrid rice,varietal response, yield.

1. INTRODUCTION

In India rice grown under widely varying conditions of altitude and climate. Rice cultivation in India extends from $8^0$to 35^0N latitude and from sea level to as high as 3000 meters above sea level. Rice crop needs a hot and humid climate. It is best suited to regions which have high humidity, prolonged sunshine and an assured supply of water. The average temperature throughout the life period of the crop ranges from 21 to 37^0C. Maximum temperature which the crop can tolerate 40^0C to 42^0C.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*.,2004)**. 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 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 tonnesfor 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 rices 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 MadhyaPradesh, Assam, Punjab, and Haryana. The hybrid rice was planted in an area of 1.3 million hectares and additional rice production of 1.5 to 2.5 million tonnes 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. Hybrid rice technology is very important for the food security of rice-consuming countries where arable land is becoming scarce, population is steadily increasing and labour is cheap. Growing of hybrid rice is a complex process and especially agronomic management of hybrid rice differs considerable from that of conventionalvarieties. Although the technology is still new, many rice-producing countries have expressed their interest in applying it to improve food security. 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 millionhactare and 1.5 to 2.5 mt was added to rice production in India through this technology.

2. MATERIALSANDMETHODS:

A field experiment was conducted at Crop Research Farm, Department of Agronomy, Sam Higginbottom Institute of Agriculture, Technology and Sciences (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 rice hybrids each replicated thrice. The hybrids studied were R 218, R 242, R 248, R 256,R 300, R305, R 311, R 315, R 400, R 405, R 410, R 458, R 462, R 504, R 510, R 600, R 603, R 605, R 607, R 610.Theobservationswererecordedondifferentgrowthparameters and yield attributes*viz*.plantheight(cm),number of tillers,plantdryweight (g), No. tillers/ m^2, panicle length (cm), No. filled grains/ panicle, grainyield (t/ha),stoveryield(t/ha), andharvestindex at 90 days after transplanting.The data were analyzed statistically to test their significance using. The experiment findings have been summarized at the light of scientific reasoning and they have also been discussed.

3. RESULTSANDDISCUSSION

A.Growthparameters(Table 1)

At 90 days after transplant (DAT) the significantly highest plant height was observed in R-504 (122.57 cm). However, R-405 (120.37 cm) and R-458 (119.84 cm) were statistically at par to R-504. Increase in plant height may be due to synchronized availability of essential plants nutrients to the crop

especially nitrogen for a longer period during its growth stages. The result conformed with**Deshpande and Devasenpathy,(2011)**. 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-504 (15.07) However, R-218 (14.00), R-300 (14.20) and R-458 (14.40) were statistically at par with R-504.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 plant dry weight was observed in R-504 (55.91 g). However, R-410 (53.53 g) and R-305 (52.87 g) which were statistically at par with R-504.The probable 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 *etal.*(2011).**The data pertaining days to 50% flowering clearly shows that significantly minimum days to 50% flowering was observed in R 300 (58.66 DAT). However, R-315 (61.33 DAT), R-218 (62.00 DAT), R-410 (62.33 DAT), R-462 (60.66 DAT) and R-510 (62.00) were statistically at par with R 300. While the maximum days to 50% flowering was recorded under variety R-504 (80.33 DAT). The reason might be due to the inherent character of variety to take minimum days to 50% flowering.The heritability is a measure of extent of phenotypic variation caused by the action of genes.

B. YieldAttributes(Table 2)

The highest tillers/m^2 was observed in R-504 (382.33tillers/m^2). However, R-410 (363.00tillers/m^2), R-400 (371.00 tillers/m^2), R-311 (356.67 tillers/m^2), R-600 (367.67 tillers/m^2) and R-607 (381.43 tillers/m^2) were statistically at par with R-504. Probably the reason for high yielding varieties is they have high tillering capacity. Similar findings are also reported by **Yadav *et al.* (2004).** The maximum panicle length/hill (29.00 cm) was recorded under hybrid R- 504. However, R-218 (28.41 cm), R 256 (28.00 cm) and R 300 (28.33 cm) were statistically at par with R- 504.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-504 (256.17). However, R-510 (245.00), R-315 (244.50), R-300 (236.17) and R-248 (251.00) were statistically at par with R-504. 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-410 (29.13 g). However, R-248 (29.01 g), R-305 (27.90 g/hill), R-405 (27.18 g/hill) R-462 (26.86 g/hill) and R-600 (26.10 g/hill) were statisticallyat par with R-410.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-504 (5.35 t/ha). However, R-256 (4.49 t/ha), R-305 (4.75 t/ha), R-400 (4.65 t/ha), R-410 (4.25 t/ha) and R-600 (4.31 t/ha) were statistically at par with R-504. 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 **Rahman*etal.*(2013).** The data showed the significantly highest straw yield/ha was observed in R-504 (12.77 t/ha). However, R-300 (11.96 t/ha), R-410 (12.26 t/ha) and R-607 (12.03 t/ha) were statistically at par with R-504.According to the findings by **Padmavathi, (1997),**itshows 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 significantly higher in R-305 (32.14 %). However, R-600 (30.06 %), R -504 (29.53 %), R -256 (30.84 %), R -400 (31.46 %) and R -510 (28.65 %) 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.

4. CONCLUSION

The experiment showed that hybrid R 504 was thebest for obtaining more productivity and was also economically feasible. Since the finding are based on the research done in one season.

5. REFERENCES

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.

Chowdhery HJ, Pal GD, Giri GS. A new species of Epipogium (Orchidaceae) from Arunachal Pradesh, *India. Nordic journal of botany*. 1993 Aug;13(4):419-421.

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.

Lin YH, Narendra K. A new error model for adaptive systems. IEEE Transactions on Automatic Control. 1980 Jun;25(3):585-587.

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 oryzarufipogon, BMC: genetics 13:33-39.

P. Sri Ranjitha, R.Mahender Kumar and G.JayasreeEvaluation of rice (Oryza sativa L.) varieties and hybrids in relation to different nutrient management practices for yield, nutrient uptake and economics in SRI*Annals of Biological Research*, 2013, 4 (10):25-28.

Padmavathi, P. 1997. Studies on relative performance of conventional hydrid 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.

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).*

Table 1.Field evaluation of rice (*Oryza sativa*) hybrids on the basis of growth parameters.

	Plant height (cm)	No. of Tillers	Dry weight	50% flowering
R-218	112.25	14.00	47.67	62.00
R-242	104.52	12.67	50.21	70.33
R-248	110.34	12.07	49.63	76.66
R-256	113.78	10.40	49.36	79.33
R-300	105.21	14.20	50.76	58.66
R-305	118.29	13.87	52.87	74.66
R-311	117.84	13.33	49.21	74.00
R-315	114.63	13.87	51.43	61.33
R-400	116.60	11.00	48.43	72.33
R-405	120.37	12.27	46.91	75.66
R-410	107.58	10.33	53.53	62.33
R-458	119.84	14.40	51.73	63.33
R-462	117.63	13.07	48.78	60.66
R-504	122.57	15.07	55.91	80.33
R-510	107.68	13.20	49.91	62.00
R-600	115.96	10.87	48.10	70.33
R-603	107.04	11.43	46.67	76.66
R-605	112.63	13.01	47.83	74.33
R-607	109.26	13.94	54.27	72.66
R-610	110.43	11.61	49.61	67.66
F-test	S	S	S	S
SEm±	1.42	0.37	1.05	1.27
CD (P=0.05)	4.26	1.12	3.17	3.82

Table 2.Field evaluation of rice (*Oryza sativa*) hybrids on the basis of yield attributes.

	Tillers/meter^2	Panicle length	Filled grains/panicle	Grain/Hill (g/hill)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)
R-218	306.67	28.41	219.50	22.87	3.16	9.76	24.46
R-242	281.67	24.33	208.17	25.19	2.43	7.43	24.65
R-248	251.67	26.67	251.00	29.01	3.51	9.83	26.31
R-256	320.00	28.00	176.33	21.24	4.49	10.07	30.84
R-300	298.33	28.33	236.17	24.98	4.14	11.96	25.71
R-305	248.33	24.67	225.00	27.90	4.75	10.03	32.14
R-311	356.67	24.67	185.17	22.14	3.45	9.93	25.78
R-315	258.33	21.33	244.50	25.21	2.56	7.53	25.37
R-400	371.00	22.45	201.76	23.59	4.65	10.13	31.46
R-405	318.67	25.68	217.43	27.18	3.94	11.23	22.92
R-410	363.00	22.34	165.87	29.13	4.25	12.26	25.74
R-458	300.00	23.59	158.34	25.23	3.36	10.90	23.56
R-462	334.67	27.41	194.56	26.86	3.56	9.83	26.59
R-504	382.33	29.00	256.17	19.03	5.35	12.77	29.53
R-510	343.67	22.56	245.00	24.15	3.32	10.76	28.65
R-600	367.67	20.33	156.00	26.10	4.31	10.03	30.06
R-603	297.33	26.67	180.33	21.21	3.35	8.62	27.99
R-605	353.00	24.89	156.17	25.52	4.09	11.13	26.87
R-607	381.43	22.56	223.50	22.30	4.15	12.03	25.65
R-610	318.67	27.45	233.24	22.94	3.07	10.23	23.08
F-test	S	S	S	S	S	S	S
SEm±	10.43	0.34	6.71	1.01	0.38	0.36	1.36
CD (P=0.05)	30.53	0.89	20.13	3.05	1.15	1.07	4.1