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Agronomic Evaluation of Rice (*Oryza sativa* L.) Hybrids under Agro-Climatic Conditions of Naini, Prayagraj

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

This research paper aims to evaluate the agronomic performance of twenty rice hybrid varieties under the specific agro-climatic conditions of Prayagraj, Uttar Pradesh, India. The study focuses on analyzing their growth and yield parameters using a randomized block design replicated thrice. The findings will provide valuable insights into the performance of rice hybrids and assist farmers in selecting suitable varieties for optimal productivity in the region. During *Kharif* season, of 2022 the field experiment was conducted at Crop Research Farm, Department of Agronomy, Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHUATS), Prayagraj (U.P.). Based on the objectives taken maximum plant height (122.57 cm), number of tillers (15.07), plant dry weight (55.91 g/plant), panicle length (29.00 cm), filled grains (256.17), were recorded significantly higher in the hybrid R-504 as compared to other treatments though grain yield/hill

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(29.13 g) was recorded significantly higher in the hybrid R-410. This research paper aims to provide an in-depth analysis of agronomic evaluation of rice hybrids. The study is intended to explore the advantages and challenges associated with rice hybrid varieties, with a focus on growth attributes, yield potential and other agronomic traits.

Keywords: Agronomy; rice hybrids; growth attributes; yield potential; other agronomic traits.

1. INTRODUCTION

Rice cultivation holds immense importance in ensuring food security in India. With varying agro-climatic conditions across regions, evaluating suitable rice hybrids becomes crucial. The present study focuses on the agronomic evaluation of rice hybrids in Prayagraj, Uttar Pradesh, aiming to provide insights into optimal cultivation practices for improved growth and yield. Rice crop is best suited to regions having hot and humid climate with prolonged sunshine and sufficient water supply. The average temperature for growing rice ranges from 21 to 37^0C. Rice crop can tolerate maximum temperature from 40^0C to 42^0C. In India rice crop contributes 42% of total food grain production and 45% of total cereal production. India has a long history of rice cultivation and stands first in rice area and second in rice production, after China [1]. Paddy is cultivated in approximately 44 million hectare in India and 5.9 million hectare in Uttar Pradesh in different conditions such as irrigated, non-irrigated, water logged, non-irrigated usher land and flood affected area. Emphasis should be given to develop high yielding variety of hybrid paddy in different conditions i.e., favorable irrigated and adverse conditions. Among the available genetic options to increase the productivity, adoption of hybrid rice breeding technology is one of the practically feasible and sustainable approaches. Hybrid rice normally have a yield advantage of 20 - 30% over non hybrid rice cultivars [2]. In India more than 80% of the total hybrid rice produced in states like Uttar Pradesh, Jharkhand, Bihar, Chhattisgarh, with some little area like states like Madhya Pradesh, Assam, Punjab, and Haryana. At present, approximately 103 million hectare area is covered by hybrid paddy in India. Hybrid paddy was cultivated in 13 lac hectare area in Kharif-2022 in Uttar Pradesh. 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 conventional varieties. Although the technology is still new, many rice-producing countries have expressed their interest in applying it to improve food security.

It is known that hybrid variety is developed by cross pollination of two varieties of different genetic characteristics. Only first generation seed of new variety is used as it possesses special reproductive capacity which is capable of giving higher yield as compared to best normal yielding variety. As the accumulated quality is disintegrated in second generation, reproductive capacity is decreased which results in low yield. Hence, seed of hybrid variety is to be purchased every year.

2. MATERIALS AND METHODS

The research employed a randomized block design to evaluate the growth attributes and yield attributes of rice hybrids. The study was conducted at Crop Research Farm, Department of Agronomy, Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHUATS), Prayagraj, Uttar Pradesh, India during *Kharif*, 2022 considering the local agro-climatic conditions. A total of 20 hybrid rice varieties were selected for evaluation and each were replicated three times. The hybrid varieties of rice studied were R 218, R 242, R 248, R 256, R 300, R 305, 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. The growth and yield parameters assessed included plant height(cm), number of tillers, plant dry weight(g), panicle length(cm), filled grains per panicle and grain yield/hill(g/hill) at 90 days after transplanting. The experimental field was having sandy loam soil in texture, organic carbon (0.75%), nearly neutral in soil reaction (pH 7.1), available N (269.96 kg/ha), available P (33.10 kg/ha), and available K (336 kg/ha). The data were analyzed statistically to test their significant using. The experiment findings have been summarized at the light of scientific reasoning and they have also been discussed.

3. RESULTS

3.1 Growth Parameters (Table 1)

3.1.1 Plant Height (cm)

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. The 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 Bahure et al. [3].

3.1.2 Number of Tillers/Hill

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. Wang et al. [4] 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 reason for high yielding varieties is they have high tillering capacity [1].

3.1.3 Plant dry weight (g/plant)

At 90 DAT the significantly highest plant dry weight as 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 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 [5].

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

SL. No.	Rice hybrids	Plant height (cm)	No. of Tillers /hil	Dry weight (g/plant)
1	R-218	112.25	14.00	47.67
2	R-242	104.52	12.67	50.21
3	R-248	110.34	12.07	49.63
4	R-256	113.78	10.40	49.36
5	R-300	105.21	14.20	50.76
6	R-305	118.29	13.87	52.87
7	R-311	117.84	13.33	49.21
8	R-315	114.63	13.87	51.43
9	R-400	116.60	11.00	48.43
10	R-405	120.37	12.27	46.91
11	R-410	107.58	10.33	53.53
12	R-458	119.84	14.40	51.73
13	R-462	117.63	13.07	48.78
14	R-504	122.57	15.07	55.91
15	R-510	107.68	13.20	49.91
16	R-600	115.96	10.87	48.10
17	R-603	107.04	11.43	46.67
18	R-605	112.63	13.01	47.83
19	R-607	109.26	13.94	54.27
20	R-610	110.43	11.61	49.61
	F-test	S	S	S
	SEm±	1.42	0.37	1.05
	CD (P=0.05)	4.26	1.12	3.17

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

Sl. No.	Rice hybrids	Panicle length	Filled grains /panicle	Grain yield /hill()
1	R-218	28.41	219.50	22.87
2	R-242	24.33	208.17	25.19
3	R-248	26.67	251.00	29.01
4	R-256	28.00	176.33	21.24
5	R-300	28.33	236.17	24.98
6	R-305	24.67	225.00	27.90
7	R-311	24.67	185.17	22.14
8	R-315	21.33	244.50	25.21
9	R-400	22.45	201.76	23.59
10	R-405	25.68	217.43	27.18
11	R-410	22.34	165.87	29.13
12	R-458	23.59	158.34	25.23
13	R-462	27.41	194.56	26.86
14	R-504	29.00	256.17	19.03
15	R-510	22.56	245.00	24.15
16	R-600	20.33	156.00	26.10
17	R-603	26.67	180.33	21.21
18	R-605	24.89	156.17	25.52
19	R-607	22.56	223.50	22.30
20	R-610	27.45	233.24	22.94
	F-test	S	S	S
	SEm±	0.34	6.71	1.01
	CD (P=0.05)	0.89	20.13	3.05

3.2 Yield Parameters (Table 2)

3.2.1 Panicle Length (cm)

The maximum panicle length (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 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. [6].

3.2.2 Filled Grains/Panicle

Significanty higher 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. Probably hybrid rice produces long roots and broad leaves that enable them to take up more nutrients and produce more grains especially during the grain-filling stage of the panicle development. Similar results have also been reported by Bhuiyan et al. [7].

3.2.3 Grain Yield/Hill(g)

The data showed the significantly highest grain yield/hill was observed in R-410 (29.13 g/hill). However, R-248 (29.10 g/hill), 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 statistically at par with R-410. Grain yield per hill 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. The short duration high yielding hybrid varieties having the potential to produce maximum grain yield then other varieties. Better growth attribute of hybrid varieties generates higher grain yield. The results are found to be similar with Ranjitha et al. [8].

4. DISCUSSION

Among the various rice hybrids evaluated, hybrid R-504 exhibited noteworthy performance in several growth and yield parameters. According to the findings by Padmavathi [9], it shows that hybrid rice has the ability of utilizing more nitrogen through the expression of better growth brought by the beneficial effect on nutrient uptake and physiological growth which increase the growth and yield. Sadimantara et al. [10] revealed that the variables observed were vegetative character and generative character including grain yield. Data on various growth and yield characteristics revealed there were growth

and yield characteristics different among breeding lines of local upland rice. The exceptional performance of hybrid R-504 in multiple growth and yield parameters underscores its suitability for cultivation in the agro-climatic conditions of Prayagraj, Uttar Pradesh. The significant improvements observed in plant height, tiller count, and yield attributes hold potential for enhancing rice production in the region.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 et al*.* [11]. The results align with previous studies that emphasize the importance of selecting suitable hybrid varieties based on local conditions for optimal outcomes.

5. CONCLUSION

On the basis of findings from the experiment hybrid R 504 was the best for obtaining more productivity and was also economically feasible. The research sheds light on the agronomic evaluation of rice hybrids under the agro-climatic conditions of Prayagraj, Uttar Pradesh. Hybrid R-504 emerges as a promising variety, displaying remarkable growth and yield attributes. These findings contribute to the knowledge base for rice cultivation in the region, offering insights that can guide farmers toward improved practices and higher yields.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Yadav P, Rangare NR, Anurag JP, Chaurasia AK. Quantitative analysis of rice (*Oryza sativa* L.) in Prayagraj Agro Climate Zone. Journal of Rice Research. 2004; 3(1).
2. Lin YH, Narendra K. A new error model for adaptive systems. IEEE Transactions on Automatic Control. 1980 Jun;25(3):585-587.
3. Bahure GK, Mahadkar UV, Raut SD, Doadke SB, Broundkar MM, Chavan AS, Dhekale JS. Agronomic assessment of different rice hybrids for sustainable production through agronomic manipulation under high rainfall conditions of Konkan. International Journal of Chemical Studies. 2019;7(6):715-719.
4. Wang Y, Ren T, Lu JW, Ming R, Li PF, Saddam H, Cong RH, Li XK. Heterogeneity in rice tillers yield associated with tillers formation and nitrogen fertilizer. Agronomy Journal. 2016;108:1717–1725.
5. Kumar SN. Evaluate the establishment techniques on growth and yield of rice, Agricultural Research Communication Centre, Agriculture Science Digest. 2016; 36(2):110- 113.
6. Rahman MM, Islam MT, Faruq AN, Akhtar N, Ora N, Uddin MM. Evaluation of Some Cultivated Hybrid Boro Rice Varieties against BLB, ShB and ALS Diseases under Natural Epiphytic Conditions Middle-East. Journal of Scientific Research. 2013;15(1):146-151.
7. Bhuiyan HS, Zahan A, Khatun H, Iqbal M, Alam F, Manir R. Yield performance of newly developed test crossed hybrid rice variety. International Journal of Agronomy and Agricultural Research. 2014;5(4):48-54.
8. Sri Ranjitha P, Mahender Kumar R, Jayasree G. Evaluation 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.
9. Padmavathi P. 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; 1997.
10. Sadimantara GR, Nuraida W, Suliartini NWS, Muhidin. Evaluation of some new plant type of upland rice (*Oryza sativa* L.) lines derived from cross breeding for the growth and yield characteristics. IOP Conf. Series: Earth and Environmental Science. 2018;157:012048.

11. Bozorgi HR, Faraji A, Danesh RK, Keshovarz A, Azarpour E, Tarighi F. Effect of plant density on yield and yield components of rice. World Applied Science Journal. 2011;12(11):2053-2057.

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