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Evaluation of rice (*Oryza sativa* L.) hybrids on growth and yield under agro-climatic conditions of Prayagraj, U.P.

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Abstract
A field experiment was conducted during *kharif* season of 2021 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, and Prayagraj (U.P.) India. The soil of experimental field was sandy loam in texture, nearly neutral in soil reaction (pH 7.8), low in organic carbon (0.35%), available N (243 kg/ha), available P_2O_5 (20.10 kg/ha) and available K_2O (105.0 kg/ha). The experiment was carried out to find the performance of 10 hybrids, which laid out in Randomized Block Design (RBD) with three replications. To find the performance of 10 Rice hybrids. The result of experimentation revealed that the Rice hybrid UR-24 recorded significantly higher growth attributes *viz.* plant height (114.37 cm), number of tillers/hill (14.20 no.), plant dry weight/plant (53.33 g), CGR (23.50 g/m^2/day**),** yield attributes *viz.*, effective tillers/m^2 (370 no.), panicle length (28.33 cm), test weight (26.48 g), and yields *viz.*, grain yield per hill (28.37 g), grain yield (6.34 t/ha), straw yield (12.26 t/ha). The highest gross return (₹ 176172.00/ha), net return (₹ 122126.00/ha) and benefit-cost ratio (2.25) were observed in hybrid UR-24 compared with other hybrid.

Keywords: Hybrid rice, varietal response, yield, *Oryza sativa* L.

Introduction
Rice (*Oryza sativa* L.) is considered as one of the most important staple cereals in the world and it is the main source of carbohydrates for nearly one half of the world population. However, 90% of rice is produced and consumed in Asia. It contributes 43% of gross cropped area of the country, 46% of total cereal production and second in rice production after China. The genetic classification of rice plant belongs to genus *Oryza* and family Gramineae (poaceae). The genus includes 24 species of which 22 are wild and 2 are cultivated *i.e. Oryza sativa* L. and *Oryza glaberimma* are cultivated. All species are cultivated in Asia, America and Europe continents. India has 44.2 million ha area with average productivity of 2.3 tonnes/ha and production of 118.87 million tonnes. (Directorate of Economics and Statistics 2016). In Uttar Pradesh 5.9 million ha with an average productivity of 2447 kg/ha and production of 14.63 million tonnes (Agriculture Statistics 2016). The current global population of 7.55 billion is expected to reach 8.1 billion by 2025 and 9.6 billion by 2050 (Department of Economics and Social Affairs -2018). Globally, rice is now cultivated on 159 million hectares with the annual production of around 748 million tonnes and average productivity of 4.68 tonnes/ha (AFO, 2016-2017). Rice contains 80% carbohydrates, 7-8% protein, the amino acid profile shows that it is rich in glutamic acid and aspartic acid, and also rich in lysine (3.8%), 3% fibre, iron 1.0 mg and Zinc 0.5 mg (Juliano *et al*. 1985) [8]. During the first decades of the release of rice hybrids for commercial cultivation, the development and spread of the technology was not as rapid as expected due to many reasons like low level of heterosis, poor grain and cooking quality, susceptibility of hybrids to the pests and diseases and problems in seed production and delivery etc. (Ou, 1985; Zhang *et al*. 1998, Chen *et al*. 2001) [3]. Hybrids of rice possessed a prominent role in enhancing the production and quality of rice, which is used for feed and industrial purposes. Hybrid rice cultivation is economically viable if management level is above 60%. Hybrids are short duration with resistance to major pests and diseases, non-lodging, they adapt better to stress and different climatic conditions and has longer shelf life Around 3 million hectares out of 43 million hectares under rice cultivation are hybrids. Because the population is growing, there is an urgent need to provide high yielding rice varieties, therefore, rice hybrids breaks yield barriers, yielding 15- 20% more.

Materials and Methods

A field experiment was conducted during *kharif* season of 2021 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, U.P, India. The soil of the experimental field was sandy loam in texture, nearly neutral in soil reaction (pH 7.8), medium in organic carbon (0.35%), medium in available nitrogen (243.0 kg/ha), low in available phosphorous (20.10 kg/ha) and medium in available potash (105.0 kg/ha). The experiment was laid out in Randomized Block Design (RBD) and replicated thrice. The experiment comprising of ten hybrids, *viz.*, T_1: UR-21, T_2: UR-22, T_3: UR-23, T_4: UR-24, T_5: UR-25, T_6: UR-26, T_7: UR-27, T_8: UR-28, T_9: UR-29, T_{10}: UR-30 observation regarding growth, yield attributes and economics was recorded during the field experiment.

Result and Discussion

Evaluation on Growth

The recorded and analysed data pertaining to growth parameters indicated that significantly higher plant height (114.37 cm), number of tillers per hill (14.20), and plant dry weight per hill (53.33) were recorded in rice hybrid UM-24.

Genetic makeup of the variety is a huge contributing factor which have been reported by Haque *et al.* (2015) [7]. 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. 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) [10].

Evaluation on Yield and yield attributes

The Hybrid UR-24 was recorded with significantly higher yield attributes *viz*. number of tillers (370 tillers/m^2), panicle length per hill (28.33 cm), test weight per hill (26.48 g), grain yield per hill (28.37 g), grain yield (6.34 t/ha) and straw yield (12.26 t/ha) harvest index (42.49%).

Increases in yield attributes such as effective tillers per m^2, panicle length (cm), test weight (g), grain yield per hill (g), grain yield (t/ha), straw yield (t/ha) and harvest index (%) have resulted in an increase in grain yield as a result of different genetic makeup. Similar findings were recorded by Meena *et al*. (2016) and Khan *et al*. (2018) [11].

Table 1: Performance on Growth Attributes of Rice Hybrids under Agro-climatic Conditions of Prayagraj, Uttar Pradesh

Hybrids	Plant height (cm)	Tillers/hill (No.)	Dry weight (g)
UR-21	104.52	10.27	50.21
UR-22	111.34	13.03	51.63
UR-23	110.78	12.07	49.86
UR-24	114.37	14.20	53.33
UR-25	111.29	10.38	49.21
UR-26	113.84	12.07	52.74
UR-27	105.63	13.57	50.27
UR-28	106.60	13.33	51.43
UR-29	112.21	13.87	46.91
UR-30	105.58	11.76	48.04
CD (P=0.05)	2.16	1.43	2.54

Table 2: Performance on yield attributes of rice hybrids under agro-climatic conditions of Prayagraj, Uttar Pradesh

Hybrids	Effective Tillers/m^2	Panicle Length	Test weight	Grain yield/Hill	Grain Yield (t/ha)	Straw Yield (t/ha)	Harvest Index
UR-21	249.67	24.33	22.06	26.42	5.51	10.45	37.44
UR-22	319.00	26.67	24.32	22.18	4.78	9.83	38.27
UR-23	298.33	23.00	22.67	24.47	5.49	11.87	36.53
UR-24	370.00	28.33	26.45	28.37	6.34	12.26	40.63
UR-25	240.33	24.67	25.87	26.10	4.25	10.03	37.27
UR-26	248.33	25.41	20.60	23.39	5.45	9.93	39.43
UR-27	349.67	21.33	18.34	18.27	5.86	11.03	36.50
UR-28	308.67	23.45	20.87	20.45	5.65	10.13	38.48
UR-29	323.00	25.68	22.06	27.65	6.14	11.23	35.27
UR-30	2.67	22.34	24.32	22.18	4.25	9.76	39.48
CD (P=0.05)	21.00	1.91	1.45	12.37	0.51	1.14	2.56

Conclusion

Based on the findings of this field experiment it is concluded that among the rice hybrids, UR-24 rice hybrid was found more adaptive, productive and profitable when compared to other rice hybrids under agro-climatic conditions of Prayagraj, U.P.

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