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

**Bandi Neena, Vikram Singh, Shruti Grace George, Vivek and Dwaram Mrudula**

### Abstract

A field experiment was conducted during kharif season of 2021 at Crop Research Farm, Department of The field experiment was conducted during *kharif* season of 2021 at Crop Research Farm Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.). The experiment was carried out to find the performance of 10 hybrids, which laid out in Randomized Block Design (RBD) & replicated thrice. The soil of experimental plot was sandy loam in texture, nearly neutral in soil reaction (PH 7.2), low in organic carbon (0.35%), available N (108.0 kg/ha), available p (22.5 kg/ha), available k (280.0 kg/ha). The hybrid UR-44 effect was observed in Rice. The experiment findings revealed that the growth parameters *viz.* number of tillers per hill (13.01) at 90 DAT, dry weight (59.92 g) at 90 DAT and CGR (49.77 g/m<sup>2</sup>/day) was recorded superior in rice hybrid UR-44. The yield parameters and yield *viz.* effective tillers/m<sup>2</sup> (400.33), number of grains per panicle (253.96), test weight (21.21 g), grain yield (6.99 t/ha) and straw yield (13.78 t/ha) was recorded superior in rice hybrid UR-44.

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

### Introduction

Rice is one of the most important food crops and feeds more than 60 percent population of India. Rice has been cultivated in China since ancient times and was introduced to India before the time of the Greeks. Cultivation has been carried into all regions having the necessary warmth and abundant moisture favourable to its growth, mainly subtropical rather than hot or cold. The rice is cultivated on the largest areas in India. In India 44.2 million ha area with an average productivity of 2.3 tonnes/ha and production of million tonnes (Directorate of economics and statistics, 2016-2017). 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 crop is grown in a diverse geographical and climatic conditions ranging from a below sea level in Kuttanad (Kerala) to high altitude in Kashmir valley. Rice is cultivated in a hydrology rang of moisture stress upland condition to waterlogged ecology. Hybrid rice accounts for more than half of the area under the crop and has contributed significantly to yield and output growth even after, relocation of land to other agriculture and non-agriculture uses. The nutrient content of rice are 80% carbohydrates, 7-8% protein. 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-2017). With the increasing popularity of hybrid among the Indian farmers it is necessary to develop appropriate cultivation practices if the full genetic potential is to be exploited. Growing of hybrid rice is a complex process and especially agronomic management of hybrid rice differs considerable from that of conventional varieties.

### Materials and Methods

A field experiment was conducted during *kharif* season of 2021 at the Crop Research farm, Department of Agronomy, Naini Agriculture Institute, Sam Higginbottom university of Agriculture, Technology and sciences (SHUATS), Prayagraj, (U.P.) which is located at 25<sup>o</sup> 24' 42" N latitude, 81<sup>o</sup> 50' 56" E longitude and 98 m altitude above the mean sea level (MSL) on sandy loam soil, having moderately basic pH (7.2), organic carbon (0.35%), available N (108.0 kg/ha), P (22.5 kg/ha), K (280.0 kg/ha), EC (0.14 dSm<sup>-1</sup>), S (16.8.00 ppm), and Zn (0.51 ppm). The climate is characterized by the alternate hot rainy season from late June to early September with mean temperature of 38 °C.

The experiment was laid down in randomized block design (RBD) with hybrids and 3 replications. Twenty-five days old seedlings were transplanted to main field conventionally at a spacing of 20 x 10 cm. The crop was fertilized with recommended dose of NPK 120:60:60 kg ha<sup>-1</sup> was applied. The (100%) full dose phosphorus and potassium whereas (50%) of N was applied at the time of planting as basal dose and the remaining N was applied in two equal split doses as top dressing at active (Tillering & Panicle initiation stage) respectively. Similarly, ZnSO<sub>4</sub> was applied as basal dose at the

rate of 25 kg ha<sup>-1</sup> for correction of zinc and Sulphur deficiency. Irrigation was scheduled at 10-12 days interval as flooding; However other normal cultural practices were followed timely as; weeding at 30 DAT & 45 DAT. One quadrat was harvested in every plot for the determination of results and data was subjected to statistical analysis separately by using analysis of variance technique. The difference among hybrid means was compared by using least significant difference test at 5% probability levels.

**Table 1:** Evaluation of rice (*Oryza sativa* L.) hybrids on growth attributes

Hybrid	Plant height(cm)	Number of tillers /hill (No.)	Dry weight/(g/plant)	CGR (g/m <sup>2</sup> /day)	RGR (g/g/day)	50% Flowering	Days to maturity
UR-35	101.73	10.02	49.35	47.01	0.0357	61.33	88.27
UR-36	113.97	12.25	58.93	49.60	0.0483	57.36	86.81
UR-37	108.77	10.60	53.04	46.67	0.0385	74.66	90.37
UR-38	104.74	10.69	53.91	45.28	0.0341	67.07	89.59
UR-39	109.82	10.66	54.02	47.90	0.0406	80.77	88.14
UR-40	105.74	10.97	53.56	45.58	0.0378	64.08	85.79
UR-41	104.66	11.34	53.33	45.14	0.0405	59.63	90.71
UR-42	104.11	11.26	53.40	47.13	0.0378	64.70	87.08
UR-43	101.39	11.54	54.29	46.26	0.0347	71.89	97.22
UR-44	110.81	13.01	59.92	49.77	0.0504	65.11	111.77
F test	S	S	S	S	NS	S	S
S.Em (±)	2.25	0.54	1.02	0.93	0.01	1.24	0.99
CD (0.05)	6.7	1.61	3.04	2.78	-	3.25	1.98

**Table 2:** Evaluation of rice (*Oryza sativa* L.) hybrids on yield attributes at harvest

Hybrids	Effective Tillers/m <sup>2</sup> (No.)	Panicle length (cm)	Filled grain/panicle (No.)	Unfilled grain/panicle (No.)	Test weight (g)	Grain yield (g/hill)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)
UR-35	315.46	22.58	118.14	50.81	17.62	18.44	5.34	9.89	35.05
UR-36	391.25	29.66	244.74	33.87	21.19	23.91	6.85	12.37	37.79
UR-37	329.83	28.21	184.01	38.88	19.54	21.21	6.02	12.01	33.39
UR-38	365.67	24.28	191.35	50.36	17.83	21.08	6.32	12.26	34.02
UR-39	365.00	26.10	206.07	47.92	18.22	20.08	6.67	11.32	37.08
UR-40	326.50	28.51	237.37	48.94	17.82	18.96	6.09	12.06	33.55
UR-41	330.83	23.36	186.27	38.63	19.65	18.51	5.98	12.29	32.59
UR-42	321.17	25.53	194.04	49.47	19.00	21.11	6.78	11.24	37.62
UR-43	334.83	23.73	115.21	37.09	19.54	18.54	6.45	11.19	36.56
UR-44	400.33	29.34	253.96	31.91	21.21	24.66	6.91	12.95	34.79
F test	S	S	S	S	S	S	S	S	NS
S.Em (±)	14.96	0.67	1.44	2.12	0.83	1.08	0.17	0.37	1.34
CD (0.05)	44.47	1.98	4.3	6.32	2.49	3.21	0.51	1.1	3.98

## Results and Discussion

### Growth attributes

**Plant height (cm):** Significantly maximum plant height (113.37 cm) was recorded in hybrid (UR-36) at 90 DAT. However, UR-44 (110.81 cm) and UR-39 (109.82 cm) were statistically at par with hybrid (UR-36). Increase in plant height may also be due to synchronized availability of essential plants nutrients to the crop especially nitrogen for a longer period during its growth stages Deshpande and Devasenpathy 2011. Also, 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.* (2019) <sup>[1]</sup>.

### Number of tillers/hills

At 90 DAT significantly maximum number of tillers per hill (13.01) was recorded in rice hybrid UR-44 However, UR-36 (12.25) and UR-43 (11.54) which were statistically at par with

UR-44. The significant differences could due to the variation in genetic make-up of the high yielding varieties (variety KHR-27) that might be influenced by heredity. This was consistent with Chowdhery *et al.* (1993).

**Plant dry weight (g):** Maximum plant dry weight (59.92 g) was observed in hybrid UR-44 at 90 DAT. However, UR-36 (58.93 g), were statistically at par with hybrid (UR-44). 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) <sup>[6]</sup>. The other 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.* (2011) <sup>[3]</sup>.

### Crop Growth Rate (g/m<sup>2</sup>/day)

At 45-60 DAT maximum crop growth rate (49.77 g/m<sup>2</sup>/day) was recorded in rice hybrid UR-44. However, UR-36 (49.60 g/m<sup>2</sup>/day) which is statistically at par with UR-44. The probable reason for maximum crop growth rate may be the availability of ample supply of nutrients especially nitrogen through foliar feeding may be the reason for the better performance with regard to CGR. Similar results have also been reported by Yadav *et al.* (2004) <sup>[11]</sup>.

### Relative Growth Rate (g/g/day)

Relative growth rate of rice recorded at different intervals was found non-significant difference among the hybrids. At 45-60 DAT the maximum relative growth rate was observed in UR-44 (0.050 g/g/day) while minimum was observed in UR-38 (0.0373 g/g/day). There is no significant difference among Rice hybrids. The probable reason for the percentage decrease RGR in various hybrids and showing non-significant difference among the Rice hybrid is due to prevalence of low temperature coupled with less humidity at the growth and reproductive stage especially during flag leaf stage. Similar findings are also reported by Singh *et al.* (2019) <sup>[10]</sup>.

### Days to 50% flowering and days to maturity

Minimum days to 50% flowering (57.36 DAT) were recorded in UR-36 and days to maturity (85.79 DAT) was recorded in UR-40. Probably heritability is a measure of extent of phenotypic variation caused by the action of genes. In the present study high heritability was observed for traits *viz.*, Days to 50% flowering and days to maturity. These results are reported by Haque *et al.* 2015 <sup>[5]</sup>. Prevalence of low temperature coupled with less humidity at flag leaf stage which might be reduced in duration as compare to earlier planting. The availability of ample supply of nutrients especially nitrogen through foliar feeding may be the reason for the better performance with regard to Days to 50% flowering and days to maturity. Similar results have been reported by Yadav *et al.*, 2004 <sup>[11]</sup>.

### Yield Attributes

The yield attributes of hybrid rice, *viz.* highest number of effective tillers hill<sup>-1</sup> (400.33) were recorded in UR-44, panicle length (29.66 cm), number filled grains panicle (253.96), number unfilled grains panicle (50.81), test weight (21.21 g), grain yield (24.66 g/hill), grain yield (6.99 t/ha) and straw yield (13.78 t/ha) were recorded highest in rice hybrid UR-44. The yield attributes are significantly influenced by genetic potential of the variety and also may be due to synchronized availability of essential plants nutrients to the crop especially NPK for a longer period during its growth & reproductive stages. Increased number of effective tillers hill<sup>-1</sup> may have helped in increasing the photosynthetic area for photosynthesis in plant. In several rice cultivars, the effect on number of effective tillers production at all the growth stages was significant, the number increased till 75 DAT followed by a decline to harvest due to death of some undeveloped tillers, thus tillers development was found to be more in hybrid varieties apart from local variety reported by Akram *et al.*, 2007. The higher grains per panicle might be due to optimum utilization of the nutrient. Another reason of the high grains per panicle of variety is due to better growth attribute resulting to produce higher grains panicle<sup>-1</sup> reported by Ranjitha *et al.*, 2013 <sup>[9]</sup>.

### Conclusion

In conclusion, from the data pertaining to the different hybrids, it may be indicated that by using hybrid UR-44 higher grain yield and monetary benefits can be realized over local cultivars. Hybrid UR-44 was found to be the best for obtaining highest grain yield, Straw yield. Since the findings are based on the research done in one season it may be repeated for conformation.

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