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**Kotla Meghana**

M.Sc. Scholar, Department of  
Agronomy, SHUATS, Prayagraj,  
Uttar Pradesh, India

**Vikram Singh**

Associate Professor, Department  
of Agronomy, SHUATS,  
Prayagraj, Uttar Pradesh, India

**Shruti Grace George**

Ph.D., Research Scholar,  
Department of Agronomy,  
SHUATS, Prayagraj, Uttar  
Pradesh, India

## Performance of rice (*Oryza sativa* L.) hybrids on growth, yield and economics under agro-climatic conditions of prayagraj

**Kotla Meghana, Vikram Singh and Shruti Grace George**

### Abstract

A field experiment was conducted during *kharif* season of 2021 at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.) India. The soil of experimental plot was sandy loamy in texture, nearly neutral in soil reaction (Ph 7.2), low in organic carbon (0.48%), available N (108.0 kg/ha), available P (22.5 kg/ha) and available K (280.0 kg/ha). The experiment was carried out to find the performance of 15 hybrids, which laid out in Randomized Block Design (RBD) & replicated thrice. The experiment finding revealed that the Rice hybrid UR-4 performed better than other treatment *viz.* Maximum number of tillers/hill (11.16), more number of tillers/m<sup>2</sup> (393.50), maximum Plant dry weight (53.97g), Crop Growth Rate (56.42g/m<sup>2</sup>/day) and Grain yield (9.41 t/ha), Straw yield (14.24 t/ha) and Harvest Index (40.20%) However the maximum plant height (109.63 cm) were recorded in UR-4. The Panicle length (33.41 cm) and Filled grains/ panicle (176.46 No.) was recorded in UR-5 and minimum days to maturity were recorded in UR- 2. Highest gross return (INR 192860.67/ha), net return (INR 130553.67/ha) and benefit-cost ratio (2.10) were observed in hybrid UR-4 compared with another hybrid.

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

### Introduction

Rice (*Oryza sativa* L.) is one of the most important staple food grain Crop of the world, which constitute the principle food for 60 per cent of the world's population and 2/3rd of Indian population. Rice is intensively grown in 88 countries across the world on an area about 160.01 million hectares with annual production of 465.48 million tonnes. More than 90 per cent of the world's rice is produced and consumed in Asia where it is an integral part of culture and tradition. Rice, it is believed, is associated with wet, humid climate, though it is not a tropical plant. It is probably a descendent of wild grass that was most likely cultivated in the foothills of the far Eastern Himalayas.

Rice based agriculture is the largest source of livelihood of majority of rural mass in Konkan, which lies along the Arabian seacoast at the extreme western part of the Indian peninsula. Among the wet season crops in Konkan, rice alone occupies an area about 3.83 lakh hectares with production of 10.59 lakh tonnes and per hectare yield of 2.76 tonnes. In Konkan region of Maharashtra about 80 per cent of rice crop is a low land, spreading over a 40-60 km in width and stretching to a length of 700 km all along the west-coast. But the yields are highly variable due to aberration in weather like late onset of monsoon, heavy continuous rains, intermittent dry spell and heavy rains at the time of harvesting, etc.

In India, the adoption of hybrid rice in the initial years has been slow but steady. Twenty six out of 59 hybrids were released during the last five years, indicating the breeding efforts from both public and private sectors for the development of high yielding and durable hybrids. The popularity of hybrid rice among rice farmers of Uttar Pradesh, Bihar, Jharkhand, Punjab, Haryana, Maharashtra, Karnataka, Madhya Pradesh and Chhattisgarh is on increasing trend.

### 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° 24' 42" N latitude, 81° 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

**Corresponding Author:**

**Kotla Meghana**

M.Sc. Scholar, Department of  
Agronomy, SHUATS, Prayagraj,  
Uttar Pradesh, India

(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.

## Results and Discussions

### Growth Attributes

#### Plant height (cm)

Significantly maximum plant height (109.63cm) was recorded in hybrid (UR-4) at 90 DAT. However, UR-10 (105.37cm) is statistically at par with hybrid (UR-4). 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<sup>[3]</sup>. 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 (11.16) was recorded in rice hybrid UR-4 However, UR-10(10.99), UR-9(10.94) and UR-2(10.93) which were statistically at par with UR-4. 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 (53.97 g) was observed in hybrid UR-4 at 90 DAT. However, UR-2 (50.13 g), were statistically at par with hybrid (UR-4). 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>[5]</sup>.

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

Minimum days to 50% flowering (53.32 DAT) were recorded in UR-5 and days to maturity (84.34 DAT) was recorded in UR-2. 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>[4]</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>[8]</sup>.

### Yield and yield attributes

The yield attributes of hybrid rice, *viz.* highest number of effective tillers hill<sup>-1</sup> (393.50) were recorded in UR-4, panicle length (33.41 cm), number filled grains panicle (176.46) were recorded in UR-5, number unfilled grains panicle (49.44) recorded in UR-7 test weight (21.64 g), grain yield (23.84 g/hill), grain yield (9.41 t/ha) and straw yield (14.24 t/ha), Harvest index (41.20) were recorded highest in rice hybrid UR-4. 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.

### Summary

Plant height (109.63cm), Number of tillers/hill (11.16), plant dry weight (53.97 g), Effective tillers/m<sup>2</sup> (393.50), grain yield (23.84g/hill), grain yield (9.41t/ha), straw yield (14.24t/ha) and harvest index (41.20%) was observed highest on rice hybrid UR-4.

At the same time higher gross returns (1,92,860.67 INR/ha), net return (1,30,553.67 INR/ha) and benefit cost ratio (2.10) was obtained with the rice hybrid UR-4.

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

Hybrid	Plant height(cm)	Number of tillers/hill (No.)	Dry weight/(g/plant)	50% Flowering	Days to maturity
UR-1	96.41	10.67	51.02	67.65	106.33
UR-2	98.47	10.93	50.13	78.00	84.34
UR-3	98.47	10.62	52.01	75.00	108.32
UR-4	109.63	11.16	53.97	62.65	84.67
UR-5	98.26	10.93	50.04	53.32	84.67
UR-6	90.45	11.14	51.02	74.33	85.33

UR-7	90.04	10.14	48.27	65.02	92.00
UR-8	101.3	11.14	49.18	56.01	90.02
UR-9	103.56	10.94	51.48	62.66	85.67
UR-10	105.37	10.99	50.08	72.33	90.00
F test	S	S	S	S	S
S.Em ( $\pm$ )	0.65	0.15	0.19	0.27	0.24
CD (0.05)	1.89	0.44	0.56	0.78	0.64

**Table 2:** Performance 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-1	375.50	28.19	98.24	46.22	19.30	21.84	8.74	13.20	39.84
UR-2	326.33	26.98	150.06	41.55	17.31	18.42	7.35	11.83	38.32
UR-3	383.17	28.12	161.17	31.57	20.31	19.04	7.65	12.12	38.69
UR-4	393.50	27.98	164.17	41.35	22.30	23.84	9.40	14.24	41.20
UR-5	351.00	33.41	176.46	39.08	18.34	23.39	9.37	13.72	39.76
UR-6	369.67	28.54	115.03	28.25	21.64	21.38	8.51	13.04	39.49
UR-7	351.77	25.76	129.06	49.44	18.33	20.07	8.08	12.56	39.15
UR-8	382.67	27.59	146.89	38.98	17.67	23.04	9.20	13.70	40.17
UR-9	341.00	29.02	152.21	34.65	15.69	22.74	9.06	13.56	40.05
UR-10	376.83	28.40	161.10	30.42	19.01	23.38	9.34	13.85	40.12
F test	NS	S	S	S	S	S	S	S	S
S.Em ( $\pm$ )	16.87	0.31	0.49	0.44	0.62	0.41	0.32	0.38	0.36
CD (00.005)	-	0.780	1.41	1.290	1.81	1.19	0.93	1.10	1.05

## Conclusion

It is concluded that in rice hybrid UR-4 performed better in growth and yield attributes which was found to be more productive and economically viable. These findings are based on one season. Therefore, further trail may be required for further confirmation.

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