



# Assessment of Rice Hybrids on Growth, Yield and Economics under Different Agro-climatic Conditions in India

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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

The field experimental trial was carried out during *kharif* season 2021 at CRF SHUATS, Prayagraj, U.P. Experiment was laid out in statistically Randomized Block Design (RBD). The soil of experimental field was sandy loam in texture, nearly neutral in soil reaction (pH 7.2), low in organic carbon (0.35%), available nitrogen (108 kg/ha), P<sub>2</sub>O<sub>5</sub> (22.15 kg/ha) and available K<sub>2</sub>O (280 kg/ha). The experimental result revealed that the hybrid UR-16 has recorded significantly higher in growth and yield attributes. Growth attributes viz., Plant height (120.57 cm), Number of tillers/hill (15.07), Maximum dry weight (55.91 g). Yield attributes viz., Panicle length (28.41 cm), Test weight (26.48 g) and yields viz., Grain yield per hill (28.37 g), Grain yield (6.85 t/ha), Straw yield (12.96 t/ha) and the same hybrid has also obtained maximum gross returns (589860.00 INR/ha), net returns (95174.00 INR/ha), and B:C ratio (1.76).

**Keywords:** Hybrid rice; varietal response; yield; kharif; randomized block design.

## 1. INTRODUCTION

Rice is considered as one of the most important cereal food crop of the world as well as our continent. About 65% of Indian population depends on rice as a staple food. Rice belongs to genus *Oryza* and the family Gramineae (Poaceae). Mainly the genus *Oryza* contains 24 recognized species, out of which 22 are wild species and also there are two cultivated species in it, which are named as *O.sativa* and *O.glaberrima*. 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. 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. 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. An estimated requirement of the food grains by the year 2021 is 310.74 million tons. But an estimated 197 grams of rice was available per person for each day in our country in the year of 2021, therefore 100 grams of rice is recommended per person in a day.

Because of these now-a-days scientists doing research on hybrids to meet the requirements of the rice crop. Due to this there is an urgent need to provide high yielding rice varieties, therefore, rice hybrids breaks yield barriers, yielding 15-20% more. Mainly this crop cultivation in our country extends from 8 to 35°N latitude and from sea level to as high as 3000 meters. The average tolerance when coming to temperature in this crop is 21 to 37°C, and maximum tolerance is 40 to 42°C. Mostly manual transplanting of rice is practiced in south and south-east Asia. Rice production and productivity was positively improved with the introduction and cultivation of semi-dwarf, non-lodging, and fertilizer responsive high yielding varieties in the early seventies which lead to "Green Revolution" [1-3]. The yield production of high yielding varieties is planting in recent year to meet the demand of increasing population the present production level needs to be elevated up to 140

million tonnes by 2025 which is only possible by increasing the rice production by over 2 million tonnes per year in the coming decade [4,5]. Hybrid rice technology has provided farmers with higher yields, saved land for agricultural diversification and created more rural employment opportunities.

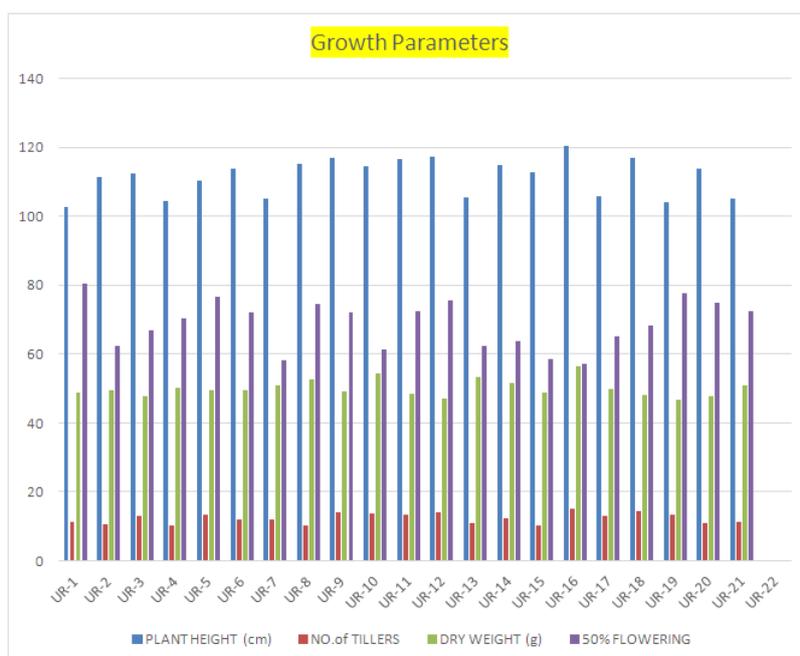
## 2. MATERIALS AND METHODS

A field experiment was carried out during *kharif* season of 2021 at the Crop Research farm, Department of Agronomy, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, U.P. The experiment comprising of twenty-two hybrids, viz., T<sub>1</sub>: UR-1, T<sub>2</sub>: UR-2, T<sub>3</sub>: UR-3, T<sub>4</sub>: UR-4, T<sub>5</sub>: UR-5, T<sub>6</sub>: UR-6, T<sub>7</sub>: UR-7, T<sub>8</sub>: UR-8, T<sub>9</sub>: UR-9, T<sub>10</sub>: UR-10, T<sub>11</sub>: UR-11, T<sub>12</sub>: UR-12, T<sub>13</sub>: UR-13, T<sub>14</sub>: UR14, T<sub>15</sub>: UR15, T<sub>16</sub>: UR16, T<sub>17</sub>: UR-17. T<sub>18</sub>: UR-18, T<sub>19</sub>: UR-19, T<sub>20</sub>: UR-20, T<sub>21</sub>: UR-21, T<sub>22</sub>: UR-22 observation regarding growth and yield attributes was recorded during the field experiment. The experiment site lies between 25-27° N latitude, 8.5°E Longitude and 98 meters altitude. It was laid out in Randomized Block Design with three replications. 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 kg/ha), low in available phosphorous (20.10 kg/ha) and medium in available potash (105 kg/ha) and with almost neutral pH. Rice hybrids were sown at a spacing of 20cm×10cm, the hybrids were supplied by UPCAR. The RDF i.e., 120 kg/ha Nitrogen, 60 kg/ha phosphorus and 60 kg/ha potassium. The observations on growth parameters were recorded from randomly selected five plants from each plot at various growth stages of crop. Yield parameters were recorded at harvesting stage in net plots. The difference among treatment means was compared by using least significant difference test at 5% probability levels using ANOVA. Economics were also calculated prevailing to market price.

## 3. RESULTS AND DISCUSSION

### 3.1 Growth Parameters

The recorded and analysed data pertaining to growth parameters indicated that significantly higher plant height (120.57 cm), number of tillers per hill (15.07) and plant dry weight per hill (56.32) were recorded in rice hybrid UR-16.



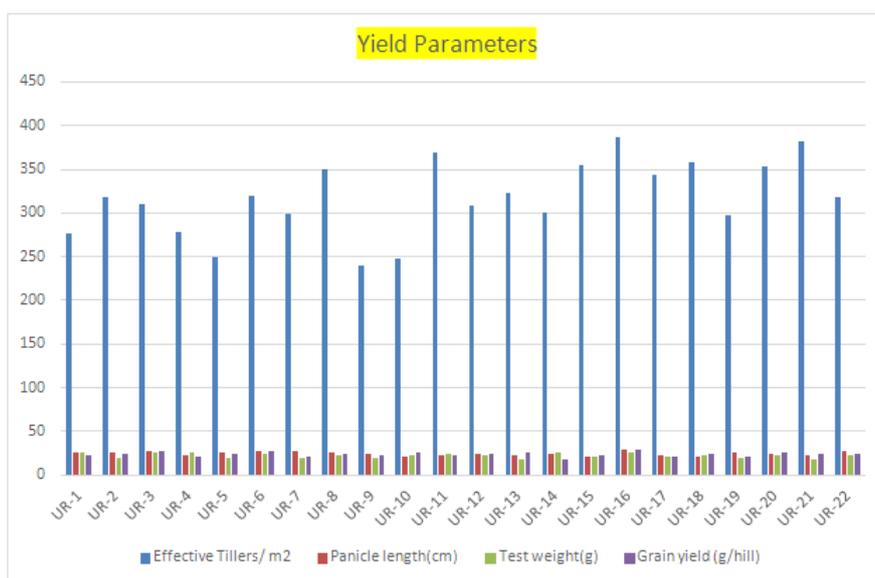
The variations in growth with respect to plant height, number of tillers per hill and plant dry weight among the hybrids may be attributed due to differences in genetic characterization of the individual, including rapid growth rates, tallness or shortness of species. Similar findings were recorded by Bozorgi et al. [6], Chamely et al. [7], Haque et al. [8].

### 3.2 Yield Parameters

The Hybrid UR-16 was recorded significantly higher yield attributes viz. number of tillers (387.33 tillers/m<sup>2</sup>), panicle length per hill (28.41

cm), test weight per hill (26.48 g), grain yield per hill (28.37 g), grain yield (6.85 t/ha), straw yield (12.96 t/ha) and harvest index (36.79%).

Increases in yield attributes such as effective tillers per m<sup>2</sup>, panicle length (cm), number of filled grains/panicle, number of unfilled grains/panicle, test weight(g), grain yield per hill (g), grain yield (t/ha), straw yield (t/ha) and harvest index (%) resulted in an increase in grain yield as a result of different genetics makeup. Similar findings were recorded by Meena et al. [9] and Khan et al. [10].



**Table 1. Growth parameters of rice hybrids under agroclimatic conditions of Prayagraj U.P.**

S.NO	Plant height (cm)	Number of tillers/hill (no.)	Plant dry weight/hill (g)	50% flowering
1	102.62	11.33	48.65	80.32
2	111.34	10.47	49.38	62.33
3	112.25	13.00	47.67	67.00
4	104.52	10.27	50.21	70.33
5	110.34	13.33	49.63	76.67
6	113.78	12.07	49.36	72.00
7	105.21	12.07	50.76	58.33
8	115.29	10.40	52.74	74.67
9	116.84	14.20	49.21	72.00
10	114.63	13.87	54.43	61.33
11	116.60	13.33	48.43	72.45
12	117.37	14.07	46.91	75.68
13	105.58	11.00	53.33	62.34
14	114.84	12.27	51.73	63.59
15	112.63	10.33	48.78	58.41
16	120.57	15.07	56.32	57.00
17	105.68	13.07	49.91	65.00
18	116.96	14.40	48.10	68.33
19	104.04	13.20	46.67	77.67
20	113.63	10.87	47.83	74.89
21	105.26	11.43	50.87	72.56
22	110.43	13.01	49.61	67.45

**Table 2. Yield parameters of rice hybrids under agroclimatic conditions of Prayagraj U.P.**

S.NO	Effective tillers/m <sup>2</sup> (No.)	Panicle length (cm)	Test weight (g)	Grain yield (g/hill)
1	276.33	25.54	26.45	22.11
2	317.67	26.33	19.59	24.43
3	309.67	27.00	25.65	28.25
4	278.67	23.33	25.58	20.48
5	249.67	25.67	19.99	24.22
6	319.00	27.00	24.30	27.14
7	298.33	27.33	20.29	21.38
8	349.67	25.67	22.61	24.45
9	240.33	23.67	20.08	22.83
10	248.33	20.33	22.06	26.42
11	370.00	23.45	24.32	22.18
12	308.67	24.68	22.67	24.47
13	323.00	23.34	18.34	26.10
14	300.00	24.59	25.87	18.27
15	354.67	20.32	20.60	23.39
16	387.33	28.41	26.48	28.37
17	343.67	22.56	20.87	20.45
18	358.67	20.33	22.54	24.76
19	297.33	26.67	20.08	21.54
20	353.00	24.89	22.06	25.34
21	381.43	22.56	18.48	24.67
22	318.67	27.45	22.67	24.83

### 3.3 Economics

Data related to economics was recorded highest by hybrid UR-16 with highest gross returns (589860 INR/ha), net returns (95174 INR/ha), B:C ratio (1.76).

### 4. CONCLUSION

Based on the findings of this field experiment it is concluded that among the rice hybrids, UR-16 rice hybrid was found more adaptive, productive and profitable when compared to other rice hybrids under agro-climatic conditions of Prayagraj.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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