ASSESSMENT OF RICE (*Oryza sativa* L.) HYBRIDS ON GROWTH AND YIELD UNDER AGRO-CLIMATIC CONDITIONS OF PRAYAGRAJ, U.P., INDIA

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.) to study the evaluation of rice (*Oryza sativa* L.) hybrids on growth, yield and economics under agro-climatic conditions of 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 experiment finding revealed that rice hybrid UR-34 performed better compared to other hybrids *i.e.* plant height (120.37 cm), tillers /hill (14.20 No.), plant dry weight (53.33 g/plant), grain yield (28.14 g/hill), grain yield (6.34 t/ha), straw yield (12.26 t/ha), and harvest index (40.63 %), were found significantly higher than other hybrids respectively.

Keywords: *hybrid rice*, *varietal response*, *yield*, (*Oryza sativa* L.), *yield attributes*

Introduction

Global demand for rice is rising with the population growth, increasing affluence and changing dietary habits. The UN/FAO forecasts that global food production will need to increase by over 40% by 2030 and 70% by 2050 (FAO, 2009). Thus, rice production in India as well as in several other Asian countries must be doubled by the year 2025 to meet the requirement of the increasing population. India is major rice growing country in world with an area of 43.79 million hectares, having production 112.91 million tonnes and productivity of 2.572 t/ha **(Directorate of Economics and Statistics 2017-2018).** In Uttar Pradesh 5.9 million ha and production 13.27 million tonnes with an average productivity of 2447 kg/ha and production of 14.63 million tonnes **(Agriculture Statistics 2016).** The nutrient contents of rice are 80% carbohydrates, 7-8% protein; the amino acid profile shows that it is rich in Glutamic acid and aspartic acid, highest quality cereal protein being rich in lysine (3.8%), 3% fiber, iron 1.0 mg and Zinc 0.5 mg **(Juliano *et al.*, 1985).** 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).**

Formatted: Font: Italic

Formatted: Font: Italic

Formatted: Font: Italic

Comment [BJ1]: Productive or total

Comment [BJ2]: Grain yield/hill

Comment [BJ3]: Not included in text

Comment [BJ4]: Mention test weight

Comment [BJ5]: Write about future usage with the research work carried out

Formatted: Font: Italic

Comment [BJ6]: Refer recent stats

Comment [BJ7]: Refer recent stats

Comment [BJ8]: Refer recent stats

Globally, rice is cultivated now 159 million hectares with annual production of around 748 million tonnes and average productivity of 4.6 tonnes/ha (**FAO, 2016-2017**). Rice production and productivity was significantly enhanced with the introduction and cultivation of semi-dwarf, fertilizer responsive and non-lodging high yielding varieties in the early seventies leading to the "Green Revolution". The yield level of high yielding varieties is planting in recent year to meet the demand of increasing population and to maintain this self sufficiency the present production level needs to be increased up to 140 million tonnes by 2025 which can be achieved only by increasing the rice production by over 2 million tonnes per year incoming decade. Hybrid rice technology has provided farmers with high yields, saved land for agricultural diversification and created rural employment opportunities. Among the limited options hybrid technology is the only prove technology currently available for stepping up rice production significantly, therefore the introduction of hybrids and popularization of their production technology is feasible and readily adoptable to achieve adoptable targeted population. Systematic, goal-oriented, and time-bound research on hybrid rice in India began in 1989 through a national network project. The project was strengthened further with funding from the United Nations Development Programme, Asian Development Bank, and the World Bank.

Comment [BJ9]: Refer recent stats

Materials and methods

The experiment was carried out during *kKharif* season of 2021 at Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, SHUATS, Prayagraj (U.P.) which is located at $25^0$24' 42" N latitude, 81^0 50' 56" E longitude and 98 m altitude above the mean sea level. This area is situated on the right side of the river Yamuna by the side of Prayagraj Rewa Road about 5 km away from the Prayagraj city. The soil samples were collected randomly from 0 to 15 cm depth from 5 spots of the experimental field just before layout of experiment. A representative homogenous composite sample was drawn by mixing all these soil samples together, which was analyzed to determine the physico-chemical properties of the soil. Chemical analysis of soil was done at pre-experiment stage of planting. Available phosphorous (22.5 kg/ha), available nitrogen (108.0 kg/ha), available potassium (280.0 kg/ha), organic carbon (0.48 %), pH (7.2), EC (0.38 ds/m). The seeds were provided by UPCAR, Lucknow. The germinability was checked before sowing the nursery. Nursery sowing was done on 12th June 2021 and transplanting was done on 5th July 2021. The experiment was laid down in randomized block

design (RBD) with 10 hybrids and 3 replications ~~and~~ to evaluate the hybrid rice under agro-climatic condition in Pprayagraj~~, variety provided by UPCAR, Lucknow~~. Twenty ~~two~~ three days old seedlings were transplanted to main field conventionally at a spacing of 20 x 10 cm. ~~The crop~~ R~~r~~ecommended dose ~~was~~ of fertilizer120-60-60 kg N-P-K/ha was applied and basal dose ~~of fertilizer~~ was applied just before last puddling, Half dose of nitrogen and full dose of phosphorus and potassium followed by two topdressings. Irrigation was scheduled at 6-8 days interval; however other normal cultural practices were followed timely as; weeding at 30 DAT & 45 DAT. In the experiment biometric observation were recorded at 15 days interval up to 90 DAT. Plant height of these plants were measured from the ground level up to the collar joint of rice plant and Number of tillers was counted from five random plants per hill~~s~~ of panicle. Moreover, grains from harvest area (1.0 m^2) were dried in sun, cleaned and weighed separately from each plot for calculating the grain yield in tones/ha. Straw from harvest area (1.0 m^2) was dried in sun, bundled, tagged and weighed separately from each plot for calculating the straw yield in tones/ha. Harvest index was calculated by using formula. The data was analyzed by the method of analysis of variance as described by Gomez and Gomez (1984). The level of significance used in "F" test was given at 5%.

Comment [BJ10]: Productive or total

Comment [BJ11]: Write the formula with reference

Results and Discussion

Growth attributes

Plant height (cm)

Plant height during the period of growth has shown significant due to various hybrids is presented in Table 1. At 90 DAT the highest plant height was observed in UR-32 (120.37 cm) which was significantly superior over rest of the hybrids except UR 30 (118.29 cm) and UR- 31 (117.84 cm) is statistically at par with UR-32. The reason for maximum plant height may be due to genetic makeup of the variety. Similar results have also been reported by Haque *et al.* (2015).

Tillers/hill (No.)

Comment [BJ12]: Productive or total

The results showed that tillers/hill was much influenced under various treatments at 90 DAT the highest tillers/hill was observed in UR-32 (14.20 tillers/hill) which was significantly superior over rest of the hybrids except UR-31(13.26 tillers/hill) and UR-33 (13.33 tillers/hill). The probable reason for high yielding varieties has high tillering capacity. Similar findings are also reported by Yadav *et al*, (2004).

Plant dry weight (g/plant)

The results presented in Table 1, ~~about~~ the analysis of variance indicated that the dry weight was significantly (P<0.05) affected by different hybrids. At 90 DAT the significantly highest dry weight was observed in UR-32 (53.33 g/plant). However, UR-30 (52.74 g/plant), UR-35 (52.43 g/plant) and UR-27 (51.63 g/plant) were statistically at par with UR-32. 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 hybrid which attained maximum growth, also accumulated higher dry matter similar result have also been reported by Senthil Kumar, N. (2016) .

Comment [BJ13]: Productive or total

Yield attributes

Test weight (g) ~~(g) /hill~~

The data showed that the significantly highest test weight was observed in UR-32 (24.32 g). However, UR-26 (24.30 g) and UR-28 (23.58 g) were statistically at par with UR-32. The results show that the adoption of 20 x 10 cm^2 spacing for rice transplanting resulted in heavier filled and healthy grains. Recorded higher test weight in hybrid (KHR-23). Similar results have been also reported by Haque *et al*, (2015)~~.~~.

Grain yield (t/ha)

During the period of investigation the data showed the highest grain yield was observed in UR-32 (6.34 t/ha). However, UR-29 (6.14 t/ha) was statistically at par with UR-32. The increased yield attributes might be due to increased growth and development parameters which ultimately resulted in increased grain. These results in the conformity with the work done by Vishwakarma (2015).

Straw yield (t/ha)

The results presented in Table 2.~~.~~ ~~And~~ the highest straw yield (t/ha) was observed in UR-32 (12.26 t/ha). However, UR-35 (11.23 t/ha), UR-28 (11.07 t/ha), in UR-26 (10.90 t/ha) and in UR-29 (10.76 t/ha) were statistically at par with UR-32. According to the findings by (Padmavathi, 1997) ~~[4] shows that~~ the capability of hybrid rice to utilize more nitrogen through the expression of better growth brought by the beneficial effect on nutrient uptake and physiological growth increase the straw yield.

Harvest index (%)

The data showed the harvest index was observed in UR-32 (36.33 %). However, UR-29 (36.08 %), UR-27 (35.91 %) and UR-31 (35.43 %) were statistically at par with UR-32. T~~t~~o mobilize and translocate the photosynthates to the sink~~.~~ **(Marri *et al.*, 2005)** found that harvest index negatively correlated with plant height, but positively correlated with grain number/panicle, grain number/plant, percentage spikelet fertility and yield/plant in rice

Table 1. Performance of rice hybrids on growth and yield attributes at 90 DAT.

Hybrids	Plant height (cm)	Tillers/hill (No.)	Plant dry weight (g/plant)
UR-26	104.52	10.27	50.21
UR-27	110.34	12.33	51.63
UR-28	113.78	12.37	49.36
UR-29	105.21	12.07	50.76
UR-30	118.29	10.40	52.74
UR-31	117.84	13.26	49.21
UR-32	120.37	14.20	53.33
UR-33	116.60	13.33	48.43
UR-34	116.63	11.04	46.91
UR-35	107.58	12.00	52.43
F-test	S	S	S
SEm±	21.05	0.43	1.02
CD (P = 0.05)	3.01	1.43	2.54

Comment [BJ14]: Productive or total

Table 2. Performance of rice hy-brids on yield attributes at harvest.

Hybrids	Test weight (g)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)
UR-26	23.58	5.43	10.9	33.25
UR-27	19.99	5.51	9.83	35.91
UR-28	24.3	5.49	11.07	33.15
UR-29	20.29	6.14	10.76	36.08
UR-30	22.61	4.25	10.23	29.76
UR-31	20.08	5.45	9.93	35.43
UR-32	24.32	6.34	12.26	36.33
UR-33	22.06	5.65	10.13	34.8
UR-34	22.67	5.56	10.03	33.51
UR-35	18.34	5.25	11.23	29.98
F-test	S	S	S	S
SEm±	0.24	0.12	0.3	0.89
CD (P = 0.05)	0.75	0.48	0.93	2.67

SUMMARY

The experiment findings revealed that maximum plant height (120.37 cm), number of tillers /hill (16.79 No.), plant dry weight (53.33 g/plant), ~~were recorded in UR-32,~~ test weight (24.32 g), grain yield (6.34 t/ha), straw yield (12.26 t/ha) and~~,~~ harvest index (36.33 %)~~,~~ recorded highest in UR-32.

CONCLUSION

The concluded experiment showed that rice hybrid UR-32 performed better in majority of growth and yield attributes which was found to be more productive. Since the finding are based on the research done in one season. Further trials are needed to confirm more precise results.

Comment [BJ15]: Productive or total

REFERENCES

Hosain M. T., Ahamed L., K. U., Haque M. M., Islam M. M., Fazle A. S. M and Mahmud J. A., 2014. Performance of Hybrid Rice (Oryza sativa L.) Varieties at Different Transplanting Dates in Aus Season applied science reports, 1-4

Ceesay M. Reid W. S., Fernandes E.C.M. and Uphoff N. T. 2006. The effect of repeated soil wetting and drying on low land rice yield with SRI methods. International Journal for agricultural sustainability, 4: 5-14

Haque M.D., Elora P. M. D. and Romel B. 2015. Identification of Potential Hybrid Rice Variety in Bangladesh by Evaluating the Yield Potential World Journal of Agricultural Sciences 11(1): 13-18.

Bahure, G. K., Mahadkar, U. V., Raut, S. D., Doadke, S. B., Broundkar, M. M., Chavan, S. and Dhekale, J. S. 2019. Agronomic assessment of different rice hybrids for sustainable production through agronomic manipulation under high rainfall conditions of Konkan. *International Journal of Chemical Studies* **7**(6): 715-719.

Dangi, K., Singh, S.K., Malviya, D.K., Gautam, D., Kanapuriya, N. And Kumar, B. 2017. Effect of Rice Varieties on Growth, Yield and Economics at Varying Levels of Nitrogen under Direct Seeded Upland Condition Rewa Region. *International Journal of Current Microbiology and Applied Sciences* **6**(9): 2313-2318. Doi: https://doi.org/10.20546/ijcmas.2017.609.283.

Deshpande, H. H., and Devasenapathy, P. 2011. Effect of green manuring and organic manures on yield, quality and economics of rice (*Oryza sativa* L.) under lowland condition. *Karnataka Journal of Agricultural Sciences* **23**(2): 235-238.

Fayaz, A., Singh, P., Qayoom, S., Ahmad, L., Lone, B., Singh, L. and Singh, K.N. 2015. Influence of different dates of sowing and spacing on growth and yield of scented rice cv. pusa sugandh-3 under temperate conditions of Kashmir. *Journal of Cereals and Oilseeds*, **6**(4): 20-23.

Fernandez R., 2002 Unlad-Ani Program: Hybrid Rice Program Now in Full Swing. Philippine Star, 7

Comment [BJ16]: Bold or not, follow uniformity

Ghosh, M. 2001. Performance of hybrid and high-yielding rice varieties in Tarai region of West Bengal. Journal of Intracadamicia, 5 (4):578-581.

Nirmala, B., Waris, A., Muthuraman, P. and Rao, N. S. 2019. An Economic Evaluation of Potential of Stress Tolerant Rice Varieties. *International Journal of Current Microbiology and Applied Sciences* **8**(1): 576-584.

Padmavathi, P. 1997. Studies on relative performance of conventional hybrid rice varieties under various levels of nitrogen, plant population and planting patterns.phd thesis, Indian agricultural research institute, New Delhi.

Pandey, V. R., Singh, P. K., Verma, O. P. and Pandey, P. 2010. Inter- relationship and path coefficient estimation in rice under salt stress environment. *International Journal of Agricultural Research* **7**(4): 169-184.

Formatted: Font: Not Italic