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RESEARCH ARTICLE

Performance of Rice Varieties under Rainfed Upland Condition in South Eastern Ghat Zone of Odisha

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ABSTRACT

Rice production from upland areas has an important contribution in total rice production and it is mainly cultivated in rainfed condition in rainy season. The present study was conducted during *kharif* season of 2021 in Malkangiri district of South Eastern Ghat Zone of Odisha to evaluate the performance of different upland varieties (Mandakini, CR Dhan 202 and CR Dhan 200) in relation to existing variety (*Sahabhagi dhan*). Rice variety Sahabhagi dhan was considered as local check (farmer's practice). Performance of CR Dhan 200 was better in terms of plant height (122.5 cm), number of tillers/m^2 (299.8), panicle length (22.3 cm), number of grains/panicle (141.2), test weight (22.5 g) with highest yield (43.5 q/ha). In terms of yield, it was 7.1-13.0% more with CR Dhan 200 as compared to others varieties. Highest economic return with more B: C ratio (1.99) was also recorded with CR Dhan 200. So, rice variety Sahabhagi dhan can be replaced with CR Dhan 200 for more yield and higher economic return in rainfed upland ecosystem of South Eastern Ghat Zone of Odisha.

HIGHLIGHTS

- Better growth and yield attributes along with more yield and higher economic return were observed with rice variety CR Dhan 200.
- CR Dhan 200 may be replaced with existing Sahabhagi dhan for higher production and more economic return for farmers of South Eastern Ghat Zone of Odisha in rainfed upland ecosystem.

Keywords: Economics, Rainfed, Rice, Upland, Variety, Yield

Rice (*Oryza sativa* L.) is one of the most important staple foods for about half of the civilization on the planet (Pathak *et al.* 2020). The country's total rice cultivated area is 43.79 million ha with production of 116.4 million tonnes and productivity of 2659 kg/ha (Anonymous 2019). In Odisha, rice is cultivated in about 41 lakh ha area and it is about 65% of total cultivated area (Mangaraj *et al*. 2021). Average rice productivity in Odisha (1972 kg/ha) is quite low as compared to national average (Anonymous 2019). Farmer faces serious challenges of low income due to different reasons associated with rice production system. Among them, drought is a major abiotic stress that adversely affects the rice growth and production mainly in the rainfed ecosystem (Emam *et al*. 2014). The challenges facing rice production in drought-prone areas are becoming even more complex with the long-term adverse effects of climate change. The development of reproductive organs, grain yields and quality of rice will be significantly affected by drought stress

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(Yan *et al*. 2022). Drought is one of the major abiotic stresses that severely affect and reduce the yield and productivity of food crops worldwide up to 70% (Thakur *et al*. 2010). In experimental region, in upland rice ecosystem the major constraints for higher productivity are water stress condition at critical stage i.e. tillering, grain filling and maturity stage due to uncertainty in normal rainfall the plant growth is badly affected and majority of the farmers use of traditional varieties of rice without proper nutriment management practices. Keeping the above points in view, the front line demonstrations were conducted to evaluate the performance of stress (drought) tolerant rice varieties with recommended package of practices in Malkangiri district of South Eastern Ghat Zone of Odisha.

MATERIALS AND METHODS

The study was carried out by Krishi Vigyan Kendra (KVK), Malkangiri, Odisha during *kharif* season of 2021. The demonstrations were conducted in adopted villages of KVK comprising total seven locations/farmers. The soil of the experimental site was slightly acidic in reaction (pH-5.8-6.4) with sandy loam in texture. The average available nitrogen, phosphorus and potassium were 187.3, 24.1, 188.1 kg/ha, respectively. Average annual rainfall of the experimental region was 1667.60 mm and 86% of it was received during rainy season. The experiment was laid out in randomized block design with four treatments (drought/stress tolerant varieties) viz. Sahabhagi dhan (Farmer's practice), Mandakini, CR Dhan 202 and CR Dhan 200 (Pyari) in seven locations (Varietal details in Table 1). While analysis, seven locations were considered as number of replications. The crop was grown in rainfed upland condition in the first to second week of July and 21 days old seedling were transplanted in main filed. The crop was raised with recommended agronomic practices and harvested within the last week of October to first week of November. Parameters like plant height, number of tillers/ m^2, panicle length, number of grains/panicle, test weight and yield were recorded at maturity stage. Gross return was calculated on the basis of the prevailing market price of the paddy and net return was calculated by deducting the cost of cultivation from gross return. Benefit-cost ratio (B: C ratio) was calculated by dividing gross return with total cost of cultivation. Different data were analyzed statistically using analysis of variance (ANOVA) as randomized block design (Gomez and Gomez, 1984). The critical difference (CD) values were calculated at 5% (P=0.05) probability level where 'F' test was significant.

RESULTS AND DISCUSSION

Plant height of different rice varieties varied significantly and highest plant height was recorded with CR Dhan 200 (122.5 cm) followed by CR Dhan 202 (107.2 cm) and Sahabahagi dhan (80.4 cm). The number of tillers/m^2 was recorded significantly maximum with CR Dhan 200 (299.8) followed by CR Dhan 202 (297.0), Sahabahagi dhan (295.8) and Mandakini (272.0). Differences in tillers number with different varieties may due to be unique genetic potential of the varieties (Rai *et al*. 2020). Panicle length (22.3 cm) and number of grains/

Table 1: Details of rice varieties taken as treatments

Rice varieties	Characteristics
Sahabhagi dhan (Farmer's practice)	Duration- 105 days, grain type- long bold, tolerant to drought, resistance to leaf blast, moderately resistance to brown spot, sheath rot, sheath blight and leaf folder. Potential yield- 40 q/ha (Pathak *et al*. 2019).
Mandakini	Duration- 120 days or less, grain type- medium slender, stress tolerant, resistant to leaf blast, sheath blight, gall midge, leaf folder, moderately resistant to sheath rot and tungro virus. Potential yield- 35 q/ha (Anonymous 2022).
CR Dhan 202	Duration- 115 days, grain type- long bold, suitable for water limiting condition, moderately resistant to brown spot, sheath rot, sheath blight and leaf folder. Potential yield- 45 q/ha (Pathak *et al*. 2019).
CR Dhan 200 (Pyari)	Duration- 115 to 120 days, grain type- short bold, moderately resistant to blast, neck blast, brown spot, sheath blight, leaf folder and gall midge. Potential yield- 45.0 q/ha (Pathak *et al*. 2019).

panicle (141.2) were recorded highest with CR Dhan 200 followed by CR Dhan 202, Mandakini and Sahabhagi dhan. Significant variation in test weight (1000 grain weight) was recorded in rice varieties and found highest with CR Dhan 200 (22.5 g) followed by Sahabhagi dhan (21.8 g), Mandakini (21.4 g) and CR Dhan 202 (20.3 g). Significant variation in test weight of rice varieties was also reported by Rai *et al*. (2020). There was a significant variation among the different rice varieties for grain yield (Table 2) and CR Dhan 200 recorded maximum grain yield (43.5 q/ha) followed by CR Dhan 202 (40.6 q/ha) and variety Sahbhagi dhan (Farmer's practice) exhibited lowest yield (38.5 q/ha). As compared to farmers practice, CR Dhan 200 and CR Dhan 202 recorded 13.0% and 5.5% more yield, respectively. Highest number of tillers, panicle length and number of grains along with highest test weight is responsible for maximum grain yield with rice variety CR Dhan 200. Variation in yield within different varieties might due to be differences in growth habit and their response to the climatic condition was different.

In case of highest yielder rice variety CR Dhan 200, significant positive correlation between panicle length and number of grains/panicle indicated that greater number of grains could be accommodated in longer panicles (Table 3). Parameters like number of tillers/m^2, panicle length and number of grains/panicle were significantly correlated with the grain yield. It was specified that more yield could be obtained with more number of tillers, panicle length and number of grains per panicle (Malik *et al.* 2020; Mangaraj *et al.* 2021).

Economics of cultivation were computed as per the farmers selling price and cost of cultivation was calculated as per the local situations (Table 4). The results on economic analysis of rice production under the experiment revealed that rice variety CR Dhan 200 recorded highest gross return/ha (₹ 84390/-) and net return/ha (₹ 41890/-) followed

Table 2: Growth, yield attributes and yield of upland rice varieties under rainfed condition

Treatments/ varieties	Plant height (cm)	No. of tillers/ m^2	Panicle length (cm)	No. of grains/ panicle	Test weight (g)	Yield (q/ha)
Sahabhagi dhan	80.4	295.8	20.2	123.4	21.78	38.5
Mandakini	78.6	272.0	20.3	128.2	21.40	38.9
CR Dhan 202	107.2	297.0	21.4	137.5	20.27	40.6
CR Dhan 200	122.5	299.8	22.3	141.2	22.54	43.5
SEm ±	2.41	1.89	0.23	0.84	0.15	0.77
CD (0.05)	7.84	5.71	0.70	2.69	0.48	2.28

Table 3: Correlation within different agronomic characters and yield for CR Dhan 200

Variables	Plant height	No. of tillers/ m^2	Panicle length	No. of grains/ panicle	Test weight	Yield
Plant height	1					
No. of tillers/m	0.313	1				
Panicle length	0.146	-0.041	1			
No. of grains/panicle	0.121	0.218	0.643*	1		
Test weight	0.113	-0.021	0.020	0.131	1	
Yield	0.012	0.634*	0.681*	0.612*	0.231	1

**Correlation is significant at the 0.05 level.*

Table 4: Economic analysis of different rice varieties

Treatments/ varieties	Gross return (₹/ha)	Net return (₹/ha)	B:C ratio
Sahabhagi dhan	74690	32190	1.76
Mandakini	75466	32966	1.78
CR Dhan 202	78764	36264	1.85
CR Dhan 200	84390	41890	1.99

by CR Dhan 202 and Sahabhagi dhan (local check) recorded the least value. The B: C ratio was also higher with rice variety CR Dhan 200 (1.99) as compared to others. Higher yield with CR Dhan 200 might be responsible for higher economic return.

CONCLUSION

Based on the evaluation, it was concluded that the rice variety CR Dhan 200 gave more yield as well as higher economic return to the farmers. So, rice variety CR Dhan may be replaced with Sahabhagi dhan for higher production and more economic return for farmers of South Eastern Ghat Zone of Odisha in upland rainfed ecosystem.

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REFERENCES

Anonymous, 2019. Agricultural Statistics at a Glance 2019. Government of India, Ministry of Agriculture and Farmers Welfare, Department of Agriculture, Cooperation and Farmers Welfare, Directorate of Economics and Statistics.

Anonymous, 2022. Rice varieties of Odisha. International Rice Research Institute (IRRI) Odisha Hub Office, Bhubaneswar, Odisha. India. (Accessed on 01.07.2022). Available: https://www.rkbodisha.in/rice-varieties-of-odisha.

Emam, M.M., Khattab, H.E., Helal, N.M. and Deraz, E,A. 2014. Effect of selenium and silicon on yield quality of rice plant grown under drought stress. *Australian J. Crop Sci.,* **8**(4): 596-605.

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. 2nd edn. A Wiley Interscience Publication, New York.

Malik, H.N., Panda, A., Behera, S. and Rahman, F.H. 2020. A comparative study of different moisture stress tolerant rice varieties in Kalahandi district of Odisha. *Int. J. Plant Soil Sci.*, **32**(7): 1-6.

Mangaraj, S., Sahu, S., Panda, P.K., Rahman, F.H., Bhattacharya, R., Patri, D., Mishra, P.J., Phonglosa, A. and Satapathy, S.K. 2021. Assessment of stress tolerant rice varieties under rainfed condition in North Eastern Ghat of Odisha. *Int. J. Environ. Climate Change,* **11**(4): 128-134.

Pathak, H., Parameswaran, C., Subudhi, H.N., Prabhukarthikeyan, S.R., Pradhan, S.K., Anandan, A., Yadav, M.K., Aravindan, S., Pandi, G.G.P., Gowda, G.B., Raghu, S., Keerthana, U., Meena, K.S., Lenka, S., Kumar, A. and Sarkar, R.K. 2019. Rice Varieties of NRRI: Yield, Quality, Special Traits and Tolerance to Biotic & Abiotic Stresses. NRRI Research Bulletin No. 20, ICAR-National Rice Research Institute, Cuttack, Odisha, India, pp. 68.

Pathak, H., Tripathi, R., Jambhulkar, N.N., Bisen, J.P. and Panda, B.B. 2020. Eco-regional rice farming for enhancing productivity, profitability and sustainability. NRRI Research Bulletin No. 22, ICAR-National Rice Research Institute, Cuttack, Odisha, India, pp. 28.

Rai, A.K., Dash, S.R., Behera, N., Behera, T.K. and Das, H. 2020. Performance of drought tolerant Rice varieties in Malkangiri district of South Eastern Ghat Zone of Odisha. *Current Agricul. Res. J.,* **8**(2): 157-162.

Thakur, P., Kumar, S., Malik, J.A., Berger, J.D. and Nayyar, H. 2010. Cold stress effects on reproductive development in grain crops: an overview. *Environ. Exp. Bot.*, **67**(3): 429-443.

Yan, J., Yang, M., Wu, K., Peng, L., Chen, J. and Ling, Y. 2022. Rice Production in Future: More challenges come from frequent extreme weathers. *Modern Concepts Dev. in Agron.*, **10**(5): 1066-1068.