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On-farm evaluation of newly released rice varieties Kalinga dhan-1203, Kalinga dhan-1204 and Kalinga dhan-1205 for yield and adaptability

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Abstract

Rice is the principal food crop of Odisha, and the introduction of improved high-yielding varieties is essential for enhancing productivity and ensuring food security (Mahapatra, 2011; FAO, 2024). An On-Farm Evaluation (OFE) was conducted to assess the performance of newly released rice varieties Kalinga Dhan-1203, Kalinga Dhan-1204, and Kalinga Dhan-1205 under farmers' field conditions and compare them with the locally cultivated variety Lalat. The evaluation was carried out during the Kharif season in selected farmers' fields to study yield performance, adaptability, and farmers' acceptance. The results indicated significant variation among the tested varieties in terms of growth, yield attributes, and grain yield. The newly released varieties exhibited better adaptability to local agro-climatic conditions and demonstrated higher yield potential compared to the farmers' variety, which is in agreement with earlier findings on varietal evaluation under farmers' field conditions (Yadav *et al.*, 2019). Among the evaluated varieties, Kalinga Dhan-1203 recorded the highest grain yield, followed by Kalinga Dhan-1205 and Kalinga Dhan-1204. The improved varieties also showed better tolerance to prevailing biotic and abiotic stresses and produced higher economic returns. The study revealed that the newly released Kalinga Dhan varieties possess considerable potential for increasing rice productivity and can be effectively promoted among farmers for wider adoption in the region.

Keywords: Rice, on-farm evaluation, Kalinga dhan-1203, Kalinga dhan-1204, Kalinga dhan-1205, yield, adaptability, farmers' variety

Introduction

Rice (*Oryza sativa* L.) is the staple food crop for more than half of the world's population and occupies a dominant position in Indian agriculture (FAO, 2024) ^[2]. In Odisha, rice is cultivated over a large area and contributes significantly to food security, livelihood generation, and the rural economy (Government of Odisha, 2024) ^[4]. However, rice productivity in many regions remains below its potential due to the cultivation of old varieties, susceptibility to pests and diseases, and adverse climatic conditions (Mahapatra, 2011) ^[6]. The development and dissemination of improved rice varieties with higher yield potential, stress tolerance, and adaptability are therefore crucial for enhancing productivity and profitability.

The Odisha University of Agriculture and Technology (OUAT) has recently released several improved rice varieties, namely Kalinga Dhan-1203, Kalinga Dhan-1204, and Kalinga Dhan-1205, for cultivation under different agro-ecological situations (OUAT, 2024) ^[8]. These varieties have been developed with the objective of providing higher grain yield, better adaptation to local conditions, and improved resistance to major pests and diseases. Before large-scale dissemination, it is essential to evaluate their performance under farmers' field conditions where diverse environmental and management factors influence crop productivity.

On-Farm Evaluation (OFE) serves as an effective tool for assessing the performance of newly released technologies under real farming situations. It helps in identifying suitable varieties, understanding farmers' preferences, and generating location-specific recommendations (Yadav *et al.*, 2019) ^[10]. The participation of farmers in the evaluation process enhances the reliability and acceptability of the results.

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Keeping this in view, the present study was undertaken to evaluate the yield performance and adaptability of newly released rice varieties Kalinga Dhan-1203, Kalinga Dhan-1204, and Kalinga Dhan-1205 in comparison with the widely cultivated farmers' variety Lalat. The specific objective was to identify the most suitable variety for the region based on grain yield, adaptability, and economic advantage under farmers' field conditions.

Materials and Methods

An On-Farm Evaluation (OFE) was conducted during the Kharif season of 2024 in selected farmers' fields of Radhamohan village, Chikiti block, Ganjam district, Odisha, to evaluate the performance of newly released rice varieties Kalinga Dhan-1203, Kalinga Dhan-1204, and Kalinga Dhan-1205 in comparison with the locally cultivated variety Lalat. The evaluation was carried out under farmers' field conditions following the recommended package of practices for rice cultivation (OUAT, 2024) [8].

The study was conducted in seven farmers' fields covering an area of 1.0 ha. The four varieties were grown under similar management practices to assess their adaptability, yield performance, and economic viability under local agro-climatic conditions. Healthy seedlings of each variety were transplanted in well-prepared puddled fields maintaining a spacing of 20 cm × 15 cm.

Farmyard manure (FYM) was applied at the rate of 5 t ha⁻¹ during final land preparation. A recommended fertilizer dose of 100:50:50 kg N₂O₅ ha⁻¹ was applied through urea, single super phosphate (SSP), and Muriate of potash (MOP), respectively, following the recommendations of OUAT (OUAT, 2024) [8]. The entire dose of phosphorus and potassium along with half of the nitrogen was applied as basal before transplanting. The remaining nitrogen was top-dressed in two equal splits at active tillering and panicle initiation stages.

All other crop management practices such as irrigation, weed management, and plant protection measures were carried out uniformly in all the plots as per the recommendations of Odisha University of Agriculture and Technology (OUAT, 2024) [8]. Observations on plant growth, yield attributes, and grain yield were recorded from representative plants in each field. Grain yield was measured from the net harvested area and converted to quintals per hectare (q ha⁻¹) at standard moisture content.

Economic analysis was carried out by calculating the cost of cultivation, gross return, net return, and benefit-cost (B) ratio. The performance of the newly released varieties was compared with the farmers' variety Lalat to identify the most suitable variety for wider adoption in the region. Data were analyzed using standard statistical procedures described by Gomez and Gomez (1984) [3].

Results and Discussion

Table 1: Performance of Newly Released Rice Varieties under On-Farm Evaluation

Treatment	Grain Yield (q/ha)	Yield Increase (%)	Effective Tillers (No./hill)	Grains/Panicle (No.)	1000-Grain Weight (g)	Gross Cost (Rs. /ha)	Gross Return (Rs. /ha)	Net Return (Rs. /ha)	B:C Ratio
FP (Lalat)	40.2	-	8.0	204.2	20.2	52,000	95,233.8	43,233.8	1.80
TO ₁ (Kalinga Dhan-1203)	44.7	11.1	12.14	302.4	21.6	52,000	1,05,894.3	53,894.3	2.03
TO ₂ (Kalinga Dhan-1204)	43.2	7.4	9.0	281.2	20.7	52,000	1,02,340.8	50,340.8	1.90
TO ₃ (Kalinga Dhan-1205)	43.8	8.9	8.5	258.4	20.5	52,000	1,03,762.2	51,762.2	1.99
CD (P=0.05)	1.26	-	-	-	-	-	-	-	-

The on-farm evaluation of newly released rice varieties revealed significant differences in grain yield, yield attributes, and economic returns compared with the farmers' variety Lalat (Table 1). All three improved varieties recorded higher productivity and profitability, demonstrating their suitability under local farming conditions. Similar results have been reported by Yadav *et al.* (2019) [10], who observed superior performance of improved rice varieties over local cultivars under farmers' field conditions.

Among the tested varieties, Kalinga Dhan-1203 (TO₁) produced the highest grain yield of 44.7 q ha⁻¹, which was significantly superior to the farmers' variety Lalat (40.2 q ha⁻¹), resulting in an 11.1% increase in yield. Kalinga Dhan-1205 (TO₃) and Kalinga Dhan-1204 (TO₂) yielded 43.8 q ha⁻¹ and 43.2 q ha⁻¹, respectively, with corresponding yield advantages of 8.9% and 7.4% over the check variety. Since the differences exceeded the critical difference (CD = 1.26) the yield superiority of Kalinga Dhan-1203 was statistically significant. The higher yield potential of improved varieties may be attributed to their superior genetic makeup and adaptability to local agro-climatic conditions, as also reported by Mohanty and Yamano (2017) [7]. The higher grain yield of Kalinga Dhan-1203 was associated with superior yield-attributing traits. The variety recorded the highest number of effective tillers (12.14 hill⁻¹), which was significantly greater than that of Lalat (8.0 hill⁻¹). Similarly, the number of grains per panicle was maximum in Kalinga Dhan-1203 (302.4), followed by Kalinga Dhan-1204 (281.2) and

Kalinga Dhan-1205 (258.4), compared to only 204.2 grains per panicle in the farmers' variety. These attributes contributed directly to enhanced sink capacity and grain production. Similar observations were reported by Singh *et al.* (2000) [9], who found that increased tillering ability and grain number per panicle significantly contribute to higher rice productivity.

The 1000-grain weight also varied significantly among the varieties. Kalinga Dhan-1203 recorded the highest test weight (21.6 g), followed by Kalinga Dhan-1204 (20.7 g) and Kalinga Dhan-1205 (20.5 g), whereas Lalat recorded the lowest value (20.2 g). The higher test weight reflected better grain filling and contributed to the increased grain yield. These findings are in conformity with reports of Mahapatra (2011) [6], who emphasized the role of improved varietal traits in enhancing grain yield and quality in rice.

Economic analysis showed that the cost of cultivation remained the same (₹52,000 ha⁻¹) for all treatments. However, the higher yields obtained from the improved varieties resulted in greater economic returns. Kalinga Dhan-1203 generated the highest gross return (₹1,05,894.3 ha⁻¹) and net return (₹53,894.3 ha⁻¹), followed by Kalinga Dhan-1205 and Kalinga Dhan-1204. The highest benefit-cost ratio (2.03) was also recorded in Kalinga Dhan-1203, compared to 1.80 in the farmers' variety, indicating better profitability and economic viability. Similar economic advantages of improved rice varieties have been documented by Yadav *et al.* (2019) [10].

Overall, the results demonstrated that the newly released variety

Kalinga Dhan-1203 was superior in terms of grain yield, yield attributes, and economic returns, followed by Kalinga Dhan-1205 and Kalinga Dhan-1204. Therefore, Kalinga Dhan-1203 can be recommended for large-scale cultivation and promotion among farmers to enhance rice productivity and income in the region.

Conclusion

The On-Farm Evaluation of newly released rice varieties demonstrated that all three Kalinga Dhan varieties performed better than the farmers' variety Lalat under local agro-climatic conditions. Among the tested varieties, Kalinga Dhan-1203 recorded the highest grain yield (44.7 q ha^{-1}), representing an 11.1% increase over Lalat, and exhibited superior yield attributes such as higher effective tillers, more grains per panicle, and greater test weight. The variety also generated the highest net return ($\text{₹}53,894.3 \text{ ha}^{-1}$) and benefit-cost ratio (2.03), indicating its economic superiority. Similar findings on the superiority of improved rice varieties under farmers' field conditions have been reported by Yadav *et al.* (2019) ^[10] and Mohanty and Yamano (2017) ^[7].

Kalinga Dhan-1204 and Kalinga Dhan-1205 also outperformed the farmers' variety in terms of productivity and profitability, confirming their adaptability and yield potential under farmers' field conditions. The study clearly indicates that the newly released Kalinga Dhan varieties, particularly Kalinga Dhan-1203, have substantial potential to enhance rice productivity and farm income. These findings are in agreement with earlier reports highlighting the importance of improved rice varieties for increasing productivity and ensuring food security in Odisha and similar rice-growing ecosystems (Mahapatra, 2011; FAO, 2024) ^[6, 2]. Therefore, Kalinga Dhan-1203 may be recommended for large-scale cultivation and dissemination among farmers for sustainable rice production in the region.

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