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RESEARCH ARTICLE

Extent of knowledge on recommended rice production practices among rice growers in Mayurbhanj district of Odisha

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Abstract

Rice is a vital staple crop that plays a central role in global food security and rural livelihoods, especially in agrarian economies like India. Despite technological advancements in rice cultivation, gaps in farmer awareness and adoption persist. This study assesses the extent of knowledge among 150 rice growers in Mayurbhanj district of Odisha regarding recommended rice production practices, using an ex-post facto survey design and multistage random sampling across five blocks. Findings reveal that the majority of farmers (76 %) had medium-level knowledge, with high familiarity in practices like field preparation, harvesting and post-harvest management, but low awareness in critical areas such as nursery management, seed treatment and pest/disease control. Multiple regression analysis indicated that economic motivation, extension participation, education level and access to information significantly influenced knowledge levels (R^2 = 0.803). Interestingly, farming experience and innovativeness showed no significant effects. The study underscores the need for targeted extension and capacity-building interventions focusing on foundational and resource-efficient practices. Strengthening institutional support and customising knowledge dissemination strategies can bridge knowledge gaps and enhance sustainable rice productivity in Odisha's tribal regions.

Keywords: cultivation practices; farmer knowledge; farmers perception; tribal regions

Introduction

Rice, as a staple crop, holds paramount importance in global food security by feeding nearly 56 % of the world's population and supporting 40 % of the world's poor (1). Valued at approximately $200 billion annually, rice accounts for 13 % of the global crop value, making it a crucial commodity in the agricultural economy. Its role in alleviating hunger and malnutrition further emphasises the importance of continuous rice research and development efforts. In India, rice is not only a dietary staple but also a major contributor to rural livelihoods, especially in eastern states like Odisha. Odisha has witnessed a notable positive trend in rice production, with growth rates of 1.95 % in area and 1.76 % in productivity between 1960 and 2019 (2). Within the state, Mayurbhanj district has emerged as a key rice-growing region with immense potential for system productivity enhancement through innovative agronomic interventions. Recent studies have demonstrated that integrating dry-seeded rice (DSR) and mechanically puddled transplanted rice (PTR-M) during the wet season, coupled with the cultivation of pulses like green gram and black gram in the dry season, significantly boosts system productivity in Mayurbhanj (3). Moreover, resource-efficient practices such as dry direct seeding, the use of medium-duration rice varieties and alternate wetting and drying (AWD) irrigation can reduce water use by 18 % while improving water productivity by 21 %, without compromising grain yield (4).

Innovations in rice production not only enhance resource use efficiency but also contribute to sustainability. Methods like the system of rice intensification (SRI) have been proven to increase yield, reduce input costs and lower greenhouse gas emissions compared to conventional transplanting (5). Similarly, bund plugging has emerged as a superior water-saving technique, maintaining high yields while conserving irrigation water (6). Mechanised rice establishment has also shown economic and agronomic advantages over traditional practices, particularly in Northwestern India (7). Adopting improved rice varieties, soil and water management practices and conservation technologies are essential for sustainable production (8). In drought-prone areas of eastern India, varieties like Sahbhagi Dhan have helped enhance food security by offering better yield and drought resilience (9). Additionally, modern rice harvesting techniques have proven effective in reducing post-harvest losses, lowering labour costs and generating employment in developing countries (10). Despite the

availability of advanced technologies, the extent of their adoption largely depends on farmers' knowledge and awareness. In Mayurbhanj, studies indicate that farmers have a moderate level of knowledge regarding improved pulse production practices, influenced by factors such as age, gender, risk-bearing capacity, scientific orientation and media exposure (11). However, limited data exist on their awareness of recommended rice production practices, which is critical for bridging yield gaps and ensuring sustainable agricultural growth.

In this context, the present study aims to assess the extent of knowledge among rice growers in Mayurbhanj district regarding recommended rice production practices. Understanding the knowledge level and its determinants will aid in designing effective extension strategies and policy interventions to enhance rice productivity and rural livelihoods in the region. This study aimed to assess the level of knowledge among rice growers in Mayurbhanj regarding recommended rice production practices and also analyse the influence of socio-economic and psychological variables on their knowledge levels. Another objective was to provide evidence-based recommendations to strengthen agricultural extension and training programs in the region. By identifying knowledge strengths and deficiencies, this research contributes to the broader goal of enhancing rice productivity and sustainability in Odisha's tribal heartland.

Materials and Methods

To investigate the extent of knowledge on recommended rice production practices among farmers in the Mayurbhanj district of Odisha, an ex-post facto survey research design was employed. This approach allowed for the systematic study of existing knowledge without manipulating variables. The problem was selected based on persistent gaps between the availability of scientific rice cultivation technologies and the actual adoption among farmers, despite government schemes. A detailed plan of work was prepared beforehand, covering sampling strategy, data collection procedures and statistical analysis methods.

The study was conducted in Mayurbhanj district- a prominent rice-growing region characterised by diverse agro-ecological settings and predominantly tribal populations. The district was purposively selected due to its low rice productivity and substantial cultivation area. To ensure geographic representation, five blocks (Baripada, Kaptipada, Saraskana, Sukurli and Bangiriposi) were chosen based on their location and concentration of rice growers, with guidance from agricultural extension officers. From each block, three villages were randomly selected, totalling 15 villages. Subsequently, 10 rice farmers from each village were selected through random sampling, resulting in a sample size of 150 respondents. The majority of the farmers selected were small and marginal.

Preliminary field visits and discussions with agricultural stakeholders, including AAOs, Kisan sathi and progressive farmers, formed the basis for the selection of study variables. Insights gathered during the pilot study guided the development of a structured interview schedule, which was prepared in consultation with subject experts and literature sources. The schedule was pre-tested with 30 farmers from the district to ensure validity and reliability; necessary revisions were made using SPSS analysis to refine the tool. Data collection was then carried out through face-to-face interviews using the finalised schedule, following rapport-building with each respondent.

Results

The study assessed the extent of knowledge among 150 rice growers in the Mayurbhanj district of Odisha regarding recommended rice cultivation practices. Table 1 illustrates the average mean scores and ranks for 14 key cultivation domains. The findings indicate that: Field preparation received the highest mean score (2.72), followed by harvesting (2.66) and post-harvest management (2.54), suggesting strong familiarity and adherence to these practices. Moderate knowledge was observed in practices such as variety selection (2.49), sowing (2.41) and weed management (2.41). Areas such as water management (2.35), selection of soil (2.29) and nutrient management (2.27) reflected slightly lower levels of knowledge. The lowest levels of awareness were reported for pest management (2.16), disease management (2.14), seed treatment (1.86), selection of seed (1.72) and nursery management (1.32). Research indicates that similar findings were noticed (12-15).

An analysis of Table 2 reveals the distribution of respondents according to their knowledge levels-low, medium and high on various recommended rice cultivation practices. Across most practices, a substantial proportion of farmers demonstrated a medium level of knowledge. For example, water management (80.00 %), nursery management (78.00 %) and nutrient management (72.00 %) had the highest percentages of respondents in the medium category. Similarly, weed management, seed treatment and selection of seed each had over 70.00 % of respondents reporting medium-level knowledge. Although medium -level knowledge was dominant, there were significant differences in the proportions of high and low knowledge across practices. Soil

Table 1. Mechanisms for dissemination and demonstration

Block	Villages covered	Mechanisms for dissemination and demonstration
Baripada	Laxmipusi, Kayiphulia and Hadahadi	On-field demonstrations by Assistant Agricultural Officers (AAOs) - Farmer group meetings and Kisan Sathi interactions - Awareness camps and training sessions organised by Krishi Vigyan Kendra (KVK)
Kaptipada	Pedagadi, Jhinkpada and Kaptipada	Structured training workshops at village level - Demonstration plots showcasing recommended nursery and pest management - Capacity building through progressive farmers and community leaders - Radio and mobile-based advisory messages.
Saraskana	Sirsa, Banaga and Neda	Field days and practical demonstrations by Agriculture Extension Officers - Farmer Field Schools focusing on seed treatment and integrated pest management - Distribution of seed kits and organic pest control inputs during extension visits.
Sukurli	Tadanga, Dhudipani and Madurasahi	On-field demonstrations by Assistant Agricultural Officers (AAOs)-Group discussions and participatory learning approaches - Demonstrations on water and nutrient management- Use of audiovisual tools during village meetings.
Bangiriposi	Sarosposi, Bankati and Kantapal	Village-level farmer workshops on nursery bed preparation and crop protection- Engagement with Self-Help Groups (SHGs), Local leaders for peer learning and technology uptake - Exposure visits to model farms.

Table 2. Extent of knowledge among the respondents on various cultivation practices (n =150)

Sr. No.	Knowledge	Average mean score	Rank
1	Field preparation	2.72	I
2	Harvesting	2.66	II
3	Post-harvest management	2.54	III
4	Variety selection	2.49	IV
5	Sowing	2.41	V
6	Weed management	2.41	V
7	Water management	2.35	VI
8	Selection of soil	2.29	VII
9	Nutrient management	2.27	VIII
10	Pest management	2.16	IX
11	Disease management	2.14	X
12	Seed treatment	1.86	XI
13	Selection of seed	1.72	XII
14	Nursery management	1.32	XIII

(Min. Score: 1; Max. Score: 3)

Table 3. Distribution of the respondents according to knowledge level on various cultivation practices (n =150)

Sl. No.	Knowledge	Low	Medium	High
1	Field preparation	22.67	61.33	16.00
2	Harvesting	12.67	63.33	24.00
3	Post harvest management	23.33	68.00	8.67
4	Variety selection	21.33	60.67	18.00
5	Sowing	22.67	67.33	8.00
6	Weed management	15.33	71.33	13.33
7	Water management	15.33	80.00	4.67
8	Selection of soil	12.00	52.00	36.00
9	Nutrient management	8.67	72.00	19.33
10	Pest management	18.67	68.67	12.67
11	Disease management	22.67	65.33	12.00
12	Seed treatment	15.33	70.00	14.67
13	Selection of seed	15.33	70.00	14.67
14	Nursery management	20.67	78.00	1.33

selection stood out with the highest proportion of respondents reporting high knowledge (36.00 %), followed by harvesting (24.00 %) and nutrient management (19.33 %). By contrast, nursery management had the lowest percentage of high knowledge (1.33 %), with water management (4.67 %) and sowing (8.00 %) also reflecting poor high-level understanding. Low knowledge responses were notable for certain practices as well. Post -harvest management (23.33 %), field preparation (22.67 %), sowing (22.67 %), disease management (22.67 %) and variety selection (21.33 %) had the highest proportions of low-knowledge respondents, indicating areas where further education and outreach may be needed (16-19).

Fig. 1 illustrates the overall level of knowledge possessed by the respondents regarding various rice cultivation practices. A predominant portion of farmers, comprising 76.00 %, fell into the medium knowledge category, indicating moderate familiarity with recommended production techniques. Meanwhile, 12.67 % of respondents exhibited low levels of knowledge, suggesting limited understanding or exposure to key cultivation procedures. Only 11.33 % were categorised under high knowledge, reflecting a comparatively small group of farmers with in-depth comprehension of rice-growing practices. Research indicates that similar findings were noticed (17, 20, 21).

Table 3 presents the outcomes of a multiple linear regression analysis conducted to determine the effect of selected independent variables on the overall knowledge level of respondents regarding rice cultivation practices. The model exhibited a high degree of explanatory power, with an R-value of 0.896 and an R^2 of 0.803, indicating that 80.3 % of the variance in knowledge level could be explained by the predictor variables. Among the ten predictors, several demonstrated statistically significant positive effects. Economic motivation emerged as the strongest predictor (Estimate = 6.681, $p < .001$), followed by extension participation (Estimate = 4.331, $p < .001$), education level (Estimate = 4.419, $p < .001$) and sources of information (Estimate = 2.115, $p < .001$). Age (Estimate = 1.829, $p = 0.014$), land holding (Estimate = 1.617, $p = 0.017$), income (Estimate = 0.499, $p = 0.003$) and risk orientation (Estimate = 0.518, $p = 0.002$) also showed significant contributions to farmers' knowledge levels. Conversely, farming experience (Estimate = 0.163, $p = 0.233$) and innovativeness (Estimate = 0.173, $p = 0.541$) did not show statistically significant relationships with knowledge level in this model. Research indicates that similar findings were noticed (18, 22, 23).

Discussion

The native and traditional methods of plant protection and nursery management in the tribal region of Mayurbhanj include a

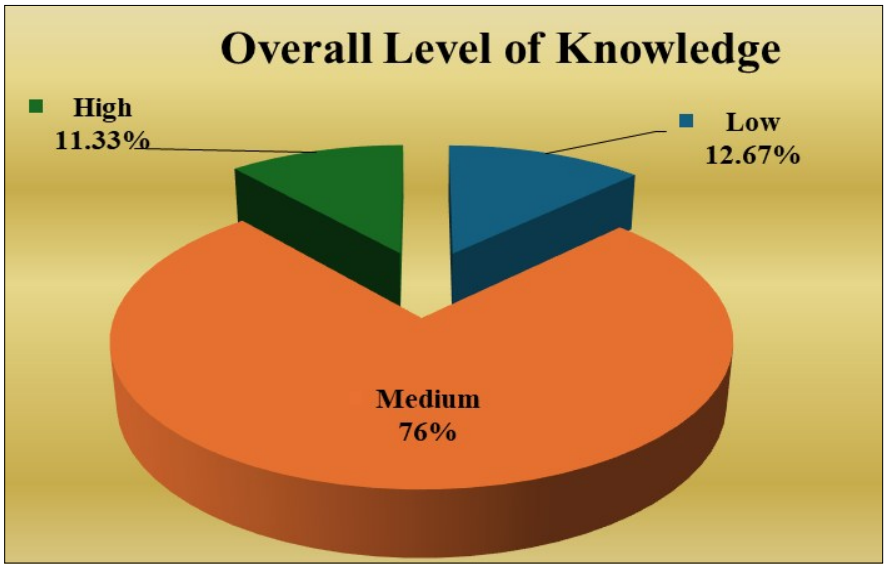

Fig. 1. Overall level of knowledge of the respondents on various cultivation practices.

variety of indigenous practices rooted in environmental sustainability and local knowledge. For plant protection, tribal farmers typically use natural repellents and remedies such as extracts from neem leaves, tulsi (holy basil) and other medicinal plants known for their insecticidal properties. Ash, cow urine and local botanicals are also applied as organic pesticides and fungicides to protect crops from pests and diseases. These methods are favoured due to their low cost, availability and eco-friendly nature. In nursery management, traditional practices often involve raised seedbeds prepared using local soil and organic manure, ensuring proper drainage and healthy seedling growth. Farmers employ techniques such as mixed cropping or intercropping to reduce pest incidence and promote soil fertility. Seed selection and treatment are commonly performed using indigenous knowledge about seed viability and local climatic conditions. From a holistic perspective, the data analysis highlights that while these native methods are widely respected and practised, there are gaps in scientific knowledge about seed treatment, pest and disease control and nursery management, which need to be bridged through integrated extension services. Strengthening the synergy between traditional wisdom and modern scientific methods can enhance sustainable rice production, improving both productivity and resource conservation in this tribal region. This approach acknowledges the value of indigenous practices while addressing critical technical gaps through targeted capacity-building interventions.

The results from Table 2 indicate a pronounced familiarity among rice growers with practices directly impacting field operations and final output, such as field preparation, harvesting and post-harvest management. These tasks are often routine and visible within the agricultural cycle, which may explain the higher knowledge levels. However, the relatively low awareness of critical pre-sowing practices-including seed selection, seed treatment and nursery management-suggests gaps in foundational agronomic knowledge. Research indicates that the majority of the respondent farmers knew variety selection, followed by weed management, seed rate, time of sowing, irrigation and fertiliser management (23). So, it can be said that farmers are well aware of cultivation practices. They should get proper training on how to improve their cultivation practices by using advanced technologies (24). These steps, although less conspicuous, are pivotal for yield potential and crop health. The knowledge deficit in pest and disease management points to a potential vulnerability in crop protection efforts. Lack of training or access to extension services could be contributing factors here. Similarly, the limited understanding of nutrient and water management signals the need for awareness campaigns focusing on resource efficiency and sustainability. Overall, the results underscore the importance of targeted interventions and capacity-building programs that emphasise holistic rice cultivation-from soil and seed preparation to crop protection and resource management. Strengthening extension systems and training modules can help bridge the knowledge gaps identified in this study. The distribution pattern in Table 3 shows that the majority of farmers possessed medium knowledge levels, reflecting general familiarity without depth of technical understanding. The extremely low proportion of respondents with high knowledge in nursery management (1.33 %) and water management (4.67 %) is particularly concerning, as these areas are vital to initial crop establishment and resource use efficiency. These results corroborate the earlier studies (22, 23).

Interestingly, relatively higher knowledge was observed in soil selection (36 %), suggesting that indigenous knowledge still plays an important role in guiding local agronomic decision-making. Such traditional familiarity with soil characteristics may have allowed farmers to maintain acceptable productivity despite lacking technical expertise in other areas. However, the sharp contrast between traditional knowledge retention and limited scientific adoption highlights the transitional nature of knowledge systems in tribal areas like Mayurbhanj. The distribution seen in Fig. 1 underscores a knowledge landscape dominated by partial awareness. The high proportion of respondents with medium-level knowledge suggests that most rice growers in Mayurbhanj are aware of common cultivation steps, but may lack the technical depth required for precision agriculture. This middle-ground knowledge can result in inconsistent or suboptimal implementation of best practices. The relatively low percentage of high-knowledge respondents (11.33 %) highlights a potential gap in access to comprehensive training or extension support, particularly on agronomic principles, resource efficiency and pest and disease control. At the same time, the presence of 12.67 % with low knowledge raises concerns about inclusion and outreach, especially for marginal or less-exposed farming communities. These findings advocate for capacity-building programs that elevate farmers from medium to high knowledge levels, ensuring that awareness translates into effective action. Strategically designed training interventions and context-specific educational materials may help bridge the gaps and promote a holistic understanding of rice cultivation practices (22, 23).

The results from the regression analysis further reveal that economic motivation, extension participation, education level and information access significantly contribute to farmers' knowledge levels (Table 4). This observation aligns with the past findings, which emphasised the critical role of institutional support and knowledge channels in facilitating learning (18, 22). On the other hand, farming experience and innovativeness showed no significant relationships, reaffirming (23). This suggests that structured instruction, rather than passive experience, drives effective knowledge improvement. Overall, the findings highlight a partial and experience-driven awareness among rice growers in Mayurbhanj, characterised by high practical familiarity but limited technical comprehension. The observed asymmetry between daily operational knowledge and scientific understanding reflects the need for integrated, area-specific extension models. Effective strategies should blend indigenous practices with formal agronomic

Table 4. Effects of independent variables on knowledge level based on multiple linear regression (n =150)

Model	R	R^2		
1	0.896	0.803		
Predictor	Estimate	SE	t	p
Intercept	-136.434	30.865	-4.420	<.001
Age	1.829	0.732	2.498	0.014
Education level	4.419	0.93	4.752	<.001
Farming experience	0.163	0.136	1.199	0.233
Land holding	1.617	0.667	2.424	0.017
Income	0.499	0.163	3.070	0.003
Sources of information	2.115	0.289	7.322	<.001
Extension participation	4.331	0.722	6.000	<.001
Innovativeness	0.173	0.283	0.612	0.541
Economic motivation	6.681	0.612	10.917	<.001
Risk orientation	0.518	0.162	3.190	0.002

training through field demonstrations, participatory learning and capacity-building workshops. This interpretative analysis underscores the necessity of aligning future efforts toward building a stronger, evidence-based extension framework to transform medium-level awareness into higher technical competency.

Conclusion

The present study reveals that rice growers in Mayurbhanj district possess a moderate level of knowledge regarding recommended rice cultivation practices, with significant variation across specific domains. Farmers exhibited relatively higher awareness in post-production and field-related practices such as field preparation, harvesting and post-harvest management. However, low levels of knowledge in critical areas like nursery management, seed treatment, pest and disease control and selection of appropriate seeds indicate serious gaps in foundational agronomic understanding. The regression analysis emphasises that economic motivation, extension participation, education level and access to information are the most significant determinants of knowledge enhancement. Surprisingly, farming experience and innovativeness did not significantly influence knowledge levels, suggesting that passive exposure alone does not ensure comprehension or adoption of scientific practices. These findings underline the urgent need for targeted capacity-building programs and context-specific extension strategies that move beyond general awareness and promote in-depth, practice-oriented knowledge. There is a pressing need to strengthen the agricultural extension system, diversify communication channels and develop customised training modules to improve technical knowledge among farmers, particularly in underperforming areas like nursery practices and crop protection. By focusing on both technical education and motivational drivers, policy-makers, extension agencies and agricultural institutions can play a pivotal role in bridging the knowledge gaps and improving the overall productivity and sustainability of rice farming in Odisha's tribal and resource-constrained regions.

Authors' contributions

AB conducted the research work and collected the data. RKB guided the data analysis, assisted in manuscript organisation and finalised the tables. SKM supervised the overall research process, refined the writing and ensured the completeness and quality of the final manuscript. All authors read and approved the final version of the manuscript.

Compliance with ethical standards

Conflict of interest: The Authors do not have any conflicts of interest to declare.

Ethical issues: None

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used the ChatGPT AI tool to improve sentence structure and correct grammar errors. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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