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RESEARCH PAPER

Constraints in Adoption of Improved Paddy Cultivation Practices among Farmers of Northern Karnataka

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ABSTRACT

The adoption of improved paddy cultivation practices is central to improve the productivity, profitability and sustainability of rice based farming systems in Karnataka. However, the rate of adoption is still limited by a number of farm-level and institutional challenges. The present study was undertaken in the year 2024-25 in order to understand the significant constraints encountered by the paddy farmers in practising improved cultivation practices and to record the farmer derived suggestions for strengthening extension services in Northern Karnataka. Using ex-post facto research design, data was collected from 150 paddy growers selected by using multi stage random sampling from Dharwad, Belagavi and Vijayapura districts. Garrett's ranking technique was used to prioritize the constraints and suggestions. The findings showed that lack of location-specific agro-advisory services, high cost of quality inputs, untimely availability of seed, labour scarcity and poor extension outreach were the most serious constraints for limiting the adoption. Farmers emphasized on time supply, of quality input, strengthening of field level extension services, regular training and demonstrations, stable market prices and improved access to institutional credit as the most important measure for improving adoption. The findings highlight the need for an integrated extension approach combining localized advisory services together with institutional coordination, financial facilitation and farmer-centred learning mechanisms. Strengthening village-level extension systems and input delivery networks will be important for accelerating adoption of improved paddy practices and ensuring sustainable intensification of rice production in the region.

HIGHLIGHTS

- High input cost, lack of local agro-advisory, and untimely quality seed are primary constraints for adoption.
- Labour scarcity and weak village-level extension delivery significantly limited effective practice adoption.
- Farmers prioritised timely inputs, strong field extension, and regular training to improve adoption.

Keywords: Extension outreach, farmer perception, institutional support, production sustainability, technology diffusion

The current agriculture is facing several climatic anomalies which becomes fatal for food and nutritional security (Santosh *et al*. 2024; Maitra *et al*. 2025; Sairam *et al*. 2025). Among different food crops, rice (*Oryza sativa* L.) is the most important staple crop which plays a vital role in ensuring food security, farm income and employment of the rural population in India. In Karnataka, paddy cultivation plays a central role in the agrarian economy

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especially in irrigated command areas where the rice-based farming systems are supporting the livelihoods and local value chains. Despite steady technological progress in rice production, substantial production yield gaps remain because of inconsistent adoption of improved rice production practices among farmers (Sagar *et al*. 2023). These practices include the use of high yielding and stress tolerant variety, scientific water management, balanced application of nutrients, integrated pest management and timely post-harvest handling.

The adoption of improved agricultural practices is a complex behavioural process which is influenced not only by the technical feasibility but also by economic, institutional, infrastructural and socio-psychological factors. Studies from Karnataka and elsewhere in India have time and again revealed that farmers face multiple constraints in the process of technology adoption thereby limiting the realization of productivity and income gains (Ashoka *et al*. 2022; Brar *et al*. 2020; Durgude *et al*. 2022; Naik *et al*. 2022). For instance, in the study by Shanabhoga *et al*. (2020), the study showed that paddy farmers of the Kalyana-Karnataka region were perfectly limited in terms of location-specific agro-advisory services, high cost of inputs, labour scarcity and low extension linkages, which limited the effective implementation of climate-resilient and improved farming practices.

Agricultural extension has a major role to play in closing the gap between research recommendations and the realities of farmers in the field by strengthening knowledge systems, facilitating the availability of inputs and services, and in improving the decision making capacity of farmers. However, when extension delivery mechanisms continue to be weak or matched to the needs of farmers, adoption of improved practices is fragmented and slow (Ravikumar *et al*. 2015; Shelar *et al*. 2021). Empirical evidences suggest that limited access to timely information, rising costs of inputs, unstable market prices and labour shortages are some of the dominant bottlenecks faced by the paddy farmers in many regions (Dupdaland Patil, 2019; Maitra *et al*. 2020; Mukesh *et al*. 2024; Ray *et al*. 2024).

Recent research has shown that adoption of improved rice technologies is highly dependent on a combination of behavioural, economic and institutional factors. Empirical evidences from Assam showed that as high as 91.6% of rice farmers were laggard category with the strong risk aversion despite being aware of improved practices, which indicates the deep behavioural dimension of technology adoption (Saikia and Rajalakshmi, 2024). Similarly, research conducted in Nigeria revealed that although the adoption of climate-smart rice practices like minimal tillage and drought resistant varieties were moderately adopted (mean scores 3.5-3.6), almost 72% of farmers did not have regular contact with extension, indicating the persistent weakness of advisory systems in driving continued adoption (Agouand Chah, 2025). National level studies in India further support these trends: Recent multi-state level studies have shown that high input cost (3.59) and poor access to finance and credit (3.71) are the biggest obstacles constraining the adoption of improved rice technology in India, while only 62.3% of farmers achieved high levels of adoption, thereby showing high scope for extension intervention (Aremu *et al*. 2025).

Recent investigations from Uttar Pradesh, Odisha and Manipur reveal persistent knowledge-practice gaps and institutional bottlenecks in systems of rice cultivation. Studies from Uttar Pradesh have shown that adoption level is much lower across the villages and highly correlated with contact and training by extension workers (Kumar and Sharma, 2025). Research on stress tolerant rice varieties in Odisha, found technological, organisational and social constraints as predominant barriers despite the various varieties was suitable to local agro-ecological conditions (Satpathy *et al*. 2025). Similarly, in Manipur, findings showed great technological gaps in the area of fertilizer application, weed management and scheduling irrigation despite having high awareness of improved varieties (Thangjam *et al*. 2025). Collectively, these findings emphasize the need for better paddy adoption to go well beyond availability of the technology; it needs the development of solid and localised extension systems, increased institutional linkages, financial facilitation and long-term behavioural change strategies - a perspective that directly informs the conceptual and analytical framework of the present study.

Furthermore, farmers themselves have great experiential knowledge of practical solutions to overcome adoption barriers. Documenting such

farmer derived suggestions is essential if extension strategies are to be strengthened and agricultural development programs are to remain farmer centered and context specific (Adger *et al*. 2003; Rai *et al*. 2018). In this context, the present study was undertaken to see the constraints faced by the paddy farmers in adopting improved cultivation practices and elicit their suggestions in improving the effectiveness of agricultural extension services in Northern Karnataka.

METHODOLOGY

The present investigation was conducted in 2024-25 with an aim to study constraints and farmer's derived suggestions regarding adoption of improved practices of paddy cultivation in Northern Karnataka. An ex-post facto research design was adopted since the independent variables had occurred before and were not controlled by the investigator (Kerlinger and Lee; Kothari, 2004). Northern Karnataka was deliberately chosen because of the significant contribution to the production of paddy and its socio-economic significance in the agrarian economy of the state. Three major paddy growing districts namely Dharwad, Belagavi and Vijayapura were selected for the study. From each selected district, one taluk that had maximum area under cultivation of paddy was identified with the help of officials of the Department of Agriculture. Further, two villages were selected randomly from each taluk. From each village, 25 paddy farmers were selected by simple random sampling for a total sample of 150 respondents. This sample size meets the general social science research requirement and is of sufficient statistical reliability (Cohen, 1990). Primary data has been collected by using pre-tested structured interview schedule conducted through personal interview. The instrument featured four sections such as (i) social economic characteristics of the respondents, (ii) adoption of improved paddy cultivation practices, (iii) constraints in adoption and (iv) suggestions for improvement of adoption and extension services. The content of the schedule was finalized as a result of expert consultation and pilot testing to achieve validity and reliability (Kothari, 2004).

The limitations and recommendations were ranked with the use of Garrett's Ranking Technique that is commonly used in agricultural extension research for the conversion of qualitative ranks to quantitative scores for effective comparison (Garrett and Woodworth, 1969; Sabarathanam, 1988). Respondents ranked the identified constraints and suggestions from most severe to least severe as well as most important to least important. The assigned ranks were being converted to percent position using the following formula:

$$\text{Percent Position} = \frac{100\left(R_{ij} - 0.5\right)}{N_j}$$

Where, R_{ij} denotes the rank given by the j^{th} respondent to the i^{th} item and N_j represents the total number of items ranked by the j^{th} respondent.

The percent positions were then translated to Garrett scores based on the normal Garrett conversion table. The average Garrett score for each item was calculated and final ranks given accordingly. Descriptive statistical tools like frequency, percentage, mean and ranking were used to analyze the data. Garrett's ranking technique helped to identify priority constraints and identify solutions suggested by the farmers. The results were interpreted in the context of extension theory and other previous empirical results to draw meaningful conclusions and policy implications.

RESULTS AND DISCUSSION

The constraints perceived by paddy farmers in adopting the improved cultivation practices were analyzed using Garrett's ranking technique, and presented in Table 1. The results show that farmers faced multidimensional challenges that can be grouped as technical, economic, input, labour, administrative and personal challenges.

Among the technical constraints, absence of place specific paddy agro-advisory services (Mean Garrett Score = 74.62), followed by poor reliability of weather and crop advisory information (72.38) and inadequate knowledge of SRI and AWD techniques (70.41) were the major constraints. This implies the existence of a critical information gap at the farm level. For extension systems, this finding means that it is not sufficient for technologies to be available unless advisory services are adapted to local ecologies and production systems. If farmers are not confident in the reliability of information, their motivation to invest in improved practices falls.

Similar findings were reported by Shanabhoga *et al*. (2020) who documented that the lack of reliable local advisories was a significant constraint to the ability of paddy farmers to adopt climate-resilient practices in Karnataka. Ravikumar *et al*. (2015) also stressed that poor communication networks have a negative impact on the ability of farmers to understand and use agrometeorological information. This highlights the need for local and continuous and interactive forms of advisory mechanism such as village level extension meetings, field demonstrations and ICT enabled decision support tools.

Table 1: Constraints in adoption of improved paddy cultivation practices among farmers of northern Karnataka (Garrett's Ranking)

Sl. No.	Constraints	Mean Garrett Score	Rank
Technical Constraints			
1	Absence of location-specific paddy agro-advisory services	74.62	I
2	Poor reliability of weather and crop advisory information	72.38	II
3	Inadequate knowledge of SRI and AWD techniques	70.41	III
4	Lack of awareness about improved and stress-tolerant varieties	68.75	IV
5	Limited technical guidance on INM and IPM	66.92	V
Economic Constraints			
6	High cost of quality seed, fertilizers and pesticides	76.85	I
7	Lack of timely institutional credit facilities	73.60	II
8	Low and unstable market price for paddy	69.44	III
Input Constraints			
9	Non-availability of quality paddy seed at the right time	75.21	I
10	Irregular supply of fertilizers and pesticides	72.86	II
11	Lack of subsidies on certified seed and farm inputs	69.35	III
12	Poor and irregular electricity supply for irrigation	67.18	IV
Labour Constraints			
13	Non-availability of labour during peak operations	74.54	I
14	High wage rate of farm labour	72.09	II
15	Labour unwillingness due to heat stress and long hours	65.73	III
Administrative Constraints			
16	Inadequate government attention to paddy production problems	71.86	I
17	Weak extension service delivery at village level	69.12	II
18	Absence of effective policy support for small paddy growers	66.45	III
Personal Constraints			
19	Cultural influence and attachment to traditional practices	70.38	I
20	Inability to give up conventional methods	68.41	II
21	Low awareness of modern paddy technologies	66.07	III
22	Inability to access timely and reliable information	64.25	IV

With respect to economic constraints, high cost of quality seed, fertilizers and pesticides emerged as the most critical issue (76.85) followed by lack of timely institutional credit (73.60) and low and unstable market price for paddy (69.44). The dominance of high cost of quality inputs and lack of access to timely institutional credit as major economic constraints is indicative of the financial vulnerability of the paddy farmers. Even in cases where farmers are well aware of the benefits of better practices, their decision to adopt them is highly conditioned by economic risk. Low and volatile prices in the markets further undermine the ability of farmers to maintain improved production practices. Comparable result was found by Dupdal and Patil (2019) and Shelar *et al*. (2021) who found that high input prices and low access to credit were the dominating adoption barriers among farmers in Karnataka and Maharashtra. Extension interventions, therefore, have to go beyond dissemination of knowledge and include financial facilitation, such as linkage with credit institutions, crop insurance programs, and market support mechanisms.

Under input-related constraints, non-availability of quality paddy seed at right time ranked first (75.21) followed by irregular supply of fertilisers and pesticides (72.86). Timely access to quality inputs is critical to the successful adoption of improved practices, and any disruption has a major impact on crop productivity. These findings are consistent with the results of Brar *et al*. (2020), Naik *et al*. (2022), which reported that the delay in the availability of

inputs was a major factor in limiting the adoption of improved rice technologies.

With respect to labour constraints, non-availability of labour during peak operations (74.54) and high rate of wages (72.09) were seen as grave constraints. The lack of availability of quality seed at the appropriate time and labour shortage during peak seasons came up as major structural constraints. Paddy cultivation is very sensitive to time; delays in the supply of seeds or labour fail the whole production process and lead to reduced yield potential. Labour shortage, especially during the transplanting and harvesting seasons, has been limiting the cultivation of paddy in recent times, which is also observed to be true by Ashoka *et al*. (2022) in the central dry zone of Karnataka. For extension agencies, these results indicate the importance of institutional coordination among the input suppliers, cooperatives, custom hiring centres and labour-sharing groups in order to achieve timely access to critical production resources.

In the area of administrative constraint, farmers reported the absence of proper attention by the government to the problems of paddy production (71.86), lack of extension services delivery at village level (69.12) as the significant constraint. This further emphasizes the need for strengthening field level extension mechanisms, which is also the conclusion inferred from the study conducted by Shanabhoga *et al*. (2020) and Shelar *et al*. (2021). Among personal constraints, cultural influence and attachment to traditional practices (70.38) and inability to give up conventional methods (68.41) came out as major impediments. Such socio-psychological barriers tend to retard the diffusion of technology as was also found by Rai *et al*. (2018) in their evaluation of smallholder climate resilient agriculture. Farmers' perception about poor extension service delivery and the lack of government attention is evidence of decline in institutional trust. At the same time, cultural attachment to traditional practice and resistance to change reflect the very deep-rooted behavioural dimensions of technology adoption. Extension strategies must therefore be participatory, trust-based and behaviourally informed, both in combining technical training with social mobilization and secondly in involving farmer-to-farmer learning.

The suggestions put forward by farmers, ranked based on Garrett's technique (Table 2) suggest valuable points to be kept in mind for planning extension. The best recommendation was timely supply of quality seed and farm inputs (78.45) followed by strengthening field-level extension services (75.92) and regular training and demonstrations on improved paddy practices (73.88). These farmer-driven recommendations have focused on the need for integrated service delivery, better institutional coordination and capacity building. Similar expectations from farmers were reported by Dupdal and Patil (2019), who found that better access to inputs and extension support considerably increased the adaptive capacity of farmers. Shanabhoga *et al*. (2020) also reported that farmers strongly demanded an improved extension connectivity and timely assistance to maximize the effectiveness of agricultural innovations. Ensuring remunerative and stable market price (71.36) and facilitating access to institutional credit and crop insurance (69.15) are additional indicators of the economic vulnerabilities of paddy farmers. These findings align with previous studies by Brar *et al*. (2020) and Shelar *et al*. (2021), which have shown the importance of financial security and assurance by the markets for sustaining technology adoption. The suggestions expressed by farmers seem to give valuable direction on how to design responsive extension programs. The high priority given to timely supply of inputs, strengthening extension services and regular trainings and demonstrations shows that farmers need both material support as well as knowledge empowerment. These farmer driven recommendations reassert the role of extension as a facilitator of agricultural transformation, rather than a conveyor of technologies. Furthermore, the farmer's focus on market stability, credit availability and crop insurance shows that they are seeking risk reduction and income stability, without which the adoption of improved practices cannot be sustained.

The study clearly demonstrates how the process of improving paddy adoption in Northern Karnataka should involve an integrated approach to extension - one that harmonises the process of disseminating technology with institutional support, financial inclusion, market facilitation and social learning processes. Strengthening village-level extension systems, increasing the reach of ICT-based advisory platforms and strengthening farmer organisations

will be crucial to translate research innovations into sustained impact at the field level.

Table 2: Suggestions expressed by paddy farmers for improving adoption of improved practices (Garrett's Ranking)

Sl. No.	Suggestions	Mean Garrett Score	Rank
1	Timely supply of quality seed and farm inputs	78.45	I
2	Strengthening field-level extension services	75.92	II
3	Regular trainings and demonstrations on improved paddy practices	73.88	III
4	Ensuring remunerative and stable market price for paddy	71.36	IV
5	Easy access to institutional credit and crop insurance	69.15	V
6	Improvement of irrigation and water management facilities	67.28	VI
7	Promotion of FPOs and cooperative marketing	65.40	VII
8	Wider use of ICT-based advisory services	63.74	VIII

CONCLUSION

The study concludes that adoption of improved cultivation practices in paddy in Northern Karnataka is limited not only by technological limitations, but by a combination of informational, economic, institutional and behavioural barriers. The most important issues identified are the lack of location-specific agro-advisory services, high input costs, untimely availability of quality seed, labour scarcity and poor extension outreach. Farmers' suggestions clearly indicate about strengthening of field level extension services, about ensuring timely and affordable supply of inputs, about improvement in access to institutional credit and crop insurance, about fixation of market prices for paddy. For effective improvement in adoption, extension agencies should adopt an integrated strategy which includes localised advisory services and regular field demonstrations, ICT based support systems, and better coordination with input suppliers, financial institutions and market agencies. Policy interventions should be focused on strengthening village-level extension infrastructure and farmer organizations. Such targeted extension and policy measures are necessary if they are to achieve the sustainable intensification of paddy production and to improve farm livelihoods in the region.

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