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Challenges of Agricultural Information Access and Implementation Among Mango Farmers

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ABSTRACT

Access to timely and accurate agricultural information is crucial for enhancing productivity, improving livelihoods, and ensuring sustainability in mango cultivation. Mango farmers, particularly in developing regions, often face multiple challenges in obtaining and effectively utilizing this information. Limited extension services, low digital literacy, inadequate infrastructure, and socio-economic constraints impede farmers from accessing modern cultivation practices, pest and disease management strategies, and post-harvest technologies. Furthermore, information that is available is frequently generalized and may not account for local agro-climatic conditions, resource availability, or market dynamics, reducing its practical applicability. The implementation of agricultural information is further constrained by financial limitations, labor shortages, cultural practices, and risk aversion among farmers. Market-related challenges, such as price volatility, limited market intelligence, and dependence on intermediaries, also restrict the benefits of informed decision-making. Technological interventions, such as mobile advisory services, ICT tools, and digital platforms, show promise in bridging information gaps; however, barriers like connectivity issues, affordability, and gender disparities limit their adoption. This paper theoretically explores the multidimensional challenges of agricultural information access and implementation among mango farmers, highlighting the interplay of informational, technological, institutional, and socio-economic factors. It underscores the need for inclusive, localized, and context-specific strategies to empower farmers, enhance productivity, and strengthen the mango value chain.

KEYWORDS: Agricultural information, Mango farmers, Extension services, ICT in agriculture, Market access.

1. INTRODUCTION

Agriculture continues to be the backbone of rural economies in many developing countries, providing food security, employment, and livelihood opportunities to millions of smallholder farmers. Among the diverse agricultural enterprises, mango cultivation holds a special significance due to its economic, nutritional, and cultural value. Mango (Mangifera indica L.), often referred to as the "king of fruits," is cultivated widely across tropical and subtropical regions and constitutes an essential part of both domestic consumption and international trade. Despite

its potential as a high-value cash crop, mango farmers frequently face numerous challenges that hinder productivity, profitability, and sustainability. One of the most critical concerns is the limited access to agricultural information and the constraints surrounding its effective implementation. In the era of globalization, digital transformation, and knowledge-driven economies, the role of timely, accurate, and relevant agricultural information cannot be overstated. It serves as a foundation for informed decision-making, improved farming practices, and resilience against risks such as pests, diseases, and climate variability. Access to agricultural information encompasses the ability of farmers to obtain knowledge related to improved cultivation techniques, modern irrigation systems, disease management, post-harvest handling, market trends, and government support schemes. However, the accessibility of such knowledge is often unevenly distributed among farming communities. Mango farmers, especially those in rural and resource-poor regions, encounter barriers such as inadequate extension services, lack of training opportunities, low literacy levels, poor digital infrastructure, and limited awareness of available technologies. These gaps create a disconnect between research institutions, policymakers, and farmers, resulting in underutilization of scientific innovations that could otherwise enhance productivity and income. Moreover, even when information is accessible, implementation remains a challenge due to constraints like financial limitations, labor shortages, cultural practices, and risk aversion to new methods.

The traditional mode of agricultural extension, which relied on government extension officers, farmer field schools, and cooperatives, has weakened in many regions due to limited funding and institutional inefficiencies. Consequently, mango farmers are often left to rely on informal sources such as fellow farmers, local traders, or unverified digital platforms. While peer-to-peer learning plays a vital role in sustaining local knowledge systems, it often lacks scientific rigor, leading to misinformation or partial adoption of practices. For instance, inaccurate advice on pesticide usage can result in over-application, thereby increasing production costs, reducing fruit quality, and posing health and environmental risks. Similarly, inadequate knowledge about post-harvest handling and storage results in significant losses along the value chain, undermining farmer incomes. Technological advancements, particularly the rise of Information and Communication Technologies (ICTs), present promising avenues to bridge information gaps in agriculture. Mobile phones, radio programs, and digital advisory platforms can disseminate information rapidly to dispersed farming populations. However, digital literacy among mango farmers remains a concern. Many lack the skills to effectively use mobile applications or online portals, and issues of affordability, connectivity, and language barriers further limit the potential of ICT solutions.

Women farmers, who play a crucial role in mango cultivation and marketing, are particularly disadvantaged due to gender disparities in technology access and ownership. As a result, interventions aimed at improving agricultural information systems must also address social inclusivity and gender-sensitive approaches. Another dimension of the challenge lies in the contextual relevance of agricultural information. Farmers often receive generalized recommendations that do not account for local agro-ecological conditions, resource availability, or market dynamics. For example, recommendations on fertilizer application may not consider soil variability, leading to inefficient nutrient management. Likewise, disease management guidelines that ignore climatic variations may fail to prevent outbreaks. Thus, the quality, specificity, and adaptability of information are just as important as access itself. Furthermore, implementing agricultural information requires not only knowledge but also enabling resources. Even when mango farmers are aware of improved practices such as drip irrigation, integrated pest management, or grafting techniques, their adoption is limited if inputs are costly, credit facilities are inaccessible, or government

subsidies are insufficient. Institutional barriers, such as bureaucratic delays in accessing crop insurance or extension support, further discourage farmers from translating information into practice. The interplay between knowledge, resources, and institutional support therefore determines the extent to which mango farmers can benefit from available agricultural information.

In addition to production-related challenges, market information remains a critical gap for mango farmers. Price volatility, middlemen exploitation, and limited bargaining power prevent farmers from realizing fair value for their produce. Access to real-time market data, demand forecasts, and export opportunities could empower farmers to make informed decisions about when, where, and how to sell their mangoes. Unfortunately, such information is often concentrated among traders and exporters, leaving farmers marginalized in the value chain. Strengthening market information systems is therefore essential for enhancing farmer profitability and promoting sustainable mango production.

In sum, the challenges of agricultural information access and implementation among mango farmers are multidimensional, encompassing informational, technological, institutional, financial, and socio-cultural barriers. Addressing these challenges requires a holistic approach that integrates modern extension systems, inclusive ICT tools, localized knowledge dissemination, capacity-building programs, and supportive policy frameworks. By doing so, mango farmers can be empowered to adopt best practices, reduce post-harvest losses, enhance productivity, and improve their livelihoods in an increasingly competitive and uncertain agricultural landscape.

II AGRICULTURAL INFORMATION: CONCEPT AND IMPORTANCE

Agricultural information encompasses the knowledge, data, and insights that farmers utilize to plan, manage, and optimize their farming activities. It is not merely raw data; rather, it is actionable knowledge that directly influences agricultural productivity, farm income, and overall food security.

The significance of agricultural information lies in its ability to enable farmers to make informed decisions, adopt best practices, and anticipate challenges. For mango farmers, who cultivate a high-value perennial crop that is highly sensitive to pests, diseases, and climatic variations, timely access to accurate information is crucial. Proper guidance allows farmers to ensure quality production, reduce losses, and maintain profitability in a competitive market.

Definition and Types of Agricultural Information

Several scholars define agricultural information as the process of collecting, disseminating, and utilizing knowledge related to agricultural production, market dynamics, and rural development policies. It is a comprehensive resource that bridges the gap between scientific research, government initiatives, and farmers' traditional knowledge. Agricultural information can be broadly classified into the following categories:

- **Technical Information:** Technical information provides farmers with practical advice on improving cultivation practices. This includes pest and disease management, irrigation scheduling, soil fertility management, pruning, fertilization, and harvesting techniques. Specifically for mango cultivation, technical guidance may cover recommended varieties suitable for local agro-climatic conditions, pest-resistant strains, and the choice between organic and chemical farming methods. By following such guidance, mango farmers can increase yield, enhance fruit quality, and reduce production losses.
- **Market Information:** Market information encompasses data on prices, supply-demand trends, export opportunities, and consumer preferences. For mango farmers, market intelligence is vital to decide when to

harvest and sell fruits to maximize profit margins. Awareness of domestic and international market trends helps farmers plan storage, packaging, and transportation strategies effectively, thereby reducing post-harvest losses and enhancing market competitiveness.

- **Policy and Institutional Information:** This type of information relates to government schemes, subsidies, credit facilities, crop insurance, and other institutional support mechanisms. Knowledge of policy initiatives enables mango farmers to leverage financial and technical assistance, access loans at favorable terms, and mitigate risks associated with crop failure. It ensures that farmers remain informed about regulatory changes and available programs that can enhance farm sustainability and resilience.
- **Weather and Climate Information:** Weather and climate information includes forecasts for rainfall, temperature, humidity, and extreme events like cyclones or droughts. Such information is particularly crucial for mango farmers, as the crop's flowering, fruit set, and pest prevalence are highly sensitive to climatic conditions. By using weather updates and climate alerts, farmers can plan irrigation schedules, protect crops from adverse weather, and adopt timely pest and disease management practices.

Role in Decision-Making, Technology Adoption, and Risk Management

Agricultural information plays a pivotal role in supporting critical farm-level decisions, particularly for mango farmers who face multiple production, market, and climatic challenges. Timely and accurate information equips farmers with the knowledge needed to make strategic choices that improve productivity, reduce risks, and enhance profitability. The utility of agricultural information for mango farmers can be explored in the following dimensions:

- **Selection of Varieties:** Choosing the right mango varieties is fundamental to achieving high yields, superior fruit quality, and disease resistance. Access to information on the performance of different cultivars under local agro-climatic conditions allows farmers to select varieties that are well-adapted to soil types, rainfall patterns, and temperature fluctuations. Knowledge of pest-resistant or drought-tolerant varieties also reduces crop losses, lowers dependency on chemical inputs, and ensures sustainability in production. Consequently, informed selection contributes to long-term farm success and market competitiveness.
- **Adoption of Modern Technologies:** Agricultural information guides farmers in implementing advanced cultivation practices and technologies. For instance, understanding the benefits of drip irrigation and fertigation systems helps optimize water and nutrient use, leading to higher yields with lower environmental impact. Similarly, adopting improved pruning methods, bio-pesticides, or integrated pest management techniques can significantly enhance plant health while reducing reliance on harmful chemicals. Access to such knowledge encourages innovation, efficiency, and sustainability in mango farming operations.
- **Risk Mitigation:** Mango cultivation is highly vulnerable to pests, diseases, and climatic uncertainties. Information regarding pest outbreaks, disease patterns, seasonal forecasts, and extreme weather events allows farmers to take preventive measures, such as timely pesticide application, pruning, or protective irrigation. Early warning systems and advisory services help reduce crop losses, minimize economic risks, and enhance the resilience of farming systems against unforeseen challenges.
- **Economic Decision-Making:** Beyond technical guidance, agricultural information aids farmers in making sound financial and market-related decisions. Knowledge of current input costs, labor requirements, and

price trends enables farmers to plan harvests, schedule sales, and negotiate better prices. By integrating market intelligence, mango growers can optimize resource allocation, avoid post-harvest losses, and make investments that improve both short-term returns and long-term financial stability.

- **Improvement of Productivity and Income:** Combining technical knowledge with market and climate-related information empowers farmers to optimize all aspects of production. Effective use of information allows for precise fertilization, efficient water management, and improved pest control, which collectively boost crop yields. Additionally, informed marketing strategies ensure better prices for produce, thereby increasing overall income. Access to comprehensive agricultural information transforms traditional farming practices into knowledge-driven, profitable, and sustainable operations.

In essence, agricultural information functions as a strategic tool that empowers mango farmers to convert raw data into actionable decisions. By reducing uncertainty, enhancing preparedness, and guiding efficient resource use, it strengthens farm resilience, fosters innovation, and promotes sustainable agricultural development. Properly harnessed, this information forms the foundation for both technical and economic progress in mango cultivation.

III SOURCES OF AGRICULTURAL INFORMATION FOR MANGO FARMERS

Mango farmers rely on a diverse set of information sources to make informed decisions about cultivation, pest management, post-harvest handling, and marketing. These sources are broadly categorized into formal, informal, and technological channels. Each type plays a crucial role in disseminating knowledge and guiding farmers toward improved productivity, enhanced profitability, and effective risk management. However, these sources also come with specific limitations related to accessibility, credibility, and applicability, which farmers must navigate carefully. Understanding and utilizing these sources effectively is vital for optimizing mango production and sustaining livelihoods in rural communities.

Formal Sources

Formal sources are structured, systematic, and typically supported by scientific research or government initiatives. These sources are highly credible and provide evidence-based guidance that can improve agricultural outcomes. They are designed to offer reliable and technically sound information, often including demonstrations, training, and publications. Key formal sources include:

Government Extension Services: Agricultural extension officers form the primary link between research institutions and farmers. They conduct training sessions on improved mango cultivation techniques, pest management, irrigation practices, and harvesting methods. These officers also organize field demonstrations and hands-on workshops where farmers can directly observe and practice recommended techniques. Beyond technical guidance, extension services disseminate crucial information on government schemes, subsidies, crop insurance programs, and new agricultural technologies. By providing policy-backed support and regular advisories, extension personnel ensure that farmers can make informed decisions that align with national agricultural priorities and maximize productivity.

Research Institutions: Universities, agricultural colleges, and specialized research centers play a central role in the development of advanced mango cultivation technologies. They work on creating improved mango varieties with higher yields, disease resistance, and better fruit quality. Research institutions also conduct controlled field trials to test new pest management strategies, irrigation systems, and post-harvest preservation methods. By translating

laboratory findings into field-level applications, these institutions bridge the gap between science and practice. Farmers benefit from workshops, demonstration plots, and technical bulletins prepared by these institutions, which help them adopt scientifically validated cultivation practices and improve overall orchard management.

Non-Governmental Organizations (NGOs): NGOs often operate at the grassroots level, complementing government services by addressing local challenges faced by smallholder mango farmers. They facilitate participatory learning programs, organize skill development workshops, and provide technical support for capacity building. By empowering farmers with knowledge of integrated pest management, organic practices, or climate-resilient farming, NGOs strengthen community-level adoption of innovative practices. They also act as advocates for farmers' needs, helping them access government resources, market linkages, and credit facilities, thereby improving both livelihood security and production efficiency.

Informal Sources

Informal sources are grounded in local experience, community interactions, and shared knowledge networks. Unlike formal channels, these sources are flexible, accessible, and highly context-specific. They allow farmers to adapt practices based on local conditions, preferences, and practical insights. Key informal sources include:

Peer Networks: Farmers regularly exchange practical knowledge, experiences, and locally tested solutions within their communities. Peer-to-peer learning is particularly important in regions where formal extension services are sparse or under-resourced. By observing the successes and failures of neighbors, farmers can adopt new cultivation techniques, disease management strategies, or harvesting practices more confidently. Such social learning networks often foster trust, encourage experimentation, and accelerate the adoption of innovative practices at the village or community level.

Local Traders and Cooperatives: Interactions with local traders, middlemen, and cooperative societies provide farmers with valuable market intelligence. These informal channels offer insights into current demand patterns, price fluctuations, and consumer preferences. Farmers often rely on this information to adjust harvesting schedules, storage practices, and sales strategies. Cooperatives also serve as a platform for pooling resources, negotiating better prices, and accessing collective marketing opportunities. By leveraging these networks, farmers can align their production with market requirements, reducing post-harvest losses and maximizing profitability.

Social media and Farmer Forums: The proliferation of smartphones and internet connectivity has made social media and online forums a key source of agricultural knowledge. Platforms like WhatsApp groups, Facebook communities, and specialized agricultural forums allow farmers to share real-time updates, seek expert advice, and discuss practical challenges. This virtual peer learning enables the exchange of innovative practices, pest management tips, and cultivation techniques across regions. Social media also facilitates rapid dissemination of warnings about pest outbreaks, weather hazards, or market trends, helping farmers respond proactively.

Technological Sources

Technological sources leverage digital tools, broadcast media, and online knowledge repositories to provide wide-reaching, timely, and often interactive information. These channels are particularly effective in delivering real-time advisories and large-scale training. Key technological sources include:

Information and Communication Technology (ICT): Mobile applications, SMS alerts, and web-based advisory portals provide farmers with immediate access to critical updates. ICT tools offer information on crop management, pest outbreaks, weather forecasts, soil health, irrigation schedules, and market prices. By enabling timely decision-making, these technologies help farmers reduce risks associated with pest infestations, climatic fluctuations, and market uncertainties. Interactive features such as expert consultation, chatbots, and automated notifications further enhance the usability and relevance of digital advisory systems.

Radio and Television: Despite the growth of digital platforms, radio and television remain effective mediums for reaching farmers in remote and underserved regions. Agricultural programs broadcast through these channels provide practical guidance on pest control, fertilizer application, pruning, irrigation management, and harvesting techniques. They also disseminate information about government schemes, policy changes, and emerging technologies. Regularly scheduled programs help farmers stay informed even in areas with limited internet connectivity, bridging the knowledge gap between research institutions and field-level practices.

Online Platforms and Knowledge Repositories: Websites, digital learning portals, and knowledge repositories serve as comprehensive sources of technical and educational content. Farmers can access training modules, video demonstrations, expert consultations, case studies, and downloadable guides on mango cultivation practices. These platforms often provide multimedia content to facilitate better understanding and practical implementation. Tech-savvy farmers can leverage these resources to keep up with innovations, adopt precision farming techniques, and integrate modern post-harvest management practices into their operations

IV CHALLENGES IN ACCESSING AGRICULTURAL INFORMATION

Despite the availability of multiple sources of agricultural information, mango farmers frequently face substantial barriers in obtaining timely, relevant, and actionable knowledge. These challenges hinder the adoption of improved cultivation practices, reduce productivity, and limit the overall effectiveness of agricultural interventions. The main challenges include limitations in extension services, digital literacy, socio-economic factors, and language or cultural barriers.

Limited Extension Services and Outreach: Government and institutional extension services often form the backbone of formal agricultural knowledge dissemination. However, in many rural areas, these services are inadequate due to a shortage of trained personnel, limited mobility, and insufficient resources. Extension officers may be unable to regularly visit farms or provide personalized guidance, resulting in delayed or incomplete advice. In some regions, farmers rely on sporadic visits or one-time training sessions, which are insufficient for understanding and implementing complex cultivation techniques. Consequently, technical recommendations may not reach all farmers, and those who do receive guidance may struggle with practical application, reducing the overall impact of extension programs.

Digital Literacy and Connectivity Issues: The advent of Information and Communication Technology (ICT) has provided new avenues for agricultural information dissemination, including mobile applications, online advisory portals, and SMS-based alerts. However, the effectiveness of these tools is constrained by low digital literacy among farmers. Many smallholder farmers may lack the skills to operate smartphones, navigate apps, or interpret online guidance. Furthermore, poor network connectivity in remote or hilly areas restricts access to real-time updates,

limiting farmers' ability to respond promptly to pest outbreaks, weather hazards, or market changes. This digital divide creates disparities in access to information, favoring tech-savvy farmers while marginalizing those in remote locations.

Socio-Economic Barriers: Economic constraints play a major role in limiting access to agricultural knowledge. The cost of smartphones, internet connections, or other technology-based solutions may be prohibitive for smallholder farmers. In addition, low literacy levels can impede comprehension of written materials or digital instructions. Social inequalities, including caste-based or gender-based disparities, further restrict information access. Women farmers, in particular, face barriers in participating in training programs or accessing digital tools due to cultural norms, household responsibilities, or limited mobility. These socio-economic challenges contribute to uneven adoption of modern practices and reduce the overall effectiveness of information dissemination programs.

Language and Cultural Constraints: Much of the content produced by formal sources, including government advisories, training manuals, and online resources, is often presented in official or regional languages that may not be understood by all farmers. This language barrier can limit comprehension and lead to misapplication of technical recommendations. Moreover, formal recommendations may not align with local cultural practices, traditional knowledge, or indigenous farming systems. Farmers may be hesitant to adopt techniques perceived as incompatible with their existing practices, even when scientifically validated. Bridging this gap between formal knowledge and local context is essential for improving adoption and enhancing the relevance of agricultural information

V CHALLENGES IN IMPLEMENTING AGRICULTURAL INFORMATION

While accessing agricultural information is crucial, the mere availability of knowledge does not guarantee its successful application. Mango farmers often encounter multiple constraints that hinder the implementation of recommended practices. These challenges are linked to financial resources, risk perception, contextual relevance of information, and institutional barriers. Understanding these obstacles is essential for designing interventions that effectively translate knowledge into improved agricultural outcomes.

Financial and Resource Limitations: A significant barrier to implementing agricultural information is the lack of financial and material resources. Farmers may struggle to procure essential inputs such as fertilizers, improved seedlings, pesticides, irrigation equipment, or farm machinery. Limited access to credit, delayed receipt of government subsidies, or high input costs further exacerbates these challenges. Without adequate resources, even well-informed farmers are unable to adopt modern cultivation practices or invest in infrastructure that could enhance productivity. This resource gap often results in partial implementation or the complete inability to apply recommended techniques, thereby limiting the potential benefits of agricultural information.

Risk Aversion and Resistance to Change: Farmers, especially smallholders, tend to be risk-averse when it comes to adopting unfamiliar practices. Fear of crop failure, potential financial loss, or reduced yield may discourage them from experimenting with new techniques, even when these methods are scientifically validated. Traditional practices and experience-based methods are often perceived as safer and more reliable, particularly in areas where environmental conditions are unpredictable. This cautious approach, while understandable, can slow the adoption of innovations and prevent farmers from realizing the full advantages of modern agricultural recommendations.

Lack of Contextual Relevance: The effectiveness of agricultural information largely depends on its alignment with local environmental and socio-economic conditions. Recommendations that are generic or not adapted to the specific soil type, climate, pest prevalence, water availability, or agro-ecological conditions may fail to produce the expected results. When farmers implement such advice and encounter poor outcomes, they may become discouraged, reducing their willingness to adopt further guidance. Tailoring information to local conditions and incorporating farmers' experiential knowledge is therefore essential to enhance adoption rates and practical effectiveness.

Institutional and Bureaucratic Barriers: Institutional and bureaucratic hurdles can also impede the implementation of agricultural information. Farmers may face complex procedures, excessive paperwork, or delays in accessing government schemes, subsidies, or credit facilities necessary for putting knowledge into practice. Instances of administrative inefficiency, corruption, or lack of coordination among agencies can further obstruct timely intervention. These institutional challenges not only limit the practical application of recommended techniques but also create frustration and reduce trust in formal agricultural systems.

CONCLUSION

The challenges faced by mango farmers in accessing and implementing agricultural information highlight the critical need for strengthening knowledge systems in agriculture. While the availability of scientific research and technological innovations continues to grow, their effective reach to grassroots farmers remains limited. Issues such as poor extension services, digital illiteracy, financial constraints, and socio-cultural barriers hinder the flow of vital information and prevent its practical application. As a result, mango farmers often rely on traditional practices or unverified sources, leading to inefficiencies and reduced profitability. To overcome these challenges, a multi-stakeholder approach is essential, involving government agencies, research institutions, non-governmental organizations, private agritech companies, and farmer cooperatives. Strategies should emphasize localized and need-based information delivery, capacity building through training and farmer field schools, expansion of affordable digital advisory platforms, and improvement of market intelligence systems. Moreover, policy frameworks must prioritize inclusivity by addressing gender disparities and ensuring marginalized farmers have equal access to resources and information. By bridging the gap between knowledge and practice, mango farmers can be empowered to enhance productivity, improve fruit quality, and secure better market opportunities. Ultimately, strengthening agricultural information systems is not only vital for farmer livelihoods but also for ensuring sustainable growth of the mango industry and rural development as a whole.

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