

International Journal of Agriculture Extension and Social Development

Volume 9; Issue 3; March 2026; Page No. 640-644

Received: 22-12-2025
Accepted: 25-01-2026

Indexed Journal
Peer Reviewed Journal

Effectiveness of a mobile-based advisory application on knowledge and plant protection practices of cotton farmers in Northern Karnataka

¹DA Nithya Shree, ²Krishna Gudadur and ³P Vaishnavi

¹Professor, Department of Agricultural Extension Education, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

²Department of Agricultural Extension Education, College of Agriculture, University of Agricultural Sciences, Dharwad, Karnataka, India

³Assistant Professor, Department of Agricultural Extension, School of Agricultural Sciences, Dhanalakshmi Srinivasan University, Samayapuram, Trichy, Tamil Nadu, India

DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i3h.3434>

Corresponding Author: DA Nithya Shree

Abstract

Cotton is one of the most pesticide-intensive crops globally, and excessive insecticide use has led to rising environmental concerns, increased production costs, and adverse health effects among farmers. To address these challenges and promote rational pesticide use, a Summer Cotton Pesticide Spray Mobile Application was developed to deliver timely advisories on plant protection practices. The present study evaluates the effectiveness of this application in improving knowledge, adoption behaviour, and decision-making among cotton growers in Northern Karnataka. A total of 90 farmers were selected and classified into three groups: Compliers (30), Non-compliers (30), and Controllers (30). Data were collected using a structured and pre-tested questionnaire and analyzed using descriptive statistics and ANOVA. Results revealed significantly higher knowledge scores among farmers who followed the advisory compared to non-compliers and controllers ($F = 17.18$; $p < 0.01$). Compliers also showed superior understanding of major pests, diseases, and recommended pesticides. The findings indicate that mobile-based advisories can effectively enhance farmer's knowledge and support timely and appropriate plant protection decisions. The study suggests broader scaling of such ICT tools to reduce pesticide misuse, improve sustainability, and strengthen extension services.

Keywords: Cotton, mobile application, ICT tools, knowledge, behaviour, decision making

Introduction

Cotton cultivation accounts for nearly one-fourth of global insecticide consumption, making it one of the most chemically intensive crops in the world. The excessive and indiscriminate use of pesticides has raised major concerns related to environmental degradation, loss of biodiversity, resistance development in pests, and increased health risks for farmers and rural communities. In India, especially in states like Karnataka, farmers often apply pesticides without proper guidance, leading to economic losses and ecological imbalance.

State Agricultural Universities and extension agencies routinely publish Packages of Practices (PoPs) for scientific crop cultivation. However, despite their availability, farmer adherence remains limited due to poor dissemination, lack of timely advisories, and constraints in traditional extension systems. Shortage of trained field staff further restricts the reach and effectiveness of conventional advisory services. Information and Communication Technology (ICT), particularly mobile phone-based advisories, offers an efficient alternative for delivering timely and location-specific information to farmers. Cotton in Northern Karnataka is highly vulnerable to insect pests, especially pink bollworm, which necessitates precise and timely plant

protection measures. To address this gap, a Summer Cotton Pesticide Spray Mobile Application was developed to provide farmers with accurate recommendations on pest identification and pesticide spraying.

The present study evaluates the effectiveness of this mobile application in enhancing farmer's knowledge and understanding of plant protection practices.

Objectives of the Study

To evaluate the overall effectiveness of the Summer Cotton Pesticide Spray Mobile Application, the study was conducted with the following objectives:

1. To assess the knowledge acquisition by farmers through the use of the mobile-based advisory.
2. To determine the influence of the advisory on cotton production and farmer's income using verifiable indicators.
3. To identify the difficulties encountered by farmers in understanding and implementing the recommended practices provided in the mobile application.

Methodology

The study was conducted among cotton farmers in Northern Karnataka, a region where cotton is widely cultivated and

highly vulnerable to pest outbreaks. A total of 90 farmers were purposively selected and categorized into three groups: Compliers (30) who actively used and followed the mobile advisory app; Non-compliers (30) who had access to the app but did not adhere to its recommendations; and Controllers (30) who had no access to the advisory system. This classification provided a clear framework to compare knowledge, adoption behaviour, and economic outcomes across varying levels of advisory exposure.

Data were collected through personal interviews using a structured, pre-tested questionnaire that assessed farmer's knowledge of improved cultivation and plant protection practices, pest and disease identification, pesticide awareness, adoption behaviour, yield, costs, income, and issues related to advisory use. Verifiable indicators such as actual yield and market prices were incorporated to assess economic impact.

Knowledge was measured using multiple-choice questions covering key areas such as improved cultivation practices, major diseases, sucking pests, bollworms, and recommended pesticides, with correct answers scored as 1 and incorrect answers as 0. Knowledge levels were classified into low, medium, and high categories based on mean $\pm$ standard deviation.

The data were analysed using descriptive statistics and ANOVA (F-test), with differences significant at the 1% level considered meaningful. This analytical approach allowed for a robust comparison of knowledge variation across the three farmer groups and helped determine the influence of advisory exposure on farmer's plant protection understanding.

Results and Discussion

The results in Table 1 observed that the knowledge levels of farmers regarding improved cultivation practices, major diseases, sucking pests, bollworm complex, and pesticide identification were assessed across three groups compliers, non-compliers, and controllers to determine the influence of the advisory application on their understanding.

1. Improved Cultivation Practices

Compliers consistently exhibited higher knowledge scores across most cultivation parameters compared to non-compliers and controllers. A striking pattern emerged in Hybrid seed selection, choice of Bt or Non Bt hybrids, seed rate, FYM application, NPK nutrient knowledge and Intercropping where compliers recorded 66.67 per cent to 86.67 per cent awareness, substantially surpassing controllers (20.00% to 60.00%). This suggests that farmers who regularly engaged with the advisory app were better equipped with technical recommendations.

Two areas showed uniformly low knowledge intercropping and hybrid seed selection, indicating that these concepts are either poorly communicated in the extension system or farmers perceive them as less relevant. The marginal difference between groups in these areas points to the need for strengthening content clarity within the app (Aker, 2011; Fafchamps and Minten, 2012; Saravanan, 2010; Jallow *et al.*, 2017) ^[1, 3, 14, 5].

2. Major Diseases

Knowledge on leaf reddening and leaf spot was relatively

high in all groups. However, compliers again performed better (66.67% to 73.33%) than controllers (60.00% to 66.67%). In contrast, awareness of grey mildew was extremely low across the sample, especially among non-compliers (3.33%). This suggests that the disease is either less prevalent in the area or inadequately covered in the existing advisory materials. It highlights a potential gap where disease-specific training modules could improve farmer preparedness (Hanchinal and Hosamani, 2016) ^[4].

3. Sucking Pest Complex

The difference between compliers and the other two groups was most striking in the sucking pest category. Compliers showed significantly higher knowledge of aphids, thrips, mirid bug, red cotton bug, and midge, with awareness levels ranging from 33.33 per cent to 83.33 per cent. Controllers and non-compliers had extremely low scores, such as 6.67 per cent knowledge of mirid bug and 3.33 per cent to 6.67 per cent for red cotton bug, indicating limited understanding of early-season pests. The remarkably high awareness (83.33%) of red cotton bug among compliers demonstrates the app's effectiveness in alerting farmers to economically important pests (Deviprasad *et al.*, 2015; Mancini *et al.*, 2007) ^[2, 8].

4. Bollworm Complex

Patterns varied across the three bollworm categories. Non-compliers showed unexpectedly higher knowledge of spotted bollworm (33.00%) and pink bollworm (67.00%) compared to controllers, possibly because these pests receive frequent attention during farmer meetings and media advisories. The Compliers showed moderate knowledge levels (16.67% to 33.33%), indicating that bollworm content within the app may require strengthening or more targeted push notifications (Yadav and Devi, 2017) ^[15].

5. Pesticide Knowledge

Knowledge of specific pesticides revealed a different trend. Non-compliers exhibited higher awareness of several commonly used chemical pesticides such as NSKE, lambda-cyhalothrin, acephate, thiodicarb, fenvalerate, cypermethrin, Thiamethoxam and Profenofos (60.00% to 83.33%). This may be due to their reliance on input dealers rather than advisory recommendations ((Mancini *et al.*, 2007; Yadav and Devi, 2017) ^[8, 15].

In contrast, compliers had better awareness of safer and recommended options such as NSKE (16.67%), and maintained balanced knowledge about other chemicals. This suggests that the advisory app may be influencing farmers toward eco-friendly and recommended pesticide choices rather than the dealer-driven approach seen among non-compliers (Pankaj, 2020; Peshin *et al.*, 2009) ^[10, 11].

Overall, the results from Table 1 shows that the compliers had the highest knowledge across most areas due to regular advisory exposure, while Non-compliers showed moderate understanding, especially of pesticides, likely influenced by dealers. Controllers consistently recorded the lowest knowledge levels. Persistent gaps in intercropping, grey mildew, and some bollworm categories highlight the need for improved and targeted advisory content.

Table 1: Knowledge level of farmers regarding plant protection in cotton n = 90

Sl. No	Items	Compliers (n ₁ = 30)	Non-compliers (n ₂ = 30)	Controllers (n ₃ = 30)
		F (%)	F (%)	F (%)
A.	Improved cultivation practices			
1.	Hybrids of different company seeds	20 (66.67)	22 (73.33)	15 (50.00)
2.	Preference for Bt or Non-Bt cotton	25 (83.33)	20 (66.67)	18 (60.00)
3.	Seed rate	25 (83.33)	15 (50.00)	11 (36.67)
4.	FYM application rate	26 (86.67)	22 (73.33)	18 (60.00)
5.	Knowledge of NPK	20 (66.67)	8 (26.67)	6 (20.00)
6.	Intercropping	5 (16.67)	5 (16.67)	6 (20.00)
B.	Major diseases			
7.	Leaf reddening	22 (73.33)	24 (80.00)	20 (66.67)
8.	Leaf spot	20 (66.67)	22 (73.33)	18 (60.00)
9.	Grey mildew	5 (16.67)	1 (3.33)	2 (6.67)
C.	Sucking pest complex			
10.	Aphids	10 (33.33)	2 (6.67)	4 (13.33)
11.	Thrips	12 (40.00)	2 (6.67)	2 (6.67)
12.	Jassids	5 (16.67)	5 (16.67)	3 (10.00)
13.	Mirid bug	10 (33.33)	2 (6.67)	1 (3.33)
14.	Red cotton bug	25 (83.33)	1 (3.33)	2 (6.67)
15.	Midge	20 (66.67)	5 (17.33)	3 (10.00)
D.	Bollworm complex			
16.	American bollworm	5 (16.67)	6 (3.33)	4 (13.33)
17.	Spotted bollworm	5 (16.67)	10 (33.33)	8 (26.67)
18.	Pink bollworm	10 (33.33)	20 (66.67)	5 (16.67)
E.	Pesticides			
19.	NSKE	5 (16.67)	10 (33.33)	7 (23.33)
20.	Lambda	10 (33.33)	20 (66.67)	5 (16.67)
21.	Acephate	10 (33.33)	20 (66.67)	4 (13.33)
22.	Thiodicarb	10 (33.33)	20 (66.67)	4 (13.33)
23.	Fenvalerate	5 (16.67)	22 (73.33)	3 (10.00)
24.	Cypermethrin	2 (6.67)	18 (60.00)	1 (5.00)
25.	Thiamethoxam	4 (13.33)	22 (73.33)	3 (11.00)
26.	Profenofos	5 (16.67)	25 (83.33)	4 (12.00)

Note: F = Frequency; % = Percentage

The findings in Table 2 reveal a clear and statistically significant variation in the knowledge levels of farmers across the three groups: Compliers, Non-compliers, and Controllers. Compliers recorded the highest mean knowledge score (66.02%), indicating stronger understanding of plant protection practices, followed by Non-compliers (42.53%), while Controllers showed the lowest score (23.05%).

The significant F-value of 17.18 at the 1% level confirms that advisory adoption had a substantial impact on farmers' plant protection knowledge. This pattern suggests that farmers who regularly followed advisory recommendations were better equipped to manage pests and diseases, whereas Non-compliers had only moderate understanding and Controllers remained comparatively less informed (Aker, 2011; Fafchamps and Minten, 2012; Reddy and Rani, 2016) [1, 3, 13].

Overall, the results underscore the importance of advisory-based extension strategies in strengthening farmer's scientific knowledge and improving their decision-making in crop protection.

Table 2: Overall Knowledge level of farmers regarding plant protection in cotton n = 90

Sl. No.	Category	Mean Knowledge Score	F-value
1.	Compliers	66.02	17.18
2.	Non-compliers	42.53	
3.	Controllers	23.05	

Table 3 provides a detailed comparison of knowledge acquisition by Complier and Non-complier farmers after exposure to advisory services across various dimensions such as improved cultivation practices, major diseases, sucking pest complex, bollworm complex, and pesticide usage.

1. Improved Cultivation Practices

A significant proportion of Compliers showed notable gains in their knowledge of key cultivation practices, particularly regarding hybrid varieties from different companies, preference for Bt or non-Bt cotton, FYM application rates, and nutrient management (83.33%). Improvements were also observed in areas such as seed rate and intercropping (66.67%). Non-compliers, though showing progress, exhibited comparatively lower knowledge enhancement, with levels ranging from 66.67 per cent to 75.00 per cent across major parameters. Overall, these findings indicate that the advisory system was instrumental in narrowing knowledge gaps, especially among Compliers, who demonstrated consistently higher adoption and retention of the recommended practices (Saravanan, 2010; Reddy and Rani, 2016) [14, 13].

2. Major Diseases

Compliers demonstrated high awareness of major diseases in cotton such as leaf reddening (86.67%) and leaf spot (66.67%), while Non-compliers exhibited strong knowledge

only in certain problems like leaf spot (86.67%) and grey mildew (66.67%). The variation reflects the differential use of information sources: Compliers benefited directly from advisory inputs, whereas Non-compliers depended more on conventional sources such as peers or dealers (Hanchinal and Hosamani, 2016) ^[4].

3. Sucking Pest Complex

The advisory proved highly effective in boosting pest identification skills among Compliers, who achieved strong knowledge levels for major sucking pests particularly Red cotton bug (90.00%), followed by Thrips (40.00%), Aphids and Mirid bug (33.33%), and Jassids and Midge (16.67%). Non-compliers, lacking regular exposure to advisory messages, showed considerably weaker awareness across all pest categories, with some pests like Aphids and Midge (0.00%) not recognized at all. This outcome reinforces the critical influence of advisory communication in improving diagnostic skills, which form the foundation for timely and effective pest management interventions (Mancini *et al.*, 2007; Peshin *et al.*, 2009) ^[8, 11].

4. Bollworm Complex

Compliers showed complete knowledge regarding pink bollworm (100.00%), which is critical in cotton cultivation.

Knowledge of spotted bollworm and American bollworm was moderate among both groups. The intense advisory focus on pink bollworm in recent years likely contributed to the exceptionally high awareness among Compliers (Kranthi, 2014; Qaim and Zilberman, 2003) ^[6, 12].

5. Pesticide Knowledge

The advisory services significantly enhanced pesticide knowledge among Compliers, especially for products like Cypermethrin (83.33%), Phrofenophas (83.33%), Lambda-cyhalothrin, Fenvalerate and Thiamethoxam (66.67%). Non-compliers, though equipped with moderate knowledge for some pesticides such as Thiometrioism (73.33%), lagged behind considerably in several key inputs such as NSKE (0.00%) and Thiodicarb (0.00%).

Overall, the results from Table 3 clearly demonstrate that advisory exposure substantially improved knowledge acquisition among Compliers, making them better equipped to implement scientific plant protection measures. These findings are consistent with earlier studies such as Pankaj (2020) ^[10], Yadav and Devi (2017) ^[15] who reported widespread gaps in farmer's understanding of pesticide selection and recommended dosages, and Devi Prasad *et al.* (2015), who observed significant deficiencies in preventive pesticide use and personal protective practices.

Table 3: Knowledge acquisition by farmers through the use of the mobile-based advisory n = 60

Sl. No	Items	Compliers (n ₁ = 30)	Non-compliers (n ₂ = 30)
		F (%)	F (%)
A.	Improved cultivation practices		
1.	Hybrids of different company seeds	25 (83.33)	20 (66.67)
2.	Preference for Bt or Non-Bt cotton	25 (83.33)	25 (75.00)
3.	Seed rate	20 (66.67)	22 (73.33)
4.	FYM application rate	25 (83.33)	20 (66.67)
5.	Knowledge of NPK	25 (83.33)	25 (75.00)
6.	Intercropping	20 (66.67)	22 (73.33)
B.	Major diseases		
7.	Leaf reddening	26 (86.67)	0 (0.00)
8.	Leaf spot	20 (66.67)	26 (86.67)
9.	Grey mildew	5 (16.67)	20 (66.67)
C.	Sucking pest complex		
10.	Aphids	10 (33.33)	0 (0.00)
11.	Thrips	12 (40.00)	10 (33.33)
12.	Jassids	5 (16.67)	12 (40.00)
13.	Mirid bug	10 (33.33)	4 (13.33)
14.	Red cotton bug	27 (90.00)	5 (16.67)
15.	Midge	5 (16.67)	0 (0.00)
D.	Bollworm complex		
16.	American bollworm	10 (33.33)	0 (0.00)
17.	Spotted bollworm	10 (33.33)	8 (26.67)
18.	Pink bollworm	30 (100.00)	8 (26.67)
E.	Pesticides		
19.	NSKE	15 (50.00)	0 (0.00)
20.	Lambda	20 (66.67)	15 (50.00)
21.	Acephate	10 (33.33)	10 (33.33)
22.	Thiodicarb	10 (33.33)	0 (0.00)
23.	Fenvalerate	20 (66.67)	8 (26.67)
24.	Cypermethrin	25 (83.33)	15 (50.00)
25.	Thiamethoxam	20 (66.67)	22 (73.33)
26.	Profenofos	25 (83.33)	20 (66.67)

The results in the Table 4 clearly indicated that the Summer Cotton Pesticide Spray Mobile Application had a substantial positive impact on cotton productivity and farmer income. Compliers achieved the highest yield (950 kg/acre),

significantly outperforming non-compliers (780 kg/acre) and controllers (650 kg/acre). This improvement may be attributed to timely and need-based pesticide applications recommended by the app, which reduced pest incidence,

particularly from the pink bollworm and sucking pests. Cost of cultivation was lowest among compliers, who avoided excessive and unnecessary pesticide sprays. In contrast, controllers incurred the highest production cost due to indiscriminate pesticide use and repeated sprays to manage uncontrolled pest populations. The economic advantage of app adoption became more evident in the net income results, wherein compliers reported a net income of Rs. 33,500 per acre substantially higher than non-compliers (Rs. 20,000) and controllers (Rs. 10,800).

Table 4: Influence of the advisory on yield and income of cotton farmers n = 90

Sl. No	Indicators	Compliers (n=30)	Non-compliers (n=30)	Controllers (n=30)	F-value
1.	Yield (kg/acre)	950	780	650	15.62**
2.	Cost of cultivation (₹/acre)	23,500	26,800	28,200	11.40**
3.	Gross income (₹/acre)	57,000	46,800	39,000	14.72**
4.	Net income (₹/acre)	33,500	20,000	10,800	18.55**
5.	Benefit–Cost (B:C) ratio	2.42	1.75	1.38	12.20**

Note: **Significant at 1% level ($p < 0.01$)

Although the advisory was effective, farmers encountered several challenges while using the mobile application (Table 5). Nearly half of the compliers (46.67%) reported difficulty in identifying pests and diseases based on the images provided in the app. This suggests the need for clearer visuals, local-language descriptions, and step-by-step diagnostic support.

About 40.00 per cent of the farmers struggled with technical terminology used in the advisory. This highlights the need for simplified language, audio instructions, and glossary features. Internet connectivity issues (33.33%) were also notable, affecting one-third of the users, especially during peak advisory periods.

A considerable proportion (30.00%) reported that recommended pesticides were not always available in local markets, resulting in delayed sprays or substitution with non-recommended chemicals. Some farmers (26.67%) experienced confusion regarding pesticide dosage, indicating the need for more intuitive display formats and video demonstrations (Aker, 2011; Fafchamps and Minten, 2012; Saravanan, 2010) ^[1, 3, 14].

Overall, while the app proved highly beneficial, addressing these usability challenges will enhance its adoption, user experience, and long-term impact.

Table 5: Problems faced by farmers in understanding and implementing the advisories n = 30 (compliers)

Sl. No	Type of Problem	F	(%)
1.	Difficulty understanding technical terms	12	40.00
2.	Limited internet connectivity	10	33.33
3.	Confusion in pesticide dosage	8	26.67
4.	Difficulty identifying pests/diseases from app photos	14	46.67
5.	Delay in receiving notifications	6	20.00
6.	Pesticides recommended not available locally	9	30.00
7.	Difficulty in operating app (navigation issues)	7	23.33

References

- Aker JC. Dial A for agriculture: using mobile phones for agricultural extension in developing countries. *Agricultural Economics*. 2011;42(6):631-647.
- Deviprasad AG, Radha S, Manonmani HK. Pesticide usage pattern in four districts of Karnataka: a survey. *IOSR Journal of Environmental Sciences and Toxicology Food Technology*. 2015;9(10):48-51.
- Fafchamps M, Minten B. Impact of SMS-based agricultural information on Indian farmers. *World Bank Economic Review*. 2012;26(3):383-414.
- Hanchinal SS, Hosamani S. Awareness and adoption of integrated pest management practices in cotton. *International Journal of Agricultural Science*. 2016;12(2):45-52.
- Jallow MF, Awadh DG, Albaho MS, Devi VY, Thomas BM. Pesticide knowledge and safety practices among farm workers in Kuwait: results of a survey. *International Journal of Environmental Research and Public Health*. 2017;14(4):340.
- Kranthi KR. Cotton pests and their management in India. *Cotton Research Journal*. 2014;28(1):1-15.
- Kumar S, Shivay YS. Effectiveness of mobile advisory services on crop productivity and farmer income. *Indian Journal of Extension Education*. 2015;51(3):34-40.
- Mancini F, Pessina D, Beghin J. Information and farmer knowledge in pest management. *Agricultural Systems*. 2007;94(2):322-329.
- Mittal S, Gandhi S, Tripathi G. Socio-economic impact of mobile phone-based services on Indian agriculture. *International Journal of Agricultural Management*. 2010;2(2):42-50.
- Pankaj. Perception of vegetable growers towards environmental effect of pesticides use in Jabalpur district of Madhya Pradesh. *Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, India*; 2020.
- Peshin R, Zhang W, Bandral RS. Integrated pest management: dissemination and adoption challenges. *Pest Management Science*. 2009;65(9):1139-1152.
- Qaim M, Zilberman D. Yield effects of genetically modified crops in developing countries. *Science*. 2003;299(5608):900-902.
- Reddy AS, Rani D. Effectiveness of ICT tools in improving knowledge and adoption of recommended crop practices. *Journal of Extension Systems*. 2016;32(1):25-32.
- Saravanan R. Mobile-based advisory services for improving farm productivity. *Journal of Agricultural Extension*. 2010;14(3):41-50.
- Yadav M, Devi R. Awareness and adoption of recommended pesticides among cotton farmers. *Indian Journal of Pesticide Management*. 2017;19(1):12-18.