

ADVANCING AGRICULTURAL KNOWLEDGE: A COMPREHENSIVE MOBILE APPLICATION FOR NON-FCV TOBACCO ON GOOD AGRICULTURAL PRACTICES

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The ICAR-Central Tobacco Research Institute, established in 1947, has been instrumental in aiding the agricultural sector by providing technological support across various dimensions of tobacco cultivation. The incorporation of advanced technology in agricultural practices is essential for achieving the Government of India's objective of doubling farmers' incomes. A large number of farmers now have smartphones equipped with internet connectivity, which enables them to engage with scientists and seek solutions to their daily agricultural problems, frequently utilizing platforms such as WhatsApp. Therefore, the implementation of technology dissemination strategies through mobile devices is poised to significantly enhance the speed and effectiveness of delivering the latest agricultural practices and contingency strategies to tobacco farmers.

ICAR-CTRI has developed an innovative Android mobile application aimed at closing critical information gaps regarding Non-FCV (Flue-Cured Virginia) tobacco cultivation. Built using Java and XML, this application is available on the Google Play Store, providing a global platform for tobacco farmers and stakeholders. It acts as a comprehensive resource for disseminating knowledge on Good Agricultural Practices (GAPs). The application encompasses detailed information on various non-FCV tobacco varieties, tailored practice packages, and insights into region-specific research infrastructure. Its user-friendly interface allows for immediate access to essential information, promoting a more knowledgeable and effective approach to non-FCV tobacco cultivation.

INTRODUCTION

The agricultural sector plays a crucial role in the Indian economy, serving as a significant source of employment and contributing to national

development through its large workforce. Tobacco cultivation, particularly the non-FCV (Flue-Cured Virginia) variety, is one of the most vital agricultural sectors. This crop holds substantial economic significance in states like Andhra Pradesh, Karnataka, and Gujarat, and is essential for producing bidi, chewing tobacco, and other tobacco products. Nevertheless, tobacco farmers encounter various challenges that can restrict their yield and income, including pest management difficulties, variations in soil and climate, and a lack of access to contemporary agricultural knowledge.

To address these challenges and improve farming practices, the Indian Council of Agricultural Research (ICAR) has increasingly integrated information and communication technology (ICT) into its initiatives. In India, mobile applications have emerged as one of the most effective ICT tools for disseminating agricultural information, particularly in rural areas where access to conventional extension services is limited. This study focuses on the development of a smartphone application by ICAR-CTRI, Rajahmundry, aimed at promoting the adoption of Good Agricultural Practices (GAPs) among non-FCV tobacco farmers. The application is designed to tackle specific issues faced by these growers, such as pest management and region-specific crop management techniques. It aims to provide farmers with information on various tobacco varieties, crop management practices, and localized guidelines that promote best agricultural practices.

In recent years, the adoption of Information and Communication Technology (ICT) in Indian agriculture has witnessed a significant surge, particularly through the utilization of mobile

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applications (Krishnan and Joshi, 2017; Mandi and Patnaik, 2019; Panda et al. 2020; Nitin et al. 2020). A study conducted by Gupta et al. (2018) indicates that smartphone applications are increasingly favored in the agricultural sector as a tool for enhancing farm productivity. The advantages of these mobile applications encompass improved decision-making, expedited access to essential information, and enhanced communication between extension services and farmers (Barh and Balakrishnan, 2018). In this context, the Indian Council of Agricultural Research (ICAR) has taken a pioneering role by developing numerous mobile applications aimed at supporting farmers across diverse agricultural sectors. Under the auspices of ICAR, various research institutes have successfully created 112 mobile applications covering a wide array of topics, including crops (Vijayakumar et al. 2022), livestock, fisheries, engineering, education, extension services, horticulture, and natural resource management. Below is a summary of some of the applications developed for different crops.

Mobile Applications in Agriculture

The Indian Council of Agricultural Research - Indian Agricultural Research Institute (ICAR-IARI, 2020) has developed the 'AgriApp', which provides a range of services including crop advisory, pest management, and weather forecasting. Similarly, the Kisan Suvidha app (Soni and Patel, 2021) from ICAR-ATARI offers farmers essential data on market prices, crop management, pest control, and advisory services. Additionally, the 'Solapur Anar' app, created by ICAR-NRC on Pomegranate, Solapur, delivers comprehensive information on pomegranate production, including quality planting materials, orchard establishment, nutrition management, plant protection, irrigation management, post-harvest management, and value addition. The 'Fertilizer Calculator' app, developed by ICAR-CCARI in Goa, serves as an offline soil test-based fertilizer recommendation tool for Android devices, calculating requirements based on farm area or the number of plants or trees. Furthermore, the 'Rice-Xpert' app, created by ICAR-NRRI in Cuttack, offers real-time information to farmers regarding insect pests, nutrients, weeds, nematodes, and disease-related issues, as well as suitable rice varieties for various

ecologies and farm implements for different field and post-harvest operations. ICAR-IGFRI in Jhansi has also introduced a mobile application named 'Farm Tree', which provides fundamental information on 20 commonly cultivated agroforestry tree species. In addition to these, numerous other applications have been developed to support the agricultural community.

MATERIALS AND METHODS

The mobile application was developed using Android Studio, a powerful integrated development environment (IDE) specifically designed for Android app development. The app's core functionality was built using the Java programming language, providing robust and efficient operations. For designing the user interface (UI) and layout elements, XML was employed, offering flexibility and ease in creating a responsive and user-friendly design.

The app is named as "Non-FCV Tobacco" in Google Play Store, with the package name 'com.nonfcv.myapplication' and a 'targetSdk' of 34 to ensure compatibility with the latest Android features. The development environment includes Android Studio Version: Hedgehog | 2023.1.1 Patch 2, with a Runtime Version of 17.0.7+0-b2043.56-10550314 amd64 and running on the OpenJDK 64-Bit Server VM by JetBrains s.r.o. The project uses Gradle Version 7.5 for dependency management and building tasks. The development was carried out on a Windows operating system, and the app consists of 186 XML pages, contributing to its comprehensive functionality and layout design.

The flowchart (Fig. 1) provides comprehensive information about various non-FCV tobacco types, offering users detailed insights into their cultivation practices, uses, and economic significance. It includes state-specific information for different regions where non-FCV tobacco is grown, such as Andhra Pradesh (Burley), Gujarat (Chewing), Karnataka (Bidi), and others. Each state's section covers critical aspects like research infrastructure, tobacco varieties, gap analysis, nursery management, field crop management, and post-harvest management. Additionally, the app delves into specific non-FCV tobacco types, including Bidi,

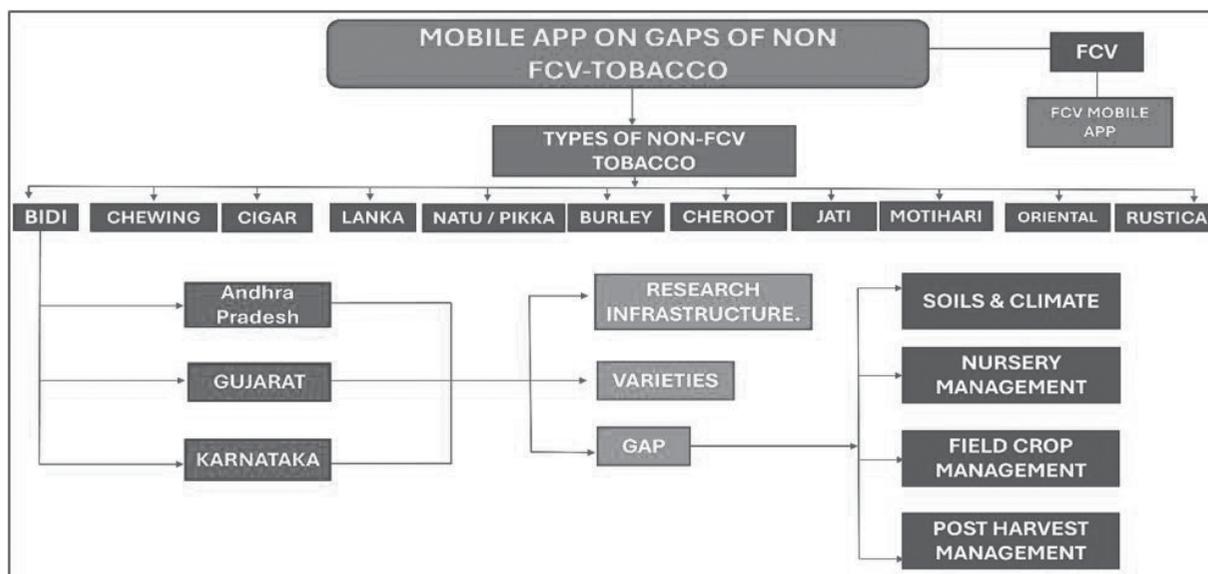


Figure 1: Flowchart of Mobile App

Chewing, Cigar, Lanka, Natu/Pikka, Burley, Cheroot, Jati, Motihari, Oriental and Rustica, providing in-depth details about their respective research infrastructure, varieties, gap analysis, nursery & field crop management and post-harvest techniques. These features aim to equip users with valuable knowledge to enhance the cultivation and management of non-FCV tobacco across different regions.

At its core, the application provides a wealth of information on various non-FCV tobacco types, presenting tailored packages of practices and region-specific research infrastructure details. The GAP module, a pivotal component of the application, comprehensively covers essential elements ranging from soil and climate conditions to nursery management, field crop management, and post-harvest procedures. With a keen focus on 11 distinct non-FCV tobacco varieties, this module serves as an indispensable guide for farmers seeking to optimize their cultivation processes.

RESULTS & DISCUSSION

The Non-FCV Tobacco App is a user-friendly, comprehensive platform designed to provide detailed information on both FCV (Flue-Cured Virginia) and Non-FCV tobacco types. The app is divided into two primary modules: the FCV Module

and the Non-FCV Module, each serving specific informational needs for their respective tobacco varieties (Figure 2).

The FCV Module focuses on Flue-Cured Virginia tobacco and offers key insights into its cultivation and management. Users can access detailed information on the area under cultivation, total production, and productivity levels across different states. Additionally, a dedicated section provides a list of states where FCV tobacco is grown, helping farmers and stakeholders understand the geographical spread of this variety. To further assist users, the module includes a direct link to the FCV Tobacco App, which offers additional resources and tools specific to FCV tobacco.

The Non-FCV Module is designed to provide an in-depth overview of various Non-FCV tobacco types cultivated across different regions of India. This module begins with a general introduction to Non-FCV tobacco, emphasizing its importance in the industry and its diverse applications. It then provides a comprehensive list of Non-FCV tobacco types, including Bidi, Chewing, Cigar, Lanka, Natu/Pikka, Burley, Cheroot, Jati, Motihari, Oriental, and Rustica (Figure 3). Each of these varieties plays a significant role in different regional markets and serves various consumer needs.

Upon selecting a specific Non-FCV tobacco variety, users are directed to a page that displays the states where that variety is cultivated (Figure 4). This state-wise distribution helps users to understand where each variety is grown, facilitating better decision-making for cultivation and trade.

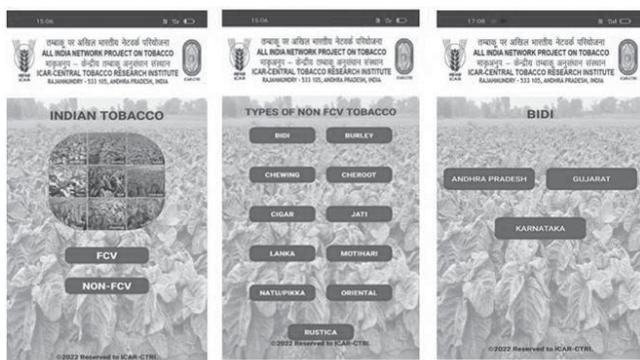


Figure 2: Home Screen

Figure 3: Types of Non-FCV Screen

Figure 4: States Screen

For each state, the app provides detailed, state-specific information about the selected variety. The Introduction section gives users an overview of the variety's significance, its history, and its economic importance in that region. Following the introduction, users can access a menu with additional features designed to provide deeper insights into the variety's cultivation practices and research support.

One of the key sections in this menu is Research Infrastructure, which offers detailed information about the research stations associated



Figure 5: State Menu



Figure 6: GAP Menu

with the cultivation of that particular variety. Users can learn about the station's history, research focus, and contact information, enabling them to reach out for expert guidance and support.

Another crucial section is Good Agricultural Practices (GAP), which provides comprehensive guidelines for successfully cultivating Non-FCV tobacco. The GAP section covers critical aspects of cultivation, including soil and climate requirements, nursery management, field crop management, and post-harvest management (Figure 6). These guidelines help farmers to adopt best practices, improve yield, and enhance the quality of their produce.

In the Soils and Climate subsection, users can find detailed information on the type of soil and climatic conditions best suited for each variety, ensuring optimal growth. The Nursery Management section offers step-by-step instructions for raising healthy seedlings, which are critical for a successful crop. Similarly, the Field Crop Management subsection provides best practices for maintaining the crop during its growth phase, while the Post-Harvest Management section guides users on proper harvesting, curing, and storage techniques to preserve quality and maximize market value.

Installation

1. Type URL 'play.google.com' in web browser
2. Type 'NON- FCV TOBACCO' in search button
3. In 'Apps' category tobacco crop photos with 'NON - FCV TOBACCO' as title will be displayed.
4. Click on 'NON - FCV TOBACCO', a new screen with description of the app, snapshots along with 'Install' option gets displayed.
5. Click 'Install' option to execute the App in your mobile.

Salient features

The following are the application's main features:

- **Non-FCV Tobacco Types:** Eleven distinct non-FCV tobacco types are covered in the app, along

with information of different varieties released and available for cultivation, their yield characteristics, soil preferences, climate requirements, and cultivation requirements.

- **Good Agricultural Practices (GAPs):** A module devoted to GAPs that addresses post-harvest procedures as well as nursery and main field management. In addition, the program covers soil fertility management, irrigation strategies, and insect control methods.
- **Region-Specific Advisory:** Personalized suggestions according to the user's location, guaranteeing that farmers get pertinent and correct guidance.
- **Research Infrastructure:** Details about the work being done on high-yielding tobacco varieties and innovative cultivation methods at ICAR-CTRI's research stations.
- The application boasts an intuitive icon-based user interface, ensuring quick and seamless access to vital information. By simplifying the complexity of agricultural practices, the application empowers farmers to adopt scientifically-backed methods, enhancing their ability to achieve and sustain higher crop yields. The user-friendly design facilitates instant access to crucial insights, fostering a more informed and efficient approach to non-FCV tobacco cultivation.

Beyond its utility for farmers, the application plays a pivotal role in the efficient transfer of cutting-edge agricultural technology. By serving as a conduit for the latest advancements in the field, the application not only benefits individual farmers but also contributes to the broader agricultural community. This dissemination of knowledge enhances the visibility of the institute responsible for the application, positioning it as a key player in advancing agricultural practices at the national level.

Hosted on the widely accessible Google Play Store, the application can be easily accessed at <https://play.google.com/store/apps/details?id=com.nonfcv.myapplication>. This technological innovation represents a significant step forward in agricultural education and empowerment, facilitating sustainable and

scientifically informed practices for non-FCV tobacco cultivation on a global scale.

CONCLUSION

The Non-FCV Tobacco Mobile Application represents a pivotal innovation in agricultural ICT for tobacco production in India. This app serves as a centralized platform for stakeholders involved in the cultivation, research, or trade of Non-FCV tobacco varieties. By facilitating access to vital information and expert recommendations, the application empowers users to make educated decisions, embrace sustainable practices, and enhance their productivity and profitability in the tobacco industry. Additionally, the app is instrumental in the dissemination of knowledge. Utilizing this application, ICAR-CTRI can provide farmers with prompt access to the latest research outcomes and technological advancements, thereby keeping them informed about new trends and best practices that can positively impact their farming operations.

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