

e-Agriculture:

Advancing Indian farming through mobile applications

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This article discusses how mobile applications can help farmers make timely decisions about pests, disease and enjoy the benefits of crop advisory services and how it can play a key role in improving pest and disease management through technology in India. Farmers all over India face many of the same problems with pests, nutrients, weather variances and limited access to timely expert advice. With the advent of new mobile technology, many farmers have access to real-time data with a specific focus on pests, disease nutrient, etc. These apps can also help farmers forecast weather and make overall farm-related decisions. The main aim of this article is to emphasise how digital tools can improve the productivity of crops while lowering the production cost. By implementing technology, farmers can begin to bridge the gap between agricultural research, extension services and the farm.

Keywords: Agricultural extension, Digital solutions, Precision farming, Smart farming

AGRICULTURE is an important part of India's economic structure, supporting the livelihood of nearly 58% of rural families. Farmers face major challenges such as pest and disease outbreaks, soil health, nutrient management and efficient water usage which hinder the growth and yield of the crops. To overcome these challenges in this digital era, mobile application offers real-time access to crucial information, thus, helping farmers address these issues effectively. These mobile applications provide them up-to-date information on farming equipments, latest technologies, diseases and pests' identification and real-time weather updates. Beside these advantages, farmers can receive expert advice from agricultural specialists through these applications. The Indian government has introduced several mobile applications to share information on agriculture-related problems and offer solution to farmers for free of cost. These applications are easily accessible through official website of mkisan.

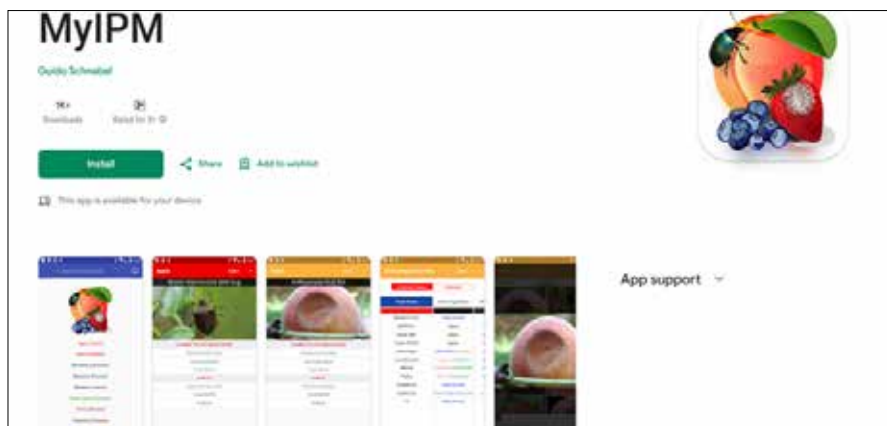
gov.in or through Google Play Store, helping bridge the gap between research and practical farming by delivering essential information directly to farmers.

Android-based mobile applications

MyIPM app: The different versions of MyIPM applications can be easily downloaded from Google Play Store and Apple Store. It provides management guidelines for commercial production, covering diseases, insects and weed problems across different crops. These recommendations include detailed descriptions, images, tables and audio clips. By including high quality images of major pests and diseases present in a region, the application helps farmers in identifying the issues, enabling them to implement effective IPM practices. After pests and diseases have been identified, the application provides an overview of its impact, followed by details about the pest's life cycle, weed biology or disease symptomology and spread. The pests and disease management

sections are divided into three parts, covering chemical control methods, pesticide resistance concerns and non-chemical management. This application also provides pesticide search tool on its homepage. Searching the pesticide by its active ingredients or trade name, provides a list of crops, targeted pests and diseases for which they are recommended and further it also provides the application rate of the pesticides. This search function allows quick comparison of pesticide uses across different crops and pests, offering a more flexible approach than traditional static pest control recommendations. For example- If a farmer is having orchards of mango, guava and litchi, they could easily look into the application if the trade name of pesticides is available for all three crops; it also provides the recommended dose rates against specific diseases and pests for the crops.

Plantix: It is a Berlin-based mobile application developed by PEAT- GmbH to help farmers in quickly identifying disease



Screenshot of the MyIPM mobile application showing pest and disease identification interface (Source: Google Play Store)

across different crops, as well as provides image references for easy identification of deficiency symptoms.

AGRIVI app: AGRIVI application enables farmers to map their fields and monitor real-time crop conditions, using weather data, and soil analysis and satellite images for accurate decision making. It offers customised recommendations on crop selection including suitable varieties, planting schedules and fertilisers and pesticides application, thereby enhancing productivity and providing more economic benefits to farmers. Its advanced features include automatic pests and diseases notification, which enables farmers take preventive measures prior to yield loss and pest outbreak. The application provides the best cultural practices for different crops and gives detailed information about how and when to perform each practice that will benefit the most. Also, the application provides detailed 7-day weather forecasts and 3-years historical weather data to support long term planning. Other benefits include enabling users to save farm records and reports in one place and give easy access whenever needed.

RiceXpert app: This application is designed to offer an all-in-one digital forum for rice cultivation management. The application provides real-time diagnosis for several field issues including insect-pests, diseases, nematodes, weeds and nutrient imbalances. Also, it provides information regarding rice varieties, equipments, weather updates and news related to rice farmers. Its key features include an e-advisory service, where farmers

infection, pest damage and nutrient deficiencies by analysing the images of affected crops. It provides a real-time solution to farmers' problems by delivering accurate diagnosis within seconds, along with management practices to tackle the problem. The application offers key features designed to support farmers comprehensively. Its database comprises of 700+ plant disorders, organised by crop type and growth stage, providing causes, prevention tips and management strategies. The app provides global discussion platform where farmers can exchange knowledge with 15,000 daily posts and 80,000 daily views, promoting peer-to-peer learning. Beneficiaries can also get expert guidance from soil preparation to irrigation and pest control based on planting dates. Additionally, the application recommends optimal fertiliser types, quantities and application schedules depending on different crops and field sizes. Plantix uses geotagged photos to deliver real-time notifications about pests and disease outbreaks within a 50 km radius and provides location-specific weather forecasts for helping the farmers in scheduling several tasks including spraying, weeding and irrigation. The platform further connects the farmers with nearby suppliers for finding the right agricultural products.

Ag PhD field pest identification and control app: This mobile application was developed to help users in identifying the pests and offers management strategies. It provides essential details about

major agricultural pests and weeds including images along with recommended management practices. Additionally, this application also saves pest-related data directly within the application while working in field. Users can also log field reports and submit their observations, enhancing real-time pest monitoring and documentation. The other applications developed by Ag PhD which are also beneficial to farmers are:

- **Ag PhD harvest loss calculator:** This application allows users to calculate pre-harvest and harvest-related yield losses for crops like wheat, barley, oats, soyabean and maize.
- **Ag PhD planting population optimiser:** It helps farmers in determining optimal plant spacing to achieve specific population densities per acre. This application also offers farmers with valuable advice for thinning operations.
- **Ag PhD nutrient deficiency application:** This application helps users in identifying nutrient deficiency symptoms



Interface of Plantix mobile app used for image-based diagnosis of crop diseases and nutrient deficiencies (Source: Google Play Store)



Ag PhD Field Guide mobile application displaying pest identification and field scouting features (Source: Google Play Store)



Screenshot of the AGRIVI mobile application highlighting farm management and decision-support tools (Source: Google Play Store)

can upload their queries through texts, photos or voice recordings and can get customised solutions through SMS responses. The application also includes pest management guide and fertiliser calculator for accurate decision making. RiceXpert application also connects farmers and buyers, helping producers in selling their rice products efficiently. When using the 'Pest solution' feature of the application, users are provided with instructional guidelines before proceeding to select specific problem, including pest type, damaged crop-stage and pest category. The application then provides reference images for visual confirmation, users verify the images by selecting 'yes' before submitting their query. The system then provides customised management strategies including use of specific pesticides and its optimal application rate.

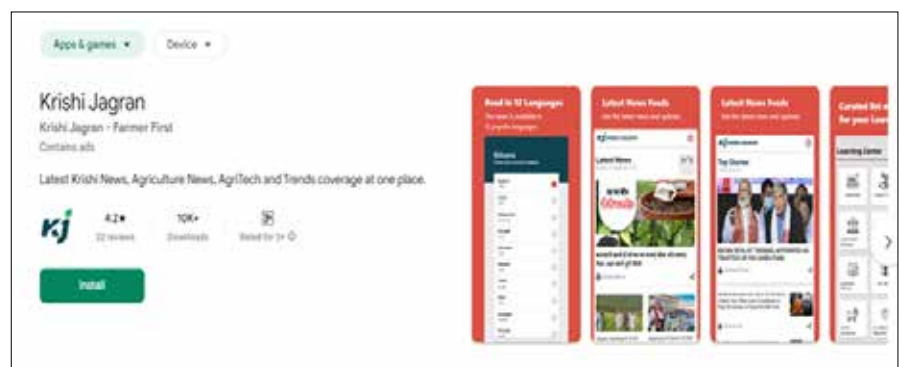
Mango cultivation app: This mobile application was developed for mango growers in different agro-climatic regions of India. It offers complete guidelines on cultivation practices, including recommended

soil type, climate conditions, propagation technique, spacing and harvesting of mangoes. The main highlight of this application is its detailed module on pest and disease control. These modules also contain pictorial keys for identification and management of important insect-pests such as fruit flies, mango hoppers, stone weevils, mealybugs, shoot borers and stem borers. It also provides management methods to control several fungal and bacterial diseases like anthracnose, blossom blight, leaf blight, powdery mildew and

dieback. By providing scientifically sound crop-specific advice, it promotes the judicious use of pesticides, thereby reducing their negative impact on biodiversity.

Krishi Jagran app: The app has been developed by Krishi Jagran, one of India's leading agricultural media and information organisation. It is a relatively new app that gives farmers instant access to critical agricultural information. Unlike agricultural diagnostic apps that focus on particular types of crops, Krishi Jagran app acts as an aggregate source of all agricultural information and serves as a gateway that gives farmers access to recent agricultural updates, agriculture-related news, control measures for pests and diseases, and agricultural guides and calendars. The app is highly useful in raising farmers' awareness about government schemes, agricultural subsidy schemes, agricultural insurance schemes, and government agricultural policies. The app is useful as it gives targeted information to farmers on the latest technologies and job opportunities in the field of agriculture. With up-to-date and local information, it produces more savvy farmers who become attuned to the technical innovations as well as policy that is shaping the sector.

Papaya cultivation app: This app was developed with the primary objective of providing a comprehensive solution for the entire papaya cultivation process. The app deals with all the requirements in papaya cultivation such as land preparation, planting techniques, variety selection, nutritional requirements, irrigation

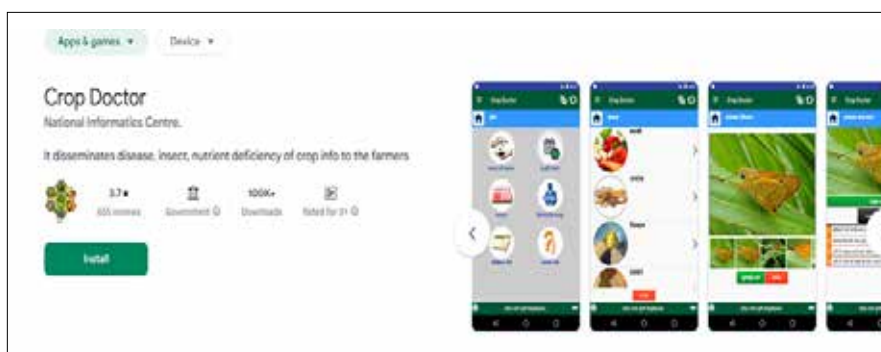


Screenshot of the Krishi Jagran mobile application providing farmers with the latest agriculture-related news (Source: Google Play Store)

Table 1. Overview of agricultural mobile applications and their utilities

Mobile App	Developer/ Organisation	Purpose	Key Features	Practical Utility
MyIPM (Fruit and Nut Crops)	Dr. Guido Schnabel, Dr. Mengjun Hu, Greg Edison and Joe Vargas (USA)	Promote adoption of Integrated Pest Management	Pest and disease identification, life cycle details, chemical and non-chemical management, pesticide search by trade name	Enables correct pest and disease diagnosis, reduces indiscriminate pesticide use and reduces input costs
Plantix	PEAT GmbH, Berlin	Pests and diseases identification and nutrient management	Image-based crop diseases, pests and nutrient deficiency diagnosis, farmer discussion forum, geotagged pest alerts, fertiliser recommendations	Provides instant diagnosis, improves timely intervention and enhances farmer learning through peer interaction
Ag PhD Field Pest Identification	Brian and Darren Hefty (USA)	Pests and weed identification and management	Pest images, field scouting reports, harvest loss calculator, nutrient deficiency guide	Helps in accurate field scouting, documentation of pest pressure and informed pest control decisions
Agrivi	Matija Zulj, Croatia	Farm management and decision support	Field mapping, weather-based advisories, pest alerts, satellite monitoring	Improves farm planning, early pest warning and optimised use of fertilisers and pesticides
RiceXpert	International Rice Research Institute (IRRI), Philippines	Rice specific advisory	Pests and diseases diagnosis, fertiliser calculator, e-advisory via SMS, farmer-buyer linkage	Enhances rice-specific decision making, ensures accurate pesticide dosage and improves market access
Mango Cultivation App	ICAR-IIHR, Bengaluru	Crop-specific guidance	Pests and diseases modules, variety recommendations, cultivation practices	Provides region-specific management practices, improves yields and fruit quality
Papaya Cultivation App	ICAR-IIHR, Bengaluru	Comprehensive papaya crop management	Pests and diseases management, varietal information, production practices	Reduces crop losses due to pests and diseases, supports better crop planning
Crop Doctor	IGKV-NIC, Raipur	Crop problem diagnosis	Image-based problem identification, recommend management practices, govt. scheme information	Support quick problem resolution, improve accessibility for small and marginal farmers
Kisan Suvidha	Government of India	Farmer information system	Weather forecasts, market prices, pest management and expert advisory	Assist in day-to-day farm decisions, reduces climate-related risks
Farm-O-Pedia	C-DAC, Mumbai	Location-specific crop advisory	Soil-based crop selection, fertiliser and pesticide guidance and banned pesticide alerts	Promote safe pesticide use, prevents misuse of banned pesticides

methods, and harvesting techniques. The pest control method primarily incorporates the detection and eradication of the most common insect-pests such as fruit flies, aphids, whiteflies, and red spider mites. In addition, the application deals with the disease management, wherein some major concerns like anthracnose, powdery mildew, and root rot have been addressed. The app keeps updating papaya growers about the new papaya varieties that have been launched and helps them in selecting the right varieties for the particular area. Thus, by providing crop-specific, research-based recommendations, it not only facilitates the increased productivity, and better pest management but also the faster and larger-scale adoption of improved papaya varieties by the growers.



Interface of Crop Doctor mobile app showing crop problem diagnosis and advisory modules (Source: Google Play Store)

Crop Doctor app: It is a diagnostic problem-solving mobile application designed for farmers and other stakeholders related to agriculture, helping them avail quick and easy access to the required agricultural information and services. The application is also available in both Hindi and English language

interfaces and has been designed specifically for small and marginal farmers, offering improved access and usability. The major features of this application include identifying crop problems through image uploads related to damaged and infected crops, and receiving a quick diagnostic result for crop diseases,



Dashboard view of Kisan Suvidha mobile application providing weather, market and advisory services to farmers [Source: National Informatics Centre (NIC)]

pests, and nutrient deficiencies. Depending on the images selected, this application provides a probable diagnosis and suitable management recommendations. This application specialises in major crops such as rice, vegetables, pulses, and oil crops. The latest version also seems to provide related information on government agriculture schemes and subsidies, modern agricultural machinery, and related news. Crop Doctor application certainly seems to act as a bridge between farmers and experts, making them useful in supplying related diagnostic information and advice.

Kisan Suvidha app: Among the various innovations in Indian agriculture, the digital service called Kisan Suvidha tops the list, introduced in 2016. This app has been a single-window information source for farmers, with numerous features and functionalities. This app is a multi-lingual platform that continues to support English, Hindi, Tamil, Gujarati, Odia, and Marathi languages. The app on the phone provides not only weather updates at the moment but also a 5-day weather forecast, which enables farmers to manage the field, spray chemicals, or harvest it at a suitable time of their own choice. Besides weather-related information, the application offers informative content on seeds, fertilisers, farm machinery, local

market rate information for different crops, godown and cold storage information. The pest control feature of the app identifies the pests and also gives the management practice for the most common insect-pests like fruit flies, aphids, whiteflies, and red spider mites. In addition, the app also deals with diseases. It also contains IPM plans that helps farmers to locate and manage pest attacks effectively by minimising the use of chemical-based insecticides. This application also helps farmers connect with experts in the agricultural sector to avail personalised advice on pest and disease identification. Kisan Suvidha application helps farmers immensely by providing effective risk management and decision support.

Farm-O-Pedia app: It offers location-specific crop recommendations based on the nature of the soil and the season, thus, enabling the farmers to decide wisely and even choose the appropriate crops for the crop productivity to increase. In addition, the application provides step-by-step instructions for the fertiliser application and herbicide usage, thus, aiding in balanced nutrient management and providing the correct answers to the problem of weeds. Pest management part of the app, however, provides a list of the

locally recommended insecticides and also vividly points out the banned or restricted chemicals, thus making it easy to use safe pesticides and exposing the least possible risks to human health and the environment. Through the integration of soil-based recommendations with regulatory information, Farm-O-Pedia is facilitating the process of sustainability and environmental friendly agriculture.

SUMMARY

Mobile applications have evolved the Indian agriculture by offering farmers real-time solutions for pest infestations, disease diagnosis, weather forecasts and crop optimisation. Government-supported applications like Krishi Jagran and Kisan Suvidha and specialised tools like Plantix, MyIPM and AgPhD enables the agricultural extension of research-based knowledge to farmers. With the advancement in technology, wider adoption of such applications can increase crop productivity, guarantee food security and enhance the rural livelihoods. Further, continued innovation, accessibility and awareness among farmers will maximise its impact on India's agricultural sector.

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