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Android Based Mobile Application for Rice Crop Management

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Abstract

Timing of precise information is critical to minimise the wastage of agricultural inputs and as a result increased use efficiency. With the help of mobile apps, agricultural related information is disseminated at a faster rate to the farmers. The benefits of such connectivity and information flow include better crop and land management decisions besides optimizing fertilizer, seeds and water use in agriculture thus save money while reducing consumption and addition of financial benefits. Short message service (SMS) and voice record have improved the social relationship between farmers and scientist. This article provides the complete information about the various android based applications available in google play store for rice crop management.

1. Introduction

Rice is the most important food crop of our country. More than 50% of our country population consume rice as their staple food. However, in recent years, rice cultivation is facing many sustainability problems including degrading natural resources, environmental pollution, change in pest and disease incidence, increasing production cost and lower return. Most of these problems are due to practice of non-scientific method of rice cultivation for many decades. Many technologies were developed to overcome this sustainability related problem associated with rice cultivation.

Even after development of many improved technologies and cultivars, the problems are not solved in the farmer's field. This is due to poor knowledge transfer and complexity of the new technology. To overcome this problem in agriculture, recently many android-based apps are being developed. Use of these applications help in solving complex decision-making process into simpler one. Similarly, spreading agricultural related information to the farmers was made easier with the help of mobile apps. Timely dissemination of precise information is critical to minimise wastage and therefore increased in efficiency. Optimizing the use

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of fertilizer, seeds and water can also be done by utilizing mobile and cloud computing technologies. This helps farmers save money while reducing consumption. The benefits of such connectivity and information flow is that it helps farmers make better crop and land management decisions. These applications also reduce the transaction cost of information. Many apps have given new direction and approach to farmers to communicate directly and share their problems with government officials, extension workers, and subject matter specialist.

The feedback of users suggested that use of mobile and cloud-based applications not only addresses the sustainability challenges but also add financial benefits for both large agriculture-based companies and farmers. Short message service (SMS) and voice record have given improvements in social relations between farmers and scientist. The knowledge and inform about choice of appropriate variety, fertilizers, pesticides and other agricultural inputs are made available to rural farmers at their doorstep. Use of android based app has the potential to make agriculture more productive, more consistent and to use time and resources more efficiently. This brings critical advantages for farmers and wider social benefits around the world.

This article provides the complete information about the various android based applications available in google play store for rice crop management. Here, the android based apps for rice is divided in five major categories.

1. Apps for nutrient management
2. Apps for pest and disease management
3. Apps for water management
4. Apps for rice cultivars information and its demand estimation
5. Apps for rice crop management

Farmers can freely download and use these application. Many state government in India providing smart phones to farmers in order to enhance the farmers, scientist communication better and easier. Young generation farmers showing higher interest and adoption of smart farming practices. However, bringing all the new technologies under single umbrella is very important. Thus, this article provides the complete information of all the smart application available for rice crop cultivation.

2. Apps for Nutrient Management

2.1. RiceNxpert

Under the RESILIENCE project, the ICAR-National Rice Research Institute created a smart nitrogen (N) monitoring and guidance application in partnership with the Norwegian Institute of Bioeconomy Research. Nitrogen is a critical major nutrient element for rice cultivation. During the growing season, N fertilizers are applied in split doses at important growth periods to meet its N requirements. However, the N application often not matching with rice crop N requirement. This is due to lack of knowledge about rice crop N requirement by farmer. A smart android-based application for leaf colour monitoring and N rates suitable for different rice ecologies was developed to monitor and determine the leaf N content and record real-time N fertiliser requirements in order to coordinate the demand and supply. The RiceNxpert is a web and android application that analyses rice leaf colour and recommends N fertiliser doses to synchronise plant demand and supply of N. This will aid farmers in determining the best time and dose of N to apply to rice plants. This is an easy-to-use tool that makes direct recommendation in terms of urea/hectare after analysis of the rice leaf colour (https://play.google.com/store/apps/details?id=cocypher.com.lccapp&hl=en_IN&gl=US).

2.2. Nutrient Decision Support Systems (NuDSS) for Irrigated Rice

NuDSS is a general decision support system for irrigated rice in tropical and sub-tropical Asia that captures the most relevant cropping circumstances. For irrigated rice, the NuDSS provides decision aid on SSNM. The NuDSS software programme aids in the creation of new fertiliser strategies that result in more efficient fertiliser use, higher and longer-lasting yields, and higher profits for farmers. The software was created in response to a need for decision aids that could help with sophisticated mathematical computations that would otherwise be impossible to accomplish. All current high-yielding rice varieties with a harvest index of around 0.50 follow the same plant feeding principles. A general settings menu specifies crop and site-specific conditions as well as instructions for local adaptation when conditions deviate from the norm (https://www.ipipotash.org/publications/eifc-75).

3. Apps for Pest and Disease Management

3.1. Rice Doctor

Rice Doctor is an interactive application for extension professionals, students, researchers, and other users who wish to learn how to diagnose and treat pest, disease

and other problems that might develop in rice. An international collaboration comprised of IRRI, University of Queensland in Australia, the Philippine Rice Research Institute in the Philippines, and the Research Institute for Rice in Indonesia developed this product. Over 88 pests, diseases, and other problems are included in the key. The usage of a combination of written descriptions and visuals aids clients in diagnosing their issues. Brief descriptions of the signs and symptoms of various problems, as well as details on any relevant management choices, are provided in fact sheets for each probable disorder. A keyword search option allows visitors to go straight to a specific fact sheet. For further information on these disorders, users can link to full fact sheets on the IRRI Rice Knowledge Bank website (https://play.google.com/store/apps/details?id=com.lucidcentral.mobile.ricedoctor&hl=en_IN&gl=US).

3.2. Mobile Rice IPM

Rice is grown by farmers in a variety of climatic zones during the dry and wet seasons. The main factors limiting rice productivity are insect pests, illnesses, and weeds. Farmers are unaware of Integrated Pest Management (IPM) Technologies and as a result, they use more chemicals, causing pollution and pest resurgence. This app was created based on IIRR scientists' experiences in reaching out to farmers with critical information on key pests, diseases, weeds, and nutritional deficiency in rice crops, as well as how to control them. This app is simple to install on Android phones and is quite valuable for farmers (https://play.google.com/store/apps/details?id=org.iirr.varipirusasyarakshana&hl=en_IN&gl=US).

3.3. Rice Pest Lab

Rice Pest Lab is an Android mobile and tablet software intended for rice researchers, students, and extensional personnel to collect and analyse data in the rice field. Pest Screening, Pest Monitoring, Pest Diversity, Pest Loss Assessment and Pesticide Evaluation are among the features provided in this software. This software uses web-based application tools to make it easier for researchers, students, and personnel to share information with farm scientists. They can utilise this app on their rice fields as an analytical tool, and the reports can be used in their ongoing research. This APP may also be a very useful tool for the students studying on rice crop in different states as well as in the country. Institute have taken great care to cover the majority of the needed rice research modules in the current version of this software Rice Pest Lab. With the help of important comments and suggestions, institute will add additional information and other components in the future to make this App more comprehensive and effective (https://play.google.com/store/apps/details?id=com.fieldxpert.www&hl=en&gl=US).

3.4. Rice IFC (Rice Insecticide and Fungicide Calculator)

Rice, Cotton, Redgram, Groundnut, Tomato, Soybean, Chickpea, Chillies, Okra, Cabbage, Cauliflower and Brinjal are among the 12 major crops for which the ICAR-National Research Centre for Integrated Pest Management, New Delhi, has developed insecticide and fungicide calculators (IFCs) on web and mobile platforms. To aid in prudent selection, sale and use on target crops, IFCs offer information on pesticides with label claims, quantity estimation based on prescribed dosages, methods of administration, and application technology against target insect pests and diseases. Pesticide dealers, crop specialists, plant protection professionals and state extension authorities would benefit greatly from IFCs, which have a broader application. The adoption of IFCs would improve the scientific marketing and field application of insecticides and fungicides (https://play.google.com/store/apps/details?id=nic.ricecal&hl=en_IN&gl=US).

3.5. Rice IPM

Integrated Pest Management (IPM) is a holistic approach to plant health management that integrates tools, methodologies, and procedures to achieve economic management of insects and diseases. IPM attempts to keep insect populations and disease severity at a minimum so that economic plant damage does not occur. IPM focuses on growing healthy crops in a safe, environmentally friendly and long-term sustainable ecosystem. R-IPM is a rice pest management mobile app that can be shared across multiple stakeholders, such as extension officers, pesticide dealers, and farmers (https://play.google.com/store/apps/details?id=nic.rice_ipm&hl=en_IN&gl=US).

The following features are available in R-IPM.

- Images of harmful stages of insect pests and disease signs are provided.
- Allows immediate access to management options for individual insect/disease.
- Provides choices for crop management based on crop stage (crop calendar based).

• Chemical choices includes a link to an insecticide and fungicide calculator to help with insecticide/fungicide selection and computation for any specific area and application technology.

3.6. Rice Expert System

It is an advisory system for dissemination of up to date scientific knowledge of plant protection in easily understandable form. Rice expert imitates human thoughts and reasoning and provides recommendations in the absence of expert. Developed by ICAR-IIRR (Indian Institute of Rice Research), Hyderabad to identify and analyse the situation regarding key rice pests and diseases, a web-based expert system has been developed. The knowledge base includes general decision rules that represent pest and disease experts' knowledge. It comprises 90 insect pest identification rules and 105 disease identification rules. An interface was created that included a questionnaire, popup menus, and list boxes with photos for each item in the drop down menus. In order to undertake formalised reasoning for user replies and matching rules in the knowledge-base, an inference mechanism was constructed using ASP.Net. Control measures such as biological, cultural, chemical, and resistant types were given their own module. These controls are suggested based on the crop stage, insect kind, nature and extent of damage, and economic threshold level. The user interface is entirely menu-driven, with combo boxes, option groups for picking responses to multiple-choice questions, and most of the questions supplemented by graphics for user convenience. Progressive farmers and agricultural extension officials can use this approach to speed up the decision-making process (http://www.ricexpert.in/).

3.7. Rice Pest and Diseases

This app provides symptoms and pictures of rice pests and diseases which make it easier to identify the rice pests and diseases for farmers, students and others.

3.8. Aavishkar

An artificial intelligence (AI) based mobile app to detect rice pest through a click of camera on the symptom (image based diagnostics). Developed ICAR-IIRR, Hyderabad.

4. Apps for Water Management

4.1. AutoMon^{PH}

A decision-making tool based on the Internet of Things (IoT) for irrigation scheduling and carbon footprint monitoring. A real-time water management data, make it easier to calculate methane emission/carbon footprint in rice. AutoMon^{PH} use wireless connectivity to communicate with water level sensors. It's a tool for sustainable water management built by IRRI and the Philippines Rice Research Institute (PhilRice) in collaboration with the Philippine Department of Agriculture. It provides a platform for information exchange, real-time monitoring and reporting, verification of water management practises, multi-stakeholder interaction and reduced transaction times and costs of effective coordination among stakeholders (https://www.irri.org/automonph).

5. Apps for Rice Cultivars Information and its Demand Estimation

5.1. SeedCast

It's a mobile application and web portal that uses Information and communication technology (ICT) to estimate seed demand. This application's first focus is on rice varieties from Odisha, India, which includes a number of freshly released stress-tolerant rice varieties that have been studied in the state. Dealers will be able to indicate demand for various varieties of rice seeds via the app. Seed firms, state and district agriculture department officials have access to this information. It will assist them in producing the desired seeds in sufficient quantities. This will help to close the gap between rice seed supply and demand. This will also encourage the substitution of older and low yielding varieties with newer and high yielding ones. Farmers who use the app will have access to information on which seeds are available from which dealers, allowing them to acquire and cultivate seeds that are appropriate for their needs and environment. Farmers can also use the application features to make decisions on varietal selection based on their land type and preferences (https://www.irri.org/seedcast).

5.2. Rice Varieties and Practices

This app provides a quick overview of rice cultivars that have been launched in the country. It includes morphological and other particular features for 1343 cultivars released in 28 states and four union territories around the country. The App includes standard cultivation practises for various rice ecologies, including hill rice, in addition to varietal characteristics (https://play.google.com/store/apps/details?id=io.ionic.rice.varieties&hl=en&gl=US).

5.3. IIRR rice seed portal

The lack of information about the rice seed availability is

the major reason for very low seed replacement ratio in rice. Though improved good quality seeds are available in various government organization, but this information is not available to farmers. This portal provide information about the availability of seeds of each varieties and it cost. This also helps the seed producing organization to calculate the demand for each varieties.

6. Apps for Rice Crop Management

6.1. Rice Xpert

It was created by the Cuttack-based ICAR-NRRI. This app offers farmers with real-time information on insect pests, nutrients, weeds, nematodes and disease-related challenges, rice varieties for various ecosystems, farm equipment for various field and post-harvest processes. Its web-based application system allows farmers to send information to farm scientists and receive immediate responses. Farmers can use this app as a diagnostic tool in their rice fields, creating customized inquiries for quick solutions to their problems by sending text, photo and recorded voice and receiving solutions by short messaging service (SMS) (https://play.google.com/store/apps/details?id=com.icar.ricexpert&hl=en_IN&gl=US).

6.2. Rice Crop Manager (RCM)

To enhance yields and profits, field-specific nutrient recommendations to each crop varieties are required. To determine the optimum nutrient management strategies for distinct rice fields, the International Rice Research Institute (IRRI) and its partners established site-specific nutrient management (SSNM) principles. A web-based platform allowing rice farmers to get field-specific information on crop and nutrient management in order to boost yields and income. It allows extension agents to provide farmers with crop management recommendations based on their field circumstances using a computer or smart phone. To improve and guide rice crop management, advices are sent to farmers in the form of a one-page printout and a SMS. It has been created in India for three states: Odisha, Bihar and Eastern Uttar Pradesh. It is available in two languages: Hindi and English (https://www.irri.org/crop-manager).

6.3. Rice Kannada

This software is easy to use and includes interactive audio and video material and created specifically for rice growers in Karnataka. After user download this app there phone, user can use it even if they don't have access to the internet. This software provides comprehensive information on agronomic activities including as planting, variety selection, disease/pest management, micro nutrient management, irrigation, and more in Kannada language. Farmers can use the LCC chart to determine whether they have a nitrogen shortfall. This application was created to give information to people who are illiterate (https://play.google.com/store/apps/details?id=com.agri.rice&hl=en_US&gl=US).

6.4. Rice Telugu

This application was created specifically for rice farmers in Andhra Pradesh and Telangana as their mother tongue is Telugu. This programme is incredibly user-friendly, with intuitive graphic information and Telugu voice support. Once downloaded in the phone, the app can be accessed without internet also. This software provides comprehensive information on agronomic activities including as planting, variety selection, disease/pest management, micro nutrient management, irrigation, and more in Telugu language. For rice/paddy growers, this is a must-have app. This app can also be used to make online purchases of agricultural inputs (https://play.google.com/store/apps/details?id=com.agri.telugurice&hl=en&gl=US).

6.5. Rice Knowledge Management Portal (RKMP)

Rice portal is the first milestone in using ICTs and knowledge management approaches in agriculture in order to create a semantic portal with a large amount of content. RKMP is the most complete and one-stop shop for reliable, validated, timely, and contextual rice information. This portal which is built on web 2.0 standards provides location-specific information to a wide range of stakeholders (policymakers, farmers, extension experts, academics, traders, NGOs and so on) 24 hours a day, seven days a week. Individuals can navigate through location-specific content using IP-based customisation. Another notable characteristic of this portal is the availability of content in the local tongue. FAO, APAARI (Asia-Pacific Association of Agricultural Research Institute), CGIAR (Consultative Group of International Agricultural Research) system and numerous national and international agencies have recognised RKMP as the best ICT innovation. RKMP is the most comprehensive collection of e-learning materials on any particular crop (https://www.icar-iirr.org/index.php/institute-research/institue-technologies-developed?layout=edit&id=122).

7. Conclusion

Android based mobile application usage is anticipated

to play a vital role in increasing agricultural production. Information is transferred to the needy farmers in an easy and cost effective way to enhance crop yield and input use efficiency in agriculture. Farming communities appreciate android based mobile application as easy, fast and convenient way to communicate and get prompt answers of respective problems. This will be highly useful for rice farmers, students and extension officials involved in rice research.

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