Development of mobile App for effective dissemination of information on castor

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Ref.No : IIOR/SS-67/18

ABSTRACT

Castor is an important industrial, non-edible oilseed crop in India. India accounts for 81 per cent of world castor production and 59 per cent of global castor area. The crop is being cultivated in different agro-ecological regions of the country under both irrigated and rainfed conditions. Despite the phenomenal increase witnessed in the production and productivity of castor over the last two decades, there still exists wide gap in the per hectare yields of castor across states. A number of improved varieties/hybrids and technologies developed in castor production do not readily reach the famers due to multiple factors including low farmer - extension worker ratio and slow pace of technology transfer. In the recent years, Information Communication Technologies (ICTs) especially the Mobile Apps have emerged as an accessible tools to strengthen the extension system by providing information on crops, market and advisory services. Hence, an android standalone mobile application on "ICARIIOR-Castor" was developed to reach the wider section of stakeholders through ICT from ICAR-Indian Institute of Oilseeds Research(ICAR-IIOR), Hyderabad. The App supports English language and available on Google play store. Features include offline and online mode and offer valuable information to the extension workers, farmers, castor researchers and other stakeholders, including state-wise preferred varieties and hybrids, crop production and protection technologies for management of insect pest and diseases, intercropping systems recommended for different states, contact details of AICRP (Castor) centres across India and commodity markets and important APMC's trading of castor. The ICT initiative can make latest and improved castor production technologies accessible to farmers and other stakeholders for realizing higher yield of crop.

Keywords: Android, Mobile Application, Crop production and protection technologies, ICARIIOR-Castor App, ICT

INTRODUCTION

Agriculture is the largest source of livelihoods in India. Seventy per cent of its rural households still depend primarily on agriculture for their livelihood, with 82 per cent of farmers

being small and marginal (FAO, 2018). The future of sustainable agriculture growth in India shall be factorized to the performance of small and marginal farmers. Access to timely, adequate, apt technology and related information is among the most important enabler for smallholders to improve productivity sustainably (Davis, 2008; Birner *et al*., 2009). In spite of a wide range of restructuring initiatives in agricultural extension in the past decades, the coverage of access to and quality of information offered to small and marginal farmers is uneven. The varied agro-ecological, socio-economic and cultural conditions of the farmers demand for diverse extension methods (Singh *et al*., 2018). The National Sample Survey Organization, 2010 results showed that the key sources of information to farmers till today are neighbors, input dealers, radio, television, newspaper and extension worker. Thus the present extension mechanism warrants a strong Information Communication and Technologies (ICT) support to reach the unreached farmers and speed up the knowledge transfer from researchers to end users. ICTs especially the Mobile applications (m-apps) have emerged as handy tools to strengthen the extension system by providing information on agricultural technologies (Qiang *et al*., 2011).

Castor (*Ricinus communis* L.) occupies an important place in the country's vegetable oil economy. Presently, castor is cultivated in 19 states over an area of 8.07 lakh hectares in the country, the states of Gujarat and Rajasthan being the major contributors (DES, 2017). Productivity of castor (1701 kg/ha) is exceptionally high compared to the performance of many annual crops in the country. Growing demand of vegetable oils by industries and biofuel production is encouraging castor and making it one of the profitable cash crops in the country. In India, castor is grown under two distinct agro-ecological situations *viz*., under irrigation and high input management in Gujarat and Rajasthan (1338 to 2072 kg/ha) and rainfed conditions under low input application with low productivity (312 to 631 kg/ha) in Andhra Pradesh, Telangana, Tamil Nadu, Karnataka and Odisha (DES, 2017). Given the current level of improved technology, there exists a wide commercially untapped yield reservoir in castor. The current extension services delivered through trained officers at the local level is having limited scope and thus necessitates a strong ICT support to align with the requirements of farmers, their existing experience and knowledge base with modern agricultural technologies and practices. Hence, a mobile application on castor production technologies was developed by ICAR-IIOR, Hyderabad aiming to empower castor farmers and other stakeholders with additional or latest information on castor for better yield. In the present paper, the design, requirement and development of ICARIIOR-Castor Mobile App and its unique features are discussed.

MATERIALS AND METHODS

A mobile application on castor management practices was developed by ICAR-IIOR to facilitate the end users with handy information. The updated content with regard to castor was compiled and was categorised into: General Information, Agronomic Practices, Preferred cultivars, Cropping systems, Insect Pests, Diseases, AICRP centres dealing with R & D on castor crop and Commodity markets for ease of the end user. The application was created in English and works both in online and offline mode once it is downloaded.

Design and Implementation

Requirement specification: The application was developed using Android Studio, an open source software for developing Mobile Apps. The Android studio uses Java development tools as its official language for coding. The greatest strength of the Android platform is the Java programming language. The Java platform supports different ways to work with XML, and most of Java's XML-related APIs are fully supported on Android. Android provides a functionally equivalent library. To test Android applications, a virtual Android device is created and launched. Before publishing the Application it is tested using the virtual device for its functionality.

Minimum system requirements: Operating System: Microsoft windows 7/8/10, 64-bit; RAM: Minimum 3 GB, Recommended up to 8 GB and 1 GB for Android Emulator; Disk space: Minimum 2 GB of available disk space, Recommended up to 4 GB; Java Version: Java Development Kit (JDK) 8.

Design Approach

The Mobile App was developed using Android Studio, an open source software for developing Mobile Apps. Once the App is developed it is compiled and then published in the Google Play store. The castor Mobile App flow chart is presented in Fig.1.

How to Use the APP:

The Mobile App ICAR-IIOR Castor can be downloaded from google playstore at: https://play.google.com/store/apps/ details?id=in.org.icar_iior.icariiorcastor2&hl=en. Once the user installs the app in the android phone, the user is can view the home page which has the list of chapters available in the app. With a simple touch the user can navigate to further screens. If the user wants to goback to the home page the user has to touch on the arrow mark which is

there on the top left side of the mobile screen. From home page to user can go to any topic of choice and can browse forward or backward any number of times. The app is user friendly, wherein the user can navigate from one point to other point for the information.

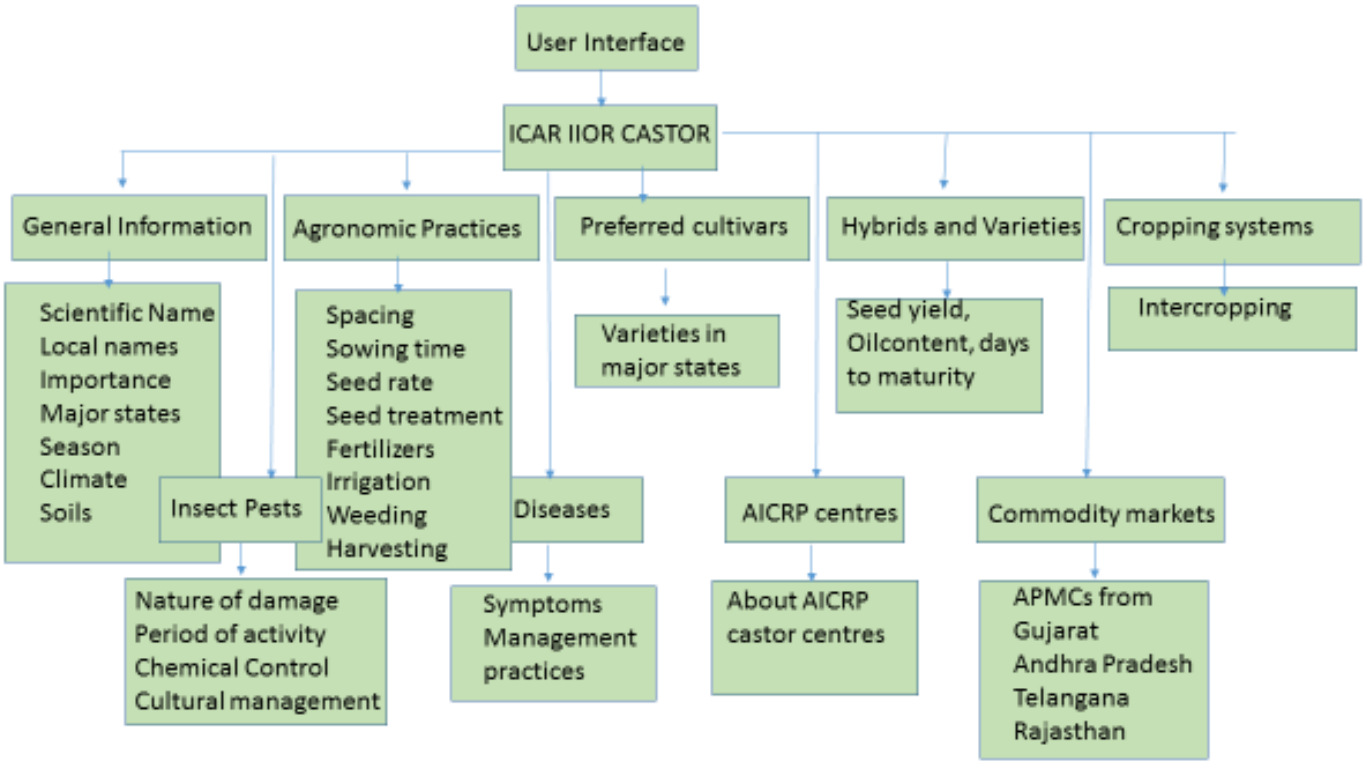

Fig. 1. Flow chart showing the structure of the ICARIIOR-Castor App

RESULTS AND DISCUSSION

Information is one of the most valuable resource and potential component for the advancement of agriculture. Information is presently viewed as a factor of production like other factors such as land, capital and labour. In order to bring substantial development in the agricultural sector, access to timely, reliable, and relevant agricultural information is a critical factor (Rao, 2007; Ogboma, 2010; Deribe Kaskekacharo, 2016). The present extension services provided through trained extension personnel at the local level is having a narrow scope and thus warrants a strong Information Communication and Technologies (ICT) support to provide information on modern agricultural technologies in a timely and cost effective manner. Among ICTs, there has been increasing use of mobile phones which is altering the agricultural communication method. Hence, a mobile application namely, ICARIIOR-Castor was developed to provide basic information of the castor crop and improved varieties/hybrids and

production technologies developed at ICAR-Indian Institute of Oilseeds Research, Hyderabad and under All India Co-ordinated Research Project (AICRP) on Castor.

The general productivity level of castor in India is 30-40 per cent of the realizable potential because of inefficient crop management and inappropriate varietal choice. The available information suggests that there are distinct possibility for expanding the area through exploitation of polymorphic nature of the castor crop permitting its cultivation as short season, whole season, perennial and as intercrop in combination with other short duration cereals/legumes in rainfed and irrigated conditions. No cost/low cost inputs like recommended sowing time, optimum plant population, irrigation at critical stages, effective moisture conservation have been found to improve the yield to the tune of 80 to 100 per cent. Extending castor cultivation to newer niches and seasons such as rice fallows and *rabi* season under protective irrigation is a new dimension with promise that provide greater stability and higher production (Hegde *et al*., 2003; Raghavaiah and Suresh, 2006; Sujatha *et al*., 2017).

In this ICARIIOR-Castor App, home screen has the drop menu option and the information available in the drop menu are: general information, agronomic practices, preferred cultivars, hybrids and varieties, cropping systems, insect pests, diseases, AICRP centres and commodity markets (Fig. 2). The basic information of the castor crop *viz*., scientific name, local names, importance, major castor growing states, seasons, climate and soils for cultivating castor have been provided under general information menu (Fig. 3). Under agronomic practices tab, the drop menu provides technical information on effective crop management techniques *viz.*, optimum spacing, sowing time, seed rate, seed treatment, recommended dose of fertilizers, irrigation, weeding and interculture operations and harvesting and threshing practices (Fig. 4). Upon clicking the cropping system tab, the popular intercropping system recommended for different states along with information on additional net returns will be displayed. This page includes photographs of inter cropping system followed in different states and description of row ratio of main crop and inter crop, which would go a long way in suggesting risk management strategy during years of low rainfall and increase per unit productivity.

Fig. 2. Home screen and major contents of the drop menu option in ICARIIOR-Castor Mobile App

Fig. 3. General information on castor provided in the ICARIIOR-Castor Mobile App

Fig. 4. Castor agronomic practices contents covered in the ICARIIOR-Castor Mobile App

For realizing optimum productivity of any crop in any production environment, the choice of an appropriate variety/hybrid is extremely essential. Improper choice of the variety would result in low productivity, even when adequate quantities of inputs are applied. It is equally important to use the latest and improved recommended varieties/hybrids, since all varieties tend to lose disease resistance on account of evolution of pathotypes/biotypes of the disease. In castor, a total of 55 high yielding genotypes including 34 varieties and 21 hybrids were developed under the AICRP on castor and recommended for different agro-climatic regions of the country (Sujatha *et al*., 2017). In the ICARIIOR-Castor App, the basic information of castor hybrids and varieties released since the last 40 years was provided under the preferred cultivars and Hybrids and Varieties tabs along with photographs of the cultivars (Lavanya and Mukta, 2008). Upon selecting the preferred cultivars menu, information like seed

yield, oil content, days to first picking, suitable area of cultivation and other special features of the popular varieties and hybrids of major castor growing states *viz*., Andhra Pradesh, Telangana, Gujarat, Karnataka, Maharashtra, Rajasthan, Tamil Nadu, Haryana and Odisha have been provided. Upon selecting the Hybrids and Varieties tab, the basic information of each varieties and hybrids has been displayed along with photographs (Fig. 5).

Fig. 5. Information of state wise preferred cultivars and details of each hybrids and varieties of castor displayed in the ICARIIOR-Castor Mobile App

Out of a number of production constraints, biotic stresses *viz*., insect pests and diseases steal the lion share of castor productivity in India (Lakshminarayana and Raoof, 2005). Identification of insect pests and their damage symptoms can facilitate the management of insect pests & diseases through appropriate management strategies and can improve productivity (Sindhuja *et al*., 2010; Mansingh *et al*., 2017; ICRISAT, 2018). In the Castor App under the insect pests sub heading, the list of major insect pests (semilooper, tobacco caterpillar, capsule borer, leafhopper, Bihar hairy caterpillar, red hairy caterpillar, thrips, leaf miner, whitefly) and mite pest (red spider mite) attacking the castor crop was displayed. Upon selecting the individual insect pest from drop menu, information on nature of damage, period of activity, chemical control and cultural management practices have been provided along with photographs of insects and their damage symptoms (Fig. 6). Disease identification based on the detection of early symptoms minimizes the yield losses and increases the effectiveness of the management practices (Alexander *et al*., 2017). Under disease tab in the Castor App, the drop menu enlists the major diseases of castor in India *viz*., gray mold, Fusarium wilt, root rot, seedling blight, Alternaria blight, bacterial leaf spot, Cercospora leaf spot, powdery mildew

and rust. Upon clicking the selected disease, the next screen provides information of the disease symptoms and disease management practices including photographs of disease symptoms (Fig. 7).

Fig. 6. Insect pests and their management tools available in the ICARIIOR-Castor Mobile App

Fig. 7. Diseases and their management tools displayed in the ICARIIOR-Castor Mobile App

Market information can play an extremely important role in promoting agricultural development and it contributes towards strengthening farmers bargaining power and improving their awareness of market opportunities and options (FAO, 2017). In the ICARIIOR-Castor Mobile App, the details of the different AICRP centres in different states along with their addresses were provided under the AICRP tab to get advice from experts. To facilitate the end user to sell the produce the user need to identify the nearest market. Hence the details of the

commodity markets from major castor growing states like Gujarat, Rajasthan, Telangana and Andhra Pradesh were provided (Fig. 8).

Linking the app to commodity markets in different agro-eco regions and making the selling price related information of each market dynamically go a long way in helping the farmer / other stakeholder of castor in making right decisions at right time for increasing the farm profitability.

Fig. 8. State wise commodity market information displayed in the ICARIIOR-Castor Mobile App

The increasing popularity, access, use of mobile phone technology and its diffusion in all the section of the society in India give a distinctive opportunity in ICT mediated extension for communicating agricultural information (Lahiri *et al*., 2017). The ICARIIOR-Castor Mobile has been developed to offer valuable information on improved and latest varieties/hybrids and package of practices of castor to extension professionals, farmers, researchers, students and other stakeholders. The Apps can contribute significantly to production and productivity of castor and boost castor farming in India.

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