



## Weed manager (App for mobile): Harnessing innovations in Indian farming

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India is an agriculture based developing country and it is the primary occupation of 65–70% Indian population. To achieve higher agriculture production, farmers should be well aware of latest technologies and current information on day-to-day agricultural affairs. The data on farming are available through many sources such as print media, audio and visual aids, newspaper, TV, internet, mobile *etc.*, but the formats and structures of data are dissimilar.

A mobile App is a software based programme that contains formally encoded knowledge of experts in a given problem area or domain and is able to provide help to a non-specialist to problem solving in that domain (Patterson 2004). In agriculture, expert systems were developed in various disciplines (Olmo and Recasens 1995, Schulthess *et al.* 1996, Chakrabarti and Chakraborty 2007, Ravisankar *et al.* 2010, Ahmed Rafea 2010) that combine the experimental knowledge and experience with intuitive reasoning skills of specialists to aid in making the best decisions. The Apps are not only useful for stakeholders located at remote area where desktop PCs are not available, but would also be available to farmers and all other stakeholders for extracting information from the web.

Presently, mobile communication technology has become the world's most common way of transmitting voice, data, images and services due to advantages of affordability, wide ownership, voice communications and instant and convenient service delivery. The cost of acquisition of a typical mobile phone is lower than that of a PC. It is also easy to learn how to use a mobile phone, even for computer-illiterate people. This fact makes a mobile device most appropriate medium to introduce technology to users who are not compute friendly. The objective of the present study was to develop App for mobile phones which provide weed management related information to different stakeholders.

The first step in building a mobile App is knowledge acquisition. Methodology is mainly based

on the principal of knowledge level which means developing a knowledge model at the farmer's level problem solving approach. Android Operating System has the largest share among the smart phones in India. Therefore, initially Apps are being developed for Android operating mobiles. In the light of existing problem and need of the user-friendly mobile app for farmers, agriculture officials, students and Industry professionals, a mobile App named '*Weed Manager*' was developed by the ICAR-Directorate of Weed Research, Jabalpur. With the help of scientists of ICAR-Directorate of Weed Research, Jabalpur, data were collected on crops/cropping systems, dominant weeds, herbicides availability in the market and crop-wise recommendations of herbicides for weed control. Data were also obtained from the data repository maintained at ICAR-Directorate of Weed Research as well as from the published information. Further, some other related information was collected from literature (Naidu 2012) where information about weeds scientific names, common names along with weed images was documented.

The knowledge engineer coded the information in the form of rules or some other representation scheme. System editor (software expert) served as intermediate between the domain expert and the mobile that emulates their expertise. The software expert acquired the information about the weeds in the form of facts and rules through consultation and document analysis and then prepared a knowledge base for the system. The process was repeated till the sufficient knowledge was collected to build the expert system. The basic requirement to operate this app is to have an Android device with net connectivity, and the software of '*Weed Manager*' to be downloaded from the Directorate website ([ww.dwr.org.in](http://ww.dwr.org.in)). After completion of download, setup file has to be run for the installation in a device. An icon () will appear on mobile screen after complete installation. Data flow in the App (**Figure 1**) along with step-by-step data flow in *Weed Manager* is presented (**Figure 2**).

Decision making to control weed is challenging. Broad-spectrum of weeds found in fields, and

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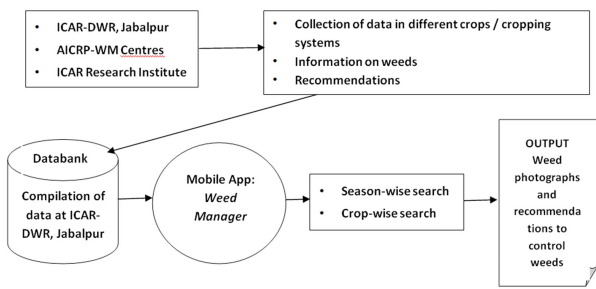


Figure 1. Data flow diagram

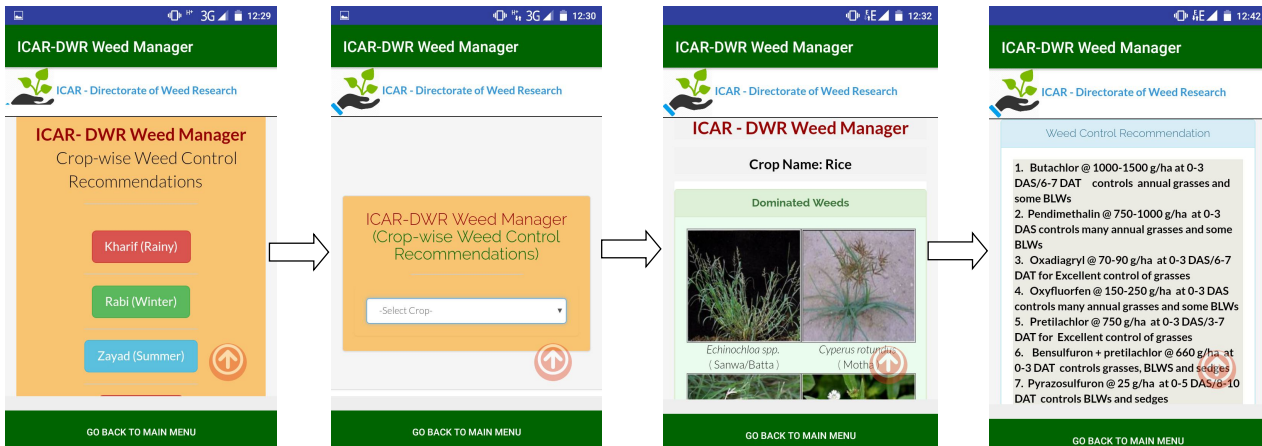


Figure 2. Step-by step data flow

availability of a number of herbicides in the market make the selection of a suitable herbicide difficult. *Weed Manager* can assist in making right decision to manage such weeds in various crops. It provides advice for the control of weeds specific to the crop and informs the best herbicide with optimum dosage and method of application.

It is a menu-driven App, where crops are grouped by season. User can select crop based on season like rainy, winter or summer (*i.e. Kharif, Rabi and Zayad*). After selecting season, user can choose the crop. A screen will appear with dominated weeds details along with weed management recommendations for that particular crop.

### Evaluation of App

The performance of the App was evaluated using the data obtained from different users. Data were collected through the pre-tested questionnaire from the users who have downloaded the App. Questionnaires were sent to all users. Questionnaire included the opinion of users on different points *viz.* general information, working of the App, quality/reliability of information provided, satisfaction level/easiness provided in the app, *etc.* along with suggestions for improvement.

Total 156 filled proforma were received. Most of the users (42%) were academicians who used this App for accessing weed management information for their academic purposes including research and extension. Around 28% users were student who are doing their research work on weed management. Only 11% farmers were using App to get information which helped them to reduce the yield losses due to weeds (**Figure 3**). The reason for less number of farmers as App users, could be the language of the

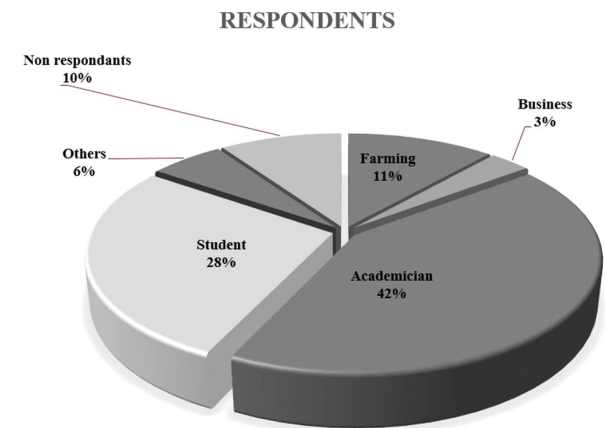
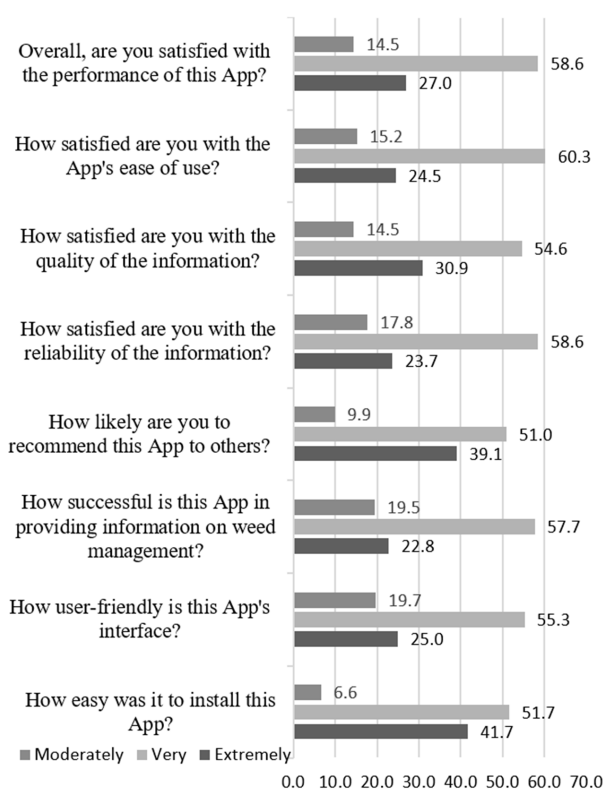


Figure 3. Distribution of respondents

App (English). Most of the farmers can not read and understand English. Therefore, considering their problem, efforts are being made to translate the information provided in the App in Hindi. In future, it is planned to translate the information in regional languages also.

Feed back of users on specific questions are depicted as the horizontal bar diagram (**Figure 4**).

Mobile applications in general and in agriculture in particular hold significant potential for advancing agricultural development. It can provide the most



\*Numbers are in percentage

**Figure 4. Views of the users in relation to different questions on quality, reliability, easiness and other aspects of the App**

affordable ways to millions of people to access information previously unavailable to them.

*Weed Manager* is capable to transfer crop specific weed management technology to stakeholders efficiently. The services of App will ensure door-step delivery of information on weed management. Further, modification and additions to current system will be a continuous process based on the information and feedback received from the users.

## SUMMARY

Agricultural system in India is an amalgamation of various sub-systems where information need is very critical at various stages starting from input supply and production till finally reaching to consumer doorsteps. The farming system faces a plethora of problems including weed management and to solve these problems, *Weed Manager* – a mobile App can provide real time weed management information to farmers and other agriculture stakeholders to improve decision making ability to manage weeds to increase their production and productivity.

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