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Communication of FRAC Code Principles with Fruit Producers via Smartphone

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ABSTRACT

Effective communication of resistance management strategies with growers is important for practical resistance management, but restrictions to crops and the many choices of active ingredients, trade names, and chemical classes make it difficult for growers to make informed decisions. We developed a smartphone application, MyIPM, to promote integrated disease and resistance management principles for fruit growers. The app features registered active ingredients and trade names for about a dozen of the most important diseases of blueberry, strawberry and peach. Active ingredients are color-coded by FRAC code and an interactive table lets the user swiftly sort products by FRAC code and efficacy ratings. The associated trade names, along with rate per acer, PHI, REI and filed EIQ, can be requested by pushing on the active ingredient name. Field EIQ values for formulated products were published by the Cornell IPM Program. Pictures of signs and symptoms, descriptions of the causal agent, and a 2-min audio from the regional specialist provide additional diagnostic tools and communicate IPM principles. The app also features field EIQ values for formulated products as published by the Cornell IPM Program. MyIPM content is provided by an external database that can be updated in real time using a web authoring tool allowing for up-to-date information. It is expandable to more crops and is currently being developed for apple, pear, cherry and cranberry. A sister product 'MyIPM-SEF-P' was just published for blueberry pest management in the southeastern USA. The apps are available free of charge in Google Play and the Apple Store.

INTRODUCTION

Extension agriculture specialists strive to provide up-to-date production information for producers to increase productivity in a sustainable and environmentally responsible way. Production information is typically conveyed via websites, extension publications, production meetings, conventions, and one-on-one interactions and other means. Mobile smartphones are

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yet another opportunity to distribute information. They are now used widely for communication, entertainment, and increased productivity and smartphone apps are being developed in virtually all science disciplines, including agriculture.

The advantages of smartphones for farmers are obvious. First and foremost it is a communication device and even technology-averse producers are seeing the benefits of using a hand-held mini computer/phone. Information can be retrieved at any time and virtually at any place, even in remote orchards. Helpful information can be conveyed through software applications (apps). There are apps for pest and disease identification, crop disorders, agricultural news, disease risk assessment, weather forecast and much more. Some popular apps include the Tank Mix Calculator, the TankMix App, Calibrate My Sprayer, Mix Tank, TeeJet Technologies, Ag Weed ID, ID Weeds, Weather Underground, and SoilWeb.

MyIPM is a free app series, designed, created and maintained by Public University Specialists (Schnabel 2015; Schnabel et *al*. 2015). It features a variety of different aspects of disease and pest management for commercial fruit growers in form of text, high resolution pictures, interactive tables, and audio. MyIPM integrates different pest and disease management approaches including pest and disease diagnostics, chemical and non-chemical management options, and tools for insecticide and fungicide resistance management. It features key elements of regional spray guides, current knowledge of control, and a picture library for diagnostic purposes. The app is designed for producers, field advisors, and specialists and is available in the Google Play Store for Android devices and in the Apple App Store for iOS devices.

MATERIALS AND METHODS

From a software perspective MyIPM can be divided into two main components: the application and an external server. The application consists of all the relevant code that allows the app to run, as well as an internal database that stores information local to the device. The server includes an external database that holds the most up-to-date version of the app's information, as well as PHP and HTML scripts which allow a user (specialist) to edit the external database, and for an individual app to update its data.

The relationship between the app and the internal database can be seen as a model-view-controller. This design pattern divides a user interface into three components: a model, a view, and a controller. The view is everything the user sees in the application; tables or user interface elements such as buttons or menus. The controller defines how the user interacts with the application. For example, it determines when a user presses a button and what logic should be executed when the event (the button was pressed) occurs. This information is then sent to the model. The model contains all of the data for a particular view and alerts its associated views and controllers when they need to be updated. In MyIPM each update to the model is accompanied by a query to the application's internal database. For example, every time a user requests a piece of information, such as selecting 'Strawberry' from the application's main menu, the application will load the relevant information from the database, in this case, a list

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of diseases that affect strawberries and an image of each disease. The app then updates the view and associated controller to reflect this new data.

The server can best be explained though the client-server model. In this architectural style there is a central server that stores information and provides a variety of services which can be requested by the client. For context this model is the basis for how websites are accessed on the Internet. Our server provides two main services. The first provides an authoring tool for the information stored in the external database. This tool provides a way for an administrative user to add, edit, and delete the information that defines the application. For example, a user with access to the authoring tool can dynamically add a new fruit or disease to the app without modifying the source code of the application. The second service connects the external database to each individual instance of the application. Using PHP scripts, the server provides a way for the mobile application to ask if any changes have been made to the external database. If so the app will download the new information and integrate it into its own internal database, where it can be seen by the user.

RESULTS AND DISCUSSION

The MyIPM series smartphone applications (Figure 1) were developed by Clemson University and content is updated in collaboration with specialists from Cornell University, North Carolina State University, Pennsylvania State University, University of Georgia and University of Massachusetts. The apps are available for free in the Apple Store and Google Play Store to promote Integrated Pest Management for sustained, commercial fruit crop production. There currently are two disease apps and one pest app available. The disease apps are MyIPM-SED (peaches, strawberries, and blueberries) and MyIPM-NED (apples, pears, cherries, and cranberries). The pest app is MyIPM-SEP. SED stands for Southeastern US Diseases, NED stands for Northeastern US Diseases, and SEP stands for Southeastern US Pests. It includes the following features:

- Diagnostics, including description and pictures of fruit crop diseases, pests, and disorders.
- Name and description of the causal agents, including a 2-min audio from the regional specialist
- Chemical and biological control tactics
- Registered conventional and biological active ingredients for each disease/pest, sortable by FRAC codes, efficacy, and EIQ value (Figure 2)
- Registered conventional and biological products (trade names), rate per acre, PHI, REI
- Audio recordings from regional specialists.

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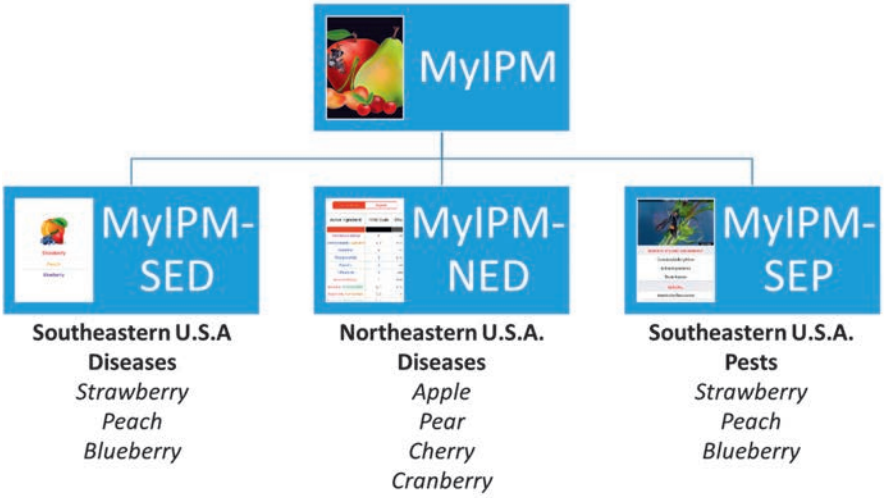

Figure 1 Three MyIPM apps are currently available. They feature IPM tools and information for various fruit crops.

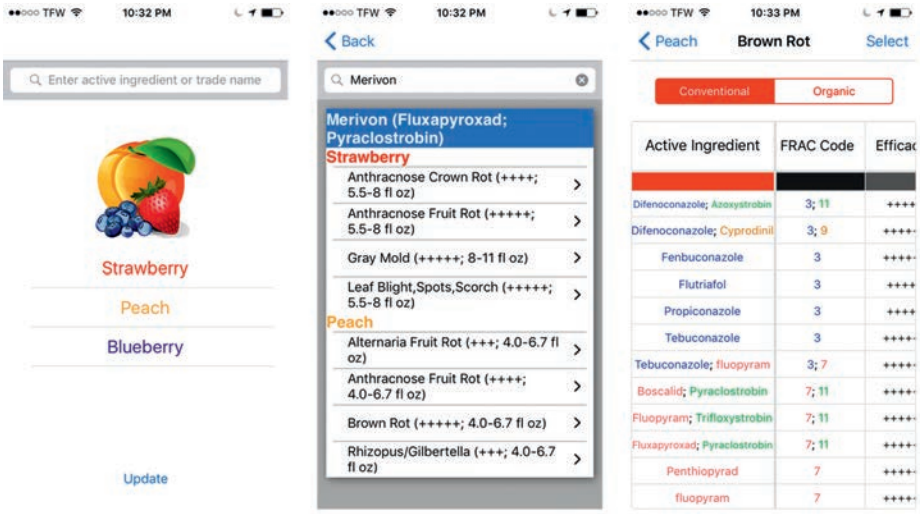

Figure 2 Selected pages of the MyIPM smartphone app. The search bar lets the user enter active ingredients or trade names and displays what crop and disease the fungicide or trade name is registered for. The user has the option to list and sort color-coded FRAC codes.

LITERATURE

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