iFertigate: A New Mobile App to Assist With Fertigation Calculations

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Abstract

Nutrition management in nurseries is critical for growing quality plant crops. Applying soluble fertilizer through the irrigation system (i.e., fertigation) requires careful calculations of concentrated fertilizer products to create nutrient mixtures that will deliver target nutrition levels. The iFertigate mobile application (app), available for both iOS and Android platforms, allows the user to create and store calculations for specific nutrient tank mixes. The app provides information on macronutrient and micronutrient concentrations of each mix and gives an alert if there is a risk of precipitates. The user can set the language to either English or Spanish. This article provides background information about the app and describes how to use it. This paper was presented at the Joint Annual Meeting of the Western Forest and Conservation Nursery Association and the Intermountain Container Seedling Growers Association (Coeur d'Alene, ID, October 25–26, 2018).

What Does It Do?

iFertigate was developed to assist with creating tanks mixes for nursery fertigation practices. With iFertigate, one can quickly and easily enter, calculate, and/or store multiple data for each tank mix:

- Water chemistry
- Macronutrient concentrations
- Micronutrient concentrations
- Nutrient ratios
- Precipitate potentials
- Preferred fertilizer products
- Past, current, and future fertigation costs

Where Did It Come From?

In 2014, the U.S. Department of Agriculture, Forest Service, Reforestation, Nurseries, and Genetics Resources (RNGR) team, in partnership with the Southern Regional Extension Forestry (SREF), began exploring the idea of developing a mobile application (app) specifically targeting a need within the forest and conservation nursery community.

Initially, a comprehensive review was launched to evaluate the cost, functionality, and overall benefits of all mobile apps that might be relevant to the forest nursery industry. Those findings were presented at the 2015 Joint Meeting of the Northeast Forest and Conservation Nursery Association and Southern Forest Nursery Association, in Kent Island, MD, and again at the 2015 Western Forest and Conservation Nursery Association Meeting, in Eugene, OR. These presentations were summarized in a 2016 article: Useful mobile applications for nursery and field personnel (Haase and Drummond 2016).

Following the presentation in Eugene, OR, the conference attendees participated in an open forum and gave their thoughts and suggestions regarding how a mobile app might be useful in the day-to-day life of a nursery manager. By combining those notes with the findings from the initial review, it became clear that there existed no mobile technology for assisting nursery managers with custom fertigation tank mixes. iFertigate was then developed to meet those needs.

How Do I Use It?

With simple data input, users can create and store any number of single- or multi-tank mixes and keep application quantities and costs in one place. After installing and launching the app, a navigation bar at

the bottom of the device screen displays buttons for the five main sections of the app: Mixes, Applications, Guide, About, and Settings (figure 1). These sections are used to tailor the app functionality for individual purposes and are described below.

Mixes

Most of the app interaction and output takes place in this section. The Fertigation Tank Mix Calculator is the first screen visible to the user under the Mixes main section. This screen displays a list of all previously made custom tank mixes, along with all included product quantities, product costs, and the total cost of the mix (figure 2a). Users can select previous mixes for review or edit, or can click the X beside any mix name to remove it completely from the app. Custom mixes can be added by clicking the Add Custom Mix button at the bottom of this screen.

From the main Fertigation Tank Mix Calculator screen, selecting an existing tank mix or the Add Custom Mix button will navigate the user to the Custom Fertigation Tank Mix screen (figure 2b). This screen allows the user to edit all information related to the custom mix and provides updated calculation results as new information is added.

The Custom Fertigation Tank Mix screen links to seven main areas:

1. Basic Information

This area displays the name of the mix, the crop to which it is to be applied, the dilution ratio of the fertilizer injector, and whether the mix is used for growing or hardening (figure 3a). Of this information, only the dilution ratio is used by any of the calculations. All other fields are optional, but are useful for keeping track of multiple tank mixes. Click the Edit Basic Information button to modify this information.

2. Water Quality

This area allows the user to enter custom water profiles (figure 3b). Each nursery has different water characteristics. Entering current water quality data enables the app to account for this in the fertigation output. Water profiles contain information about the nutrient concentrations, electrical conductivity, alkalinity, and pH of
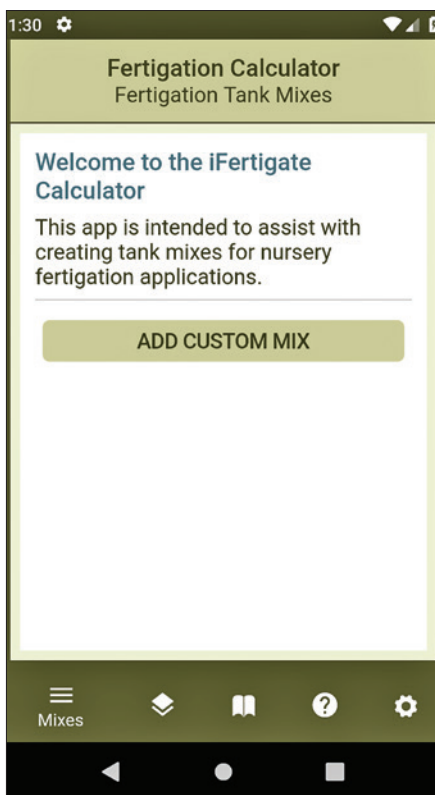

Figure 1. The iFertigate mobile app has five main buttons at the bottom of the screen. From left to right: Mixes, Applications, Guide, About, and Settings.
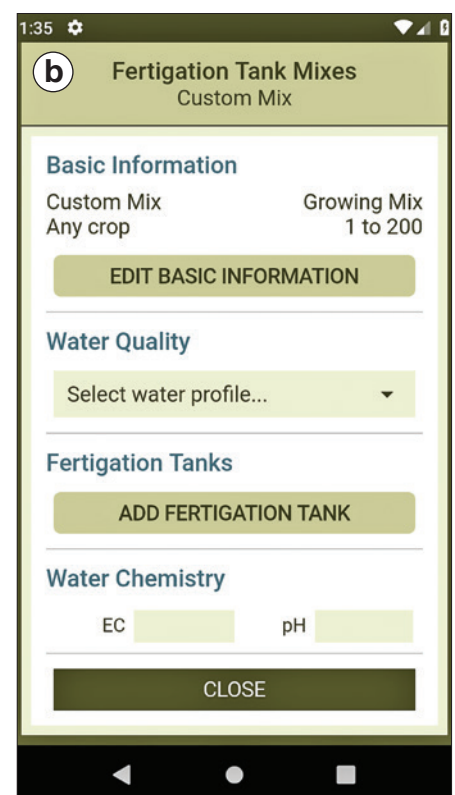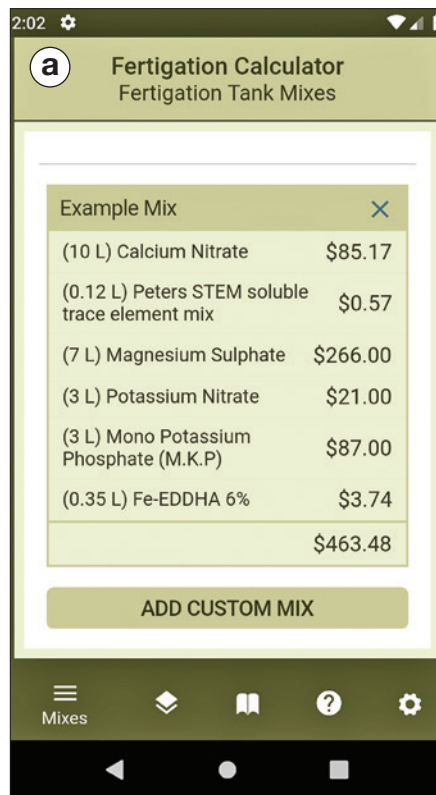
Figure 2. In the Mixes section of the iFertigate app, the user can view (a) all existing mixes stored in the app and their associated costs. By selecting "Add Custom Mix", the user can navigate to (b) the Custom Fertigation Tank Mix area of the app where the majority of data entry and app output occurs.
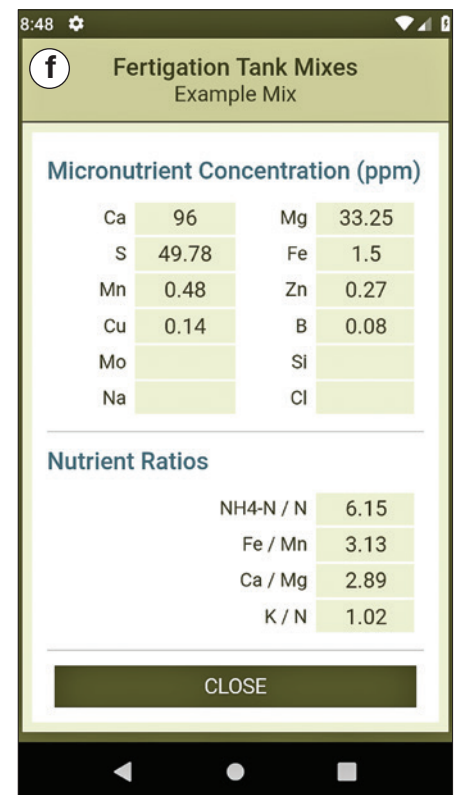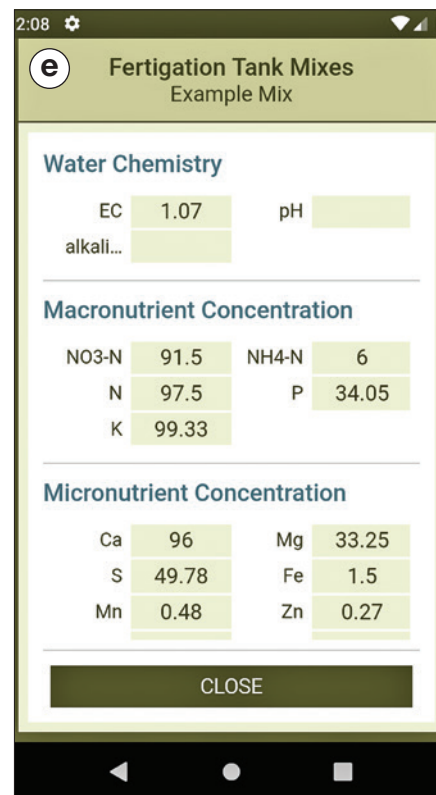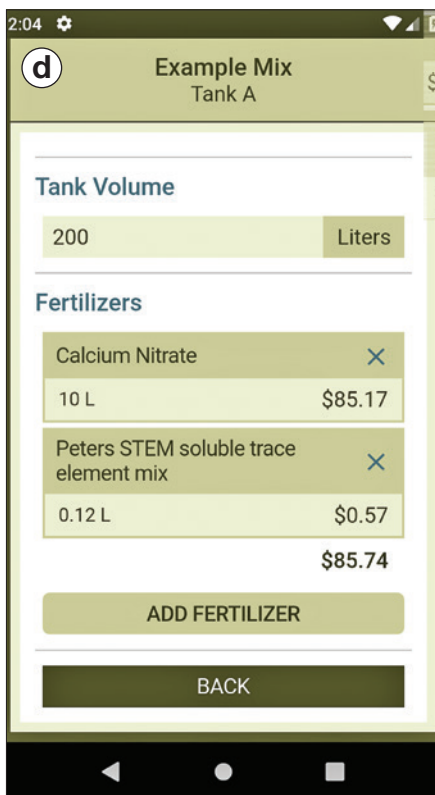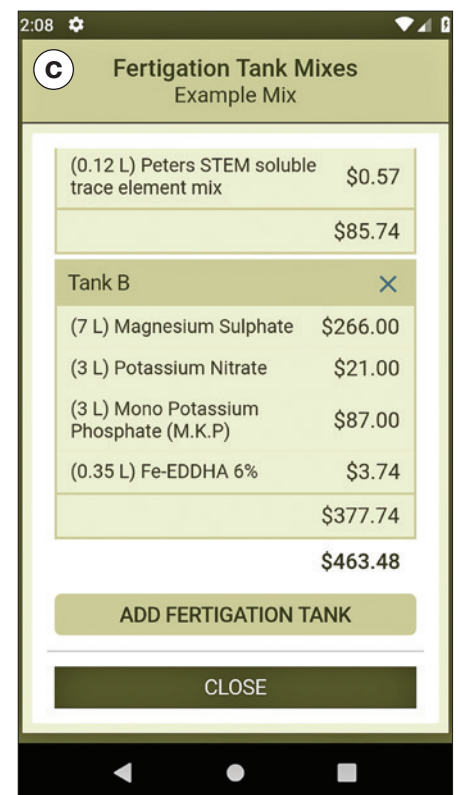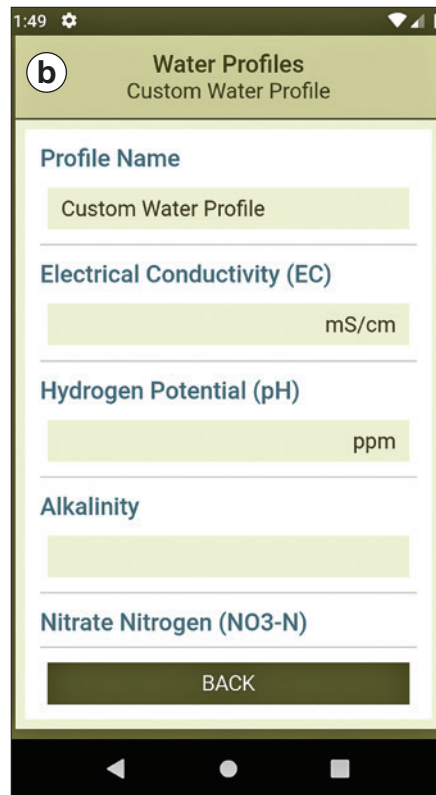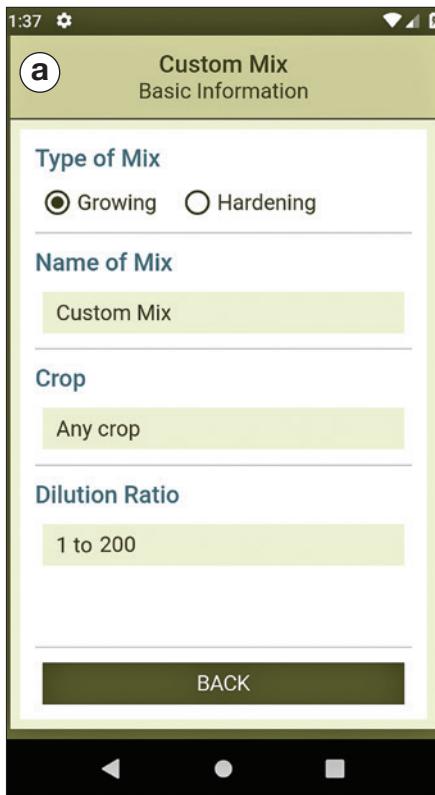
Figure 3. To use the iFertigate mobile app, the user starts by entering (a) basic information and (b) the irrigation water profile. The user can (c) view, add, or (d) edit tanks within existing mixes. For each mix, the app provides the resulting. [Additionally, these screenshots are taken from the phone application; the tablet application offers the same features but appears slightly different with more information visible on the screen at one time.] (e) water chemistry, macronutrient concentration, (f) micronutrient concentration, and nutrient ratios. [Note: these screenshots only show a portion of each page for description purposes; the user must scroll down to see all components. Additionally, these screenshots are taken from the phone application; the tablet application offers the same features but appears slightly different with more information visible on the screen at one time.]

the irrigation water prior to addition of fertilizer. These values are used in tank mix calculations. If no water profiles are available, a Create Water Profile button is shown instead. Water profiles are optional but can greatly impact the overall calculation results. Once one or more profiles are entered into the app, they will be available in this screen to select for specific tank mixes. Additional water profiles can be created or modified in the Settings section.

3. Fertigation Tanks

This area displays a list of fertigation tanks used in the mix, along with all included product quantities, product costs, the total costs of each tank, and the total cost of the mix (figure 3c). There is no limit to the number of tanks that can be included in a given mix. Warnings will appear in this area if any given tank has potential for precipitates caused by incompatible fertilizer products. Users can select a tank name to edit it or click the X beside any name to remove it completely from the mix. Fertigation tanks can be added to the mix by clicking the Add Fertigation Tank button at the bottom of this area.

Selecting an existing tank to edit it or choosing to add a new tank opens a screen that allows the user to edit/enter the name and volume (in liters or gallons) of a particular tank and to add fertilizers by clicking the Add Fertilizer button at the bottom of the screen (figure 3d). The screen displays a list of fertilizer quantities, fertilizer costs, and the total cost of the tank. Warnings will also appear in this area, if the mix in this tank could cause precipitates. Users can select a fertilizer name to edit it or click the X beside any name to remove it completely from the tank. There is no limit to the number of fertilizers that can be included in a given tank.

When adding a fertilizer to a tank mix, the app allows the user to select from a menu of available products, and enter a quantity (in liters, gallons, kilograms, or pounds), and optionally, product costs. A complete list of available fertilizer products can be modified in the Settings section.

4. Water Chemistry

Once a mix of one or more tanks is customized, this area displays the resulting electrical conductivity, alkalinity, and pH (figure 3e).

5. Macronutrient Concentration

This area displays the resulting concentrations (ppm) of nitrogen (nitrate and ammonium), phosphorus,

potassium, calcium, and magnesium in a given mix (figure 3e). By examining these values carefully, the grower can adjust the products and amounts in the mix as needed to meet nutrition targets based on plant species, growing stage, and other factors.

6. Micronutrient Concentration

This area displays the resulting concentrations (ppm) of sulfur, iron, manganese, zinc, copper, boron, molybdenum, silicon, sodium, and chlorine in a given mix (figure 3f). Again, close scrutiny of these values can aid the grower in creating the optimum mix for the crop.

7. Nutrient Ratios

This area displays four common nutrient ratios: NH4-N/N, Fe/Mn, Ca/Mg, and K/N (figure 3f). Paying attention to these ratios can assist the grower in creating a balanced fertilizer regime.

Fertilizer Applications

The Fertilizer Applications screen displays a list of past and future applications of custom tank mixes, along with total application costs (figure 4). Users can select an application name to edit it or click the X beside any name to remove it completely from the app. There is no limit to the number of applications that can be recorded. Additional applications can be added by clicking the Add Application button at the bottom of this screen which allows the user to select from a menu of available custom tank mixes and enter a date of application.

Guide

This screen provides the user with helpful information regarding the iFertigate app and its use.

About

This screen provides information about the app, links to related resources, and contact emails. It also displays the following disclaimer:

This app was created for to use as a helpful tool with nursery fertigation practices. Every attempt has been made to ensure the accuracy of fertilizer data and associated calculations. Nonetheless, it is the app user's responsibility to confirm that the information generated by this app is correct and that the overall nutrition regime is appropriate for his/her crop(s). The information reported about specific fertilizer products does not imply recommendations or endorsements for their use.

Settings

The Settings screen is divided into four main areas:

1. Language

The app is available in English or Spanish. The user can use the radio buttons to change the language used throughout the app (figure 5).

2. Font Size

Font size can be adjusted by dragging the slider from left to right to reduce or enlarge the font size for readability (figure 5).

3. Products

This area provides the user with three possible actions (figure 5):

- Clicking Add New Product opens a screen where the name, cost, and nutrient information of a product can be entered (figure 6a). The new product will then be added to the list of available fertilizer products in the app.
- Clicking Edit Product List displays a list of available fertilizer products (figure 6b). Users can select a fertilizer product name to edit it or click the X beside any name to remove it from the app.
- Clicking Restore Defaults restores the list of available fertilizer products to its original settings.

4. Water Profiles

This area allows the user to Add Water Profile or to Edit Water Profile (figure 3b). There is no limit to the number of water profiles that can be added. Users can select a water profile name to edit it or click the X beside any name to remove it from the app. The user can enter the name, nutrient concentrations, electrical conductivity, alkalinity, and pH of a given irrigation water source.

Where Can I Find It?

Both iOS and Android versions are available on the iOS App and Google Play Stores, respectively. Links are also available at https://rngr.net/resources/apps/ifertigate. The app is available for both phones and tablets and will be updated periodically to address any glitches or inaccuracies.
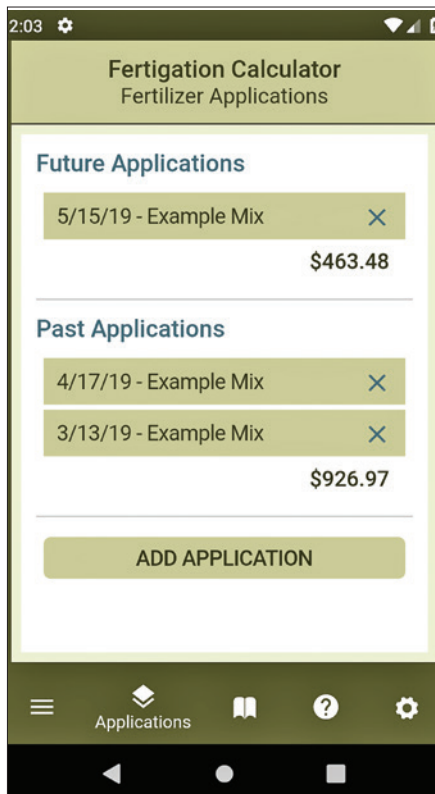
Figure 4. The iFertigate mobile app allows the user to record past and future fertigation applications and costs.
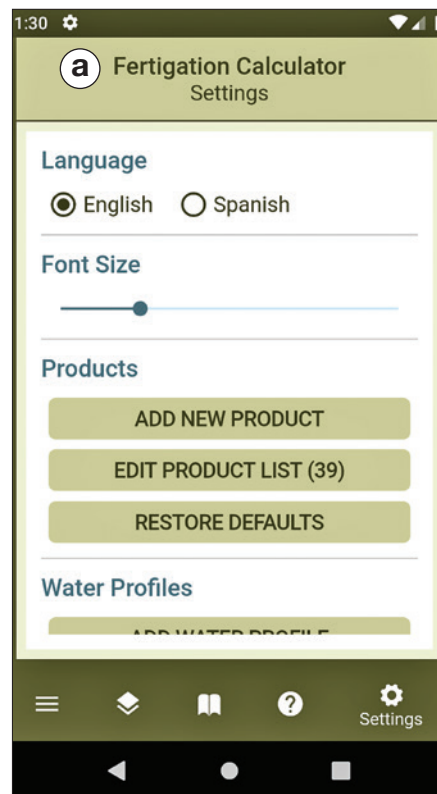
Figure 5. a) The iFertigate app settings allow the user to choose the language and font size as well as edit fertilizer products and water profiles. (b) The entire app is available in Spanish.
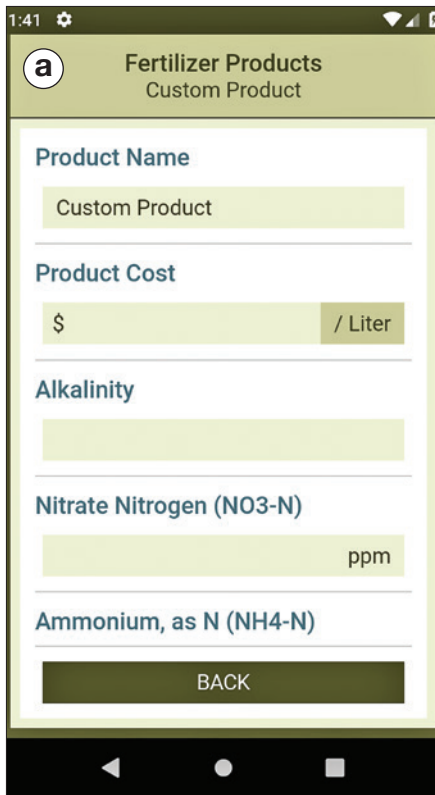
Figure 6. The iFertigate app comes pre-loaded with common fertilizer products. The user can (a) add additional products and (b) view, edit, or delete existing products.

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REFERENCES

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