

# Useful Mobile Applications for Nursery and Field Personnel

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## Abstract

The dramatic increase in use of mobile devices has resulted in an accompanying increase in mobile applications (apps). These downloadable software programs are available for numerous personal and professional purposes. Mobile devices and apps are being used to increase productivity, access information, and improve efficiency within many professions. This article describes several mobile apps, along with some Web-based tools, that have potential benefit to nursery production, reforestation, restoration, and conservation operations. This paper was presented at a joint meeting of the Northeast Forest and Conservation Nursery Association and Southern Forest Nursery Association (Kent Island, MD, July 20–23, 2015) and the annual meeting of the Western Forest and Conservation Nursery Association (Eugene, OR, October 26–27, 2015).

## Introduction

Mobile technology has increased dramatically in the past few years. The average person interacts with his or her mobile device approximately 150 times per day to retrieve text, voice, and e-mail messages; get the time; take photos; check social media; access information; and use many other functions (Meeker and Wu 2013). Mobile applications (apps)—software programs that can be downloaded and accessed via a smartphone or other mobile device—are available for many purposes. Cloud technology has also influenced app development, enabling users to securely store and access information and to synchronize and integrate with other users and devices (Taylor 2015). Businesses are creating increasingly more mobile enterprise apps and equipping their employees with mobile devices to increase

productivity, collaboration, and efficiency (Panepinto 2014, Stanley 2015, Taylor 2015). People are also using mobile apps for marketing (Chaffey 2016), for education and research (Drill 2012, 2013), and for agriculture (Ciampitti 2014, Hopkins 2015).














The ever-expanding array of available apps and the portability of mobile devices make this technology ideal for many field uses, including forestry, restoration, and nursery operations. This article highlights mobile apps and Web-based tools that have potential to accomplish or simplify a variety of tasks in those natural resource fields.

## Mobile Apps

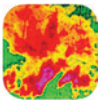


As of July 2015, 1.6 million apps were available to Google Android users and 1.5 million apps were available to Apple iOS users, reflecting a 400-percent increase in available apps in just 5 years (Statista 2015). Apps exist for nearly every imaginable use: communication, shopping, finances, hobbies, games, fitness, information, music, travel, and so much more. In addition to apps created for personal use, many science-based apps can serve as decision-support tools by analyzing and storing data and by providing information, calculations, and guidelines. Recordkeeping features in many apps automatically attach time and location information to data. Most apps are either available for free or for a nominal fee. Before paying for an app, it is always wise to check reviews or consult others who are familiar with that app to determine its potential benefits.

For purposes of this article, we researched available apps with potential application to nursery production and outplanting of trees and shrubs for reforestation, restoration, and conservation. Table 1 lists these apps

**Table 1.** Currently available apps with potential benefit to nursery production, reforestation, restoration, and conservation operations. Most apps are available in both Apple iOS and Google Android platforms. Check your device's app store to determine availability and to see details about each app's developer and functions. Some developers also have a Web site to further describe their apps and how to use them; it can be very useful to do an Internet search for each app by name to check for additional information.

App Name	Cost	Description	
<b>Integrated Pest Management</b>			
	IPM Toolkit	Free	Allows the user to read news articles, view videos, download publications, and access pictures to aid in adapting IPM practices to any agricultural operation. There are built-in news feeds from the University of Wisconsin IPM blogs, Twitter, and YouTube channels. The app, however, can be customized to use feeds from any region. The IPM pest picture search uses a national database of more than 200,000 images from all areas of the country.
	SSCA Tank Mix	Free	Estimates the amount of water and product required for a spray application after the user enters the application volume, pesticide and adjuvant rates, and tank capacity. The user can also enter the amount remaining in the tank at fill-up to calculate the net amount of pesticide and water to put in tank.
	Mix Tank	Free + in-app purchases	Assists with the proper tank mixing sequence of crop protection products. Also captures product use rates and application information and maintains spray logs for record keeping. Included is a database of over 1,300 crop protection products from more than 17 manufacturers. The available weather Integration feature (\$5.99) helps prevent spray drift risk by displaying weather information.
	Greenhouse Scout	\$9.99	Provides a summary of information on biocontrol of common greenhouse insect pests, as well as an interactive interface for collecting, organizing, and presenting scouting data and recording product applications. Users must create an account and define locations on the Web site. Includes photos and information on a variety of insect pests and beneficials.
	Purdue Tree Doctor	\$1.99	Helps to identify and manage tree problems in the Midwestern and Eastern United States caused by a variety of factors including insects and diseases.
	Forest Insect Pests in North America	Free	Helps users to recognize common pest insects and to understand their life cycles and how they damage trees. Photos are searchable by both common and scientific names.
	Plant Diagnostic Sample Submission	Free	Allows users to submit digital photo samples to a university lab (located in the Midwest and Northeast) for diagnosis or identification. Some labs may charge a fee.
	Biobest Side Effects	Free	Gives guidelines for the integrated use of biocontrol agents and pollinators in combination with crop protection products. Allows users to find pesticides compatible with specific biologicals.
<b>Mapping</b>			
	SSCA Flag This	Free	Allows users to flag a GPS location that requires action (scouting for plant symptoms, draining standing water, etc.). After taking a picture or making a voice recording of instructions, the entry can be shared via email. The recipient receives directions to the specific location via Google Maps, along with the image and the recording.
	Acre & Acreage	\$1.99	Calculates acreage and square feet/yards/inches/meters/kilometers based on values entered (e.g. length and width).
	MyMeasure	\$2.99	Allows users to measure length, perimeter, and area by using an interactive cross hair to trace the outline of any feature on a map.
	Avenza PDF Maps	Free	Allows users to load their own maps and find, purchase, and download maps for a variety of purposes with a connected iTunes-like map store. Downloaded maps are stored on the user's device and are always available even when not connected to the Internet.
	MotionX GPS	\$1.99	Tracks routes and is useful for tracking site perimeters, inventory/treatment routes, setting waypoints, and much more. App can be upgraded (\$6.99) to use multilayers.

App Name	Cost	Description	
<b>Plant Nutrition</b>			
	TankMix	Free	Calculates the amount of product and water needed to treat a specific field area, the amount of product needed for a specific tank size, and the amount of product needed for a desired volume to volume ratio.
	Fertilizer Blend Calculator	\$4.99	Designed for farmers, calculates details for custom dry or liquid fertilizer blends (products and proportions defined by the user). The output includes net elements in blend per acre, weight per load, volume, costs, etc.
	SSCA Fertilizer Blend	Free	Assists in calculating liquid or dry fertilizer blends to meet fertility goals. The user enters the desired N-P-K-S fertility for a field and selects from available fertilizer products. The app calculates the blend requirements, the application rate, the resulting N-P-K-S fertility, and the cost. The user can enter soil test information and target recommendations to obtain the necessary fertilizer additions.
	N Price Calculator	Free	Allows the user to compare the price of various forms of nitrogen fertilizer products in terms of their price per pound of nitrogen.
	Plant Tool	\$2.99	Serves as a reference tool to help identify nutrient deficiencies and to provide information and guidelines about nutrients, soil pH, and fertilizer applications.
	Crop Nutrients in Irrigation Water Calculator	Free	After users input laboratory results of their irrigation water, estimates the amount of nutrients delivered. Users can adjust fertilizer management strategies based on the results.
<b>Plant Identification</b>			
	Leafsnap	Free	Uses visual recognition software to identify tree species from photographs of their leaves. Contains high-resolution images of leaves, flowers, fruit, petiole, seeds, and bark. Includes the trees of the Northeast (but will soon include the trees of the entire continental United States).
	vTree	Free	Contains factsheets for woody plants from all over North America, including descriptions, range maps, and images. Filter the species list for any location using GPS or an address, by answering tree attribute questions, or by using search terms. Tree questions or photos can be sent to "Dr. Dendro," a tree expert at Virginia Tech, to help with identification.
	TreeBook	Free	Allows users to identify trees using images, search terms, synonyms for trees, layman terms, or detailed terminology. Supports a tree leaf key and provides a botanical glossary of the most common tree identifiers. Includes hand-drawn images, photos, and range maps of each tree.
	Invasive Plants in Southern Forests	Free	Provides a field guide for identification of 56 nonative invasive plants in forests in the 13 Southern States, including trees, shrubs, vines, grasses, ferns, and forbs. Includes basic management strategies. User can report new sightings by submitting photos and reports.
	ID Weeds	Free	Allows users to search for weeds by common or scientific name or to identify weeds based upon different characteristics. Photos and details about each weed are included. App is specific to the South Central United States.
<b>Other (Growing tools, soil, weather)</b>			
	Greenhouse Growers Toolbox Lite	Free + in-app purchases	For the free Lite version, includes three calculators (greenhouse volume and area, dripper timings and volumes, and acid or product dosing). The full version (\$32.99) includes five more calculators (boiler fuel cost, hydronic boiler size estimator, irrigation pump capacity, irrigation rate targets, and radaiton and light unit conversions).
	PGR Mix Master	Free	Allows users to calculate dilutions for plant growth regulators. The user can specify the product, the final dilution volume, and the dilution concentration.
	Trial Tracker	Free	Assists with tracking greenhouse plant trials. Online and mobile portals enable tracking and sharing of plant measurements, crop data points, plant treatments, etc.

App Name	Cost	Description
 NOAA Radar Plus	\$1.99	Provides accurate and timely weather data using NOAA's weather sources. It is a high-resolution, predictive radar app with forecasts, etc., useful for weather-dependent scheduling of field and nursery culturing.
 Growing Degree Days	Free	Estimates the maturity of a crop based on current and past growing degree days data for a specific location.
 SoilWeb	Free	GPS-based, real-time access to USDA-NRCS soil survey data around the United States. This application retrieves graphical summaries of soil types associated with the user's current geographic location. Sketches of soil profiles are linked to official soil series page within the California Soil Resource Lab's online soil survey.

IPM = Integrated Pest Management; GPS = Global Positioning System; SSCA = Saskatchewan Soil Conservation Association; PGR = plant growth regulator; NOAA = National Oceanic and Atmospheric Administration; USDA = U.S. Department of Agriculture; NRCS = Natural Resources Conservation Service.

and their descriptions. This list is by no means exhaustive, but it represents several apps that may be the most useful in various nursery and field operations.






## Web-Based Tools

In addition to the availability of mobile apps, several useful tools can be accessed on Web sites via a mobile device or a desktop computer. Table 2 presents a list of especially useful grower tools available online.

## Looking to the Future

The use of mobile devices to access the Internet has now surpassed the use of desktop computers (Chaffey 2016), and the number of available mobile apps has skyrocketed over the past few years. This trend is likely to continue. Furthermore, younger professionals who have grown up with modern technology, will expect to use mobile technology as a primary tool for obtaining information, performing calculations, recordkeeping, marketing, etc. While it is still of utmost importance to

**Table 2.** Web-based tools available to growers, with calculations and guidelines to assist with nursery activities.

Application	Description
 FertCalc	FERTCALC is an online spreadsheet capable of calculating fertilizer formulations for water soluble fertilizer. FERTCALC calculates values for up to four injectors. <a href="http://extension.unh.edu/Agric/AGGHFL/fert_calc.cfm">http://extension.unh.edu/Agric/AGGHFL/fert_calc.cfm</a>
 DLICalc	DLICALC calculates daily light integral (DLI) for supplemental lighting in a greenhouse. <a href="http://extension.unh.edu/Agric/AGGHFL/dlicalc/index.cfm">http://extension.unh.edu/Agric/AGGHFL/dlicalc/index.cfm</a>
 AlkCalc	This calculator provides recommendations for the amount of acid to add to irrigation water in order to modify the pH and alkalinity levels. In addition, the calculator provides the amount of added phosphorus, nitrogen, and sulfur that the corresponding acids will provide, plus an economic comparison of each acid. <a href="http://extension.unh.edu/Agric/AGGHFL/alk_calc.cfm">http://extension.unh.edu/Agric/AGGHFL/alk_calc.cfm</a>
 PGRCalc	PGRCALC is a web based calculator capable of calculating plant growth regulator mixing rates. PGRCALC can calculate mixing amounts for sprays, and if appropriate, drenches (ppm and mg a.i.) and dips. PGRCALC will also calculate your final solution costs, after you provide the chemical cost. <a href="http://extension.unh.edu/Agric/AGGHFL/Pg_calc.cfm">http://extension.unh.edu/Agric/AGGHFL/Pg_calc.cfm</a>
 Back Pocket Grower	Back Pocket Grower™ provides training and crop management tools to greenhouse and nursery growers. The site includes interactive tools to calculate solutions, understand economics, and determine water quality. <a href="http://www.backpocketgrower.com">http://www.backpocketgrower.com</a>

understand the concepts and processes associated with a mobile app's function to assist with job responsibilities, using these apps can improve efficiency, accuracy, knowledge, and productivity.

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