WEED CONTROL STRATEGIES

2017 SFNMC Contact Meeting
Myrtle Beach, South Carolina
July 10, 2017

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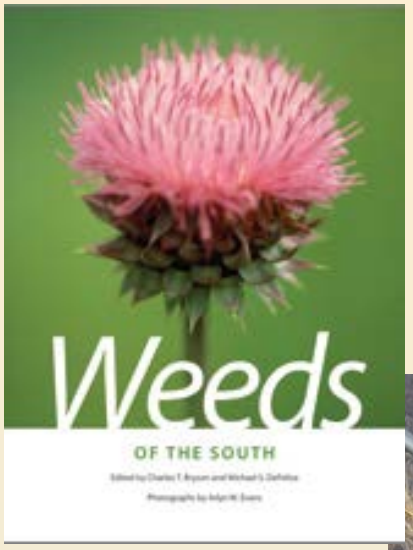
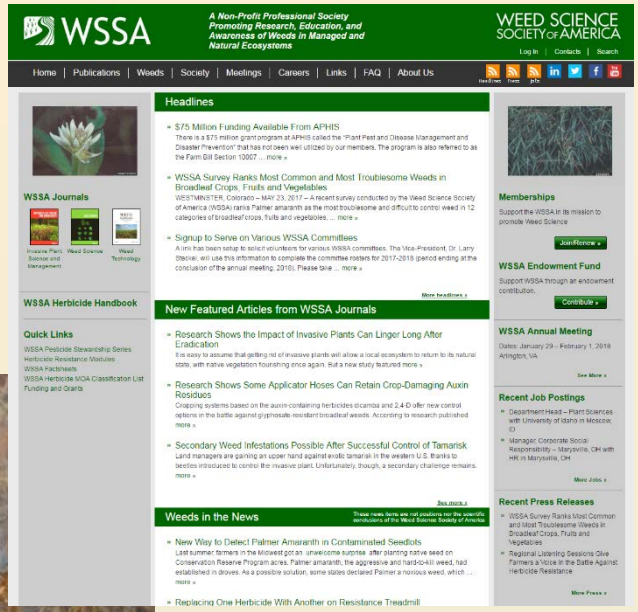
SFNMC
Auburn University

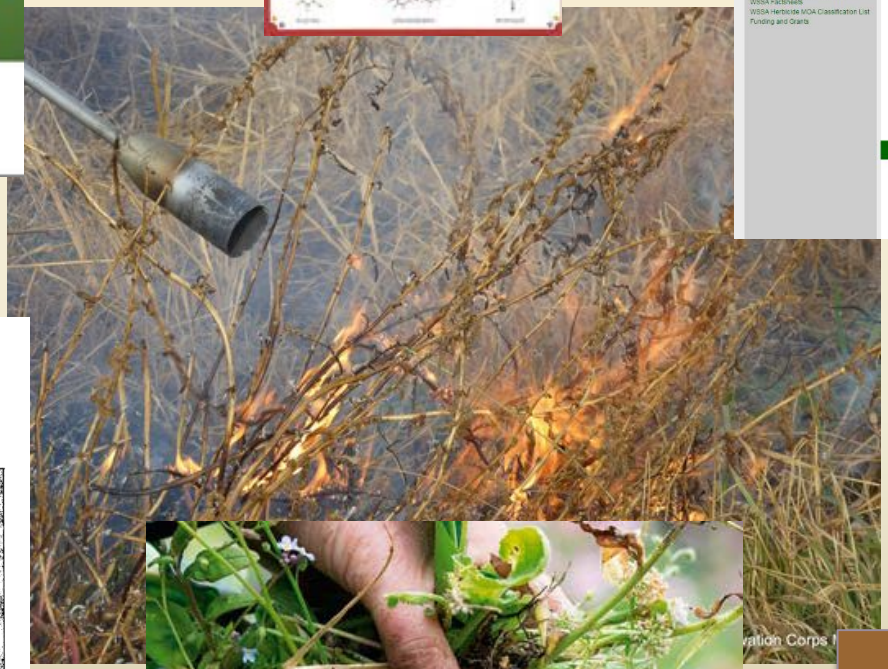
Control weeds ***before*** and *after* they appear in the nursery

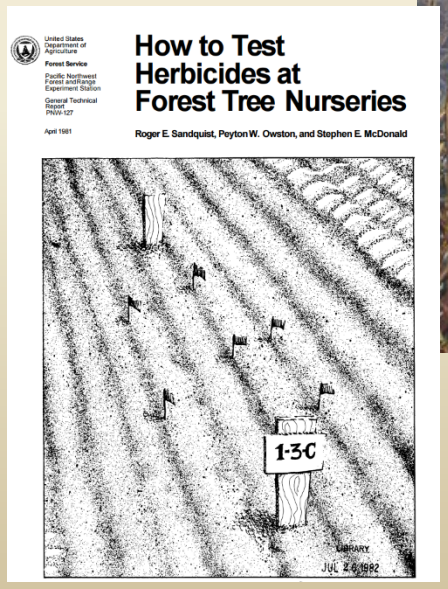
pre-emergent herbicides

Control weeds *before* and ***after*** they appear in the nursery









post-emergent herbicides

Any new herbicides on the market?

NO

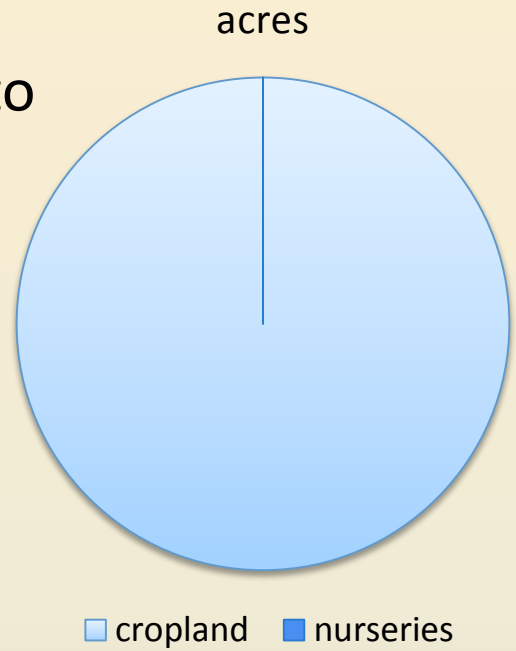
- More emphasis on developing crops with traits that will tolerate existing herbicides
- Less emphasis on developing herbicides with new sites of action
- Most new products on the market are combinations of older chemistries:

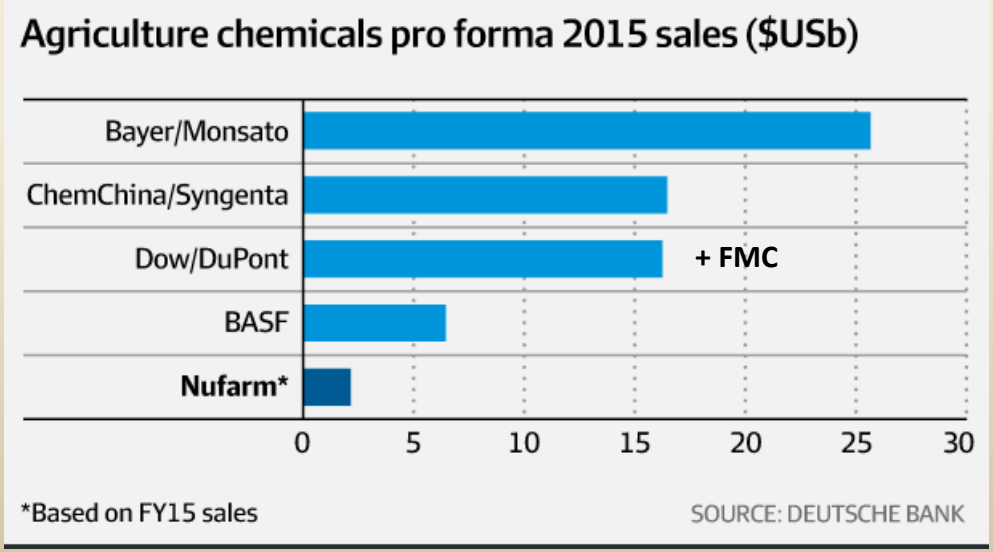
Example: DiFlexx Duo (Bayer) = tembotrione + dicamba + cyprosulfamide for pre- and post-emergent use in corn

Example: Resicore (Dow) = acetochlor + mesotrione + clopyralid for pre- and post-emergent use in corn

Availability of new herbicides for our nurseries' use is constrained by:

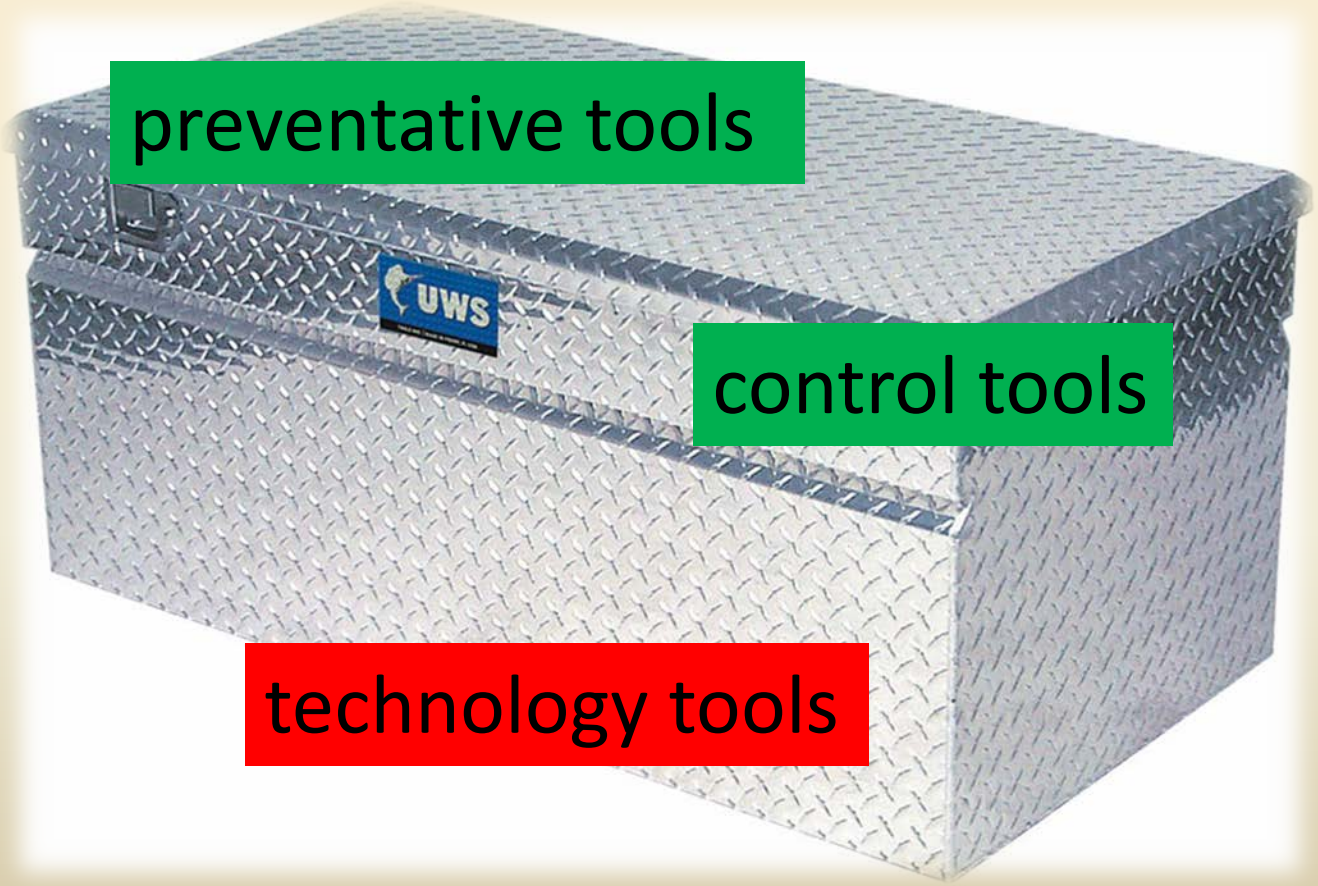
- Our market size (acres) relative to ag and turf markets





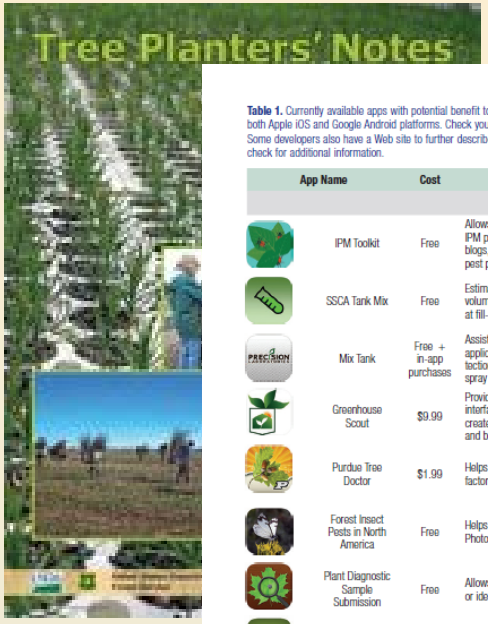
- Mergers/acquisitions of chemical companies

Weed management toolbox



technology tools

Fall 2016 issue



Useful Mobile Applications for Nursery and Field Personnel

Diane L. Haase and Daniel J. Drummond

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 det
Some developers also have a Web site to further describe their apps and how to us
check for additional information.

App Name	Cost	
Integrated Pest		
IPM Toolkit	Free	Allows the user to read news arti IPM practices to any agricultural blogs, Twitter, and YouTube chann pest picture search uses a nation
SSCA Tank Mix	Free	Estimates the amount of water ar volume, pesticide and adjuvant r at fill-up to calculate the net amo
Mix Tank	Free + in-app purchases	Assists with the proper tank mixi application information and maint tection products from more than spray drift risk by displaying weat
Greenhouse Scout	$9.99	Provides a summary of informati interface for collecting, organizin create an account and define loc and beneficials.
Purdue Tree Doctor	$1.99	Helps to identify and manage tre factors including insects and dis
Forest Insect Pests in North America	Free	Helps users to recognize commo Photos are searchable by both c
Plant Diagnostic Sample Submission	Free	Allows users to submit digital ph or identification. Some labs may
Biobest Side Effects	Free	Gives guidelines for the integrate products. Allows users to find pe
Mapp		
SSCA Flag This	Free	Allows users to flag a GPS locatio After taking a picture or making receives directions to the specific
Acre & Area & Acreage	$1.99	Calculates acreage and square fe width).
MyMeasure	$2.99	Allows users to measure length, feature on a map.
Avenza PDF Maps	Free	Allows users to load their own m connected iTunes-like map store. when not connected to the Intern
MotionX GPS	$1.99	Tracks routes and is useful for tra more. App can be upgraded ($6.

App Name	Cost	Description
Plant Nutrition		
TankMix	Free	Calculates the amount of product and water a specific tank size, and the amount of prod
Fertilizer Blend Calculator	$4.99	Designed for farmers, calculates details for c by the user). The output includes net element
SSCA Fertilizer Blend	Free	Assists in calculating liquid or dry fertilizer bl fertility for a field and selects from available f application rate, the resulting N-P-K-S fertiliz recommendations to obtain the necessary fer
N Price Calculator	Free	Allows the user to compare the price of vario pound of nitrogen.
Plant Tool	$2.99	Serves as a reference tool to help identify nut nutrients, soil pH, and fertilizer applications.
Crop Nutrients in Irrigation Water Calculator	Free	After users input laboratory results of their irr adjust fertilizer management strategies base
Plant Identification		
Leafsnap	Free	Uses visual recognition software to identify tr images of leaves, flowers, fruit, petiole, seeds the trees of the entire continental United Stat
vTree	Free	Contains factsheets for woody plants from images. Filter the species list for any locati or by using search terms. Tree questions or to help with identification.
TreeBook	Free	Allows users to identify trees using images, terminology. Supports a tree leaf key and p Includes hand-drawn images, photos, and
Invasive Plants in Southern Forests	Free	Provides a field guide for identification of 56 trees, shrubs, vines, grasses, ferns, and forbs ings by submitting photos and reports.
ID Weeds	Free	Allows users to search for weeds by common teristics. Photos and details about each weed
Other (Growing tools, soil, we		
Greenhouse Growers Toolbox Lite	Free + in-app purchases	For the free Lite version, includes three calcu acid or product dosing). The full version ($32. estimator, irrigation pump capacity, irrigation
PGR Mix Master	Free	Allows users to calculate dilutions for plant g volume, and the dilution concentration.
Trial Tracker	Free	Assists with tracking greenhouse plant trial measurements, crop data points, plant trea

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

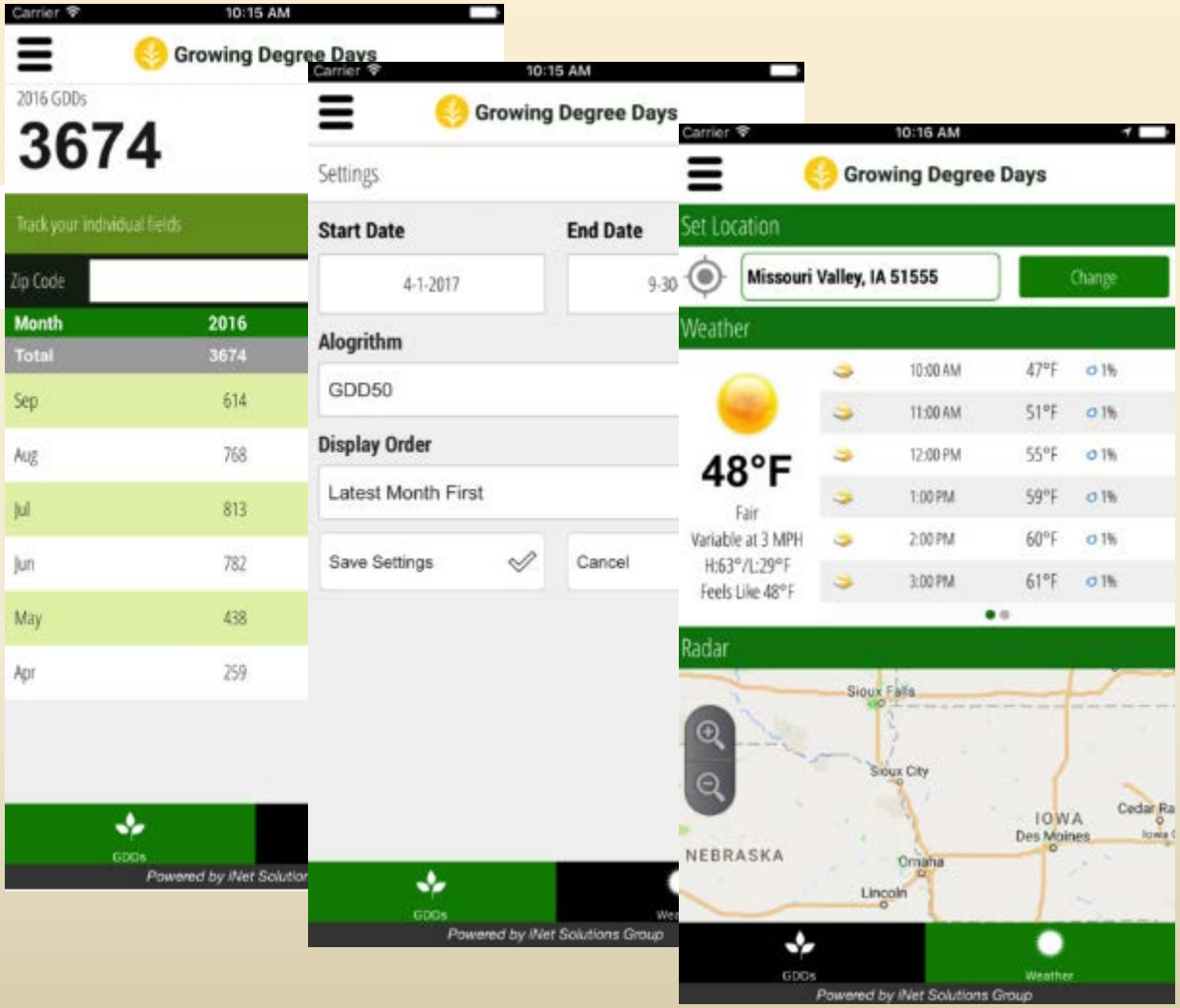
The use of mobile devices to access the Internet has now surpassed the use of desktop computers (Chaffey 2016), and the number of available mobile apps has skyrocketed over the past few years. This trend is likely to continue. Furthermore, younger professionals who have grown up with modern technology, 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	FERTCALC is an online spreadsheet capable of calculating fertilizer formulations for water soluble fertilizer. FERTCALC calculates values for up to four injectors. http://extension.unh.edu/Agric/AGGHFL/fert_calc.cfm
DLICALC	DLICalc	DLICALC calculates daily light integral (DLI) for supplemental lighting in a greenhouse. http://extension.unh.edu/Agric/AGGHFL/dlicalc/index.cfm
ALKCALC	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. http://extension.unh.edu/Agric/AGGHFL/alk_calc.cfm
PGRCALC	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. http://extension.unh.edu/Agric/AGGHFL/Pg_calc.cfm
	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. http://www.backpocketgrower.com

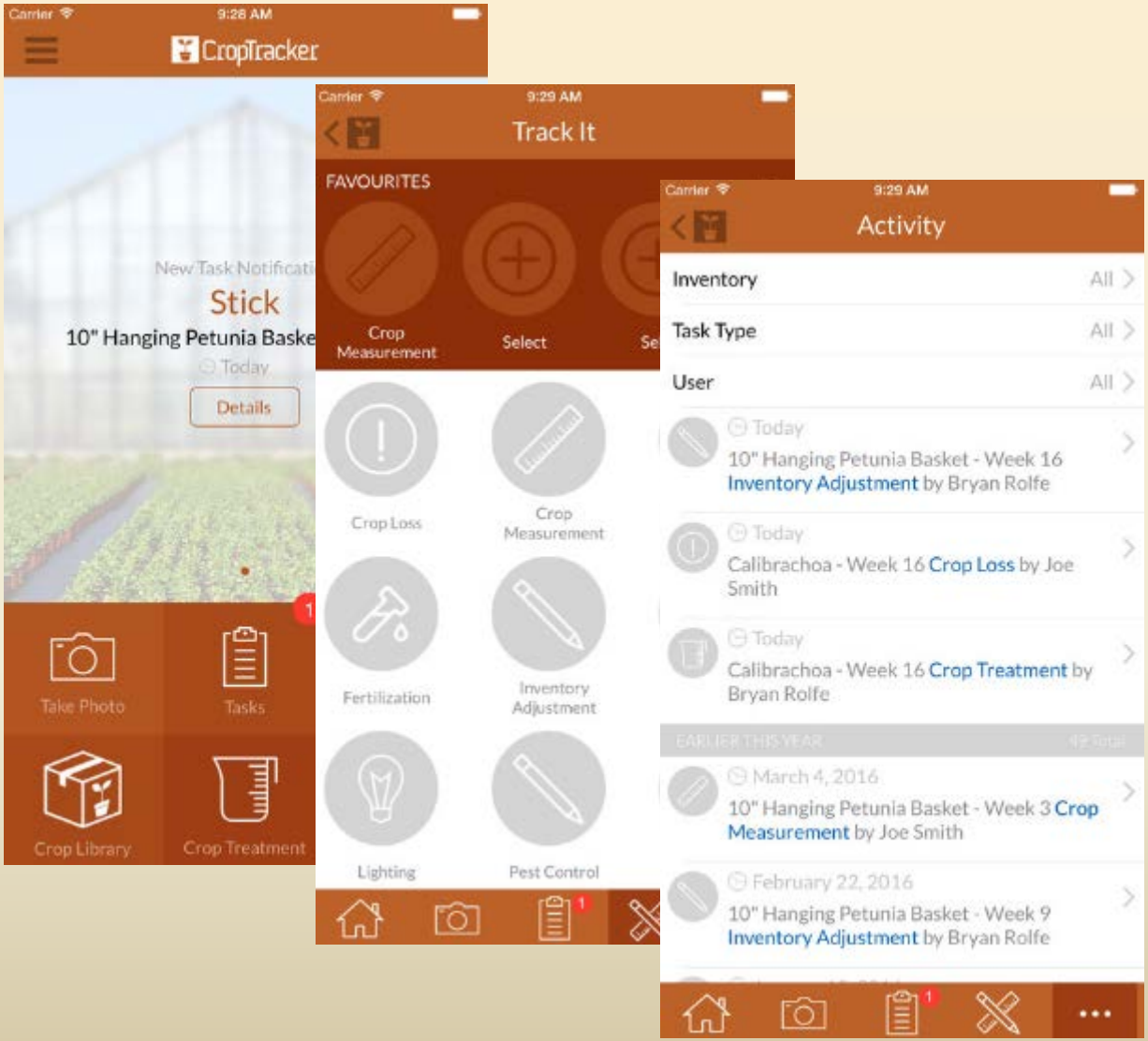
Growing Degree Days

By iNet Solutions Group



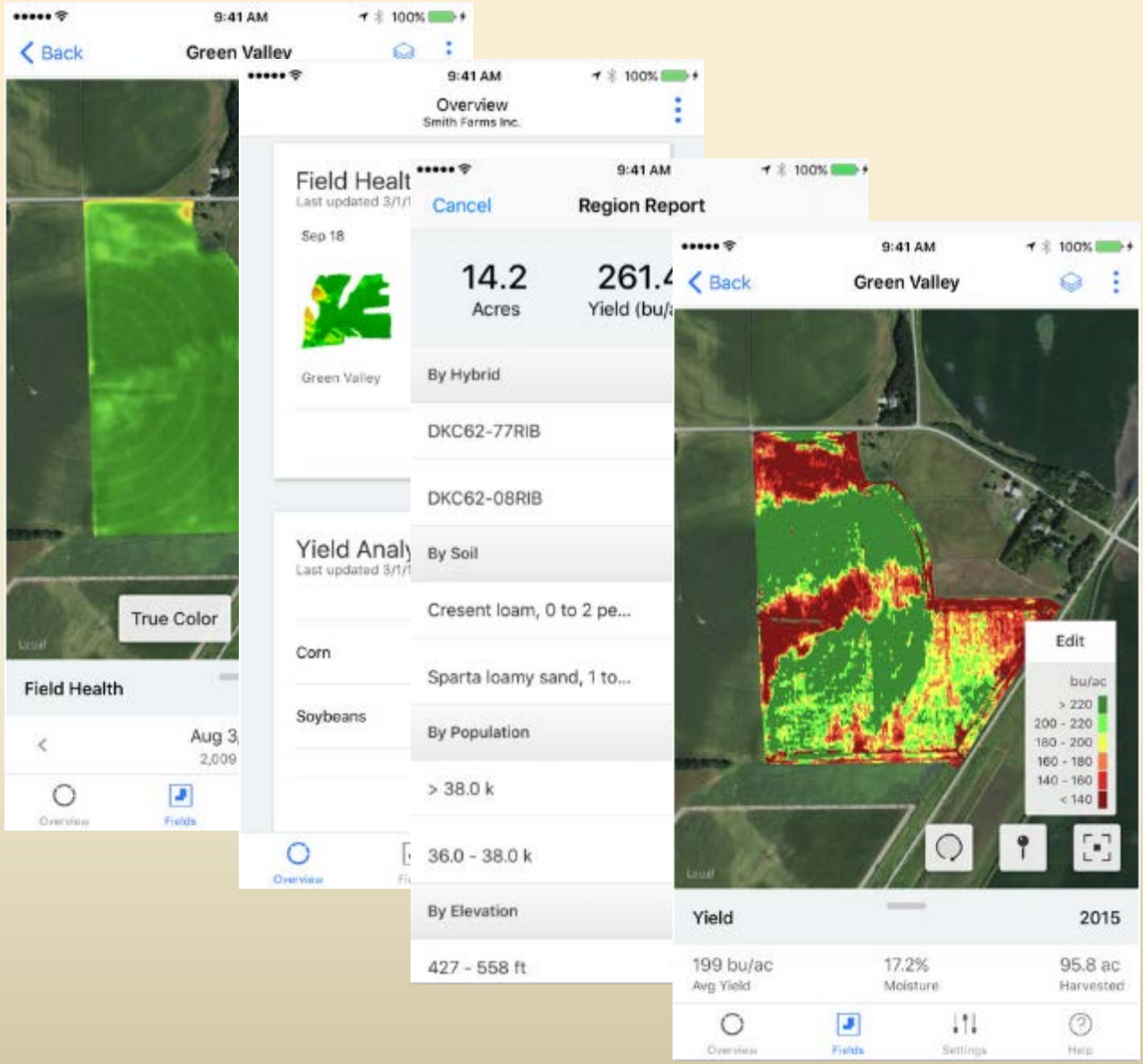
Crop Tracker

By Extreme Technology



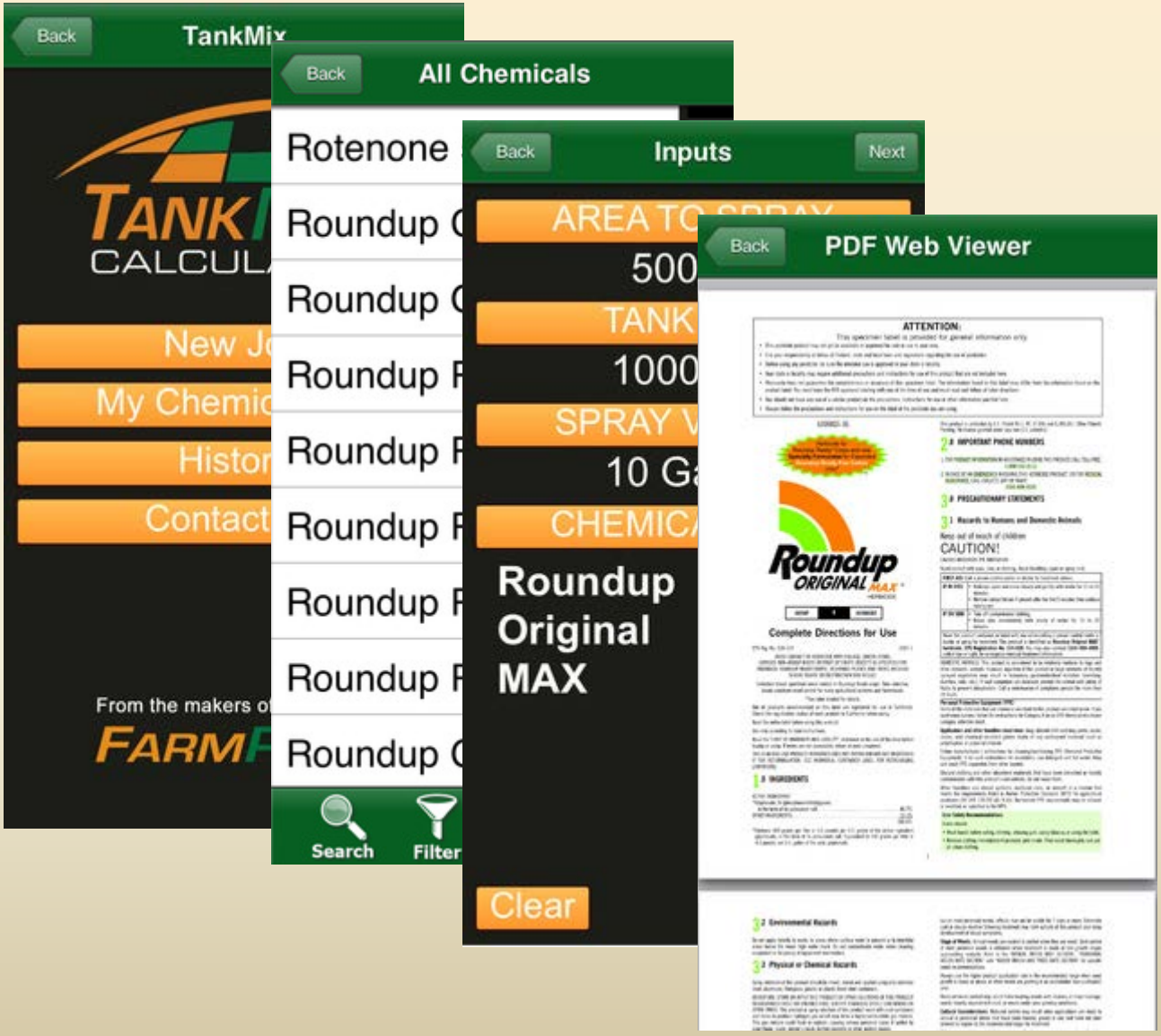
Climate FieldView™

By The Climate Corporation



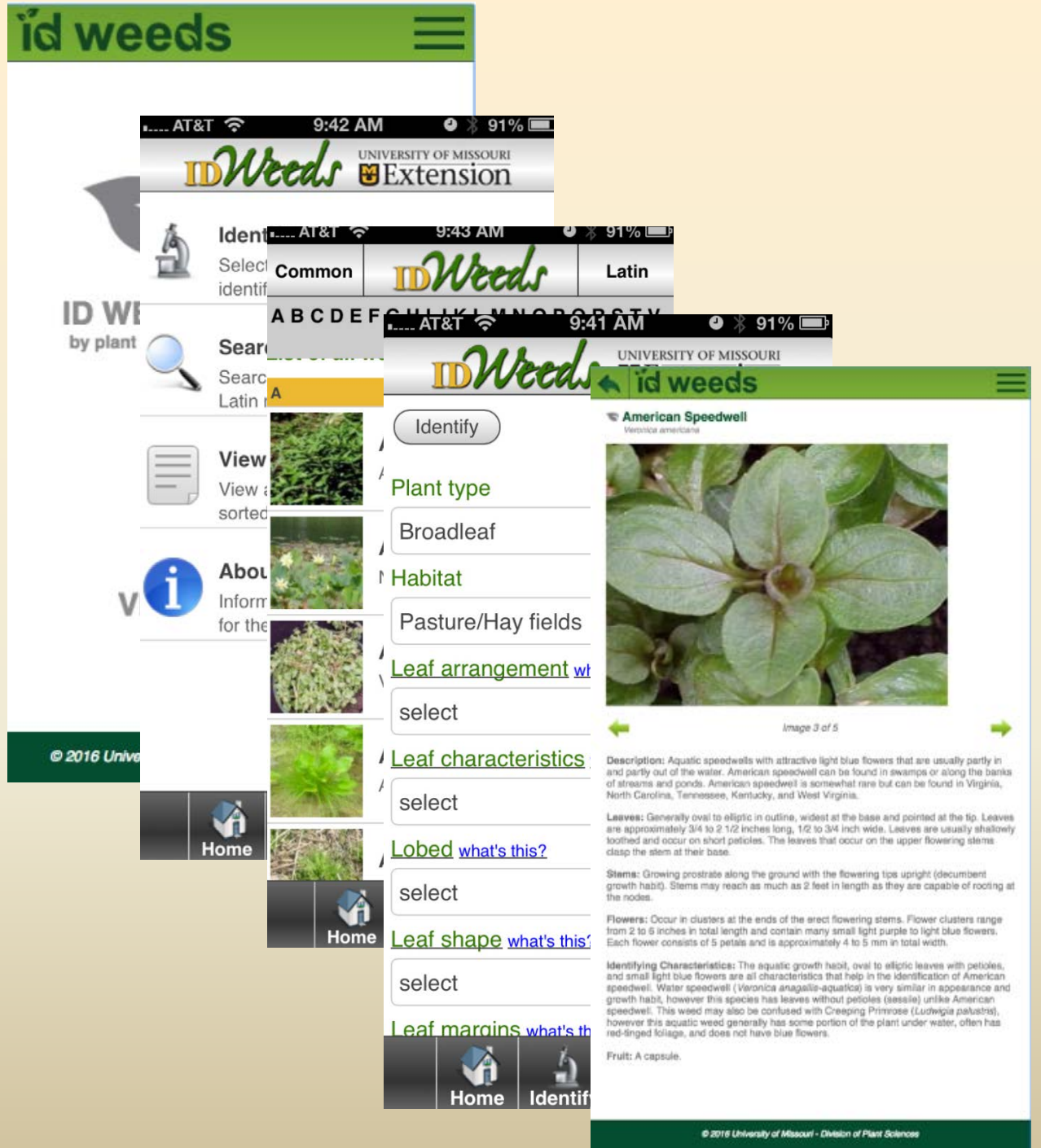
Tank Mix Calculator

TapLogic, LLC >



ID Weeds

University of Missouri - Extension Division
Reference

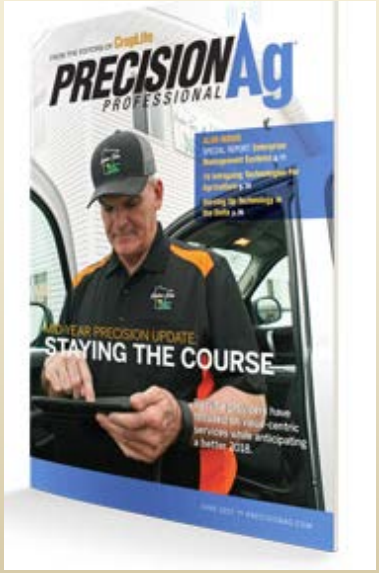


Precision Agriculture/Precision Forestry Technology

"It is important for us to understand that precision agriculture is in the stage of infancy. We have been practicing agriculture for thousands of years, but precision agriculture for about the past two decades." and "Though precision agriculture uses many aspects of IT and ICT technologies, the core business of agriculture cannot simply change in a few years, like in the IT world where technology can advance through 2G to 3G to 4G in a matter of couple of years." Dr. Raj Khosla CSU Precision Agriculture Extension Specialist

precise, site-specific crop management

- drones
- robotics
- RFID
- remote sensing
- artificial intelligence



DroneSeed of Seattle, Washington
drone sprayer and seed planter

https://youtu.be/EkNdrTZ7CG4

Drone Seed Video

one step further…..

Jack Stewart of University of Glasgow
aerial reforestation with seedling darts

https://youtu.be/cBslqoJ2gvs

Aerial Darts Video

Abundant Robotics of Menlo Park, California
robotic vacuum apple picker

https://youtu.be/mS0coCmXiYU

Apple Picker Video

RFID

Knox Nursery of Winter Garden, Florida
use of RFID on seed trays

https://youtu.be/AyE4c7hFdEw

RFID Tags

Artificial Intelligence

Prospera of Tel Aviv, Israel
using computer vision to monitor crop health

The sensors collect hundreds of thousands of data points about plants' health. These include issues with pests, diseases, nutrients, irrigation, and climate.

For example, in the photo below, the camera notices that phytophthora (a plant-killing mold) is on the leaves.

Prospera

http://prospera.ag/

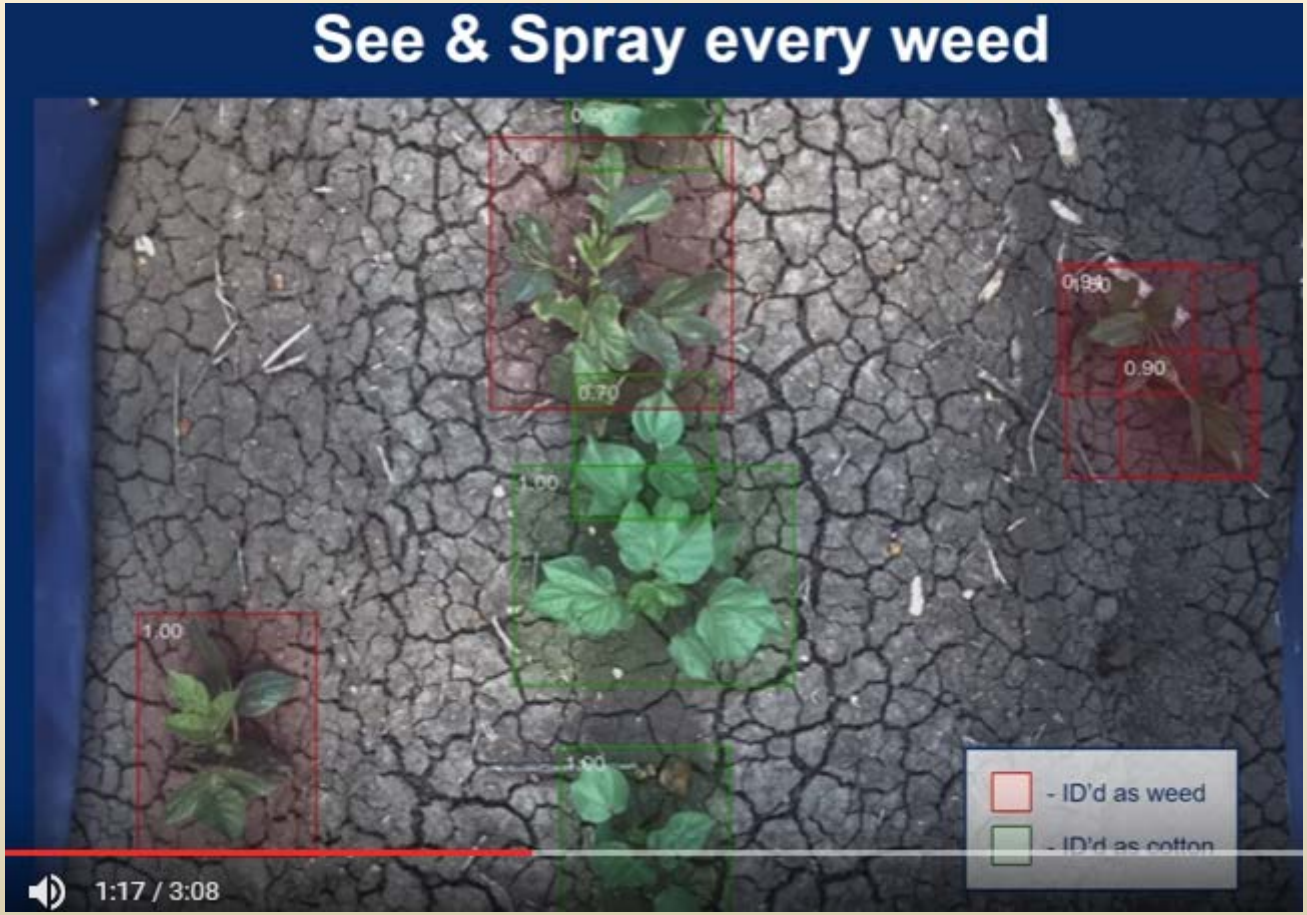
NIR can be used to detect *Fusarium* and other stress in nursery before human eye can see it

Photos courtesy of Poona et al 2016

Applied Spectroscopy
"Random Forest (RF) Wrappers for Waveband Selection
And Classification of Hyperspectral Data"
by N. K. Poona, A. van Nierkerk, R. L. Nadel and R. Ismail

Artificial Intelligence

Blue River Technology of Sunnyvale, California
using computer vision and precision ag to make decisions about individual plants



https://youtu.be/65_71XYsO64

Blue River Technology of Sunnyvale, California
Zea phenotyping technology

https://youtu.be/2IGq1weUh9U

Blue River Technology of Sunnyvale, California
See & Spray technology

https://youtu.be/1I6mSQK4aPI

See and Spray Video

Questions/comments?

Thanks to
Katherine Schwarzauer, AU SFWS IT

handout in your packet

Useful Mobile Applications for Nursery and Field Personnel

Diane L. Haase and Daniel J. Drummond

Western Nursery Specialist, U.S. Department of Agriculture, Forest Service, Portland, OR; Information Technology Specialist and Mobile Applications Director, Southern Regional Extension Forestry, University of Georgia, Athens, GA

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

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