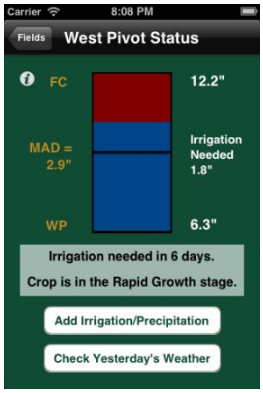
Water Irrigation Scheduler for Efficient (WISE) Application

Allan A. Andales, Department of Soil and Crop Sciences
Mazdak Arabi, Department of Civil and Environmental Engineering
Colorado State University

Summary:

Improved irrigation water management (IWM) in approximately 54.9 million acres of irrigated farm land in the U.S. can play a key role in water conservation, prevention of water pollution, and enhanced crop productivity. There is a need for a widely accessible decision tool that will increase the capacity of producers and water managers to determine real-time irrigation water demand for a field or region of interest. This integrated research and extension project aims to develop, pilot, and disseminate a scalable device-independent mobile system for improved IWM. An online IWM system named Water Irrigation Scheduler for Efficiency (WISE; http://wise.colostate.edu/) has been developed and pilot-tested in Eastern Colorado. The home page provides video tutorials and other educational materials to guide new users in setting up their field for irrigation scheduling. WISE is accessible via a web browser, with soil profile water status information also accessible via mobile apps. Early in its development, a stakeholder committee (10 individuals) was formed representing progressive crop producers and advisers, researchers, conservation agency personnel, farm managers, and crop commodity group representatives to test and provide suggestions for improving the tool. In addition, WISE has been demonstrated at more than 15 producer- or conservation agency-conferences and workshops.



The figure to the right shows the WISE iPhone® app with a "water bucket" representation of soil water status of a field. Field capacity (FC) and wilting point (WP) show the upper and lower limits of plant available water (inches of water) in the root zone, respectively. The red bar shows the estimated amount of deficit or depletion (irrigation needed) relative to management allowed depletion (MAD).

Impact:

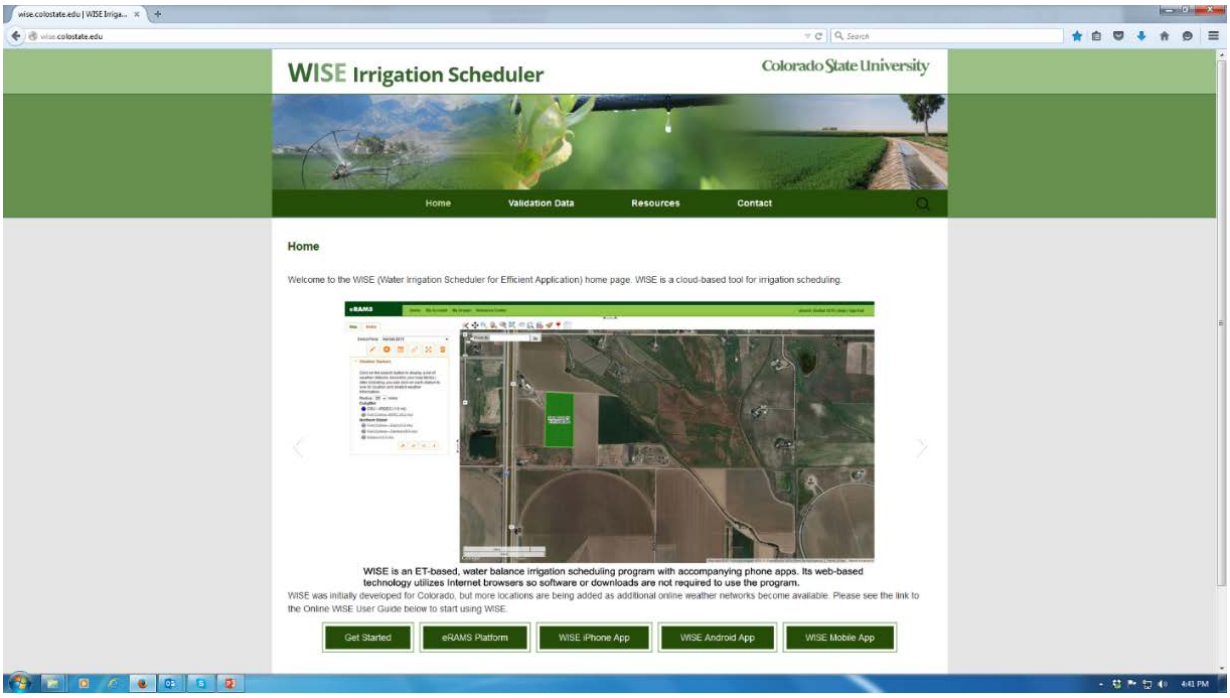
In 2014, a prototype version of WISE was demonstrated to 48 individuals including farmers, water managers, crop consultants, and agency personnel. WISE was pilot-tested on about 130 hectares of sprinkler-irrigated fields during the 2014 growing season. In addition, other producers (early adopters) tested WISE for irrigation scheduling on approximately 668 hectares in Colorado.

A total of 235 individuals heard about or saw demonstrations of the prototype WISE tool in 2015 via 5 outreach events in Colorado. These individuals included farmers, crop consultants, conservationists, engineers, water managers, and students. Participants learned about the benefits of irrigation scheduling using WISE, including the potential for saving irrigation water by avoiding over-irrigation or by using

deficit irrigation strategies. Western Sugar Cooperative and Coca Cola Corporation have contributed to the development and testing of WISE for irrigated sugar beet and corn production, respectively. The cloud-based production version (fully tested and debugged) of WISE became available to the public in spring of the 2017 growing season. The Colorado State University Extension Water Resources Team has continued to use WISE to demonstrate tactical irrigation scheduling at producer conferences, agency workshops (NRCS, Conservation Districts, etc.), and webinars. Currently, WISE is used by Colorado NRCS as a water management tool for their Environmental Quality Incentives Program (EQIP) clients. Western Sugar Cooperative has also adopted WISE as a tool for their growers. Western Sugar has growers in Colorado, Wyoming, Nebraska, and Montana. They are promoting the use of WISE across their 135,000 base acres of irrigated sugar beet fields as part of their sustainability and conservation program. As part of Coca Cola's efforts to reduce their water footprint, WISE has been used to offset water use (50 million gallons/year) at the Coca Cola bottling plant in Denver by conserving an equivalent amount of water in selected northeast Colorado farms. WISE is currently being improved and promoted as a water conservation tool in the Ogallala Aquifer Region affected by declining groundwater, with support from the Ogallala Water Coordinated Agricultural Project (USDA-NIFA CAP; http://ogallalawater.org/).

The WISE tool provides mobile access to field-level information on the soil water deficit (net irrigation requirement) that can be used by the irrigator to decide how much and when to apply irrigations. The stakeholders gave positive comments on the system as well as additional suggestions for improving the functionality. The suggestions were prioritized and were implemented in the online WISE tool. An online user guide was developed, along with video tutorials. Both an iPhone app and Android app that displays irrigation requirement and synchronizes with the WISE cloud-based tool is available from iTunes (https://itunes.apple.com/app/id928128681) and Google Play (https://play.google.com/store/apps/details?id=com.erams.irrigation), respectively.

Evaluations of an early spreadsheet version of WISE for 3 growing seasons (2010-2012) to calculate daily root zone deficit (*D*) for a sprinkler-irrigated corn field in north east Colorado gave relative errors ranging from 2% to 31% compared to measured daily *D*. Average root mean square error (RMSE) was 16 mm of water, an acceptable amount as it could be compensated by a single irrigation event. In this study, it was shown that a 27% (139 mm) reduction in gross irrigation was possible for 2011 by using WISE, compared to actual irrigations applied by the farmer.



The WISE home page (http://wise.colostate.edu/)

Photo Highlights:

Installation of soil water balance instruments on a corn field near Greeley, CO for WISE validation.

Presentation of the WISE cloud-based concept to stakeholders at a field day on September 5, 2013 near Iliff, CO.

Presentation of WISE example applications to the Rocky Mountain Agribusiness Association on January 11, 2018 in Denver, CO.