

SOIL WATER BALANCES FOR IRRIGATING COTTON USING A PHONE APP

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Water is an important factor that affects crop yields. The University of Missouri Extension Service developed an on-line, mobile program (app) called Crop Water Use (CWU) to help farmers manage irrigation for optimum crop yields and irrigation water use (Figure 1). The Crop Water Use app can be run on a computer or smartphone. To register, go to <http://cropwater.org>. Farmers with irrigation are usually able to harvest consistent yields, even in times of drought. Irrigation helps in periods of short-term crop water stress, which are common in July and August. The app helps growers see how much soil water is stored for root uptake between rainfall and irrigation events in specific fields on their farms.

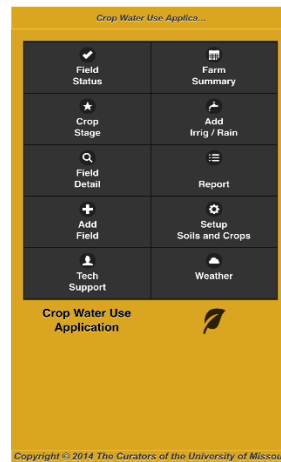


Figure 1. The main menu screen in the mobile app

Reports include indexes to help farmers determine when to irrigate. University of Missouri Extension automatically downloads data each day from a network of agricultural weather stations. ET is calculated from temperature, humidity, wind and solar radiation. This application uses the Standardized short crop Penman-Monteith Evapotranspiration equation. ET is the amount of combined water lost from a reference crop, such as grass, and soil evaporation. ETo is multiplied by a crop coefficient, which is specific for the crop and growth stage. Beginning at planting, growth stages are predicted from growing degree days for corn, rice, and cotton. This information is used to estimate daily crop water use, or ETc. When setting up new fields, farmers can enter soil texture or a NRCS mapping unit (Figure 2).

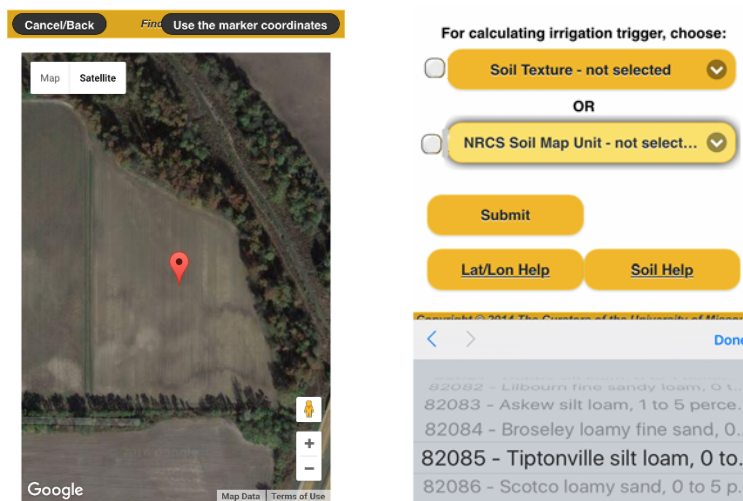


Figure 2. Two new features to the app in 2016 are the ability to mark fields coordinates with Google Maps and use NRCS soil mapping units for better estimation of available soil water holding capacity.

Daily soil water deficit is reported for individual fields and crops using a system similar to a checkbook which tallies rainfall and irrigation as deposits and daily crop water use (ETc) as withdrawals. For each field, users specify latitude and longitude, dominant soil texture, crop planted (corn, soybeans, rice, cotton), planting date, rooting depth, irrigation method and inches of water per irrigation and maximum allowable field water depletion. CWU provides daily field water balance summaries with forecasts of a dryness index for the next week. As soil water deficits worsen, alerts indicate the need to irrigate before yield loss occurs. Field validation work for the logic in the program was conducted for the last four years on cotton. Soil water balances for fields can be viewed from Field Status or Farm Summary. In Field Status, as a field becomes drier between rainfalls or irrigations, fewer blue ticks are displayed on the right side of the bar graph (Figure 3). A message is displayed when the irrigation trigger point has been reached. A line graph tracks daily changes in soil water balance over the last four weeks relative to the irrigation trigger.

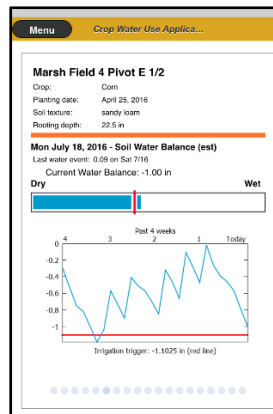


Figure 3. Fields are sorted driest to wettest. To navigate between fields use a finger to swipe across the phone screen.

Farm Summary helps farmers plan ahead for labor and equipment needs. The predicted dryness indexes for each field assume historical evapotranspiration, or ET, for the projected days and no rainfall will occur in the next week (Table 1). Field reports are can be printed to distribute to workers who control irrigation pumps.

Table 1. Farm Summary example from Tuesday, July 14, 2015.

Name	Soil Water	Projected Dryness Index With No Rain						
	Today	Tues	Wed	Thu	Fri	Sat	Sun	Mon
Marsh Field 4 Soybean	-0.84	OK	OK	*	***	XXX	XXX	XXX
Marsh Field 5 Corn	-1.15	***	XXX	XXX	XXX	XXX	XXX	XXX
Rhodes Field 1 Cotton	-0.17	OK	OK	**	***	XXX	XXX	XXX
Rhodes Fields 14 Cotton	0	OK	OK	OK	***	XXX	XXX	XXX
Lee Field 12-1 Soybean	-1.27	XXX	XXX	XXX	XXX	XXX	XXX	XXX
Lee Field 12-2 Corn	-1.16	**	***	XXX	XXX	XXX	XXX	XXX

The symbols *, **, ***, and XXX represent 70, 80, 90, and 100 percent of management allowed depletion (MAD) level.

The Crop Stage page allows farmers to track growing degree days based on max and min daily temperatures for crops in fields. (Figure 4 and Table 2). To access scout recommendations, click the black box in the right column.

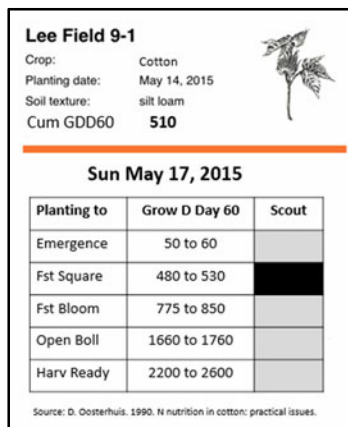


Figure 4. Example crop stage report.

Table 2. Scouting recommendations at first square growth stage.

➤ Square retention during this period should range from 70 to 80 %. Monitor retention during scouting.
➤ Irrigate to prevent water stress beginning at first square stage to establish plant structure and yield potential.
➤ Start PGR applications at 9 to 10 nodes-with a height-to-node ratio of no less than 2 on cotton that is stress-free and well-fertilized.
➤ Preserve beneficial insects. Avoid pesticide convenience applications.