

A photograph of a center pivot irrigation system. The image shows the metal structure of the system, including wheels and support beams, stretching across a dry, brown field. The sky is clear and blue. The title text is overlaid on the upper portion of the image.

Smart Irrigation Practices to Promote Plant Defense Against Diseases

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Water stress and plant disease

- Too much water or flooding
 - Anoxic conditions
 - Disease spread
(*Phytophthora*)
- Too little water
 - Greater susceptibility to disease
 - Insects view as a ‘good target’



Role of irrigation

- Add water to plants to prevent water stress
- Right amount, right time, right place
- Too much irrigation can create new problem



Components of good irrigation

- Equipment has been maintained and is regularly checked for leaks, breaks, problems
- The right system is being used (drip, micro sprinkler, lateral, etc.)
- A smart irrigation schedule is applied



Michael Gutierrez photos

Smart irrigation schedules

- “Do it myself” scheduling
- Site specific smart hardware scheduling
- Web and app scheduling tools



Michael Gutierrez photo

Do it myself style

FAWN

- Florida Automated Weather Network
- Free resource with valuable information
- Rainfall and evapotranspiration
- <http://fawn.ifas.ufl.edu/mffw/>

FAWN - Florida Automated Weather Network - Mozilla Firefox

File Edit View History Bookmarks Tools Help

FAWN - Florida Automated Weather Net... +

← fawn.ifas.ufl.edu/tools/ ☆ Google

UF University of Florida IFAS Extension

FAWN Florida Automated Weather Network

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Tools

Cold Protection

- Cold Protection Toolkit
- Citrus Leaf Freezing
- FAWN Desktop Widgets
- FAWN Freeze Alert Tool

Irrigation

- Interactive Irrigation Tool
- Vegetable Irrigation Scheduler
- Citrus Irrigation
- Strawberry Irrigation
- Urban Irrigation Scheduler
- Row Crop Irrigation
- Evapotranspiration (ET)
- Fact Sheets

Tools

- Citrus Pesticide Tool
- Air Temperature Threshold
- Video Presentations

Freeze Alert Txt Service

Latest Observations

Graphic Weather Data

FAWN Data Hotline

NWS Forecast

My Florida Farm Weather
Weather data for Florida Farmers

Tweets Follow

FAWN @UF_FAWN 5h
server "glitches" over last couple days resulted in some website data gaps; historic data can be manually retrieved from backup by request

FAWN @UF_FAWN 26 Aug
DeFuniak Springs problem is being resolved; historic data will then be available (tower is OK)

FAWN @UF_FAWN 26 Aug
Tweet to @UF_FAWN

Tools

Tools are used by growers, using historical weather data and farm planning.

Toolkit

A set of tools for guidance in cold protection practices.

Determining Critical Temperature

Advice from IFAS Extension for determining Critical Freezing Temperatures for plants in Florida.

Minimum Overnight Temperature

Estimates based on the Brunt equation and the air & dew point temperatures at sunset.

Wet-Bulb Based Irrigation Cutoff Temperature

Estimates a safe cutoff temperature based on the air & dew point temperatures.

Forecast Tracker

Compares NWS forecast to FAWN observations.

Fruit Frost Station Forecast

Links to NWS forecast for Florida Fruit Frost Stations.

fawn.ifas.ufl.edu/tools/

4:06 PM 8/27/2013

FAWN: Irrigation using ET

FAWN - Florida Automated Weather Network - Mozilla Firefox

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fawn.ifas.ufl.edu/tools/et/graphic.php?locId=440

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FAWN Florida Automated Weather Network

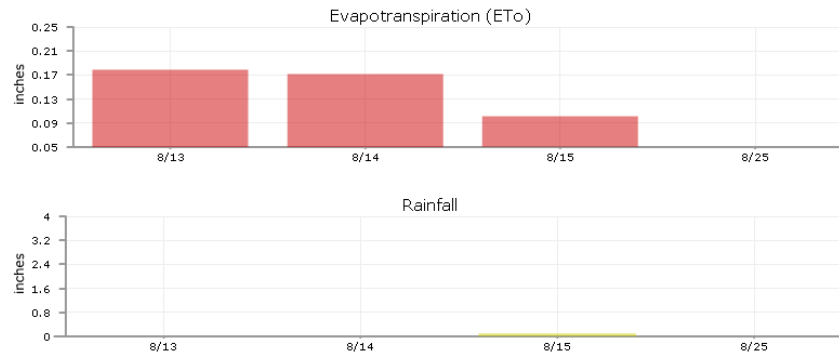
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[Tools](#) » [Irrigation](#) » [ET](#)

Visual ET for Homestead

Jump to:

This is a visual view of the last 14 days of ET calculations at Homestead.



How to use FAWN ET for irrigation?

1. Take average of last few days (0.11 inches), multiple by crop coefficient (K_c) (0.9) $ET_c = 0.1$ in/day
2. ET_c is the amount of water needed per day, determine how many days you want to irrigate (3 days/wk)
3. Total irrigation for the week (7×0.1 in) divided by the number of irrigation events gives you the amount per event (0.23 in)
4. Determine the deliver rate of your system (0.25 in/hr)
5. Divide amount per event by rate ($0.23 / 0.25 \times 60$ min); 56 minutes

Smart irrigation systems

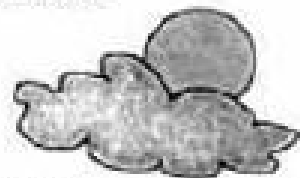
ET Controllers



2 methods of determining irrigation:

(1) Soil water balance (2) Relative to historic peak ET

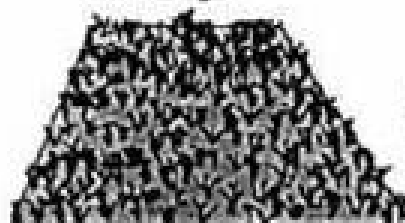
climate



Radiation
Temperature
Wind speed
Humidity

+

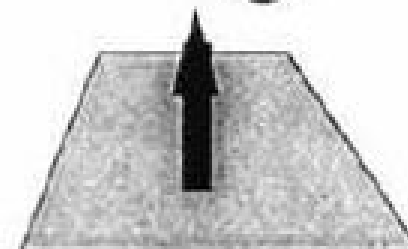
grass
reference
crop



well watered
grass

=

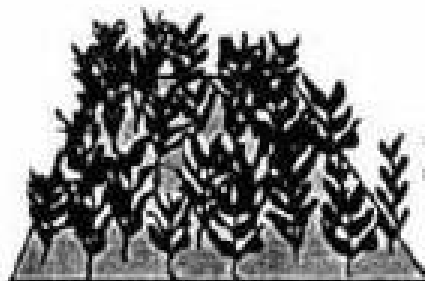
ET_0



ET_0

x

K_c factor

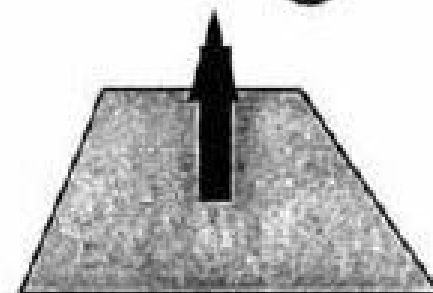


well watered crop

optimal agronomic conditions

=

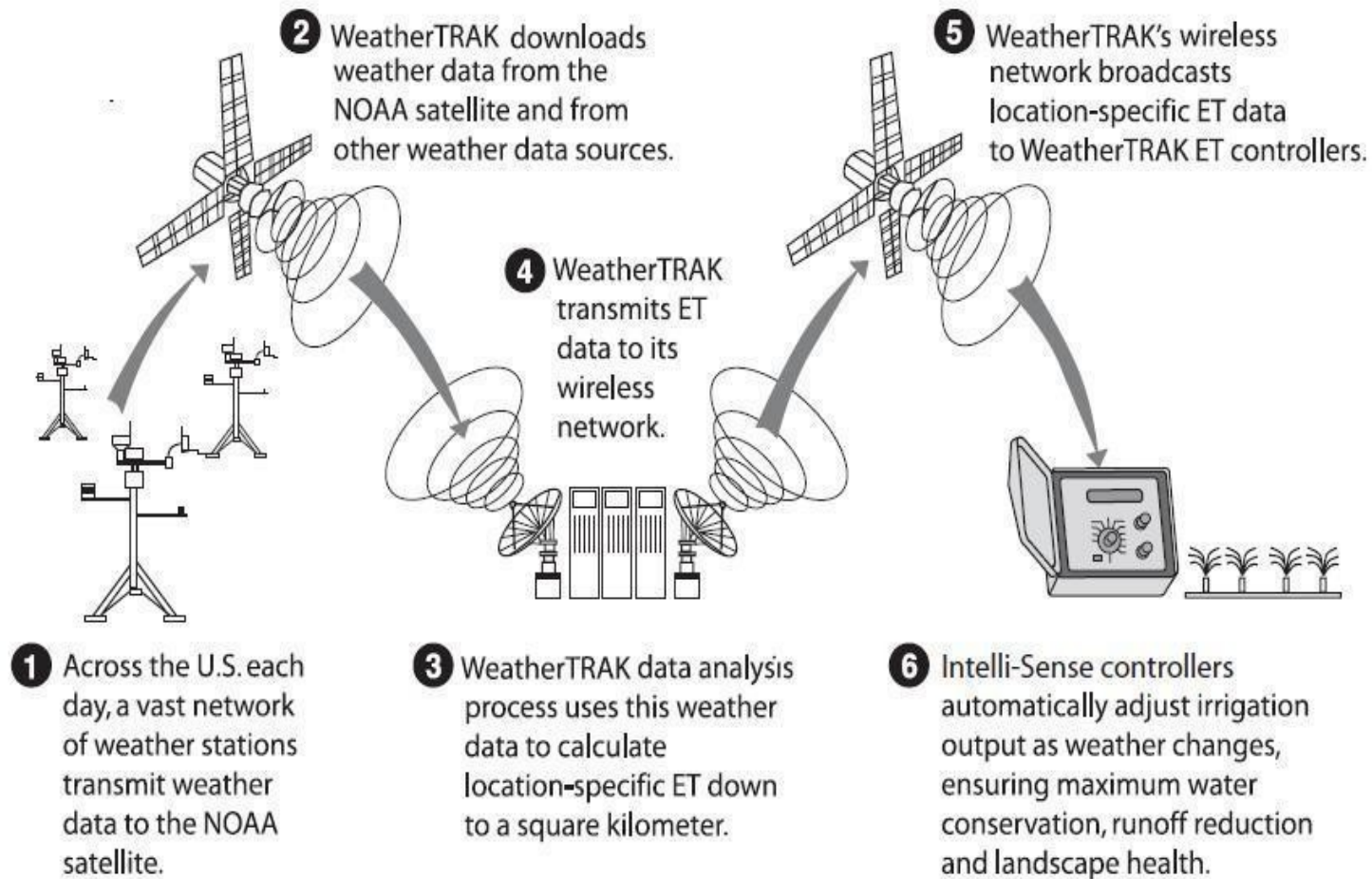
ET_c



ET based smart irrigation system

- **Signal based**
 - Receive weather data from remote source on daily basis to update irrigation schedule (measurement and control)
 - Annual fee for data, more real-time data used in ET estimation
- **On-site weather based or stand-alone**
 - Uses an on-site sensor to estimate ET and update irrigation schedule (measurement and control)
 - No annual fee for data, less real-time ET data used in ET estimation

ET system schematic



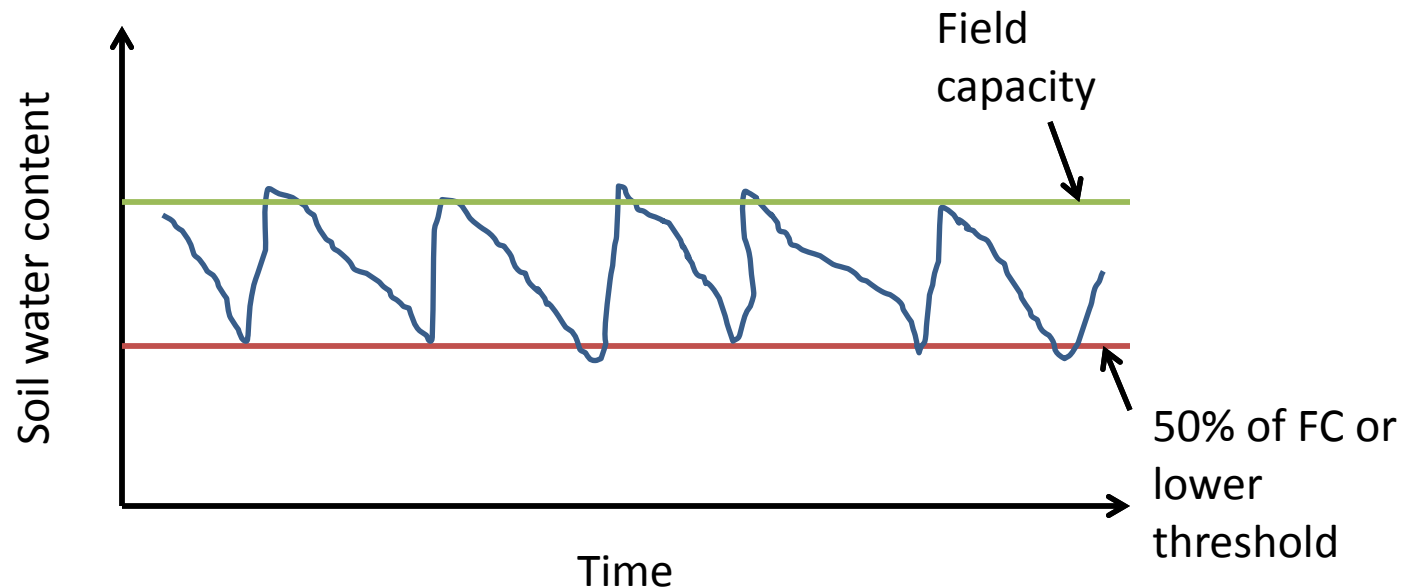
Soil water based smart irrigation system

- Use some type of soil water sensor (SWS) or soil moisture sensor (SMS) to allow or bypass irrigation events (measurement and control)
- Sensor acts as a switch
- Different types exists – but generally use a sensor with TDT technology



Thresholds

- Set to a 'lower threshold' or lower soil water content at which irrigation is needed



Not convinced?

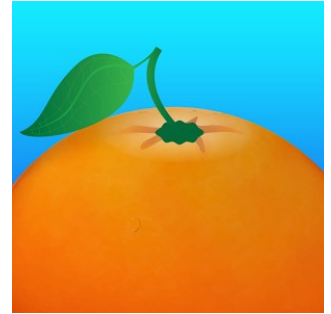
- Try out the virtual tool on FAWN
- Compare different irrigation technologies and see water savings in a virtual environment
- Weblink: <http://irrigationtool.appspot.com>
- MANY resources on this – most are linked in the tool above or are found on Dr. Duke's website

Web tools / apps

App examples

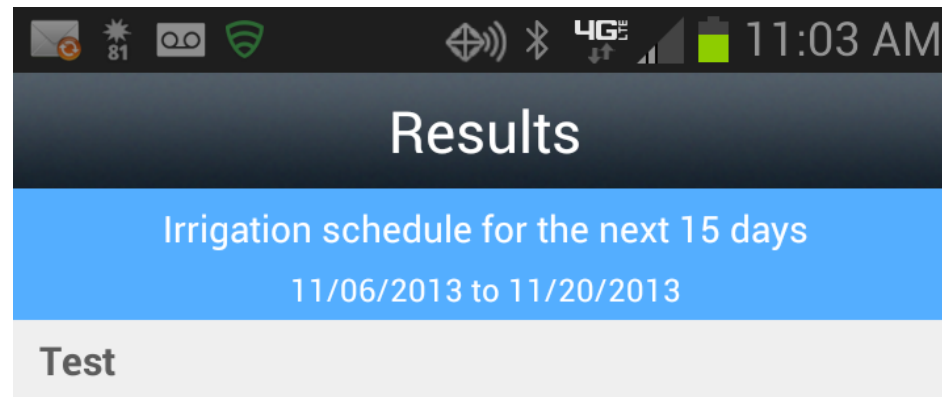
- Currently develop a suite of irrigation apps
- Citrus, strawberry, and turf have been released
- Coming soon: cotton, avocado, tomato, cabbage, peanut
- Use real-time weather data from FAWN

Citrus app



- Irrigation system: micro sprinkler
 - Tree row distances, emitter characteristics, soil type, irrigation depth, trigger depth
- Irrigation delays for rainfall amounts (days)
- Irrigation schedule (minutes) every so many days
- User can select the day of week to receive irrigation notifications

Citrus screenshot



Every 5 days irrigate 4 hours and 10 minutes

Irrigation delay for when it rains

Rain amount	Irrigation delay
1/4"	1 day
1/4" to 1/2"	3 days
1/2" to 3/4"	5 days
3/4" to 1"	5 days
> 1"	5 days

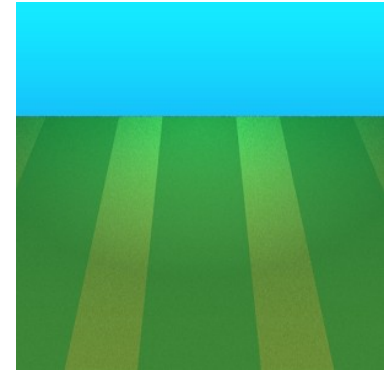
Strawberry app



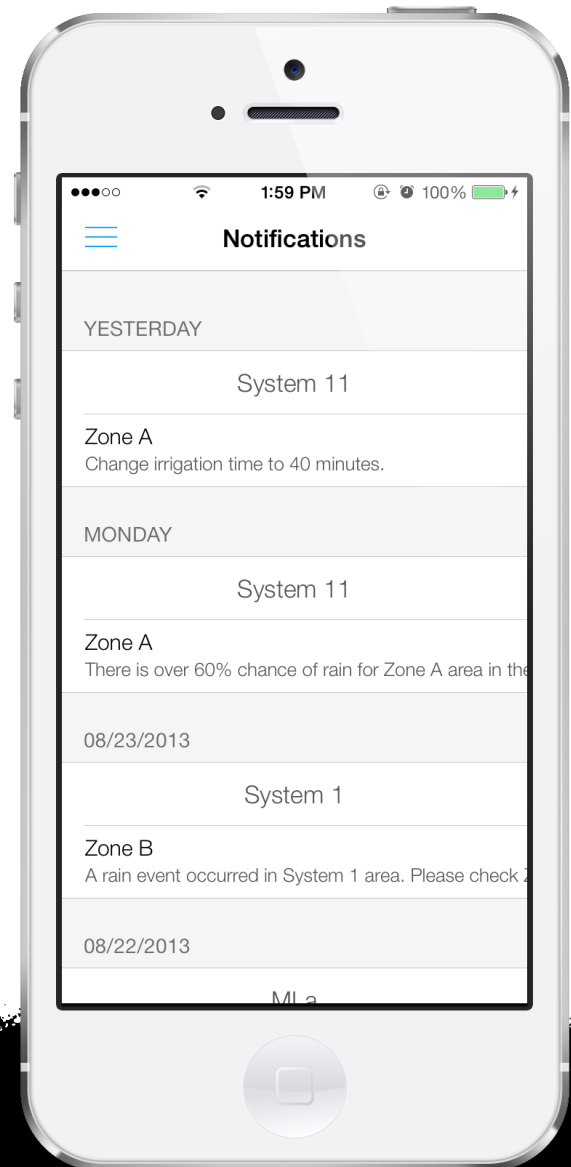
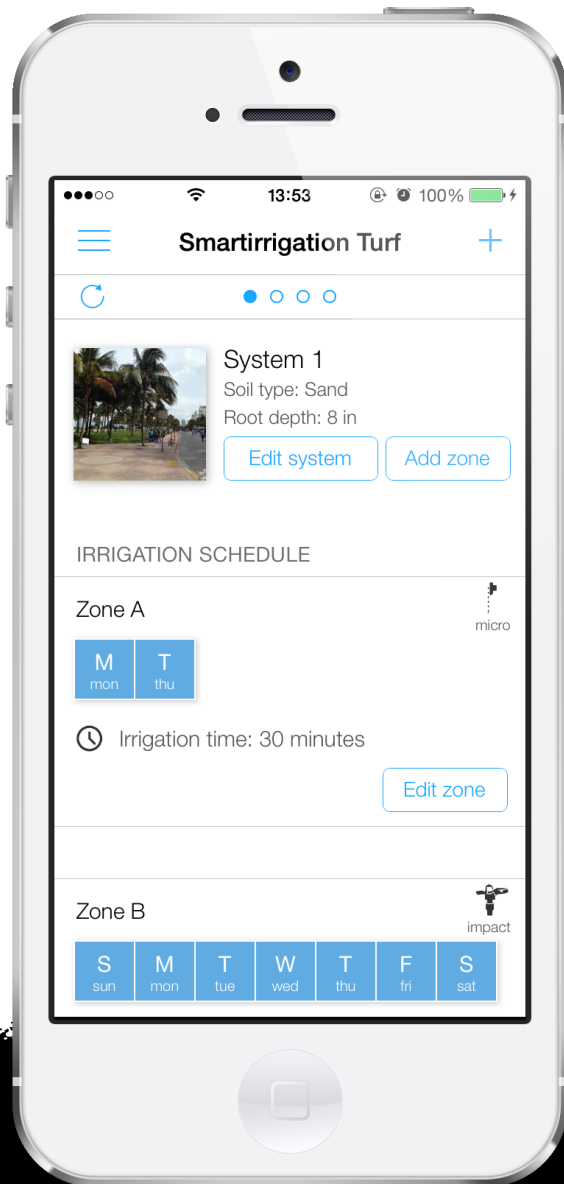
- Irrigation system: drip
 - Between-row, planting date, harvest date, irrigation rate, efficiency
- Irrigation schedule (minutes/hrs) and degree days accumulated for everyday irrigation

Results
Irrigation schedule for the next 15 days 11/06/2013 to 11/20/2013
Test
Irrigate 1 hour a day
Accumulated degree days: 2619

Urban turf app



- Irrigation system: sprinkler heads
 - Soil type, root depth
 - Micro sprinkler, spray, multi-stream spray, gear driven rotors, impacts
 - Days of week to irrigate
- Irrigation schedule in minutes considering number of irrigation events per week
- Notifications used to adjust irrigation schedules due to rainfall



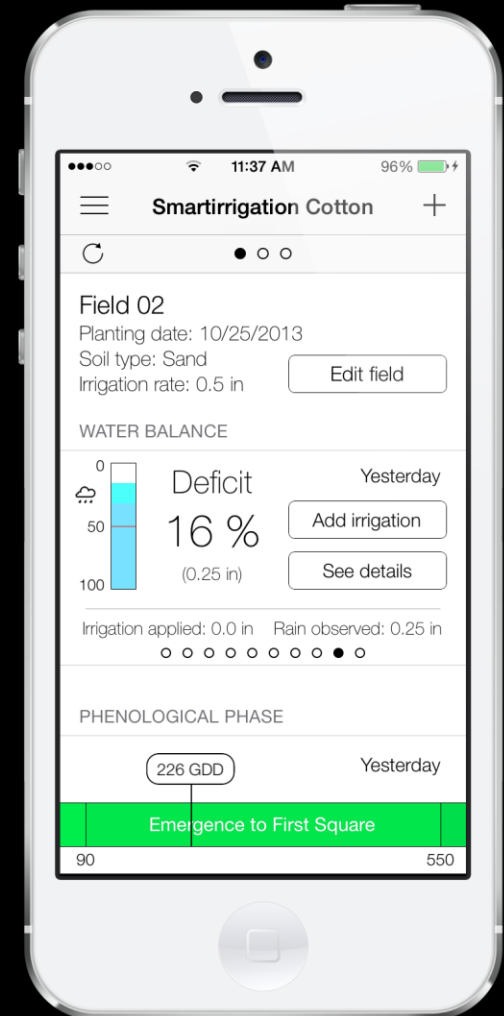
Cotton app



- Irrigation application rate
- Plant phenology and crop coefficient (K_c) change with accumulated heat units (GDDs)
 - User can override GDD-driven phenology
- Does not recommend irrigation amounts
 - Advises user of available soil water and stress threshold

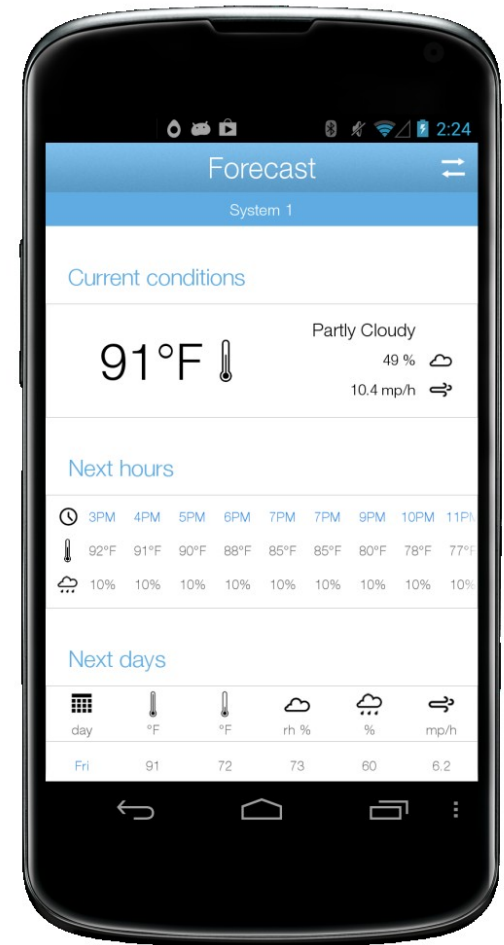
Cotton app

- Uses real-time rain data from FAWN and GAEMN
- A daily water balance approach: allow for R to be changed and I to be input



Forecast data

- **National Weather Service** data: temperature, relative humidity, wind speed, probability of rain
- Current conditions
- Forecast by hour for next 11 hrs
- Forecast by day for next 5 days



Summary

- There are a variety of resources, pick the one (or more) that works best for you
- **FAWN** – good for the manual irrigation system operator that likes to be in the ‘know’ and have a say in the decision; **works for all crops**
- **Field tools** – good for those that want exact information at their field and/or want automation; **works for all crops**
- **App tool** – great for automatic irrigation systems and manual systems, does the math for you; **limited on crop**

AgroClimate Disease tools