UF | IFAS Extension
UNIVERSITY of FLORIDA

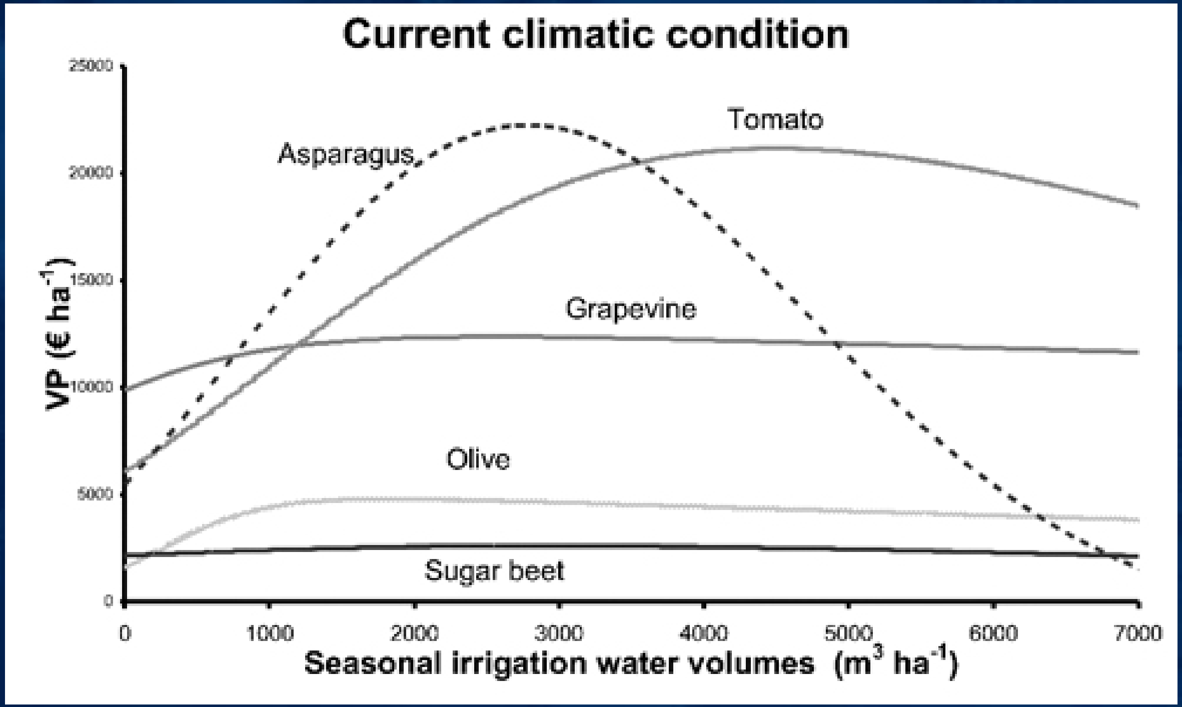
Innovation in Agriculture Irrigation: Today and Tomorrow

FOR THE
#GATORGOOD

Kati Migliaccio, Diane Rowland, Kelly Morgan, Lincoln Zotarelli, Michael Dukes, Tatiana Borisova, Clyde Fraisse, Paul Fisher, Reza Ehsani

Irrigation benefits

Irrigation is one part of the production system, ideally this input results in greater output or yield



Rubino et al 2012 Journal of Agroecosystem Management

Economics

There is also economics to consider, does additional irrigation result in additional net revenue?

Soybeans

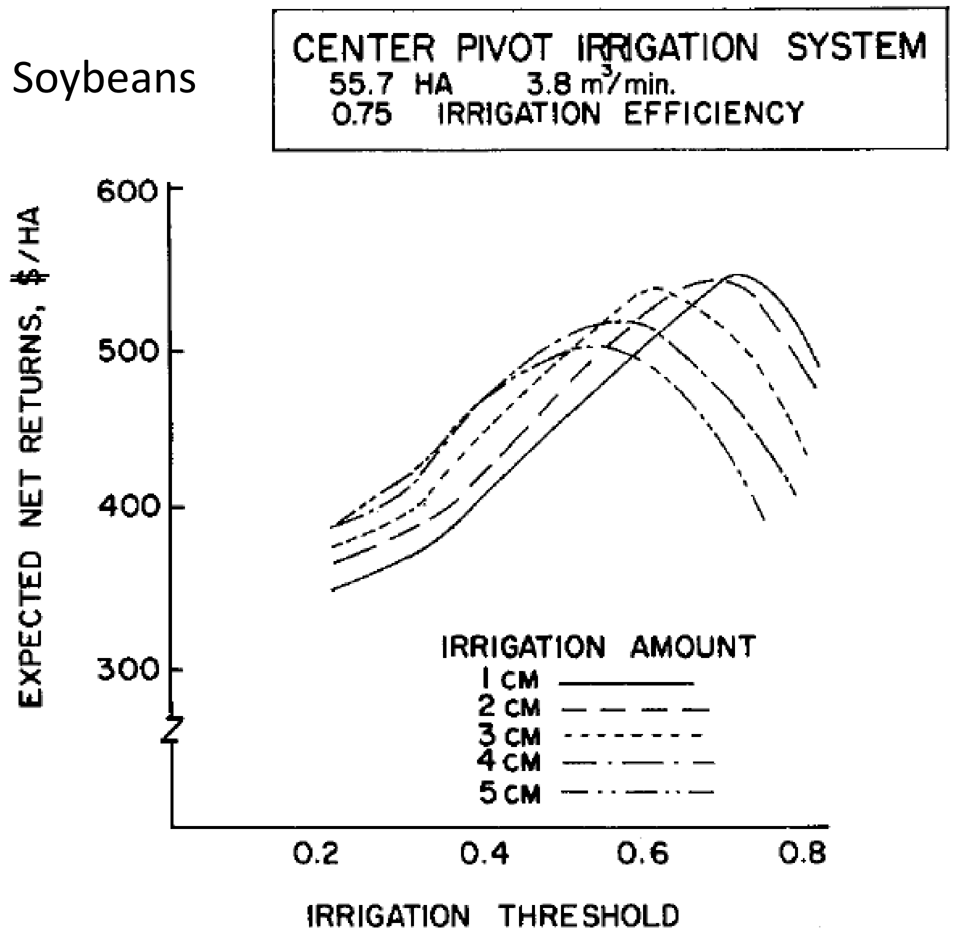


Figure 2. Simulated Net Returns Above Variable Irrigation Costs as Related to Irrigation Threshold and Water Application Rate per Hectare, Soybeans.

Boggess et al. 1983 Southern Journal of Agricultural Economics

Purpose

- Show innovative tools for agriculture water management
- Showcase some specific examples from UF IFAS faculty
- Provide some ideas/tools that increase viability of agriculture in Florida

M. Gutierrez

UF IFAS INNOVATION

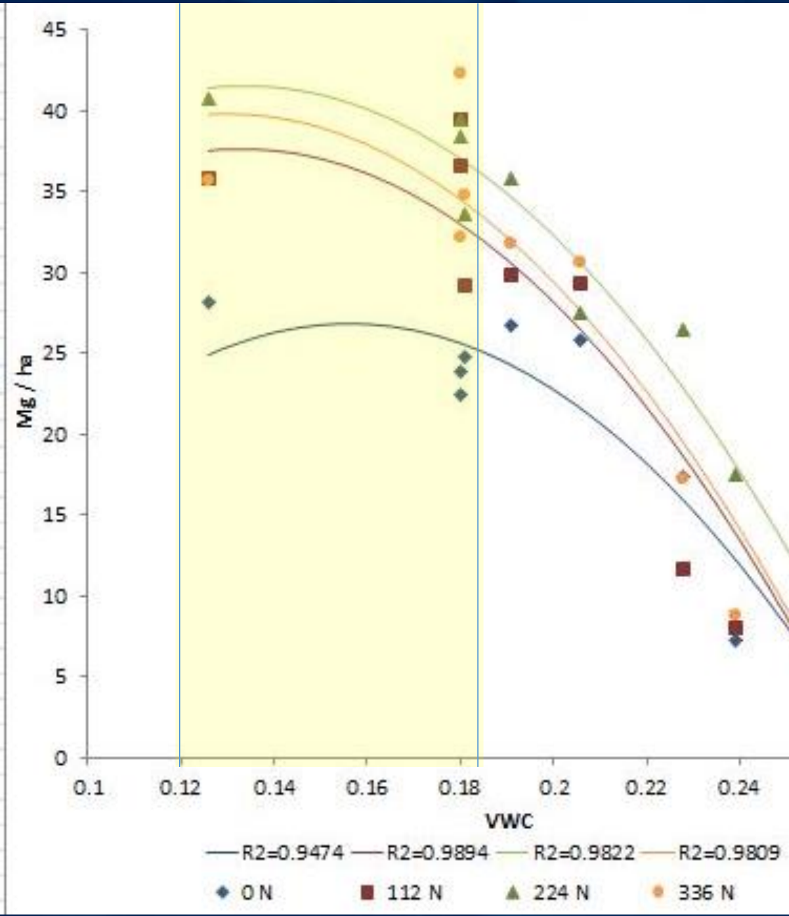
Seepage irrigation/water tables: L Zotarelli

- Research to maximize potato yield through better seepage irrigation water management
- Investigated potato production with different water table levels (14, 21, & 30 inches below surface) and fertilizer levels, assessed yield

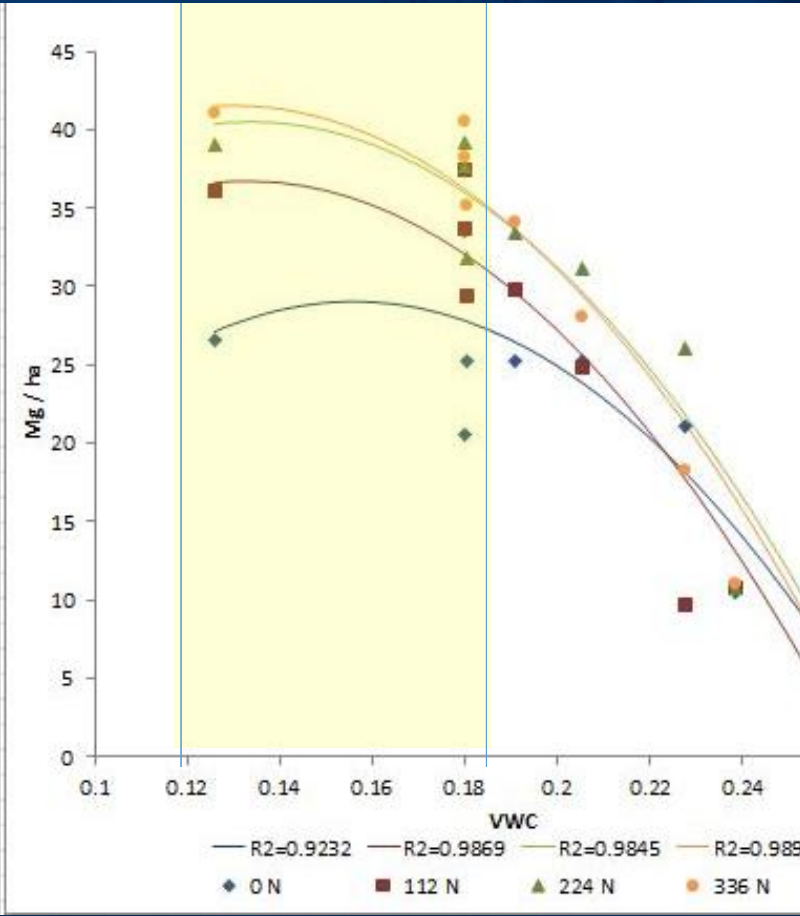
Seepage irrigation/water tables: L Zotarelli

Atlantic

FL1867



Kg/ha



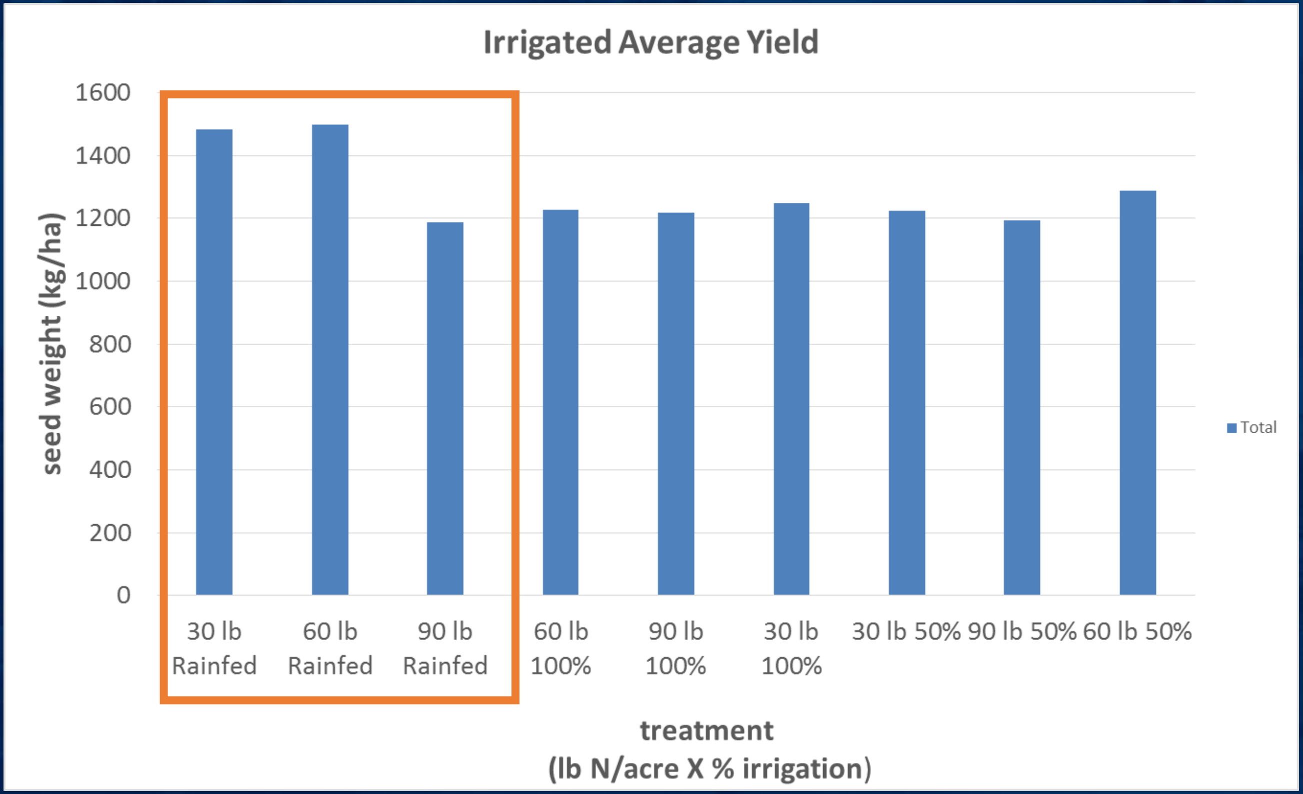
Kg/ha

Improving agricultural viability by reducing inputs & increasing yield

- Irrigation volume was reduced by 60-70% without a reduction in yield
- Reduce losses due to flooding (reduce risk)

Irrigation scheduling: D Rowland

- Study to improve irrigation scheduling using Growing Degree Day based method for sesame



Panhandle Ag e-News

PANHANDLE AG EXTENSION TEAM

UF | IFAS Extension
UNIVERSITY of FLORIDA

« Carbon Credit Markets May Be Making A Return
The Majestic Longleaf: One of the South's Distinguished Trees »

SUBSCRIBE

Pan Ag Articles by Topic

- Educational Training
- Field Crops
- Forage & Pasture
- Forestry
- General Agriculture
- Horticulture
- Livestock
- Natural Resources
- Pest Management
- Weather
- Wildlife
- Jokes

Ag Production Pages

- Beef Cattle
- Beekeeping
- Field & Row Crops

Sesame Production: A New Crop for Florida

Field Crops, Sesame

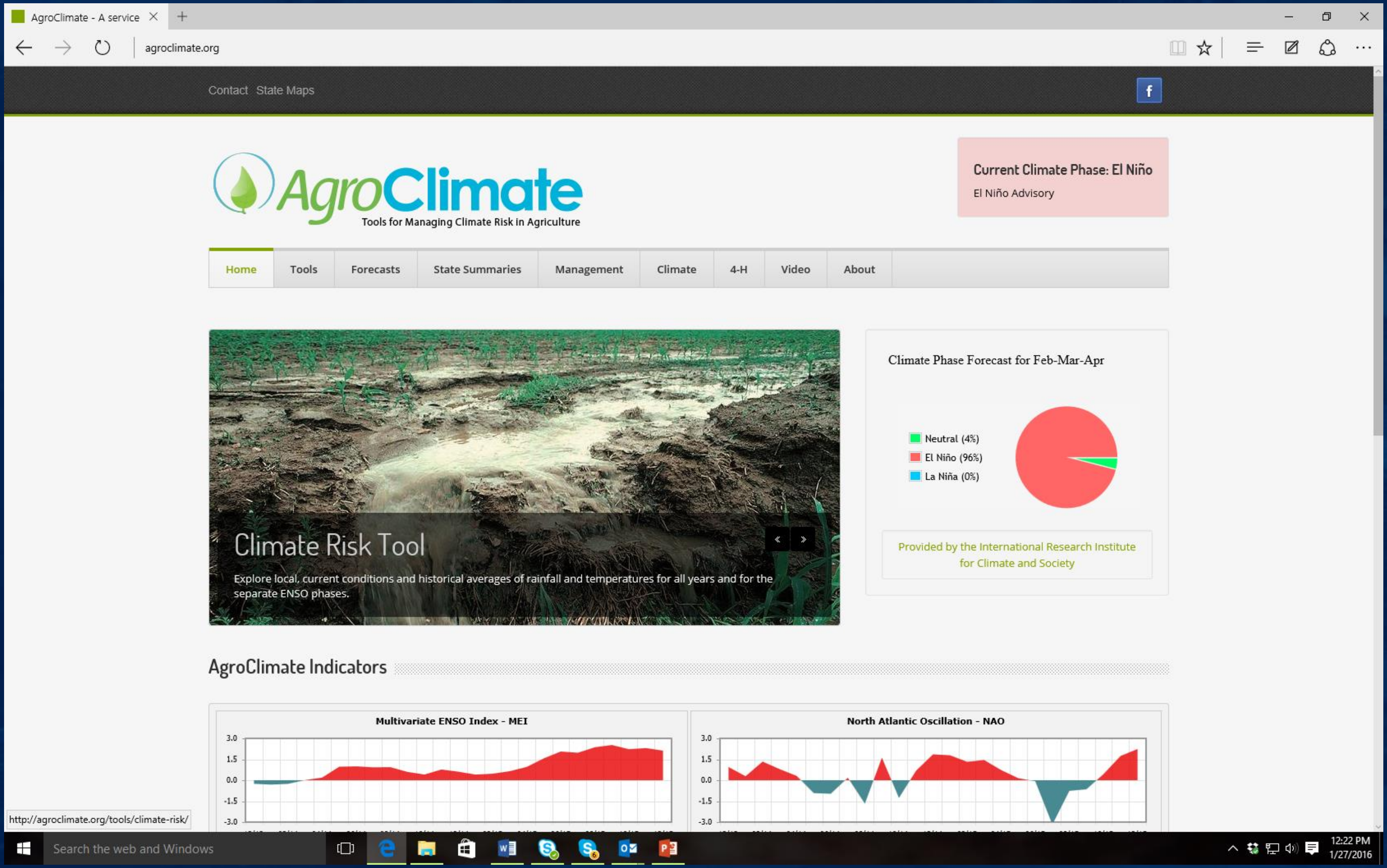
by Diane | October 10, 2014

Growers Randall Dasher and Jerry Goff at a sesame field in McAlpin, FL. Photo credit: Diane Rowland

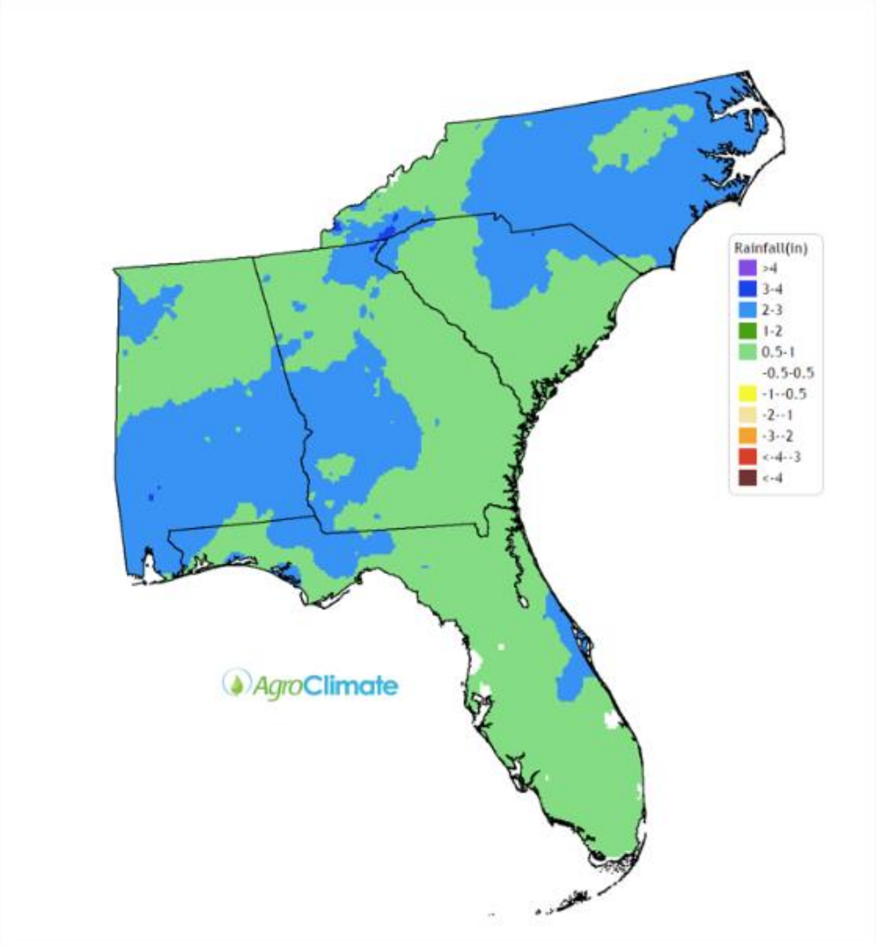
Improving agricultural viability by reducing inputs & increasing yield

- On average lower amounts of irrigation and fertilizer performed better (in a wet year) than relatively high irrigation and nitrogen application
- Results suggest a relatively wet growing season combined with irrigation may show negative yield impacts
- Sesame is a low water crop, alternative crop for Florida
- Climate variability – ENSO phase

AgroClimate: C Fraisse



El Niño is already causing conditions in the tropical Atlantic to be less conducive to tropical storm development and the systems that have formed have encountered high wind shear and struggled to survive. During the winter El Niño causes the Pacific jet stream current to dip into the Southeast. This provides cold fronts with more moisture and energy. El Nino typically leads to 40 to 50% more rainfall than normal for the Florida peninsula, and about 30% more than normal for South Georgia. El Niño's impacts on the weather in the Southeast US are usually most prominent in the winter, but given the strength of this year's event, we could begin to see its effects this fall. Many climate models are predicting a wet fall with above-normal temperatures for the Southeast.



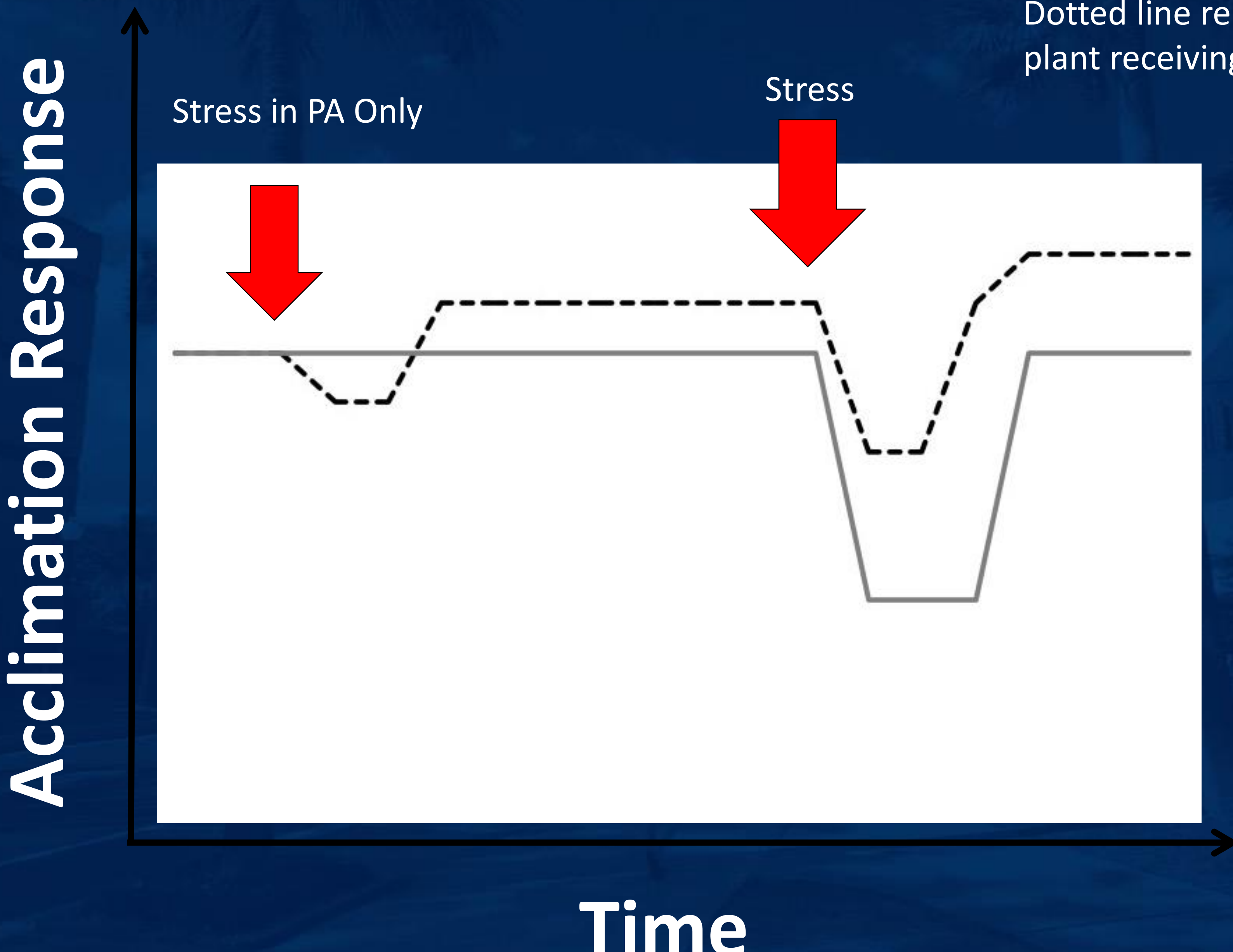
Improving agricultural viability by providing risk management information

- Dynamic, free tool to help predict climate variability
- Provide information to modify production practices based on predicting climate patterns

Primed acclimation: D Rowland

- Induction of physiological responses that prepares plants to tolerate or resist stresses by activating defense responses faster, stronger, or both; mechanism of stress memory (based on Bruce et al. 2007)
- Water-saving irrigation strategy that takes advantage of priming and stress memories in crops to improve drought response
  - Deficit Irrigation during vegetative growth
  - Mild to moderate deficit (Rowland et al., 2012)
- Leads to changes in root architecture, biomass partitioning, increased WUE, yields

Solid line represents normal plant
Dotted line represents plant receiving PA



Peanut yield

Irrigation treatments:

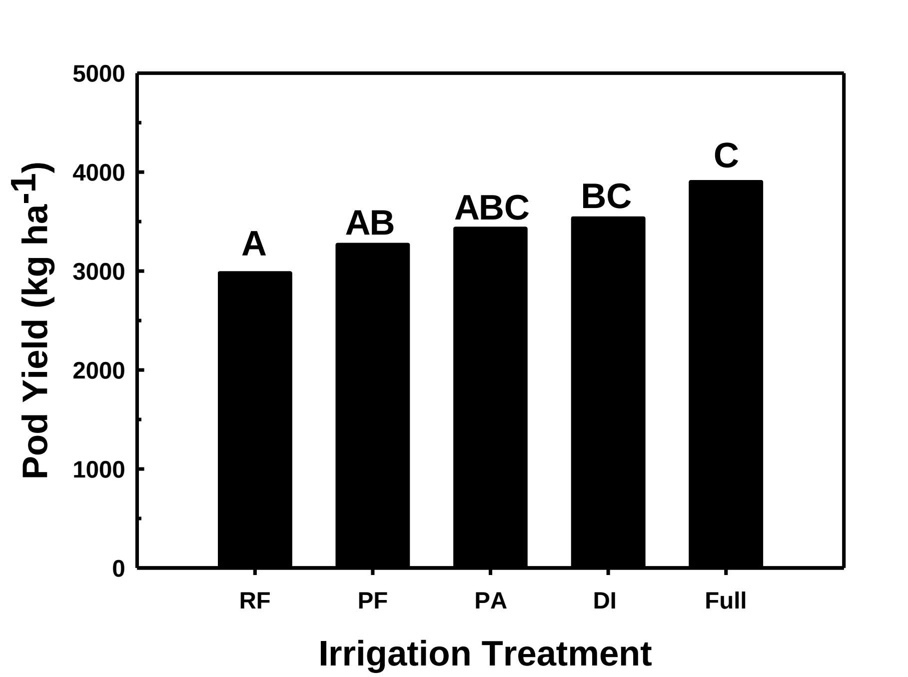
1) Rainfed control (RF)

2) PeanutFARM with applications at a 1.9 cm amount for the entire season (PF)

3) Application of 1.1 cm until mid-bloom and 1.9 cm following mid-bloom scheduled using tensiometers placed treatment #2 (PA)

4) Application of 1.1 cm application amount for the entire season scheduled using tensiometers

5) Irrigation scheduled with tensiometers at an optimum application amount of 1.9 cm (Full) for the entire season



Improving agricultural viability by reducing drought impacts

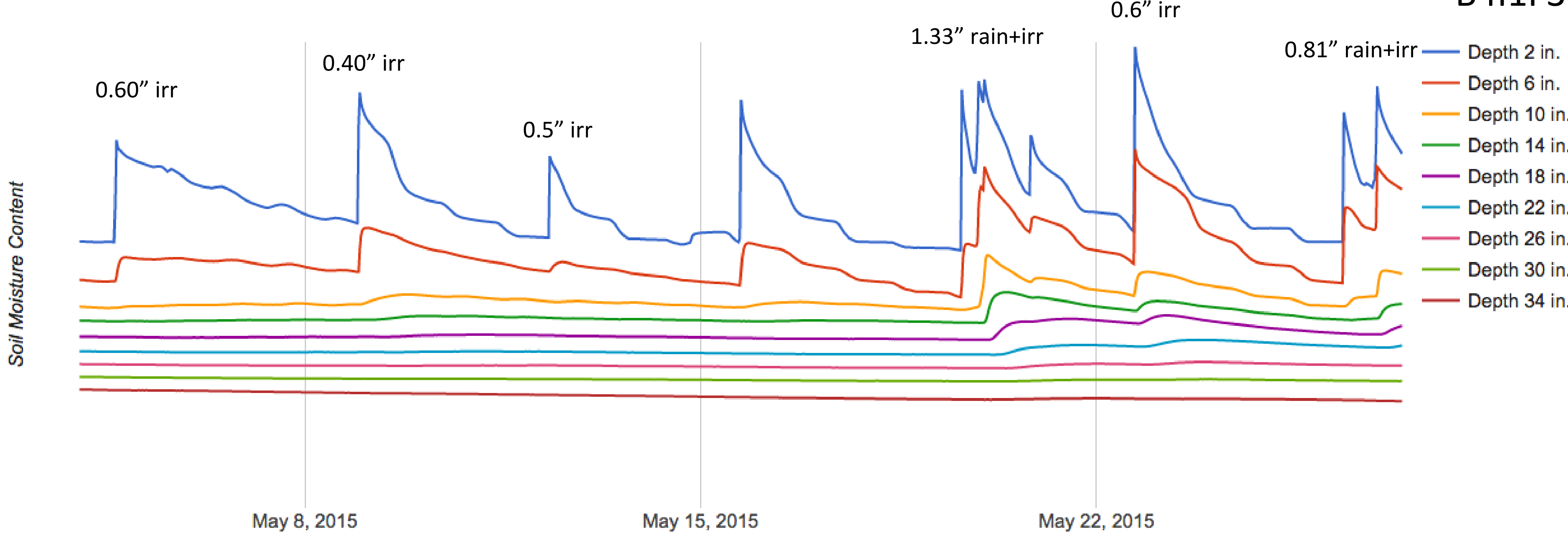
- Using primed acclimation to reduce water needs and improve yield during drought
- Tensiometer based irrigation with greatest yield (based on soil water content)

Soil moisture sensor irrigation: M Dukes

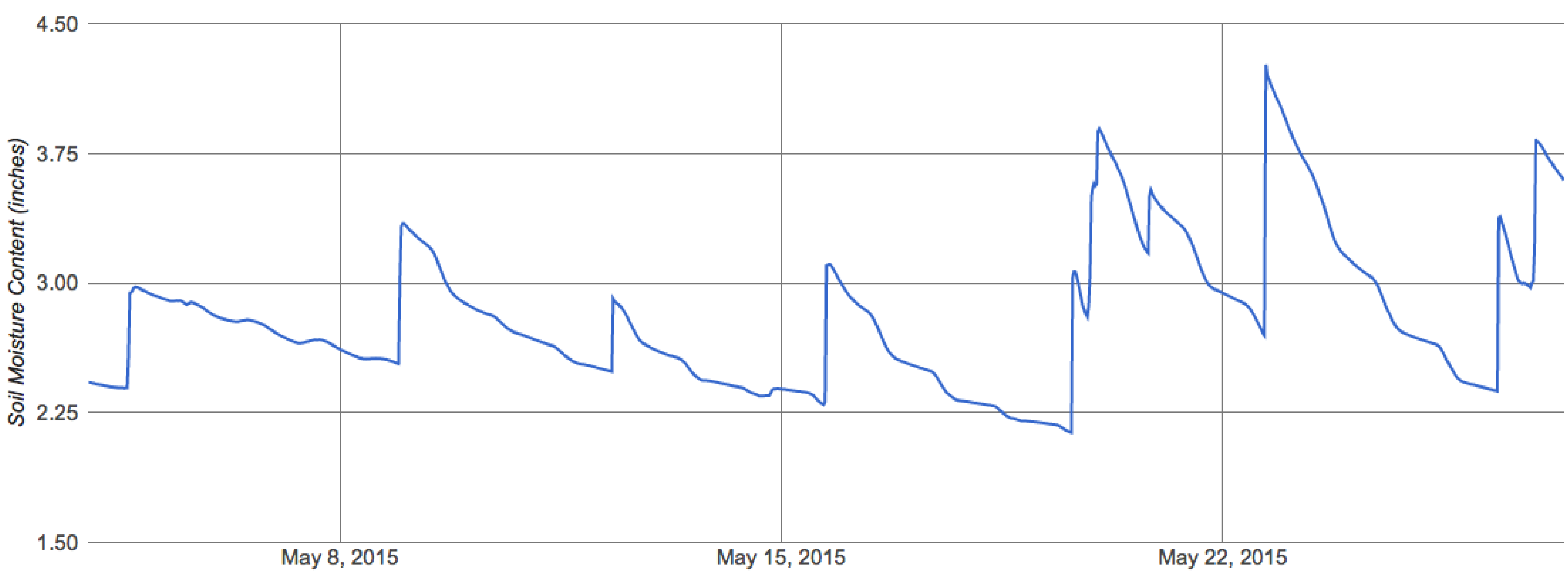

M Gutierrez

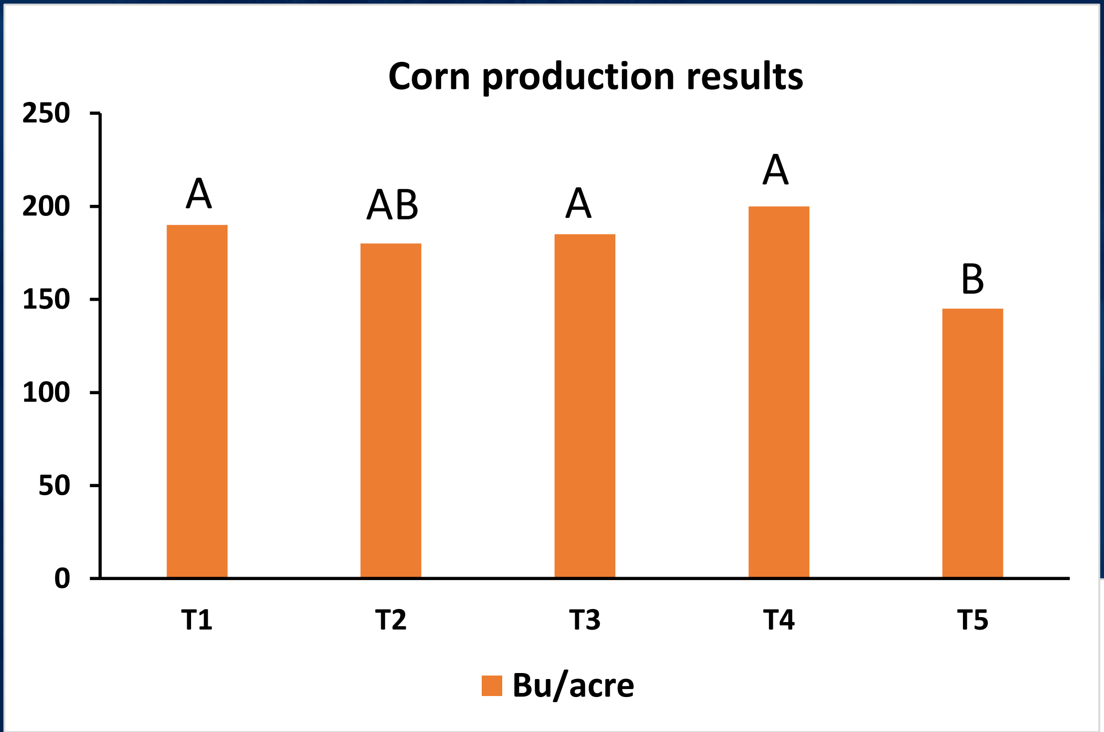
Discrete Sensors

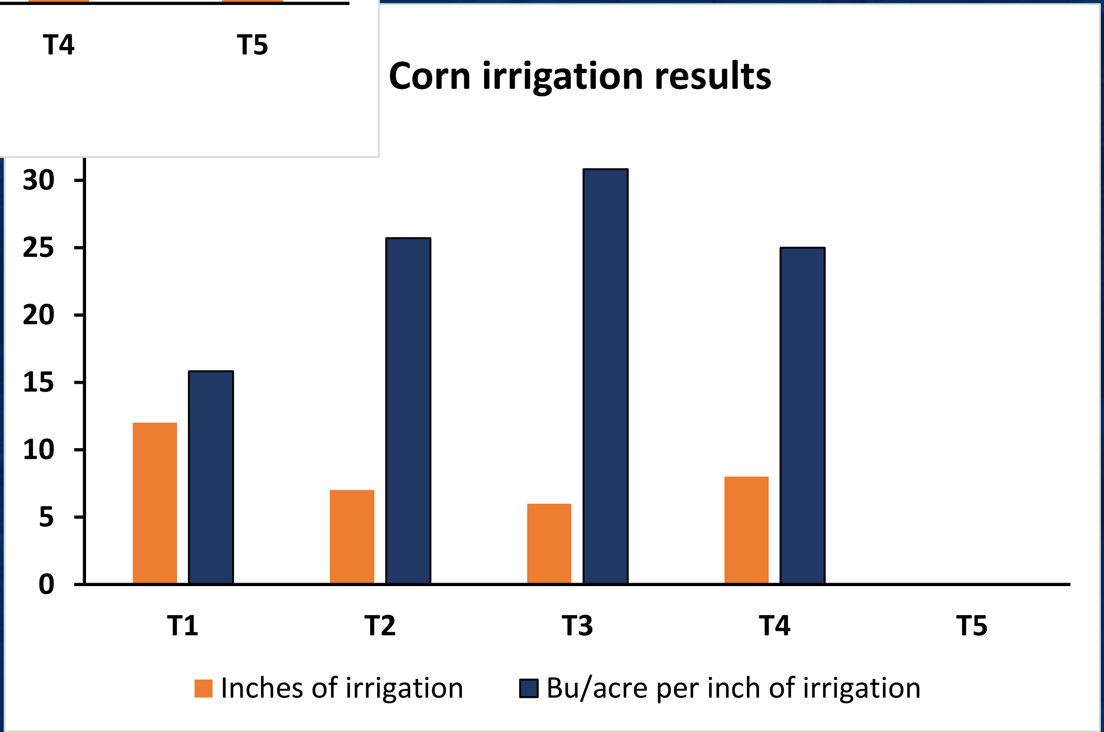
B4I1F3



Sum of Sensors







T1 = Typical practices in the field
T2 = Soil water balance with FAWN
T3 = Soil moisture sensors
T4 = 60% of T1
T5 = No irrigation

Improving agricultural viability by optimizing water inputs

- More than one way to optimize irrigation: FAWN / water balance approach and using field equipment such as soil moisture sensors
- Applicable to most crops and locations

Smartirrigation apps

- Smartphone apps that develop real-time irrigation schedules

  Avocado (*Persea Americana)*

  Citrus *(Citrus spp. L.)*

  Cotton (*Gossypium hirsutum* L.)

  Peanut (*Arachis hypogaea* L.)

  Strawberry (*Fragaria ananassa)*

  Urban turf [e.g., St. Augustine grass (*Stenotaphrum secundatum)]*

  Vegetable [cabbage *(Brassica oleracea var. capitata*), squash (*Cucurbita pepo)*, tomato (*Solanum lycopersicum L.)* and watermelon (*Citrullus lanatus)*]

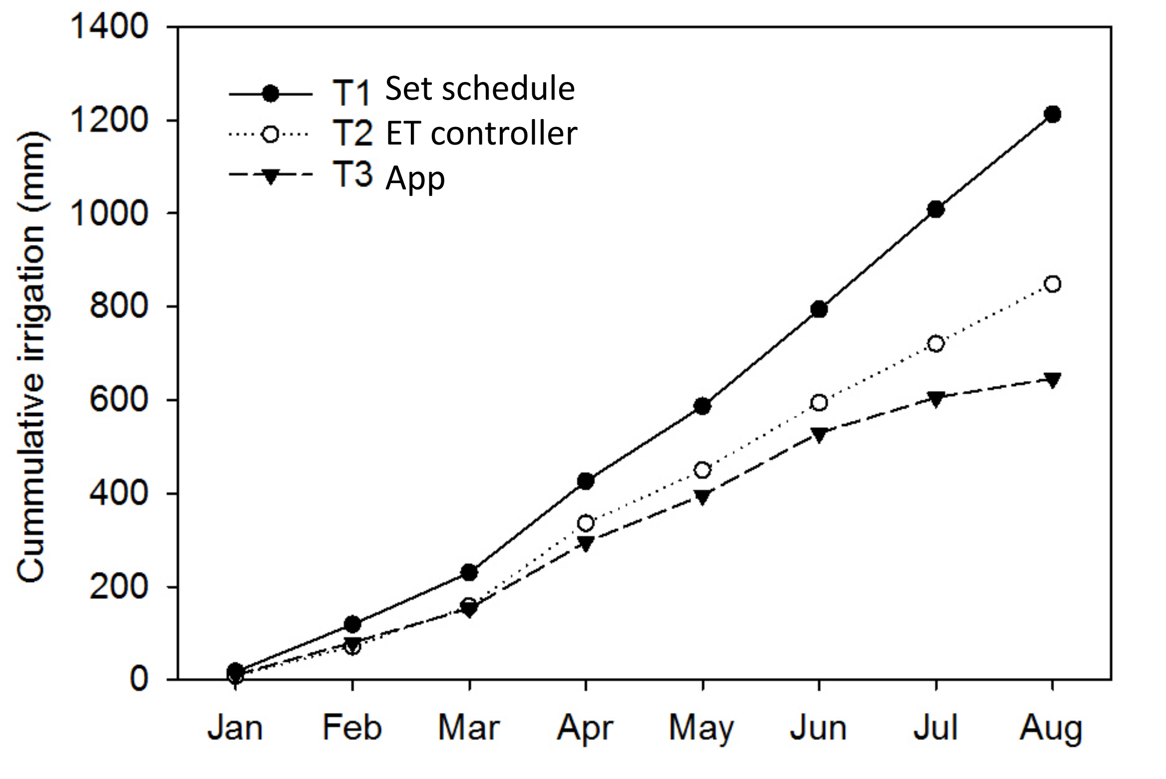
Citrus app: K Morgan

Method	2013/2014 Sap Flow	Water Applied	Fruit Yield
	($g\ hr^{-1}\ m^{-2}$)	($1000\ L\ ha^{-1}$)	(kg/tree)
Site 1			
Citrus App	38.88 a	2218.4 b	299.2 a
Std Practice	18.72 c	3189.0 a	263.7 b
Current IFAS	29.02 b	2913.2 a	283.3 a
Site 2			
Citrus App	21.78 a	2251.9 b	315.1 a
Std Practice	9.77 b	3223.7 a	284.7 b
Current IFAS	18.75 a	2825.6 a	289.6 b
Site 3			
Citrus App	69.39 a	2223.8 b	374.1 a
Std Practice	34.54 b	3207.6 a	315.1 b
Current IFAS	60.58 a	2117.5 b	325.1 b

Method	2014/2015 Sap Flow	Water Applied	Fruit Yield
	($g\ hr^{-1}\ m^{-2}$)	($1000\ L\ ha^{-1}$)	(kg/tree)
Site 1			
Citrus App	39.72 a	2968 b	258.5 a
Std Practice	23.84 b	3684 a	216.1 b
Current IFAS	26.21b	2681 b	223.4 b
Site 2			
Citrus App	34.82 a	2801 b	298.4 a
Std Practice	23.68 b	3195 a	226.8 b
Current IFAS	25.95 b	2984 a	216.5 b
Site 3			
Citrus App	28.98 a	2811 b	286.5 a
Std Practice	19.90 b	3846 a	198.4 b
Current IFAS	29.54 a	2843 b	265.1 a

Avocado app: K Migliaccio

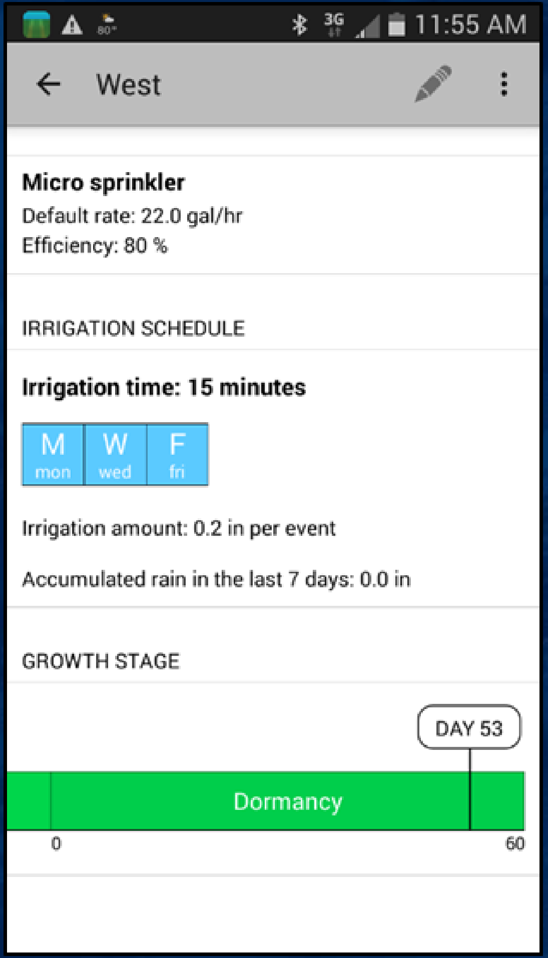
Harvested fruit weight and fruit number per treatment for each harvest date (n=21 trees per treatment)



Treatment	Fruit number per treatment per tree			Total weight kg tree^{-1}		
	6 July	13 Aug	Total	6 July	13 Aug	Total
Set sched.	39	20	59ab	21.1	12.7	33.8ab
ET	15	31	46a	7.3	18.6	25.9a
App	29	35	64b	14.6	22.7	37.3b

Improving agricultural viability by optimizing water inputs

- Smartphone apps for real-time scheduling with FAWN data / evapotranspiration based



Floriculture resources: P Fisher

Floriculture Research Alliance

About us | Current projects | Grower resources | Our industry partners | Search us

The Floriculture Research Alliance includes researchers that collaborate across universities and organizations on applied research.

Our mission is to partner with industry stakeholders to develop science-based solutions to sustainability issues for floriculture.

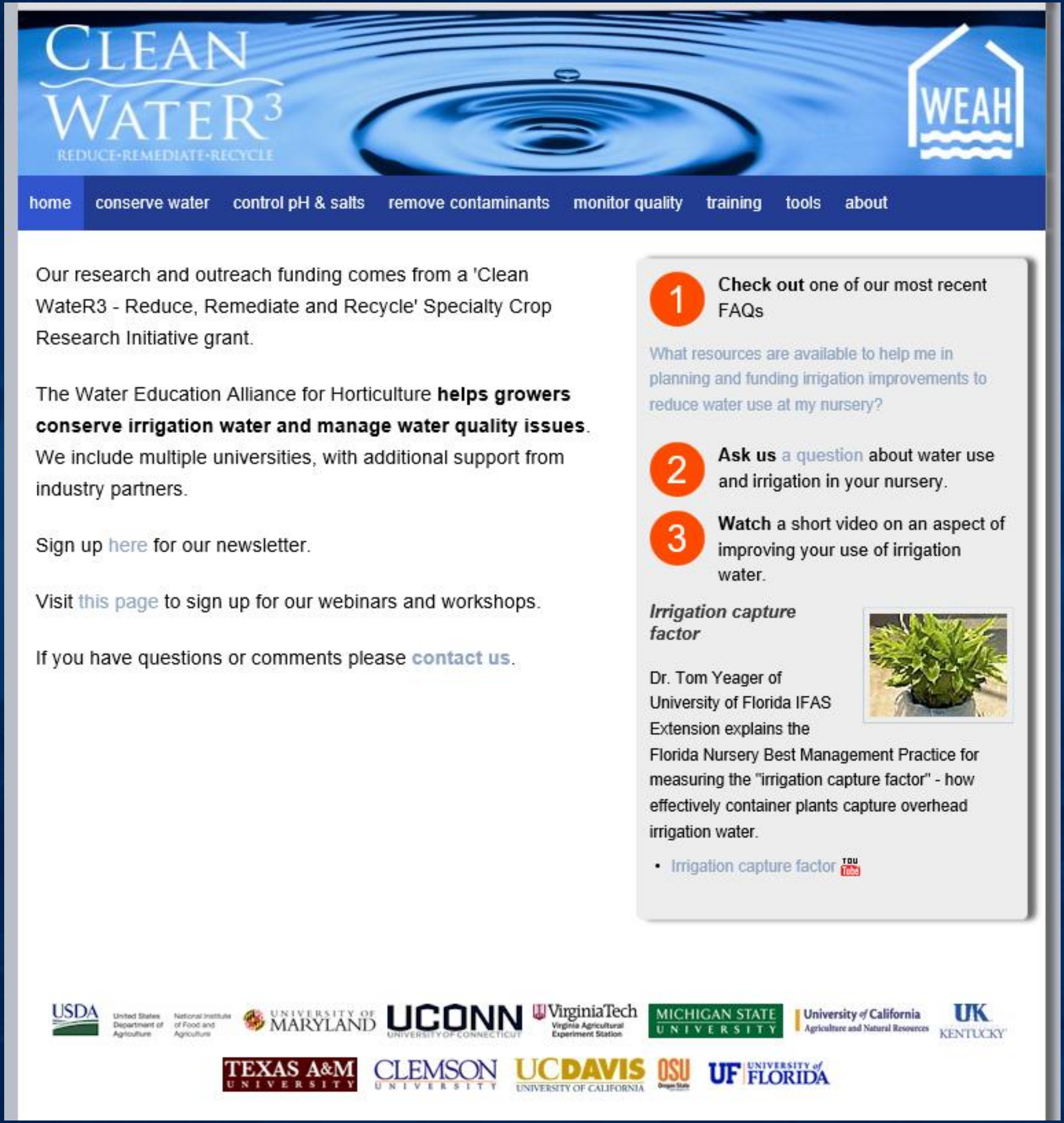
This website publicizes our research on sustainable production including efficient use of water, energy, agrichemical and nutrient resources.


Young plant research at the University of Florida

Contributing universities

Funding organisations

http://floriculturealliance.org/



CLEAN WATER³
REDUCE·REMEDIATE·RECYCLE

WEAH

home | conserve water | control pH & salts | remove contaminants | monitor quality | training | tools | about

Our research and outreach funding comes from a 'Clean WateR3 - Reduce, Remediate and Recycle' Specialty Crop Research Initiative grant.

The Water Education Alliance for Horticulture **helps growers conserve irrigation water and manage water quality issues**. We include multiple universities, with additional support from industry partners.

Sign up here for our newsletter.

Visit this page to sign up for our webinars and workshops.

If you have questions or comments please **contact us**.

1 **Check out** one of our most recent FAQs

What resources are available to help me in planning and funding irrigation improvements to reduce water use at my nursery?

2 **Ask us** a question about water use and irrigation in your nursery.

3 **Watch** a short video on an aspect of improving your use of irrigation water.

Irrigation capture factor

Dr. Tom Yeager of University of Florida IFAS Extension explains the Florida Nursery Best Management Practice for measuring the "irrigation capture factor" - how effectively container plants capture overhead irrigation water.

- Irrigation capture factor

http://watereducationalliance.org/

Improving floriculture viability through education

- Floriculture Research Alliance and Clean WateR3 - Reduce, Remediate and Recycle
- Programs that assist growers
- Extension programs / educational programs

FUTURE INNOVATION

Future innovation: smartphone monitoring and control

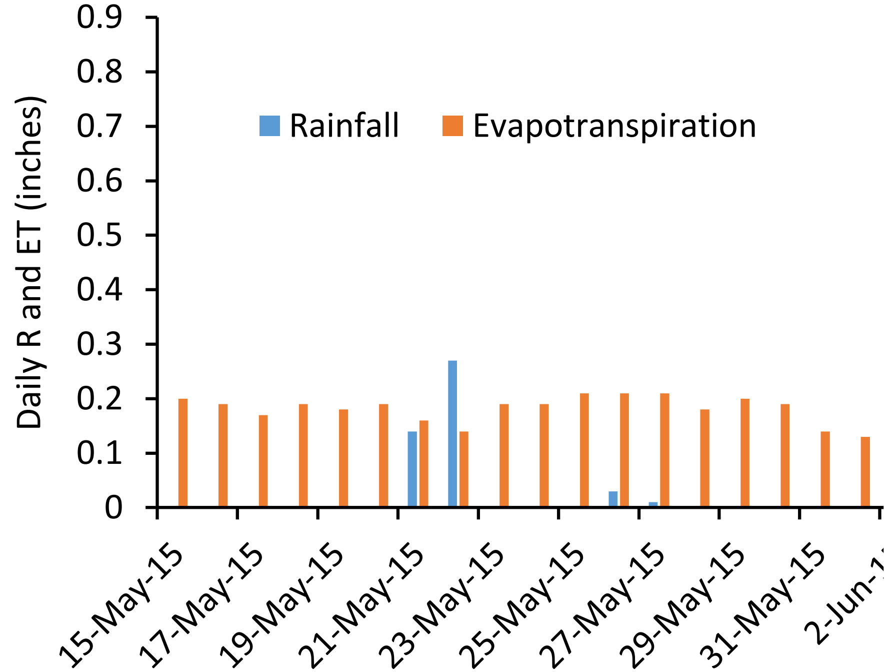
- Smartphone based communication with field monitoring equipment (using real time data)
- Adopt industry-wide data communications standards, data format standards, and metadata requirements
    - Improving communication amongst devices, equipment, information, and people

Future innovation: Use of Unmanned Aerial Vehicle (UAV)

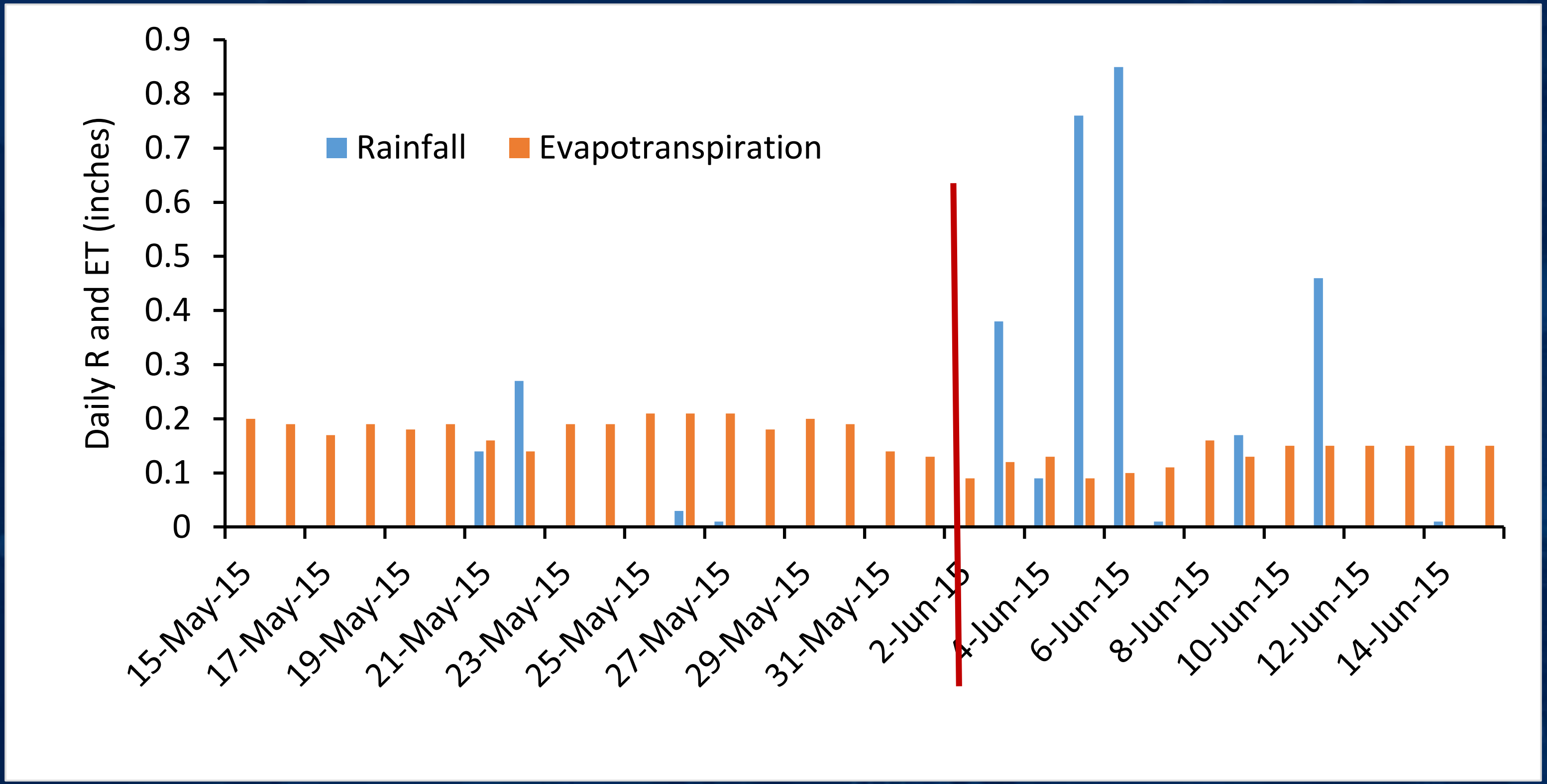
- Monitor for disease, problems, etc.
- Collect data
- Provide ‘eyes’ for hard to get to places
- Reduce man power and increase on-ground knowledge

Future innovation: forecast data integrated into scheduling

- Incorporation of forecast data (such as forecasted ET and rainfall considering day-to-day variability and seasonal variability) into agricultural production planning
- Combining real-time data with forecast data for better irrigation need assessment



Daily R and ET (inches)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Rainfall
Evapotranspiration
15-May-15
17-May-15
19-May-15
21-May-15
23-May-15
25-May-15
27-May-15
29-May-15
31-May-15



Daily R and ET (inches)
Rainfall
Evapotranspiration
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
15-May-15
17-May-15
19-May-15
21-May-15
23-May-15
25-May-15
27-May-15
29-May-15
31-May-15
2-Jun-15
4-Jun-15
6-Jun-15
8-Jun-15
10-Jun-15
12-Jun-15
14-Jun-15

Future innovation: smartphone monitoring and control

- Optimized systems: considering in-field spatial variability for water, nutrients, pests
- Variable Rate Irrigation / Fertigation Systems

Take home points to increase agriculture viability

- More water doesn’t always equal more yield
- Consider economics, does a practice result in greater profit?
- Low water alternative crops
- Primed acclimation to ‘prep’ plants for drought
- Manage irrigation considering potential flood risk
- Use tools for optimizing schedules: soil moisture sensors, smartphone apps, ET or GDD information
- Stay connected with UF IFAS extension agents and specialists for the latest information

Take home tools

- AgroClimate.org
  - Help predict wet/dry year, make decisions on water management and crop
- Florida Automated Weather Network (FAWN)
  - Real-time weather and tools (more to come)
- IFAS apps: http://ifas.ufl.edu/mobile-apps/
  - List of many tools to help optimize different aspects of production using IFAS science
  - http://agronomy.ifas.ufl.edu/peanutfarm
- Evapotranspiration and Soil Moisture Sensors
  - Many resources on this in EDIS http://edis.ufl.edu for irrigation scheduling (or email Kati)
- Floriculture websites
  - Learning opportunities to optimize production

Acknowledgements

UF IFAS Departments and Centers

Graduate students, post docs, technicians

Funding agencies

SFWMD and hosts

Kati’s contact info:
klwhite@ufl.edu
@hydroKati