

# Conserving Water in South Texas Cotton Production Through the Use of Strip Tillage and Developmentally Timed Water Deficit Periods

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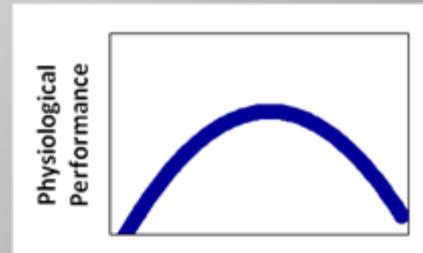
How do you improve drought tolerance and/or water-use efficiency in a crop??

*New viewpoint: develop MANAGEMENT TOOLS that manipulate physiology under typical field conditions*

What do we want to improve?: RUNNERS ANALOGY

## Long term (seasonal):

1. Seasonal physiological **CONDITIONING** – seasonal performance curve TRANSLATES INTO YIELD



## Short term (daily/weekly):

2. Daily physiological **ENDURANCE** – how many days after irrigation/rain do plants “hit the wall”
3. Stress **RECOVERY** - physiological ability to return to pre-stress levels of performance



# Two promising *management techniques* that improve crop

**CONDITIONING**, **ENDURANCE**, and **RECOVERY**

## CONSERVATION TILLAGE

(Strip Till = ST)

*Increases soil moisture,  
increases root growth,  
changes crop water-use  
patterns*

## PRIMED ACCLIMATION (PA)

*Exposing crop to  
moderate drought  
stress during early  
development to  
increase drought  
tolerance later on*



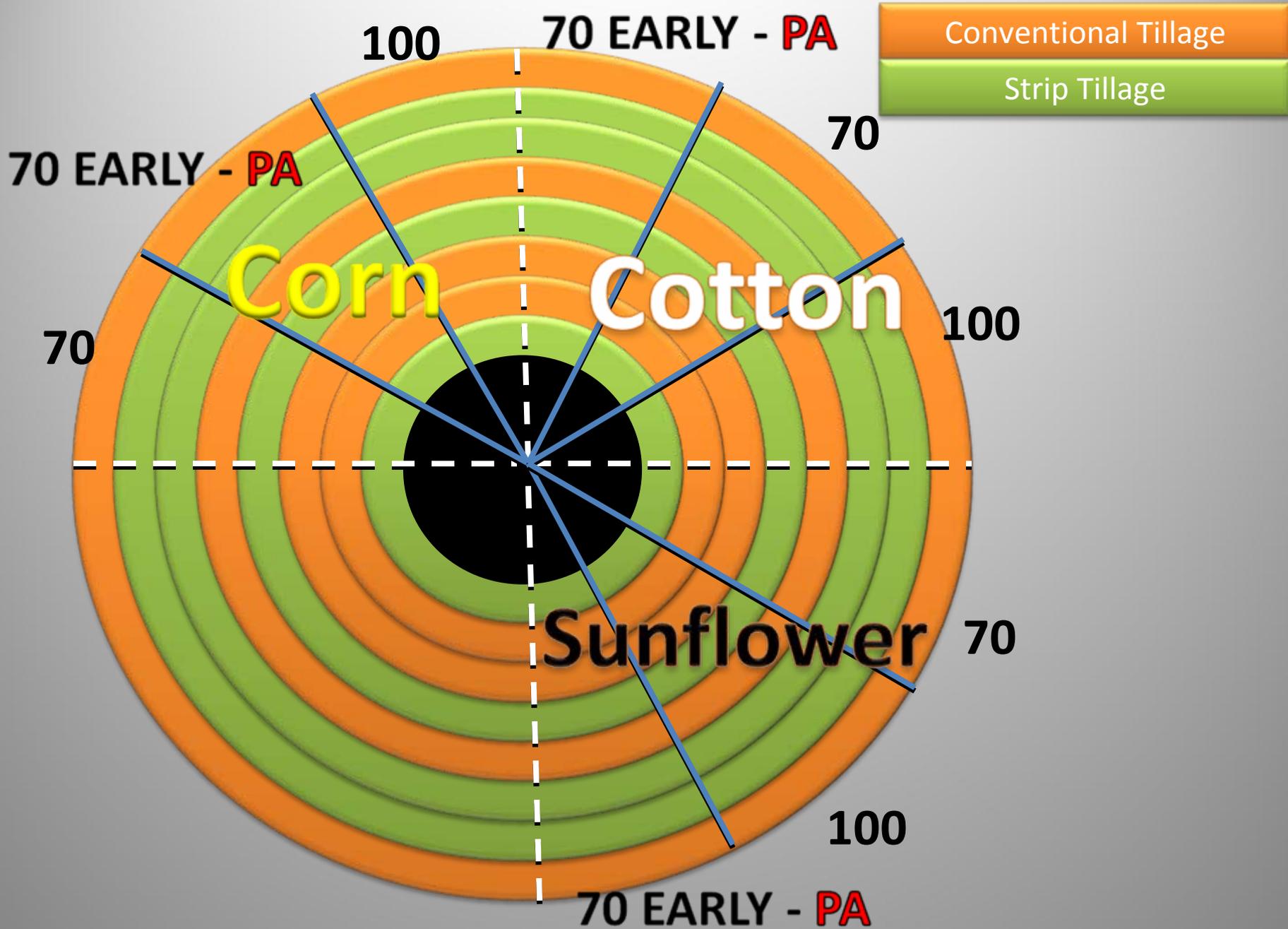
**Greatest benefit may be by combining the two techniques**

# PA + CONSERVATION TILL (ST) 2009 Center Pivot, Uvalde, TX

AgriLIFE RESEARCH A&M Center

- ✿ 50 acre center pivot
- ✿ Quarter sections of COTTON, CORN, SUNFLOWER
- ✿ Winter 2008/2009 planted to ryegrass
- ✿ Grazed until one month before planting for EACH crop
- ✿ Cattle removed and ryegrass terminated one month before planting
- ✿ Conventional till – deep tilled, disked
- ✿ Strip till – KMC strip till unit – approx. 12” across bed
- ✿ 3 irrigation treatments: 100%, 70%, 70% early/100% rest of the season (**Primed Acclimation – 70E**)
- ✿ SIMILAR SYSTEM IN LUBBOCK – USDA/ARS



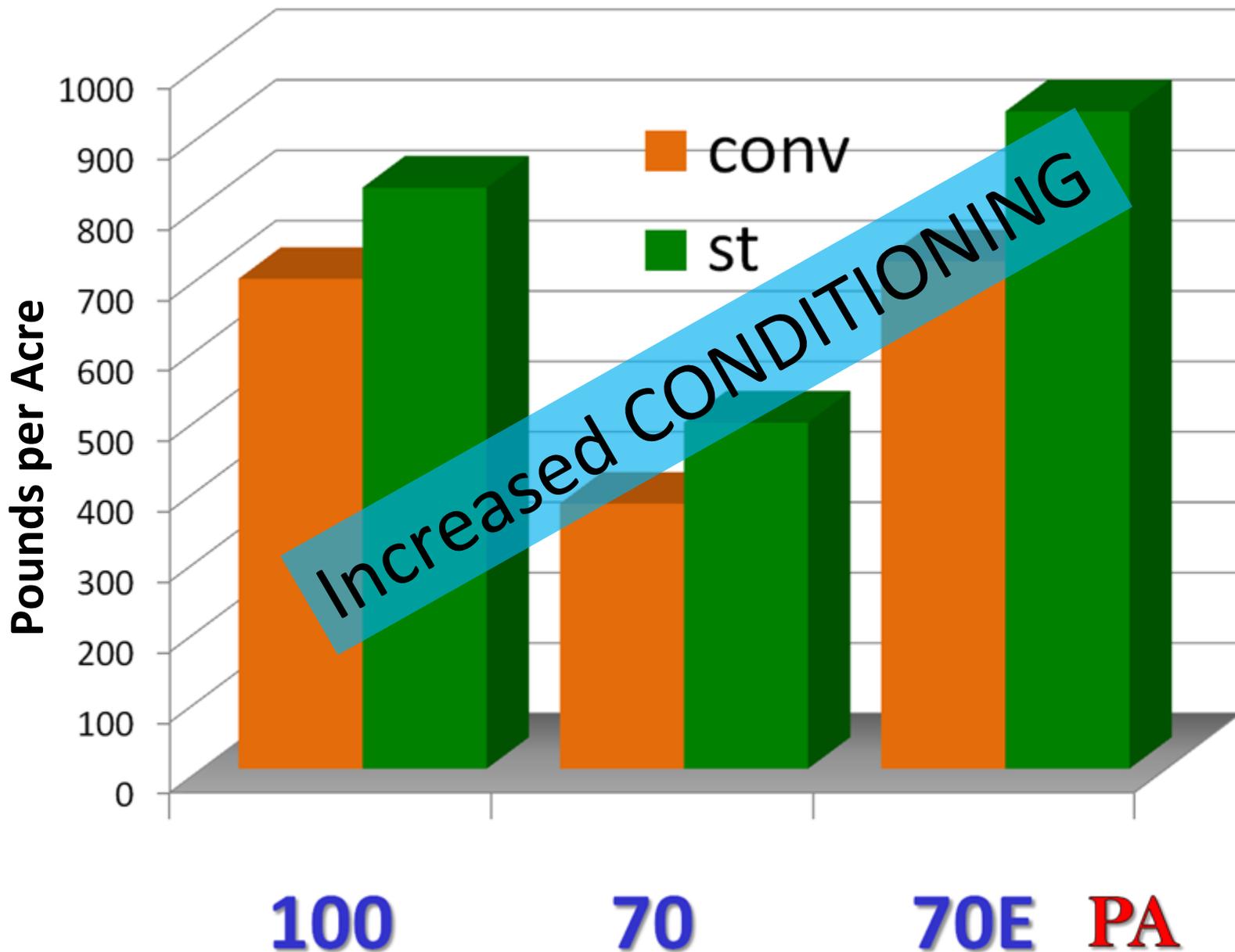






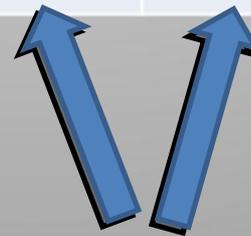


# *Cotton Lint Yield, Uvalde - 2009*



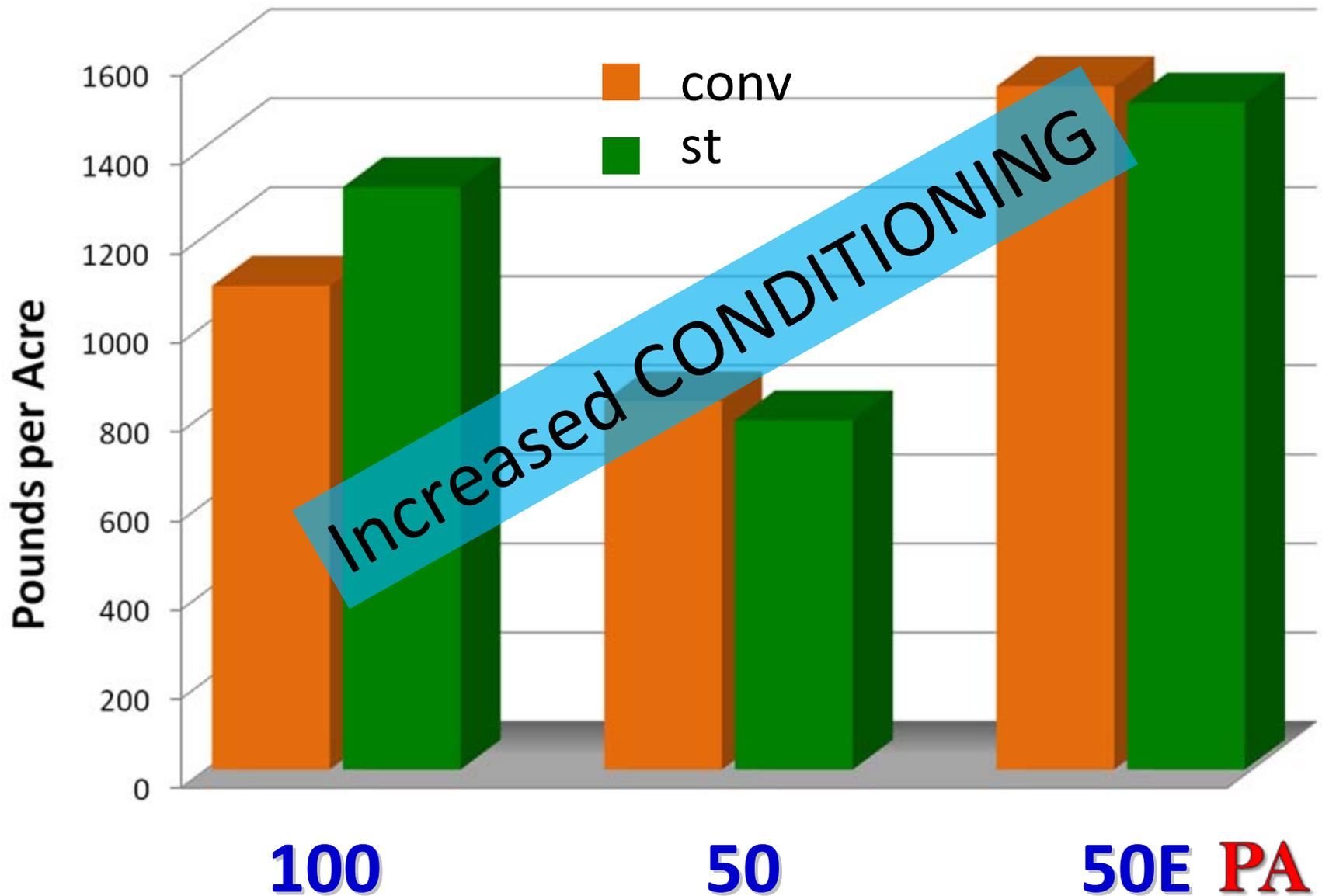
# Total water applied and received - 2009

Crop	Irrigation (inches)			Irrigation + Rain		
	70%	70E	100%	70%	70E	100%
Cotton	11.8	14.5	16.0	14.6	17.3	18.8
Corn	11.7	13.8	15.0	13.7	15.8	17.0
Sunflower	10.3	11.8	13.0	11.5	13.0	14.2



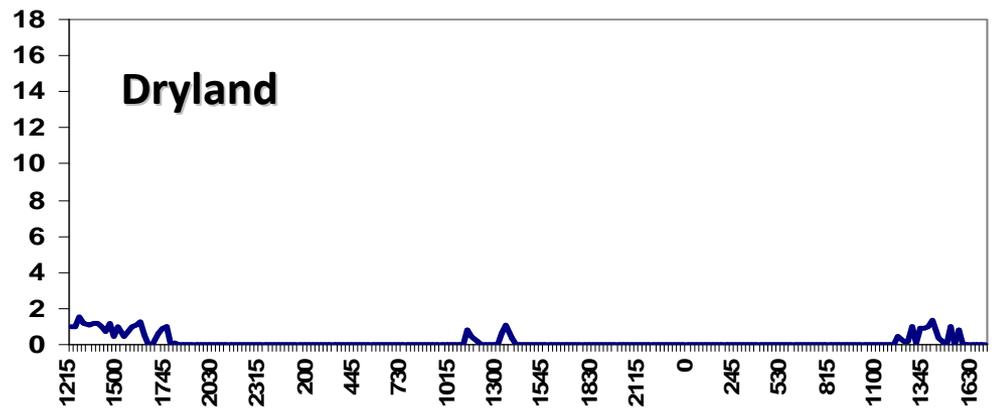
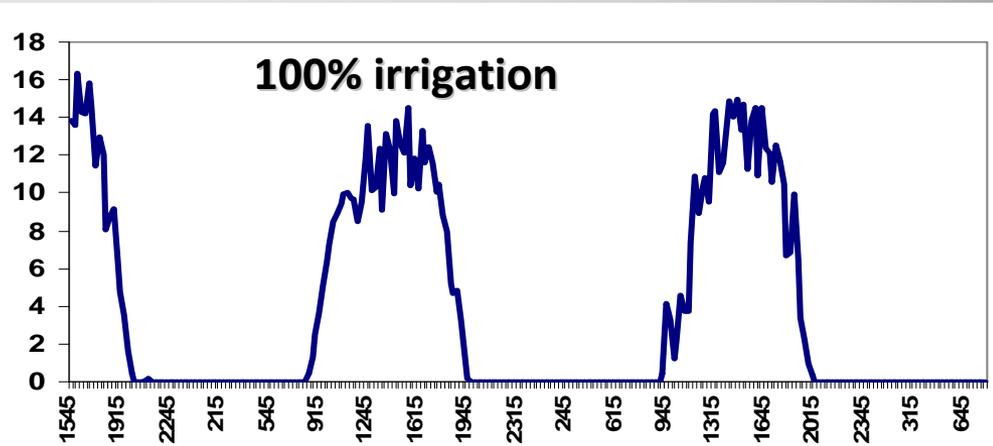
**70E (Primed Acclimation) applied 1.2 – 1.5 inches less than 100%**

# Cotton Lint Yield, Lubbock - 2009



# How is the crop **ENDURANCE?**

*Daily Water Use = Sap Flow*



# Sap Flow = Plant water-use

■ Lower water-use rates in **ST**

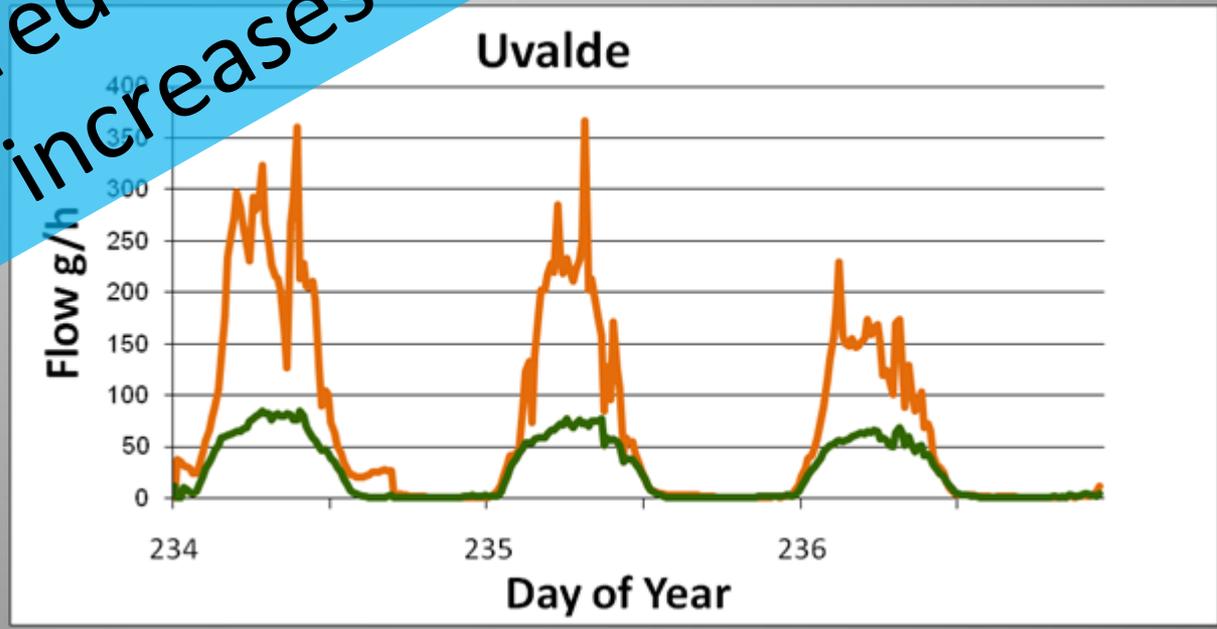
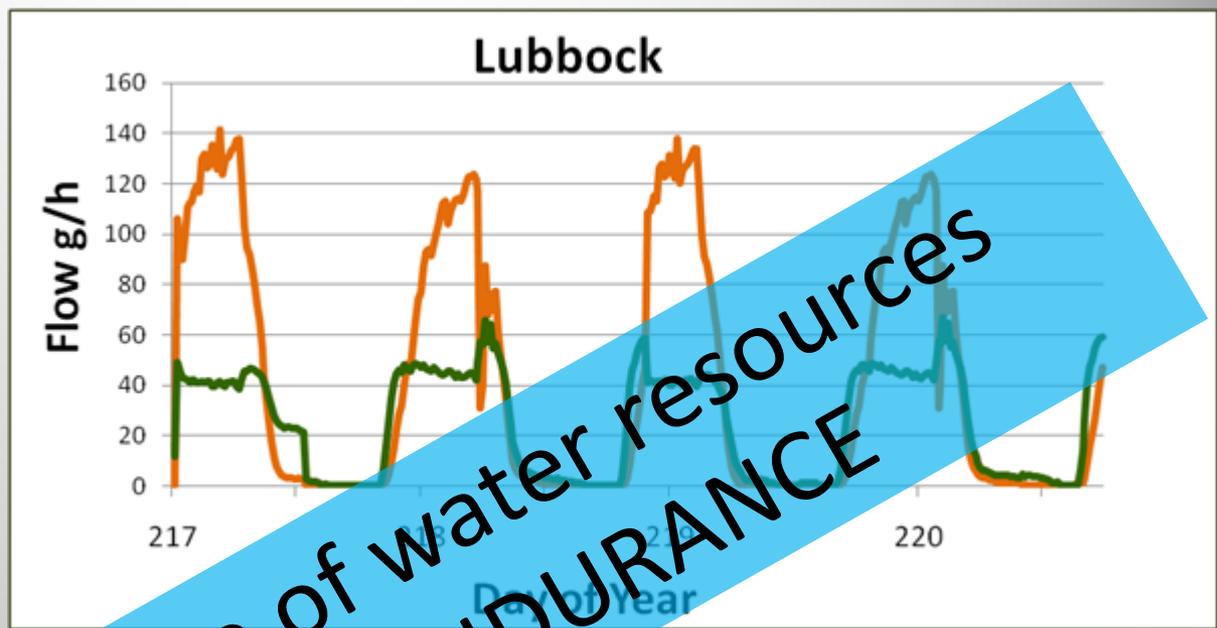
■ When combined with greater yields,

this spells **HIGH**

**WATER-USE**

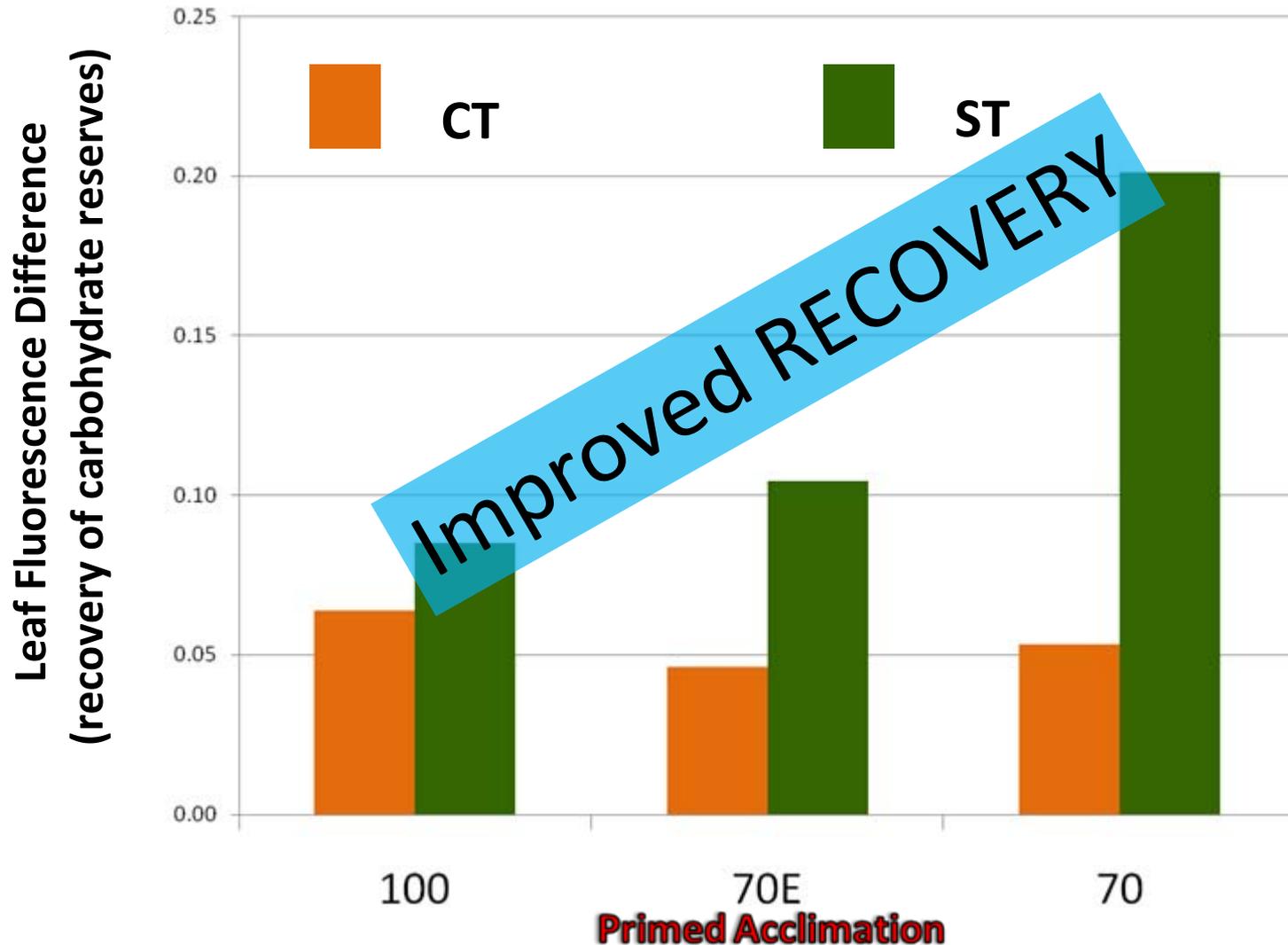
**EFFICIENCY** in

conservation tillage



Lowered use of water resources increases ENDURANCE

# Recovering from a **dry** condition – mid-season



## PA + ST mechanisms for drought tolerance:

### CONDITIONING, ENDURANCE, RECOVERY

- Yields indicate both **PA** and **ST** help increase the overall performance or **CONDITIONING** of the crop
- **PA** may be “programming” plant at the beginning of the season to stress later on – genetic defense mechanisms may be triggered
- **ST** improves the **ENDURANCE** of the crop by lowering overall daily water-use and increasing water-use efficiency
- Evidence of improved **RECOVERY** ability with **ST**; recovery mechanisms may be extremely important in drought tolerance
- *Next question: how do we schedule irrigation for the **PA** treatment? **Need to sense stress level...***

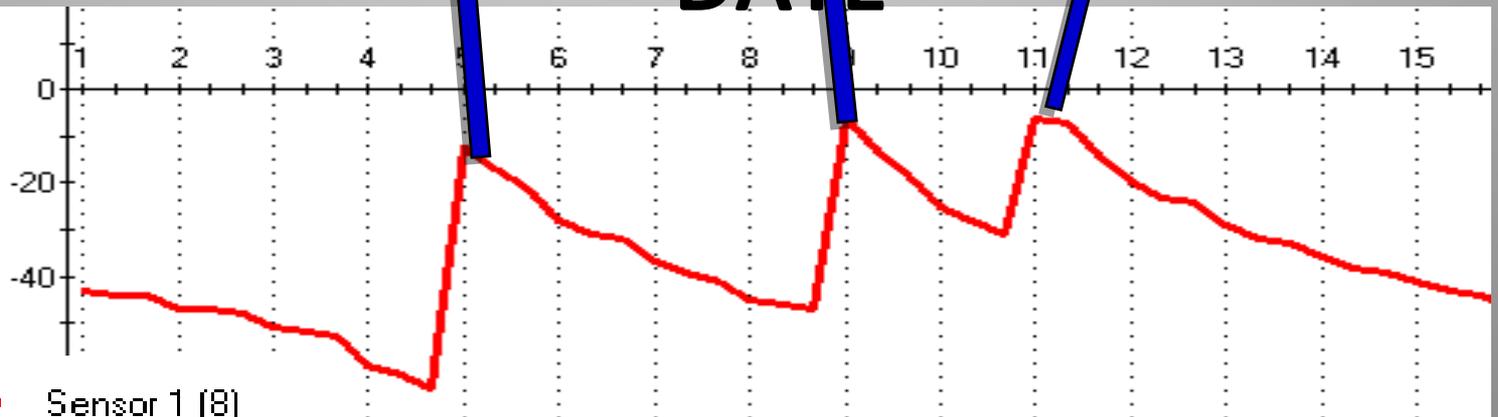
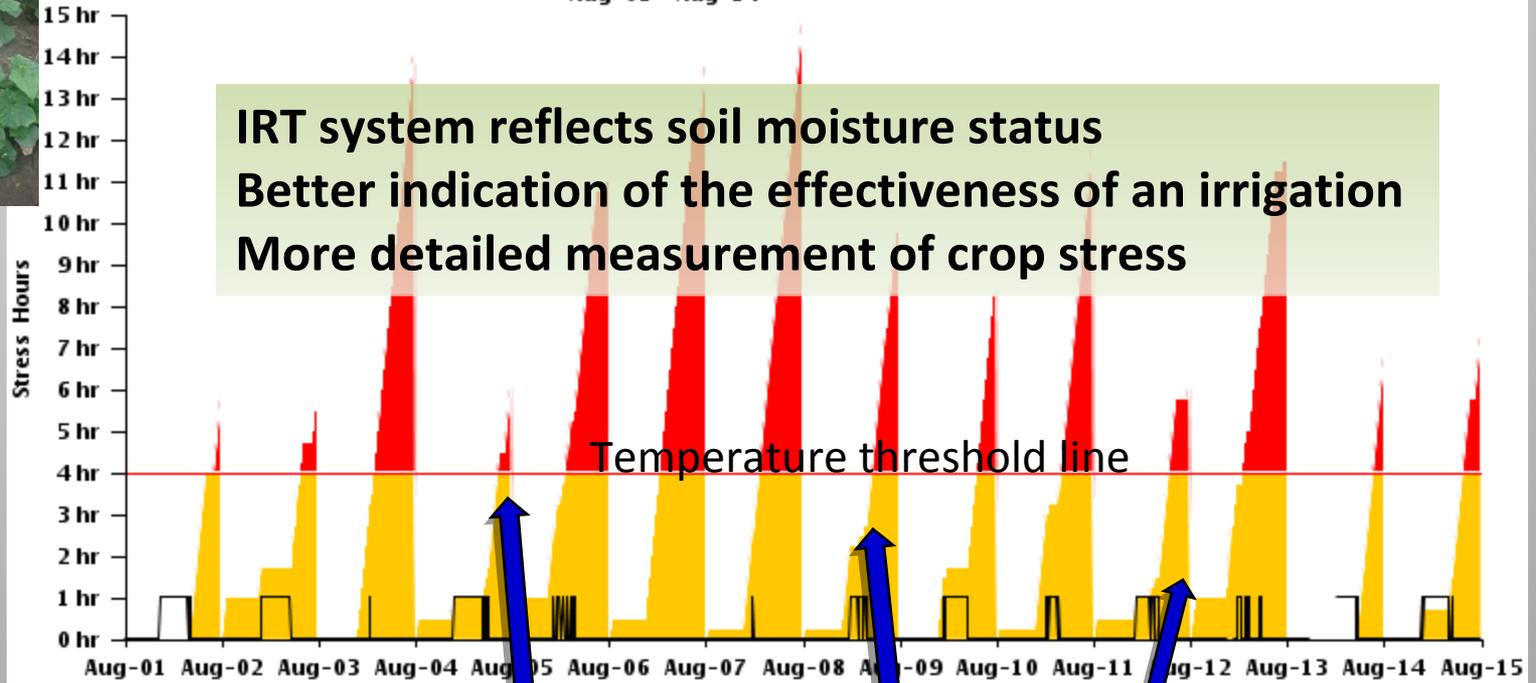
# Current Irrigation Decision Support Program – Uvalde,





Rowland #1 - Sorghum - Rowland #1  
Aug-01 - Aug-14

IRT system reflects soil moisture status  
Better indication of the effectiveness of an irrigation  
More detailed measurement of crop stress



— Sensor 1 (8)