Irrigation Management for Cotton

NC STATE UNIVERSITY

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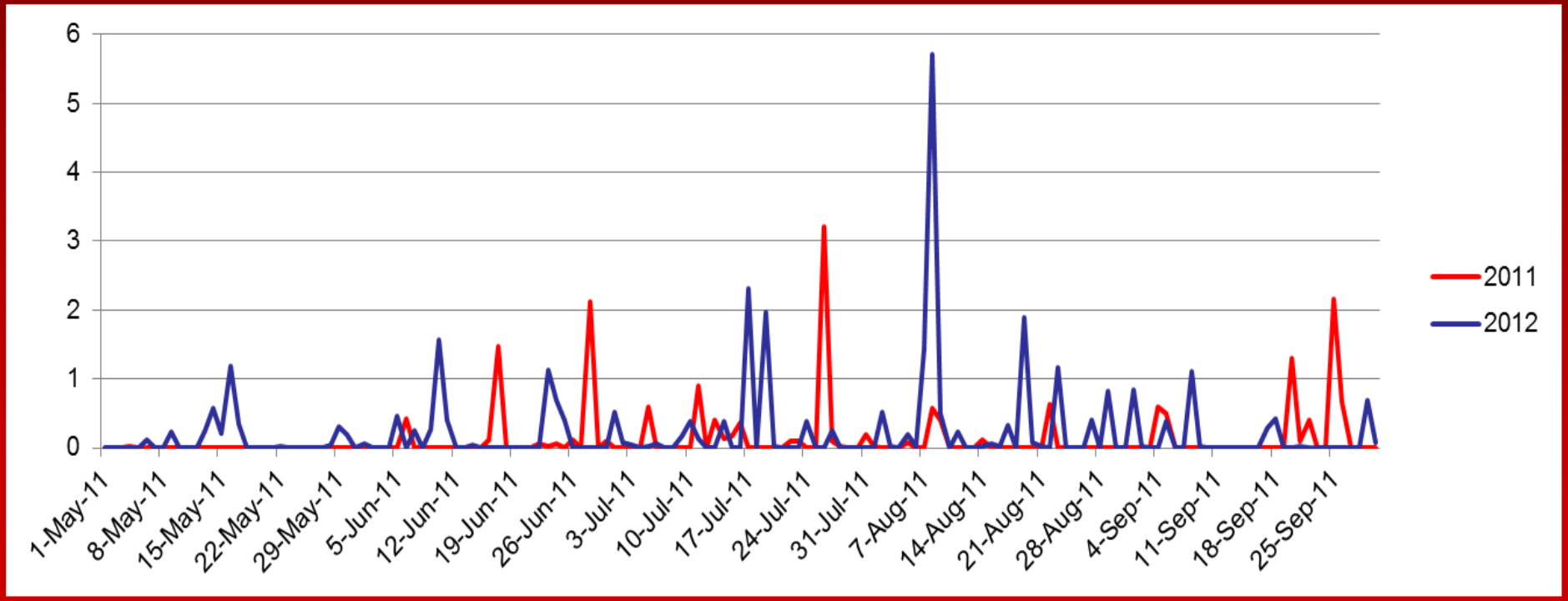
March 6-7th, 2018

Irrigation Basics

- **General Rule of Thumb = 18 inches of water required to produce a cotton crop (Bednarz)**
- **Tifton: May 1 – September 30 (2009-2012) = 23.6 inches**
  - **Range of 18.3 to 32.6 inches**



Irrigation Basics

- **Water availability affected by several factors (soil type, crop growth stage / root development, environment)**
- **Dry periods affect crop development and yield differently, depending on when it occurs, severity (compounded by heat), and longevity**
- **Crop development….when is water needed, and how much?**
- **Basics on how and when to irrigate – considerations for adjusting irrigation practices**
- **Two primary schools of thought among growers (both are false):**
  - **Cut the pivot on and let it run all year**
  - **Avoid irrigating until you absolutely have to**

Factors to consider

- **Evapotranspiration (from plants and soil)**
  - wind, temperature, humidity, rain, sunlight, crop growth stage

- **Soil water potential (determines longevity of rain events, irrigation frequency, availabity of soil water) – basis for IrrigatorPro®**

- **Irrigation is supplement to rainfall….easier to maintain than to play catch up**
  - water demands significantly higher as soon as bloom period begins
  - want an adequate soil water supply once bloom begins
  - want an adequate soil water supply when irrigation ceases
  - we are never more than 4-5 days from a severe drought

- **System efficiency**

General water requirements

- Prior to bloom – ¾ - 1 inches per week
- Bloom – 1 to 2 inches per week
- Cutout to first open boll – 0.75 inches per week

- These requirements vary depending upon soil texture / water potential, evapotranspiration (heat, sunlight), crop condition, etc.

- Increase rates in sandy soils, runoff situations, hot dry forecast (June-Aug), rapid wilting during bloom

Year	Rainfall	Rainfall + Irrigation	Non-Irrigated Yield	Irrigated Yield
	---------- in ----------		---------- kg/ha ----------	
2001	8.6	13.8	900	1140*
2002	13.0	18.5	515	1010*
2003	18.9	24.4	941	952
2004	24.9	31.8	1030	1131
2005	12.2	18.3	952	1456*
2006	19.5	27.8	907	963
2007	11.5	21.3	521	1138*
2008	13.8	25.2	432	935*
2011	19.9	39.1	538	898*
2012	18.1	26.7	1529	1622
2013	19.8	21.8	1605	1671
2014	26.5	33.3	1299	1238
2015	12.9	25.6	534	1054*
Mean	**16.9**	**25.2**	**900**	**1170**

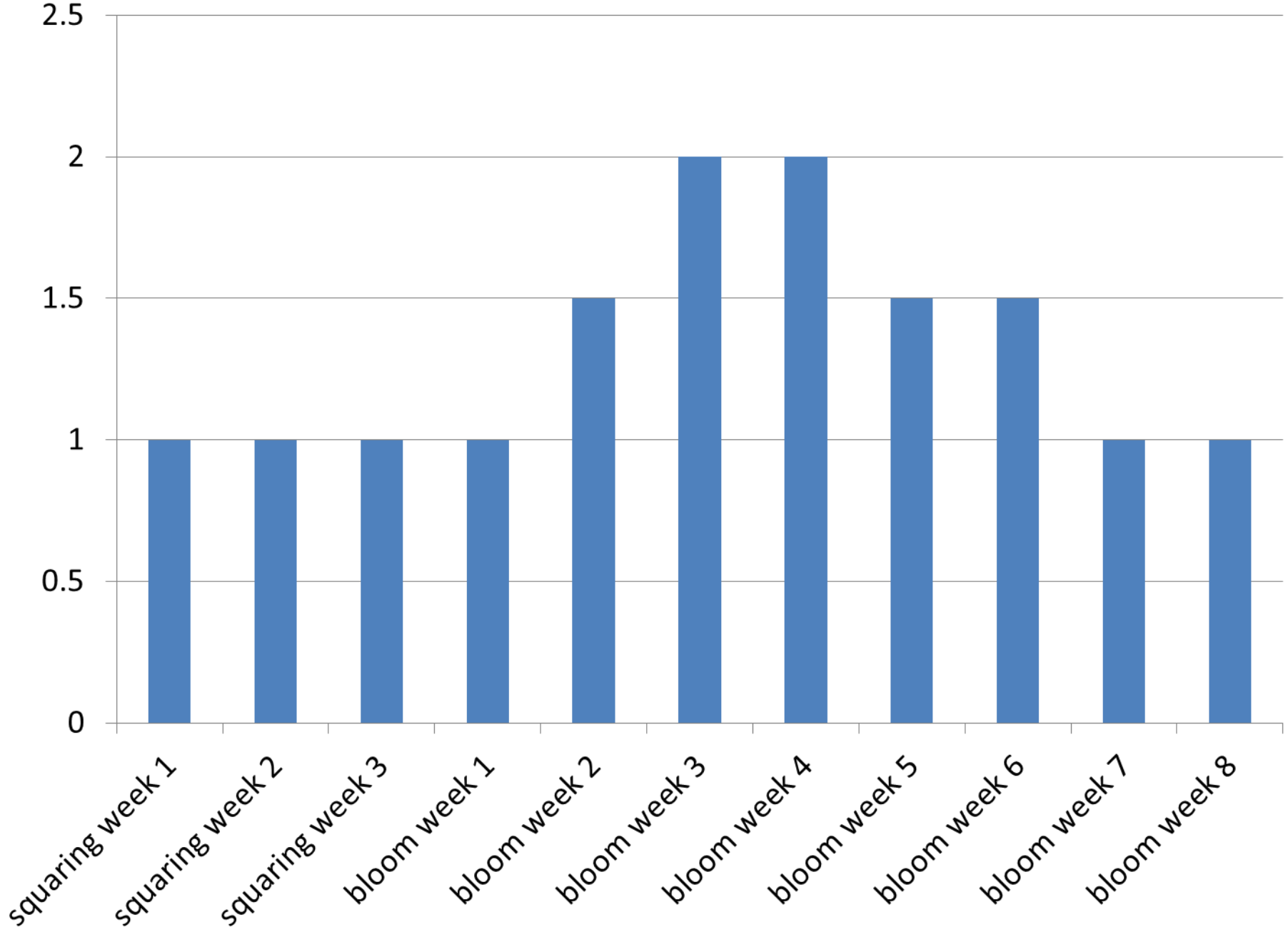
*Significance at $p \leq 0.05$ within each year

Edmisten, 2016

Summary

- Response to irrigation 54% of the time
- Increase due to irrigation averaged 270 pounds lint/acre
- Increase due to irrigation averaged 463 pounds lint/acre in the 7 out of 13 years with statistically significant response to irrigation
- Lint yield of irrigation was only numerically lower in 1 of 13 years

100 % UGA Checkbook (in/week)



Irrigation Considerations

- Know efficiency of irrigation system (60-95%) and soil water holding capacity (0.6-1.8 inches per foot)
  - High pressure Impact sprinklers (75-85%), Low pressure Spray sprinklers with drop hoses (90-95%) (Vellidis 2014), travelling gun = 50%...maybe 60% (Bednarz)

Soil series / texture

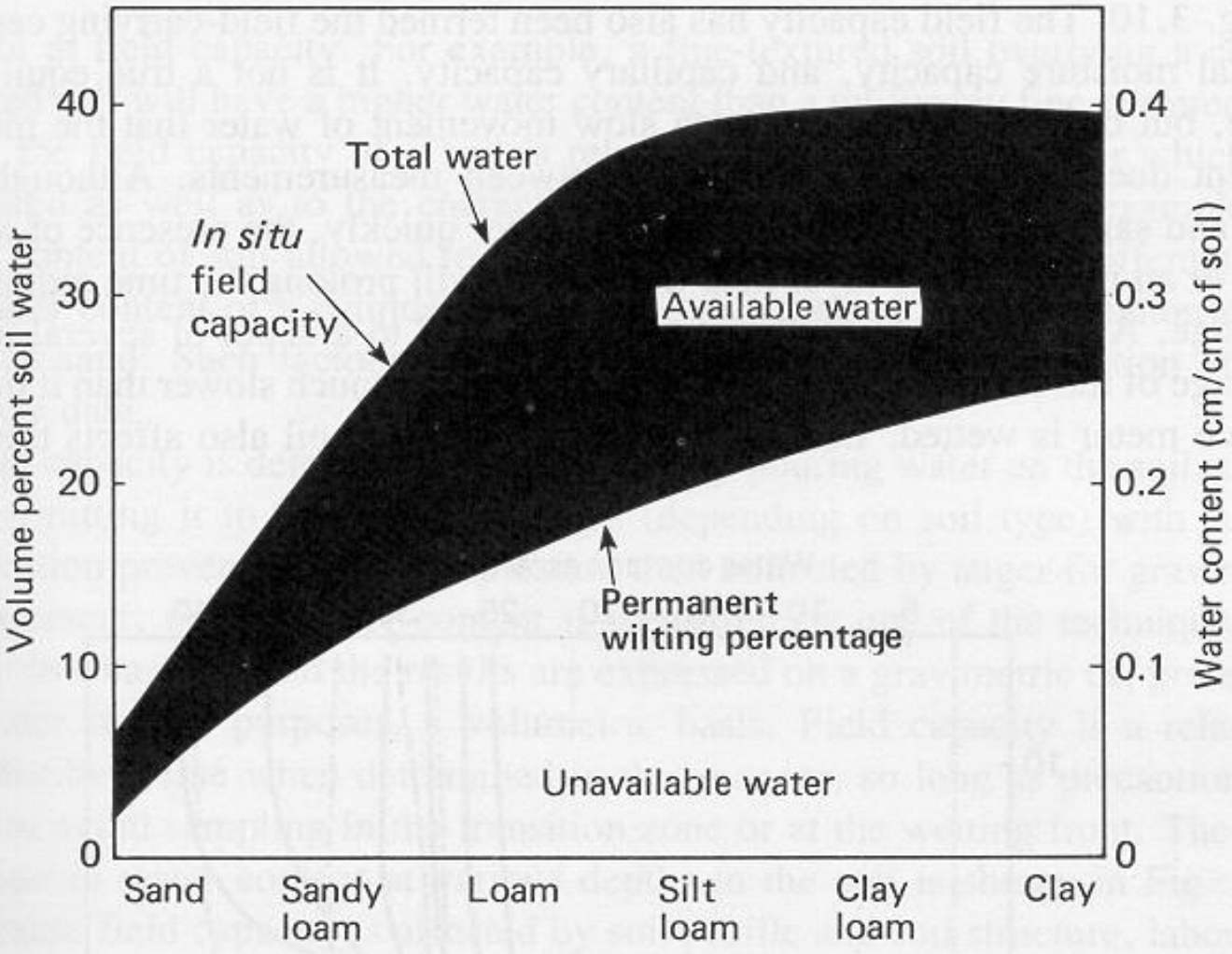


Fig. 3.9. Diagram showing the relative amounts of available and unavailable water in soils ranging from sand to clay. Amounts are expressed as percentages of soil volume and as centimeters of water per centimeter of soil. (From Cassell, 1983.)

Bednarz

Bednarz

Irrigation Intervals

- Sandy – 3 to 4 days
- Sandy loam, loamy sand, loam – 4 to 6 days
- Fine sandy loams, clay – 5 to 8 days

- Intervals vary depending upon soil texture / water potential, evapotranspiration (heat, sunlight), crop condition, etc.
- Irrigator Pro®

(2010 Cotton Production Guide)

Calvin Perry, 2015

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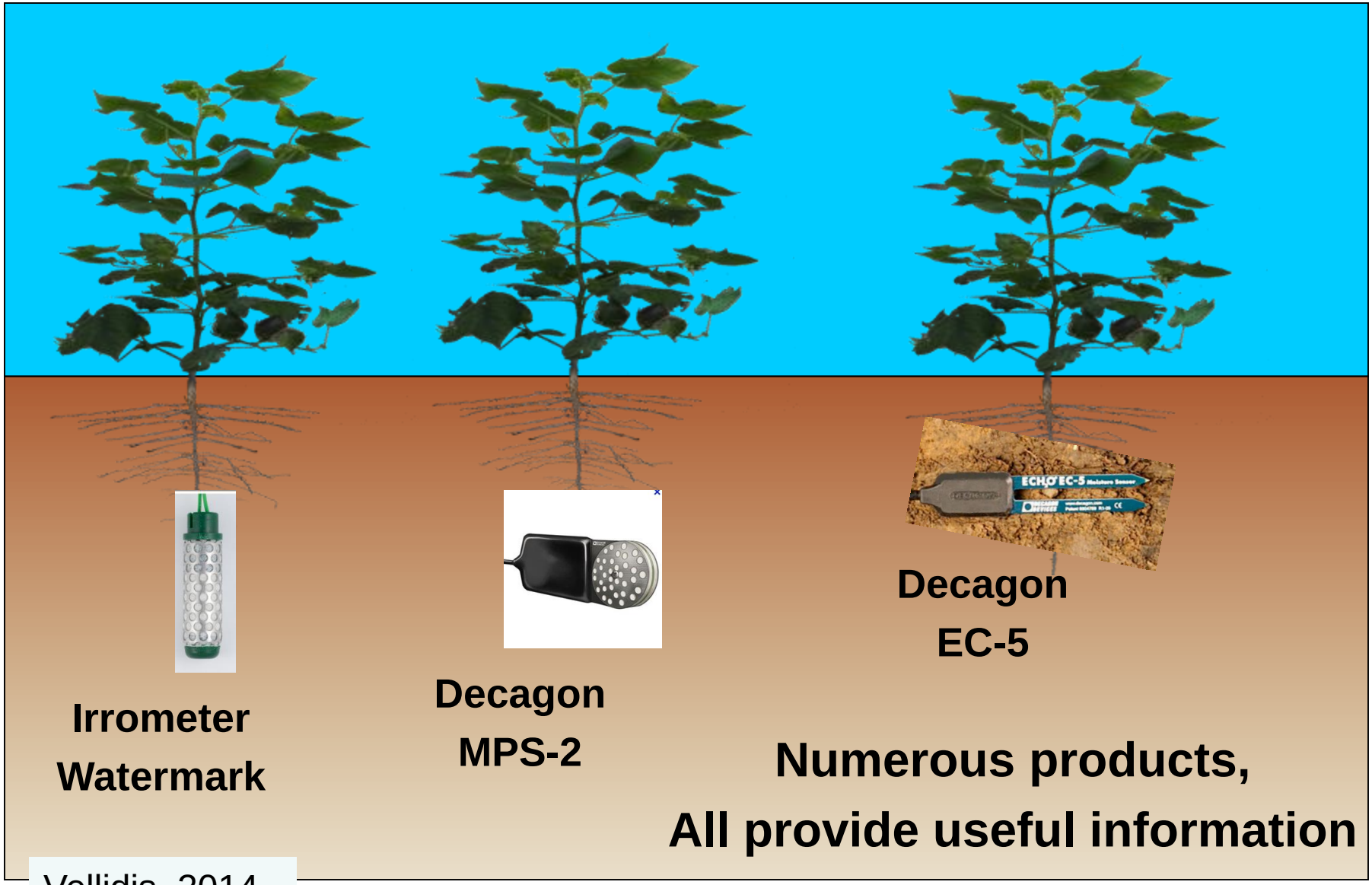
- Keep close track of growth stages
  - 1st square
  - 1st bloom
  - 1st open boll (length of bloom period may vary)

- Utilization of sensors in concert with weekly checkbook
  - Adjust for soil type and retention of moisture (20-60 kPa) (Vellidis, 2014)
  - Account for rainfall….when to resume irrigation
  - Quantify when stress may be encountered
    - ET, Heat, boll demands, etc
    - Wilting indicates you are WAY too late

Soil Moisture Sensors



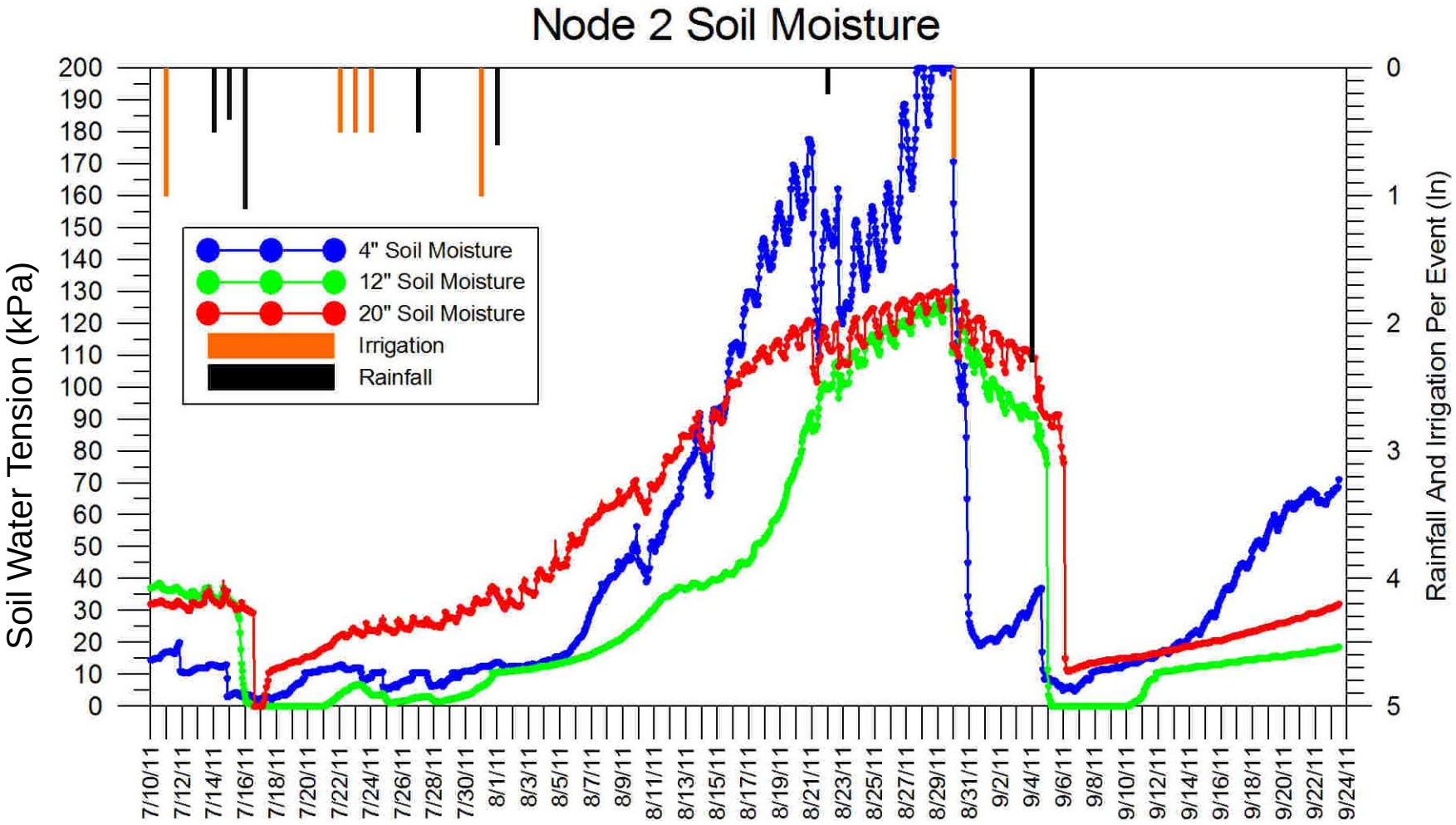
Irrometer
Watermark

Decagon
MPS-2

Decagon
EC-5

Numerous products,
All provide useful information

Vellidis, 2014

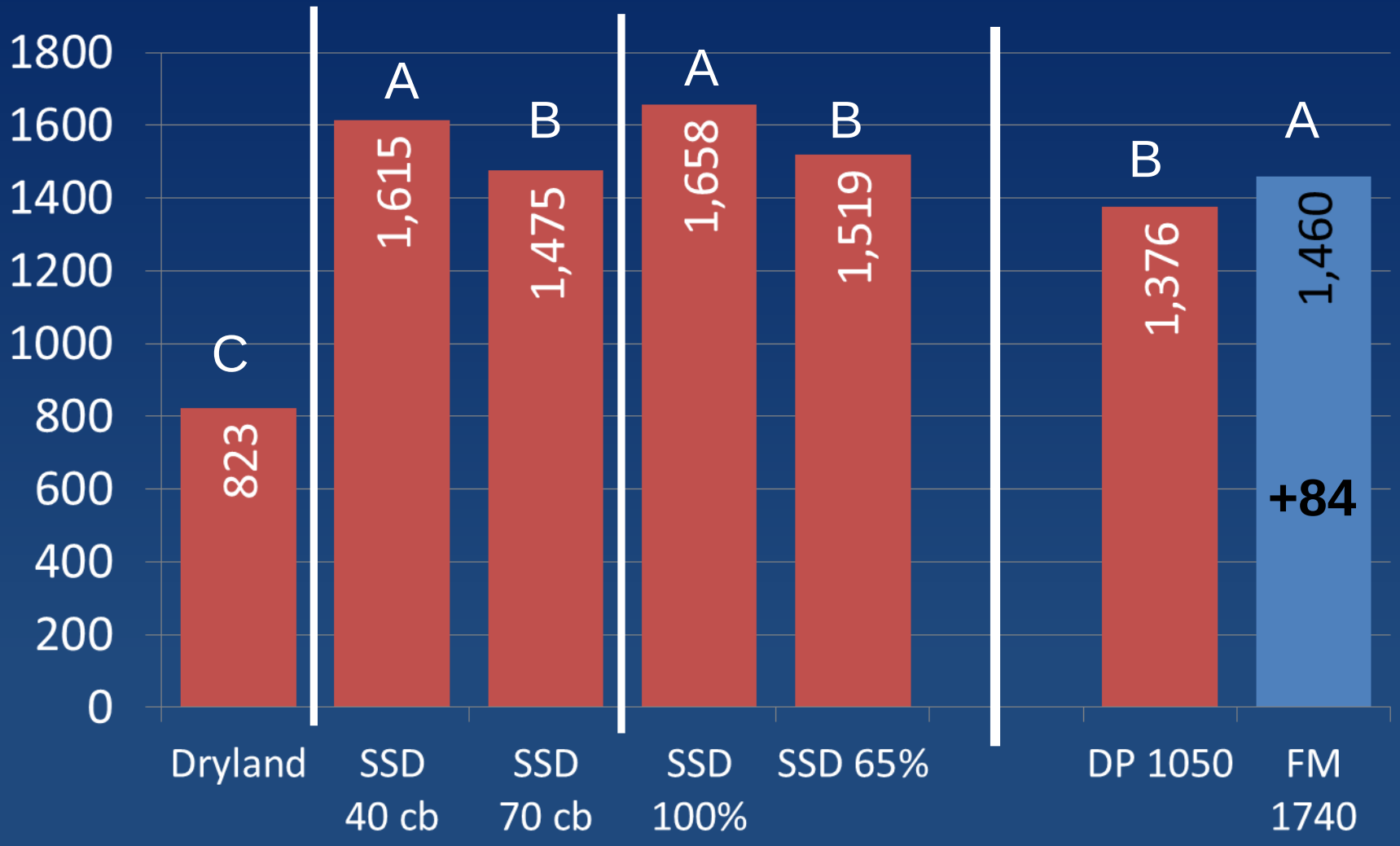


Vellidis, 2014

Irrigation Considerations

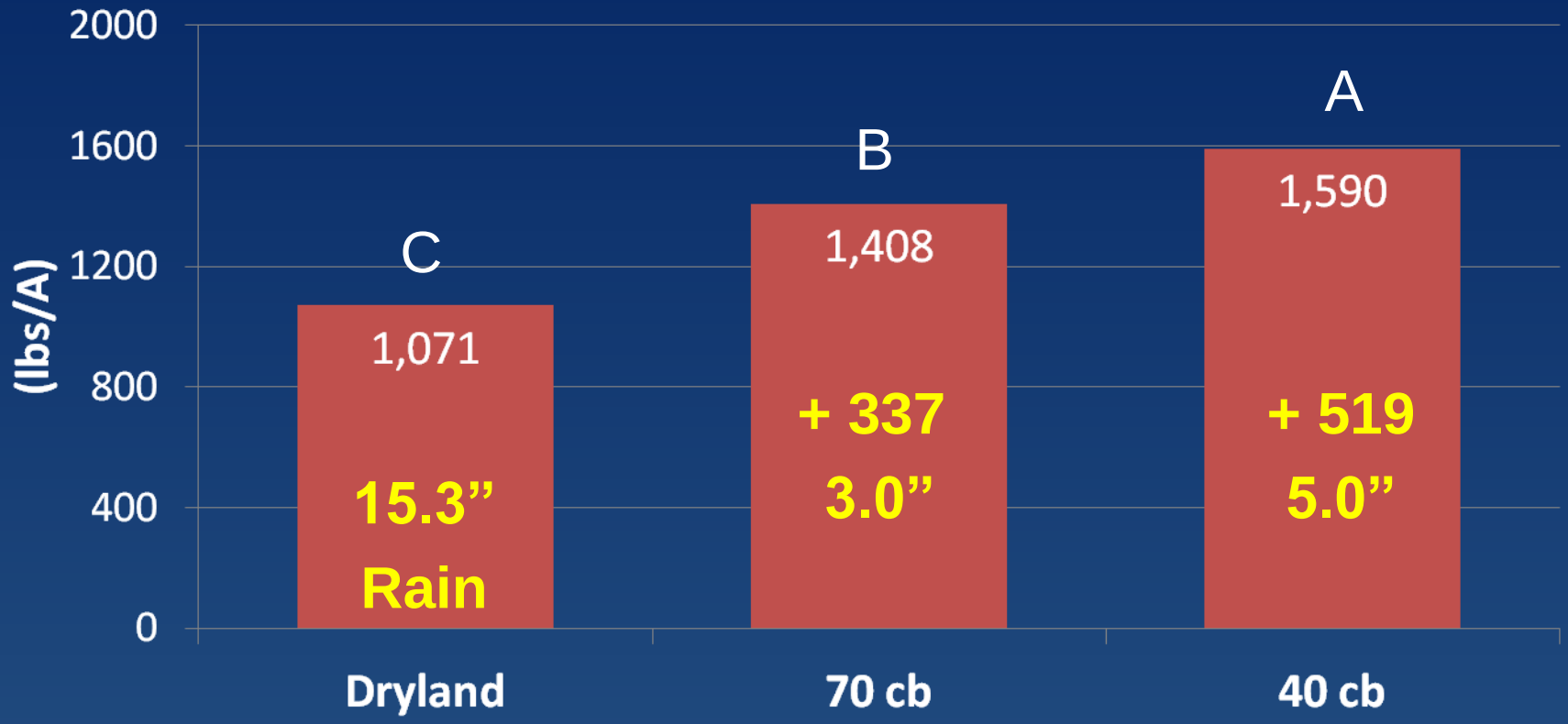
- Split apply weekly rates into 2-3 applications
  - System capacity and time required for application
  - Adjust for rainfall (any meaninful rainfall > 0.2-0.3 inches)
  - Soil uptake, runoff, slope, depth to subsoil
  - Prevent complete depletion of soil moisture
  - Short-lived drought can have significant negative effects on yield

Lint Yield (lbs/A)
(averaged across locations)



Sensor Trigger Effect on Lint Yield – Camilla 2011

Overhead Irrigation (averaged over varieties)



Irrigation increased yields 337 – 519 lbs

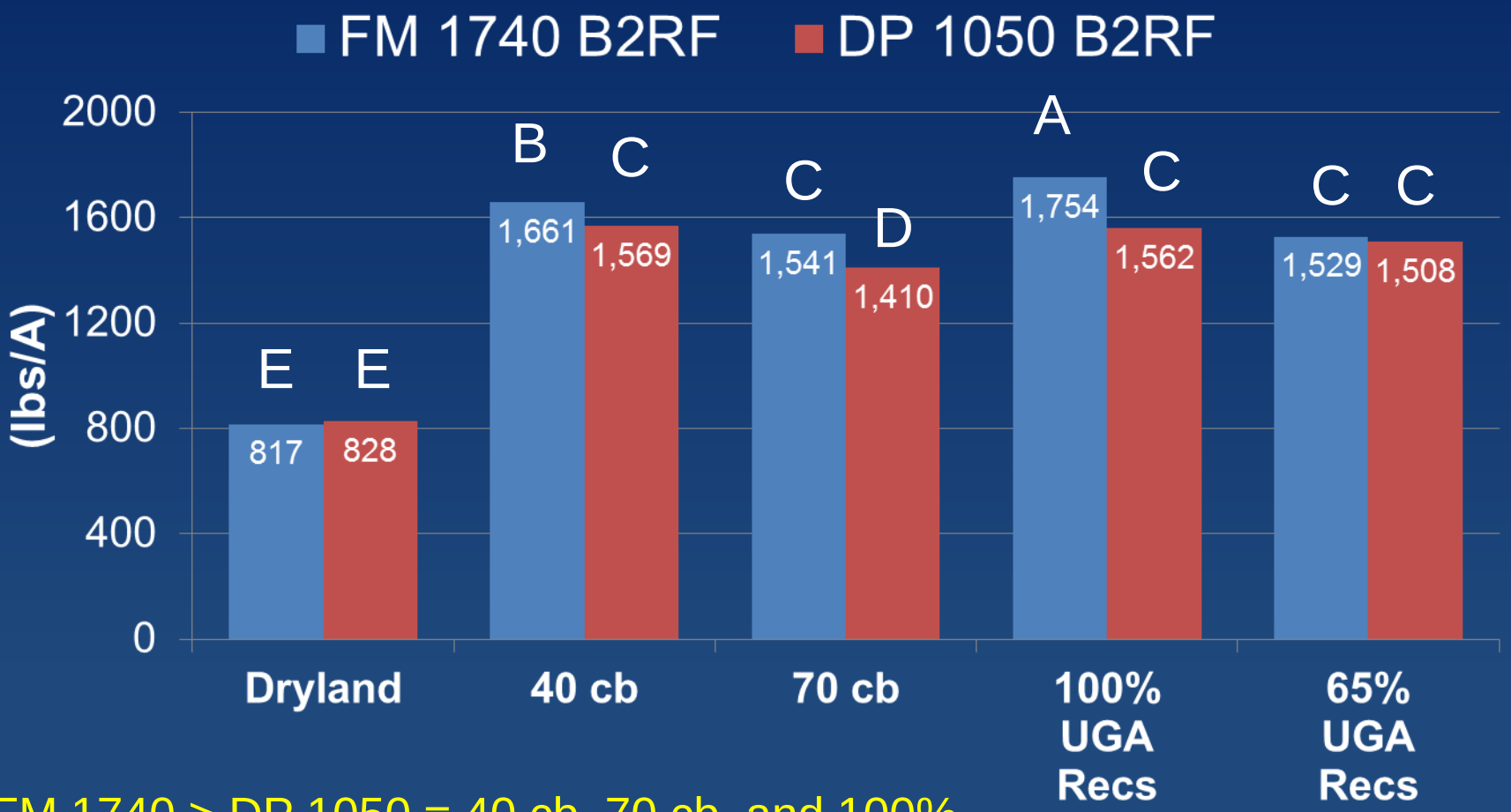
40 cb > 70 cb = 182 lbs/A

91 lbs/A per additional inch of irrigation

SDI -40 cb vs 100% CHBK

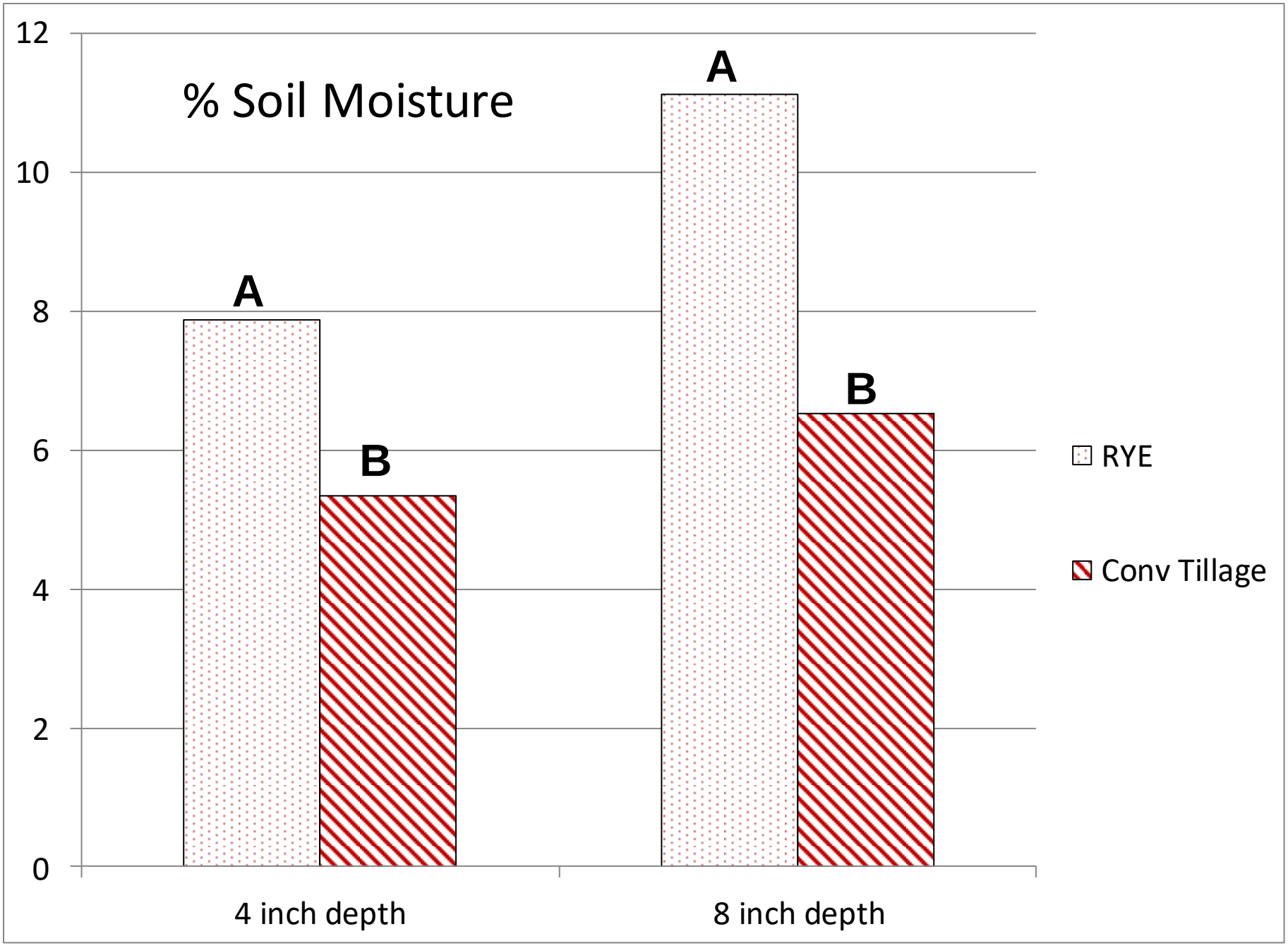
- 0.1 to 44 % water savings in 2011
  - 0.1 to 3.2 inches
- 51 to 60 % water savings in 2012
  - 2.2 to 4.6 inches

2011 Lint Yield
(averaged across locations)

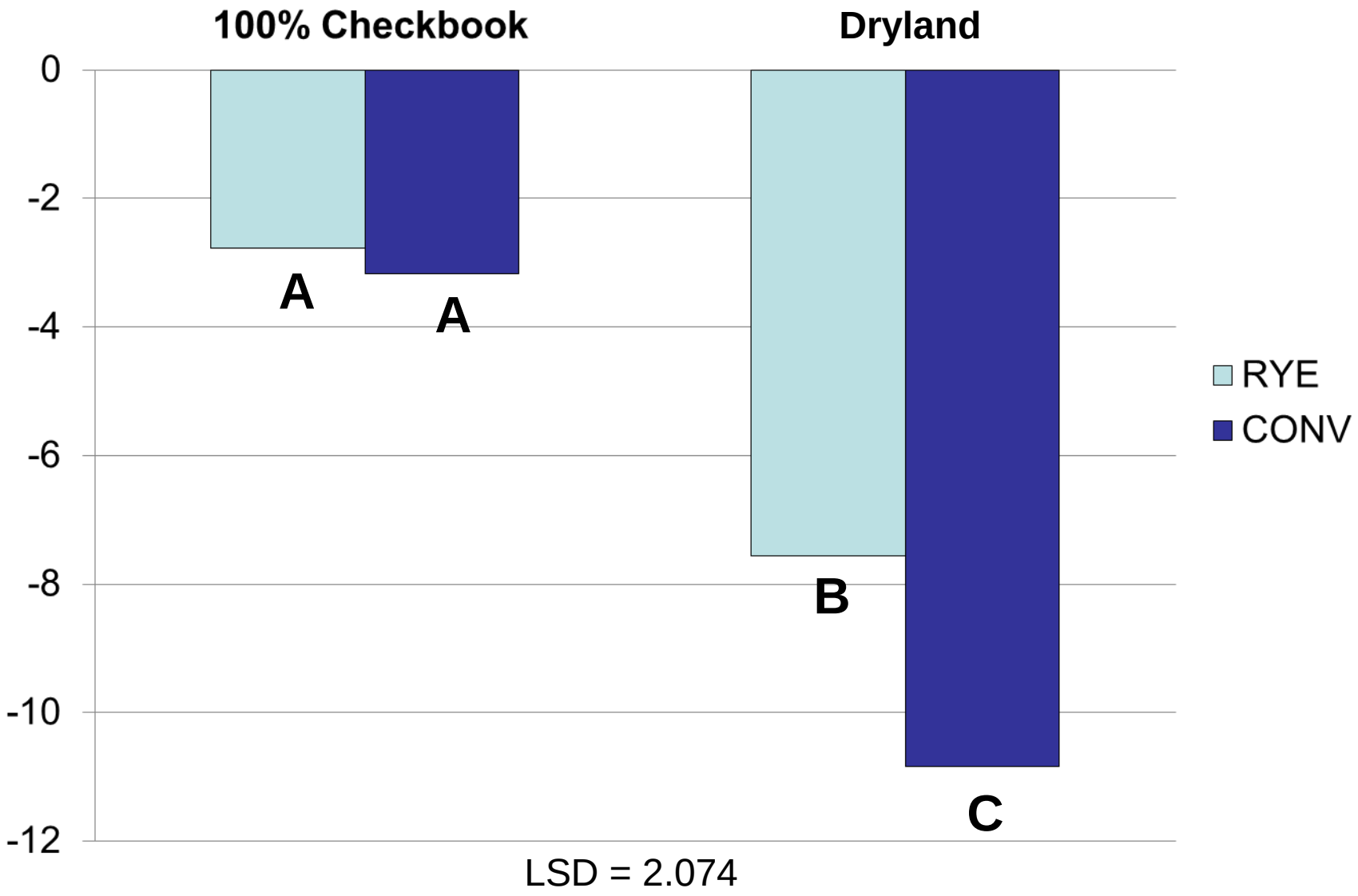


- FM 1740 > DP 1050 = 40 cb, 70 cb, and 100%
- FM 1740 = DP 1050 = dryland, 65% UGA recs.

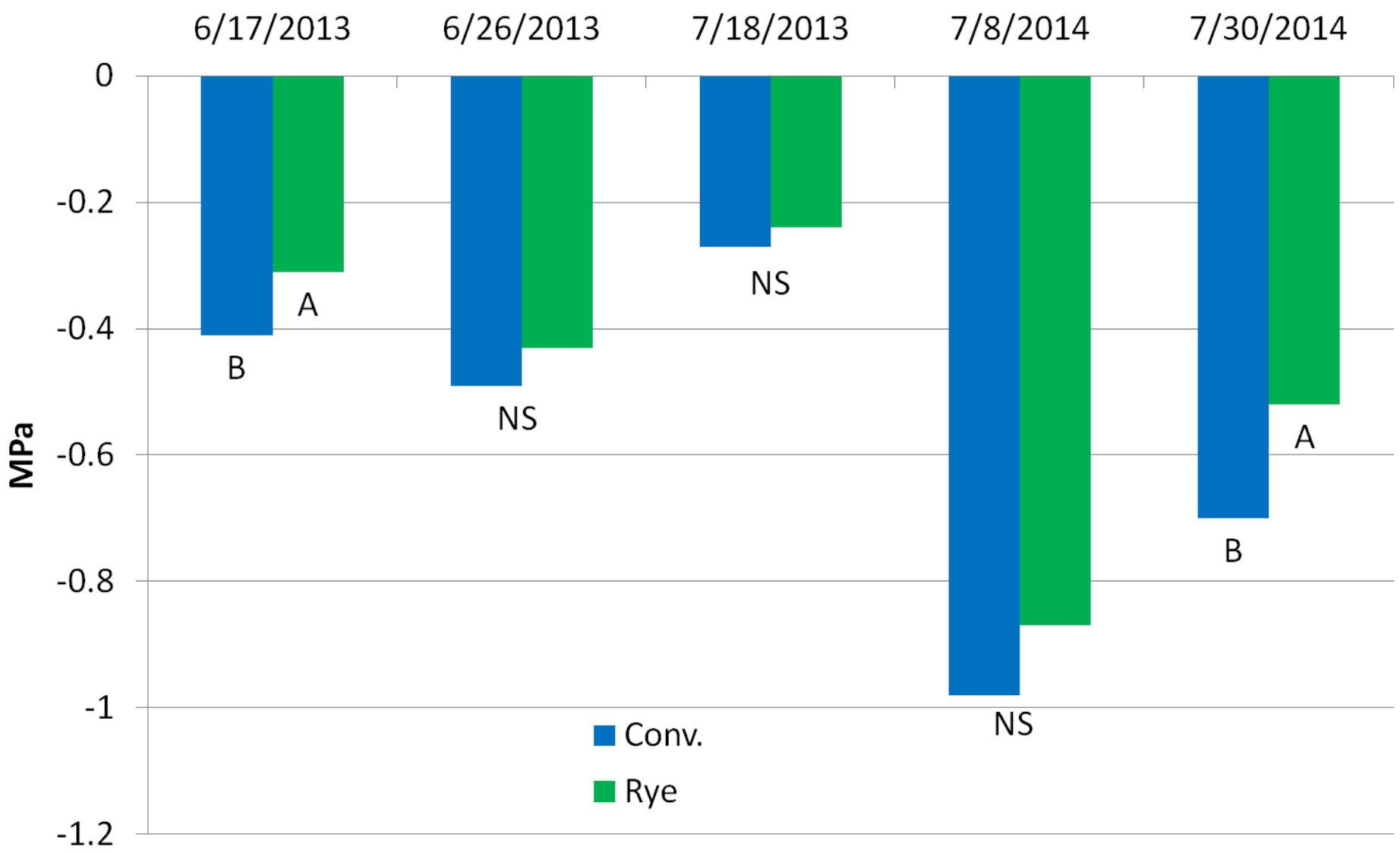
Using Heavy Rye Covers For Sustainability


% Soil Moisture
12
10
8
6
4
2
0
A
B
A
B
4 inch depth
8 inch depth
RYE
Conv Tillage

Predawn Water Potential



Predawn Leaf Water Potential



Cotton Irrigation Management for Humid Regions

Cotton Incorporated

Cotton Irrigation Management for Humid Regions

http://www.cottoninc.com/fiber/AgriculturalDisciplines/Engineering/Irrigation-Management/

http://www.cottoninc.com/fiber/AgriculturalDisciplines/Engineering/Irrigation-Management/cotton-irrigation-web.pdf

Resources for You

Cotton Portal Website: http://cotton.ces.ncsu.edu/

NC Variety Calculator: https://trials.ces.ncsu.edu/cotton/

Facebook:
North Carolina Cotton
facebook.com/groups/344058599029946

Twitter:
List: NCSU Cotton
Keith Edmisten: @NCcotton
Guy Collins: @Cotton_Guy
Dominic Reisig: @DominicDReisig