EVALUATION OF IRRIGATION PRACTICE: COMPARING SUB-SURFACE DRIP IRRIGATION TO TRADITIONAL METHODOLOGIES IN ARIZONA AND TEXAS USING JOHN DEERE FIELD CONNECT

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Abstract

Fields in Arizona and West Texas were identified, and sub-surface drip irrigation (SDI) was installed for the purposes of comparing irrigation practices. In West Texas, SDI was compared to standard pivot irrigation. In Arizona, SDI was referenced to traditional furrow irrigation. John Deere Field Connect was used to evaluate the effectiveness of the irrigation practices. Additionally, in season measurements including plant status, yield, crop quality, fertilizer and water use were evaluated over the course of the season.

Introduction

As water becomes more scarce in certain regions of the cotton belt, the ability to manage soil moisture in a way that optimizes production will become essential. Productivity per unit of water will require more advanced methodologies over time. The purpose of this work is to compare commercially produced cotton irrigated by pivot or furrow that is managed by the producer's standard practice to subsurface drip irrigation (SDI) that is managed with input from John Deere Field Connect in the Texas high plains and Arizona.

Measurements and Methods

Two adjacent fields were used having uniform soil type, slope, and environmental conditions separated only by a field road to compare SDI and pivot or furrow irrigation in West Texas and Arizona. In season observation of plant height & uniformity, number of reproductive branches, NAWF (nodes above white flower), and NACB (nodes above cracked boll) were made at the appropriate crop timing. In addition, measurement of irrigation water use by field in acre inches was made. Yield was taken commercially in pounds of seed cotton per acre.

John Deere Field Connect was used to monitor soil moisture levels throughout the season with systems installed in both compared fields. Data were evaluated a minimum of twice weekly and results used to manage irrigation in the SDI fields. In the pivot or furrow fields, John Deere Field Connect data were used were to monitor but not to manage the irrigation.

Results

In west Texas, early season rains and cool weather resulted in a delay in planting until early June but each field was planted on the same day. In AZ, the furrow field did not provide an acceptable comparison for the SDI field. Further reference to the SDI field in AZ will be to compliment trends shown in the West Texas SDI field.

Monitoring results are summarized in the table below for the west Texas SDI and pivot commercial comparison.

Crop Measurements	SDI	Pivot
Plant Height Range **7-30-13** **10-9-13**	 25 to 27 inches 36 to 40 inches	 18 to 27 inches 24 to 30 inches
Number of Repro. Branches **8-27-13** **10-9-13**	 10 to 12 8 to 12	 7 to 9 7 to 9
Nodes Above White Flower (NAWF) **8-27-13**	1 to 2	1
Nodes Above Cracked Boll (NACB) **10-9-13**	5 to 7	0 to 3

Most notable was the uniformity of the crop and superior size of the SDI crop versus the pivot. The SDI crop consistently had a larger number of reproductive branches by mid to late season than the pivot grown crop. The bolls on the lower portion of the SDI irrigated plants were maintained season long with many of the plants producing a boll at the first square position.

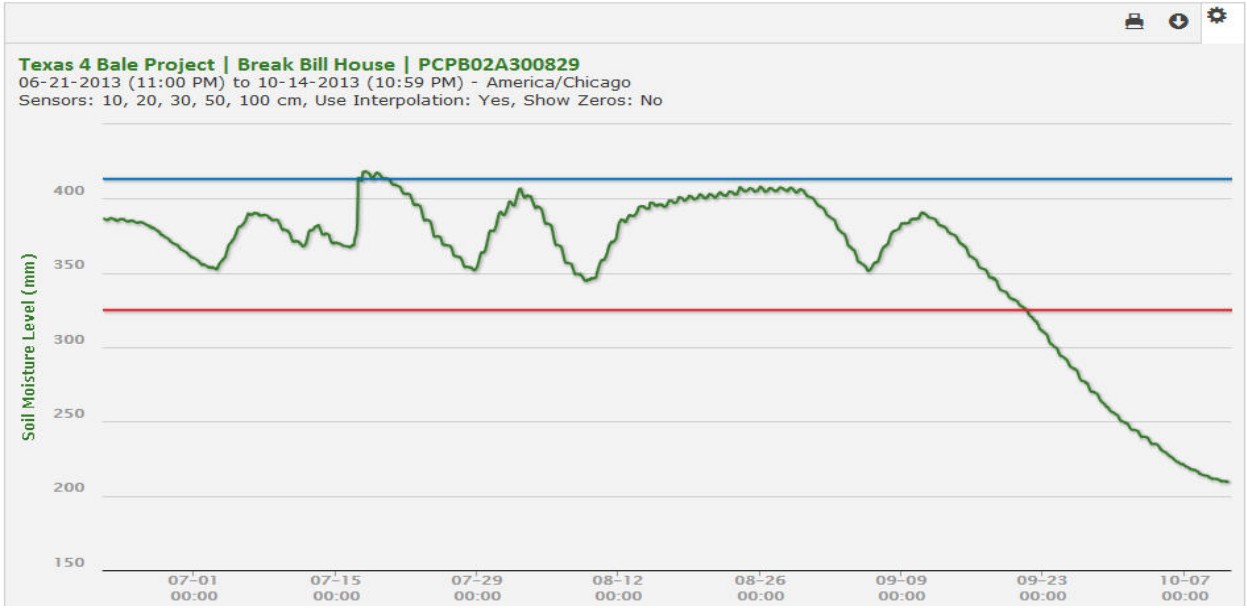
Results for yield and water use are:

Irrigation Type	Yield/Acre (seed cotton)	Bales/Acre	Total Irrigation water Applied (Acre Inches)	Irrigation WUE (Acre Inches/Bale)
SDI	1800	3.6	18	5.0
Pivot	1400	2.8	24	8.5

Yields were higher in the SDI field by approximately **22%** over the pivot. The amount of water used to produce the crop in the SDI field was reduced by **25%** versus the pivot field. The improvement in WUE with SDI using 5.0 acre inches per bale versus 8.5 with pivot irrigation. This represents a reduction in water use per bale of **41.2 %.**

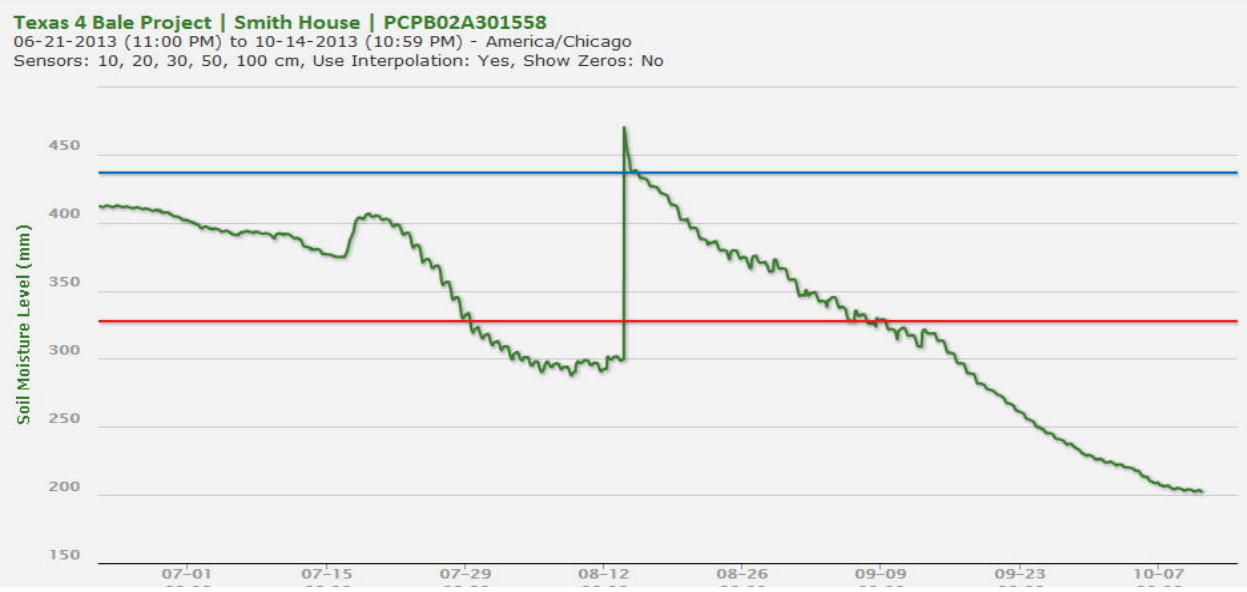
The John Deere Field Connect graphs for each field are shown below:

SDI



FC graphs indicate that SDI irrigations maintained soil moisture in the desirable range of readily available soil moisture without causing stress from low or excess moisture. In addition, during irrigation events water did not move through the lower part of the soil profile below 40 inches.

PIVOT



The FC graphs indicate that producer managed Pivot irrigations allowed the soil moisture level to drop below the refill line reducing the availability of soil moisture needed by the plant at a critical midseason timing. The corrective irrigation event resulted in excess moisture moving through the soil profile at 40 inches and slowed the uptake of moisture for approximately 24-48 hours due to excess water needed to refill the profile.

Summary

Irrigation with SDI managed using John Deere Field Connect data proved very effective compared to traditionally managed pivot irrigation in West Texas cotton. The SDI irrigated crop demonstrated improved plant growth and structure, crop uniformity, higher yield and improved water use efficiency. The use of Field Connect to monitor and provide management data resulted in irrigations that maintained moisture within the soil root profile without leaching which is highly desirable environmentally. Results from the Arizona SDI Field Connect managed system also demonstrated similar trends to those in West Texas, particularly, those of crop uniformity, improved growth and water use efficiency when compared to historic furrow fields.