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TIMELY INFORMATION

Agriculture & Natural Resources

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2009-2010 Subsurface Drip Irrigation (SDI) Report – WREC Corn

General Description

A sub-surface drip irrigation (SDI) demonstration was installed on the Wiregrass Research Center in Headland, Alabama in late spring/early summer 2009. The site has slightly rolling topography with one or two terraces and is visible from State Highway 134. Growers will be able to visit this location throughout the year and see how subsurface drip irrigation works on the light sandy soils of Southeast Alabama. Six plots, each 950 feet long by 48 feet wide, were established for a three year irrigated and rainfed (dry land) rotation of corn, cotton, and peanuts. The six plots are grouped into three, 2-plot blocks. Each block has a 16 row rainfed (dry land) plot and a 16 row irrigated zone. Each irrigation zone has 15 mil drip tape lateral buried between every other row at 15 inches deep (eight drip laterals per irrigation zone). John Deere Auto Steer was used during installation to allow future drip tape location. With 0.26 GPH emitters spaced every 2' along tape length, design tape flow rate was 0.0022 GPM/foot. Each 1.07 acre irrigated zone requires 16.81 GPM (15.73 GPM/acre). Irrigation water is supplied by a 3-hp submersible pump with pressure tank control, installed in a farm pond approximately 1/2 mile from the site. A 2-inch time and pressure automatic cleaning filter provides clean water to the three irrigated zone control heads. An irrigation controller for zone control, a Watermark Monitor with Watermark soil moisture sensors, and a tipping bucket rain gauge were installed. A low power field radio was connected to the Watermark Monitor to allow remote reading of received rain, soil moisture, and irrigation operation from a desktop computer located in the WREC offices about 1200 feet away. MoisMis2020, an Xcel-based irrigation scheduling program using crop growth curves, rainfall, and Watermark soil moisture feedback was to be used to schedule irrigation for the three crops.

This publication reports on rainfall, irrigation, and corn yield results from the first two years of this WREC SDI demonstration operation.

2009

Corn was planted April 24, 2009, about three weeks later than normal. Drip tape laterals were installed April 23 but installation of manifolds, control station, main lines, and pond water pumping station occurred over the next two months. Soil moisture sensors were not installed due to system start-up problems. Manifold/lateral leaks were repaired and the first irrigation, a four (4) hour operational test, occurred June 17, 2009. *This was day 54 after planting and the crop had already begun experiencing drought stress.* The irrigation controller never worked throughout the season. All irrigations were manually started and stopped based on MoisMis2020 recommendations without soil moisture feedback. Corn harvest was early September.

Figure 1 shows the magnitude and distribution of **48 rainfall events (shown in red) totaling 26.19**" received on the SDI corn demo. There were 11 irrigation events (blue) totaling 8.36" during this same period (April 23 – August 22).

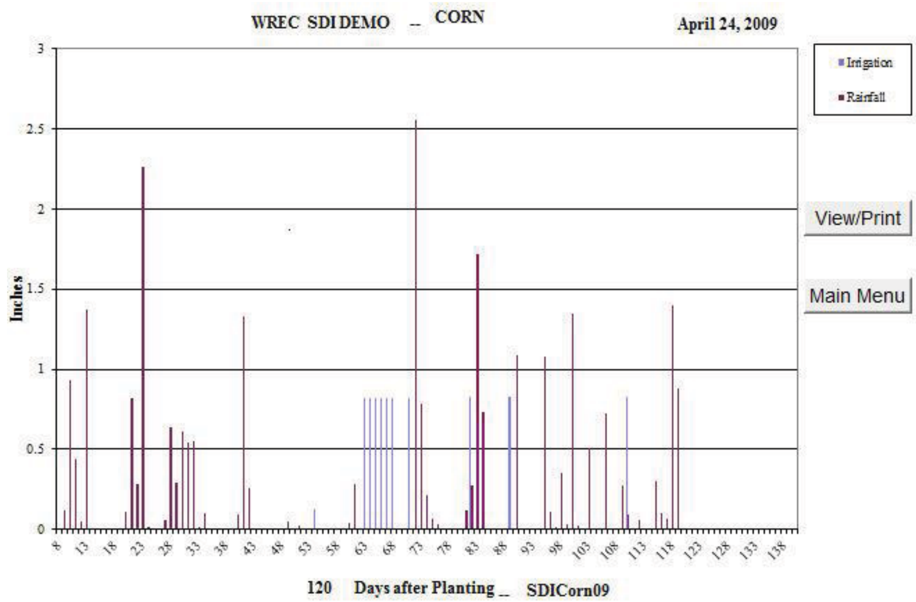

Figure 1 - 2009 Rainfall and Irrigation for WREC SDI Corn Demo

Note the 43-71 days after planting period where less than .4" total rain was received. The six days of continuous irrigation beginning day 63 brought the high soil moisture deficit below the 50% limit (see **Figure 2**). Sixty-nine (69) % of the 8.36" of applied irrigation occurred during this 63-71 day growth period (14th leaf to tassel emerging).

Figure 2 shows the soil moisture deficit for the 2009 SDI Corn Demo. Red line indicates the 50%

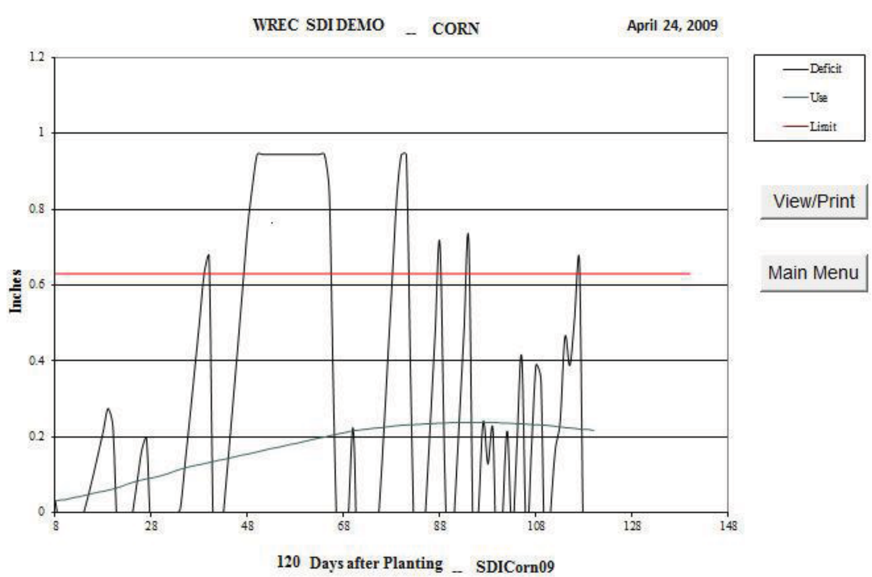

Figure 2 - 2009 SDI Corn Demo Season Soil Moisture Deficit

Available Water Holding Capacity (AWC) of the Dothan Sandy Loam used as the irrigation trigger in MoisMis2020.

2010

Corn was planted March 30, 2010. MoisMis2020 was started with a 120 (one-twenty) day corn crop water use curve. Three (3) weeks into the season, field scouting verified crop growth to be 6 days ahead of the growth curve. The CropAdjust feature of MoisMis2020 was used to "shorten" the season by these six days. Soil moisture sensors were installed early May, about one and one-half (1 1/2) weeks later than the "within 30 days after planting" recommendation. The irrigation controller again failed to work and a second used controller was installed the last of May. It also failed and again, all irrigations were started and stopped manually the remainder of the season.

Figure 3 shows the magnitude and distribution of **31 rainfall events (shown in red) totaling 14.08"** received on the SDI corn demo. Over 75% of the 31 rain events were smaller than 0.5". More than ½ (7.09") of this amount fell by day 50 (May 19) and contributed to excellent early root development. No rain events greater than 0.5" after day 84 hurt dryland (rainfed) yield development. **The first of 18 irrigation events (shown in blue) totaling 12.7", occurred May 21 (day 50).** 10 irrigation events totaling more than 6" were applied from June 25 to July 20 during the critical Dough to Black Layer Formation period (day 87 thru 112) for this mid-season corn.

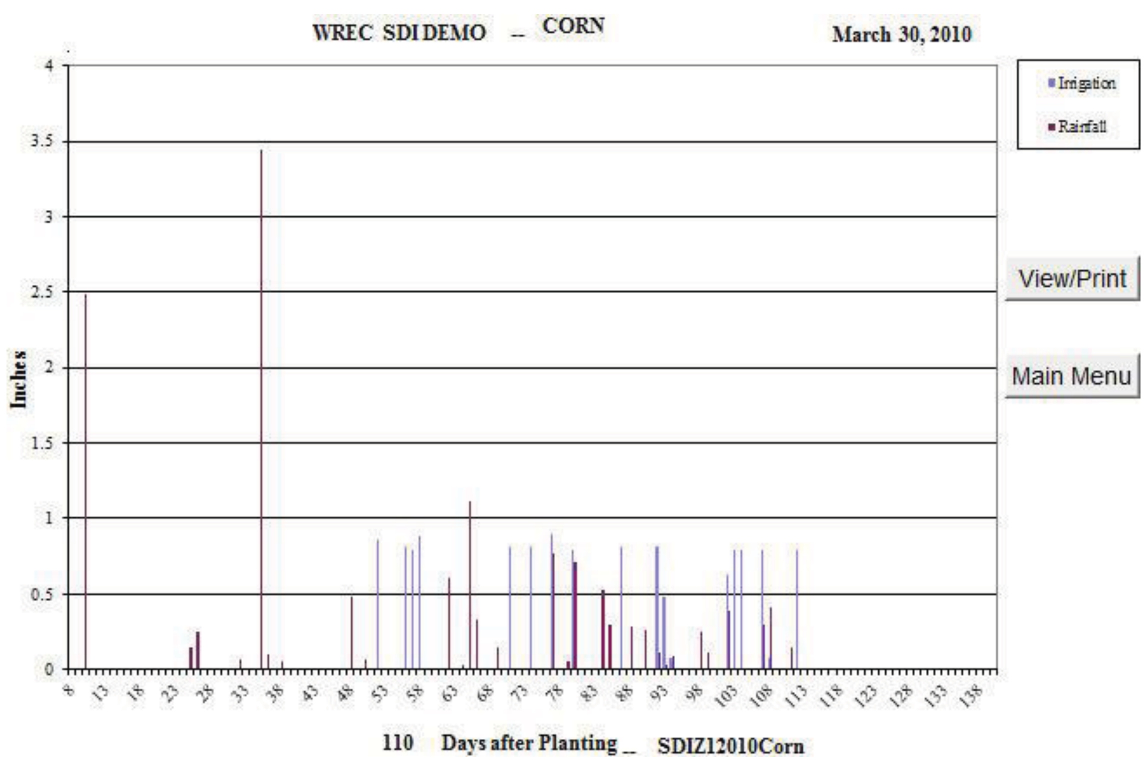

Figure 3 - 2010 Rainfall and Irrigation for WREC SDI Corn Demo

Figure 4 shows the soil moisture deficit for the 2010 SDI Corn Demo. Red line indicates the 50% Available Water Holding Capacity (AWC) of the Dothan Sandy Loam used as the irrigation trigger in MoisMis2020.

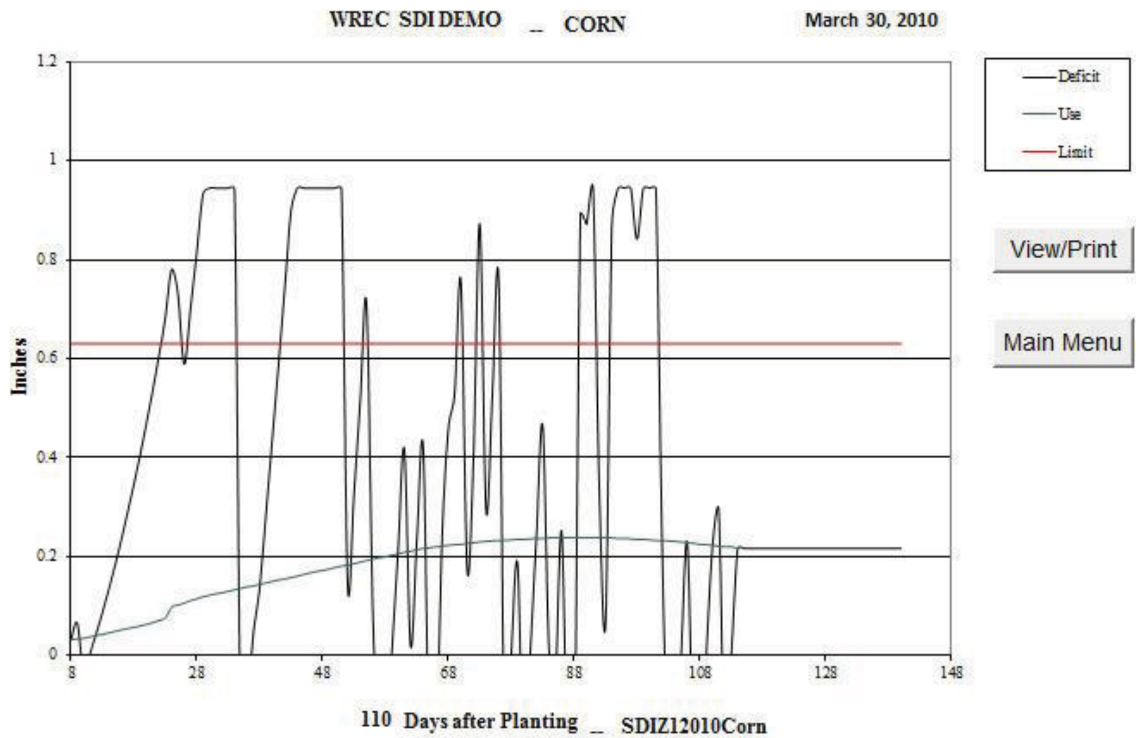

Figure 4 - 2010 SDI Corn Season Soil Moisture Deficit

Basis for Scheduling Irrigation

MoisMis2020, an Xcel-based irrigation scheduling program, used typical corn SOIL WATER Daily Use values, along with measured rainfall, applied irrigation, and available soil moisture (not available in 2009*)* to schedule irrigation for both crop years. That electro-mechanical irrigation controller equipment failed to operate caused irrigation to be manually shut on/off and hampered optimal irrigation scheduling.

Yield Results from Rain and Irrigation

There were four checks within each treatment each year. These checks were compared and averaged to give the final dryland and irrigated corn yield. Yearly irrigated yield increases are shown in red in table below.

Year	Plant Date	Rain (#) Total	Irrigation (#) Total	Yield (Bu/Acre)
2009	**April 24**	**(48) 26.19"**	**-**	**40**
		(48) 26.19"	**(11) 8.36"**	**100 (+60 IRR)**
2010	**March 30**	**(31) 14.08"**	**-**	**80**
		(31) 14.08"	**(18) 12.7"**	**173 (+93 IRR)**

Conclusion

Even though more than 26" of rain fell on the 2009 crop and only minor soil moisture deficit was experienced from mid-pollination through black layer development in both rainfed and irrigated corn, severe potential yield reduction had already occurred in the near 30-day drought in the 6-10 week growth period (4 to 15 leaf development stages). This was only partially overcome by late-started irrigation in the 14th leaf to tassel emerging stage. ***This 2009 season clearly demonstrated the need for earlier planting and being ready to irrigate as soon as drought develops***.

Corn was planted March 30, 2010, more than 3 weeks earlier than 2009. Drought began to develop in early May within thirty (30) days after planting. A 3.45" rain came too quickly May 4 and contributed little to soil moisture available to the crop. Starting irrigation in response to this early season drought was key to the **170+ bushel per acre 2010 SDI yield**. Early planting helped the **rainfed (dryland) yield 80 bushel/acre**, twice the late-planted 2009 rainfed yield of 40 bushel/acre with almost ½ the rain.

These first two years of large-plot SDI irrigation at the Wiregrass Research and Education Center in Headland have demonstrated the **ability of timely applications of irrigation water using a permanently buried drip tape system to more than double typical rainfed (dryland) corn yield**. A soon-to-follow life-cycle economic analysis based on WREC SDI Demo yields and installed and operational costs should highlight accompanying economic advantages of small-field SDI irrigation in the Wiregrass.

References

Tyson, Ted W, and Larry M. Curtis. 2010. 2010. An Overview of Moisture Management and Irrigation Scheduling 2020 (MoisMIS2020). BSEN-IRR-01. Timely Information Alabama Cooperative Extension System, http://www.aces.edu/timelyinfo/BioSysEng/2010/May/BSEN-IRR-10-02.pdf, 4 pp.

Tyson, Ted W, and Larry M. Curtis. 2010. 2010. An Overview of Moisture Management and Irrigation Scheduling 2020 (MoisMIS2020). BSEN-IRR-01. Timely Information Alabama Cooperative Extension System, http://www.aces.edu/timelyinfo/BioSysEng/2010/May/BSEN-IRR-10-02.pdf, 4 pp.

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