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Irrigation Scheduling for Humid Environments

FACT SHEET NO. 2010-03

Improving Water Management, Crop Performance, and Economic Return

Irrigation can increase crop yields when water is applied correctly. Unpredictable rainfall and highly variable soils make water management in humid growing areas such as the Mississippi Delta particularly challenging. To ensure adequate yields, farmers are increasingly using irrigation to supplement the sporadic and often insufficient rain during the growing season. While Mississippi receives high rainfall throughout the year, pumping from the aquifer in excess of that which is recharged has begun to deplete the alluvial aquifer. Wise water management requires knowledge of how much water the crop needs and when the water is needed. Irrigation scheduling is a method of managing water to better match the timing and application of irrigation with crop water use.

Several methods are available to monitor or estimate the loss of water through evaporation from the soil surface or transpiration through the crop, termed evapotranspiration (ET). Simple, inexact methods such as the "feel" method rely on tactile changes in a soil sample taken from the rooting zone to estimate soil moisture. Sensors can also be placed in the rooting zone to measure soil moisture during the growing season (Figure 1). These sensors track changes in soil moisture with crop growth and irrigation or rainfall. Depletion of soil moisture below a certain level indicates that irrigation is needed. Because the sensors measure the loss of moisture in the soil, the readings are plotted on a negative scale and indicate the deficit, or reduction, in water available for crop growth. Replacement of soil moisture with irrigation increases the readings towards zero.

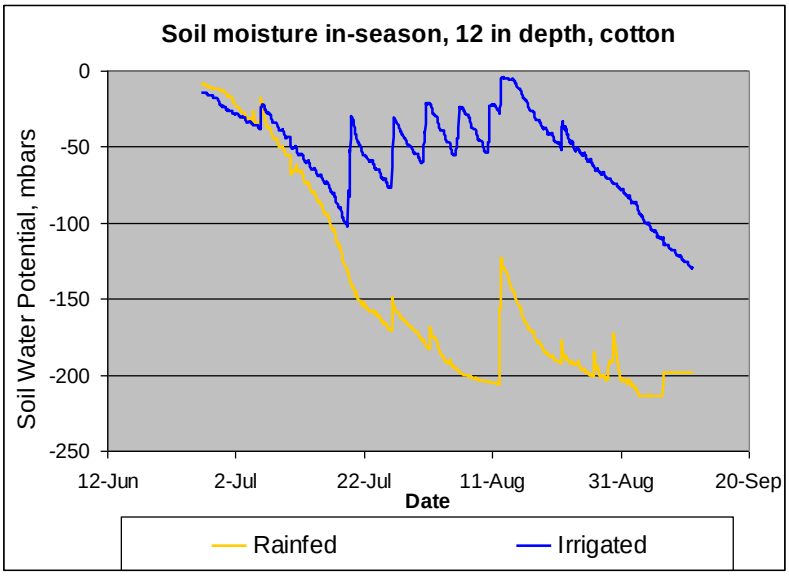

Figure 1. Changes in soil moisture during the growing season. Soil sensors are buried in the soil near the crop roots. As the plants grow, they remove moisture from the soil, decreasing the available soil moisture. The blue line recorded soil moisture in an irrigated field. Soil moisture is held around -50 mbars through irrigation. The lower line is in a rainfed field. The soil quickly dries out in this field. Rain fall is seen as an increase in the soil moisture, but is still not adequate to replace the water lost by evapotranspiration (ET).

Another method of scheduling irrigation is based on estimating crop water use from weather conditions and calculating total available soil moisture. A water balance is then determined as the initial water in the soil, plus water from rainfall or irrigation, minus water used by the crop or evaporated from the soil (ET). This "checkbook" method sums the water balance of the soil and indicates the need for irrigation when the available soil water falls below that which is readily available for the plant (Figure 2). The checkbook method relies on knowledge of crop water use, soils, and weather during the growing season to make an estimate of crop water use and show the need for irrigation. An irrigation scheduling tool using the checkbook method is currently under development for Mississippi.

IRRIGATION SCHEDULING TOOL

Soil Type	medium		Planting Date	4/19/10				
Crop	soybeans		Irrigation System	furrow				
		Water Lost			Water Gained		Water Balance (WB)	
Date	Evapotranspiration	Crop Coefficient	Crop Water Use	Rainfall	Irrigation			Irrigation
	ET	Kc	ET * Kc	R	I		WB - (ET*Kc) + R + I	Needed
	(inches)		(inches)	(inches)	(inches)			
6/8/10	0.24	1.12	0.27	0.46			-2.45	
6/9/10	0.21	1.12	0.24	0			-2.69	
6/10/10	0.15	1.12	0.17	0			-2.86	
6/11/10	0.18	1.12	0.20	0			-3.06	
6/12/10	0.21	1.12	0.23	0			-3.29	
6/13/10	0.23	1.12	0.26	0			-3.55	
6/14/10	0.23	1.12	0.26	0			-3.81	
6/15/10	0.24	1.12	0.27	0			-4.08	Begin Irrigation
6/16/10	0.24	1.12	0.27	0			-4.35	Begin Irrigation
6/17/10	0.22	1.12	0.25	0			-4.60	Begin Irrigation
6/18/10	0.22	1.12	0.25	0			-4.84	Begin Irrigation

Figure 2. Irrigation Scheduling Tool based on weather-based calculation of crop water use.

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