MISSISSIPPI WEB-BASED IRRIGATION SCHEDULING TOOL

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Abstract

Increasing use of water in the Mid-South has begun to deplete water levels in aquifers, with few guidelines in place for farmers as to when and how much to irrigate. Irrigation can increase crop yields when water is applied correctly. Irrigation scheduling is a method of managing water to better match the timing and application of irrigation with crop water use. The Mississippi Irrigation Scheduling Tool (MIST) is being developed for Mississippi to assist producers in developing good irrigation scheduling practices. The MIST system allows producers and crop consultants to track crop water use and develop an irrigation schedule for crop production. The irrigation scheduler is based on estimating crop water use from weather conditions and estimating total available soil moisture. A water balance is determined by taking the initial water in the soil, adding water from rainfall or irrigation, and subtracting water used by the crop or evaporated from the soil (ET). This "checkbook" method keeps track of the available water content of the soil and indicates the need for irrigation when the available soil water falls below that which is readily available for the plant. The checkbook method relies on knowledge of crop water use characteristics, soils, and weather during the growing season to make estimates of daily crop water use and show the need for irrigation. The web-based system is designed to automatically import information from national soil and weather databases into a central server, decreasing input requirements for the end user. The irrigation scheduling system will give farmers important tools for improving their crop production system while conserving precious water resources.

Introduction

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.

Materials and Methods

An irrigation scheduler is being developed based on calculated crop water use from weather conditions. The scheduler calculates water balance based on 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. 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. Soils information is extracted from the SSURGO soils database for information on field textural and hydrologic conditions. Weather data is downloaded from automated weather stations supported by the Delta Research and Extension Weather Center.

Results and Discussion

The irrigation scheduler calculated crop water use from weather parameters downloaded from weather stations supported by the Delta Research and Extension Center Weather Center (DAWC, 2010). Initial crop water use occurs from soil evaporation (Figure 1). As the crop grows, the daily water use increases to a maximum, and then declines gradually.

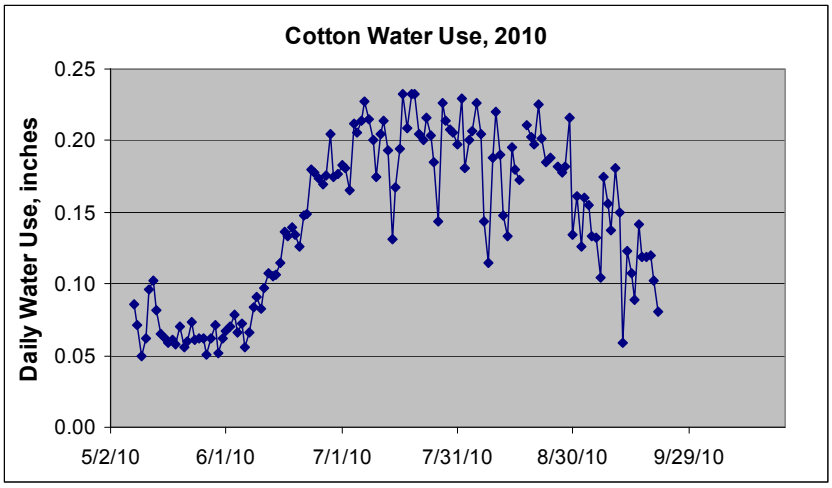

Figure 1. Crop water use calculated from weather conditions for the preceding growing season.

The irrigation scheduler calculates daily crop water balance and signals the need to irrigate based on a predetermined allowable water deficit (Figure 2).

Mississippi Irrigation Scheduling Tool

Soil Type	Dundee SiC			Planting Date		5/7/10
Crop	4427			Irrigation System		furrow

	Water Lost	Water Gained		Water	
Date	Crop Water Use	Rainfall	Irrigation	Balance	Irrigation Needed
	ET * Kc	**R**	**I**	**R + I - (ET*Kc)**	
	(inches)	(inches)	(inches)		
7/8/10	0.2	0.0		-2.5	0
7/9/10	0.2	0.0		-2.7	0
7/10/10	0.2	0.0		-2.8	0
7/11/10	0.2	0.0		-3.0	0
7/12/10	0.2	0.0		-3.2	0
7/13/10	0.2	0.0		-3.4	0
7/14/10	0.1	0.0		-3.5	0
7/15/10	0.2	0.0		-3.7	0
7/16/10	0.2	0.0		-3.9	0
7/17/10	0.2	0.3		-3.8	0
7/18/10	0.2	0.0		-4.0	Begin Irrigation
7/19/10	0.2	0.0		-4.3	Begin Irrigation
7/20/10	0.2	0.0	3.0	-1.5	0
7/21/10	0.2	0.0		-1.7	0

Figure 2. Output from the scheduler for a furrow-irrigated cotton field.

Disclaimer

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References

Delta Agricultural Weather Center. 2010. Delta Research and Extension Center, Mississippi State University, Stoneville, MS. http://www.deltaweather.msstate.edu/