# Water Meters as a Water Management Tool On Georgia Farms

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Agricultural irrigated acres in Georgia have increased from fewer than 200,000 acres in 1970 to more than 1.5 million in 2004 (Harrison and Hook, 2005) — with a similar number, if not slighlty more, currently. This increase of irrigated acres, the documented short and long term droughts (USGS, 2000), and the tri-state water dispute among Geor-gia, Alabama, Florida and the Corps of Engineers have led to a greater awareness of the need to con-serve water in all sectors of Georgia's economy. In 2004, the Georgia General Assembly passed and the governor signed House Bill 579, which required all permitted irrigation withdrawals in Georgia to be metered by 2009, depending on available funds.

Farmers are continually trying to manage their irrigation systems to increase yields and improve the quality of food and fiber. Some management examples include end gun shut-offs (repaired or installed), uniformity tests, installing new sprinkler packages and improved irrigation methods. Each of these methods help improve the system, reduce costs and distribute more of the pumped water to the growing crop. The agricultural water meter also can be used for improved yields while conserving water.

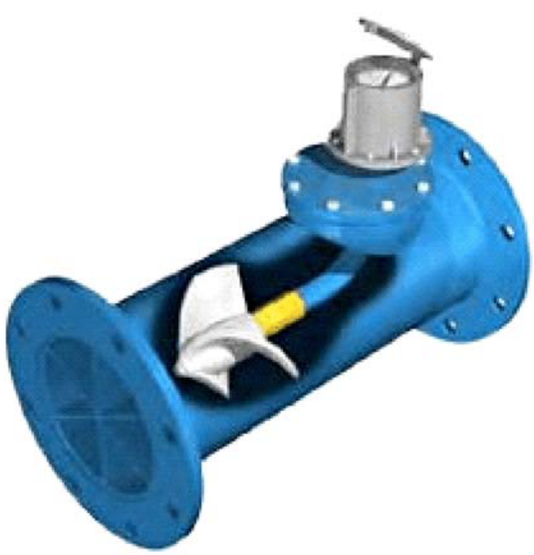

Figure 1. Propeller type water meter being installed in Georgia in response to HB 579

The agency charged with running the water metering program is the Georgia Soil and Water Conservation Commission (GSWCC). They have the responsibility to install, read and maintain meters on and manage data from the irrigation systems that meet the conditions of HB579. The meter being installed by GSWCC is a propeller type meter. As can be seen in Figure 1, the meter has a multi-blade propeller occupying a majority of the inside pipe area. The meter may or may not have straightening vanes depending on the specific installation site (Rogers and Black, 1992). Vanes ensure the water passes the propeller with linear flow. Vanes are required if the pipe preceding the meter is less than five (5) pipe diameters and the tailpipe is less than one (1) pipe diameter, otherwise no vanes are required. Water volume is measured as the water passes the propeller.

The purpose of this publication is not to explain the selection, installation or maintenance of a propeller meter but rather how to use the meter as a water management tool. An example will be used to illustrate how the meter can assist the farmer in improving his/her water conservation efforts. To accomplish this, a 65-acre field with 90-day old cotton crop will be used as an example.

## Process of Using Meter as a Management Tool

**First**, determine how many days of crop growth can be achieved from a known watering event (rainfall or irrigation). From Figure 2, a 90-day old cotton plant requires 0.32 inches of water per day, if the water is applied uniformly. Charts for peanuts and corn can been seen at the end of this paper.

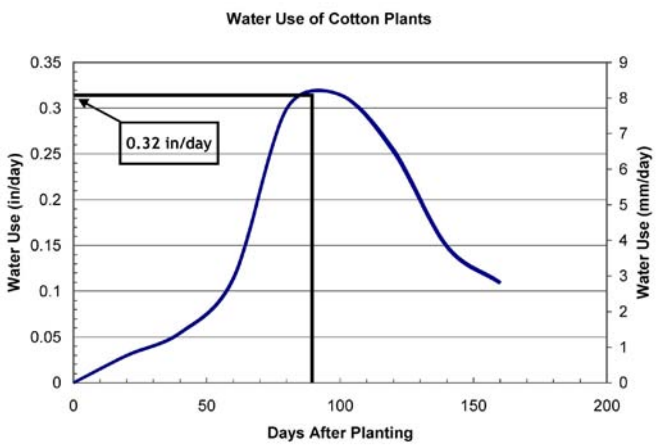


**Figure 2. A 90-day old cotton plant requires 0.32 inches of water per day, if the water is applied uniformly.**

**Second**, determine the amount of water that has been applied to the field. To do this, use the totalizer on the meter (Figure 3). Assume that the farmer recorded the initial reading prior to irrigating the 65 acres and that reading was 1326.11 acre-inches (ac-in), and the reading after irrigating was 1526.11 ac-in.


**Figure 3. Image of a water meter counter showing the ending irrigation volume used in the example and the dial used for instantaneous flow.** *Photo courtesy of GSWCC.*

**Applied volume of water:**

| | |
|---|---|
| Irrigation end reading | 1526.11 ac-in |
| Irrigation beginning reading | 1477.11 ac-in |
| Total application | 49 ac-in |

*Acre-inches* is a term typically used by engineers for describing large volumes of water without using large numbers, so let's look at the amount of water applied in gallons. One acre-inch of water (the amount of water covering 1 acre with a depth of 1 inch) is equal to 27,154 gallons. Therefore, the 49 ac-in of water applied by the irrigation system would be equivalent to 1,330,546 gallons.

**The total volume of water applied to the 65 acres was 49 acre-inches of water.**

**1526.11 ac-in - 1477.11 ac-in = 49 ac-in applied**

**Third**, calculate the number of inches of water depth applied.

**Depth of water applied:**

$$\frac{\text{Difference in counter reading (ac-in)}}{\text{Acres irrigated (ac)}} = \text{Depth of water applied (in)}$$

For the example: $\frac{49 \text{ ac-in}}{65 \text{ ac}} = 0.75$ in.

**Fourth**, determine if enough water was applied to supply the required amount of water to the plants to meet the water use.

To do this, understand that no irrigation system is 100 percent efficient. Application efficiencies vary from 75 to 90 percent (Harrison and Tyson, 1993; Evans et al., 1998). Irrigation system losses include such things as drift, evaporation prior to ground contact, runoff, deep percolation and evaporation from water on the canopy (Figure 4). These factors are typically unseen but can contribute to major water loss prior to plant uptake. For purposes of the example, let's say the irrigation system is 83 percent efficient, which calculates to being 0.62 inches of water available for plant uptake.

**The 0.75 inches of water actually provided:**

**0.75 inches x 83% = 0.62 inches of actual water applied to crop**

The question then is "How many days will the applied water sustain the crop?" Based on the crop curve for 90-day cotton (0.32 inches per day) and 0.62 inches of actual water, the crop can be sustained for approximately 2 days (0.62 inches/0.32 inches per day = approximately 2 days). Therefore, the irrigation system would need to operate every other day in order to satisfy the water needs of a 90-day cotton crop with this application depth. If this schedule does not meet optimum production needs, then a different depth needs to be applied.

## Conclusion

By using the water meter in conjunction with the basic calculations above, the irrigation manager can determine if (s)he is applying the correct amount of water to meet the plants' daily need as well as the watering schedule for optimum crop production, while at the same time improving water conservation efforts.

The above example was for cotton, but it can be used to manage irrigation for any crop. If you need the water curves for other crops, assistance in determining your irrigation systems uniformity or efficiency, or help determining whether you are applying the correct amount of water to your crop, call the local Cooperative Extension Office in your county and talk to the Agricultural and Natural Resources (ANR) agent.

## References


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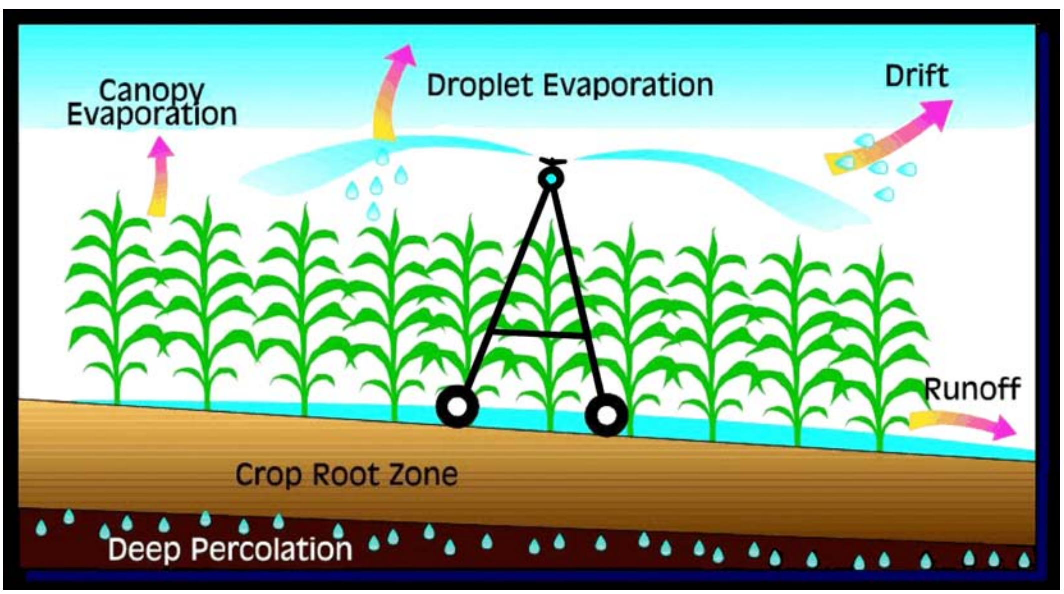
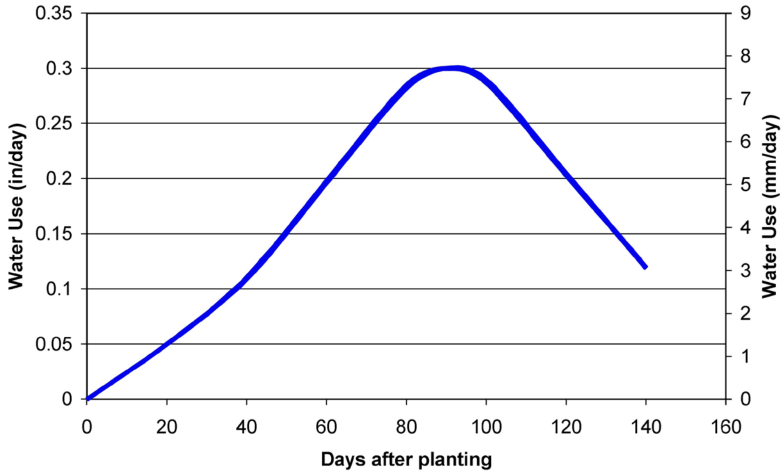


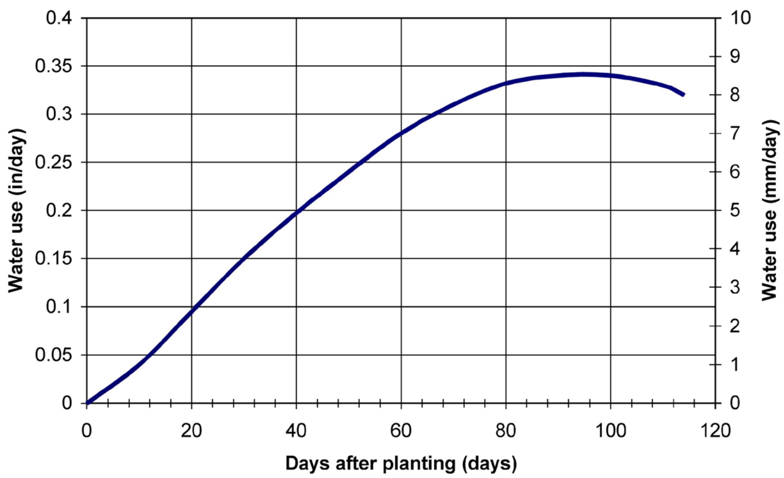

**Figure 4. Potential factors attributed to irrigation system inefficiencies. Picture from University of Nebraska-Lincoln Biological Systems Engineering Department.**

# Appendix

**Daily Water Use of Peanuts**




**Daily Water Use of Corn**

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