

3.2 Irrigation Scheduling

Applicability

This best management practice is used to determine when to irrigate a crop and is intended for agricultural producers that have access to irrigation water in adequate quantities and at times required by the producer. Advanced irrigation scheduling methods are particularly applicable to nursery/floral irrigation systems that have an adequate water supply and delivery system.

Description

Irrigation scheduling is a generic term for the act of scheduling the time and amount of water applied to a crop based on the amount of water present in the crop root zone, the amount of water consumed by the crop since the last irrigation, and other management considerations such as salt leaching requirements, deficit irrigation, and crop yield relationships. Irrigation scheduling is a water management strategy that reduces the chance of too much or too little water being applied to an irrigated crop. Extensive publications exist regarding irrigation scheduling, many of which are documented in “Evapotranspiration and Irrigation Water Requirements” by the American Society of Civil Engineers, Manual No. 70. The most common irrigation scheduling methods are:

- 1) Direct measurement of soil moisture content, soil water potential, or crop stress including soil sampling, tensiometers, gypsum blocks, infrared photography of crop canopy, time domain reflectometry, plant leaf water potential, and other methods.
- 2) Irrigation methods based on soil water balance equations. These equations range from very simple “checkbook” accounting methods to complex computer models that require input of climatic measurements such as temperature, humidity, solar radiation, and wind speed. Texas AgriLife Extension maintains a network of weather stations that are used to determine the “Reference Evapotranspiration” in agricultural regions throughout the state.

Implementation

Each type of irrigation scheduling method has specific steps required for implementation. The manufacturers of soil moisture measurement equipment typically provide detailed instruction on how to operate their equipment. Soil water balance implementation information can be obtained from Texas AgriLife Extension– Texas Evapotranspiration Network web site (texaset.tamu.edu) ET User’s Guide for Growers. This guide has step-by-step instructions for using evapotranspiration for scheduling irrigations.

Scope and Schedule

All agricultural producers, to one degree or another, schedule their irrigations. However, only a small percentage of producers use advanced irrigation scheduling methods. The producer has to balance when a crop is irrigated with both the demand by the crop for water and the amount of labor and water supply that the producer has available to irrigate. In many cases in western

Texas where there is little rainfall, the producers have a limited water supply and limited capacity to deliver water to the field. Under these conditions the producer is continually using 100 percent of his water supply to irrigate, and most, if not all, of the producer's fields are under-irrigated (deficit irrigation). Another issue for many producers is the economics of scheduling. Yield and/or quality of many irrigated crops can be very dependent on adequate soil moisture at one or more critical periods in crop growth. Often, a producer will balance the cost of irrigation with the risk of reducing crop yield and/or quality if the irrigation is delayed or no water is applied. Irrigation scheduling can be implemented at any time during crop production, but normally an irrigation scheduling program is established prior to the first irrigation of the crop.

Measuring Implementation and Determination of Water Savings

To document this best management practice, the agricultural water user should document and maintain one or more of the following records:

- Records of the amount of rainfall, irrigation dates, and volumes of water applied during each irrigation and the method;
- Records of the location and information collected from direct measurement of soil moisture; and
- Copies of irrigation scheduling program reports or printouts.

The amount of water saved by implementing advanced irrigation scheduling is difficult to quantify, likely varies from year to year, and is strongly influenced by weather variation, cropping practices, irrigation water quality, and total amount of water used to irrigate. The Pacific Northwest Laboratory (1994) attempted to verify estimates of reduction in the amount of irrigation water pumped in the Grand County Public Utility District resulting from the implementation of irrigation scheduling. The public utility district estimated savings of 0.3 to 0.5 acre-feet per acre, but actual savings could not be confirmed or disproved by the Pacific Northwest Laboratory's review.

Cost-Effectiveness Considerations

The cost for implementing advanced irrigation scheduling methods depends on the method of scheduling used and the number of fields scheduled, the type of scheduling program, and the cost for technical assistance. Depending on the producer's investment in the crop (\$200 to \$1,200 per acre) and the cost of water (\$10 to \$50 per acre per irrigation), the producer may choose to irrigate independently of any irrigation scheduling program.

Determination of Impact on other Resources

Other than water savings, energy usage is the primary resource impact resulting from implementing this best management practice. Energy usage per acre-feet of water used can be calculated if the volume of water used is measured (see Volumetric Measurement of Irrigation Water Use Best Management Practice) and the energy required to pump the water is measured. However, as discussed in an earlier section, the amount of water saved is difficult to quantify.

References for Additional Information

- 1) *Evapotranspiration and Irrigation Water Requirements, Manuals and Reports on Engineering Practice No. 70*, 332 p., American Society of Civil Engineers, 1990
- 2) *Texas AgriLife Research Centers*. <http://agriliferesearch.tamu.edu/units/centers>
- 3) *Texas Evapotranspiration Network, Texas A&M University-College Station*, Department of Biological and Agricultural Engineering. <http://texaset.tamu.edu/>
- 4) *Applicability and Limitation of Irrigation Scheduling Methods and Techniques*, Iteier, B. *et al.*, United Nations, Food and Agricultural Organization. <http://www.fao.org/docrep/W4367E/w4367e04.htm>

Acknowledgments-None