



Wetting Front News



Soil and Water Management Research News

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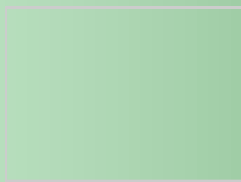
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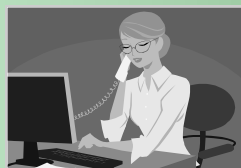
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BACKGROUND

Useful information on canopy water relations can be derived from infrared thermography, which provides spatio-temporal imagery and relational surface temperature measurements. Infrared thermography in agriculture has been used as a non-invasive versatile tool to investigate plant water status issues. Jones et al. (2002) performed field studies to assess the consistency and repeatability of using thermal imagery to measure stomatal conductance in grapevine canopies. They concluded that thermography allows for semi-automated analysis of large areas of canopy with much more effective replication than can be achieved with porometry. Möeller et al. (2007) used thermal and visible imagery to estimate the crop water status of irrigated wine grapes. Included in their methodol-

ogy was the temperature of an artificial wet reference to estimate a wet baseline (i.e., a surrogate for a fully transpiring leaf) and maximum daily air temperature to estimate a dry baseline.

Thermal imagery is a tool that enables detailed investigation of: (1) the temperature contribution of a specific material within an image, for example leaf temperature versus bloom or tassel temperature of a crop; (2) the frequency distribution of temperatures over a selected area, which can assist in estimating fraction of vegetation or discerning between sunlit and shaded samples; and (3) the reference temperatures for further use as thresholds to eliminate extraneous surfaces when analyzing large areas of canopy that may include some sky or soil.

At the Bushland USDA-ARS Conservation and Production Research Laboratory, we have been using thermal imagery to document the spatial variability of crop water status in irrigated cotton fields and have made use of an empirical crop water stress index to characterize in-field crop water stress.

METHODS AND MATERIALS

Agronomy

Cotton (*Gossypium hirsutum* L.), variety Paymaster

¹Mention of trade names or commercial products in this article is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

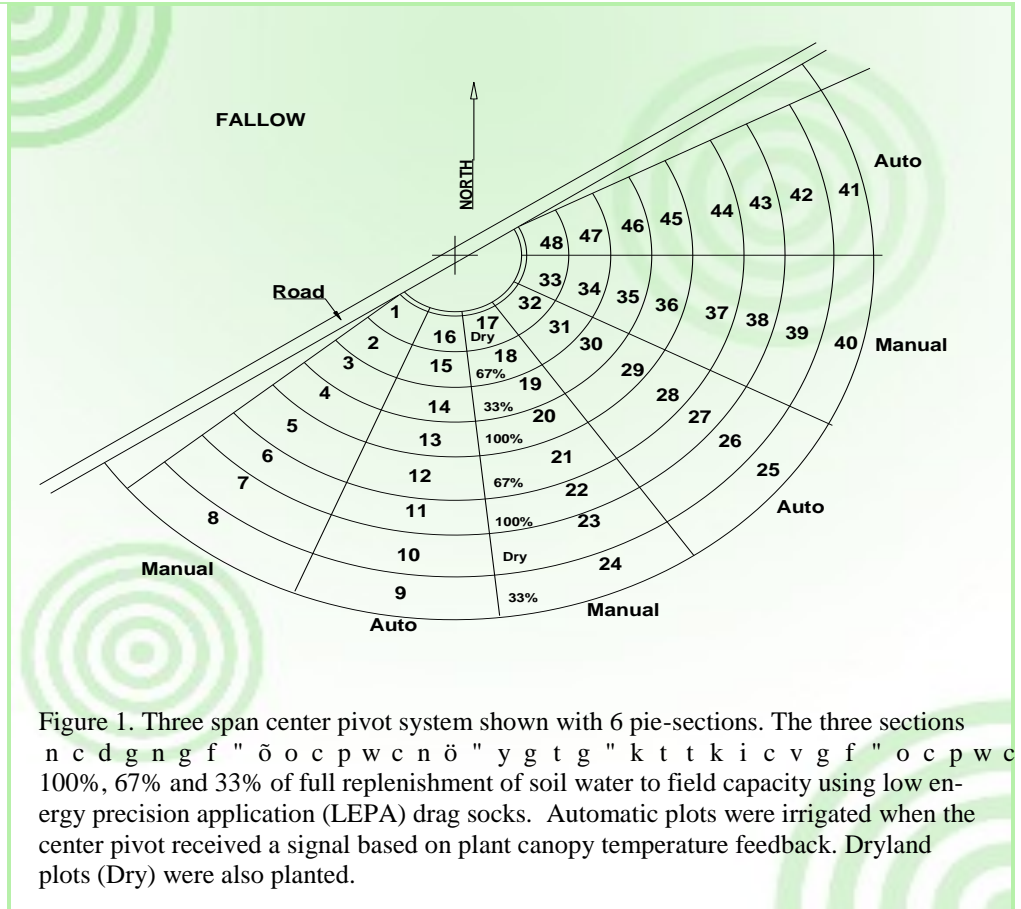


Figure 1. Three span center pivot system shown with 6 pie-sections. The three sections n c d g n g f " ö o c p w c n ö " y g t g " k t t k i c v g f " o c p w c n n { 100%, 67% and 33% of full replenishment of soil water to field capacity using low energy precision application (LEPA) drag socks. Automatic plots were irrigated when the center pivot received a signal based on plant canopy temperature feedback. Dryland plots (Dry) were also planted.

2280¹ (Bollgard II® Roundup Ready®, Delta and Pine Land Co., Scott, Miss.) was planted on DOY 149 (May 29) in 2007. The crop was grown in eighteen row plots on beds spaced 0.76-m apart under a three span center pivot in D w u j n c p f . " V g z 0 " * 5 7 • " 3 3 ø " P . " 3 mean sea level). Manual irrigations were applied weekly to three designated pie sections, comprised of four treatment plots and two replicates (Fig. 1). Irrigation was applied at the levels of 33%, 67%, and 100% of full replenishment of soil water in the root zone to field capacity (treatments designated I_{33%}, I_{67%} and I_{100%}) based on neutron moisture meter readings and using low energy precision application (LEPA) drag socks. Dryland plots were also included as the fourth treatment (I_{0%}). Irrigation treatments ran concentrically in the southeast half of the field, while the northwest half was planted to sorghum. The pie sections n c d g n g f " ö c w v q ö " y g t g " k t t k i c v g automation and control that use canopy temperature measurements (Fig. 1). The full irrigation level for automatic treatments was week-long peak cotton water use.

In situ measurements

Ten leaf stem water potential samples were taken from each treatment plot on each of four sampling days near

