Canopy temperature and cotton performance

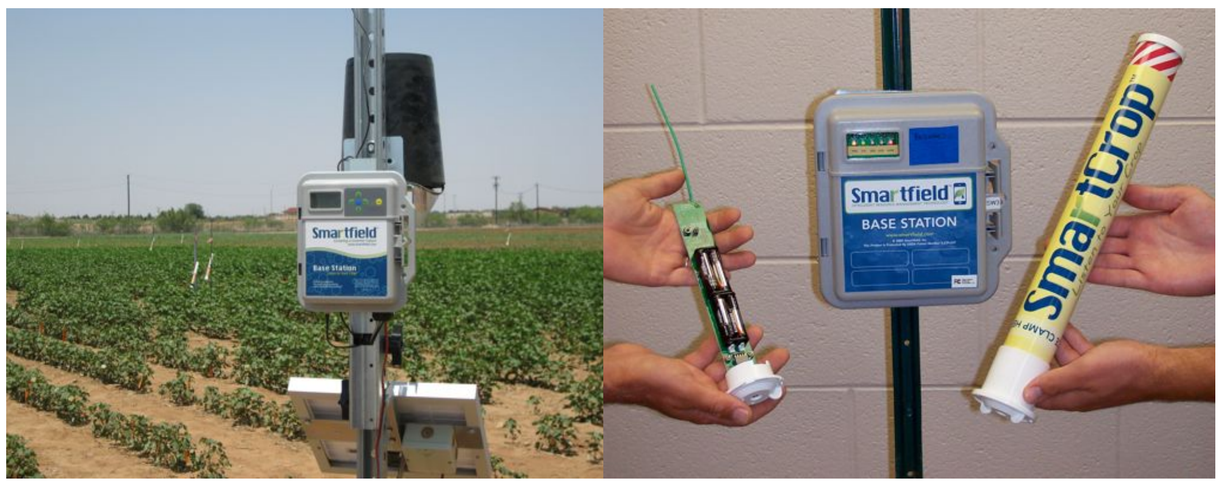
James R. Mahan 1, Michael Bange 2, Andrew Young 3
1. USDA/ARS, Lubbock TX USA, james.mahan@ars.usda.gov
2. CSIRO, Narrabri NSW, Michael.Bange@csiro.au
3. Texas Tech University, Lubbock TX USA,

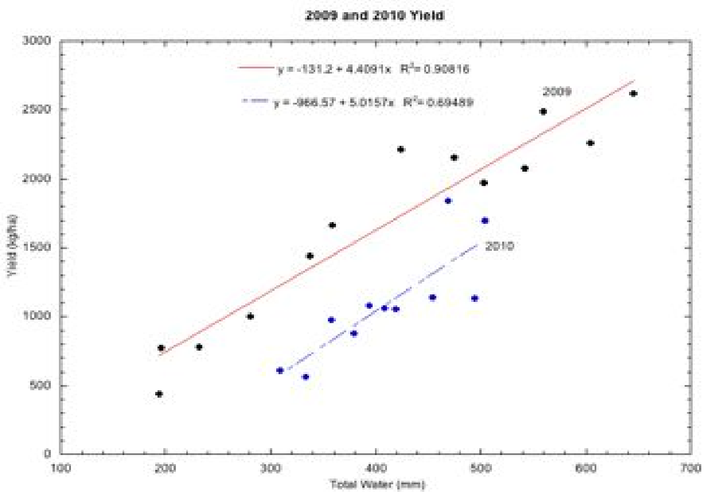
The temperature of a cotton canopy is a useful indicator of both the metabolic state and water status of the crop. As the water status becomes favorable the temperature of the canopy increases. The elevation of canopy temperature affects metabolic function and ultimately, over time, the performance of the crop. Recent advances in canopy temperature measurement have decreased the cost and complexity of continuous monitoring of canopy temperature to the point that it can be a routine measurement in both research and production settings.

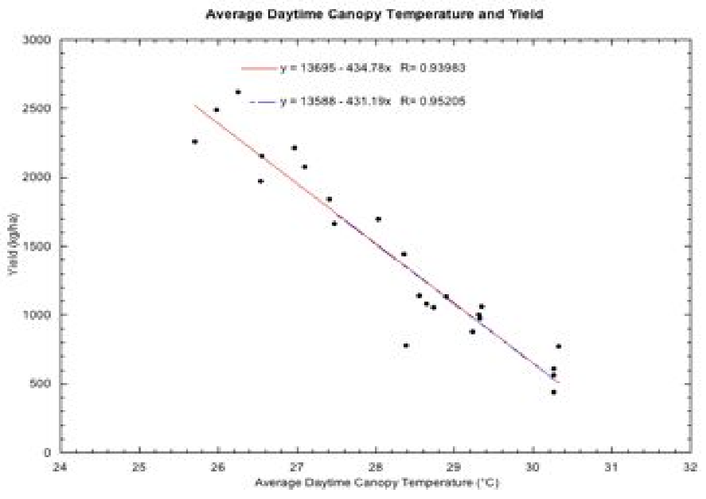
Monitoring canopy temperature on a 15-minute interval over a growing season provides a near-continuous measurement of water use and metabolic optimality. The goal of our current efforts is to use the temporal pattern and magnitude of canopy temperature to identify, quantify and manage water and thermal stress in cotton.

Two examples of our efforts relate to 1) use of canopy temperature-based heat units to define developmental effects of water stress and thermal environments on cotton and 2) the use of cumulative seasonal canopy temperature as a measure of water use by the plant.

Concluded...continuous canopy temperature provides additional insight into yield and water relationships and a potentially-enhanced means of monitoring cotton development.





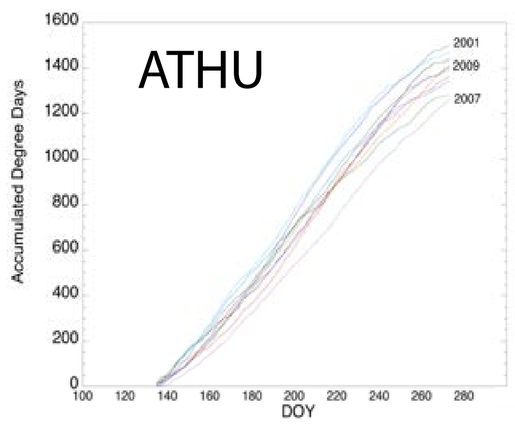


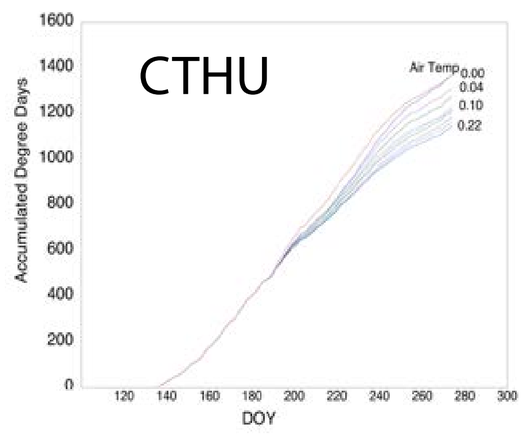
Cotton was grown under 11 irrigation regimes in 2009 and 2010. Yield and water relationships for the 2 years were described by 2 linear relationships.

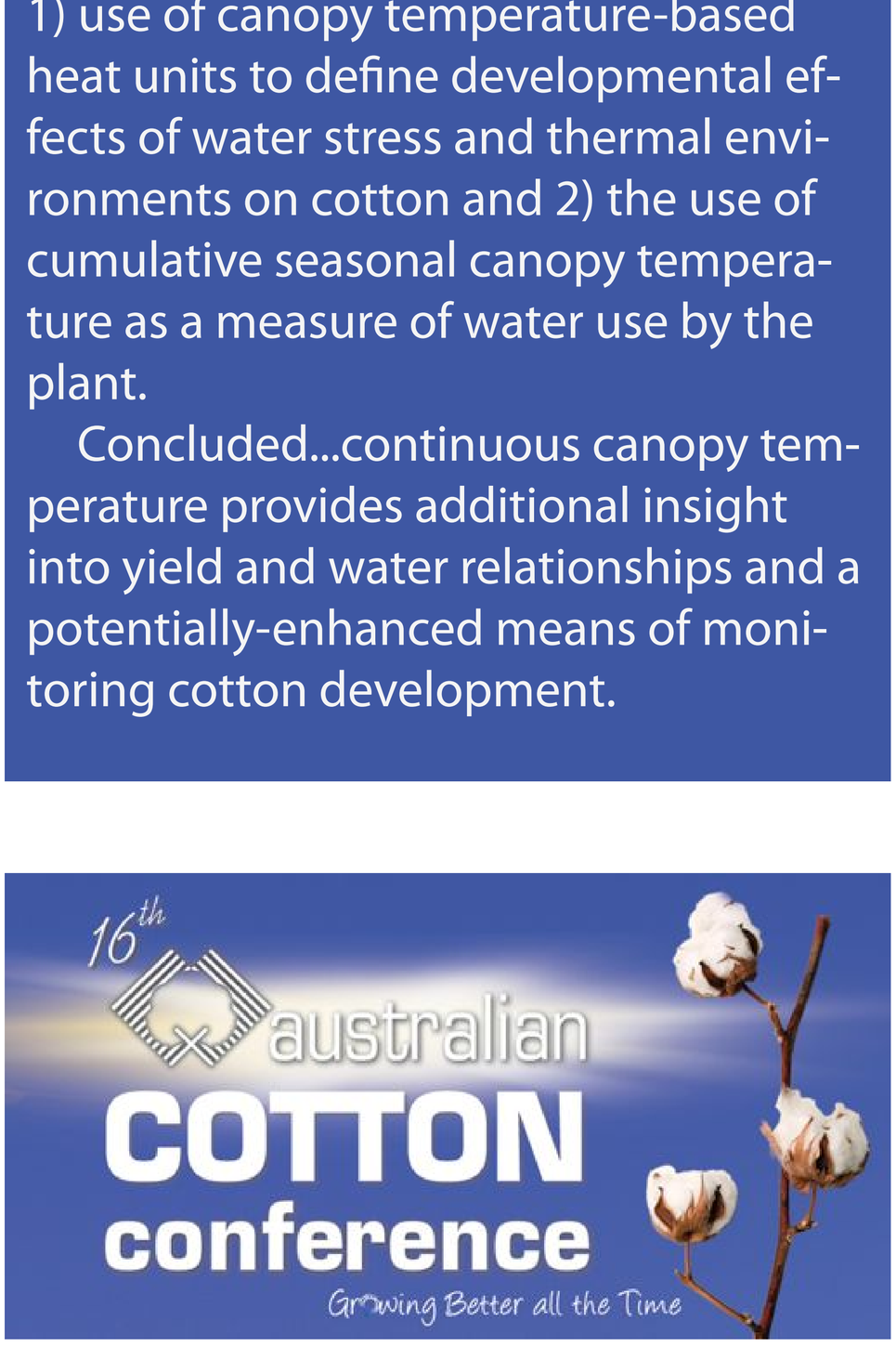
Average daytime canopy temperature was used as a surrogate for water use by the crop. Yield and average daytime canopy temperature relationships for the 2 years were described by a single linear.

Average canopy temperature may provide an improved estimate of crop water use.

Canopy temperatures of cotton grown under differential irrigation in 2009 were used to calculate Canopy Temperature-Based Heat Units (CTHU). Cooler (higher irrigation) canopies accumulate CTHU at lower rates that those based on air temperature (ATHU). Comparisons of accumulation of ATHU over the decade 2000-2009 with CTHU during 2009 indicate that irrigation-induced variation in a single year was similar to climate-induced variation over a decade.







Cotton Incorporated

gallala Aquifer
Funded by USDA ARS Research Initiative
A research consortium between USDA-Agricultural Research Service, Kansas State University, Texas Agricultural Experiment Station, Texas Cooperative Extension, Texas Tech University, and West Texas A&M University