On-Farm Research to Evaluate Irrigation Scheduling Tools to Increase Yield and Control Diseases

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Water for agricultural, urban and industrial use in the Austin – San Antonio – Uvalde corridor is pumped from the Edwards aquifer. This unique aquifer is in a class by itself in terms of containment, recharge, and political sensitivity. The regulation of this aquifer, however, is portent to the regulation of all aquifers in Texas. In 1993 Senate bill 1477 imposed a maximum draw of 450,000 acre-feet (AF) of water per year from the Edwards aquifer, with an additional reduction to 400,000 AF by the year 2008. However, current water permits amount to 563,000 AF imposing an immediate reduction of approximately 100,000 AF. Since 50 percent of the water drawn from the aquifer is for agricultural use, agricultural water conservation strategies are of utmost importance in the Edwards region and must play a role in reducing the shortfall. Research has repeatedly shown that proper irrigation management is essential to sustaining profitability. PET networks and crop simulation models have proven to be reliable, inexpensive, and effective tools for estimating crop water needs in research settings.

Networks of weather stations have been recently established in the Texas High Plains (TXHPET) as the site-specific basis for computing crop water use. It has been estimated in the northern Texas Panhandle, yearly fuel cost and pumping savings could exceed $18 million annually if all irrigators used the PET network data. This value is based on a reduction of irrigation water applied of only 2 inches.

Based on 90,000 acres of irrigated land in the Edwards aquifer region (TWDB report 347, 2001), we estimate that when all irrigators in the region implement limited irrigation scheduling, 14.6 to 19.5 billion gallons of water (50,000 to 60,000 AF) per year could be saved and made available for water purposes other than agricultural use within the region.

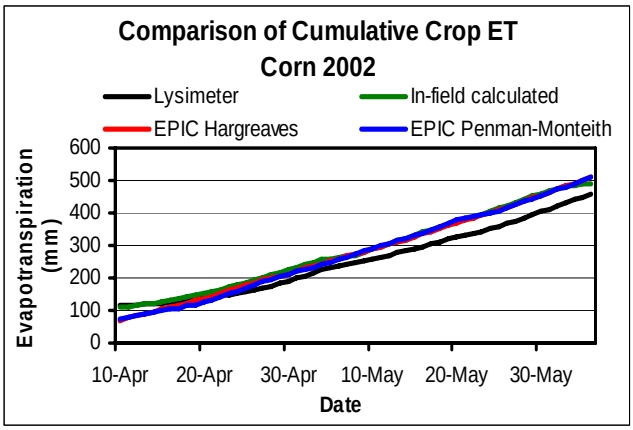
The ultimate goal of this project is to evaluate research findings from experiment stations statewide in a farm environment. Computer models such as CropMan will be utilized and crop ET (ETc) will be computed to assess growth and development and to evaluate production practices that achieve water conservation without adversely affecting yield and profitability.

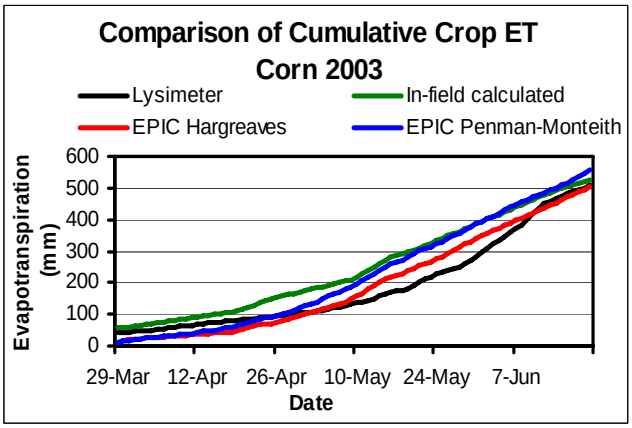
Activities Carried Out In This Project

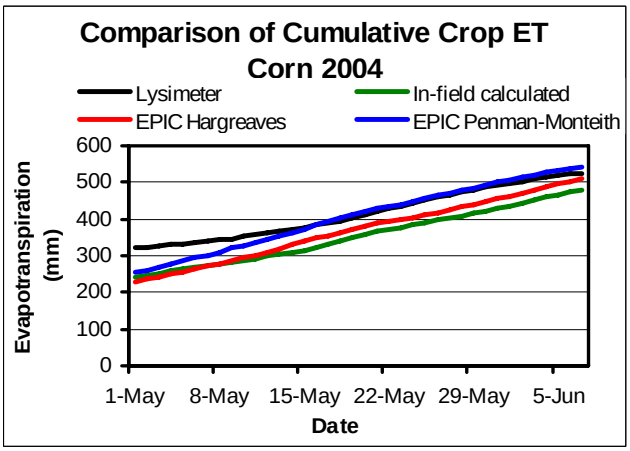
In the spring and summer of 2005, the Precision Irrigators Network (PIN) collected data from the crops grown in Uvalde, Medina, Bexar, Frio, Atascosa, Dimmit, and Maverick counties.

“Water mark” sensors were purchased for 15 participating farmers to record water use data. County Extension agents in the study area traveled to these farms each week and gathered water information on water use, soil moisture, and the growth stages (phenology) of plants during the growing season. The location of pivot irrigation systems was recorded with a global positioning system.

These data were used as inputs to the Texas A&M University "CropMan" model to analyze the relationships between water supplies, water use, and crop yields. The CropMan model was calibrated using various possible ETc formulas. Comparisons were made between corn ET data measured with in-ground weighing lysimeters and calculated with several ETc formulas to validate the model. Results of the calibration equations are in the following graphs and are summarized in numerical form in the table.







Crop Water Usage Under Unstressed Crop Conditions				
Year	**Measured lysimeter**	**In-field calculated (modified PM)**	**EPIC Simulated (Hargreaves)**	**EPIC Simulated (original PM)**
	mm	*mm*	*mm*	*mm*
2002	**457.71**	**491.24**	**509.27**	**511.56**
2003	**507.49**	**523.24**	**502.41**	**560.07**
2004	**526.03**	**477.52**	**509.52**	**541.53**
3-year mean	**497.08**	**497.33**	**506.98**	**537.72**
Difference from measured lysimeter data	**------**	**0.25**	**9.91**	**40.64†**

† indicates the crop ET is significantly different from the measured lysimeter crop ET at the 0.1 alpha level