Texas Alliance for Water Conservation

Cotton - Field to Gin

Yesterday
Today
Tomorrow

Texas Alliance for Water Conservation

Rick Kellison, Project Director

Texas Tech University
College of Agricultural Sciences
& Natural Resources

Funded by:
Texas Alliance for Water Conservation

- Project established 2004 from a State of Texas grant administered through the Texas Water Development Board.

- Project is **Producer Driven** and **Board Directed**.

**Project Objectives**

- Develop and Demonstrate new technologies and management tools and strategies that result in less water being used with enhanced profitability.
- Identify effective crop and irrigation systems.
- Impact producer decision-making.
Ogallala Aquifer

- Aquifer covers 174,000 square miles across 8 states in the High Plains of the United States.
- Over 95% water pumped is for irrigated agriculture.

The Texas South Plains on the southern end of the aquifer is an intensive agricultural production area and the focus of this program.
Field to Gin
Texas Cotton Production

- Texas No. 1 Cash Crop

- Statewide:
  - 65% of acres are rain-fed
  - 35% are irrigated

- High Plains:
  - 60% of acres are rain-fed
  - 40% irrigated

- Weather (rainfall) is most influential factor in yield
  - Rain-fed: 250–650 lbs/acre
  - Irrigated: 500–1,500 lbs/acre

- Harvest Methods
  - Stripper: Lower purchase & maintenance cost
  - Picker: Higher purchase & maintenance cost

Data provided by Plains Cotton Growers
In 1980, the peak of irrigated acreage on the High Plains:

- **2.2 million** acres of cotton planted
- **2 million** acres harvested
- **1.59 million** bales produced

In 2010:

- **1.74 million** acres of irrigated cotton planted (LESS than the peak)
- **1.68 million** acres harvested
- **3.5 million** bales produced (120% increase in yield on LESS acreage)
More than fiber

- 1980 – 50 lbs lint/inch water
- 2015 – 100 lbs lint/inch water
- 2029 – ?
Cotton and Value
U.S. Dollar

- **Yield** per pound of raw cotton
  - Lint 35 %
  - Cotton seed 49 %
  - Trash 16 %
- For every pound of cotton we get 1.4 pounds of **cotton seed**

- Example of value
  - Lint 65 cents per pound
  - **Cotton** seed at $230.00 per ton
    = .115 per pound X 1.4 pounds
    = $.161 per pound of lint or **24.7% the value of the lint**
1980’s to Today

- Greatest improvements in farming technology since mechanization
- Advancements in irrigation technology
- Improvements in cotton genetics
- Dramatic increases in yield
  - Average yield per acre has jumped from 150 lbs/acre in the 1930’s to about 750 lbs/acre in 2013

Data provided by Plains Cotton Growers
Irrigation: Yesterday and Today

- First Irrigation Well on the High Plains: drilled in Bailey County, 1909
- First in Lubbock: 1911
- Used open discharge wells to deliver water to the field
- General decline in water well irrigation during World War I; introduction of tractor encouraged dryland farming on large tracts
- Little irrigation used from 1919–1926 because of above average rainfall
- Interest revived during 1930’s drought, Dust Bowl and World War II
- Furrow irrigation introduced in 1940’s

Data provided by Plains Cotton Growers
Irrigation Advances

- Underground pipelines replaced open ditches in 1950’s and 1960’s
- High pressure center pivot and side roll sprinkler systems popular in 1960’s and 1970’s; had water losses of about 50 percent
- Center pivot sprinkler systems became popular in early 1980’s; helped reduce water losses to about 20 percent
- Low energy precision application (LEPA) systems developed by Dr. Bill Lyle with the Texas A&M Research and Extension Center at Lubbock, Texas in 1980’s
- Many producers now installing drip irrigation systems
- New technologies being evaluated

~98% Efficiency increase in return per inch of water since irrigation began. Combination of irrigation, fertility, tillage, pest management (Best Management Practices)
Technologies and Tools
Improved Water Management

Capacitance probes
VRI
PMDI

Online ET Scheduling Tool

Crop Temperature Sensors

### Crop Summary

<table>
<thead>
<tr>
<th>Site</th>
<th>Weather Station</th>
<th>Acreage</th>
<th>Type</th>
<th>Land Use</th>
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Click on the above crops to view the chart and daily measurements by site.
AquaSpy™ Capacitance Probe

REAL TIME FIELD STATUS

- **Root Depth**
  - Indicates depth of active roots

- **Infiltration Depth**
  - Shows date and depth of last wetting event

- **Graphs**
  - Provide detailed view

- **Field Status**
  - Icon changes color to indicate status
AquaSpy™ Capacitance Probe

- Annual Subscription
- Web-based dashboard
- Visual cues for field status
- Optimum soil moisture
- When need to irrigate

**IRRIGATION TEMPLATES**

- **Full Point**: Indicates soil profile is full
- **Optimum Band**: Shows optimum moisture conditions for best yield and quality
- **Nearing Irrigation**: Soil moisture is between the optimum band and the refill

**Why are Irrigation Templates so important?**
- Season-long roadmap on how best to irrigate
- Catch and correct issues before they become a problem
- Enable you to effectively manage seasonal changes and new varieties
- They provide PROCESS CONTROL & are your RECIPE FOR SUCCESS
4”–20” zones wetting up with drip turned on
Rainfall stored moisture all the way to 48”
Technology can be adapted to any type of crop and desired spacing.
Precision Mobile Drip Irrigation

Contrast of water application with drag drip vs spray application
Precision Mobile Drip Irrigation

PMDI™

Precision water application using a center pivot
Variable Rate Technology

Why VRT?

- 20–30% of pivot irrigated acres should be converted to dryland

- Application of water to meet specific field needs through Pre-determined prescription

- Prescription based on:
  - Satellite imagery
  - EM mapping
  - Yield monitors
  - Soil type
  - Others

Ability to control individual nozzles and speed of pivot
Variable rate technology for pivots
Measures crop **canopy temperature** using an infrared thermometer.

Temperature is a significant measure of plant stress.

Measures an individual plant's level of stress.

Can be used to determine if irrigation is necessary.
Advances individual sensing

Captures canopy temperature data on hundreds of test areas

Automatic irrigation triggers and crop management alerts
Potential Evapotranspiration

Wind at 2 meters

Over 80 West Texas Mesonet Stations and expanding
Free web–based tool used to determine:

- When to apply water.
- How much water to apply.
- How to achieve specific management goals.

www.tawcsolutions.org
## Crop Summary

<table>
<thead>
<tr>
<th>Site</th>
<th>Weather Station</th>
<th>Acreage</th>
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<th>Last Et</th>
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## Daily Measurements

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Yield and Percent Water Demand
Project Sites 2006–2013

Lbs per acre vs % Crop water demand

- 2006-2010, 2012-2013
- 2011
Yesterday –
- Open ditch high pressure pivot
  - 50% Efficiency

Today –
- SDI
  - 98% Efficiency
- Soil moisture monitoring
- PMDI™
- VRI
- Ability to measure plant stress
- Water management tools

Tomorrow –
- Can we expect more of the same?
- Best Management Practices
Thank You!

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