Demonstrated Water Conservation Technologies

Texas Alliance for Water Conservation

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TEXAS TECH UNIVERSITY
College *of* Agricultural Sciences & Natural Resources

Funded by:
Texas Water Development Board

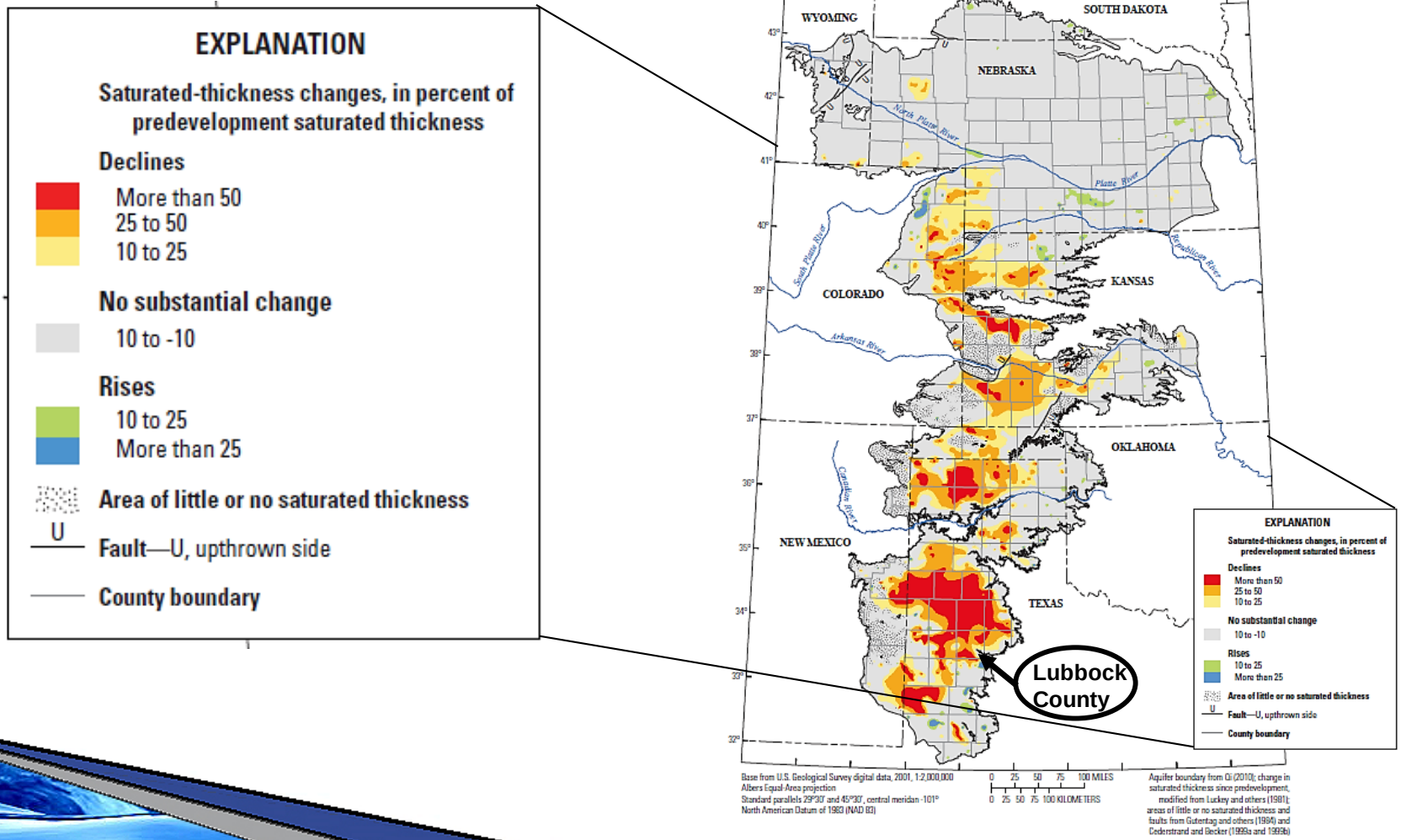
Ogallala Aquifer

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

- Texas South Plains on southern end of aquifer and is an intensive agricultural production area and focus of this program.

Percent Saturated-Thickness Change

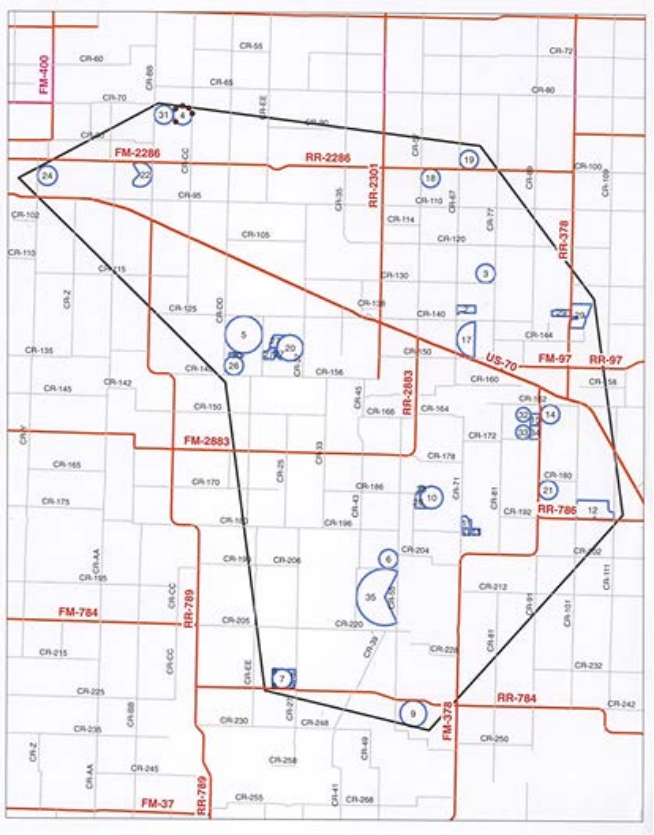
Predevelopment (about 1950) to 2013

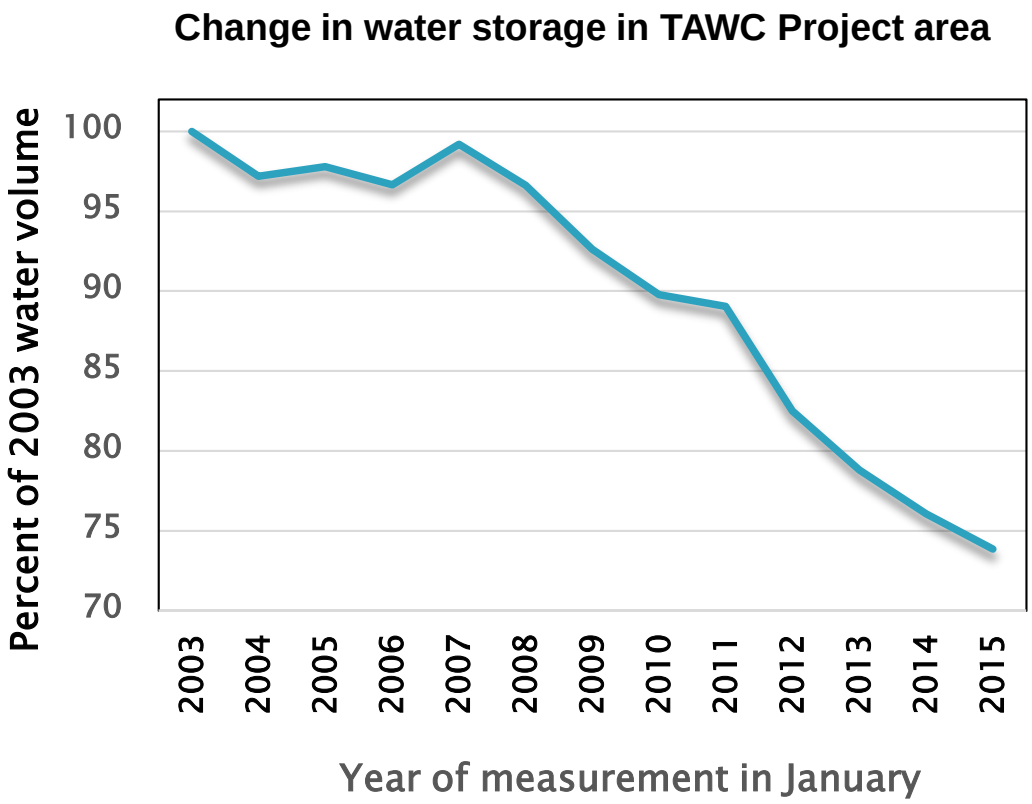


USGS, Scientific Investigations Report 2014-5218

TAWC 2004–2015 Project Area

Original TAWC Project Area (97,900 acres)

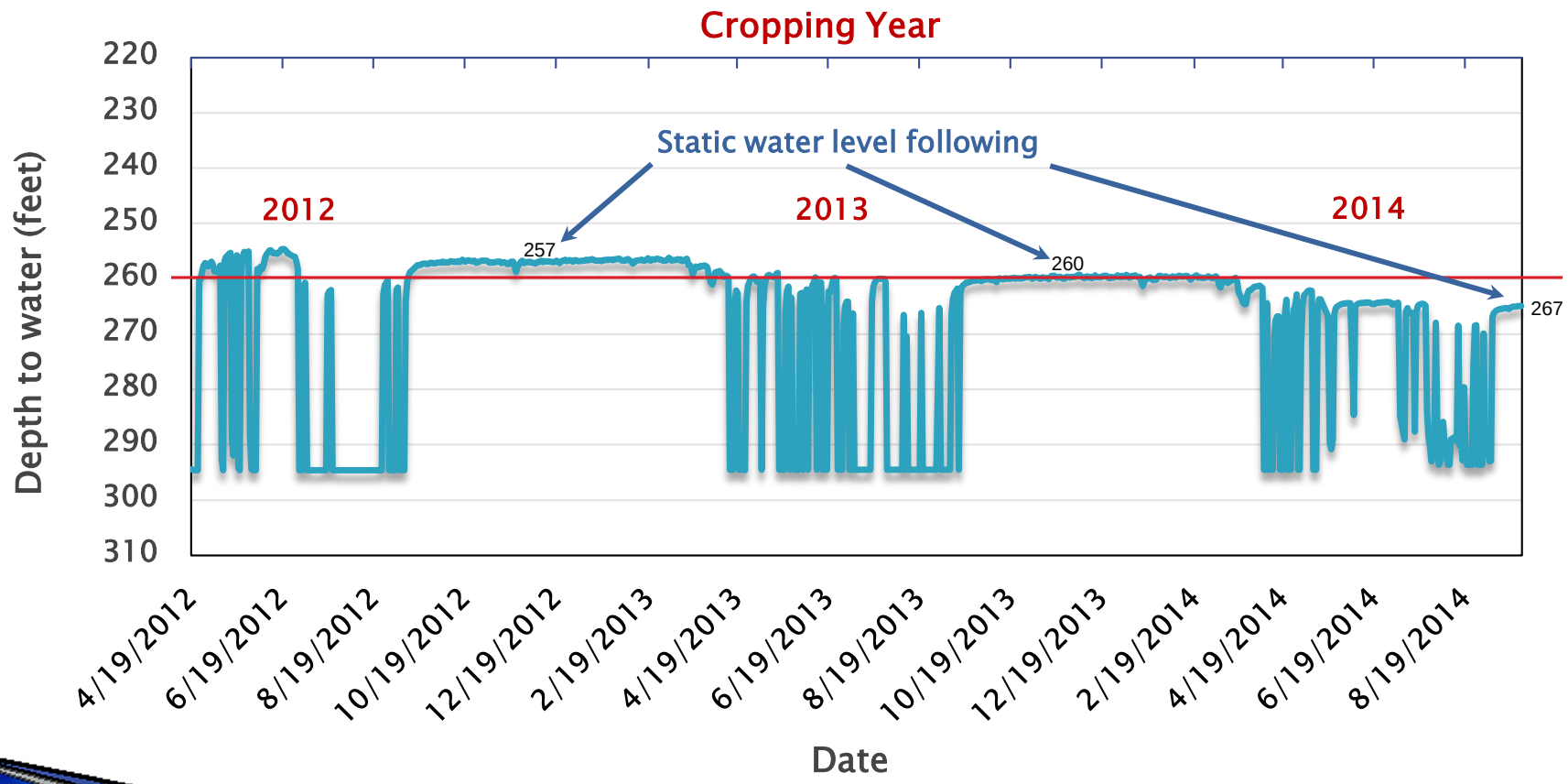




Data provided by High Plains Underground Water Conservation District No. 1. Lubbock, TX

Depth to Water for single site

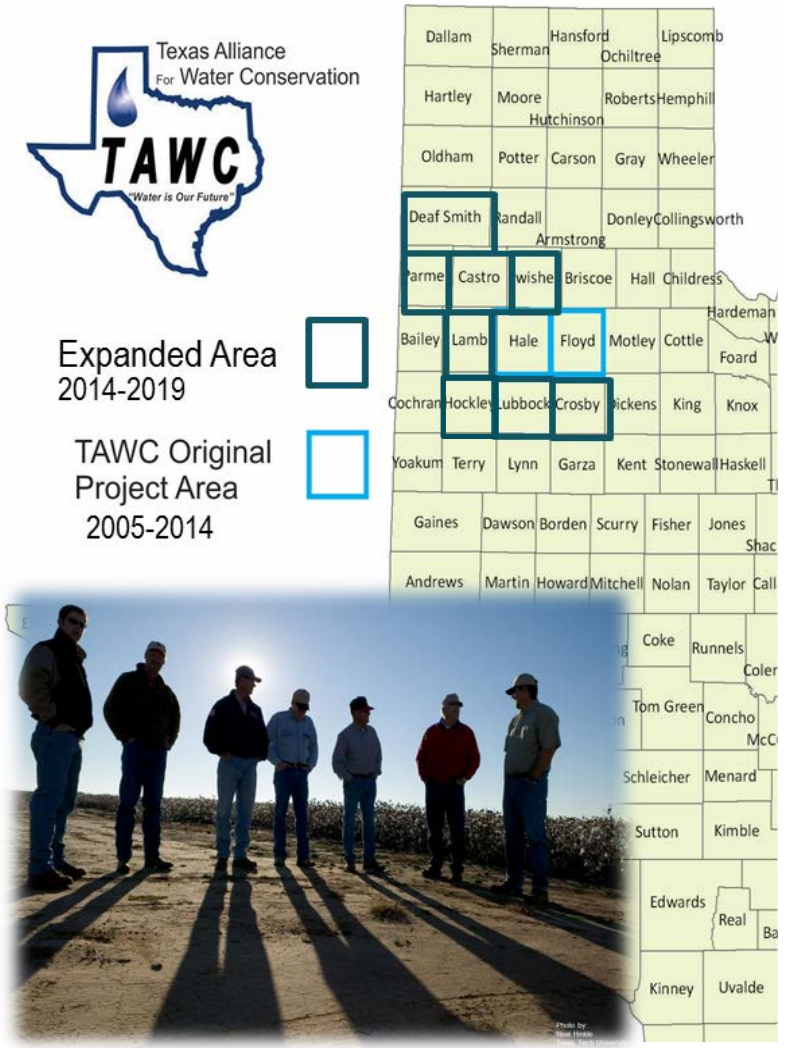
(as measured with HPWD installed transducer)



Hale County Data provided by High Plains Underground Water Conservation District No. 1. Lubbock, TX

Texas Alliance for Water Conservation

- 2004 – $6.2M for 8 years (2005-2012) and extended through April 2014, administered through TWDB.
- 2014 – State renewed funding for additional $3.6M for 5 years (2014-2019) and project expansion.
- Project is **Producer Driven** and **Board Directed**.



Project Objectives

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

Site Monitoring

- Rainfall
- Temperature
- Water applied
  - *Netirrigate*
- Soil moisture
  - *AquaSpy*
  - *Crop Sense*
  - *Aqua Check*
- Production inputs
- Plant & animal yields
- Economic analysis

Technology Comparison and Demonstration

LESA Spray

PMDI

LEPA

Span comparisons of different water application configurations

LEPA vs LESA Budget Comparison
2011

	2011			
	LESA		LEPA	
PER ACRE GROSS INCOME	**Quantity**	**Total**	**Quantity**	**Total**
Cotton lint	879	$ 791.10	1001	$ 900.90
Cotton seed	0.63	$ 215.48	0.72	$ 245.39
PER ACRE TOTAL GROSS INCOME		$ 1,006.58		$ 1,146.29
PER ACRE TOTAL OF ALL COST		$ 945.93		$ 968.89
PER ACRE NET PROJECTED RETURNS		**$ 60.65**		**$ 177.40**
Percent increase				193%
WATER APPLIED - INCHES		26.1		26.1
Lint lbs per acre-in of water applied		**33.7**		**38.4**
Percent increase				13.9%

LEPA vs LESA Budget Comparison
2012

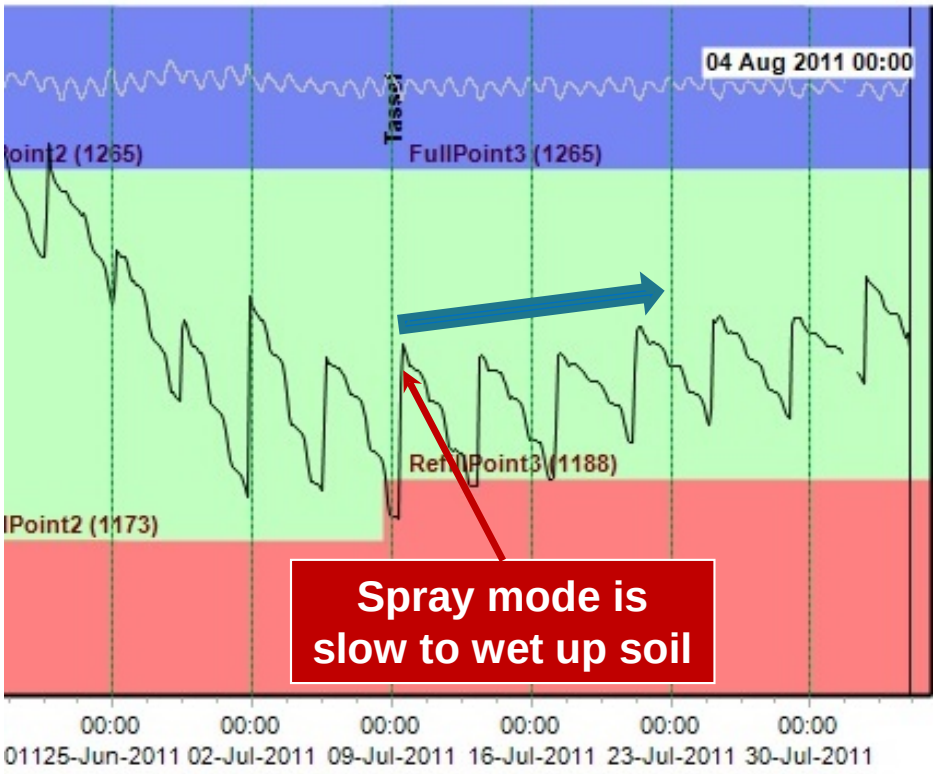
	2012			
	LESA		LEPA	
PER ACRE GROSS INCOME	**Quantity**	**Total**	**Quantity**	**Total**
Cotton lint	896	$ 806.40	1057	$ 951.30
Cotton seed	0.65	$ 180.88	0.76	$ 213.39
PER ACRE TOTAL GROSS INCOME		$ 987.28		$ 1,164.69
PER ACRE TOTAL OF ALL COST		$ 950.04		$ 980.33
PER ACRE NET PROJECTED RETURNS		**$ 37.25**		**$ 184.35**
Percent increase				395%
WATER APPLIED - INCHES		19		19
Lint lbs per acre-in of water applied		**47.2**		**55.6**
Percent increase				18.0%

LEPA vs LESA Budget Comparison
2013

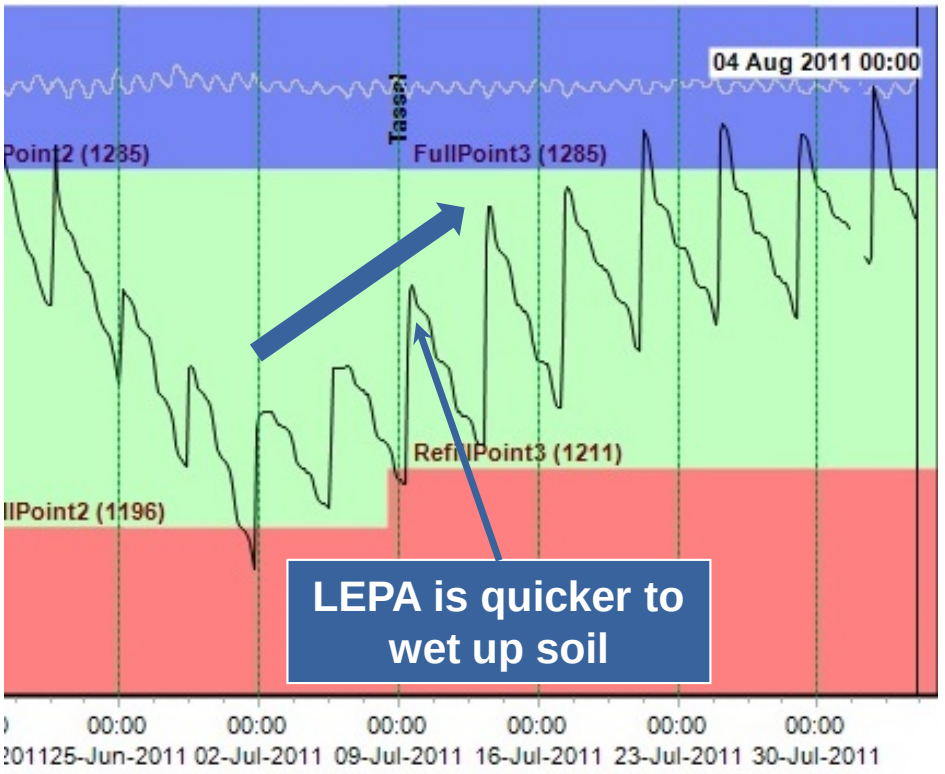
	2013			
	LESA		LEPA	
PER ACRE GROSS INCOME	**Quantity**	**Total**	**Quantity**	**Total**
Cotton lint	1028	$ 771.00	1165	$ 873.75
Cotton seed	0.74	$ 207.53	0.84	$ 235.19
PER ACRE TOTAL GROSS INCOME		$ 978.53		$ 1,108.94
PER ACRE TOTAL OF ALL COST		$ 906.33		$ 924.94
PER ACRE NET PROJECTED RETURNS		**$ 72.20**		**$ 184.00**
Percent increase				155%
WATER APPLIED - INCHES		16.5		16.5
Lint lbs per acre-in of water applied		**62.3**		**70.6**
Percent increase				13.3%

Comparison of Irrigation Method

LESA Mode



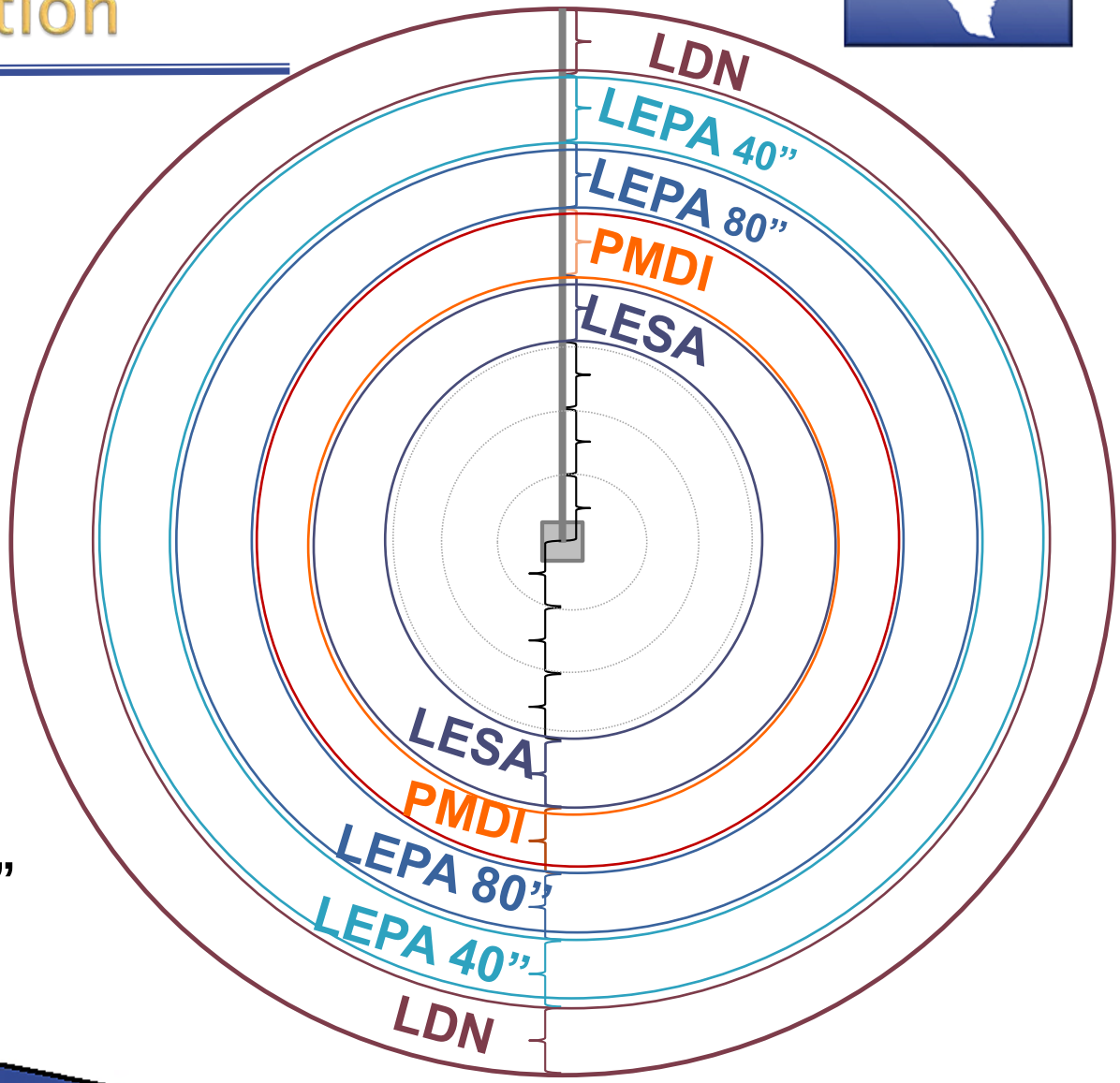
LEPA Mode



Pivot Irrigation Technology

2016 Demonstration

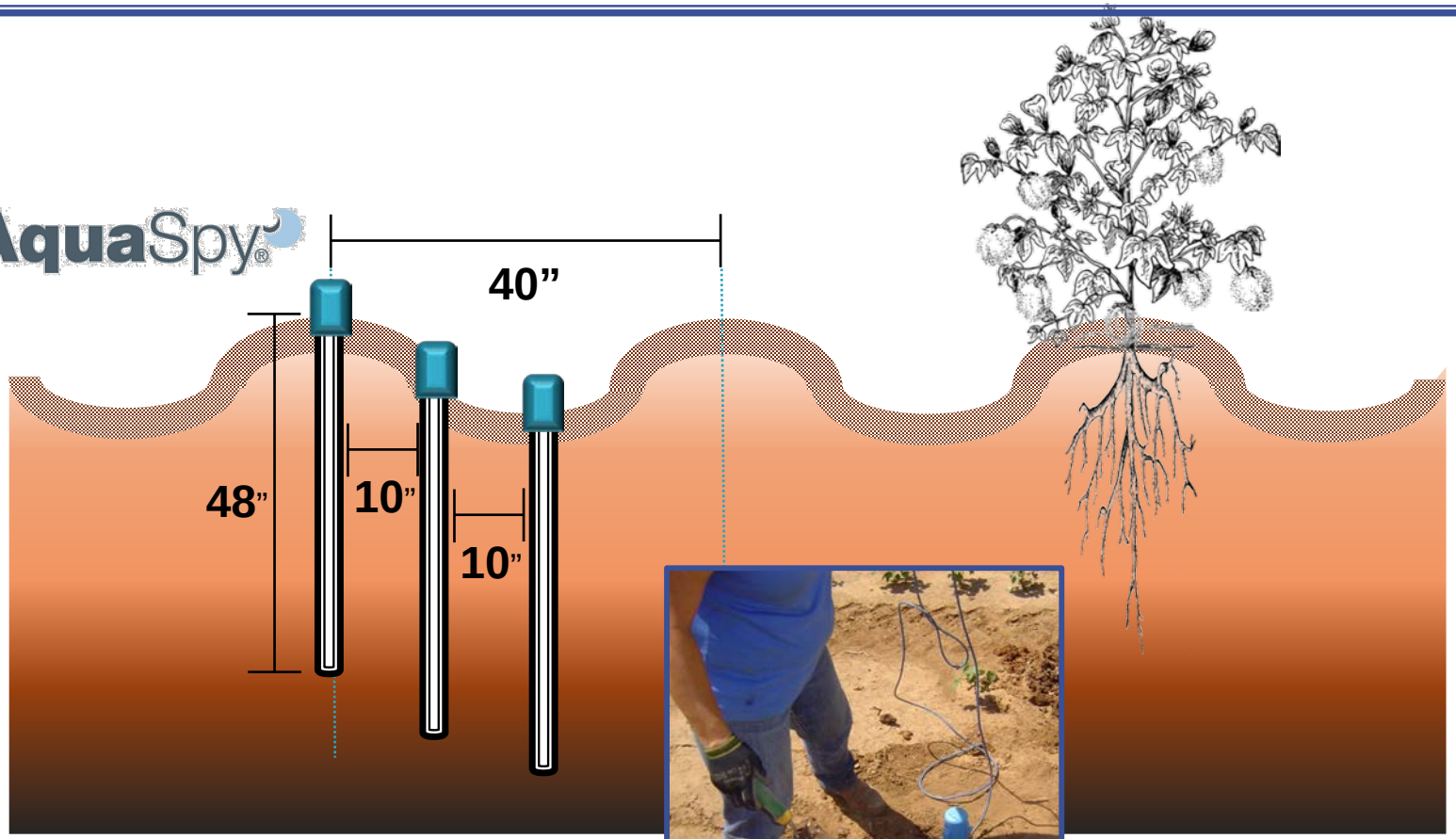
- **LDN**
  - Low drift nozzels
- **LEPA**
  - 40”
  - 80”
- **PMDI**
  - Precision Mobile Drip Irrigation
- **LESA**
  - Broadcast spray 80”



*450 gallon per minute from 3 wells

Placement of AquaSpy®

Capacitance Probes



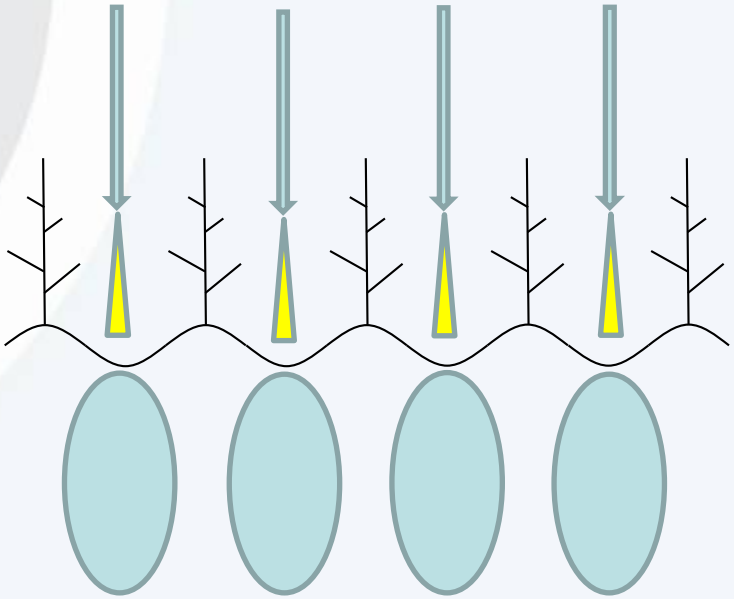
LEPA LDN 80”

LEPA 40”

LEPA 80”

Wetting Patterns - LEPA

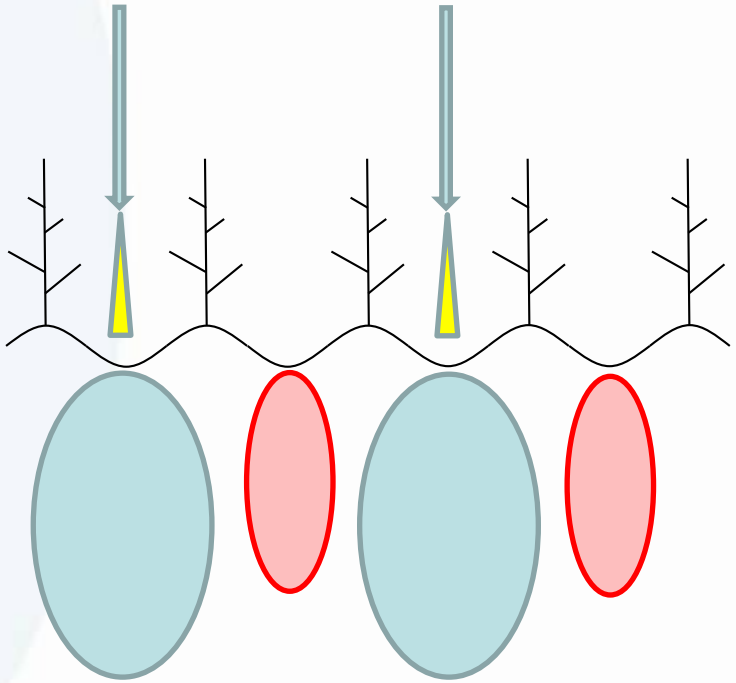
Low **E**nergy **P**recision **A**pp (40”)



Wetting is deep and more uniform

- Water follows cracks root channels
- Water tends to “marry up”
- More expensive investment

Low **E**nergy **P**recision **A**pp (80”)



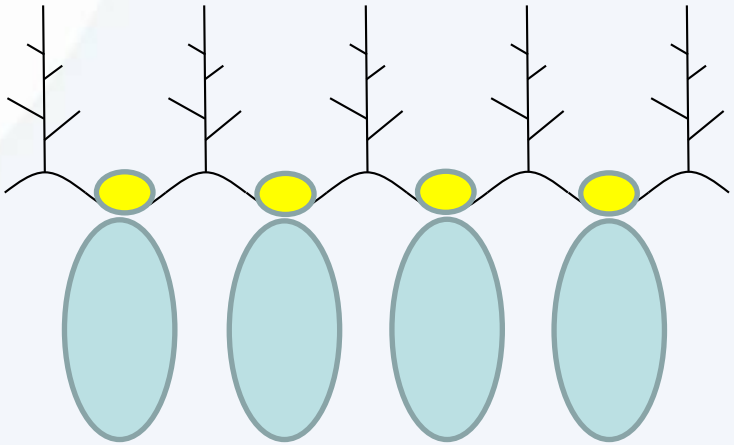
Wetting is deep but less uniform

- Water follows cracks root channels
- Wet spots and dry spots
- Cheaper alternative

PMDI

Wetting Patterns – PMDI & LDN

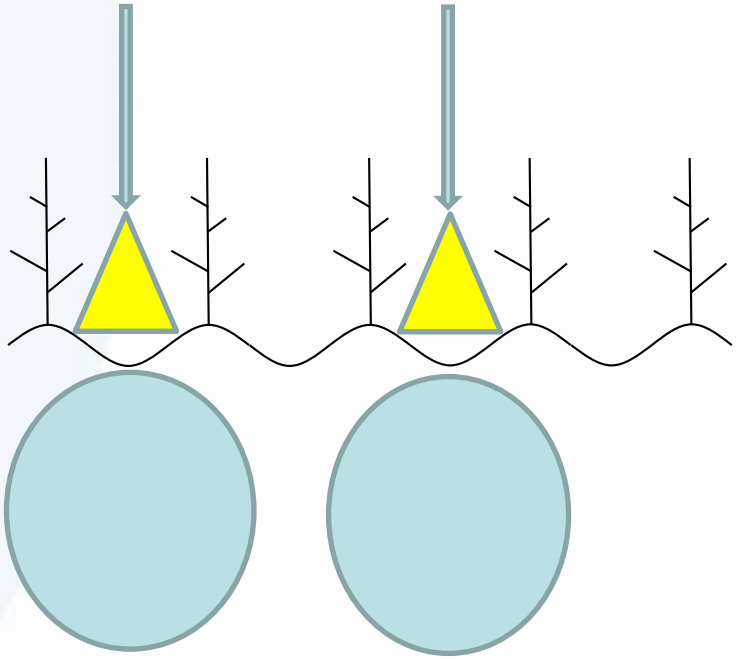
Precision **M**obile **D**rip **I**rrigation



Similar pattern to LEPA

- Longer infiltration time
- More uniform wetting pattern
- More expensive investment

Low **D**rift **N**ozzle



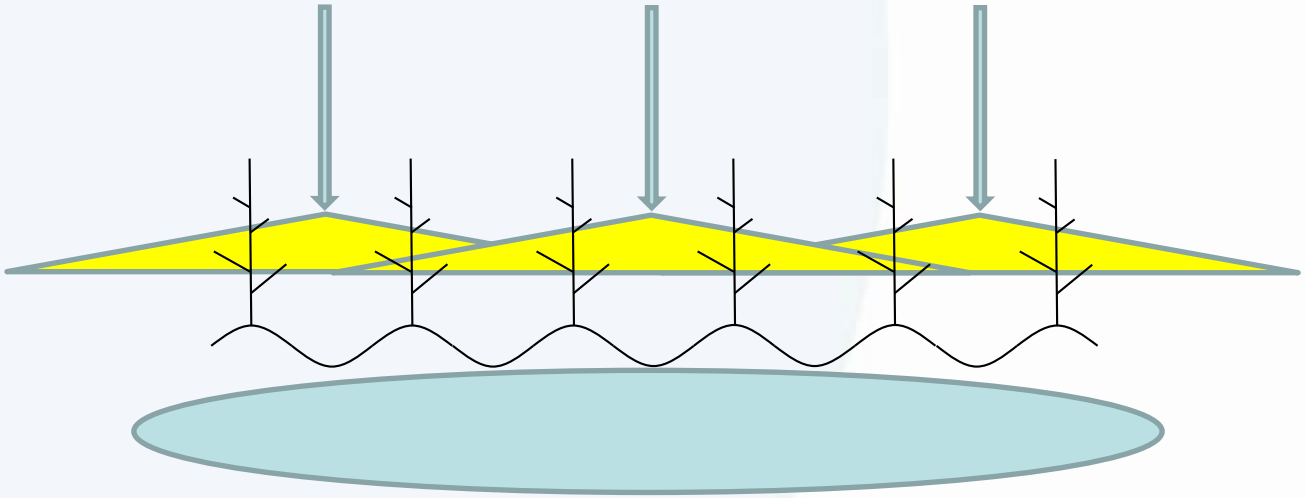
Wetting is deep and more uniform

- Water follows cracks root channels
- Fewer wet spots and dry spots

LESA Broadcast Spray

Wetting Patterns - LESA

Low **E**nergy **S**pray **A**pp



Wetting pattern is uniform but shallow

- Prone to evaporation from plants and soil
- Hard to get deep penetration

Technology Comparison
2016 Grain Sorghum

Irrigation System	Yield/acre	Moisture %
LEPA 80” LDN	4492	14.5
LEPA 40”	6612	14.2
LEPA 80”	7033	14.1
PMDI	7066	14.1
LESA Broadcast	6267	14.1

Technology Comparison
2016 Cotton

Irrigation System	Yield, lbs/acre	Turnout, %	$/lb
LEPA 80” LDN	1272	37.83	0.4802
LEPA 40”	1333	34.62	0.4788
LEPA 80”	1203	29.65	0.4909
PMDI	1420	35.47	0.4871
LESA Broadcast	1500	32.16	0.4870

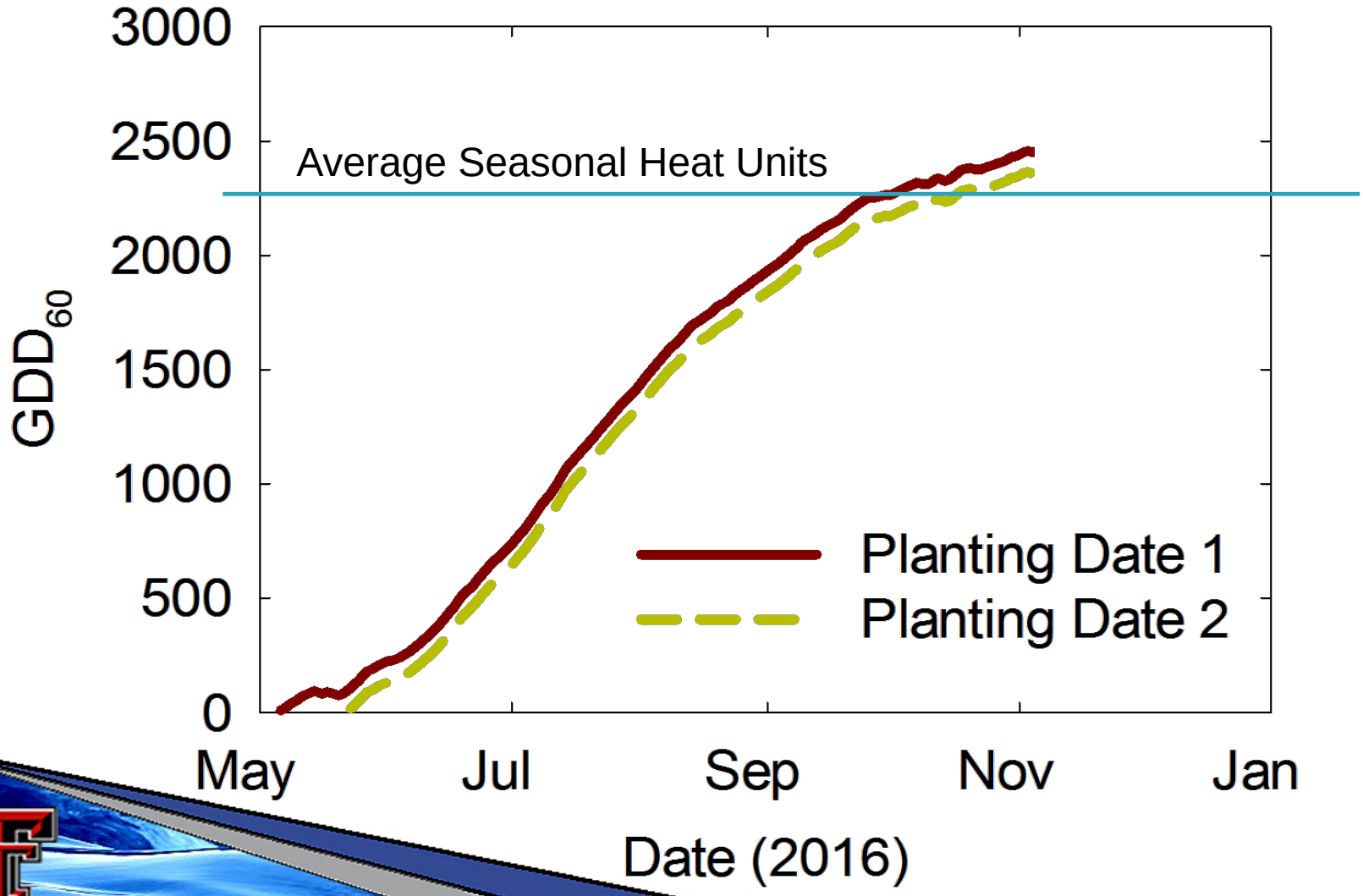
Rainfall Makes a Difference

- High rainfall results in a lower impact of the various irrigation systems.

Plainview Rainfall 2005-2016

Month	Avg Rainfall (inches) 2005-2016	Rainfall (inches) 2016
January	0.48	0.15
February	0.59	0.16
March	1.10	0.20
April	1.11	1.11
May	3.03	1.98
June	2.28	2.79
July	2.66	0.77
August	1.87	5.48
September	1.88	2.28
October	1.41	0.44
November	0.46	0.98
December	0.63	0.54

Heat Units New Deal, TX

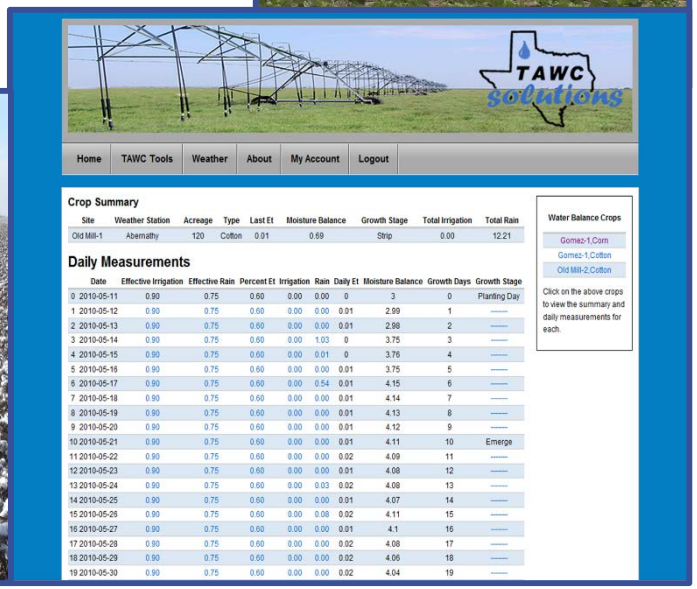


TAWC–Solutions

ET Irrigation Scheduling Tool

Web–based tool used to determine:

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



www.tawcsolutions.org

TAWC-Solutions

ET Irrigation Scheduling Tool

Crop Summary

Site	Weather Station	Acreage	Type	Last Et	Moisture Balance	Growth Stage	Total Irrigation	Total Rain	Total ET
Cotton 2014-1	Abernathy 5ENE	120	Cotton	0.01	1.57	Strip	14.00	14.14	19.62

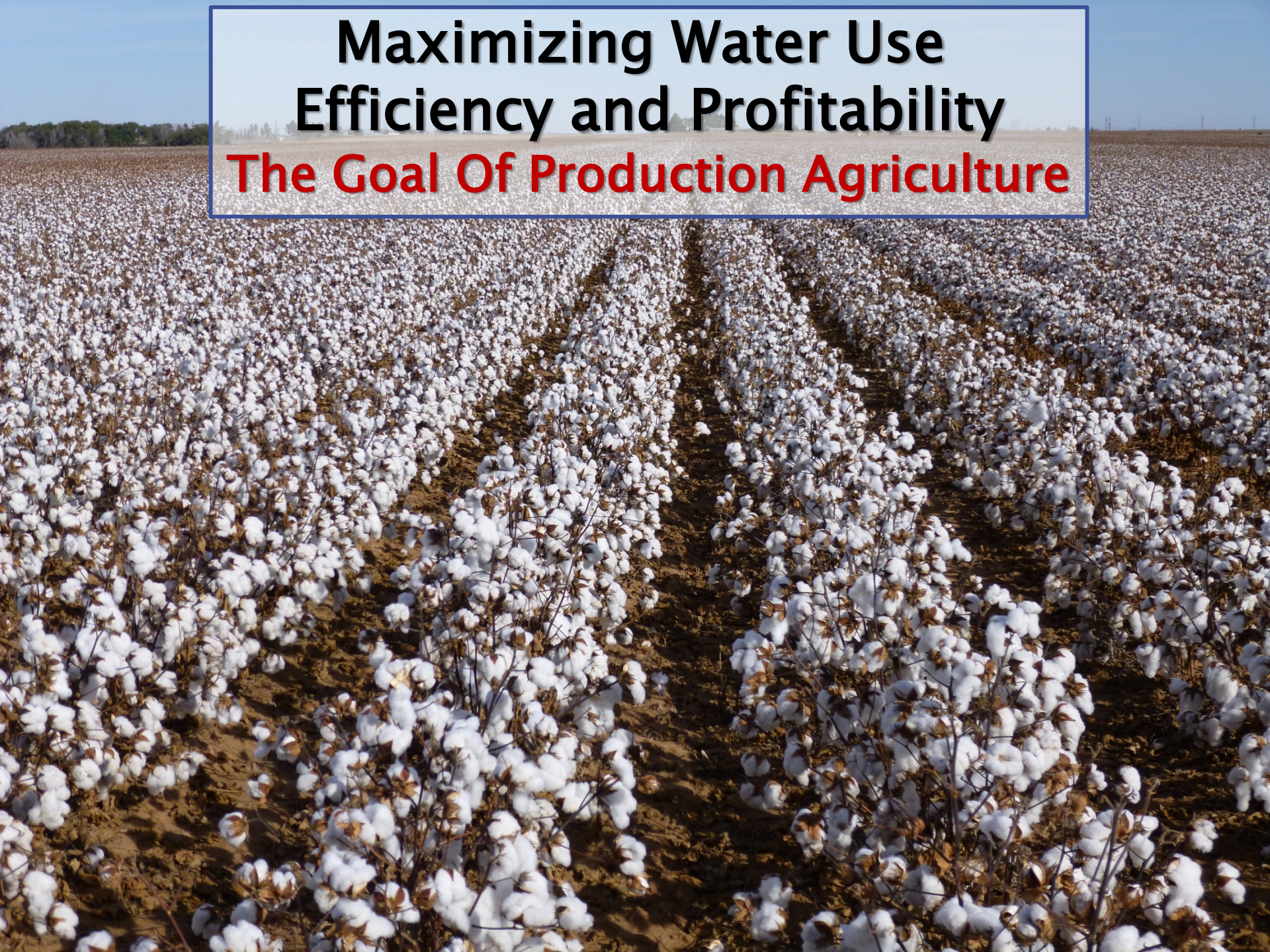
Daily Measurements

	Date	Effective Irrigation	Effective Rain	Percent Et	Irrigation	Rain	Daily Et	Moisture Balance	Growth Days	Growth Stage
0	2014-05-10	1.00	1.00	1.00	0.00	0.00	0	0	0	Planting Day
1	2014-05-11	0.90	0.60	1.00	0.00	0.00	0.03	0	1	-------
2	2014-05-12	0.90	0.60	1.00	0.00	0.00	0.02	0	2	-------
3	2014-05-13	0.90	0.60	1.00	0.00	0.00	0.01	0	3	-------
4	2014-05-14	0.90	0.60	1.00	0.00	0.00	0.02	0	4	-------

Water Balance Crops

- Cotton 2013-1,Cotton
- Cotton 2013-1,Cotton
- Corn 2013-1,Corn
- Corn 2014-1,Corn
- GS 2013-1,Sorghum
- GS 2014-1,Sorghum

Click on the above crops to view the summary and daily measurements for each.


Maximizing Water Use
Efficiency and Profitability
The Goal Of Production Agriculture

Thank You!

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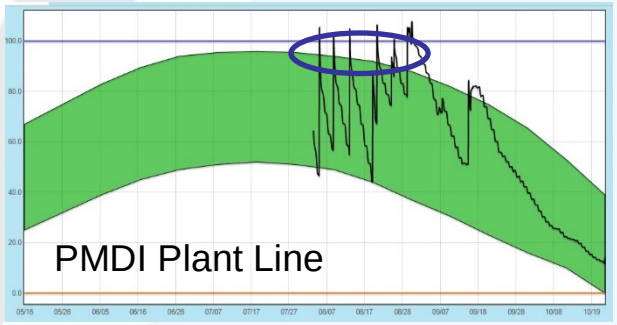
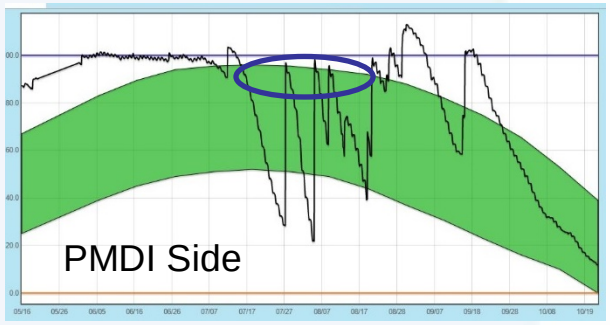
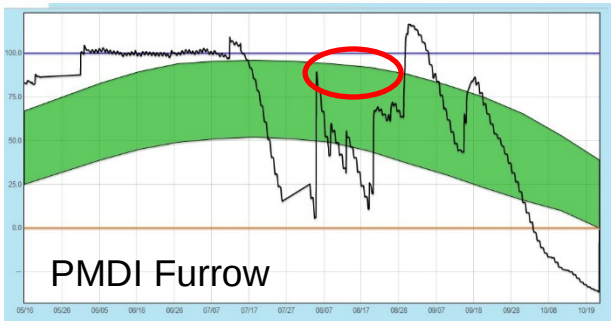
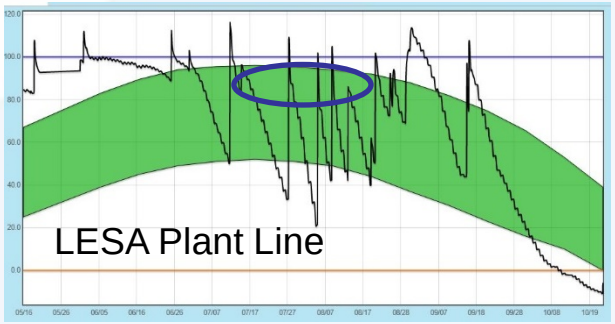
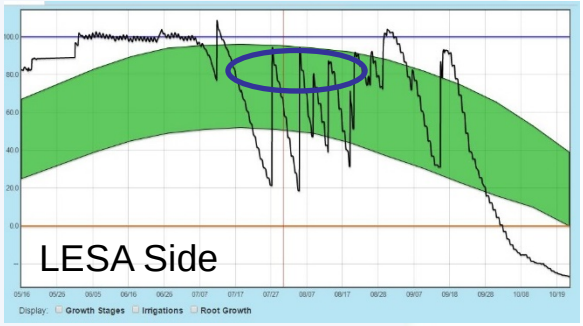
Lateral Movement of Water

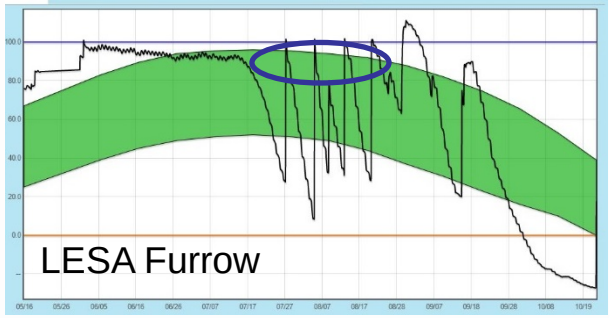


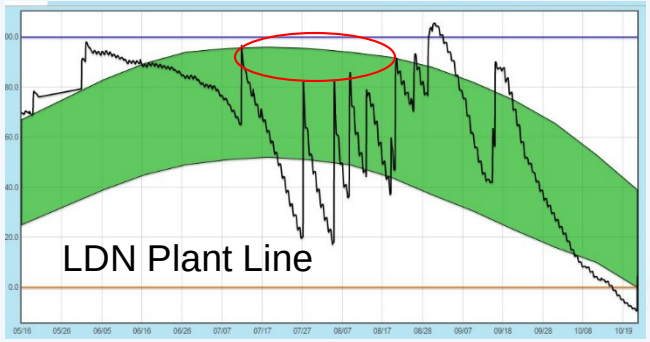


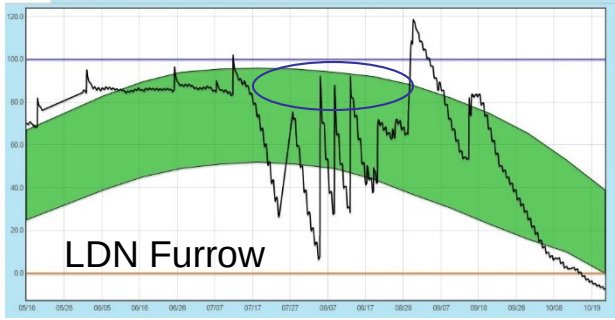












Treatment Comparison

	PMDI 40”	LEPA 40”	LEPA 80”	LESA 80”	LDN 80”
Wetting Pattern	Tending to wet the row and not the furrow	Tending to wet the furrow and not the bed	Tending to wet the furrow and not the bed	Wetting the bed and the furrow	Not wetting edge of bed as much as the furrow and the row
Issues	Uneven wetting pattern	Small wetting pattern	Wet rows and dry rows	Excellent infiltration and good uniformity	Water tending to run off side of bed
Reason	Tape probably dragging against the row	Outside of sprinkler, fast speed, low volume	Only wetting every other row	Inside span has slowest speed and longest soak time	Water following path of least resistance