

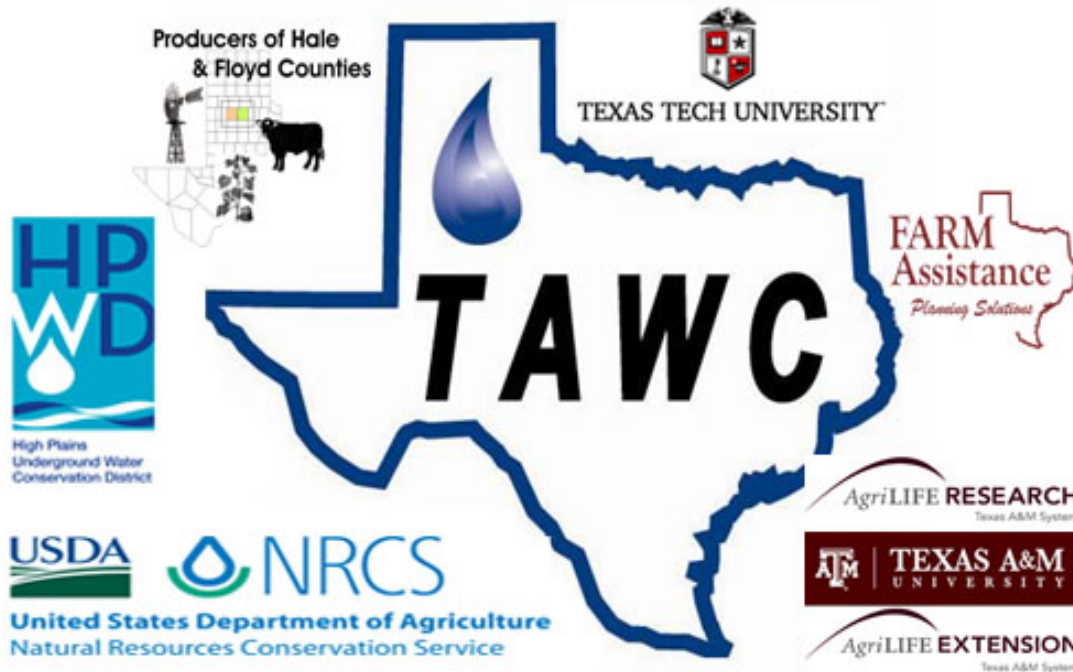
**'AN INTEGRATED APPROACH TO WATER CONSERVATION FOR
AGRICULTURE IN THE TEXAS SOUTHERN HIGH PLAINS'**

8TH ANNUAL REPORT
TO THE
TEXAS WATER DEVELOPMENT BOARD



JUNE 1, 2013

TEXAS ALLIANCE FOR WATER CONSERVATION PARTICIPANTS:



Appreciation is expressed to
Senator Robert Duncan
and the
Texas Water Development Board



With their vision for the future of Texas and their passion for the protection of our Water Resources this project is made possible

The future of our region and our state depend on the protection and appropriate use of our water resources.

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WATER CONSERVATION DEMONSTRATION PRODUCER BOARD

Glenn Schur, Chair
Boyd Jackson, Co-Chair
Eddie Teeter, Secretary
Keith Phillips
Mark Beedy
Jeff Don Terrell
Jody Foster
Lanney Bennett
Louis (Bubba) Ehrlich
Rick Kellison (ex-officio), Project Director

The Producer Board of Directors is composed of producer representatives within the focus area of Hale and Floyd Counties and is specifically charged to:

- 1) Ensure the relevance of this demonstration project to meet its objectives;
- 2) Help translate the results into community action and awareness;
- 3) Ensure the credibility and appropriateness of work carried out under this project;
- 4) Assure compatibility with and sensitivity to producer needs and concerns; and
- 5) Participate in decisions regarding actions that directly impact producers.

The board elects their chair, chair-elect, and secretary. Individuals serving on this board include representation of, but are not limited to producers cooperating in specific demonstration sites. The Chair serves as a full voting member of the Management Team. The Project Manager serves in an *ex officio* capacity on the Producer Board. Meetings of the Producer Board of Directors are on an as need basis to carry out the responsibilities of the project and occur at least annually in conjunction with the overall Management Team.

The value of this board to the project continues to be a key factor in its success.

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‘AN INTEGRATED APPROACH TO WATER CONSERVATION FOR AGRICULTURE IN THE TEXAS SOUTHERN HIGH PLAINS’

BACKGROUND

The Texas High Plains currently generates a combined annual economic value of crops and livestock that exceeds \$9.9 billion (\$2.4 crops; \$7.5 livestock; Texas Agricultural Statistics, Texas Department of Agriculture, 2012) but is highly dependent on water from the Ogallala Aquifer. Ground water supplies are declining in this region (The Cross Section Vol. 58 No.6, High Plains Underground Water Conservation District No. 1, 2012) while costs of energy required to pump water are escalating. Improved irrigation technologies including low energy precision application (LEPA) and subsurface drip (SDI) irrigation have increased water use efficiencies to over 95%, but have not always led to decreased water use. Furthermore, agriculture is changing in the Texas High Plains in response to a growing dairy industry and to current U.S. policy placing emphasis on renewable biofuels, especially ethanol. Both the dairy and the ethanol industries are increasing demands for grain crops, primarily corn. Feeds demanded by the dairy industry also include corn for silage and alfalfa, both of which require irrigation at levels above the current major cropping systems in this region. Increasing grain prices, fertilizer costs, and uncertain energy costs are driving changes in this region as well as increasing water scarcity.

Diversified systems that include both crops and livestock have long been known for complementary effects that increase productivity. Research conducted at Texas Tech over the past 15 years has shown that an integrated cotton/forage/beef cattle system, compared with a continuous cotton monoculture, lowered irrigated water use by about 25%, increased profitability per unit of water invested, diversified income sources, reduced soil erosion, reduced nitrogen fertilizer use by about 40%, and decreased needs for other chemicals, while maintaining similar cotton yields per acre between the two systems (Allen et al., 2005; 2007; 2008; 2012). Profitability was found similar for the integrated system as compared to the cotton monoculture system. Furthermore, soil health was improved, more carbon was sequestered, and soil microbial activities were higher in the integrated system compared with the cotton monoculture (Acosta-Martinez et al., 2004; 2008; 2010). This ongoing replicated research originally provided the information for designing the demonstration project and now provides the basis for interpretation of results from the demonstration project. Together, the demonstration sites coupled with the replicated research are providing a uniquely validated approach to discovery and implementation of solutions to preserving and protecting our water resource while offering viable agricultural solutions to the Texas High Plains and beyond.

No single technology will successfully address water conservation. Rather, the approach must be an integration of agricultural systems, best irrigation technologies, improved plant genetics, and management strategies that reduce water demand, optimize water use and value, and maintain an appropriate level of productivity and profitability. Water conservation must become both an individual goal and a community ethic. Educational programs are needed at all levels to raise awareness of the necessity for, the technology to accomplish, and the impact of water conservation on regional stability and economics. As state and global populations increase with an increasing demand for agricultural products, the future of the Texas High Plains, and indeed the

State of Texas and the world depends on our ability to protect and appropriately use our water resources. Nowhere is there greater opportunity to demonstrate the implications of successfully meeting these challenges than in the High Plains of west Texas.

A multidisciplinary and multi-university/agency/producer team, coordinated through Texas Tech University, assembled during 2004 to address these issues. In September of 2004 the project '*An Integrated Approach to Water Conservation for Agriculture in the Texas Southern High Plains*' was approved by the Texas Water Development Board and funding was received in February, 2005 to begin work on this demonstration project conducted in Hale and Floyd Counties. A producer Board of Directors was elected to oversee all aspects of this project. Initially, 26 producer sites were identified to represent 26 different 'points on a curve' that characterize and compare cropping and livestock grazing system monocultures with integrated cropping systems and integrated crop/livestock approaches to agriculture in this region. The purpose is to understand where and how water conservation can be achieved while maintaining acceptable levels of profitability.

OBJECTIVE

To conserve water in the Texas Southern High Plains while continuing agricultural activities providing the needed productivity and profitability for producers, communities, and the region. Results of this study assist area producers in meeting the challenges of declining water supplies and reduced pumping capacities by demonstrating various production systems and water saving technologies.

REPORT OF THE FIRST EIGHT YEARS

In the first year of any demonstration or research project, the data should be interpreted with caution. As systems are begun and data collection is initiated, there are also many factors that do not function as they will over more time when everything becomes a mature system with data gathering techniques well developed. For each added year of reporting, some data will be missing because there is only a partial years accounting or because some data are not yet complete. However, because each annual report updates and completes each previous year, the current year's annual report is the most correct and comprehensive accounting of results to date and will contain revisions and additions for the previous years.

Because this project uses existing farming systems that were already functioning at the beginning of the project, the startup time was minimized and even in the first year, interesting data emerged that had meaningful interpretations. These data become more robust and meaningful with each additional year's data.

A key strategy of this project is that all sites are producer owned and producer driven. The producers make all decisions about their agricultural practices, management strategies, and marketing decisions. Thus, practices and systems at any specific site are subject to change from year to year as producers strive to address changes in market opportunities, weather, commodity prices, and other factors that influence their decisions. This project allows us to measure, monitor, and document the effects of these decisions. As this project progresses, it is providing a valuable

measure of changes in agricultural practices in this region and the information to interpret what is driving these changes.

Sites were picked originally by the Producer Board of Directors in response to the request for sites that would represent a range of practices from high input, intensive management systems to low input, less intensive practices. The sites represent a range from monoculture cropping practices, integrated cropping systems, integrated crop and livestock systems, and all forage/livestock systems. Irrigation practices include subsurface drip, center pivot, furrow, and dryland systems.

It is important to recognize that these data and their interpretations are based on certain assumptions. These assumptions are critical to being able to compare information across the different sites involved in this demonstration project. These assumptions are necessary to avoid differences that would be unique to a particular producer or site that have nothing to do with understanding how these systems function. Thus, we have adopted certain constants across all systems such as pumping depth of wells to avoid variables that do not influence system behavior but would bias economic results. This approach means that the economic data for an individual site are valid for comparisons of systems but do not represent the actual economic results of the specific location. Actual economic returns for each site are also being calculated and made available to the individual producer but are not a part of this report.

ASSUMPTIONS OF DATA COLLECTION AND INTERPRETATION

1. Although actual depth to water in wells located among the 26 sites varies, a pumping depth of 300 feet is assumed for all irrigation points. The actual depth to water influences costs and energy used to extract water but has nothing to do with the actual functions of the system to which this water is delivered. Thus, a uniform pumping depth is assumed.
2. All input costs and prices received for commodities sold are uniform and representative of the year and the region. Using an individual's actual costs for inputs would reflect the unique opportunities that an individual could have for purchasing in bulk or being unable to take advantage of such economies and would thus represent differences between individuals rather than the system. Likewise, prices received for commodities sold should represent the regional average to eliminate variation due to an individual's marketing skill.
3. Irrigation system costs are unique to the type of irrigation system. Therefore, annual fixed costs were calculated for each type of irrigation system taking into account the average cost of equipment and expected economic life.
4. Variable cost of irrigation across all systems was based on a center pivot system using electricity as the energy source. The estimated cost per acre inch includes the cost of energy, repair and maintenance cost, and labor cost. The primary source of variation in variable cost from year to year is due to changes in the unit cost of energy and repair and maintenance costs.

5. Mechanical tillage operations for each individual site were accounted for with the cost of each field operation being based on typical custom rates for the region. Using custom rates avoids the variations among sites in the types of equipment owned and operated by individuals.

ECONOMIC ASSUMPTIONS (TERM DEFINITIONS ON PAGE 235)

1. Irrigation costs were based on a center pivot system using electricity as the energy source.

Table 1. Electricity irrigation cost parameters for 2005 through 2012.

Item	2005	2006	2007	2008	2009	2010	2011	2012
Gallons per minute (gpm)	450	450	450	450	450	450	450	450
Pumping lift (feet)	260	250	252	254	256	285	290	300
Discharge Pressure (psi)	15	15	15	15	15	15	15	15
Pump efficiency (%)	60	60	60	60	60	60	60	60
Motor Efficiency (%)	88	88	88	88	88	88	88	88
Electricity Cost per kWh	\$0.085	\$0.085	\$0.090	\$0.110	\$0.140	\$0.081	\$0.086	\$0.100
Cost of Electricity per Ac. In.	\$4.02	\$4.26	\$5.06	\$6.60	\$3.78	\$4.42	\$4.69	\$5.37
Cost of Maint. & Repairs per Ac. In.	\$2.05	\$2.07	\$2.13	\$2.45	\$3.37	\$3.49	\$4.15	\$3.83
Cost of Labor per Ac. In	\$0.75	\$0.75	\$0.80	\$0.90	\$0.90	\$0.90	\$0.90	\$1.00
Total Cost per Ac. In.	\$6.82	\$7.08	\$7.99	\$9.95	\$8.05	\$8.81	\$9.74	\$10.20

2. Commodity prices are reflective of the production year: however, prices were constant across sites.

Table 2. Commodity prices for 2005 through 2012.

Commodity	2005	2006	2007	2008	2009	2010	2011	2012
Cotton lint (\$/lb)	\$0.54	\$0.56	\$0.58	\$0.55	\$0.56	\$0.75	\$0.90	\$0.90
Cotton seed (\$/ton)	\$100	\$135	\$155	\$225	\$175	\$150	\$340	\$280
Grain Sorghum – Grain (\$/cwt)	\$3.85	\$6.10	\$5.96	\$7.90	\$6.48	\$9.51	\$9.75	\$13.10
Grain Sorghum – Seed (\$/lb)	-	-	-	-	-	-	-	\$0.17
Corn – Grain (\$/bu)	\$2.89	\$3.00	\$3.69	\$5.71	\$3.96	\$5.64	\$5.64	\$6.00
Corn – Food (\$/bu)	\$3.48	\$3.55	\$4.20	\$7.02	\$5.00	\$4.88	\$7.50	\$7.50
Barley (\$/cwt)	-	-	-	-	-	-	-	\$14.08
Wheat – Grain (\$/bu)	\$2.89	\$4.28	\$4.28	\$7.85	\$5.30	\$3.71	\$5.75	\$6.85
Sorghum Silage (\$/ton)	\$20.19	\$18.00	\$18.00	\$25.00	\$24.00	\$24.00	\$24.00	\$24.00
Corn Silage (\$/ton)	\$20.12	\$22.50	\$25.00	\$25.00	\$42.90	\$43.50	\$43.50	\$43.50
Wheat Silage (\$/ton)	\$18.63	\$22.89	\$22.89	\$29.80	\$26.59	\$26.59	\$26.59	\$26.59
Oat Silage (\$/ton) -	\$17.00	\$17.00	-	\$14.58	-	-	-	\$14.58
Millet Seed (\$/lb)	\$0.17	\$0.17	\$0.22	\$0.25	-	\$0.25	\$0.25	\$0.25
Sunflowers (\$/lb)	\$0.21	\$0.21	\$0.21	\$0.29	\$0.27	-	-	\$0.39
Alfalfa (\$/ton)	\$130	\$150	\$150	\$160	\$160	\$185	\$350	\$350
Hay (\$/ton)	\$60	\$60	\$60	\$60	\$60	-	-	\$60
WWB Dahl Hay (\$/ton)	\$65	\$65	\$90	\$90	-	\$60	\$200	\$200
Hay Grazer (\$/ton)	-	\$110	\$110	\$70	\$110	\$65	\$65	\$125
Sideoats Seed (\$/lb)	-	-	\$6.52	\$6.52	\$3.90	\$8.00	\$5.70	\$5.70
Sideoats Hay (\$/ton)	-	-	\$64	\$64	\$70	\$60	\$220	\$220
Triticale Silage (\$/ton)	-	-	-	-	-	-	-	\$45
Triticale Forage (\$/ton)	-	-	-	-	-	-	-	\$24

3. Fertilizer and chemical costs (herbicides, insecticides, growth regulators, and harvest aids) are reflective of the production year; however, prices were constant across sites for the product and formulation.
4. Other variable and fixed costs are given for 2005 through 2012 in Table 3.

Table 3. Other variable and fixed costs for 2005 through 2012.

VARIABLE COSTS	2005	2006	2007	2008	2009	2010	2011	2012
<i>Boll weevil assessment: (\$/ac)</i>								
Irrigated cotton	\$12.00	\$12.00	\$12.00	\$1.50	\$1.00	\$1.00	\$1.00	\$1.00
Dryland cotton	\$6.00	\$6.00	\$6.00	\$1.50	\$1.00	\$1.00	\$1.00	\$1.00
<i>Crop insurance: (\$/ac)</i>								
Irrigated cotton	\$17.25	\$17.25	\$17.25	\$20.00	\$20.00	\$20.00	\$30.00	\$30.00
Dryland cotton	\$12.25	\$12.25	\$12.25	\$12.25	\$12.25	\$12.25	\$20.00	\$20.00
Irrigated corn	\$15.00	\$15.00	\$15.00	\$15.00	\$15.00	\$15.00	\$15.00	\$15.00
Irrigated corn silage	-	-	-	-	-	-	-	\$11.00
Irrigated Wheat	-	-	-	-	-	-	-	\$5.00
Irrigated Sorghum Grain	-	-	-	-	-	-	-	\$2.00
Dryland Sorghum Grain	-	-	-	-	-	-	-	\$2.00
Irrigated Sorghum Silage	-	-	-	-	-	-	-	\$2.00
Irrigated Sunflowers	-	-	-	-	-	-	-	\$5.00
Cotton harvest – strip and module (\$/lint lb)	\$0.08	\$0.08	\$0.08	\$0.08	\$0.08	\$0.08	\$0.08	\$0.08
Cotton ginning (\$/cwt)	\$1.95	\$1.75	\$1.75	\$1.95	\$1.95	\$1.95	\$1.95	\$1.95
Bags, Ties, & Classing (\$/bale)	\$17.50	\$19.30	\$17.50	\$18.50	\$18.50	\$18.50	\$18.50	\$18.50
FIXED COSTS	2005	2006	2007	2008	2009	2010	2011	2012
<i>Irrigation system:</i>								
Center Pivot system	\$33.60	\$33.60	\$33.60	\$33.60	\$33.60	\$40.00	\$40.00	\$40.00
Drip system	\$75.00	\$75.00	\$75.00	\$75.00	\$75.00	\$75.00	\$75.00	\$75.00
Flood system	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00	\$25.00
<i>Cash rent:</i>								
Irrigated cotton, grain sorghum, sun-flowers, grass, pearl millet, and sorghum silage.	\$45.00	\$45.00	\$45.00	\$75.00	\$75.00	\$100.00	\$100.00	\$100.00
Irrigated corn silage, corn grain, and alfalfa.	\$75.00	\$75.00	\$75.00	\$100.00	\$100.00	\$140.00	\$140.00	\$140.00
Dryland cropland	\$15.00	\$15.00	\$15.00	\$25.00	\$25.00	\$30.00	\$30.00	\$30.00

5. The custom tillage and harvest rates used for 2005 were based on rates reported in USDA-NASS, 2004 Texas Custom Rates Statistics, Bulletin 263, September 2005. The custom rates used for 2006 were 115% of the reported 2004 rates to reflect increased cost of operation due to rising fuel prices and other costs while 2007 rates were 120% of the 2006 rates. 2008 rates were calculated at 125% of 2007 due to a 25% rise in fuel prices. 2009 rates were unchanged from 2008, as fuel prices stabilized. 2010 rates were estimated based on the most recent survey from Texas AgriLife Extension Service. 2011 rates were increased approximately 39% from 2010 rates to adjust for increased fuel expenses of 26% and increased expenses for repairs and maintenance. 2012 rates were unchanged from 2011.

WEATHER DATA

2005

The 2005 growing season was close to ideal in terms of temperatures and timing of precipitation. The precipitation and temperatures for this area are presented in Figure 1 along with the long-term means for this region. While hail events occurred in these counties during 2005, none of the specific sites in this project were measurably affected by such adverse weather events. Year 1, 2005, also followed a year of abnormally high precipitation. Thus, the 2005 growing season likely was influenced by residual soil moisture.

Precipitation for 2005, presented in Table 4, is the actual mean of precipitation recorded at the 26 sites during 2005 but begins in March when the sites were identified and equipped. Precipitation for January and February are amounts recorded at Halfway, TX; the nearest monitoring site.

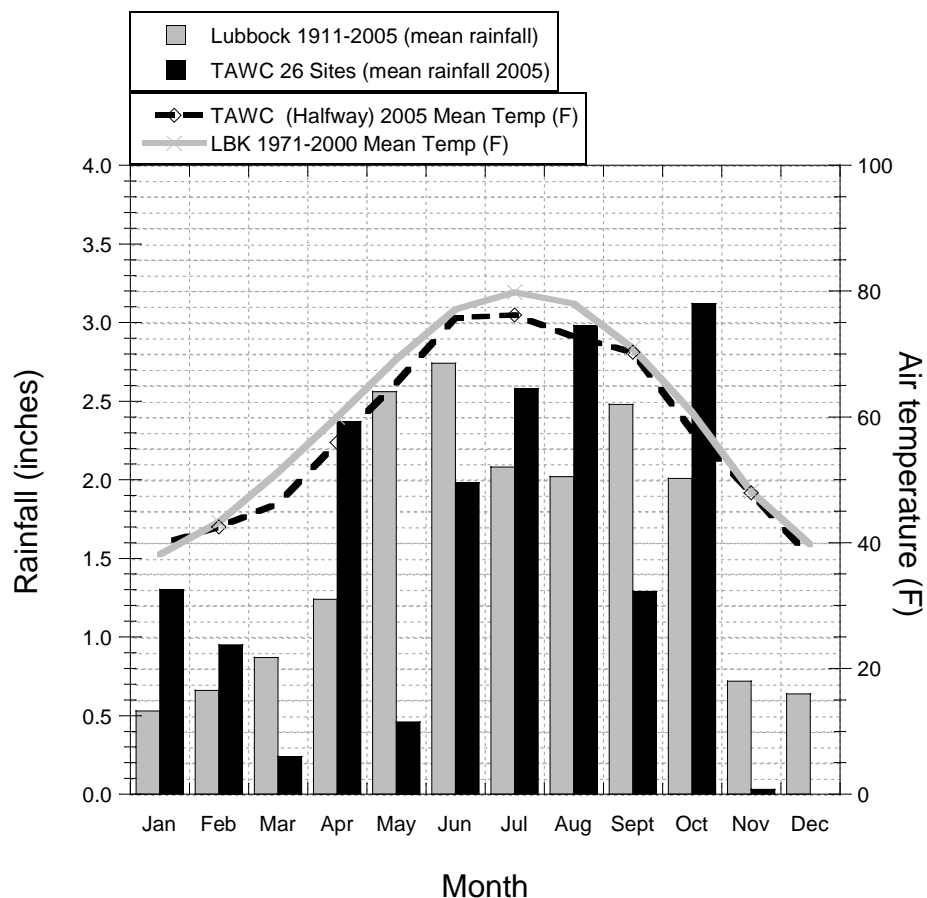


Figure 1. Temperature and precipitation for 2005 in the demonstration area compared with long term averages.

Table 4. Precipitation by each site in the Demonstration Project in Hale and Floyd Counties during 2005.

SITE	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
01	0	0	0.4	1.3	0.2	1.7	2.2	2.4	2	4.1	0	0	14.3
02	0	0	0.4	1.8	0.5	1.4	2.4	3.6	0.8	3.4	0	0	14.3
03	0	0	0.7	2	0.6	1.4	2.5	4	0.4	3.2	0	0	14.8
04	0	0	0.6	8	0.3	1.4	2.2	3.2	0.1	1	0	0	16.8
05	0	0	0.6	2.9	0.4	1.5	3.2	4.2	0.6	1.7	0	0	15.1
06	0	0	0.5	1.5	0.4	3	2.4	1	2	4.2	0	0	15
07	0	0	0.5	1.5	0.6	2.6	2.4	1.5	3.3	3	0	0	15.4
08	0	0	0	1.5	0.6	2.6	2.4	1.5	3.3	3	0	0	14.9
09	0	0	0.5	1.5	0.5	2.6	2	1	3	3.3	0	0	14.4
10	0	0	0.4	1	0.2	2	1.8	1	1.6	3.1	0	0	11.1
11	0	0	0	1.2	0.4	3	2	1.7	1.8	4.3	0	0	14.4
12	0	0	0	0.7	0.4	3.2	2	2.2	1.2	2.8	0	0	12.5
13	0	0	0	1.7	0.4	3.4	3	2.6	1.2	4	0	0	16.3
14	0	0	0	1.3	0.5	1.8	3	2.2	2.2	3	0	0	14
15	0	0	0.4	1.3	0.5	2	3.6	4	2	5.4	0	0	19.2
16	0	0	0	1.4	0.4	2	3.2	3.4	1.8	4.1	0	0	16.3
17	0	0	0	2	0.5	2.2	3	3.6	1.6	4.6	0	0	17.5
18	0	0	0	4	0.9	1	2.8	4.8	0	3	0	0	16.5
19	0	0	0	3.2	0.5	1	2	4.6	0	2.6	0	0	13.9
20	0	0	0	2.8	0.4	1.6	3.4	4	0.8	2	0.4	0	15.4
21	0	0	0	1.2	0.6	2.5	2	2.5	2	4	0.3	0	15.1
22	0	0	0	5.8	0.3	1.6	2.6	4	0.2	0.6	0	0	15.1
23	0	0	0	3	0.3	1.2	2.9	3.6	0.5	0.9	0	0	12.4
24	0	0	0.8	4.8	0.3	1	2.9	4	0.4	0.8	0	0	15
25	0	0	0	2.3	0.9	2	2.4	3.4	0	7.4	0	0	18.4
26	0	0	0	2	0.4	1.7	2.8	3.4	0.7	1.7	0	0	12.7
Average	0.0	0.0	0.2	2.4	0.5	2.0	2.6	3.0	1.3	3.1	0.0	0.0	15.0

2006

The 2006 growing season was one of the hottest and driest seasons on record marked by the longest period of days with no measurable precipitation ever recorded for the Texas High Plains. Most dryland cotton was terminated. Rains came in late August and again in October delaying harvests in some cases. No significant hail damage was received within the demonstration sites.

Precipitation for 2006, presented in Figure 2 and Table 5, is the actual mean of precipitation recorded at the 26 sites during 2006 from January to December. The drought and high temperatures experienced during the 2006 growing season did influence system behavior and results. This emphasizes why it is crucial to continue this type of real-world demonstration and data collection over a number of years and sets of conditions.

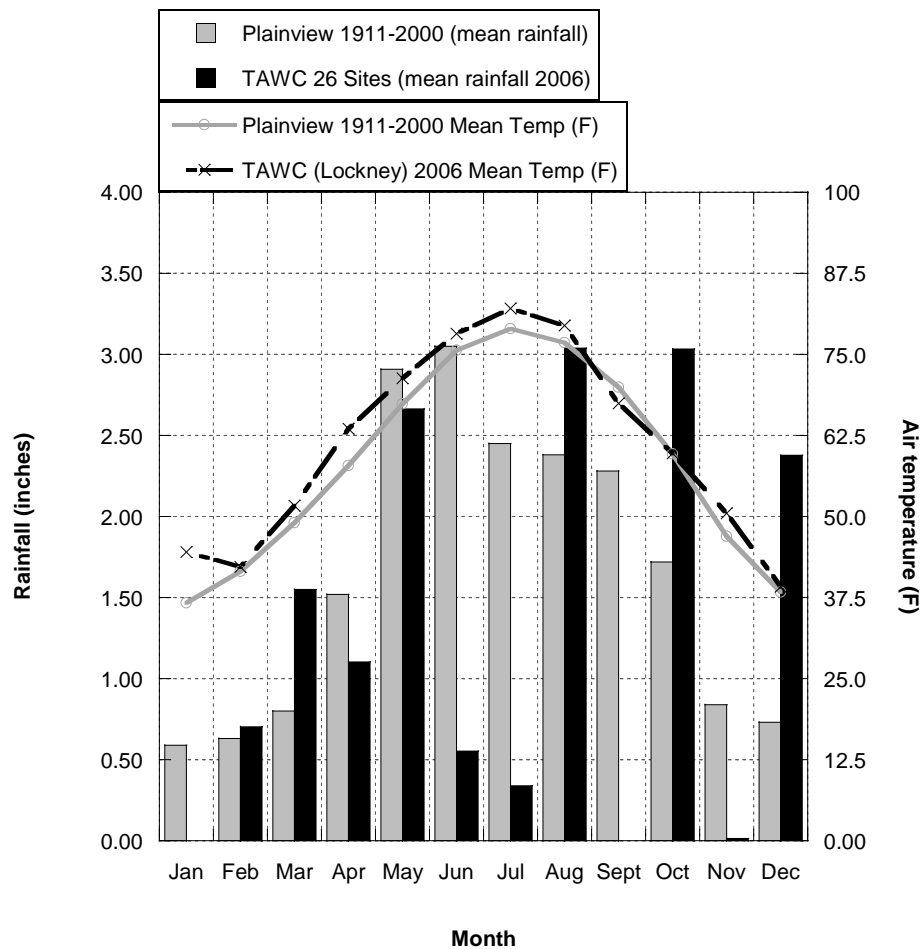


Figure 2. Temperature and precipitation for 2006 in the demonstration area compared with long term averages.

Table 5. Precipitation by each site in the Demonstration Project in Hale and Floyd Counties during 2006.

SITE	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
01	0	0.9	1.7	1.2	2.6	0.5	0.55	2.3	0	2.87	0	2.6	15.22
02	0	0.8	1.9	1.1	1.9	0.2	0	2.6	0	3.05	0	1.8	13.35
03	0	0.6	1.5	0.9	2.6	0.7	0.22	3	0	3.14	0	3.2	15.86
04	0	0.5	1.4	1.1	2.7	0.2	0.4	3.8	0	2.56	0	2.8	15.46
05	0	0.7	1.4	1.8	3.2	0.4	0.57	4	0	2.78	0	2.8	17.65
06	0	0.7	1.5	0.8	3	0.4	0.2	5.4	0	2.6	0	2.7	17.3
07	0	0.5	1.3	0.9	1.92	0.5	0.33	3.8	0	2.75	0	2.1	14.1
08	0	0.5	1.3	0.9	1.92	0.5	0.33	3	0	2.75	0	2.1	13.3
09	0	0.6	1.5	0.8	1.82	0.5	0.12	3.8	0	3.28	0	2.4	14.82
10	0	0.6	1.5	1	3	0.4	0.11	3.1	0	2.8	0.1	2.4	15.01
11	0	0.5	0.7	0.4	2.5	0.4	0.1	3.5	0	3.3	0	1.6	13
12	0	0.8	1.4	0.8	2.2	0.9	0.2	1.9	0	3.3	0	2	13.5
13	0	1	1.8	0.8	2.2	1.1	0.1	2.7	0	3.05	0	1.8	14.55
14	0	0.8	1.8	1	2.8	0.3	0	1.6	0	3.8	0	2.6	14.7
15	0	1.4	2.2	1.4	2.8	0.4	0	2	0	4.4	0.1	2.6	17.3
16	0	1	2.2	1.3	2	0.8	0.2	2.6	0	2.69	0	2.2	14.99
17	0	0.8	2	1.3	2	1	0.3	3.3	0	3.38	0.1	3.2	17.38
18	0	0.7	1.2	1.2	1.8	1.1	0.74	2.6	0	3.11	0	3.6	16.05
19	0	0.6	1.3	1.1	1.3	1.4	0.75	1.2	0	3.11	0	2.3	13.06
20	0	0.6	1.4	1.3	3.8	0.4	0.55	4.07	0	2.56	0	2.2	16.88
21	0	0.9	2.6	1.4	2.8	0.4	0.73	2.2	0	3.54	0.1	2.7	17.37
22	0	0.6	1.5	1.3	3.8	0.3	0.22	1.8	0	2.66	0	1.9	14.08
23	0	0.4	0.9	1.1	3.8	0.2	0.55	3.6	0	3.7	0	2	16.25
24	0	0.5	1.6	1.2	4	0.7	0.12	2.8	0	2.64	0	2.3	15.86
26	0	0.7	1.3	1.3	3	0.3	0.86	4.3	0	2.49	0	1.7	15.95
27	0	0.6	1.4	1.3	3.8	0.4	0.55	4.07	0	2.56	0	2.2	16.88
Average	0.0	0.7	1.6	1.1	2.7	0.6	0.3	3.0	0.0	3.0	0.0	2.4	15.40

2007

Precipitation during 2007 totaled 27.2 inches (Table 6) and was well above the long-term mean (18.5 inches) for annual precipitation for this region. Furthermore, precipitation was generally well distributed over the growing season with early season rains providing needed moisture for crop establishment and early growth (Figure 3). Many producers took advantage of these rains and reduced irrigation until mid-season when rainfall declined. Growing conditions were excellent and there was little effect of damaging winds or hail at any of the sites. Temperatures were generally cooler than normal during the first half of the growing season but returned to normal levels by August. The lack of precipitation during October and November aided producers in harvesting crops.

Precipitation for 2007, presented in Figure 3 and Table 6, is the actual mean of precipitation recorded at the 26 sites during 2007 from January to December. Growing conditions during 2007 differed greatly from the hot dry weather encountered in 2006.

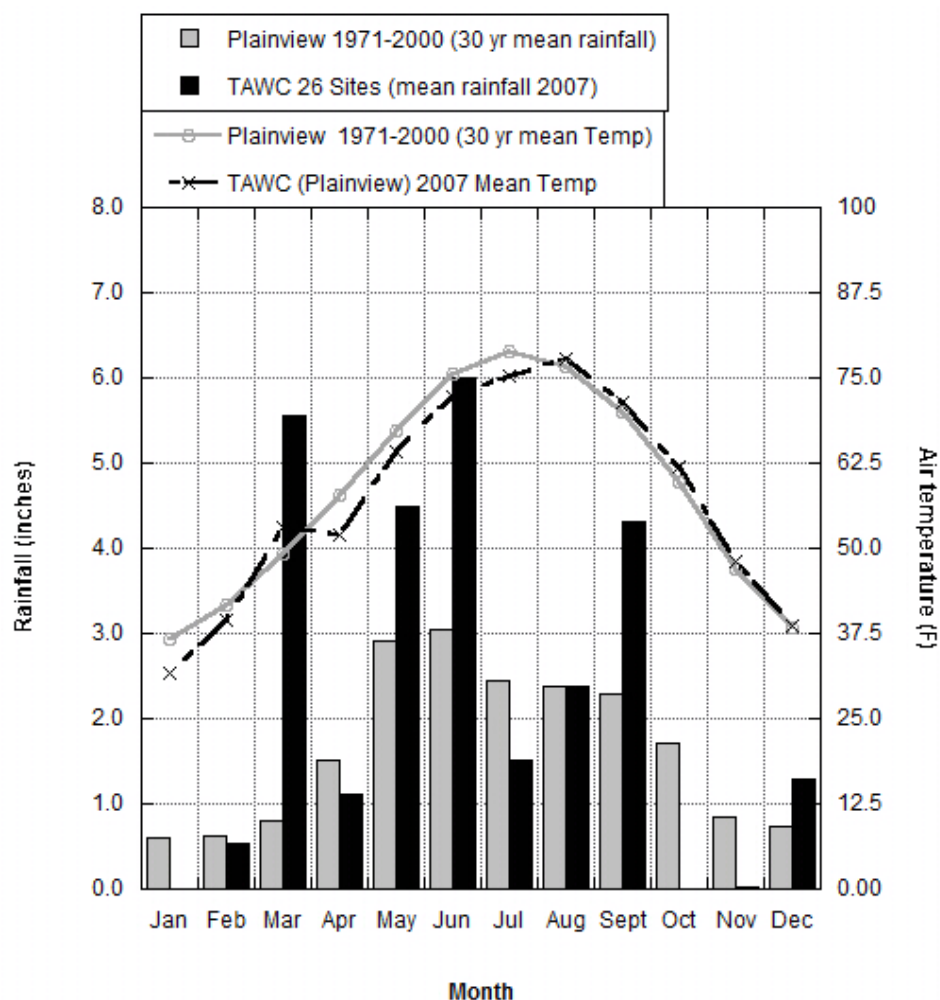


Figure 3. Temperature and precipitation for 2007 in the demonstration area compared with long term averages.

Table 6. Precipitation by each site in the Demonstration Project in Hale and Floyd Counties during 2007.

SITE	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
01	0	0.74	5.4	0.8	4.92	4.75	0.71	2.3	3.6	0	0	1.2	24.42
02	0	0.52	3.7	0.8	2.86	6.93	1.32	3	4.8	0	0	1.2	25.13
03	0	0.47	4.8	0.9	2.74	6.88	1.41	2.4	4.4	0	0	1	25
04	0	0.29	7.6	0.9	3.53	6.77	4	1.5	5	0	0	1	30.59
05	0	0.72	6	1.1	5.09	7.03	0.79	1.2	4.7	0	0	1.2	27.83
06	0	0.46	6	0.7	5.03	5.43	0.54	2	4.5	0	0	1.4	26.06
07	0	0.9	6.4	1	5.4	4.12	0.74	1.2	3.2	0	0	1.4	24.36
08	0	0.9	6.4	1	5.4	4.12	0.74	1.2	3.2	0	0	1.4	24.36
09	0	0.42	4.8	0.6	5.13	4.05	0.75	1.6	3	0	0	1	21.35
10	0	0.41	4.8	0.6	4.62	6.62	0.81	2.2	4.5	0	0	1.2	25.76
11	0	0.41	4.6	1.5	4.74	6.8	1.2	3.4	5.3	0	0	1	28.95
12	0	0.41	6.7	1.3	5.3	6.6	1.6	3	5.3	0	0	1	31.21
13	0	0.41	5.5	0.6	5	7.1	2	3	4	0	0	1.3	28.91
14	0	0.52	6.2	0.9	5.29	3.79	0.71	2.6	3.8	0	0	1.8	25.61
15	0	0.52	6.75	4	5.29	4.25	0.71	2.5	4	0	0	3	31.02
16	0	0.45	5	1	3.6	5.65	0.85	2.5	4.2	0	0	1	24.25
17	0	0.67	5.3	1	3.85	7.27	1.5	3.2	4.6	0	0	1.2	28.59
18	0	0.52	5.8	1.9	4.54	5.61	2.22	3	4	0	0	1.2	28.79
19	0	0.55	4	1	4.7	7.7	2.8	3.9	4.5	0	0	2	31.15
20	0	0.41	5.6	0.8	4.06	7.24	1.15	3	4.8	0	0	1	28.06
21	0	0.52	7.4	2	5.3	5.28	1.17	3.4	5.4	0	0	1.4	31.87
22	0	0.34	6.2	0.9	3.9	6.88	3.17	1.8	4	0	0	1	28.19
23	0	0.4	4.6	0.7	4.65	7.86	2.19	2	4.5	0	0	0.5	27.4
24	0	0.91	5.4	0.9	3.22	3.47	3.94	1.7	4.2	0	0	1.8	25.54
26	0	0.48	4	0.8	4.76	6.45	1.31	1	3.8	0	0	1.2	23.8
27	0	0.41	5.6	0.8	4.06	7.24	1.15	3	4.8	0	0	1	28.06
Average	0.0	0.5	5.6	1.1	4.5	6.0	1.5	2.4	4.3	0.0	0.0	1.3	27.2

2008

Precipitation during 2008, at 21.6 inches, was above average for the year (Table 7). However, the distribution of precipitation was unfavorable for most crops (Figure 4). Beginning the previous autumn, little rain fell until December and then less than an inch of precipitation was received before May of 2008. Four inches was received in May, well above the average for that month. This was followed by below average rain during most of the growing season for crops. In September and October, too late for some crops and interfering with harvest for others, rain was more than twice the normal amounts for this region. Following the October precipitation, no more rain came during the remainder of the year. This drying period helped with harvest of some crops but the region entered the winter with below normal moisture.

Temperatures during 2008 were close to the long-term mean for the region (Figure 4).

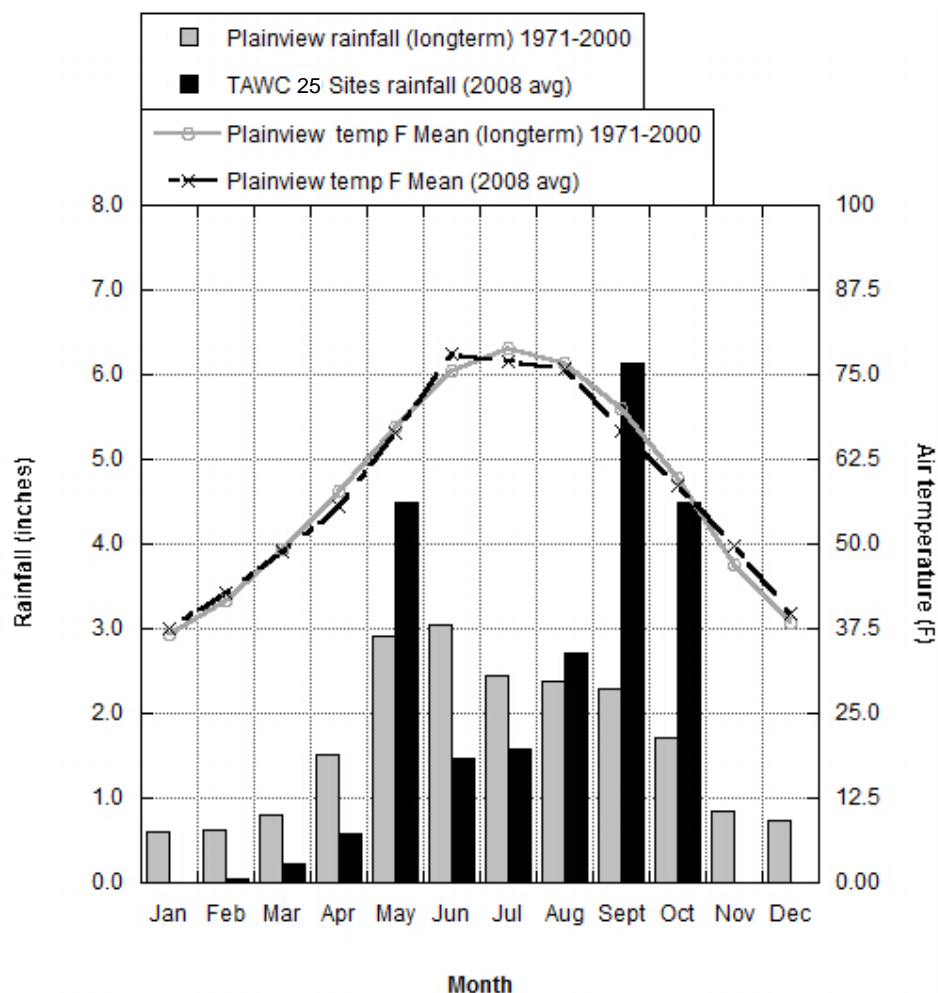


Figure 4. Temperature and precipitation for 2008 in the demonstration area compared with long term averages.

Table 7. Precipitation by each site in the Demonstration Project in Hale and Floyd Counties during 2008.

Site	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
2	0	0	0.2	0.8	4.75	1.7	1	2.1	5.4	4.1	0	0	20.1
3	0	0	0.2	0.5	4.5	1.1	0.95	2	4.7	4.4	0	0	18.4
4	0	0	0.4	0.6	4	2.9	1.1	4.1	3	2.9	0	0	19
5	0	0	0	0.2	4	1.5	0.5	4.2	5	3.5	0	0	18.9
6	0	0	0.2	0.5	4.2	1.2	1.9	4	9.4	6	0	0	27.4
7	0	0	0	0.6	5.6	1.2	3.2	1.8	8.6	6.5	0	0	27.5
8	0	0	0	0.6	5.6	1.2	3.2	1.8	8.6	5.4	0	0	26.4
9	0	0	0	0.4	4.1	1	2.4	1.7	5.5	4	0	0	19.1
10	0	0	0	0.4	4.5	0.9	1	2.7	6.9	4.8	0	0	21.2
11	0	0	0.4	0.5	5.3	1.1	1.7	3.2	7.6	4.3	0	0	24.1
12	0	0	0.2	0.6	5	1.5	1.6	2.25	6.5	4.2	0	0	21.9
14	0	0.2	0.4	0.9	5	1.3	1.6	2.5	7.4	6	0	0	25.3
15	0	0.2	0.4	0.9	5	1.5	2.5	2.5	7.4	6	0	0	26.4
17	0	0	0.2	1.1	5	1.8	1.8	2.6	6.4	5.6	0	0	24.5
18	0	0.2	0.4	0.2	3.6	1.3	0.7	2.2	3	4	0	0	15.6
19	0	0.2	0.4	0.8	5	1	1.1	2.1	4.25	4.8	0	0	19.7
20	0	0	0.4	0.5	5	1.9	1.4	4.8	6.8	4.2	0	0	25
21	0	0.2	0.4	0.8	5	1.5	4	2.4	6	4.2	0	0	24.5
22	0	0	0.2	1	4.6	3	1.1	2.6	5	3.2	0	0	20.7
23	0	0	0.2	0.2	1.3	1.1	1	2.4	5.5	3.4	0	0	15.1
24	0	0	0.4	0.9	4.2	2.9	1.4	2.1	3.5	3	0	0	18.4
26	0	0	0.2	0.2	3.2	0.5	1.4	2.3	5.3	3.3	0	0	16.4
27	0	0	0.4	0.5	5	1.9	1.4	4.8	6.8	4.2	0	0	25
28	0	0	0	0.4	4.5	0.9	1	2.7	6.9	4.8	0	0	21.2
29	0	0	0	0.4	4	1	0.7	1.8	6.4	4.7	0	0	19
Average	0.0	0.04	0.2	0.6	4.5	1.5	1.6	2.7	6.1	4.5	0.0	0.0	21.6

2009

Precipitation during 2009 totaled 15.2 inches averaged across all sites. This was similar to precipitation in 2005, the first reporting year for this project. However, in 2005 above average winter moisture was received followed by precipitation in April that was nearly twice the long-term mean (Fig. 1; 2005). July, August, and October precipitation were also higher than normal in that year. In 2009, January began with very little precipitation that followed two months of no precipitation in the previous year (Fig. 4; 2008). Thus, the growing season began with limited soil moisture. March and May saw less than half of normal precipitation. While June and July were near of slightly above normal, August, September, October and November were all below normal. December precipitation was above normal and began a period of higher than normal moisture entering 2010.

Temperatures in February and March were above the long-term mean and peak summer temperatures were prolonged in 2009. However, by September, temperatures fell below normal creating a deficit in heat units needed to produce an optimum cotton crop.

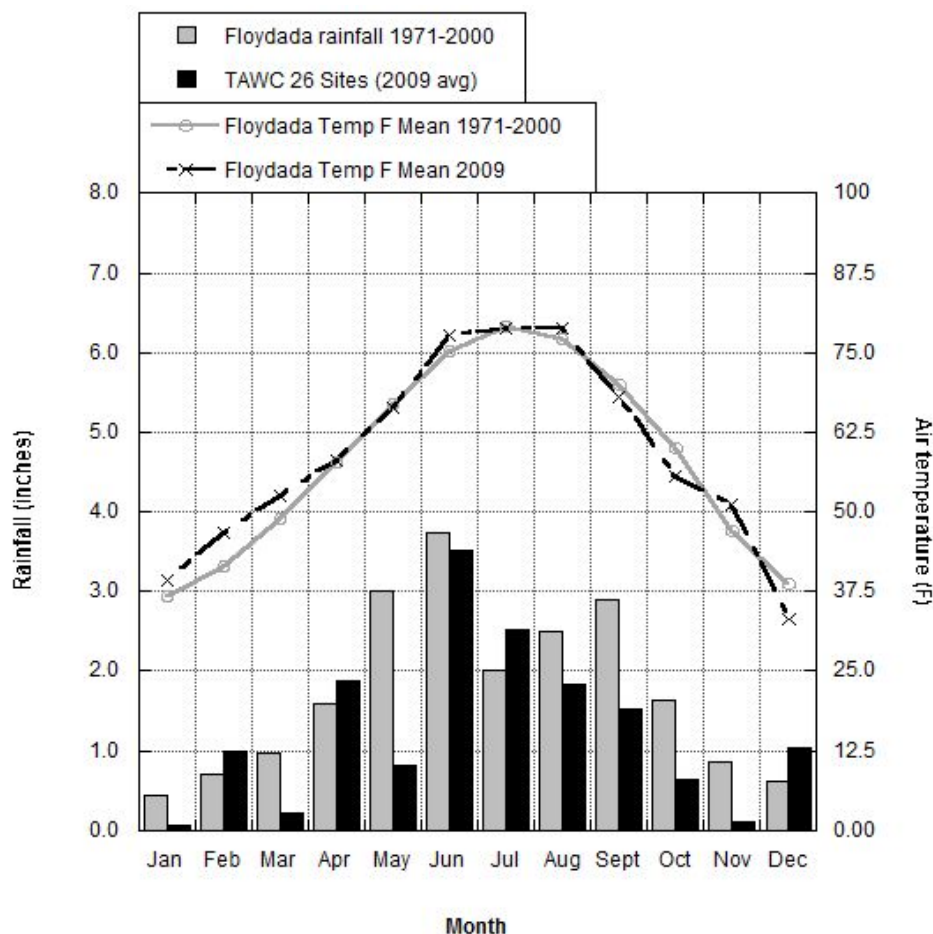


Figure 5. Temperature and precipitation for 2009 in the demonstration area compared with long term averages.

Table 8. Precipitation by each site in the Demonstration Project in Hale and Floyd Counties during 2009.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2	0.08	1.22	0.27	2.30	0.12	3.13	2.23	2.57	0.24	1.18	0.15	1.61	15.10
3	0.10	1.45	0.32	2.74	0.30	4.79	2.33	0.00	0.07	1.41	0.18	1.92	15.60
4	0.09	1.25	0.27	2.37	0.14	4.73	1.90	2.58	2.01	0.80	0.18	0.99	17.30
5	0.07	0.96	0.21	1.82	0.68	4.58	3.92	1.73	1.72	0.68	0.06	0.27	16.70
6	0.05	0.78	0.17	1.47	1.07	2.01	2.86	3.55	0.20	0.02	0.09	0.73	13.00
7	0.05	0.75	0.16	1.42	0.52	2.89	2.24	1.22	1.60	0.60	0.09	1.55	13.10
8	0.05	0.75	0.16	1.42	0.52	2.89	2.24	1.22	1.60	0.60	0.09	1.55	13.10
9	0.04	0.59	0.13	1.12	0.73	2.20	2.48	1.34	1.65	0.59	0.08	0.66	11.60
10	0.04	0.56	0.12	1.05	0.44	2.13	2.64	3.01	2.18	0.41	0.06	0.56	13.20
11	0.04	0.63	0.14	1.18	0.86	2.56	2.21	1.25	1.31	0.61	0.08	0.83	11.70
14	0.12	1.80	0.39	3.41	1.10	0.81	4.21	0.67	0.02	0.00	0.14	1.41	14.10
15	0.09	1.33	0.29	2.52	1.50	0.84	1.25	0.16	2.79	1.30	0.16	1.77	14.00
17	0.04	0.64	0.14	1.21	0.51	2.88	1.90	2.88	3.41	0.55	0.05	0.69	14.90
18	0.08	1.14	0.25	2.16	0.66	6.25	1.50	1.63	2.26	0.35	0.09	0.75	17.10
19	0.07	0.95	0.21	1.80	0.85	5.41	2.31	2.53	1.89	0.00	0.12	0.66	16.80
20	0.06	0.84	0.18	1.59	0.37	3.87	2.43	3.41	2.09	0.37	0.11	0.89	16.20
21	0.06	0.80	0.18	1.52	0.58	2.70	1.43	3.35	1.83	0.51	0.08	0.77	13.80
22	0.11	1.56	0.34	2.95	1.01	3.75	0.98	1.86	2.05	0.96	0.24	1.19	17.00
23	0.09	1.26	0.28	2.38	0.76	4.84	1.29	1.59	1.96	0.75	0.00	0.91	16.10
24	0.08	1.19	0.26	2.25	1.31	6.82	2.38	1.73	0.28	0.66	0.12	0.51	17.60
26	0.08	1.09	0.24	2.06	1.91	4.21	4.61	0.99	0.19	0.63	0.12	1.29	17.40
27	0.06	0.89	0.19	1.68	1.22	3.64	3.14	1.78	1.86	0.86	0.11	1.18	16.60
28	0.05	0.71	0.15	1.33	0.97	2.89	2.49	1.41	1.48	0.69	0.09	0.94	13.20
29	0.13	0.45	0.44	0.94	0.41	2.9	3.26	2.35	2.82	0.75	0.22	1.41	16.08
30	0.08	1.09	0.24	2.06	1.91	4.21	4.61	0.99	0.19	0.63	0.12	1.29	17.40
Average	0.07	0.99	0.23	1.87	0.82	3.52	2.51	1.83	1.51	0.64	0.11	1.05	15.15

2010

The project sites and the region received above average rainfall for the 2010 calendar year with an average of 28.9 inches measured across the project, as indicated in Table 9 and illustrated in Figure 6. Much of this rainfall came in the late winter and early spring/summer months, with above average rainfall from January through July, and significant rainfall amounts in the months of April and July. Temperatures for the year were slightly above average during the late fall and early spring months across the TAWC sites, allowing for increased soil temperatures at planting, further stabilizing the germination and early growth stages of the upcoming crops. An average of 6.0 inches fell on the project sites in April and 6.5 inches in July which when combined with the favorable conditions of the previous three months, provided ideal conditions for the 2010 summer growing season. The abnormally high rainfall continued in July and October allowing for summer crops to receive needed moisture during the final stages of production. This record high rainfall allowed some producers to achieve record yields, specifically on cotton and corn, while maintaining or decreasing their irrigation use from previous years of the project.

2011

The project sites and the region received below average rainfall for the 2011 calendar year with an average of 5.3 inches measured across the project, as indicated in Table 10 and illustrated in Figure 7. This was a year of historic drought and caused many fields to be abandoned. Virtually no rainfall was received during the normal growing season.

2012

The project sites and the region again received below average rainfall for the 2012 calendar year with an average of 10.0 inches measured across the project, as indicated in Table 11 and illustrated in Figure 8. Slightly above average rainfall was received in the months of March, June and September. Mean temperatures ran slightly above normal early season but were close to normal during the growing season.

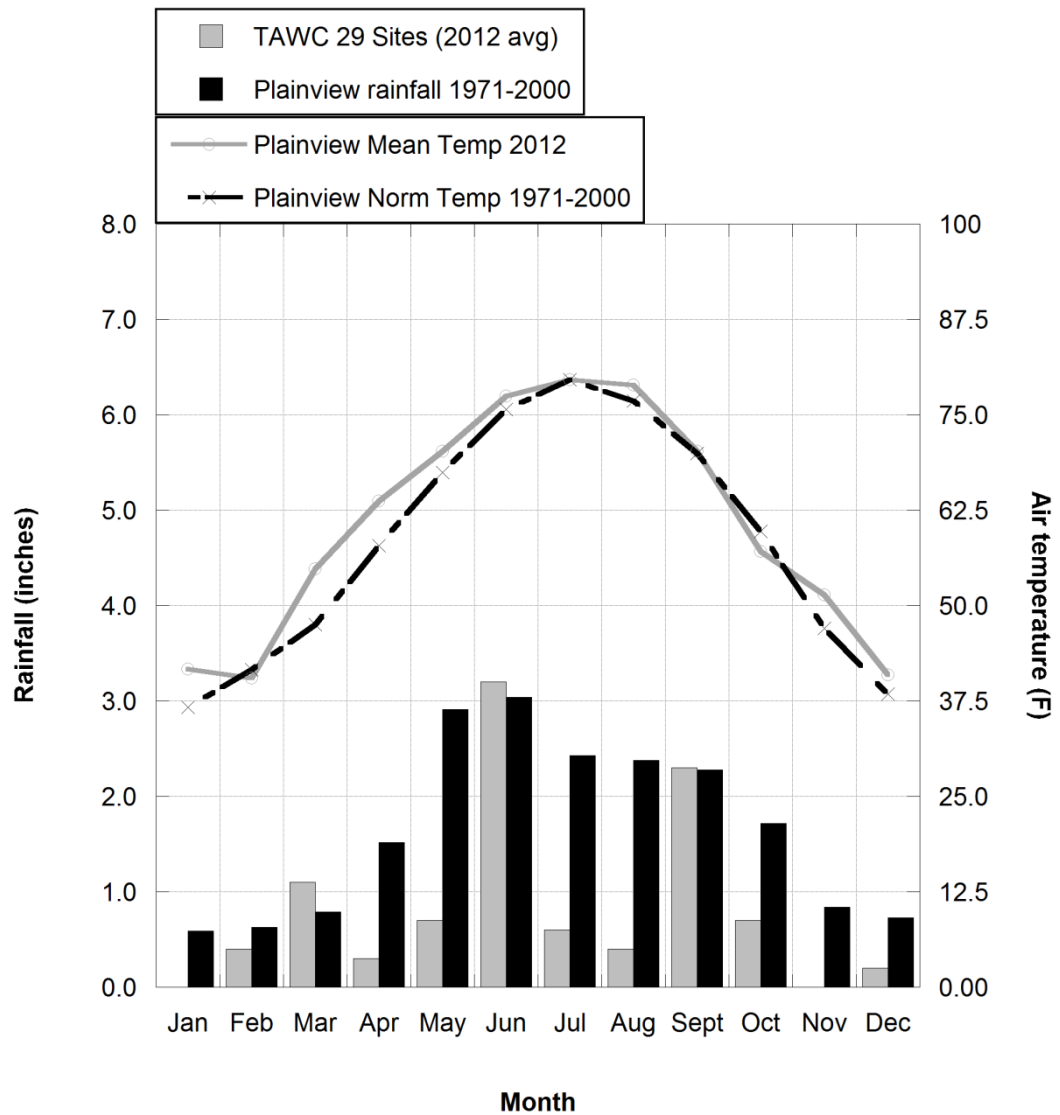


Figure 8. Temperature and precipitation for 2012 in the demonstration area compared with long term averages.

Table 11. Precipitation by each site in the Demonstration Project in Hale and Floyd Counties during 2012.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2	0.0	0.5	1.0	0.7	1.0	3.3	0.8	0.6	2.0	0.6	0.0	0.2	10.7
3	0.0	0.4	1.2	0.8	0.6	0.7	0.4	0.6	1.4	0.7	0.0	0.0	6.8
4	0.0	0.5	1.2	0.0	1.6	2.9	0.5	0.4	3.3	0.8	0.0	0.2	11.3
5	0.0	0.6	0.8	0.0	0.4	2.9	1.0	0.2	2.8	1.5	0.0	0.0	10.2
6	0.0	0.3	0.0	0.0	0.0	3.7	0.6	0.3	2.0	0.1	0.0	0.4	7.3
7	0.0	0.2	1.0	0.4	0.3	5.2	0.1	0.4	2.2	0.2	0.0	0.2	10.2
8	0.0	0.3	1.0	0.4	0.3	5.2	0.1	0.4	2.2	0.2	0.0	0.2	10.3
9	0.0	0.3	1.0	0.4	0.4	4.9	1.4	0.4	4.2	0.5	0.0	0.2	13.7
10	0.0	0.6	1.4	0.2	0.6	3.4	0.4	0.2	2.2	0.2	0.0	0.3	9.5
11	0.0	0.4	2.0	0.2	0.8	4.2	0.1	0.2	2.6	0.2	0.0	0.2	10.9
12	0.0	0.5	1.9	0.4	0.9	2.5	0.2	0.1	1.9	0.4	0.0	0.3	9.1
14	0.0	0.4	1.8	0.1	0.6	3.3	0.2	0.4	2.2	0.4	0.0	0.3	9.7
15	0.0	0.4	1.8	0.1	0.7	2.9	0.2	0.4	2.2	0.2	0.0	0.4	9.3
17	0.0	0.4	1.0	0.7	1.0	2.7	0.7	0.4	2.4	0.5	0.0	0.2	10.0
18	0.0	0.3	0.5	0.0	0.8	2.6	0.2	0.8	2.4	1.0	0.0	0.1	8.7
19	0.0	0.4	1.0	1.2	1.2	3.3	0.4	1.0	2.8	1.0	0.0	0.2	12.5
20	0.0	0.4	1.2	0.2	0.4	3.4	1.4	1.0	2.4	1.0	0.0	0.4	11.8
21	0.0	0.5	1.5	0.2	0.8	2.9	0.2	0.1	2.1	0.5	0.0	0.1	8.9
22	0.0	0.6	1.0	0.0	1.0	3.4	1.2	0.5	3.1	0.8	0.0	0.1	11.7
24	0.0	0.2	2.0	1.5	0.7	4.0	3.0	0.3	1.8	3.6	0.0	0.1	17.2
26	0.0	0.6	0.8	0.0	0.4	2.9	1.0	0.2	2.8	1.5	0.0	0.0	10.2
27	0.0	0.5	1.0	0.0	0.5	2.7	1.4	0.9	2.2	1.8	0.0	0.1	11.1
28	0.0	0.6	1.4	0.2	0.6	3.4	0.4	0.2	2.2	0.2	0.0	0.3	9.5
29	0.0	0.4	1.3	0.2	1.4	2.8	0.4	1.2	2.0	0.4	0.0	0.3	10.4
30	0.0	0.6	0.8	0.0	0.4	2.9	1.0	0.2	2.8	1.5	0.0	0.0	10.2
31	0.0	0.5	1.2	0.0	1.6	2.9	0.5	0.4	3.3	0.8	0.0	0.2	11.3
32	0.0	0.4	0.0	0.0	0.7	2.9	0.0	0.0	0.0	0.2	0.0	0.4	4.6
33	0.0	0.4	0.0	0.0	0.7	2.9	0.0	0.0	0.0	0.2	0.0	0.4	4.6
34	0.0	0.3	0.0	0.0	0.0	3.2	0.7	0.6	2.4	0.1	0.0	0.2	7.5
Average	0.0	0.4	1.1	0.3	0.7	3.2	0.6	0.4	2.3	0.7	0.0	0.2	10.0

SUPPLEMENTARY GRANTS TO PROJECT

Grants Directly used and/or their % used within the TAWC project sites are noted in blue highlight. Other grants are considered complementary and outside of the TAWC project but were attempted or obtained through leveraging of the base platform the TeCSIS-TAWC (Texas Coalition for Sustainable Integrated Systems (Research component) and Texas Alliance for Water Conservation (Demonstration Sites) program represents and adds valuable information to this overall effort.

2006

Allen, V. G., Song Cui, and P. Brown. 2006. Finding a Forage Legume that can Save Water and Energy and Provide Better Nutrition for Livestock in West Texas. High Plains Underground Water Conservation District No. 1. \$10,000 (funded).

2007

Trostle, C.L., R. Kellison, L. Redmon, S. Bradbury. 2007. Adaptation, Productivity, & Water Use Efficiency of Warm-Season Perennial Grasses in the Texas High Plains. Texas Coalition, Grazing Lands Conservation Initiative, a program in which Texas State Natural Resource Conservation Service is a member. \$3,500 (funded).

Li, Yue and V.G. Allen. 2007. Allelopathic effects of small grain cover crops on cotton plant growth and yields. USDA-SARE. Amount requested, \$10,000 (funded).

Allen, V.G. and multiple co-authors. Crop-livestock systems for sustainable High Plains Agriculture. 2007. Submitted to the USDA-SARE program, Southeast Region, \$200,000 (funded).

2008

Doerfert, D. L., Baker, M., & Akers, C. 2008. Developing Tomorrow's Water Conservation Researchers Today. Ogallala Aquifer Program Project. \$28,000 (funded).

Doerfert, D.L., Meyers, Courtney. 2008. Encouraging Texas agriscience teachers to infuse water management and conservation-related topics into their local curriculum. Ogallala Aquifer Initiative. \$61,720 (funded).

Request for Federal Funding through the Red Book initiatives of CASNR - \$3.5 million. Received letters of support from Senator Robert Duncan, mayors of 3 cities in Hale and Floyd Counties, Glenn Schur, Curtis Griffith, Harry Hamilton, Mickey Black, and the Texas Department of Agriculture.

Prepared request for \$10 million through the stimulus monies at the request of the CASNR Dean's office.

2009

Texas High Plains: A Candidate Site for Long-Term Agroecosystems Research. USDA-CSREES 'proof of concept' grant. \$199,937 (funded).

Building a Sustainable Future for Agriculture. USDA-SARE planning grant, \$15,000 (funded).

Maas, S., A. Kemanian, & J. Angerer. 2009. Pre-proposal was submitted to Texas AgriLife Research for funding research on irrigation scheduling to be conducted at the TAWC project site.

Maas, S., N. Rajan, A.C. Correa, & K. Rainwater. 2009. Proposal was submitted to USGS through TWRI to investigate possible water conservation through satellite-based irrigation scheduling.

Doerfert, D. 2009. Proposal was submitted to USDA ARS Ogallala Aquifer Initiative.

2010

Kucera, J.M., V. Acosta-Martinez, V. Allen. 2010. Integrated Crop and Livestock Systems for Enhanced Soil C Sequestration and Biodiversity in Texas High Plains. Southern SARE grant. \$159,999 (funded with ~15% applied directly to TAWC project sites).

Calvin Trostle, Rick Kellison, Jackie Smith. 2010. Perennial Grasses for the Texas South Plains: Species Productivity and Irrigation Response, \$10,664 (2 years).

2011

Johnson, P., D. Doerfert, S. Maas, R. Kellison & J. Weinheimer. 2011. The Texas High Plains Initiative for Strategic and Innovative Irrigation Management and Conservation. USDA-NRCS joint proposal with North Plains Groundwater Conservation District. \$499,848 (funded).

Allen, V. 2011. Long-Term Agroecosystems Research and Adoption in the Texas Southern High Plains. Southern SARE grant. \$110,000 (funded).

Maas, S. 2011. Auditing Irrigation Systems in the Texas High Plains. Texas Water Development Board. \$101,049 (funded).

Maas, S. & co-authors. 2011. Development of a Farm-Scale Irrigation Management Decision-Support Tool to Facilitate Water Conservation in the Southern High Plains. USDA-NIFA. \$500,000 requested (status pending).

Fultz, L. Assessment of soil C quality using mid-infrared diffuse reflectance spectrometry for alternative agroecosystems in the Southern High Plains. USDA-SSARE graduate student fellowship. \$9,953 (not funded).

Davinic, Marko. Diversity and ecology of fungal communities in soil aggregates under integrated crop and livestock systems. USDA-SSARE graduate student fellowship. \$10,000 (not funded).

Trostle, C. 2011. Dryland reduced Tillage/No Tillage Cropping Sequences for the Texas South Plains. \$4,133 (funded from Texas State Support Committee, Cotton, Inc.,).

2012

Trostle, C. 2012. Dryland reduced Tillage/No Tillage Cropping Sequences for the Texas South Plains. \$8,500 (funded from Texas Grain Sorghum Association).

Trostle, C. 2012. Dryland reduced Tillage/No Tillage Cropping Sequences for the Texas South Plains. \$35,500 (funded from USDA Ogallala Aquifer Project).

West, C. 2012. Calibration and validation of ALMANAC model for growth curves of warm-season grasses under limited water supply. \$76,395 (funded by USDA Ogallala Aquifer Project).

DONATIONS TO PROJECT

2005

City Bank, Lubbock, TX. 2003 GMC Yukon XL. Appraised value \$16,500.



2008

July 31, 2008 Field Day sponsors:

Coffey Forage Seeds, Inc.	\$500.00
Agricultural Workers Mutual Auto Insurance Co.	\$250.00
City Bank	\$250.00
Accent Engineering & Logistics, Inc.	\$100.00
Bamert Seed Co.	\$100.00
Floyd County Supply	\$100.00
Plainview Ag Distributors, Inc.	\$100.00
Production-Plus+	\$100.00

2010

February 3, 2010 Field Day sponsors:

Grain Sorghum Producers	\$250.00
D&J Gin, Inc.	\$250.00
Ronnie Aston/Pioneer	\$500.00
Floyd County Supply	\$200.00
Lubbock County	\$250.00
City Bank	\$250.00
High Plains Underground Water Conservation District	\$250.00

August 10, 2010 Field Day sponsors:

Ted Young/Ronnie Aston	\$250.00
Netafim USA	\$200.00
Smartfield Inc.	\$500.00
Floyd County Soil & Water Conservation District #104	\$150.00
Grain Sorghum Producers	\$500.00

Lucia Barbato, TTU Center for Geospatial Technology. Donation
for server support software for TAWC database. \$10,000.00

2011

February 24, 2011 Field Day sponsors:

Texas Corn Producers Board	\$500.00
West Texas Guar, Inc.	\$500.00
Texas Grain Sorghum Producers	\$500.00
Happy State Bank	\$500.00

August 4, 2011 Field Day sponsors:

Texas Corn Producers Board	\$500.00
City Bank	\$500.00
Texas Grain Sorghum Producers	\$500.00
AquaSpy, Inc.	\$250.00
NetaFim USA	\$200.00
Panhandle-Plains Land Bank Association, FLCA	\$ 50.00

2012

August 4, 2012 Field Day sponsors:

Texas Corn Producers Board	\$500.00
City Bank	\$500.00
Texas Grain Sorghum Producers	\$500.00
AquaSpy, Inc.	\$250.00
NetaFim USA	\$200.00
Panhandle-Plains Land Bank Association, FLCA	\$ 50.00

January 17, 2013 Field Day sponsors:

Texas Corn Producers Board	\$500.00
Plains Cotton Growers	\$250.00
Grain Sorghum Producers	\$250.00
Ronnie Aston	\$500.00
Ag Tech	\$250.00
Diversified Sub-Surface Irrigation	\$500.00

VISITORS TO THE DEMONSTRATION PROJECT SITES

2005

Total Number of Visitors	190
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2006

Total Number of Visitors	282
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2007

Total Number of Visitors	36
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2008

Total Number of Visitors	53
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2009

Total Number of Visitors	33
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2010

Total Number of Visitors	14 +
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2011

Total Number of Visitors	11 +
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2012

Total Number of Visitors	15 +
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Bloomberg News group	Dr. Mike Galyean	Larry Gambone
Jane Henry	David Henry	T.J. Martinez
Gilbert Mokry	Texas AgriLife agents	Dr. Sara Trojan
Comer Tuck	Voice of America group	Farm Journal Media
Secretary of State Group	Justin Weinheimer	

PRESENTATIONS

2005

1-Mar	Radio interview (KRFE)	Allen
17-Mar	Radio interview	Kellison
17-May	Radio interview (KFLP)	Kellison
21-Jul	Presentation to Floyd County Ag Comm.	Kellison
17-Aug	Presentation to South Plains Association of Soil & Water Conservation Districts	Kellison
13-Sep	Presentation at Floyd County NRCS FY2006 EQIP meeting	Kellison
28-Sep	Presentation at Floyd County Ag Tour	Kellison/Trostle/Allen
20-Oct	Presentation to Houston Livestock and Rodeo group	Allen/Baker
3-Nov	Cotton Profitability Workshop	Pate/Yates
10-Nov	Presentation to Regional Water Planning Committee	Kellison
16-Nov	Television interview (KCBD)	Kellison
18-Nov	Presentation to CASNR Water Group	Kellison/Doerfert
1-Dec	Radio interview (KRFE)	Kellison
9-Dec	Radio interview (AgriTALK – nationally syndicated)	Kellison
15-Dec	Presentation at Olton Grain Coop Winter Agronomy meeting	Kellison

2006

<u>Date</u>	<u>Presentation</u>	<u>Spokesperson(s)</u>
24—26 Jan	Lubbock Southwest Farm & Ranch Classic	Kellison
6-Feb	Southern Region AAAE Conference: <i>The value of water: Educational programming to maximize profitability and decrease water consumption</i> (poster presentation), Charlotte, NC	M. Norton/Doerfert
7-Feb	Radio Interview	Kellison/Baker
2-Mar	South Plains Irrigation Management Workshop	Trostle/Kellison/Orr
30-Mar	Forage Conference	Kellison/Allen/Trostle
19-Apr	Floydada Rotary Club	Kellison
20-Apr	Western Region AAAE Conference: <i>Conservation outreach communications: A framework for structuring conservation outreach campaigns</i> (poster presentation), Boise, ID	M. Coutts/Doerfert
27-Apr	ICASALS Holden Lecture: <i>New Directions in Groundwater Management for the Texas High Plains</i>	Conkwright
18-May	Annual National AAAE Conference: <i>The value of water: Educational programming to maximize profitability and decrease water consumption</i> (poster presentation), Charlotte, NC	M. Norton/Doerfert
18-May	Annual National AAAE Conference: <i>Conservation outreach communications: A framework for structuring conservation outreach campaigns</i> (poster presentation), Charlotte, NC	M. Coutts/Doerfert
15-Jun	Field Day @ New Deal Research Farm	Kellison/Allen/Craddock/Doerfert
21-Jul	Summer Annual Forage Workshop	Trostle
27-Jul	National Organization of Professional Hispanic NRCS Employees annual training meeting, Orlando, FL	Craddock (on behalf of Kellison)
11-Aug	2006 Hale County Field Day	Kellison
12-Sep	Texas Ag Industries Association Lubbock Regional Meeting	Doerfert (on behalf of Kellison)
11-Oct	TAWC Producer meeting	Kellison/Pate/Klose/Johnson
2-Nov	Texas Ag Industries Association Dumas Regional Meeting	Kellison
10-Nov	34th Annual Banker's Ag Credit Conference	Kellison
14-Nov	Interview w/Alphaeus Media	Kellison
28-Nov	Amarillo Farm & Ranch Show	Doerfert
8-Dec	2006 Olton Grain COOP Annual Agronomy Meeting	Kellison/Trostle
12-Dec	Swisher County Ag Day	Kellison/Yates
12-Dec	2006 Alfalfa and Forages Clinic, Colorado State University	Allen

2007

<u>Date</u>	<u>Presentation</u>	<u>Spokesperson(s)</u>
11-Jan	Management Team meeting (Dr. Jeff Jordan, Advisory Council in attendance)	
23—25 Jan	2007 Southwest Farm & Ranch Classic, Lubbock, TX	Kellison/Doerfert
6-Feb	Cow/Calf Beef Producer Meeting at Floyd County Unity Center	Allen
8-Feb	Management Team meeting	
13-Feb	Grower meeting, Clarendon, TX	Kellison
26-Feb	Silage workshop, Dimmitt, TX	
8-Mar	Management Team meeting	
21-Mar	Silage Workshop, Plainview, TX	Kellison/Trostle
22-Mar	Silage Workshop, Clovis, NM	Kellison/Trostle
30-Mar	Annual Report review meeting w/Comer Tuck, Lubbock, TX	
2-Apr	TAWC Producer meeting, Lockney, TX	
11-Apr	Texas Tech Cotton Economics Institute Research/Extension Symposium	Johnson
12-Apr	Management Team meeting	
21-Apr	State FFA Agricultural Communications Contest, Lubbock, TX (100 high school students)(mock press conf. based on TAWC info)	Johnson
7-May	The Lubbock Round Table meeting	Kellison
9-May	Area 7 FFA Convention, Texas State University, San Marcos, TX (distributed 200 DVD and info sheets)	Baker
10-May	Management Team meeting	
12-May	RoundTable meeting, Lubbock Club	Allen
15—17-May	21st Biennial Workshop on Aerial Photog., Videography, and High Resolution Digital Imagery for Resource Assessment: <i>Calibrating aerial imagery for estimating crop ground cover</i> , Terre Haute, IN	Rajan
30-May	Rotary Club (about 100 present)	Allen
7-Jun	Lubbock Economic Development Association	Baker
14-Jun	Management Team meeting	
18-Jun	Meeting with Senator Robert Duncan	Kellison
10-Jul	Management Team meeting	
24—26-Jul	Universities Council on Water Resources (UCOWR)/National Institutes for Water Resources (NIWR) Annual Conference: <i>Political and civic engagement of agriculture producers who operate in selected Idaho and Texas counties dependent on irrigation</i> , Boise, ID	Doerfert
30-Jul—3-Aug	Texas Vocational Agriculture Teachers' Association Annual Conference, Arlington, TX (distributed 100 DVDs)	Doerfert
9-Aug	Management Team meeting	

10-Aug	Texas South Plains Perennial Grass Workshop, Teeter Farm & Muncy Unity Center	Kellison/Trostle
13—15-Aug	International Symposium on Integrated Crop-Livestock Systems conference, Universidade Federal do Parana in Curitiba, Brazil	(Presentation made on behalf of Allen)
13—14-Aug	2007 Water Research Symposium: <i>Comparison of water use among crops in the Texas High Plains estimated using remote sensing</i> , Socorro, NM	Rajan
14—17-Aug	Educational training of new doctoral students, Texas Tech campus, Lubbock, TX (distributed 17 DVDs)	Doerfert
23-Aug	Cattle Feeds and Mixing Program	
12-Sep	West Texas Ag Chem Conference	Kellison
18-Sep	Floyd County Farm Tour	Trostle
20-Sep	Management Team meeting	
1-Oct	Plant & Soil Science Departmental Seminar: <i>Overview and Initial Progress of the Texas Alliance for Water Conservation Project</i>	Kellison
8-Oct	Plant & Soil Science Departmental Seminar: <i>Estimating ground cover of field crops using multispectral medium, resolution satellite, and high resolution aerial imagery</i>	Rajan
11-Oct	Management Team meeting	
4—8-Nov	American Society of Agronomy Annual meetings: <i>Using remote sensing and crop models to compare water use of cotton under different irrigation systems</i> (poster presentation), New Orleans, LA	Rajan
4—8-Nov	American Society of Agronomy Annual meetings: <i>Assessing the crop water use of silage corn and forage sorghum using remote sensing and crop modeling</i> , New Orleans, LA	Rajan
7—9-Nov	National Water Resources Association Annual Conference, Albuquerque, NM	Bruce Rigler (HPUWCD #1)
8-Nov	Management Team meeting (Comer Tuck in attendance)	
12—15-Nov	American Water Resources Association annual meeting: <i>Considering conservation outreach through the framework of behavioral economics: a review of literature</i> (poster presentations), Albuquerque, NM	M. Findley/Doerfert
12—15-Nov	American Water Resources Association annual meeting: <i>How do we value water? A multi-state perspective</i> (poster presentation), Albuquerque, NM	L. Edgar/Doerfert
16-Nov	Water Conservation Advisory Council meeting, Austin, TX	Allen
19-Nov	Plant & Soil Science Departmental Seminar: <i>Finding the legume species for West Texas which can improve forage quality and reduce water consumption</i>	Cui
27—29-Nov	Amarillo Farm Show, Amarillo, TX	Doerfert/Leigh/Kellison
2—4-Dec	Texas Water Summit, San Antonio, TX	Allen
13-Dec	Management Team meeting	

2008

<u>Date</u>	<u>Presentation</u>	<u>Spokesperson(s)</u>
8—11-Jan	Beltwide Cotton Conference Proceedings: <i>Energy Analysis of Cotton Production in the Southern High Plains of Texas</i> , Nashville, TN	Johnson/Weinheimer
10-Jan	Management Team meeting	
1-Feb	Southwest Farm and Ranch Classic, Lubbock	Kellison
14-Feb	Management Team meeting (Weinheimer presentation)	
14-Feb	TAWC Producer Board meeting	Kellison
5-Mar	Floydada Rotary Club	Kellison
13-Mar	Management Team meeting	
25-Mar	National SARE Conference: New American Farm Conference: <i>Systems Research in Action</i> , Kansas City, MO	Allen
27-Mar	Media training for TAWC Producer Board	Doerfert/Kellison
Apr	Agricultural Economics Seminar: <i>Transitions in Agriculture</i> , Texas Tech University	Weinheimer
10-Apr	Management Team meeting	
5-May	Pasture and Forage Land Synthesis Workshop: <i>Integrated forage-livestock systems research</i> , Beltsville, MD	Allen
8-May	Management Team meeting	
9-Jun	Walking tour of New Deal Research farm	Allen/Kellison/Li/Cui/Craddock
10—12-Jun	Forage Training Seminar: <i>Agriculture and land use changes in the Texas High Plains</i> , Cropland Genetics, Amarillo	Allen
12-Jun	Management Team meeting	
14-Jul	Ralls producers	Kellison
14-Jul	Water and the AgriScience Fair Teacher and Student Workshops	Kellison/Brown/Craddock
15-Jul	Pioneer Hybrids Research Directors	Kellison
20—23-July	9 th International Conference on Precision Agriculture, Denver, CO	Rajan
31-Jul	TAWC Field Day	all
8-Aug	TAWC Producer Board meeting	
12-Aug	Pioneer Hybrids Field Day	Kellison
9-Sep	Texas Ag Industries Association, Lubbock regional meeting	Allen
11-Sep	Management Team meeting	
16-Sep	Mark Long, TDA President, Ben Dora Dairies, Amherst, TX	Kellison/Trostle/ Craddock
5—9-Oct	American Society of Agronomy Annual meeting, Houston	Rajan
8-Oct	American Society of Agronomy Annual meeting, Houston	Maas
15-Oct	State Energy Conservation Office (SECO) meeting	

16-Oct	Management Team meeting	
17-Oct	Thesis defense: <i>A Qualitative Investigation of the Factors that Influence Crop Planting and Water Management in West Texas.</i>	Leigh
20-Oct	Farming with Grass conference, Soil and Water Conservation Society, Oklahoma City, OK	Allen
23-Oct	Thesis defense: <i>Farm Level Financial Impacts of Water Policy on the Southern Ogallala Aquifer</i>	Weinheimer
13-Nov	Management Team meeting (Weinheimer presentation)	
17—20-Nov	American Water Resources Association Conference: <i>Farm-based water management research shared through a community of practice model</i> , New Orleans, LA	Leigh
17—20-Nov	American Water Resources Association Conference: <i>The critical role of the community coordinator in facilitating an agriculture water management and conservation community of practice</i> , New Orleans, LA	Wilkinson
17—20-Nov	American Water Resources Association Conference: <i>An exploratory analysis of the rural population and their attitudes toward water management and conservation</i> (poster presentation), New Orleans, LA	Newsom
17—20-Nov	American Water Resources Association Conference: <i>Developing tomorrow's water researchers today</i> (poster presentation), New Orleans, LA	C. Williams
19-Nov	TTU GIS Open House	Barbato
Dec	Panhandle Groundwater District: <i>Farm Level Financial Impacts of Water Policy on the Southern Ogallala Aquifer</i> , White Deer, TX	Johnson/Weinheimer
2—4-Dec	Amarillo Farm Show	Doerfert
3-Dec	Dr. Todd Bilby, Ellen Jordan, Nicholas Kenny, Dr. Amosson (discussion of water/crops/cattle), Amarillo	Kellison
6-Dec	Lubbock RoundTable	Kellison
6—7-Dec	Meeting regarding multi-institutional proposal to target a future USDA RFP on water management, Dallas	Doerfert
11-Dec	Management Team meeting	
12-Dec	Olton CO-OP Producer meeting	Kellison
19-Dec	TAWC Producer meeting	Kellison/Schur/ Craddock/Weinheimer

2009

<u>Date</u>	<u>Presentation</u>	<u>Spokesperson</u>
15-Jan	Management Team meeting	
21-Jan	Caprock Crop Conference	Kellison
27—29 -Jan	Southwest Farm & Ranch Classic (TAWC booth), Lubbock	Doerfert/Jones/Wilkinson/ Williams
27-Jan	Southwest Farm & Ranch Classic: <i>Managing Wheat for Grain</i> , Lubbock	Trostle
27-Jan	Southwest Farm & Ranch Classic: <i>2009 Planting Decisions – Grain Sorghum and Other Alternatives</i> , Lubbock	Trostle
28-Jan	Southwest Farm & Ranch Classic: <i>Profitability Workshop</i> , Lubbock	Yates/Pate
Feb	Floyd County crop meetings, Muncy	Trostle
Feb	Hale County crop meetings, Plainview	Trostle
12-Feb	Management Team meeting	
17-Feb	Crops Profitability workshops, AgriLife Extension and Research Center, Lubbock	Yates/Trostle
5-Mar	Crops Profitability workshops, AgriLife Extension and Research Center, Lubbock	Yates/Trostle
12-Mar	Management Team meeting	
1-Apr	Texas Tech Cotton Economics Institute Research Institutes 9 th Annual Symposium (CERI): <i>Water Policy Impacts on High Plains Cropping Patterns and Representative Farm Performance</i> , Lubbock	Johnson/Weinheimer
9-Apr	Management Team meeting	
15-Apr	Texas Tech Forage Class	Kellison
21-Apr	Presentation to High Plains Underground Water District Board of Directors	Kellison
14-May	Management Team meeting	
27-May	Consortium for Irrigation Research and Education conference, Amarillo	Kellison
11-Jun	Management Team meeting	
22—24-Jun	Joint Meeting of the Western Society of Crop Science and Western Society of Soil Science: <i>Evaluation of the bare soil line from reflectance measurements on seven dissimilar soils</i> (poster presentation), Ft. Collins, CO	Rajan
26-Jun	Western Agricultural Economics Association: <i>Economics of State Level Water Conservation Goals</i> , Kauai, HI	Weinheimer/Johnson
7-Jul	Universities Council of Water Resources: <i>Water Policy in the Southern High Plains: A Farm Level Analysis</i> , Chicago, IL	Weinheimer/Johnson
9-Jul	Management Team meeting	
27—31 -Jul	Texas Agriscience Educator Summer Conference, Lubbock	Doerfert/Jones
6-Aug	Management Team meeting	
17—19– Aug	TAWC NRCS/Congressional tour and presentations, Lubbock, New Deal & Muncy	TAWC participants
27-Aug	Panhandle Association of Soil and Water Conservation Districts	Kellison
10-Sep	Management Team meeting	
8-Oct	Management Team meeting	
9-Oct	Presentation to visiting group from Colombia, TTU campus, Lubbock	Kellison

13-Oct	Briscoe County Field day, Silverton, TX	Kellison
1—5-Nov	Annual Meetings of the American Society of Agronomy, oral presentations: <i>Evapotranspiration of Irrigated and Dryland Cotton Fields Determined Using Eddy Covariance and Penman-Monteith Methods</i> , and <i>Relation Between Soil Surface Resistance and Soil Surface Reflectance</i> , poster presentation: <i>Variable Rate Nitrogen Application in Cotton Using Commercially Available Satellite and Aircraft Imagery</i> ,” Pittsburgh, PA	Maas/Rajan
10—12-Nov	Cotton Incorporated Precision Agriculture Workshop: <i>Biomass Indices</i> , Austin, TX	Rajan/Maas
12-Nov	Management Team meeting	
Dec	United Farm Industries Board of Directors: <i>Irrigated Agriculture</i> , Lubbock	Johnson/Weinheimer
Dec	Fox 34 TV interview, Ramar Communications, Lubbock	Allen
1—3-Dec	Amarillo Farm Show, Amarillo	Doerfert/Jones/Oates/ Kellison
3-Dec	Management Team meeting	
10-Dec	TAWC Producer Board meeting, Lockney	Kellison/Weinheimer/Maas
14-Dec	Round Table meeting with Todd Staples, Lubbock, TX	Kellison
12—18 – Dec	Fall meeting, American Geophysical Union: <i>Vegetation cover mapping at multiple scales using MODIS, Landsat, RapidEye, and Aircraft imageries in the Texas High Plains</i> , San Francisco, CA	Rajan/Maas

2010

<u>Date</u>	<u>Presentation</u>	<u>Spokesperson(s)</u>
4—7-Jan	Beltwide Cotton Conference: <i>Energy and Carbon: Considerations for High Plains Cotton</i> , New Orleans, LA	Yates/Weinheimer
14-Jan	TAWC Management Team meeting	
3-Feb	TAWC Farmer Field Day, Muncy, TX	TAWC participants
6—9-Feb	Southern Agricultural and Applied Economics Association annual meeting: <i>Macroeconomic Impacts on Water Use in Agriculture</i> , Orlando, FL	Weinheimer
9—11-Feb	Southwest Farm & Ranch Classic (TAWC booth), Lubbock	Doerfert/Jones/Frederick
10-Feb	Southwest Farm & Ranch Classic, Lubbock	Kellison/Yates/Trostle/Maas
11-Feb	TAWC Management Team meeting	
9-March	TAWC Producer Board Meeting, Lockney	TAWC participants
11-March	TAWC Management Team meeting	
31-March	Texas Tech Forage Class	Kellison
8-April	TAWC Management Team meeting	
13-April	Matador Land & Cattle Co., Matador, TX	Kellison
13-May	TAWC Management Team meeting	
10-June	TAWC Management Team meeting	
30-June	TAWC Grower Technical Working Group meeting, Lockney	Glodt/Kellison
8-July	TAWC Management Team meeting	
9-July	Southwest Council on Agriculture annual meeting, Lubbock	Doerfert/Sell/Kellison
15-July	Universities Council on Water Resources (UCOWR): <i>Texas Alliance for Water Conservation: An Integrated Approach to Water Conservation</i> , Seattle, WA	Weinheimer
25—27-July	American Agricultural Economics Association annual meeting: <i>Carbon Footprint: A New Farm Management Consideration on the Southern High Plains</i> , Denver, CO	Weinheimer
27-July	Tour for Cotton Incorporated group, TAWC Sites	Kellison/Maas
August	Ag Talk on FOX950 am radio show	Weinheimer
10-Aug	TAWC Field day, Muncy, TX	TAWC participants
12-Aug	TAWC Management Team meeting	
30-Aug	Tour/interviews for SARE film crew, TTU campus, New Deal and TAWC Sites	TAWC participants
9-Sept	TAWC Management Team meeting	
14-Sept	Floyd County Farm Tour, Floydada, TX	Kellison
14-Oct	TAWC Management Team meeting	
27-Oct	Texas Agricultural Lifetime Leadership Class XII	Kellison

31-Oct—3-Nov	Annual Meetings of the American Society of Agronomy: <i>Carbon fluxes from continuous cotton and pasture for grazing in the Texas High Plains</i> , Long Beach, CA	Rajan/Maas
31-Oct—3-Nov	Annual Meetings of the American Society of Agronomy: <i>Closure of surface energy balance for agricultural fields determined from eddy covariance measurements</i> , Long Beach, CA	Maas/Rajan
8-Nov	Fox News interview	Kellison
8-Nov	Fox 950 am radio interview	Doerfert
9-Nov	Texas Ag Industries Association Regional Meeting, Dumas, TX	Kellison
18-Nov	TAWC Management Team meeting	
19-Nov	North Plains Water District meeting, Amarillo, TX	Kellison/Schur
1—3-Dec	Amarillo Farm & Ranch Show (TAWC booth), Amarillo	Doerfert/Zavaleta/Graber
9-Dec	TAWC Management Team meeting	
12—18-Dec	American Geophysical Union fall meeting: <i>Vegetation cover mapping at multiple scales using MODIS, Landsat, RapidEye, and Aircraft imageries in the Texas High Plains</i> , San Francisco, CA	Rajan/Maas

2011

<u>Date</u>	<u>Presentation</u>	<u>Spokesperson(s)</u>
13-Jan	High Plains Irrigation Conference	Kellison
13-Jan	TAWC Management Team meeting	
18-Jan	Fox Talk 950 AM radio interview	Doerfert/Graber/Sullivan
24-Jan	Wilbur-Ellis Company	Kellison
25-Jan	Caprock Crop Conference	Kellison
4-Feb	KJTV-Fox 34 Ag Day news program: <i>TAWC rep discusses optimal irrigation, Field Day preview, Lubbock, TX</i>	Glodt
6—8-Feb	American Society of Agronomy Southern Regional Meeting: <i>Seasonal Ground Cover for Crops in The Texas High Plains</i> , Corpus Christi, TX	Maas/Rajan
7-Feb	KJTV-Fox 34 Ag Day news program: <i>Risk management specialist gives best marketing options for your crop</i> , Lubbock, TX	Yates
8-Feb	KJTV-Fox 34 Ag Day news program: <i>Producer Glenn Schur shares his water conservation tips</i> , Lubbock, TX	Schur
8—10-Feb	Southwest Farm & Ranch Classic (TAWC booth), Lubbock, TX	Doerfert/Graber/Sullivan
9-Feb	Southwest Farm & Ranch Classic: <i>Managing Warm Season Annual Forages on the South Plains</i> , Lubbock, TX	Trostle
9-Feb	KJTV-Fox 34 Ag Day news program: <i>Rep of the HPWD discusses possible water restrictions</i> , Lubbock, TX	Carmon McCain
10-Feb	Hale County Crops meeting, Plainview, TX	Trostle
17-Feb	TAWC Management Team meeting	
23-Feb	Pioneer Hybrids	Kellison
24-Feb	2011 Production Agriculture Planning Workshop, Muncy, TX	TAWC participants
25-Feb	KJTV-Fox 34 Ag Day news program: <i>Producers gain knowledge about water conservation at TAWC Field Day</i> , Lubbock, TX	Doerfert
4-Mar	Texas Tech Forage class	Kellison
10-Mar	TAWC Management Team meeting (Maas presentation)	
30-Mar	West Texas Mesonet (Wes Burgett), TTU Reese Center, Lubbock, TX	Kellison/Brown/Maas/Rajan /Weinheimer
31-Mar—1-Apr	Texas Cotton Ginners Show (TAWC booth), Lubbock, TX	Doerfert/Graber/Sullivan
13-Apr	USDA-ARS/Ogallala Aquifer project (David Brauer), Lubbock, TX	Kellison/TAWC participants
13-Apr	KJTV-Fox 34 Ag Day news program: <i>TAWC introduces solution tools for producers</i> , Lubbock, TX	Weinheimer
14-Apr	TAWC Management Team meeting	

18-Apr	KJTV-Fox 34 Ag Day news program: <i>Cotton overwhelmingly king this year on South Plains</i> , Lubbock, TX	Boyd Jackson
18-Apr	KJTV-Fox 34 Ag Day news program: <i>Specialty, rotation crops not popular this growing season</i> , Lubbock, TX	Trostle
12-May	TAWC Management Team meeting	
17-May	KJTV-Fox 34 Ag Day news program: <i>Tools available to maximize irrigation efficiency</i> , Lubbock, TX	Kellison
18-May	Floydada Rotary Club, Floydada, TX	Kellison
9-Jun	TAWC Management Team meeting	
29-Jun—2-Jul	Joint meetings of the Western Agricultural Economics Association/Canadian Agricultural Economics Society: <i>Evaluating the Implications of Regional Water Management Strategies: A Comparison of County and Farm Level Analysis</i> , Banff, Alberta, Canada	Weinheimer
12—14-Jul	UCOWR/NIWR Conference: <i>Texas Alliance for Water Conservation: An Innovative Approach to Water Conservation: An Overview</i> , Boulder, CO	Kellison
12—14-Jul	UCOWR/NIWR Conference: <i>Sunflowers as an Alternative Irrigated Crop on the Southern High Plains</i> , Boulder, CO	Pate
12—14-Jul	UCOWR/NIWR Conference: <i>Economic Considerations for Water Conservation: The Texas Alliance for Water Conservation</i> , Boulder, CO	Weinheimer
12—14-Jul	UCOWR/NIWR Conference: <i>Determining Crop Water Use in the Texas Alliance for Water Conservation Project</i> , Boulder, CO	Maas
12—14-Jul	UCOWR/NIWR Conference: <i>What We Know About Disseminating Water Management Information to Various Stakeholders</i> , Boulder, CO	Doerfert
12—14-Jul	UCOWR/NIWR Conference: <i>Assessment of Improved Pasture Alternatives on Texas Alliance for Water Conservation</i> , Boulder, CO	Kellison
12—14-Jul	UCOWR/NIWR Conference: <i>Integrating forages and grazing animals to reduce agricultural water use</i> , Boulder, CO	Brown
21-Jul	TAWC Management Team meeting	
4-Aug	KXDJ-FM news radio interview	Weinheimer
4-Aug	TAWC Field Day, Muncy, TX	TAWC participants
11-Aug	TAWC Management Team meeting	
1-Sep	KJTV-Fox 34 Ag Day news program: <i>High Plains producers struggling to conserve water in drought</i> , Lubbock, TX	Boyd Jackson
5-Sep	KJTV-Fox 34 Ag Day news program: <i>New ideas, concepts emerging from surviving historic drought</i> , Lubbock, TX	Kellison
8-Sep	TAWC Management Team meeting (Brown presentation)	
29-Sep	Texas & Southwestern Cattle Raiser Association Fall meeting, Lubbock, TX	Kellison
13-Oct	TAWC Management Team meeting (Maas presentation)	

16—19-Oct	Annual Meetings of the American Society of Agronomy: <i>Satellite-based irrigation scheduling</i> , San Antonio, TX	Maas/Rajan
16—19-Oct	Annual Meetings of the American Society of Agronomy: <i>Comparison of carbon, water and energy fluxes between grassland and agricultural ecosystems</i> , San Antonio, TX	Maas/Rajan
16—19-Oct	Annual Meetings of the Soil Science Society of America: <i>CO₂ and N₂O Fluxes in Integrated Crop Livestock Systems</i> (poster presentation), San Antonio, TX	Lisa Fultz/Marko Davinic/Jennifer Moore-Kucera
16—19-Oct	Annual Meetings of the Soil Science Society of America: <i>Dynamics of Soil Aggregation and Carbon in Long-Term Integrated Crop-Livestock Agroecosystems in the Southern High Plains</i> (poster presentation), San Antonio, TX	Lisa Fultz/Marko Davinic/Jennifer Moore-Kucera
16—19-Oct	Annual Meetings of the Soil Science Society of America: <i>Long-Term Integrated Crop-Livestock Agroecosystems and the Effect on Soil Carbon</i> (poster presentation), San Antonio, TX.	Lisa Fultz/Marko Davinic/Jennifer Moore-Kucera
16—19-Oct	Annual Meetings of the Soil Science Society of America: <i>Soil Microbial Dynamics in Alternative Cropping Systems to Monoculture Cotton in the Southern High Plains</i> , San Antonio, TX.	Marko Davinic/Lisa Fultz/Jennifer Moore-Kucera
16—19-Oct	Annual Meetings of the Soil Science Society of America: <i>Soil Fungal Community and Functional Diversity Assessments of Agroecosystems in the Southern High Plains</i> , San Antonio, TX.	Marko Davinic/Lisa Fultz/Jennifer Moore-Kucera
16—19-Oct	Annual Meetings of the Soil Science Society of America: <i>Aggregate Stratification Assessment of Soil Bacterial Communities and Organic Matter Composition: Coupling Pyrosequencing and Mid-Infrared Spectroscopy Techniques</i> , San Antonio, TX.	Marko Davinic/Lisa Fultz/Jennifer Moore-Kucera
6—10-Nov	47 th Annual American Water Resources Association: <i>The Use of Communication Channels Including Social Media Technology by Agricultural Producers and Stakeholders in the State of Texas</i> , Albuquerque, NM	Doerfert/Graber
6—10-Nov	47 th Annual American Water Resources Association: <i>What We Know About Disseminating Water Management Information to Various Stakeholders</i> , Albuquerque, NM	Doerfert, et al.
6—10-Nov	47 th Annual American Water Resources Association: <i>The Water Management and Conservation Instructional Needs of Texas Agriculture Science Teachers</i> , Albuquerque, NM	Doerfert/Sullivan
6—10-Nov	47 th Annual American Water Resources Association: <i>The Attitudes and Opinions of Agricultural Producers Toward Sustainable Agriculture on the High Plains of Texas</i> , Albuquerque, NM	Doerfert, et al.
6—10-Nov	47 th Annual American Water Resources Association: <i>The Issues That Matter Most to Agricultural Stakeholders: A Framework for Future Research</i> (poster presentation), Albuquerque, NM	Sullivan/Doerfert, et al.
10-Nov	TAWC Management Team meeting	
18-Nov	39 th Annual Bankers Agricultural Credit Conference, Lubbock, TX	Kellison
22-Nov	KJTV 950 AM AgTalk radio interview	Trostle
		Doerfert/Graber/Sullivan/Kellison /Borgstedt
29-Nov—1-Dec	Amarillo Farm Show (TAWC booth), Amarillo, TX	
7-Dec	Plainview Lions Club, Plainview, TX	Kellison
8-Dec	TAWC Management Team meeting	
13-Dec	Channel Bio Water Summit (TAWC booth), Amarillo, TX	Borgstedt/Sullivan/Graber

2012

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6-March	Lubbock Kiwanis Club	Kellison
7-March	Monthly Management Team Meeting	Kellison
23-March	New Mexico Ag Bankers Conference	Kellison, Klose
3-April	AgriLife Extension Meeting	Kellison
12-April	Monthly Management Team Meeting	Kellison
10-May	Monthly Management Team Meeting	Kellison
10-May	Carillon Center	Kellison
11-May	Tours-Comer Tuck with the Texas Water Development Board	Kellison
14-May	Tours-Farm Journal Media	Kellison
17-May	Tours-Secretary of State Group	Kellison
14-June	Monthly Management Team Meeting	Kellison
19-June	Lloyd Author Farm	Kellison
20-June	Blake Davis Farm	Kellison
21-June	Glenn Schur Farm	Kellison
10-July	Tours-Justin Weinheimer	Kellison
12-July	Texas Agricultural Coop Council	Kellison
12-July	Texas Independent Ginners Conference	Kellison
18-July	Monthly Management Team Meeting	Kellison
16-August	Monthly Management Team Meeting	Kellison
5-September	Leadership Sorghum Class 1	Kellison
20-September	Monthly Management Team Meeting	Kellison
18-October	Monthly Management Team Meeting	Kellison
24-October	Texas Agriculture Lifetime Leadership	Kellison
30-October	Special Management Team Meeting	Kellison
8-November	Monthly Management Team Meeting	Kellison
27-28-November	Amarillo Farm & Ranch Show	Borgstedt/Doerfert/Kellison
13-December	Monthly Management Team Meeting	Kellison

16-18-November	48 th Annual American Water Resources Association conference	Doerfert/Kellison/P. Johnson/Maas
20-November	Special Management Team Meeting	Kellison
3-January	KFLP Radio	Kellison
7-9-January	Beltwide Cotton Conference	Doerfert
15-January	Fox 950 AM	Doerfert
4-February	Texas Seed Trade Association	Kellison
14-February	Monthly Management Team Meeting	Kellison
21-March	Monthly Management Team Meeting	Kellison
29-30-March	Texas Gin Association Convention	Borgstedt/Doerfert
11-April	Monthly Management Team Meeting	Kellison

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- Rajan, N., and S. J. Maas. 2007. Comparison of water use among crops in the Texas High Plains estimated using remote sensing. Abstracts, 2007 Water Research Symposium, Socorro, NM.
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- Allen, V.G., D. Philipp, W. Craddock, P. Brown, and R. Kellison. 2007. Water dynamics in integrated crop-livestock systems. Proc. Simpósio Internacional em Integração Lavoura-Pecuária. 13, 14, and 15 August, 2007. Curitiba, Parana, Brazil.
- Acosta-Martínez, V., G. Burow, T.M. Zobeck, and V. Allen. 2007. Soil microbial diversity, structure and functioning under alternative systems compared to continuous cotton. Annual meeting of the American Society of Agronomy, New Orleans, LA. Nov. 4-8, 2007.
- Deycard, Victoria N., Wayne Hudnall, Vivien G. Allen. 2007. Soil sustainability as measured by carbon sequestration using carbon isotopes from crop-livestock management systems in a semi-arid environment. Annual meeting of the American Society of Agronomy, New Orleans, LA. Nov. 4-8, 2007.
- Doerfert, D., V. Allen, W. Craddock, and R. Kellison. 2007. Forage sorghum production in the Southern Plains Region. Texas Alliance for Water Conservation, Summary of Research. Vol. 1, No. 1. Texas Tech Univ., Lubbock, TX.
- Leigh, K., D. Doerfert. 2008. Farm-based water management research shared through a community of practice model. 44th Annual American Water Resources Association (AWRA) Conference, New Orleans, LA.
- Maas, S. J., and N. Rajan. 2008. Estimating ground cover of field crops using medium-resolution multispectral satellite imagery. *Agronomy Journal* 100:320-327.
- Rajan, N., and S. J. Maas. 2008. Acclimation of crops to soil water availability. Abstracts, Annual Meetings, Amer. Soc. Agronomy. 5-9 October, Houston, TX. (CD-ROM)
- Maas, S. J., and N. Rajan. 2008. Estimating plant transpiration and soil evaporation using remote sensing. Abstracts, Annual Meetings, Amer. Soc. Agronomy. 5-9 October, Houston, TX. (CD-ROM)

- Rajan, N., and S. J. Maas. 2008. Comparison of PVI and NDVI for estimating crop ground cover for precision agriculture applications. In Proc., 9th International Conference on Precision agriculture. 20-23 July, Denver, CO. (CD-ROM)
- Robertson, G. P., V. G. Allen, G. Boody, E. R. Boose, N. G. Creamer, L. E. Drinkwater, J. R. Gosz, L. Lynch, J. L. Havlin, L. E. Jackson, S. T.A. Pickett, L. Pitelka, A. Randall, A. S. Reed, T. R. Seastedt, R. B. Waide, and D. H. Wall. 2008. Long-Term Agricultural Research: A Research, Education, and Extension Imperative. *BioScience* 58(7):604-645.
- Johnson, J., P. Johnson, E. Segarra and D. Willis. 2009. Water conservation policy alternatives for the Ogallala Aquifer in Texas. *Water Policy*. 11: (2009) 537-552.
- Weinheimer, J., and P. Johnson. 2009. Energy and Carbon. Considerations for High Plains cotton. 2010 Beltwide Cotton Conference. January 2010, New Orleans, LA.
- Yates, J., J. Pate, J. Weinheimer, R. Dudensing, and J. Johnson. 2010. Regional economic impact of irrigated versus dryland agriculture in the Texas High Plains. Beltwide Cotton Conference. January, New Orleans, LA.
- Weinheimer, J., N. Rajan, P. Johnson, and S.J. Maas. 2010. Carbon footprint: A new farm management consideration in the Southern High Plains. Selected paper, Agricultural & Applied Economics Association Annual Meeting. July 25-27, Denver, CO.
- Weinheimer, J. 2010. Texas Alliance for Water Conservation: An integrated approach to water conservation. Universities Council on Water Resources. July, Seattle, WA.
- Doerfert, D.L., L. Graber, D. Meyers, and E. Irlbeck. 2012. Traditional and social media channels used by Texas agricultural producers. Proceedings of the 2012 American Association for Agricultural Education (AAAE) Research Conference, Ashville, NC.
- Doerfert, D., R. Kellison, P. Johnson, S. Maas, and J. Weinheimer. 2012. Crop production water management tools for West Texas farmers. Paper to be presented at the 2012 American Water Resources Association (AWRA) Annual Conference, November, Jacksonville, FL.
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SITE DESCRIPTIONS

BACKGROUND

This project officially began with the announcement of the TWDB grant in September, 2004. However, it was February, 2005, before all of the contracts and budgets were finalized and actual field site selections could begin. By February, 2005, the Producer Board had been named and was functioning, and the Management Team was identified to expedite the decision-making process. Initial steps were taken immediately to advertise and identify individuals to hold the positions of Project Director and Secretary/Accountant. Both positions were filled by June of 2005. By autumn 2005, the FARM Assistance position was also filled.

Working through the Producer Board, 26 sites were identified that included 4,289 acres in Hale and Floyd counties (Figure 9). Soil moisture monitoring points installed, maintained and measured by the High Plains Underground Water Conservation District No. 1 were purposely located close to these sites and GPS position coordinates were taken for each of these monitoring points. This was completed during 2005 and was operational for much of the 2005 growing season. All data recorded from these points continue to be maintained by the High Plains Underground Water District No. 1.

Total number of acres devoted to each crop and livestock enterprise and management type in 2005 - 2012 are given in Tables 12 - 19. These sites include subsurface drip, center pivot, and furrow irrigation as well as dryland examples. It is important to note when interpreting data from Year 1 (2005), that this was an incomplete year. We were fortunate that this project made use of already existing and operating systems; thus there was no time delay in establishment of systems. Efforts were made to locate missing information on water use while the original 26 sites were brought on-line. Such information is based on estimates as well as actual measurements during this first year and should be interpreted with caution. The resulting 2005 water use data, however, provided useful information as we began this long-term project. It is also important to note that additional improvements were made in 2006 in calibration of water measurements and other protocols.

In year 2 (2006), site 25 was lost to the project due to a change in land ownership, but was replaced by site 27, thus the project continued to monitor 26 sites. Total acreage in 2006 was 4,230, a decline of about 60 acres between the two years. Crop and livestock enterprises on these sites and the acres committed to each use by site are given in Table 13.

In year 3 (2007), all sites present in 2006 remained in the project through 2007. Total acreage was 4,245, a slight increase over year 2 resulting from expansion of Site 1.

In year 4 (2008), 25 sites comprised 3,967 acres (Table 15). Sites 1, 13, 16, and 25 of the original sites had left the project, and sites 28 and 29 were added.

In year 5 (2009), all sites present in 2008 remained in the project. Site 30 with 21.8 acres was added. Thus, 26 total sites were present in 2009 for a total of 3,991 acres.

In year 6 (2010), three new sites were added as part of the implementation phase of the project. These sites were designed to limit total irrigation for 2010 to no more than 15 inches. Crops grown included cotton, seed millet and corn. The purpose of these added sites was to demonstrate successful production systems while restricting the water applied. With the addition of sites 31, 32, and 33, the project now totaled 29 sites and increased the project acreage from 3,991 acres to 4,272 acres though these new sites were treated separately in this year. The new sites also increased the number of producers involved in the project by one.

In year 7 (2011), the previously mentioned implementation sites were incorporated into the whole project and no longer differentiated from other sites in management or data analysis due to changes in water policy. In addition, site 5 was converted from a livestock-only system to an annual cropping system. The site acreage declined from 626.4 to 487.6 by dropping the grassland corners but maintaining the cropping system under the center pivot. Site maps will be adjusted for 2012 to better reflect this change. Total acres for the project decreased from 4272 acres in 2010 to 4133 acres in 2011 as a result.

In year 8 (2012), site 34 was added to the project. The new 726.6 acres was partially offset by the exit of site 23 (121.1 acres). The 2012 report includes new satellite imagery of each site, and site information has been updated accordingly. As always minor corrections to site acreages continue to occur as discrepancies are discovered. Total acres for the project increased from 4133 acres in 2011 to 4732 acres in 2012 as a result of these site changes.

All numbers in this report continue to be checked and verified. THIS REPORT SHOULD BE CONSIDERED A DRAFT AND SUBJECT TO FURTHER REVISION. However, each year's annual report reflects completion and revisions made to previous years' reports as well as the inclusion of additional data from previous years. Thus, the most current annual report will contain the most complete and correct report from all previous years and is an overall summarization of the data to date.

The results of years 1-8 follow and are presented by site.

Texas Alliance for Water Conservation 2012

Scale: 1:120,000



Site Acres

2	60.0	19	120.4
3	123.3	20	233.3
4	123.0	21	122.6
5	484.1	22	148.7
6	122.7	23	121.1
7	130.0	24	129.7
8	61.8	26	125.1
9	237.8	27	108.4
10	173.6	28	51.4
11	92.5	29	221.6
12	283.8	30	21.8
14	124.1	31	121.9
15	101.1	32	70.0
17	220.7	33	70.0
18	122.2	34	726.6



**Texas Alliance for
Water Conservation**

"Water is Our Future"

Agriculture Division
High Plains Underground
Water Conservation District No. 1

March 2012

Figure 9. Site map index for 2012 (year 8).

Table 12. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 26 producer sites in Hale and Floyd Counties during 2005.

Site	irrigation type	cotton	corn grain	corn silage	sorghum grain	sorghum forage	Pearl millet	sunflowers	alfalfa	grass seed	perennial pasture	cattle	wheat	rye	triticale	oats
1	SDI	62.3														
2	SDI	60.9														
3	PIV	61.8			61.5											
4	PIV	109.8							13.3							
5	PIV/DRY								69.6		551.3	620.9				
6	PIV	122.9										122.9	122.9			
7	PIV									130.0						
8	SDI								61.8							
9	PIV	137.0									95.8	232.8		232.8		
10	PIV	44.5									129.1	129.1				
11	FUR	92.5														
12	DRY	151.2				132.7										
13	DRY	201.5											118.0			
14	PIV	124.2														
15	FUR	95.5														
16	PIV	143.1														
17	PIV	108.9		58.3							53.6					
18	PIV	61.5			60.7											
19	PIV	75.3					45.1									
20	PIV			115.8		117.6							117.6			
21	PIV	122.7														
22	PIV	72.7	76.0													
23	PIV	51.5						48.8								
24	PIV	64.7	65.1													
25	DRY	90.9			87.6											
26	PIV	62.9	62.3													
Total	2005 acres	2118.3	203.4	174.1	209.8	250.3	45.1	48.8	82.9	191.8	829.8	1105.7	358.5	232.8	0.0	0.0

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation (acres may overlap due to multiple crops per year and grazing).

Table 13. Irrigation type and total acres, by site, of crops, forages and acres grazed by cattle in 26 producer sites in Hale and Floyd Counties during 2006.

Site	irrigation type	cotton	corn grain	corn silage	sorghum grain	sorghum forage	Pearl millet	sunflowers	alfalfa	grass seed	perennial pasture	cattle	wheat	rye	triticale	oats
1	SDI	135.2														
2	SDI	60.9														
3	PIV	123.3														
4	PIV	44.4				65.4			13.3				65.4			
5	PIV/DRY								69.6		551.3	620.9				
6	PIV	122.9														
7	PIV									130.0						
8	SDI								61.8							
9	PIV	137.0									95.8	95.8		137.0		
10	PIV					44.5					129.1	129.1				44.5
11	FUR	92.5														
12	DRY	132.7											151.2			
13	DRY	118.0											201.5			
14	PIV	124.2														
15	FUR	67.1			28.4											
16	PIV	143.1														
17	PIV	58.3		108.9							53.6	162.5	108.9			
18	PIV	60.7				61.2										61.2
19	PIV	75.1					45.3									
20	PIV			117.6		115.8									115.8	
21	PIV	61.3	61.4									61.3	61.3			
22	PIV	72.7	76													
23	PIV	51.5	48.8													
24	PIV	65.1		64.7												
26	PIV	62.3	62.9													
27	SDI	46.2														
Total	2006 acres	1854.5	249.1	291.2	28.4	286.9	45.3	0.0	82.9	191.8	829.8	1069.6	588.3	137.0	115.8	105.7

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation (acres may overlap due to multiple crops per year and grazing)

Table 14. Irrigation type and total acres, by site, of crops, forages and acres grazed by cattle in 26 producer sites in Hale and Floyd Counties during 2007.

Site	irrigation type	cotton	corn grain	corn silage	sorghum grain	sorghum forage	pearlmillet	sunflowers	alfalfa	grass seed	perennial pasture	cattle	wheat	rye	triticale	oats
1	SDI	135.2														
2	SDI	60.9														
3	PIV	61.5				61.8							61.8			
4	PIV	65.4							13.3			109.8	109.8			
5	PIV/DRY										620.9	620.9				
6	PIV	122.9														
7	PIV									130.0						
8	SDI									61.8						
9	PIV				137.0						95.8	95.8		232.8		
10	PIV			44.5							129.1	129.1				
11	FUR	92.5														
12	DRY	151.2			132.7											
13	DRY	201.5											118.0			
14	PIV	124.2														
15	FUR	66.7			28.8											
16	PIV	143.1														
17	PIV	108.9									167.2	167.2	108.9			
18	PIV				61.5								60.7			
19	PIV	75.8					45.6									
20	PIV			117.6		115.8									233.4	
21	PIV		61.3							61.4						
22	PIV	148.7														
23	PIV		105.2													
24	PIV		129.8													
26	PIV		62.3				62.9					62.9				
27	SDI	16.2		46.2												
Total	2007 acres	1574.7	358.6	208.3	360.0	177.6	108.5	0.0	13.3	253.2	1013.0	1185.7	459.2	232.8	233.4	0.0

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation

Table 15. Irrigation type and total acres, by site, of crops, forages and acres grazed by cattle in 25 producer sites in Hale and Floyd Counties during 2008.

Site	irrigation type	total acres (no overlap)	cotton	corn grain	sunflowers	grain sorghum	grain sorghum for seed	grain sorghum for silage	forage sorghum for hay	pearl millet for seed	alfalfa	grass seed	hay	perennial pasture	cattle	wheat for grain	wheat for silage	wheat for grazing	grazing of crop residue	barley for seed	fallow or pens/facilities
2	SDI	60.9			60.9																
3	PIV	123.3	61.8			61.5										61.5					
4	PIV	123.1				65.4					13.3		13.3	13.3	44.4	44.4		44.4			
5	PIV/DRY	628.0											81.2	620.9	620.9						5.5
6	PIV	122.9	92.9	30.0																	
7	PIV	130.0										130.0	130.0	130.0							
8	SDI	61.8										61.8	61.8	61.8							
9	PIV	237.8	137.0											95.8	95.8						5.0
10	PIV	173.6		44.5									42.7	129.1	129.1	44.5					
11	FUR	92.5	47.3			45.2															
12	DRY	283.9						151.2													132.7
14	PIV	124.2	124.2																		
15	FUR	95.5	67.1													28.4					
17	PIV	220.8		108.9								111.9		111.9	220.8				108.9		
18	PIV	122.2	61.5			60.7											60.7				
19	PIV	120.4	75.0							45.4											
20	PIV	233.4				117.6		115.8					117.6			233.4					
21	PIV	122.7							61.3			61.4	122.7	61.4						61.3	
22	PIV	148.7		148.7																	
23	PIV	105.1	60.5		44.6																
24	PIV	129.8		129.8																	
26	PIV	125.2		40.4			22.5			62.3					125.2				125.2		
27	SDI	108.5	46.2	62.3																	
28	SDI	51.5		51.5																	
29	DRY	221.6	117.3												104.3			104.3			
	Total 2008 acres	3967.4	890.8	616.1	105.5	350.4	22.5	267.0	61.3	107.7	13.3	365.1	569.3	1224.2	1340.5	412.2	60.7	148.7	234.1	61.3	143.2
# of sites		25	11	8	2	5	1	2	1	2	1	4	7	8	7	5	1	2	2	1	3
Site	irrigation type	total acres (no overlap)	cotton	corn grain	sunflowers	grain sorghum	grain sorghum for seed	grain sorghum for silage	forage sorghum for hay	pearl millet for seed	alfalfa	grass seed	hay	perennial pasture	cattle	wheat for grain	wheat for silage	wheat for grazing	grazing of crop residue	barley for seed	fallow or pens/facilities

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation

Table 16. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 26 producer sites in Hale and Floyd Counties during 2009.

Site	irrigation type	System acres	cotton	corn grain	Corn silage	sunflowers	grain sorghum	grain sorghum for silage	forage sorghum for hay	alfalfa	grass seed	hay	perennial pasture	cattle	wheat for grain	wheat for silage	wheat for grazing	grazing of crop residue	Oat silage	fallow or pens/facilities
2	SDI	60.9	60.9																	
3	PIV	123.3	61.8				61.5													
4	PIV	123.1	13.3				28.4			16.0			16.0	98.3	65.4			98.3		
5	PIV/DRY	626.4										89.2	620.9	620.9						5.5
6	PIV	122.9	90.8	32.1																
7	PIV	129.9									129.9	129.9	129.9							
8	SDI	61.8									61.8	61.8	61.8							
9	PIV	237.8	137.0										100.8	100.8						
10	PIV	173.6	44.5										129.1	129.1						
11	FUR	92.5	68.1				24.4													
12	DRY	283.9						151.2												132.7
14	PIV	124.2	61.8												62.4					
15	FUR/SDI	102.8	102.8																	
17	PIV	220.8				108.9					53.6		111.9	111.9						
18	PIV	122.2	60.7												61.5					
19	PIV	120.3	60.2												60.1					
20	PIV	233.3	117.6		115.7															
21	PIV	122.6							61.2		61.4	61.4	61.4		61.2					
22	PIV	148.7	148.7																	
23	PIV	101.4						101.4								60.5			40.9	
24	PIV	129.7		64.6		65.1														
26	PIV	125.2		62.3		62.9								62.9			62.9			
27	SDI	108.5	48.8	59.7																
28	SDI	51.5	51.5																	
29	DRY	221.7	116.4												104.3					
30	PIV	21.8				21.8														
	Total 2009 acres	3990.8	1244.9	218.7	115.7	258.7	114.3	252.6	61.2	16.0	306.7	342.3	1231.8	1123.9	414.9	60.5	62.9	98.3	40.9	138.2
# of sites		26	16	4	1	4	3	2	1	1	4	4	8	6	6	1	1	1	1	2
Site	irrigation type	System acres	cotton	corn grain	Corn silage	sunflowers	grain sorghum	grain sorghum for silage	forage sorghum for hay	alfalfa	grass seed	hay	perennial pasture	cattle	wheat for grain	wheat for silage	wheat for grazing	grazing of crop residue	Oat silage	fallow or pens/facilities

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation

Table 17. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 26 producer sites in Hale and Floyd Counties during 2010.

Site	Irrigation type	System acres	cotton	corn grain	Corn silage	sunflowers	grain sorghum	grain sorghum for silage	forage sorghum for hay	alfalfa	grass seed	hay	perennial forage	cattle	wheat for grain	wheat for silage	wheat for grazing	grazing of crop residue	Triticale silage
2	SDI	60.9		60.9															
3	PIV	123.3	61.8				61.5												
4	PIV	123.0	78.6						28.4	16.0			16.0		28.4				
5	PIV/DRY	628.0											628	628					
6	PIV	122.8	62.2	60.6															
7	PIV	130.0									130.0	130.0	130						
8	SDI	61.8									61.8	61.8	61.8						
9	PIV	237.8	137.0										100.8	100.8					
10	PIV	173.6		87.2									86.4	86.4					
11	FUR	92.5	69.6				22.9												
12	DRY	283.9																	
14	PIV	124.2	62.4												61.8				
15	FUR/SDI	102.8	102.8																
17	PIV	220.8		108.9									111.9	220.8					
18	PIV	122.2	61.5												60.7				
19	PIV	120.4	59.2												61.2				
20	PIV	233.4	115.8		117.6														115.8
21	PIV	122.6	61.2	61.4															
22	PIV	148.7		148.7															
23	PIV	121.1		121.1															121.1
24	PIV	129.7		129.7															
26	PIV	125.2	62.9	62.3										62.3	62.3		62.3		
27	SDI	108.5	59.7		48.8														
28	SDI	51.5	51.5																
29	DRY	221.7	104.3				117.4												
30	SDI	21.8		21.8															
	Total 2010 acres	4012.2	1150.5	862.6	166.4	0.0	201.8	0.0	28.4	16.0	191.8	191.8	1134.9	1098.3	274.4	0.0	62.3	0.0	236.9
	# of sites	26	15	10	2	0	3	0	1	1	2	2	7	5	5	0	1	0	2
Site	irrigation type	System acres	cotton	corn grain	Corn silage	sunflowers	grain sorghum	grain sorghum for silage	forage sorghum for hay	alfalfa	grass seed	hay	perennial forage	cattle	wheat for grain	wheat for silage	wheat for grazing	grazing of crop residue	Triticale silage

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation

Table 18. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 29 producer sites in Hale and Floyd Counties during 2011.

Site	Irrigation type	System acres	cotton	corn grain	Corn silage	fallow	grain sorghum	grain sorghum for silage	forage sorghum for hay	alfalfa	grass seed	hay	perennial forage	cattle	wheat for grain	wheat for silage	wheat for grazing	grazing of crop residue	Triticale silage	seed millet
2	SDI	60.9	41.3			19.6														
3	PIV	123.3	123.3																	
4	PIV	123.0	79.0						13.3	16.0					28.0					
5	PIV	487.6	347.8			139.8														
6	PIV	122.8	92.9	29.9																
7	PIV	130.0									130.0	130.0	130							
8	SDI	61.8									42.5	42.5	61.8							
9	PIV	237.8	137.0										100.8	100.8						
10	PIV	173.6	131.5										42.1	42.1						
11	FUR	92.5	74.5					18.0												
12	DRY	283.9	283.9																	
14	PIV	124.2	124.2																	
15	SDI	102.8	57.2		45.6															
17	PIV	220.8	108.9										111.9	111.9						
18	PIV	122.2	100.0												61.5					
19	PIV	120.4	120.4																	
20	PIV	233.4	117.6		115.8							117.6							117.6	
21	PIV	122.6	61.4	61.2																
22	PIV	148.7	148.7																	
23	PIV	121.1			121.1														121.1	
24	PIV	129.7	65.1	64.6																
26	PIV	125.2	62.9	62.3																
27	SDI	108.5	48.8		59.7															
28	SDI	51.5	51.5																	
29	DRY	221.7	221.7																	
30	SDI	21.8				21.8														
31	PIV	121.0	55.4																	66.1
32	PIV	70.0		70.0																
33	PIV	70.0		70.0																
	Total 2011 acres	4132.8	2655.0	358.0	342.2	181.2	0.0	18.0	13.3	16.0	172.5	290.1	446.6	254.8	89.5	0.0	0.0	0.0	238.7	66.1
# of sites		29	23	6	4	3	0	1	1	1	2	3	5	3	2	0	0	0	2	1
Site	Irrigation type	System acres	cotton	corn grain	Corn silage	fallow	grain sorghum	grain sorghum for silage	forage sorghum for hay	alfalfa	grass seed	hay	perennial forage	cattle	wheat for grain	wheat for silage	wheat for grazing	grazing of crop residue	Triticale silage	seed millet

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation

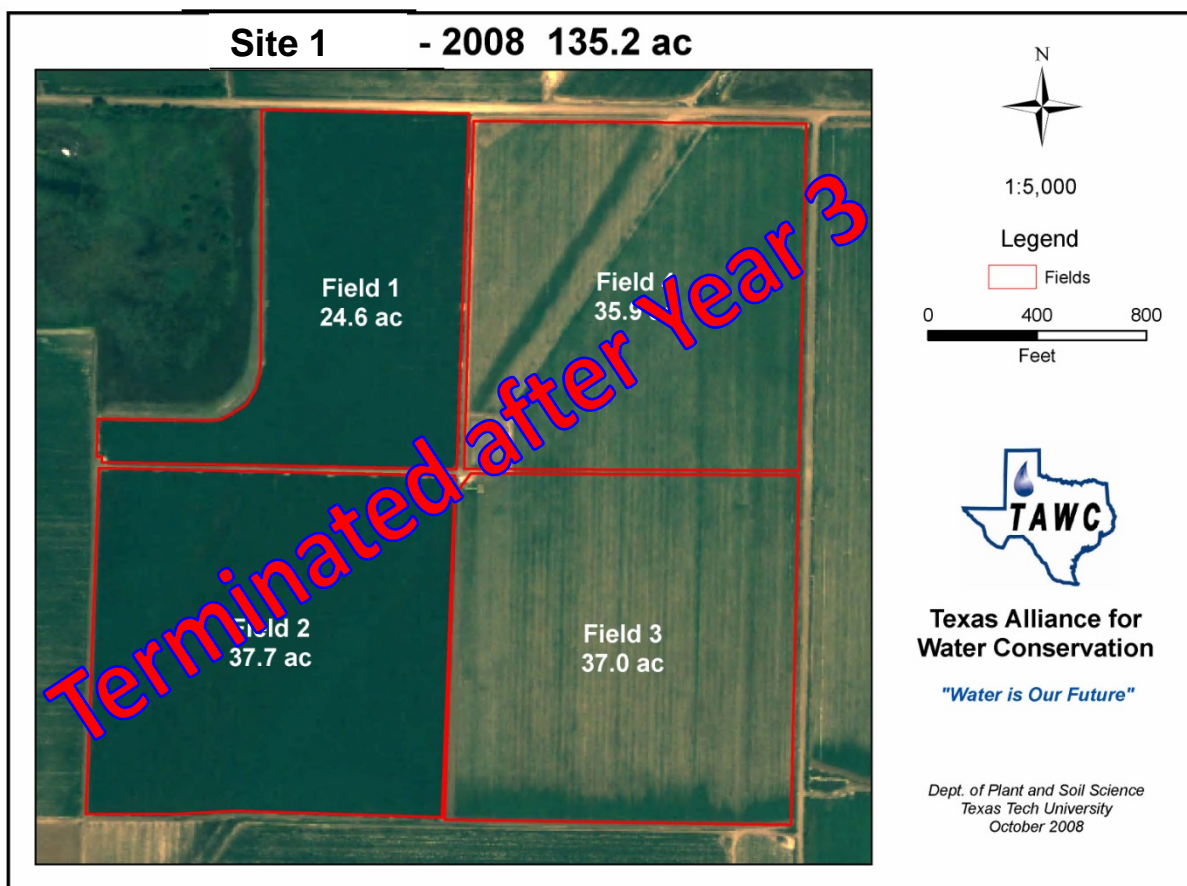
**Yellow notes abandoned, Tan partially abandoned, Brown fallowed

Table 19. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 29 producer sites in Hale and Floyd Counties during 2012.

Site	Irrigation type	System acres	cotton	corn grain	Corn silage	fallow	grain sorghum	Seed Sorghum	forage sorghum for hay	alfalfa	grass seed	hay	perennial forage	cattle	wheat for grain	wheat for silage	wheat for grazing	Sunflowers	Triticale silage	seed millet
2	SDI	60.0	24	36																
3	PIV	123.3	123.3																	
4	PIV	123.0	29.6					50.5	13.2	16					26.9					
5	PIV	484.1	398.3			85.5														
6	PIV	122.7		60.6		62.1														
7	PIV	130.0									130	130	130							
8	SDI	61.8									61.8	61.8	61.8							
9	PIV	237.8	137										100.8							
10	PIV	173.6			87.2								86.4							
11	FUR	92.5	92.5				92.5													
12	DRY	283.8	283.8			283.8														
14	PIV	124.1	62.4												61.7					
15	SDI	101.1	101.1				101.1													
17	PIV	220.7	54.5	54.4									111.8	111.8						
18	PIV	122.2																		
19	PIV	120.4	59.2			61.2														
20	PIV	233.3	115.7	117.6															115.7	
21	PIV	122.6	61.2						61.4						61.4					
22	PIV	148.7	148.7																	
24	PIV	129.7	65.1	64.6																
26	PIV	125.2	62.3															62.9		
27	SDI	108.4	59.6		48.8															
28	SDI	51.5	51.5	51.5																
29	DRY	221.6	117.3				104.3													
30	SDI	21.8	21.8																	
31	PIV	121.9	66.8																	55.1
32	PIV	70.0	70	70																
33	PIV	70.0		70																
34	PIV	726.6	364	182		362.6														
	Total 2012 acres	4732.4	2569.7	706.7	136	855.2	297.9	50.5	74.6	16	191.8	191.8	490.8	111.8	150	0	0	62.9	115.7	55.1
# of sites		29	23	9	2	5	3	1	2	1	2	2	5	1	3	0	0	1	1	1
Site	irrigation type	System acres	cotton	corn grain	Corn silage	fallow	grain sorghum	Seed Sorghum	forage sorghum for hay	alfalfa	grass seed	hay	perennial forage	cattle	wheat for grain	wheat for silage	wheat for grazing	Sunflowers	Triticale silage	seed millet

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation

**Yellow denotes field was abandoned due to hail/drought, tan denotes partially abandoned, brown denotes fallowed



Site 1 Description

Total site acres:	135.2
Field No. 1 Acres:	24.6
Major soil type:	Estacado clay loam; 1 to 3% slope
Field No. 2 Acres:	37.7
Major soil type:	Lofton clay loam, 0 to 1% slope Pullman clay loam, 1 to 3% slope
Field No. 3 Acres:	37.0
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 4 Acres:	35.9
Major soil type:	Pullman clay loam; 0 to 1% slope

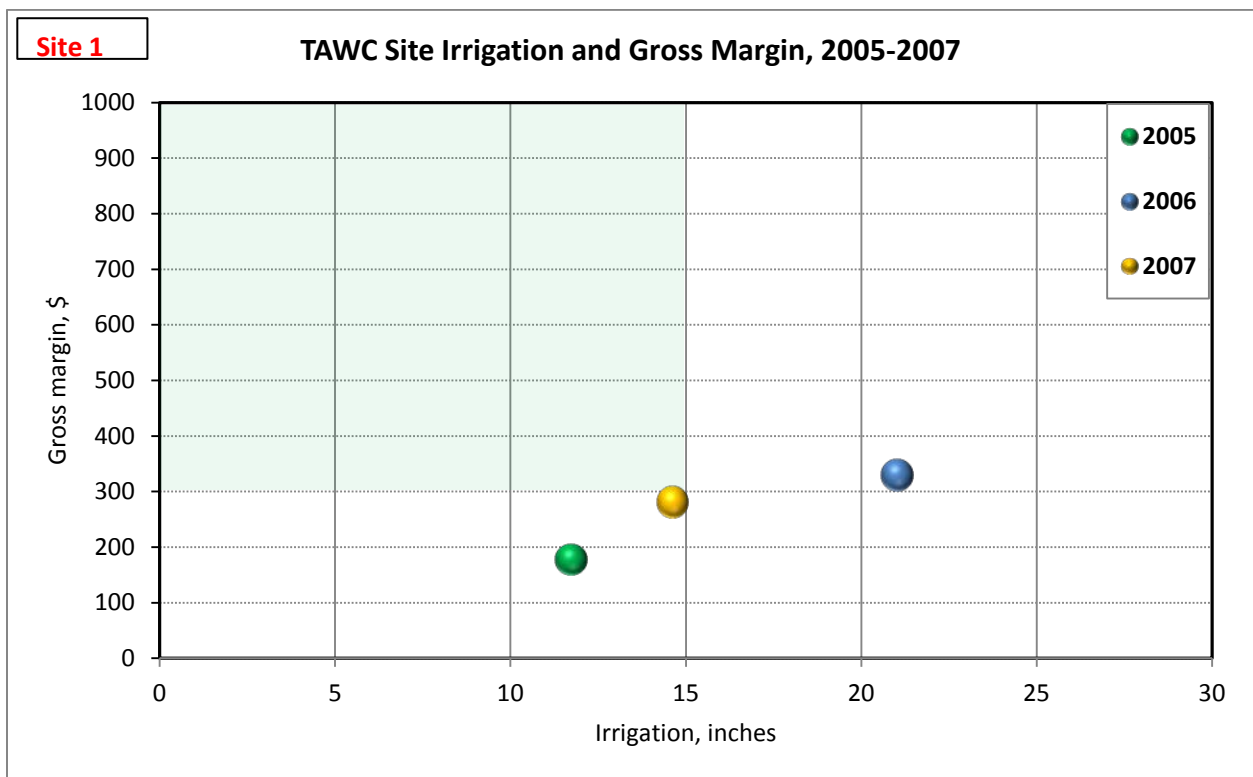
Irrigation

Type:	Subsurface Drip (SDI) (Field 1 and 2 installed prior to 2004 crop year) (Field 3 and 4 installed prior to 2006 crop year)
Pumping capacity, gal/min:	850
Number of wells:	2
Fuel source:	Electric Natural gas

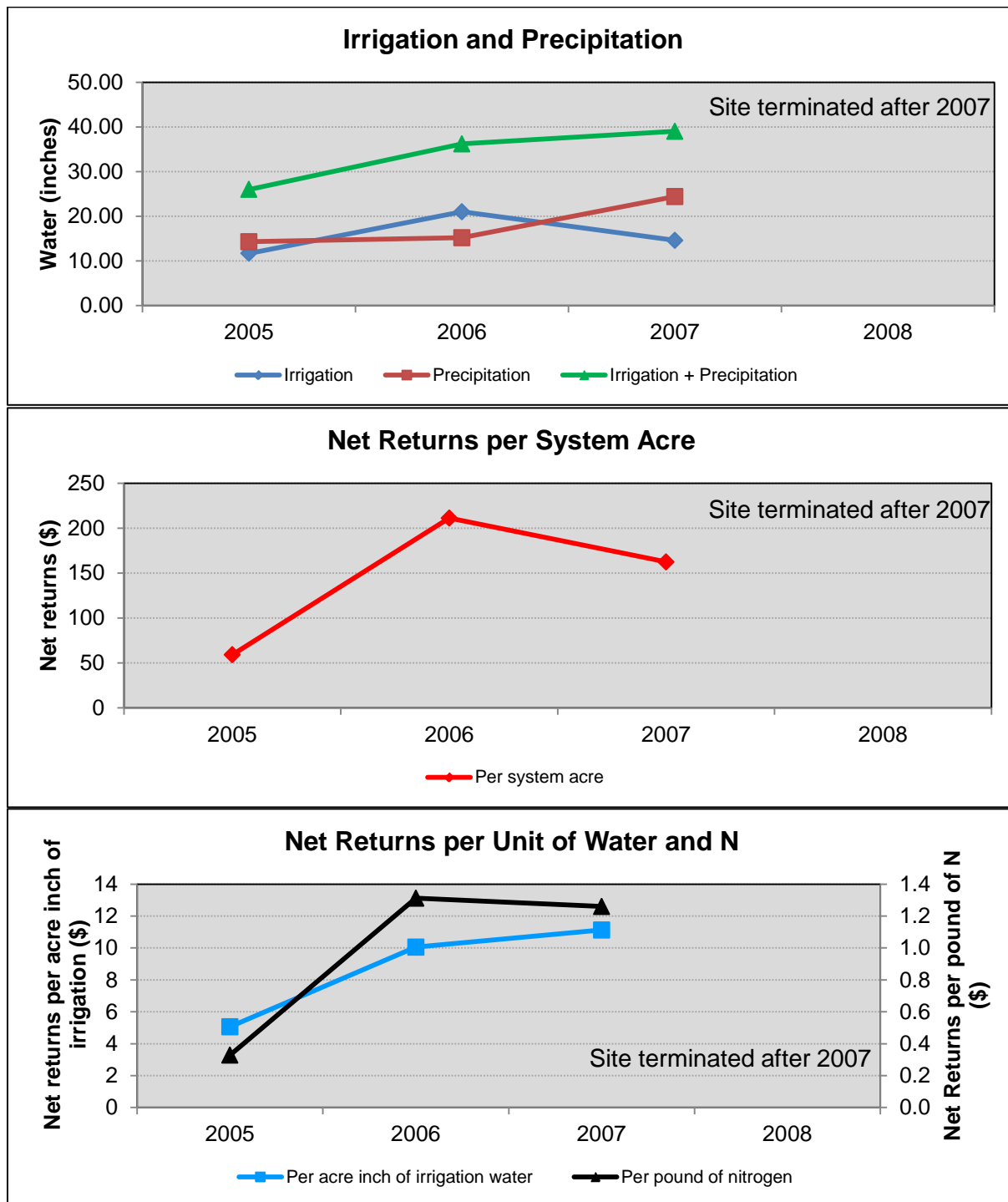
Comments: Drip irrigation cotton and corn system, conventional tillage with crops planted on 40-inch centers.

Site 1

	Livestock	Field 1	Field 2	Field 3	Field 4
2005	None	Cotton	Cotton		
2006	None	Cotton	Cotton		
2007	None	Cotton	Cotton	Cotton	Cotton
2008	Site terminated in 2008				



Site 1





Site 2 Description

Total site acres: 60

Field No. 2 Acres: 36

Major soil type: Pullman clay loam, 0 to 1% slope
Olton clay loam, 1 to 3% slope

Field No. 3 Acres: 24

Major soil type: Pullman clay loam, 0 to 1% slope
Olton clay loam, 1 to 3% slope

Irrigation

Type: Sub-surface Drip
(SDI, installed prior to 2004 crop year)

Pumping capacity,
gal/min: 360

Number of wells: 2

Fuel source: Electric

Site 2

	Livestock	Field 1	Field 2
2005	None	Cotton	
2006	None	Cotton	
2007	None	Cotton	
2008	None	Sunflowers	
2009	None	Cotton	
2010	None	Corn	
	Livestock	Field 2	Field 3
2011	None	Cotton	Fallowed
2012	None	Corn	Cotton

Comments: This drip site was planted to corn and cotton on 30-inch centers in 2012. In prior years the cropping mix for this site was corn, cotton or sunflowers.

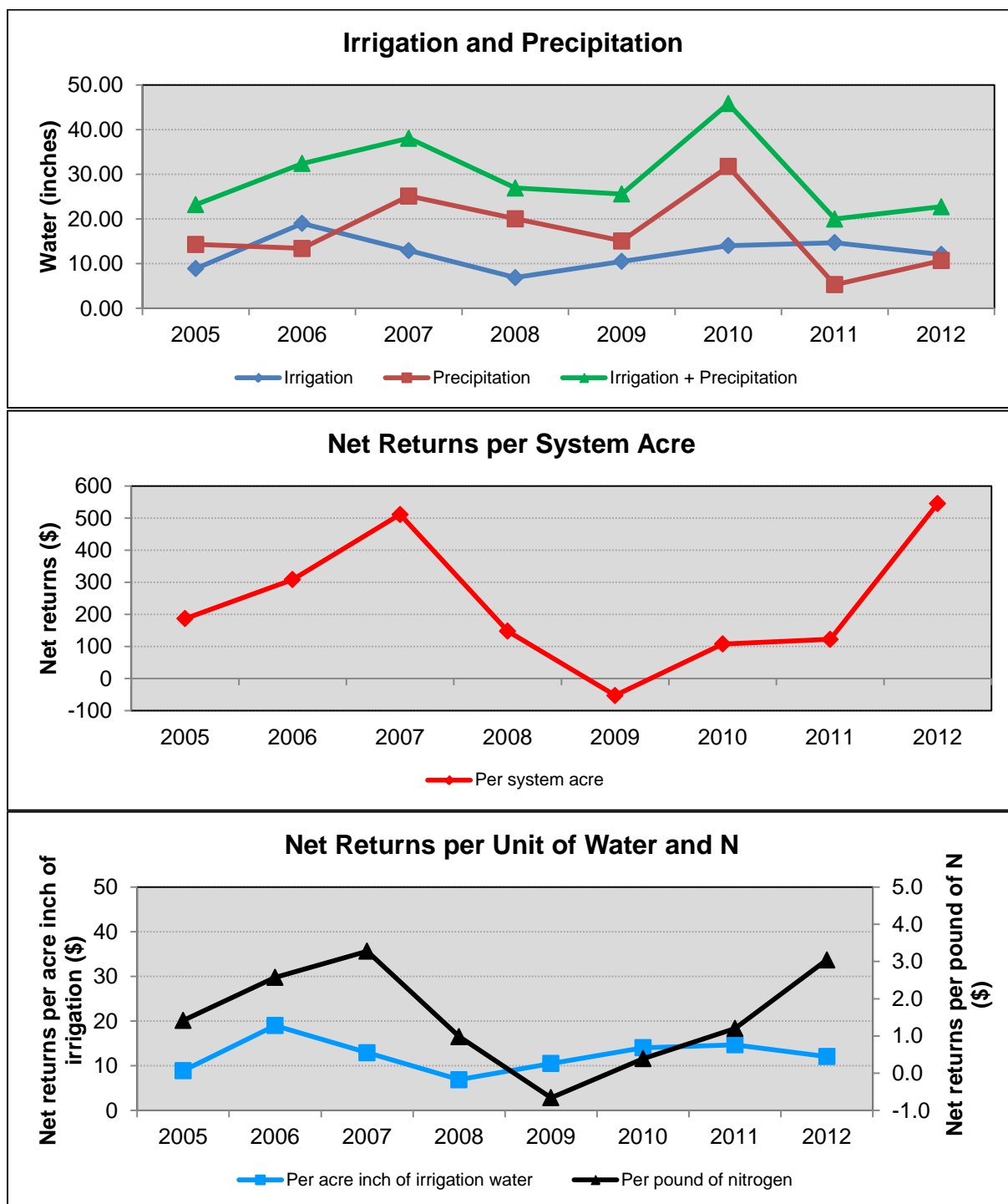


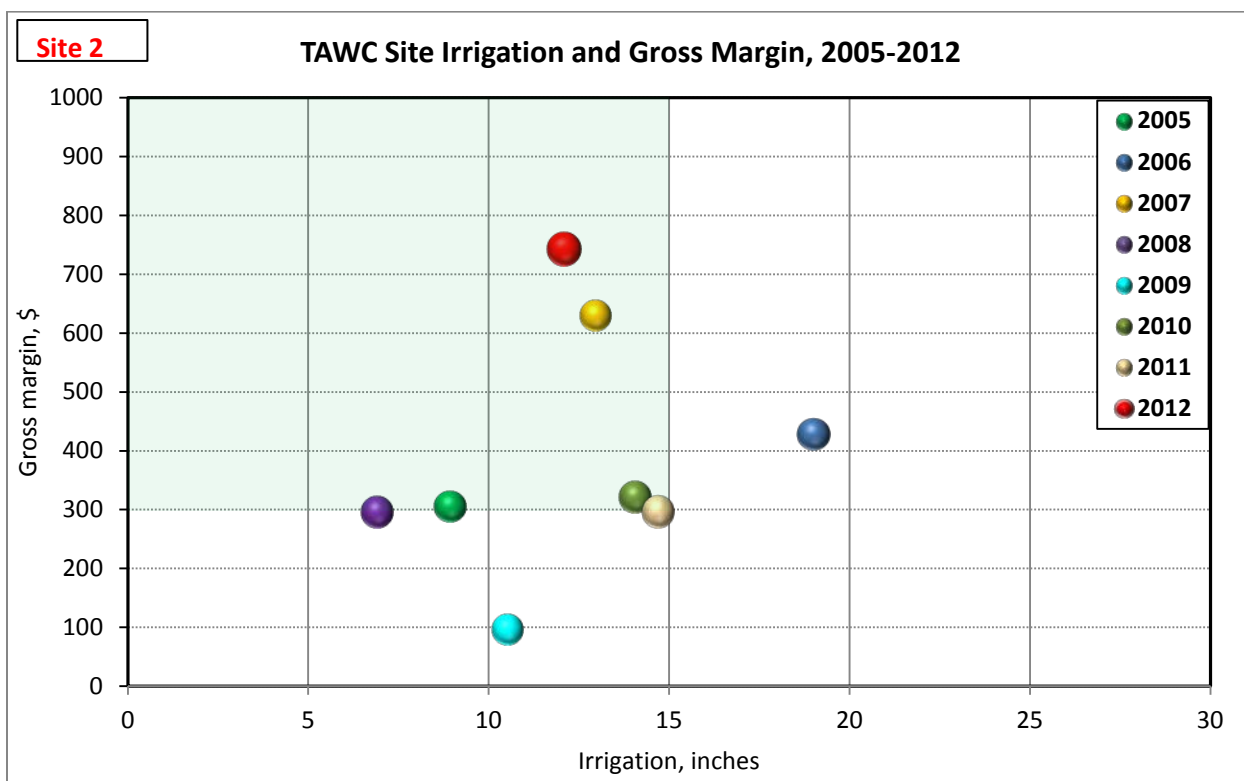
Cotton over Drip Irrigation

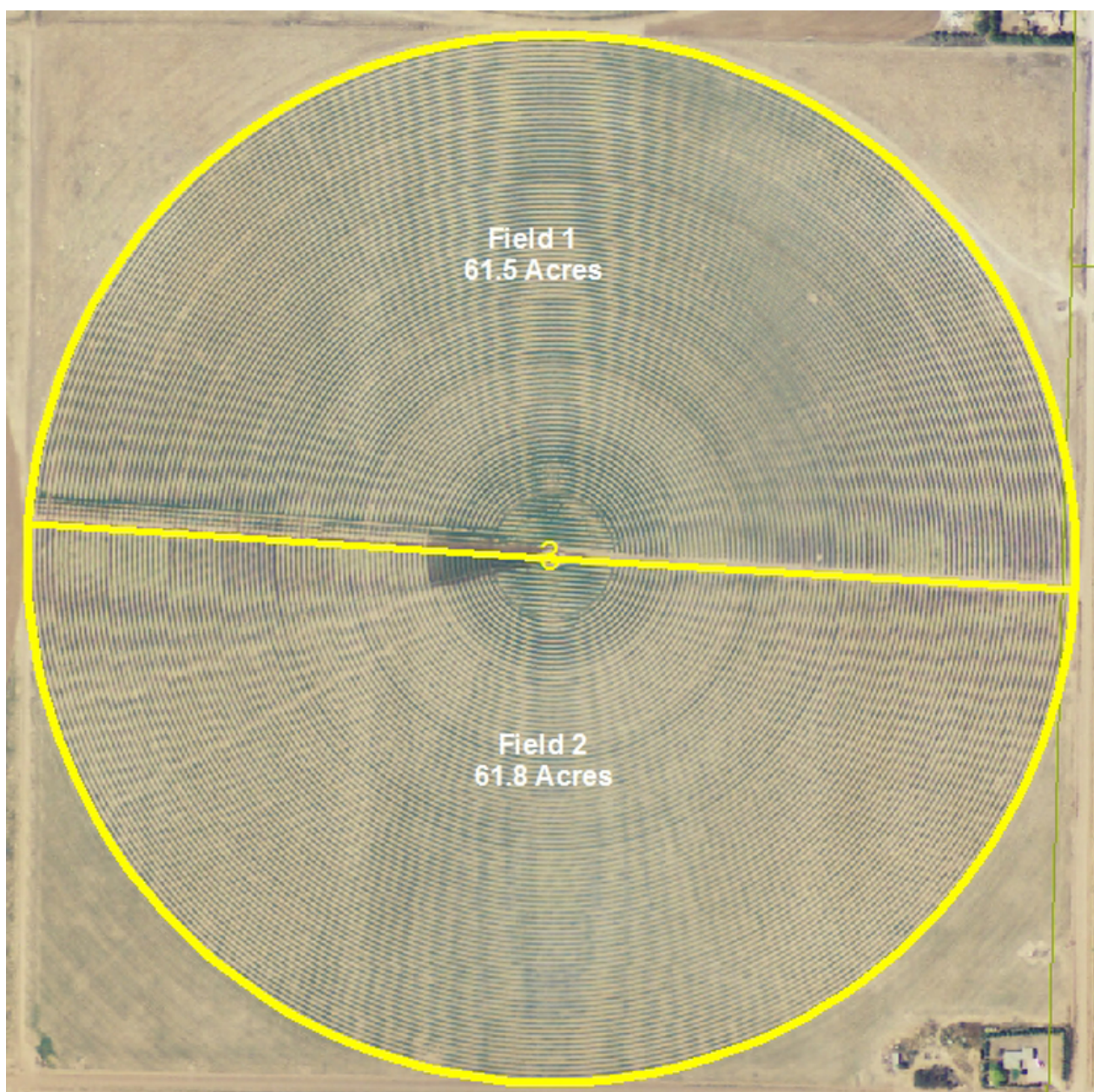


Corn field

Site 2







Site 3 Description

Total site acres: 123.3

Field No. 1 Acres: 61.5
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 61.8
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (MESA)

Pumping capacity,
gal/min: 450

Number of wells: 2

Fuel source: 1 Natural gas
1 Electric

Site 3

	Livestock	Field 1	Field 2
2005	None	Grain Sorghum	Cotton
2006	None	Cotton	Cotton
2007	None	Cotton following Wheat cover crop	Wheat for grain followed by Grain Sorghum
2008	None	Wheat for grain followed by Grain Sorghum	Cotton
2009	None	Wheat/Grain Sorghum	Cotton
2010	None	Cotton	Wheat/Grain Sorghum
2011	None	Cotton	Cotton
2012	None	Cotton	Cotton

Comments: This is a pivot irrigated system using conventional tillage, and row crops are planted on 40-inch centers. Crops have included cotton, wheat and grain sorghum. In 2012 this site was planted to cotton in a skip-row pattern.

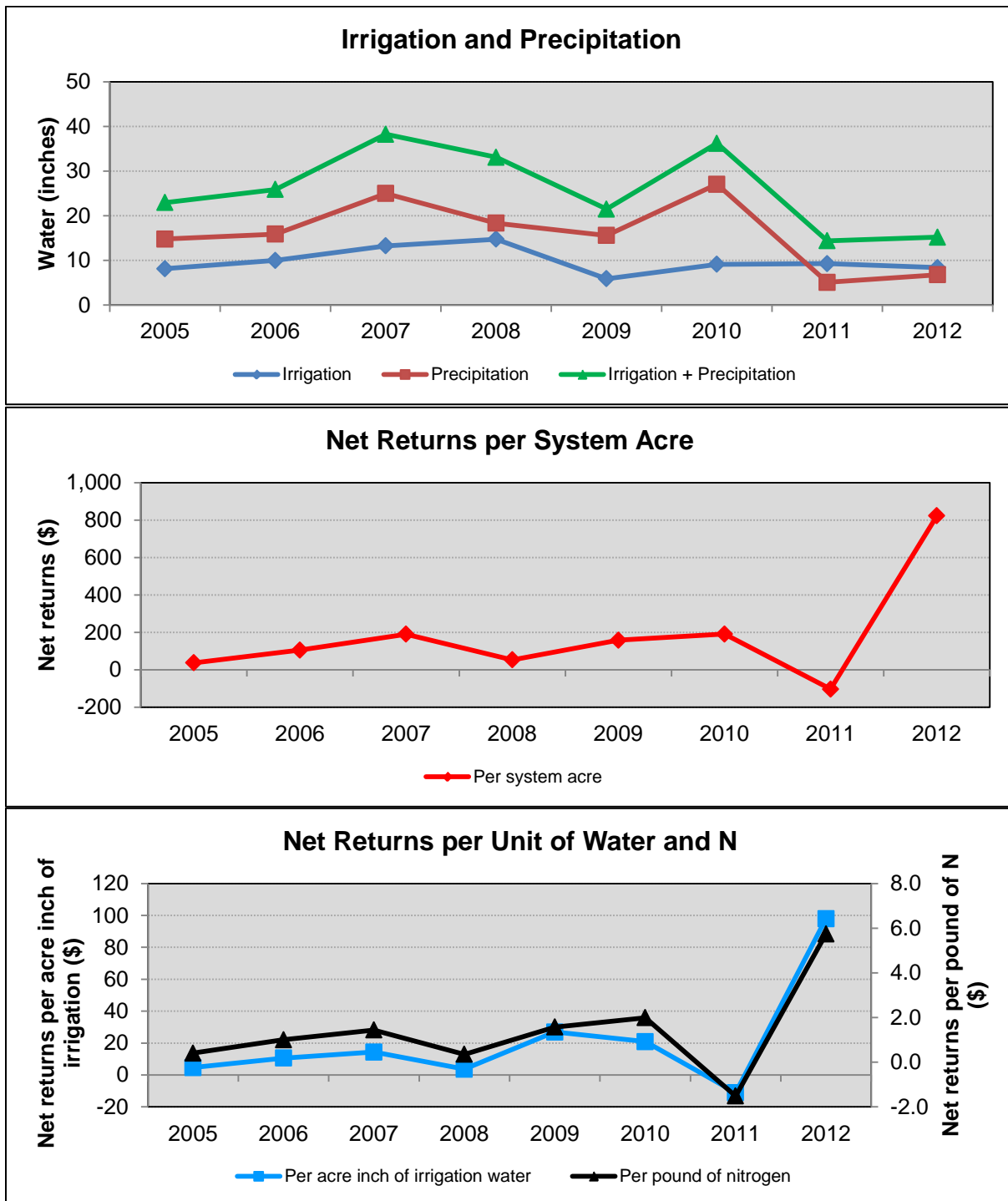


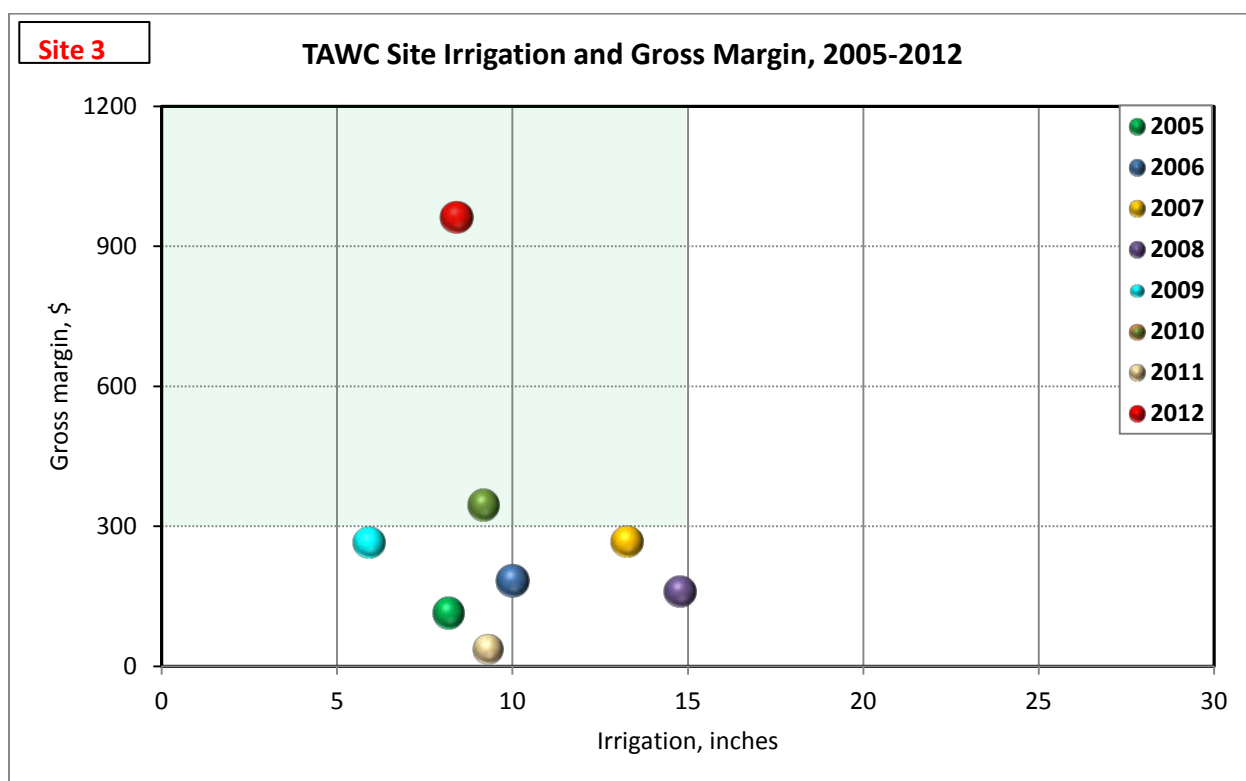
June skip-row cotton

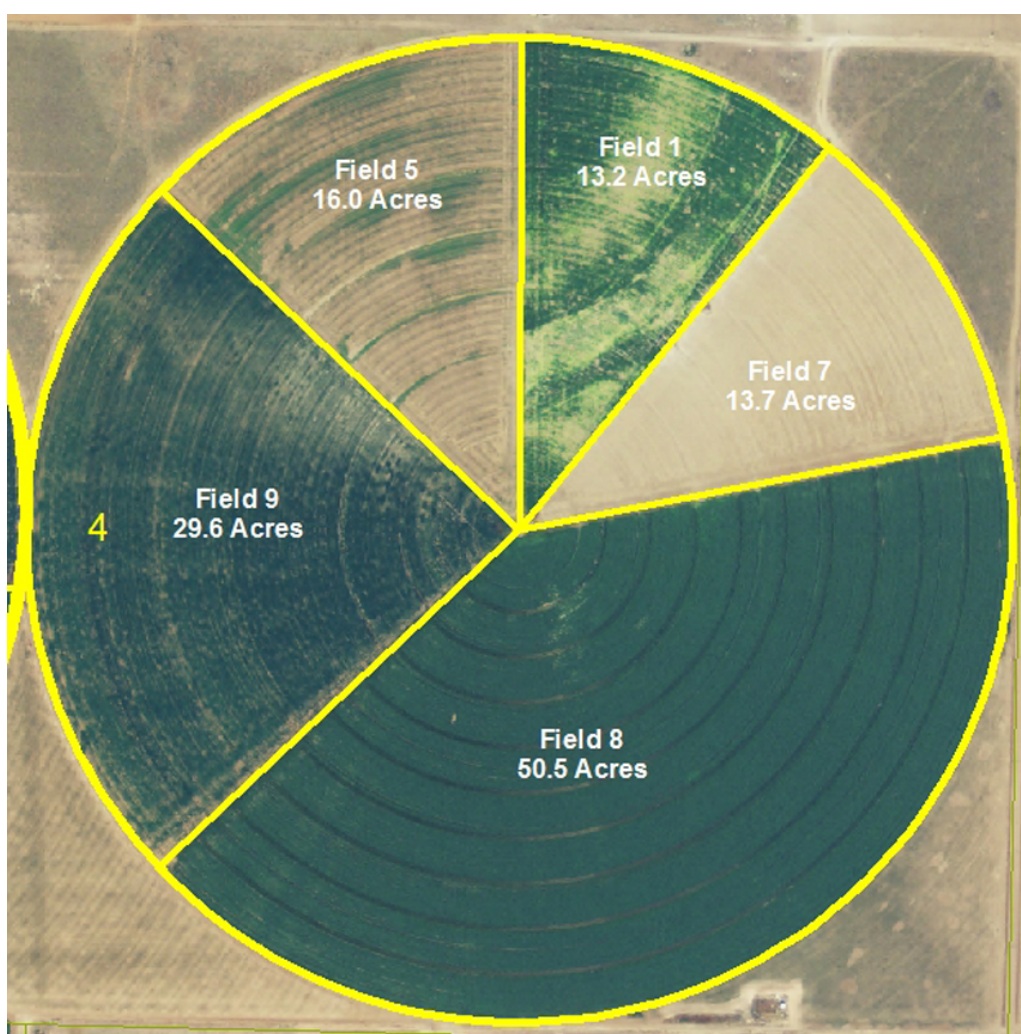


August cotton

Site 3







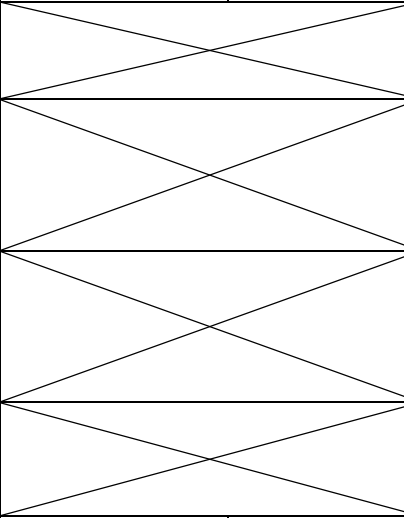
Site 4 Description

Total site acres:	123.0
Field No. 1 Acres:	13.2
Major soil type:	Estacado clay loam, 1 to 3% slope
Field No. 5 Acres:	16.0
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 7 Acres:	14.7
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 8 Acres:	50.5
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 8 Acres:	29.6
Major soil type:	Pullman clay loam, 0 to 1% slope

Irrigation

Type:	Center Pivot (LESA)
Pumping capacity, gal/min:	500
Number of wells:	3
Fuel source:	1 Natural gas 2 Electric

Site 4

	Livestock	Field 1	Field 2	Field 3	Field 4	Field 5
2005	None	Alfalfa for hay	Cotton following Wheat cover crop	Cotton following Wheat cover crop		
2006	None	Alfalfa for hay	Wheat for silage, followed by Forage Sorghum for silage and hay	Cotton		
2007	Cow-calf	Alfalfa for hay	Wheat for grazing (winter-spring) and cover crop, followed by Cotton	Wheat for grain, followed by Wheat for grazing (fall-winter)		
2008	Cow-calf	Alfalfa for hay	Grain Sorghum	Wheat for grain, followed by Wheat for grazing (fall-winter) and partly planted to Alfalfa		
2009	None	Cotton	Wheat/hay	Split into Fields 4 and 5	Grain Sorghum	Alfalfa
2010	None	Cotton	Cotton		Wheat/Forage Sorghum	Alfalfa
	Livestock	Field 1	Field 5		Field 6	Field 7
2011	None	Hay Grazer	Alfalfa		Cotton	Wheat
	Livestock	Field 1	Field 5	Field 7	Field 8	Field 9
2012	None	Wheat/haygrazer	Alfalfa	Wheat	Sorghum	Cotton

Comments: This pivot irrigated system uses strip tillage. Crops planted for 2012 include alfalfa, cotton, wheat, sorghum and forage sorghum. Forage sorghum and alfalfa were harvested for hay to be used in this producer's cow-calf program.

Site 4



September Cotton



August Alfalfa



Swathed Alfalfa



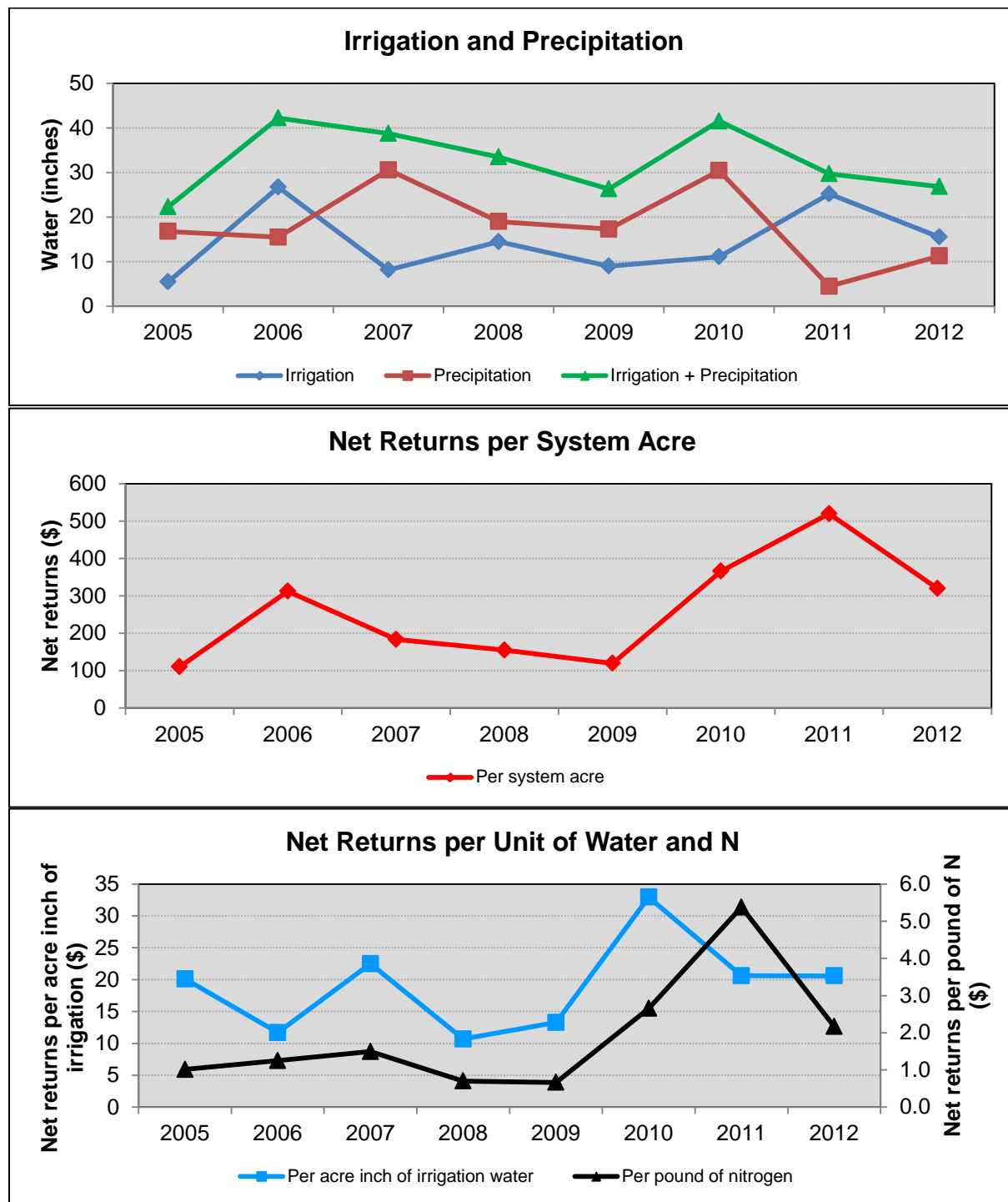
June Sorghum



August Sorghum

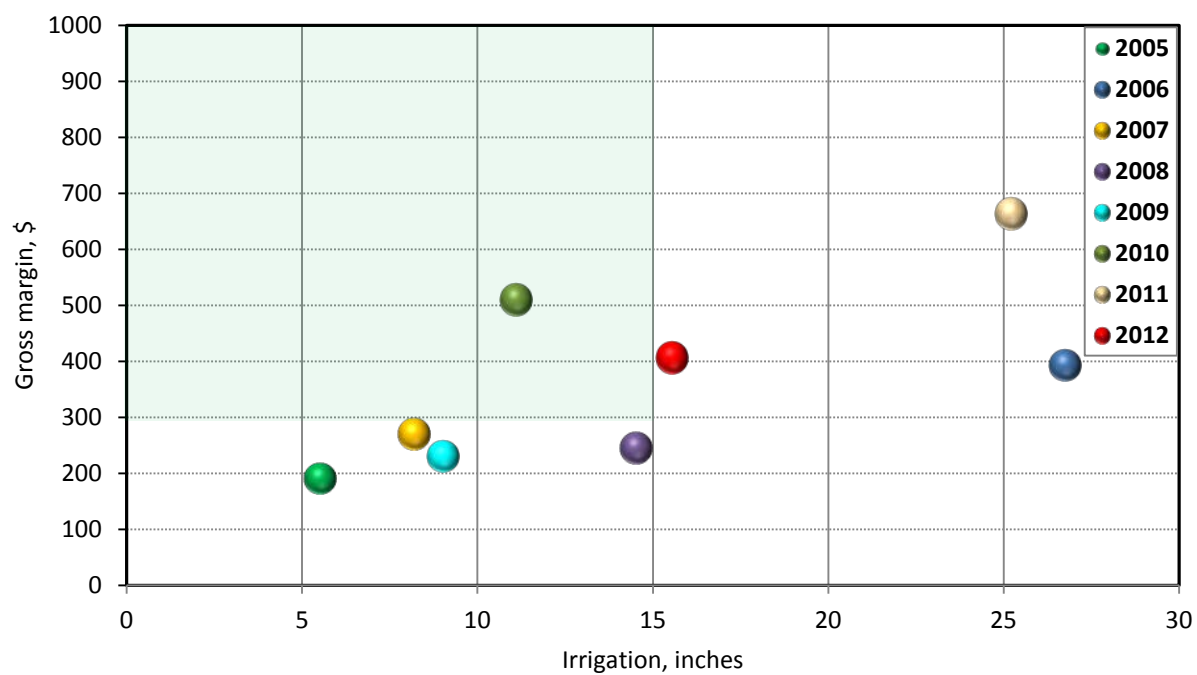


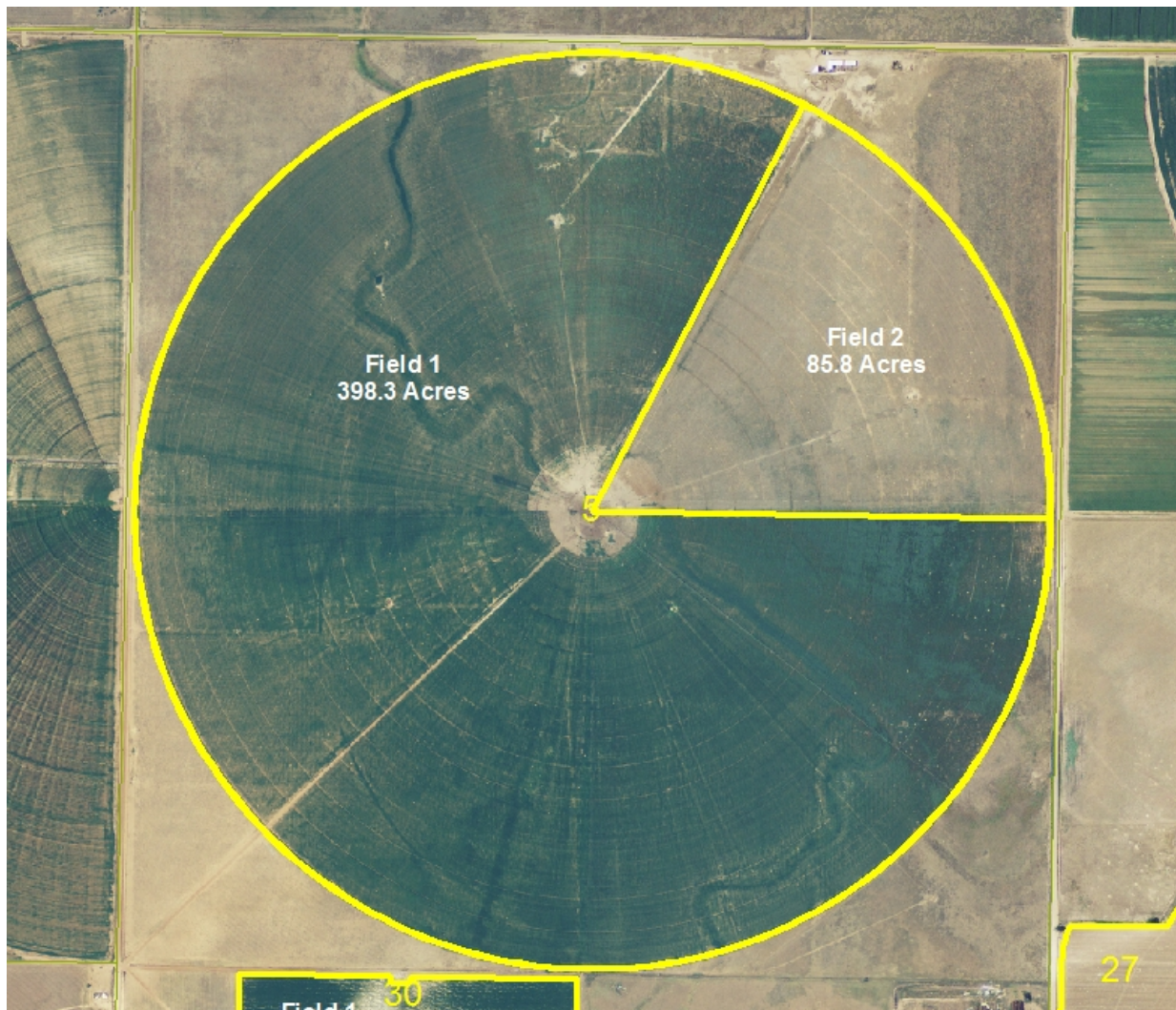
September Sorghum



Site 4

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 5 Description

Total site acres: 484.1

IRRIGATED

Field No. 1 Acres: 398.3
 Major soil type: Bippus loam, 0 to 1% slope
 Mansker loam, 0 to 3 and 3 to 5% slope
 Olton loam, 0 to 1% slope

Field No. 2 Acres: 85.8
 Major soil type: Olton loam, 0 to 1% slope
 Bippus loam, 0 to 1% slope
 Mansker loam, 0 to 3% slope

Irrigation

Type: Center Pivot (MESA)

Pumping capacity,
 gal/min: 1100

Number of wells: 4

Fuel source: Electric

Site 5 *Crops - Irrigated*

	Livestock	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6
2005	Cow-calf	Klein/Plains/Dahl/Blue grama/Buffalograss mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Plains/Klein/Blue grama mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Plains/Klein/Blue grama mixture for grazing	Alfalfa/Plains/Blue grama/Klein mixture for grazing
2006	Cow-calf	Klein/Plains/Dahl/Blue grama/Buffalograss mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Renovated, Plains/Klein/Blue grama/Dahl mixture for grazing and hay	Plains/Blue grama/Klein mixture for grazing	Plains/Klein/Blue grama mixture for grazing	Alfalfa/Plains/blue grama/Klein mixture for grazing
2007	Cow-calf	Klein/Plains/Dahl/Blue grama/Buffalograss mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Plains/Klein/Blue grama/Dahl mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Renovated, Plains/Klein/Dahl mixture for grazing and hay	Dahl/Green sprangletop/Plains mixture for grazing and hay
2008	Cow-calf	Klein/Plains/Dahl/Blue grama/Buffalograss mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Plains/Klein/Blue grama/Dahl mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Renovated, Plains/Klein/Dahl mixture for grazing and hay	Dahl/Green sprangletop/Plains mixture for grazing and hay
2009	Cow-calf	Klein/Plains/Dahl/Blue grama/Buffalograss mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Plains/Klein/Blue grama/Dahl mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Renovated, Plains/Klein/Dahl mixture for grazing and hay	Dahl/Green sprangletop/Plains mixture for grazing and hay
2010	Cow-calf	Klein/Plains/Dahl/Blue grama/Buffalograss mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Plains/Klein/Blue grama/Dahl mixture for grazing	Plains/Blue grama/Klein mixture for grazing	Renovated, Plains/Klein/Dahl mixture for grazing and hay	Dahl/Green sprangletop/Plains mixture for grazing and hay
	Livestock	Field 12	Field 13				
2011	None	Fallowed	Cotton/abandoned				
	Livestock	Field 1	Field 2				
2012	None	Cotton	Cotton				

Site 5***Crops - Dryland***

	Field 7	Field 8	Field 9	Field 10	Field 11	Fields 12 and 13
2005	Plains/Blue grama mixture for grazing	Plains/Blue grama/Sand dropseed/Buffalograss mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Pens and barns
2006	Plains/Blue grama mixture for grazing	Plains/Blue grama/Sand dropseed/Buffalograss mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Pens and barns
2007	Plains/Blue grama mixture for grazing	Plains/Blue grama/Sand dropseed/Buffalograss mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Pens and barns
2008	Plains/Blue grama mixture for grazing	Plains/Blue grama/Sand dropseed/Buffalograss mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Pens and barns
2009	Plains/Blue grama mixture for grazing	Plains/Blue grama/Sand dropseed/Buffalograss mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Pens and barns
2010	Plains/Blue grama mixture for grazing	Plains/Blue grama/Sand dropseed/Buffalograss mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Plains/Blue grama mixture for grazing	Pens and barns
	Livestock	Field 7,8,9,10,11				
2011	None	Corners/grass Plains/Blue grama Mixture for grazing (Not part of system-dropped in 2011)				

Comments: In 2012 this pivot irrigated site was planted to cotton and wheat. The cotton was planted on 30-inch centers and a cotton picker is used for harvest.

Site 5



June cotton

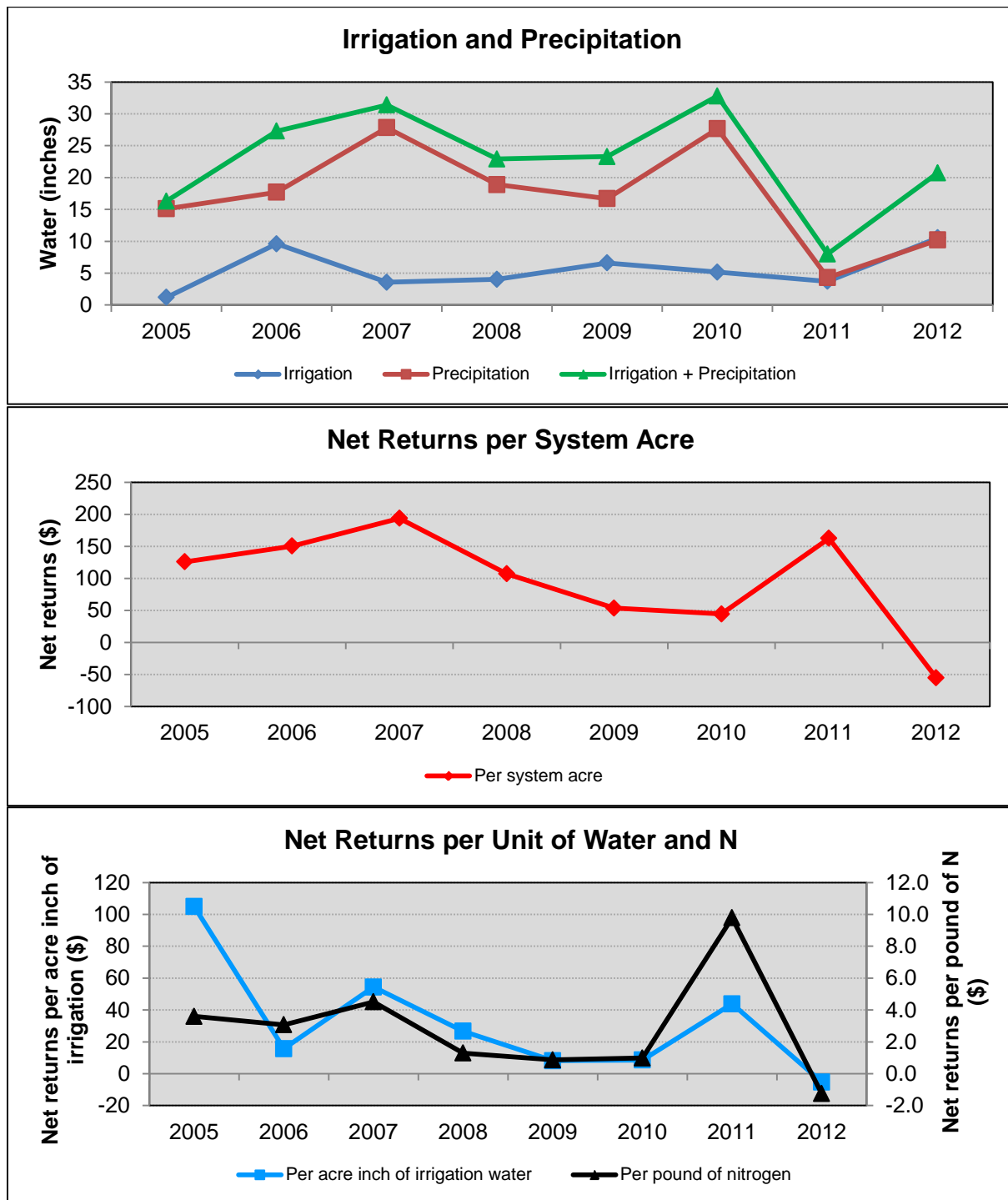


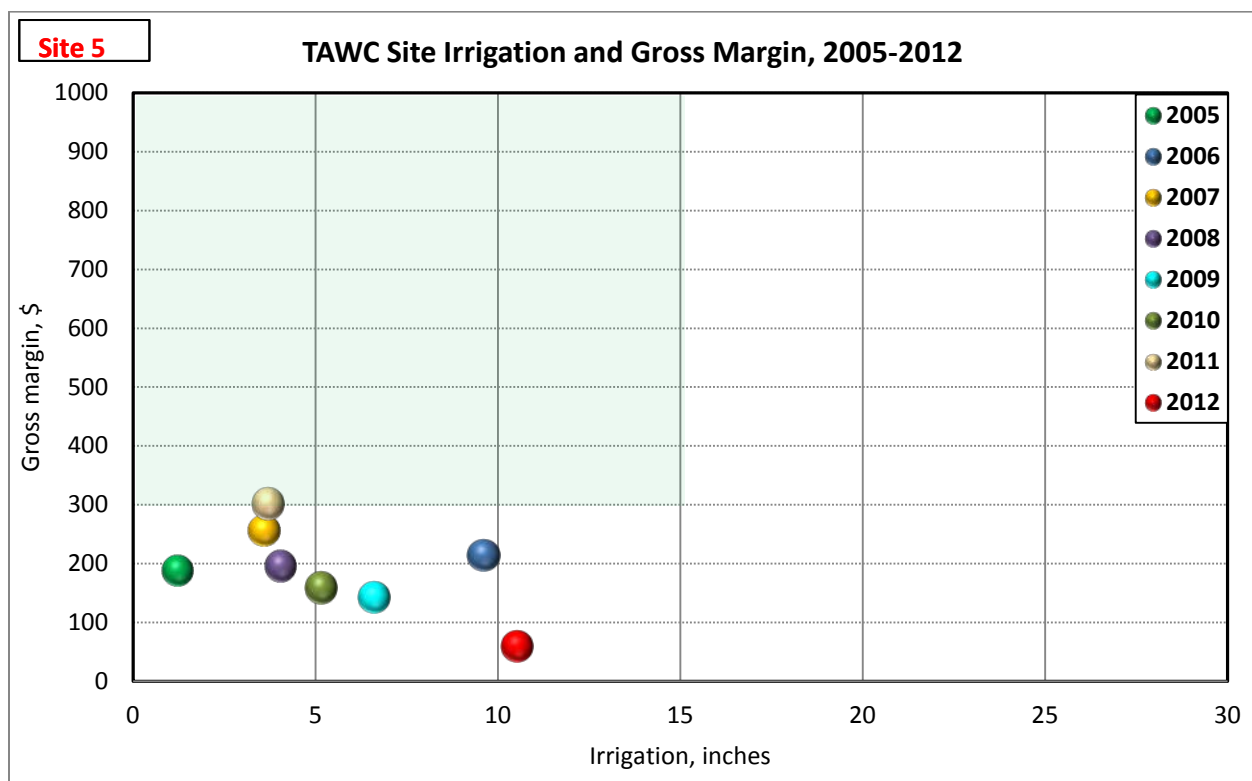
August cotton

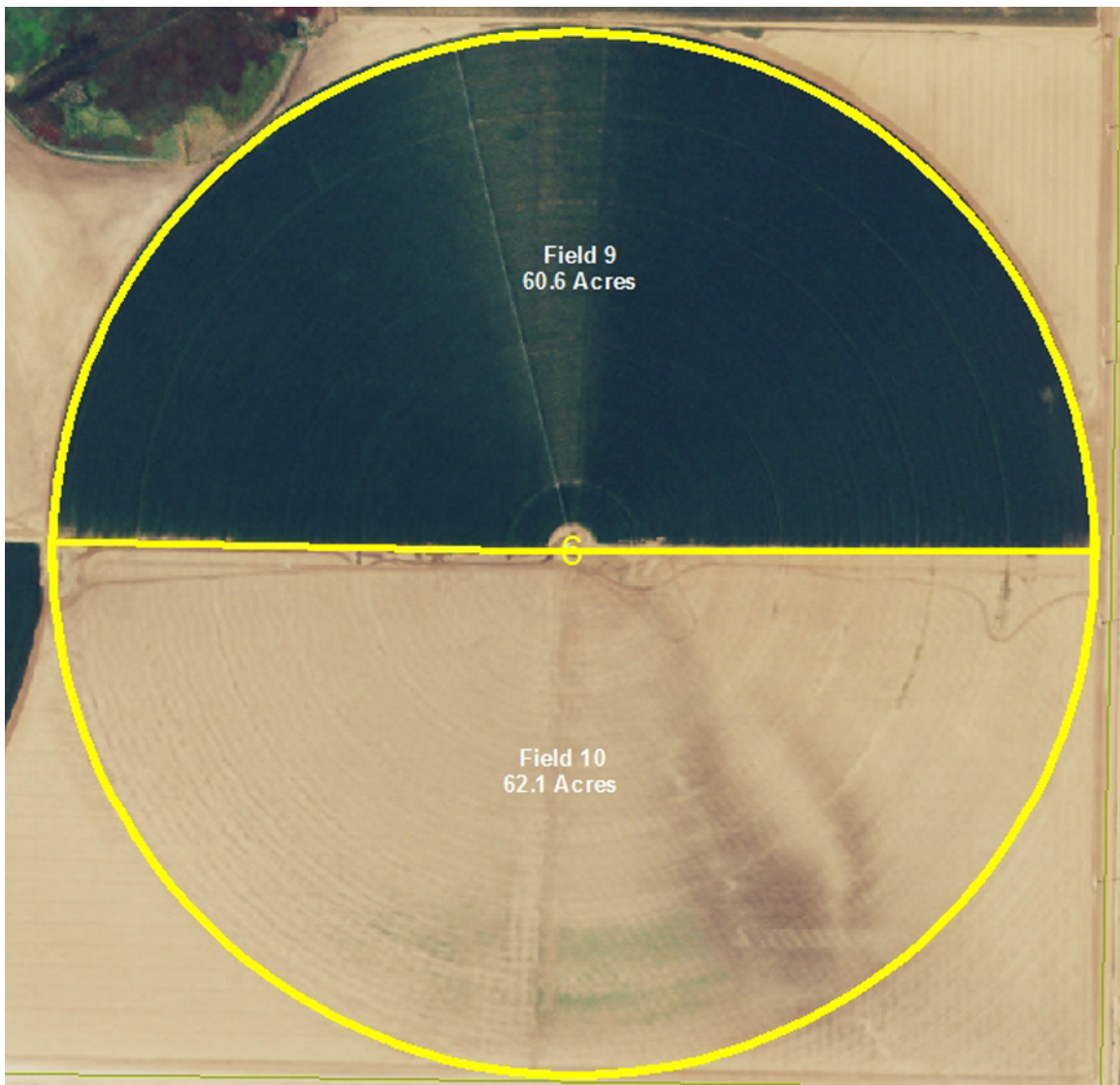


Late January- cotton stalks

Site 5







Site 6 Description

Total site acres:	122.7
Field No. 5 Acres:	32.1
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 6 Acres:	29.8
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 7 Acres:	31.2
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 8 Acres:	29.7
Major soil type:	Pullman clay loam, 0 to 1% slope

Irrigation

Type:	Center Pivot (LESA)
Pumping capacity, gal/min:	500
Number of wells:	4
Fuel source:	Natural gas

Site 6

	Livestock	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8
2005	Stocker steers	Wheat for grazing and cover followed by Cotton							
2006	None	Cotton							
2007	None	Cotton							
2008	None	Split into Fields 2 and 3	Cotton	Corn for grain					
2009	None		Split into Fields 4 and 5		Cotton	Corn			
2010	None					Corn	Corn	Cotton	Cotton
2011	None					Cotton	Cotton	Cotton	Corn/Abandoned
	Livestock	Field 9	Field 10						
2012	None	Corn	Fallow						

Comments: In 2012 this site was planted to cotton on 40-inch centers and wheat. The cotton was lost to a June 4th hail storm and replanted to corn.

Site 6



January wheat



July corn

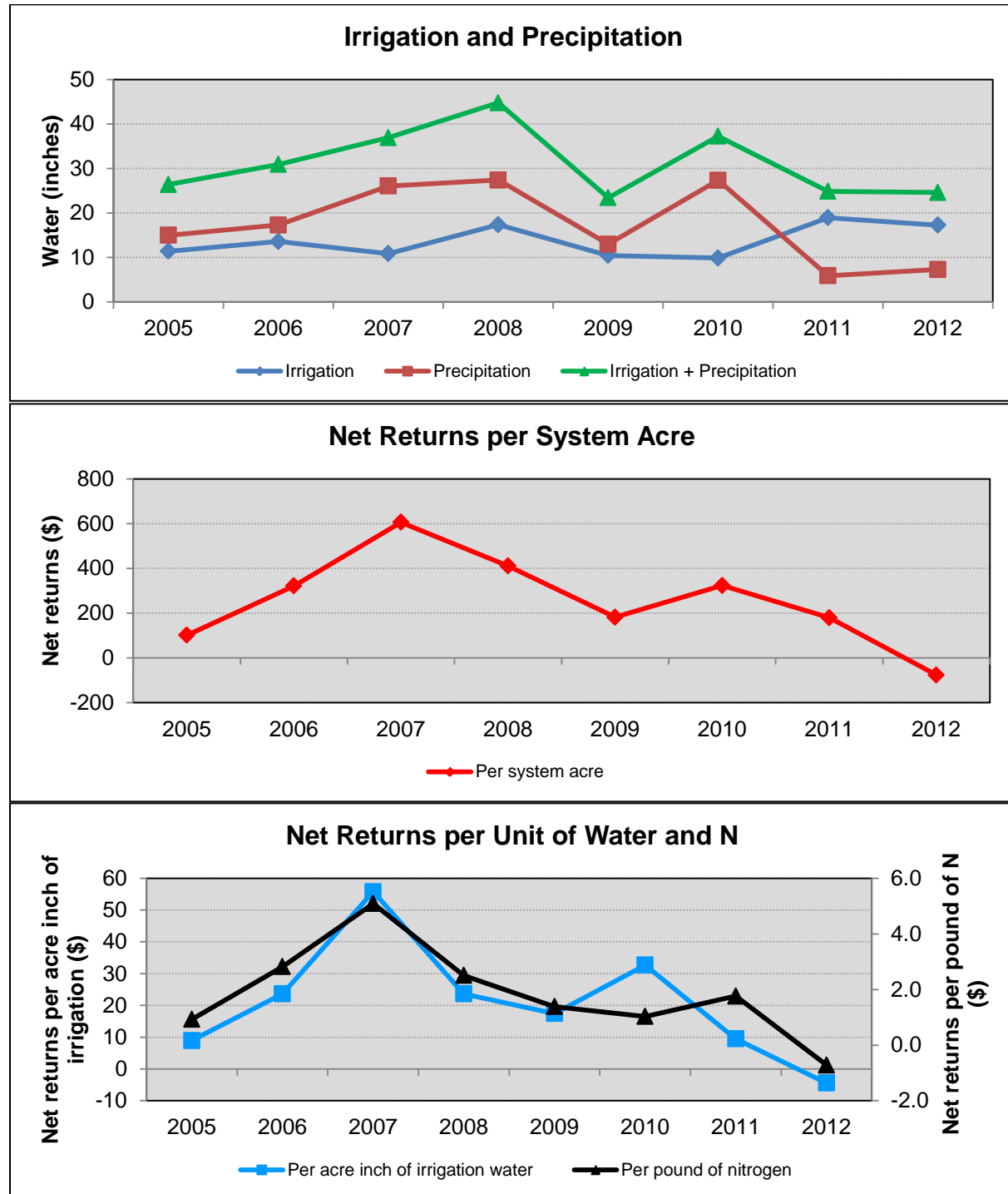


September corn



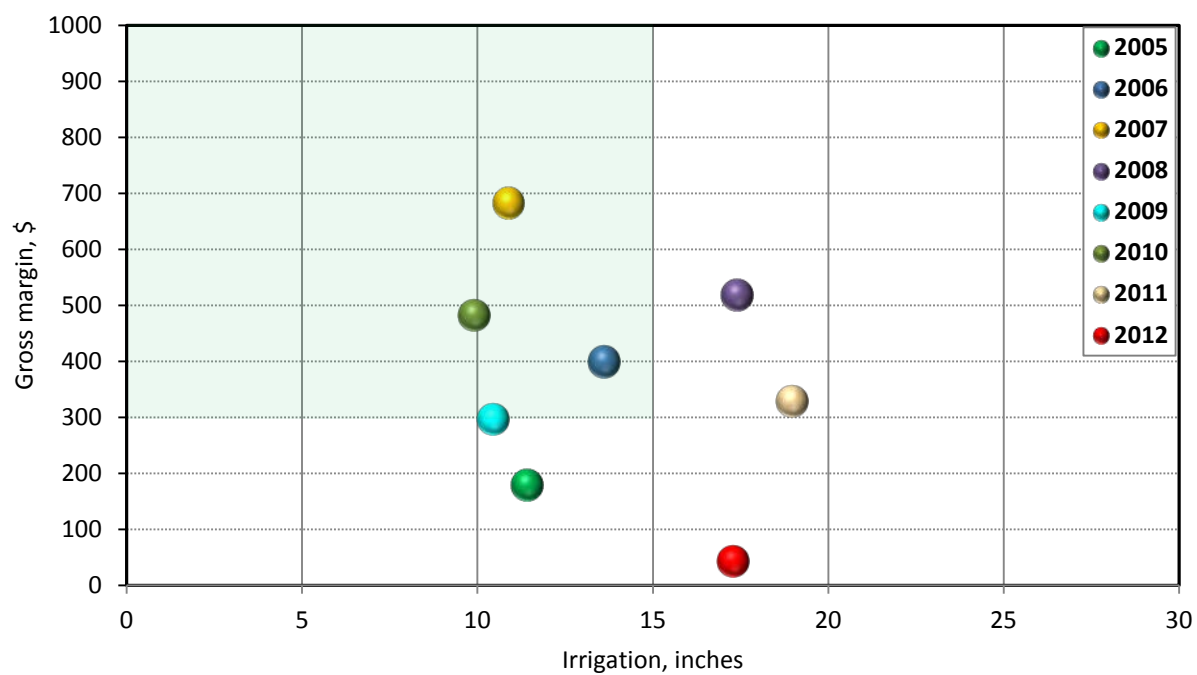
September ground preparation for
wheat

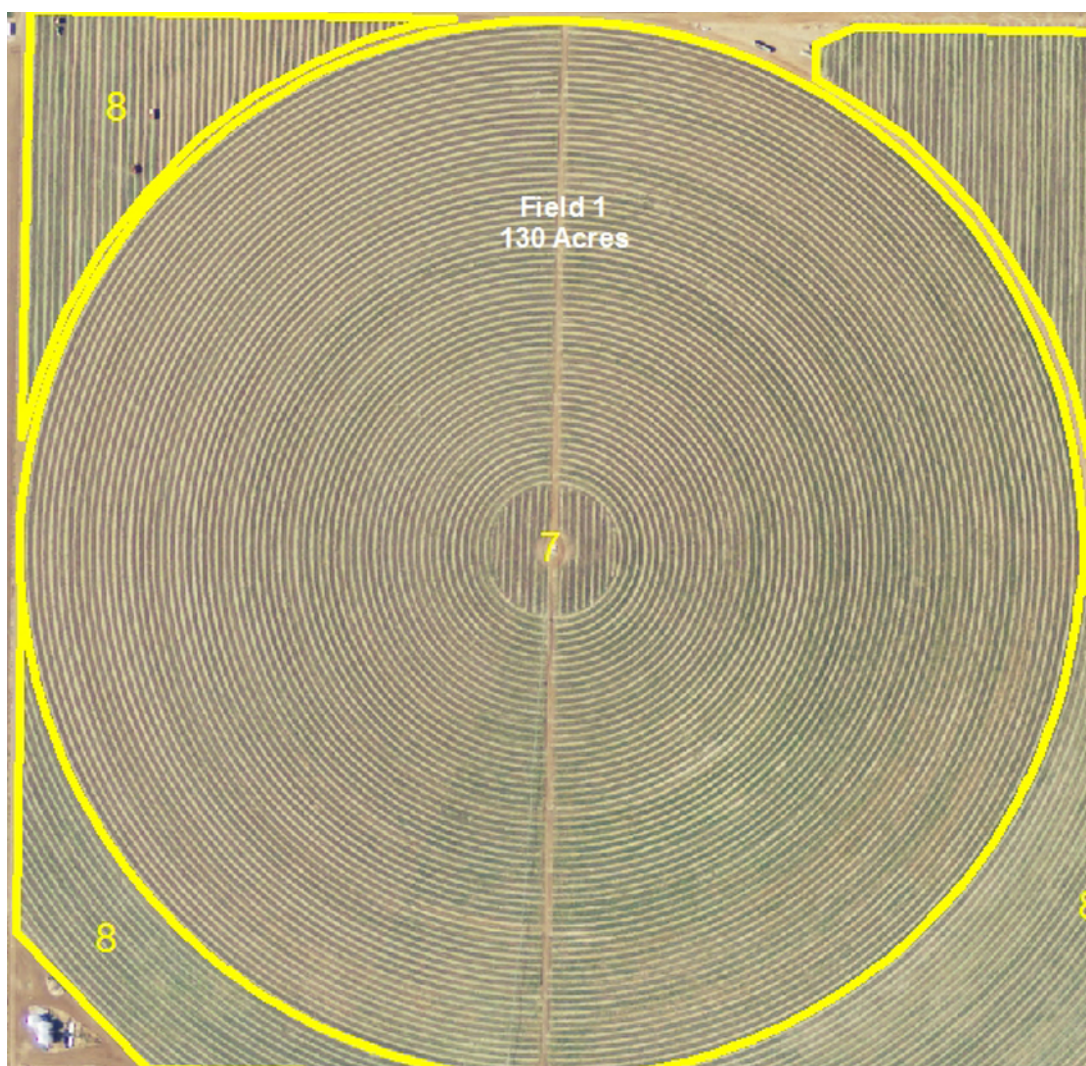
Site 6



Site 6

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 7 Description

Total site acres: 130.0
 Field No. 1 Acres: 130.0
 Major soil type: Pullman clay loam, 0 to 1% slope

Irrigation

Type: Center Pivot (LESA)
 Pumping capacity,
 gal/min: 500
 Number of wells: 4
 Fuel source: Electric

Site 7

	Livestock	Field 1
2005	None	Sideoats grama for seed and hay
2006	None	Sideoats grama for seed and hay
2007	None	Sideoats grama for seed and hay
2008	None	Sideoats grama for seed and hay
2009	None	Sideoats grama for seed and hay
2010	None	Sideoats grama for seed and hay
2011	None	Sideoats grama for seed and hay
2012	None	Sideoats grama for seed and hay

Comments: This is a pivot irrigated field of sideoats grama grown for seed production and the grass residue is round baled for hay and sold. This field was established to grass 18 years ago.

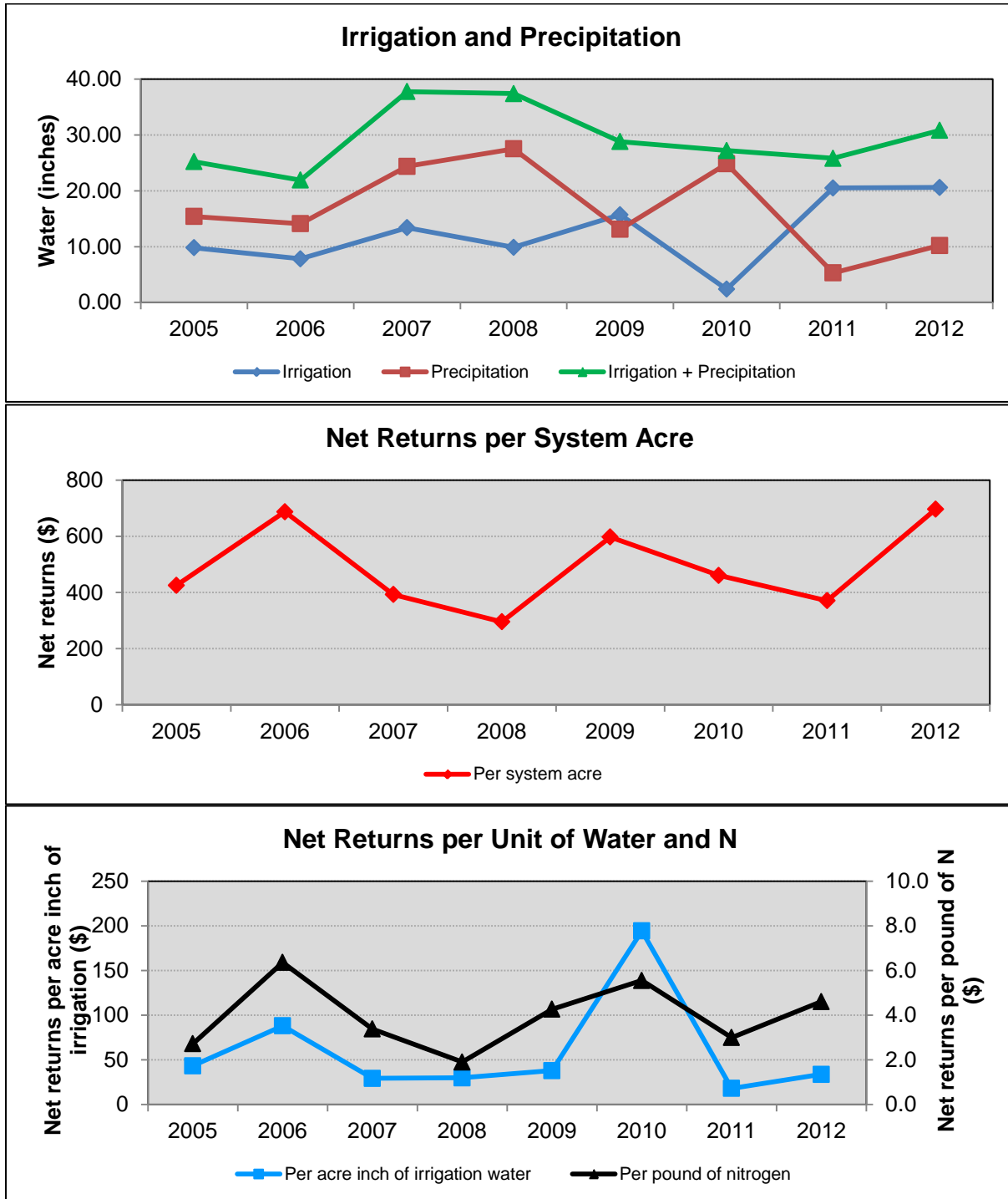


July sideoats grama ready for harvest



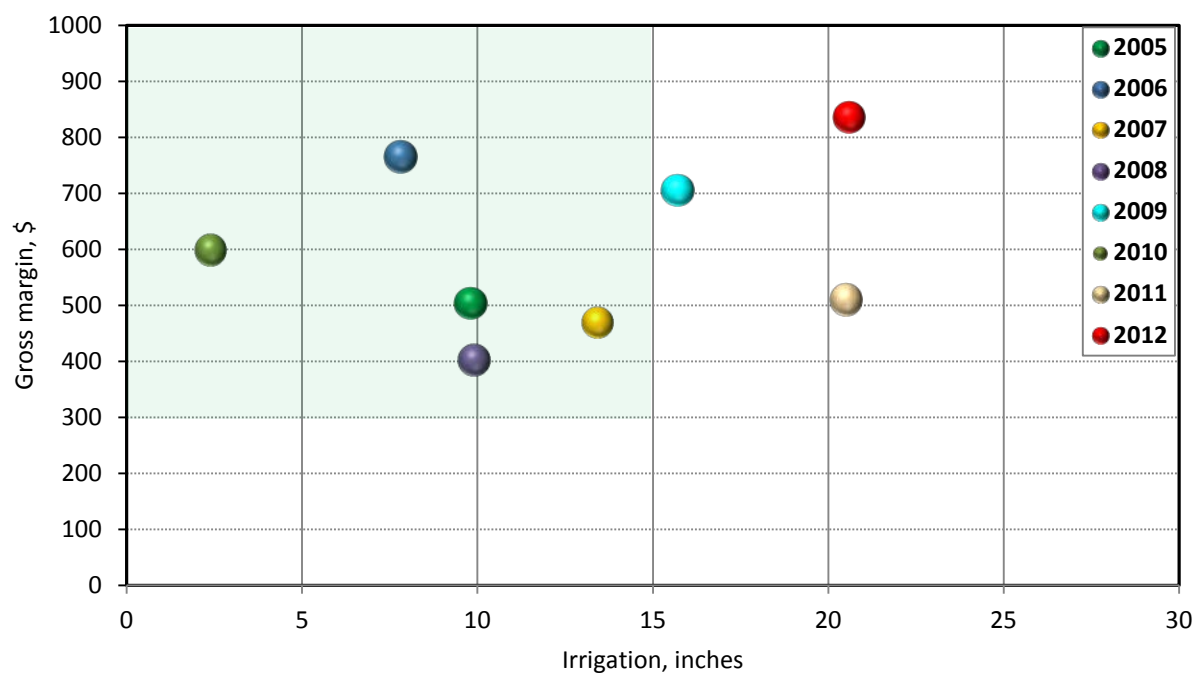
Sideoats round bales from hay harvest

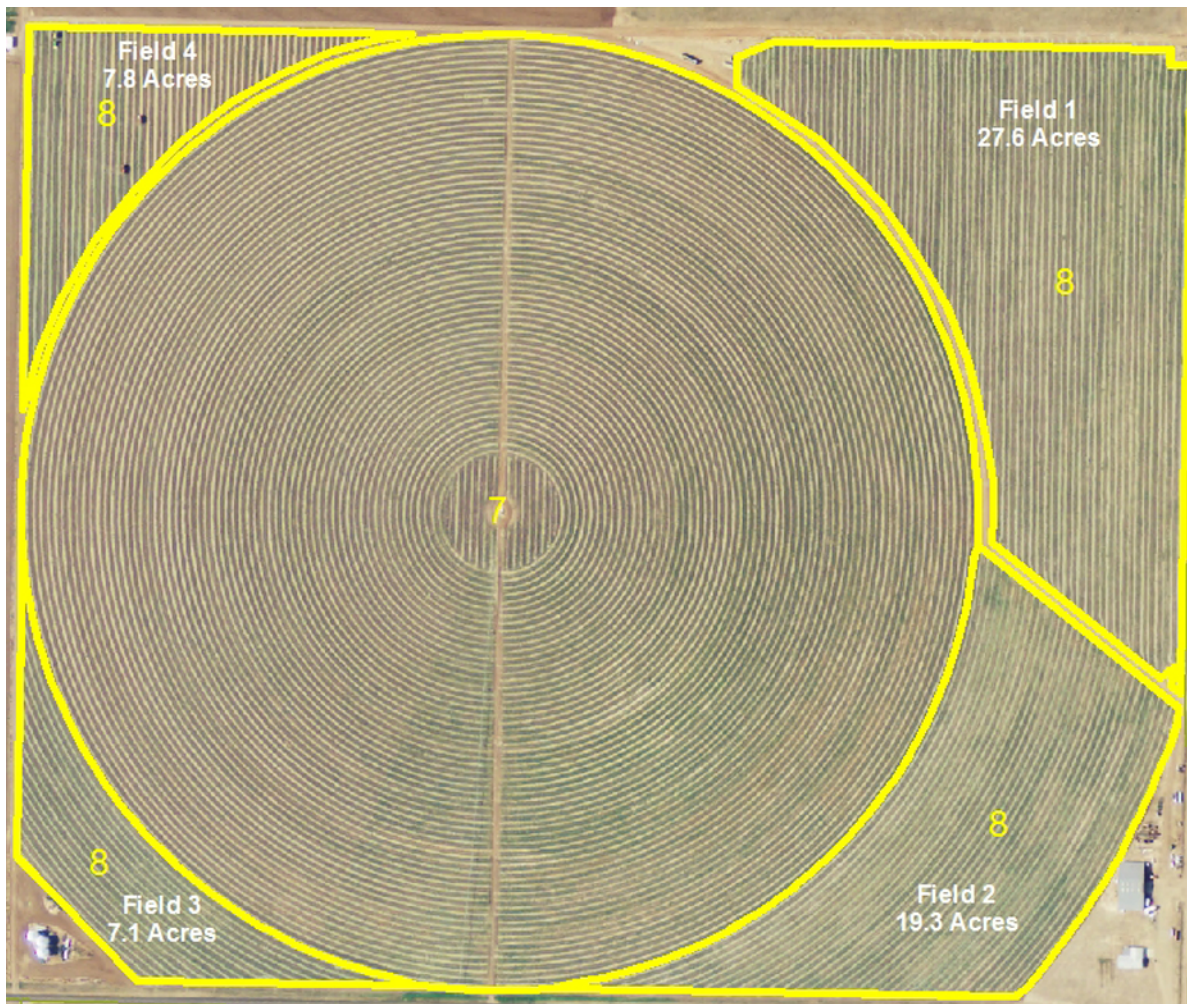
Site 7



Site 7

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 8 Description

Total site acres:	61.8
Field No. 1 Acres:	27.6
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 2 Acres:	19.3
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 3 Acres:	7.1
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 4 Acres:	7.8
Major soil type:	Pullman clay loam, 0 to 1% slope

Irrigation

Type:	Sub-surface Drip (SDI)
Pumping capacity, gal/min:	360
Number of wells:	4
Fuel source:	Electric

Site 8

	Livestock	Field 1	Field 2	Field 3	Field 4
2005	None	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay
2006	None	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay
2007	None	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay
2008	None	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay
2009	None	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay
2010	None	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay
2011	None	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay
2012	None	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay	Sideoats grama for seed and hay

Comments: This is a drip irrigated field of side-oats grama grown for seed production and the grass residue is round baled for hay and sold. These four fields were put into drip irrigation nine years ago. Prior to the installation of drip these fields were furrow irrigated.

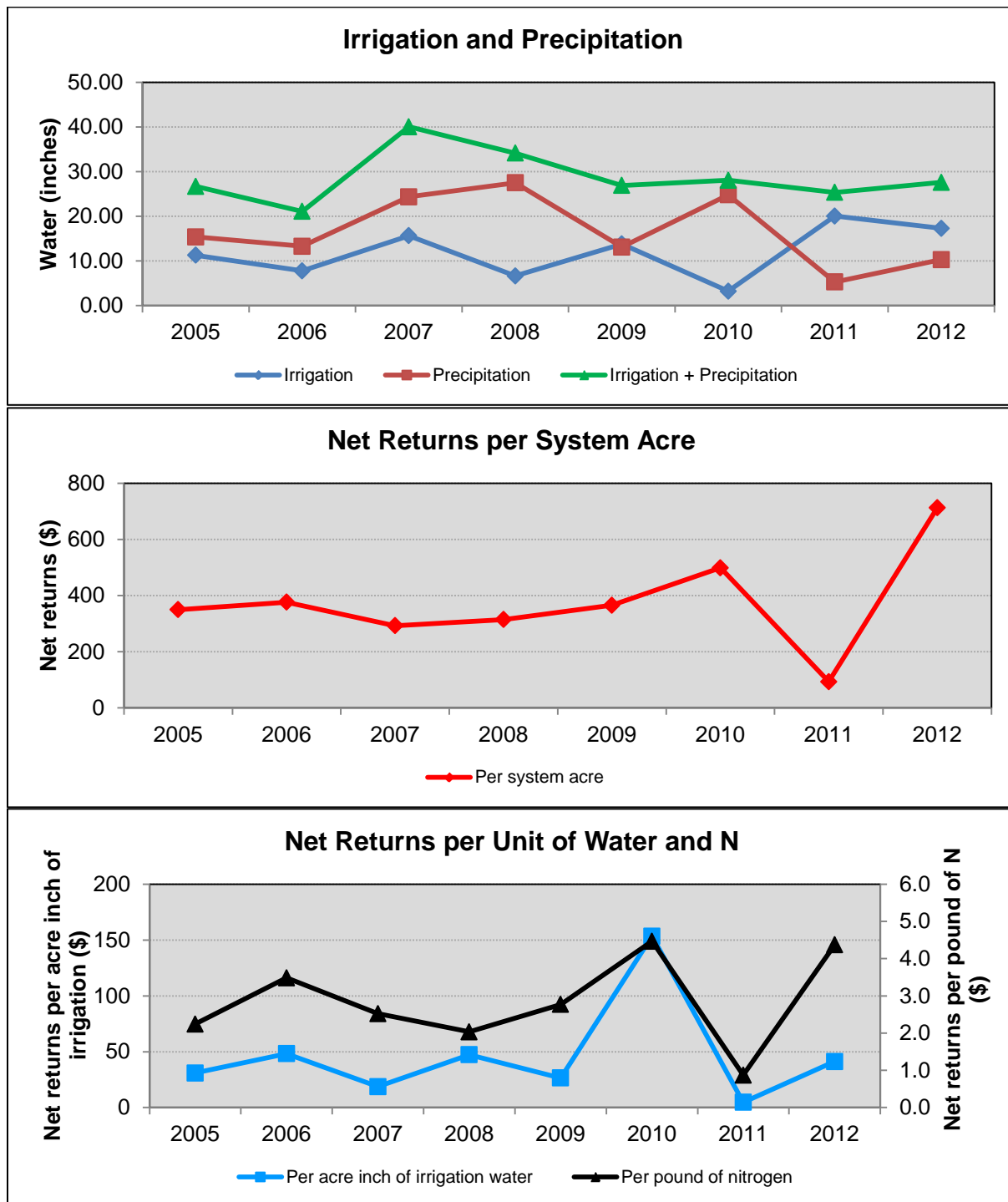


April sideoats over drip tape



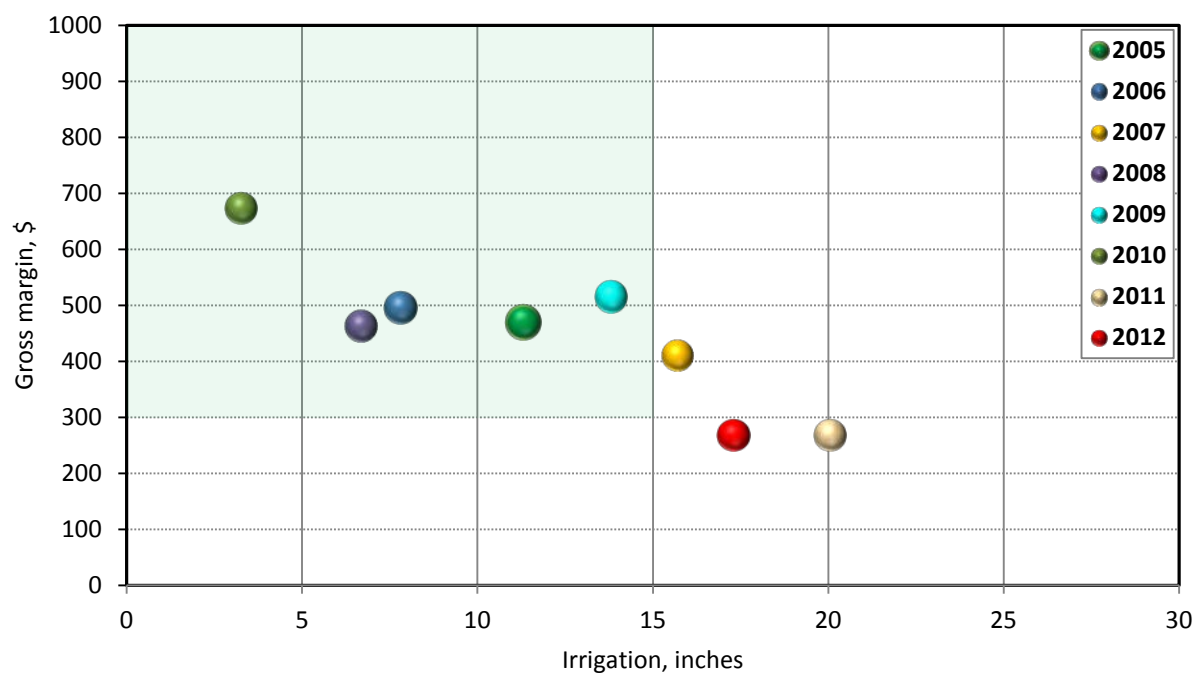
Sideoats swathed and ready for baling

Site 8



Site 8

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 9 Description

Total site acres: 237.8
 Field No. 1 Acres: 100.8
 Major soil type: Mixed shallow soils
 Field No. 2 Acres: 137.0
 Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (MESA)
 Pumping capacity, gal/min: 900
 Number of wells: 4
 Fuel source: 2 Natural gas
 2 Diesel

Site 9

	Livestock	Field 1	Field 2
2005	Stocker steers	Klein/Buffalo/Blue grama/Annual forb mix interseeded with Rye for grazing	Rye for grazing and cover crop followed by Cotton
2006	Stocker steers	Klein/Buffalo/Blue grama/Annual forb mix interseeded with Rye for grazing	Cotton following Rye cover crop
2007	Stocker heifers	Klein/Buffalo/Blue grama/Annual forb mix interseeded with Rye for grazing	Grain Sorghum following Rye cover crop
2008	Cow-calf	Klein/Buffalo/Blue grama/Annual forb mix for grazing	Cotton
2009	None	Klein/Buffalo/Blue grama/Annual forb mix for grazing	Cotton
2010	Cow-calf	Klein/Buffalo/Blue grama/Annual forb mix for grazing and hay	Cotton
2011	Stocker	Klein/Buffalo/Blue grama/Annual forb mix for grazing and hay	Cotton
2012	Stocker	Klein/Buffalo/Blue grama/Annual forb mix for grazing and hay	Cotton

Comments: This site was returned to conventional tillage after 11 years of no-till production. Field 1 is predominantly kleingrass and used for cow-calf production. Field 2 was planted to cotton on 40-inch centers for 2012.

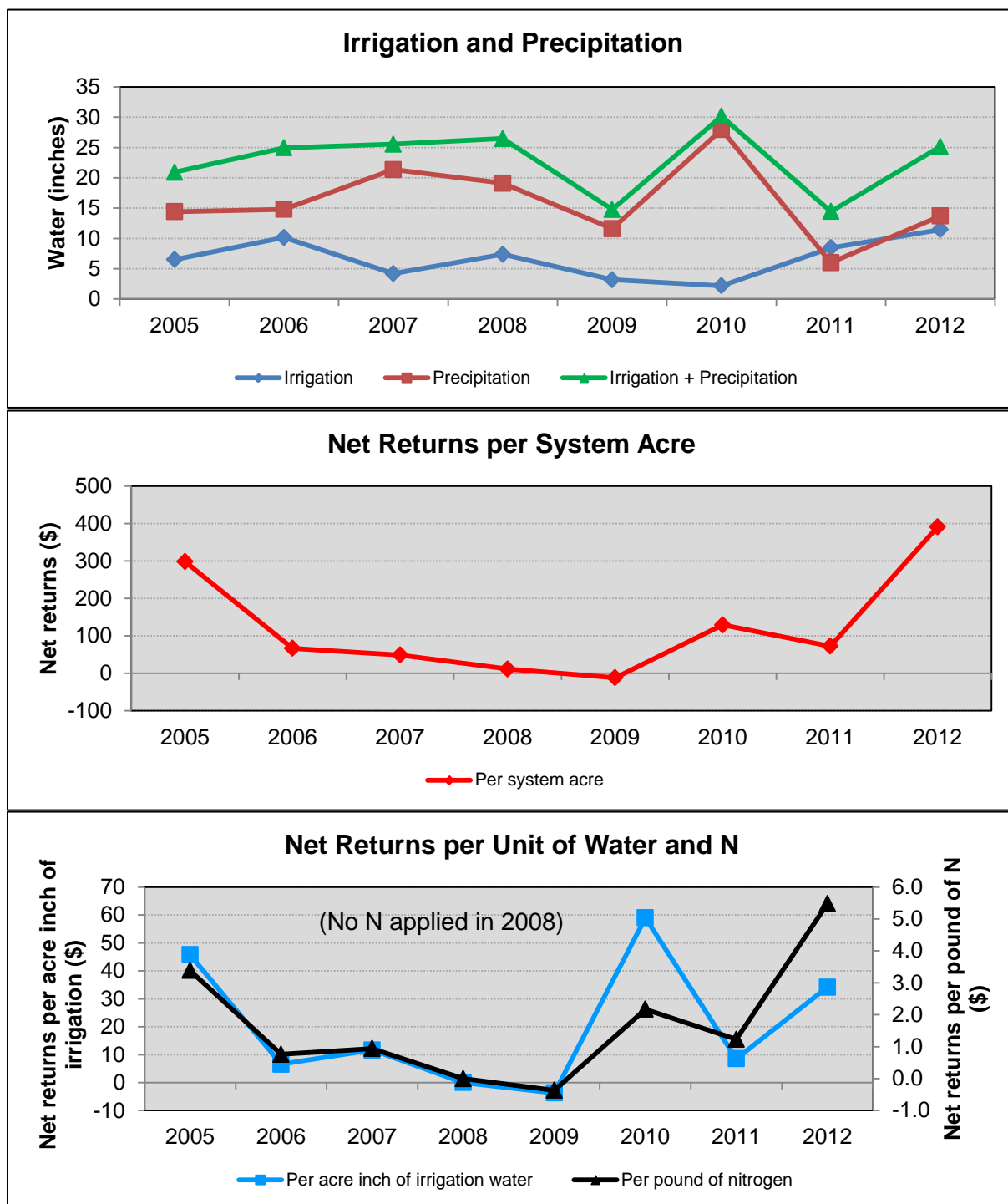


Field 1 in June



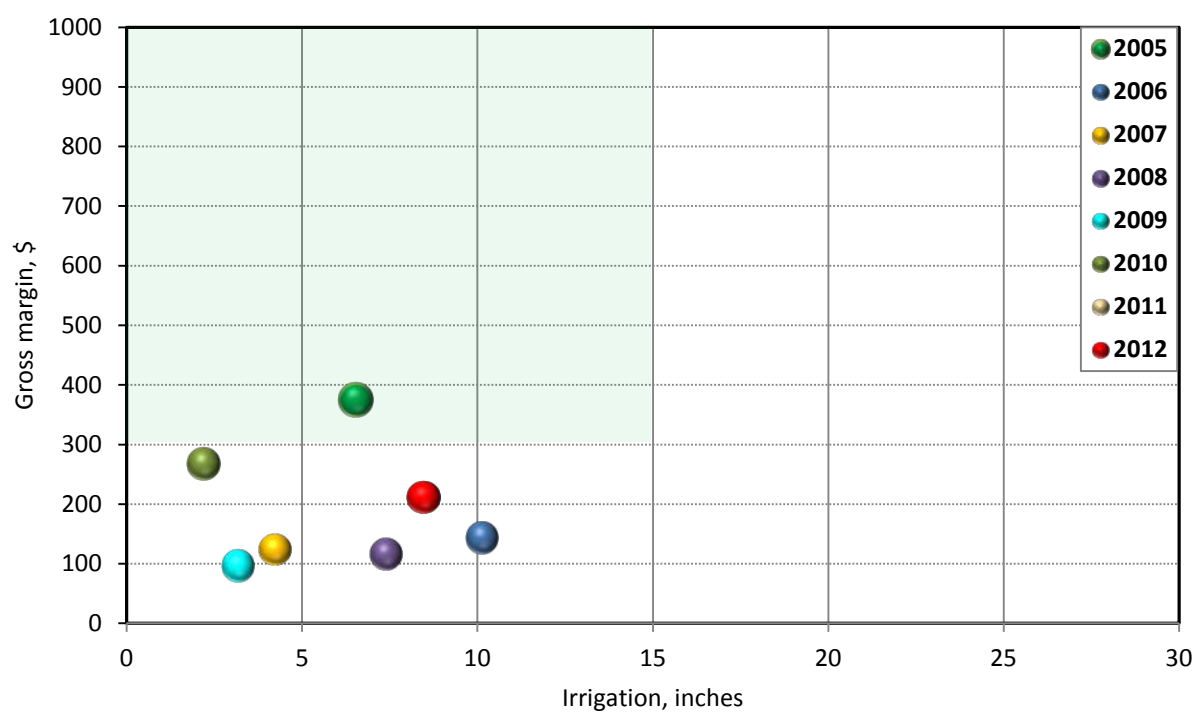
November cotton harvest

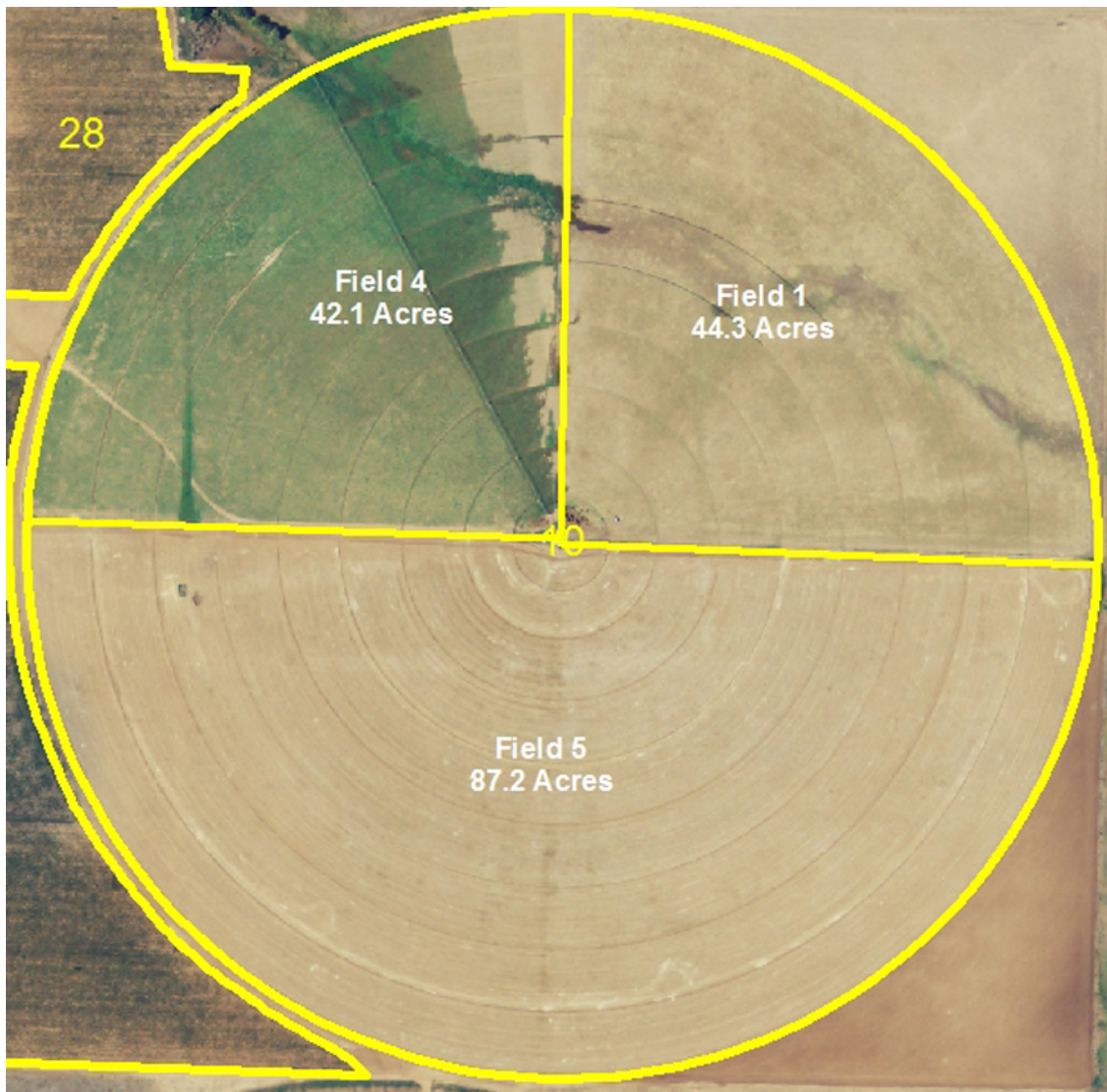
Site 9



Site 9

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 10 Description

Total site acres:	173.6
Field No. 1 Acres:	44.3
Major soil type:	Pullman clay loam; 0 to 1% slope Lofton clay loam; 0 to 1% slope Estacado clay loam; 0 to 1% slope
Field No. 4 Acres:	42.1
Major soil type:	Pullman clay loam; 0 to 1% slope Estacado clay loam; 0 to 1% slope
Field No. 5 Acres:	87.2
Major soil type:	Pullman clay loam; 0 to 1% slope

Irrigation

Type:	Center Pivot (LESA)
Pumping capacity, gal/min:	800
Number of wells:	2
Fuel source:	Electric

System 10

	Livestock	Field 1	Field 2	Field 3	Field 4
2005	Cow-calf	Dahl planted, no grazing this year	Cotton	Dahl for grazing and hay	Bermudagrass planted, some grazing
2006	Cow-calf	Dahl for grazing	Oats for hay followed by Forage Sorghum for hay	Dahl for grazing	Bermudagrass for grazing and hay
2007	Cow-calf	Dahl for grazing	Corn for silage following Wheat cover crop	Dahl for grazing and seed	Bermudagrass for grazing
2008	Cow-calf	Dahl for grazing	Wheat for grain followed by Corn for grain	Dahl for grazing and hay	Bermudagrass for grazing
2009	Cow-calf	Dahl for grazing	Cotton	Dahl for grazing	Bermudagrass for grazing
2010	Cow-calf	Dahl for grazing	Corn	Corn	Bermudagrass for grazing
2011	Cow-calf	Cotton	Cotton	Cotton	Bermudagrass for grazing
	Livestock	Field 1	Field 4	Field 5	
2012	Cow-calf	?	Bermudagrass for grazing	Corn Silage	

Comments: This is a two cell, pivot irrigated row crop, improved forage, cow-calf system. Old-world bluestem and bermudagrass are used in rotation for livestock grazing. One-half of this system was planted to corn on 40-inch centers for 2012.

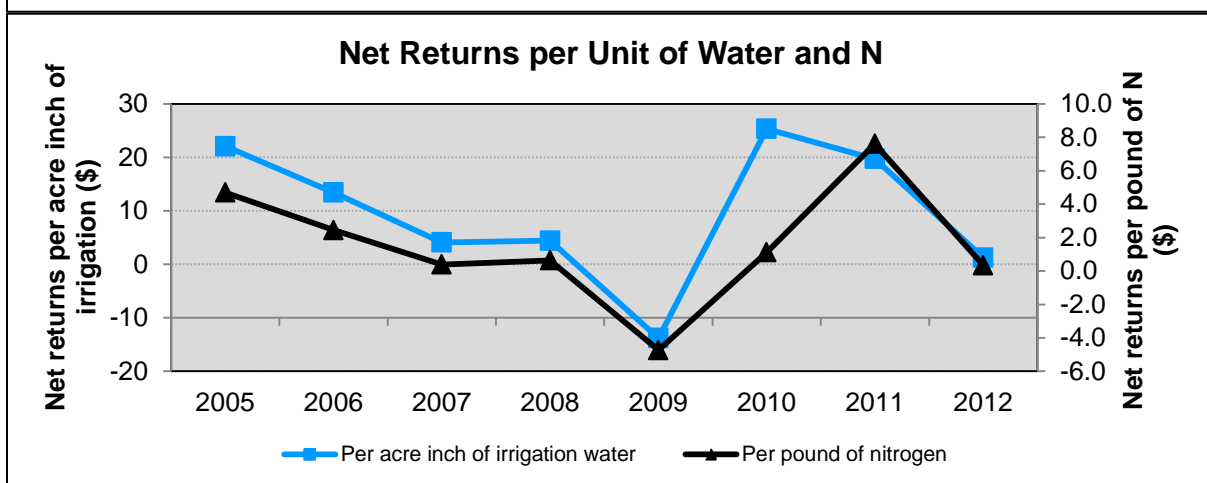
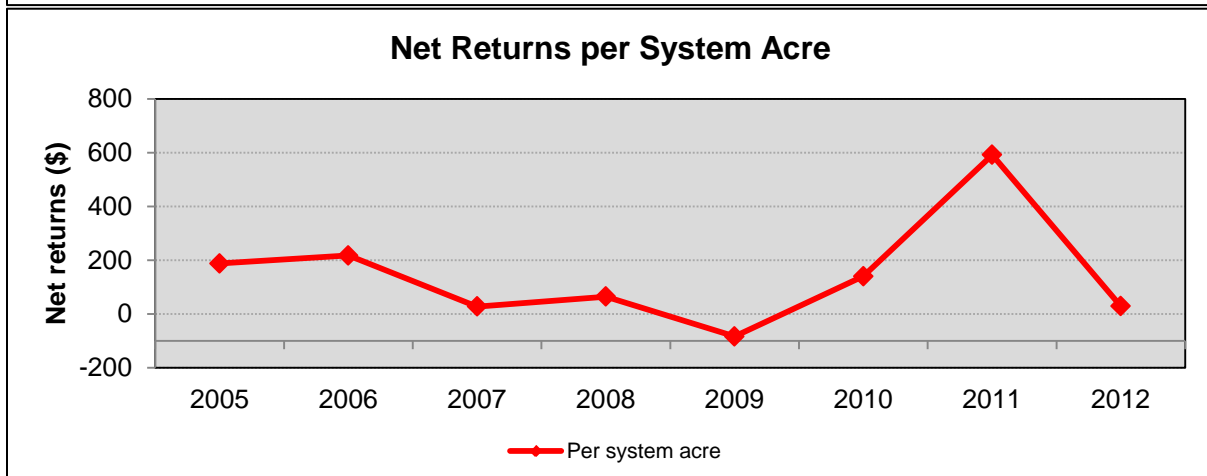
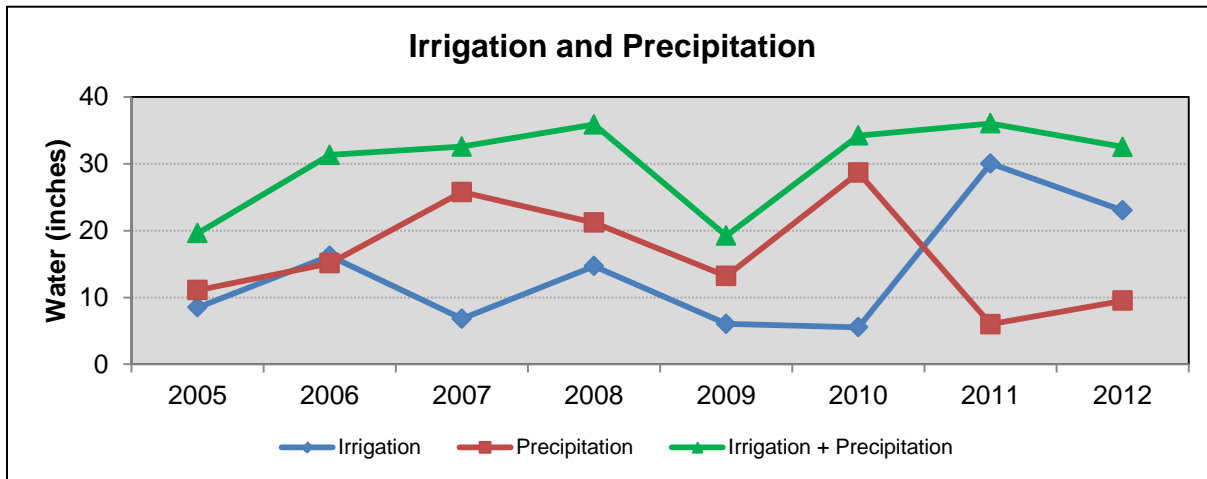


Rotational grazing



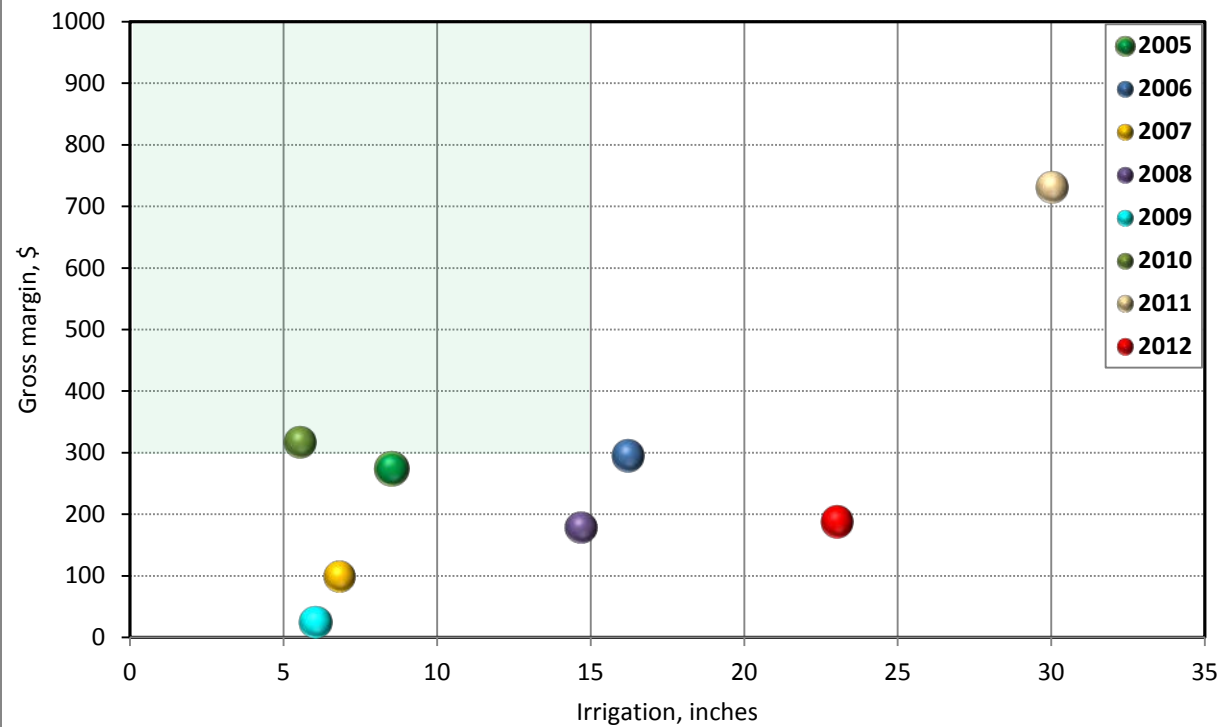
June corn

Site 10



Site 10

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 11 Description

Total site acres: 92.5

Field No. 2 Acres: 24.4
Major soil type: Pullman clay loam; 0 to 3% slope

Field No. 3 Acres: 22.9
Major soil type: Pullman clay loam; 0 to 3% slope

Field No. 5 Acres: 45.2
Major soil type: Lofton clay loam; 0 to 1% slope
Olton clay loam; 1 to 3% slope
Pullman clay loam; 0 to 3% slope

Irrigation

Type: Furrow

Pumping capacity, gal/min: 490

Number of wells: 1

Fuel source: Electric

Site 11

	Livestock	Field 1	Field 2	Field 3	Field 4
2005	None	Cotton following Wheat cover crop	Cotton	Cotton	
2006	None	Cotton	Cotton	Cotton	
2007	None	Cotton	Cotton	Cotton	
2008	None	Grain Sorghum	Cotton	Cotton	
2009	None	Cotton	Grain sorghum	Cotton	
2010	None	Cotton	Cotton	Grain Sorghum	
2011	None	Cotton	Cotton	Cotton	Grain Sorghum
	Livestock	Field 2	Field 3	Field 5	
2012	None	Milo	Milo	Milo	

Comments: This is a furrow irrigated cotton and grain sorghum system using conventional tillage and planted on 40-inch centers. The cotton was lost to a June 4th hail storm and replanted to grain sorghum.

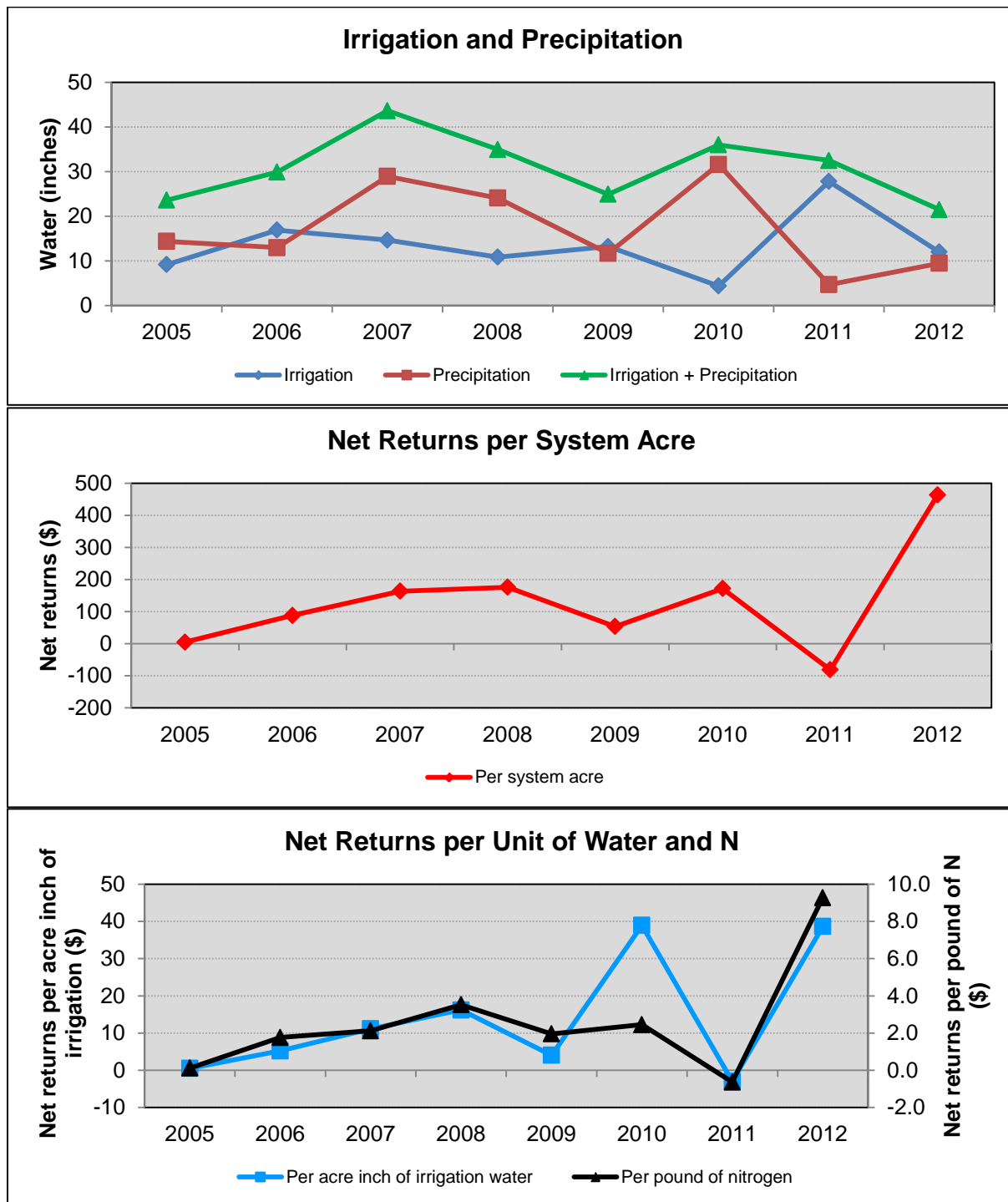


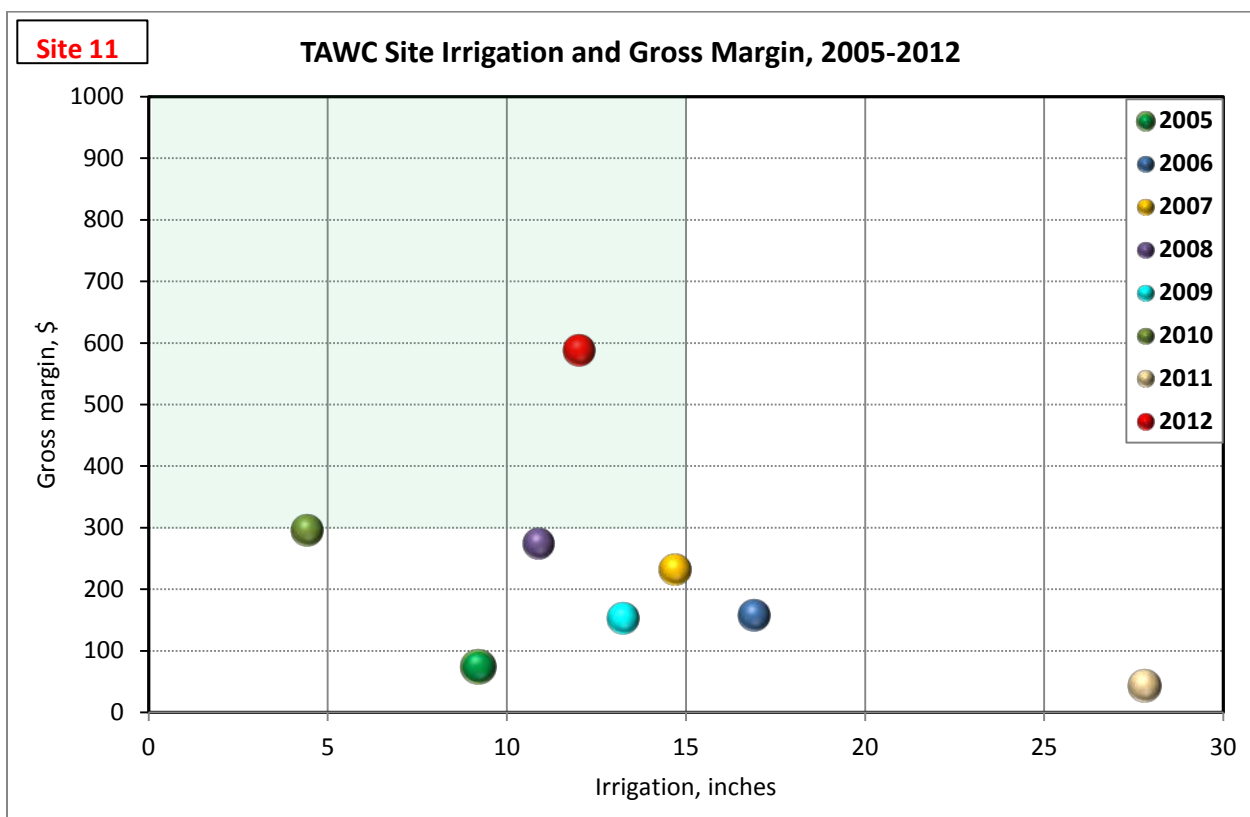
June cotton replanted to sorghum



September grain sorghum

Site 11







Site 12 Description

Total site acres: 283.8

Field No. 1 Acres: 151.2

Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 132.7

Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Dryland

Pumping capacity, gal/min: na

Number of wells: na

Fuel source: na

Site 12
Dryland Site

	Livestock	Field 1	Field 2
2005	None	Cotton following wheat cover crop	Forage sorghum for cover following Wheat
2006	None	Wheat for grain	Cotton following previous year cover of Forage Sorghum
2007	None	Cotton	Grain sorghum following wheat cover crop
2008	None	Grain sorghum for silage	Fallow, volunteer Wheat for cover crop
2009	None	Grain sorghum for silage	Fallow
2010	None	Cotton	Cotton
2011	None	Cotton	Cotton
2012	None	Fallow	Fallow

Comments: This dryland system uses cotton, grain sorghum and wheat in rotation. One field was planted to cotton in 2012 but not harvested.

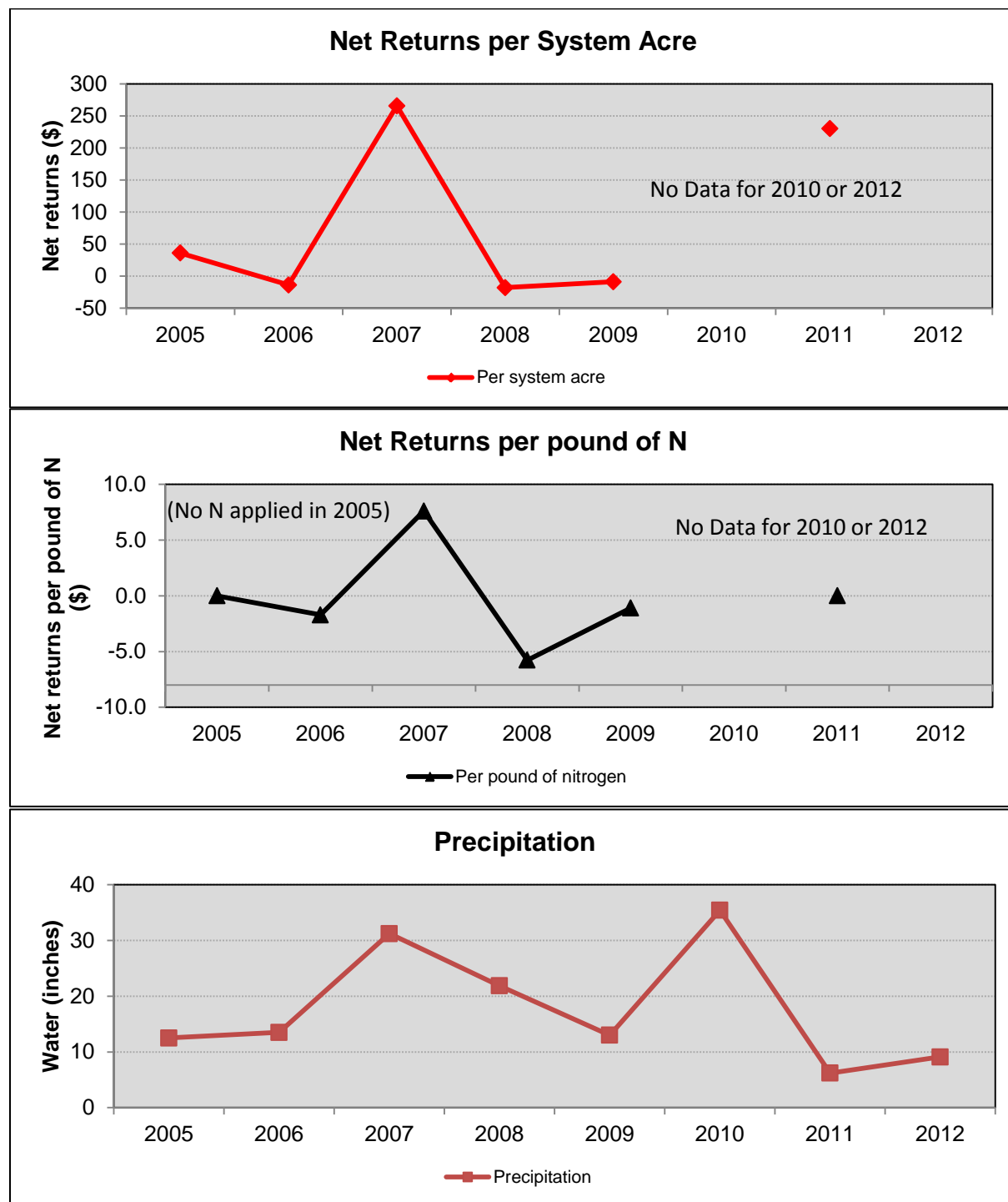


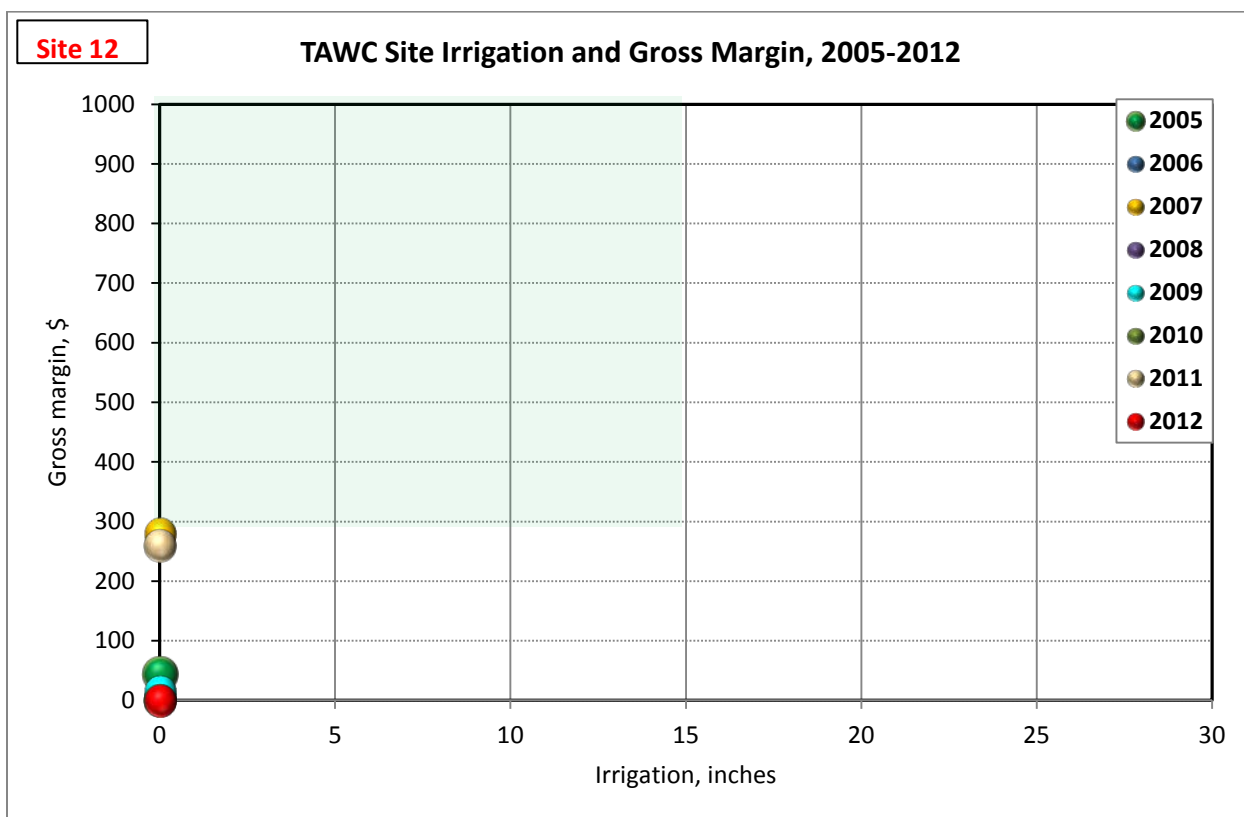
Late July cotton



August No harvest to be made

Site 12 - Dryland Site

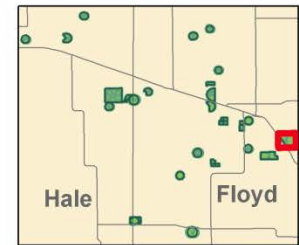




Dryland Site

Site 13 - 2007

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Legend

- Systems 2007
- Fields 2007



0 0.1 0.2 0.3 0.4 mi

0 500 1,000 1,500 ft



Texas Alliance for Water Conservation
SB 1053

Water is Our Future

Center for Geospatial Technology
Texas Tech University
September 2007

Site 13 Description

Total site acres: 319.5

Field No. 1 Acres: 118.0
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 201.5
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Dryland

Pumping capacity,
gal/min:

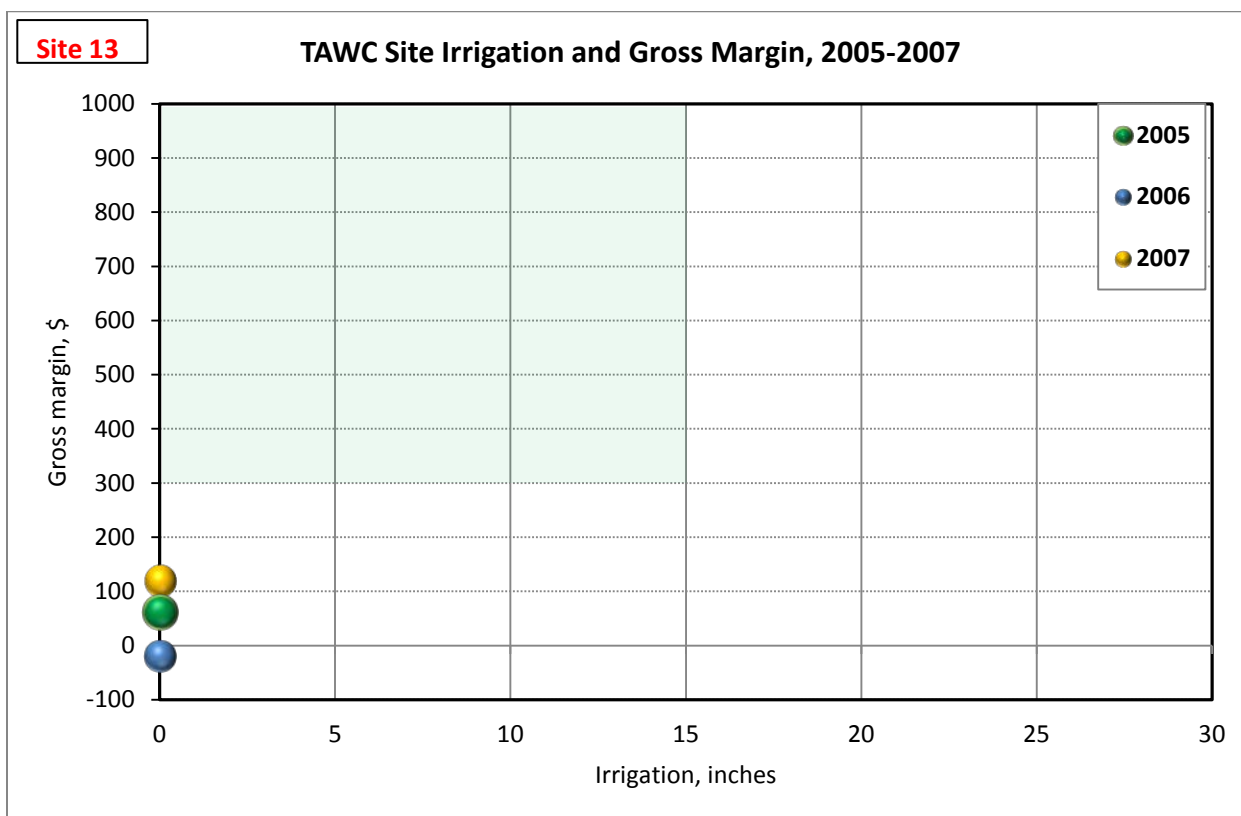
Number of wells:

Fuel source:

Comments: This dryland site used cotton and small grains in rotation. Cotton was planted on 40-inch centers under limited tillage. Small grains were drilled after cotton harvest.

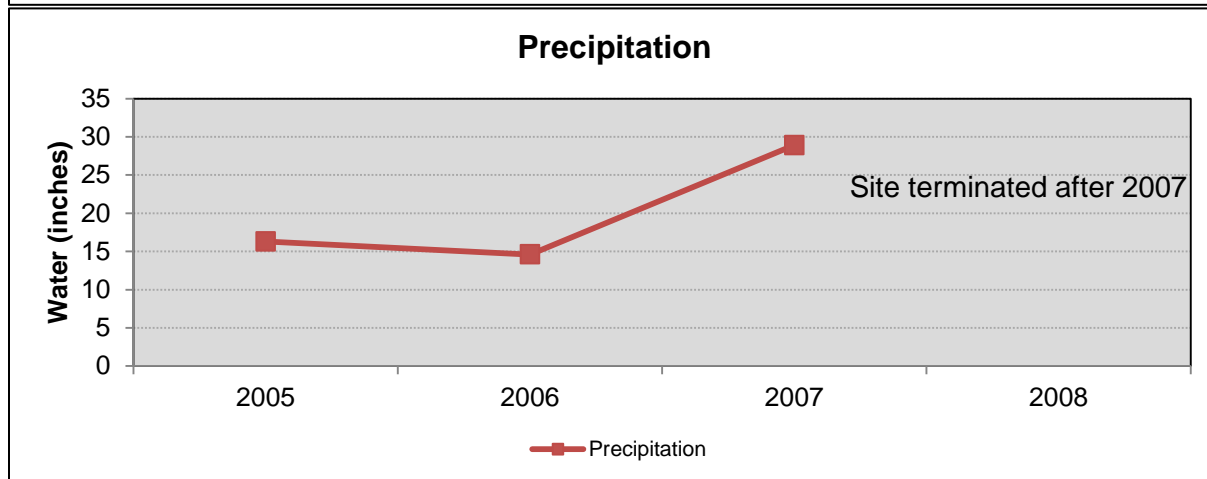
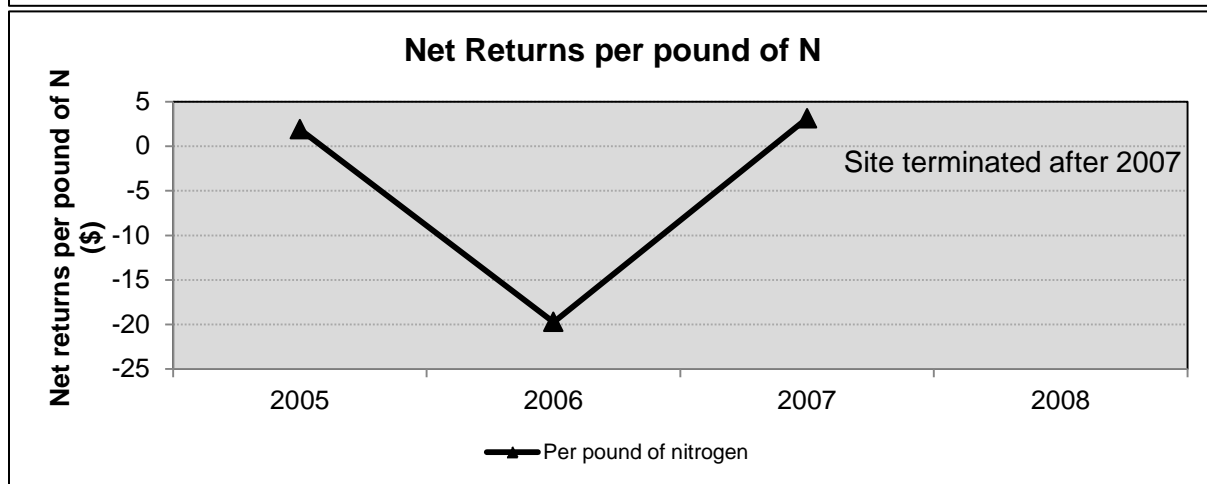
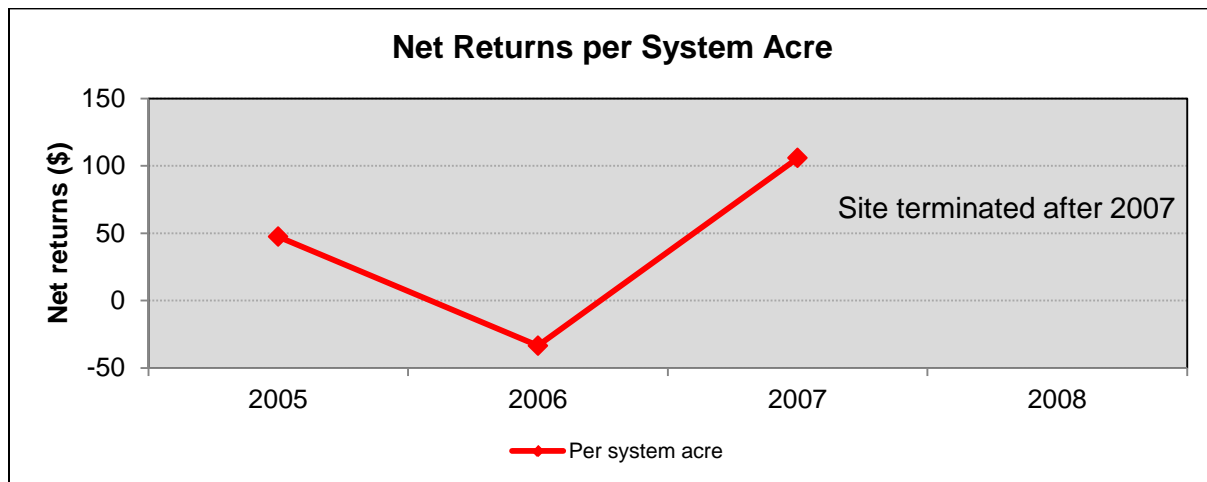
Site 13
Dryland Site

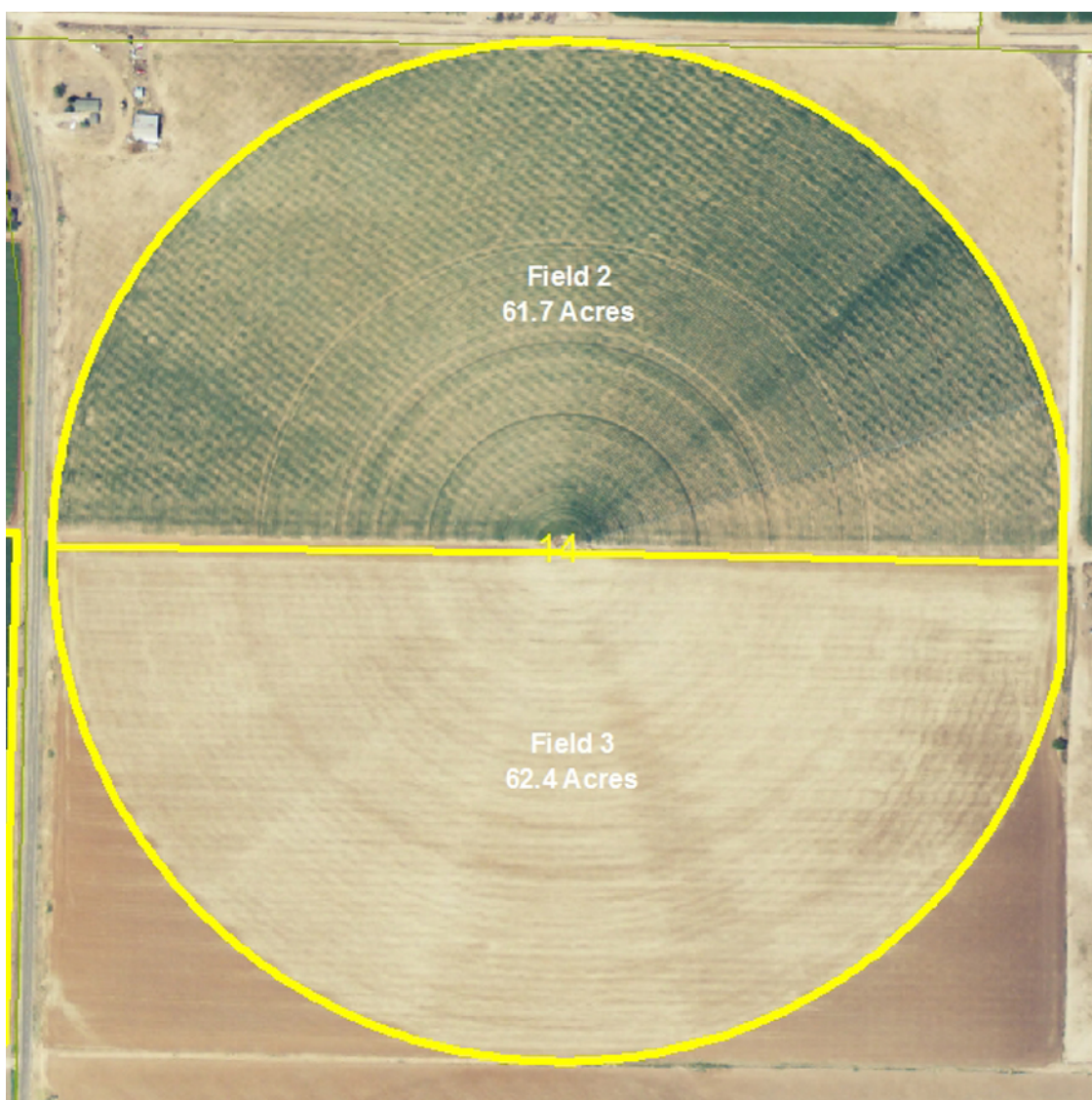
	Livestock	Field 1	Field 2
2005	None	Wheat for grain	Cotton following previous year's cover of Wheat stubble
2006	None	Cotton following previous year's cover of wheat stubble	Wheat lost to drought
2007	None	Wheat for grain	Cotton following wheat cover crop
2008	Site terminated for 2008		



Dryland Site

Site 13 - Dryland Site





Site 14 Description

Total site acres: 124.1

Field No. 2 Acres: 61.7
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3 Acres: 62.4
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

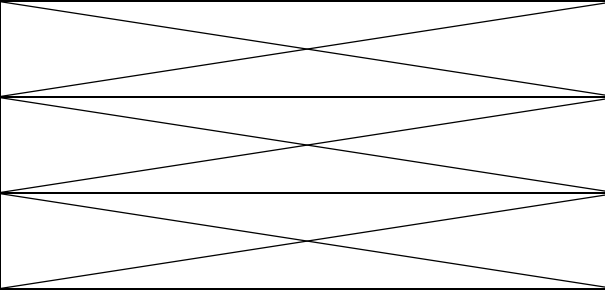
Type: Center Pivot (LEPA)

Pumping capacity,
gal/min: 300

Number of wells: 3

Fuel source: Electric

Site 14

	Livestock	Field 1	Field 2	Field 3
2005	None	Cotton		
2006	None	Cotton		
2007	None	Cotton		
2008	None	Split into Fields 2 and 3	Cotton	Cotton
2009	None		Cotton	Wheat
2010	None		Wheat	Cotton
2011	None		Cotton	Cotton
2012	None		Wheat	Cotton

Comments: This is a pivot irrigated cotton and wheat rotation system with limited irrigation. This producer uses conventional tillage on 40-inch centers.

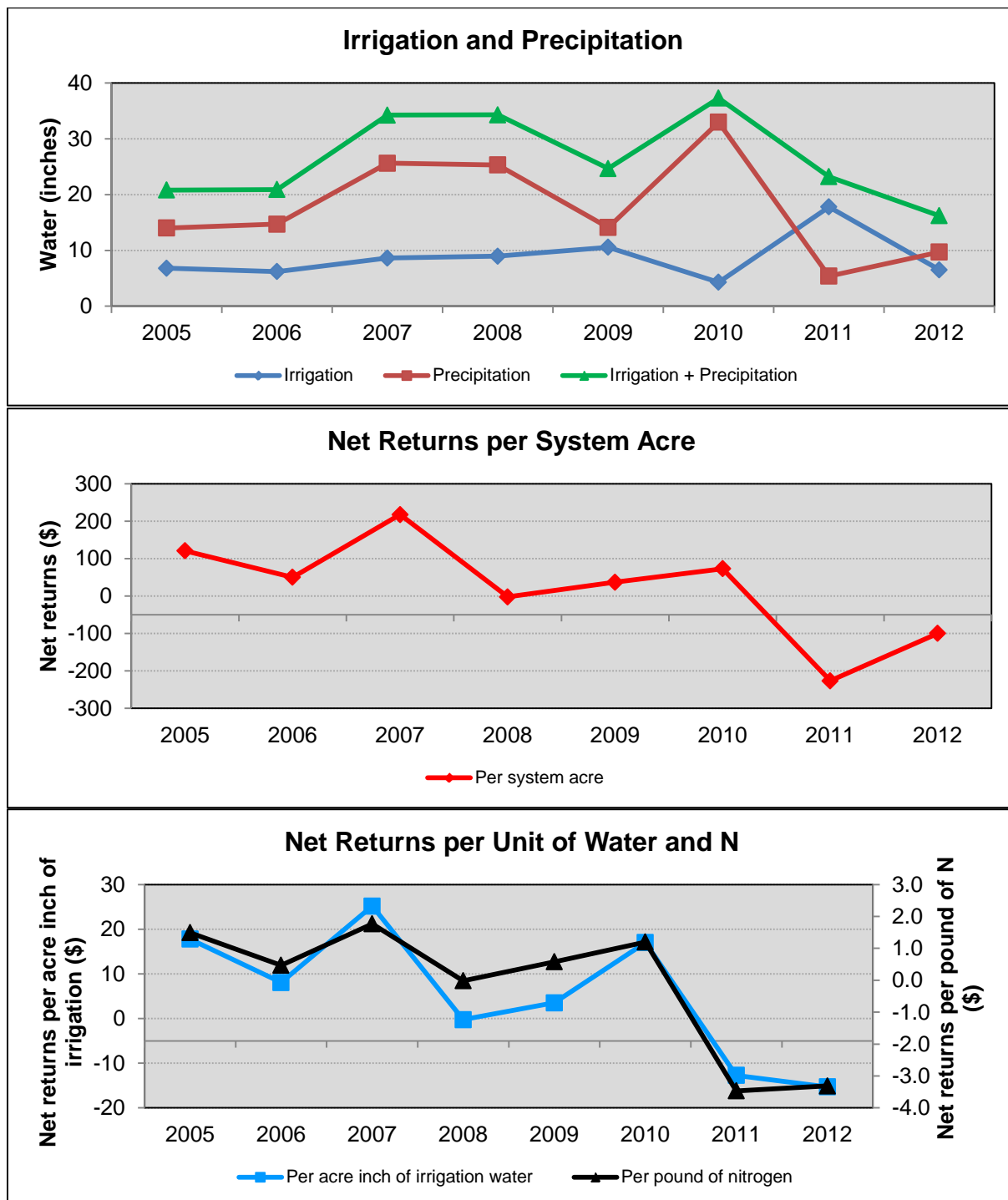


April wheat



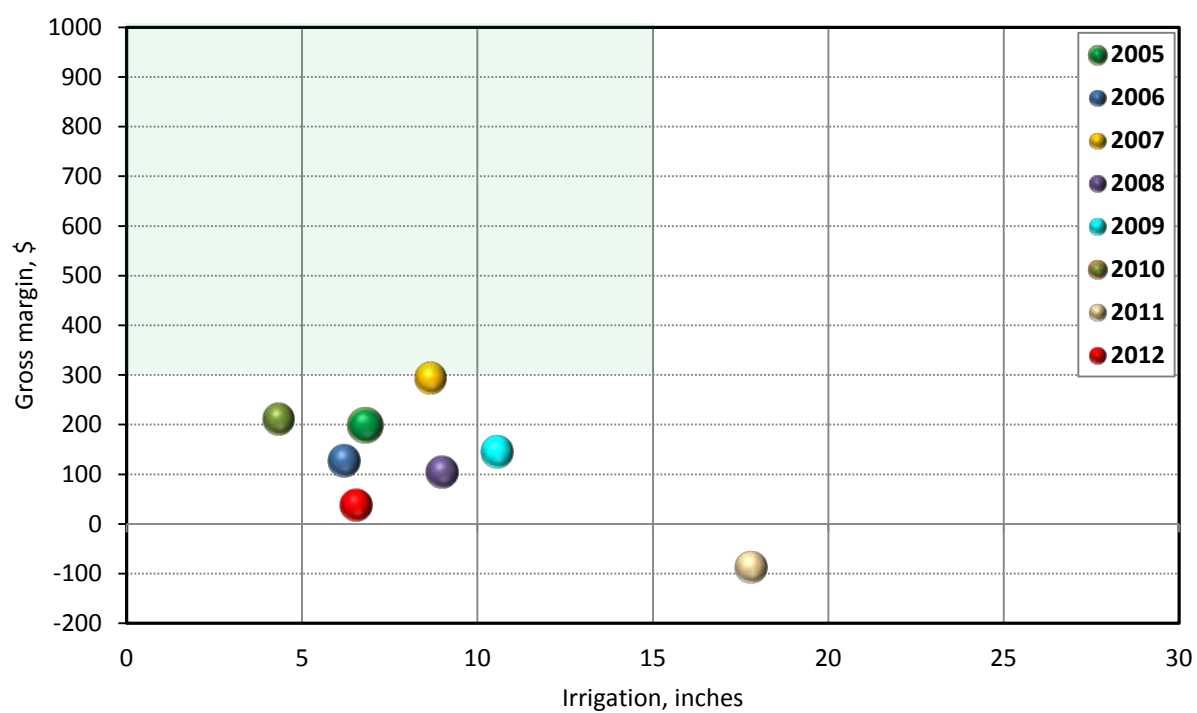
August cotton

Site 14



Site 14

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 15 Description

Total site acres: 101.1

Field No. 8 Acres: 56.7
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 9 Acres: 44.4
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Subsurface Drip

Pumping capacity,
gal/min: 290

Number of wells: 1

Fuel source: electric

Site 15

	Livestock	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9
2005	None	Cotton	Cotton							
2006	None	Cotton	Split into Fields 3 and 4	Cotton	Grain sorghum					
2007	None	Cotton		Grain Sorghum	Cotton					
2008	None	Split into Fields 5 and 6		Cotton	Wheat harvested, volunteer sheat for cover crop, replanted to Wheat	Cotton	Cotton			
2009	None			Cotton	Cotton	Cotton	Acres added to become Field 7	Cotton		
2010	None			Split into Fields 8 and 9				Split into Fields 8 and 9	Cotton	Cotton
2011	None								Corn	Cotton
2012	None								Milo	Milo

Comments: This has been a cotton, wheat and grain sorghum system in previous years. This year both fields were planted to cotton on 40-inch centers. The cotton crop was lost to hail on June 4th and replanted to grain sorghum.



April wheat



June cotton hailed out

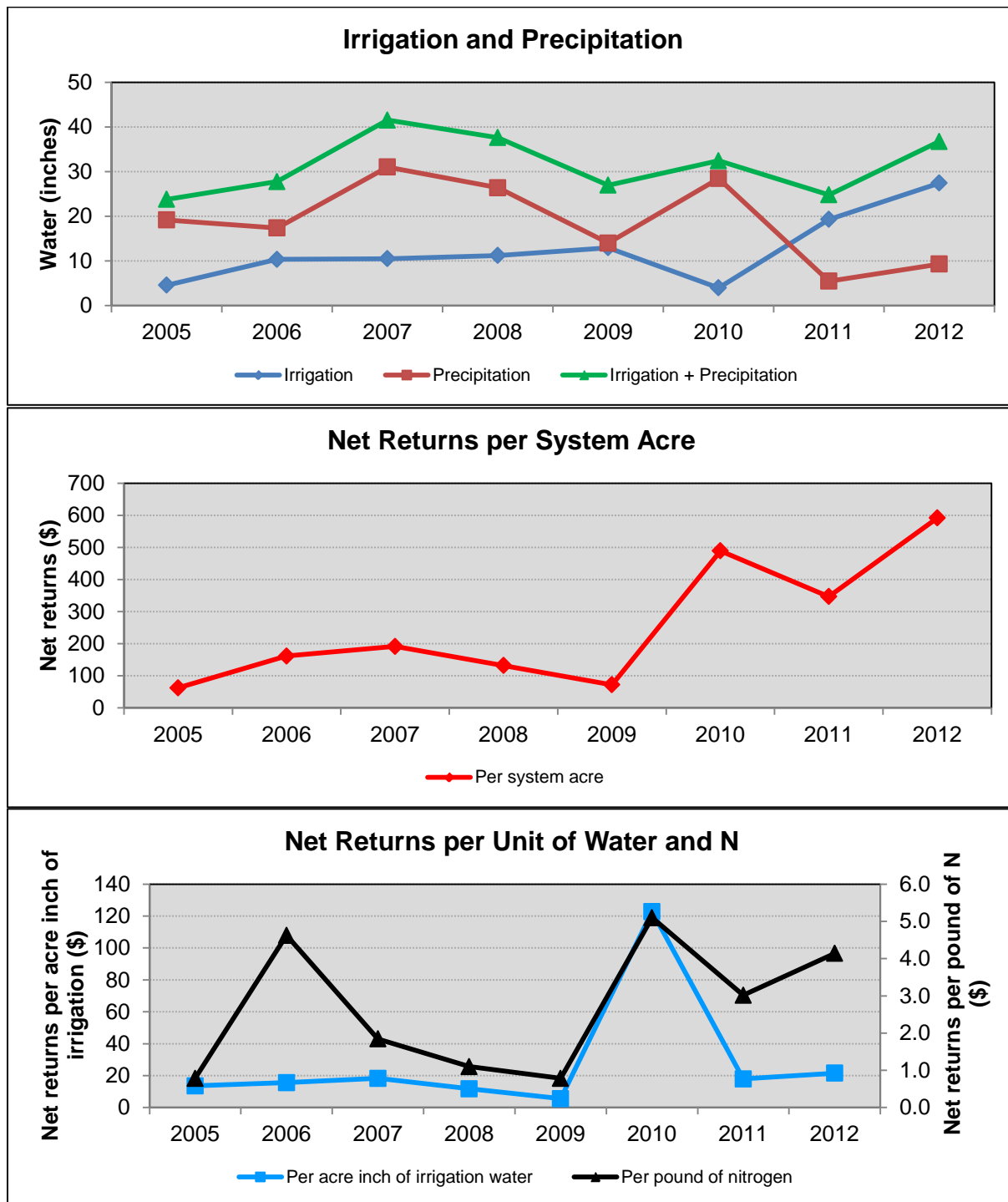


Replanted cotton to grain sorghum



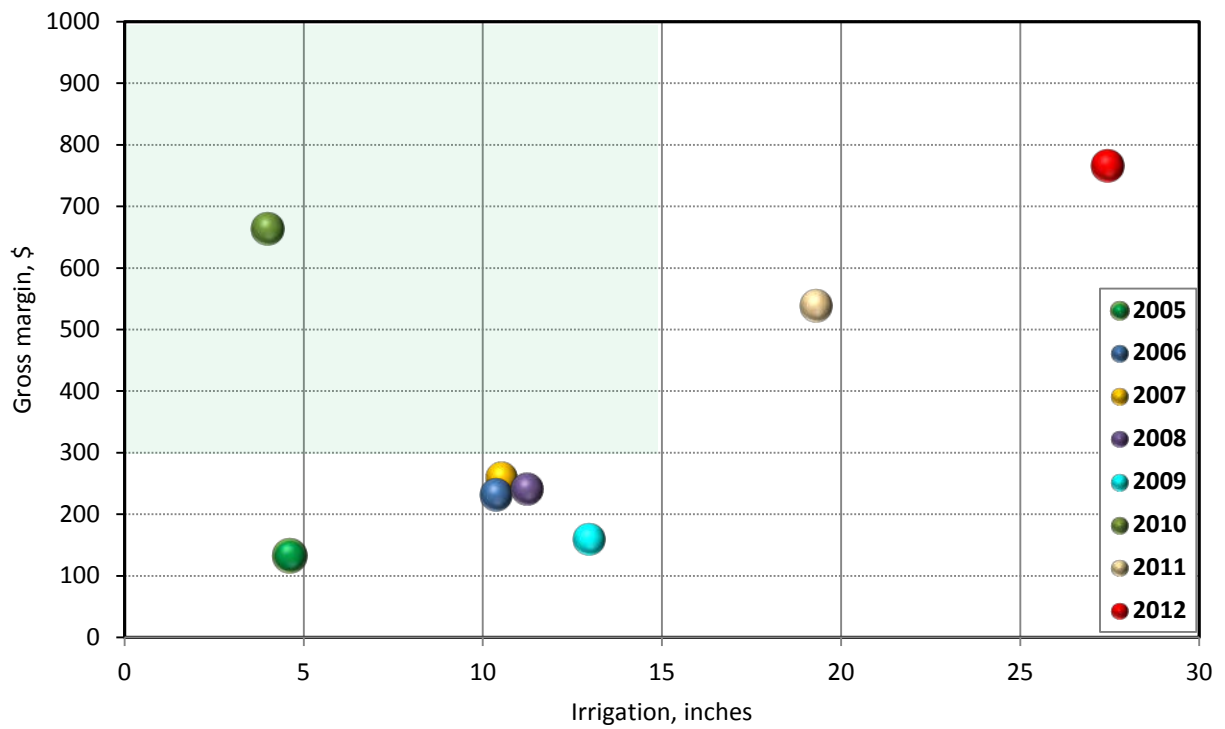
Grain sorghum nearing harvest

Site 15



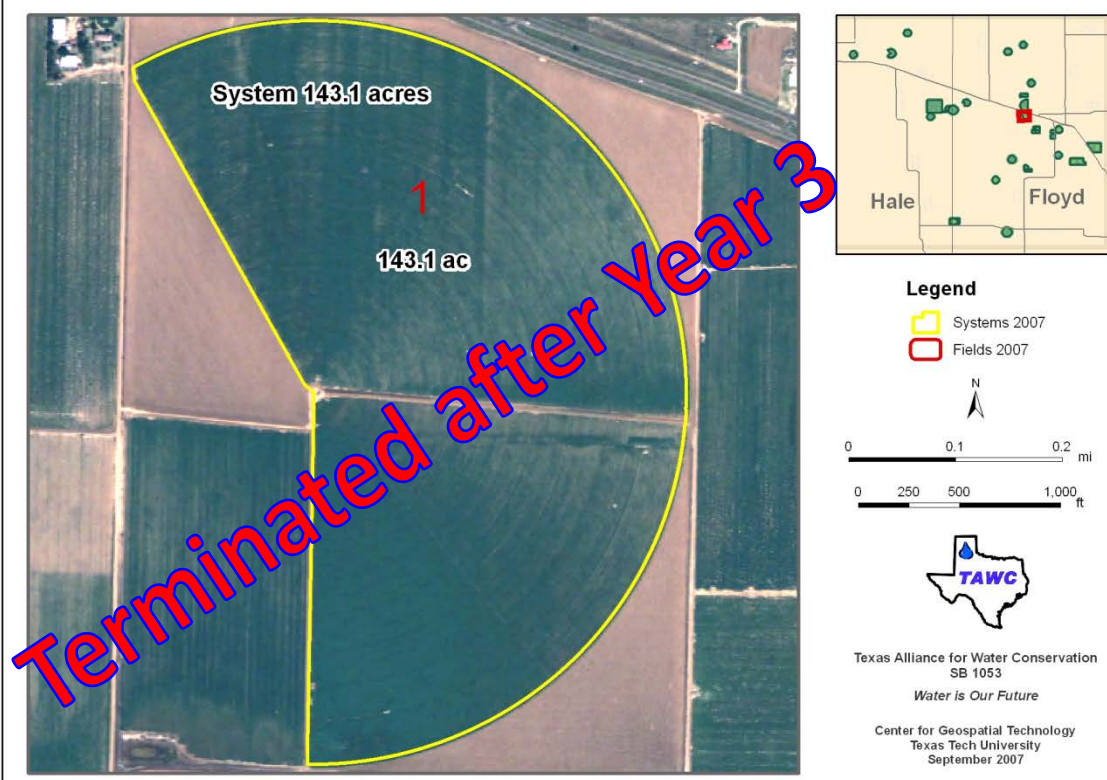
Site 15

TAWC Site Irrigation and Gross Margin, 2005-2012



Site 16 - 2007

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Site 16 Description

Total site acres: 143.1
 Field No. 1 Acres: 143.1
 Major soil type: Pullman clay loam; 0 to 1% slope

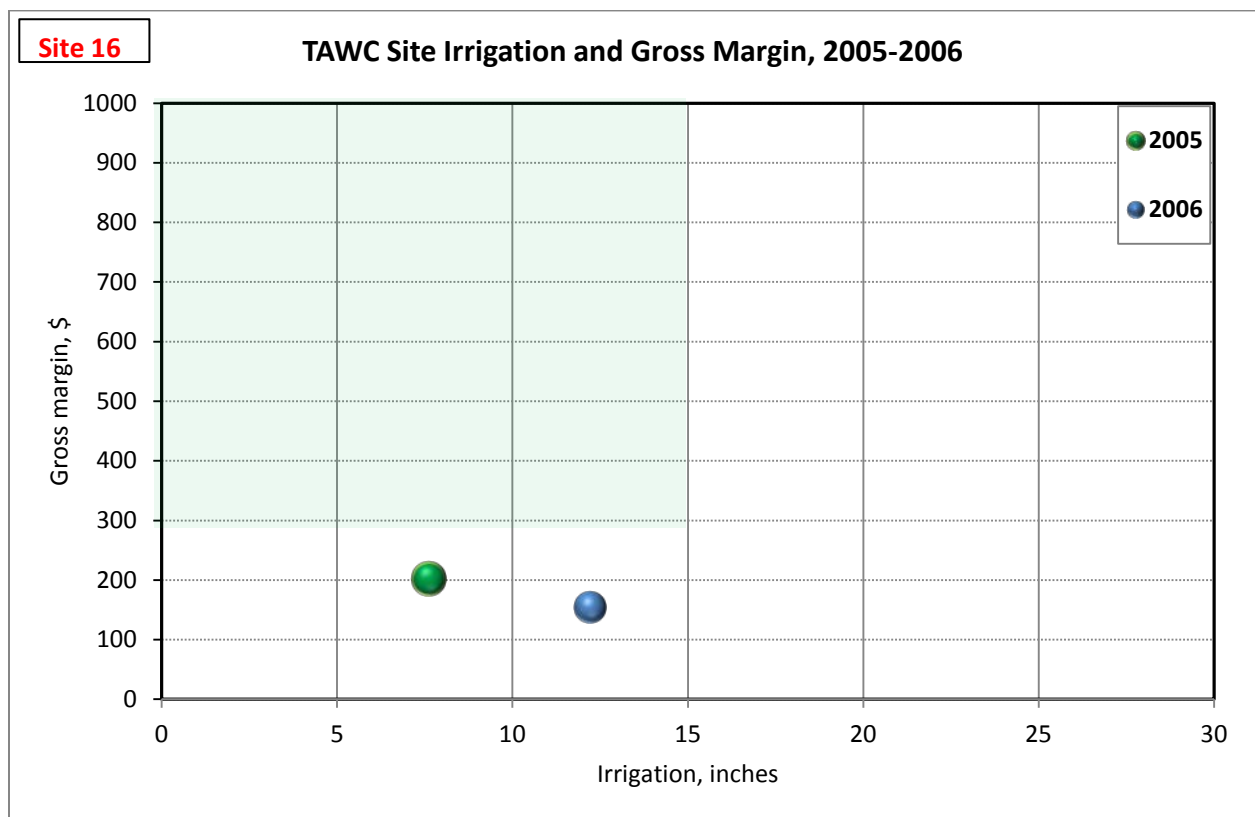
Irrigation

Type: Center Pivot (LESA)
 Pumping capacity, gal/min: 600
 Number of wells: 3
 Fuel source: Electric

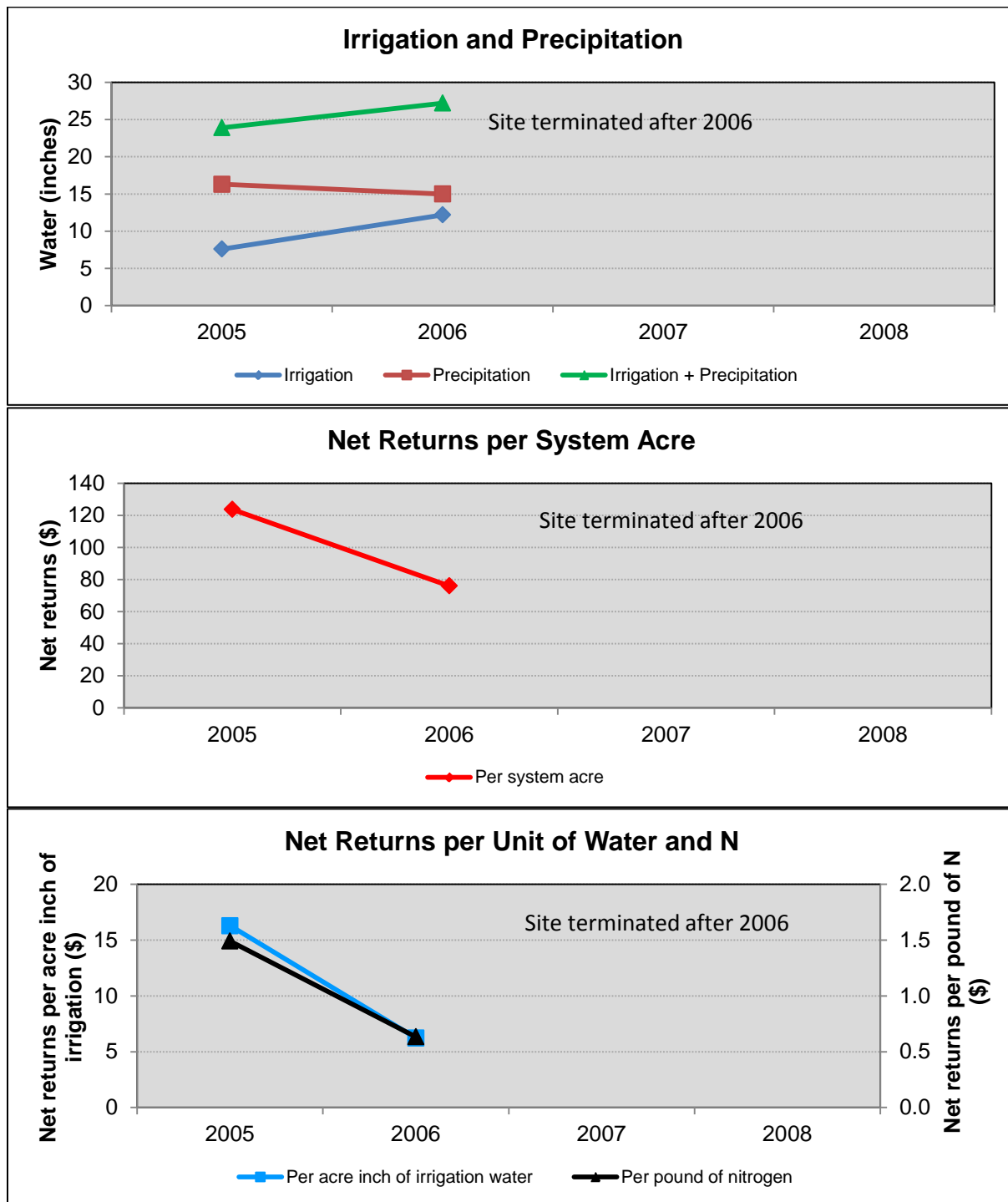
Comments: This pivot irrigated cotton site used conventional tillage and planted on 40-inch centers.

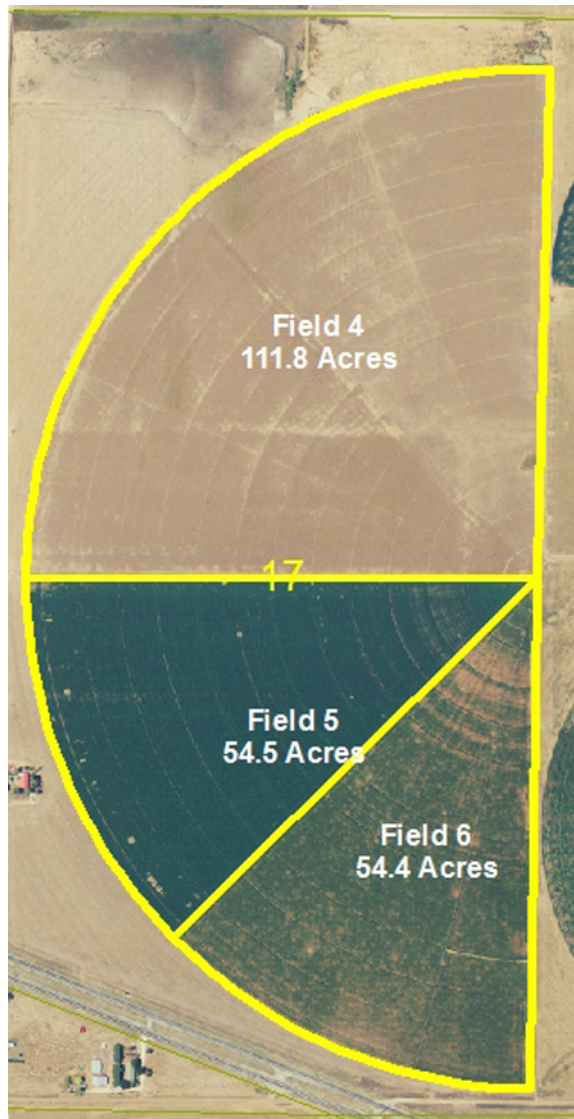
Site 16

	Livestock	Field 1
2005	None	Cotton
2006	None	Cotton
2007	None	Cotton following wheat cover crop
2008	Site terminated for 2008	



Site 16





Site 17 Description

Total site acres: 220.7

Field No. 4 Acres: 111.8
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 5 Acres: 54.5
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 6 Acres: 54.4
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (MESA)

Pumping capacity,
gal/min: 900

Number of wells: 8

Fuel source: Electric

Site 17

	Livestock	Field 1	Field 2	Field 3
2005	None	WW-B. Dahl grass for hay	Corn for silage, followed by wheat for grazing and cover	Cotton following cover crop of wheat
2006	Cow-calf	WW-B. Dahl grass for grazing and hay	Wheat for grazing and cover followed by cotton	Corn for silage, followed by wheat for grazing and cover
2007	Cow-calf	WW-B. Dahl grass for grazing and seed	WW-B. Dahl grass for grazing, hay, seed, established after wheat cover crop	Wheat for grazing and cover followed by cotton
2008	Cow-calf	WW-B. Dahl grass for grazing and seed	WW-B. Dahl grass for grazing and seed	Corn for grain and grazing of residue
2009	Cow-calf	WW-B. Dahl grass for grazing and seed	WW-B. Dahl for grazing	Sunflowers
2010	Cow-calf	WW-B. Dahl grass for grazing	WW-B. Dahl for grazing	Corn
2011	Cow-calf	WW-B. Dahl grass for grazing	WW-B. Dahl for grazing	Cotton
	Livestock	Field 4	Field 5	Field 6
2012	Cow-calf	WW-B. Dahl grass for grazing	Cotton	Corn

Comments: This pivot irrigated site has grown cotton, corn, sunflowers, and Old World bluestem. Corn and cotton were planted on thirty-inch centers. The Old World bluestem has been used for grazing and/or seed production. In 2012 the bluestem was not grazed due to the lack of rainfall, but was harvested for seed.

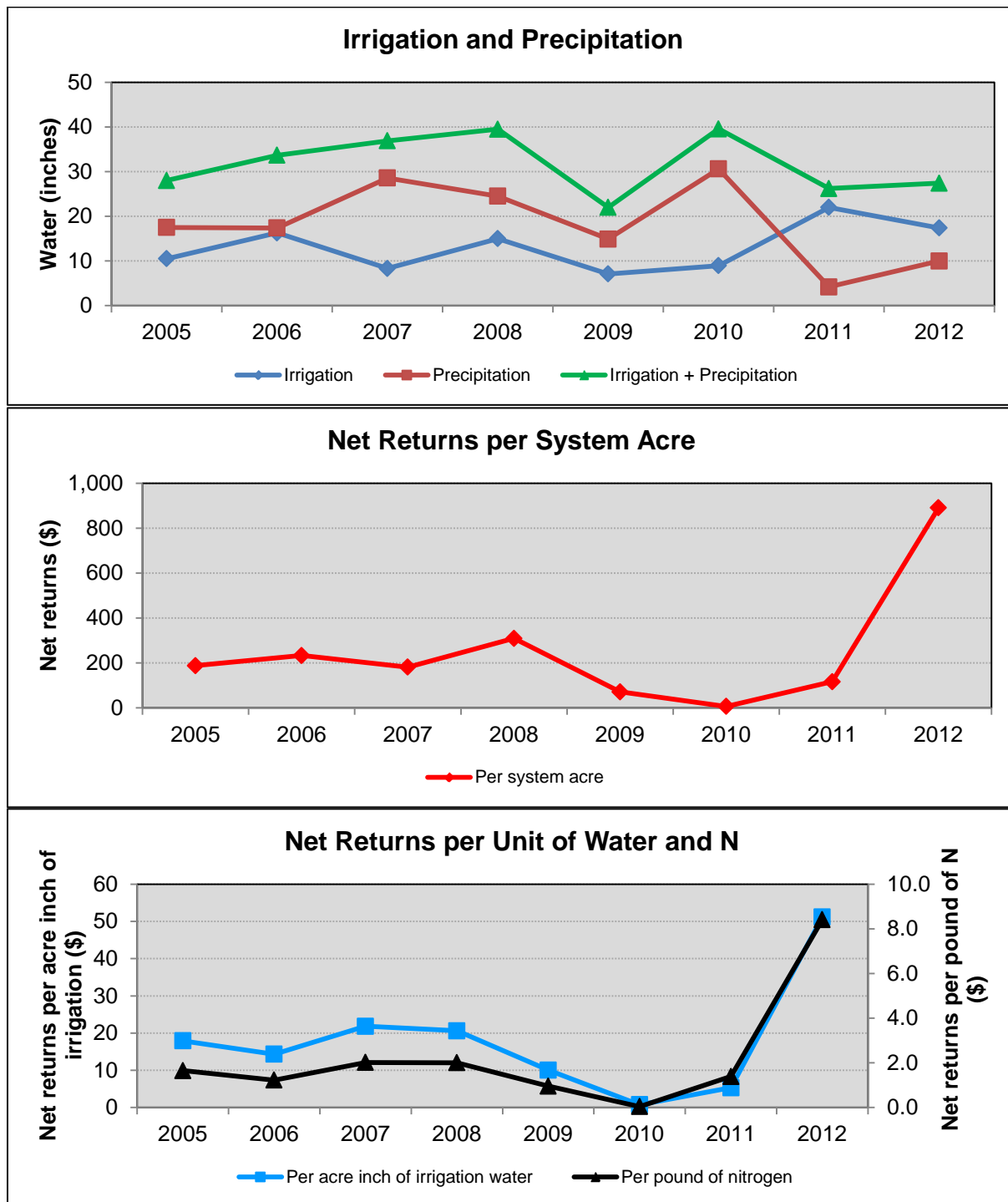


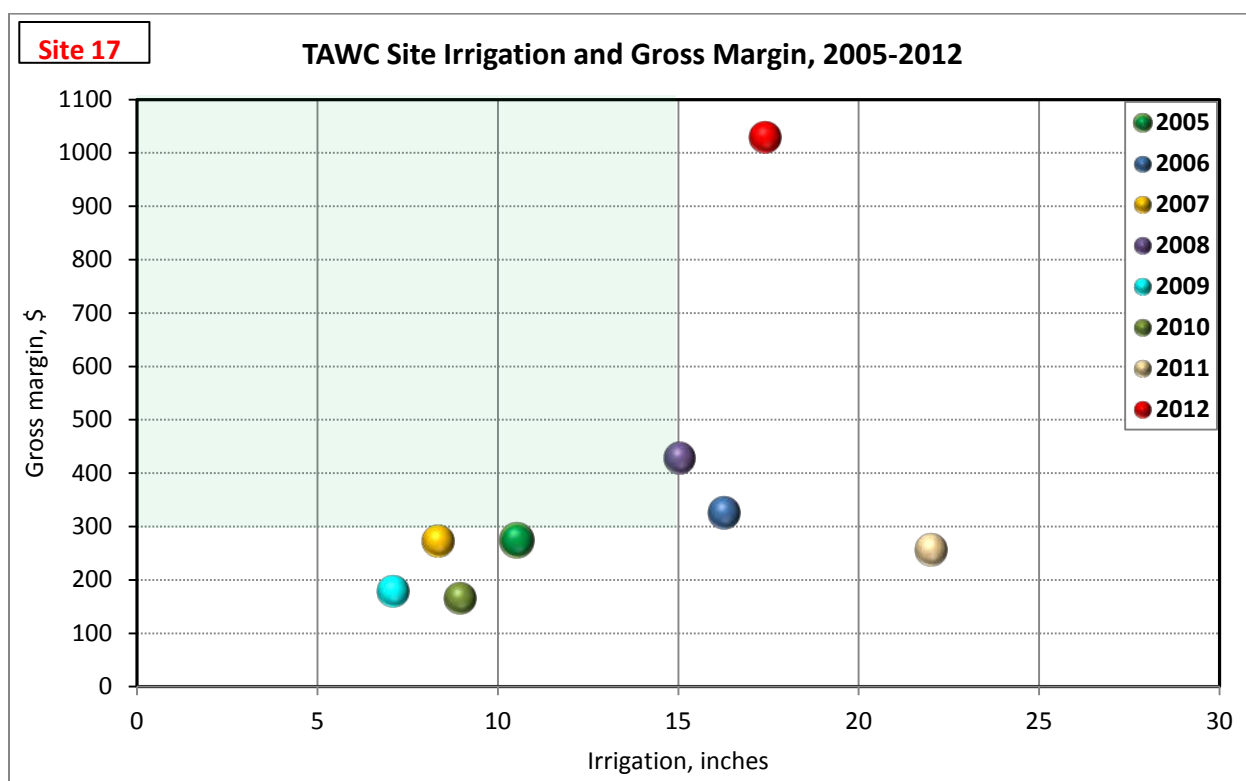
September old world bluestem



Corn in background with cotton in foreground

Site 17







Site 18 Description

Total site acres: 122.2

Field No. 1 Acres: 60.7
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 61.5
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (LEPA)

Pumping capacity,
gal/min: 250

Number of wells: 3

Fuel source: Electric

Site 18

	Livestock	Field 1	Field 2
2005	None	Cotton	Grain sorghum
2006	None	Cotton	Oats for silage followed by forage sorghum for hay
2007	None	Wheat for grain	Grain sorghum
2008	None	Wheat for silage followed by grain sorghum	Cotton
2009	None	Cotton	Wheat
2010	None	Wheat	Cotton
2011	None	Cotton Abandoned	Wheat/cotton Abandoned both
2012	None	Cotton	Cotton

Comments: This is a pivot irrigated site with limited irrigation. Grain sorghum, cotton and wheat are planted on a rotational basis.

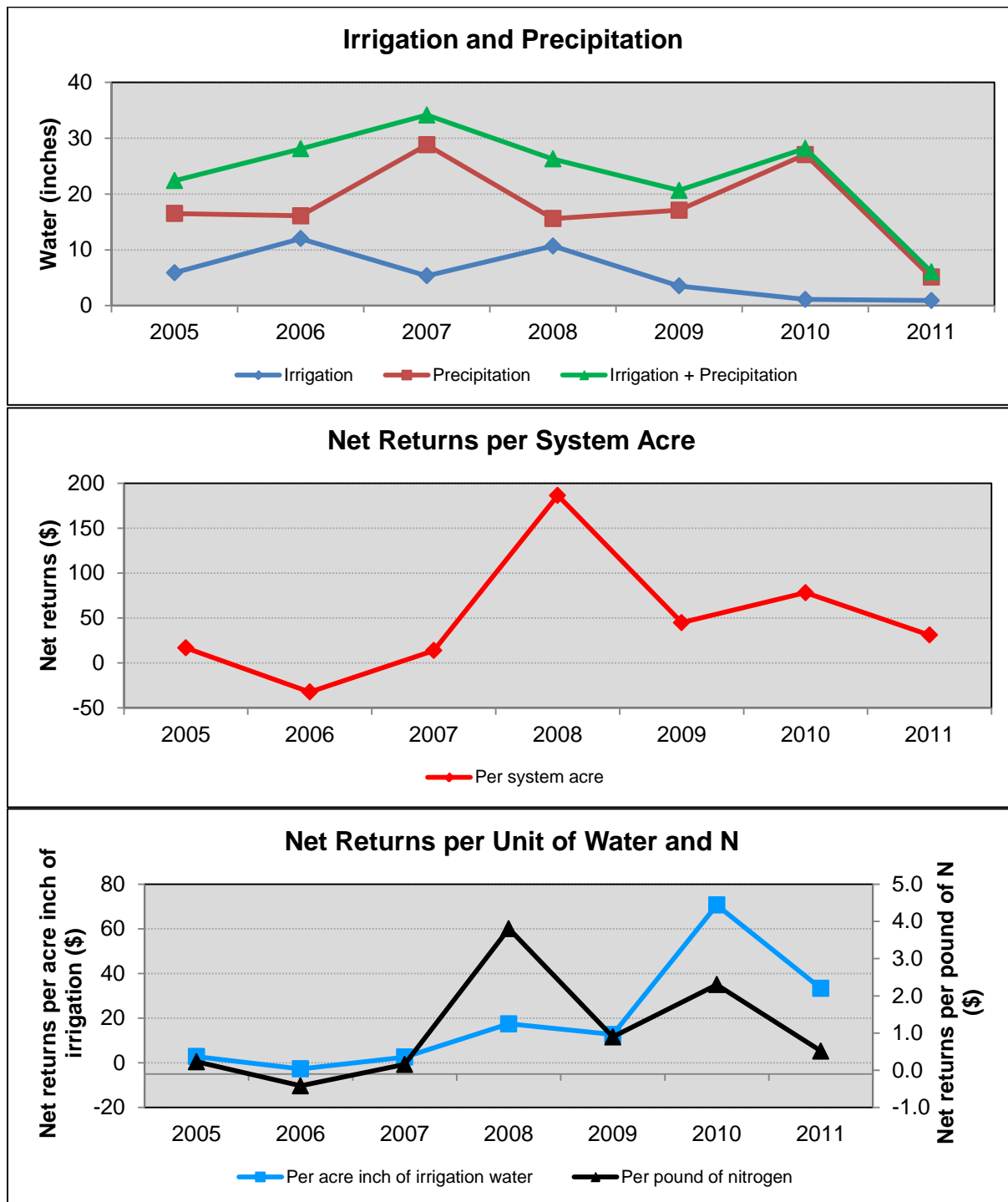


April wheat



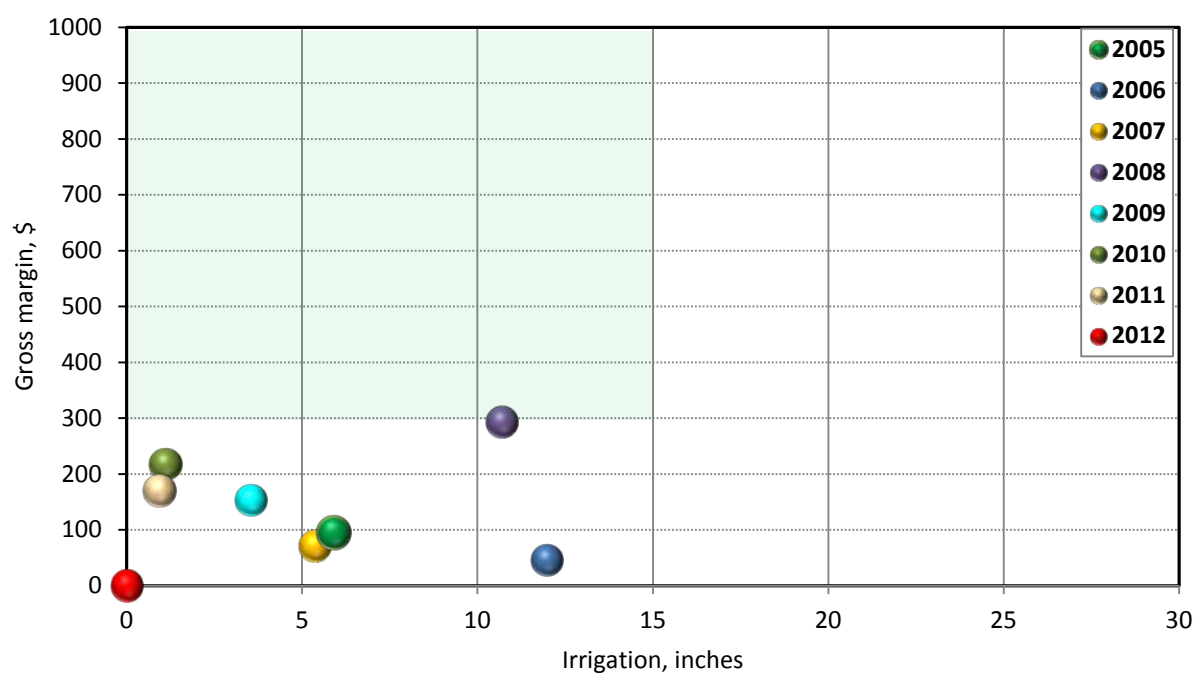
Abandoned cotton

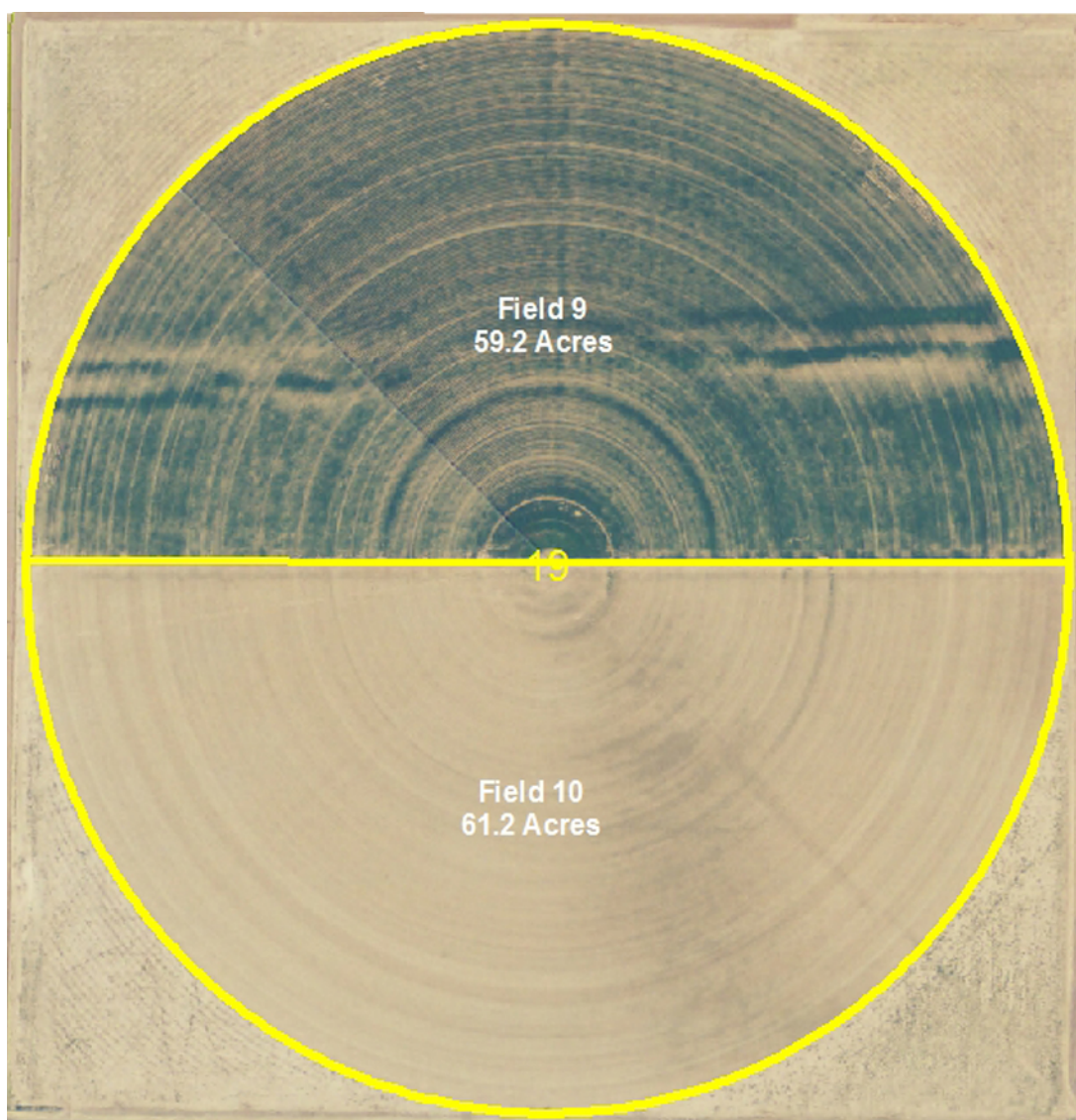
Site 18



Site 18

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 19 Description

Total site acres: 120.4

Field No. 9 Acres: 59.2
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 10 Acres: 61.2
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (LEPA)

Pumping capacity,
gal/min: 400

Number of wells: 3

Fuel source: Electric

Site 19

	Livestock	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9	Field 10
2005	None	Cotton	Pearlmillet for seed								
2006	None	Split into Fields 3 and 4		Pearlmillet for seed	Cotton						
2007	None			Split into Fields 5 and 6		Cotton	Pearlmillet for seed				
2008	None					Split into Fields 7 and 8		Cotton	Pearlmillet for seed		
2009	None							Split into Fields 9 and 10		Wheat	Cotton
2010	None									Cotton	Wheat
2011	None									Cotton	Cotton
2012	None									Cotton	Fallow

Comments: This is a pivot irrigated cotton and wheat site using conventional tillage. Cotton is planted on 40-inch centers in a skip-row pattern.



Cotton in June

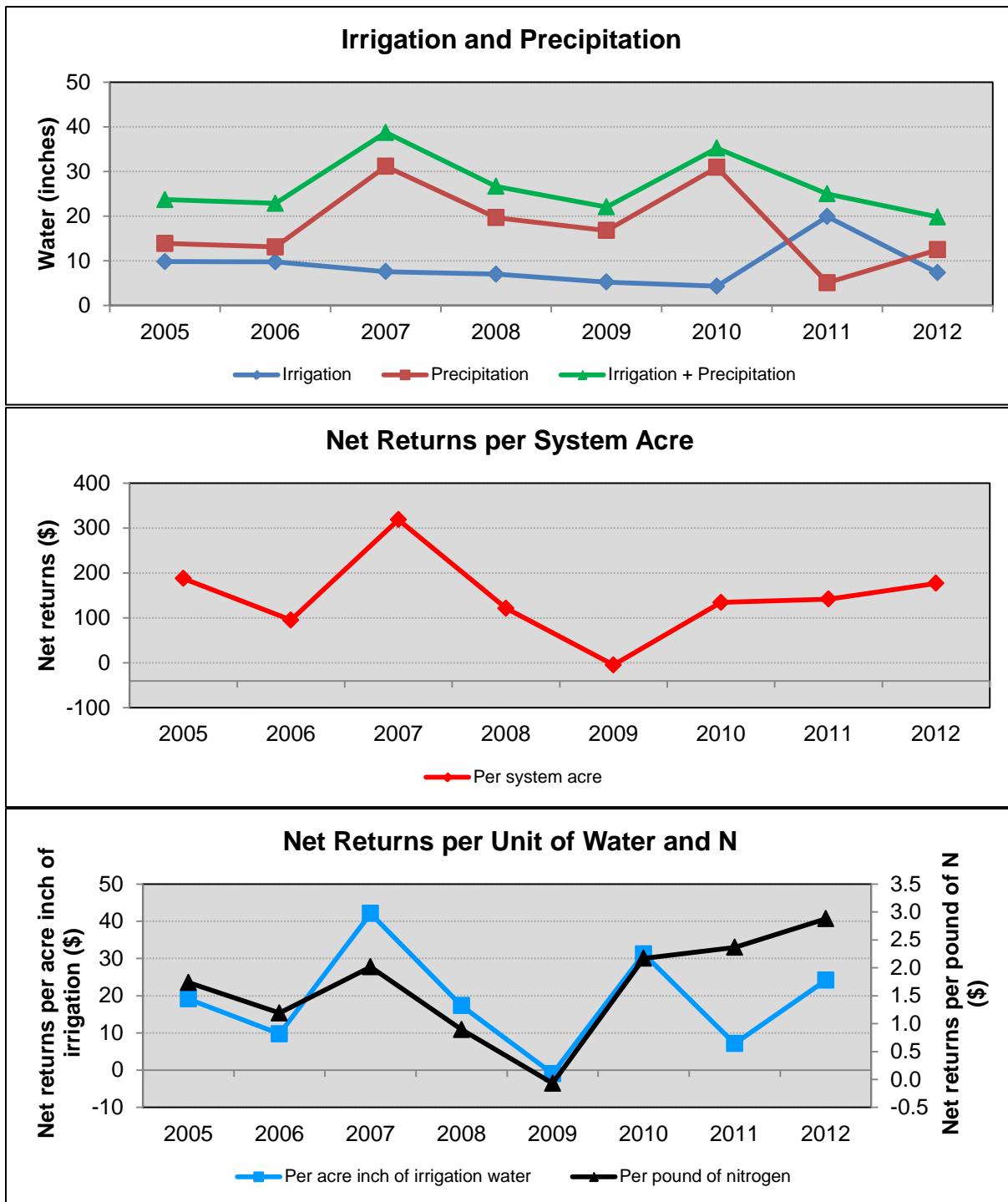


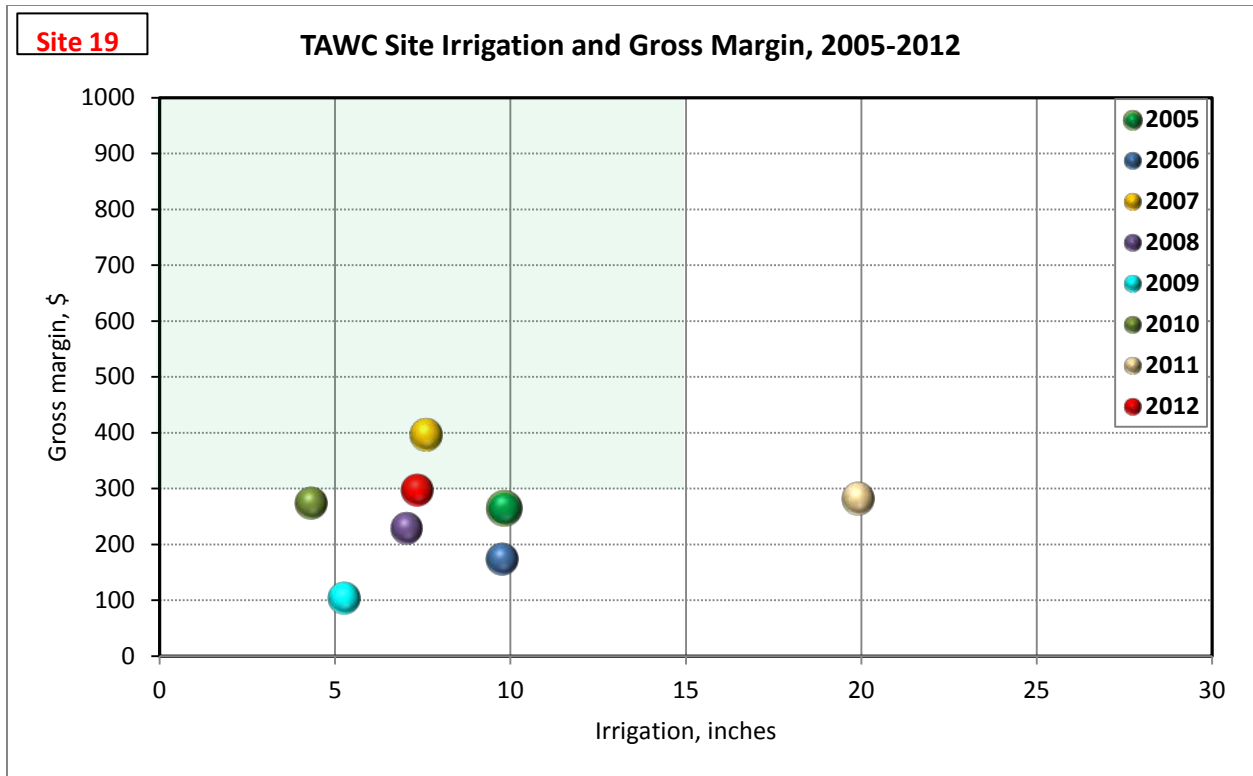
August cotton

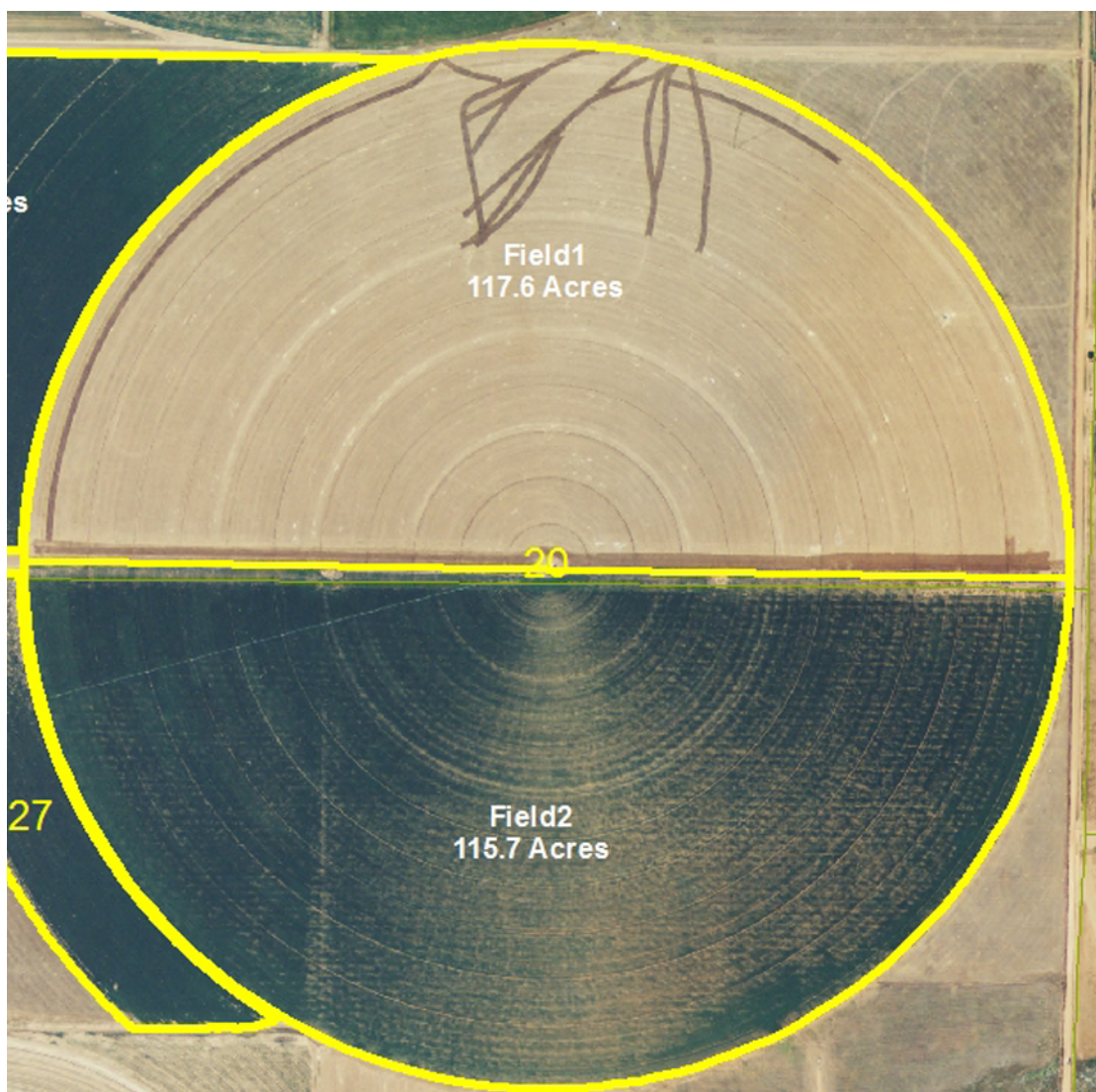


August cotton

Site 19







Site 20 Description

Total site acres: 233.3

Field No. 1 Acres: 117.6
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 115.7
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (LEPA)

Pumping capacity,
gal/min: 1000

Number of wells: 3

Fuel source: Electric

Site 20

	Livestock	Field 1	Field 2
2005	None	Wheat for silage followed by forage sorghum for silage	Corn for silage
2006	None	Corn for silage	Triticale for silage followed by forage sorghum for silage
2007	None	Triticale for silage, followed by corn for silage	Triticale for silage, followed by forage sorghum for silage
2008	None	Wheat for grain followed by grain sorghum for grain and residue for hay	Wheat for grain followed by grain sorghum for silage
2009	None	Cotton	Corn for silage
2010	None	Corn for silage	Triticale for silage followed by cotton
2011	None	Triticale for silage/hay and cotton double crop	Corn for silage
2012	None	Corn	Triticale for silage followed by cotton

Comments: This site was planted to corn and triticale for silage. After triticale harvest, cotton was planted no-till on forty-inch centers and corn was planted on forty-inch centers.



Triticale for silage

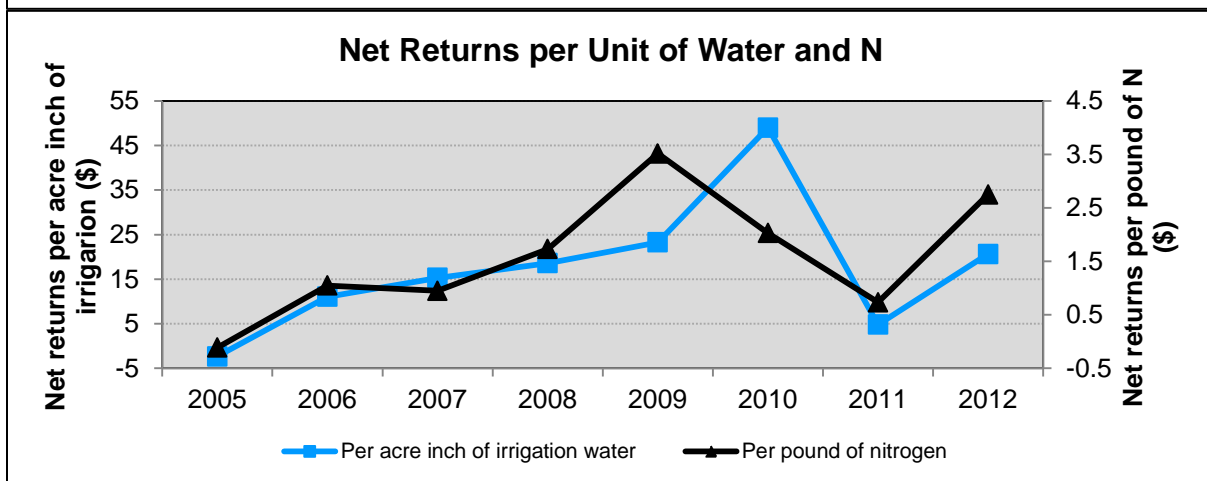
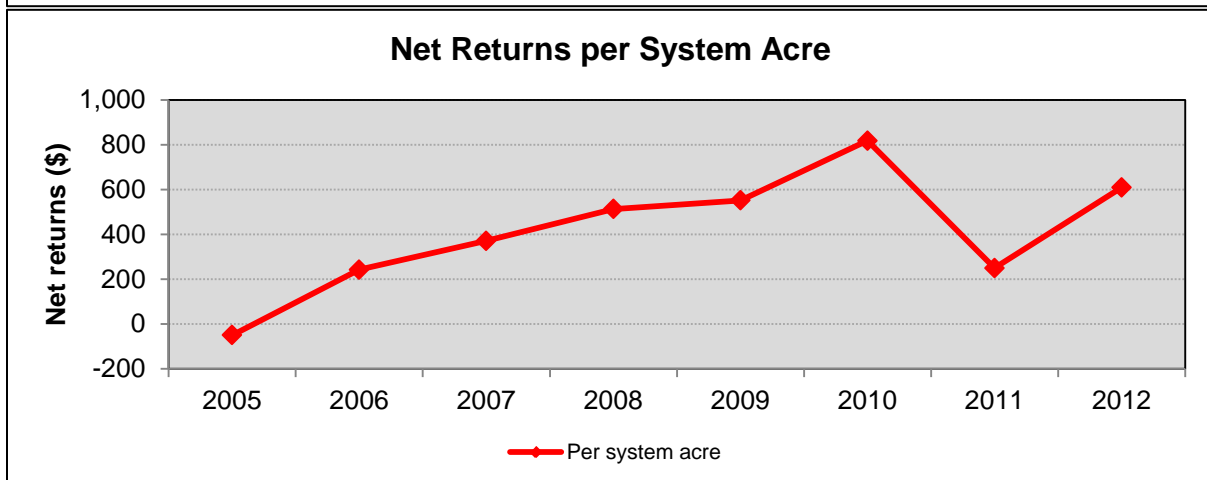
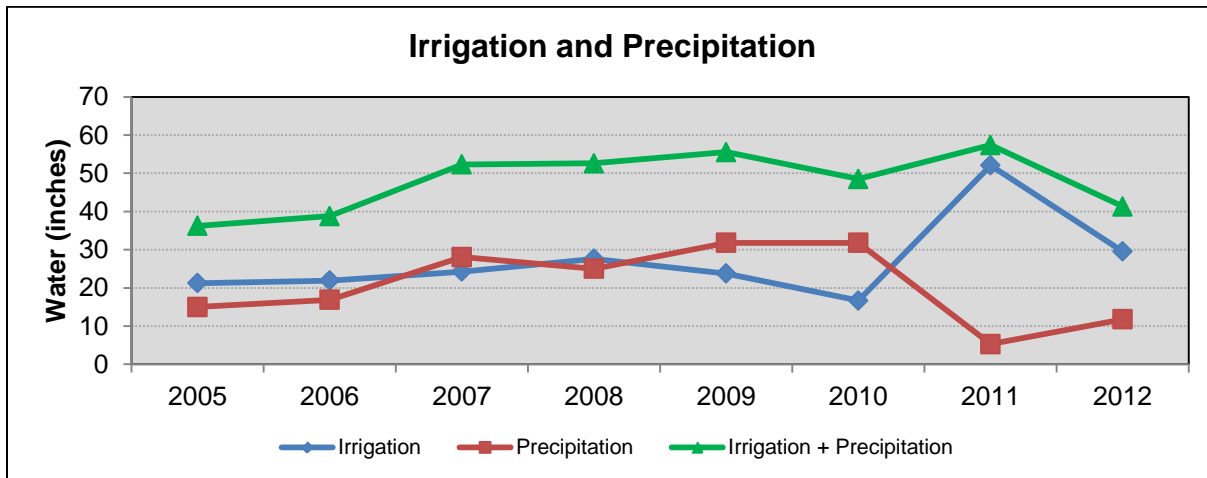


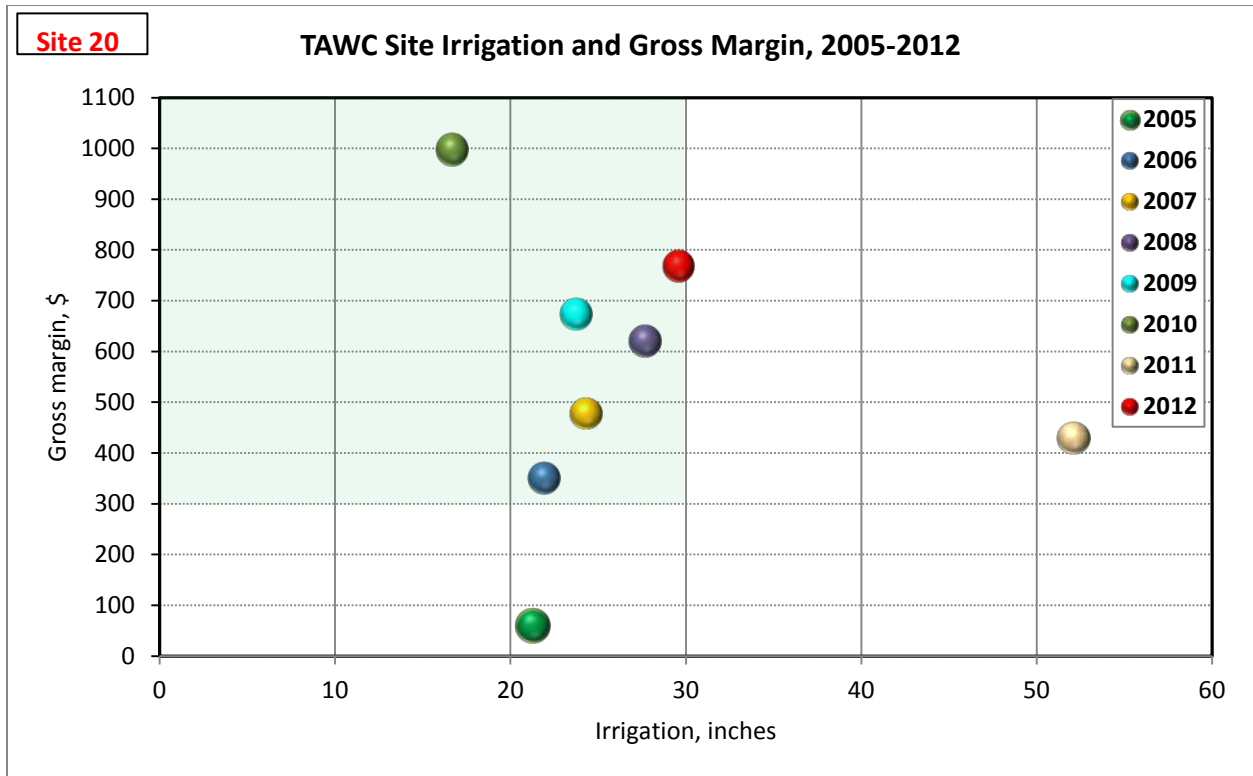
August cotton

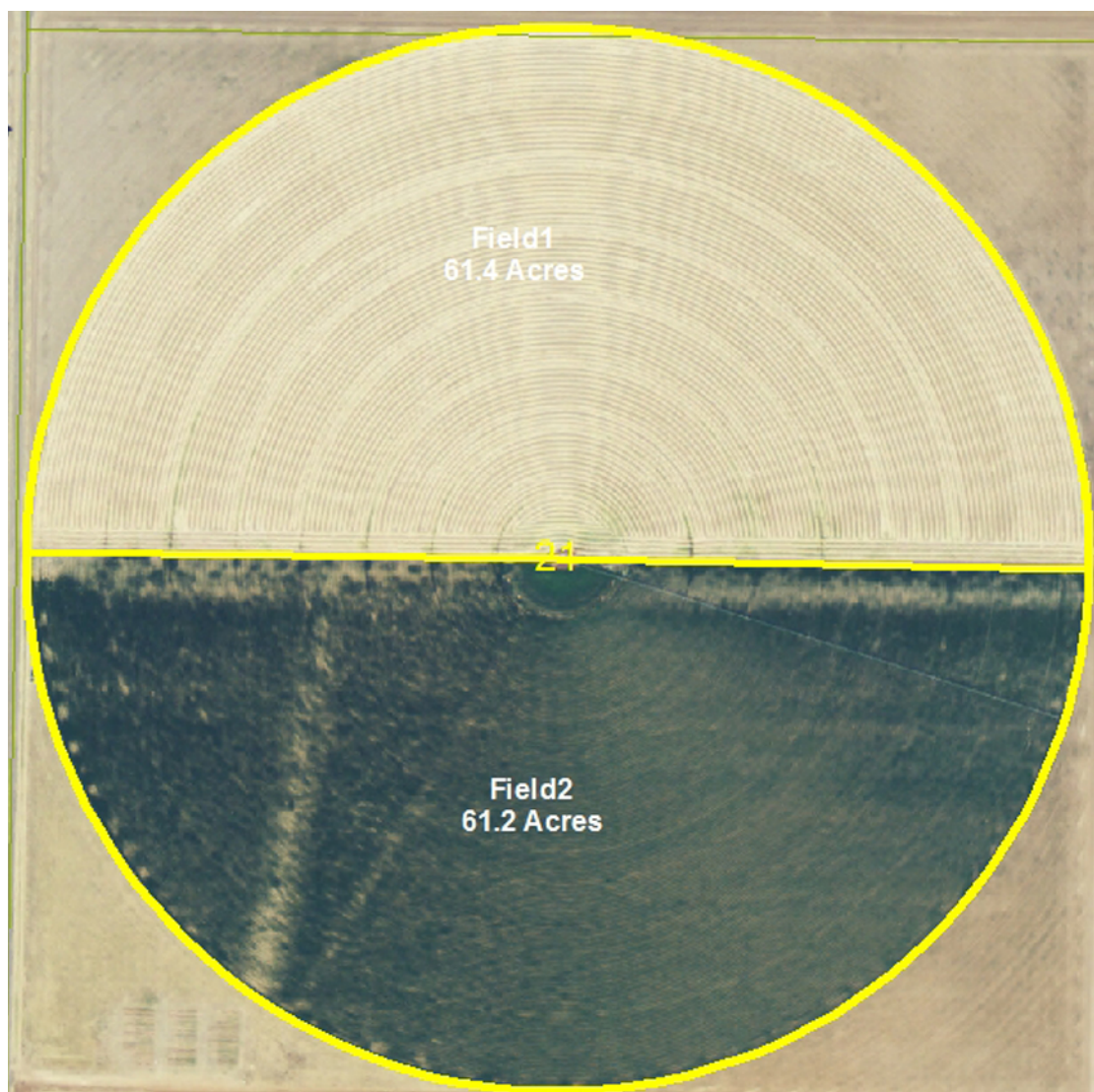


June corn

Site 20







Site 21 Description

Total site acres: 122.6

Field No. 1 Acres: 61.4
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 61.2
Major soil type: Pullman clay loam

Irrigation

Type: Center Pivot (LEPA)

Pumping capacity,
gal/min: 500

Number of wells: 1

Fuel source: Electric

Site 21

	Livestock	Field 1	Field 2
2005	None	Cotton	Cotton
2006	Stocker steers	Corn for grain	Wheat for grazing and cover followed by cotton
2007	None	Sideoats grama grass for seed and hay	Corn for grain
2008	None	Sideoats grama grass for seed and hay	Barley for seed followed by forage sorghum for hay
2009	None	Sideoats grama grass for seed and hay	Wheat/forage sorghum for hay
2010	None	Corn	Cotton
2011	None	Cotton	Corn abandoned
2012	None	Wheat/Haygrazer sudangrass	Cotton

Comments: This is a pivot irrigated site with one-half planted to wheat and one-half planted to cotton. Both crops are planted on 40-inch centers using conventional tillage. Following wheat harvest this field was drilled to forage sorghum for hay production.

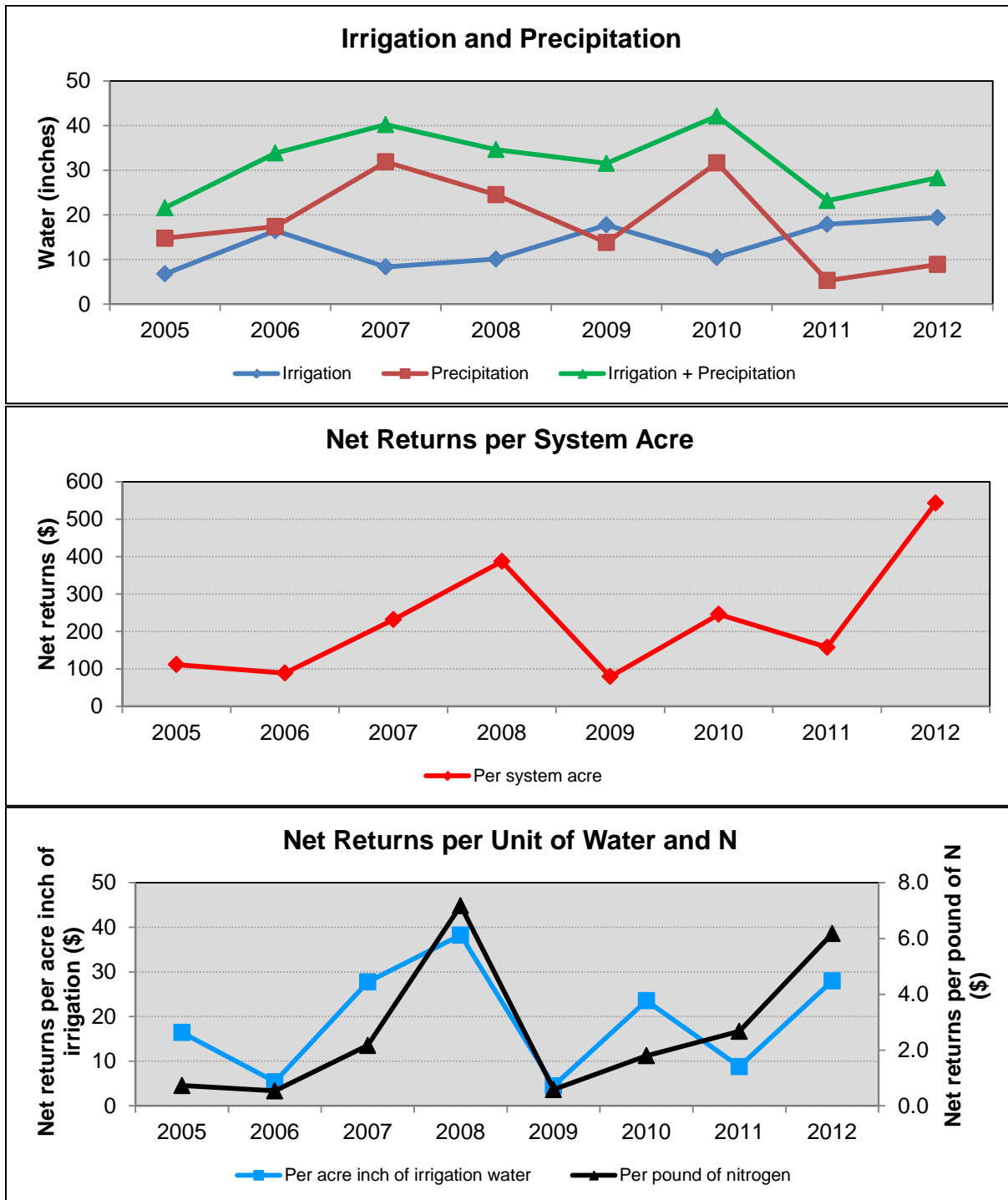


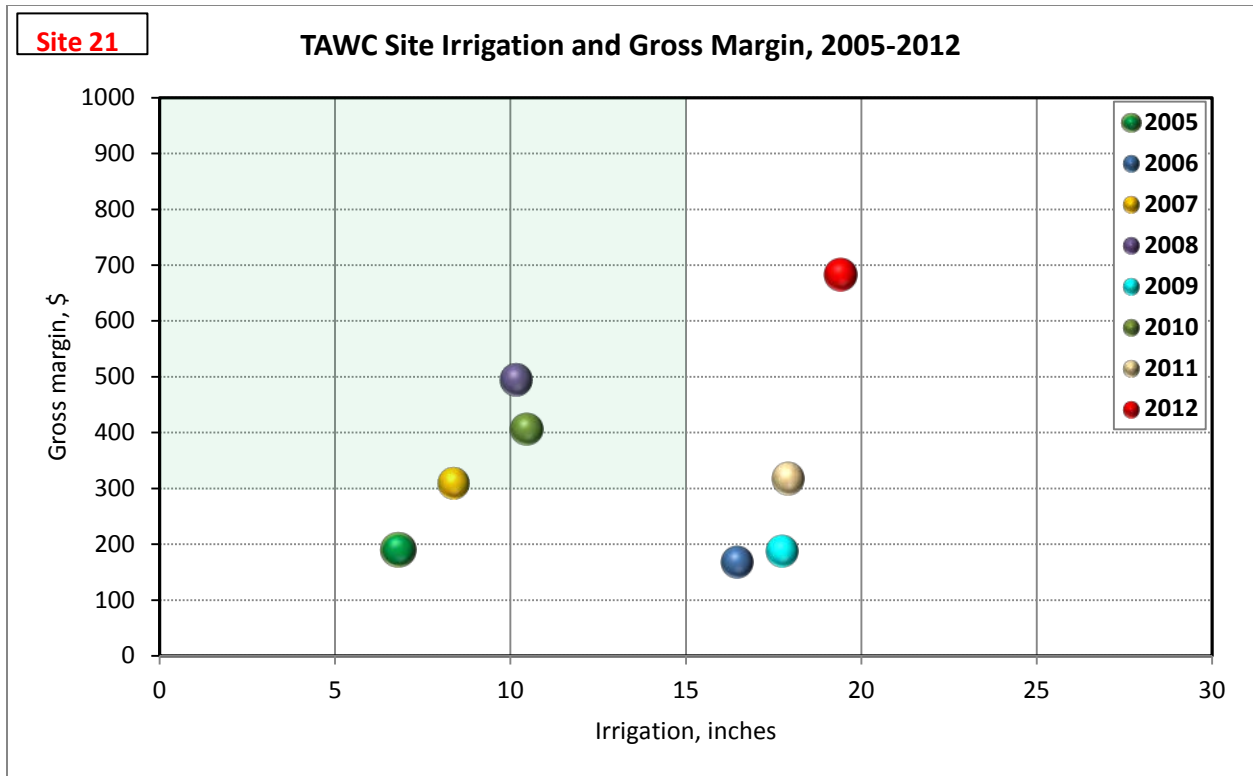
May wheat harvest

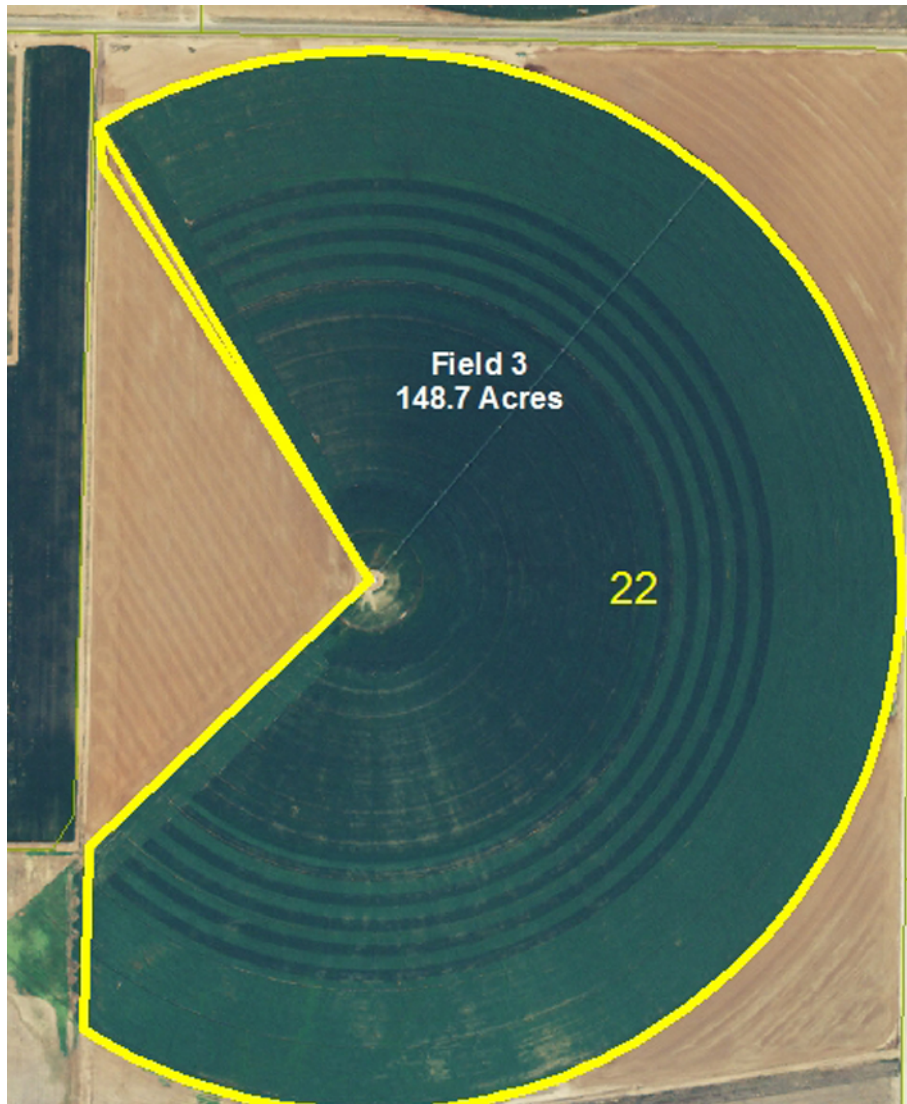


July cotton

Site 21







Site 22 Description

Total site acres: 148.7
 Field No. 3 Acres: 148.7
 Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (LEPA)
 Pumping capacity,
 gal/min: 800
 Number of wells: 4
 Fuel source: Electric

Site 22

	Livestock	Field 1	Field 2	Field 3
2005	None	Corn for grain	Cotton	
2006	None	Cotton	Corn for grain	
2007	None	Cotton following wheat cover crop	Cotton	
2008	None	Corn for grain	Corn for grain	
2009	None	Combined into Field 3		Cotton
2010	None			Corn
2011	None			Cotton
2012	None			Cotton

Comments: This is a pivot irrigated corn and cotton system. In 2012 both fields were planted to cotton on thirty-inch centers.

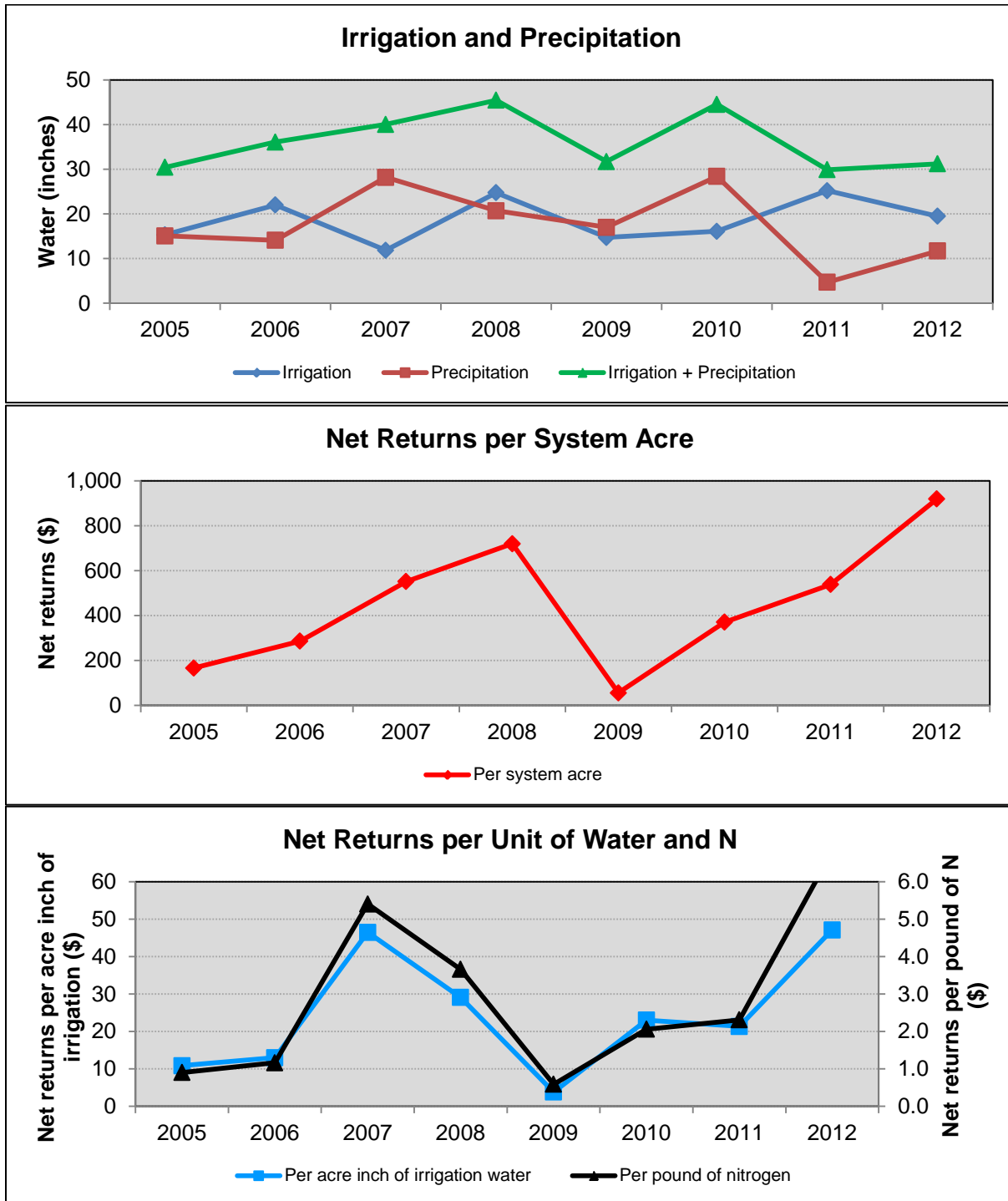


Pre-watering for cotton planting in April



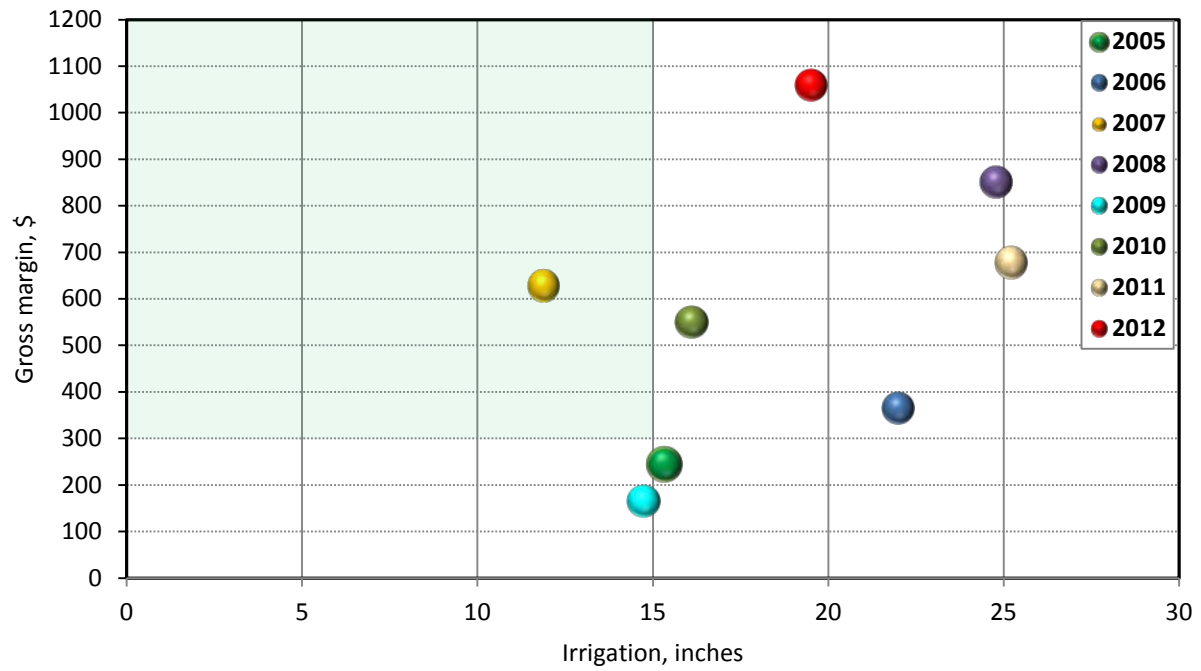
Cotton on 30-inch centers

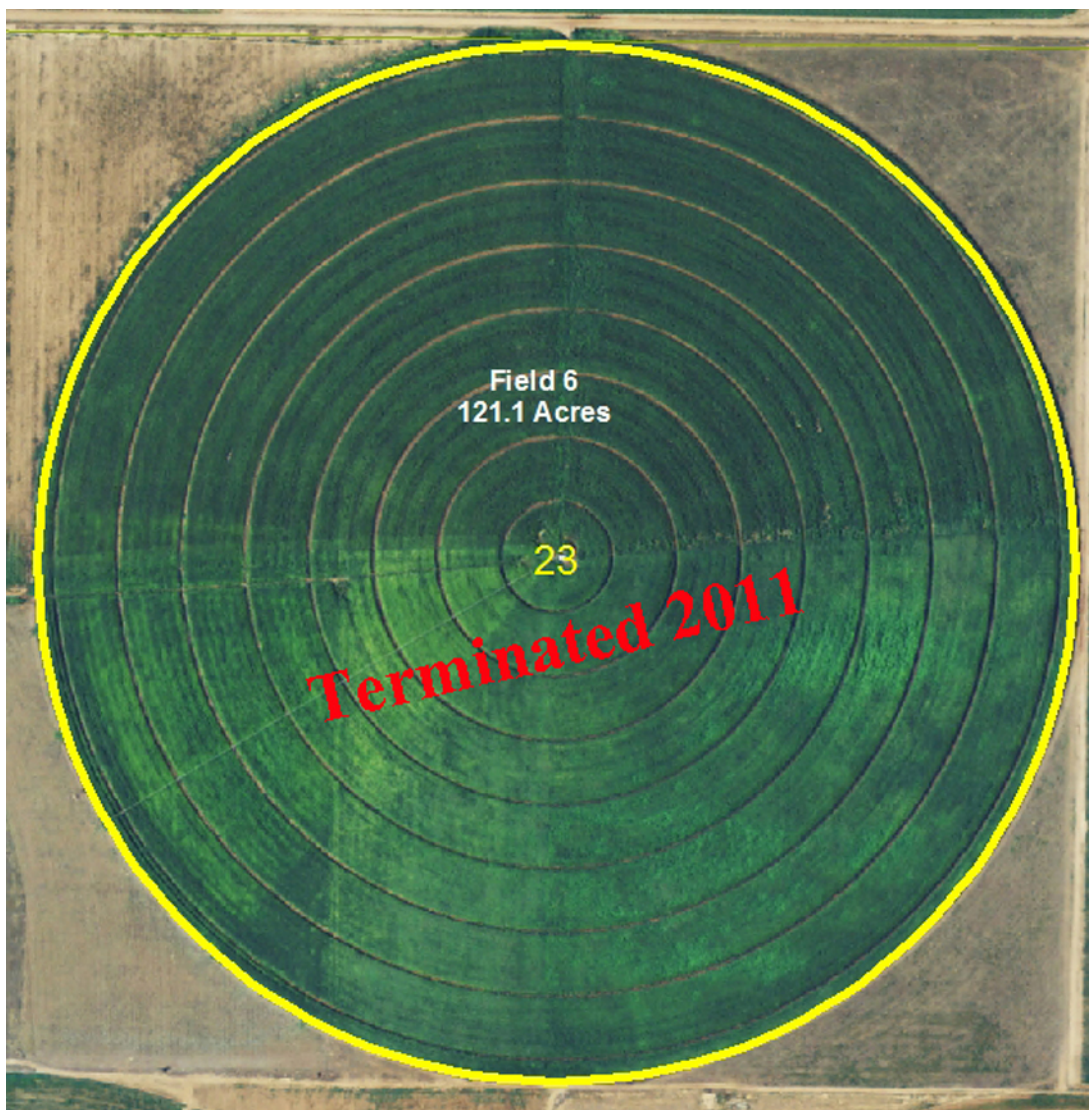
Site 22



Site 22

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 23 Description

Total site acres: 121.1
 Field No. 6 Acres: 121.1
 Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

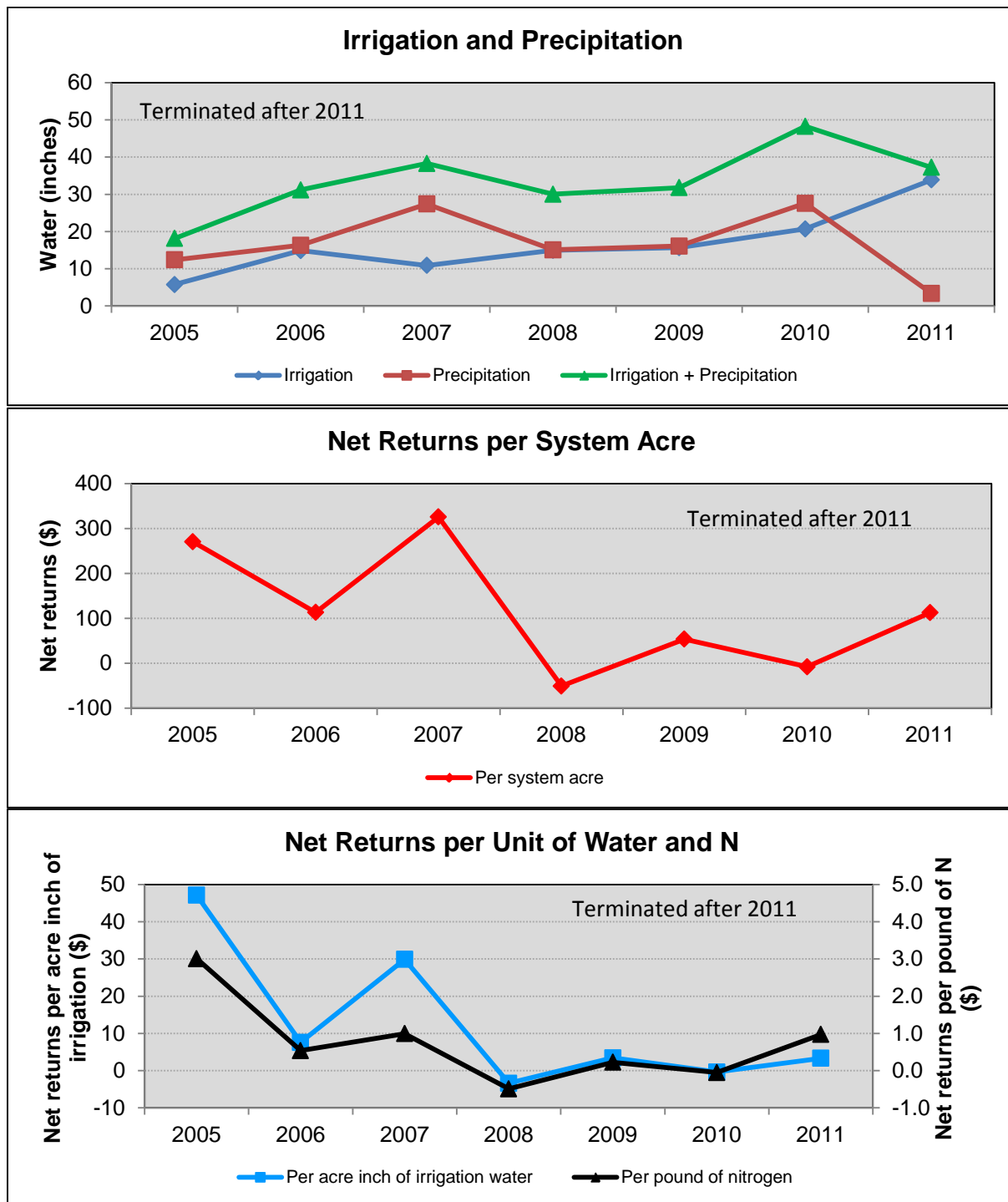
Type: Center Pivot (LESA)
 Pumping capacity,
 gal/min: 800
 Number of wells: 2
 Fuel source: Natural gas

Site 23

	Livestock	Field 1	Field 2	Field 3	Field 4	Field 5	Field 6
2005	None	Cotton	Sunflowers for seed	Cotton (dryland)			
2006	None	Cotton	Corn for grain	Cotton			
2007	None	Corn for grain	Corn for grain	Corn for grain			
2008	None	Split into Fields 4 and 5		Sunflowers	Sunflowers	Cotton	
2009	None			Combined with Field 4	Oats/forage sorghum for silage	Wheat/forage sorghum for silage	
2010	None				Combined to create Field 6		Triticale for silage/corn for silage
2011	None						Triticale/corn silage

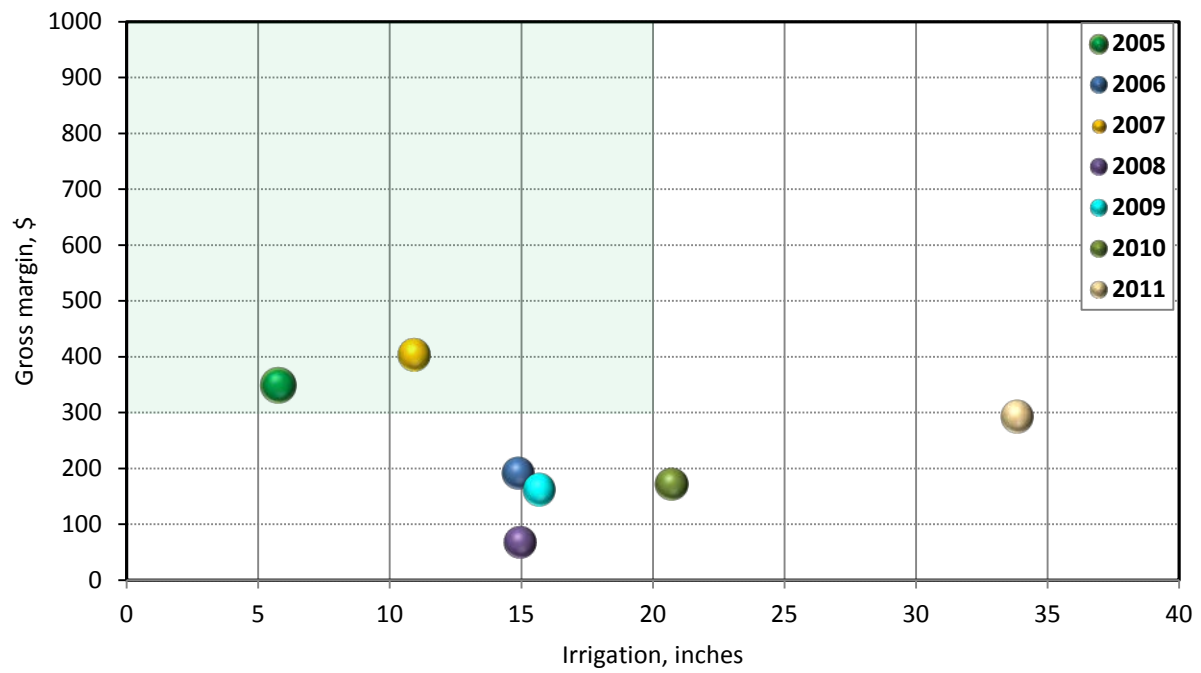
Comments: This pivot was planted to triticale then double cropped to corn with both crops being harvested for silage.

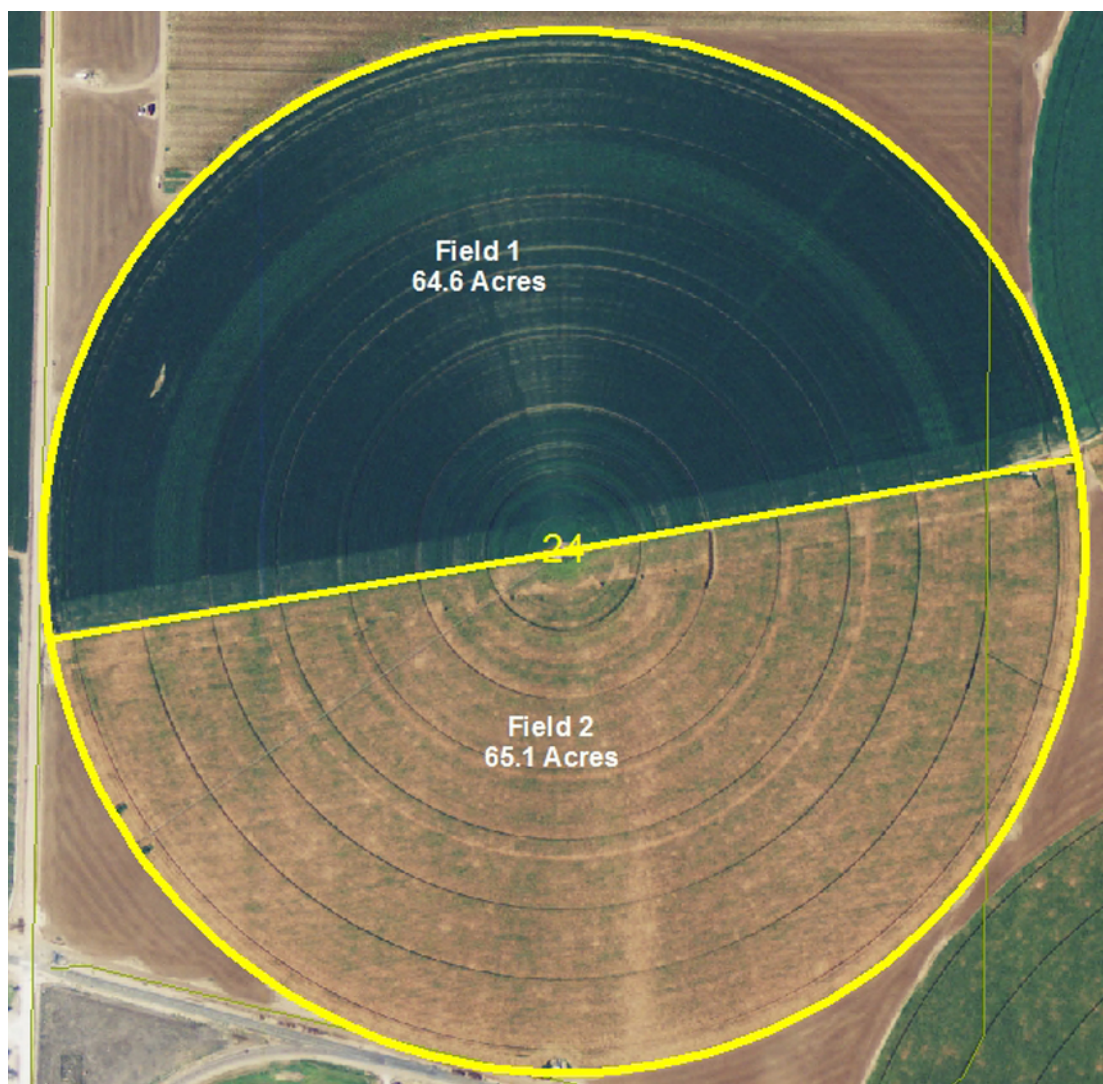
Site 23



Site 23

TAWC Site Irrigation and Gross Margin, 2005-2011





Site 24 Description

Total site acres: 129.7

Field No. 1 Acres: 64.6
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 65.1
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (LESA)

Pumping capacity,
gal/min: 700

Number of wells: 1

Fuel source: Diesel

Site 24

	Livestock	Field 1	Field 2
2005	None	Cotton	Corn for grain
2006	None	Corn for grain	Cotton
2007	None	Corn for grain	Corn for grain
2008	None	Corn for grain	Corn for grain
2009	None	Corn	Sunflowers
2010	None	Corn	Corn
2011	None	Corn	Cotton
2012	None	Cotton	Corn

Comments: This has been a corn/cotton/sunflower pivot irrigated system using conventional tillage. In 2012 this system was planted to white food corn and cotton.

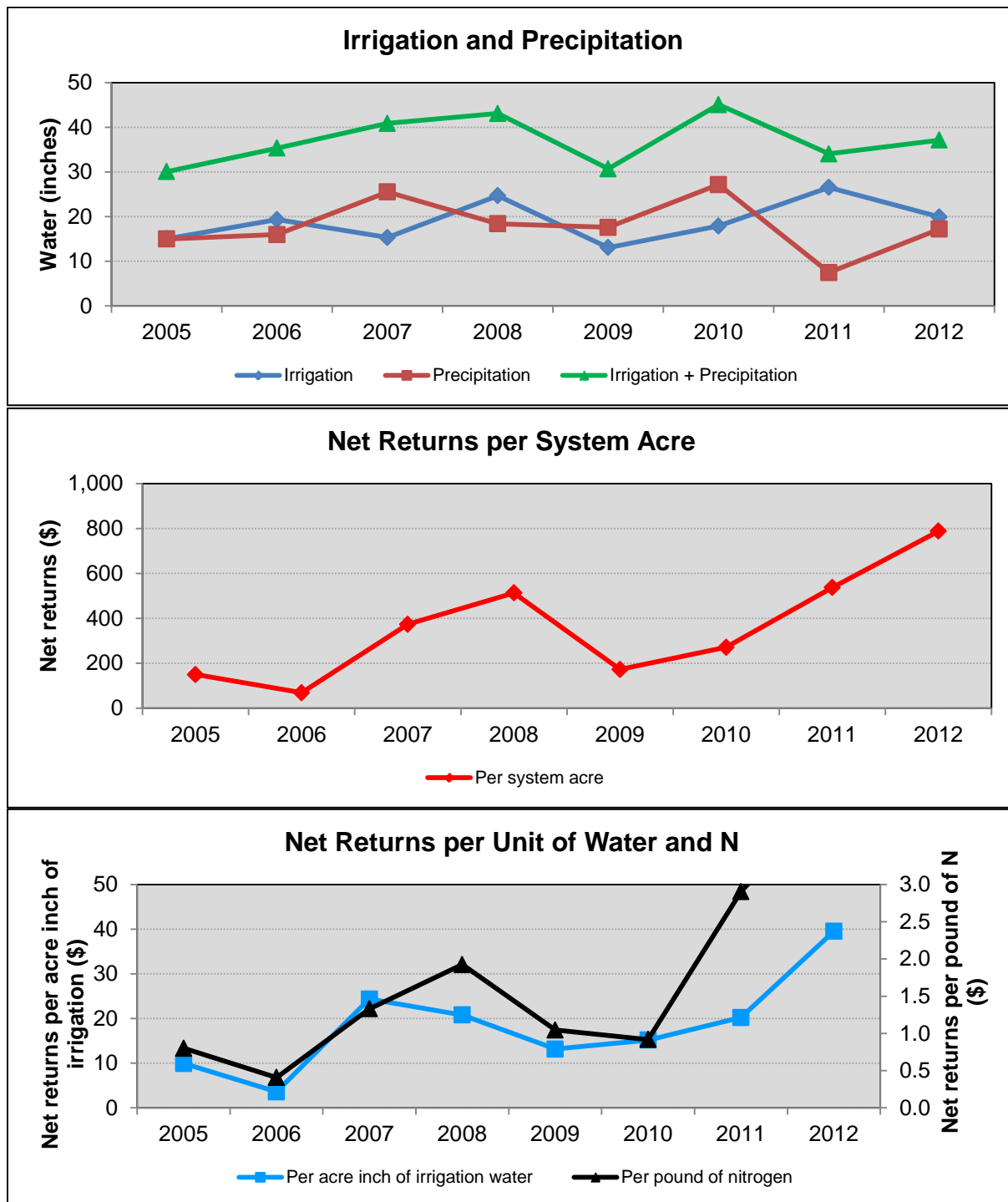


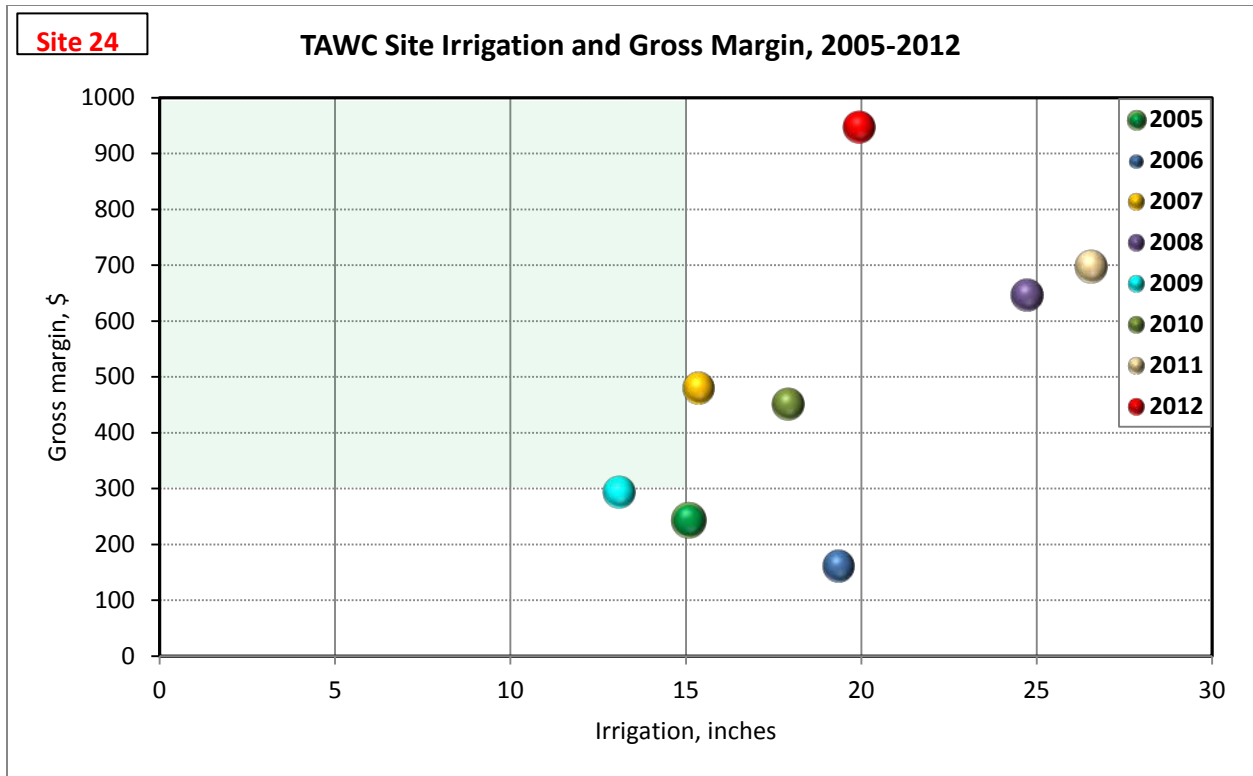
July corn



August cotton in bloom

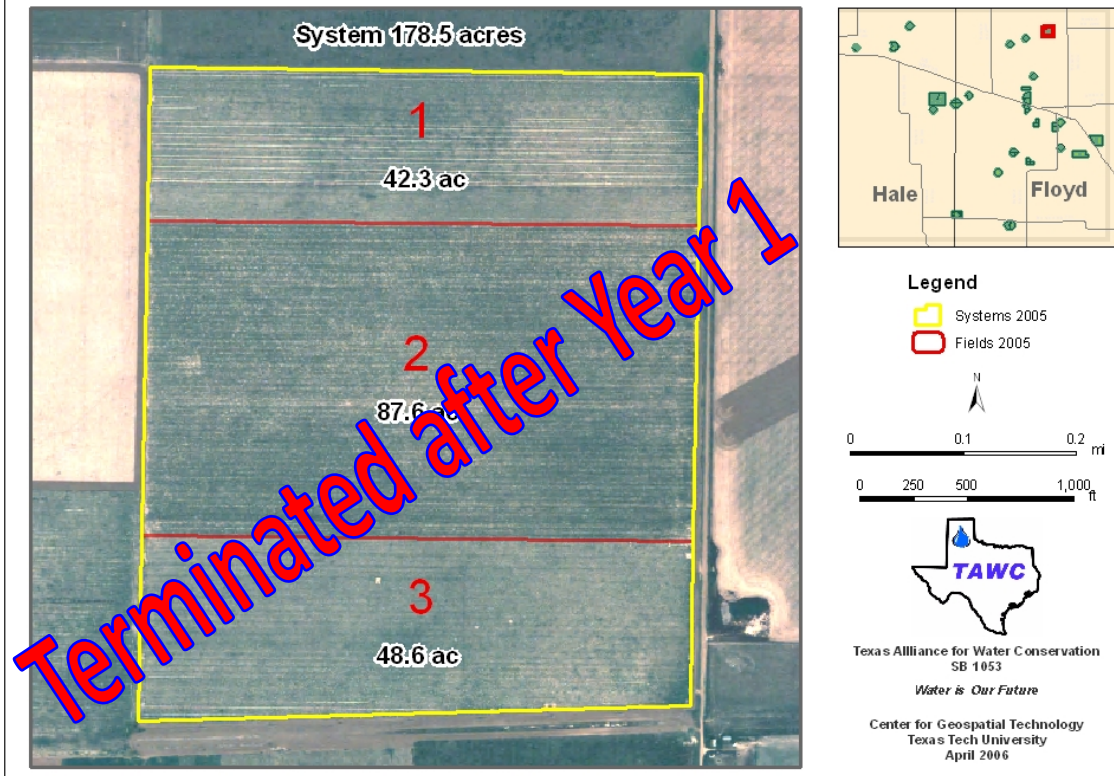
Site 24





Site 25

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Site 25 Description

Total site acres: 178.5

Field No. 1 Acres: 42.3
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 87.6
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3 Acres: 48.6
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Dryland

Pumping capacity, gal/min:

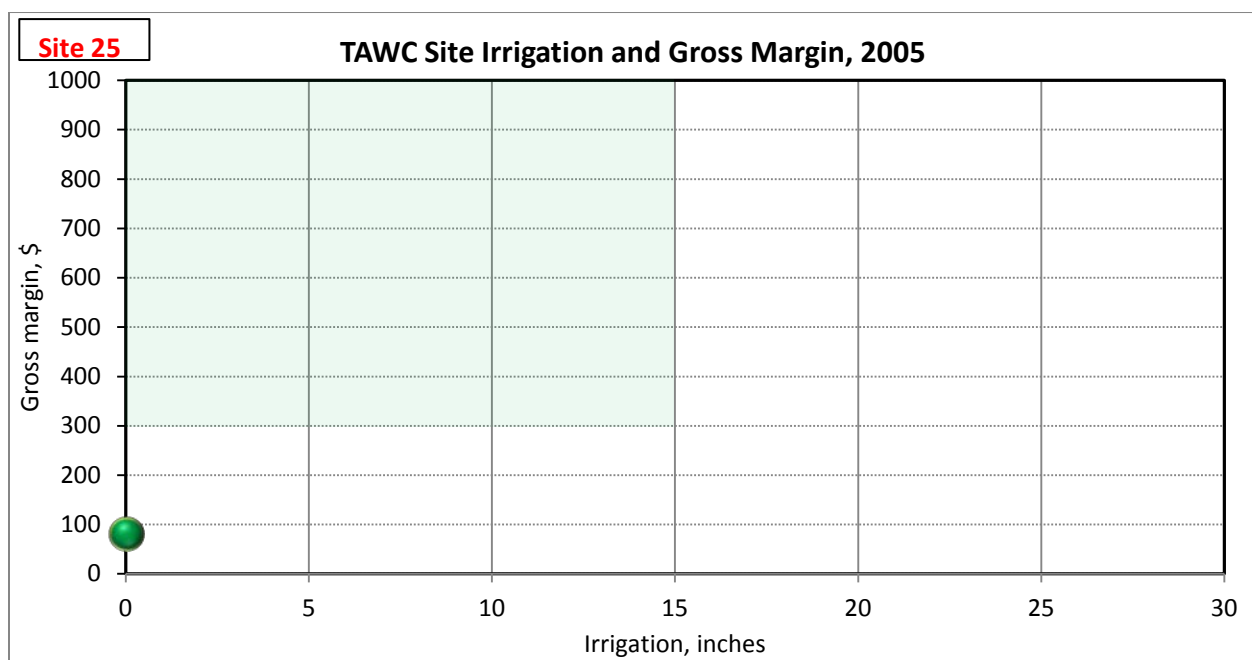
Number of wells:

Fuel source:

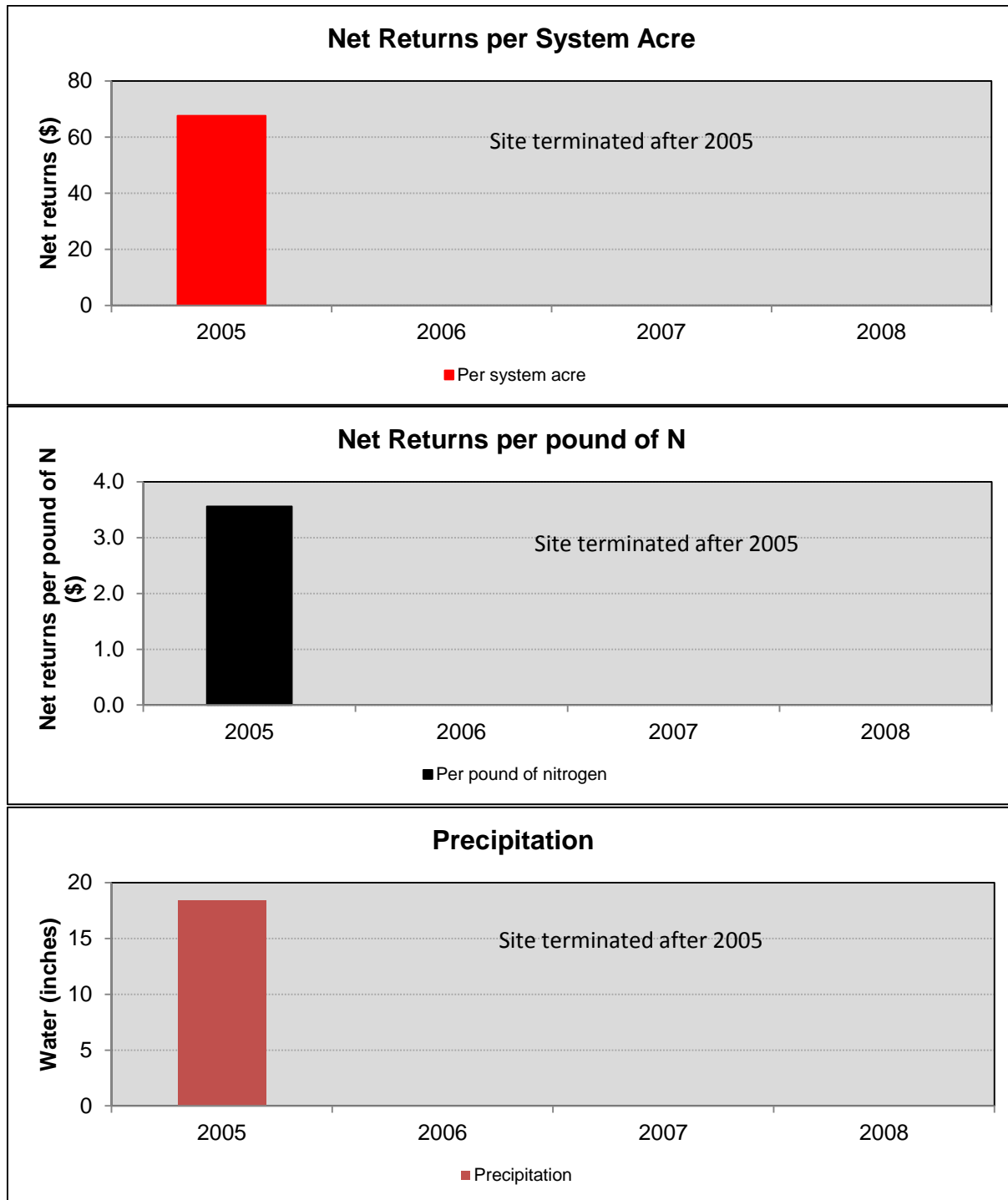
Comments: At this dryland site cotton and grain sorghum were grown in rotation. The cotton was planted in standing grain sorghum stalks. Cotton and grain sorghum were planted on 40-inch centers.

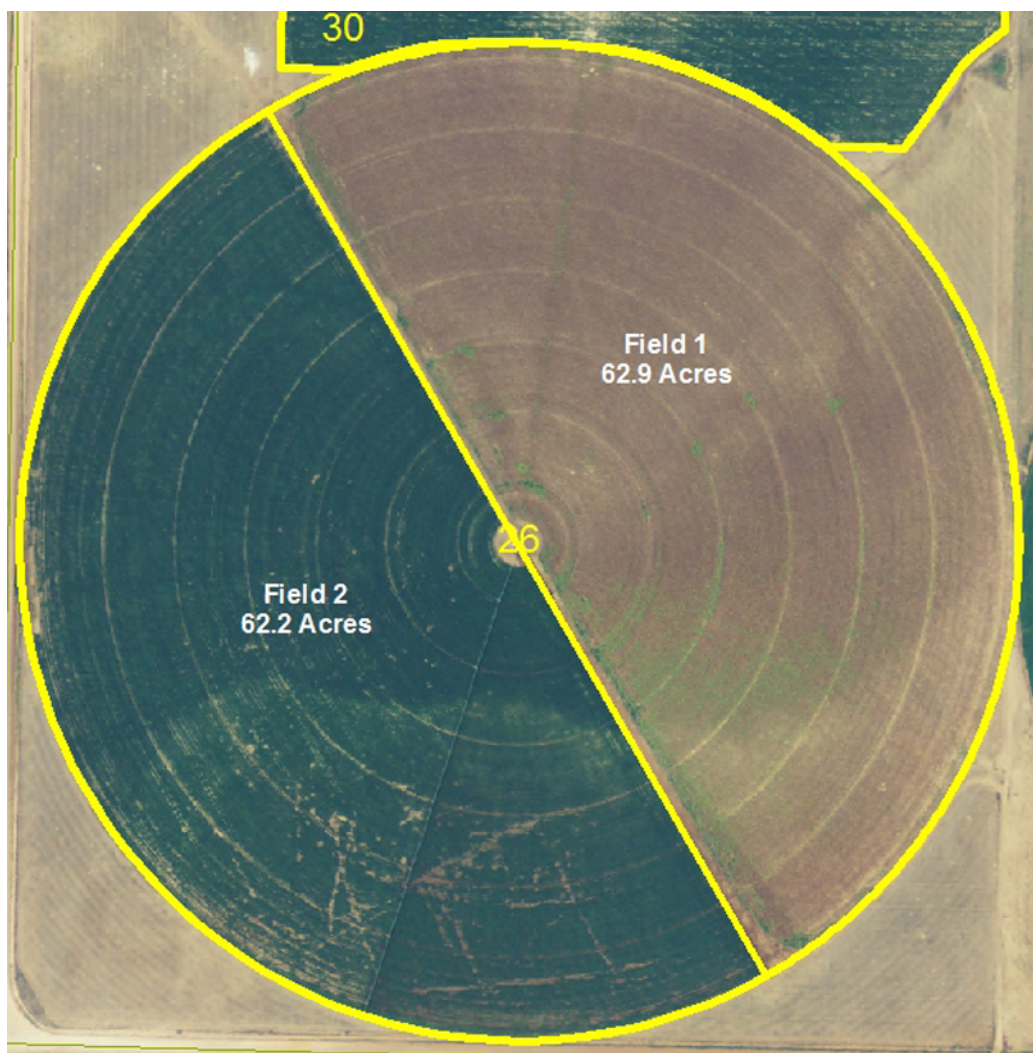
Site 25
Dryland

	Livestock	Field 1	Field 2	Field 3
2005	None	Cotton	Grain sorghum	Cotton
2006	Site terminated in 2006			



Site 25 - Dryland





Site 26 Description

Total site acres: 125.1

Field No. 1 Acres: 62.9
Major soil type: Bippus loam; 0 to 3% slope
Mansker loam; 3 to 5% slope

Field No. 2 Acres: 62.2
Major soil type: Bippus loam; 0 to 3% slope
Mansker loam; 3 to 5% slope

Irrigation

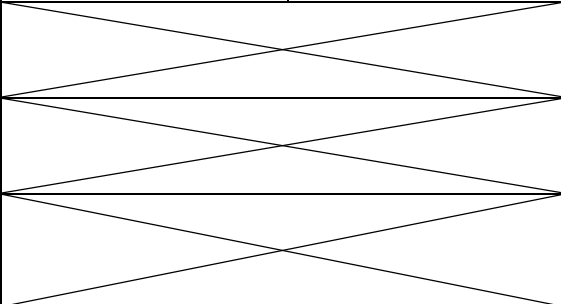

Type: Center Pivot (LESA)

Pumping capacity,
gal/min: 600

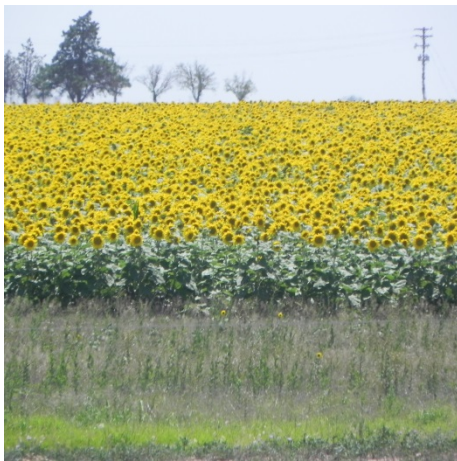
Number of wells: 2

Fuel source: 1 Electric
1 Diesel

Site 26

	Livestock	Field 1	Field 2	Field 3	Field 4
2005	None	Cotton	Corn for grain		
2006	None	Corn for grain	Cotton		
2007	Cow-calf	Pearlmillet for seed and grazing of residue	Corn for grain		
2008	Cow-calf	Split into Fields 3 and 4	Pearlmillet for seed and grazing of residue	Grain sorghum for seed and grazing of residue	Corn for grain and grazing of residue
2009	Stocker	Sunflowers	Corn	Combined to make fields 1 and 2	
2010	Cow-calf	Wheat for grazing/corn for grain	Cotton		
2011	None	Cotton	Corn		
2012	None	Sunflowers	Cotton		

Comments: This was a sunflower/corn system for 2012. Cotton was planted on 20-inch centers.

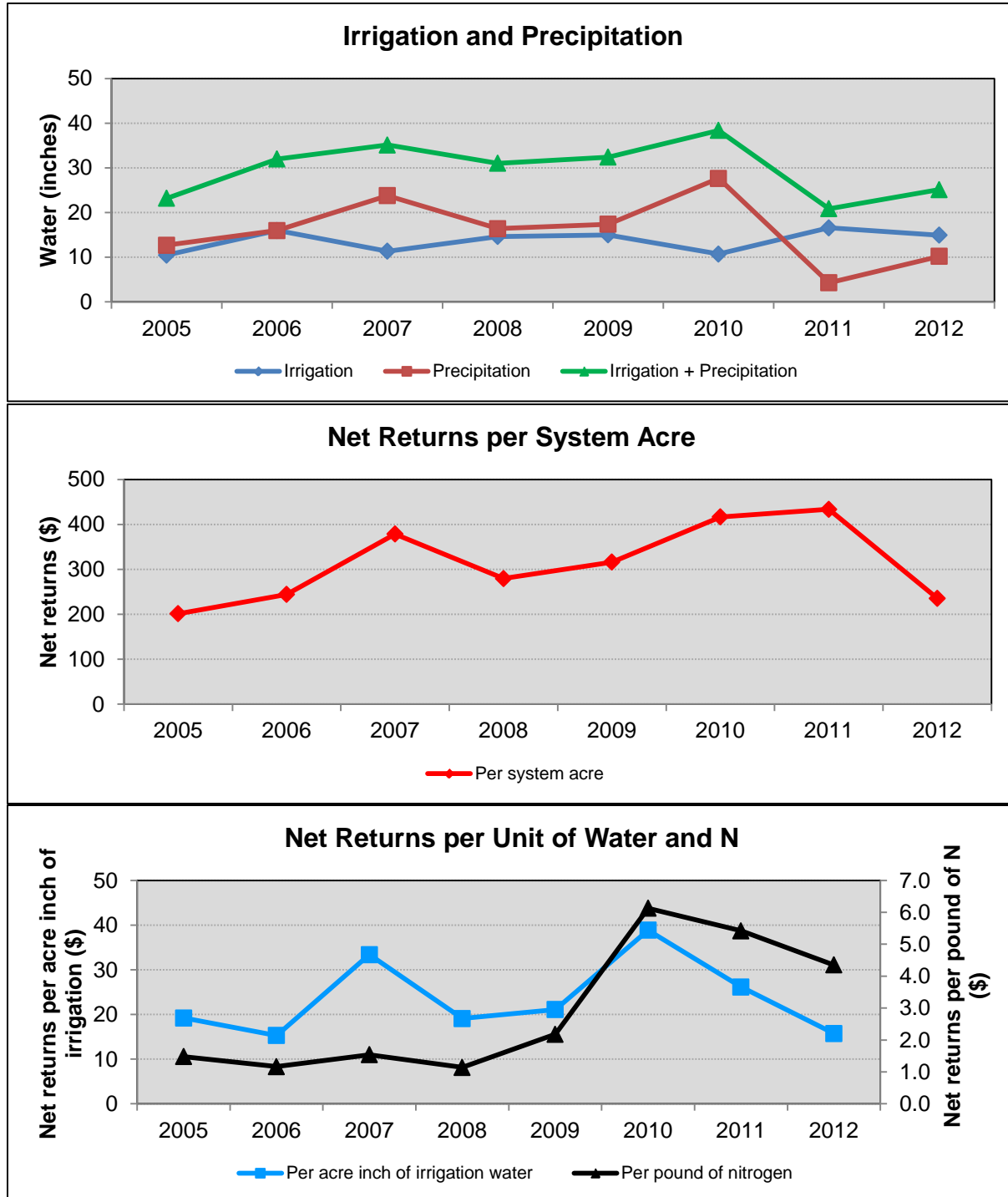


July sunflowers



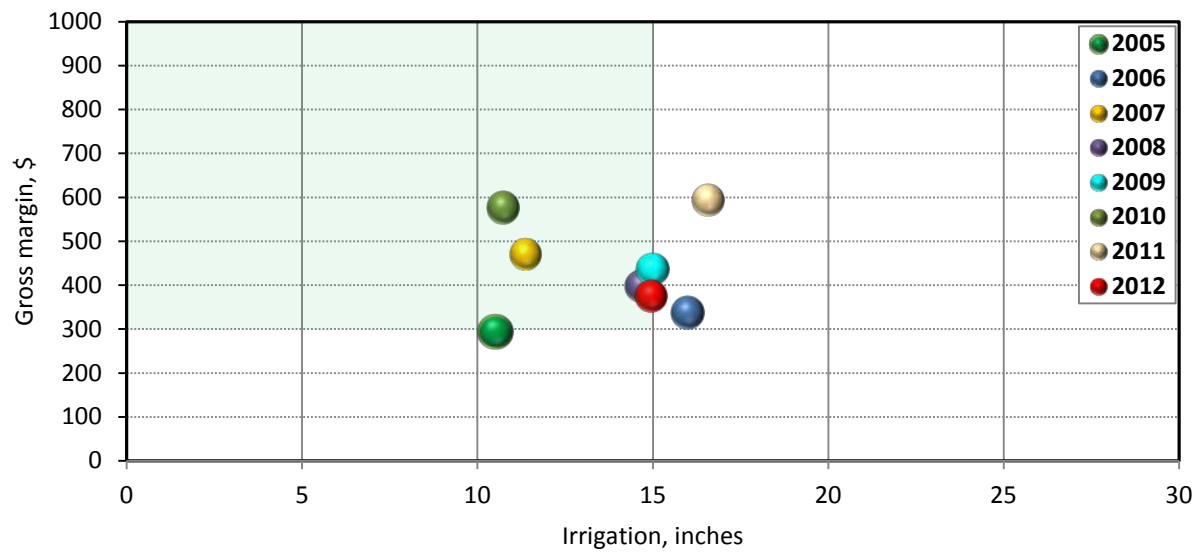
Cotton planted on 20" rows

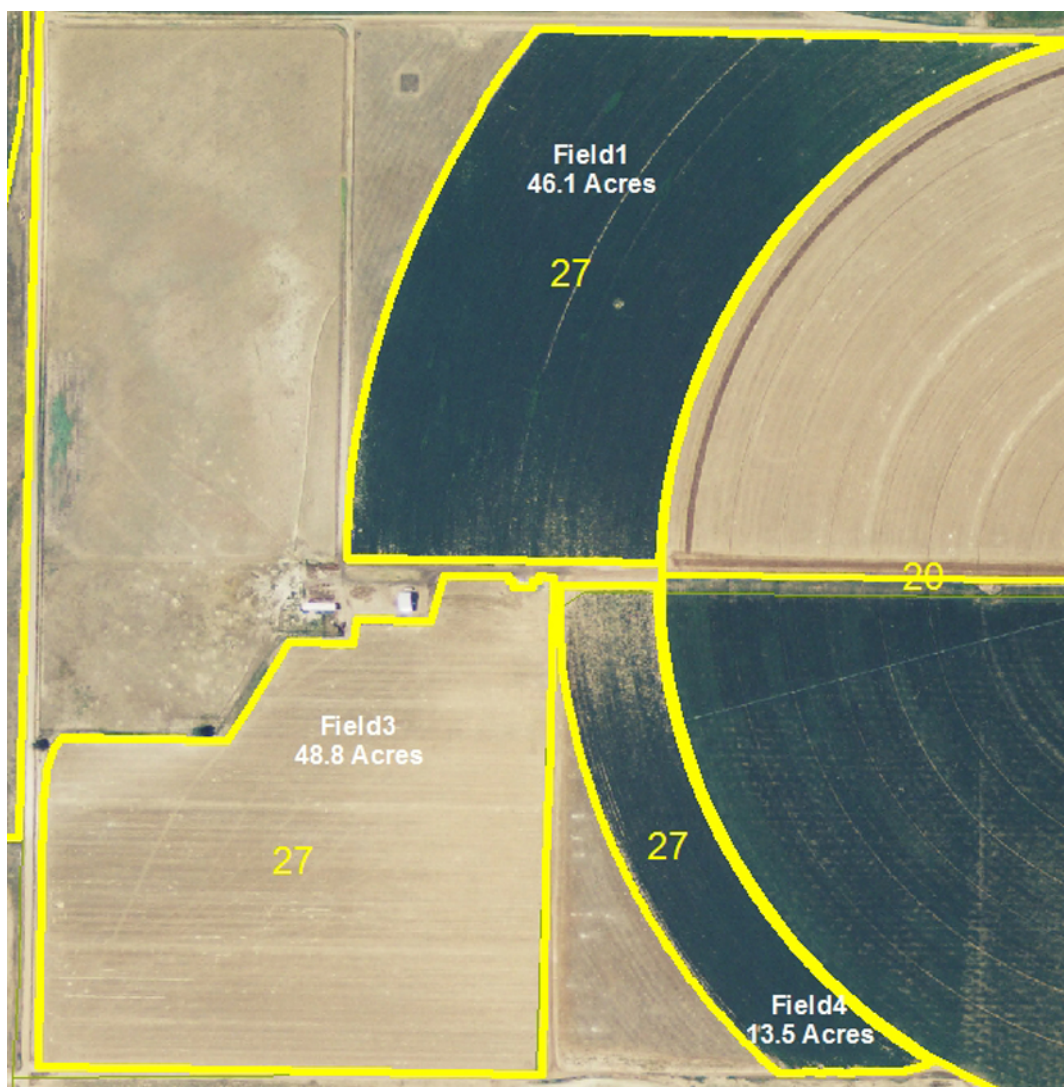
Site 26



Site 26

TAWC Site Irrigation and Gross Margin, 2005-2012





Site 27 Description

Total site acres: 108.4

Field No. 1 Acres: 46.1
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3 Acres: 48.8
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 4 Acres: 13.5
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Subsurface Drip
(SDI, installed prior to 2006 crop year)

Pumping capacity, gal/min: 400

Number of wells: 2

Fuel source: Electric

Site 27

	Livestock	Field 1	Field 2	Field 3	Field 4
2005	Entered project in Year 2				
2006	None	Cotton following wheat cover crop			
2007	None	Corn for silage			
2008	None	Cotton following wheat cover crop	Additional acres added to create Field 3	Corn for grain	Corn for grain – high moisture
2009	None	Corn for silage		Cotton	Corn for silage
2010	None	Cotton		Corn for silage	Cotton
2011	None	Corn abandoned		Cotton abandoned	Corn abandoned
2012	None	Cotton		Corn for silage	Cotton

Comments: This is the sixth year for this cotton/corn drip irrigated site. Corn is planted on twenty-inch centers with cotton planted on forty-inch centers.

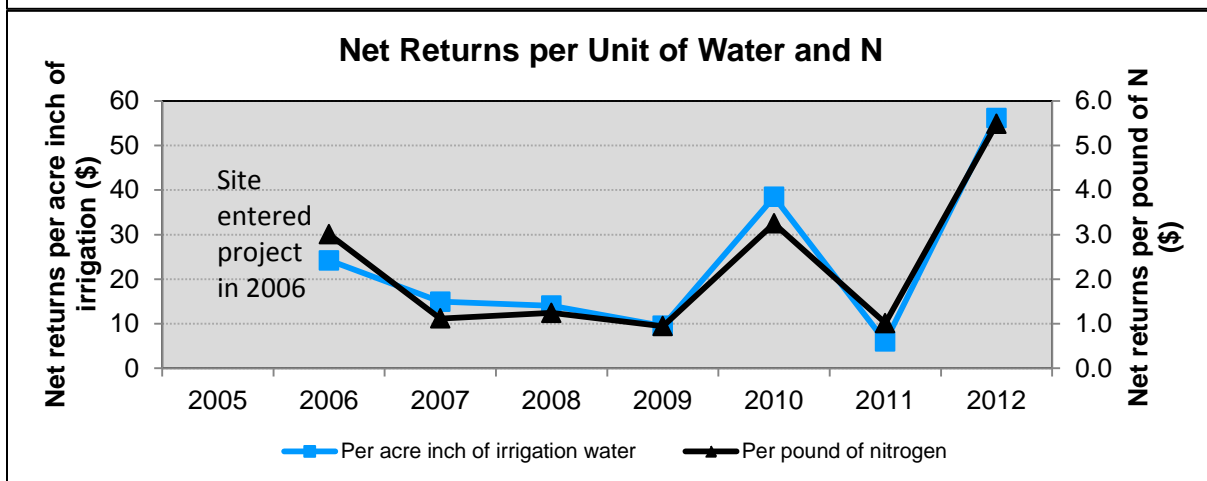
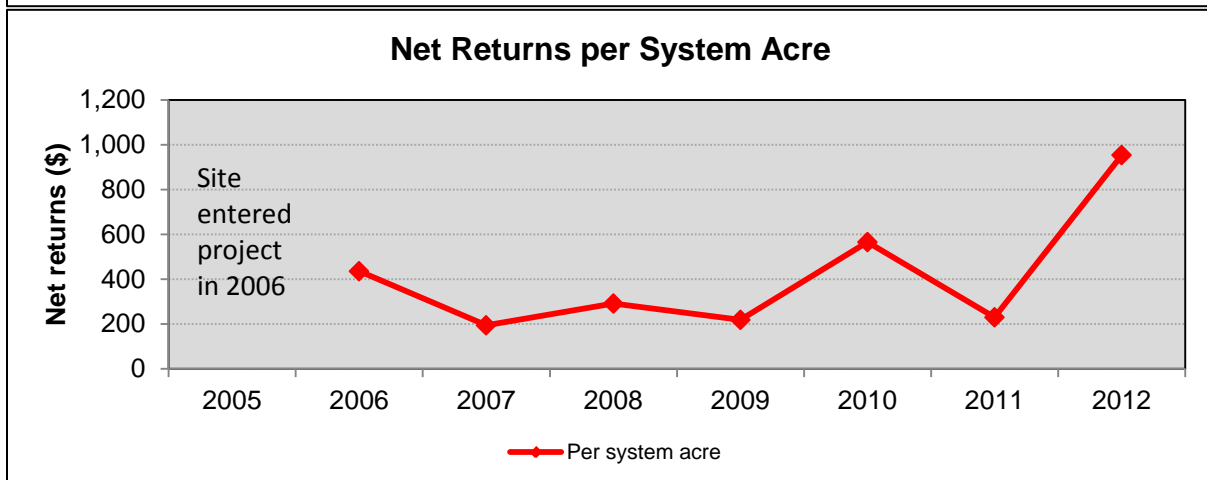
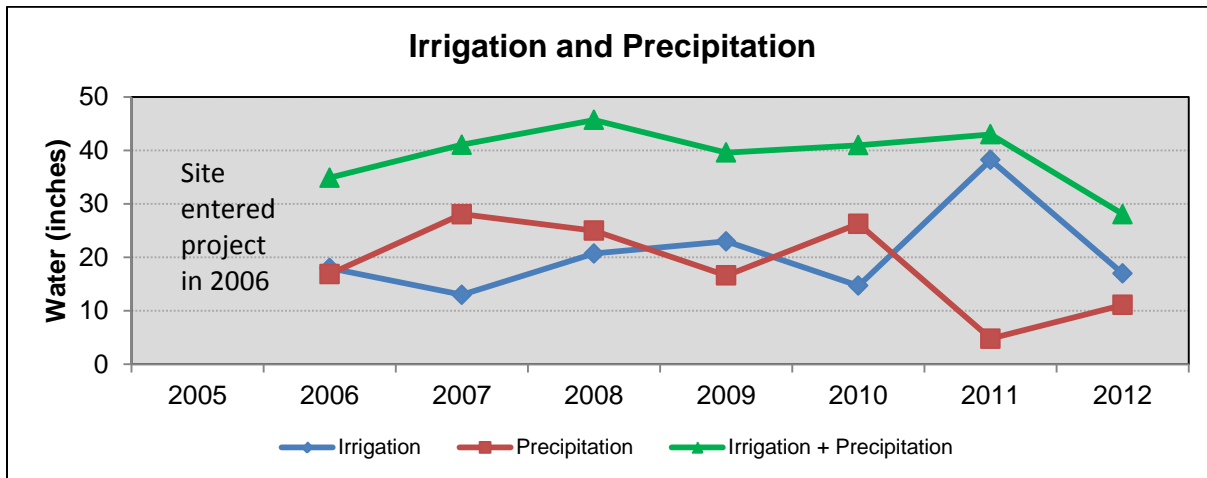


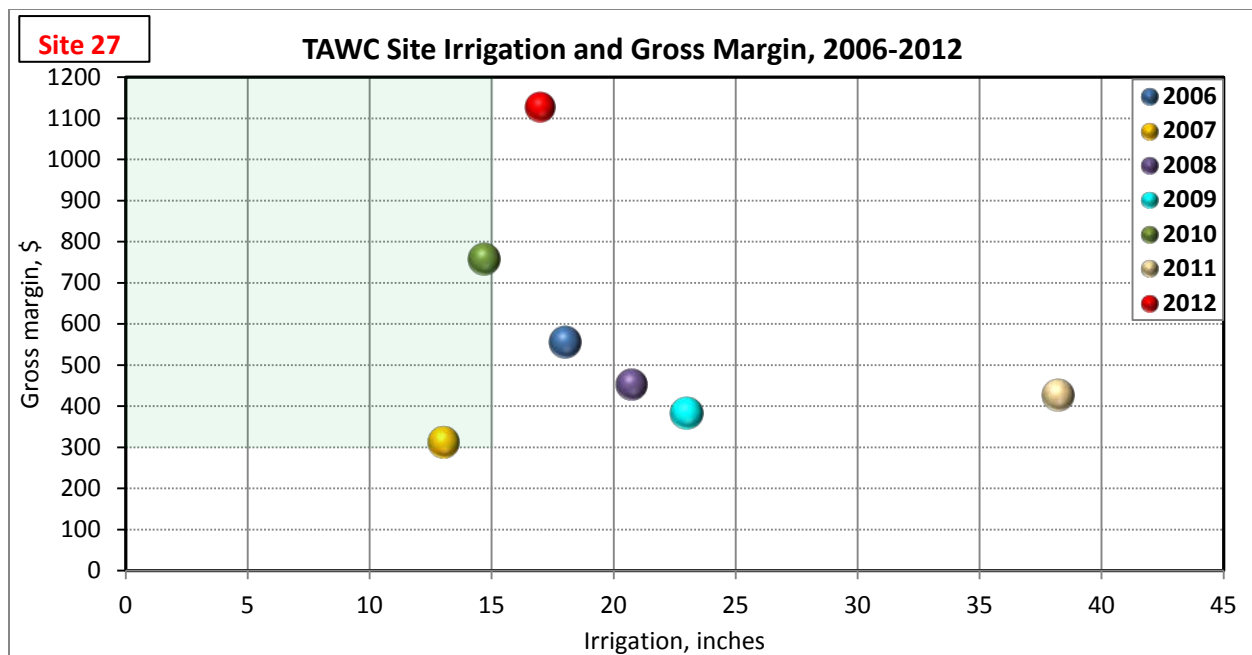
June cotton



August cotton

Site 27







Site 28 Description

Total site acres: 51.4
 Field No. 1 Acres: 51.4
 Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Subsurface Drip (SDI)
 Pumping capacity, gal/min: 300
 Number of wells: 1
 Fuel source: electric

Site 28

	Livestock	Field 1
2005	Entered project in Year 4	
2006		
2007		
2008	None	Corn for grain
2009	None	Cotton
2010	None	Cotton
2011	None	Cotton
2012	None	Cotton

Comments: This is the fifth year for this drip irrigated site to be in the project. In 2012 this site was planted to cotton on 40-inch centers. The cotton was lost due to hail and replanted to corn.

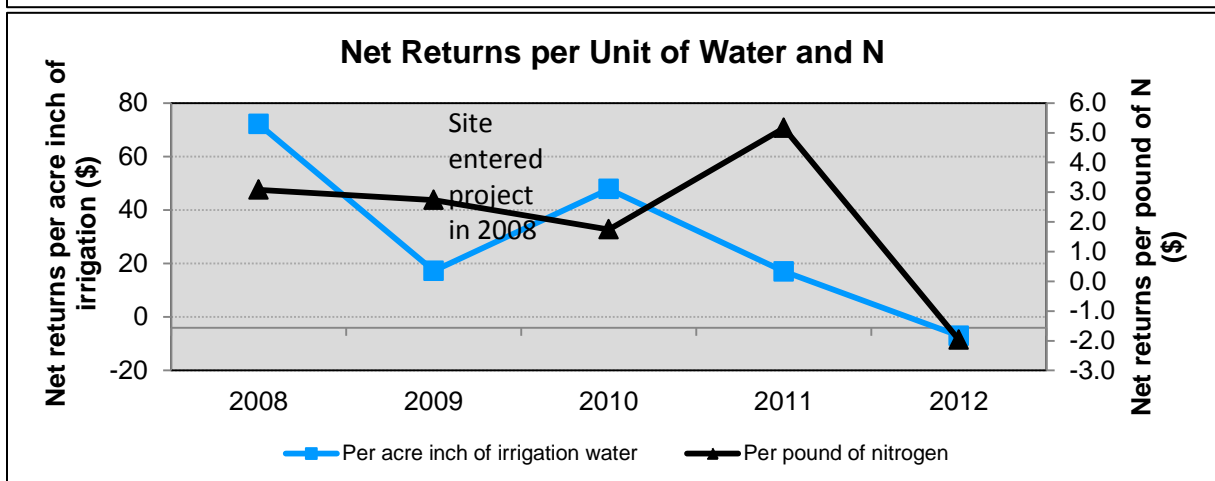
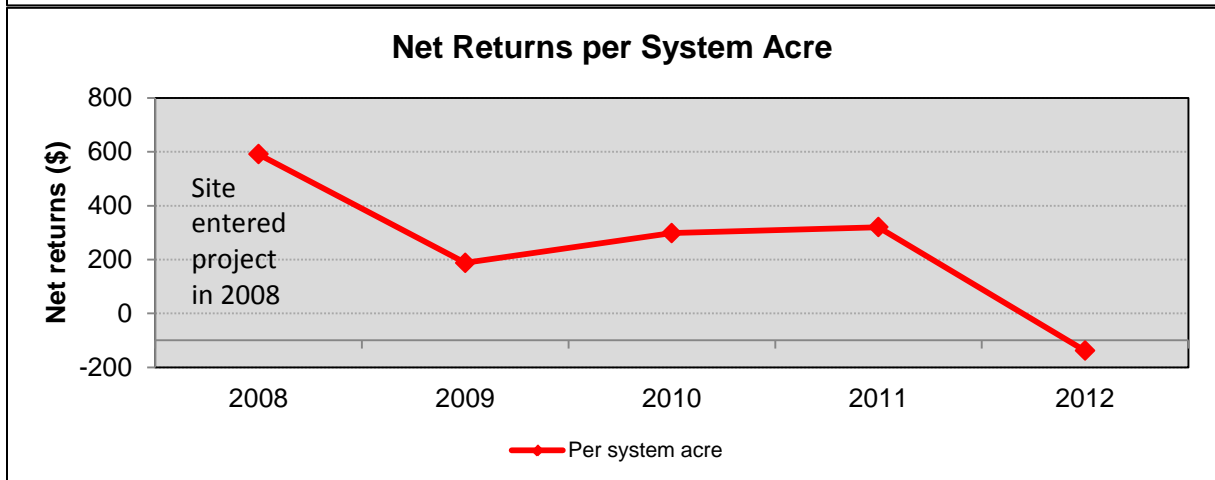
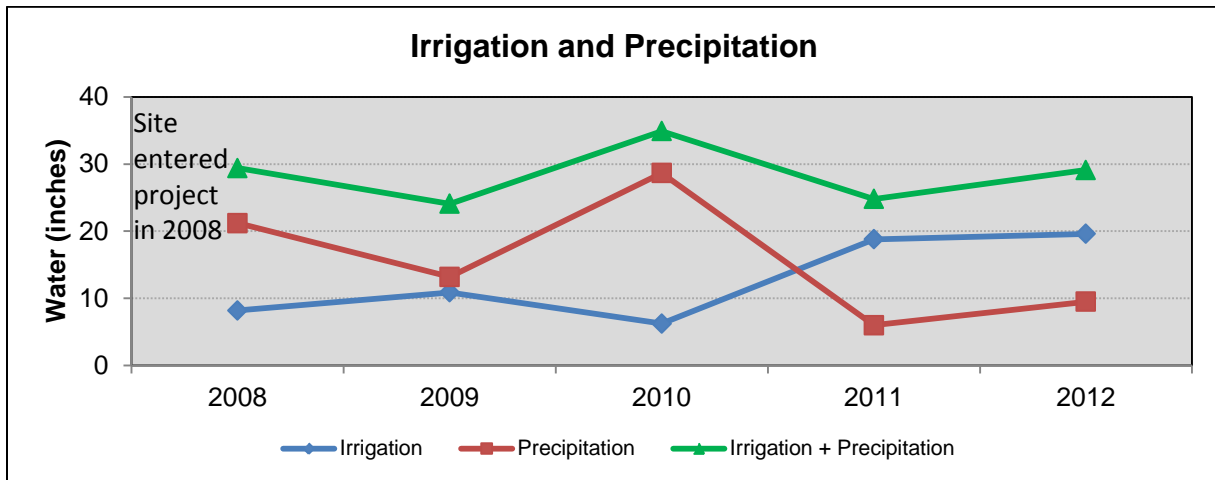


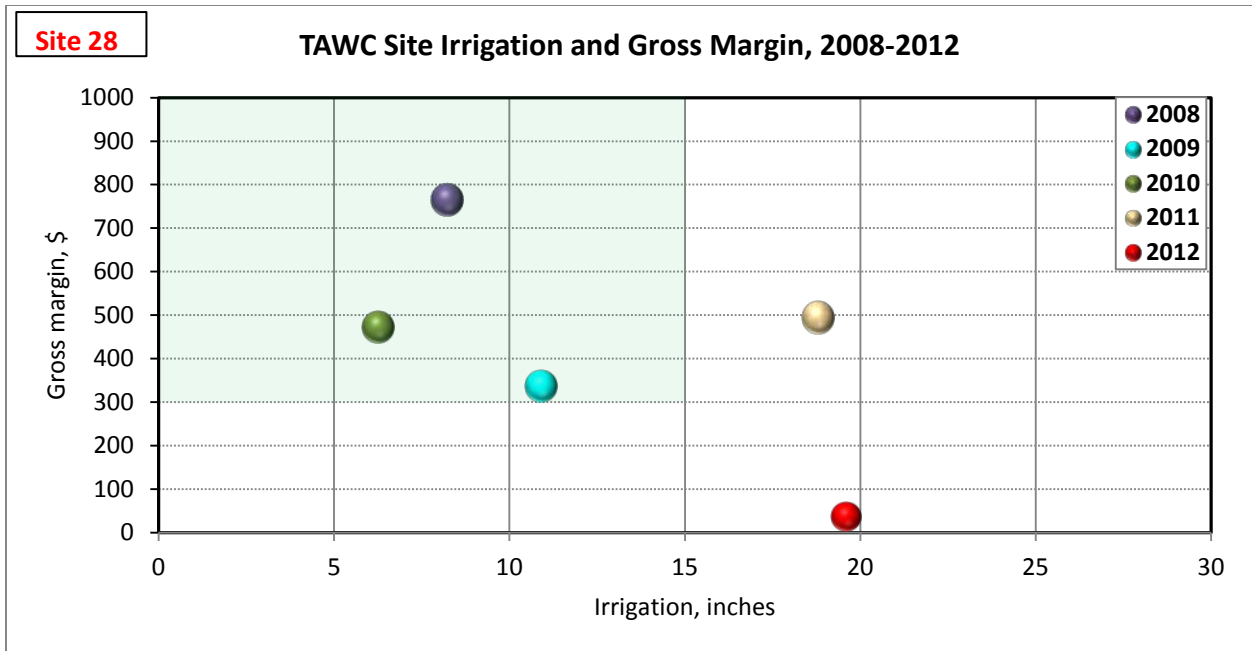
June cotton

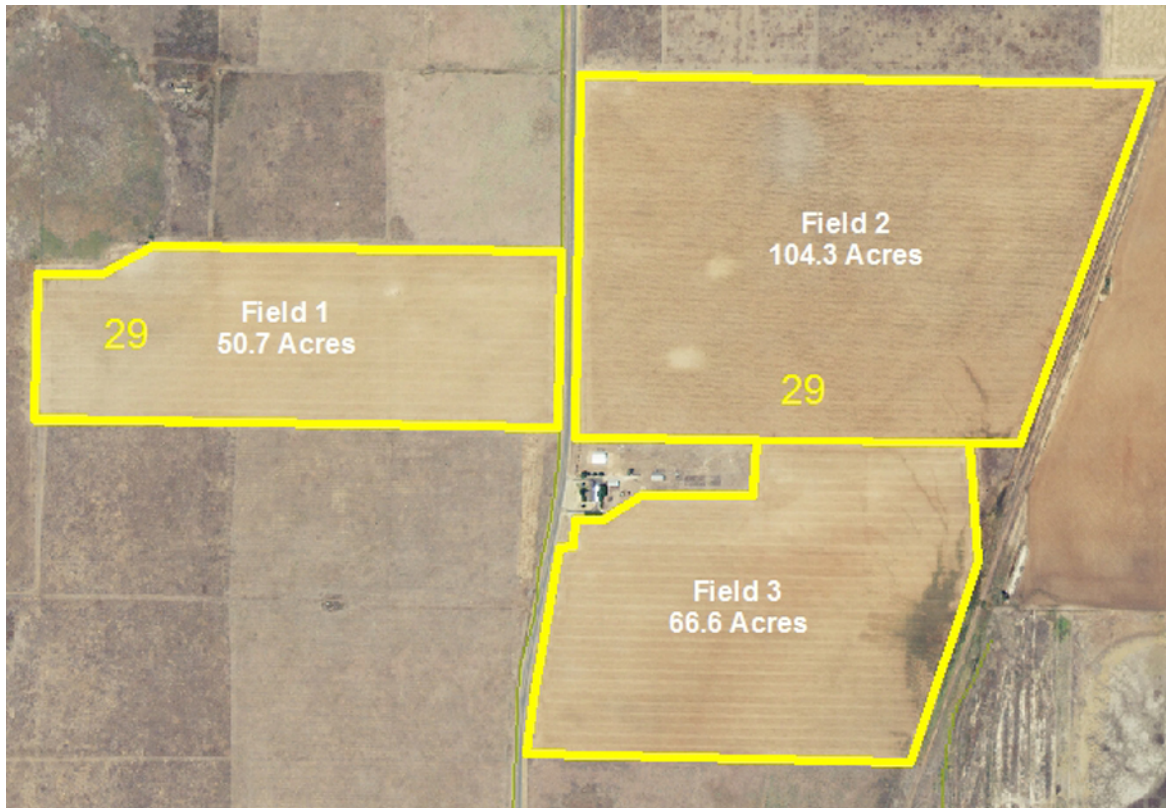


August corn

Site 28







Site 29 Description

Total site acres: 221.6

Field No. 1 Acres: 50.7
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 104.3
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3 Acres: 66.6
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Dryland

Pumping capacity,
gal/min: na

Number of wells: na

Fuel source: na

Site 29
Dryland Site

	Livestock	Field 1	Field 2	Field 3
2005	Entered project in Year 4			
2006				
2007				
2008	None	Cotton following wheat cover crop	Fallow, followed by wheat for cover and grazing	Cotton following wheat cover crop
2009	None	Cotton	Wheat	Cotton
2010	None	Cotton	Cotton	Grain sorghum
2011	None	Cotton	Cotton	Cotton
2012	None	Cotton	Milo	Cotton

Comments: This is a conventional till dryland site using cotton and grain sorghum in rotation. Cotton and grain sorghum are planted on 40-inch centers.

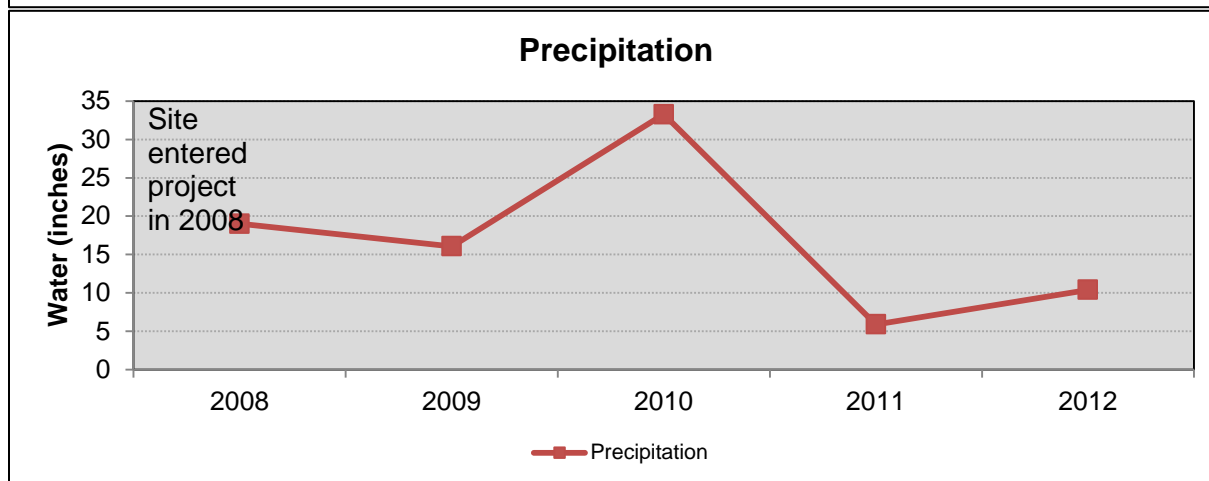
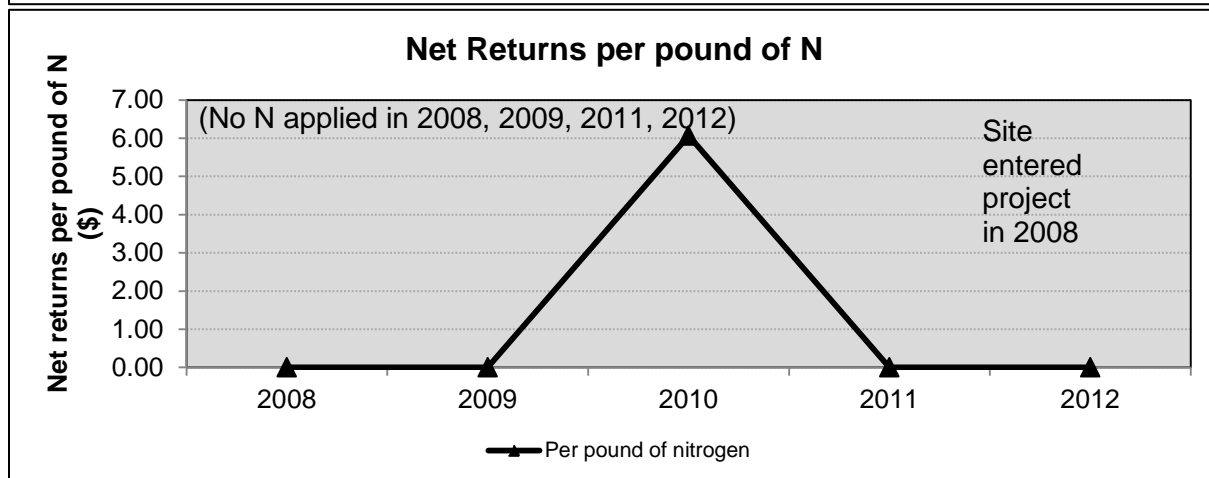
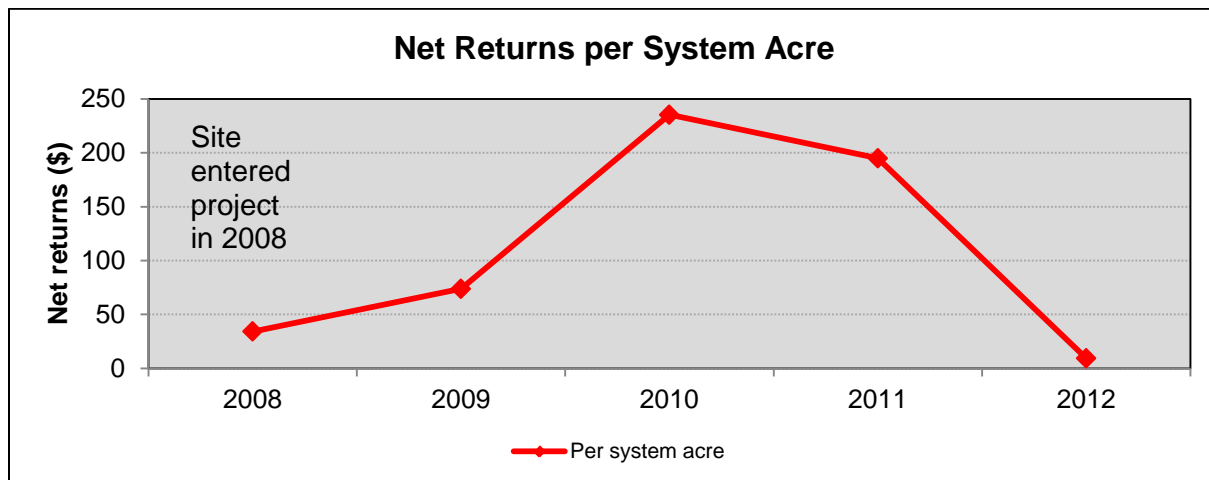


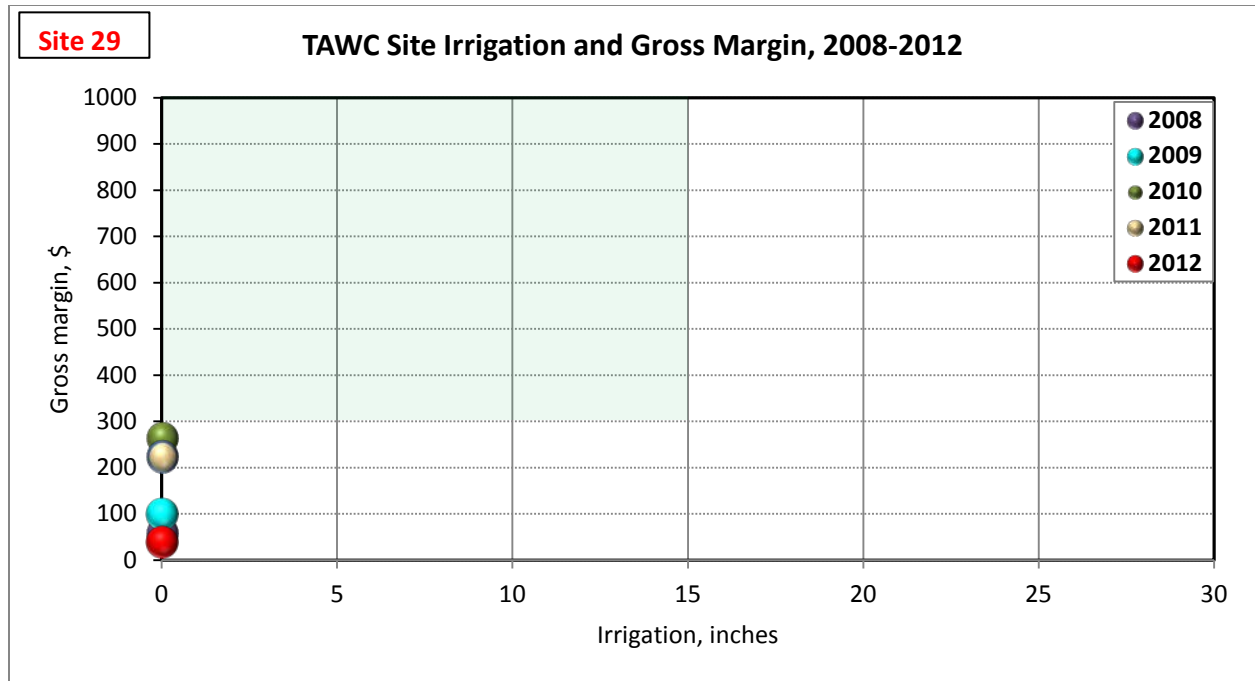
June cotton



August grain sorghum
(milo)

Site 29 – Dryland Site





Dryland Site



Site 30 Description

Total site acres: 21.8

Field No. 1 Acres: 21.8

Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Sub-surface Drip (SDI)

Pumping capacity,
gal/min: 150

Number of wells: 1

Fuel source: Electric

Site 30

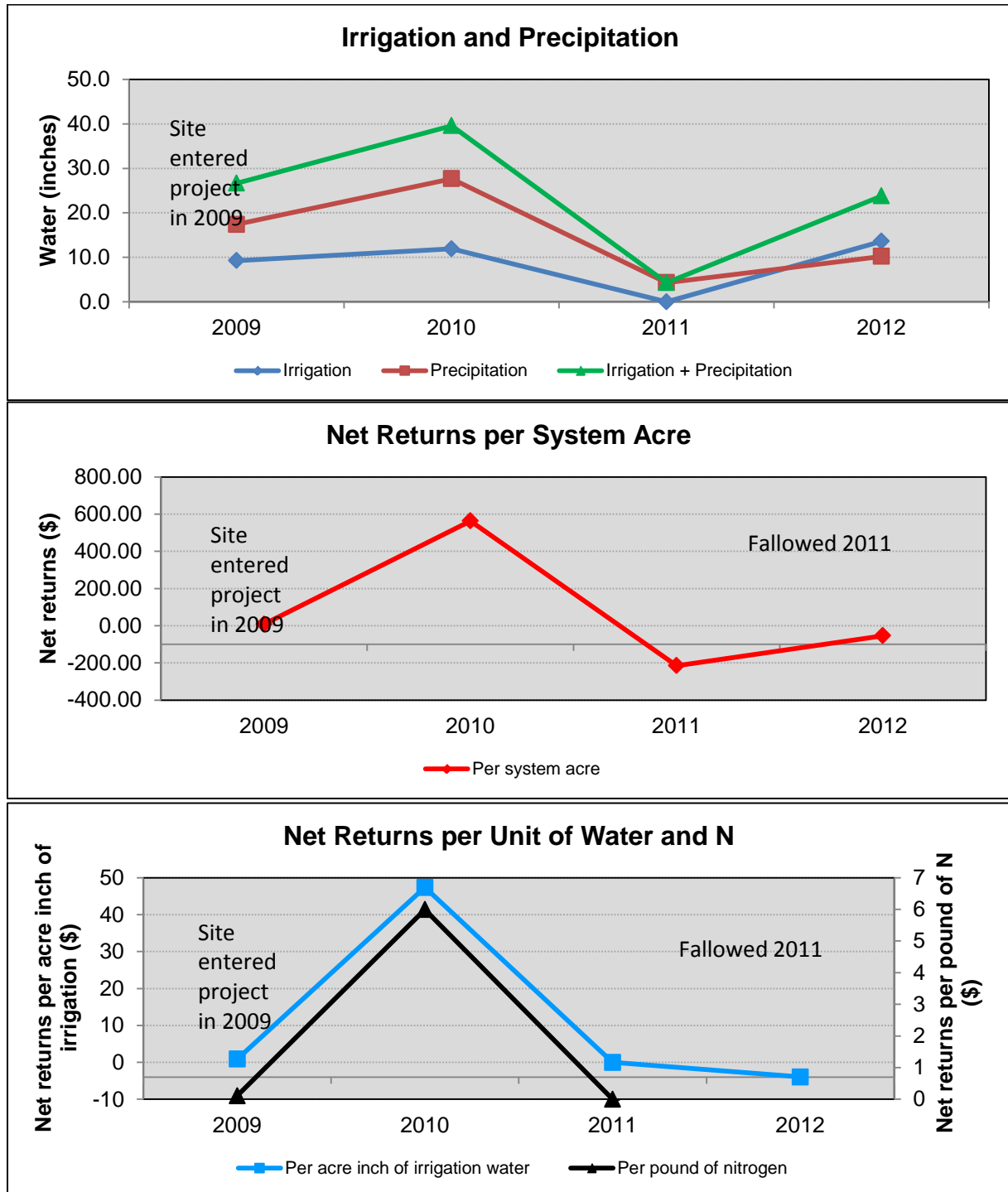
	Livestock	Field 1
2005	Entered project in Year 5	
2006		
2007		
2008		
2009	None	Sunflowers
2010	None	Corn
2011	None	Not planted
2012	None	Cotton

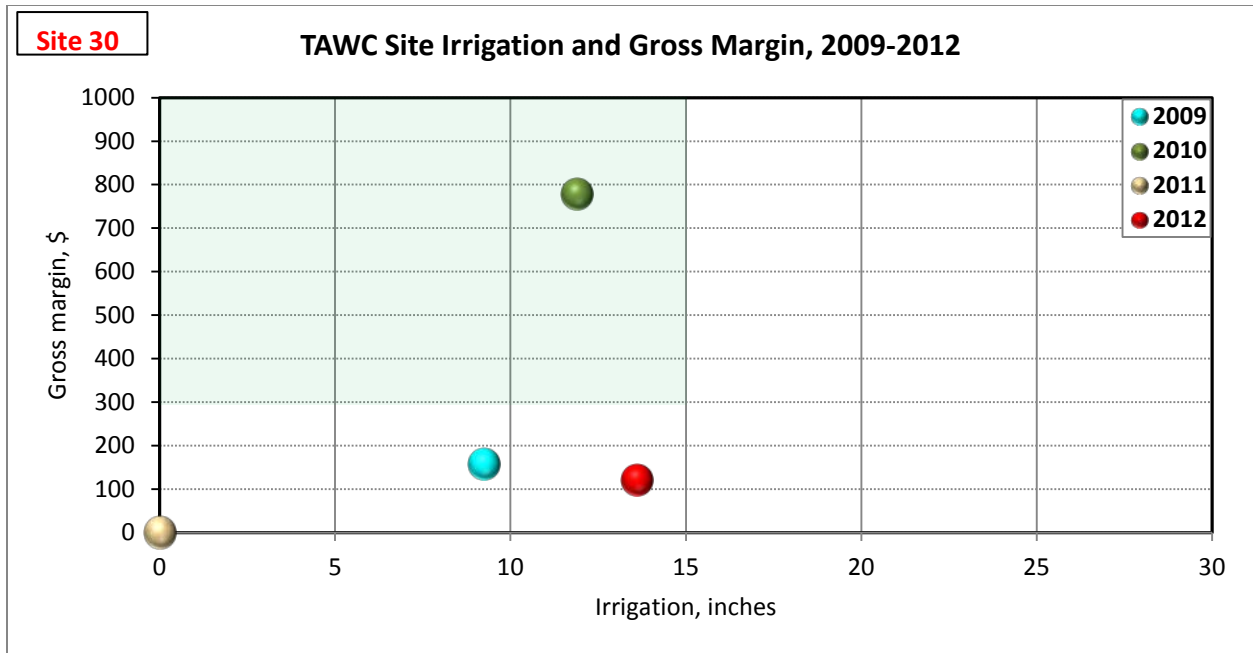
Comments: This site is drip irrigated and was planted to cotton using conventional tillage.

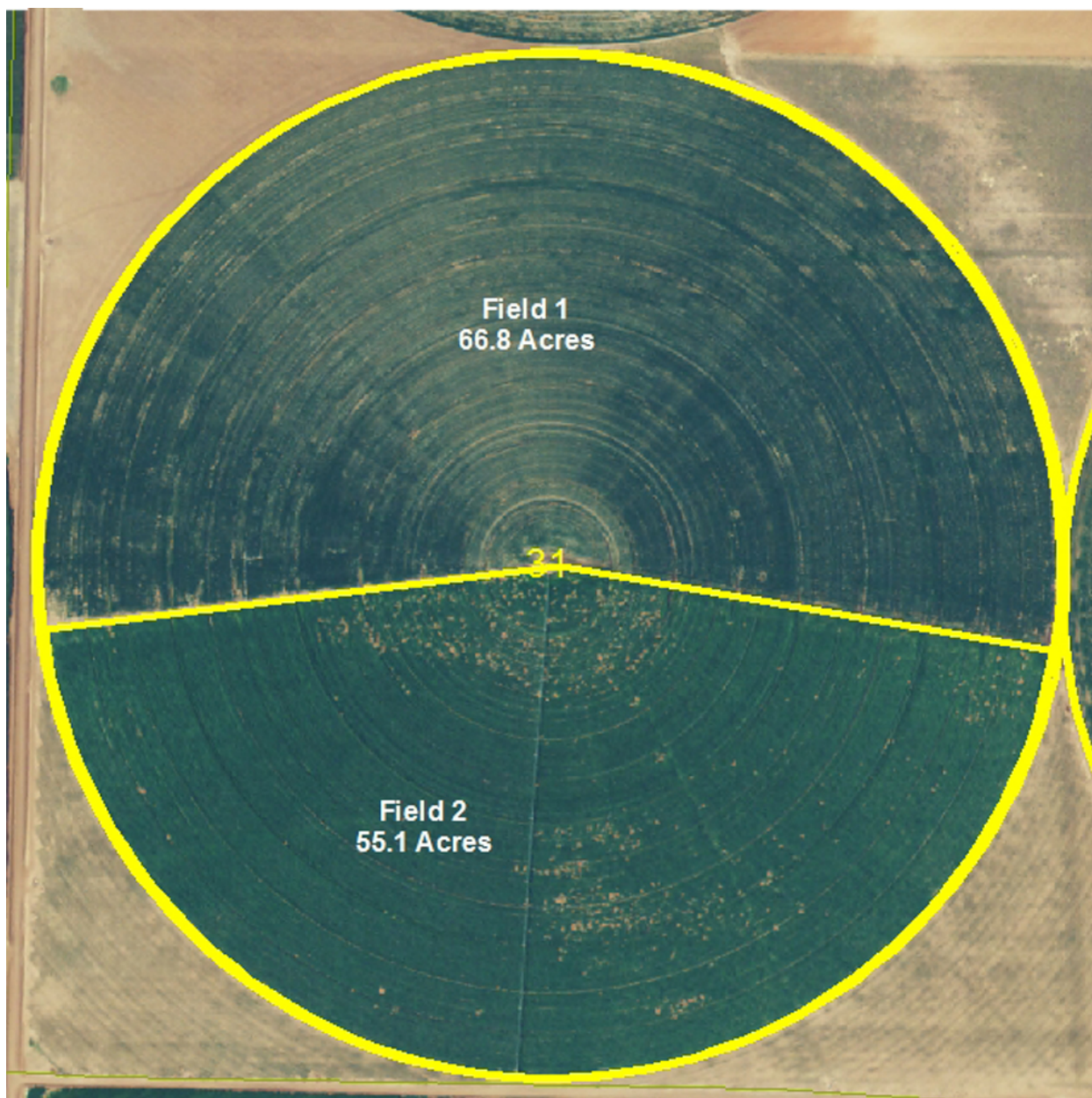


Cotton on drip in August

Site 30







Site 31 Description

Total site acres: 121.9

Field No. 1 Acres: 66.8
Major soil type: Pullman clay loam, 0 to 1% slope

Field No. 2 Acres: 55.1
Major soil type: Pullman clay loam, 0 to 1% slope

Irrigation

Type: Center pivot

Pumping capacity,
gal/min: 450

Number of wells: 2

Fuel source: Natural gas
Electric

Site 31

	Livestock	Field 1	Field 2
2005	Entered project in Year 6		
2006			
2007			
2008			
2009			
2010	None	Cotton	Seed millet
2011	None	Seed millet	Cotton
2012	None	Cotton	Seed millet

Comments: This is a pivot irrigated site which was planted to cotton and seed millet in 2012. Both crops were planted on 40-inch centers using conventional tillage.

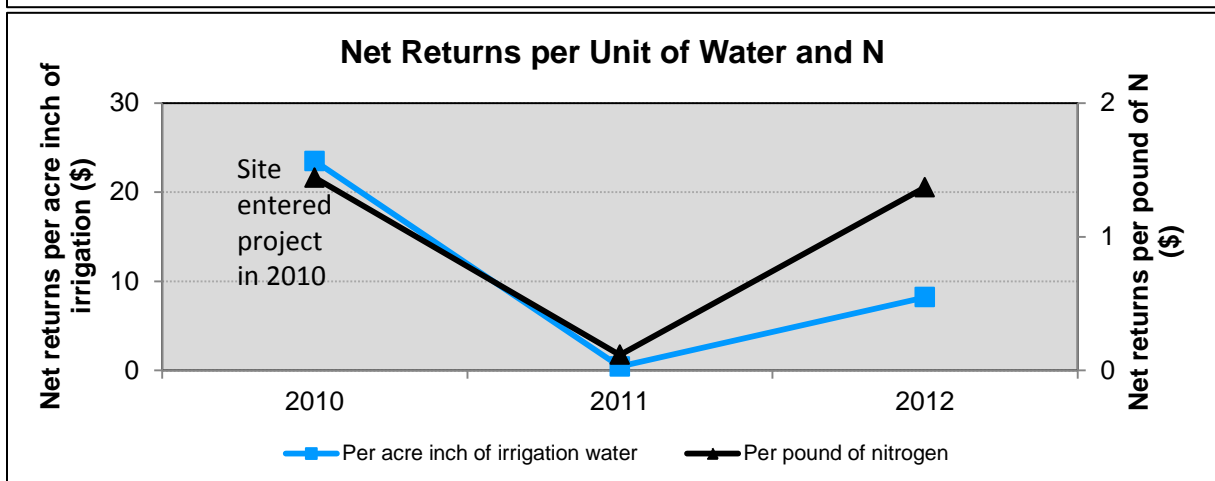
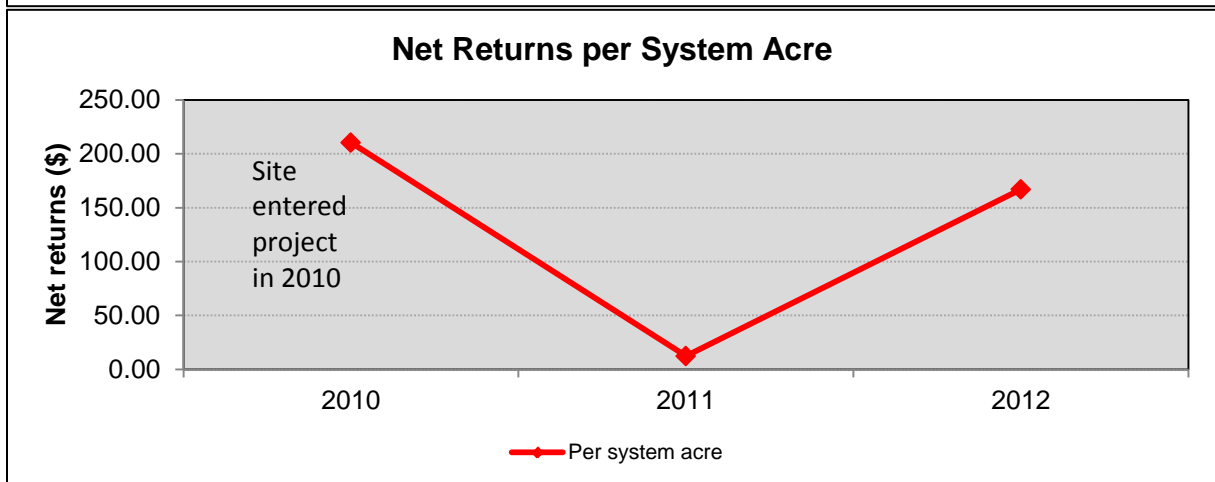
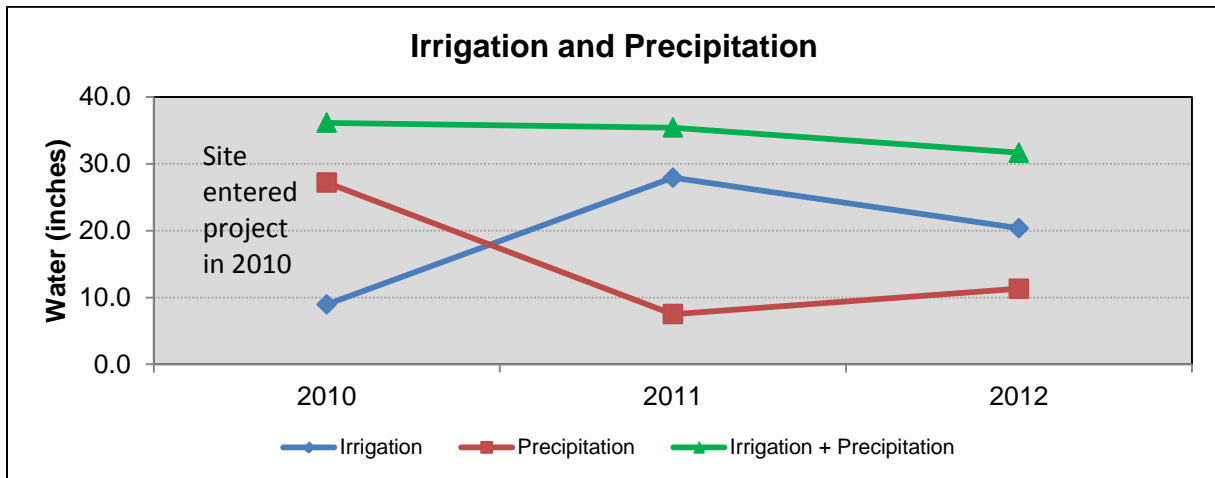


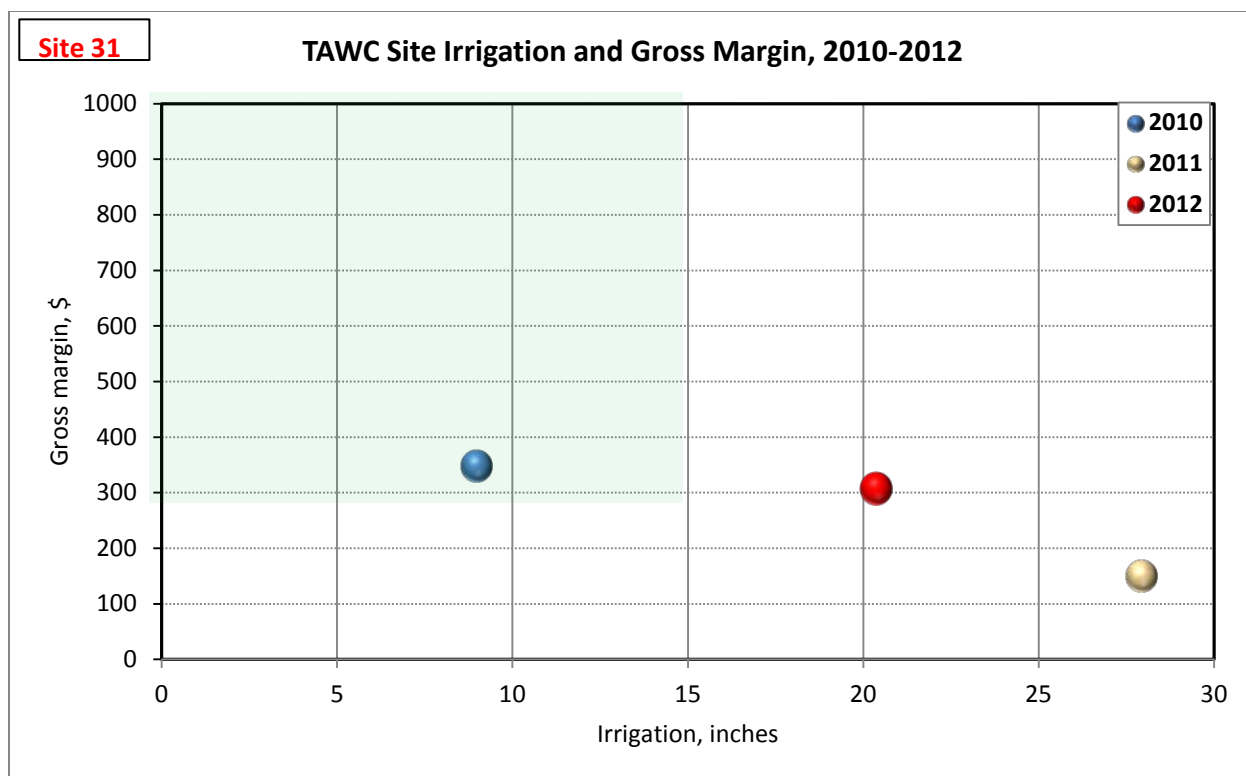
October cotton preparing for harvest

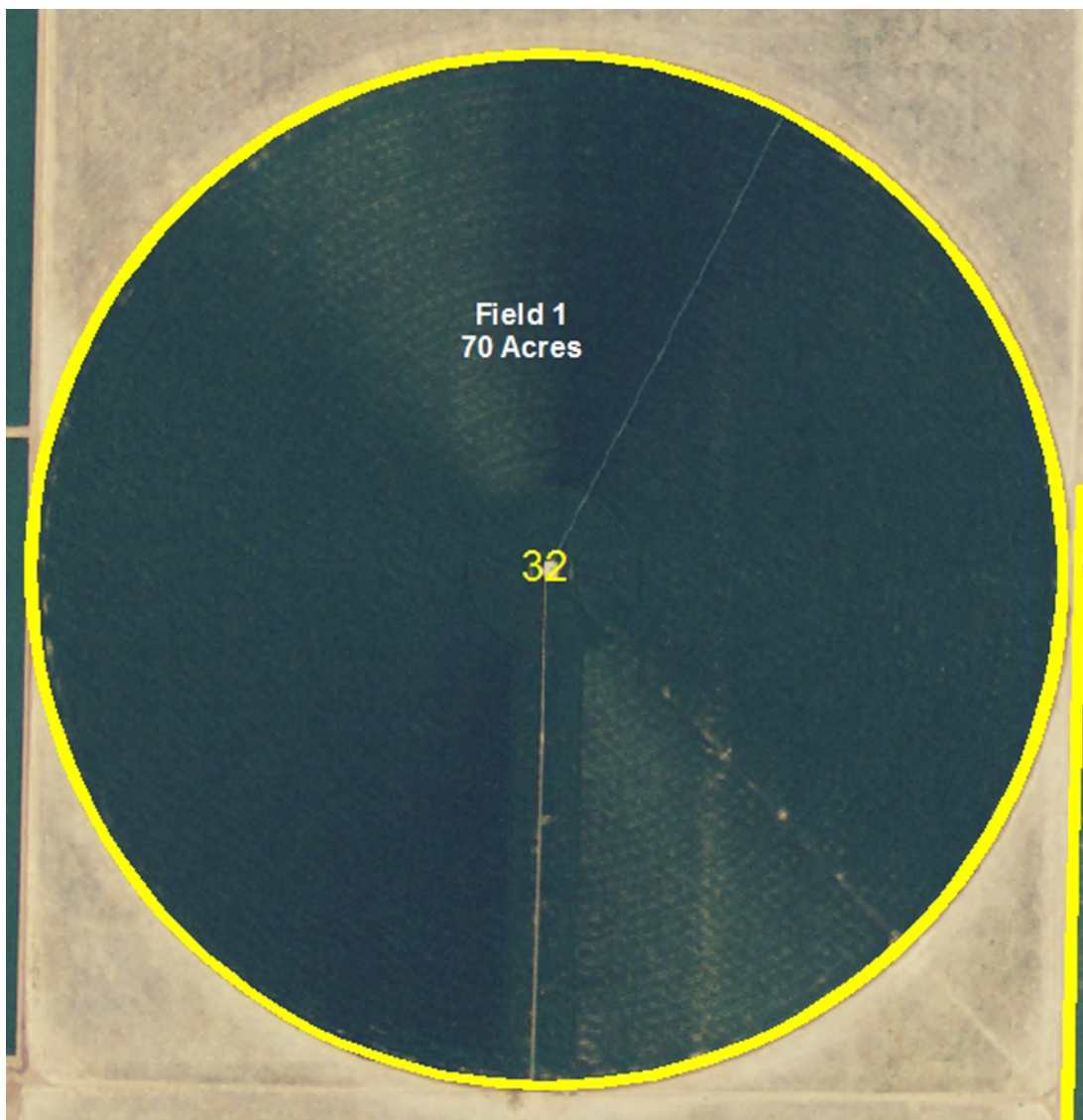


September seed millet

Site 31







Site 32 Description

Total site acres: 70.0
 Field No. 1 Acres: 70.0
 Major soil type: Pullman clay loam, 0 to 1% slope

Irrigation

Type: Center pivot
 Pumping capacity,
 gal/min: 350
 Number of wells: 2
 Fuel source: Electric

Site 32

	Livestock	Field 1
2005	Entered project in Year 6	
2006		
2007		
2008		
2009		
2010	None	Corn
2011	None	Corn
2012	None	Corn

Comments: This is a pivot irrigated site which was planted to cotton on 40-inch centers for 2012. The cotton was lost due to a June 4th hail storm and replanted to corn.

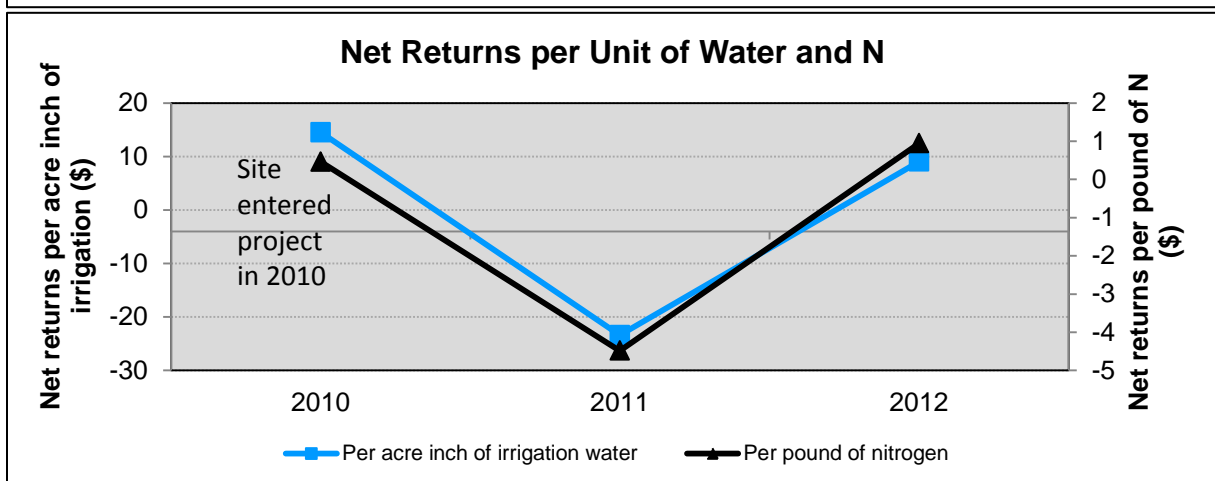
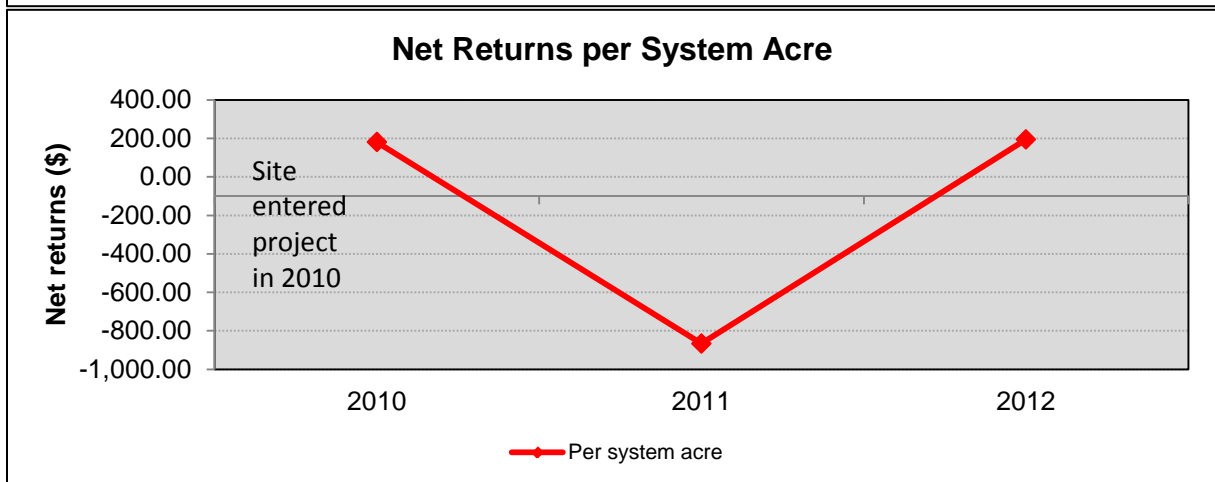
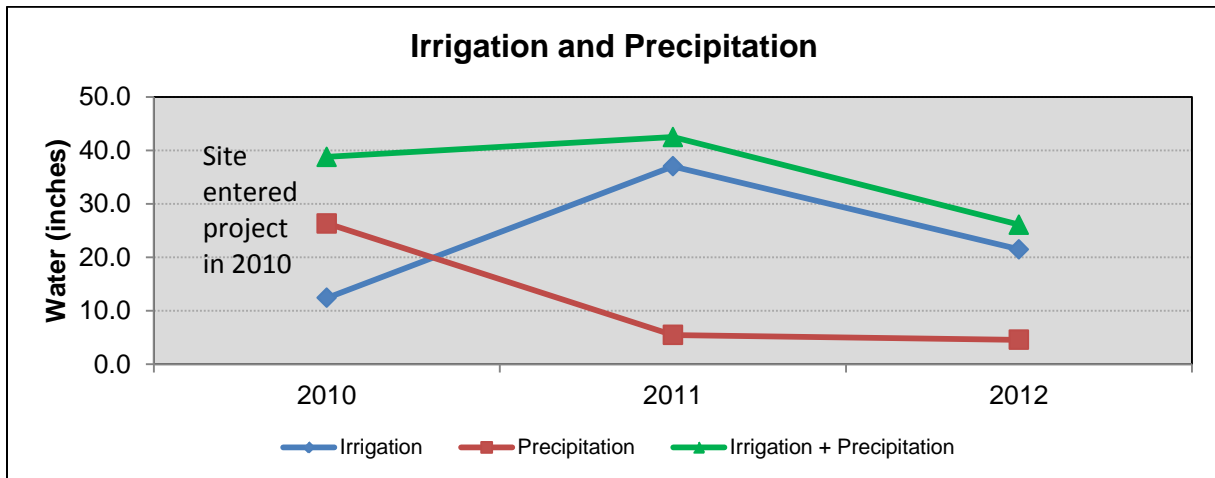


September corn



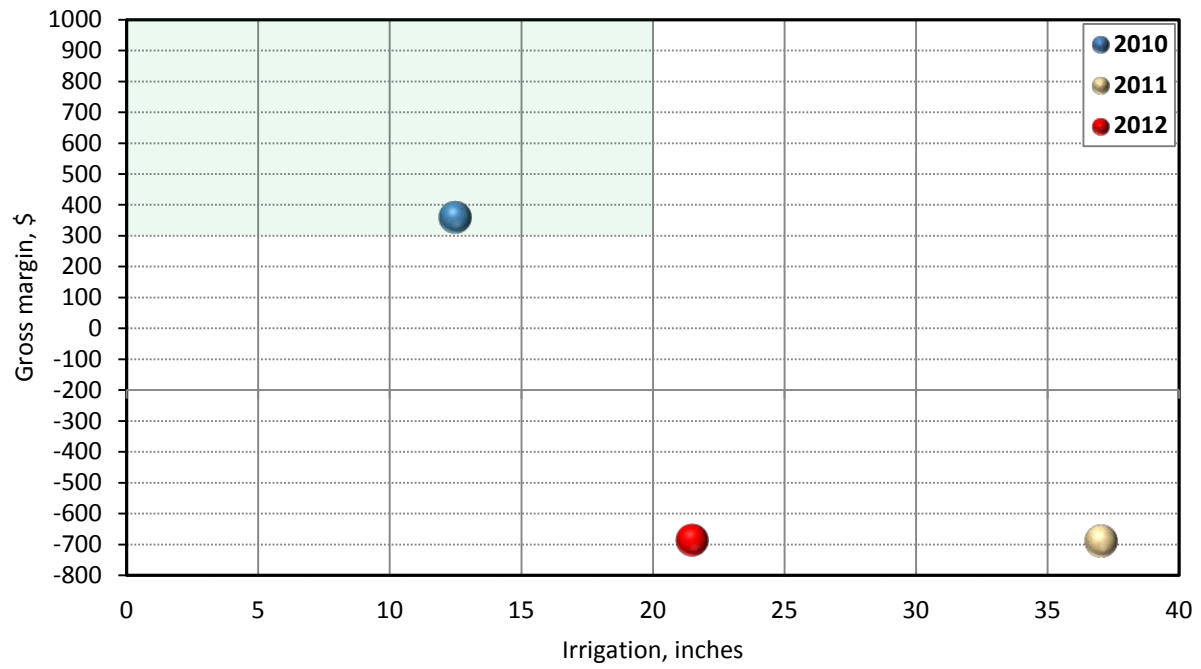
August corn harvest

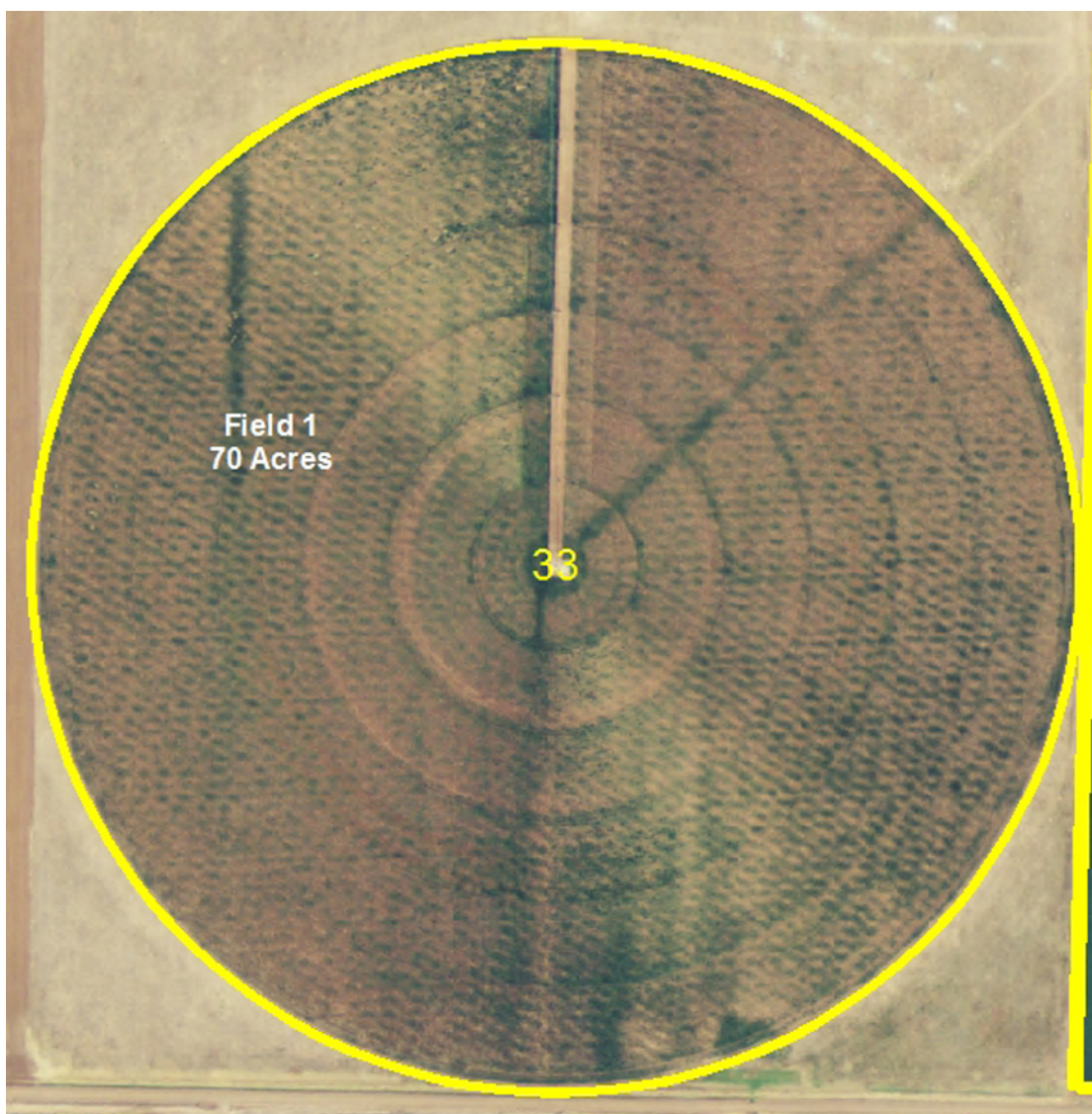
Site 32



Site 32

TAWC Site Irrigation and Gross Margin, 2010-2012





Site 33 Description

Total site acres: 70.0
 Field No. 1 Acres: 70.0
 Major soil type: Pullman clay loam, 0 to 1% slope

Irrigation

Type: Center pivot
 Pumping capacity,
 gal/min: 350
 Number of wells: 2
 Fuel source: Electric

Site 33

	Livestock	Field 1
2005	Entered project in Year 6	
2006		
2007		
2008		
2009		
2010	None	Cotton
2011	None	Corn
2012	None	Corn

Comments: In 2012 this site was planted to cotton on 40-inch centers using conventional tillage. The cotton was lost to a June 4th hail storm and replanted to corn.

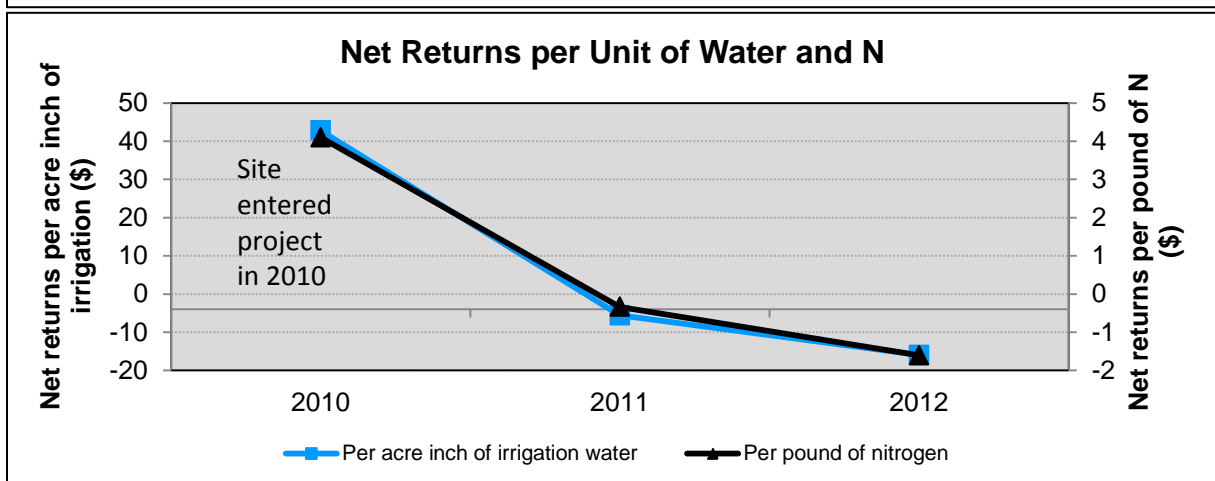
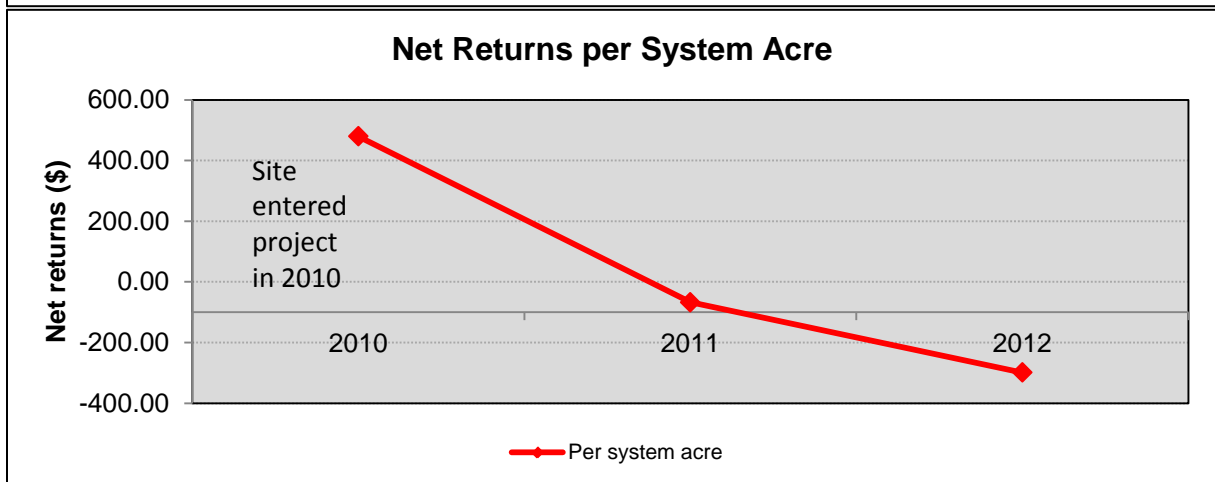
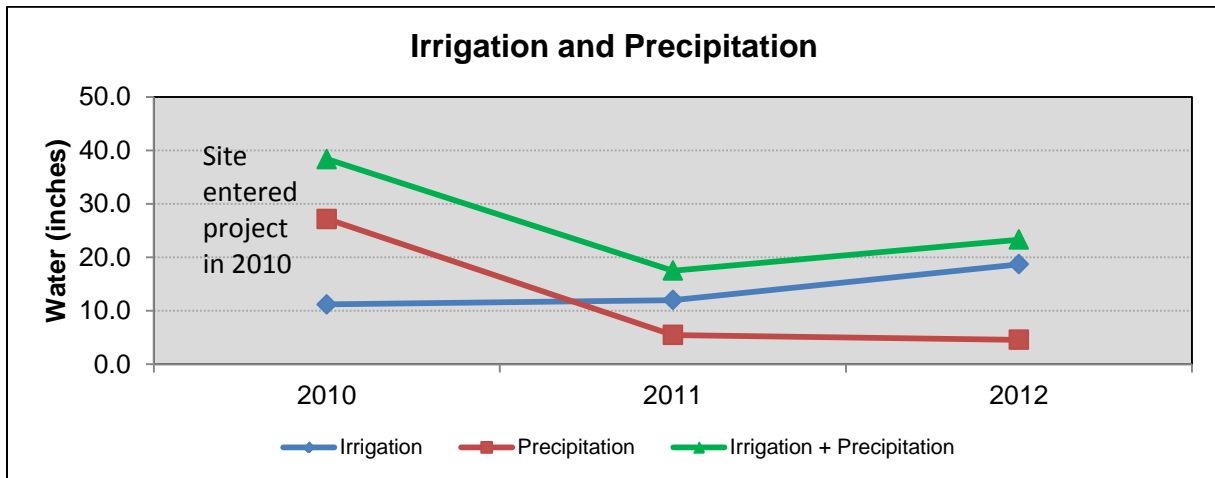


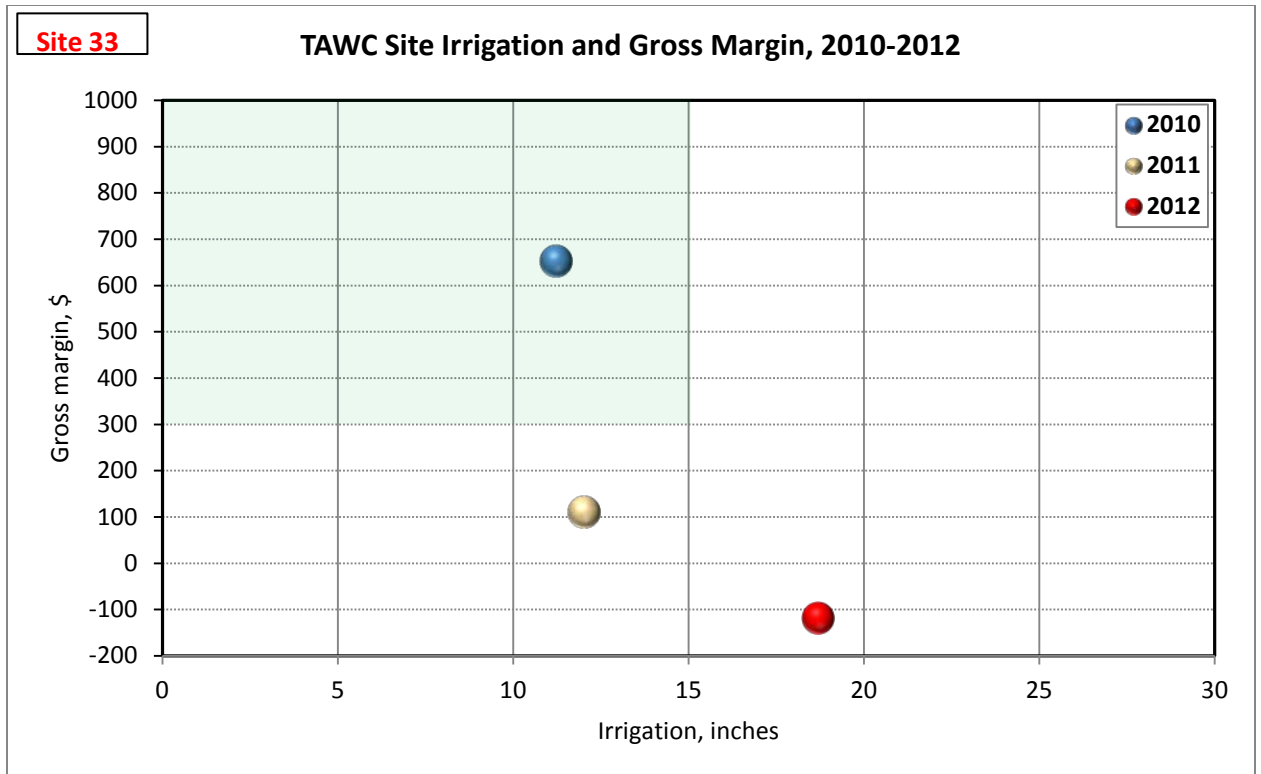
June cotton hailed out

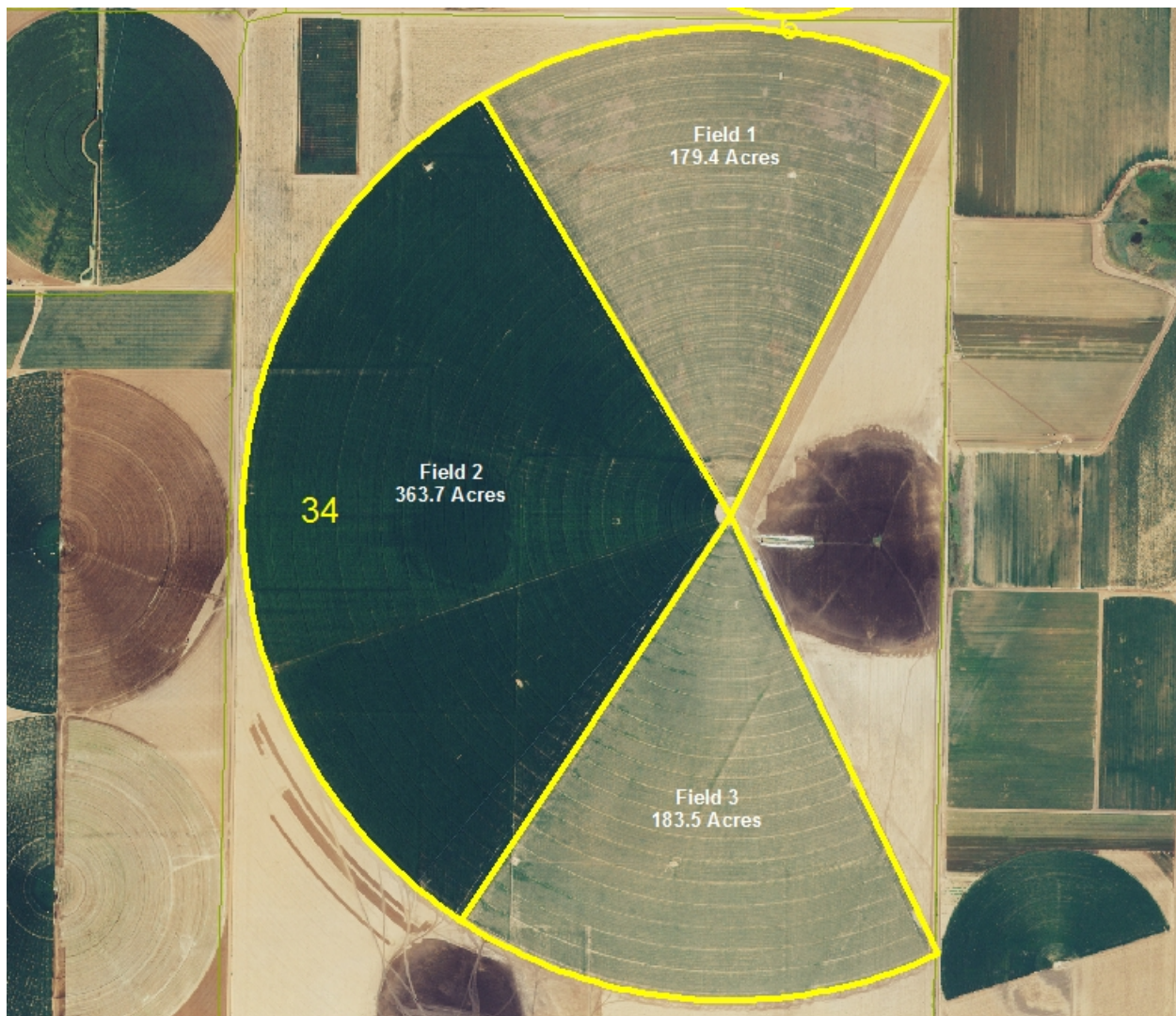


July Corn

Site 33







Site 34 Description

Total site acres: 726.6

Field No. 1 Acres: 179.4
Major soil type: Pullman clay loam, 0 to 1% slope

Field No. 2 Acres: 363.7
Major soil type: Pullman clay loam, 0 to 1% slope

Field No. 3 Acres: 183.5
Major soil type: Pullman clay loam, 0 to 1% slope

Irrigation

Type: Center pivot

Pumping capacity, gal/min: ?

Number of wells: 2

Fuel source: Electric

Site 34

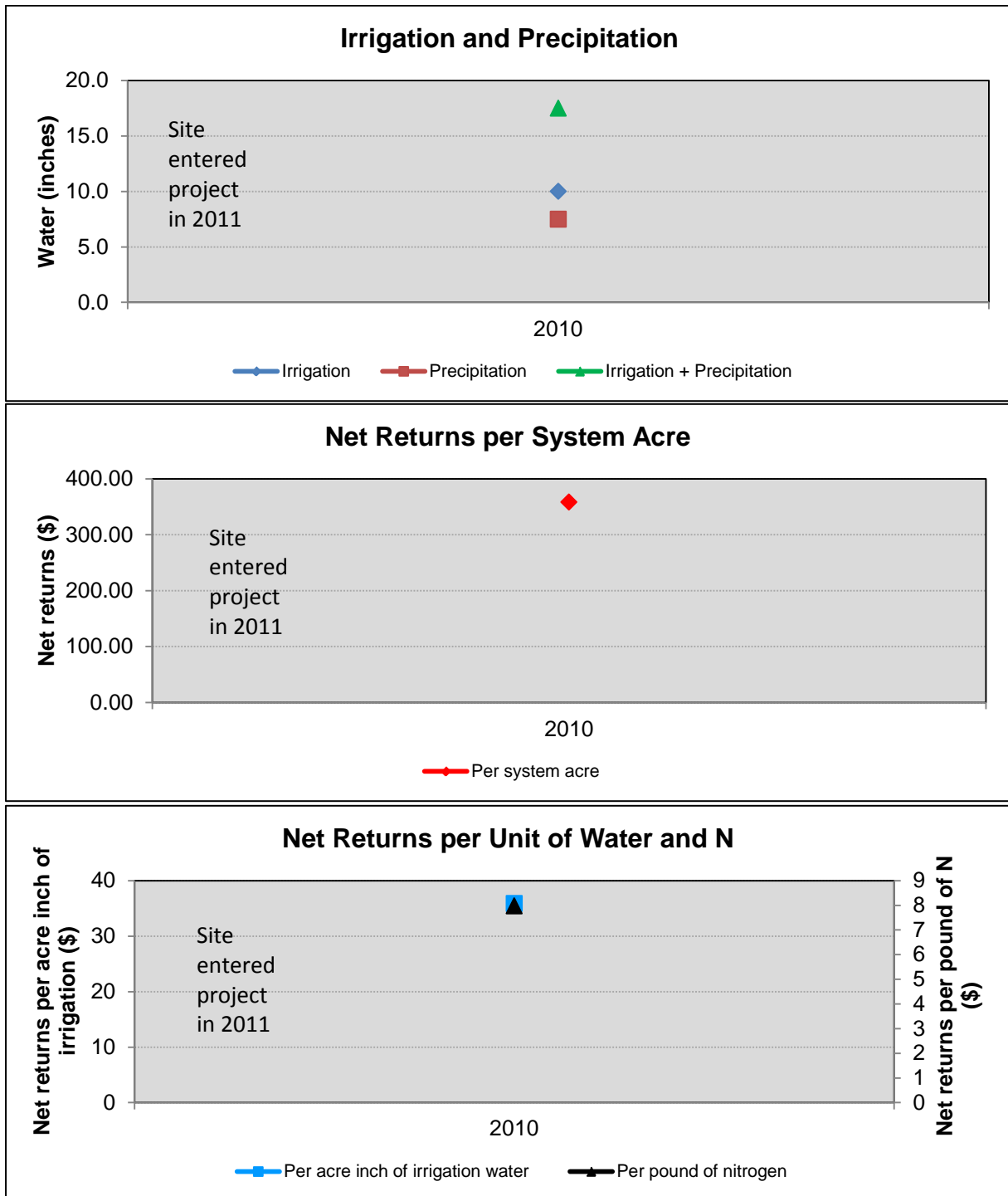
	Livestock	Field 1
2012	None	Cotton/Corn

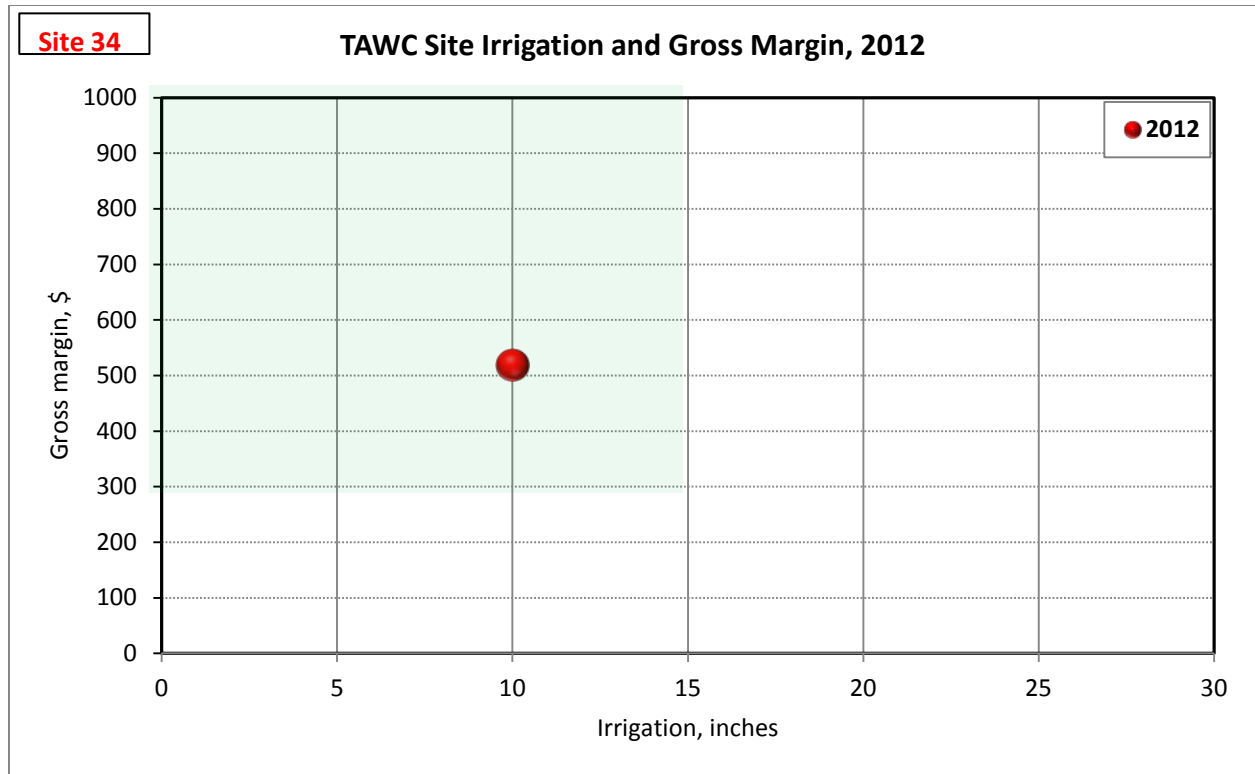
Comments: This is a new pivot site added in 2012. This producer uses limited tillage and incorporates cotton, corn, sunflowers and wheat in rotation.



Cotton and Corn planted in 2012

Site 34





OVERALL SUMMARY OF YEARS 1 through 8

With 8 years completed of this study, trends and patterns are emerging and more useful information is accumulating. Each year's results are highly influenced by weather, availability of irrigation water, input and commodity prices, anticipated prices for crops and livestock, and previous years' experiences. Amount and distribution of precipitation and irrigation water to buffer inadequate precipitation are key drivers of production and profit. During these 8 years, annual precipitation ranged from a low of 5.3 inches (2011) to a high of 28.5 inches (2010), averaging 17.3 inches (2005-2012), which is slightly lower than the long-term mean (18.5 inches) for the region (Fig. 10). Five of 8 years exhibited below-average rainfall, with the last two years, 2011 and 2012, substantially below average. The record-setting drought of 2011 (5.3 inches) was followed by another severe drought in 2012 (9.9 inches). Consequently, irrigation applied (mean of all sites) was greatest in these two years. Since 2011 was severely dry, storage of soil-profile water in spring of 2012 was extremely low. Very low summer precipitation was associated with high ambient temperatures during the growing season, causing high water losses via evapotranspiration and, for many sites, insufficient supply of irrigation water to meet crop water demand. Persistent drought in the fall and early winter of 2012 increased the risk of low soil water stores going into the 2013 growing season.

As in 2011, insufficient irrigation supply at some sites in 2012 resulted in abandonment of at least part of planted acres in order to focus available irrigation more effectively on fewer acres. Five fields of cotton comprising nearly 600 acres were abandoned or drastically reduced in irrigation due to severe water deficit. Corn grain yields for 2012 averaged 7475 lbs/acre, which was somewhat greater than in 2011, but still only 64% of the average across 2005-2010 (Table 28, page 228). Corn silage yield was only 6.3 tons/acre, or 21% of the 2005-2010 average, indicating drastic silage yield reduction. Cotton lint yield, however, was virtually unchanged from the 2005-2010 average.

Crop insurance played a role in 2012 in the producers' ability to recoup initial input cost as several fields in the TAWC were either abandoned or produced very low yields. Insurance indemnity payments within the crop budgets were handled one of two ways. If the producer's record book indicated what the insurance indemnity payment was, this value was incorporated into the budgeting process. If this value was not available or the producer did not know the particular insurance payment, the indemnity was estimated. This was done by using average county yields to simulate a farm's T yield (or trigger yield); a 65% coverage level was assumed for all grain and fiber crops, and a 2012 harvest price was used as the payment price. If the producer indicated any residual crop at the time of abandonment or if there was sufficient evidence to indicate that there was some crop left standing in the field at the time of the insurance claim, this was deducted from the 65% coverage yield. The net result was an estimate for the indemnity payment from crop insurance. This method was standardized for all dryland and irrigated crops within the TAWC sites.

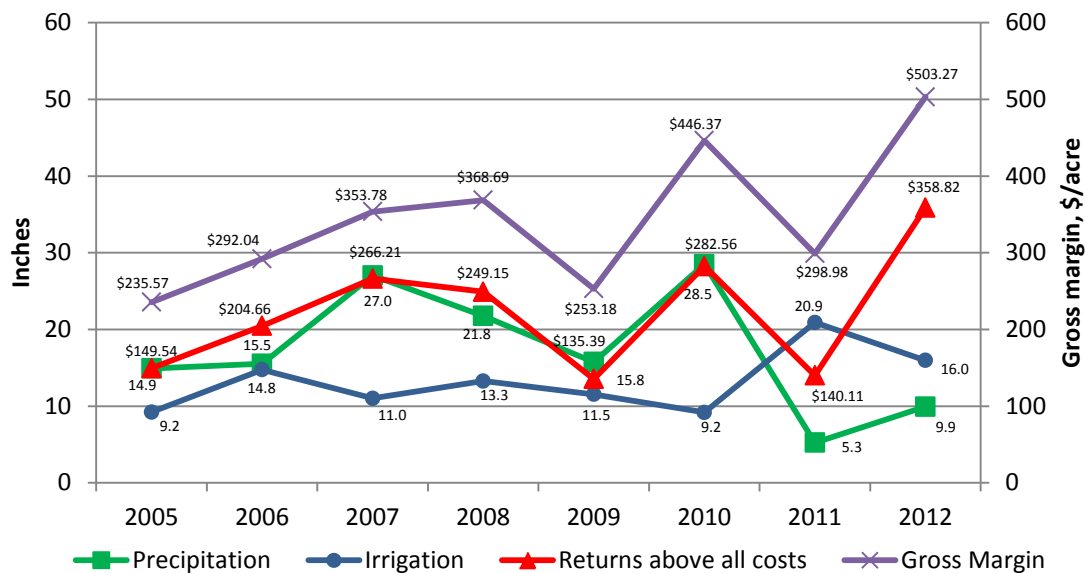


Figure 10. Average precipitation (inches), irrigation applied (inches), returns above all costs (\$/acre), and gross margin (\$/acre) for irrigated sites only.

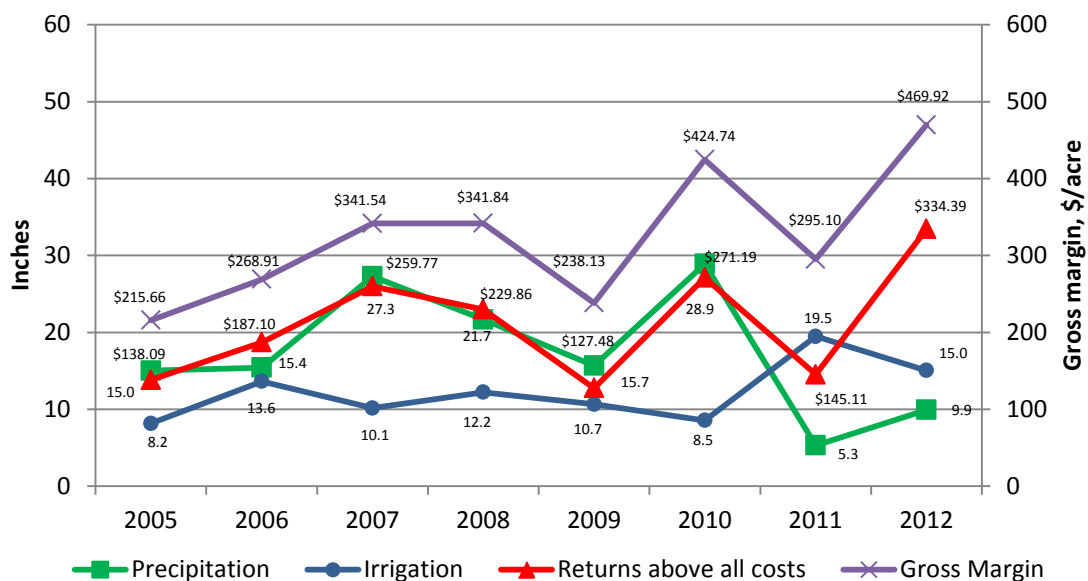


Figure 11. Average precipitation (inches), irrigation applied (inches), returns above all costs (\$/acre), and gross margin (\$/acre) for all sites, irrigated and dryland.

Depth of irrigation applied averaged over 8 years on the irrigated sites only (Fig. 10) was 13.2 inches, with a range across years of 9.2 to 20.9 inches. The mean irrigation level of 13.2 would comply with current and projected future application restrictions for this region (21 inches across contiguous acres in 2012, stepping down to 18 inches in 2014 and to 15 inches in 2016). In the drought years of 2011 and 2012, average irrigation applied was 20.9 and 15.6 inches,

respectively, which are near the restriction levels. Spikes in irrigation during a year like 2011 can be absorbed into an allowable 3-year rolling-average use to stay within tightened restrictions, especially if bracketed by wet years like 2010; however, protracted droughts over consecutive years may present challenges to staying within the tightening restriction.

When all sites including the non-irrigated fields (Fig. 11) are included in the means, average irrigation applied declines from 13.2 to 12.2 inches, pointing out the importance of inclusion of non-irrigated acres within a producer's overall enterprise in assessing water use. As water availability declines, two basic strategies can be used alone or in combination to stretch water supplies: a) apply less water per acre to a level that still maintains profitable yields (70-80% of crop ET); and b) apply available water to fewer acres. Both approaches have merit depending on the crop species and variety, how water is allocation over the cropland, and the distribution of precipitation within a year. Choices of crop species/variety and the land allocation of water are under the control of the producer. Distribution of precipitation is not under their control and therefore only involves retrospective responses.

Total returns above all costs of production in 2012 (\$334.39/ acre), including irrigated and dryland sites, were the highest of all 8 years of the project (Fig. 11). Profitability in 2005 and 2009 were negatively impacted by high production costs in relation to values of crops and livestock. Low profitability in 2011 reflected reduction in livestock numbers and yield losses in crops, but was buffered by insurance payments. The relatively high returns in 2012 were favored by high commodity prices across many crop types and adequate irrigation available to attain profitable yields in cotton.

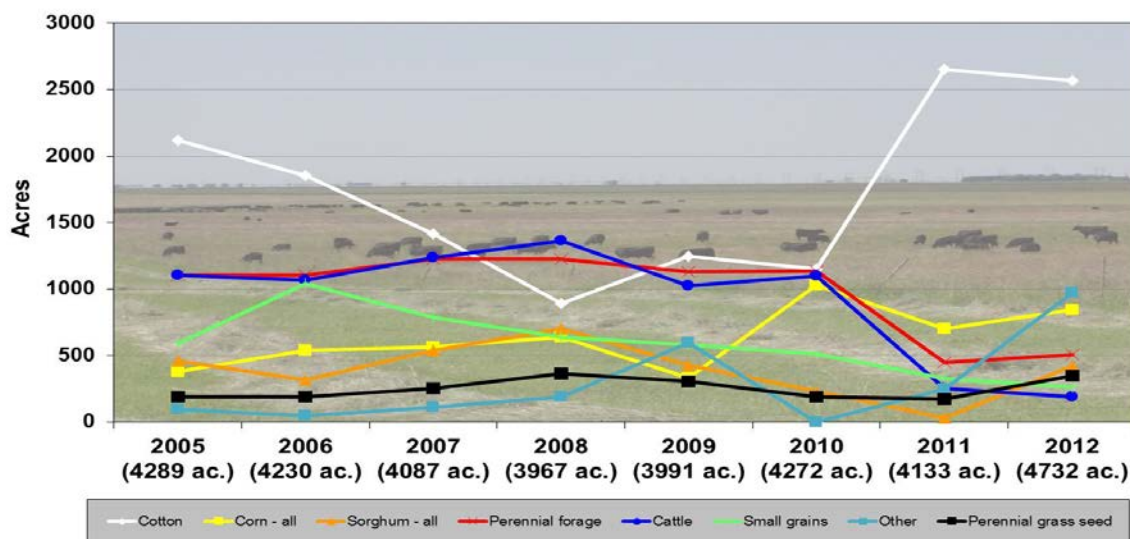


Figure 12. Number of acres that include cotton, corn, sorghum, perennial forages, cattle, small grains and other crops within the producer systems located in Hale and Floyd Counties.

Producers in the TAWC project make their own decisions each season on enterprise selection and production practices. Land use reflects current crop and livestock prices, contracts, expected profitability, water supply, and decisions to terminate leases, sell property, or retire. Therefore, the number of acres and number of sites of the enterprise choices have varied. Figures 12 and 13

show the acreages and number of sites, respectively, that were devoted to cotton, corn, sorghum, perennial forages, cattle, small grains, and other crops. The total of enterprise acres exceeds total acres in the project in any given year due to double cropping and multi-use for livestock, e.g. harvesting a seed crop followed by harvesting hay from the regrowth in the same field. In 2012, irrigated cotton maintained the relatively high acreage attained in 2011 (Fig. 12), reflecting expectation of favorable profitability and the ability of cotton to produce profitable yield with relatively low irrigation. Acreages of perennial forage and cattle pasture show declines in the latter years of the project, owing to liquidation and reduction of some herds. The most significant changes in crop acreage allocation were increased sorghum (grain + forage types) and other crops (mainly sunflower and seed crops). Corn acreage was little changed from the previous year.

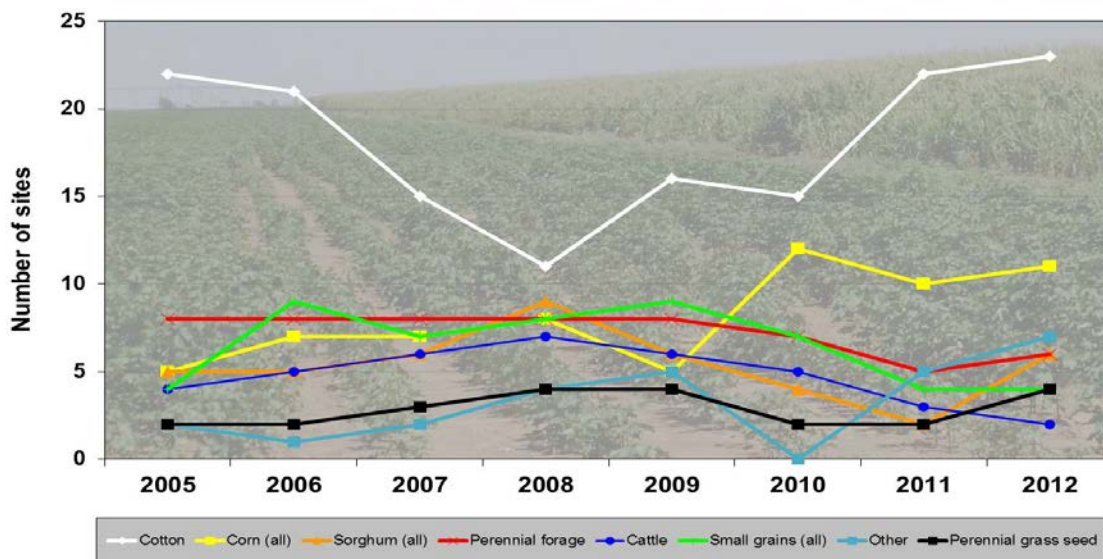


Figure 13. Number of sites that include cotton, corn, sorghum, perennial forages, cattle, small grains and other crops within the producer systems located in Hale and Floyd Counties.

The trends in number of sites where different production systems are practiced are dynamic (Fig. 13), but generally follow the trends in acreage distribution (Fig. 12). Cotton was dominant in the first two years and most recent two years. The alternatives to cotton showed greater year-to-year fluctuation in the latter 4 years than in the first 4 years of the project. Other notable trends are the upsurge in corn sites after 2009, the steady decline in livestock sites after 2008, and a resurgence in sorghum sites after 2011.

Water Use and Profitability

Patterns are emerging with respect to profitability in relation to irrigation applied. This is important because of the constant need to increase water use efficiency by the crops and prolong the groundwater supply, while maintaining or even increasing profitability of agricultural

production in the High Plains. To examine systems for meeting criteria of relatively low water use and high profitability, we arbitrarily selected a maximum of 15 inches of irrigation and a minimum of \$300 gross margin per acre as a desired target for performance. Please note that these levels were selected only to identify whether certain sites and cropping systems consistently performed to those criteria and *not* to relate system performance to pumping restrictions nor to state a minimum amount of revenue required for economic viability.

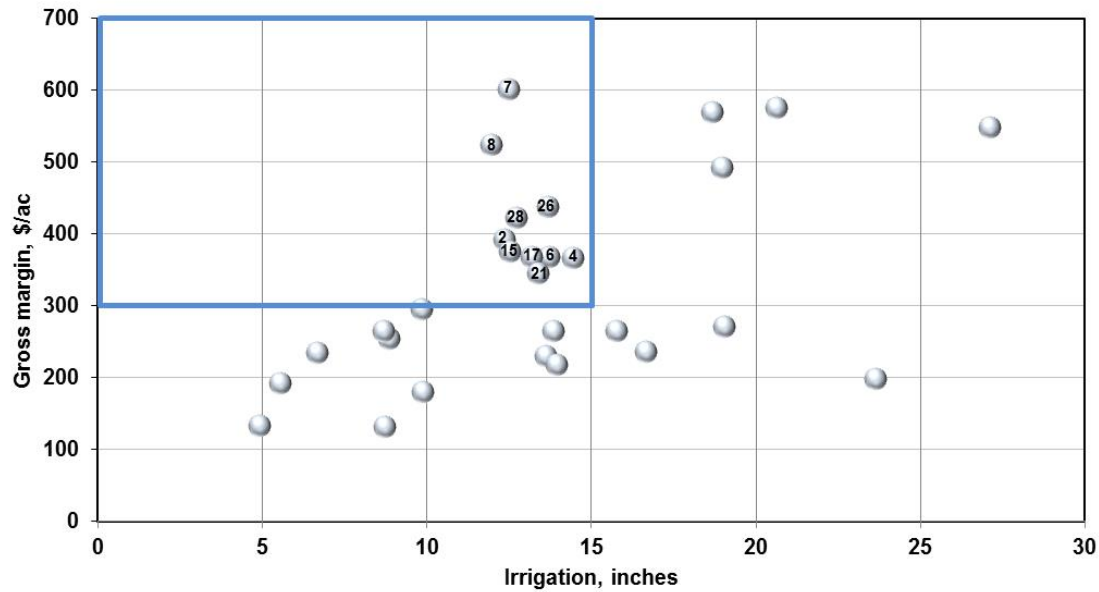


Figure 14. Gross margin per acre in relation to inches of applied irrigation averaged over 2005 to 2012. Points represent 23 sites which were irrigated in all years. The blue box brackets those sites which met the arbitrary criteria of 15 inches maximum irrigation and \$300 minimum gross margin per acre. Points within the box are labeled with their site number. See Tables 29 and 30 in the Task 4 report on pages 236 and 238 for site descriptions. Site 34 was deleted from this figure as this was first year in project.

Nine sites met the criteria of 15 or fewer inches of irrigation and \$300 or more gross margin/acre, when averaged over 2005-2011 (Fig. 14; economic analysis of 2012 data is pending). Of these, sites 7 and 8 were grass seed production (sideoats grama). Site 28 was continuous cotton using subsurface drip irrigation. Sites 2 and 6 were cotton/corn rotations; site 15 was cotton multi-cropped with wheat, sorghum, or corn and included subsurface drip irrigation. Sites 4, 10, and 26 were multi-crop rotations with cattle grazing, all using low elevation spray application (LESA irrigation). Four sites that met the \$300 gross margin per acre criterion but with average irrigation over 18 inches (points located to the right of the blue box in Fig. 14) were cotton/corn rotations. Inclusion of corn in multi-cropping systems can produce high gross margins, but requires more irrigation than cotton. Sites 2, 6, 10, 15, and 26 all included corn in the multi-crop rotations and met the double criteria of 15 inches and \$300/acre, indicating that inclusion of corn in the cropping system can result in high return at low water use, averaged over years. Of the five sites that used subsurface drip irrigation, all had gross margins above \$300/acre and four applied less than 15 inches of irrigation. See the Task 4 report (pages 233-240) for discussion of gross margin per acre-inch of irrigation applied. Again, the two sites

with grass seed production were among the highest ranked sites for gross return per acre-inch. When the final analysis of all years from 2005 through 2013 is completed, clearer generalizations of which type of cropping systems, irrigation technologies, and overall input managements favor high profitability at low water use will be ascertained.

2012 Project Year

Producer sites can be categorized according to type of farming system insofar as a site represents a conceptual farm. The system categories in use in 2012 were corn monoculture (entire site in corn only), cotton monoculture (entire site in cotton only), grass seed monoculture (entire site in grass seed production consisting of sideoats grama), integrated crop/livestock (site included cattle on pasture plus an annual crop and/or hay), multi-cropping (more than one annual crop species harvested in the reporting year). All 2012 systems were capable of irrigation on at least part of the acreage. Other systems occurring in previous years but not in 2012 included cow-calf pasture, sunflower monoculture, cotton monoculture (dryland only), and multi-cropping (dryland only). A site categorized in one system is recategorized each year that the crop choice changes.

In 2012, corn monoculture, grass seed, and integrated crop/livestock each accounted for 7% of the sites, while cotton monoculture occupied 21% and multi-cropping occupied 58%. Averaged over the 8 years of the project, percentage allocations of the systems were similar to 2012 except that integrated crop/livestock was 15% and multi-cropping was 45% of the sites.

This section compares the cropping systems for net returns per acre and per acre-inch of irrigation, and usage of irrigation and nitrogen fertilizer for 2012. Grass seed production had by far the highest average net returns per acre at \$700, followed by multi-cropping and cotton monoculture (Fig.15). Corn monoculture showed negative returns.

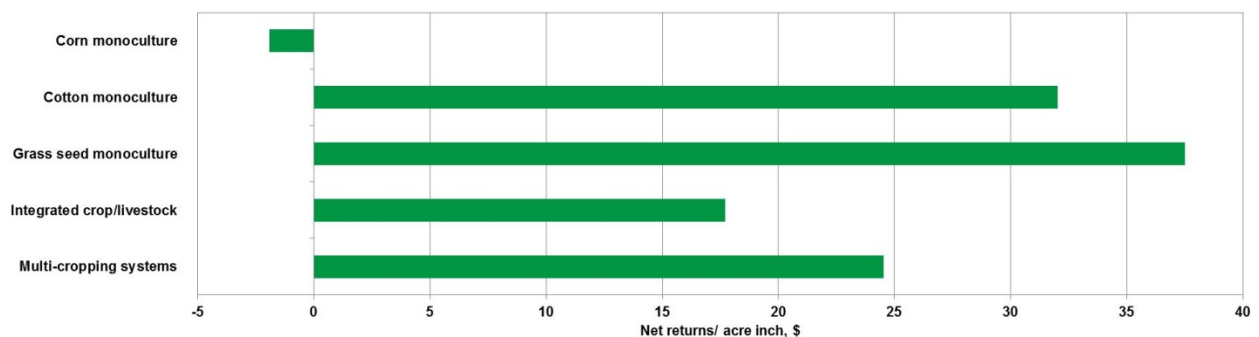


Figure 15. Net returns per acre for five cropping systems in 2012.

When these systems were examined in terms of net returns per acre-inch of irrigation applied (Fig. 16, green bars), corn again was negative, with grass seed monoculture and cotton monoculture being highest, followed by multi-cropping. The blue bars in Fig. 16 indicate average inches of irrigation applied per system. Grass seed had the highest application and cotton monoculture had the lowest. While not as dry as in 2011, the low rainfall in 2012 contributed to fairly high irrigation amounts and low yields in corn monocultures, which explains

the negative net returns that year.

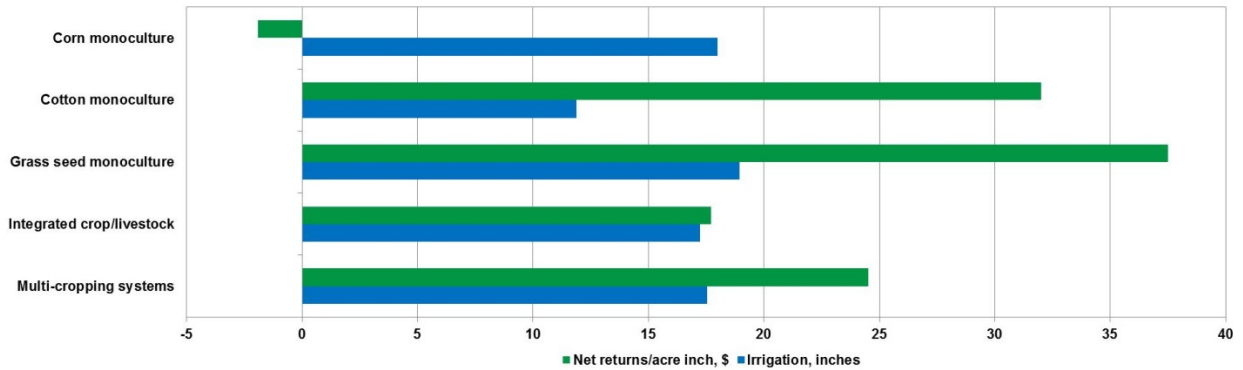


Figure 16. Net returns per acre-inch irrigation water (green bars), and inches of irrigation applied (blue bars), 2012.

Grass seed monocultures and corn monocultures had the highest application rates of nitrogen (N) fertilizer at around 150 lbs/acre (Fig. 17). The lowest N applied was to the integrated crop-livestock systems and cotton monoculture at around 80 lbs/acre. Because of the role of fertilizer N in promoting the release of nitrous oxide, rate of application takes on significance in addition to the costs of the fertilizer per se because nitrous oxide is both ozone depleting and a greenhouse gas.

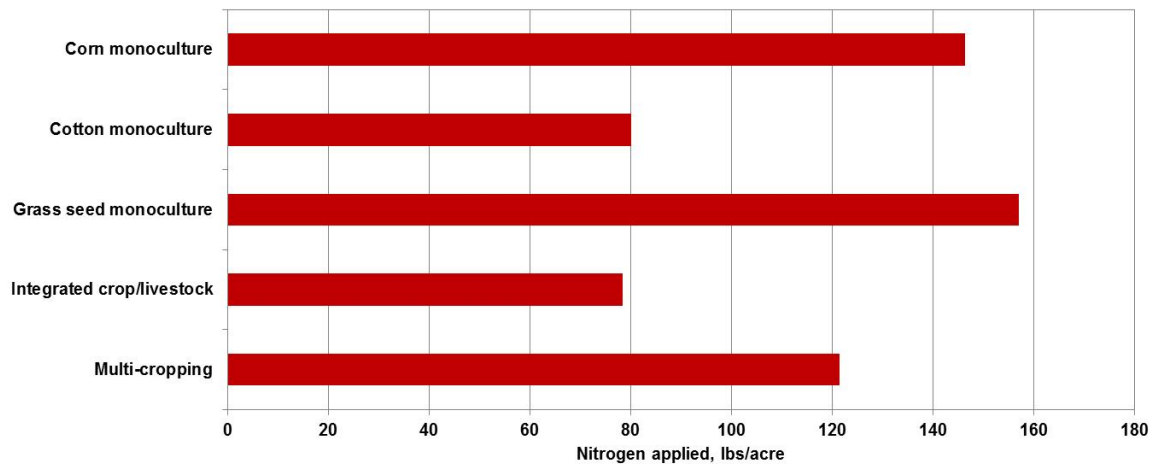


Figure 17. Pounds per acre of nitrogen (N) applied in fertilizer, 2012.

Project years 1 through 8

Average net returns per acre averaged over 8 years of the project (2005-2012) indicate that grass seed monoculture was the most profitable system at about \$430 per acre (Fig. 18). This system also had the highest net returns per acre-inch of irrigation water applied, which were similar to cotton in terms of total irrigation water used (Fig. 19). The 8 years of this project now

cover a wide range of weather and economic swings. It is notable that grass seed production appears more buffered against these variations than any of the other systems in that it yielded the greatest net returns per acre in 7 out of 8 years. While multi-cropping and cotton monoculture yielded similar average net returns per acre (around \$220/acre), integrated crop-livestock was at \$175 and corn monoculture was around \$165/acre (Fig. 18).

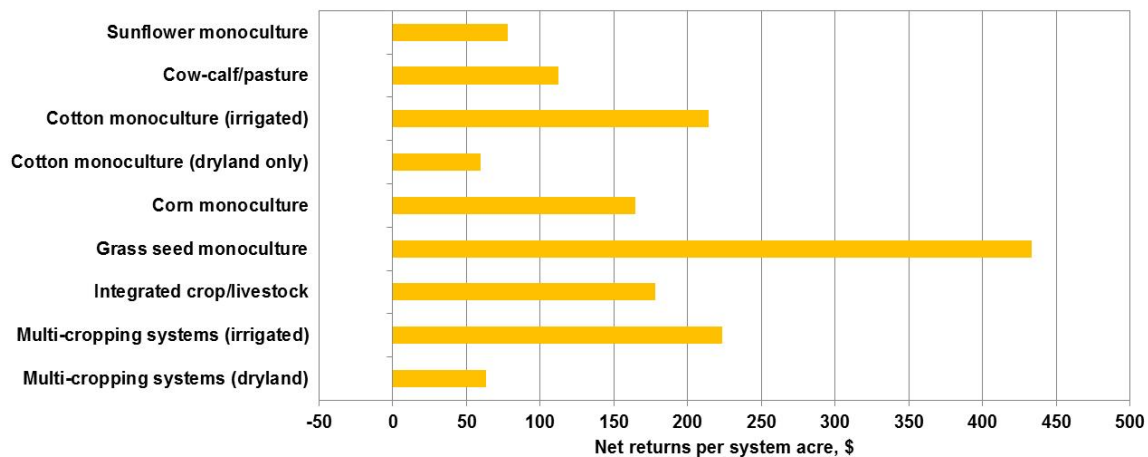


Figure 18. Net returns per system acre, average of 2005-2012, or for those years which those systems occurred.

Irrigation applied was greatest for corn monoculture, followed by multi-cropping (Fig. 19, blue bars). Irrigated cotton used about the same amount of irrigation as did grass seed and the integrated crop-livestock system. Net returns per acre-inch of irrigation applied were highest for grass seed, followed by cow-calf/pasture (Fig. 19, green bars); the latter because the amount of irrigation applied was very low. With such high net returns per acre-inch of irrigation and low water usage, cattle production on perennial forages may be offer a sustainable option as groundwater becomes more depleted. Net returns for irrigated cotton monoculture were ranked third. Corn monocultures were not present in some of the earlier years of this project and thus their means reflect fewer years. The droughts of 2011 and 2012 hit corn yields particularly hard, therefore with fewer years in the mean, the effects of drought have a proportionally greater effect on this crop. Sunflowers represent a specialty crop in this region and required less irrigation water than any system type with the exception of the cow-calf/ pasture. However, returns per unit of water applied were also relatively low. Dryland systems have always had the lowest average net returns in this project.

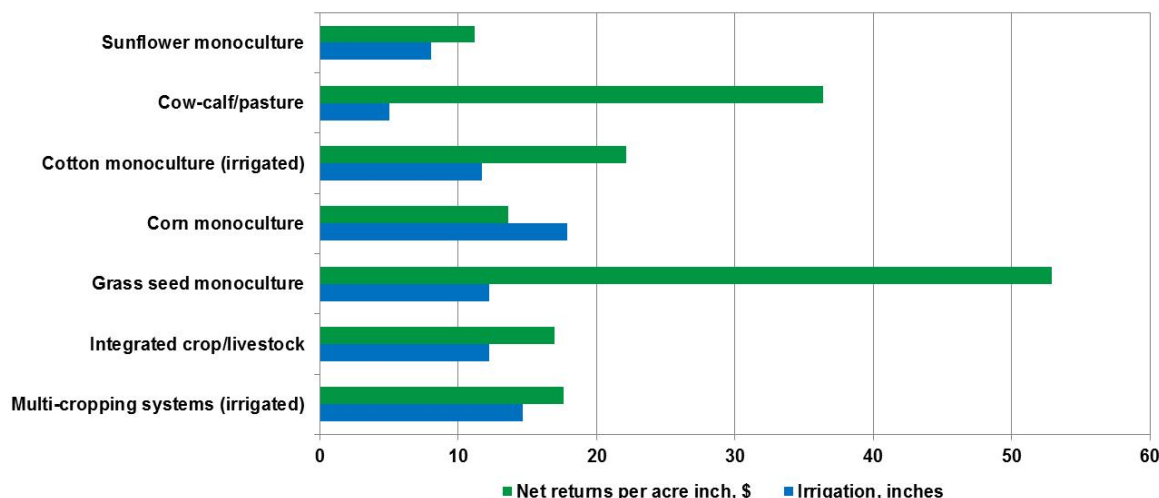


Figure 19. Net returns per acre-inch of irrigation water (green bars), and inches of irrigation applied (blue bars), average of 2005-2012.

Dryland cotton and multi-cropping systems received the least nitrogen fertilizer per acre, whereas corn monoculture received by far the most (Fig. 20). Cow-calf perennial grass pastures were the second lowest users of N fertilizer. For warm-season pasture grasses, 50 to 60 lbs of N/acre annually is generally considered adequate. In contrast, corn monocultures represented the other extreme with about 225 lbs N/acre received annually. All other systems received from about 110 to 130 lbs/acre of N.

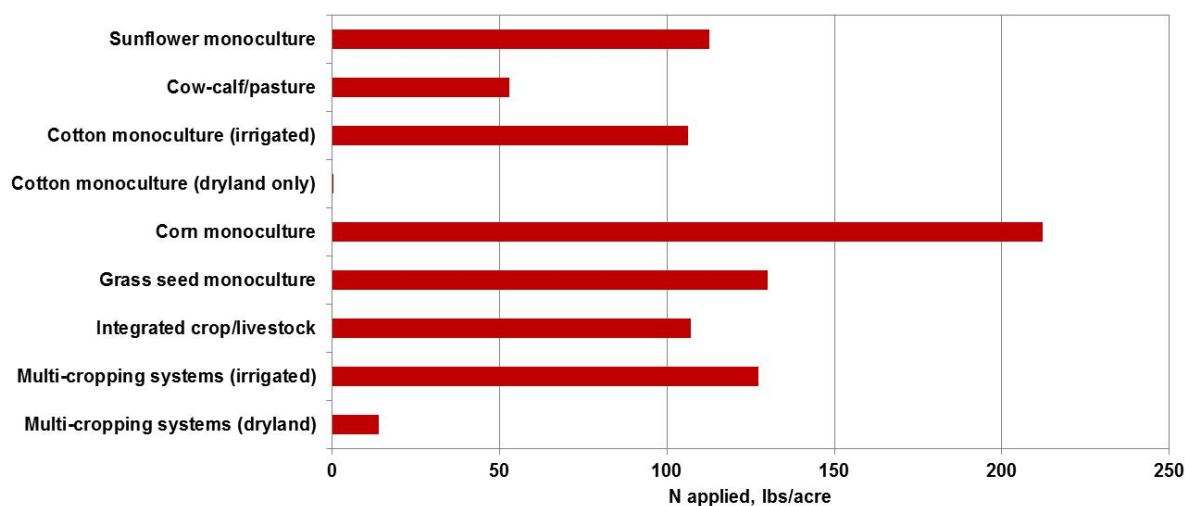


Figure 20. Pounds of nitrogen per acre applied in fertilizer, average of 2005-2012.

Discussion

Over the 8 years of the project we have observed a number of system configurations under varied environmental conditions, irrigation technologies, and market conditions. Management is the key to how these systems behave under the extreme year to year variations experienced. Producers make strategic and tactical production decisions to maintain economic viability and utilize available resources efficiently. Strategic decisions relate to crop and livestock enterprise selection, whether it is year-to-year crop selection or longer term planning. Planting perennial grasses for seed and pasture production, integrating livestock into an operation, and the selection of irrigation technologies are examples of strategic decisions. Tactical decisions relate to enterprise management within the growing season, such as variety selection, fertilizer management, irrigation scheduling and harvest timing.

There are a number of irrigation management technologies such as Smart Crop, AquaSpy and NetIrrigate which aid specifically in the tactical decision process. We have been able to provide some of these technologies to producers within the TAWC project. Information received from these technologies in conjunction with measurement of evapotranspiration (ET) on a field by field basis has helped producers gain insight into better irrigation management techniques. Feedback from producers who have used these technologies has helped us formulate tools to address the short-term and long-term irrigation management challenges facing the region.

Two management tools were developed and made available to producers in the region through the TAWC Solutions web site (<http://www.tawcsolutions.com>) in early 2011. Use of these tools by producers within and outside TAWC has grown tremendously. As of early May 2013, there were nearly 500 people registered to log on to the web site. The Water Allocation Tool, the Irrigation Scheduling Tool, and the Resource Allocation Analyzer are the three practical tools available on this web site. These tools are free of charge to any producer.

The dissemination of results and information from the project through various outreach efforts is an important part of the project. Continuing activities as in previous years, field days were held in February 2012 at Muncy, TX and August 2012 at Plainview, TX. These field days allow attendees to visit several project sites and observe the technologies that are currently being demonstrated within the project to better manage and monitor irrigation use and timing. The February field day was devoted to a more in-depth discussion of results and analysis from the project as well as demonstration of the TAWC Solutions Tools. In addition to the field days, the project was represented at several farm shows within the region, which allowed further dissemination of findings and information regarding the project and demonstrations and producer interaction on the management tools that are being provided on the TAWC Solutions Website.

The long term ability of this project to observe and monitor a variety of crop and integrated crop/livestock systems under various environmental conditions is now allowing us to provide valuable information on irrigation management and water conservation techniques to producers in the area. The management of the Ogallala water resource is critical to the continued economic success of agriculture in the region. Producers face many technical and climatic challenges. The information we are providing from this project will assist producers in meeting these challenges and allow the region to continue to lead in agricultural production through innovation.

Table 20. Summary of results from monitoring 26 producer sites during 2005 (Year 1).

System	Site No.	Acres	Irrigation Type ¹	System Inches	\$/system Acre	\$/inch water
<u>Monoculture systems</u>						
Cotton	1	61	SDI	11.7	84.02	7.19
Cotton	2	68	SDI	8.9	186.94	21
Cotton	14	125	CP	6.8	120.9	17.91
Cotton	16	145	CP	7.6	123.68	16.38
Cotton	21	123	CP	6.8	122.51	18.15
Cotton	11	95	Fur	9.2	4.39	0.48
Cotton	15	98	Fur	4.6	62.65	13.62
<u>Multi-crop systems</u>						
Cotton/grain sorghum	3	125	CP	8.3	37.79	4.66
Cotton/grain sorghum	18	120	CP	5.9	16.75	2.84
Cotton/grain sorghum	25	179	DL	0	67.58	na
Cotton/forage sorghum	12	250	DL	0	36	na
Cotton/pearlmillet	19	120	CP	9.5	186.97	19.12
Cotton/corn	22	148	CP	15.3	166.63	10.9
Cotton/corn	24	129	CP	14.7	149.87	9.96
Cotton/corn	26	123	CP	10.5	192.44	18.34
Cotton/sunflowers	23	110	CP	5.4	270.62	47.07
Cotton/alfalfa	4	123	CP	5.5	110.44	19.06
Cotton/wheat	13	315	DL	0	47.37	na
Cotton/corn silage/grass	17	223	CP	10.5	188.44	17.91
Corn/wheat/sorghum silages	20	220	CP	21.5	-48.6	-2.16
<u>Crop-Livestock systems</u>						
Cotton/wheat/stocker cattle	6	123	CP	11.4	162.63	9.04
Cotton/grass/stocker cattle	9	237	CP	6.5	298.14	46.17
Cotton/grass/cattle	10	175	CP	8.5	187.72	22.06
Forage/beef cow-calf	5	630	CP	1.23	125.89	93.34
Forage/Grass seed	7	61	SDI	9.8	425.32	37.81
Forage/Grass seed	8	130	CP	11.3	346.9	35.56

¹SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland**Table 21.** Summary of results from monitoring 26 producer sites during 2006 (Year 2).

System	Site No.	Acres	Irrigation type ¹	System inches	\$/system acre	\$/inch water	Gross margin per inch irrigation
<u>Monoculture systems</u>							
Cotton	1	135	SDI	21	225.9	10.76	15.77
Cotton	2	61	SDI	19	308.71	16.25	22.56
Cotton	27	46	SDI	18	417.99	23.22	29.89
Cotton	3	123	CP	10	105.79	10.58	18.44
Cotton	6	123	CP	13.6	321.79	23.64	29.42
Cotton	14	124	CP	6.2	44.81	7.2	19.84
Cotton	16	143	CP	12.2	71.08	5.81	8.43
Cotton	11	93	Fur	16.9	88.18	5.22	9.37
<u>Multi-crop systems</u>							
Cotton/grain sorghum	15	96	Fur	11.2	161.89	14.51	20.78
Cotton/forage sorghum	12	284	DL	0	-13.72	na	na
Cotton/forage sorghum/oats	18	122	CP	12	-32.31	-2.69	3.86
Cotton/pearlmillet	19	120	CP	9.8	95.28	9.77	17.83
Cotton/corn	22	149	CP	22	285.98	12.98	16.55
Cotton/corn	24	130	CP	19.4	68.17	3.51	8.34
Cotton/corn	26	123	CP	16	243.32	15.22	21.08
Cotton/corn	23	105	CP	14.8	127.39	8.59	13.9
Cotton/alfalfa/wheat/forage sorghum	4	123	CP	26.7	312.33	11.69	14.75
Cotton/wheat	13	320	DL	0	-33.56	na	na
Corn/triticale/sorghum silages	20	233	CP	21.9	242.79	10.49	15.17
<u>Crop-Livestock systems</u>							
Cotton/stocker cattle	21	123	CP	16.4	94.94	5.79	10.22
Cotton/grass/stocker cattle	9	237	CP	10.6	63.29	6.26	13.87
Cotton/corn silage/wheat/cattle	17	221	CP	13	242.21	14.89	20.64
Forage/beef cow-calf	5	628	CP	9.6	150.46	15.62	22.31
Forage/beef cow-calf	10	174	CP	16.1	217.71	13.52	18.4
Forage/Grass seed	7	130	CP	7.8	687.36	88.69	98.83
Forage/Grass seed	8	62	SDI	10.1	376.36	48.56	64.05

¹SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland

Table 22. Summary of results from monitoring 26 producer sites during 2007 (Year 3).

System	Site No.	Acres	Irrigation Type ¹	System inches	\$/system acre	\$/inch water	Gross margin per inch irrigation
<u>Monoculture systems</u>							
Cotton	1	135	SDI	14.60	162.40	11.12	19.34
Cotton	2	61	SDI	12.94	511.33	39.52	48.79
Cotton	6	123	CP	10.86	605.78	55.78	63.02
Cotton	11	93	Fur	14.67	163.58	11.15	15.92
Cotton	14	124	CP	8.63	217.38	25.19	34.30
Cotton	22	149	CP	11.86	551.33	46.49	53.11
Corn	23	105	CP	10.89	325.69	29.91	37.12
Corn	24	130	CP	15.34	373.92	24.38	31.46
Perennial grass: seed and hay	7	130	CP	13.39	392.59	29.32	35.19
Perennial grass: seed and hay	8	62	SDI	15.67	292.63	18.67	26.33
<u>Multi-crop systems</u>							
Cotton/grain sorghum/wheat	3	123	CP	13.25	190.53	14.38	20.31
Cotton/grain sorghum	12	284	DL	0.00	265.71	Dryland	Dryland
Cotton/wheat	13	320	DL	0.00	105.79	Dryland	Dryland
Cotton/grain sorghum	15	96	Fur	10.50	191.68	18.26	24.92
Grain sorghum/wheat	18	122	CP	5.34	13.91	2.60	13.62
Cotton/pearlmillet	19	121	CP	7.57	318.61	42.10	52.49
Corn/sorghum/triticale silages	20	233	CP	24.27	371.14	15.29	19.76
Corn/perr. grass: seed and hay	21	123	CP	8.35	231.60	27.75	37.16
Corn silage	27	62	SDI	13.00	194.40	14.95	24.18
<u>Crop-Livestock systems</u>							
Wheat: cow-calf, grain/cotton/alfalfa hay	4	123	CP	8.18	183.72	22.47	33.30
Perennial grass: cow-calf, hay	5	628	CP	3.56	193.81	54.38	72.45
Perr. grass, rye: stocker cattle/grain sorghum	9	237	CP	4.19	48.89	11.65	30.00
Perennial grass: cow-calf, hay/corn silage	10	174	CP	6.80	27.84	4.09	14.74
Perennial grass: cow-calf, seed, hay/cotton/wheat for grazing	17	221	CP	8.31	181.48	21.83	33.06
Pearlmillet: seed, grazing/corn	26	123	CP	11.34	378.61	33.39	41.65

¹SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland

Table 23. Summary of results from monitoring 25 producer sites during 2008 (Year 4).

System	Site No.	Acres	Irrigation Type ¹	System inches	\$/system acre	\$/inch water	Gross margin per inch irrigation
<u>Monoculture Systems</u>							
Sunflowers	2	60.9	SDI	6.89	147.83	21.46	43.23
Perennial grass: seed and hay	7	130.0	CP	9.88	295.43	29.90	40.89
Perennial grass: seed and hay	8	61.8	SDI	6.65	314.74	47.33	69.89
Cotton	14	124.2	CP	8.97	-2.12	-0.24	11.87
Corn	22	148.7	CP	24.75	720.10	29.09	34.49
Corn	24	129.8	CP	24.70	513.54	20.79	26.20
Corn	28	51.5	SDI	8.20	591.15	72.09	93.43
<u>Multi-crop systems</u>							
Cotton/Wheat/Grain sorghum	3	123.3	CP	14.75	53.79	3.65	11.01
Cotton/Corn	6	122.9	CP	17.35	411.02	23.68	29.94
Cotton/Grain sorghum	11	92.5	Fur	10.86	176.14	16.22	25.43
Sorghum silage/fallow wheat	12	283.9	DL	0.00	-17.89	Dryland	Dryland
Cotton/Wheat	15	95.5	Fur/SDI	11.22	132.15	11.78	21.57
Cotton/Wheat silage/Grain sorghum hay & silage	18	122.2	CP	10.67	186.42	17.47	27.64
Cotton/Seed millet	19	120.4	CP	7.01	121.40	17.33	32.83
Wheat grain/Grain sorghum grain & silage/hay	20	233.4	CP	27.61	513.56	18.60	22.54
Barley seed/forage sorghum hay/perr. Grass: seed & hay	21	122.7	CP	10.13	387.20	38.24	48.96
Cotton/Sunflowers	23	105.1	CP	14.93	-50.54	-3.38	4.60
Cotton/Corn grain	27	108.5	SDI	20.69	291.15	14.07	22.01
Cotton/Wheat/fallow	29	221.6	DL	0.00	34.06	Dryland	Dryland
<u>Crop-Livestock systems</u>							
Wheat: cow-calf, grain/cotton/alfalfa hay	4	123.1	CP	14.51	154.85	10.68	17.00
Perennial grass: cow-calf, hay	5	628	CP	4.02	107.14	26.65	49.02
Perennial Grass: stocker cattle/Cotton	9	237.8	CP	7.26	11.63	1.60	16.25
Perennial grass: cow-calf, hay/Grass seed/Corn	10	173.6	CP	14.67	64.80	4.42	0.00
Perennial grass: cow-calf, seed, hay/cotton/wheat for grazing	17	220.8	CP	15.00	309.34	20.62	28.68
Pearlmillet: seed, Grain sorghum/Corn: grazing, hay	26	125.2	CP	14.65	279.69	19.09	27.36

¹SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland

Table 24. Summary of results from monitoring 26 producer sites during 2009 (Year 5).

System	Site No.	Acres	Irrigation Type ¹	System inches	\$/system acre	\$/inch water	Gross margin per inch irrigation
<u>Monoculture Systems</u>							
Cotton	2	60.9	SDI	10.50	-52.29	-4.98	9.31
Perennial grass: seed and hay	7	129.9	CP	15.70	597.23	38.04	44.96
Perennial grass: seed and hay	8	61.8	SDI	13.80	365.46	26.48	37.35
Cotton	15	102.8	Fur/SDI	12.96	72.15	5.57	12.39
Cotton	22	148.7	CP	14.73	56.35	3.83	11.20
Cotton	28	51.5	SDI	10.89	187.72	17.24	31.01
Sunflower	30	21.8	SDI	9.25	8.13	0.88	17.10
<u>Multi-crop systems</u>							
Cotton/Grain Sorghum	3	123.3	CP	5.89	158.51	26.91	45.35
Cotton/Corn	6	122.9	CP	10.43	182.14	17.52	28.49
Cotton/Rye	9	237.8	CP	3.17	-11.71	-3.69	30.52
Cotton/Grain Sorghum	11	92.5	Fur	13.24	53.67	4.05	11.60
Sorghum silage/Wheat	12	283.9	DL	0.00	-8.81	Dryland	Dryland
Wheat grain/Cotton	14	124.2	CP	10.57	37.15	3.52	13.79
Wheat grain/Cotton	18	122.2	CP	3.53	44.88	12.71	43.47
Wheat grain/Cotton	19	120.3	CP	5.26	-4.88	-0.93	19.71
Corn silage/Cotton	20	233.3	CP	23.75	552.08	23.25	28.35
Wheat grain/Hay/perennial grass	21	122.6	CP	17.75	79.79	4.50	10.61
Oats/Wheat/Sorghum – all silage	23	105.2	CP	15.67	53.80	3.43	10.36
Corn/Sunflower	24	129.7	CP	13.09	172.53	13.18	22.42
Corn/Cotton	27	108.5	SDI	23.00	218.72	9.51	16.63
Wheat grain/Cotton	29	221.6	DL	0.00	73.79	Dryland	Dryland
<u>Crop-Livestock systems</u>							
Wheat/haygrazer; contract grazing, grain sorghum/cotton/alfalfa hay	4	123.1	CP	9.03	119.85	13.28	25.67
Perennial grass: cow-calf, hay	5	626.4	CP	6.60	53.76	8.15	21.79
Perennial grass: contract grazing, /Cotton	10	173.6	CP	6.04	-83.25	-13.79	4.20
Perennial grass: contract grazing, /sunflower/dahl for seed and grazing	17	220.8	CP	7.09	71.37	10.07	25.39
Corn/Sunflower, contract grazing	26	125.2	CP	14.99	316.22	21.09	29.16

¹SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland

Table 25. Summary of results from monitoring 26 producer sites during 2010 (Year 6).

System	Site No.	Acres	Irrigation Type ¹	System inches	\$/system acre	\$/inch water	Gross margin per inch irrigation
<u>Monoculture systems</u>							
Corn	2	60.9	SDI	14.04	107.81	7.68	22.99
Perennial grass: seed and hay	7	130	CP	2.37	460.56	194.33	253.40
Perennial grass: seed and hay	8	61.8	SDI	3.25	498.82	153.48	207.33
Cotton	15	102.8	Fur/SDI	3.98	489.46	122.85	166.77
Corn	22	148.7	CP	16.10	370.88	23.04	34.22
Corn	24	129.7	CP	17.90	271.50	15.17	25.22
Cotton	28	51.5	SDI	6.24	298.35	47.81	75.86
Corn	30	21.8	SDI	11.90	563.63	47.36	65.43
<u>Multi-crop systems</u>							
Cotton/Grain Sorghum/Wheat	3	123.3	CP	9.15	191.55	20.93	38.10
Alfalfa/Cotton/Wheat/Hay	4	123	CP	11.11	365.89	32.92	45.99
Cotton/Corn	6	122.8	CP	9.88	323.38	32.72	48.88
Cotton/Grain Sorghum	11	92.5	Fur	4.41	6,910	38.93	67.25
	12	283.9	DL	0.00	0.00	Dryland	Dryland
Wheat grain/Cotton	14	124.2	CP	4.30	73.13	17.02	49.59
Wheat grain/Cotton	18	122.2	CP	1.11	78.24	70.66	197.11
Wheat grain/Cotton	19	120.3	CP	4.31	134.55	31.21	63.69
Corn/Trit Silage/Cotton	20	233.4	CP	16.69	817.74	49.01	59.80
Cotton/Corn	21	122.6	CP	10.45	246.09	23.54	38.85
Trit/Corn Silage	23	121.1	CP	20.70	-7.64	-0.37	8.33
Corn Silage/Cotton	27	108.5	SDI	14.70	565.29	38.46	51.59
Grain Sorghum/Cotton	29	221.6	DL	0.00	235.29	Dryland	Dryland
<u>Crop-Livestock systems</u>							
Perennial grass: cow-calf, Hay	5	628	CP	5.15	44.47	8.63	31.08
Perennial grass: contract grazing, /Cotton	9	237.8	CP	2.19	129.12	58.98	122.93
Perennial grass: contract grazing, /Corn	10	173.6	CP	12.00	140.43	25.32	57.36
Perennial grass: contract grazing, /Corn	17	220.8	CP	8.94	6.82	0.76	18.62
Wheat/Cotton/Corn, contract grazing	26	125.2	CP	10.73	416.76	38.85	53.75

¹SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland

Table 26. Summary of results from monitoring 29 producer sites during 2011 (Year 7).

System	Site No.	Acres	Irrigation Type ¹	System inches	\$/system acre	\$/inch water	Gross margin per inch irrigation
<u>Monoculture systems</u>							
Cotton	2	60.9	SDI	16.61	122.37	7.37	17.90
Cotton	3	123.3	CP/MESA	9.30	-102.89	-11.07	3.99
Perennial grass: seed and hay	7	130	CP/LESA	20.50	370.64	18.08	24.91
Perennial grass: seed and hay	8	61.8	SDI	20.04	93.50	4.67	13.40
Cotton	12	283.9	DL	0.00	230.29	Dryland	Dryland
Cotton	14	124.2	CP/MESA	17.80	-226.26	-12.71	-4.85
Cotton	19	120.3	CP/LEPA	19.90	141.92	7.13	14.17
Cotton	22	148.7	CP/LEPA	25.20	538.44	21.37	26.92
Cotton	28	51.5	SDI	18.80	319.90	17.02	26.32
Cotton	29	221.6	DL	0.00	194.89	Dryland	Dryland
Fallow	30	21.8	SDI	0.00	-215.00	Fallow	Fallow
Corn	32	70	CP/LEPA	37.00	-866.35	-23.41	-18.55
Corn	33	70	CP/LEPA	12.00	-67.05	-5.59	9.41
<u>Multi-crop systems</u>							
Alfalfa/Cotton/Wheat /Haygraze	4	123	CP/LEPA	25.32	519.67	20.53	26.26
Cotton/fallow	5	487.6	CP/LESA	3.71	162.53	43.82	81.56
Cotton/Corn	6	122.8	CP/LESA	18.94	179.82	9.49	17.40
Cotton/Grain Sorghum	11	92.5	Fur	27.80	-81.18	-2.92	1.58
Corn/Cotton	15	102.8	SDI	19.31	346.96	17.97	27.95
Wheat grain/Cotton	18	122.2	CP/MESA	0.93	31.02	33.35	183.89
Corn/Trit	20	233.4	CP/LEPA	52.08	250.23	4.80	8.26
Silage/Cotton	21	122.6	CP/LEPA	17.91	157.78	8.81	17.75
Trit/Corn Silage	23	121.1	CP/LESA	33.85	112.64	3.33	8.65
Corn grain/Cotton	24	129.7	CP/LESA	26.54	537.36	20.25	26.27
Corn/Cotton	26	125.2	CP/LESA	16.57	433.62	26.16	35.81
Corn Silage/Cotton	27	108.5	SDI	38.20	229.80	6.02	11.17
Cotton/Seed millet	31	121	CP/LEPA	27.90	12.26	0.44	5.46
<u>Crop-Livestock systems</u>							
Perennial grass: contract grazing, /Cotton	9	237.8	CP/MESA	8.45	72.39	8.56	25.12
Perennial grass: contract grazing, /Cotton	10	173.6	CP/LESA	30.02	592.02	19.72	24.38
Perennial grass: contract grazing, /Cotton	17	220.8	CP/MESA	22.00	116.96	5.32	11.68

¹SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland

Table 27. Summary of results from monitoring 29 producer sites during 2012 (Year 8).

System	Site No.	Acres	Irrigation Type ¹	System inches	\$/system acre	\$/inch water	Gross margin per inch irrigation
<u>Monoculture systems</u>							
Cotton	3	123.3	CP/MESA	8.40	822.71	97.93	114.60
Cotton/fallow	5	484.1	CP/LESA	10.53	-55.06	-5.23	5.71
Corn grain/fallow	6	122.7	CP/LESA	17.29	-76.28	-4.41	2.52
Perennial grass: seed and hay	7	130	CP/LESA	20.60	696.38	33.80	40.60
Perennial grass: seed and hay	8	61.8	SDI	17.30	712.46	41.18	51.30
Cotton (No Data)	12	283.8	DL	0.00	0.00	Dryland	Dryland
Cotton/fallow	19	120.4	CP/LEPA	7.33	177.03	24.16	40.50
Cotton	22	148.7	CP/LEPA	19.50	918.83	47.12	54.30
Cotton	30	21.8	SDI	13.60	-53.60	-3.94	8.93
Corn grain	33	70	CP/LEPA	18.70	-298.65	-15.97	-6.34
<u>Multi-crop systems</u>							
Cotton/Corn grain	2	60	SDI	12.06	545.42	45.23	61.73
Alfalfa/Cotton/Wheat/Seed Sorghum	4	123	CP/LEPA	15.54	320.03	20.59	26.24
Cotton (failed)/Grain Sorghum	11	92.5	Fur	12.00	463.87	38.66	49.07
Cotton/Wheat	14	124.1	CP/MESA	6.51	-99.71	-15.31	6.19
Cotton (failed)/Grain Sorghum	15	101.1	SDI	27.43	591.80	21.57	27.95
Perennial grass: contract grazing, /Cotton/Corn g.	17	220.7	CP/MESA	17.40	890.46	51.18	59.23
Wheat/Cotton (No Data)	18	122.2	CP/MESA	0.00	0.00	0.00	0.00
Corn/Trit Silage/Cotton	20	233.3	CP/LEPA	29.53	609.85	20.66	26.08
Wheat/Haygrazer/Cotton	21	122.6	CP/LEPA	19.41	542.88	27.97	35.19
Corn grain/Cotton	24	129.7	CP/LESA	19.94	788.27	39.53	47.55
Sunflowers/Cotton	26	125.1	CP/LESA	14.95	235.53	15.75	25.12
Corn Silage/Cotton	27	108.4	SDI	16.98	953.77	56.17	66.40
Cotton (hail)/Corn grain	28	51.5	SDI	19.6	-138.03	-7.04	1.89
Cotton/Grain Sorghum	29	221.6	DL	0.00	9.39	Dryland	Dryland
Cotton/Seed millet	31	121.9	CP/LEPA	20.36	167.05	8.21	15.08
Cotton (hail)/Corn grain	32	70	CP/LEPA	21.50	194.39	9.04	17.41
Cotton (hail)/Corn grain	34	726.6	CP/LESA	10.00	358.39	35.84	51.84
<u>Crop-Livestock systems</u>							
Perennial grass: contract grazing, /Cotton	9	237.8	CP/MESA	11.46	391.18	34.14	46.35
Perennial grass: contract grazing, /Cotton	10	173.6	CP/LESA	23.02	29.08	1.26	8.22

¹SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland

Table 28. Overall summary of crop production, irrigation, and economic returns within all production sites in Hale and Floyd Counties during 2005-2012.

Item	2005	2006	2007	2008	2009	2010	2011	2012	Crop year Average
Mean Yields, per acre (only includes sites producing these crops, includes dryland) (Yield averages across harvested fields within sites)									
Cotton									
Lint, lbs	1,117 (22) (1)	1,379 (20)	1,518 (13)	1,265 (11)	1,223 (16)	1,261 (15)	1,166 (19)	1,299 (16)	1,278.50
Seed, tons	0.80 (22)	0.95 (20)	1.02 (13)	0.86 (11)	0.81 (16)	0.83 (15)	0.77 (19)	0.92 (16)	0.87
Corn									
Grain, lbs	12,729 (3)	8,814 (4)	12,229 (4)	10,829 (8)	12,613 (4)	12,685 (10)	6,766 (4)	7,475 (7)	10,517.50
Silage, tons	30.9 (2)	28.3 (3)	27.3 (3)	-	38.3 (1)	31 (2)	20.5 (3)	6.3 (4)	26.09
Sorghum									
Grain, lbs	4,147 (3)	2,987 (1)	6,459 (4)	6,345 (5)	6,907 (3)	4,556 (3)	1,196 (1)	6358 (2)	4,869.38
Silage, tons	26.0 (1)	20.4 (2)	25.0 (1)	11.3 (2)	9.975 (2)	-	-	-	18.54
Seed, lbs	-	-	-	3507 (1)	-	-	-	3396 (1)	3,438.00
Wheat									
Grain, lbs	2,034 (1)	-	2,613 (5)	4,182 (5)	2,061 (6)	2,860 (6)	3,060 (1)	2052 (3)	2,694.57
Silage, tons	16.1 (1)	7.0 (1)	-	7.5 (1)	3.71 (1)	-	-	-	8.58
Hay, tons	-	-	-	-	2.5 (1)	-	-	-	2.50
Oat									
Silage, tons	-	4.9 (1)	-	-	12.5 (1)	-	-	-	8.70
Hay, tons	-	1.8 (1)	-	-	-	-	-	-	1.80
Barley									
Grain, lbs	-	-	-	3,133 (1)	-	-	-	-	3,133.00
Hay, tons	-	-	-	5.5 (1)	-	-	-	-	5.50
Triticale									
Hay, tons	-	-	-	-	-	-	3(1)	-	3.00
Silage, tons	-	21.3 (1)	17.5 (1)	-	-	13 (2)	2.5(2)	12 (1)	13.26
Sunflower									
Seed, lbs	-	-	-	1,916 (2)	2,274 (4)	-	-	1903 (1)	2,031.00
Pearl millet for seed									
Seed, lbs	3,876 (1)	2,488 (1)	4,002 (2)	2,097 (2)	-	-	1,800(1)	2014 (1)	2,712.83
Perennial forage									
Dahl									
Seed, PLS lbs	-	-	-	30 (1)	83.14 (1)	-	-	62.8 (1)	58.65
Hay, tons	-	-	-	2.5 (1)	-	-	-	-	2.50
SideOats									
Seed, PLS lbs	313 (2)	268 (2)	183.5 (3)	192.9 (3)	362 (3)	212.5 (2)	200.75 (2)	267 (2)	249.96
Hay, tons	3.6 (2)	2.1 (2)	1.46 (3)	1.66 (3)	1.83 (3)	1.1 (2)	0.5 (2)	1.9 (2)	1.77
Other									
Hay, tons	-	-	-	0.11 (1)	4.3 (1)	2.4 (1)	-	-	2.27
Alfalfa									
Hay, tons	8.3 (1)	9.18 (1)	4.90 (1)	12.0 (1)	9.95 (1)	9.0 (1)	10.6 (1)	8.4 (1)	9.04
Annual forage									
Forage Sorghum									
Hay, tons	-	-	-	-	-	-	6.8 (1)	1.9 (2)	4.35
Precipitation, inches (including all sites)	15.0	15.4	27.3	21.7	15.7	28.9	5.3	10.0	17.40
Irrigation applied, inches (not including dryland)									
By System									
Total irrigation water (system average)	9.2 (26)	14.8 (26)	11.0 (25)	13.3 (23)	11.5 (24)	9.2 (24)	20.99 (27)	16.6 (26)	13.32
By Crop (Primary Crop)									
Cotton	8.7 (19)	14.3 (19)	11.3 (11)	12.2 (10)	12.5 (15)	7.4 (15)	23.2 (19)	14.8 (16)	13.05
Corn grain	17.4 (3)	21.0 (4)	12.5 (4)	21.7 (8)	19.2 (4)	12.8 (10)	27.1 (4)	22.1 (7)	19.23
Corn silage	18.0 (2)	24.0 (3)	12.6 (3)	-	24.3 (1)	18 (2)	34.7 (3)	22.5 (4)	22.01
Sorghum grain	7.5 (1)	4.2(1)	6.6 (4)	13.8 (5)	9.4 (3)	6.13(2)	27.8 (1)	19.7 (2)	11.70
Sorghum silage	15.0 (1)	12.5 (2)	13.5 (1)	11.5 (1)	15.7 (1)	-	-	-	13.64
Wheat grain	-	-	5.3 (3)	7.68 (4)	5.7 (5)	2.6 (6)	11.3 (1)	4.7 (3)	6.21
Wheat silage	7.5 (1)	16.3 (1)	-	5.5 (1)	15.7 (1)	-	-	-	11.25
Oat silage	-	4.3 (1)	-	-	15.7 (1)	-	-	-	10.00
Oat hay	-	4.9 (1)	-	-	-	-	-	-	4.90
Triticale silage	-	10.0 (1)	12.9 (1)	-	-	6.9 (2)	17.8 (2)	19.6 (1)	13.44
Barley grain	-	-	-	12.8 (1)	-	-	-	-	12.80
Small Grain (grazing)	0.5 (3)	0.8 (2)	0.8 (3)	-	-	-	-	-	0.70
Small Grain (grains)	-	-	5.3 (3)	8.7 (5)	5.7 (5)	2.6 (6)	11.3 (1)	4.7 (3)	6.38
Small Grain (silage)	7.5 (1)	10.2 (3)	12.9 (1)	5.5 (1)	15.7 (2)	6.9 (2)	17.8 (2)	19.6 (1)	12.01
Small Grain (hay)	-	4.9 (1)	-	-	-	-	-	-	4.90
Small Grain (all uses)	5.2 (5)	7.3 (10)	7.4(11)	8.2 (6)	8.6 (7)	3.7 (8)	15.6 (3)	8.4 (4)	8.00
Sunflower seed	-	-	-	9.6 (2)	8.9 (4)	-	-	15.1 (1)	11.20
Millet seed	-	-	-	9.6 (2)	-	-	29.4 (1)	22.0 (1)	20.33
Dahl									
hay	-	-	-	4.65 (1)	-	-	-	-	4.65
seed	-	-	-	9.4 (1)	8.9 (1)	-	-	8.2 (1)	8.83
grazing	-	-	-	-	4.1 (1)	4.6 (3)	8.9 (2)	22.7 (1)	10.08
Sideoats									
seed	-	-	-	8.0 (3)	15.3 (3)	2.8 (2)	20.3 (2)	18.9 (2)	13.06
Bermuda									
grazing	-	-	-	6.2 (1)	5.3 (1)	0 (1)	17.1 (1)	12.0 (1)	8.12
Other Perennials/Annuals									
hay	-	-	-	4.02 (1)	-	8.5 (1)	-	13.9 (2)	8.81
grazing	-	-	-	5.5 (1)	6.6 (1)	5.1 (1)	-	-	5.73
Perennial grasses (grouped)									
Seed	-	-	-	8.35 (4)	13.7 (4)	2.8 (2)	-	8.2 (1)	8.26
Grazing	-	-	-	5.85 (2)	5.3 (3)	3.8 (5)	11.6 (3)	10.8 (1)	7.47
Hay	-	-	-	4.33(2)	-	-	-	13.9 (2)	9.12
All Uses	6.5 (6)	8.8 (6)	7.1 (7)	6.7 (8)	10.1 (7)	3.5 (7)	11.6 (3)	11.7 (2)	8.25
Alfalfa	10.3 (1)	34.5 (1)	10.6 (1)	15.6 (1)	18.6 (1)	15.6 (1)	44.1 (1)	28.3 (1)	22.20
Income and Expense, \$/system acre									
Projected returns	660.53	773.82	840.02	890.37	745.82	961.87	951.66	1063.98	861.01
Costs									
Total variable costs (all sites)	444.88	504.91	498.48	548.53	507.69	537.14	677.42	578.28	537.17
Total fixed costs (all sites)	77.57	81.81	81.77	111.98	110.65	153.55	149.98	135.53	109.61
Total all costs (all sites)	522.45	586.72	580.25	660.51	618.34	690.69	827.40	713.80	650.02
Gross margin									
Per system acre (all sites)	215.66	268.91	341.54	341.84	238.13	424.74	295.10	469.92	324.48
Per acre inch irrigation water (irrigated only)	33.51	22.53	34.01	31.17	22.95	71.51	24.20	32.73	34.08
Net returns over all costs									
Per system acre (all sites)	138.09	187.10	259.77	229.86	127.48	271.19	145.11	334.39	211.62
Per acre inch of irrigation water (irrigated only)	21.58	15.88	24.99	20.89	9.99	43.71	9.60	22.89	21.19
Per pound of nitrogen (all sites)	1.62	0.81	2.34	1.48	0.87	2.40	1.82	2.51	1.73

[1] Numbers in parenthesis refer to the number of sites in the mean.

REPORTS BY SPECIFIC TASK

TASK 2: Administration and Support **Annual Report ending February 28, 2013**

2.1: Project Director: Rick Kellison, Project Director (TTU)

Although 2012 was well below average precipitation for our region, it was better than the 2011 growing season. After learning from weather events in 2011, producers adjusted their irrigated acres and crop mixes for 2012. Some of the TAWC sites did receive rain and hail on June 4 with most of the cotton acres affected replanted to grain sorghum. By the fall, we had seen some recovery in perennial pastures, but were still a long way from full recovery.

On March 23rd, Jeff Pate and Rick Kellison were invited to make TAWC presentations to the New Mexico Ag Bankers Conference in Ruidoso. The 45 agricultural lenders in attendance were very interested in the TAWC tools to aid producers in planning and managing various cropping systems.

On April 2, TAWC management team members had their first meeting with Dr. Bill Robertson with National Cotton Council. Dr. Robertson requested our cooperation in a pilot project to test the Keystone Alliance field print calculator. We are the second group nation-wide to be asked to be involved in this project. This web-based tool allows producers to evaluate and rank their production practices based on their sustainability. The objective is to test the tool and develop a method where producers might be able to receive a premium for commodities grown in a more sustainable manner. Of course, our most limiting factor to sustainable agricultural production in this region of Texas is the efficient and effective use of water. On December 10, 2012, we held a conference call to discuss how Keystone might include water conservation into their formula.

On April 16, Jeff Pate and Rick Kellison held a TAWC tools training for a group of Texas A&M AgriLife County Extension Agents at the Experiment Station in Lubbock. This meeting was held to help agents understand how these tools could aid producers with crop systems pre-planning and in season irrigation scheduling. We believe this was an excellent opportunity to extend the outreach of the TAWC demonstration project. These agents will have access to all site technology information through the growing season.

On May 11th, Comer Tuck, with the Texas Water Development Board met with Phil Brown and Rick Kellison to review the TAWC annual report. After completing the meeting, Comer and Kellison drove to the demonstration area to tour some of the project sites.

Linda Lind with the Secretary of State's office and a group of foreign journalists toured some of the TAWC sites on May 17. This group was very interested in how we were attempting to aid producers in these drought conditions. They had an opportunity to interview three of our producers.

During the first quarter Jeff Pate and I met several times with various John Deere employees. John Deere is introducing a new type of soil moisture probe to aid producers with soil moisture

monitoring and irrigation scheduling. We installed four of these probes in the TAWC project sites in 2012.

On June 19, 20, and 21, Kellison made TAWC tools presentations. These producer meetings were held in Lorenzo, Littlefield, and Plainview with good attendance by area growers. Presentations were also made by Dr. Calvin Trostle, and representatives from John Deere Water, AquaSpy, and Smartfield. June 21, I met with three representatives from Monsanto to discuss future cooperation on irrigation scheduling tools.

July 10, I hosted Justin Weinheimer, with the Grain Sorghum Checkoff, to view and meet with producers growing grain sorghum in the TAWC project, and I attended a meeting announcing future grant opportunities with the State of Texas Emerging Technology Funds. July 11, I attended the first Texas Tech University campus-wide Water Summit.

Dr. Phil Johnson and I made TAWC presentations to the Texas Agricultural Cooperative Council on July 12, with approximately one hundred attendees. The audience was comprised of coop managers, agricultural lenders and AgriLife Extension personal. Also on July 12, I made a TAWC presentation to the Texas Independent Ginners Association Conference.

On July 9th, TAWC held its annual summer field day at the Ollie Liner Center in Plainview. There were approximately 65 in attendance at this field day. We visited two producers sites; Glen Schur and Scott Horne. Both producers made in-field presentations on their water management practices for the 2012 growing season. The Honorable Pete Laney was our keynote speaker for this year's field day.

On September 3, TAWC hosted an appreciation cook-out for all TAWC cooperators and their families and the TAWC management team. Our cook-out was held at Ronnie Aston's seed barn south of Lockney. It appeared that a good time was had by all attending. The College of Agriculture at Texas Tech sponsored this event and we'll have a similar event in 2013.

The Sorghum Checkoff launched its first class of a new program called Leadership Sorghum in September, 2012. Fifteen sorghum producers from eight states were selected for Leadership Sorghum Class 1. The program's first session was held September 4-6 in the Texas Panhandle introducing Class 1 to the sorghum seed industry and public research. An estimated 90% of all grain sorghum seed production comes from this region. On September 5, I had the opportunity to make a presentation about the TAWC project to Class1 at the ARS Lab in Lubbock. On October 24, I made a presentation to the Texas Agricultural Lifetime Leadership group (TALL). The Tall program is sponsored by Texas A & M University and comprises 25 outstanding young men and women from all across Texas. Each class will be involved in the Tall program for two years.

Beginning in October the TAWC management team has met at least twice monthly. The objective of these meetings is to develop an executive summary of the TAWC demonstration project from its inception to date. Each task leader has taken specific areas of the summary to complete. The summary will include such things as accomplishments of the project, water

saved, economic drought impact, changes in available water, and future direction of the project. We plan to have this summary completed in early 2013.

On November 25 and 28, I attended the Amarillo Farm Show where I helped man the TAWC booth. While at the farm show on the 28, TAWC received the Blue Legacy Award from the Texas Water Development Board and several of our management team was in attendance. On December 17, Todd Carpenter, with Syngenta, and I met in Lubbock. Syngenta is interested in incorporating the TAWC tools to aid producers in planning their cropping systems and in season irrigation scheduling. Syngenta will have a pilot project in 2013 working with producers to test their new dashboard. There is a possibility that TAWC will be involved in this project. I spent much of my time in January working on details for the TAWC annual winter field day which was held on January 17, at the Unity Center, Muncy, Texas. This year we wrapped up the morning session with a producer panel comprised of Glenn Schur, Boyd Jackson, and Scott Horne. They shared how the drought of 2011 had impacted their cropping systems and irrigation management for 2012. They also discussed their management strategy for 2013 which included adopting the new water policy.

Senator Robert Duncan, Sarah Clifton, Dr. Chuck West and I met on February 8, 2013 to review the TAWC seven year summary and the future direction of the TAWC project. One addition to the project for 2013 are regularly scheduled producer “Field Walks”. The purpose of these “Field Walks” are to include producers, crop consultants, extension, and industry to evaluate specific fields for irrigation management and other crop inputs. We will demonstrate various irrigation scheduling technologies such as the TAWC ET program and various constant probe data. All “Field Walks” will be videoed and made available on u-tube. KFLP Radio will interview participants and air these interviews on their agronomic updates. We hope that these regular meetings will expose more producers to the management technologies available. Texas A&M AgriLife extension personal from Lubbock, Crosby, Floyd, Hale and Swisher counties have agreed to be involved in this effort.

On February 25, 2013, TAWC was involved in the Texas Ag Forum, held in Austin, Texas. Dr. Chuck West made a presentation on the TAWC Project. Dr. West and I met with Comer Tuck and Cameron Turner after the Ag Water Forum. We discussed additions and corrections to the TAWC executive and seven year summaries. Presentations this year:

03-06-2012	Lubbock Kiwanis Club	Lubbock, Texas
03-23-2012	New Mexico Ag Bankers Conference	Ruidoso, New Mexico
04-03-2012	AgriLife Extension Meeting	Tulia, Texas
05-10-2012	Carillon Center	Lubbock, Texas
06-19-2012	Lloyd Author Farm	Lorenzo, Texas
06-20-2012	Blake Davis Farm	Littlefield, Texas
06-21-2012	Glenn Schur Farm	Plainview, Texas
07-12-2012	Texas Agricultural Coop Council	Ruidoso, New Mexico
07-12-2012	Texas Independent Ginners Conf.	Ruidoso, New Mexico
09-05-2012	Leadership Sorghum Class 1	Lubbock, Texas
10-24-2012	Texas Agriculture Lifetime Leadership	Hart, Texas
01-03-2013	KFLP Radio	Floydada, Texas
02-04-2013	Texas Seed Trade Association	Austin, Texas

Tours this year:

05-14-2012	Farm Journal Media
05-11-2012	Comer Tuck
05-17-2012	Secretary of State group
07-10-2012	Justin Weinheimer

We have held our monthly management team meeting this year and I have made regular site visits.

2.2: Administrative Coordinator: Christy Barbee, Unit Coordinator (TTU)

Position previously held by Angela Beikmann was vacated in March of 2012 and replaced by Christy Barbee in August of the same year. Year 8 main objectives for the secretarial/administrative and bookkeeping support role for the TAWC Project include the following:

Accurate Accounting of All Expenses for the Project Includes monthly reconciliation of accounts with TTU accounting system, quarterly reconciliation of subcontractors' invoices, preparation of itemized quarterly reimbursement requests, and preparation of Task and Expense Budget and Cost Sharing reported for Year 8 of the project. Budget was balanced for annual report and assistance was given preparing the annual report to completion.

Administrative Support for Special Events 1st annual Producer Appreciation Day was held on Monday September 3rd. Assistance was given with mail out and advertisement for event. The TAWC Farmer Field Day was held at the Unity Center in Muncy Texas on January 17th, 2013. Sponsor donations were received and deposited and were used for Field Day expenses such as catering, venue rentals and print services. Assistance was given by helping to coordinate meals on the day of the event.

Ongoing Administrative Support Daily administrative tasks include correspondence through print, telephone and e-mail; completing various clerical documents such as mileage logs, purchase orders, cost transfers, travel applications, human resource forms, and pay payroll paperwork; and other duties as requested or assigned.

Six monthly Management Team meetings have been attended and all minute shave been transcribed and distributed.

TAWC producer binders were assembled for each TAWC producer to categorize their records. These binders greatly assist the research team in acquiring useful data for this annual report and other communications.

TASK 3: FARM Assistance Program Annual Report ending February 28, 2013

Principal Investigator(s): Dr. Steve Klose, Jeff Pate and Jay Yates (AgriLife)

Texas AgriLife Extension Service, FARM Assistance Sub-Contract with Texas Tech University

Year 8 project progress regarding Task 3 in the overall project has occurred in several areas ranging from collaborating in project coordination and data organization to data collection and communication, as well as providing additional services to the area producers in conjunction with the TAWC project. A brief summary of specific activities and results follows:

Project Collaboration

A primary activity of initiating the FARM Assistance task included collaborating with the entire project management team and coordinating the FARM Assistance analysis process into the overall project concepts, goals, and objectives. The assessment and communication of individual producer's financial viability remains crucial to the evaluation and demonstration of water conserving practices. Through AgriLife Extension participation in management team meetings and other planning sessions, collaboration activities include early development of project plans, conceptualizing data organization and needs, and contributions to promotional activities and materials.

Farm Field Records

AgriLife Extension has taken the lead in the area of data retrieval in that FARM Assistance staff is meeting with producers multiple times each year to obtain field records and entering those records into the database. AgriLife Extension assisted many of the project participants individually with the completion of their individual site demonstration records (farm field records). Extension faculty have completed the collection, organization, and sharing of site records for all of the 2012 site demonstrations.

FARM Assistance Strategic Analysis Service

FARM Assistance service is continuing to be made available to the project producers. The complete farm analysis requires little extra time from the participant, and the confidentiality of personal data is protected. Extension faculty has completed whole farm strategic analysis for several producers, and continues to seek other participants committed to the analysis. Ongoing phone contacts, e-mails, and personal visits with project participants promote this additional service to participants.

In addition to individual analysis, FARM Assistance staff has developed a model farm operation that depicts much of the production in the demonstration area. While confidentiality will limit some of the analysis results to averages across demonstrations, the model farm can be used to more explicitly illustrate financial impacts of water conservation practices on a viable whole farm or family operation.

FARM Assistance Site Analysis

While the whole farm analysis offered to demonstrators as a service is helpful to both the individual as well as the long-term capacities of the project, the essential analysis of the financial

performance of the individual sites continues. FARM Assistance faculty completed and submitted economic projections and analysis of each site based on 2011 demonstration data. These projections will serve as a baseline to for future site and whole farm strategic analysis, as well as providing a demonstration of each site's financial feasibility and profitability. Each producer in the project received a copy of the analysis for their site based on the 2011 data. This analysis can be used by each producer to establish some economic goals for the future. 2012 analysis will be completed this summer, as yield data has only recently been finalized for the 2012 crop.

Economic Study Papers

Farm Assistance members completed a study paper utilizing the economic data on some sites within the TAWC project. The paper examined the profitability of irrigated cotton grown during the extreme drought conditions of 2011 and 2012. The results of this paper were presented at the Beltwide Cotton Conference held in San Antonio, Texas this past January.

Continuing Cooperation

Farm Assistance members also continue to cooperate with the Texas Tech Agriculture Economics Department by furnishing data and consulting in the creation of annual budgets. These budgets will later be used by Farm Assistance members to conduct site analysis for each farm in the TAWC project.

Conservation Innovation Grant

Nine additional sites operated by six producers have been selected. Beginning in 2012, data were collected from these sites, as well as the 29 existing sites in the TAWC project. All of these sites were furnished with soil moisture monitoring equipment, water metering devices, and center pivot monitors. Farm Assistance members assisted in training producers in the use and interpretation of data from each of these devices. Two training days were held for producers, as well on-site meetings with each producer to adequately train each one about the equipment installed on his site.

Other Presentations

Farm Assistance members, along with project director, Rick Kellison, made a presentation to agricultural lenders within the New Mexico Bankers Conference. Tools that were developed by the TAWC were demonstrated that show water savings, as well as decision-aid tools. These tools were developed for producers in the Texas High Plains, but proved to be useful to producers outside of this area.

Farm Days

Three Farm Days were held in July at sites in Hale, Crosby, and Lamb counties. The purpose of these Farm Days was to make producers aware of irrigation timing practices using soil moisture probes. These probes were located in fields adjacent to the meeting sites so as to allow attendees to see the data generated by the probe and see the irrigation operations taking place in the field.

Field Days

Two Field Days were held in the TAWC project during the 2012 growing season. The Summer Field Day was held August 9 and the Winter Field Day was held January 17. Both meetings were held at the Unity Center in Muncy, Texas. The purpose of these meetings were to allow

producers outside of the project to see what takes place within the project, as well as allow producers to hear about the latest research and policy that could have an impact on their operation . Personnel from AgriLife Extension, AgriLife Research, Farm Assistance, the High Plains Water District, and Texas Tech University were involved in these field days.

TASK 4: Economic Analysis
Annual Report ending February 28, 2013

Principal Investigator(s): Drs. Phillip Johnson and Eduardo Segarra, and Donna Mitchell

The primary objectives of Task 4 are to compile and develop field level economic data, analyze the economic and agronomic potential of each site and system, and evaluate relationships within each system relative to economic viability and efficiency. In conjunction with Texas AgriLife Extension, field level records of inputs, practices and production are used to develop enterprise budgets for each site. The records and enterprise budgets provide the base data for evaluation of the economics of irrigation technologies, cropping strategies, and enterprise options. All expenses and revenues are accounted for within the budgeting process. In addition to an economic evaluation of each site, energy and carbon audits are compiled and evaluated.

Major Achievements for 2012:

- 2012 represented the eighth year of economic data collection from the project sites. Data for the 2012 production year were collected and enterprise budgets were generated.
- TAWC cooperated with the National Cotton Council in a pilot project for the Fieldprint Calculator which is being developed by Field-to-Market – The Keystone Alliance for Sustainable Agriculture. The Fieldprint Calculator estimates the carbon and energy footprint for crop production. TAWC site information for 2006 through 2011 has been entered into the calculator. The results from the Fieldprint Calculator will be compared to the carbon and energy analysis previously completed for sites in the project. We have had discussions with Field-to-Market representatives the possibility of including additional criteria regarding water conservation into the Fieldprint Calculator.

Journal articles related to the TAWC in 2012:

- Allen, V., C.P. Brown, R. Kellison, p. Green, C. Zilverberg, P. Johnson, J. Weinheimer, T. Wheeler, E. Segarra, V. Acosta-Martinez, T. Zobeck, J. Conkwright. 2012. Integrating Cotton and Beef Production to Reduce Water Withdrawal from the Ogallala Aquifer in the Southern High Plains: I. Ten-years of effect on water use and productivity. *Agronomy Journal* 104:1625-1642.
- Zilverberg, C.J., V.G. Allen, C.P. Brown, P. Green, P. Johnson, J. Weinheimer. 2012. Integrating cotton and beef production to reduce water withdrawal

from the Ogallala aquifer in the Southern High Plains: II. Ten-years of effect on energy and carbon. *Agronomy Journal* 104:1643-1651.

Proceedings related to the TAWC in 2012:

- Mitchell, D., P. Johnson, J. Johnson, R. Kellison, and J.A. Weinheimer. 2012. Texas High Plains Initiative for Strategic and Innovative Irrigation Management. Proceedings of 2012 Conference of the Universities Council on Water Resources. July 19, 2012. Santa Fe, New Mexico.

Presentations related to the TAWC in 2012:

- Johnson, P. Overview of the TAWC Project and Water Issues in the Texas High Plains. Sunray Cooperative Board Meeting at CoBank. January 10, 2012, Denver, CO.
- Tewari, R., J. Johnson, S. Amosson, B. Golden, L. Almas, and B. Guerrero. 2012. Evaluating Implementation costs of selected water conservation policies in the Southern Ogallala Region. Poster presentation at the Southern Agricultural Economics Association meetings, February 7, 2012, Birmingham, AL.

Demonstration Project Profitability Evaluation 2005 – 2012

Profitability for each demonstration site was calculated for the years 2005 through 2012. Efficiency related to the primary resources – land and applied irrigation water – was measured by gross margin per acre of land and gross margin per acre-inch of applied irrigation water. Gross margin (gross revenue less direct costs) was used as the measure of profitability.

Tables 29 and 30 give a summary of irrigation applied, gross margin per acre and per acre-inch of applied irrigation, irrigation technology, and crop or rotation for each site over the period 2005 through 2012. Table 29 ranks the sites by gross margin per acre. The average irrigation applied ranged from 6.65 to 27.14 inches. Sixteen sites had average gross margins over \$300 per acre, with average irrigation ranging from 11.58 to 27.14 inches.

Figure 21 shows the distribution of gross margin per acre to inches of applied irrigation. The area delineated by the rectangle in the upper left corner of the chart represents gross margins greater than \$300 per acre and applied irrigation of 15 inches or less. Ten sites met these criteria over the 8-year period 2005- 2012. Of these, sites 7 and 8 were monoculture grass seed production; site 28 was cotton; sites 6, 2, 30 and 15 were cotton/corn rotations; and sites 26, 4, 21 and 17 were multi-crop rotations with grazing. Five sites met the \$300 gross margin per acre criterion with average irrigation over 18 inches, and were cotton/corn rotations.

Table 30 ranks the sites by gross margin per acre-inch of applied irrigation. Gross margin per acre-inch ranged from \$47.96 to \$14.07. Figure 22 shows the distribution of gross

margin per acre and gross margin per acre-inch of applied irrigation. The area delineated by the rectangle in the upper right corner of the chart represents gross margin per acre over \$300 and gross margin per acre-inch over \$30. Six sites were in the “top ten” for gross margin per acre and gross margin per acre-inch of irrigation. These included sites representing grass seed monoculture (7 and 8), cotton (28), multi-crop rotation with grazing (26), cotton/corn rotation (2 and 30), and multi-crop rotation (15).

Over the years of the project certain sites have been taken out and sites have been added. The analysis presented here only included sites that have at least three (3) years of results. There were 3 sites added in 2010 and 1 additional site added to the project in 2012, however, these sites are not included in the analysis.

Abbreviations used in the tables: A – Alfalfa, CC – Cow/Calf, CT – Cotton, CR – Corn, CS – Corn Silage, FS – Forage Sorghum, GR – Grass, GS – Grass Seed, ML – Millett Seed, OS – Oat Silage, SC – Stocker Cattle, SF – Sunflowers, SR – Grain Sorghum, TR – Triticale, WH – Wheat, WS – Wheat Silage, CF – Conventional Furrow, LESA – Low Elevation Spray Application, LEPA – Low Energy Precision Application, MESA Mid Elevation Spray Application, SDI – Subsurface Drip System. Gross Margin (GM) represents Gross Revenues less Direct Costs.

Economic Term Definitions

Gross Income – The total revenue received per acre from the sale of production

Variable Costs – Cash expenses for production inputs including interest on operating loans.

Gross Margin – Total revenue less total variable costs

Fixed Costs – Costs that do not change with a change in production. These costs are incurred regardless of whether or not there was a crop produced. These include land rent charges and investment costs for irrigation equipment.

Net Returns – Gross margin less fixed costs.

Table 29. Sites ranked by gross margin per acre, 2005 - 2012.

Site	Irrigation Applied	Gross Margin Per Acre	Gross Margin Per Acre Inch	Irrigation Technology	Crop or Rotation							
	Inches	\$/Acre	\$/Acre Inch		2005	2006	2007	2008	2009	2010	2011	2012
7	12.51	599.82	47.96	LESA	GS	GS	GS	GS	GS	GS	GS	GS
27	20.65	574.42	27.81	SDI		CT	CS	CT/CR	CT/CR	CT/CS	CT/CS	CT/CS
22	18.69	568.36	30.42	LEPA	CT/CR	CT/CR	CT	CR	CT	CR	CT	CT
20	27.14	548.16	20.20	LEPA	WH/FS/CR	CS/FS	TR/FS	WH/SR/FS	CS/CT	CR/TR/CT	CR/TR/CT	CS/TR/CT
8	12.03	523.61	43.54	SDI	GS	GS	GS	GS	GS	GS	GS	GS
24	18.98	490.84	25.86	LESA	CT/CR	CT/CS	CR	CR	CR/SF	CR	CR/CT	CR/CT
26	13.71	436.11	31.81	LESA	CT/CR	CT	CR/ML	SR/ML/CR	CR/SF/GR	WH/CT/CR/GS	CR/CT	CT/SF
28	12.75	421.80	33.09	SDI				CR	CT	CT	CT	CT/CR
2	12.61	390.90	30.99	SDI	CT	CT	CT	SF	CT	CR	CT	CT/CR
15	12.52	381.50	30.48	CF/SDI	CT	CT/SR	CT/SR	CT/WH/FALLOW	CT	CT	CR/CT	CT/SR
17	13.19	367.56	27.87	MESA	GR/CR/CT	GR/CC/CT/CR	GR/CC/CT	GR/CC/GS/CT/WH	GR/CC/SF/GS	GR/CR	GR/CT	GR/CT/CR
6	13.72	367.29	26.77	LESA	CT	CT	CT	CT/CR	CT/CR	CT/CR	CT/CR	CR/FALLOW
4	13.71	365.05	26.63	LESA	CT/A	CT/A/WH/FS	CT/WH/A/CC	A/SR/WH/CC	WH/FS/SR/CT/A	A/CT/WH/	A/CT/WH/HAY	WH/CT/GS

										HAY		
30	11.58	352.73	30.45	SDI					SF	CR	FALLOW	CT
21	13.41	344.90	25.73	LEPA	CT	CT/CR/S C	CR/GS	GS/FS	WH/HAY/G S	CT/CR	CT/CR	CT/WH/FS
10	14.66	294.41	20.09	LESA	GR/ CC/ CT	GR/CC/O S	GR/CC/C R	GR/CC/GS/C R	GR/CC/GS/C R	GR/CR	GR/CT	GR/CS
3	9.91	293.49	29.61	MESA	CT/ SR	CT	WH/SR	CT/SR/WH	CT/SR	CT/SR/W H	CT	CT
5	7.05	264.62	37.55	MESA	GR/ CC	GR/CC	GR/CC	GR/CC	GR/CC	GR/CC	CT/GS/FALLO W	CT/FALLO W
19	8.88	252.95	28.50	LEPA	CT/ ML	CT/ML	CT/ML	CT/ML	CT/WH	CT/WH	CT	CT/FALLO W
23	16.66	234.52	14.07	LESA	CT/ CR	CT	CR	CT	CR	CT	CT	CT/CR
9	6.65	234.02	35.17	MESA	GR/ SC/ CT	GR/SC/C T	GR/SC/S R	GR/SC/CT	CT/RYE	GR/CT	GR/CC/CT	CT/GR
11	13.64	228.21	16.73	CF	CT	CT	CT	CT	CT/SR	CT/SR	CT/SR	CT
14	8.68	154.14	17.77	LEPA	CT	CT	CT	CT	CT/WH	CT/WH	CT	CT/WH
18	5.05	135.10	26.75	LEPA	SR/ CT	CT/OS/F S	WH/SR	CT/FS/FR	CT/WH	CT/WH	CT/WH	CT/WH
29	-	137.48	-	DL				CT/WH/FL	CT/WH	SR	CT	CT/SR
12	-	101.60	-	DL	CT/ FS	CT/WH	CT/SR	FS	WH/FS	CT	SR	

Table 30. Sites ranked by gross margin per acre-inch of applied irrigation, 2005 - 2012.

Site	Irrigation Applied	Gross Margin Per Acre	Gross Margin Per Acre Inch	Irrigation Technology	Crop or Rotation							
	Inches	\$/Acre	\$/Acre Inch		2005	2006	2007	2008	2009	2010	2011	2012
7	12.51	599.82	47.96	LESA	GS	GS	GS	GS	GS	GS	GS	GS
8	12.03	523.61	43.54	SDI	GS	GS	GS	GS	GS	GS	GS	GS
5	7.05	264.62	37.55	MESA	GR/C C	GR/CC	GR/CC	GR/CC	GR/CC	GR/CC	CT/GS/ FALLOW	CT/ FALLOW
9	6.65	234.02	35.17	MESA	GR/S C/CT	GR/SC/CT	GR/SC/SR	GR/SC/CT	CT/RYE	GR/CT	GR/CC/CT	CT/GR
28	12.75	421.8	33.09	SDI				CR	CT	CT	CT	CT/CR
26	13.71	436.11	31.81	LESA	CT/C R	CT	CR/ML	SR/ML/ CR	CR/SF/GR	WH/CT/ CR/GS	CR/CT	CT/SF
2	12.61	390.9	30.99	SDI	CT	CT	CT	SF	CT	CR	CT	CT/CR
15	12.52	381.5	30.48	CF/SDI	CT	CT/SR	CT/SR	CT/WH/ FL	CT	CT	CR/CT	CT/SR
30	11.58	352.73	30.45	SDI					SF	CR	FALLOW	CT
22	18.69	568.36	30.42	LEPA	CT/C R	CT/CR	CT	CR	CT	CR	CT	CT
3	9.91	293.49	29.61	MESA	CT/SR	CT	WH/SR	CT/SR/W H	CT/SR	CT/SR/WH	CT	CT
19	8.88	252.95	28.50	LEPA	CT/M L	CT/ML	CT/ML	CT/ML	CT/WH	CT/WH	CT	CT/FALLO W
17	13.19	367.56	27.87	MESA	GR/C R/CT	GR/CC/CT /CR	GR/CC/CT	GR/CC/GS /CT/WH	GR/CC/SF/ GS	GR/CR	GR/CT	GR/CT/CR
27	20.65	574.42	27.81	SDI		CT	CS	CT/CR	CT/CR	CT/CS	CT/CS	CT/CS

6	13.72	367.29	26.77	LESA	CT	CT	CT	CT/CR	CT/CR	CT/CR	CT/CR	CR/FALLO W
18	5.05	135.10	26.75	LEPA	SR/CT	CT/OS/FS	WH/SR	CT/FS/FR	CT/WH	CT/WH	CT/WH	CT/WH
4	13.71	365.05	26.63	LESA	CT/A	CT/A/WH /FS	CT/WH/A /CC	A/SR/WH /CC	WH/FS/SR / CT/A	A/CT/WH/ HAY	A/CT/WH/ HAY	WH/CT/GS
24	18.98	490.84	25.86	LESA	CT/C R	CT/CS	CR	CR	CR/SF	CR	CR/CT	CR/CT
21	13.41	344.9	25.73	LEPA	CT	CT/CR/SC	CR/GS	GS/FS	WH/HAY/G S	CT/CR	CT/CR	CT/WH/FS
20	27.14	548.16	20.20	LEPA	WH/F S/CR	CS/FS	TR/FS	WH/SR/F S	CS/CT	CR/TR/CT	CR/TR/CT	CS/TR/CT
10	14.66	294.41	20.09	LESA	GR/C C/CT	GR/CC/FR	GR/CC/CR	GR/CC/GS /CR	GR/CC/GS/ CR	GR/CR	GR/CT	GR/CS
14	8.68	154.14	17.77	LEPA	CT	CT	CT	CT	CT/WH	CT/WH	CT	CT/WH
11	13.64	228.21	16.73	CF	CT	CT	CT	CT	CT/SR	CT/SR	CT/SR	CT
23	16.66	234.52	14.07	LESA	CT/C R	CT	CR	CT	CR	CT	CT	CT/CR

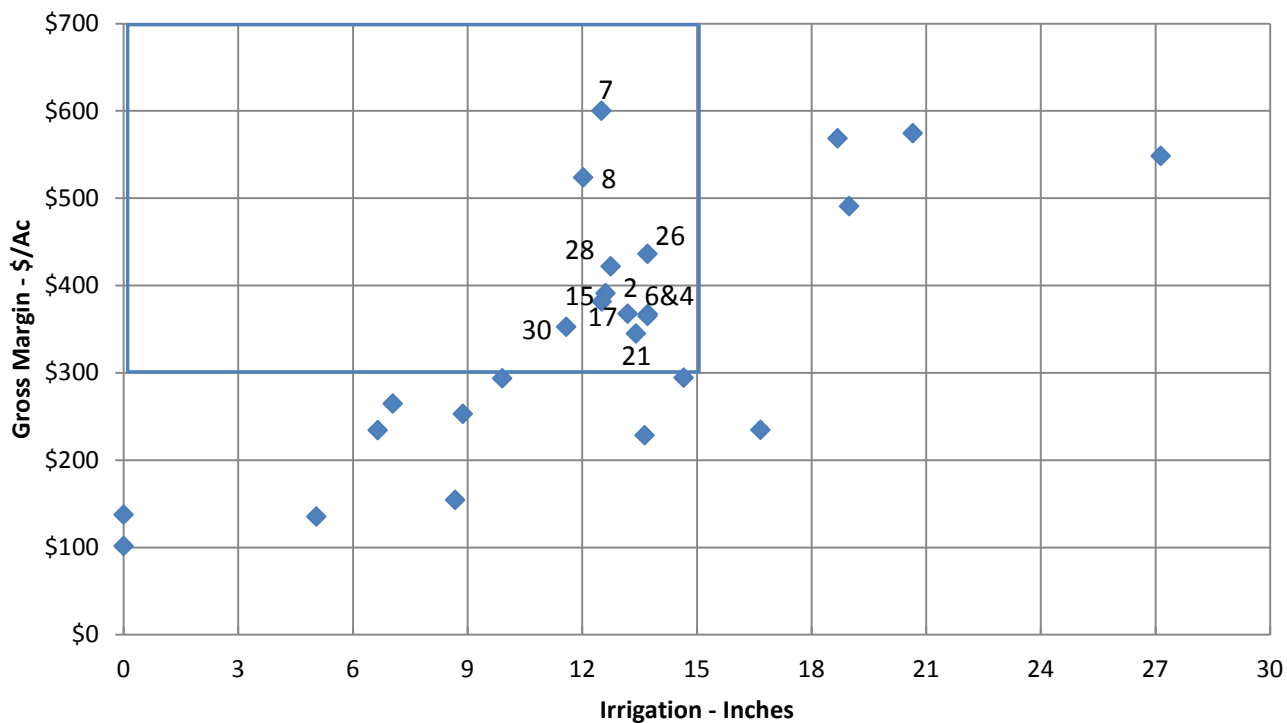


Figure 21. Gross margin per acre and inches of applied irrigation, 2005 - 2012.

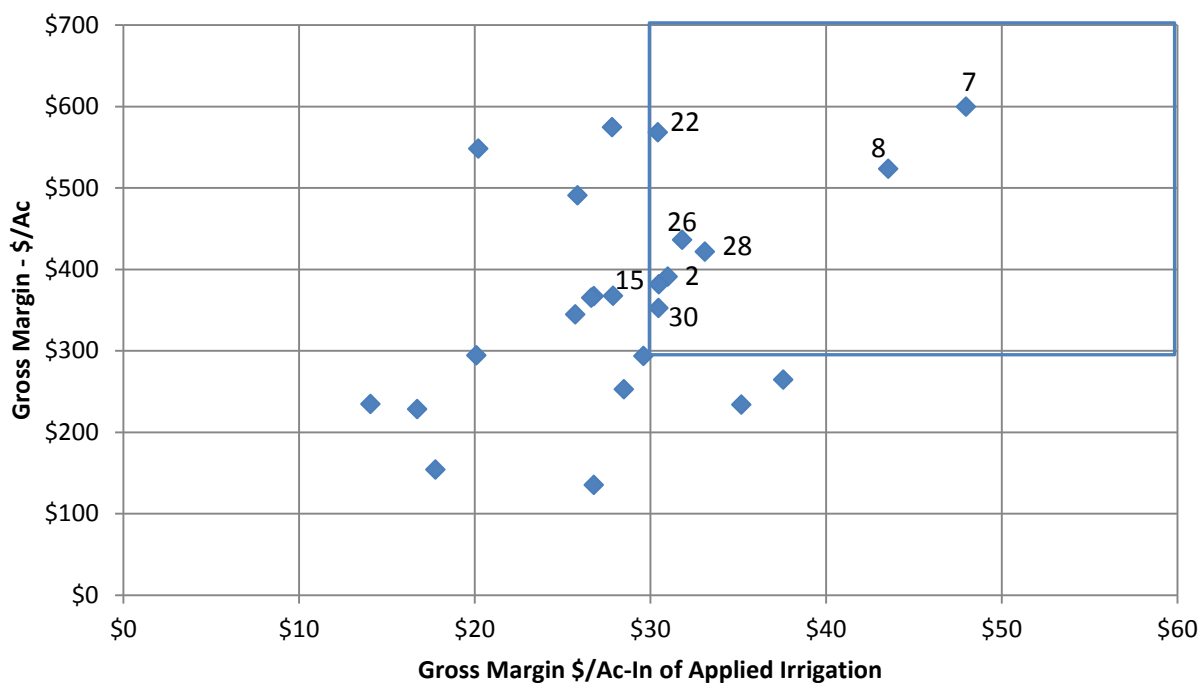


Figure 22. Gross margin per acre and gross margin per acre-inch of applied irrigation, 2005 - 2012.

TASK 5: Plant Water Use and Water Use Efficiency

Annual Report ending February 28, 2013

Principal Investigator(s): Drs. Steve Maas and Nithya Rajan

Several major areas of investigation were pursued during 2012. These are summarized in the following sections.

Test of Spectral Crop Coefficient Approach

Extensive tests of the Spectral Crop Coefficient (K_{sp}) approach were conducted during 2012 to demonstrate its accuracy and efficacy. The K_{sp} approach is an important component of the Next Generation TAWC Irrigation Scheduling Tool that has been developed for implementation in the Texas High Plains. Tests of this approach had the following two goals:

- (1.) To validate the accuracy of the K_{sp} approach in estimating actual crop water use;
- (2.) To compare the performance of the K_{sp} approach versus standard crop coefficient approaches in estimating crop water use.

To provide data for testing the approach, evapotranspiration (ET) was measured using eddy covariance (EC). EC data were used from three dissimilar site situations: TAWC Site 1 in 2008, which supported fully irrigated (subsurface drip, SSD) cotton; TAWC Site 15 in 2010, which supported deficit-irrigated (SSD) cotton; and TAWC Site 29 in 2008, which supported dryland cotton. Since the irrigated sites were irrigated using SSD, the soil surface remained dry except after rain events. The soil surface for the dryland site also remained dry between rain events. EC data used in the validation were taken from the periods between rain events, which insured that the soil evaporation component of the measured ET was small. Thus, ET used in the validation approximated actual crop water use (CWU) and thus could be compared to corresponding values of CWU estimated using K_{sp} . Weather data used in calculating CWU using the K_{sp} approach were taken from the West Texas Mesonet observing station located at Plainview.

Validation results are presented in Fig. 23. Values of estimated versus measured daily CWU cluster along the 1:1 line for all three cropping systems, with an R^2 value of 0.781. The slope and intercept of the regression line through these points are not significantly different ($\alpha = 0.05$) from the slope and intercept of the 1:1 line, suggesting that the 1:1 line represents a best fit to the validation data. Average daily estimated and measured CWU values for the three systems are presented in Table 31. Estimated and measured CWU values are close between each system, and the estimated CWU averaged over all systems is less than 0.1 mm different from the corresponding measured value. These results confirm that the K_{sp} approach is an accurate estimator of CWU for a variety of cropping systems.

Results of comparing the K_{sp} approach to standard crop coefficient (K_c) approaches are presented in Figs. 24 and 25. In Fig. 23, daily estimates of CWU estimated using K_{sp} are plotted over the 2008 growing season for the fully irrigated cotton field (Site 1). Also shown in that figure are

corresponding values of crop ET (ET_c) calculated using crop coefficients recommended for use by Texas AgriLife and New Mexico State University (NMSU). Two versions of the K_{sp} results are presented-- one calibrated using actual ground cover observations from the site, and the other using a standard K_{sp} curve determined from long-term satellite observations of TAWC sites. There is a big difference early in the growing season between the K_c results and the K_{sp} results. This is because the ET_c estimated using K_c includes soil evaporation, while CWU estimated using K_{sp} does not include soil evaporation. In the Next Generation TAWC Irrigation Scheduling Tool, soil evaporation is estimated separately using a two-layer soil water balance model. Later in the growing season, the results from the two approaches are in reasonable agreement, and both agree with the observed values of CWU for this site. This is because the cotton in Site 1 attained an almost complete crop canopy during this period. An underlying assumption of the K_c approach is that the crop growth is not restricted by water or other stresses.

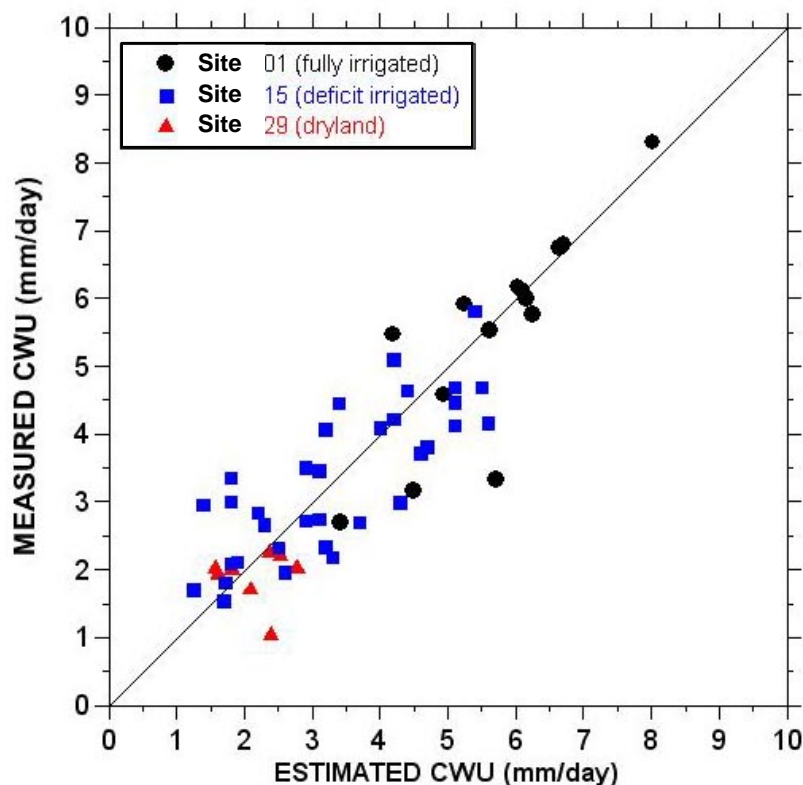


Figure 23. Estimated versus observed crop water use (CWU) for three cotton sites in TAWC.

Table 31. Average daily CWU (mm/day) for each of the three sites and for the combination of the data from the three sites.

	Site 01	Site 15	Site 29	All 3 Sites
Estimated	5.68	3.47	2.15	3.80
Measured	5.47	3.43	1.90	3.72

A different situation occurs in Fig. 25. In this case, the methods are applied to the deficit-irrigated cotton in Site 15. Again, the two approaches produce different values early in the growing season due to soil evaporation. However, in the middle portion of the growing season

(DAY 220-260), the K_c approaches produce values that are markedly greater than the corresponding values from the K_{sp} approach. In addition, they markedly overestimate the actual values of CWU. The calibrated K_{sp} approach produced estimates of CWU that reasonably agree with observed values. During this period, the crop ground cover in Site 15 ranged from 30 to 60 percent as a result of the deficit irrigation. The K_{sp} approach was able to directly accommodate this sub-optimum condition.

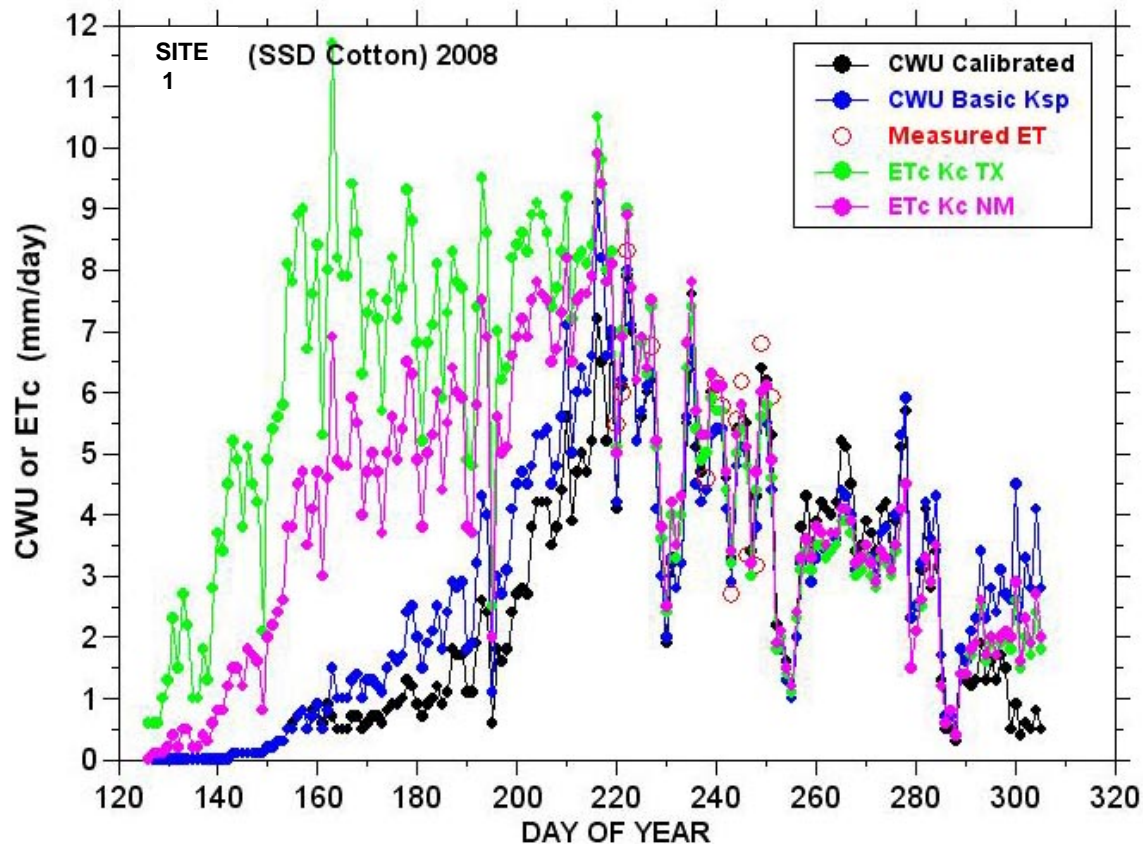


Figure 24. Daily crop water use (CWU) estimated using the K_{sp} and K_c approaches for Site 01.

The conclusions of this study are as follows. The spectral crop coefficient approach is effective in accurately estimating the actual water use of crops on a field-by-field basis. Both the standard crop coefficient (K_c) and the spectral crop coefficient (K_{sp}) approaches perform reasonably well for fully irrigated fields, where crop growth approaches “standard conditions.” However, the spectral crop coefficient approach does a much better job of estimating the actual water use of crops under non-standard conditions, particularly when calibrated using ground cover observations. The K_{sp} approach uses the same weather data required by the standard crop coefficient approach. The only additional information required is an estimate of crop ground cover. For irrigation scheduling intended to replace the water used by the crop and potential depletion of water resources. These results were reported in two presentations made at the 2012 UCOWR Conference in Santa Fe, NM.

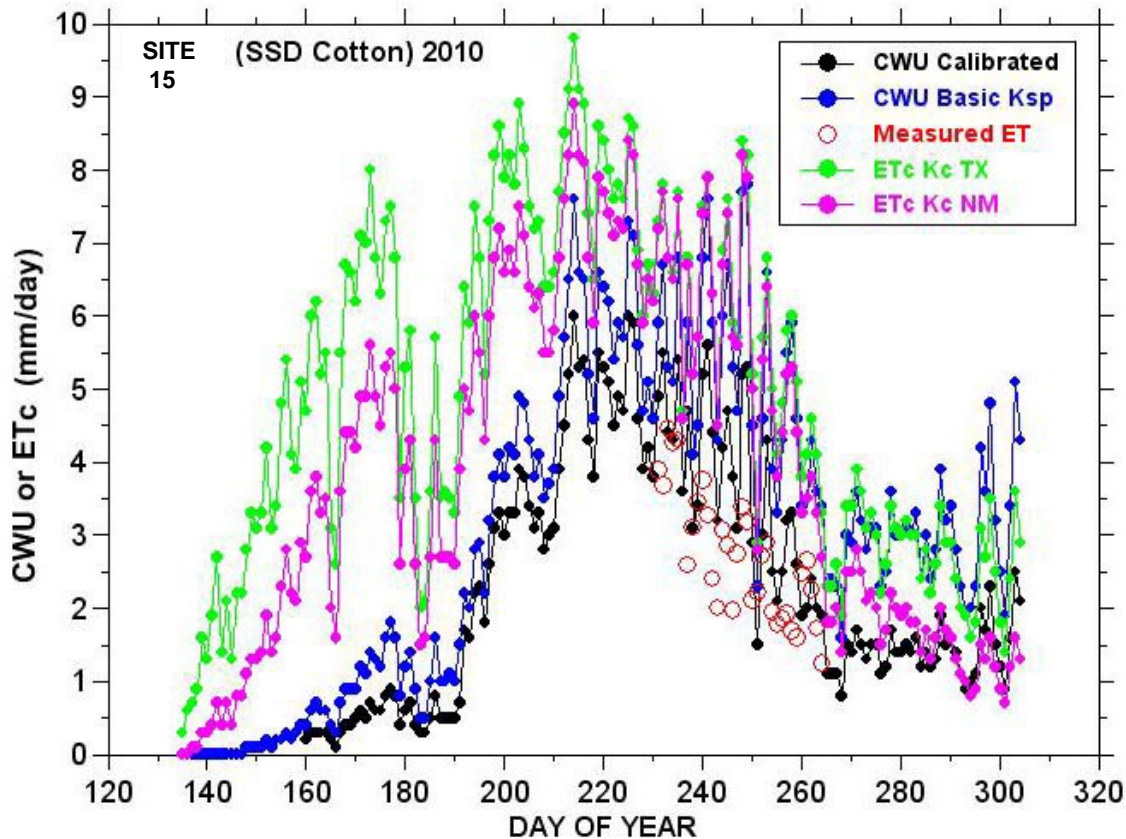


Figure 25. Daily crop water use (CWU) estimated using the K_{sp} and K_c approached for Site 15.

Agro-ecosystem Carbon and Water Fluxes

Although native and managed grasslands in the semi-arid Texas High Plains are unique ecosystems adapted to this region, their role in regional carbon exchange processes has not been adequately studied and they are not adequately represented in the current estimates of regional or continental scale carbon balance. Eddy covariance flux measurements have been obtained from TAWC Site 17 (an improved WW-B.Dahl pasture) since mid-2010. These measurements are contributing to our understanding of how grasslands in the region respond to the semi-arid Texas High Plains environment. Fortuitously, the measurement period for this site contains the mega-drought event of 2011. This offers us a special opportunity to investigate the impact of an extreme drought event on key carbon exchange processes in this agro-ecosystem. The main objectives of this study were to assess the impact of the drought on daily and seasonal net ecosystem exchange (NEE) of this pasture and compare the results to those obtained in 2010, which was a year with above-normal rainfall. We also examined the relationship between gross primary production (GPP), ecosystem respiration (R_{eco}) and light use efficiency as affected by temperature and grazing.

Meteorological differences between the two years were evident in the observations of rainfall (RF), air temperature (T_{air}), soil temperature (T_{soil}), relative humidity (RH) and vapor pressure deficit (VPD). The cumulative precipitation and seasonal distribution were noticeably different between 2011 and 2012 (Fig. 31). The precipitation received during the 2010 peak growing

season period (June-August) was 278 mm, which was much greater than the 9-year average precipitation of 153 mm recorded by the TAWC weather station located near the site. In contrast, the growing season precipitation received in 2011 was only 12 mm, or 8% of the 9-year average precipitation. The exceptionally dry 2011 summer was coupled with a higher average T_{air} as compared to 2010 during the period of peak growth in the summer months. Significant differences between the two years were also observed in T_{air} during June-September. The average T_{air} in June-August in 2011 was 3.3°C higher than the corresponding value from 2010, while the average T_{air} during the flowering period in 2010 was 1.8°C higher than in 2011. There were no significant differences between the average T_{air} values during the dormant seasons for the two years. The T_{soil} values recorded during the peak growth months were similar in both years. However, the T_{soil} values recorded in the flowering and dormant seasons in 2010 were higher compared to those recorded in 2011 ($p < 0.05$). Average RH values recorded for all growing season periods were significantly different between the two years. The dry, warm 2011 summer caused VPD to peak above 3.0 kPa on several days, and VPD values generally stayed above 2.0 kPa on most days during the summer. During the 2010 peak growth months, the VPD stayed below 2.0 kPa on most days. VPD values were similar in both years for the flowering and dormant seasons.

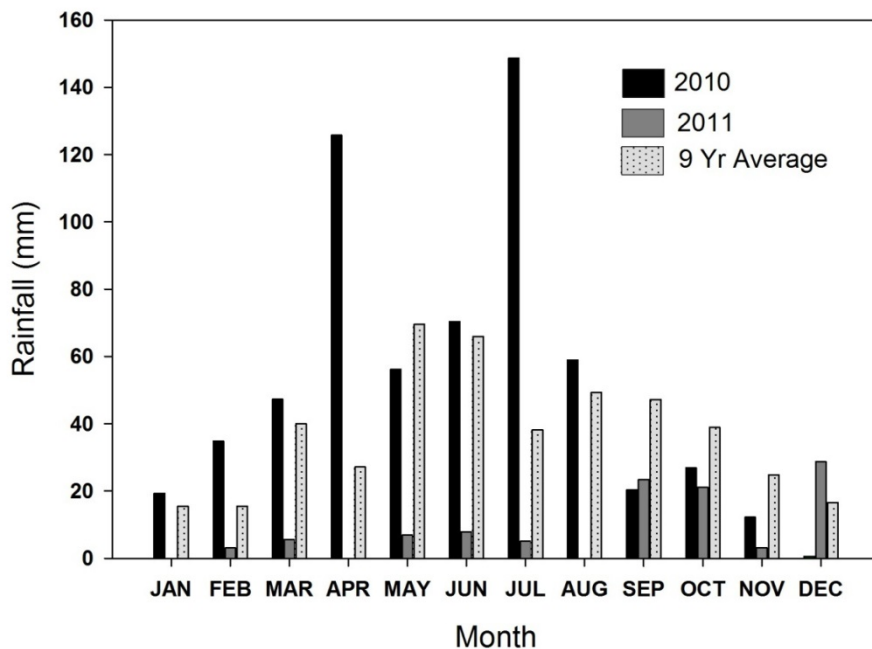


Figure 26: Monthly precipitation recorded at the pasture eddy covariance flux site near Lockney, TX, compared with 9-year average for this site.

Figure 27 presents daily accumulated carbon uptake of the pasture in 2010 and 2011, respectively. Daily NEE observed during the summer months of 2010 showed a net CO_2 uptake by the pasture (negative NEE) on most days. Daytime NEE showed a steady decrease following the establishment of the eddy flux tower on DOY 167 until DOY 179. This decrease was due to gradual soil drying. Above-average rainfall received after DOY 179 (a total of six rain events)

caused a rapid increase in green biomass in late July (DOY193- 207). The peak carbon uptake of $27.9 \text{ g CO}_2 \text{ m}^{-2} \text{ day}^{-1}$ was measured on DOY 202. Grazing started in the pasture on DOY 199. As grazing progressed, the removal of vegetation in the flux footprint area had a direct effect on NEE, with daily NEE values showing a rapid decrease and approaching zero at the end of grazing on DOY 227. The short-term carbon release occurring on 14 days (DOY 179, 182-184, 217-221 and 226-230) during the summer was primarily triggered by precipitation events (also termed “precipitation pulses”). The CO_2 released on those days ranged from near zero to as high as $13.2 \text{ gCO}_2 \text{ m}^{-2} \text{ day}^{-1}$ (DOY 218).

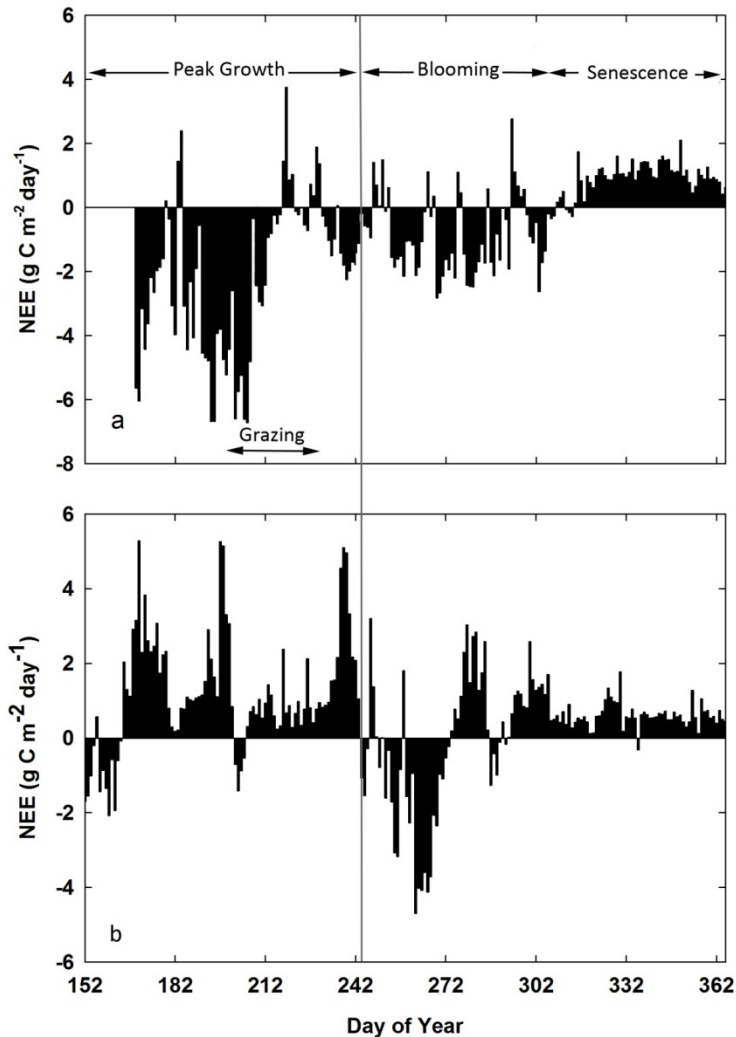


Figure 27: **(a)** Daily accumulated net ecosystem exchange (NEE) during the measurement period in 2010. **(b)** Daily accumulated net ecosystem exchange (NEE) during the measurement period in 2011.

Unlike the rainy 2010 summer, the summer in 2011 was characterized by extreme drought which significantly impacted the CO_2 exchange of the pasture. Daily NEE in the summer of 2011 showed a net CO_2 release by the pasture (positive NEE). Diurnal variations in NEE in 2010

showed daytime CO₂ uptake and nighttime CO₂ release, as would be expected during the peak growth period of the pasture. However, the diurnal variations in NEE in 2011 on the same day showed daytime CO₂ uptake near zero. Similar characteristics of diurnal variations were observed for most days during the 2011 summer. The CO₂ release peaked above 15 g CO₂ m⁻² day⁻¹ on 6 days (DOY 170, 172, 197, 198, 238 and 239) during the 2011 summer. Two small rain events in June and July of 2011 caused short-term periods of CO₂ uptake, but the pasture rapidly reverted to a dormant state as the soil dried.

September through October was the blooming period for the pasture in 2010. Daily NEE stayed relatively constant on most days during the blooming period. Similar to the summer months, precipitation triggered short-term pulse events on several days. The NEE gradually decreased following DOY 302. The pasture remained dormant from November through December, becoming a CO₂ source. The severe drought and poor growth during the summer months in 2011 caused the pasture to be in the dormant stage with no blooming occurred during September through October. The pasture was irrigated in late August and early September (DOY 237 and 250), which caused a brief greening of the pasture and gradual increase in NEE until DOY 262. As the soil dried out, the NEE again rapidly declined. This was followed by another short-lived increase in NEE after two small rainfall events on DOY 251 and 281. The pasture continued as a CO₂ source for the rest of the year.

At the beginning of the measurement period in 2010, the increase in cumulative NEE and GPP reflected the intensive growth period of the pasture. The pasture continued to sequester C until the end of the flowering period, where the GPP curve reached a peak. The NEE curve started declining at the onset of senescence because of the continued increase in R_{eco}. The pasture remained a carbon sink for the rest of the year. The total accumulated C for 2010 was 164 g C m⁻². In 2011, the total R_{eco} was greater than the gross photosynthetic production, which resulted in positive NEE throughout the measurement period. The occurrences of short-lived negative NEE events (see Fig. 27) did not alter the general nature of the pasture as a C source during 2011. The net cumulative loss of C from the pasture for 2011 was 142 g C m⁻².

Carbon flux measurements made on a managed WW-B. Dahl old world bluestem pasture in the semi-arid Texas High Plains demonstrated that the dynamics of NEE, R_{eco} and GPP for this agro-ecosystem were strongly affected by environmental variables. In a year with adequate precipitation (2010), the pasture acted as a strong sink for C. In contrast, severe drought conditions in the following year (2011) resulted in the pasture acting as a strong source for C. In the absence of water stress conditions, temperature was the major driving variable for total ecosystem respiration. Although we did not explicitly model the effect of soil moisture on ecosystem respiration in the current study, our analysis showed that low soil moisture levels were the main factor associated with reducing the temperature sensitivity (Q₁₀) of ecosystem respiration. During 2010, grazing reduced NEE and GPP of the pasture, but the reductions were not sufficient to change the overall C balance of the ecosystem from a sink to a source. The extreme drought of 2011 caused the pasture grass to remain dormant throughout most of the year, and the ecosystem remained an overall carbon source throughout this period. These results support the need for continued study of pastures in the Southern High Plains to better understand the highly dynamic nature of their C exchange processes and their implications on regional and

hemispheric C dynamics. Results of this study have been submitted for publication in *Agronomy Journal*.

Irrigation System Efficiency

During the 2012 growing season, complete irrigation audits were performed for three center pivot sites. All of these sites are part of the TAWC Demonstration Project (Sites 4, 21 and 31). Sites 21 and 31 were planted to cotton during the time of the irrigation audits, while the portion of Site 4 in which measurements were made was planted to alfalfa. All three sites were all set up for LEPA, although one site (Site 31) included one span set up as LESA (the fifth span from the outer edge of the pivot). The inclusion of this LESA span was intended to compare crop growth and yield under the two types of irrigation. This also provided the opportunity to compare water budgets for the two types of irrigation.

For all sites, direct measurements of emitter flow rate were made for the entire center pivot system. Emitter flow rates were measured by placing an emitter into a plastic jug (see Figure 33) and measuring the time it took for the water level in the jug to rise to a specified mark. The time was measured with a stop watch. By knowing the volume of water in the portion of the jug up to the mark (1/3 gal), the flow rate of the emitter could be calculated. It took approximately 2 hours to measure all the emitters on an 8-span center pivot system (typically around 192 emitters) using this method. Standard practice in many irrigation auditing efforts has been to determine the variation in emitter output along the length of the pivot system by catching the water at the soil surface below the emitters using catch cans. However, this is only an indirect estimate of emitter flow rate. The procedure used in this study provides more accurate direct measurements of emitter flow rates.

One of the audited sites (Site 31) had 7 spans set up for LEPA, but also has one span set up for LESA. This was done as part of the TAWC project to compare the effect of the two irrigation methods on crop growth and yield. It provided a good opportunity to collect data on the relative efficiencies of the two irrigation methods. Catch trays were used to measure the amount of irrigation water reaching the soil surface under each system (see Figure 34). These trays were 33 inches long, 14 inches wide, and 6 inches deep. Trays were used instead of catch cans because the low height of the emitters above the soil surface (nominally around 1 ft) made the catch cans ineffective in catching the water put out by the emitters. Catch cans are more effective when the source of water is several feet above the soil surface, as with MESA irrigation. In Site 31, one set of trays was placed to catch water from the LEPA emitters (span 4), while another set of trays was placed to catch water from the LESA emitters (span 5). The trays were placed so that their long dimension spanned the distance between adjacent rows of cotton. The cotton in this site was planted on 40-inch rows, so the trays covered most of the area between the rows. Depth of water in the trays was measured after the irrigation system passed over their location. Values from trays between the same pair of rows were averaged.



Figure 28. Measuring emitter flow rate in Site 4.



Figure 29. Catch trays placed between rows of cotton in Site 31.

Results from Site 31 showed that, of the water emitted by the LEPA emitters, approximately 1.66 inches reached the soil surface. For the LESA emitters, only around 1.48 inches reached the soil surface. With the LEPA emitters, water was applied directly to the soil surface between adjacent rows. Thus, there should have been little loss of water between the emitter and the soil surface.

The LESA emitters sprayed water out horizontally, with a large portion being intercepted by the plant canopy. The difference between the values for the two systems could result from the water intercepted by the plant canopy, some of which went to wetting the leaves. Water from the wet leaves could later evaporate without reaching the soil surface. This could lead to a lower irrigation application efficiency for the LESA system as compared to the LEPA system.

Three criteria were identified for evaluating the performance of the three irrigation systems audited. These criteria are described below.

(i.) *Proper nozzle selection.* Theoretically, emitter flow rates should fall off linearly with distance from the center of the pivot according to the equation,

$$Q_e = [2 * L_s * Q_p * L_e] / [L_p]^2 \quad \text{[Equation 1]}$$

where Q_e is the flow rate (gal/min) for a given emitter, L_s is the distance (ft) of the emitter from the center of the pivot, Q_p is the total flow (gal/min) rate for the pivot, L_e is the distance between emitters (ft), and L_p is the total length (ft) of the pivot (“Water Application Solutions for Center Pivot Irrigation”, Nelson Irrigation Corp., Walla Walla, WA, 2008). This relationship assumes that the pivot is on level ground. For all three sites evaluated, L_p was 1280 ft and L_e was 6.67 ft (80 inches). Total flow rates measured during the audits for the three sites are presented in Table 32 below. These were calculated by summing the measured emitter flow rates for all emitters on the pivot.

Table 32. Total flow rates for irrigation systems audited.

SITE	Q_p (gal/min)	Pumping Rate* (gal/min)
04	468.2	500
21	427.3	500
31	543.2	500

*Reported by the farmer to TAWC and assumed approximate for the system.

How well the pivot was nozzled can be assessed by how close the distribution of emitter rates along the pivot lies to the theoretical relationship (Equation 1).

(ii.) *Emitter uniformity.* Emitter-to-emitter variability along the pivot should be reasonably small. Substantial deviations can indicate the presence of defective or damaged nozzles. Variation in emitters is visible in the measured values of emitter flow rates. However, one should recognize that part of this variability is the result of random measurement errors. Emitter uniformity was assessed by statistically analyzing the emitter-to-emitter variability and using the results to construct confidence limits about the general trend in emitter flow rates calculated using linear regression analysis. Confidence limits equal to the overall regression plus or minus two standard deviations were constructed for each pivot. Variation in measured emitter rates within these confidence limits could be assumed to result from measurement error. Emitter rates lying outside these confidence limits could be considered to be non-uniform and likely to be associated with defective or damaged nozzles.

(iii.) *System application efficiency.* For the systems audited, application efficiency is considered to represent how much of the irrigation water emitted by the system makes it into and remains within the root zone so that it is available for uptake by the crop plants. For these systems, application efficiency (E_a) can be calculated as follows,

$$E_a = [W_i - W_a - W_s - W_p] / W_i \quad \text{[Equation 2]}$$

where W_i is the water put out by the emitters, W_a is the water lost before it reaches the soil surface, W_s is the water lost through evaporation from the soil surface, and W_p is the water lost through deep percolation from the soil profile. Each of the terms on the right side of Equation 2 can be expressed as depth of water (inches). E_a is often expressed as a percentage. The terms in Equation 2 were evaluated for each system audited based on measurements or assumptions involving the type of irrigation system.

Assessments of these three criteria for each system audited are summarized as follows:

SITE 04. Figure 30 shows the emitter flow rates measured for this site. The solid black line shows the theoretical relationship described by Equation 1 for this system. The solid red line shows the least-squares linear regression determined from the observed emitter values. The pair of dashed lines show the upper and lower confidence limits around the regression line. There is no statistical difference between the black and red lines, suggesting that the selection of nozzles was appropriate for the system. A fall-off in emitter rates for the 6th and 7th spans was observed. This is visible in Fig. 30, where the emitter rates for those spans fall below the line representing the theoretical relationship. This feature may be related to the topography of the site. In the portion of the site within which the system was situated during the audit, the ground under the three spans closest to the center was level. However, beyond the third span, the field fell away sharply down slope to the edge of the field. Emitter rates were somewhat above the theoretical line for the outer five spans, where water movement through the irrigation system was aided by gravity. During the audit, the irrigation system was being used to water the alfalfa section of the site, as indicated in Fig. 28. Effects of under-irrigation were visible in the alfalfa canopy under these two spans, where plant height was noticeably greater under the emitter position.

Emitter-to-emitter uniformity was good in all spans except span 6. In span 6, eight emitters were noted in the site as putting out too little water. This is apparent in Fig. 30, where points lie below the lower confidence limit. Two emitters (one in span 1 and the other in span 5) were putting out substantially more than neighboring emitters. On both, the nozzle of the emitter was missing, so flow from the emitters was uncontrolled. Even with these problems, 95% of the emitters were within the upper and lower confidence limits, suggesting reasonable uniformity for the system.

This was a LEPA system, so a relatively high application efficiency would be expected. Calculation of application efficiency for such a system is presented in the discussion for Site 31.

SITE 21. Of the three sites receiving complete audits, this site exhibited the best overall performance. As shown in Fig. 36, the observed trend in emitter rate (solid black line) was very close to the theoretical relationship (solid red line). Variation in emitter rate was generally

between the upper and lower confidence limits, except for one emitter in span 2 that was putting out too much water due to a missing nozzle. In addition, two emitters (one in span 6 and the other in span 7) were putting out too little water. This resulted in an overall uniformity of 98%. This was also evident from the cotton being irrigated, which displayed a very uniform canopy across the site.

Again, this was a LEPA system, so a relatively high application efficiency would be expected. See the discussion for Site 31 for calculation of application efficiency.

SITE 31. There was a tendency for emitter rates to be below the theoretical line (Fig. 37) for spans 2 and 3, while above the line for spans 5 and 6. The site is relatively flat, so this is not a topography effect. The differences were not great, and there was no noticed effect on the cotton canopy being watered.

Emitter uniformity was generally good, with most of the emitter rates falling between the upper and lower confidence limits. There was one emitter in span 3 putting out markedly too much water, and one in span 4 putting out too little water. There were also two emitters at the end of the system putting out too much water. Still, the overall uniformity of this system was 97%.

In terms of conserving water, this site was of interest because of the comparison between LEPA and LESA emitters. As described earlier, data from the catch trays indicated that, of the water emitted by the LEPA emitters in span 4, approximately 1.66 in. reached the soil surface. Since the LEPA emitters put the water directly on the soil surface, the W_a term in Equation 2 would be approximately zero for the LEPA system and W_i would be 1.66 in. For the LESA emitters in span 5, only around 1.48 in. reached the soil surface. The difference, which amounted to around 0.2 in. (5 mm) was likely lost by evaporation from the plant canopy wetted by the LESA emitters. This would represent the W_a term in Equation 2 for the LESA system. An insufficient number of microlysimeter measurements were obtained to directly evaluate the W_s term for the two systems. However, this term can be estimated for the two systems based on soil characteristics. For the type of soil in this site (an Amarillo sandy clay loam), the “upper limit for Phase 1 soil evaporation” (U) is approximately 0.35 inch (J. T. Ritchie, “Model for predicting evaporation from a row crop with incomplete cover,” Water Resources Research, 1972, Vol. 8, No. 5, p. 1204-1213). This value represents the amount of water lost over time by the wet soil surface due to evaporation. For the LESA system, which wets the entire soil surface, this value of U would represent W_s in Equation 2. In contrast, the LEPA system wets only half the soil surface, so its corresponding value of W_s would be 0.175 in. Since soil moisture measurements made in the fields at the time of the irrigation indicated no loss of water from the soil profile by deep percolation, the W_p term would be zero for both systems. Solving Equation 2, we obtain application efficiencies of 89.5% for the LEPA system and 66.9% for the LESA system. The efficiency for the LESA system assumes that there is a substantial crop canopy to intercept water before it reaches the soil surface. Without such a canopy, the corresponding application efficiency would increase to 78.9% for the LESA system. Still, the LEPA system should be substantially more efficient in supplying water to the plants than a LESA system.

In a similar investigation conducted the previous year, a higher yield was reported by the producer for the LEPA span as compared to the LESA span, suggesting that the water applied by the LEPA system was more effective in producing yield.

No major deficiencies were noted for the three irrigation systems audited. Correction of the small number of defective emitters per system would not realize significant water savings. Correcting the below-trend application rates in the two inner spans of Site 4 would result in greater overall water use. No significant net decrease in water use would be realized by correcting the below- and above-trend application rates for the affected spans for Site 31.

As indicated by the comparison of LEPA and LESA systems in Site 31, substantial annual water savings could be realized by switching from LESA to LEPA, assuming the choice of crop allowed it. If we assume an average application efficiency of around 73% (midway between the values with and without a crop canopy) for the LESA system, a producer who applied 15 in. of irrigation during the year using LESA would have realized an additional 1.6 in. of water available to be taken up by the crop if the 15 in. had been applied using LEPA.

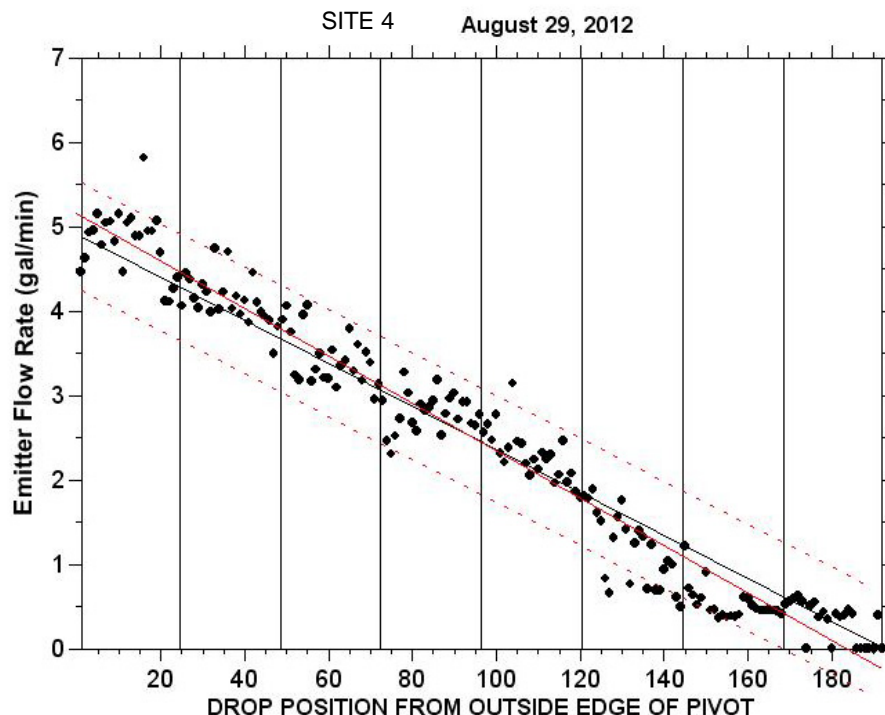


Figure 30. Trend in emitter flow rates for Site 4.

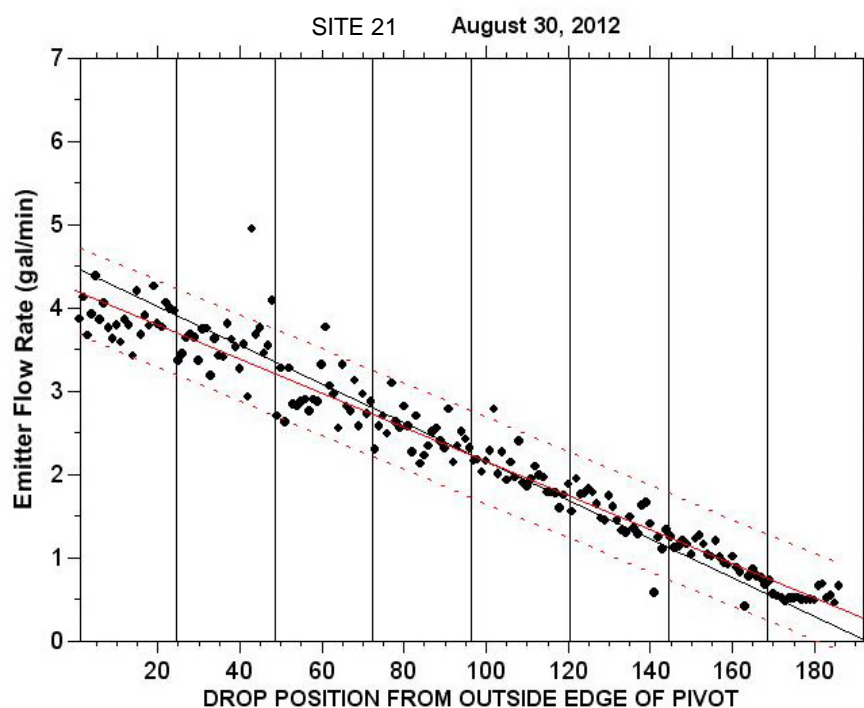


Figure 31. Trend in emitter flow rates for Site 21.

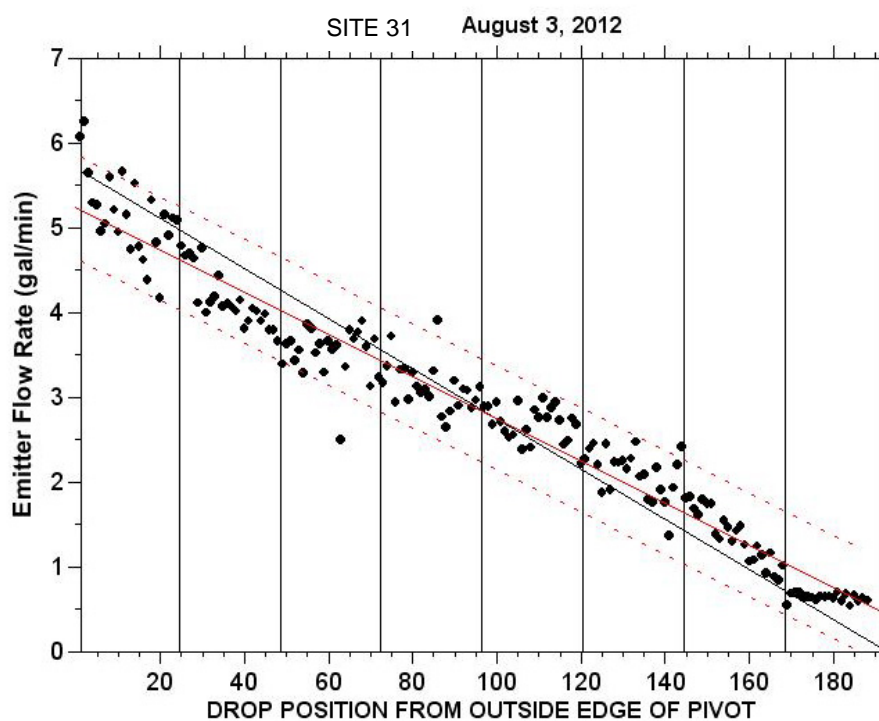


Figure 32. Trend in emitter flow rates for Site 31.

PUBLICATIONS AND PRESENTATIONS RELATED TO TAWC

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Nair, Shyam, Stephan Maas, Changgang Wang, and Steven Mauget. 2012. Optimal field partitioning for center-pivot-irrigated cotton in the Texas High Plains. *Agronomy Journal*, 105(1): 124-133.

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Rajan, Nithya, and S. J. Maas. 2012. Inter-Annual Variation In Carbon Dioxide and Water Fluxes From a Grazed Pasture In the Semi-Arid Texas High Plains. Abstracts, Annual Meetings, Amer. Soc. Agronomy. 21-24 October 2012, Cincinnati, OH. (abstract)

Rajan, Nithya, M. Roy, S. J. Maas and F.M. Padilla. 2012. Soil Background Effects On Reflectance-Based Estimates of Leaf Area Index of Cotton. Abstracts, Annual Meetings, Amer. Soc. Agronomy. 21-24 October 2012, Cincinnati, OH. (abstract)

Maas, Stephan, and Nithya Rajan. 2012. Spectral Crop Coefficient Approach: Its Development and Validation. Proceedings, 2012 UCOWR/NIWR Annual Conference, 17-19 July 2012, Santa Fe, NM. (abstract)

Rajan, Nithya, and Stephan Maas. 2012. Comparison of the Spectral Crop Coefficient and Standard Crop Coefficient Approaches. Proceedings, 2012 UCOWR/NIWR Annual Conference, 17-19 July 2012, Santa Fe, NM. (abstract)

TASK 6: Communications and Outreach

Annual Report ending February 28, 2013

Principal Investigator(s): Dr. David Doerfert (TTU)

Several activities were designed and implemented in 2012 towards the goal of expanding the community of practice that is developing around agricultural water conservation. Behind the scenes, additional steps were taken to increase the awareness and potential influence of the TAWC project beyond the region. David Doerfert and Samantha Borgstedt completed the majority of the work with assistance by graduate students funded by Texas Tech University.

More specific details of these and additional accomplishments are described below under each of the four communication and outreach tasks.

- 6.1 *Increase awareness, knowledge, and adoption of appropriate technologies among producers and related stakeholder towards the development of a true community of practice with water conservation as the major driving force.*

6.1 — Accomplishments

NEW – Summer Water Management Update meetings

In cooperation with Texas AgriLife Extension Service, TAWC hosted three Summer Water Management Update meetings taking place at individual farm locations on June 19-21, 2012. The first meeting was held Tuesday, June 19, at the barn of Lloyd Arthur in Lorenzo, Texas. There were approximately 22 people in attendance at this meeting. The second was held Wednesday, June 20, at the barn of Blake Davis in Littlefield, with approximately 18 people in attendance. The final meeting was held on Thursday, June 21, at the barn of Glenn Schur in Plainview. This meeting drew our largest crowd of approximately 30 attendees. Speakers at these meetings included representatives from John Deere Water and AquaSpy discussing their water monitoring technologies. Dr. Calvin Trostle of Texas AgriLife Extension Service also covered water requirements of various crops and how these technologies affect the timing of water application. Rick Kellison, TAWC project director, demonstrated how to use the TAWC tools. These meetings lasted two hours each and we had great response from producers. They liked the format and ability to ask questions on a one-on-one basis.

Farmer Field Day #1 (August 9, 2012)

Due to the continued drought, we focused on what results could be experienced by participants in this drought influenced growing season. The agenda included expert speakers, field tours where discussions were held with TAWC producers, a catered lunch, and keynote speaker Pete Laney. Sponsors also set up booths that attendees could visit during breaks and lunch. There were 60 people in attendance. Additional logistical work for this event included reserving facility, portable restrooms, tent, chairs, buses, caterer, speakers, and finalizing individual agendas. Based on post-workshop evaluation results submitted by the participants, attendees were very satisfied with all aspects of the program.

Farmer Field Day #2 (January 17, 2013)

The TAWC spring planning meeting that was held January 17, 2013, at the Unity Center in Muncy, TX. Planning activities included promotion of the events through radio advertisements, “save the date” cards, mail outs, press releases, email and social media. Additional effort was put forth towards the development of the morning program and coordination of speakers, facilitates and refreshments for the meeting, which included coffee and donuts as well as a catered lunch. Nearly 60 farmers and industry professionals attended the event. The meeting was also broadcast by KFLP All Ag, All Day Radio.

Informational Items Created & Disseminated

New materials were created for use in the TAWC booth including a “save the date” card for the 2012 & 2013 field days. In addition, a new summary of research summary was prepared titled "When Water Determines Your Success." This handout illustrated the return that sorghum, corn, and cotton returned for per inch of irrigation and is reportedly being used by the Kansas state government in their agriculture water discussions. Also new was a document titled "Increasing Sustainability of Production Agriculture: Glen Schur." This handout profiled one of the TAWC producers and his efforts to improve his water management practices including the use of TAWC Solution tools—Resource Allocation Analyzer and the Irrigation Scheduling tool.

In addition to these new items, work continued on the web-based water management guide for producers—a collaboration with several of the Texas commodity groups. This was created and on display during the farm shows for producer review and feedback.

Presentations and Project Promotions

Samantha Borgstedt and graduate assistant Nichole Sullivan staffed an information booth at the 2012 Texas Gin Association meeting March 29-30, 2012. Project materials were distributed to attendees and the TAWC tools and water management guide were shared. Project descriptions and summaries of research were distributed to 3,000 attendees.

The new materials were used in the TAWC booth at the 2012 Amarillo Farm & Ranch Show (Nov. 27-29, 2012) including a “save the date” card for the 2013 field day. Doerfert and Borgstedt staffed the booth experiencing heavier interest than in previous years. Project descriptions and summaries of research were also distributed to attendees.

Doerfert staffed an information booth at the 2013 Beltwide Cotton Conference in San Antonio January 7-9, 2013. Project materials were distributed to attendees and the TAWC tools and water management guide were shared.

Borgstedt had several on-air appearances that included the Farm Bureau Radio Network and two regional agriculture radio programs during the Summer 2012 months to promote the Summer Water Management meetings and the August field day. Doerfert appeared on Fox 950 AM radio on Tuesday, January 15th to share latest project activities including information related to the January field days.

Borgstedt and Kelly Harkey (new masters-level graduate assistant funded by Texas Tech University) update the project's Twitter and Facebook accounts regularly with new tweets/postings. In addition, reprints of all handouts were made to replenish dwindling supplies.

6.2 Project communication campaign planning, implementation, and related research activities.

As the communications and outreach activities move from the initial efforts to create awareness of the TAWC project and the launch of a community of practice to activities that will facilitate the adoption of the research results and best practices produced in the previous years, additional communication planning and research activities were conducted to achieve the desired future outcomes. The items that were accomplished are listed below.

6.2a — Accomplishments: *Communications Planning*

Photo documentation of the individual field sites continued with five visits during 2012 growing season. These photographs were used in the preparation of a variety of information resources as a visual indicator of the project activities and results. Additional project photos were taken during tours of the project sites and at various related events including the farmer field days.

Dr. Doerfert completed an award application to American Water Resources Association (AWRA) for integrated water management projects. While not selected as the national winner, the application lead to the project being asked to submit a case study about the TAWC so that others may learn about our success. Dr. Doerfert will present a webinar in April 2013 highlighting the project and its collaborative efforts.

Finally, a clipping service was continued to help the project monitor the extent and type of print media coverage on the TAWC project. Content analysis illustrated that the drought was a driver in increased print media coverage of agriculture water-related topics.

6.2b — Accomplishments: *Research*

Dr. Doerfert met with representatives from six universities in Dallas on November 16-18, 2012 to continue efforts that would secure funding to expand the social science research efforts of the TAWC project. Discussions included establishing baseline data on community resiliency.

Three project-related papers were shared at the 48th annual American Water Resources Association (AWRA) conference in Jacksonville, FL, November 12-15, 2012. The paper titles and authors were:

- *Crop Production Water Management Tools for West Texas Farmers* by David Doerfert, Rick Kellison, Phil Johnson, Steve Maas, Justin Weinheimer.
- *The Texas Alliance for Water Conservation: An Integrated Water Resources Management Model for Agriculture* by David Doerfert
- *Use of Multi-user Virtual Environments (MUEs) for Training Purposes* by David Doerfert and Tracy Rutherford.

Nichole Sullivan successfully defended her thesis research on March 27, 2012. Dr. Doerfert served as her committee chair. Nichole's study focused on Texas agriscience teachers in the

semi-arid and arid regions of Texas and the inclusion of agricultural water management content in their local instructional efforts.

High school agriscience teachers are an important factor in the future success of the Texas agriculture industry. As one of the early influencers of future industry leaders, agriscience teachers help to shape individual students and the communities in which they teach and reside. Within this changing environment of dwindling water resources, changes in TEKS, and new technologies and regulations, we need to know what instructional support, in terms of materials and training, agriscience teachers need to enhance their instructional efforts and abilities in teaching TEKS-related water management and conservation curriculum in their classrooms. The purpose of this study was to determine the instructional needs of Texas agriculture science teachers as it pertains to the teaching of agricultural water management and conservation. A population of 658 Texas agriscience teachers was surveyed collecting quantitative data related to the teachers' beliefs, attitudes, and levels of inclusion, confidence, and importance of water-related material in classroom curriculum. Responses were voluntary and yielded a 74% response rate. Results indicated that agriscience teachers feel content relating to water management and conservation is important, but lack the confidence for full inclusion of the material into the classroom. Agriscience teachers identified instructional materials being used in the classroom along with how they seek out information on water management and conservation. The results will facilitate possible professional development activities for Texas agriscience teachers as well as teaching materials incorporating water management and conservation.

Two Letters of Intent were filed with USDA AFRI Climate Change: Change Mitigation and Adaptation in Agriculture research area for potential research projects connected to the TAWC project. One was focused on the potential impact of various winter cover crops on soil moisture and the second sought to begin a data analytic system that facilitate a farmer's decision-making processes while being easy to read and use on mobile devices. Work is underway to submit full proposals for the April 2013 deadline.

To better understand the challenges that will need to be overcome to achieve wide-scale adoption of more efficient and effective water management practices and technologies, one-on-one interviews were conducted Doerfert and graduate assistants with the producers involved in the TAWC project. The rationale for using this population was that these farmers likely represent other farmers in the region who would be the most likely to be early adopters of change in their agriculture water management practices. To encourage honesty in their responses, the identity of the individual farmers was known only to the TAWC management team interviewer and was not shared with other members in the TAWC project except in summary form. Data analysis of the individual interviews identified the common themes that emerged from each conversation are summarized below.

- The most consistent response was that the farmers involved in the demonstration project increased their understanding of agricultural water management practices and technologies as a result of their involvement in the TAWC project.
- It was clear from the interviews and consistent with previous social science research conducted in the TAWC project that West Texas farmers and ranchers cannot be thought of a homogeneous population creating the need for multiple strategies when disseminating research results and best practices.
- The majority of the farmers in the TAWC project professed that the most influential factor for change in their production systems were other farmers in their personal networks.
- When questioned about the new technologies and production-related practices tested in the TAWC project, the producers generally saw the demonstration of these as helpful but complex and, at times, overwhelming. Most often cited as a barrier to adoption were the costs related to the technology (e.g. unit cost, the total cost to fully adopt across their entire operation, labor/time to install), and the personal time necessary to learn the nuances of each technology.
- Those seeking to adopt new water management technologies were increasingly looking to their crop consultants for assistance in dealing with greater technology complexity and time constraints for them to personally learn the new technologies.
- The final barrier to adoption identified through the interviews is likely the most difficult to overcome—the fear of change in what was commonly linked to individual water rights.

6.3 *Creation of longitudinal education efforts that include, but are not limited to, Farmer Field Schools and curriculum materials.*

6.3 — Accomplishments

Building on the thesis research completed by Lindsay Graber, plans are being made to increase the use of social media technologies in promoting the project and water conservation by producers.

As more have learned about the project, relevant education and project promotion outlets have emerged. To that end, Doerfert participated in the *Drought Outlook and Assessment* forum held on the Texas Tech campus on April 27, 2012 and the *Texas Water Summit* in Austin May 20-21, 2012.

6.4 *It is the responsibility of the leader for this activity to submit data and reports as required to provide quarterly and annual reports to the TWDB and to ensure progress of the project.*

6.4 — Accomplishments

- Timely quarterly reports and project summaries were provided as requested.

TASK 7: Producer Assessment of Operation

Annual Report ending February 28, 2013

Principal Investigator(s): Dr. Calvin Trostle (Texas AgriLife Extension Service)

Support to Producers

Visits were made with eleven producers during 2012 about their operations as part of the ongoing producer assessment of their needs and what crop information they would like to have for their operation. Numerous research and extension reports were provided as needed in the TAWC area.

Common questions among producers in 2012 were on split pivot irrigation scenarios (see the base information, updated for 2013, at <http://lubbock.tamu.edu/files/2013/03/Texas-South-Plains-Irrigation-Strategies-2013.pdf>) whereby producers are choosing two different crops over which to spread water use (and demand) rather than require irrigation on a full circle at one time. Then as the drought deepened its grip, information was sought on how different crops respond to drought and what to do about water intensive crops that were failing and what to do.

Field Demonstrations

A) Lockney & Brownfield Range Grass & Irrigation Trials

One season-long harvest was conducted in early November. The trial was irrigated at the 0", 3", and 6" levels. Forage samples remain in storage for weighing and reporting. Growth was minimal, and all species still demonstrated effects of the 2011 drought as recovery was fair at best.

Opportunities to Expand TAWC Objectives

Project awareness: Commented on the project on eight different radio programs, answered producers phone calls, and information and the approach that the TAWC project is taking has helped shape other programs and Extension activities in the Texas South Plains.

Educational Outreach

Participated in four TAWC educational meetings in the region as well as three county Extension meetings covering the TAWC demonstration area in 2012. These included the Hale Co. crops conference, Floyd-Crosby crops conference, and a series of three TAWC irrigation meetings in June 2012.

Existing TCE publications and reports were provided in the TAWC target area to at least 11 producers.

Support to Overall Project

Activities include attending five monthly management team meetings and/or producer advisory board meetings.

Report A

Perennial Grasses for the Texas South Plains: Species Productivity & Irrigation Response

Project conducted at: Eddie Teeter Farm, Lockney, Texas (seeded April 2006)
Mike Timmons Farm, Brownfield, Texas (initial seeding, June 2008;
overseeded, May 2009)

Project Overview

Beginning in 2005 TAWC participants frequently discussed the slow but steady trend of producers converting cropland back into permanent grassland. Since then, due to expiring Conservation Reserve Program (CRP) contracts, a significant portion of land is being plowed up, though in many cases the mix of grass, especially if weeping lovegrass, is the reason for this as these grasses are viewed as not productive in a grazing program or perhaps difficult to manage. Nevertheless, there remains the opportunity for some of this land where row cropping is problematic, that producers and landowners could irrigate perennial grasses if that would be a more efficient and profitable use of groundwater resources. The Lockney trial site was initiated in 2006, and a second site was initiated in Terry Co. in 2008 (and overseeded in 2009) as an outreach of the TAWC project into surrounding areas. The Ogallala Aquifer Project (OAP) began partnering with the current project in 2009 to supplement support for the project in fulfilling OAP goals in the region.

As noted in previous reports the primary objective was to determine which perennial grass species and varieties are adapted to the region and productive under conditions ranging from dryland to ~1" irrigation per week (late-April to early October). Two of the four years since this project was initiated have had high rainfall through August hence irrigation levels have been less than expected, and furthermore, we are only able to irrigate when irrigation is occurring on the adjacent pivot, thus sharing water.

Lockney Site

The record drought in 2011 affected the entire region. Beginning in January when deep soil moisture might be accumulated then through the growing season (end of October) 4.2" of rain was received, of which 2.0 was received in October with minimal effect on growth (Table 33). Three supplemental irrigations were applied of 3" and 6", but irrigation was limited due to the limited pumping that occurred on the adjacent center pivot, which must be running in order to irrigate.

Yield data for 2011 are listed in Table 34. There was no harvest on the dryland, and due to minimal growth on the low and moderate irrigation levels, a season-ending yield harvest was collected in December.

With limited results for 2011 we still get a window on perennial species performance in severe conditions. Multiyear averages are not updated due to no yield or low yield where irrigated. Which species were "tough" in 2011? Historically, with irrigation and dryland, we have seen since 2007 the old world bluestems and Alamo switchgrass yield at the top, 1.5 times more than the yields of the native species of blue grama, sideoats grama, and the native NRCS blend (and Alamo yielding twice the natives). In a drought year, these native species yielded 1,243 to 1,834 (blue grama) lbs./A, whereas the OWB species yielded 1,049 to 1,350 (Caucasian) lbs./A at the moderate (6") irrigation level. Alamo switchgrass, however, still yielded the highest at 2,263 lbs. of dry forage per acre. Bermudagrass, sprigged or seeded, did

not handle the drought as well, and buffalograss, which is perhaps the most drought tolerant of all the grasses yielded low at 494 lbs./A. This one year of drought is not a final view on these species, however, we suggest that the long-term yield potential of the old world bluestems still make these species a better fit for yield over years compared to the native species.

Yields and regrowth ratings of these grasses will be of particular interest, especially in 2012 on the dryland, to evaluate regrowth and recovery.

Table 33. Rainfall and irrigation levels on perennial grass trial, Lockney, TX, 2011.

2011 Lockney Rainfall Month	Monthly Rainfall (inches)	Cumulative 2011 Total (inches)	Irrigation Levels (inches)		
			Level 0	Level 1	Level 2
January	0.1	0.1	D		
February	0.3	0.4	R		
March	0.6	1.0	Y		
April	0.0	1.0	L		
May	0.3	1.3	A		
June	0.0	1.3	N	1.0	2.0
July	0.3	1.6	D	1.0	2.0
August	0.0	1.6	"	1.0	2.0
September	0.6	2.2	"		
October	2.0	4.2	"		
November	0.5	4.7			
December	1.3	6.0			

Table 34. Perennial grass trial yield results for 2011, Lockney, Texas. Exceptional drought curtailed growth (no dryland harvest) and availability of irrigation. Trial established in 2006.

Perennial Grass Species	Variety	Irrigation Level [^]	Avg. yield @ target irrigation (dry matter, Lbs./A) 12/14/11
Buffalograss	Plains	0	No data
		1	388
		2	494
Sideoats Grama	Haskell	0	No data
		1	805
		2	1,243
Blue Grama	Hatchita	0	No data
		1	1,568
		2	1,834
NRCS Natives Blend	3 Grasses [‡]	0	No data
		1	1,226
		2	1,623
Switchgrass	Alamo	0	No data
		1	1,200
		2	2,263

Kleingrass	Selection 75	0	No data
		1	985
		2	1,150
Old World Bluestem	Spar	0	No data
		1	573
		2	1,049
Old World Bluestem	WW-B Dahl§	0	No data
		1	760
		2	1,218
Old World Bluestem	Caucasian	0	No data
		1	1,717
		2	1,350
Indiangrass	Cheyenne	0	No data
		1	682
		2	727
Bermudagrass	Ozark sprigged	0	No data
		1	517
		2	723
Bermudagrass	Giant/Common (1:1 ratio.) seeded¶	0	No data
		1	739
		2	1,105
Trial Averages		0	No Data
		1	930
		2	1,231

Table 34. Continued

Rainfall (inches)	4.2
Irrigation, dryland/low/moderate (inches)	0/3.0/6.0
Total Moisture (inches)	4.2/7.2/10.2

P-Value (Variety)	<0.0001
P-Value (Irrigation)	0.0024
P-Value (Variety X Irrigation)	0.0010
Fisher's Least Signif. Diff. (0.05)--Variety ^α	464
Fisher's Least Signif. Diff. (0.05)--Irrigation ^α	189
Coefficient of Variation, CV (%)	55.3

[^]Dryland, low, and moderate target irrigation levels.

[‡]50% Hatchita, 40% Haskell, 10% green sprangletop (NRCS blend for Floyd Co.).

^αValues in the same column that differ by more than PLSD are not statistically/significantly different at 95% confidence level.

Terry Co. Grass Species Test

A TAWC prime area of interest in perennial grasses and the potential to convert irrigated agriculture back to dryland centered on the highly sandy soils of the southwest South Plains. This trial site was initiated on a sandy loam/loamy sand soil near Brownfield in 2008. Weeds remain a limitation at the site. In addition, irrigation is no longer available to the test, so the trial will be converted to dryland, but due to the drought in 2011 there was little to no measureable growth. The site largely remained dormant. The site will continued to be hoed and use spot

sprays to check the weeds. Seeded Bermudagrass was to have been added to the site in 2011, but due to the drought this was not completed and will be attempted again in 2012.

Report B

Irrigated Wheat Grain Variety Trial Results, Floyd Co., Texas, 2011

Irrigated grain trials for wheat were added in the fall of 2008 in Floyd Co. to represent the eastern South Plains. Duplicate tests occur in Yoakum, Castro, and other counties in the Texas Panhandle. Due to lack of rainfall, this trial's irrigation level places it comparable to dryland yields. The trial received ~6" of irrigation.

The Floyd Co. trial was seeded Oct. 29, then irrigated to a stand on Nov. 3 (initial irrigation for germination Nov. 11) at the R.N Hopper farm at a seeding rate of 1.1 million seeds/acre (on average about 70 lbs./A; this means that pounds per acre varied depending on the seed size). The test was seeded on no-till ground at ½ to 1". The test was harvested July 1, a delay due to needed repairs to the harvest equipment.

Trial results: Trial results statistically noted that there were differences among varieties, however, a measure of variability (coefficient of variation) notes that the results had a relatively high variability among varietal yields (CV, 24.1%; we like to have tests under 15%, and tests are usually discarded if %CV > 20%). The high CV, however, is due in great part to the range of yields, from 12.9 to 30.5 bu/A.

- 1) The seven varieties that were currently recommended from Texas AgriLife for irrigated wheat yielded 25.6 bu/A (TAM 111, 112, 304; Hatcher, Endurance, Duster, Bill Brown), compared the rest of the trial averaging 23.7 bu/A. Two additional varieties that yielded well, which I believe will soon be added to the recommended varieties list are TAM 113 (similar to TAM 111 but better disease resistance) and Winterhawk, which has performed well in dryland trials.
- 2) In spite of drought conditions, test weights were good averaging 59.0 lbs./bu.
- 3) Texas AgriLife Extension Service agronomy in Lubbock has begun testing of Clearfield herbicide-tolerant varieties in the South Plains and southwest Panhandle. Data to this point suggest that Bond CL from Colorado State may have comparable yield to typical varieties in the region.
- 4) Planting seed quality parameters are measured for the wheat that was drilled in the test, which was drilled for a target seed number of 1.1 million seeds per acre. This trial averaged 75 lbs./A (15,000 seeds/lb.), but the range of seed size was vast, from 11,600 seeds per lb. (large seed, 95 lbs./A) to small seed of 19,600 (small seed, 56 lbs./A). When producers plant by pounds per acre, if small seed has good germination, then seeding rates could be reduced. On the other hand, large seed would necessitate increasing seeding rates.
- 5) Stand ratings are normally taken ~1 month after drilling to evaluate vigor and stand (this year this observation was not recorded due to late emergence of the wheat). No varieties demonstrated exceptional ground cover.

For further info. on recent Texas High Plains wheat variety trials, consult the multi-year irrigated and dryland summary at <http://varietytesting.tamu.edu> as well as Extension's list of recommended varieties at <http://amarillo.tamu.edu/> (find under 'Agronomy' then 'Wheat') or contact your local county/IPM Extension staff or Calvin Trostle.

Table 35. Irrigated wheat grain variety trial under no-till and minimal irrigation, R.N. Hopper Farm, Floyd Co., TX 2011.

Variety	Source	Stand† 12/2/10	Vigor† 12/2/10	Height (in.)	Test Wt. (lbs./bu)	Yield (lbs./A)
Jagalene	Syngenta	3.0	2.8	17	59.8	22.8
Fannin	Syngenta	2.9	2.9	16	58.6	15.1
Doans	Syngenta	2.8	2.4	17	59.1	22.8
Jackpot	Syngenta	3.1	2.4	18	58.8	24.3
Greer	Syngenta	3.0	2.3	17	57.1	21.3
AP08T5913	Syngenta	3.0	2.3	17	58.6	21.9
AP08T6224	Syngenta	2.8	2.5	16	59.4	26.7
AP08TA6927	Syngenta	3.0	2.8	17	58.2	17.0
APH09T1122	Syngenta	3.1	2.8	16	59.1	20.9
Jagger	Kansas St.	2.8	2.4	18	59.4	21.6
Fuller	Kansas St.	2.9	2.6	18	59.7	23.4
Endurance	Okla. St.	2.5	2.3	17	60.2	22.5
Bullet	Okla. St.	2.8	2.5	19	59.4	28.1
Duster	Okla. St.	3.0	2.6	18	58.9	26.0
Billings	Okla. St.	3.0	2.3	17	59.1	23.8
Pete	Okla. St.	2.9	2.3	15	58.8	12.9
OK05212	Okla. St.	3.1	2.4	18	58.3	24.8
OK07209	Okla. St.	3.0	2.1	17	59.4	22.6
OK07214	Okla. St.	3.1	2.8	17	60.3	27.1
Santa Fe	WestBred	3.0	2.6	18	58.3	24.9
Shocker	WestBred	3.1	2.9	18	58.0	21.3
Armour	WestBred	2.9	2.5	15	59.2	25.3
TAM W-101	Texas AgriLife	2.9	2.6	17	57.2	22.1
TAM 111	Texas AgriLife	3.1	2.6	19	59.7	23.5
TAM 112	Texas AgriLife	2.9	2.4	18	60.2	29.5
TAM 203	Texas AgriLife	3.1	2.5	19	56.2	25.5
TAM 304	Texas AgriLife	3.4	2.6	17	59.1	22.9
TAM 401†	Texas AgriLife	3.1	2.6	18	57.6	25.4
TAM 113	Texas AgriLife	2.6	2.6	18	59.2	29.0
TX06A001263	Texas AgriLife	3.1	2.6	19	58.0	22.8
TX06A001281	Texas AgriLife	2.8	2.5	16	58.5	17.2
TX05A001188	Texas AgriLife	3.0	2.8	17	59.5	24.0
Winterhawk	WestBred	3.3	2.4	19	60.2	29.5
Bill Brown	Colo. State	2.9	2.5	17	60.5	30.5
Hatcher	Colo. State	3.0	2.4	15	60.0	24.2
Mace	Nebraska	3.0	2.3	17	59.4	25.5
AP 503 CL2	Syngenta	2.9	2.5	18	60.0	24.3
Cedar HV9W96	WestBred	2.9	2.5	16	59.5	22.1
T197	Trio Research	3.1	2.8	16	58.7	29.2

T136	Trio Research	3.1	2.9	18	59.4	21.5
Centerfield CL	Okla. St.	3.0	2.4	18	58.3	22.8
Bond CL	Colo. State	3.4	2.3	19	58.3	32.9
Protection CL	DeLange Seed	3.4	2.8	17	58.9	23.4
WeatherMaster 135‡	TAMU-Amarillo	3.3	2.5	17	58.0	27.0
Average		3.0	2.5	17	59.0	23.9

Table 35. Continued.	P-Value (Variety)	0.1226	0.0687	0.0067	<0.0001	<0.0001
	P-Value (Range)	0.2107	0.1026	0.0866	0.1500	0.1136
	Fisher's PLSD (0.05)	NS	NS	NS	1.8	3.2
	Coefficient of Variation (%CV)	11.6	14	10.1	2.2	24.1

‡Stand or vigor rating: 0 none; 1 poor; 2 fair; 3 good; 4 very good; 5 exceptional.

‡Beardless

TASK 8: Integrated Crop/Forage/Livestock Systems and Animal Production Evaluation Annual Report ending February 28, 2013

Principal Investigator(s): Dr. Charles West, Phil Brown (TTU)

Writing and editing manuscripts for publication was a major focus over the last year of this reporting period. Dr. Charles West succeeded Dr. Vivien Allen in leading Task 8 and has assumed the overall role of Program Administrator of TAWC.

During this transition period Dr. Vivien Allen has remained part-time and continued work on completing publications derived from our over-all research effort. The following papers with references have been published and/or accepted for publication:

1. Allen, V.G., C.P. Brown, R. Kellison, P. Green, C.J. Zilverberg, P. Johnson, J. Weinheimer, T. Wheeler, E. Segarra, V. Acosta-Martinez, T.M. Zobeck, and J.C. Conkwright. 2012. Integrating cotton and beef production in the Texas Southern High Plains. I. Water use and measures of productivity. *Agronomy Journal* 104:1625-1642.
2. Zilverberg, C.J., V.G. Allen, C.P. Brown, P. Green, P. Johnson, and J. Weinheimer. 2012. Integrating cotton and beef production in the Texas Southern High Plains. II. Fossil fuel use. *Agron. J.* 104:1643-1651.
3. P. Johnson, C.J. Zilverberg, V.G. Allen, J. Weinheimer, C.P. Brown, R. Kellison, and E. Segarra. 2013. Integrating cotton and beef production in the Texas Southern High Plains: III. An economic evaluation. *Agronomy Journal* 105:929-937.
4. Song Cui, V.G. Allen, C.P. Brown, and D.B. Wester. 2013. Growth and nutritive value of three old world bluestems and three legumes in the semiarid Texas High Plains. *Crop Science* 53:1-12.
5. Davinic, M., J. Moore-Kucera, V. Acosta-Martinez, J. Zak, and V. Allen. 2013. Soil fungal groups' distribution and saprophytic functionality as affected by grazing and vegetation components of integrated cropping-livestock agroecosystems. *Applied Soil Ecology* 66:61-70.
6. Fultz, L.M., J. Moore-Kucera, T.M. Zobeck, V. Acosta-Martínez, and V.G. Allen. 2013. Soil aggregate-carbon pools after 13 years under a semi-arid integrated crop-livestock agroecosystem. *Soil Science Society of America Journal* (Accepted with revisions).
7. Zilverberg, C.J., C.P. Brown, P. Green, M.L. Galyean, and V.G. Allen. 2013. Three integrated crop-livestock systems in the Texas High Plains: productivity and water use. *Agronomy Journal* (Accepted with revisions).

8. Li, Yue, F. Hou, J. Chen, C.P. Brown, and V.G. Allen. 2013. Long-term grazing of a rye cover crop by steers influences growth of rye and no-till cotton. *Agronomy Journal* (Accepted with revision).
9. Li, Yue, J. Chen, F. Hou, C.P. Brown, P. Green and V.G. Allen. 2013. Allelopathic influence of a wheat or rye cover crop on growth and yield of no-till cotton. *Agron. J.* (Accepted with revision).

The number of forage/livestock systems taking part in the demonstration project has declined due to retirement of a TAWC producer, changes in market prices for competing commodities, and the historic drought of 2011 cause sell-off of some cattle. We believe that water-conserving forage/livestock systems will become increasingly important as aquiver levels continue to decline in the Texas High Plains. As we look to the future and the next phase of TAWC we are planning to increase again the number forage/livestock systems among the demonstration sites. New forage research is planned at the Texas Tech research station at New Deal which will complement the on-farm demonstrations of forage/livestock systems within TAWC. We intend to promote education of forages and their role in reducing water use through proper management and strategic use in forage/livestock systems.

TASK 9: Equipment, Site Instrumentation and Data Collection for Water Monitoring Annual Report ending February 28, 2013

Principal Investigator(s): Jim Conkwright and Gerald Crenwelge (HPWCD #1)

Total Water Efficiency Summary

Table 36 gives the information relating to the irrigation efficiency. The values are based on using 100% of ET (ET Crop Water Demand column) and 70% effectiveness for rainfall during the growing season that has been used in the past Annual Reports. Recent discussions talk about using a lower value for ET. The "Total Water Potential Used" column is the "Total Crop Water" compared to the ET Crop Water Demand.

The ET Crop Water Demand was calculated using the TAWC's ET calculator tool for the available crops that include cotton, corn and sorghum.

This year was another dry year. Several crops were abandoned because of the lack of rainfall and weak irrigation. The stress on crops was compounded by the fact that we had more significant days with high winds, high air temperature and very low humidity. Several crops were abandoned because the irrigation was not sufficient to establish a crop or to make a crop once it was established. In some instances, irrigation was applied for insurance purposes only. Therefore, more irrigation was applied than would have been done by the producer.

The extreme weather conditions this year make an evaluation of water efficiency difficult. In most cases, the few fields that had ample irrigation had to use a large amount of water to insure an adequate crop while those that did not have much irrigation did not use as much water. This difference was not a management difference but a water availability issue that is difficult to translate to an efficiency value.

The potential irrigation conserved in this table is represented in the last column.

Table 36. Total water efficiency (WUE) summary by various cropping and livestock systems in Hale and Floyd Counties (2012).

Year	System	Field	Crop	Harvest status	Application Method	Acres	Irrigation Applied (Inches)	(70% of Actual Rain)	Total Crop Water (Inches)	ET Crop Water Demand (Inches)	Total Water Potential Used (%)	Total Water Potential Water Demand Conserved (%)	Total Water Potential Use (Inches)	Total Irrigation Potentially Conserved (ac ft)
2012	2	2	corn (research)		SDI	36.7	10.1	5.2	15.3	35.4	43.2%	56.8%	20.1	61.5
2012	2	3	cotton		SDI	22.8	15.0	5.7	20.7	23.6	87.4%	12.6%	3.0	5.6
2012	3	1	cotton		MESA	61.4	8.1	3.1	11.2	23.0	48.7%	51.3%	11.8	60.3
2012	3	2	cotton		MESA	61.4	8.7	3.1	11.8	23.0	51.3%	48.7%	11.2	57.2

2012	4	1	haygrazer		LEPA	13.2	12.2	3.5	15.7		na	na	na	na
2012	4	1	wheat		LEPA	13.2	2.1	4.1	6.2		na	na	na	na
2012	4	5	alfalfa		LEPA	16.0	28.3	7.3	35.6		na	na	na	na
2012	4	7	wheat		LEPA	13.7	2.9	4.1	7.0		na	na	na	na
2012	4	8	grain sorghum		LEPA	50.5	16.8	5.3	22.1	27.6	80.1%	19.9%	5.5	23.1
2012	4	9	cotton		LESA	30.5	12.9	6.0	18.9	20.8	90.8%	9.2%	1.9	4.9
2012	5	2	cotton	Abandoned	LESA	80.0	2.5	5.9	8.4		na	na	na	na
2012	5	14	cotton		LESA	400.0	12.8	6.0	18.8	20.2	92.8%	7.2%	1.5	48.3
2012	6	9	corn		LESA	60.6	35.0	4.1	39.1	35.0	111.8%	11.8%	-4.1	-20.9
2012	6	10	corn	Abandoned	LESA	62.1	6.9	4.1	11.0		na	na	na	na
2012	7	1	sideoats		LESA	130.0	20.6	6.2	26.8		na	na	na	na
2012	7	1	sideoats hay		LESA	130.0	na	6.2	na	na	na	na	na	na
2012	8	1,2,3,4	sideoats		SDI	61.8	17.3	6.2	23.5		na	na	na	na
2012	8	1,2,3,4	sideoats hay		SDI	61.8	na	6.2	na	na	na	na	na	na
2012	9	1	grass		MESA	100.8	4.2	8.5	12.7		na	na	na	na
2012	9	2	cotton		MESA	137.0	16.9	8.1	25.0	21.4	116.9%	16.9%	-3.6	-41.3
2012	10	1	grass		LESA	44.3	3.6	5.0	8.6		na	na	na	na
2012	10	4	grass		LESA	42.1	4.8	5.0	9.8		na	na	na	na
2012	10	5	corn silage		LESA	87.2	28.5	3.2	31.7	37.6	84.4%	15.6%	5.9	42.7
2012	11	1	grain sorghum		Furrow	45.2	12.0	3.6	15.6	24.9	62.8%	37.2%	9.3	34.9
2012	11	2	grain sorghum		Furrow	24.4	12.0	3.6	15.6	24.8	63.1%	36.9%	9.2	18.6
2012	11	3	grain sorghum		Furrow	22.0	12.0	3.6	15.6	24.8	63.1%	36.9%	9.2	16.8
2012	12	1	fallow	Fallow	Dryland	151.2	0.0	0.0	0.0		na	na	na	na
2012	12	2	fallow	Fallow	Dryland	132.7	0.0	0.0	0.0		na	na	na	na
2012	14	2	wheat		MESA	61.8	4.0	3.2	7.2		na	na	na	na
2012	14	3	cotton		MESA	62.4	9.0	2.2	11.2	19.8	56.7%	43.3%	8.6	44.7
2012	15	8	grain sorghum		SDI	57.2	28.4	2.7	31.1	25.2	123.4%	23.4%	-5.9	-28.1
2012	15	9	grain sorghum		SDI	45.6	26.2	2.7	28.9	25.2	114.7%	14.7%	-3.7	-14.1
2012	17	4	bluestem		MESA	111.8	8.2	6.9	15.1		na	na	na	na
2012	17	5	cotton		MESA	54.5	18.2	5.3	23.5	23.3	100.8%	-0.8%	-0.2	-0.9
2012	17	6	corn		MESA	54.5	35.5	4.1	39.6	38.2	103.8%	-3.8%	-1.5	-6.6
2012	18	1	cotton	Abandoned	MESA	60.7	1.2	4.8	6.0		na	na	na	na
2012	18	2	cotton	Abandoned	MESA	61.5	2.1	4.8	6.9		na	na	na	na
2012	19	9	cotton		LEPA	59.2	14.9	6.8	21.7	19.7	109.9%	-9.9%	-1.9	-9.6
2012	19	10	fallow	Fallow	LEPA	61.2	0.6	6.8	7.4		na	na	na	na
2012	20	1	corn silage		LEPA	117.6	21.9	3.7	25.6	38.2	67.1%	32.9%	12.6	123.1
2012	20	2	cotton		LEPA	115.7	19.2	6.7	25.9	22.7	114.3%	14.3%	-3.3	-31.3
2012	20	2	triticale silage		LEPA	115.7	19.6	4.4	24.0		na	na	na	na
2012	21	1	haygrazer		LEPA	61.4	15.6	2.2	17.8		na	na	na	na
2012	21	1	wheat		LEPA	61.4	6.7	4.1	10.8		na	na	na	na

2012	21	2	cotton		LEPA	61.2	15.6	4.4	20.0	23.6	84.8%	15.2%	3.6	18.3
2012	22	3	cotton		LEPA	148.7	19.5	6.6	26.1	21.8	119.6%	19.6%	-4.3	-53.0
2012	24	1	cotton		LESA	64.6	17.0	8.5	25.5	22.8	112.2%	12.2%	-2.8	-15.0
2012	24	2	corn silage		LESA	65.1	21.9	6.3	28.2	36.9	76.5%	23.5%	8.7	47.0
2012	26	1	sunflowers		LESA	62.9	15.1	3.1	18.2		na	na	na	na
2012	26	2	cotton		LESA	62.2	14.8	6.0	20.8	21.0	99.0%	1.0%	0.2	1.1
2012	27	3	corn silage		SDI	48.8	13.7	3.2	16.9	38.1	44.5%	55.5%	21.1	86.0
2012	27	1 & 4	cotton		SDI	59.7	15.9	6.4	22.3	22.7	98.6%	1.4%	0.3	1.5
2012	28	1	cotton		SDI	51.4	8.3	2.8	11.1	16.8	66.1%	33.9%	5.7	24.4
2012	29	1	cotton	Abandoned	Dryland	50.8	0.0	5.7	5.7		na	na	na	na
2012	29	2	grain sorghum	Abandoned	Dryland	104.3	0.0	5.7	5.7		na	na	na	na
2012	29	3	cotton	Abandoned	Dryland	66.6	0.0	5.7	5.7		na	na	na	na
2012	30	1	cotton		SDI	21.8	13.6	4.2	17.8	22.4	79.5%	20.5%	4.6	8.3
2012	31	1	cotton		LEPA	66.1	19.0	6.2	25.2	22.0	114.8%	14.8%	-3.3	-18.0
2012	31	2	millet seed		LEPA	55.4	22.0	5.5	27.5		na	na	na	na
2012	32	1	corn		LEPA	70.0	21.6	3.2	24.8	28.5	87.1%	12.9%	3.7	21.5
2012	33	2	corn		LEPA	70.0	18.7	3.1	21.8	37.9	57.5%	42.5%	16.1	94.0
2012	34	1	cotton	Abandoned	LESA	178.7	6.0	4.8	10.8		na	na	na	na
2012	34	2	corn		LESA	363.8	14.0	2.7	16.7	27.0	61.7%	38.3%	10.3	313.5
2012	34	3	cotton	Abandoned	LESA	183.9	6.0	4.8	10.8		na	na	na	na

****TOTAL IRRIGATION POTENTIALLY CONSERVED TOTALS 919 ACRE FT. (ONLY INCLUDES RAINFALL AND IRRIGATION)****

Water Use Efficiency Summary

Water use efficiency values are shown in the Water Use Efficiency table (Table 37). Data is presented where a neutron probe data was used to determine the beginning and ending soil moisture of the growing season for the crop that was grown. Silage and hay yield values are converting to a dry weight equivalent.

The dry year in 2012 influenced the values greatly. In nearly every case, the soil moisture values declined significantly during the crop season, which was expected. The data also shows several sites that had a significant amount of irrigation applied but the crop was still abandoned before harvest.

In evaluating the results briefly, it is again apparent that the LEPA and SDI type of irrigation is much more efficient than the other forms of irrigation this year. The values need to be

evaluated in a more statistical method at a later time but the results clearly show that the yield per inch of irrigation is much more efficient.

Table 37. Water use efficiency (WUE) by various cropping and livestock systems in Hale and Floyd Counties (2012).

Year	System	Field	Crop	Harvest status	Application Method	Acres	Moisture at Planting (0-5 ft)	Harvest (0-5 ft)	Contribution to WUE	Irrigation Applied (Inches)	Growing Season Rain (in)	Effective Rainfall (70% of Actual Rain)	Total Crop Water (Inches)	Yield (lbs/ac)	Yield Per Acre Inch Of Irrigation (lbs.)	Yield Per Acre Inch Of Total Water (lbs.)
2012	2	2	corn (research)		SDI	36.7	9.5	6.3	3.2	10.1	7.4	5.2	18.48	5678	562.2	307.3
2012	3	1	cotton		MESA	61.4	7.6	4.7	2.9	8.1	4.4	3.1	14.08	1535	189.5	109.0
2012	3	2	cotton		MESA	61.4	4	1.4	2.6	8.7	4.4	3.1	14.38	1535	176.4	106.7
2012	4	5	alfalfa		LEPA	16	7	4.2	2.8	28.3	10.4	7.3	38.38	16840	595.1	438.8
2012	4	7	wheat		LEPA	13.7	5.6	2.5	3.1	2.9	5.8	4.1	10.06	2820	972.4	280.3
2012	4	9	cotton		LESA	30.5	4.8	3.2	1.6	12.9	8.6	6.0	20.52	1093	84.7	53.3
2012	5	14	cotton		LESA	400	7.1	5.1	2	12.8	8.5	6.0	20.75	541	42.3	26.1
2012	6	9	corn		LESA	60.6	3.6	3.2	0.4	35	5.9	4.1	39.53	9800	280.0	247.9
2012	7	1	sideoats		LESA	130	10.7	6	4.7	20.6	8.8	6.2	31.46	263	12.8	8.4
2012	8	14	sideoats		SDI	61.8	3	1.3	1.7	17.3	8.8	6.2	25.16	271	15.7	10.8
2012	9	1	grass		MESA	100.8	6.9	2.6	4.3	4.2	12.2	8.5	17.04	na	na	na
2012	9	2	cotton		MESA	137	2.1	1.1	1	16.9	11.6	8.1	26.02	1074	63.6	41.3
2012	10	4	grass		LESA	42.1	3	0.9	2.1	4.8	7.1	5.0	11.87	na	na	na
2012	10	5	corn silage		LESA	87.2	8.4	8	0.4	28.5	4.6	3.2	32.12	17500	614.0	544.8
2012	11	3	grain sorghum		Furrow	22	8.4	4.8	3.6	12	5.2	3.6	19.24	4922	410.2	255.8
2012	12	2	fallow	Fallow	Dryland	132.7	3	2.3	0.7	0		0.0	0.7	na	na	na
2012	14	3	cotton		MESA	62.4	1.4	2.1	-0.7	9	3.2	2.2	10.54	530	58.9	50.3
2012	15	8	grain sorghum		SDI	57.2	3.7	6.2	-2.5	28.4	3.9	2.7	28.63	8152	287.0	284.7
2012	15	9	grain sorghum		SDI	45.6	7.4	4.5	2.9	26.2	3.9	2.7	31.83	7800	297.7	245.1
2012	17	4	bluestem		MESA	111.8	0.7	3.1	-2.4	8.2	9.8	6.9	12.66	na	na	na
2012	17	6	corn		MESA	54.5	9.7	9.2	0.5	35.5	5.9	4.1	40.13	11592	326.5	288.9
2012	18	1	cotton	Abandoned	MESA	60.7	2.5	3.8	-1.3	1.24	6.8	4.8	4.7	na	na	na
2012	18	2	cotton	Abandoned	MESA	61.5	0.7	4.1	-3.4	2.1	6.8	4.8	3.46	na	na	na
2012	19	9	cotton		LEPA	59.2	8.7	1.7	7	14.9	9.65	6.8	28.655	990	66.4	34.5
2012	20	1	corn silage		LEPA	117.6	8.4	6.1	2.3	21.9	5.3	3.7	27.91	22750	1038.8	815.1
2012	20	2	triticale silage		LEPA	115.7	7	6.3	0.7	19.6	6.3	4.4	24.71	8400	428.6	339.9
2012	21	1	wheat		LEPA	61.4	3.6	3.4	0.2	6.7	5.9	4.1	11.03	1416	211.3	128.4
2012	21	2	cotton		LEPA	61.2	6	3.2	2.8	15.6	6.3	4.4	22.81	1540	98.7	67.5
2012	22	3	cotton		LEPA	148.7	7.8	6.9	0.9	19.5	9.4	6.6	26.98	1756	90.1	65.1
2012	24	1	cotton		LESA	64.6	5.3	2	3.3	17	12.2	8.5	28.84	1951	114.8	67.6
2012	24	2	corn silage		LESA	65.1	7.2	7.1	0.1	21.9	9	6.3	28.3	10298	470.2	363.9

2012	26	1	sunflower s		LESA	62.9	4.7	0.2	4.5	15.1	4.4	3.1	22.68	1903	126.0	83.9
2012	26	2	cotton		LESA	62.2	2.9	5	-2.1	14.8	8.6	6.0	18.72	1091	73.7	58.3
2012	27	3	corn silage		SDI	48.8	7	5.7	1.3	13.7	4.6	3.2	18.22	21000	1532.8	1152.6
		1 &														
2012	27	4	cotton		SDI	59.7	9.1	5.5	3.6	15.9	9.2	6.4	25.94	2036	128.1	78.5
2012	28	1	cotton		SDI	51.4	6.1	4	2.1	8.3	4	2.8	13.2	2700	325.3	204.5
2012	29	1	cotton	Abandoned	Dryland	50.8	3.5	0.7	2.8	0	8.2	5.7	8.54	na	na	na

Irrigation Efficiency Summary

Table 38 highlights the irrigation efficiency aspects of this study.

The “Total Crop Water” column in this table is derived from adding the irrigation plus 70% of the growing season rainfall.

The “ET Provided to Crop From Irrigation” column illustrates a relatively low percent of the required ET that irrigation provided this year on many of the crops. The assumption for this study at the beginning was that 100% of the irrigation would be normal. On average, only 54% of the ET was provided by irrigation this year. Again, the values are biased because of the extremely dry conditions this year and the fact that several fields were abandoned at some time during the growing season. A more comprehensive analysis needs to be done to compare the abandoned fields in the data at a later date.

The potential irrigation conserved as acre feet of water in this table is represented in the last column.

Table 38. Irrigation Efficiency Summary by various cropping and livestock systems in Hale and Floyd Counties (2012).

Year	System	Field	Crop	Harvest status	Application Method	Acres	Irrigation Applied (Inches)	Total Crop Water (Inches)	ET Crop Water Demand (Inches)	ET Provided to Crop From Irrigation (%)	Potential Irrigation Conserved (%)	Potential Irrigation Conserved (Inches per acre)	Total Irrigation Potentially Conserved (ac ft)
2012	2	2	corn (research)		SDI	36.7	10.1	15.3	35.4	28.5%	71.5%	25.3	77.3
2012	2	3	cotton		SDI	22.8	15.0	20.7	23.6	63.5%	36.5%	8.6	16.4
2012	3	1	cotton		MESA	61.4	8.1	11.2	23.0	35.3%	64.7%	14.9	76.0
2012	3	2	cotton		MESA	61.4	8.7	11.8	23.0	37.9%	62.1%	14.3	73.0
2012	4	1	haygrazer		LEPA	13.2	12.2	15.7		na	na	na	na
2012	4	1	wheat		LEPA	13.2	2.1	6.2		na	na	na	na
2012	4	5	alfalfa		LEPA	16.0	28.3	35.6		na	na	na	na
2012	4	7	wheat		LEPA	13.7	2.9	7.0		na	na	na	na
2012	4	8	grain sorghum		LEPA	50.5	16.8	22.1	27.6	60.8%	39.2%	10.8	45.5

2012	4	9	cotton		LESA	30.5	12.9	18.9	20.8	61.9%	38.1%	7.9	20.2
2012	5	2	cotton	Abandoned	LESA	80.0	2.5	8.4		na	na	na	na
2012	5	14	cotton		LESA	400.0	12.8	18.8	20.2	63.4%	36.6%	7.4	246.7
2012	6	9	corn		LESA	60.6	35.0	39.1	35.0	100.0%	0.0%	0.0	0.0
2012	6	10	corn	Abandoned	LESA	62.1	6.9	11.0		na	na	na	na
2012	7	1	sideoats		LESA	130.0	20.6	26.8		na	na	na	na
2012	7	1	sideoats		LESA	130.0	na	na	na	na	na	na	na
2012	7	1	hay		LESA	130.0	na	na	na	na	na	na	na
2012	8	1,2,3,4	sideoats		SDI	61.8	17.3	23.5		na	na	na	na
2012	8	1,2,3,4	sideoats		SDI	61.8	na	na	na	na	na	na	na
2012	8	1,2,3,4	hay		SDI	61.8	na	na	na	na	na	na	na
2012	9	1	grass		MESA	100.8	4.2	12.7		na	na	na	na
2012	9	2	cotton		MESA	137.0	16.9	25.0	21.4	79.0%	21.0%	4.5	51.4
2012	10	1	grass		LESA	44.3	3.6	8.6		na	na	na	na
2012	10	4	grass		LESA	42.1	4.8	9.8		na	na	na	na
2012	10	5	corn silage		LESA	87.2	28.5	31.7	37.6	75.8%	24.2%	9.1	66.1
2012	11	1	grain sorghum		Furrow	45.2	12.0	15.6	24.9	48.2%	51.8%	12.9	48.6
2012	11	2	grain sorghum		Furrow	24.4	12.0	15.6	24.8	48.4%	51.6%	12.8	26.0
2012	11	3	grain sorghum		Furrow	22.0	12.0	15.6	24.8	48.4%	51.6%	12.8	23.5
2012	12	1	Fallow	Fallow	Dryland	151.2	0.0	na		na	na	na	na
2012	12	2	Fallow	Fallow	Dryland	132.7	0.0	na		na	na	na	na
2012	14	2	wheat		MESA	61.8	4.0	7.2		na	na	na	na
2012	14	3	cotton		MESA	62.4	9.0	11.2	19.8	45.4%	54.6%	10.8	56.3
2012	15	8	grain sorghum		SDI	57.2	28.4	31.1	25.2	112.6%	-12.6%	-3.2	-15.1
2012	15	9	grain sorghum		SDI	45.6	26.2	28.9	25.2	103.8%	-3.8%	-1.0	-3.7
2012	17	4	bluestem		MESA	111.8	8.2	15.1		na	na	na	na
2012	17	5	cotton		MESA	54.5	18.2	23.5	23.3	78.2%	21.8%	5.1	23.0
2012	17	6	corn		MESA	54.5	35.5	39.6	38.2	93.0%	7.0%	2.7	12.2
2012	18	1	cotton	Abandoned	MESA	60.7	1.2	6.0		na	na	na	na
2012	18	2	cotton	Abandoned	MESA	61.5	2.1	6.9		na	na	na	na
2012	19	9	cotton		LEPA	59.2	14.9	21.7	19.7	75.6%	24.4%	4.8	23.7
2012	19	10	Fallow	Fallow	LEPA	61.2	0.6	na		na	na	na	na
2012	20	1	corn silage		LEPA	117.6	21.9	25.6	38.2	57.4%	42.6%	16.3	159.4
2012	20	2	cotton		LEPA	115.7	19.2	25.9	22.7	84.7%	15.3%	3.5	33.5
2012	20	2	triticale silage		LEPA	115.7	19.6	24.0		na	na	na	na
2012	21	1	haygrazer		LEPA	61.4	15.6	17.8		na	na	na	na
2012	21	1	wheat		LEPA	61.4	6.7	10.8		na	na	na	na
2012	21	2	cotton		LEPA	61.2	15.6	20.0	23.6	66.1%	33.9%	8.0	40.8
2012	22	3	cotton		LEPA	148.7	19.5	26.1	21.8	89.4%	10.6%	2.3	28.5
2012	24	1	cotton		LESA	64.6	17.0	25.5	22.8	74.7%	25.3%	5.8	31.0

2012	24	2	corn silage		LESA	65.1	21.9	28.2	36.9	59.4%	40.6%	15.0	81.2
2012	26	1	sunflowers		LESA	62.9	15.1	18.2		na	na	na	na
2012	26	2	cotton		LESA	62.2	14.8	20.8	21.0	70.3%	29.7%	6.2	32.3
2012	27	3	corn silage		SDI	48.8	13.7	16.9	38.1	36.0%	64.0%	24.4	99.1
2012	27	1 & 4	cotton		SDI	59.7	15.9	22.3	22.7	70.2%	29.8%	6.8	33.6
2012	28	1	cotton		SDI	51.4	8.3	11.1	16.8	49.4%	50.6%	8.5	36.4
2012	29	1	cotton	Abandoned	Dryland	50.8	0.0	5.7		na	na	na	na
2012	29	2	grain sorghum	Abandoned	Dryland	104.3	0.0	5.7		na	na	na	na
2012	29	3	cotton	Abandoned	Dryland	66.6	0.0	5.7		na	na	na	na
2012	30	1	cotton		SDI	21.8	13.6	17.8	22.4	60.8%	39.2%	8.8	16.0
2012	31	1	cotton		LEPA	66.1	19.0	25.2	22.0	86.5%	13.5%	3.0	16.4
2012	31	2	millet seed		LEPA	55.4	22.0	27.5		na	na	na	na
2012	32	1	corn		LEPA	70.0	21.6	24.8	28.5	75.8%	24.2%	6.9	40.3
2012	33	2	corn		LEPA	70.0	18.7	21.8	37.9	49.3%	50.7%	19.2	112.0
2012	34	1	cotton	Abandoned	LESA	178.7	6.0	10.8		na	na	na	na
2012	34	2	corn		LESA	363.8	14.0	16.7	27.0	51.9%	48.1%	13.0	394.1
2012	34	3	cotton	Abandoned	LESA	183.9	6.0	10.8		na	na	na	na

****TOTAL IRRIGATION POTENTIALLY CONSERVED TOTALS 2,022 ACRE FT. (INCLUDES SOIL MOISTURE CONTRIBUTION, IRRIGATION AND RAINFALL)****



<http://www.tawcsolutions.org>

TAWC SOLUTIONS: MANAGEMENT TOOLS TO AID PRODUCERS IN CONSERVING WATER

*Rick Kellison
Justin Weinheimer
Philip Brown*

The **Texas Alliance for Water Conservation** released three web-based tools to aid producers at our February 2011 field day. Producers involved in the TAWC project had indicated the need for tools to aid them in making cropping decisions and managing these crops in season.

The **Irrigation Scheduling Tool** is a field level, crop specific ET tool to aid producers in irrigation management. The producer can customize this tool for beginning soil moisture, effective rainfall, effective irrigation application and percent ET replacement. Users can select from a list of local weather stations that supplies the correct weather information for each field. Once the decision is made on which crop a grower plants, this tool produces an in-season, check-book style water balance output to aid in irrigation applications.

The **TAWC Resource Allocation Analyzer** provide producers with a simple, comprehensive approach to planning and managing various cropping systems. The Resource Allocation Tool is an economic based optimization model that aids producers in making decisions about different cropping systems. Based on available irrigation water, projected cost of production and expected revenue, this model will aid producers in their decisions to plant various crops.

Because of implementation of new water policy by the High Plains Underground Water Conservation District, growers need a method to determine the amount of irrigation that they were allowed to apply to each irrigated acre. The **Contiguous Acre Calculator** allows growers to project specific levels of irrigation water to be applied to various delivery systems. The tool then calculates how much water can be banked for future use. Once the growing season is completed the producer can enter actual water applied and use it for record keeping.

Provided on the following pages are the usage instructions for each tool with more detail concerning each individual program as provided on our website.



TAWC ET IRRIGATION SCHEDULING TOOL

THE TAWC SOLUTIONS IRRIGATION SCHEDULING TOOL is intended as an aid to producers in determining a more refined irrigation schedule. This program utilizes weather information collected from the Texas Tech Mesonet along with specific producer input information to automatically calculate and update the soil water balance for a specific crop based on information provided by the user. Some key inputs include: crop type, planting date, site rainfall, irrigation, and other environmental and producer information. This provides a checkbook-style water balance register with which a producer can determine when and how much water to apply for an irrigation event based on tracking of the soil water balance available to the crop at any given growth stage during the growing season. The TAWC Solutions Irrigation Scheduling Tool is designed to help producers make the most out of their irrigation regime while being conscious of this precious natural resource.

To utilize the **TAWC Solutions ET program** you must first create a User ID and Password by selecting **Request User ID/New Password** from the top of the TAWC Solutions homepage banner next to the logon prompts. Once this is completed, log into the site and place your mouse cursor over **TAWC Tools** from the Navigation menu at top and a drop down menu will appear with the following selections:

TAWC ET – Irrigation Scheduling Tool
Resource Allocation – Economic Decision Aid Tool

To begin, move your cursor over **TAWC Tools** then over **TAWC ET** on the main navigation menu and select **Manage Production Sites** from the side menu. A **Site** is considered a location and field is the irrigated field or crop for that location. There can be multiple fields per location (ie. pivot 1, pivot 2, drip 1 etc...).

Illustrations and instructions for use of the program are presented on the following pages.

Screen 1

Welcome to TAWC Beta Website

The Texas Alliance for Water Conservation (TAWC) demonstration project is a demonstration funded by the State of Texas through the Texas Water Conservation Act. The demonstration came through Senate Bill 1111, signed by Governor Rick Warren. The TAWC, partnered with the Texas Tech University (TeCSIS) long-term integrated study, provides for research, demonstration, and the economic viability of agriculture in the Texas High Plains.

This Demonstration Project is overseen by a Board of Directors comprised of area producers from Hale and Floyd Counties in cooperation with scientists from Texas Tech University College of Agriculture and Natural Resources, Texas A&M Agrilife Research and Extension, USDA-ARS and NRCS, and the High Plains Underground Water District No. 1.

The **TAWC** program is intended to link research with on-farm demonstration sites that can demonstrate water savings and maintain profitability through use of alternative production systems, water saving technologies, and management tools that allow the producer to save water and remain profitable. As water continues to decline in the Ogallala Aquifer and policies are developed to limit agricultural water use, the ability of our producers to remain both productive and profitable requires closer cooperation between research and production systems and improved interaction and information exchange. This project is intended to bridge the gap between research and "real-world" agricultural production systems through a tighter coalition of researchers and producers and is intended to benefit our agricultural community by providing them with alternative strategies and decision aids that are useful and easily accessible.

TAWC Solutions is intended to provide a simple web-based management decision tool and an ET (evapotranspiration) tool that can aid in improved management decisions in the application of irrigation water. The tools on this site are evolving and through their use we hope to continue to improve and expand their capabilities to help secure the future of agriculture in the Texas High Plains.

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You will see a screen that states “There are no rows in this table.” In the right column you have the option of entering a new site location name (ie. Gomez) in the box. Enter the desired name and irrigated field number (ie. pivot 1) and click “**Create Site**”. You will then see a green confirmation box stating “**Your Production Site has been created**” with the new site name and an option to delete the site if desired. You can then create additional site locations and irrigated fields for each location as appropriate. A maximum of 10 fields per site location can be created. You can return to this page and create and delete site locations and fields as needs evolve or a new cropping year begins.

Screen 2

Home TAWC Tools Weather About My Account Logout

Your Production Site has been created.

New Production Site

Site Name:

Enter the name of the Production Site.

Field Number:

The number assigned to the irrigated area at the site, i.e. pivot 1, pivot 2 at site Gomez.

Create Site

	Site Name	Field	
1	Gomez	1	DELETE THIS SITE
2	Old Mill	1	DELETE THIS SITE
3	Old Mill	2	DELETE THIS SITE

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Return to **TAWC ET** on the navigation menu and select the next option “**Manage Water Balance Crops**”, a new screen will appear with an option “[Click here to create a new crop water balance track](#)”.

Screen 3

Home TAWC Tools Weather About My Account Logout

Water Balance Crops

This is a list of the particular crops that have a water balance track against them. This data cannot be edited and is just a listing of the crops as they were created.

[Click here to create a new crop water balance track.](#)

You currently have no tracked Water Balance Crops.


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Click the text and a new **Crop Water Balance Track** information page will be presented. In the **Site** location box select a previously entered **Production Site** from the drop down menu and provide all requested information then select the “**Create New Crop Water Balance Track**”

button at the bottom of the page. You will then see a new page with a green confirmation box stating that “**Your new crop water balance track has been created**”.

Screen 4



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Your new crop water balance track has been created.

New Crop Water Balance Track

Site:

Select the site where this crop is located.

Crop Type:

Select the type of crop and crop coefficients. Currently only Northern High Plains(NHP) coefficients are supported.

Select Planting Date:

Weather Station:

Select the nearest or preferred weather station.

Crop Acreage: *

Total acreage for this crop, not necessarily the irrigated area.

Starting Moisture[in]: *

The initial estimate for moisture in the soil at planting time.

Initial Effective Rain[%]: *

This is the initial effective rain percentage, which can be adjusted at a later date if necessary.

Initial Effective Irrigation [%]: *

This is the initial effective irrigation value, which can be changed at a later date.

Initial Et[%]: *

This is the percentage of predicted evapotranspiration to use. This can be changed at a later date as well.

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Repeat this procedure for each **Production Site** and irrigation field created. Definitions for each input are provided on the next page.

The confirmation page will revert to default entries after clicking “Create New Crop Water Balance Track” for information requested and is not representative of the track just created.

Crop type: the appropriate crop being tracked for the specific site location and irrigation field.

Planting Date: date the irrigated crop is planted by selecting the appropriate month, day and year from the drop down menus.

Weather Station: select the closest weather station to the specific site location being tracked from the drop down menu list of stations from the Texas Tech Mesonet.

Crop Acreage: enter total field acres for a specific irrigated field.

Starting Moisture: an estimated soil profile water content in inches for your specific soil type based on soil probing to a depth of 3 feet within the field and is a number in 0.0 inches (ie. 2.5 inches).

Initial Effective Rain: the % (in whole numbers) rain that you expect to normally capture in any given rain event for your specific soil type (this number can be changed for any given event in the Daily Measurements table (ie. 85%).

Initial Effective Irrigation: the % (in whole numbers) of irrigation water that is expected to be absorbed by the soil profile at the site under a given irrigation method (ie. Sprinkler – 90%, Drip – 95%, etc...).


Initial ET: the % of ET or evapotranspiration that you desire to water a given crop and can vary from 0 to 100 % depending of specific producer management desires and goals.

NEXT SELECT “**WATER BALANCE TABLES**” FROM THE **TAWC ET** MENU.

You are now presented with the “Check Book” style register for monitoring and adjusting various parameters as the season progresses. The **Daily Measurements** table should be populated with default settings for Effective Irrigation, Effective Rain, and Percent ET based on the information you provided in creating a **Water Track**. You may change the displayed Water Balance Crop being monitored from the left hand column by selecting the desired crop to monitor and the page will update to display that specific location field and crop information. The top of the Table has a **Crop Summary** which maintains current information for the Site location and field selected including **Last ET**, current soil **Moisture Balance**, **Growth Stage**, **Total Irrigation**, and **Total Rain** received since the start date. This allows a producer to get a quick overview of the current status of his operation for that specific location and field.

Below this summary is the **Daily Measurements** table and is a day by day record of measurements for the selected water balance crop. The selected **Water Balance Crop** can be changed by clicking on the list of water balance crops in the right hand column.

Screen 5



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Crop Summary

Site	Weather Station	Acreage	Type	Last Et	Moisture Balance	Growth Stage	Total Irrigation	Total Rain
Old Mill-1	Abernathy	120	Cotton	0.01	0.33	Strip	0.00	11.34

Daily Measurements

	Date	Effective Irrigation	Effective Rain	Percent Et	Irrigation	Rain	Daily Et	Moisture Balance	Growth Days	Growth Stage
0	2010-05-11	0.90	0.75	0.60	0.00	0.00	0	3	0	Planting Day
1	2010-05-12	0.90	0.75	0.60	0.00	0.00	0.01	2.99	1	-----
2	2010-05-13	0.90	0.75	0.60	0.00	0.00	0.01	2.98	2	-----
3	2010-05-14	0.90	0.75	0.60	0.00	1.03	0	3.75	3	-----
4	2010-05-15	0.90	0.75	0.60	0.00	0.01	0	3.76	4	-----
5	2010-05-16	0.90	0.75	0.60	0.00	0.00	0.01	3.75	5	-----
6	2010-05-17	0.90	0.75	0.60	0.00	0.54	0.01	4.15	6	-----
7	2010-05-18	0.90	0.75	0.60	0.00	0.00	0.01	4.14	7	-----
8	2010-05-19	0.90	0.75	0.60	0.00	0.00	0.01	4.13	8	-----
9	2010-05-20	0.90	0.75	0.60	0.00	0.00	0.01	4.12	9	-----
10	2010-05-21	0.90	0.75	0.60	0.00	0.00	0.01	4.11	10	Emerge
11	2010-05-22	0.90	0.75	0.60	0.00	0.00	0.02	4.09	11	-----
12	2010-05-23	0.90	0.75	0.60	0.00	0.00	0.01	4.08	12	-----
13	2010-05-24	0.90	0.75	0.60	0.00	0.03	0.02	4.08	13	-----
14	2010-05-25	0.90	0.75	0.60	0.00	0.00	0.01	4.07	14	-----
15	2010-05-26	0.90	0.75	0.60	0.00	0.08	0.02	4.11	15	-----
16	2010-05-27	0.90	0.75	0.60	0.00	0.00	0.01	4.1	16	-----

Select a Different

Water Balance Crop

1 [Gomez-1,Corn](#)

2 [Old Mill-2,Cotton](#)

The only **Required** input for this table is for **Irrigation** events but through added user input and interaction with the program ET can be more accurately calculated for a producer's specific crop. The **TAWC ET** program is intended to be simple, yet flexible by allowing the producer to tailor irrigation based on specific crop and environmental factors.

Columns displayed in a blue color may be manually adjusted at any time during the season. For example, if you click on a blue number in the column for **Effective Irrigation** a data entry box will pop up allowing you to change the **Effective Irrigation** % for any specific date during the growing season. An option also exists that allows you to select a checkbox that will apply this new value to all subsequent dates in the table or leave the box unchecked and make the change to the current date only. This applies to **Effective Irrigation**, **Effective Rain** and **Percent ET** columns.

For the **Irrigation** and **Rain** columns the user may click on a blue number for any specific date and enter an irrigation or rainfall event that applies to his specific location. Rainfall will be recorded automatically on a daily basis from the nearest **Weather Station** selected by the user during the creation of a **Water BalanceTrack** unless overridden by that user through manual entry. This allows the producer to better control the conditions of the specific field being monitored by manually updating rainfall measured at the individual site and thus more representative of the sites conditions. **However, the user must manually input each Irrigation event by clicking the blue number and entering each irrigation event amount in inches.**

The **Growth Stage** column is filled with estimated growth stages of the crop based on planting date. These values may be adjusted by the producer to more accurately represent the stage of his crop maturity thereby adjusting the calculated ET value for the crops current and subsequent growth stages. This is accomplished by clicking the blue lines in the column and selecting the appropriate growth stage for the calendar date from the drop down menu in the pop up. For example if you planted cotton on May 9 the estimated **Emerge** date is May 19, however if emergence occurred a day earlier or a day later the actual **Emerge** date can then be adjusted by clicking the blue lines on the appropriate day and selecting the correct growth stage from the drop down menu. This same logic is followed through the season for **1st Square, 1st Bloom, Max Bloom, 1st Open, 25% Open, 50% Open, 95% Open, and Strip**. Adjusting these values to the actual date of occurrence adjusts the ET calculation to more appropriately reflect the plant requirements and potentially reduce water use. Adjustment of the plants growth stage is not a requirement but will allow the **ET calculation** to be more accurate for the crops individual stage of growth.



TAWC Resource Allocation Analyzer


THE TAWC RESOURCE ALLOCATION ANALYZER is an economic-based decision aid which utilizes economic variables provided by an individual agricultural producer to estimate options for cropping systems which maximize per acre profits, whether at field or farm level. Utilizing information such as expected commodity prices, water availability, and enterprise options, irrigated agricultural producers can view cropping options which maximize their net returns per acre while accounting for irrigation demands and revenue potential. This user friendly aid is designed to provide the agronomic planning options to maintain profitability and sustainability in irrigated row crop agriculture.

To utilize the **TAWC Solutions Resource Analyzer** a User ID and Password must be created under **MY Account** in the Navigation menu. Once this is completed, log into the site and place the mouse cursor over **TAWC Tools** from the Navigation menu at top and a drop down menu will appear with the following selections:

TAWC ET Irrigation Scheduling Tool Resource Allocation

To begin, move your cursor over **TAWC Tools** then, click on **Resource Allocation** as seen in **Screen 1**. This will take you to **Screen 2**.

Screen 1



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Resource Allocation

Welcome to TAWC Beta Website

The Texas Alliance for Water Conservation (TAWC) is a producer-led demonstration funded by the State of Texas through the Texas Water Development Board. Initial funding for this demonstration came through Senate Bill 1053 that was sponsored by Senator Robert Duncan. The TAWC, partnered with the Texas Coalition for Sustainable Integrated Systems Research (TeCSIS) long-term integrated systems research at Texas Tech University, provides for research, demonstration, and implementation to reduce water use while ensuring the economic viability of agriculture in the Texas High Plains.

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Screen 2

Resource Allocation Analyzer

Production Site Parameters

Field Acreage	Pumping Capacity	Water Budget	Pumping Cost	Pumping Season
120 [Acres]	400 [GPM]	24 [In]	\$ 9 /[Acre-Inch]	90 [Days]

Crops to be Analyzed

Crop Type	Contracted Acres	Maximum Yield	Irrigation Required	Production Cost	Expected Price
None	0 [Acres]	0 [lb,bu]	0 [In]	\$ 0 /[Acre]	\$ 0 /[lb,bu]
None	0 [Acres]	0 [lb,bu]	0 [In]	\$ 0 /[Acre]	\$ 0 /[lb,bu]
None	0 [Acres]	0 [lb,bu]	0 [In]	\$ 0 /[Acre]	\$ 0 /[lb,bu]
None	0 [Acres]	0 [lb,bu]	0 [In]	\$ 0 /[Acre]	\$ 0 /[lb,bu]
None	0 [Acres]	0 [lb,bu]	0 [In]	\$ 0 /[Acre]	\$ 0 /[lb,bu]

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Useful Information

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The Resource Allocation Analyzer is designed to estimate field level cropping options for irrigated land which maximize net returns per acre. This program designs acreage allotments, yield goals, and irrigation application rates in a manner which maximizes profit while utilizing the available irrigation water to its greatest potential.

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Screen 2 represents the platform of which the Resource Allocation Analyzer works from. This is the only input screen for the program. Default values appear for the Production Site Parameters but each field or cell can be modified if so desired. To start the process, select each production site parameter to fit the field or farm to analyze. For definitions of each parameter please refer to the definitions on page 6. With the Production Site Parameters set, choose 1 of 5 crops to analyze. A single crop or up to a maximum of 5 can be chosen for the analysis. An example of selecting corn and cotton is illustrated in **Screen 3**.

Screen 3

Resource Allocation Analyzer

Production Site Parameters

Field Acreage	Pumping Capacity	Water Budget	Pumping Cost	Pumping Season
120 [Acres]	400 [GPM]	12 [In]	\$ 9 [/Acre-Inch]	90 [Days]

Crops to be Analyzed

Crop Type	Contracted Acres	Maximum Yield	Irrigation Required	Production Cost	Expected Price
Cotton	0 [Acres]	1500 [lb, bu]	18 [In]	\$ 500 [/Acre]	\$.90 [/lb, bu]
Corn	0 [Acres]	250 [lb, bu]	22 [In]	\$ 500 [/Acre]	\$ 5 [/lb, bu]
None	0 [Acres]	0 [lb, bu]	0 [In]	\$ 0 [/Acre]	\$ 0 [/lb, bu]
None	0 [Acres]	0 [lb, bu]	0 [In]	\$ 0 [/Acre]	\$ 0 [/lb, bu]
None	0 [Acres]	0 [lb, bu]	0 [In]	\$ 0 [/Acre]	\$ 0 [/lb, bu]

[Analyze](#) [Clear Form](#)

Useful Information

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The Resource Allocation Analyzer is designed to estimate field level cropping options for irrigated land which maximize net returns per acre. This program designs acreage allotments, yield goals, and irrigation application rates in a manner which maximizes profit while utilizing the available irrigation water to its greatest potential.

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Screen 4 illustrates the output from analyzing the crops and field parameters chosen in screen 3. The Maximum Profit Scenario indicates that the entire 120 acre field could be planted to cotton, with a yield goal of 1441 lbs utilizing 13.9 acre inches of water. This option will produce the highest net returns for the field at \$88,884. The next three scenarios offer alternatives which can be compared against the maximum profit scenario. Definitions and descriptions of the output screen can be seen on Page 7. Utilizing the Back button at the bottom of the page, alternative runs can be conducted by adding or deleting crop chooses and varying the production site parameters.

Screen 4

Resource Allocation Analyzer

Maximum Profit Scenario

	Crop Acreage [Acres]	Irrigation [Inches]	Yield per Acre [lbs, bu]	Cost per Acre	Return per Acre	Return per Crop	Total Irrigation [Acre- Inches]	Reduced Irrigation Demand [Acre- Inches]	Weighted Net Return	Net Return
Cotton	120	13.9	1,441	\$557	\$741	\$88,884	1,669	491	\$741	\$88,884

Maximum Profit Scenario for Equal Acreage among crops not contracted

	Crop Acreage [Acres]	Irrigation [Inches]	Yield per Acre [lbs, bu]	Cost per Acre	Return per Acre	Return per Crop	Total Irrigation [Acre- Inches]	Reduced Irrigation Demand [Acre- Inches]	Weighted Net Return	Net Return
Cotton	60	13.9	1,441	\$557	\$741	\$44,442	1,773	627	\$686	\$82,304
Corn	60	15.7	234	\$540	\$631	\$37,862				

Alternative Scenario 1

	Crop Acreage [Acres]	Irrigation [Inches]	Yield per Acre [lbs, bu]	Cost per Acre	Return per Acre	Return per Crop	Total Irrigation [Acre- Inches]	Reduced Irrigation Demand [Acre- Inches]	Weighted Net Return	Net Return
Cotton	80	13.9	1,441	\$557	\$741	\$59,256	1,738	582	\$704	\$84,497
Corn	40	15.7	234	\$540	\$631	\$25,241				

Alternative Scenario 2

	Crop Acreage [Acres]	Irrigation [Inches]	Yield per Acre [lbs, bu]	Cost per Acre	Return per Acre	Return per Crop	Total Irrigation [Acre- Inches]	Reduced Irrigation Demand [Acre- Inches]	Weighted Net Return	Net Return
Cotton	61	13.9	1,441	\$557	\$741	\$45,183	1,771	625	\$687	\$82,413
Corn	59	15.7	234	\$540	\$631	\$37,231				

Back

Production Site Parameters and Input Value Descriptions

Field Acreage - enter the amount of acres to be analyzed.

Pumping Capacity - enter the Gross Pumping Capacity at the delivery system. This value is estimated in gallons per minute or GPM.

Water Budget - select a water budget in acre inches as it applies to your particular field. This cell can be used to evaluate crop options under restricted water scenarios. The water budget is defaulted at 24 acre inches.

Pumping Cost - enter the per acre inch pumping cost for the field being analyzed.

Pumping Season - enter the typical length of irrigated days. This is used in conjunction with the Pumping Capacity to estimate the total amount of water that could be applied to the field.

Crop Type - choose from the pull down menu one of the five crops to be analyzed. (cotton, corn, sorghum, wheat, & sunflowers). A maximum of five crops can be analyzed.

Contracted Acres - enter an acreage value in this column only if you have contracted a crop by acres. The will produce solutions that must have at least as many acres for a crop as entered into this column. For example if entered 60 acres of contracted corn on a 120 acre pivot, then the solution will solve such that at least 60 acres of corn will be in production with the remaining water being allocated to another crop chosen.

Maximum Yield - enter the maximum yield for a chosen crop. This yield number should represent the realistic maximum yield which could be achieved on the field analyzed. For example, while genetics do allow for 2200 lbs of cotton to be produced, the field analyzed may have never produced more than 1500 lbs. In this case, 1500 lbs should be entered into the cell.

Production Cost - enter the total expenses incurred to produce the crop at the maximum yield, excluding pumping costs. Typically these expenses represent the total cash expenses such as seed, fertilizer, tillage operations, chemical applications, and other in field operations.

Expected Price - enter the price which is expected to be received upon selling or marketing the crop.

Output Definitions and Descriptions

Maximum Profit Scenario – This result provides an optimal level of crops acres, irrigation levels, and yield goals which maximize the total net returns per acre. This outcome can be a single crop or a combination of several crops of chosen.

Maximum Profit Scenario for Equal Acreage – This scenario produces the optimal outcome for all of the crops selected in the input screen and divides them equally among the field or farm acres analyzed.

Alternative Scenario 1 - This scenario presents the optimal chose of crop acreages, irrigation levels, and yield goals which maximize profit 5% below the true maximum.

Alternative Scenario 1 - This scenario presents the optimal chose of crop acreages, irrigation levels, and yield goals which maximize profit 10% below the true maximum.

Crop Acreage – the optimal acres by crop which could be planted to maximize net returns.

Irrigation – the optimal amount of irrigation required to produce the yield goal generated.

Yield Goal per Acre – the yield goal which maximizes net returns at the given irrigation level.

Cost per Acre – the total per acre cost of production including irrigation, at the optimal yield goal and irrigation levels.

Return per Acre – the net return per acre per crop representing the total revenue less total expenses.

Return per Crop – the total net returns per crop summed over the optimal acreage

Total Irrigation – the total amount of optimal irrigation applied in acre-inches.

Reduced Irrigation Demand – the amount of irrigation water that was not applied by avoiding producing at the maximum yield but by producing at the optimal level of yield and irrigation which maximized returns.

Weighted Net Return - the weighted amount of returns per acre if multiple crops were within the optimal solution.

Net Return - the total net returns over the acreage analyzed.

TAWC solutions

Texas Alliance for Water Conservation HPWD Contiguous Acre Inch Calculator

Enter information in white boxes to calculate the *Maximum Inches/Irr. Acre Allowed*

Total Contiguous Acres		Irrigated Acres within Contiguous	
Acres	120	Acres	100

Prior Years Bankable Water Contiguous Acre (Inches/Acre): 0
Leave 0 if none

HPWD Contiguous In./Ac. Limit: 21
Select Limit from Dropdown

Maximum In./Irr. Acre Allowed: 25.2

Allocation Calculator for Systems within Contiguous Acres

Pumping times based on inches of irrigation within pumping restrictions

Please enter information below in white input boxes for all *Irrigated Systems* within the *Total Contiguous Acres* (top).
 Acre entry for *Irrigated Acres within Contiguous* (top) must match *Total Irrigated Acres* (bottom tally).
Total Inches/Irr. Acre Applied (bottom tally) must not exceed *Maximum Inches/Irr. Acre Allowed* (top).

Enter # Systems in Irrig Acres: 2
Click mouse anywhere outside of boxes to calculate or use Tab key. Use Menu at bottom to Reset/Print

Irrigation System 1		Acres in System (Zone/Pivot)		Target Inches Desired for Year	
GPM	500	Acres	60	Inches	12
		Hours to Pump Target Inches		Days to Pump Target Inches	
		Hours	652.8	Days	27.2

Irrigation System 2		Acres in System (Zone/Pivot)		Target Inches Desired for Year	
GPM	250	Acres	40	Inches	15
		Hours to Pump Target Inches		Days to Pump Target Inches	
		Hours	1,087.2	Days	45.3

Total Irrigated Acres		Total Inches/Irr. Acre Applied	
Acres	100	Inches	13.20
of....Total	100	of....Total	25.2

Bankable Water/Contig. Ac. Inches: 10.00
BANKABLE WATER

OK
Calculate

Reset Print



TAWC Contiguous Acre Calculator

THE *TAWC CONTIGUOUS ACRE CALCULATOR* is a two-part tool.

The top portion of the calculator is intended to be used to aid producers in determining the maximum amount of water that may be applied per irrigated acre based on the High Plains Underground Water Conservation District (HPWD) rules regarding water withdrawal from the Ogallala Aquifer. This tool allows the producer to enter their total contiguous acres as defined by HPWD and the total irrigated acres within the contiguous land area. Upon entering these two pieces of information, the producer can select from the current or future HPWD contiguous inches per acre

limits from a drop down box (HPWD Contiguous In./Ac. Limit) and the maximum inches per irrigated acre allowed will be calculated based on the limit selected. This allows the producer to view how the future restrictions would affect the maximum inches per irrigated acre allowed. If the producer has banked water (water allowed not used from one of the previous 3 years) he may enter this amount which will be added to the maximum inches per acre allowed for that crop production year.

The 2nd or lower part of the calculator is a water allocation calculator for irrigated systems within the contiguous acres that allow the producer to distribute the maximum inches per acre allowed across irrigated systems within the contiguous land area. This portion of the calculator allows a producer to first enter the number of irrigation systems within a specific contiguous land area. This will expand data entry fields to the number of systems requested, allowing the producer to enter the gpm, irrigated acres within each zone or pivot and target inches desired for each individual irrigated system. The producer may enter various scenarios for each system varying the amount of inches of water to view how the water may be distributed to maximize or minimize the designated water amount on any given system as well as view any bankable or “carry forward water” remaining. If the calculator detects an error such as maximum water allowed or number of irrigated acres exceeded the program will give a “red flag” error notification which will allow the producer to correct the offending issue. Once all data entry values have been entered correctly “OK” will display at the bottom of the calculator and no red flag warnings will be visible. If there is any unused water remaining of the total allowed, this amount will display in the “Bankable Water/Contig. Ac.” box at the bottom of the calculator.

Information obtained from this two-part tool include the maximum inches/irrigated acre allowed, hours and days required to pump the target inches of water, bankable water for carry forward and the ability to distribute the allowed water among irrigated systems based on the HPWD total acre inches allowed. In addition the producer may use the tool to try varying scenarios to distribute the allowed water based on the crops within each system.

We are continually striving to improve the accuracy, usability and performance of these programs. Through your feedback and assistance we can be proactive in addressing the needs of the Texas High Plains. This program has been created through the efforts of many involved in this project including Texas Tech University, Texas A&M AgriLife Research and Extension, USDA-ARS/NRCS, High Plains Underground Water District No. 1, Producers of Hale and Floyd Counties and the Texas Water Development Board.

We must work together to solve the growing issues faced by agriculture today and tomorrow because ‘Water is Our Future’.

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Disclaimer: Neither the programmers nor the Texas Alliance for Water Conservation and its affiliated institutions are to be held responsible for the information generated from these programs and tools.

BUDGET

Table 39. Task and expense budget for years 1-8 of the demonstration project.

2005-358-014		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	
		(9/22/04 - 1/31/06)	(2/01/06 - 2/28/07)	(3/01/07 - 2/29/08)	(3/01/08 - 2/28/09)	(03/01/09 - 2/28/10)	03/01/10 - 2/28/11	03/01/11 - 2/29/12	03/01/12 - 2/28/13	
Task Budget	Task Budget*	revised	revised							Total Expenses
1	4,537	4,537	0	0	0	0	0	0	0	4,537
2	2,561,960	216,966	335,319	317,317	299,727	249,163	299,550	296,282	249,082	2,260,760
3	675,402	21,112	33,833	80,984	61,455	56,239	28,122	46,033	145,566	473,342
4	610,565	52,409	40,940	46,329	53,602	64,124	43,569	117,206	118,858	537,038
5	376,568	42,428	40,534	47,506	38,721	51,158	27,835	29,231	45,096	322,509
6	568,773	54,531	75,387	71,106	60,257	39,595	60,473	52,444	56,865	470,657
7	306,020	37,014	22,801	30,516	25,841	11,497	14,302	34,398	87,024	248,929
8	334,692	44,629	43,089	41,243	43,927	42,084	42,984	37,157	38,169	333,281
9	623,288	145,078	39,011	35,656	82,844	52,423	65,785	32,971	76,416	516,274
10	162,970	0	0	0	0	0	86,736	55,871	0	142,607
TOTAL	6,224,775	618,702	630,914	670,657	666,374	566,283	669,355	701,594	817,075	5,309,890

		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	
		(09/22/04 - 01/31/06)	(02/01/06 - 02/28/07)	(3/01/07 - 2/29/08)	(3/01/08 - 2/28/09)	(03/01/09 - 2/28/10)	03/01/10 - 2/28/11	03/01/11 - 2/29/12	03/01/12 - 2/28/13	
Expense Budget	Total Budget*									Total Expenses
Salary and Wages ¹	2,524,172	230,611	304,371	302,411	301,933	259,929	293,198	307,459	300,033	2,299,944
Fringe ² (20% of Salary)	370,655	28,509	34,361	36,263	40,338	37,180	43,410	42,061	32,852	294,974
Insurance	186,600	13,634	26,529	25,302	25,942	21,508	23,294	24,918	17,554	178,680
Tuition and Fees	199,922	8,127	16,393	21,679	18,502	13,277	9,828	21,803	35,299	144,908
Travel	158,482	14,508	25,392	14,650	15,556	16,579	12,329	19,127	17,148	135,289
Capital Equipment	154,323	23,080	13,393	448	707	18,668	95,993	(146)	0	152,141
Expendable Supplies	105,455	14,277	16,100	12,205	18,288	8,614	4,802	8,265	21,058	103,610
Subcon	1,758,667	212,718	103,031	161,540	183,125	131,627	115,587	131,779	335,505	1,343,849
Technical/Computer	61,364	9,740	3,879	16,225	430	7,990	11,857	10,550	0	60,671
Communications	270,192	25,339	41,374	35,497	23,062	14,448	18,300	45,344	17,002	220,366
Reproduction (see comm)										0
Vehicle Insurance	2,000	0	397	235	187	194	114	130	222	1,479
Producer Compensation	57,450	0	0	0	0	0	0	39,225	0	39,225
Overhead	375,493	38,160	45,694	44,202	38,302	36,270	40,644	51,079	40,403	334,754
Profit										
TOTAL	6,224,775	618,702	630,914	670,657	666,374	566,283	669,355	701,594	817,075	5,309,890

COST SHARING

Table 40. Cost sharing figures for TTU, AgriLife (TAMU), and HPUWCD for years 1-8 of the demonstration project.

Cost Sharing Balance Summary (estimated)

Budget	Total Cost Share Budgeted	Actual Funds Contributed	Balance
TTU		885,990.99	
TAMU		356,012.33	
HPUWCD		200,053.70	
TOTAL	1,100,000.00	1,442,057.02	(-342,057.02)

Expense Categories	Total Expense Budget	Actual Funds Contributed	Balance
Salary & Wages		350,471.81	
Overhead		535,519.18	
SubCon - TAMU		356,012.33	
\$25,000/yr - HPUWCD		200,053.70	
TOTAL	1,100,000.00	1,442,057.02	(-342,057.02)

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