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

6th Annual Report

to the

Texas Water Development Board

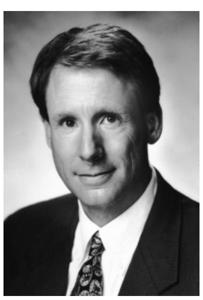
Texas Alliance For Water Conservation

TAWC

“Water is Our Future”

JUNE 22, 2011

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.

Texas Alliance for Water Conservation Participants

Texas Tech University
Rick Kellison, Project Director*
Dr. Vivien Gore Allen*
Mr. Philip Brown
Dr. David Doerfert*
Dr. Phil Johnson*
Dr. Stephan Maas*
Dr. Eduardo Segarra*
Mr. Tom Sell*
Ms. Angela Beikmann,*
Secretary/Bookkeeper

Texas AgriLife Extension
Dr. Steven Klose*
Mr. Jeff Pate*
Dr. Calvin Trostle*
Mr. Jay Yates*

High Plains Underground Water
Conservation District #1
Mr. Jim Conkwright*
Gerald Crenwelge

USDA - Natural Resource
Conservation Service
Mr. Monty Dollar (retired)*

USDA – Agricultural Research Service
Dr. Ted Zobeck
Dr. Veronica Acosta-Martinez

Producer Board Chairman
Mr. Glenn Schur*

Post Doctoral Fellow
Dr. Nithya Rajan
Dr. Justin Weinheimer

Graduate Research Assistants
Rebekka Martin (completed 2005)
Pamela Miller (completed 2006)
Nithya Rajan (completed 2007)
Paul Braden (completed 2007)
Jurahee Jones (completed 2007)
Justin Weinheimer (completed 2008)
Katie Leigh (completed 2008)
Heather Jones (completed 2010)
Yue Li (completed 2011)
Swetha Dorbala
Morgan Newsom
Jarrott Wilkinson
Rachel Oates
Song Cui
Cody Zilverberg
Lindsay Graber
Jennifer Zavaleta
Nichole Sullivan

* Indicates Management Team member

'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 $5.6 billion ($1.1 crops; $4.5 livestock; TASS, 2004) but is highly dependent on water from the Ogallala Aquifer. Ground water supplies are declining in this region (TWDB, 2007) while costs of energy required to pump water are escalating. Improved irrigation technologies including low energy precision application (LEPA) and sub-surface 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 fuels, 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 complimentary effects that increase productivity. Research conducted at Texas Tech over the past ten years has shown that an integrated cotton/forage/beef cattle system, compared with a 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). At cotton yields average for irrigated cotton in the region, profitability was greater for the integrated system than a cotton monoculture. 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). This ongoing replicated research provided originally 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 though 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 that provide needed productivity and profitability for producers, communities, and the region.

Report of The First Six 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.

The assumptions necessary for system comparisons are elaborated below.

ASSUMPTIONS OF DATA COLLECTION AND INTERPRETATION

1. Although actual depth to water in wells located among the 26 sites varies, a pumping depth of 260 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. In 2009, prices of electricity decreased compared with the previous two years, reflecting the decline in crude oil prices.

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

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

Table 1. Electricity irrigation cost parameters for 2005, 2006, 2007, 2008, 2009 and 2010.

	2005	2006	2007	2008	2009	2010
Gallons per minute (gpm)	450	450	450	450	450	450
Pumping lift (feet)	260	250	252	254	256	285
Discharge Pressure (psi)	15	15	15	15	15	15
Pump efficiency (%)	60	60	60	60	60	60
Motor Efficiency (%)	88	88	88	88	88	88
Electricity Cost per kWh	$0.085	$0.09	$0.11	$0.14	$0.081	$0.086
Cost of Electricity per Ac. In.	$4.02	$4.26	$5.06	$6.60	$3.78	$4.42
Cost of Maintenance and Repairs per Ac. In.	$2.05	$2.07	$2.13	$2.45	$3.37	$3.49
Cost of Labor per Ac. In.	$0.75	$0.75	$0.80	$0.90	$0.90	$0.90
Total Cost per Ac. In.	$6.82	$7.08	$7.99	$9.95	$8.05	$8.81

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

Table 2. Commodity prices for 2005, 2006, 2007, 2008, 2009 and 2010.

	2005	2006	2007	2008	2009	2010
Cotton lint ($/lb)	$0.54	$0.56	$0.58	$0.55	$0.56	$0.75
Cotton seed ($/ton)	$100.00	$135.00	$155.00	$225.00	$175.00	$150.00
Grain Sorghum – Grain ($/cwt)	$3.85	$6.10	$5.96	$7.90	$6.48	$9.51
Corn – Grain ($/bu)	$2.89	$3.00	$3.69	$5.71	$3.96	$5.64
Corn – Food ($/bu)	$3.48	$3.55	$4.20	$7.02	$5.00	$4.88
Wheat – Grain ($/bu)	$2.89	$4.28	$4.28	$7.85	$5.30	$3.71
Sorghum Silage ($/ton)	$20.19	$18.00	$18.00	$25.00	$24.00	$24.00
Corn Silage ($/ton)	$20.12	$22.50	$25.00	$25.00	$42.90	$43.50
Wheat Silage ($/ton)	$18.63	$22.89	$22.89	$29.80	$26.59	$26.59
Oat Silage ($/ton)	-	$17.00	$17.00	-	$14.58	-
Millet Seed ($/lb)	$0.17	$0.17	$0.22	$0.25	-	$0.25
Sunflowers ($/lb)	$0.21	$0.21	$0.21	$0.29	$0.27	-
Alfalfa ($/ton)	$130.00	$150.00	$150.00	$160.00	$160.00	$185.00
Hay ($/ton)	$60.00	$60.00	$60.00	$60.00	$60.00	-
WWB Dahl Hay ($/ton)	$65.00	$65.00	$90.00	$90.00	-	$60.00
Hay Grazer ($/ton)	-	$110.00	$110.00	$70.00	$110.00	$65.00
Sideoats Seed ($/lb)	-	-	$6.52	$6.52	$3.90	$8.00
Sideoats Hay ($/ton)	-	-	$64.00	$64.00	$70.00	$60.00

3. Fertilizer and chemical costs (herbicides, insecticides, growth regulators, and harvest aids) are reflective of the production year; however, prices were held constant across sites for the product and formulation.

4. Other variable and fixed costs are given for 2005 through 2010 in Table 3.

Table 3. Other variable and fixed costs for 2005, 2006, 2007, 2008, 2009 and 2010.

	2005	2006	2007	2008	2009	2010
VARIABLE COSTS						
Boll weevil assessment: ($/ac)						
Irrigated cotton	$12.00	$12.00	$12.00	$1.50	$1.00	$1.00
Dryland cotton	$6.00	$6.00	$6.00	$1.50	$1.00	$1.00
Crop insurance ($/ac)						
Irrigated cotton	$17.25	$17.25	$17.25	$20.00	$20.00	$20.00
Dryland cotton	$12.25	$12.25	$12.25	$12.25	$12.25	$12.25
Irrigated corn	$15.00	$15.00	$15.00	$15.00	$15.00	$15.00
Cotton harvest – strip and module ($/lint lb)	$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	$1.95
Bags, Ties, & Classing ($/480 lb bale)	$17.50	$19.30	$17.50	$18.50	$18.50	$18.50
FIXED COSTS						
Irrigation system:						
Center Pivot system	$33.60	$33.60	$33.60	$33.60	$33.60	$40.00
Drip system	$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
Cash rent:						
Irrigated cotton, grain sorghum, sunflowers, grass, millet, and sorghum silage.	$45.00	$45.00	$45.00	$75.00	$75.00	$100.00
Irrigated corn silage, corn grain, and alfalfa.	$75.00	$75.00	$75.00	$100.00	$100.00	$140.00
Dryland cropland	$15.00	$15.00	$15.00	$25.00	$25.00	$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.

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.

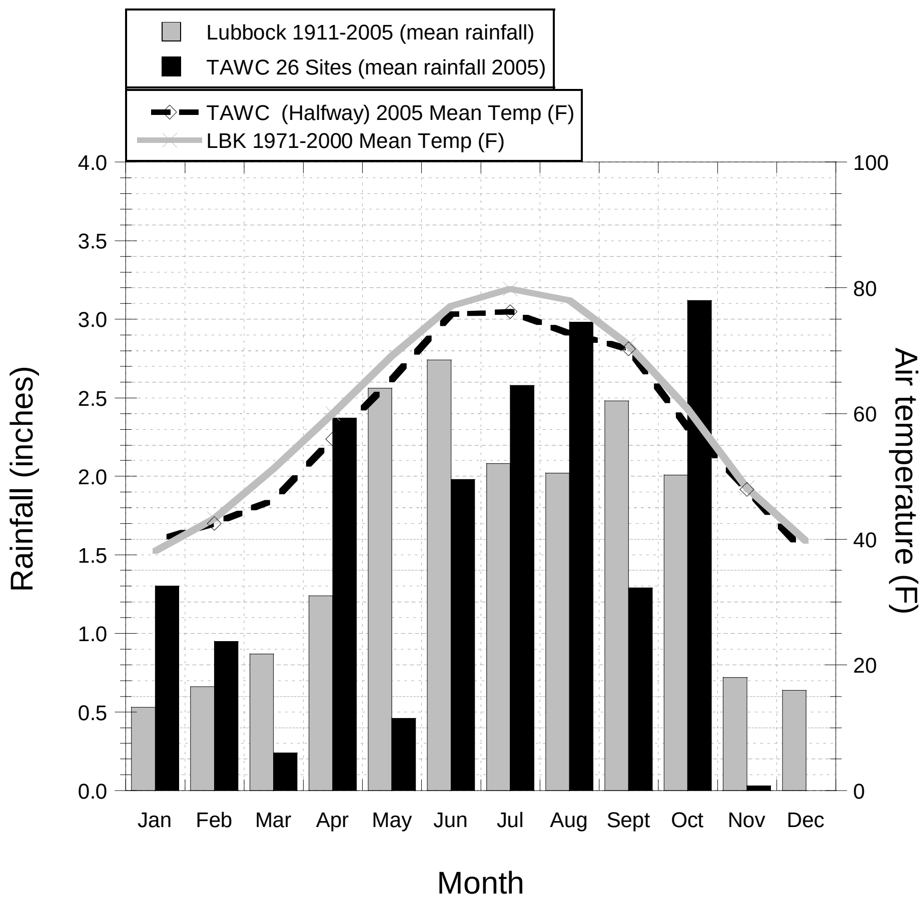

Figure 1. Temperature and precipitation for 2005 in the demonstration area compared with long term averages.

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.

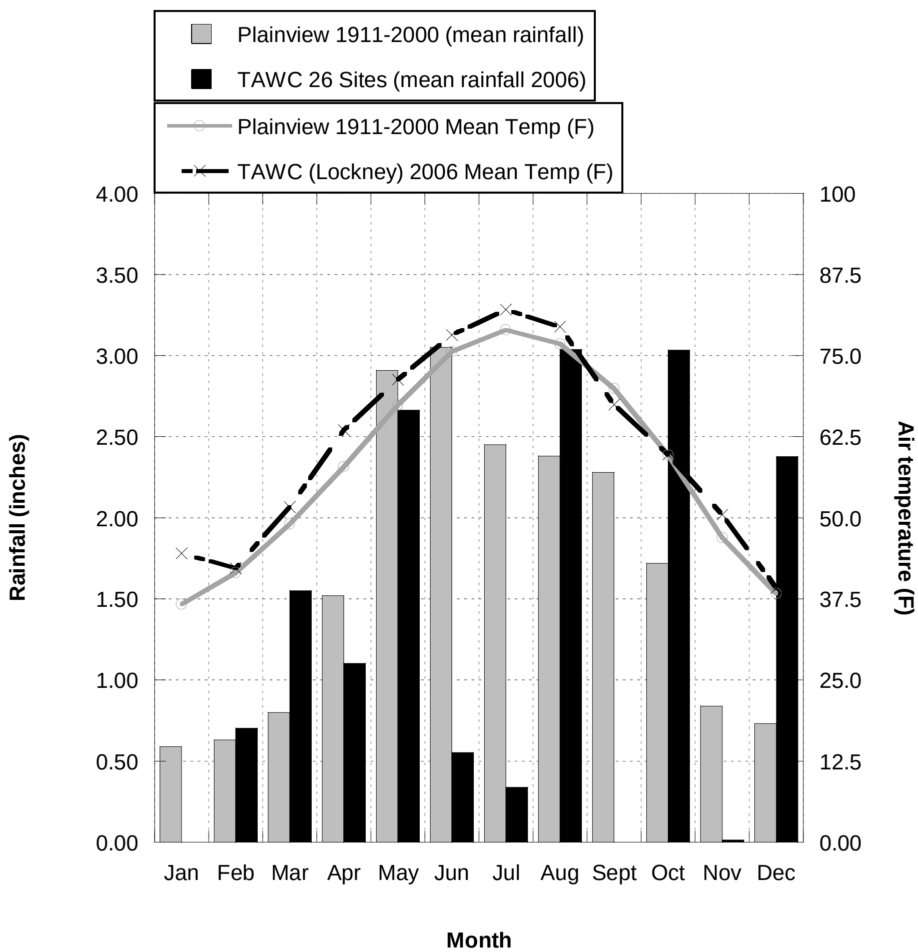

Figure 2. Temperature and precipitation for 2006 in the demonstration area compared with long term averages.

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.

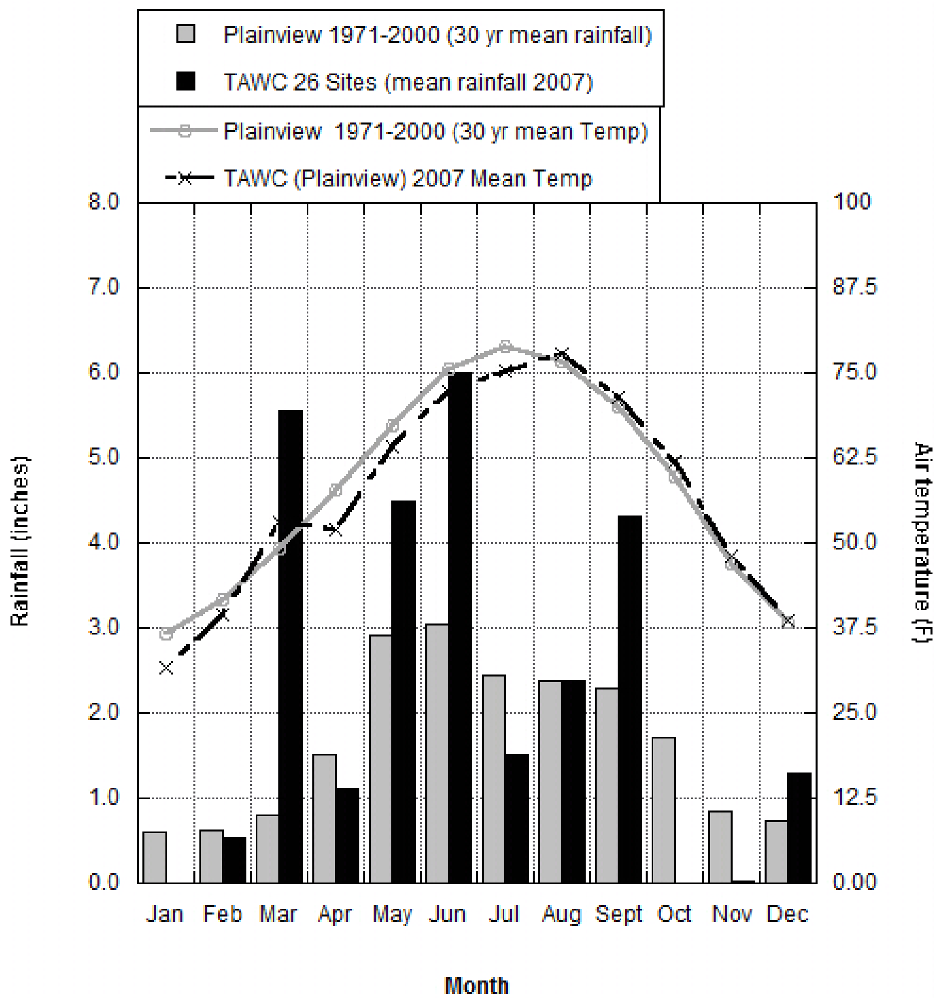

Figure 3. Temperature and precipitation for 2007 in the demonstration area compared with long term averages.

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).

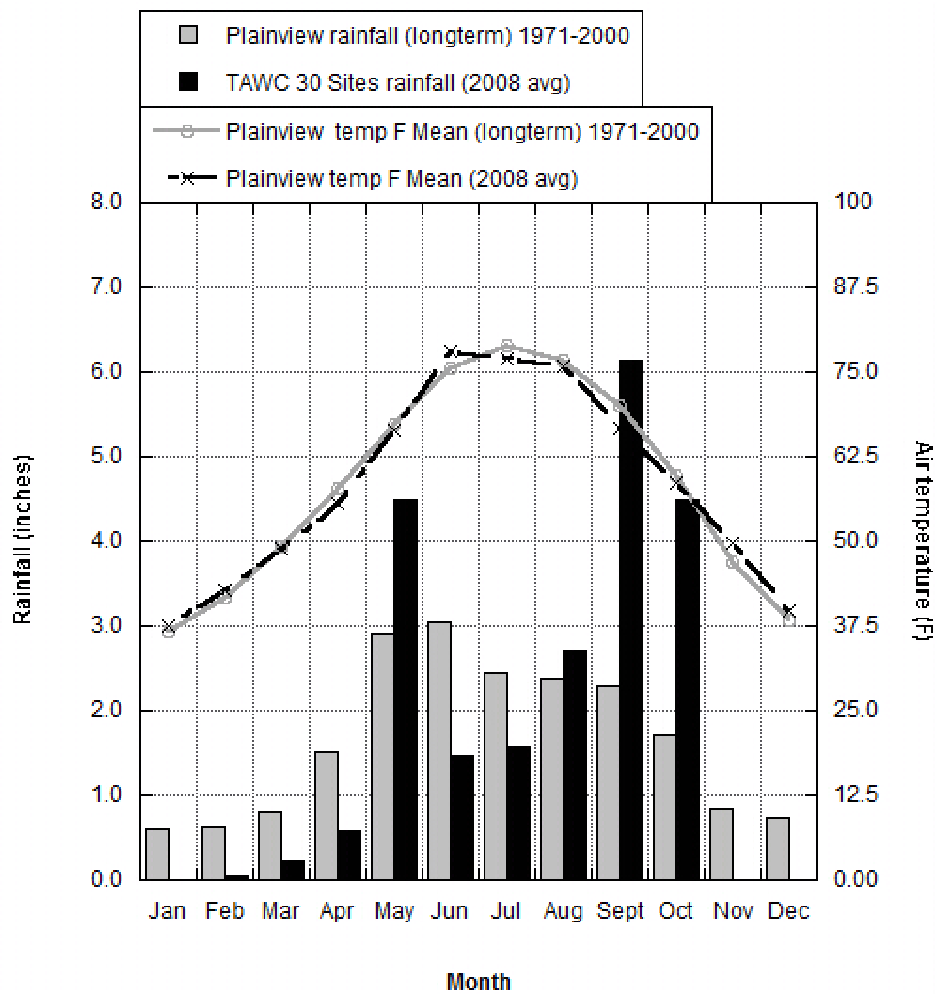

Figure 4. Temperature and precipitation for 2008 in the demonstration area compared with long term averages.

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	Year Total
2	0	0	0.2	0.8	4.75	1.7	1	2.1	5.4	4.1	0	0	20.05
3	0	0	0.2	0.5	4.5	1.1	0.95	2	4.7	4.4	0	0	18.35
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	21.85
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	19.65
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	0.00	0.04	0.22	0.58	4.48	1.48	1.59	2.71	6.07	4.46	0.00	0.00	21.62

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.

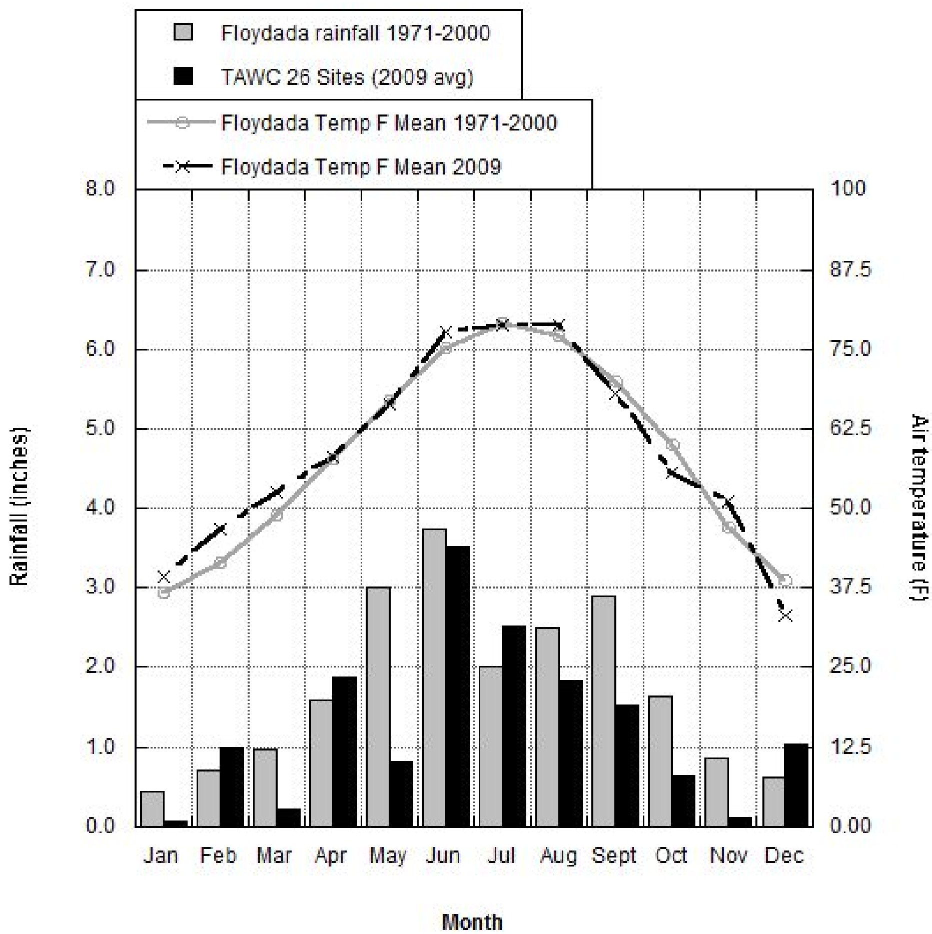

Figure 5. Temperature and precipitation for 2009 in the demonstration area compared with long term averages.

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	Annual
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.

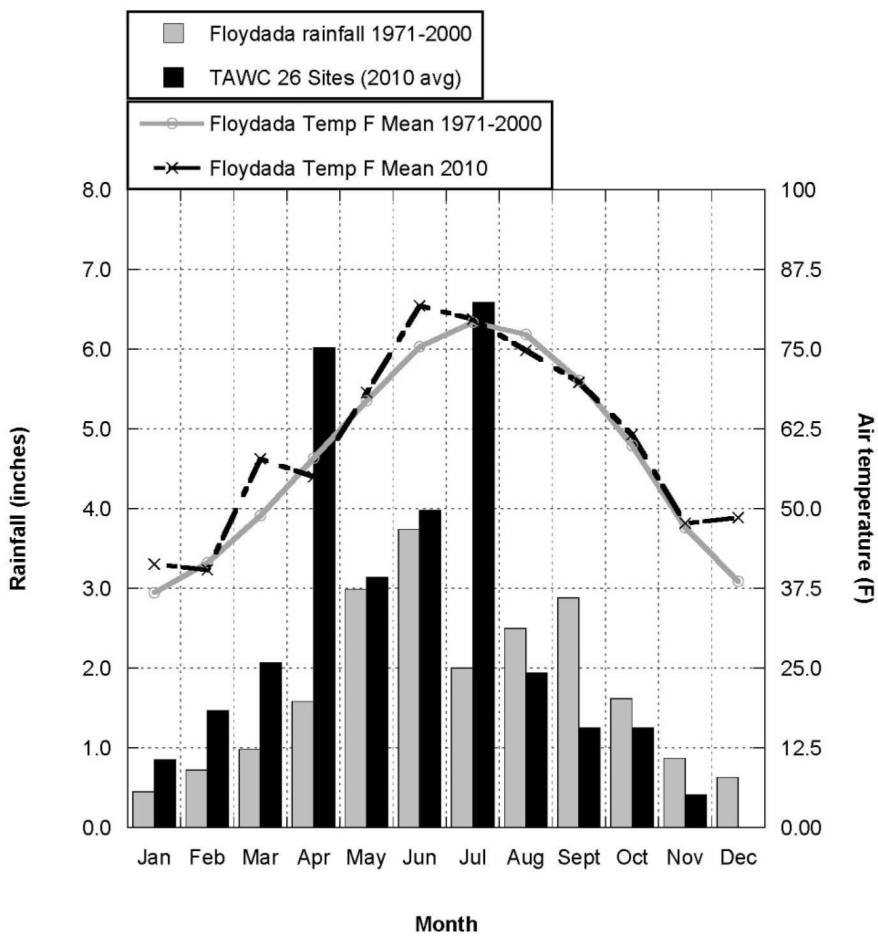

Figure 6. Temperature and precipitation for 2010 in the demonstration area compared with long term averages.

Table 9. Precipitation by each site in the Demonstration Project in Hale and Floyd Counties during 2010.

Site	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2	1.5	1.1	2.0	6.2	2.0	7.0	7.8	1.2	1.6	1.4	0.0	0.0	31.8
3	0.8	1.4	1.9	5.0	2.2	4.7	5.8	1.4	2.0	1.8	0.2	0.0	27.1
4	0.6	1.3	2.1	5.2	4.6	2.2	10.0	1.4	0.4	2.0	0.6	0.0	30.4
5	0.8	1.4	1.9	5.0	3.2	3.6	8.0	2.3	0.6	0.6	0.4	0.0	27.7
6	0.5	1.4	1.9	5.4	3.4	4.8	5.4	2.4	1.2	0.6	0.4	0.0	27.4
7	0.8	1.5	2.5	6.0	2.8	1.6	5.0	2.3	1.5	0.6	0.3	0.0	24.8
8	0.8	1.5	2.5	6.0	2.8	1.6	5.0	2.3	1.5	0.6	0.3	0.0	24.8
9	0.5	1.5	2.2	7.0	4.6	2.8	4.4	2.2	1.6	0.8	0.4	0.0	28.0
10	0.8	1.6	2.2	7.7	4.2	3.4	4.4	1.8	1.2	1.0	0.4	0.0	28.7
11	0.8	1.6	2.2	9.1	5.4	4.0	4.4	1.7	1.2	0.9	0.4	0.0	31.6
12	0.8	1.5	2.1	7.4	3.8	4.2	7.6	3.4	2.8	1.2	0.6	0.0	35.4
14	0.8	1.5	2.1	7.7	4.0	5.1	6.0	2.2	2.0	1.2	0.4	0.0	33.0
15	0.8	1.5	2.1	6.2	2.0	5.8	5.2	1.7	1.4	1.4	0.4	0.0	28.5
17	0.8	1.6	2.0	5.2	2.8	6.6	7.2	1.2	1.6	1.2	0.4	0.0	30.6
18	0.8	1.3	2.0	7.3	1.6	6.6	4.6	1.6	0.1	1.0	0.2	0.0	27.1
19	0.7	1.3	2.0	7.6	2.2	5.4	6.2	2.4	0.8	2.0	0.4	0.0	30.9
20	0.8	1.4	1.9	6.3	3.2	4.4	9.0	2.3	0.8	1.2	0.6	0.0	31.8
21	0.8	1.5	2.1	6.2	2.7	4.6	7.4	2.2	2.4	1.2	0.6	0.0	31.7
22	1.4	1.8	2.1	4.1	3.4	3.6	8.4	0.8	0.2	2.0	0.6	0.0	28.4
23	1.4	1.4	2.1	5.4	2.6	4.4	7.0	2.1	0.4	0.5	0.4	0.0	27.6
24	1.4	1.8	2.1	3.8	3.6	1.6	7.5	1.5	0.7	2.6	0.6	0.0	27.2
26	0.8	1.4	1.9	5.0	3.2	3.6	8.0	2.3	0.6	0.6	0.4	0.0	27.7
27	0.8	1.4	1.9	5.0	2.2	3.0	7.0	2.3	0.8	1.4	0.6	0.0	26.3
28	0.8	1.6	2.2	7.7	4.2	3.4	4.4	1.8	1.2	1.0	0.4	0.0	28.7
29	0.8	1.5	2.1	6.2	1.8	6.0	7.4	1.7	4.0	1.4	0.4	0.0	33.3
30	0.8	1.4	1.9	5.0	3.2	3.6	8.0	2.3	0.6	0.6	0.4	0.0	27.7
31	1.4	1.8	2.1	3.8	3.6	1.6	7.5	1.5	0.7	2.6	0.6	0.0	27.2
32	0.8	1.5	2.1	6.2	2.7	2.4	6.0	1.7	1.1	1.6	0.3	0.0	26.4
33	0.8	1.5	2.1	6.2	2.7	2.4	6.0	1.7	1.1	1.6	0.3	0.0	26.4
Average	**0.9**	**1.5**	**2.1**	**6.0**	**3.1**	**3.9**	**6.6**	**1.9**	**1.2**	**1.3**	**0.4**	**0.0**	**28.9**

SUPPLEMENTARY GRANTS TO PROJECT

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).

Doerfert, D. 2010. Proposal was submitted to a joint USDA/NIFA and NASA.

Joint proposal with North Plains Groundwater Conservation District was submitted to USDA-NRCS for Conservation Innovation Grant.

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

VISITORS TO THE DEMONSTRATION PROJECT SITES

2005

Total Number of Visitors	190

2006

Total Number of Visitors	282

2007

Total Number of Visitors	36

2008

Total Number of Visitors	53

2009

Total Number of Visitors	33

2010

Total Number of Visitors	14+

Cristiano Das Neves Almeida
Wesley Brown
Dr. A.C. Correa
Cotton Incorporated group
Andrea Sousa Fontes
Fred Gerendasy
Rebecca Gerendasy
Alfredo Ribeiro Neto
Iana Alexandra Alves Rufino
Celso Augusto Guimaraes Santos
David Sloane
Aucimaia De Oliveira Tourinho
Chance Van Dyke
Dr. Alice White

PRESENTATIONS

2005

Date		
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

Date	Presentation	Spokesperson(s)
24-26 Jan	Lubbock Southwest Farm & Ranch Classic	Kellison
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
27-Apr	ICASALS Holden Lecture: "New Directions in Groundwater Management for the Texas High Plains"	Conkwright
15-Jun	Field Day @ New Deal Research Farm	Kellison/Allen/Cradduck/Doerfert
21-Jul	Summer Annual Forage Workshop	Trostle
27-Jul	National Organization of Professional Hispanic NRCS Employees annual training meeting, Orlando, FL	Cradduck (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

Date	Presentation	Spokesperson(s)
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	Calibrating aerial imagery for estimating crop ground cover. 21st Biennial Workshop on Aerial Photog., Videography, and High Resolution Digital Imagery for Resource Assessment, 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	
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	Comparison of water use among crops in the Texas High Plains estimated using remote sensing. 2007 Water Research Symposium, 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. "Overview and Initial Progress of the Texas Alliance for Water Conservation Project"	Kellison
8-Oct	Plant & Soil Science Departmental Seminar. "Estimating ground cover of field crops using multispectral medium, resolution satellite, and high resolution aerial imagery"	Rajan
11-Oct	Management Team meeting	
4-8 Nov	Using remote sensing and crop models to compare water use of cotton under different irrigation systems (poster). Accepted for presentation at the Annual Meetings, Amer. Soc. Agronomy. New Orleans, LA	Rajan
4-8 Nov	Assessing the crop water use of silage corn and forage sorghum using remote sensing and crop modeling. Accepted for presentation at the Annual Meetings, Amer. Soc. Agronomy. 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, Albuquerque, NM (2 poster presentations)	Doerfert
16-Nov	Water Conservation Advisory Council meeting, Austin, TX	Allen
19-Nov	Plant & Soil Science Departmental Seminar. "Finding the legume species for West Texas which can improve forage quality and reduce water consumption"	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

Date	Presentation	Spokesperson(s)
4—7-Jan	Beltwide Cotton Conference Proceedings: *Energy Analysis of Cotton Production in the Southern High Plains of Texas,* 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. "Systems Research in Action," Kansas City, MO	Allen
27-Mar	Media training for TAWC Producer Board	Doerfert/Kellison
Apr	Agricultural Economics Seminar: *Transitions in Agriculture,* Texas Tech University	Weinheimer
10-Apr	Management Team meeting	
5-May	Pasture and Forage Land Synthesis Workshop. "Integrated forage-livestock systems research," Beltsville, MD	Allen
8-May	Management Team meeting	
9-Jun	Walking tour of New Deal Research farm	Allen/Kellison/Li/Cui/Cradduck
10—12-Jun	Forage Training Seminar. "Agriculture and land use changes in the Texas High Plains," 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/Cradduck
15-Jul	Pioneer Hybrids Research Directors	Kellison
20—23-July	9th 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/ Cradduck
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: *A Qualitative Investigation of the Factors that Influence Crop Planting and Water Management in West Texas*.	Leigh
20-Oct	Farming with Grass conference, Soil and Water Conservation Society, Oklahoma City, OK	Allen
23-Oct	Thesis defense: *Farm Level Financial Impacts of Water Policy on the Southern Ogallala Aquifer*	Weinheimer
13-Nov	Management Team meeting (Weinheimer presentation)	
17—20-Nov	American Water Resources Association, New Orleans (paper/posters presentations)	Doerfert/Leigh/ Newsom/Wilkinson/ Williams
19-Nov	TTU GIS Open House	Barbato
Dec	Panhandle Groundwater District: *Farm Level Financial Impacts of Water Policy on the Southern Ogallala Aquifer,* 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/ Cradduck/Weinheimer

2009

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: *Managing Wheat for Grain*, Lubbock	Trostle
27-Jan	Southwest Farm & Ranch Classic: *2009 Planting Decisions – Grain Sorghum and Other Alternatives*, Lubbock	Trostle
28-Jan	Southwest Farm & Ranch Classic: *Profitability Workshop*, 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 9th Annual Symposium (CERI): *Water Policy Impacts on High Plains Cropping Patterns and Representative Farm Performance*, 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: *Evaluation of the bare soil line from reflectance measurements on seven dissimilar soils* (poster presentation), Ft. Collins, CO	Rajan
26-Jun	Western Agricultural Economics Association: *Economics of State Level Water Conservation Goals*, Kauai, Hawaii	Weinheimer/Johnson
7-Jul	Universities Council of Water Resources: *Water Policy in the Southern High Plains: A Farm Level Analysis*, 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: *Evapotranspiration of Irrigated and Dryland Cotton Fields Determined Using Eddy Covariance and Penman-Monteith Methods,* and *Relation Between Soil Surface Resistance and Soil Surface Reflectance,* poster presentation: *Variable Rate Nitrogen Application in Cotton Using Commercially Available Satellite and Aircraft Imagery,"* Pittsburgh, PA	Maas/Rajan
10—12-Nov	Cotton Incorporated Precision Agriculture Workshop: *Biomass Indices*, Austin, TX	Rajan/Maas
12-Nov	Management Team meeting	
Dec	United Farm Industries Board of Directors: *Irrigated Agriculture,* 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: *Vegetation cover mapping at multiple scales using MODIS, Landsat, RapidEye, and Aircraft imageries in the Texas High Plains,* San Francisco, CA	Rajan/Maas

2010

Date	Presentation	Spokesperson(s)
6-Jan	Beltwide Cotton Conference, New Orleans, LA	Yates/Weinheimer
14-Jan	TAWC Management Team meeting	
3-Feb	TAWC Farmer Field Day, Muncy, TX	TAWC participants
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): *Texas Alliance for Water Conservation: An Integrated Approach to Water Conservation*, Seattle, WA	Weinheimer
27-July	American Agricultural Economics Association: *Carbon Footprint: A New Farm Management Consideration on the Southern High Plains,* 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: *Carbon fluxes from continuous cotton and pasture for grazing in the Texas High Plains,* Long Beach, CA	Rajan/Maas

31-Oct—3-Nov	Annual Meetings of the American Society of Agronomy: *Closure of surface energy balance for agricultural fields determined from eddy covariance measurements,* 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: *Vegetation cover mapping at multiple scales using MODIS, Landsat, RapidEye, and Aircraft imageries in the Texas High Plains*, San Francisco, CA	Rajan/Maas

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SITE DESCRIPTIONS

BACKGROUND

This project officially began with the announcement of the grant in September, 2004. However, it was February, 2005, before all of the contracts and budgets were finalized and actual field site selection could begin. By February, 2005, the Producer Board had been named and was functioning and the Management Team had been 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 7). Soil moisture monitoring points installed, maintained and measured by the High Plains Underground Water Conservation District No. 1 were purposely located in close proximity 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, 2006, 2007, 2008, 2009 and 2010 are given in Tables 10, 11, 12, 13, 14 and 15. 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 the information to fill gaps that occur due to the time it took to bring these 26 sites on-line but information in regard to water use is based on estimates as well as actual measurements during this first year and should be interpreted with caution. However, it provided useful information as we began this long-term project. It is also important to note that the first year of any project is unlikely to resemble closely any following year because of all the factors involved in start-up and calibration of measurement techniques. This is always the case. As we entered year 2, we were positioned to collect increasingly meaningful data and all sites were complete.

In year 2 (2006), Site No. 25 was lost to the project due to a change in ownership of the land. However, Site 27 was added, thus, the project continued to monitor 26 sites. Total acreage in 2006 was 4,230, a difference of about 60 acres between the two years. Crop and livestock enterprises on these sites and the acres committed to each use by site is given in Table 11.

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 due to expansion of the area in Site No. 1.

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

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 the project.

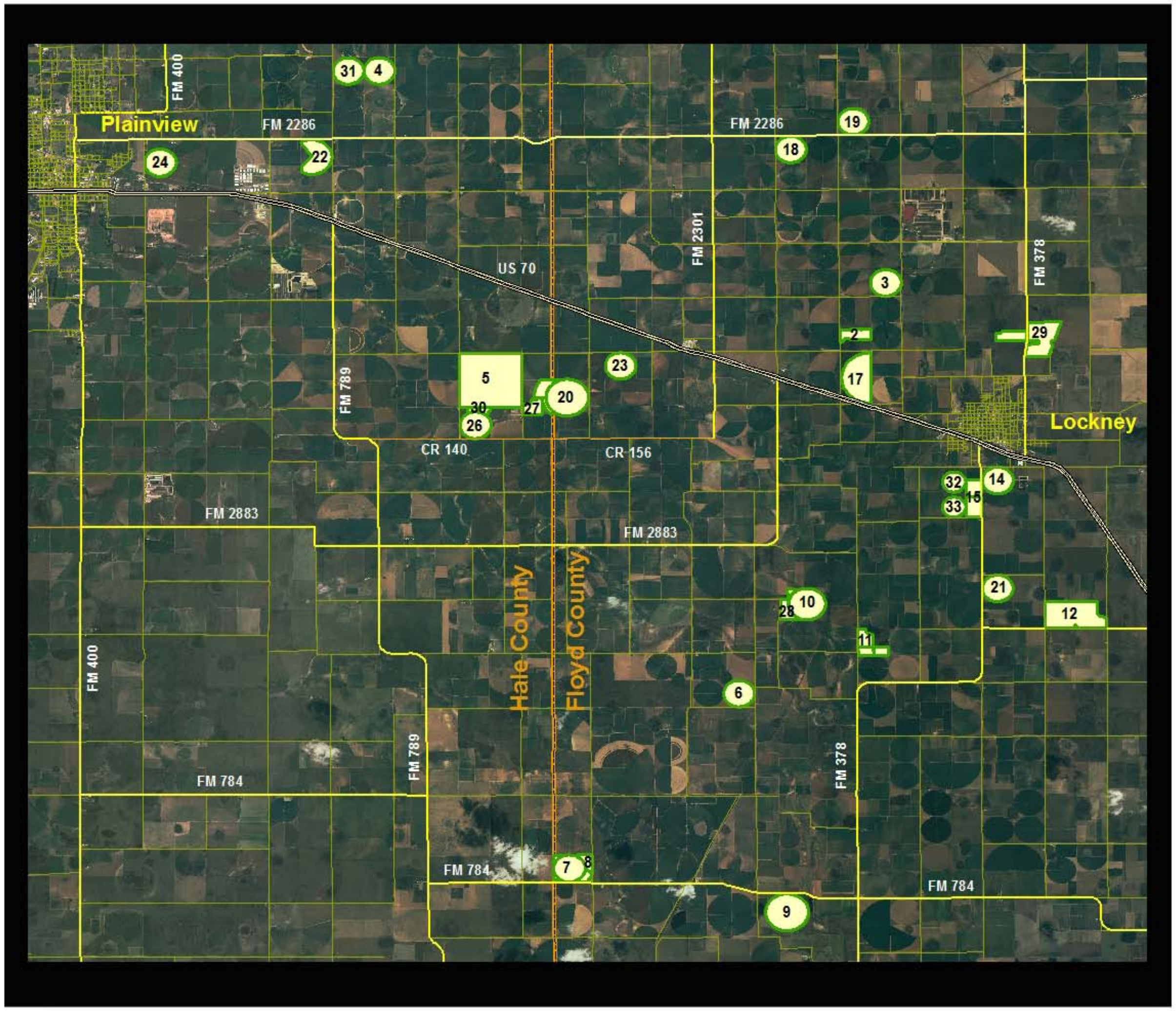
In year 6 (2010), three additional sites were added as part of the implementation phase of the project. These three new sites limited total irrigation for 2010 to no more than 15 acre inches. With the addition of sites 31, 32, and 33, the project totaled 29 sites and increased the acreage from 3,991 acres to 4,273 acres in the project. These new sites also increased the number of producers involved in the project by one.

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 reflect completion and revisions made to previous year's 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 1-6 follow and are presented by site.

Texas Alliance for Water Conservation 2010

Scale: 1:120,000



System Acres

2	60.9	19	120.3
3	123.3	20	233.4
4	123.0	21	122.6
5	628.0	22	148.7
6	122.8	23	121.1
7	130.0	24	129.7
8	61.8	26	125.2
9	237.8	27	108.5
10	173.6	28	51.5
11	92.5	29	221.6
12	283.9	30	21.8
14	124.2	31	121.0
15	102.8	32	70.0
17	220.8	33	70.0
18	122.2		

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TAWC

Texas Alliance for Water Conservation

"Water is Our Future"

Agriculture Division
High Plains Underground
Water Conservation District No. 1
March 2010

Figure 7. System map index for 2010 (year 6).

Table 10. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 26 producer systems in Hale and Floyd Counties during 2005.

TAWC 2005 CROP ACRES - ACRES MAY OVERLAP DUE TO MULTIPLE CROPS PER YEAR AND GRAZING

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													
27	SDI	n/a														
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

Table 11. Irrigation type and total acres, by site, of crops, forages and acres grazed by cattle in 26 producer systems in Hale and Floyd Counties during 2006.

TAWC 2006 CROP ACRES - ACRES MAY OVERLAP DUE TO MULTIPLE CROPS PER YEAR AND GRAZING

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												
25	DRY	n/a														
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

Table 12. Irrigation type and total acres, by site, of crops, forages and acres grazed by cattle in 25 producer systems in Hale and Floyd Counties during 2007.

TAWC 2007 CROP ACRES - ACRES MAY OVERLAP DUE TO MULTIPLE CROPS PER YEAR AND GRAZING

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													
25	DRY	n/a														
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 13. Irrigation type and total acres, by site, of crops, forages and acres grazed by cattle in 26 producer systems in Hale and Floyd Counties during 2008.

TAWC 2008 CROP ACRES - ACRES OFTEN OVERLAP DUE TO MULTIPLE CROPS PER YEAR, GRAZING, AND OVERLAPPING CATEGORIES.																					
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 14. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 26 producer systems in Hale and Floyd Counties during 2009.

TAWC 2009 CROP ACRES - ACRES OFTEN OVERLAP DUE TO MULTIPLE CROPS PER YEAR, GRAZING, AND OVERLAPPING CATEGORIES.

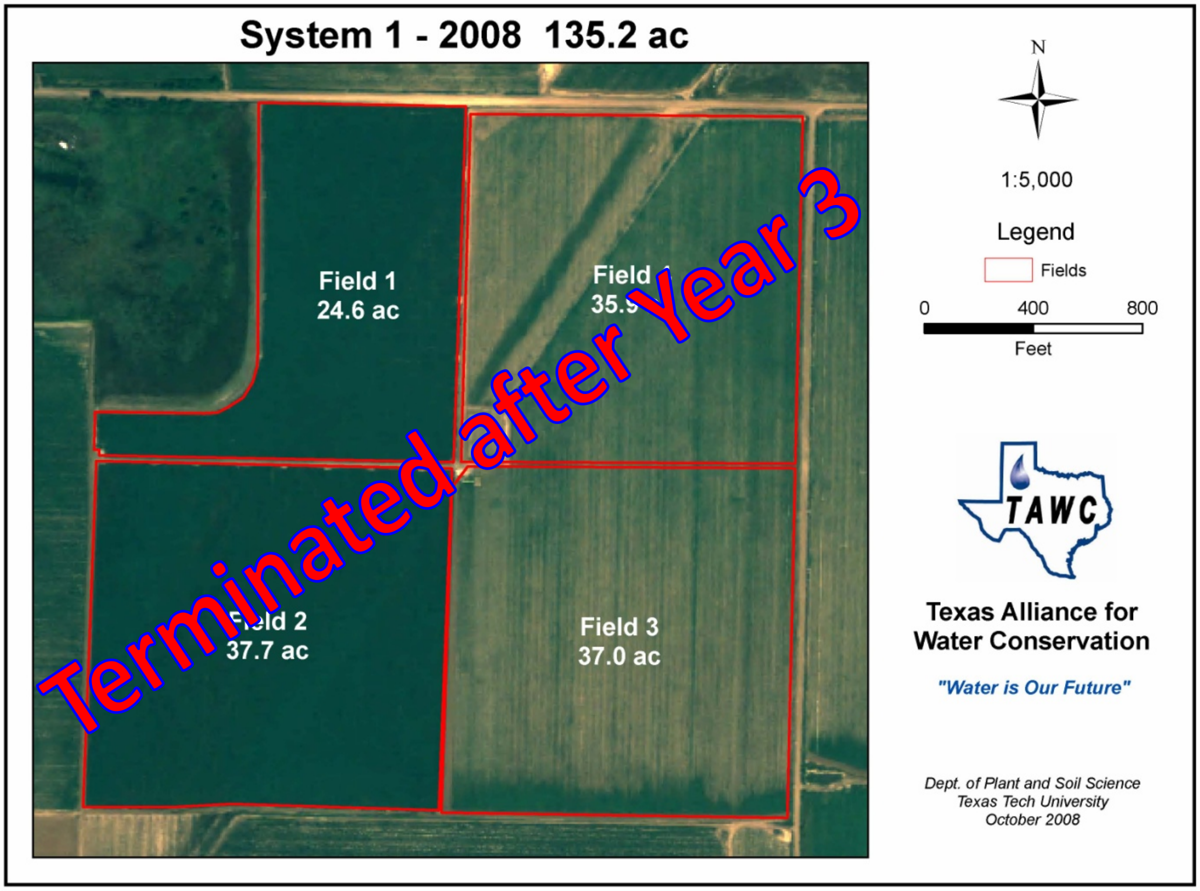
Site	irrigation type	System acres	cotton	corn grain	Corn silage	sunflowers	grain sorghum	grain sorghum for silage	forage sorghum for hay	alfalfa	grass seed	hay	perennial pasture	cattle	wheat for grain	wheat for silage	wheat for grazing	grazing of crop residue	Oat silage	fallow or pens/facilities
2	SDI	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**	**total acres (no overlap)**	**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 15. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 26 producer systems in Hale and Floyd Counties during 2010.

TAWC 2010 CROP ACRES - ACRES OFTEN OVERLAP DUE TO MULTIPLE CROPS PER YEAR, GRAZING, AND OVERLAPPING CATEGORIES.																			
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**	**total acres (no overlap)**	**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



System 1 Description

Total system 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: Sub-surface 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

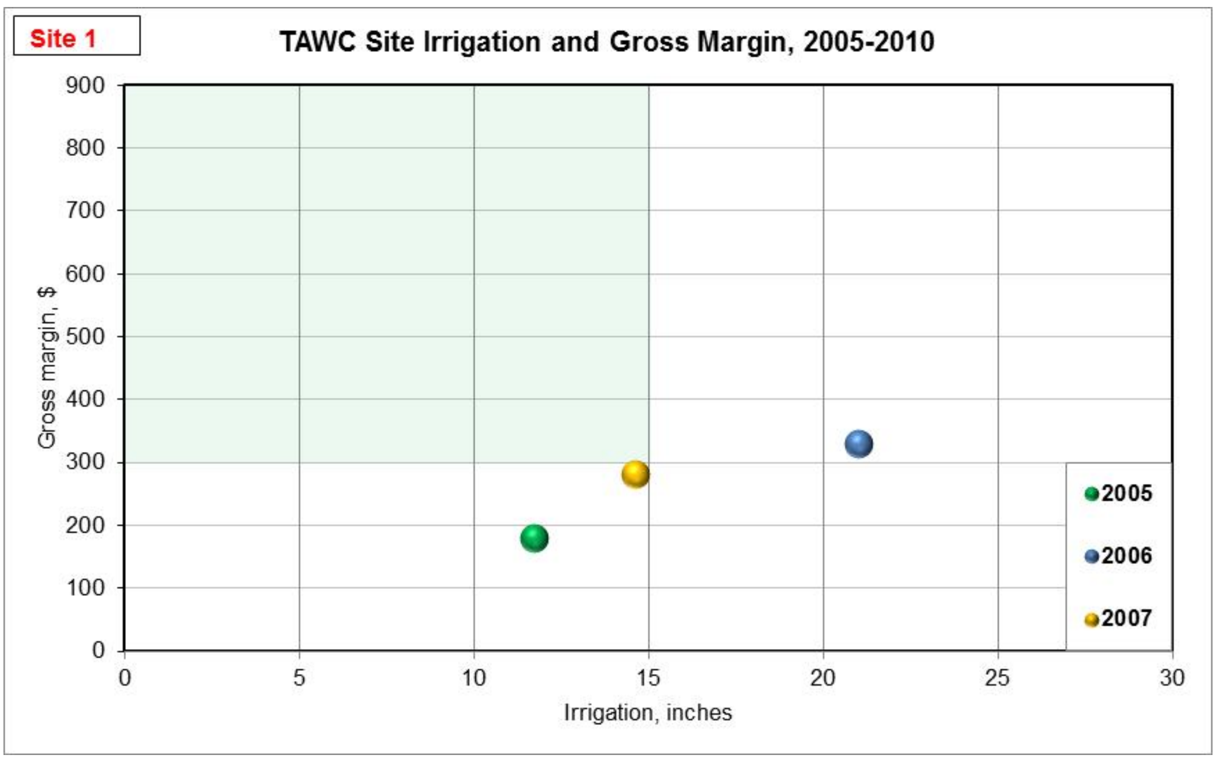
Number of wells: 2

Fuel source: Electric
Natural gas

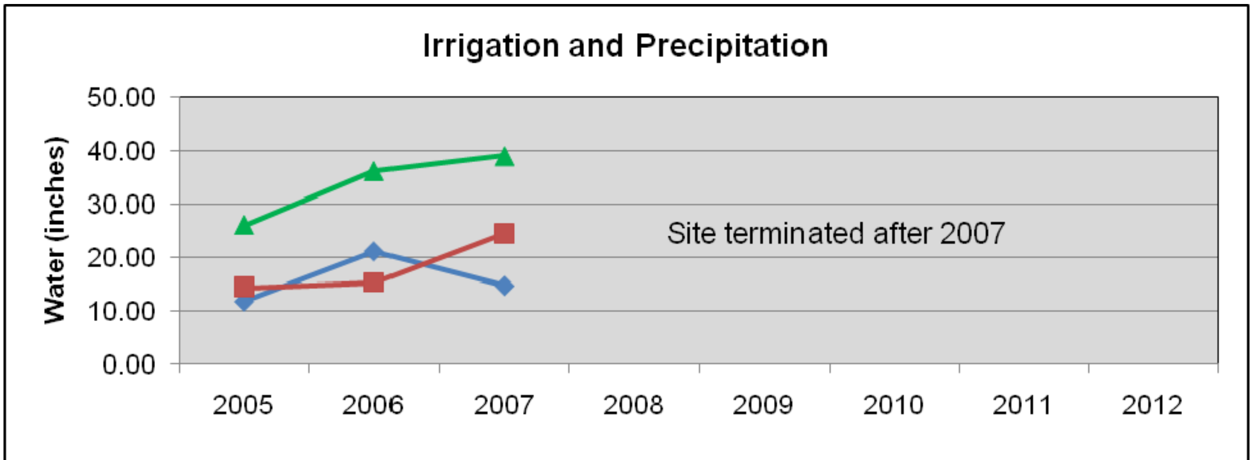
Comments: Drip irrigation cotton and corn system, conventional tillage with crops planted on forty-inch centers.

System 1

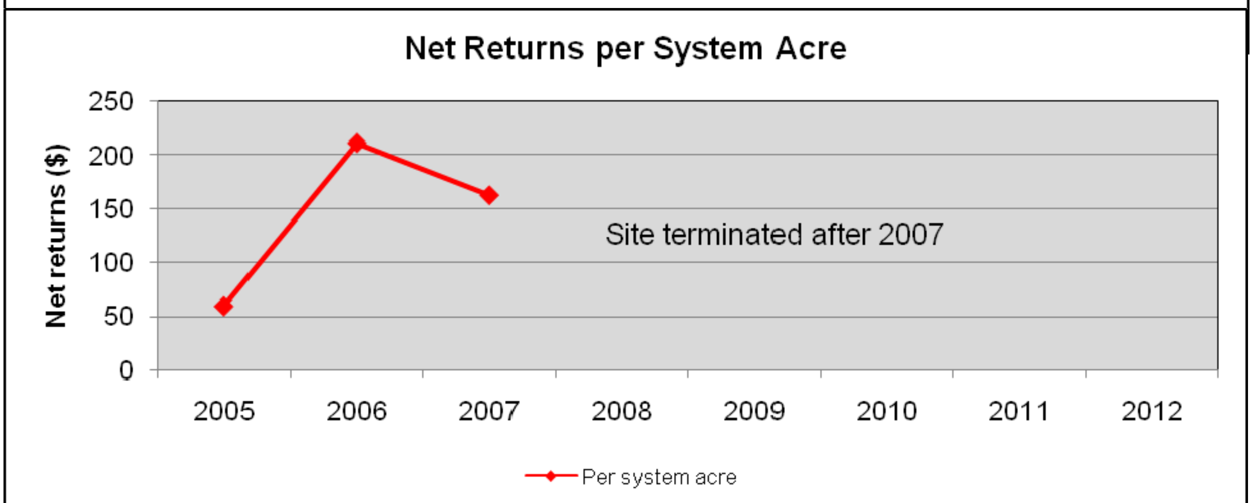
	Livestock	Field 1	Field 2	Field 3	Field 4
2005	None	Cotton	Cotton		
2006	None	Cotton	Cotton	Cotton	Cotton
2007	None	Cotton	Cotton	Cotton	Cotton
2008	Site terminated in 2008				
2009					
2010					



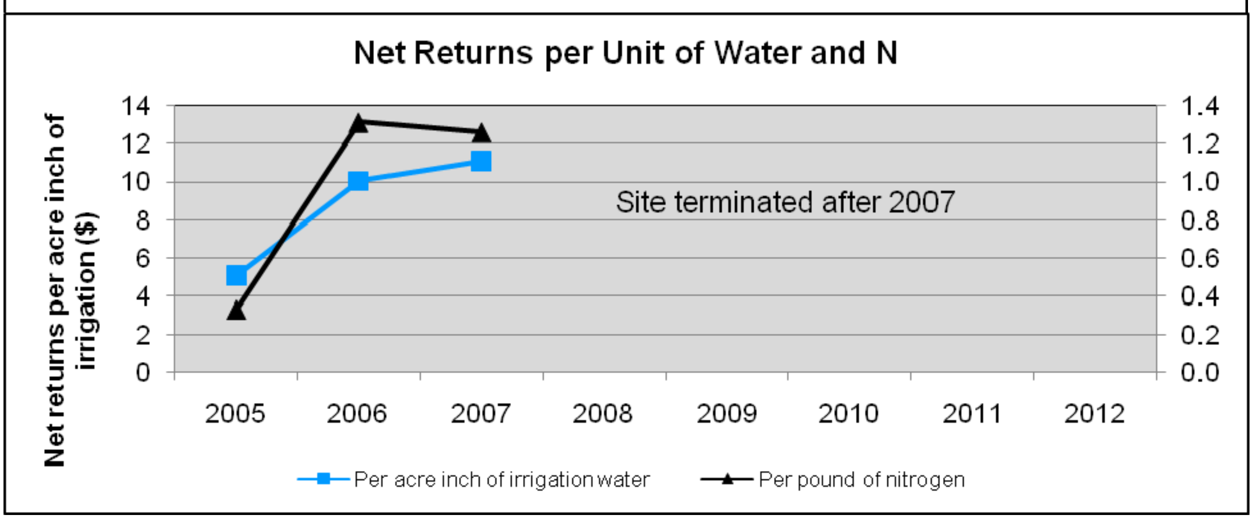
System 1



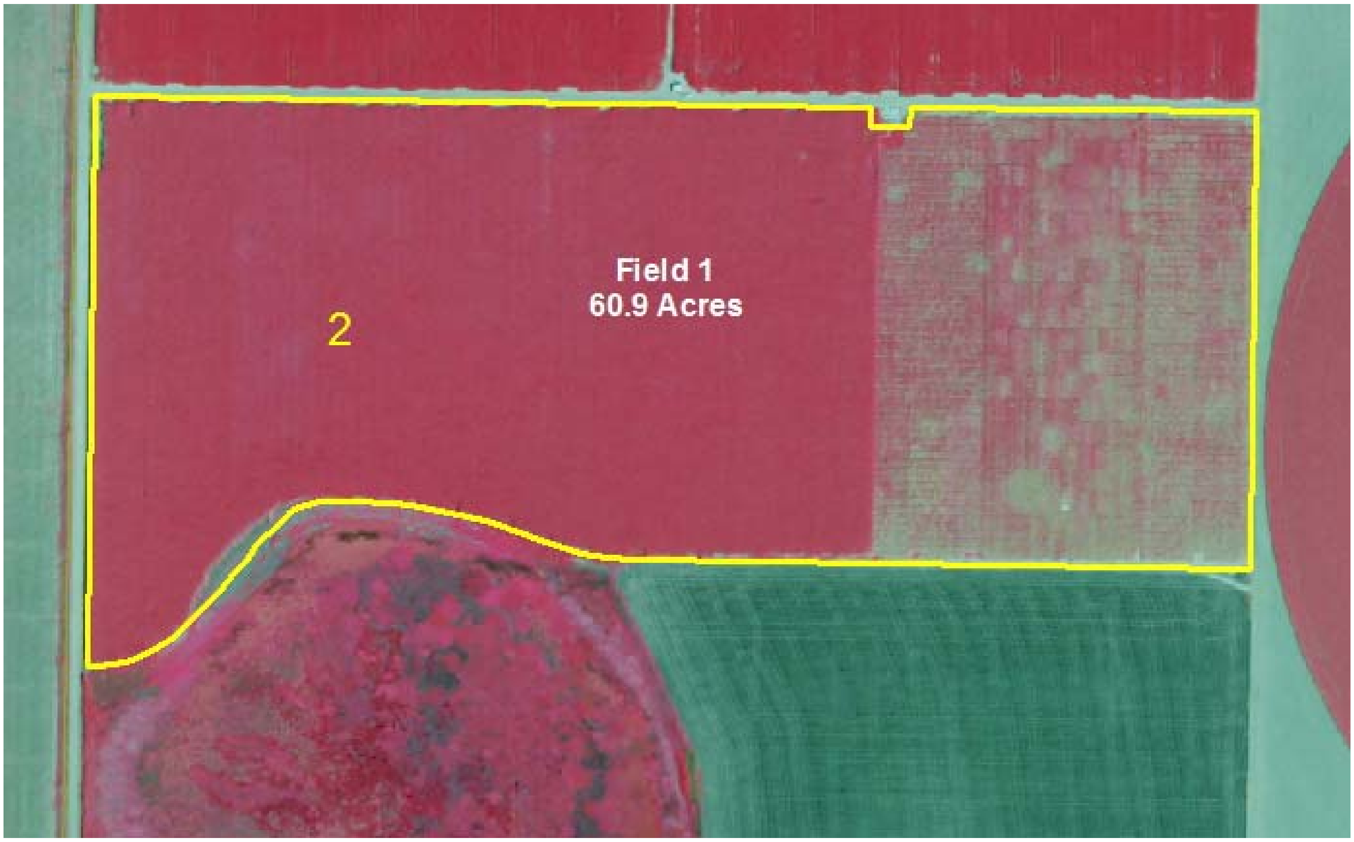
Irrigation and Precipitation
Water (inches)
50.00
40.00
30.00
20.00
10.00
0.00
2005
2006
2007
2008
2009
2010
2011
2012
Site terminated after 2007



Net Returns per System Acre
Net returns ($)
250
200
150
100
50
0
2005
2006
2007
2008
2009
2010
2011
2012
Site terminated after 2007
Per system acre



Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
14
12
10
8
6
4
2
0
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2005
2006
2007
2008
2009
2010
2011
2012
Site terminated after 2007
Per acre inch of irrigation water
Per pound of nitrogen



System 2 Description

Total system acres: 60.9

Field No. 1 Acres: 60.9
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

System 2

	Livestock	Field 1
2005	None	Cotton
2006	None	Cotton
2007	None	Cotton
2008	None	Sunflowers
2009	None	Cotton
2010	None	Corn


Site 2, Field 1 (April 2010)


Site 2, Field 1 (May 2010)

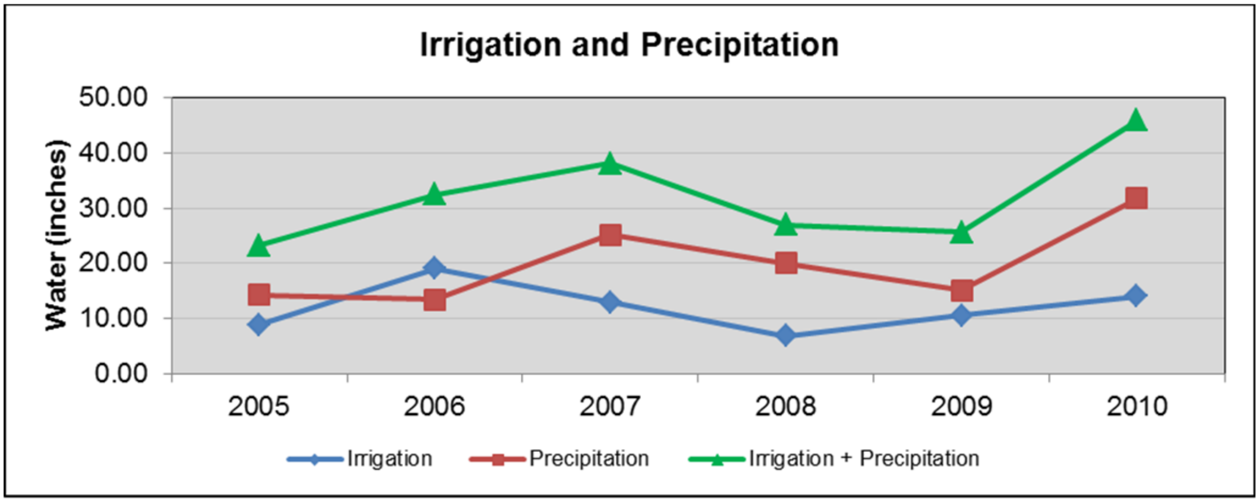

Site 2, Field 1 (June 2010)

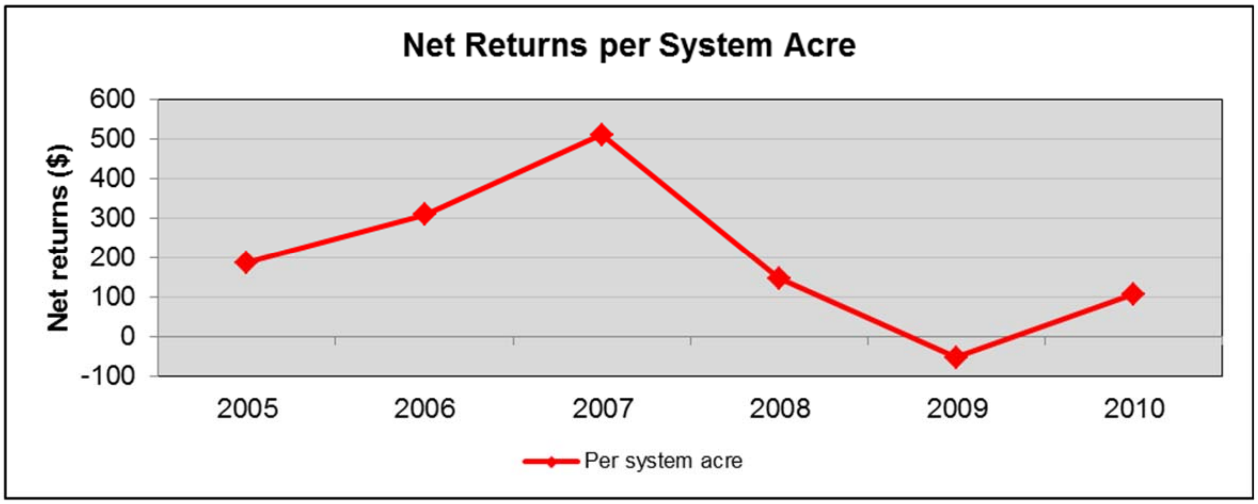

Site 2, Field 1 (June 2010)

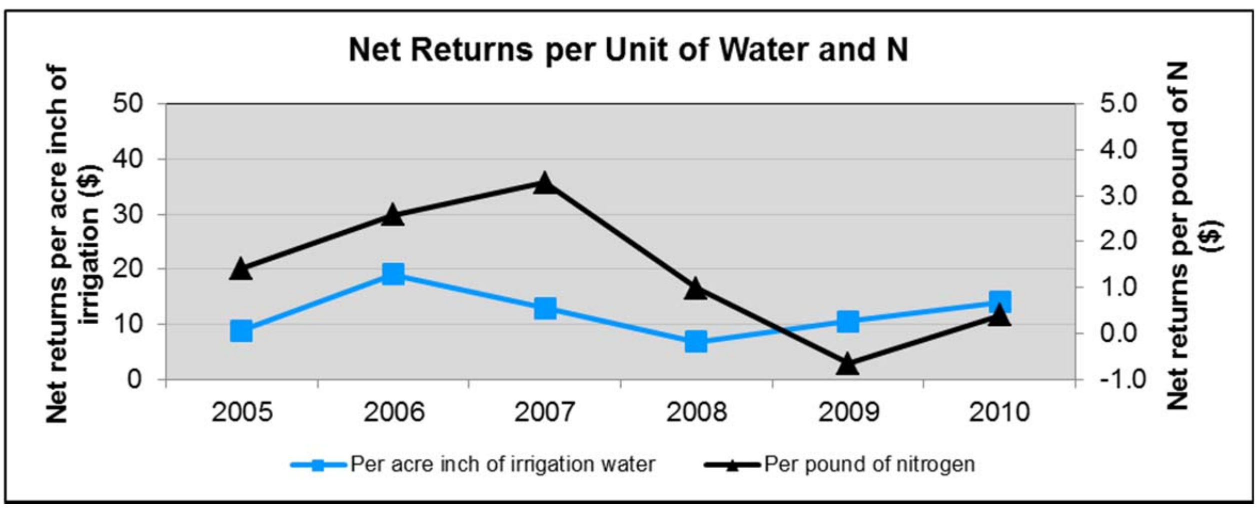

Site 2, Field 1 (August 2010)

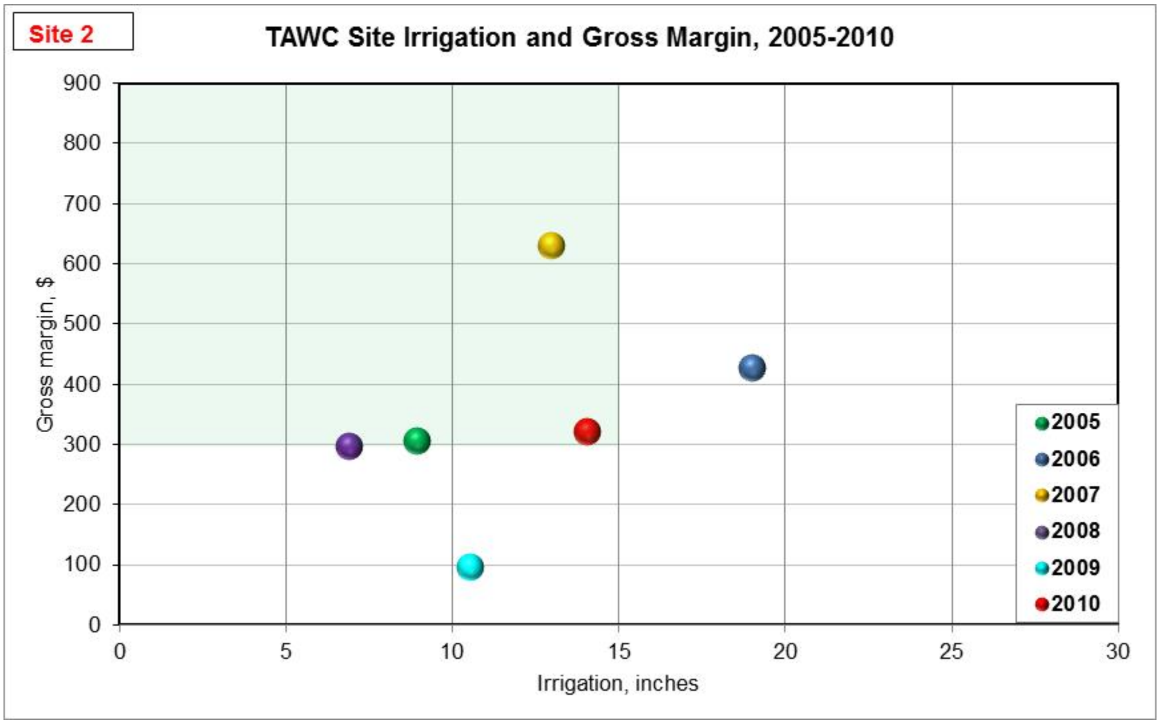
Comments: This drip site was planted to corn on thirty-inch centers in 2010. In prior years the cropping mix for this site has been either cotton or sunflowers.

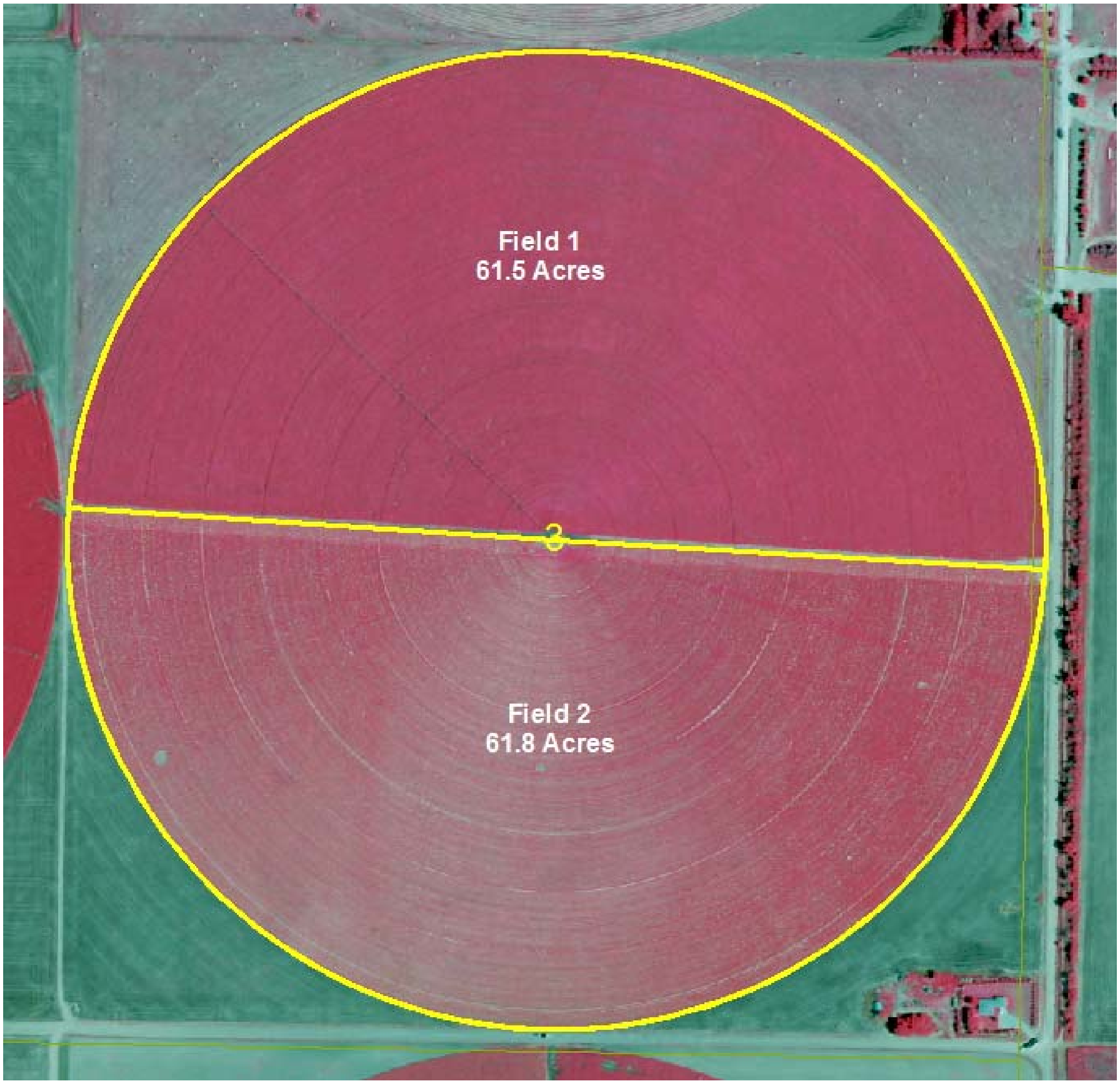
System 2


Irrigation and Precipitation
Water (inches)
50.00
40.00
30.00
20.00
10.00
0.00
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
600
500
400
300
200
100
0
-100
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
50
40
30
20
10
0
Net returns per pound of N ($)
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 2
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 3 Description

Total system 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

System 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


Site 3, Field 1 (May 2010)


Site 3, Field 1 (August 2010)


Site 3, Field 1 (September 2010)

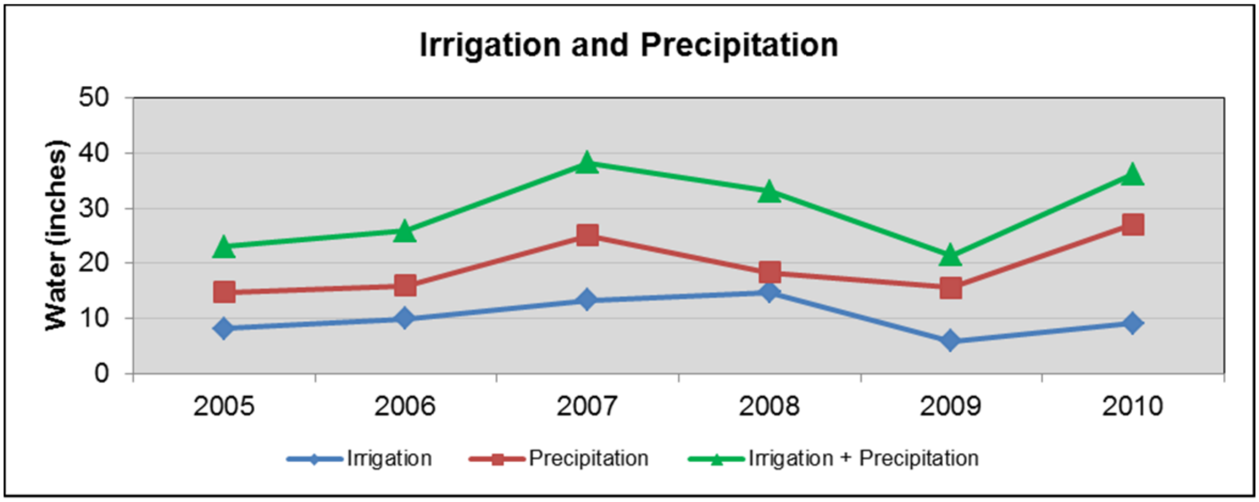

Site 3, Field 2 (June 2010)


Site 3, Field 2 (August 2010)

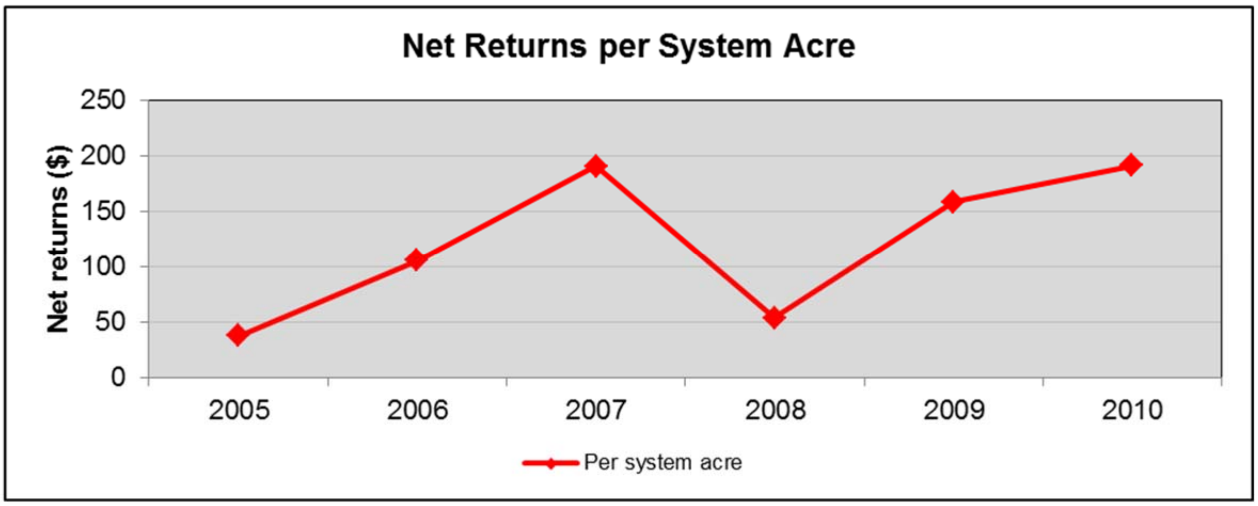

Site 3, Field 2 (September 2010)

Comments: This is a pivot irrigated system using conventional tillage, and row crops are planted on forty-inch centers. Crops have included cotton, wheat and grain sorghum.

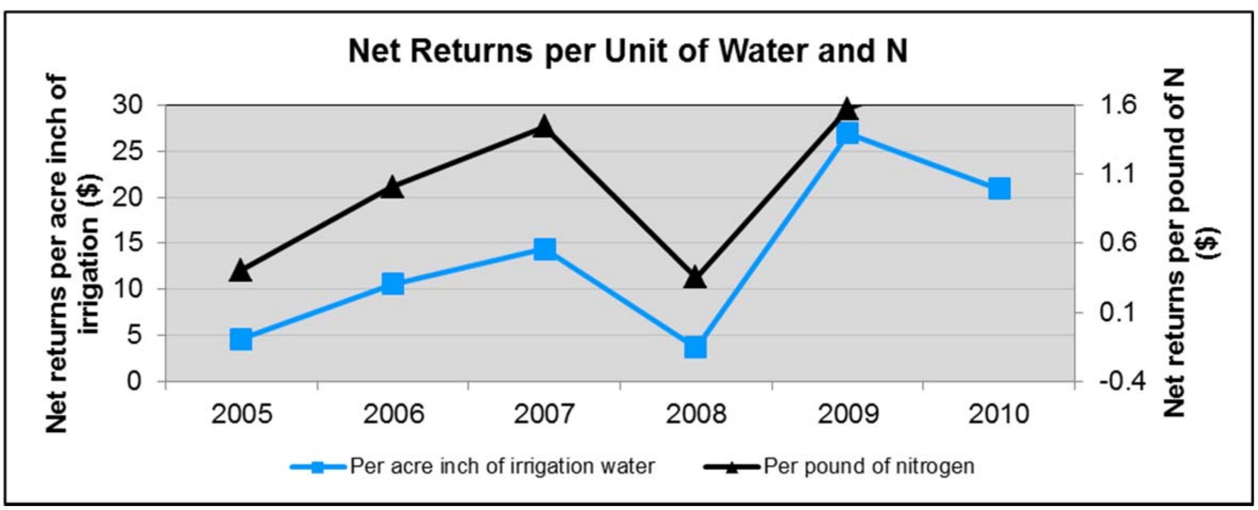
System 3



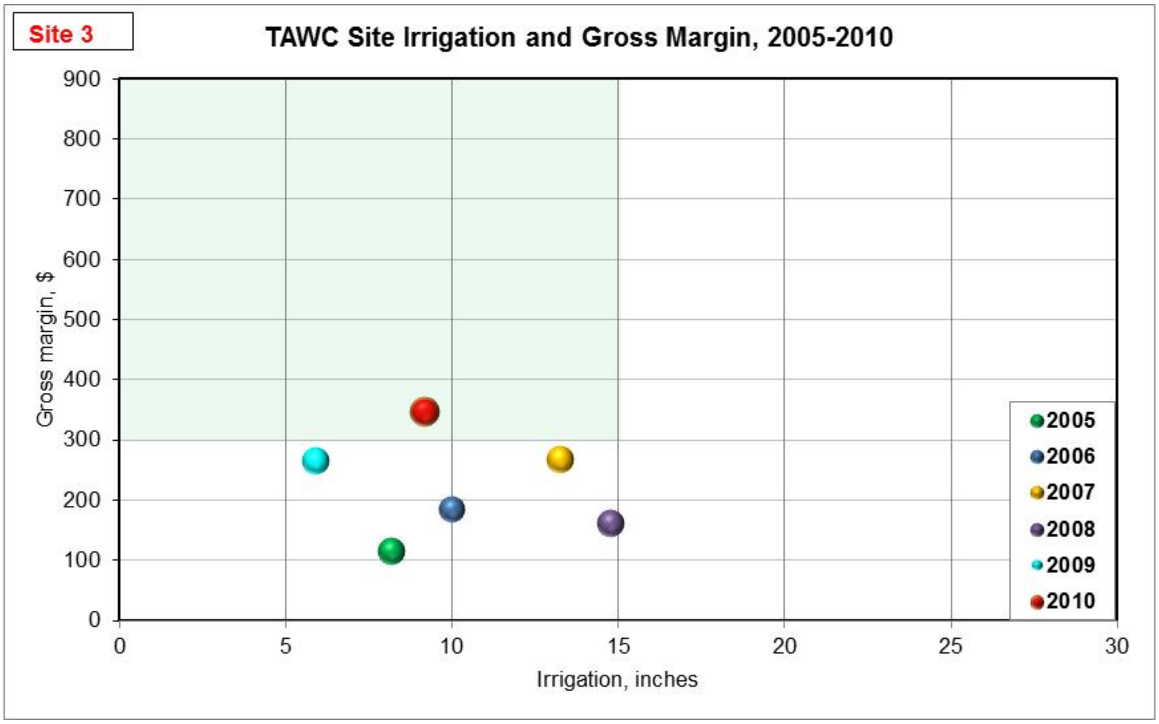
Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation



Net Returns per System Acre
Net returns ($)
250
200
150
100
50
0
2005
2006
2007
2008
2009
2010
Per system acre



Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
30
25
20
15
10
5
0
1.6
1.1
0.6
0.1
-0.4
Net returns per pound of N ($)
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen



Site 3
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
Irrigation, inches
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
2005
2006
2007
2008
2009
2010

System 4 Description

Total system acres: 123.0

Field No. 1 Acres: 13.3
Major soil type: Estacado clay loam, 1 to 3% slope

Field No. 2 Acres: 65.3
Major soil type: Pullman clay loam, 0 to 1% slope

Field No. 4 Acres: 28.4
Major soil type: Pullman clay loam, 0 to 1% slope

Field No. 5 Acres: 16.0
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

System 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


Site 4, Field 1 (November 2010)


Site 4, Field 2 (April 2010)

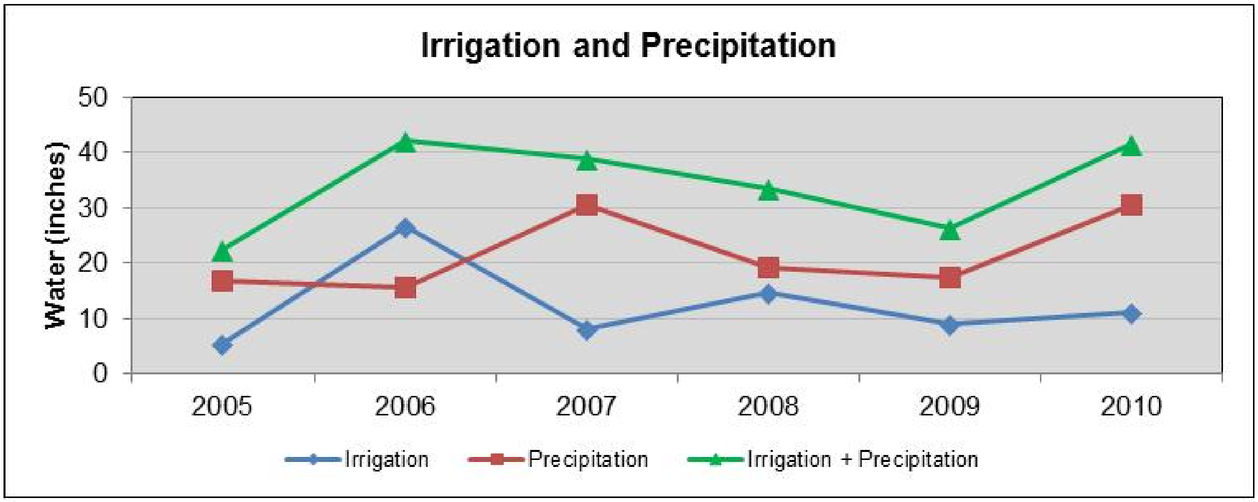

Site 4, Field 4 (August 2010)


Site 4, Field 5 (June 2010)

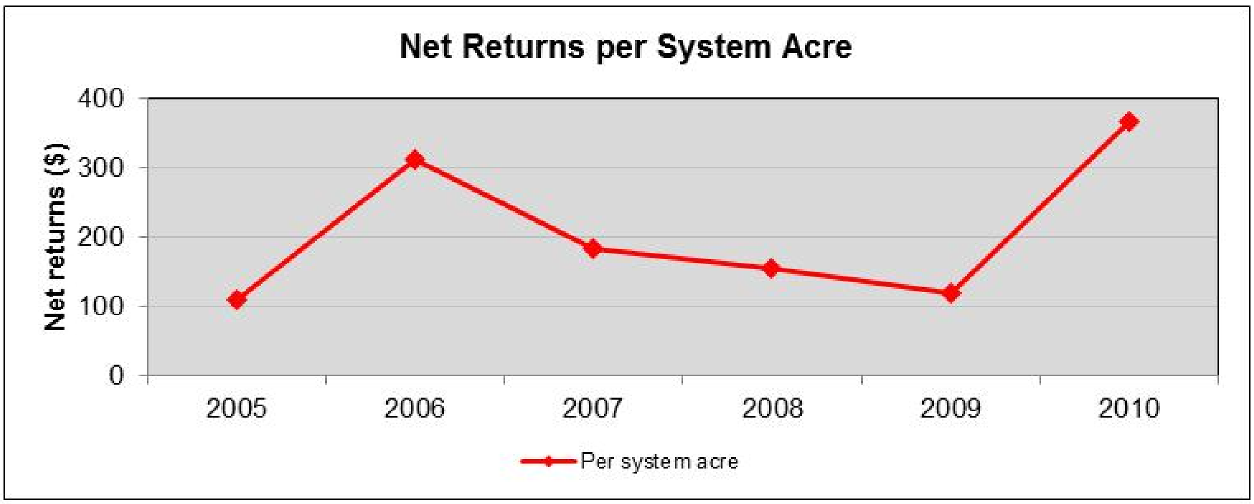

Site 4, Field 5 (August 2010)

Comments: This pivot irrigated system uses strip tillage. Crops planted for 2010 include alfalfa, cotton, wheat, and forage sorghum. Forage sorghum and alfalfa were harvested for hay to be used in the producer's cow-calf program.

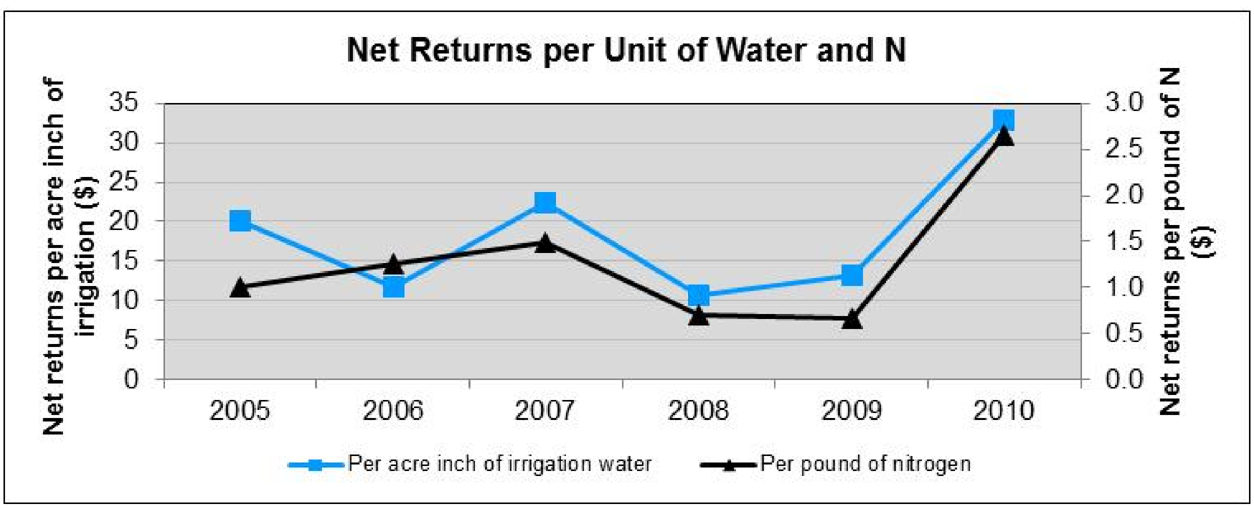
System 4



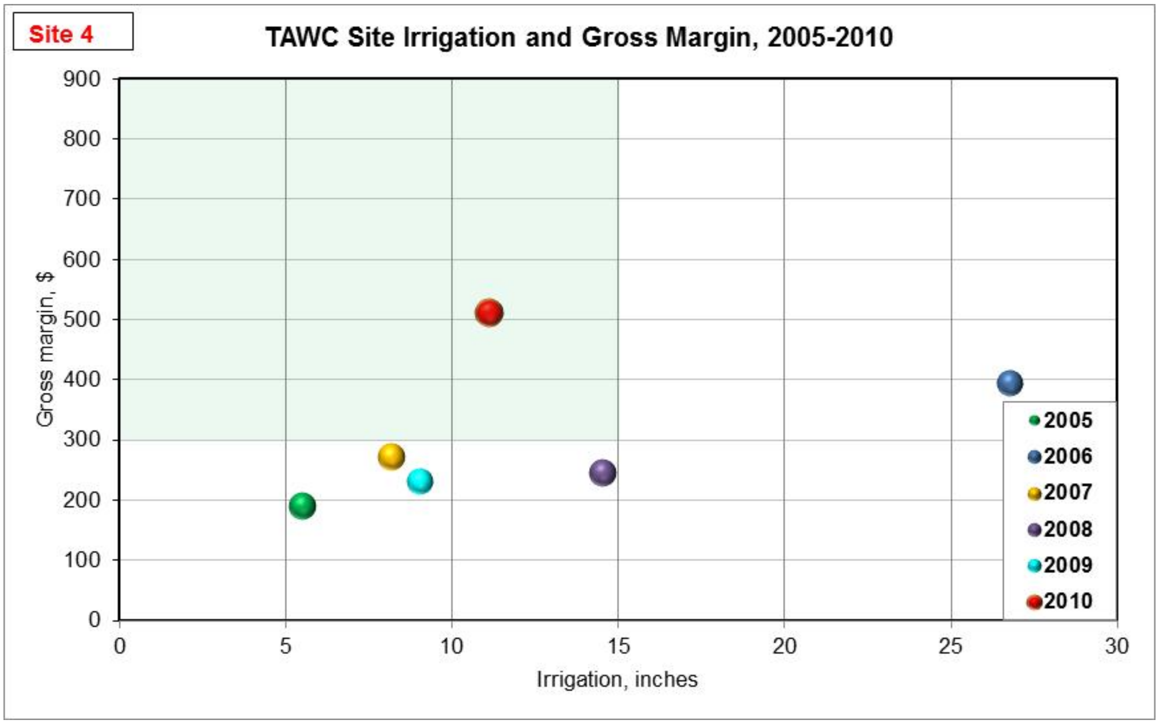
Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation

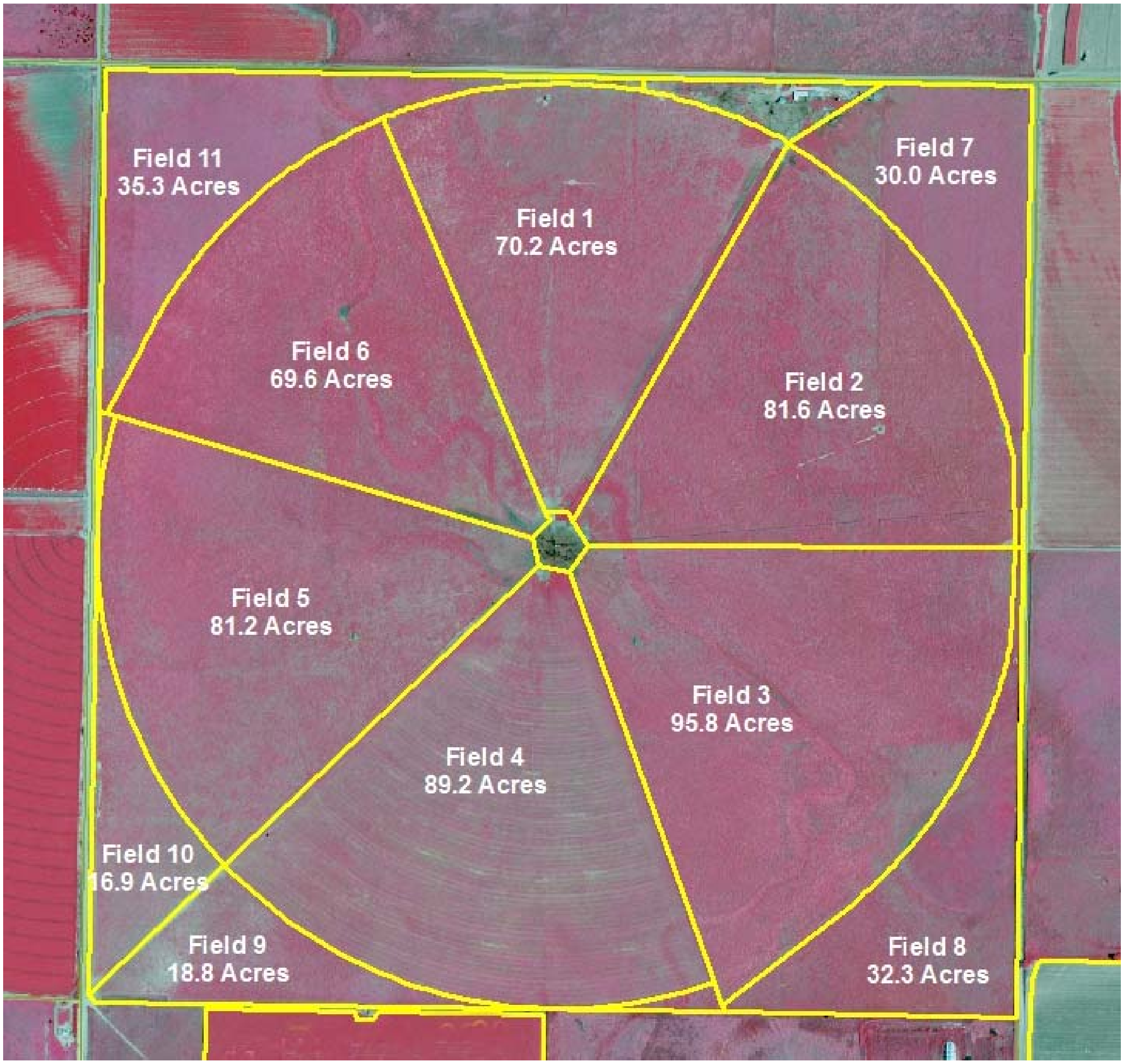


Net Returns per System Acre
Net returns ($)
400
300
200
100
0
2005
2006
2007
2008
2009
2010
Per system acre



Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
35
30
25
20
15
10
5
0
Net returns per pound of N ($)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 4
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
Irrigation, inches
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
2005
2006
2007
2008
2009
2010



System 5 Description

Total system acres: 628.0
(487.6 irrigated; 133.3 dryland, 7.1 facilities)

IRRIGATED

Field No. 1 Acres: 70.2

Major soil type: 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

Field No. 2 Acres:	81.6
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. 3 Acres:	95.8
Major soil type:	Bippus loam, 0 to 1% slope
Field No. 4 Acres:	89.2
Major soil type:	Bippus loam, 0 to 1% slope Olton loam, 0 to 1 and 1 to 3% slope
Field No. 5 Acres:	81.2
Major soil type:	Olton loam, 0 to 1% slope Bippus loam, 0 to 1% slope Mansker loam, 0 to 3% slope
Field No. 6 Acres:	69.6
Major soil type:	Bippus loam, 0 to 1% slope

DRYLAND

Field No. 7 Acres:	30.0
Major soil type:	Pullman clay loam, 0 to 1% slope
Field No. 8 Acres:	32.3
Major soil type:	Bippus loam, 0 to 1% slope Randall clay Estacado loam, 1 to 3% slope
Field No. 9 Acres:	18.8
Major soil type:	Olton loam, 1 to 3% slope Mansker loam, 3 to 5% slope Bippus fine sandy loam, overwash, 1 to 3% slope
Field No. 10 Acres:	16.9
Major soil type:	Olton loam, 0 to 1% slope Pullman clay loam, 0 to 1% slope
Field No. 11 Acres:	35.3
Major soil type:	Bippus loam, 0 to 1% slope
Field No. 12 and 13 Acres:	7.1
Major soil type:	Pens and barns

System 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

System 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

Site 5 (March 2010)

Site 5 (April 2010)

Site 5 (April 2010)

Site 5 (April 2010)

Site 5 (June 2010)

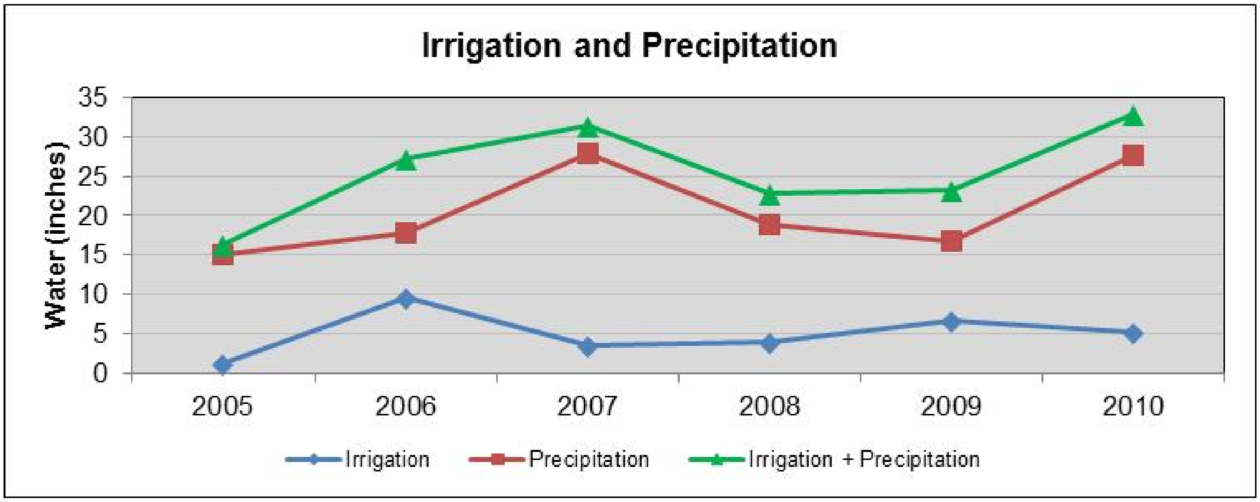
Site 5 (June 2010)

Site 5 (August 2010)

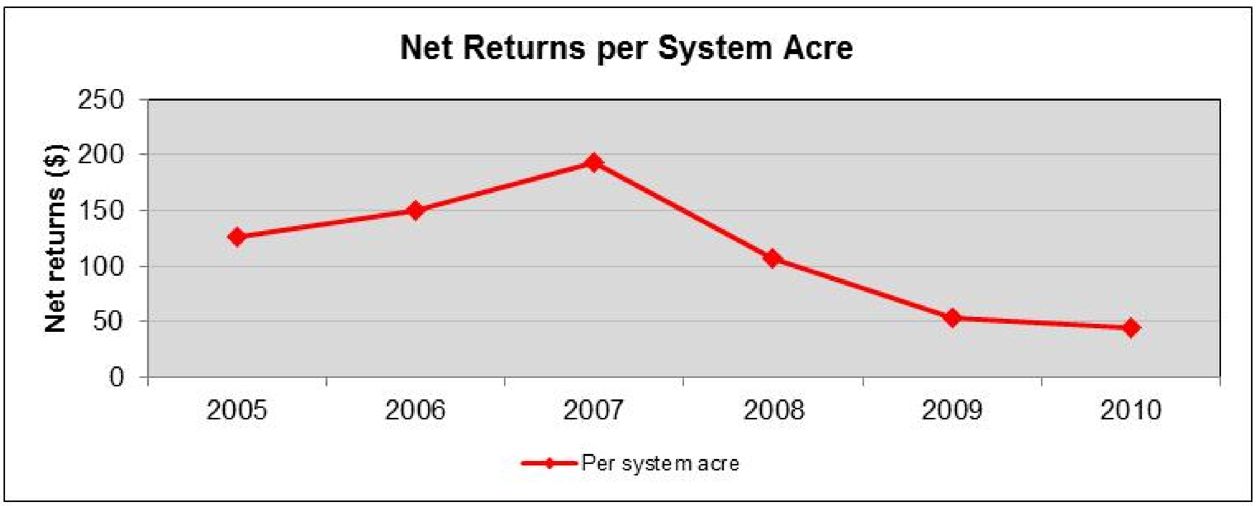
Site 5 (August 2010)

Comments: This is a commercial, spring calving cow-calf operation. The 487.6 acres of irrigated grass is divided into six cells. This producer usually moves all cattle off site in early winter after the calves are weaned. Cows will calve on wheat and are moved back on site.

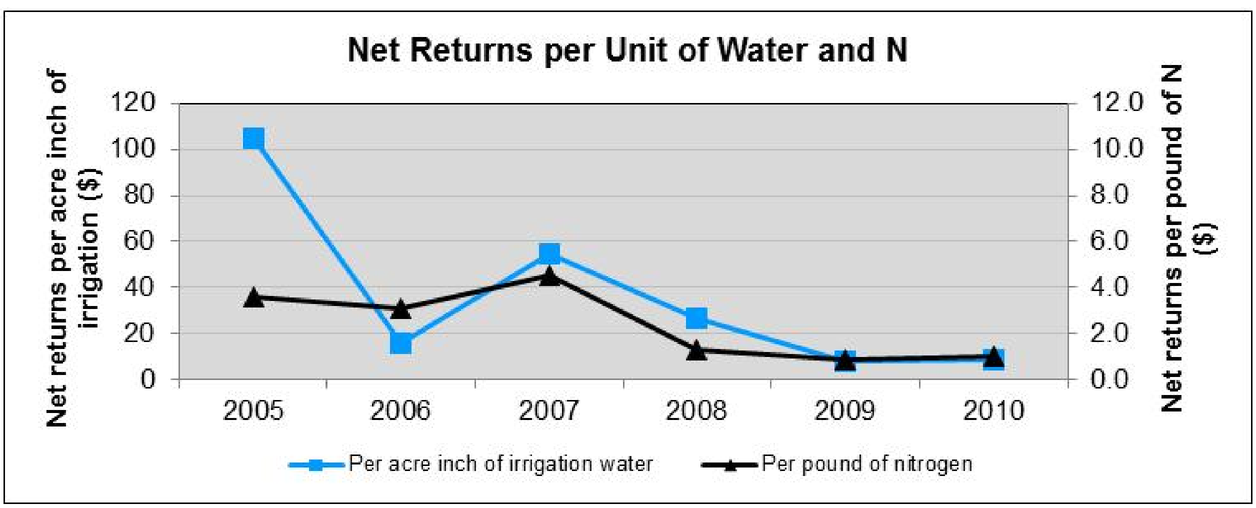
System 5



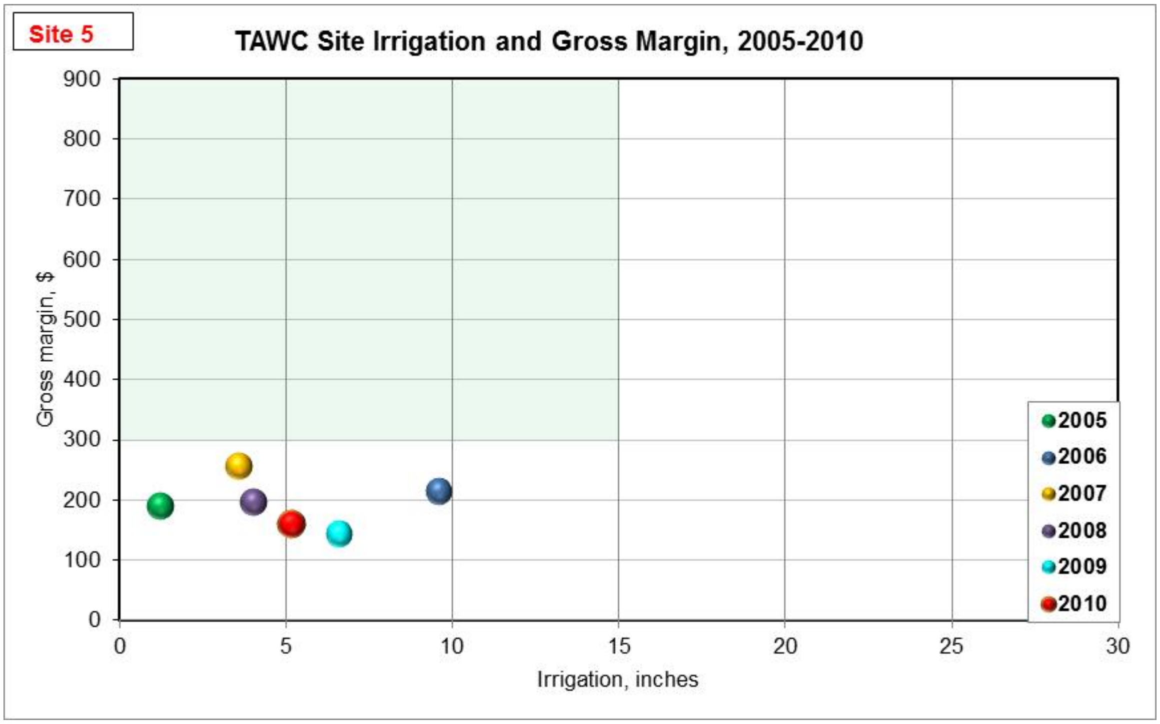
Irrigation and Precipitation
Water (inches)
35
30
25
20
15
10
5
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation



Net Returns per System Acre
Net returns ($)
250
200
150
100
50
0
2005
2006
2007
2008
2009
2010
Per system acre



Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
120
100
80
60
40
20
0
2005
2006
2007
2008
2009
2010
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Net returns per pound of N ($)
Per acre inch of irrigation water
Per pound of nitrogen


Site 5
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010

System 6 Description

Total system acres: 122.8

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

System 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

Site 6, Field 8 (June 2010)

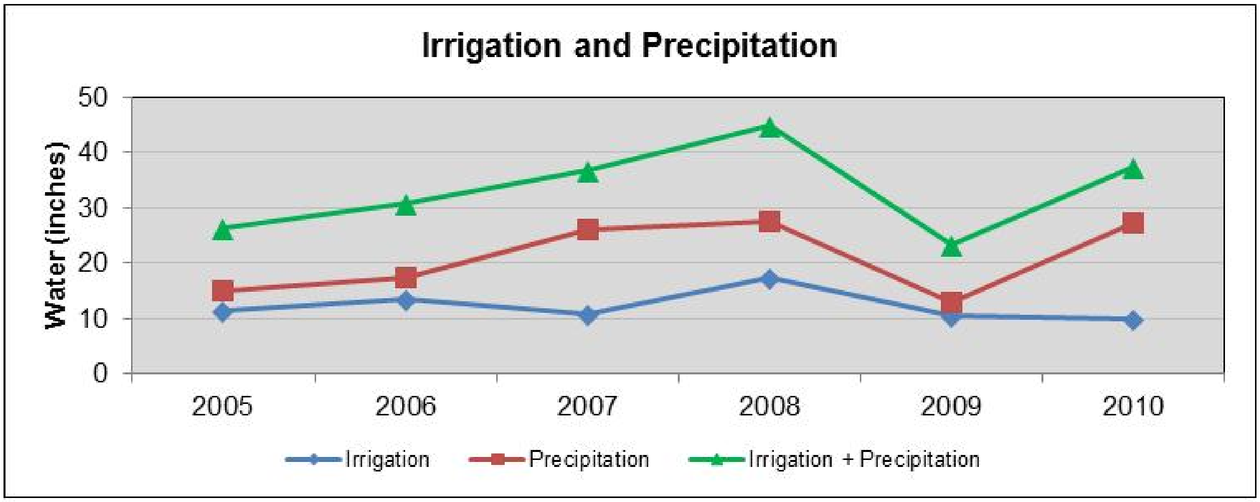
Site 6, Field 7 (July 2010)

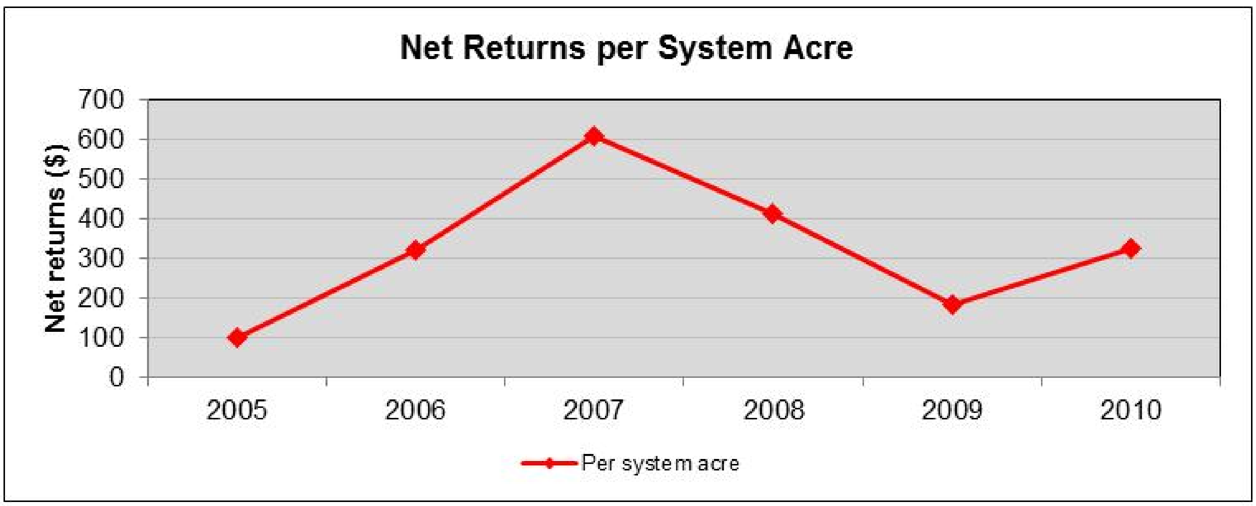
Site 6, Field 6 (August 2010)

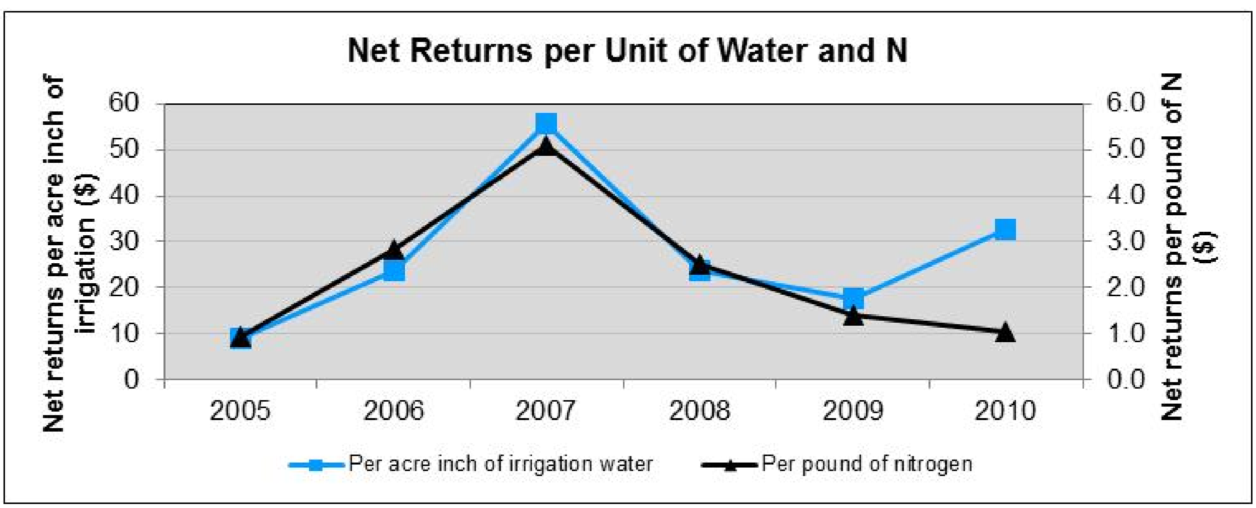
Site 6, Field 5 (November 2010)

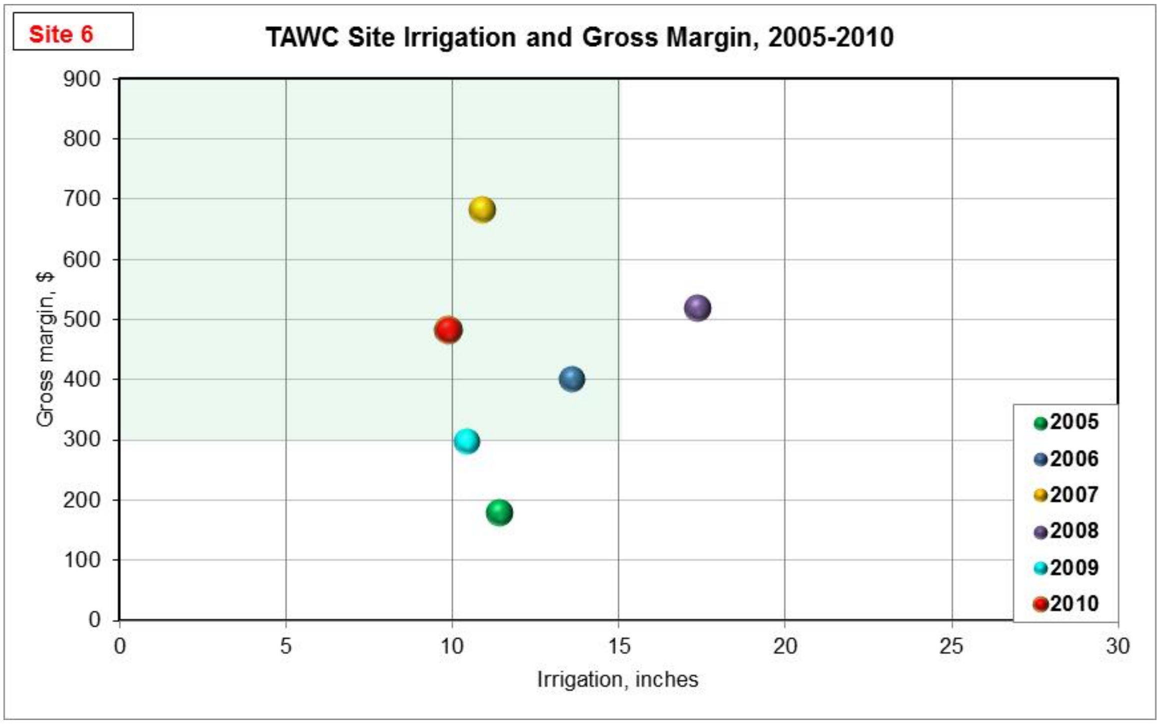
Comments: In 2010 this site was one-half cotton and one-half corn. Oats were planted in late winter for a cotton cover crop.

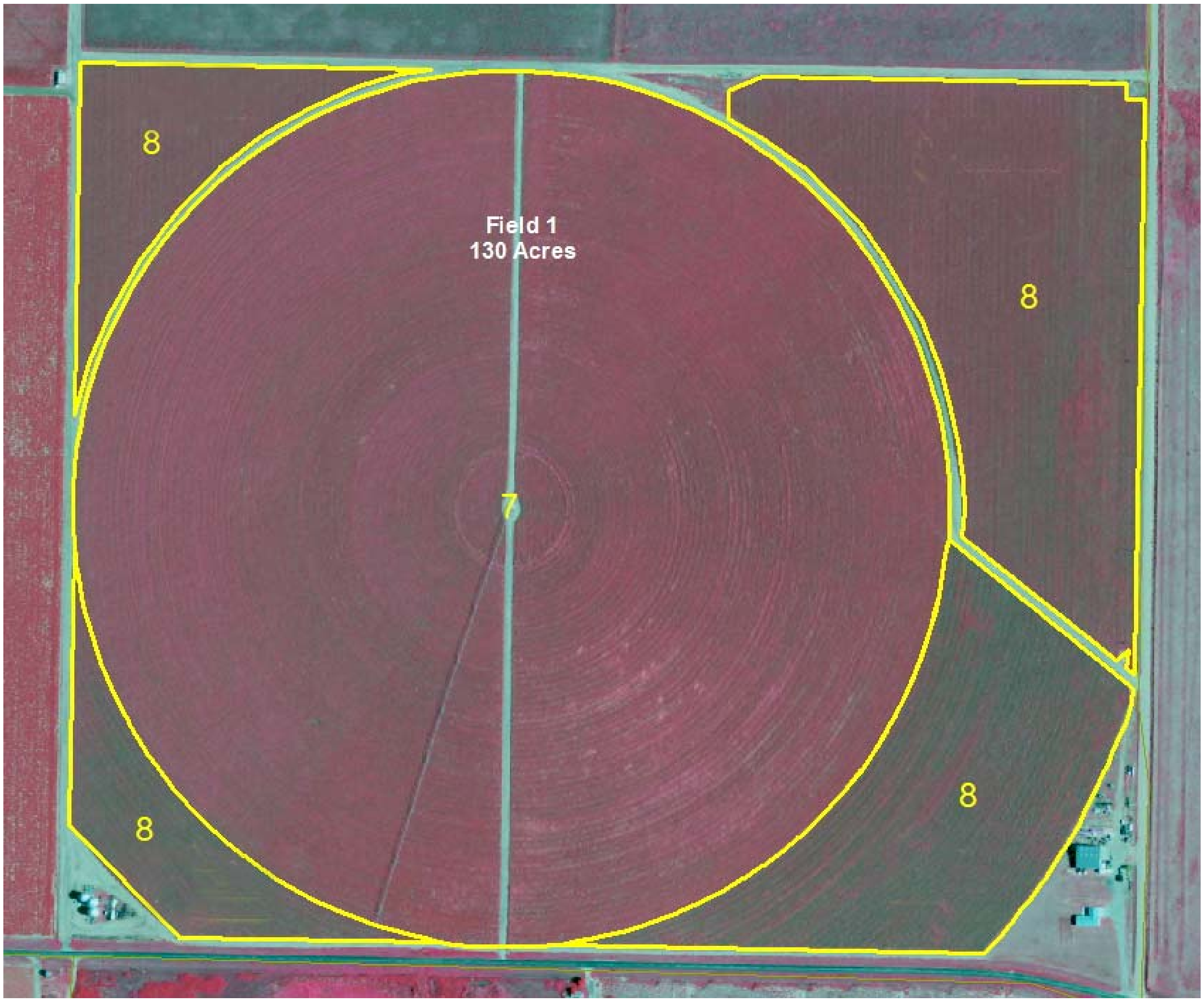
System 6


Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
700
600
500
400
300
200
100
0
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
60
50
40
30
20
10
0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Net returns per pound of N ($)
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 6
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 7 Description

Total system 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

System 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

Site 7, Field 1 (April 2010)

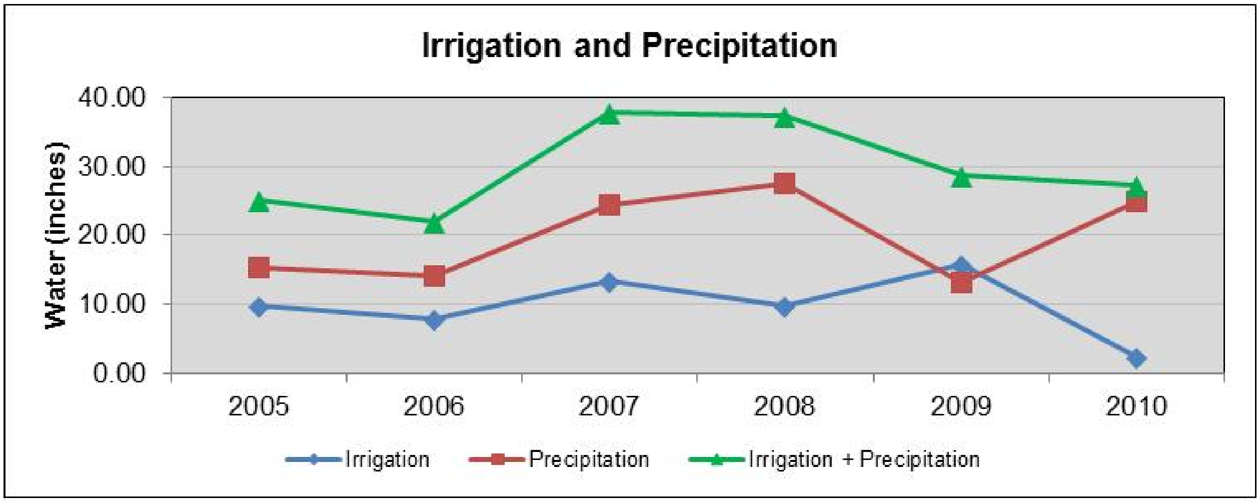
Site 7, Field 1 (June 2010)

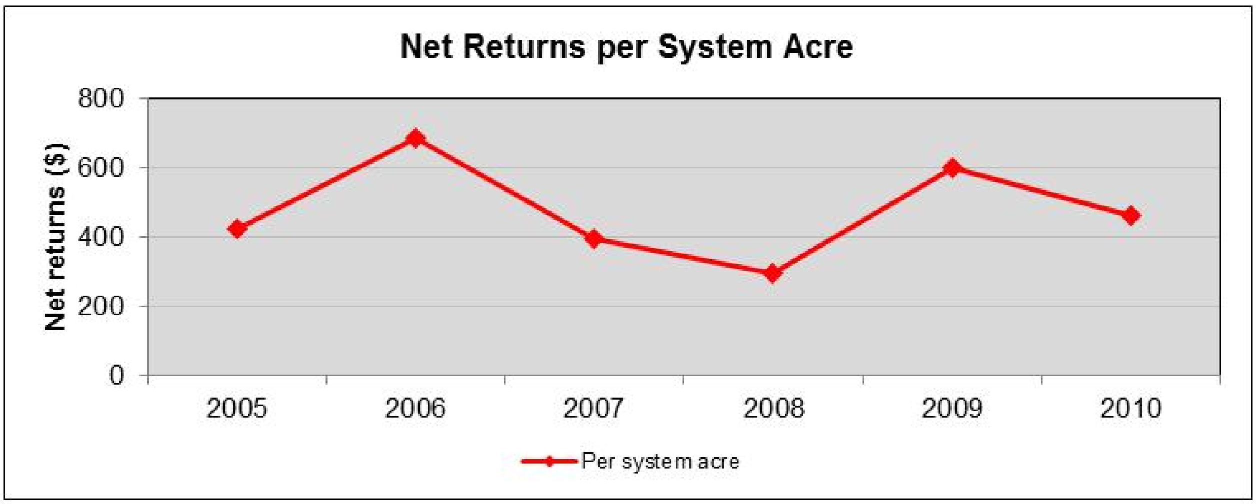
Site 7, Field 1 (July 2010)

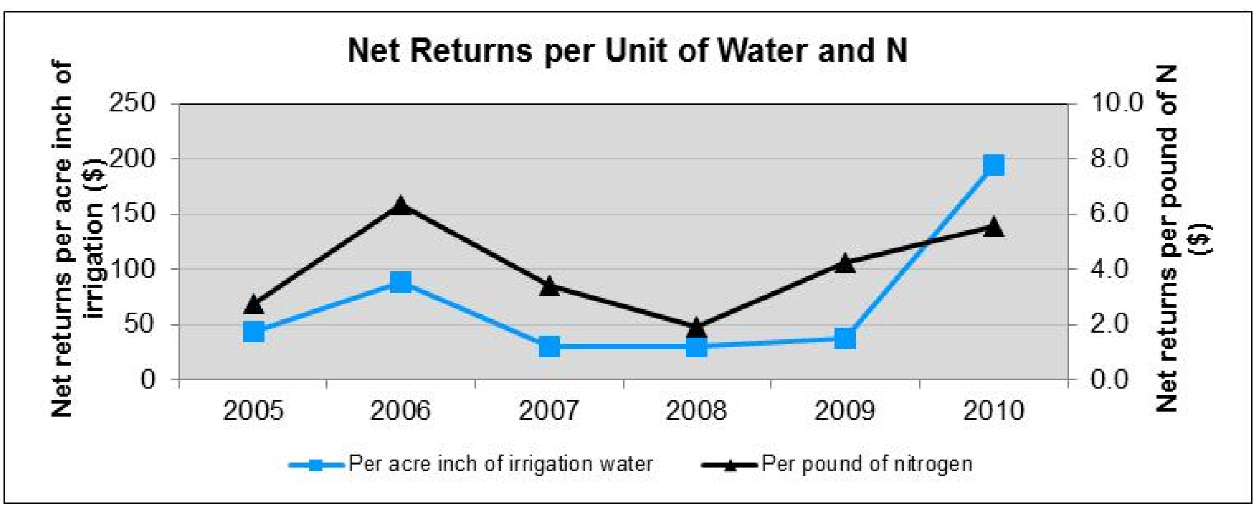
Site 7, Field 1 (August 2010)

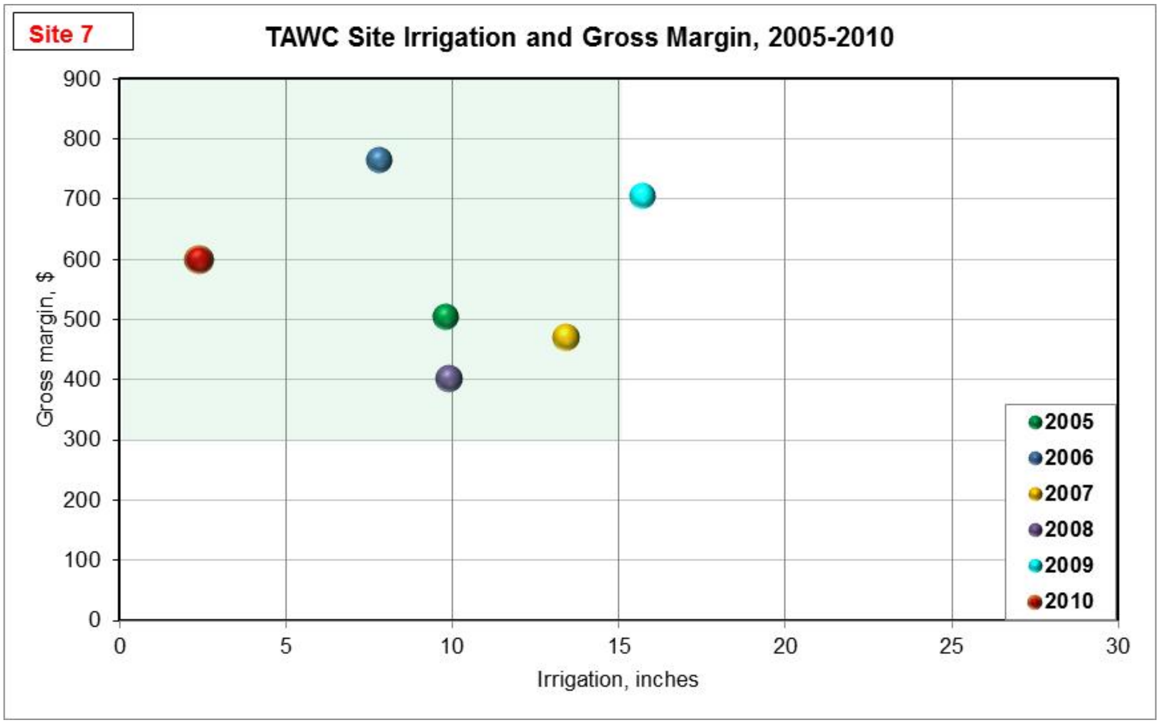
Comments: This is a pivot irrigated field of side-oats grama grown for seed production and the grass residue is round baled for hay and sold. This field was established to grass sixteen years ago.

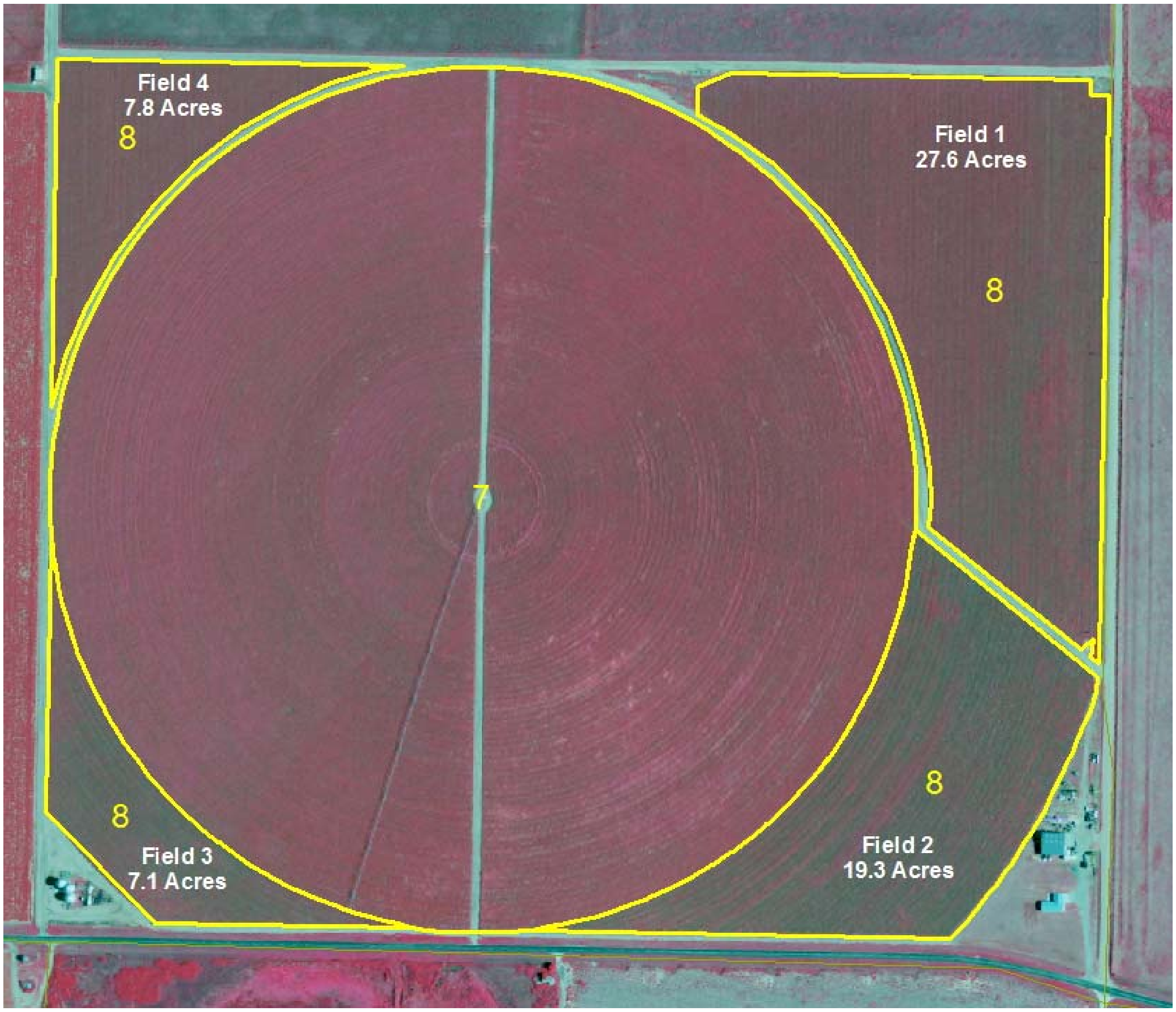
System 7


Irrigation and Precipitation
Water (inches)
40.00
30.00
20.00
10.00
0.00
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
800
600
400
200
0
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
250
200
150
100
50
0
Net returns per pound of N ($)
10.0
8.0
6.0
4.0
2.0
0.0
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 7
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 8 Description

Total system 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

System 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


Site 8 (April 2010)

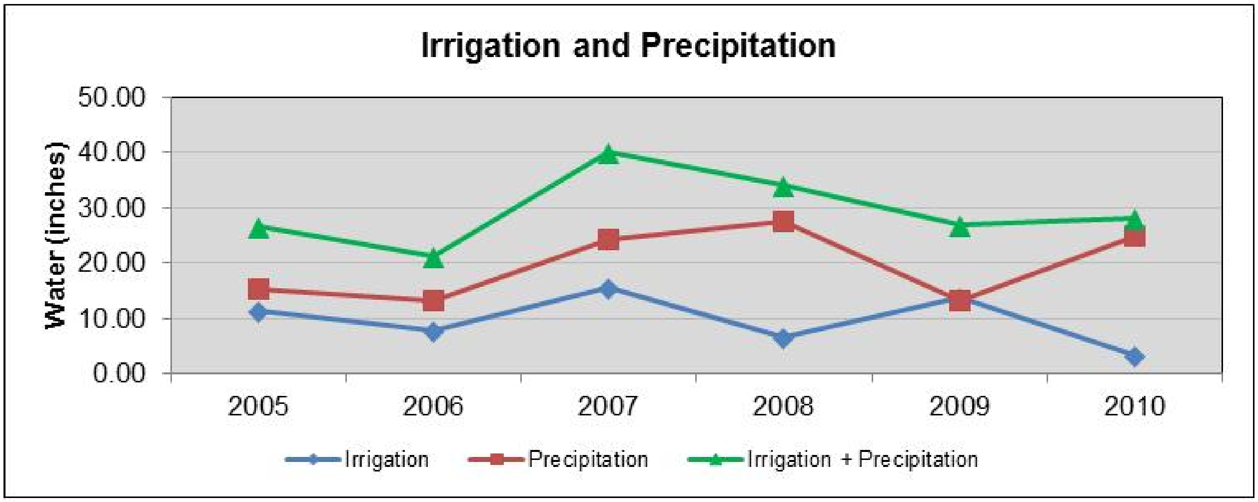

Site 8 (June 2010)


Site 8 (July 2010)

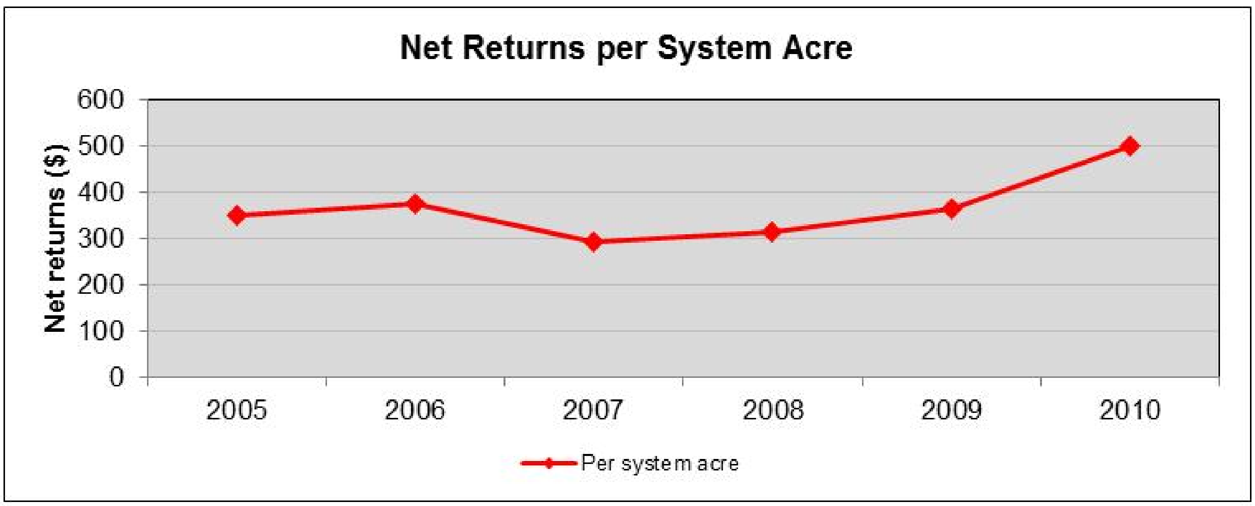

Site 8 (September 2010)

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 seven years ago. Prior to the installation of drip these fields were furrow irrigated.

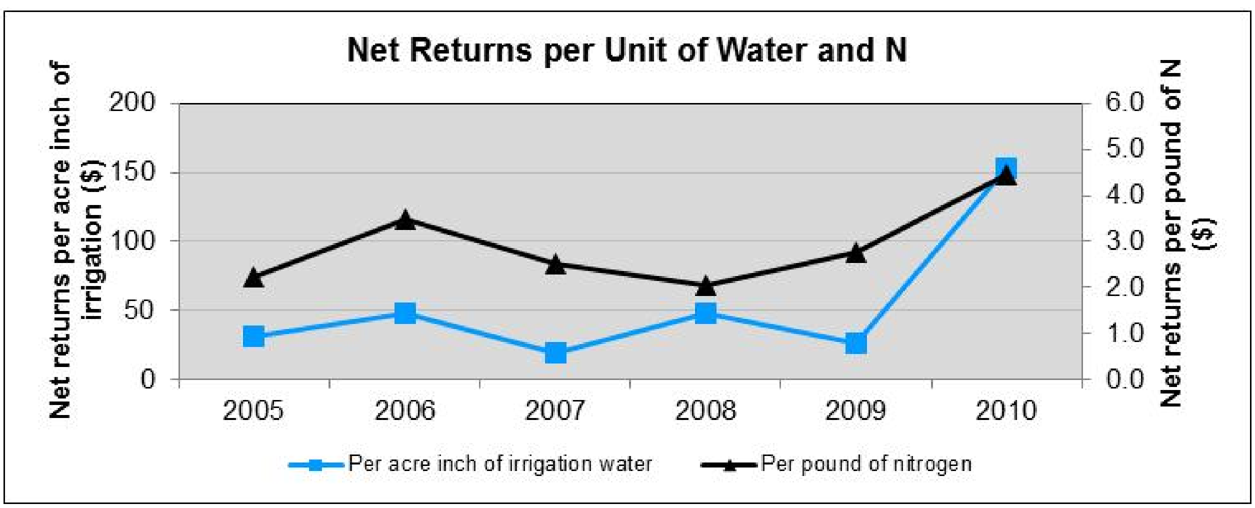
System 8



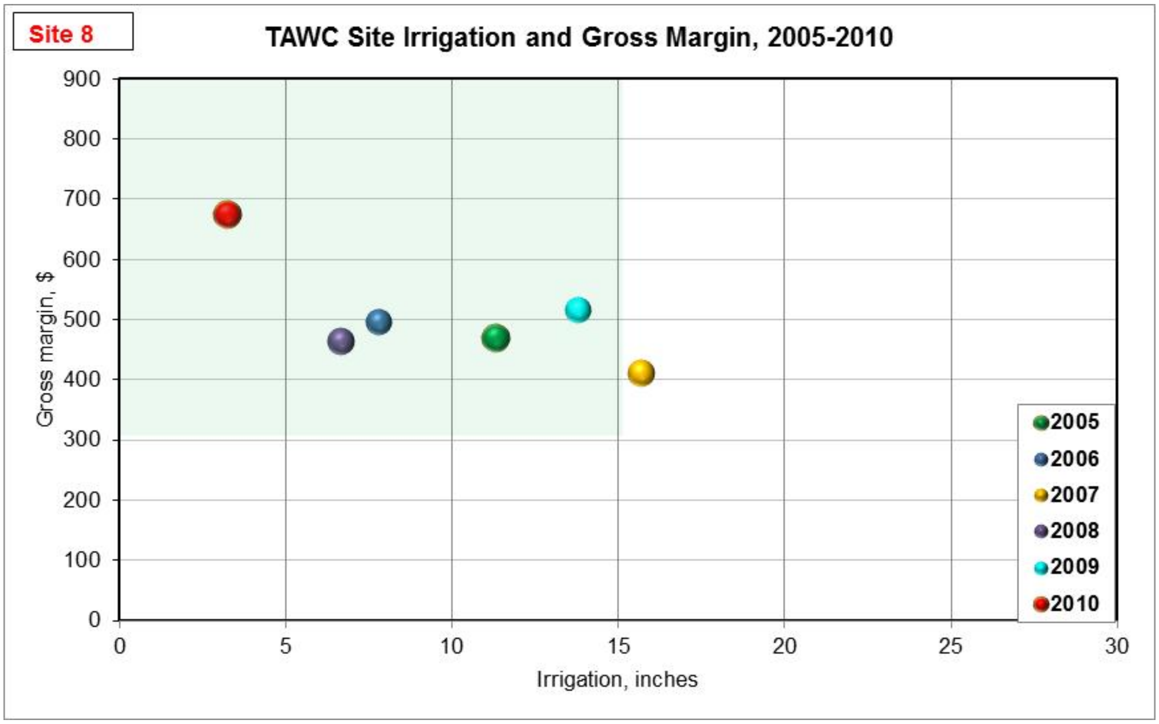
Irrigation and Precipitation
Water (inches)
50.00
40.00
30.00
20.00
10.00
0.00
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation



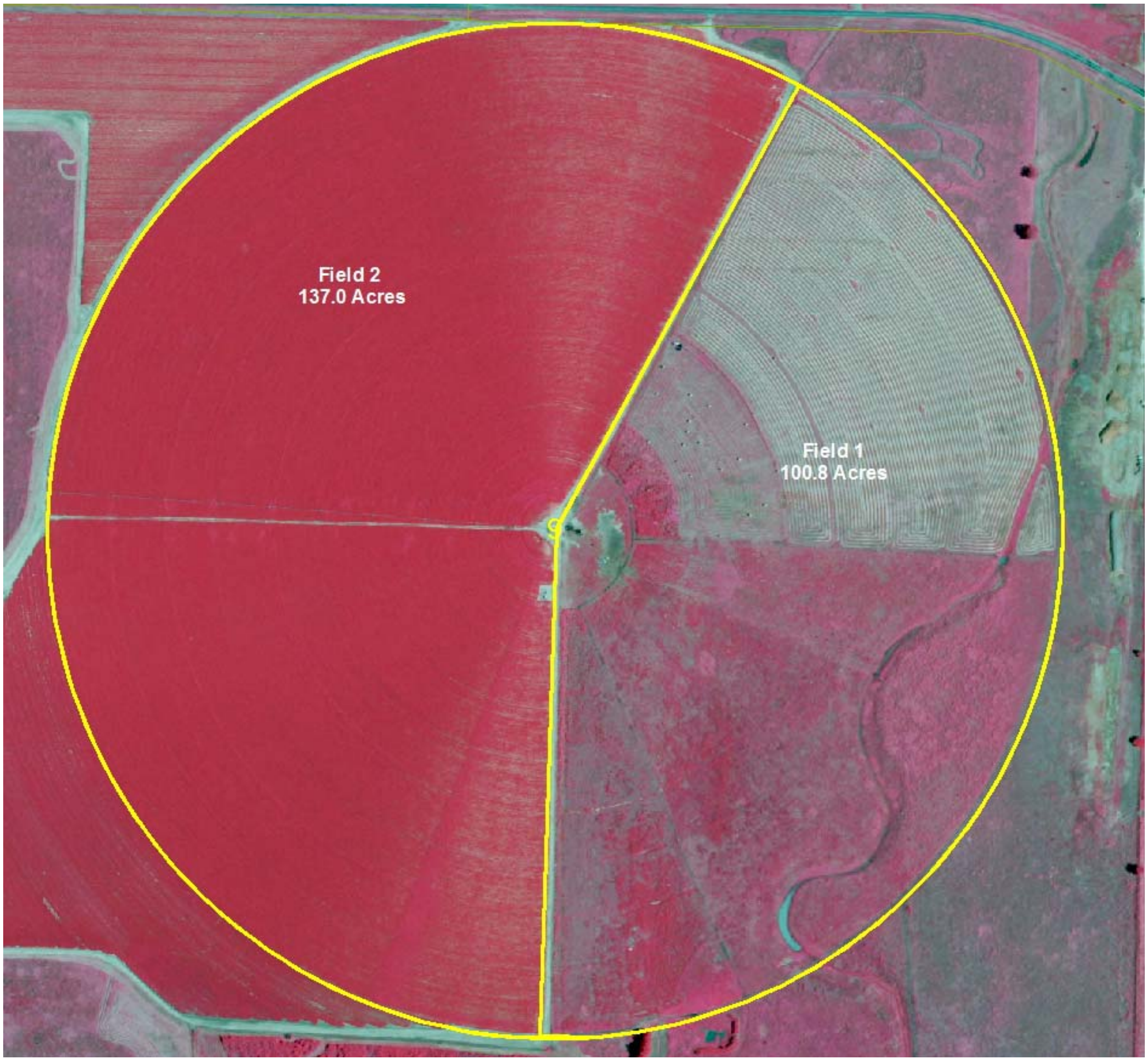
Net Returns per System Acre
Net returns ($)
600
500
400
300
200
100
0
2005
2006
2007
2008
2009
2010
Per system acre



Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
200
150
100
50
0
Net returns per pound of N ($)
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen



Site 8
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 9 Description

Total system 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

System 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


Site 9, Field 1 (April 2010)

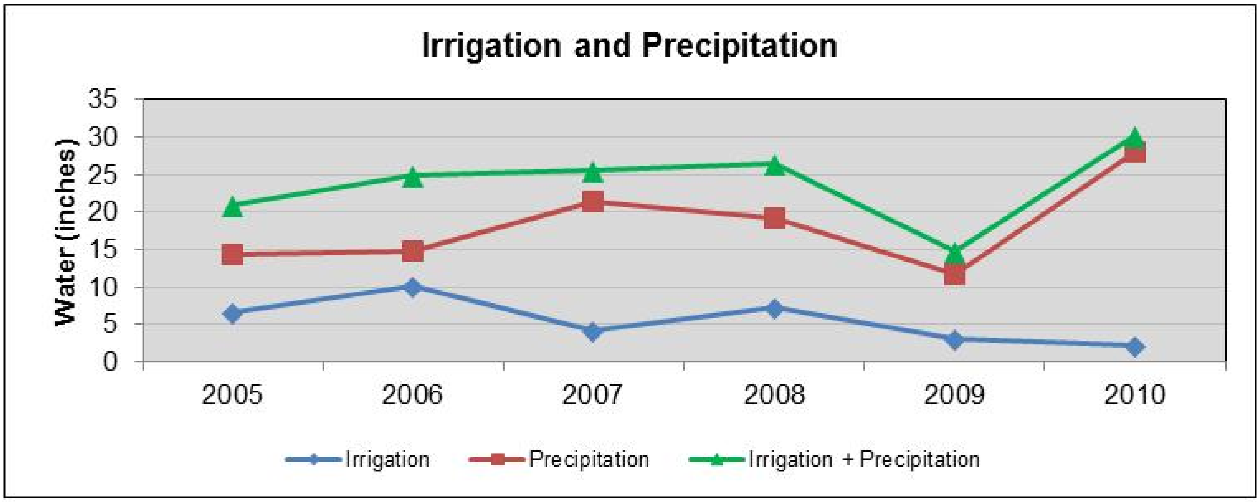

Site 9, Field 1 (August 2010)

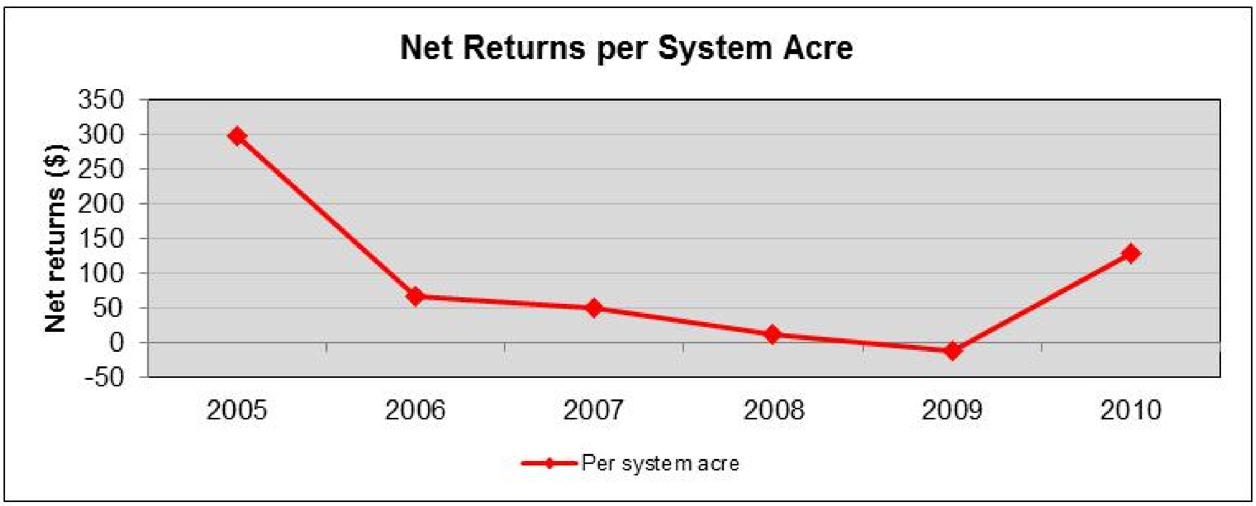

Site 9, Field 2 (March 2010)

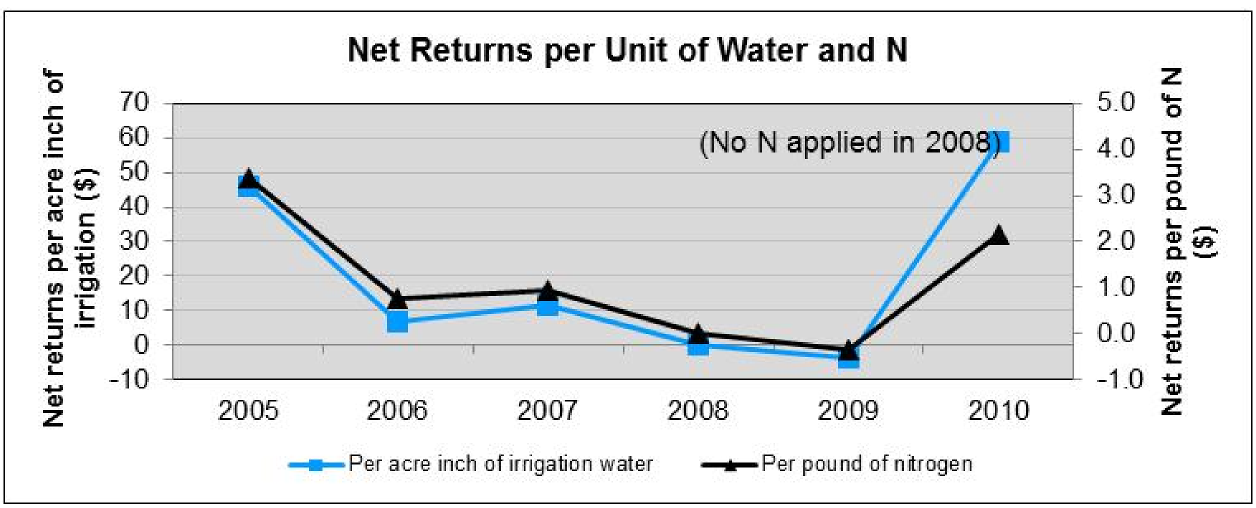

Site 9, Field 2 (July 2010)

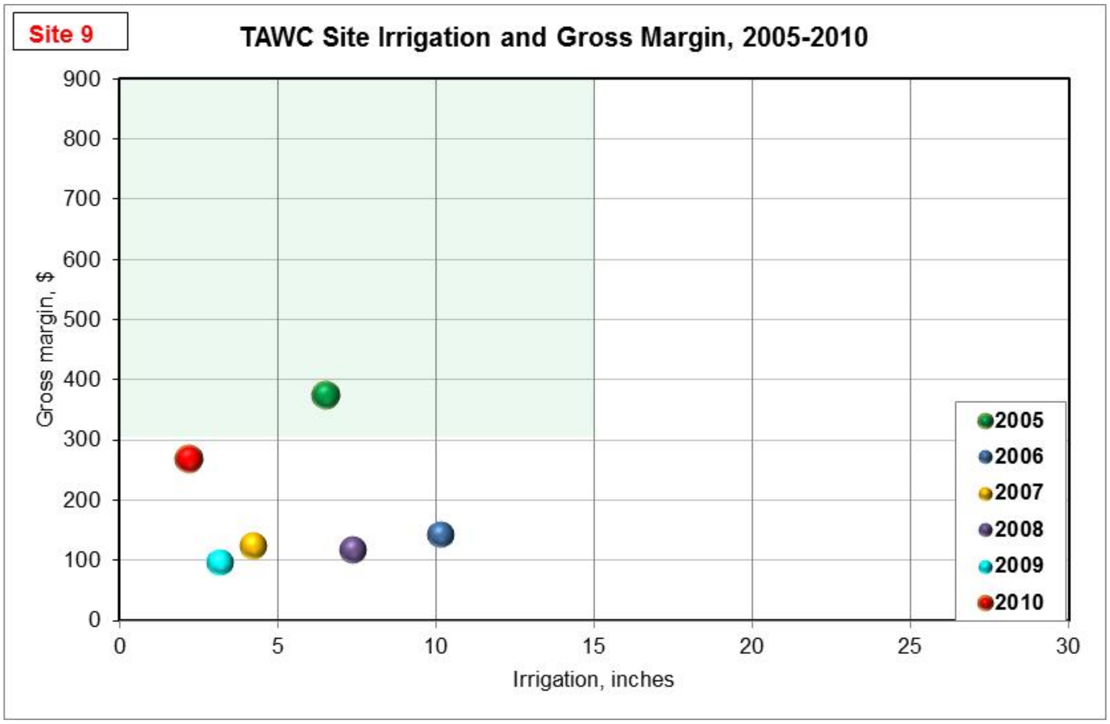
Comments: This site was returned to conventional tillage after eleven years of no-till production. Field 1 is predominantly kleingrass and used for cow-calf production. Field 2 was planted to cotton on forty-inch centers.

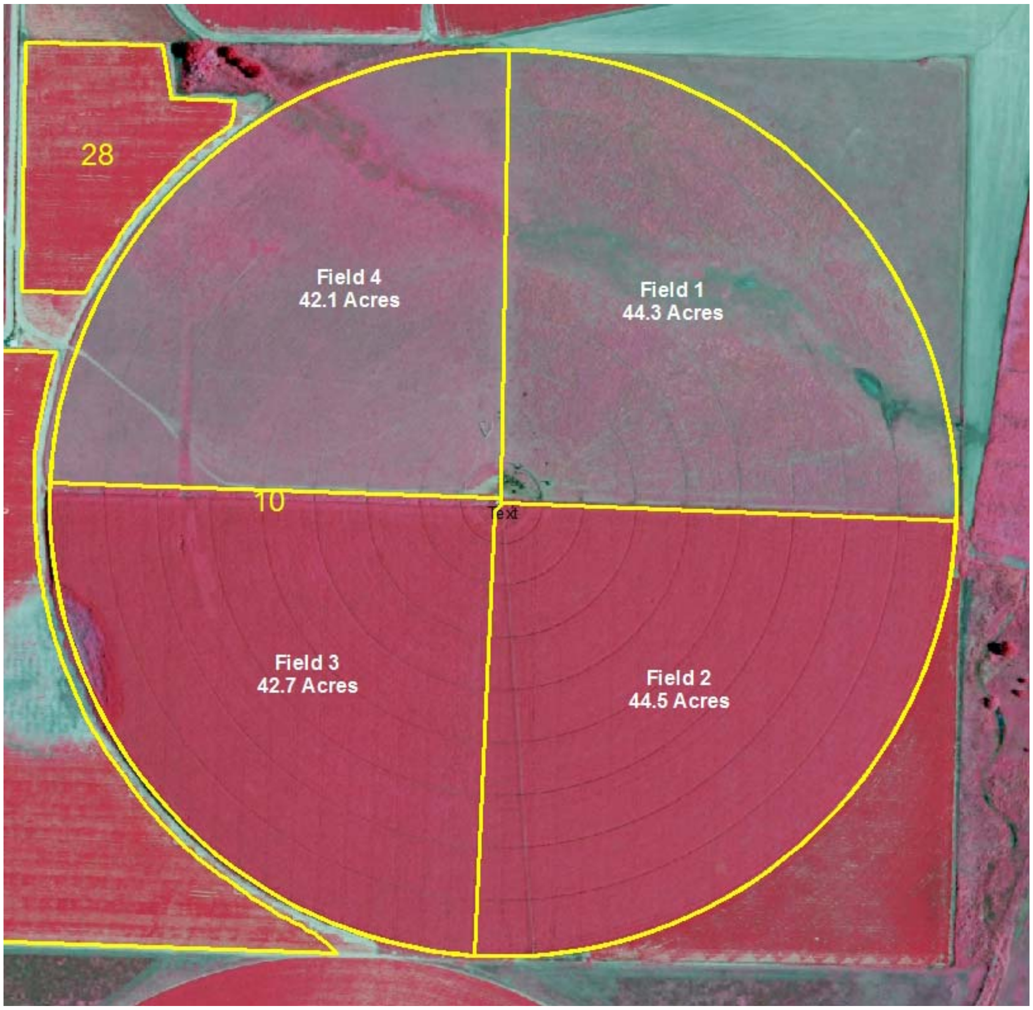
System 9


Irrigation and Precipitation
Water (inches)
35
30
25
20
15
10
5
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
350
300
250
200
150
100
50
0
-50
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
70
60
50
40
30
20
10
0
-10
(No N applied in 2008)
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
Net returns per pound of N ($)
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 9
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 10 Description

Total system 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. 2 Acres: 44.5
Major soil type: Pullman clay loam; 0 to 1% slope
Estacado clay loam; 0 to 1% slope

Field No. 3 Acres: 42.7
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 4 Acres: 42.1
Major soil type: Pullman clay loam; 0 to 1 and 1 to 3% slope
Lofton clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (LESA)

Pumping capacity, gal/min: 800

Number of wells: 2

Fuel source: Electric

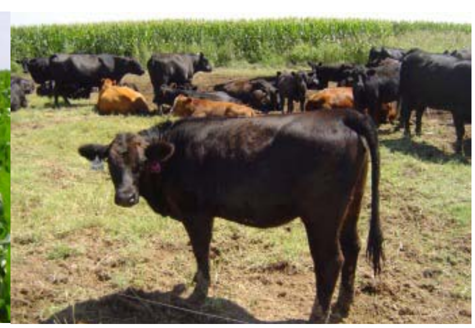
System 10

	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


Site 10, Field 1 (August 2010)

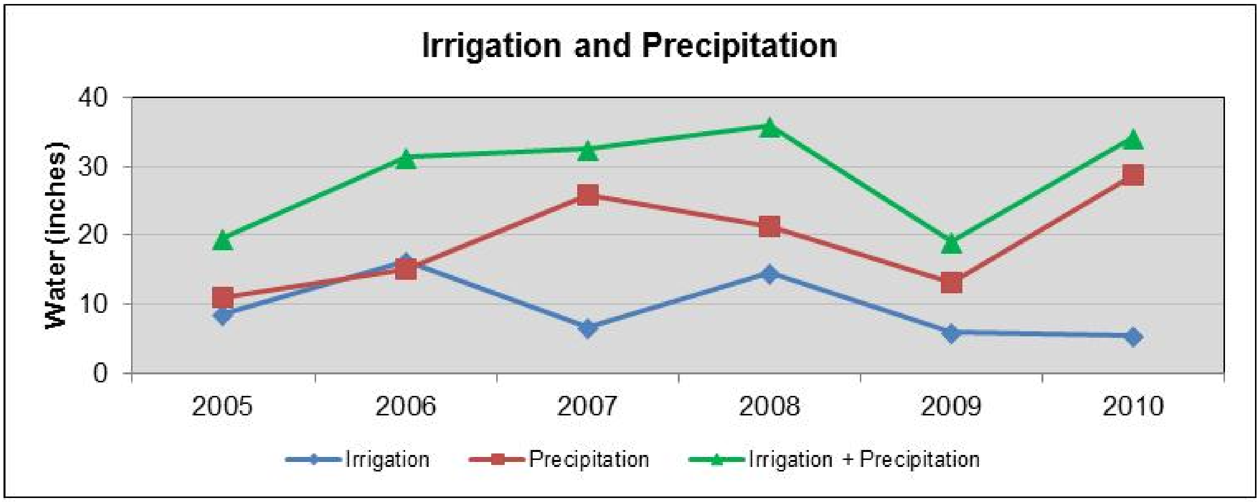

Site 10, Field 2 (June 2010)


Site 10, Field 3 (June 2010)

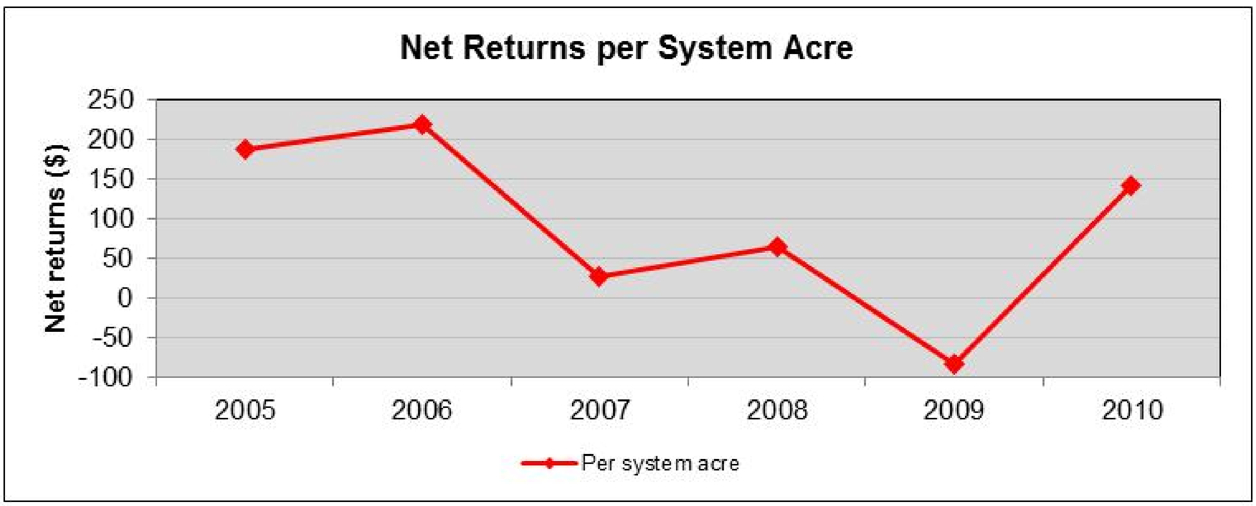

Site 10, Field 4 (August 2010)

Comments: This is a three cell, pivot irrigated row crop, improved forage, cow-calf system. Old-world bluestem and Bermuda grass are used in rotation for livestock grazing. One-half of this system was planted to corn on twenty-inch centers for 2010.

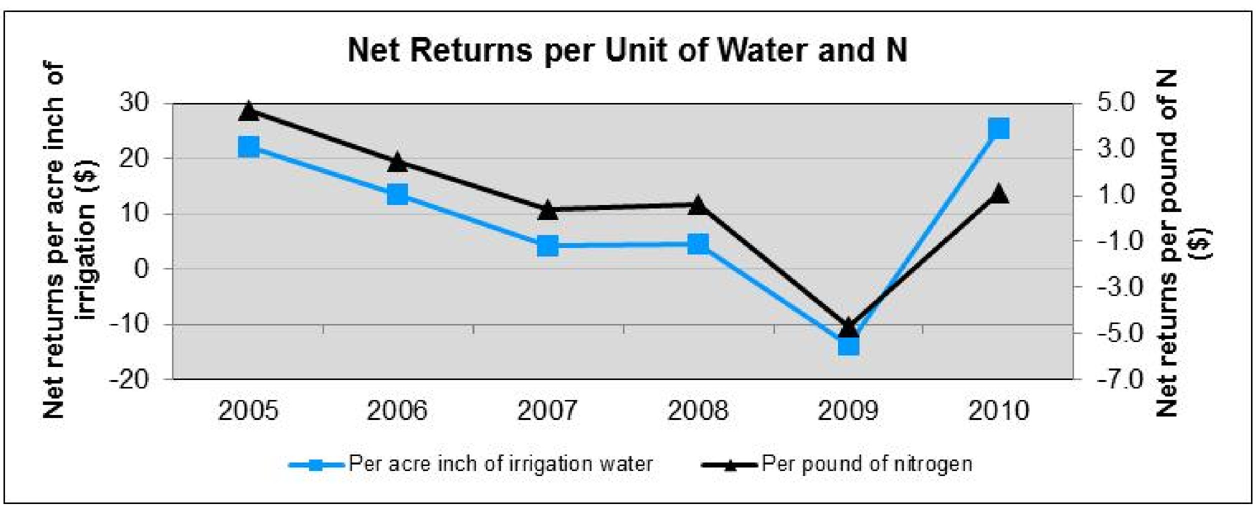
System 10



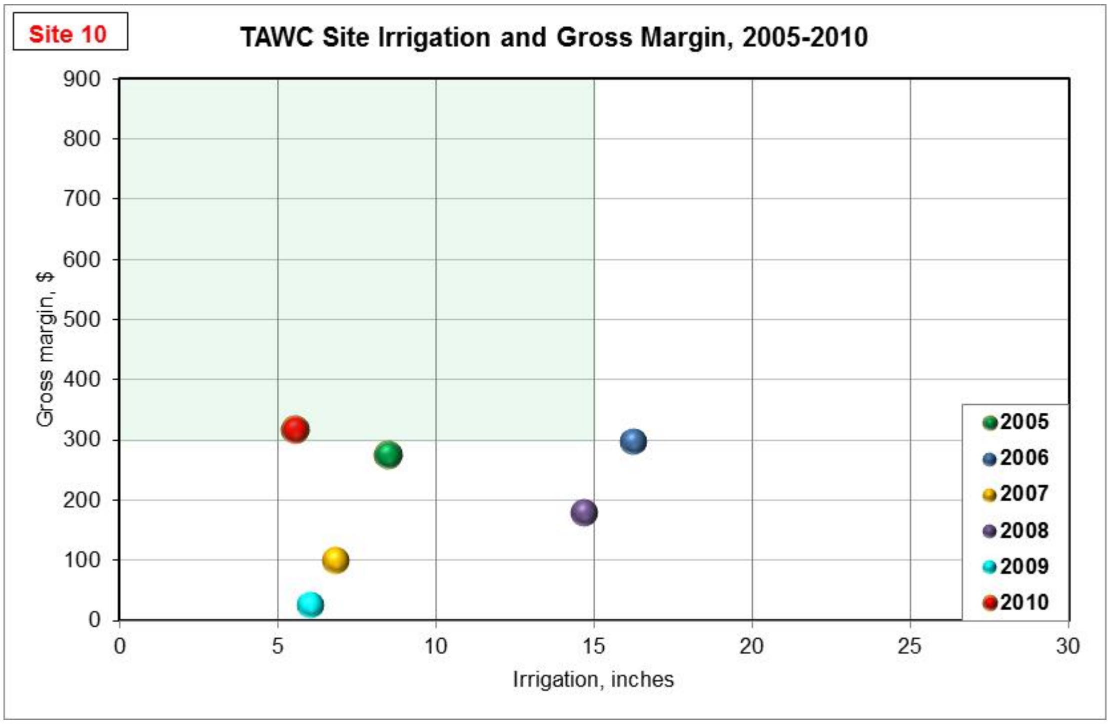
Irrigation and Precipitation
Water (inches)
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation

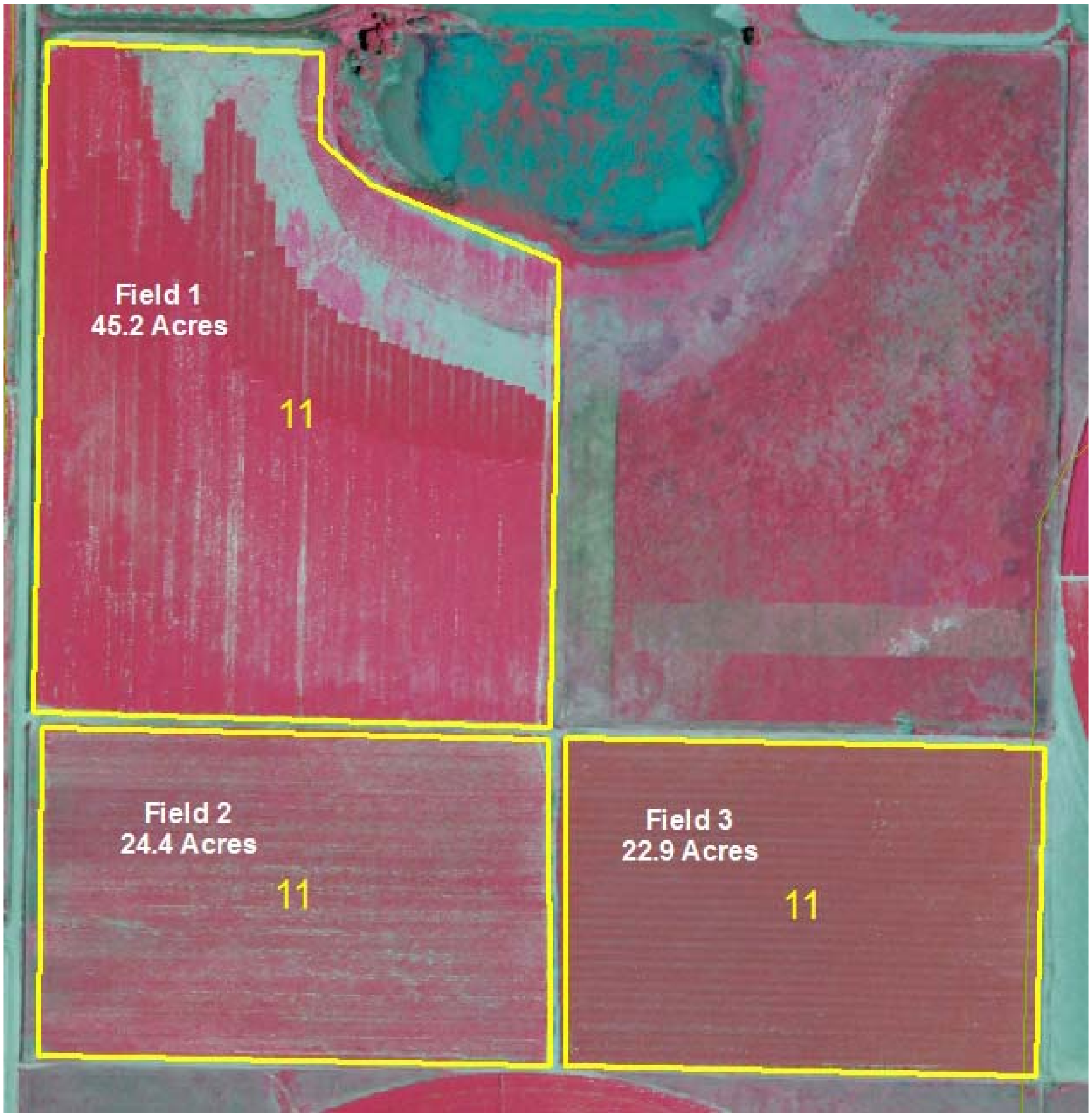


Net Returns per System Acre
Net returns ($)
250
200
150
100
50
0
-50
-100
2005
2006
2007
2008
2009
2010
Per system acre



Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
30
20
10
0
-10
-20
2005
2006
2007
2008
2009
2010
5.0
3.0
1.0
-1.0
-3.0
-5.0
-7.0
Net returns per pound of N ($)
Per acre inch of irrigation water
Per pound of nitrogen


Site 10
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 11 Description

Total system acres: 92.5

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

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

Irrigation

Type:	Furrow
Pumping capacity, gal/min:	490
Number of wells:	1
Fuel source:	Electric

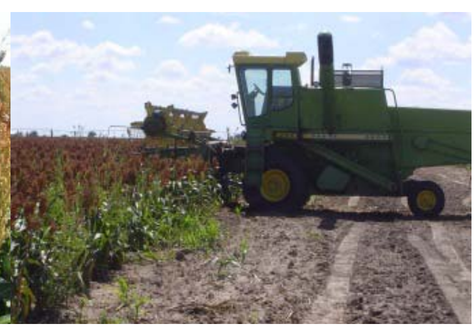
System 11

	Livestock	Field 1	Field 2	Field 3
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


Site 11 (July 2010)

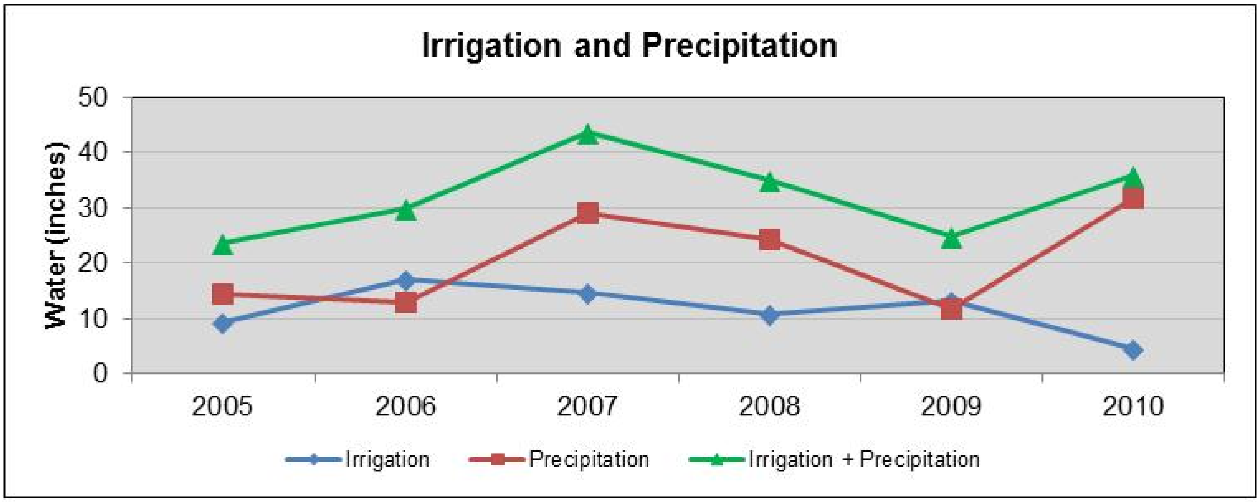

Site 11 (July 2010)

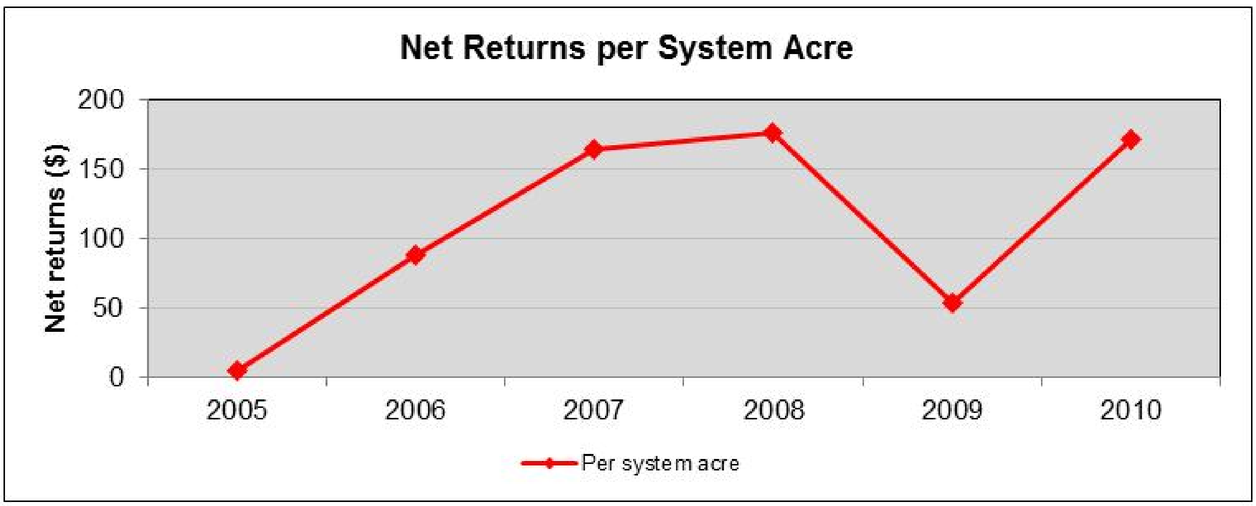

Site 11 (August 2010)

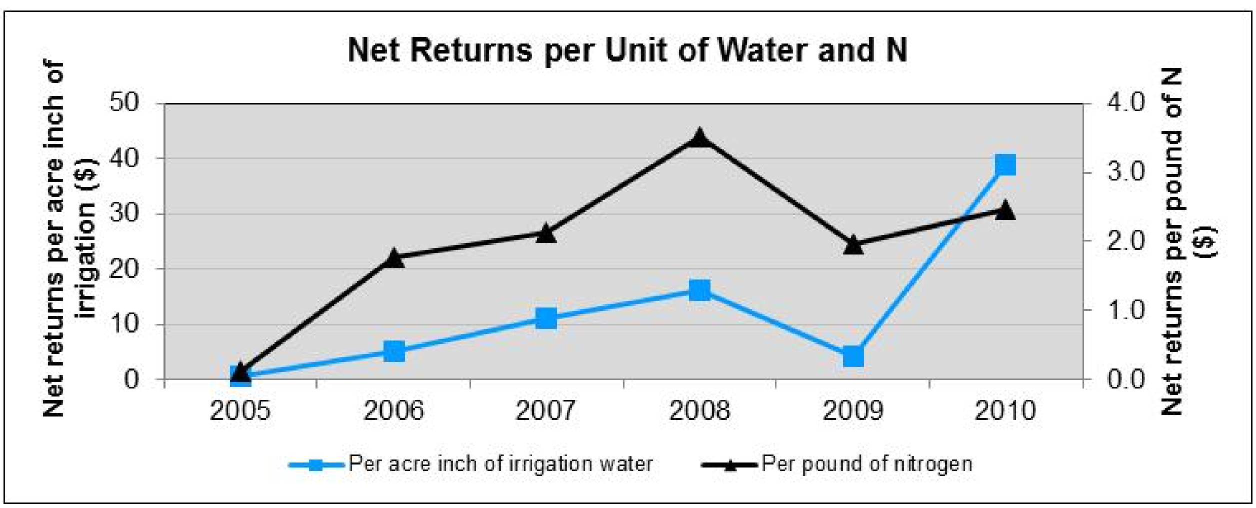

Site 11 (September 2010)

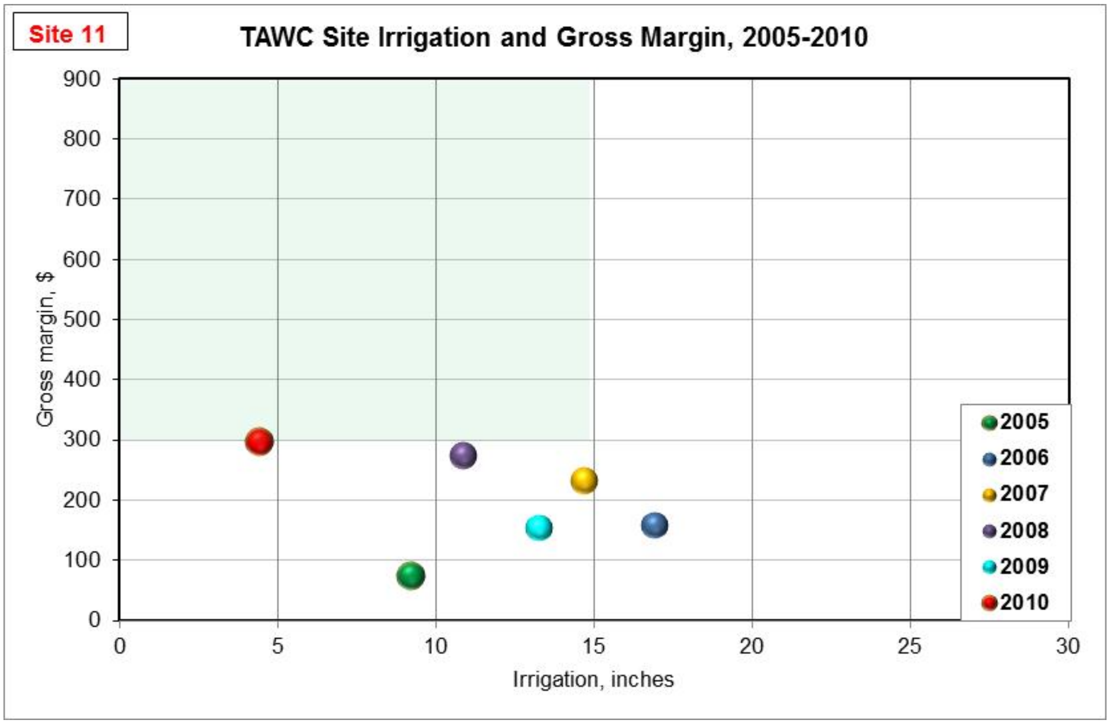
Comments: This is a furrow irrigated cotton and grain sorghum system using conventional tillage and planted on forty-inch centers.

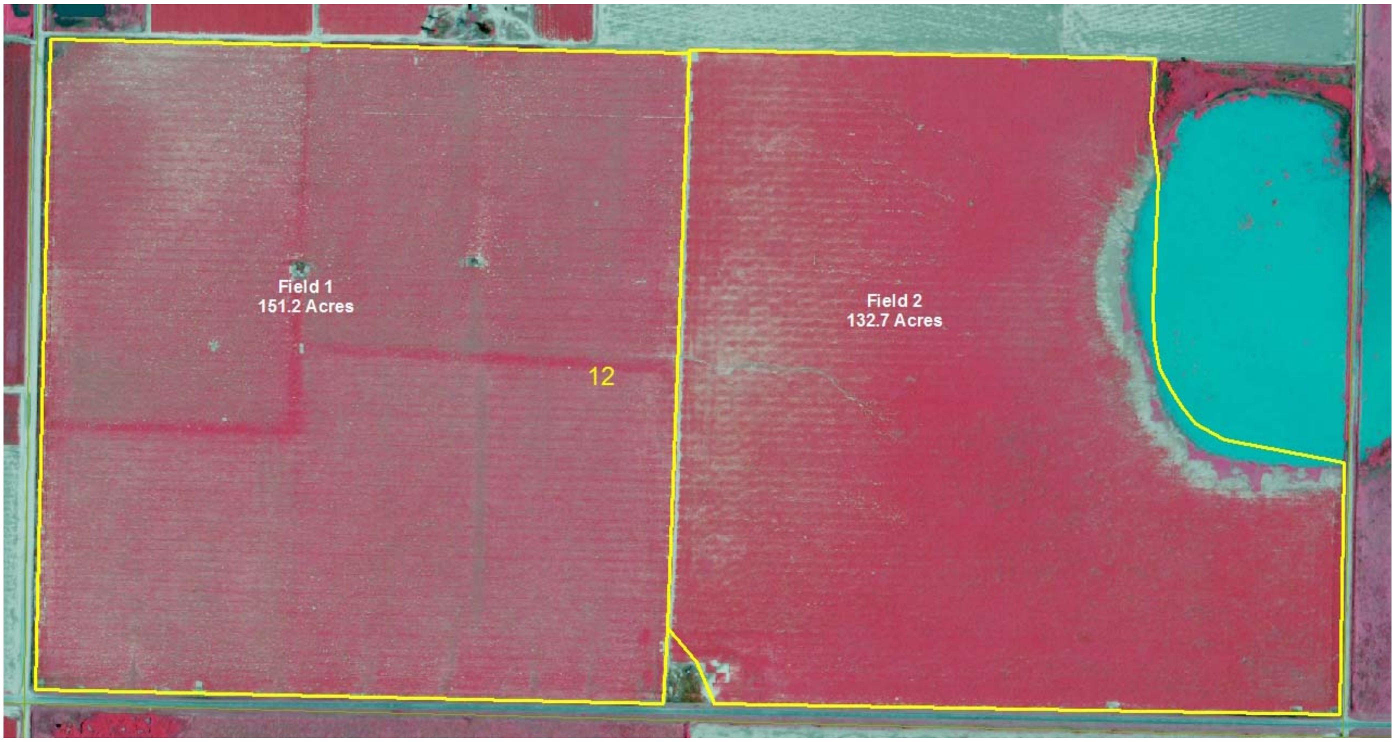
System 11


Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
200
150
100
50
0
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
50
40
30
20
10
0
4.0
3.0
2.0
1.0
0.0
Net returns per pound of N ($)
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 11
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 12 Description

Total system acres:	283.9
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

System 12

	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

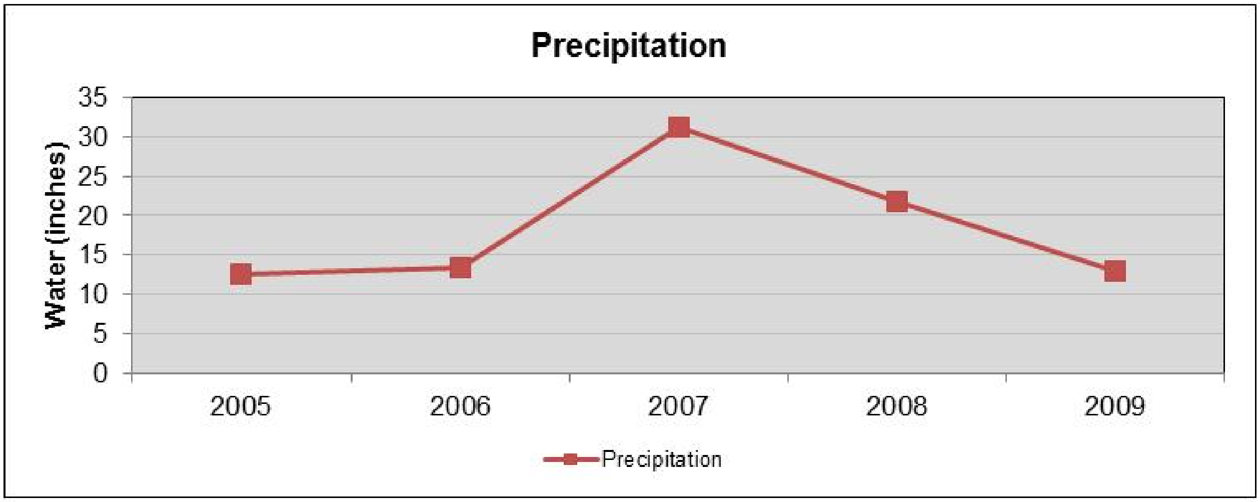

Site 12 (June 2010)


Site 12 (August 2010)

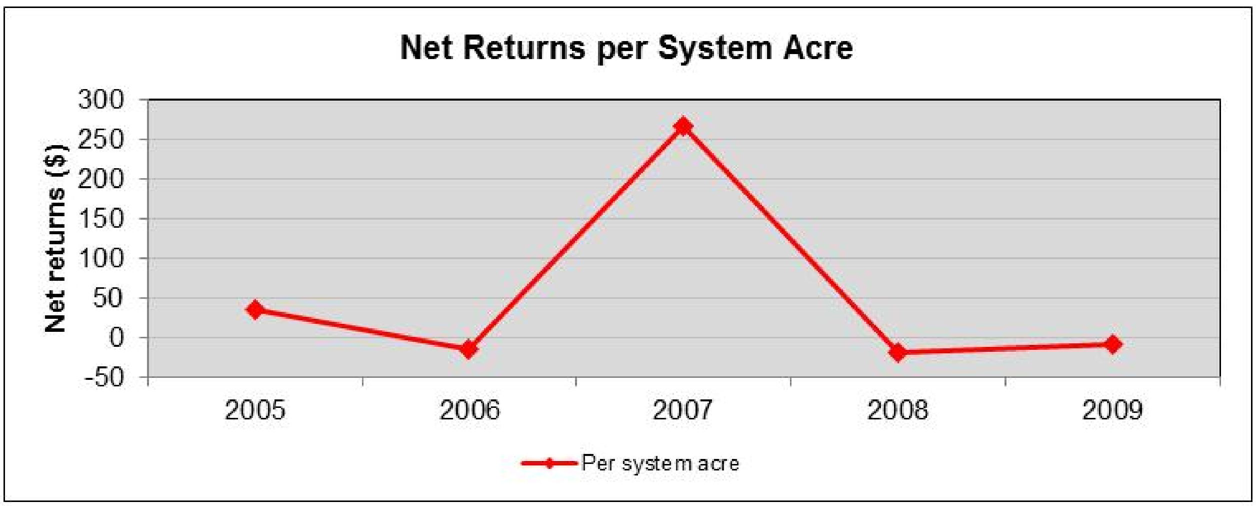

Site 12 (September 2010)

Comments: This dryland system uses cotton, grain sorghum and wheat in rotation. Both fields were planted to cotton in 2010.

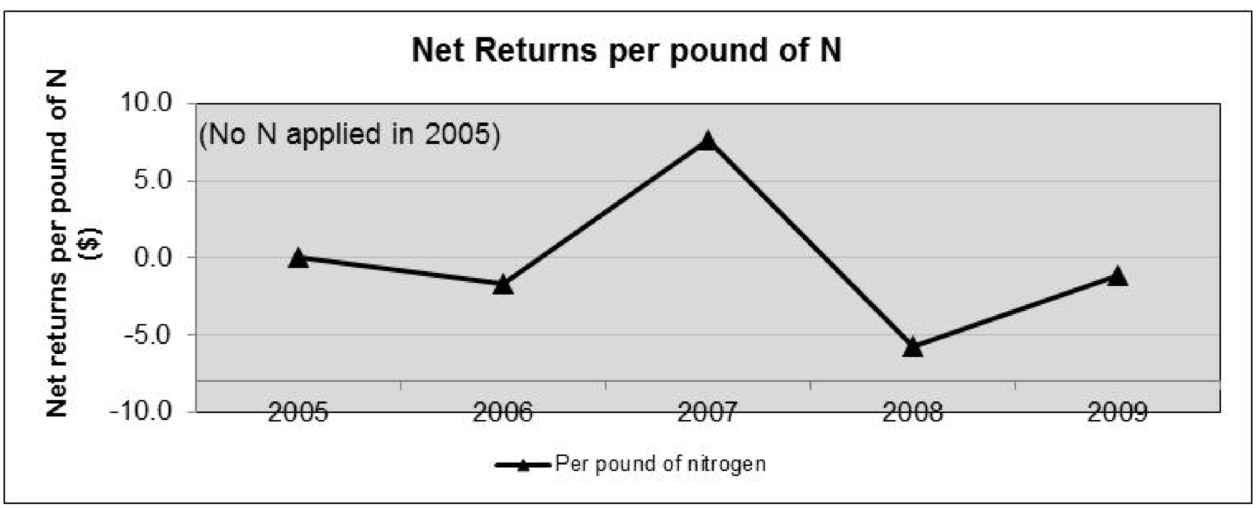
System 12



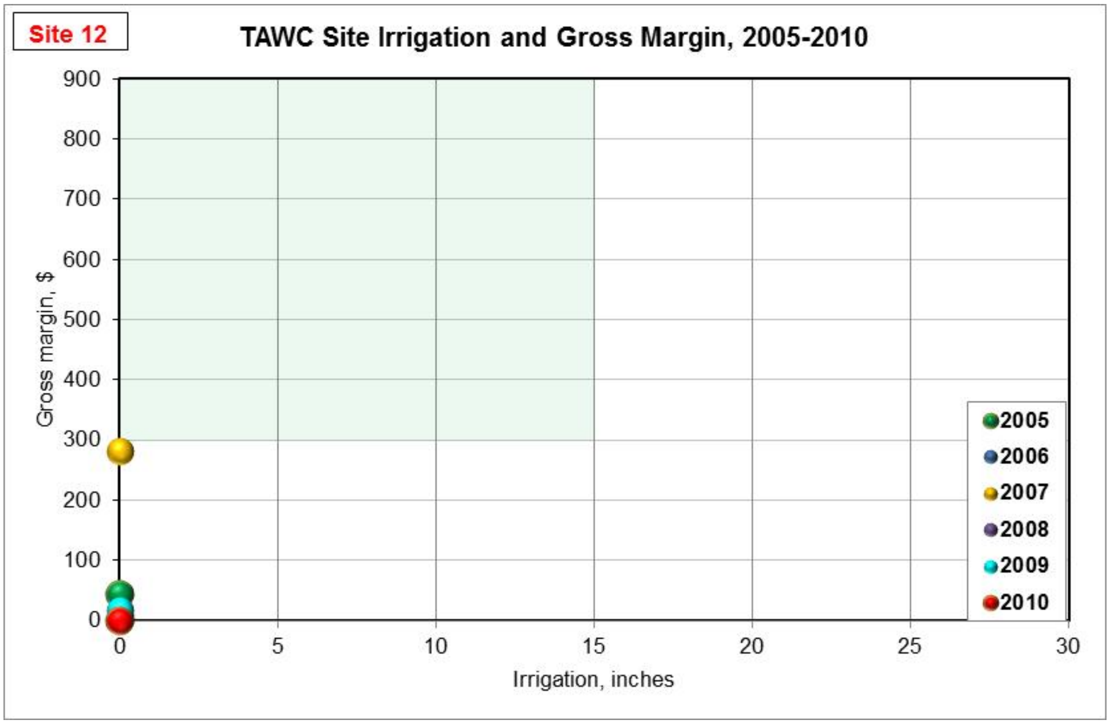
Precipitation
Water (inches)
35
30
25
20
15
10
5
0
2005
2006
2007
2008
2009
Precipitation

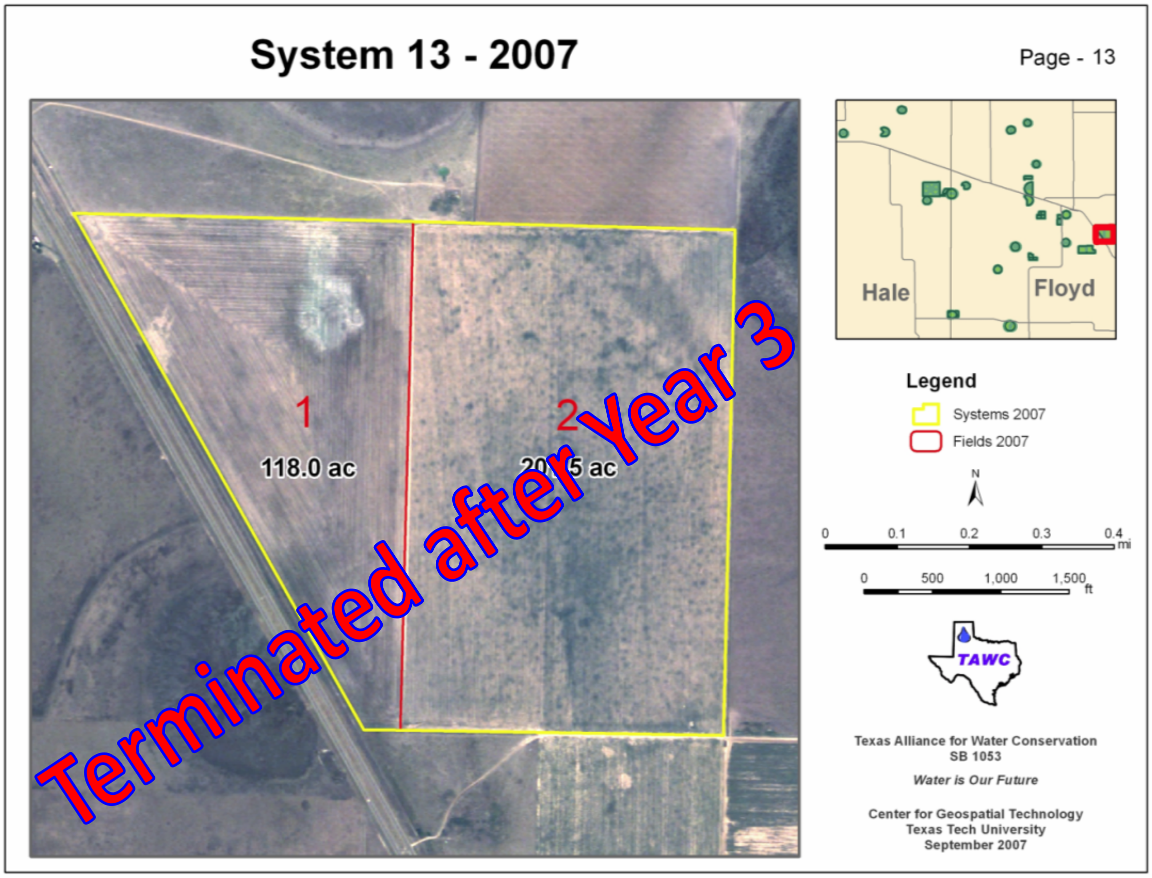


Net Returns per System Acre
Net returns ($)
300
250
200
150
100
50
0
-50
2005
2006
2007
2008
2009
Per system acre



Net Returns per pound of N
Net returns per pound of N ($)
10.0
5.0
0.0
-5.0
-10.0
(No N applied in 2005)
2005
2006
2007
2008
2009
Per pound of nitrogen


Site 12
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 13 Description

Total system 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:

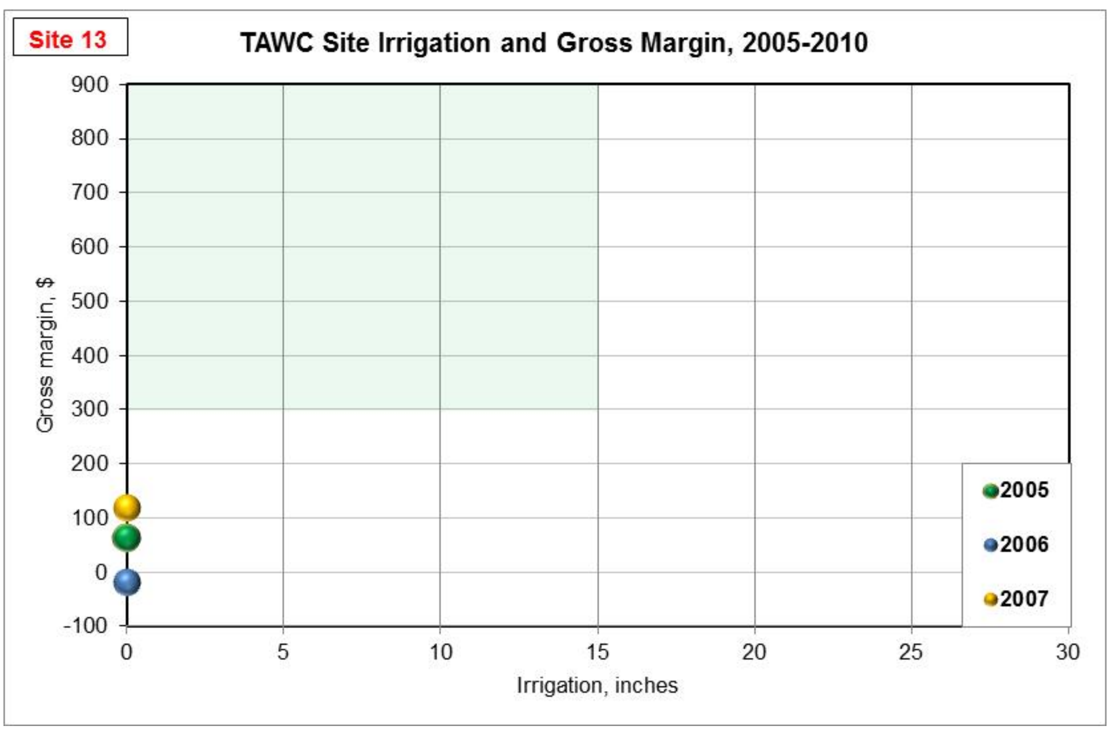
Number of wells:

Fuel source:

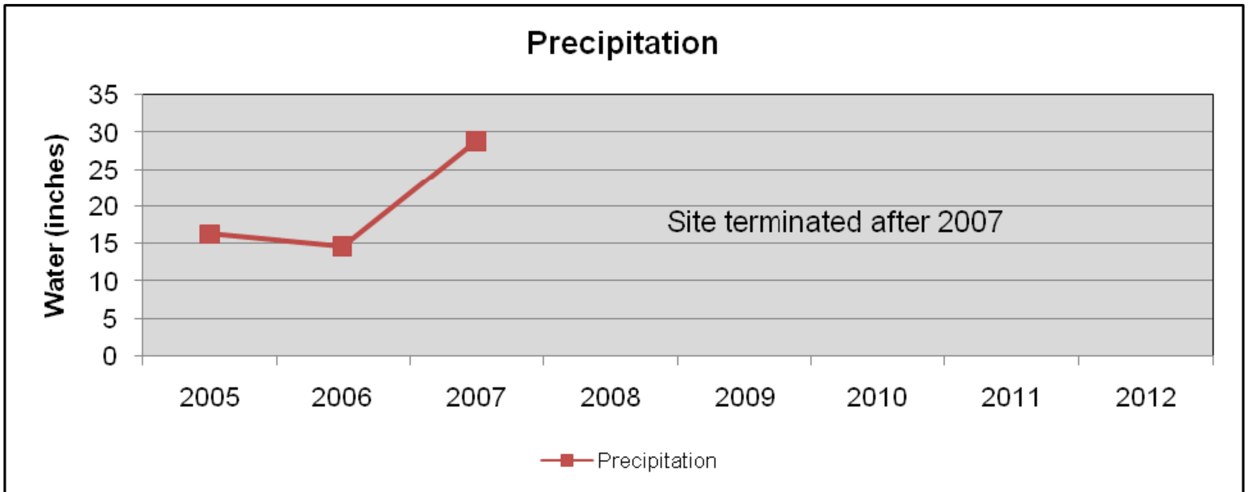
Comments: This dryland site uses cotton and small grains in rotation. Cotton is planted on forty-inch centers under limited tillage. Small grains are drilled after cotton harvest.

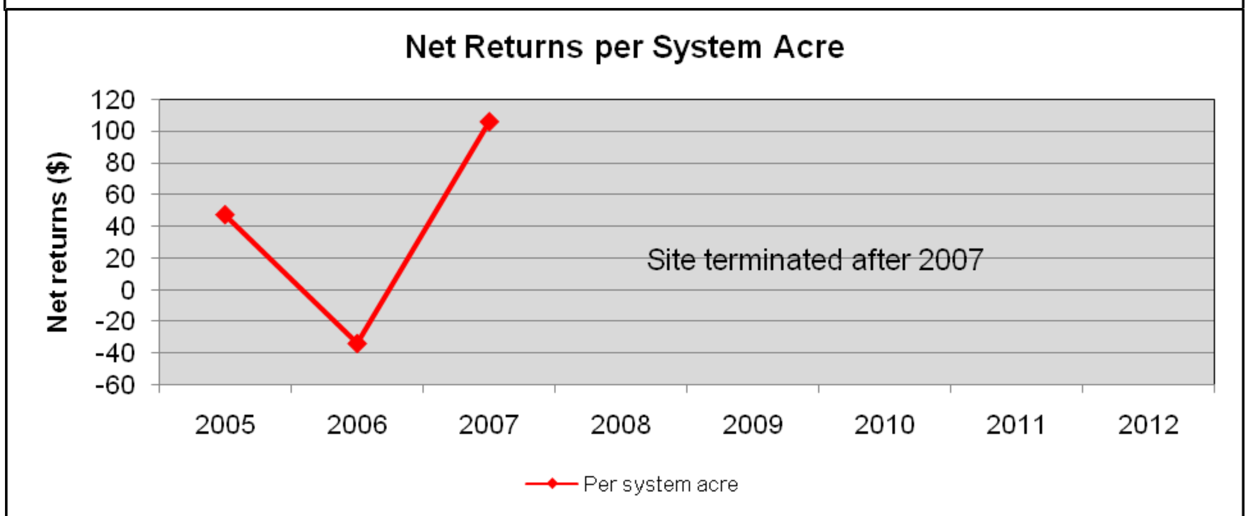
System 13

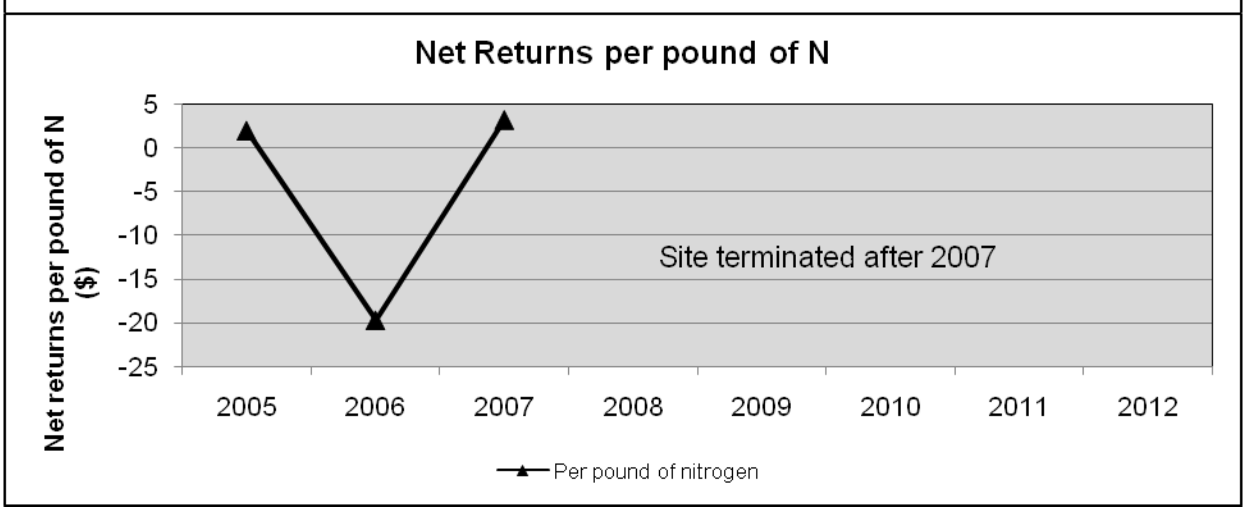
	Livestock	Field 1	Field 2
2005	None	Wheat for grain	Cotton following previous year's cover of Wheat stubble
2006	None	Cotton following previous year's cover of Wheat stubble	Wheat lost to drought
2007	None	Wheat for grain	Cotton following Wheat cover crop
2008	Site terminated for 2008		
2009			
2010			

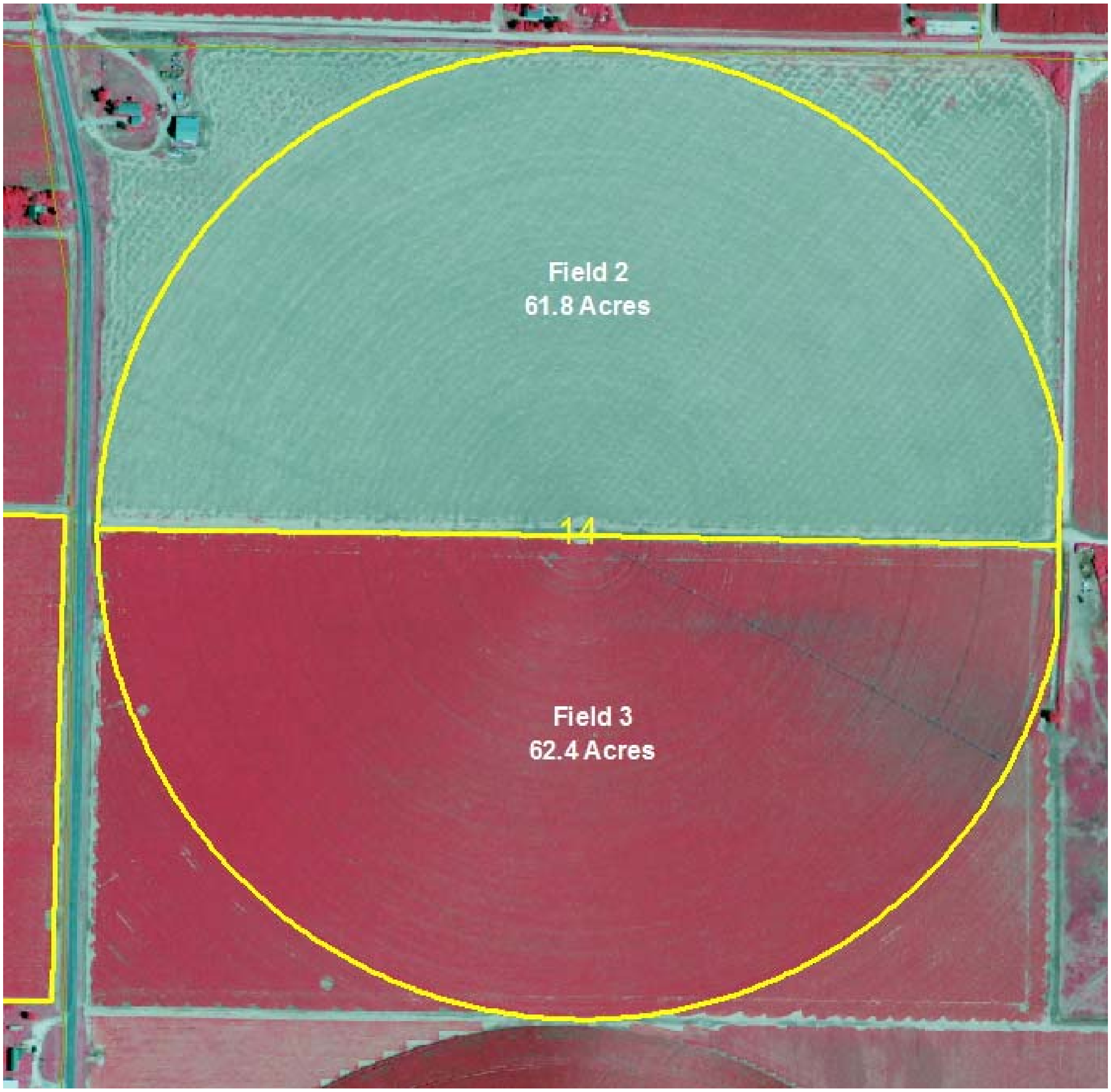


System 13


Precipitation
Water (inches)
35
30
25
20
15
10
5
0
Site terminated after 2007
2005
2006
2007
2008
2009
2010
2011
2012
Precipitation


Net Returns per System Acre
Net returns ($)
120
100
80
60
40
20
0
-20
-40
-60
Site terminated after 2007
2005
2006
2007
2008
2009
2010
2011
2012
Per system acre


Net Returns per pound of N
Net returns per pound of N ($)
5
0
-5
-10
-15
-20
-25
Site terminated after 2007
2005
2006
2007
2008
2009
2010
2011
2012
Per pound of nitrogen



System 14 Description

Total system acres: 124.2

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

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

Irrigation

Type: Center Pivot (LEPA)

Pumping capacity, gal/min: 300

Number of wells: 3

Fuel source: Electric

System 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

Site 14, Field 2 (March 2010)

Site 14, Field 2 (May 2010)

Site 14, Field 2 (September 2010)

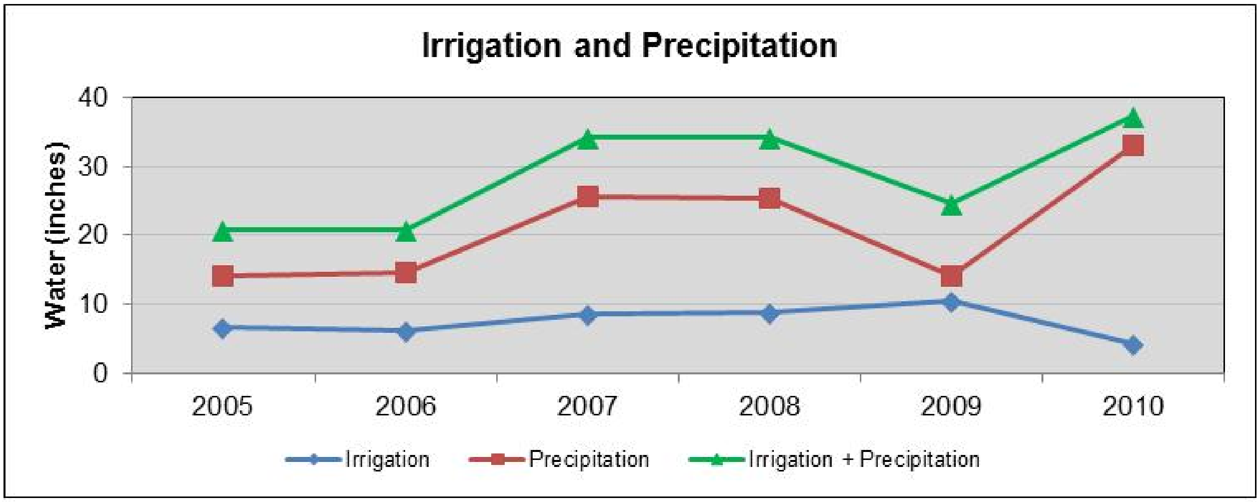
Site 14, Field 3 (March 2010)

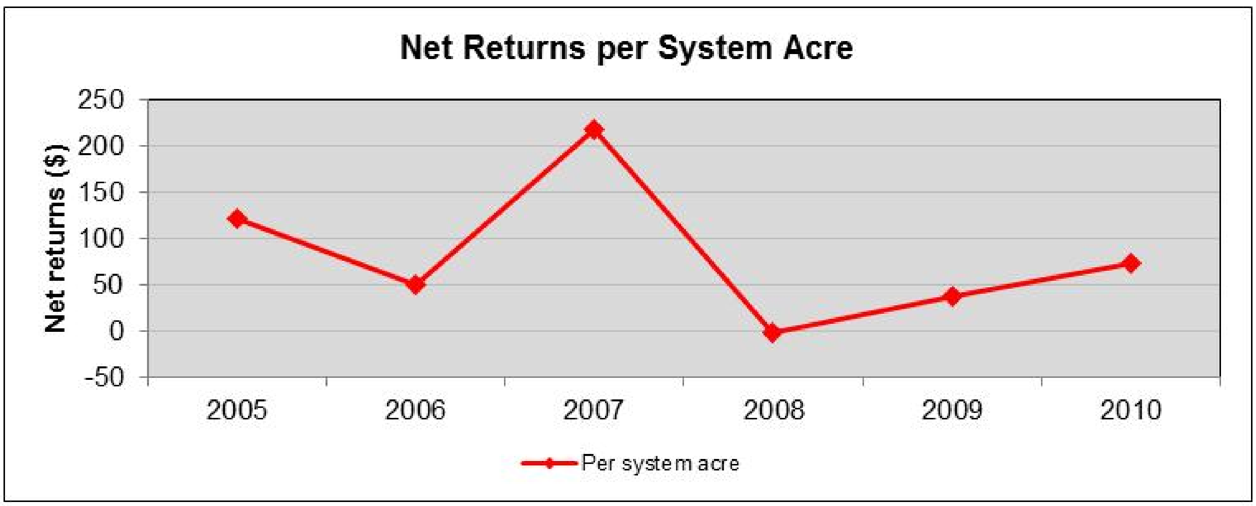
Site 14, Field 3 (May 2010)

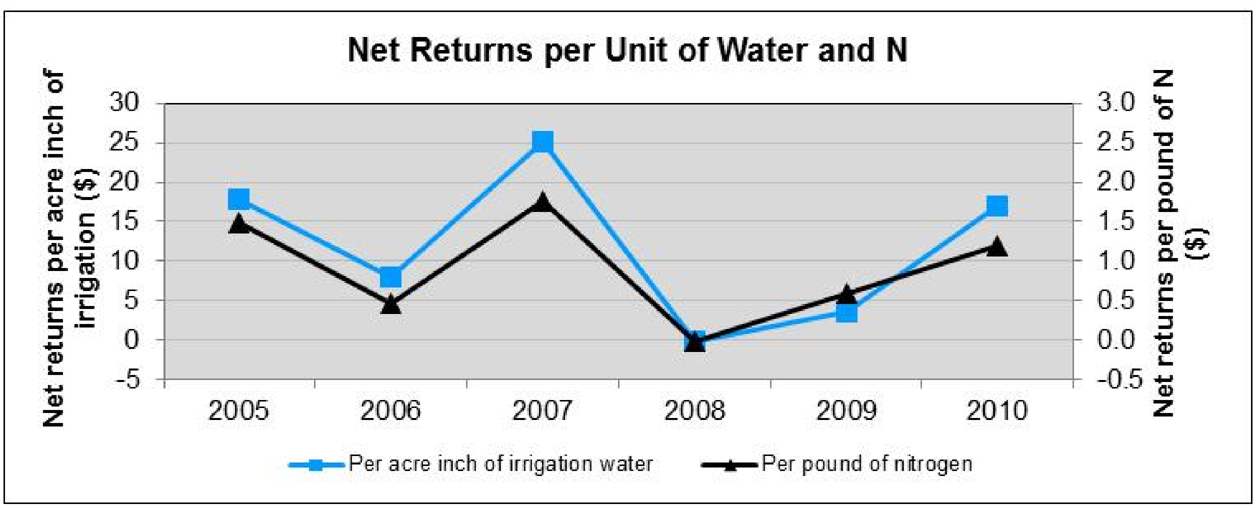
Site 14, Field 3 (June 2010)

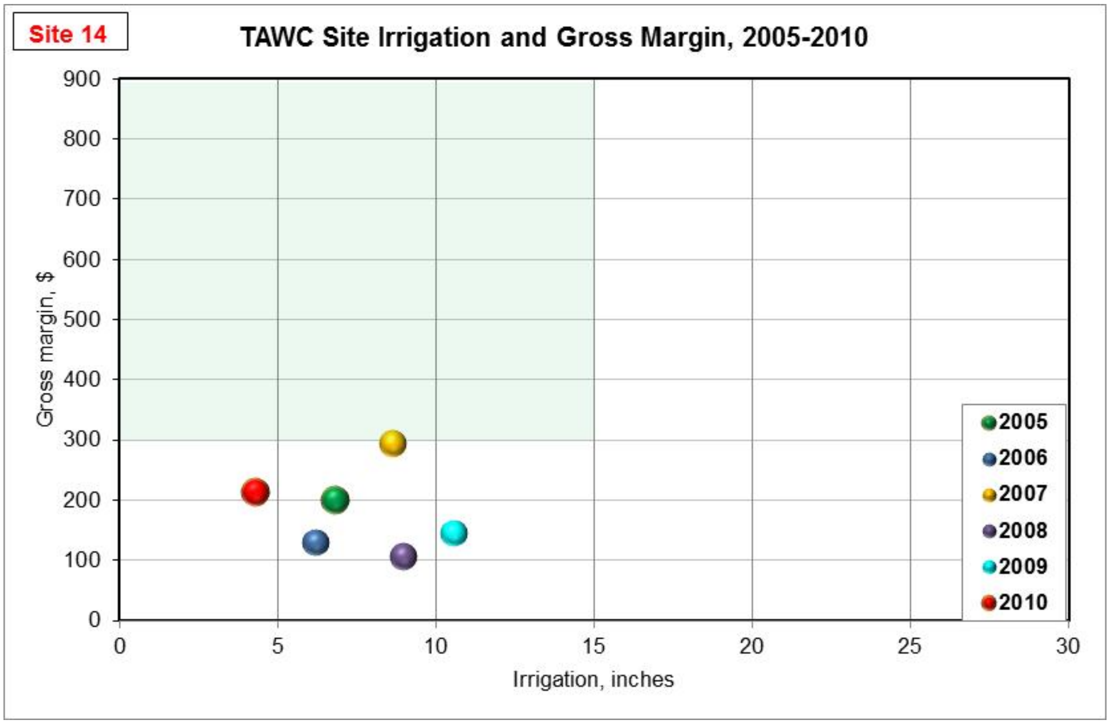
Comments: This is a pivot irrigated cotton and wheat rotation system with limited irrigation. This producer uses conventional tillage on forty-inch centers.

System 14


Irrigation and Precipitation
Water (inches)
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
250
200
150
100
50
0
-50
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
30
25
20
15
10
5
0
-5
Net returns per pound of N ($)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 14
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010

System 15 Description

Total system acres: 102.8

Field No. 8 Acres: 57.2
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 9 Acres: 45.6
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Furrow Field 8
Subsurface Drip Field 9

Pumping capacity, gal/min: 290

Number of wells: 1

Fuel source: Natural gas

System 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 Wheat 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

Site 15, Field 8 (June 2010)

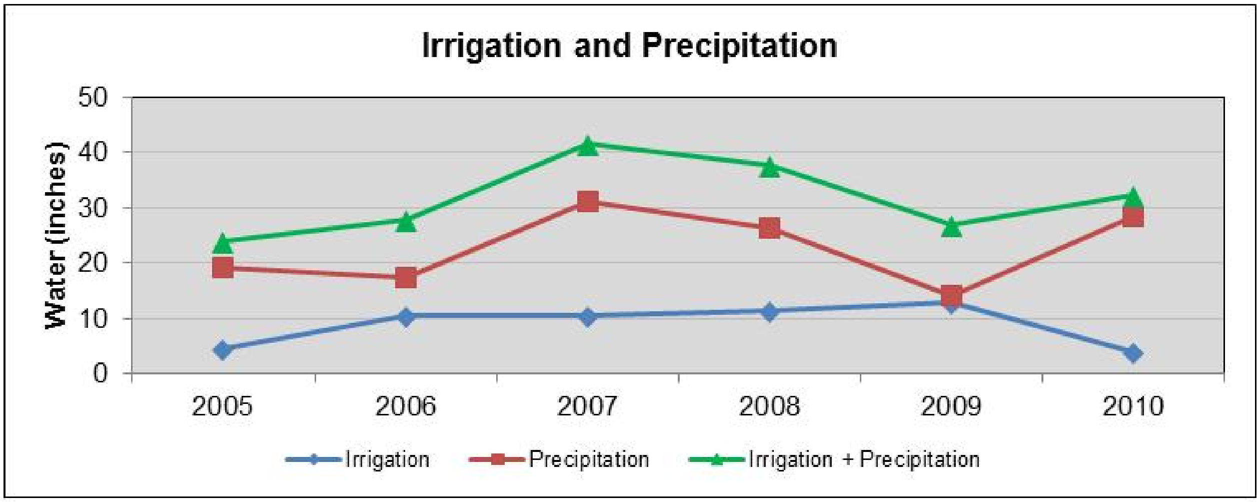
Site 15, Field 8 (August 2010)

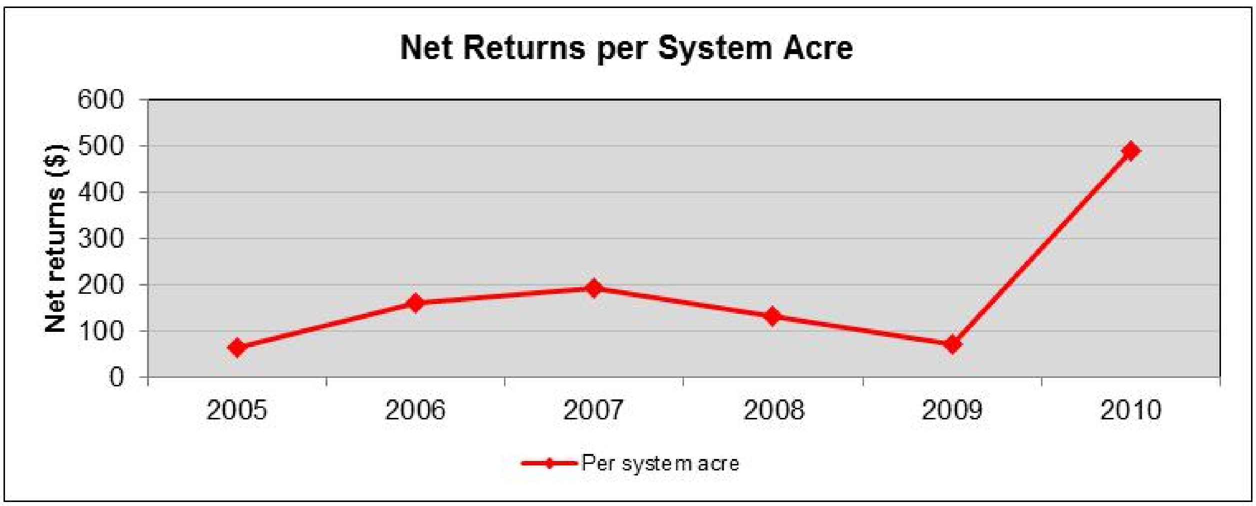
Site 15, Field 9 (June 2010)

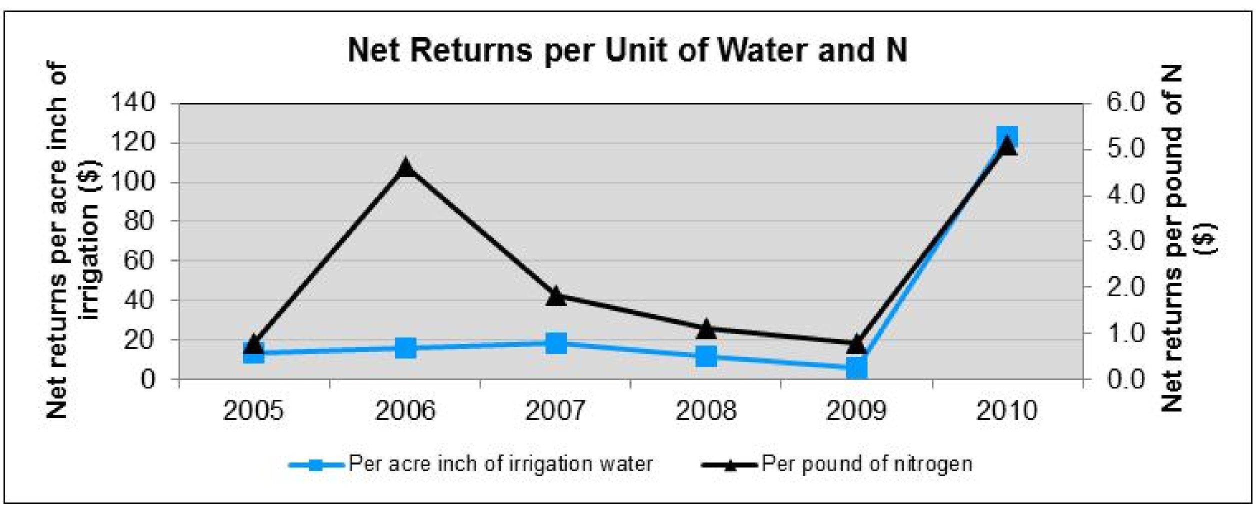
Site 15, Field 9 (July 2010)

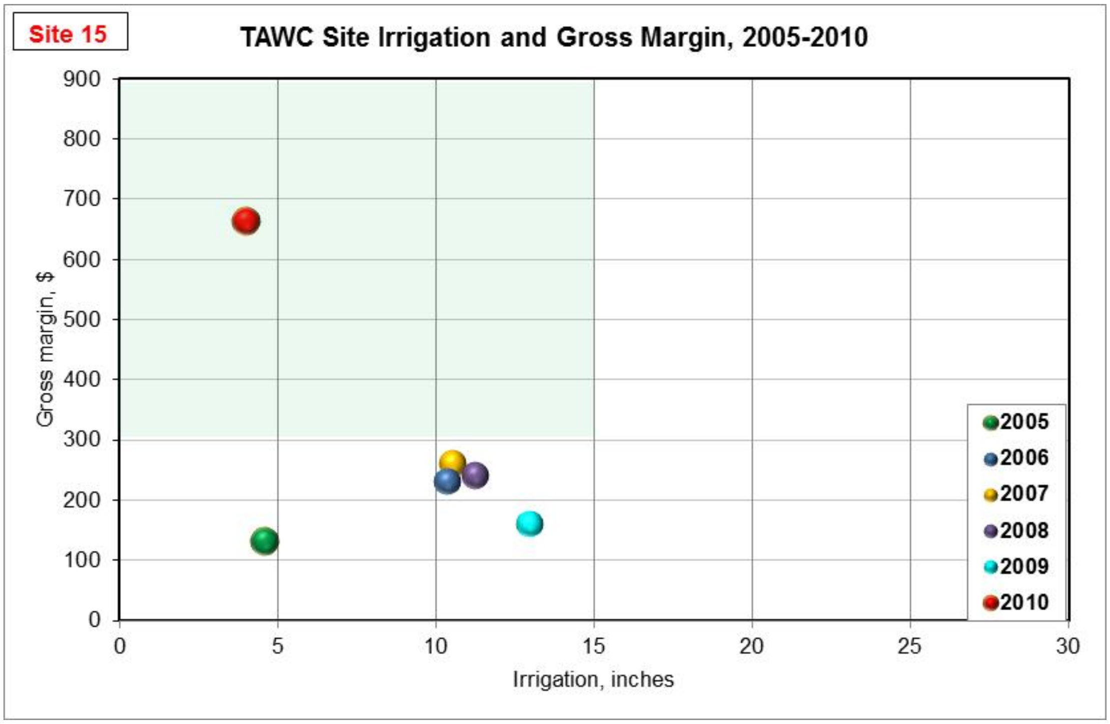
Comments: This has been a cotton, wheat and grain sorghum system in previous years. This year both fields were planted to cotton on forty-inch centers. A portion of this farm is drip irrigated with the balance using furrow irrigation.

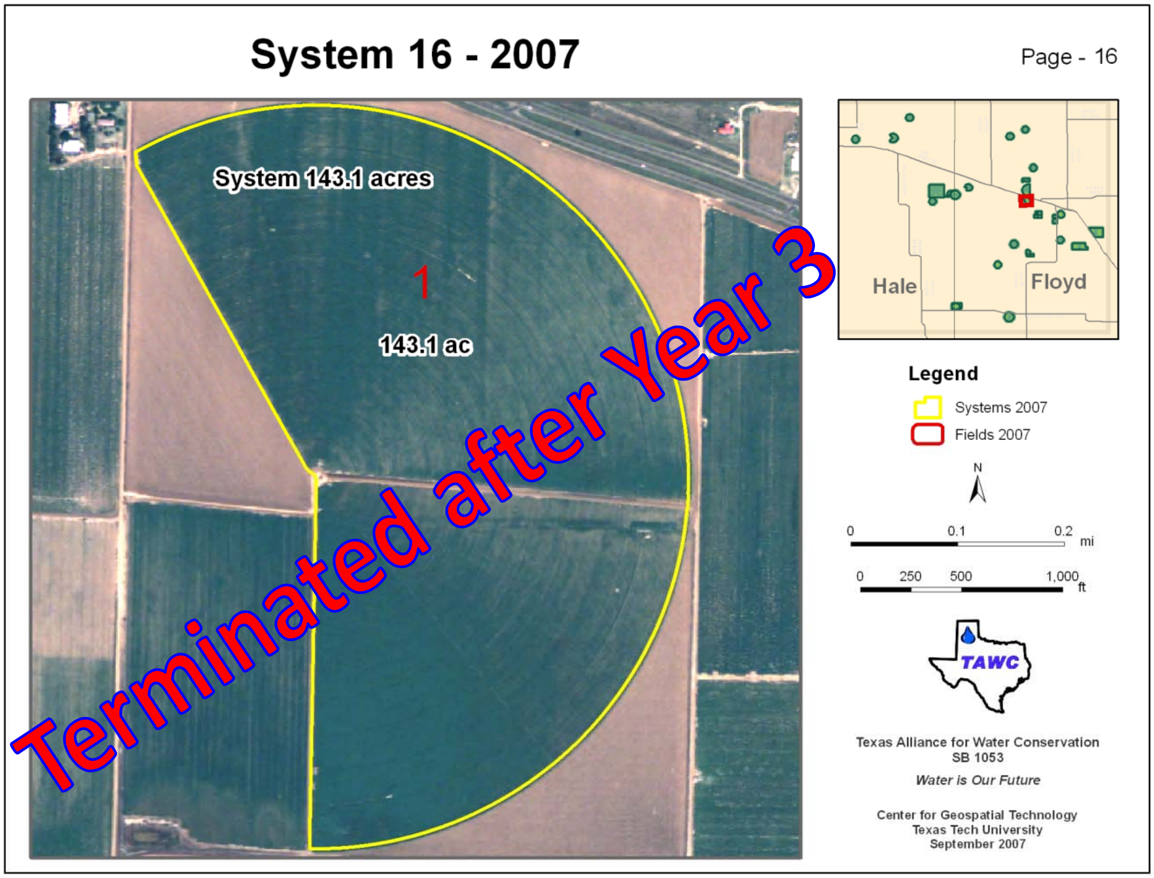
System 15


Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
600
500
400
300
200
100
0
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
140
120
100
80
60
40
20
0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Net returns per pound of N ($)
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 15
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 16 Description

Total system 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

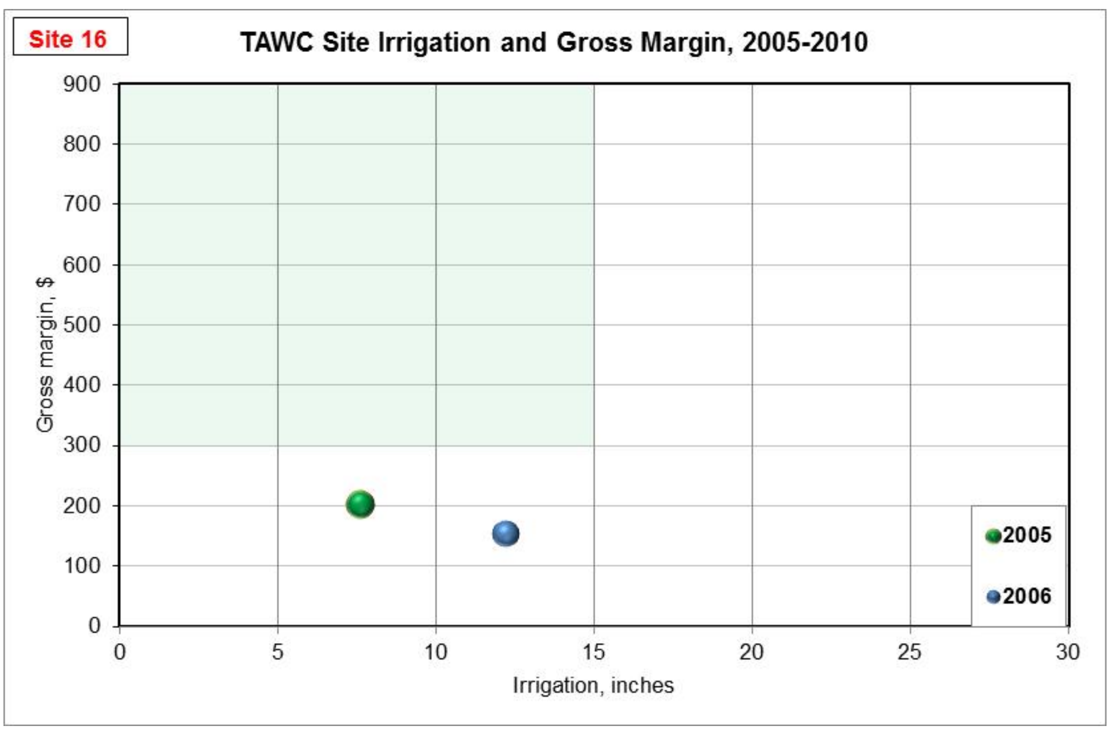
Number of wells: 3

Fuel source: Electric

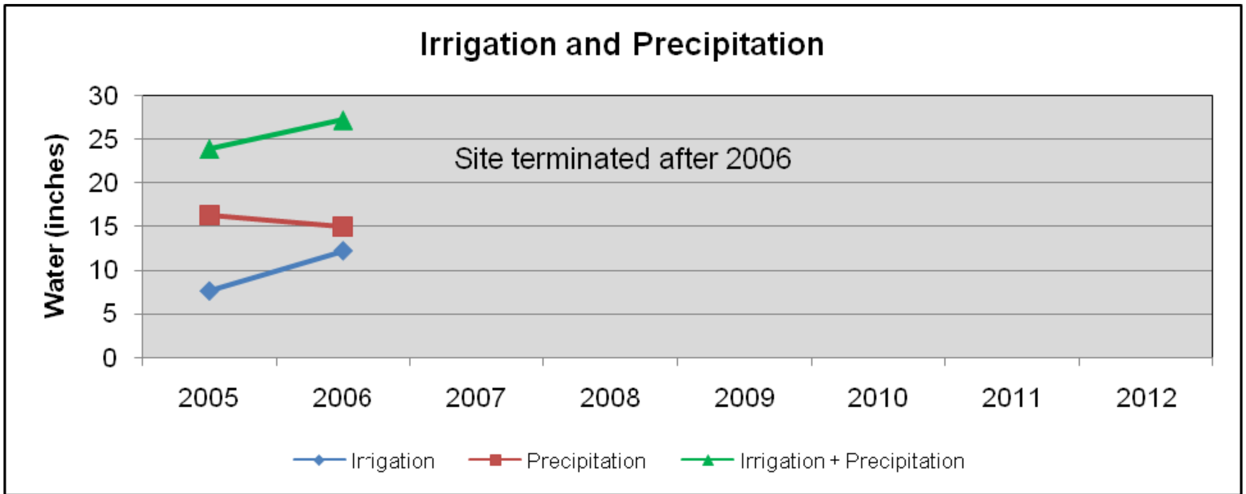
Comments: This pivot irrigated cotton site uses conventional tillage and plants on forty-inch centers.

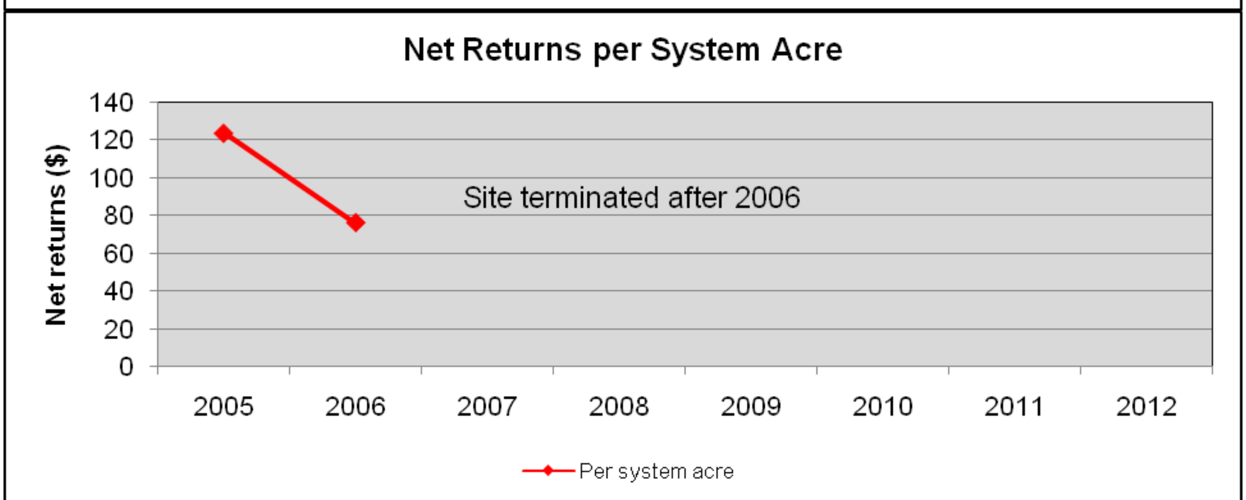
System 16

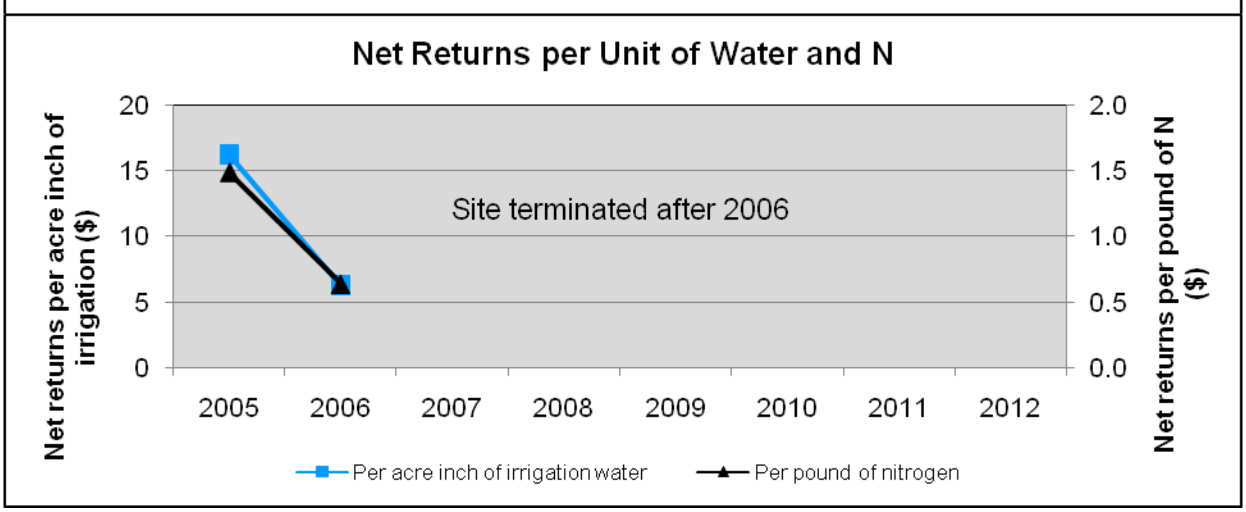
	Livestock	Field 1
2005	None	Cotton
2006	None	Cotton
2007	None	Cotton following Wheat cover crop
2008	Site terminated for 2008	
2009		
2010		

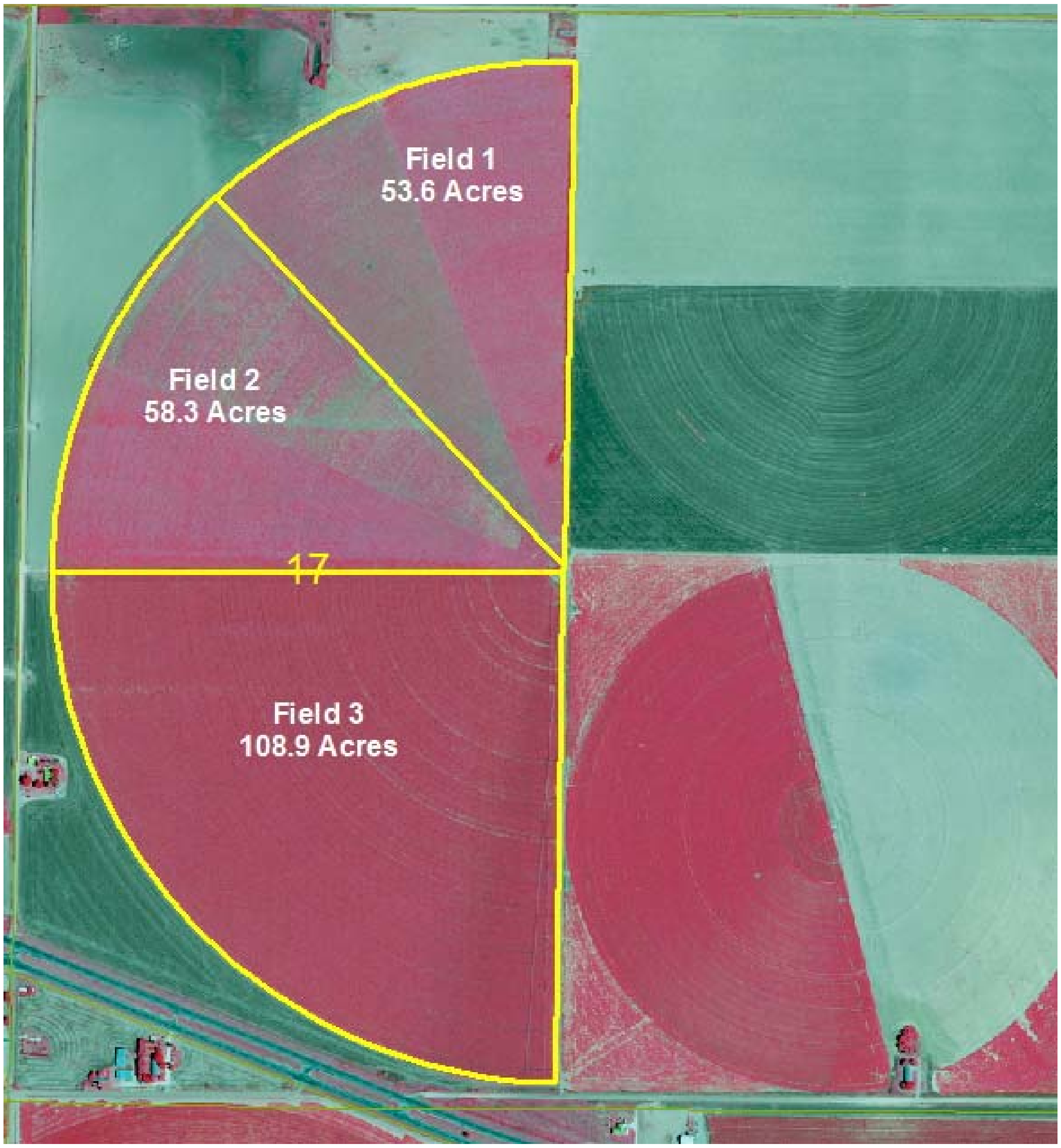


System 16


Irrigation and Precipitation
Water (inches)
30
25
20
15
10
5
0
Site terminated after 2006
2005
2006
2007
2008
2009
2010
2011
2012
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
140
120
100
80
60
40
20
0
Site terminated after 2006
2005
2006
2007
2008
2009
2010
2011
2012
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
20
15
10
5
0
Site terminated after 2006
2.0
1.5
1.0
0.5
0.0
Net returns per pound of N ($)
2005
2006
2007
2008
2009
2010
2011
2012
Per acre inch of irrigation water
Per pound of nitrogen



System 17 Description

Total system acres: 220.8

Field No. 1 Acres: 53.6
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2 Acres: 58.3
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3 Acres: 108.9
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (MESA)

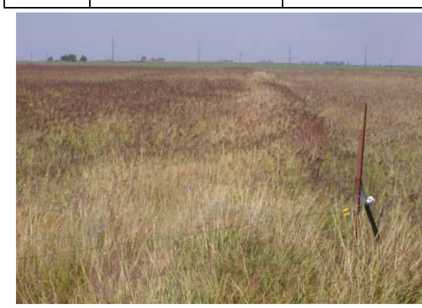
Pumping capacity, gal/min: 900

Number of wells: 8

Fuel source: Electric

System 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 and seed	WW-B. Dahl for grazing	Corn



Site 17, Field 2 (September 2010)

Site 17, Field 1 (May 2010)

Site 17, Field 1 (October 2010)

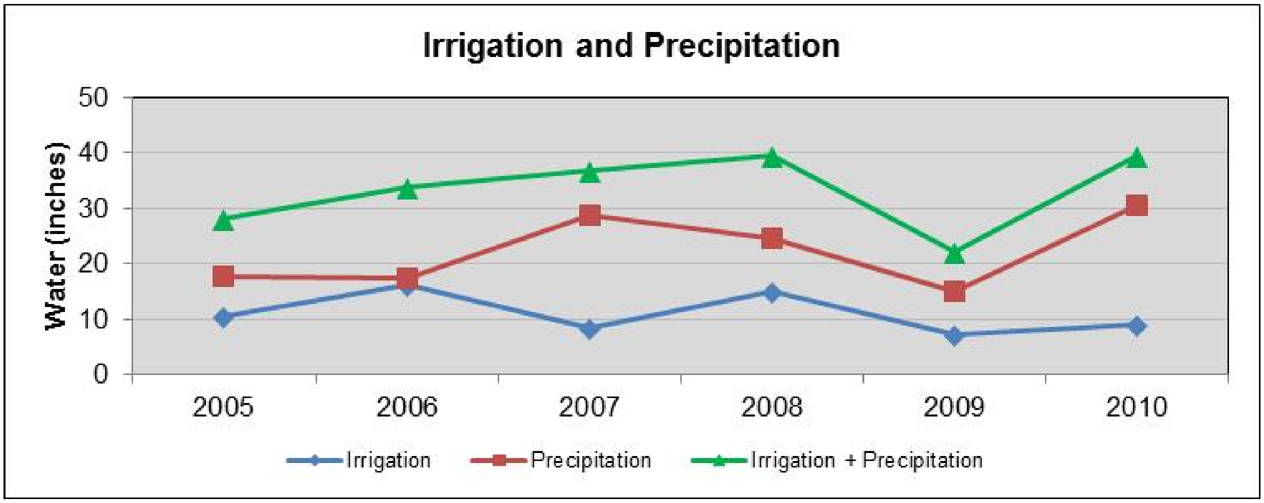
Site 17, Field 3 (May 2010)

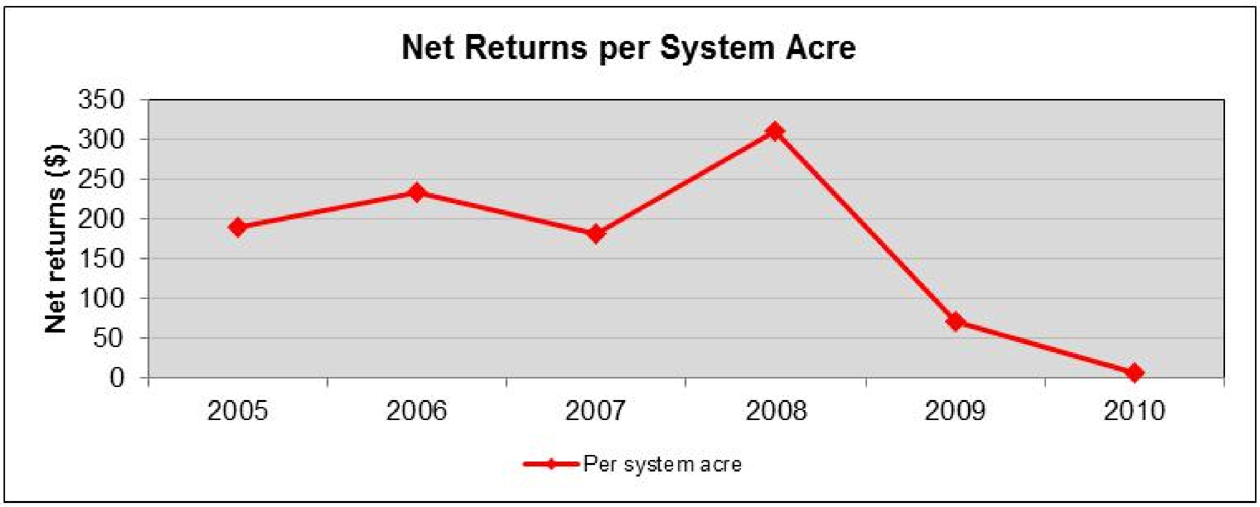
Site 17, Field 3 (June 2010)

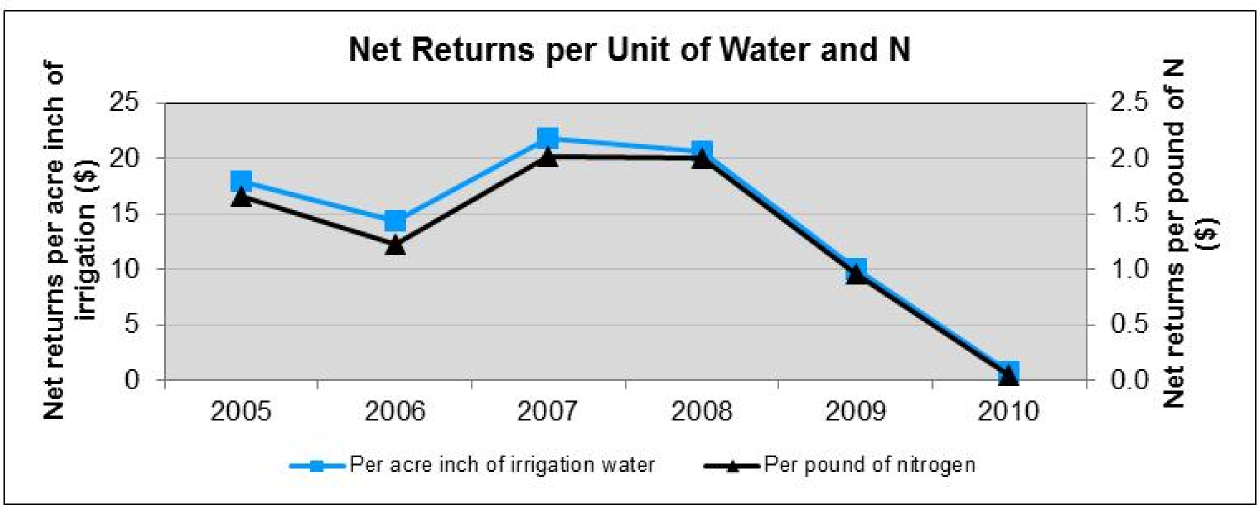
Site 17, Field 3 (November 2010)

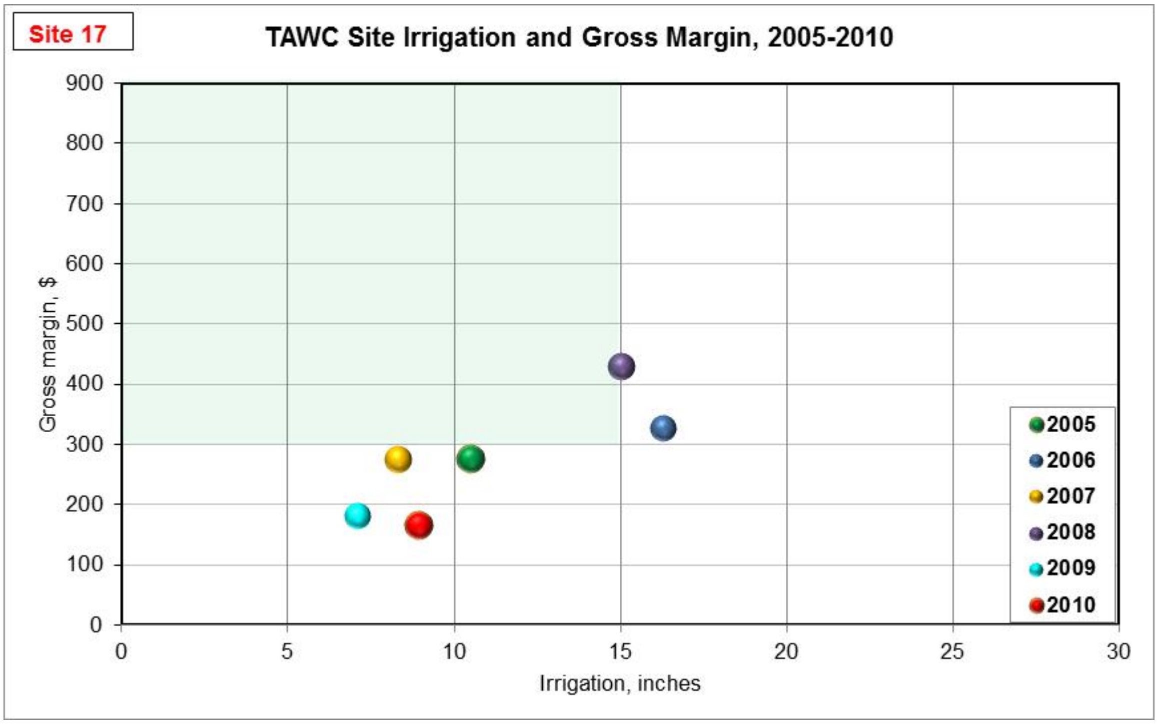
Comments: This pivot irrigated site has grown cotton, corn, sunflowers, and Old-World bluestem. Corn and sunflowers are planted on twenty-inch centers with cotton planted on thirty-inch centers. The Old-World bluestem is used for grazing and/or seed production.

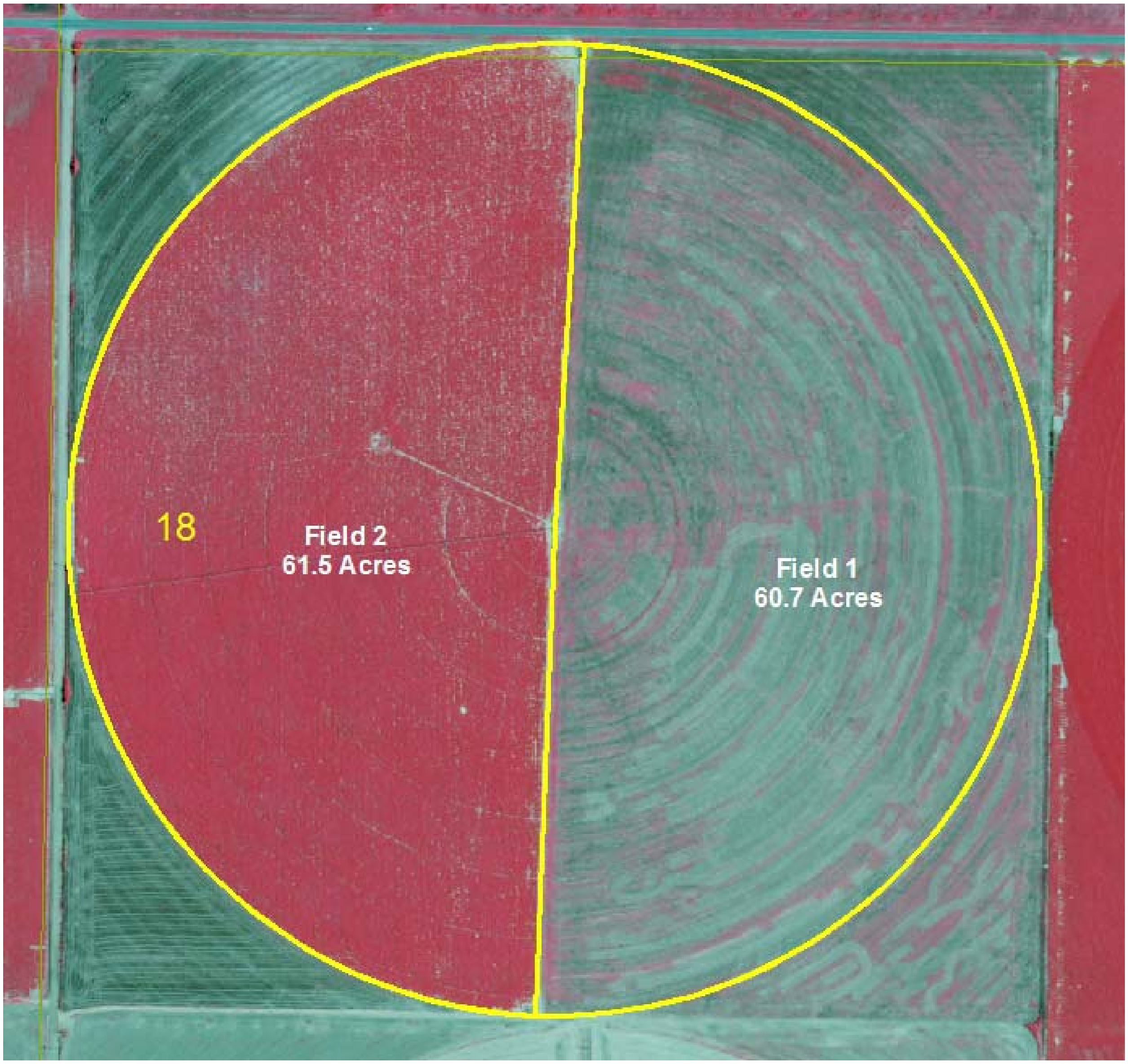
System 17


Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
350
300
250
200
150
100
50
0
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
25
20
15
10
5
0
2.5
2.0
1.5
1.0
0.5
0.0
Net returns per pound of N ($)
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 17
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
Irrigation, inches
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
2005
2006
2007
2008
2009
2010



System 18 Description

Total system 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

System 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


Site 18, Field 1 (May 2010)


Site 18, Field 1 (June 2010)


Site 18, Field 1 (August 2010)

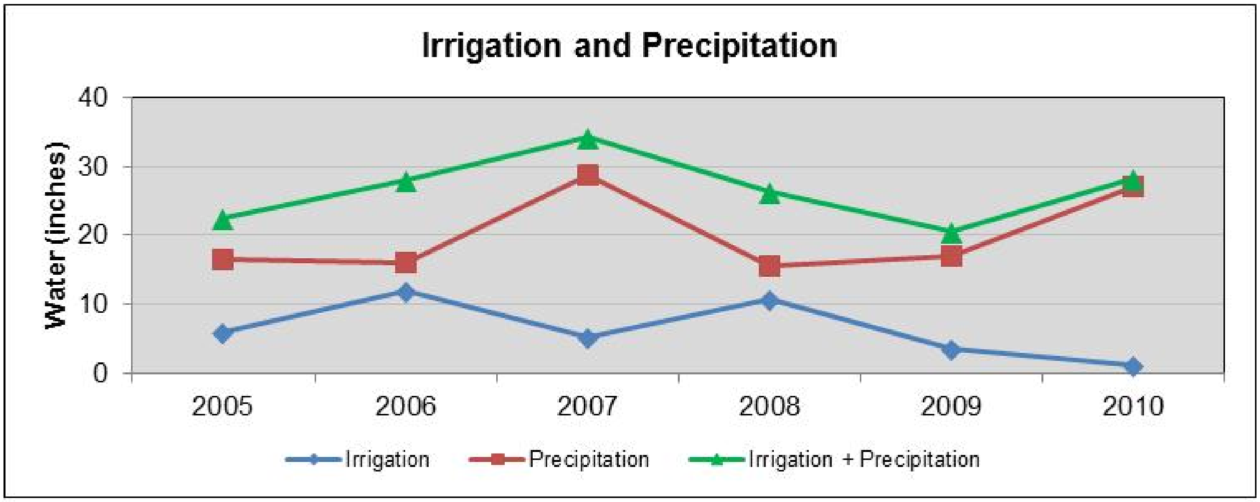

Site 18, Field 2 (May 2010)


Site 18, Field 2 (June 2010)

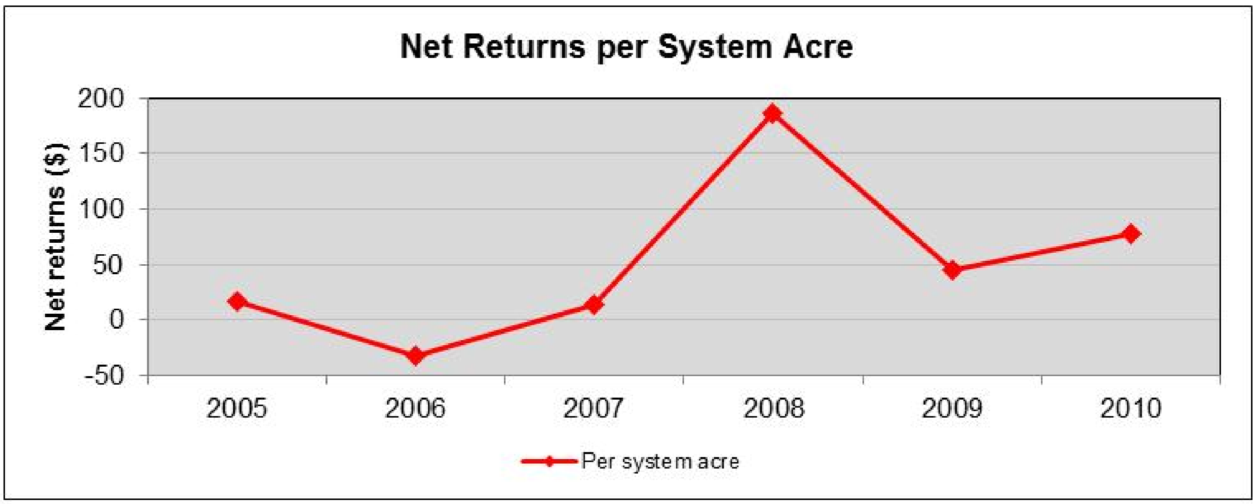

Site 18, Field 2 (August 2010)

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

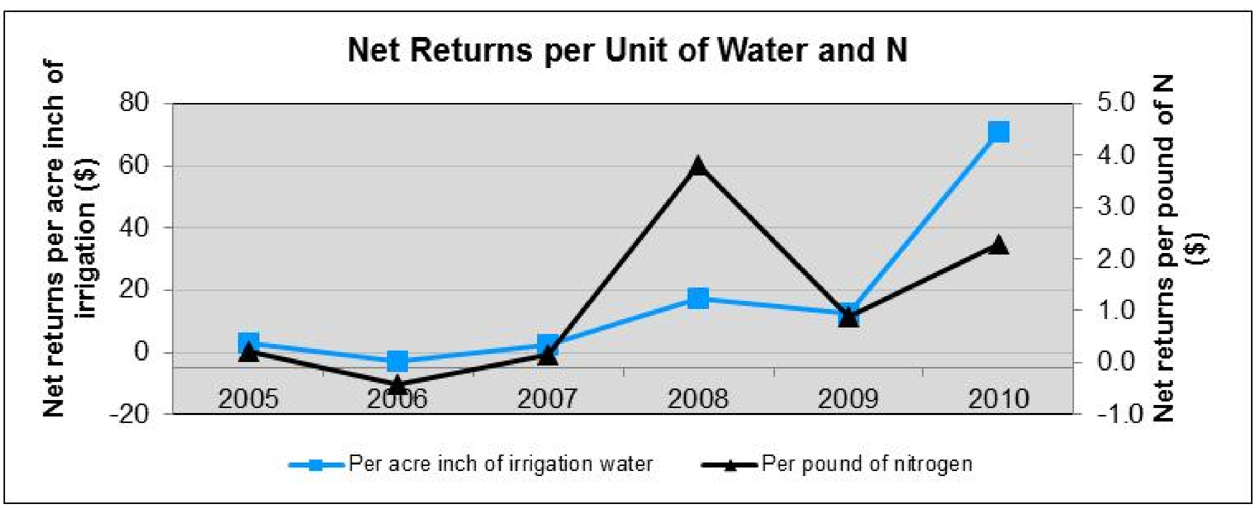
System 18



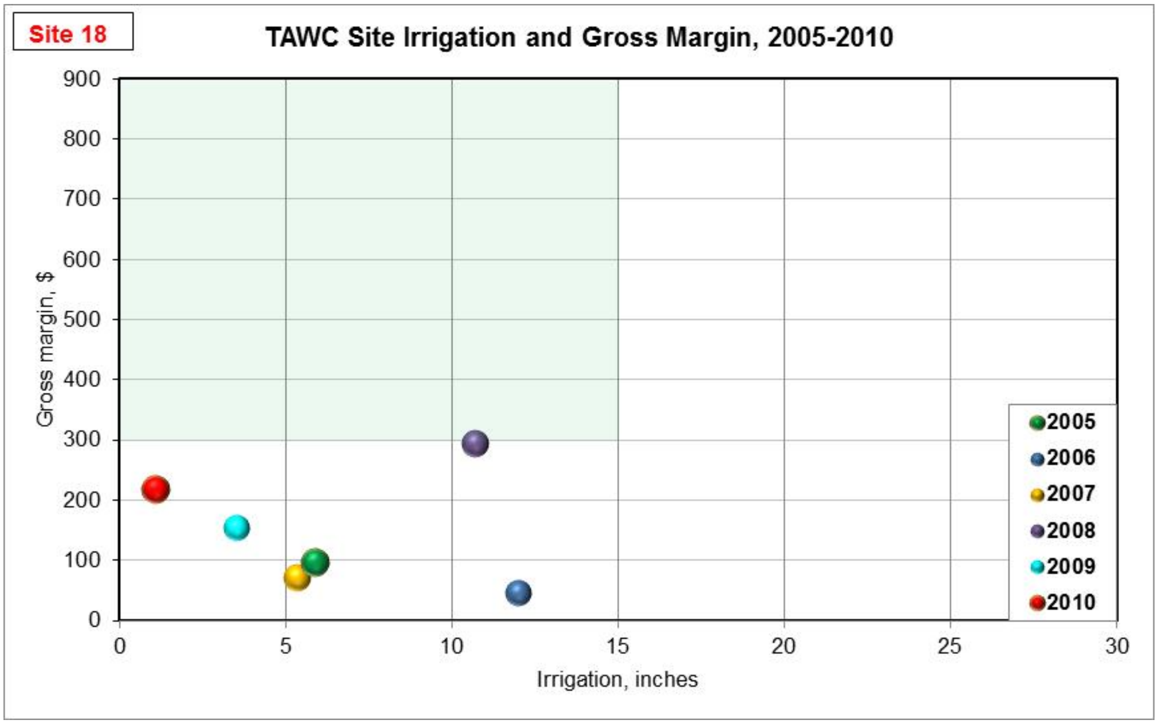
Irrigation and Precipitation
Water (inches)
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation

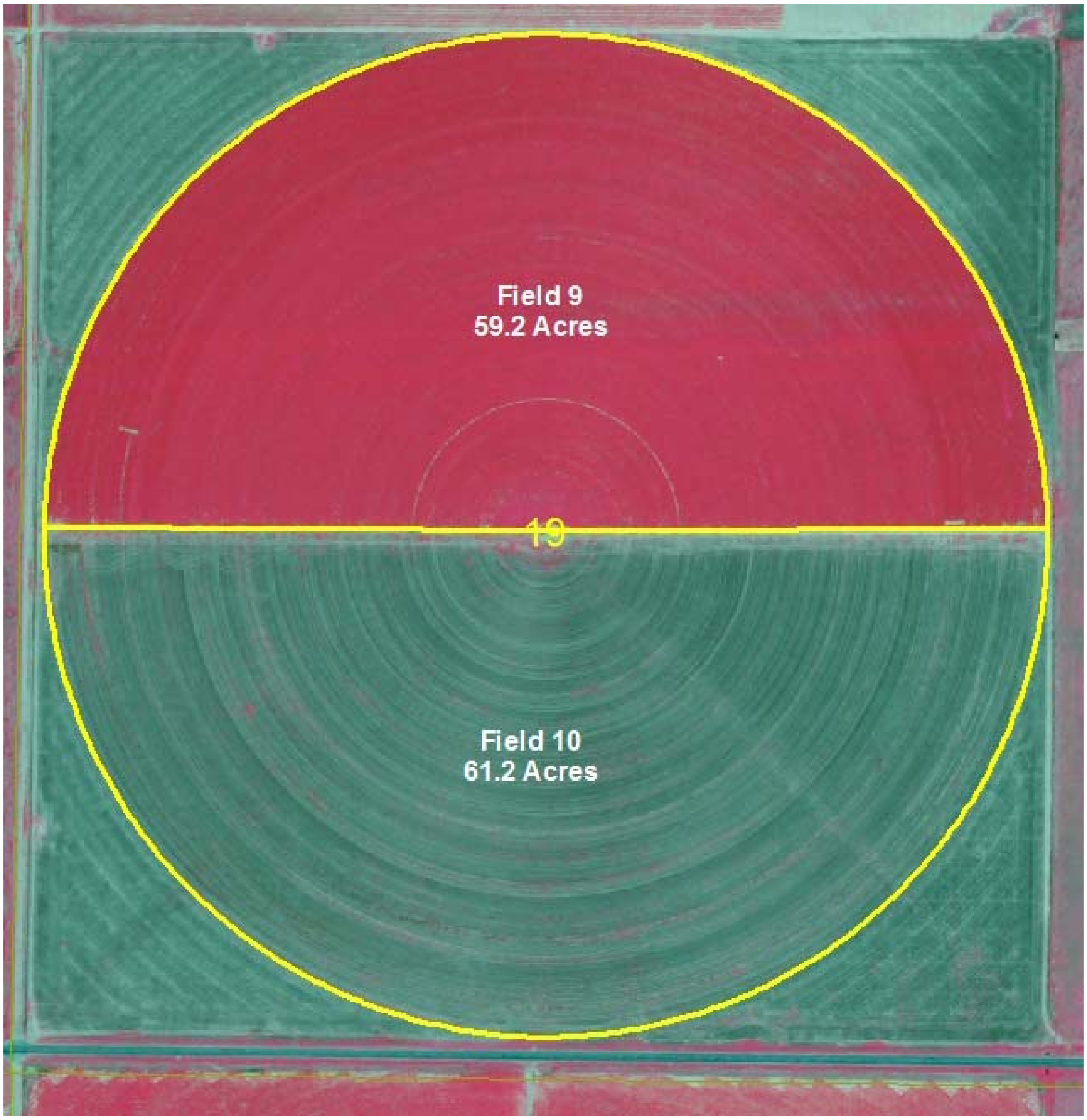


Net Returns per System Acre
Net returns ($)
200
150
100
50
0
-50
2005
2006
2007
2008
2009
2010
Per system acre



Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
80
60
40
20
0
-20
2005
2006
2007
2008
2009
2010
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
Net returns per pound of N ($)
Per acre inch of irrigation water
Per pound of nitrogen


Site 18
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 19 Description

Total system 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

System 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

Site 19, Field 9 (June 2010)

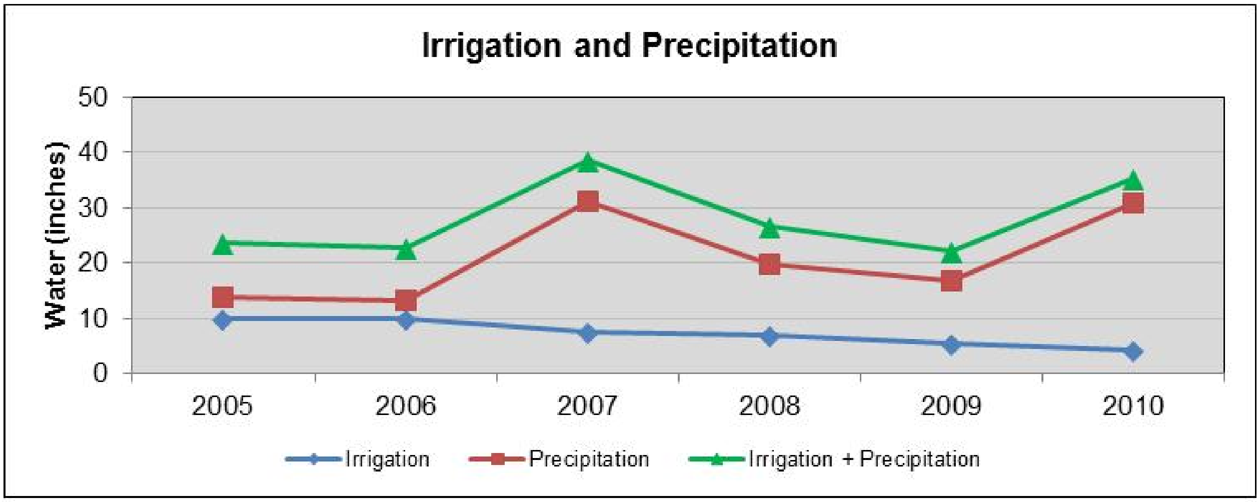
Site 19, Field 9 (August 2010)

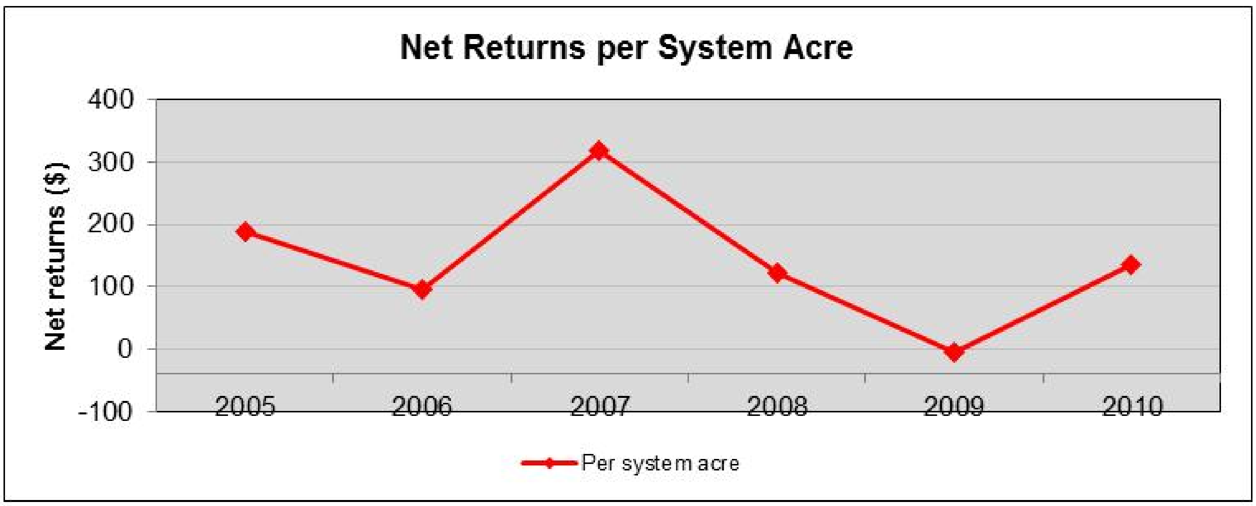
Site 19, Field 10 (April 2010)

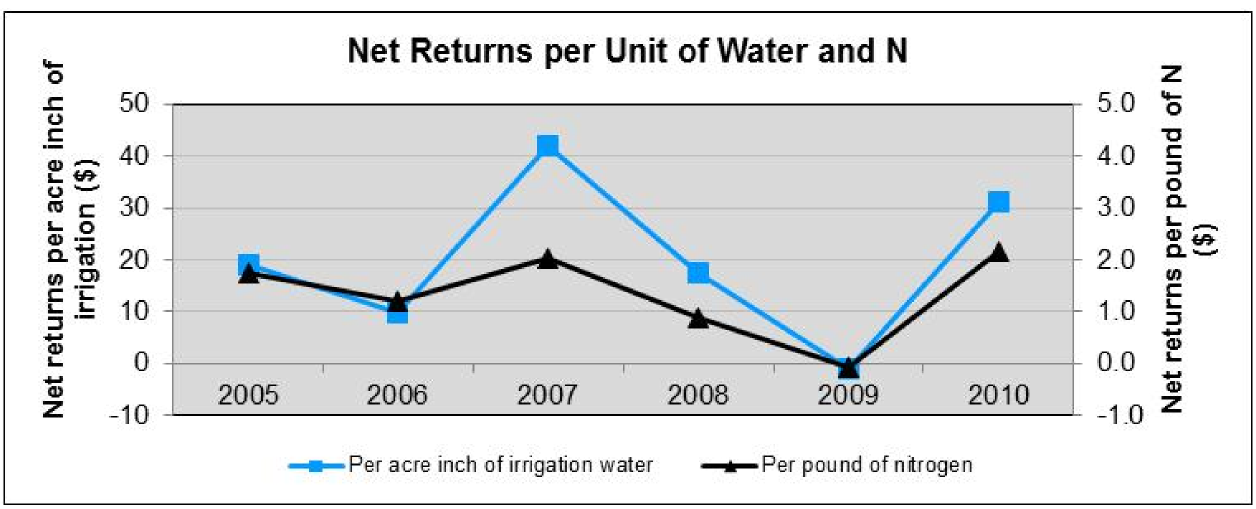
Site 19, Field 10 (June 2010)

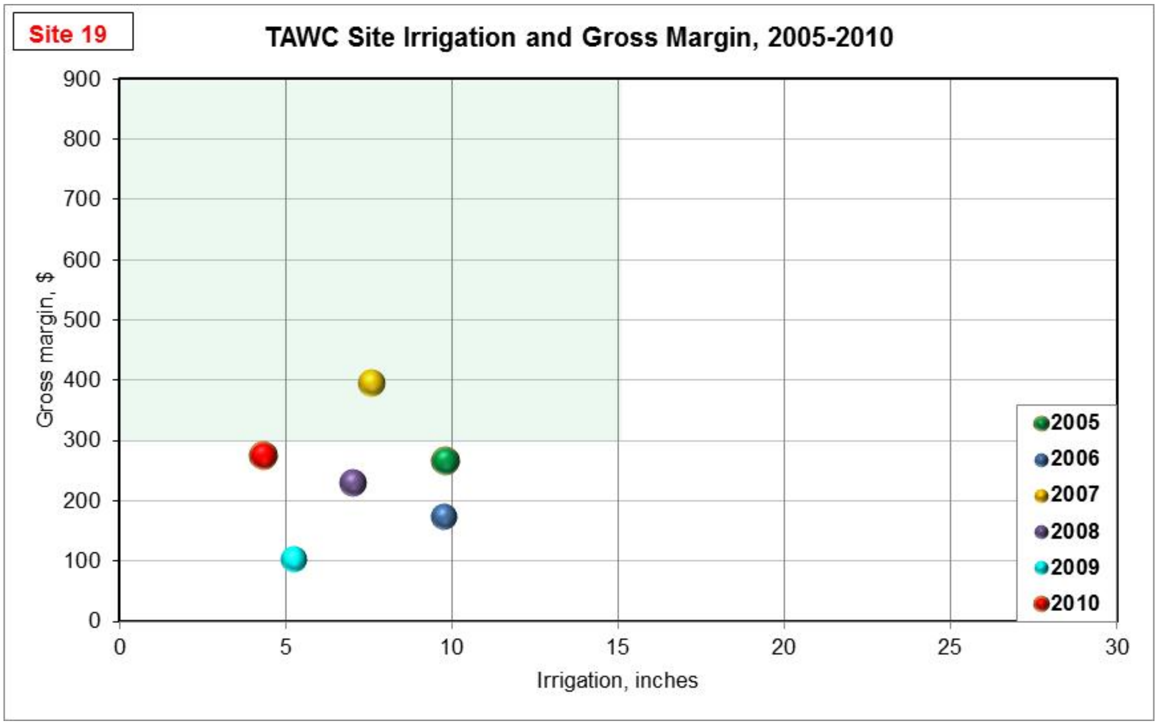
Comments: This is a pivot irrigated cotton and wheat site using conventional tillage. Cotton is planted on forty-inch centers.

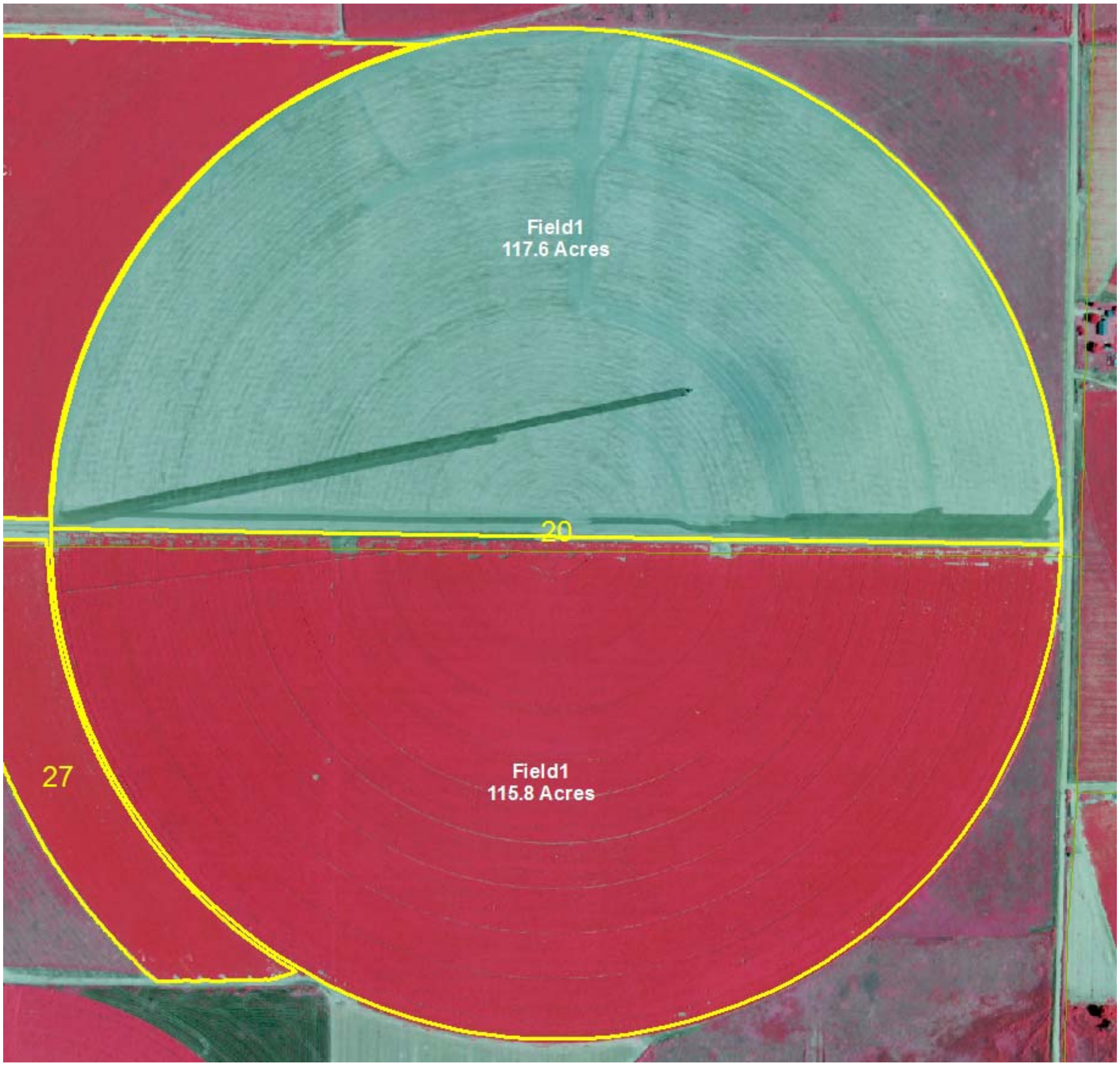
System 19


Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
400
300
200
100
0
-100
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
50
40
30
20
10
0
-10
2005
2006
2007
2008
2009
2010
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
Net returns per pound of N ($)
Per acre inch of irrigation water
Per pound of nitrogen


Site 19
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 20 Description

Total system acres: 233.4

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

Field No. 2 Acres: 115.8
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

System 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


Site 20, Field 1 (April 2010)


Site 20, Field 1 (June 2010)


Site 20, Field 1 (September 2010)

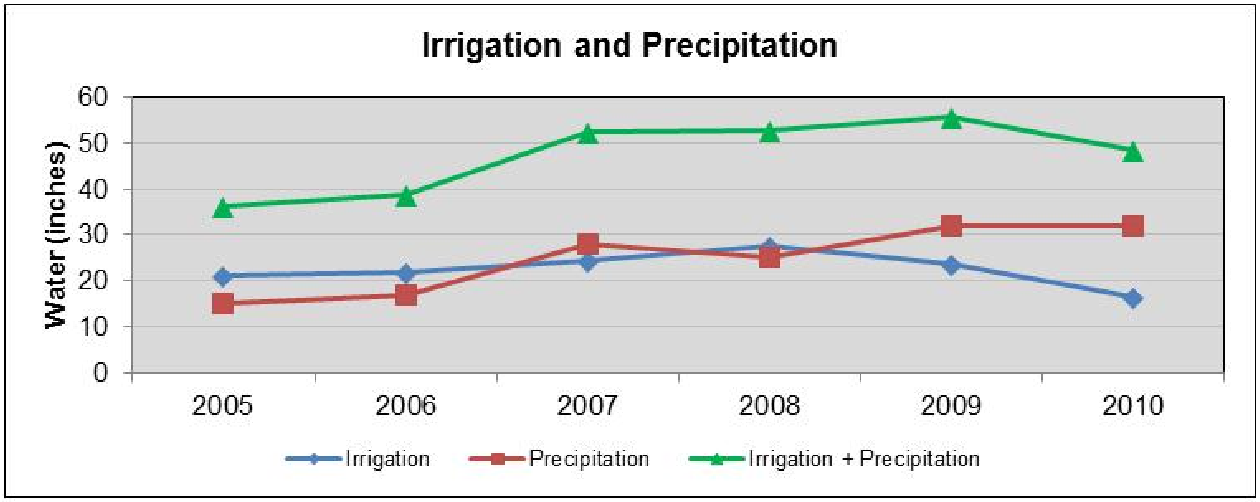

Site 20, Field 2 (May 2010)

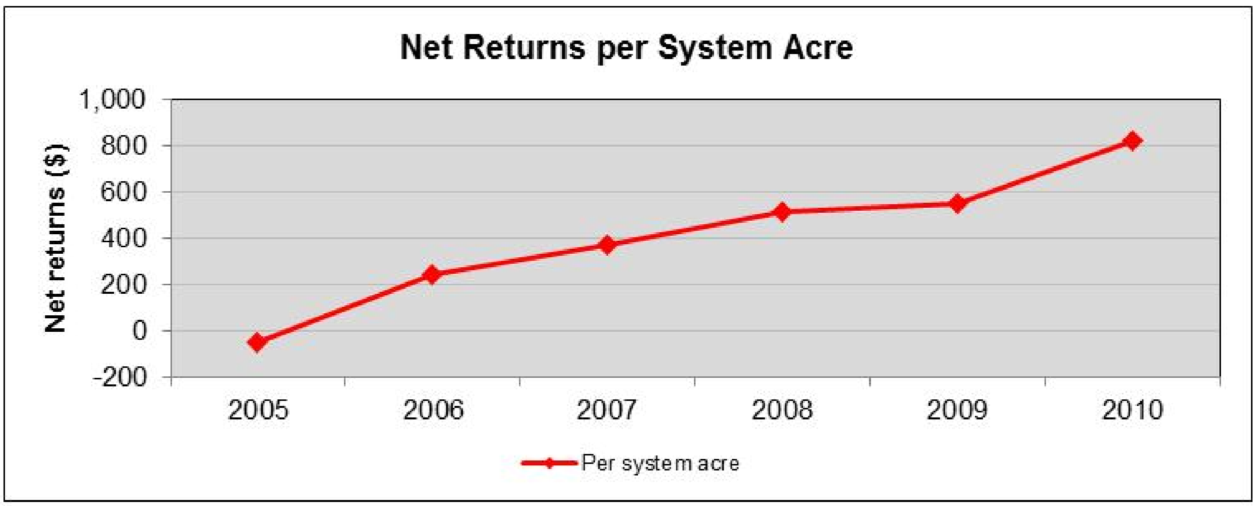

Site 20, Field 2 (June 2010)

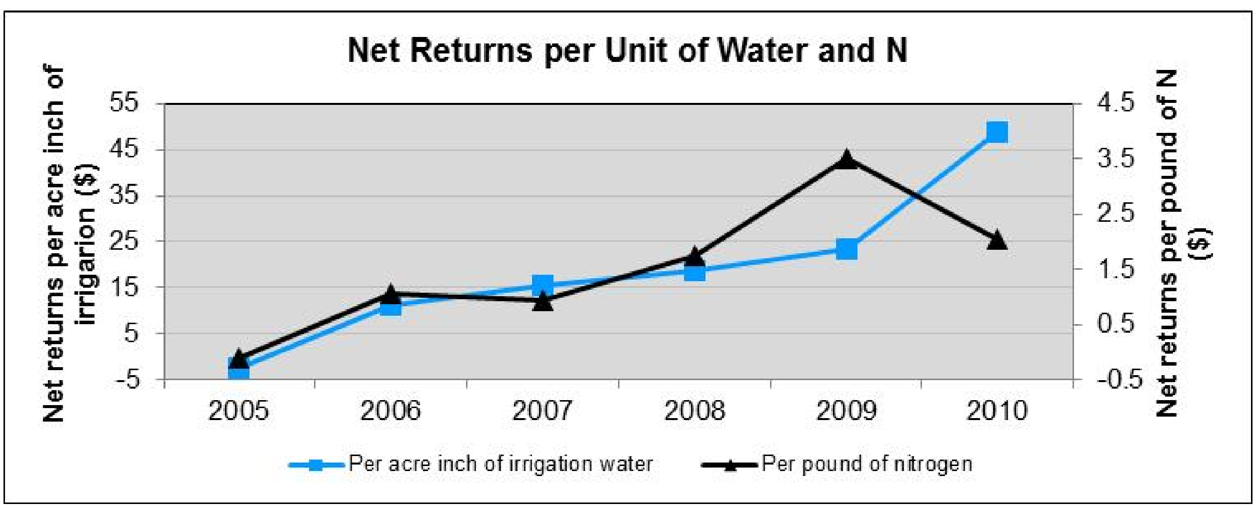

Site 20, Field 2 (November 2010)

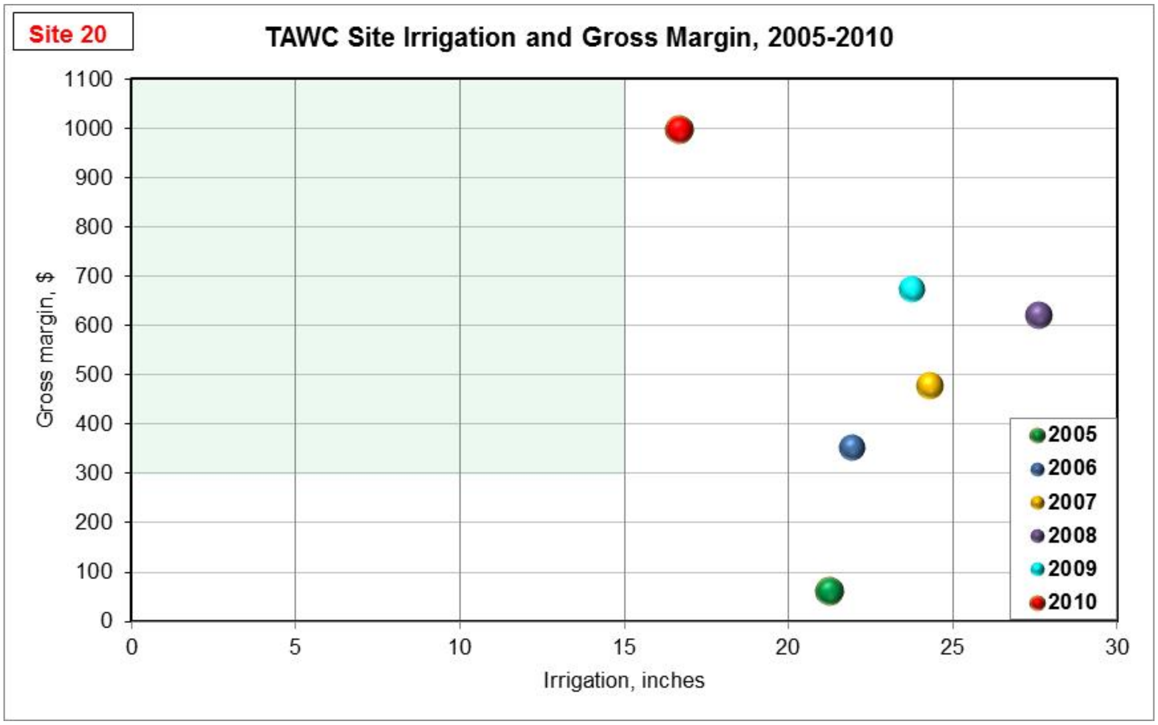
Comments: This site was planted to corn and triticale for silage. After triticale harvest cotton was planted no-till on forty-inch centers and corn was planted on forty-inch centers.

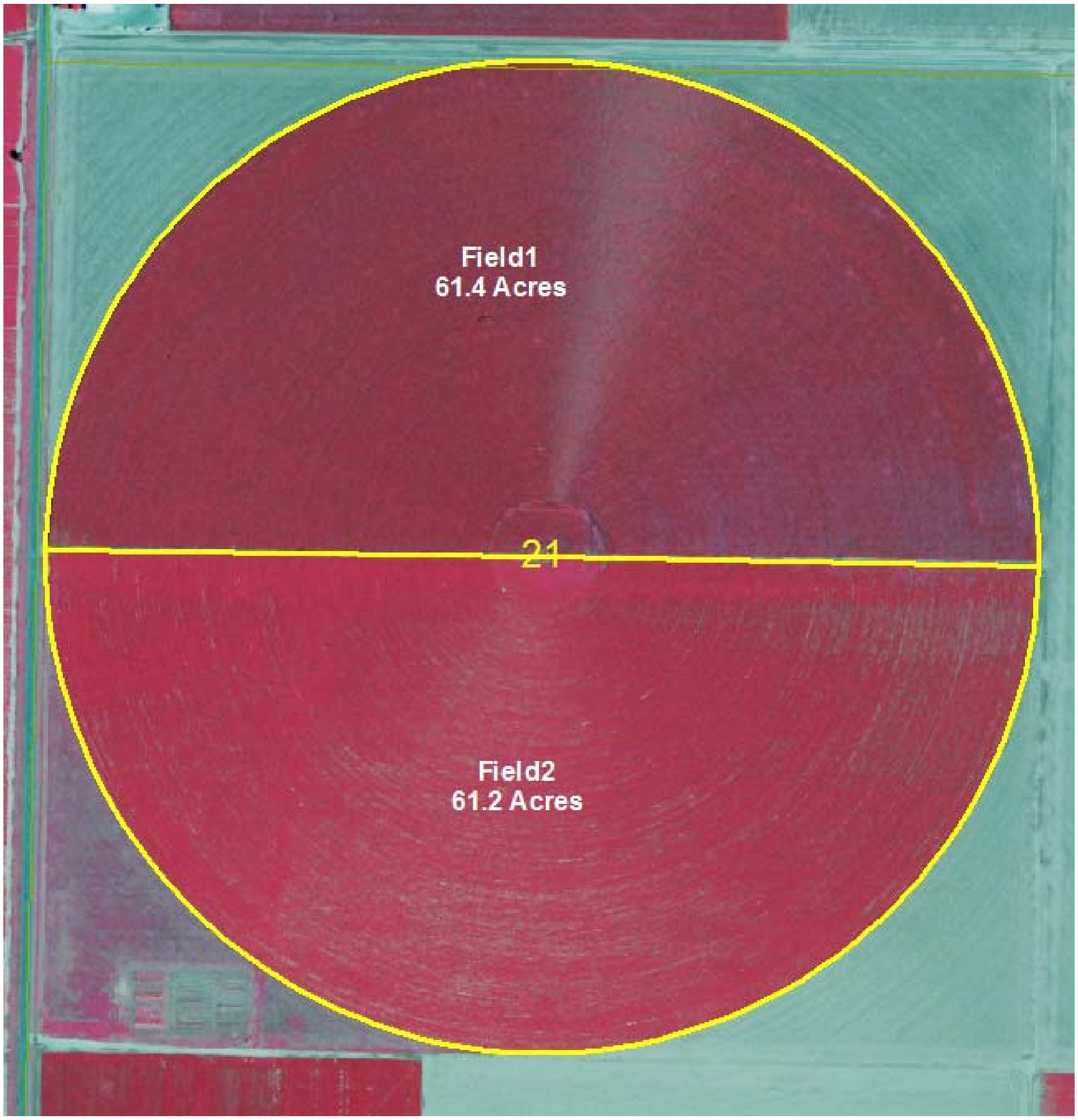
System 20


Irrigation and Precipitation
Water (inches)
60
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
1,000
800
600
400
200
0
-200
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigarion ($)
55
45
35
25
15
5
-5
4.5
3.5
2.5
1.5
0.5
-0.5
Net returns per pound of N ($)
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 20
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
1100
1000
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 21 Description

Total system 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

System 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


Site 21, Field 1 (May 2010)


Site 21, Field 1 (August 2010)


Site 21, Field 1 (September 2010)

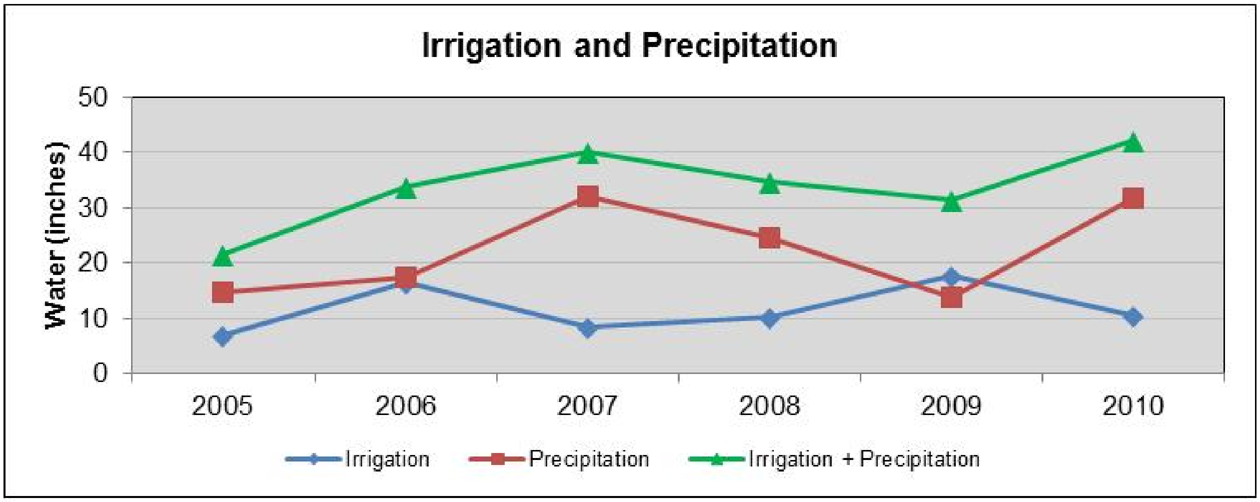

Site 21, Field 2 (May 2010)

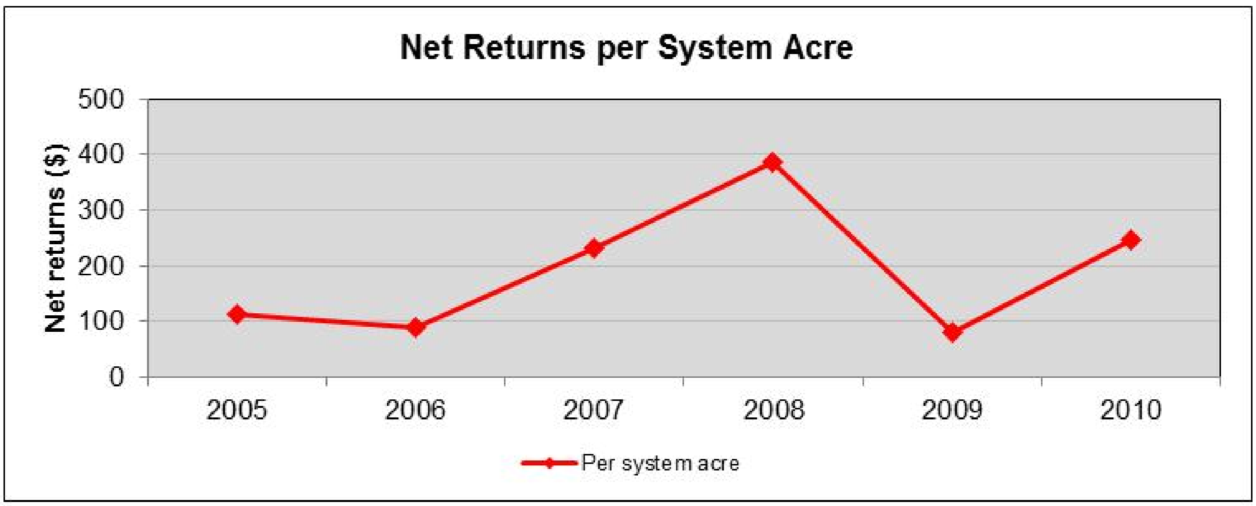

Site 21, Field 2 (August 2010)

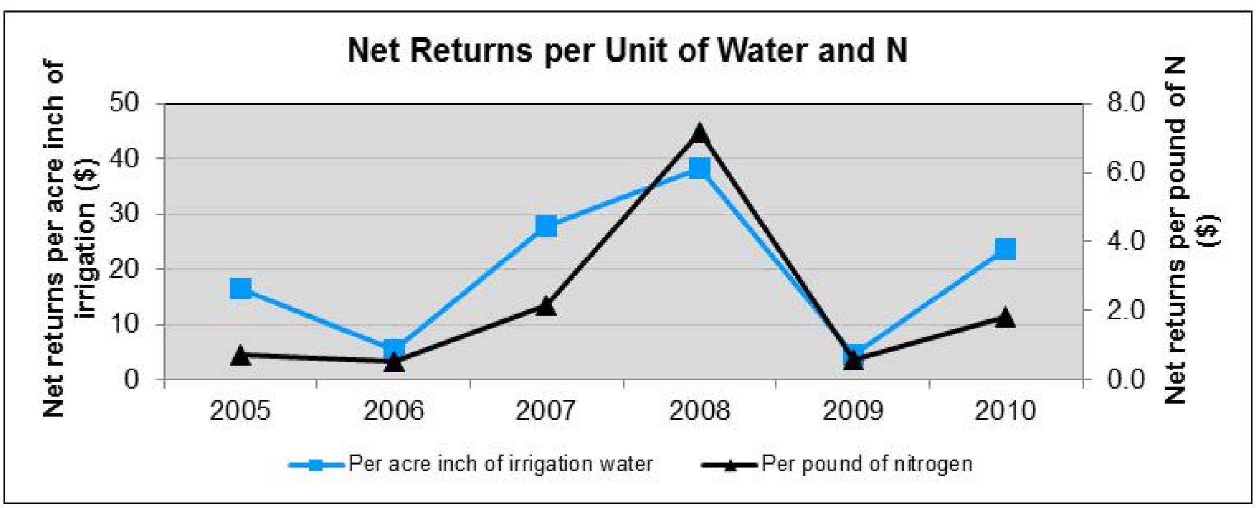

Site 21, Field 2 (September 2010)

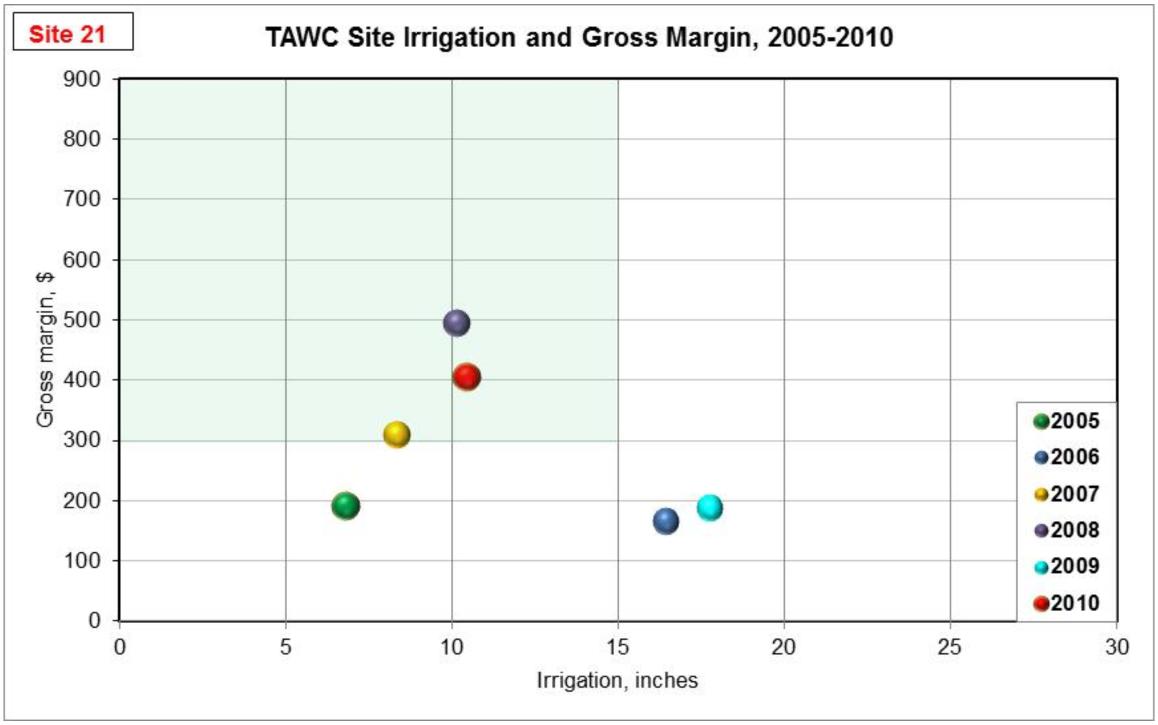
Comments: This is a pivot irrigated site with one-half planted to white food corn and one-half planted to cotton. Both crops are planted on forty-inch centers using conventional tillage.

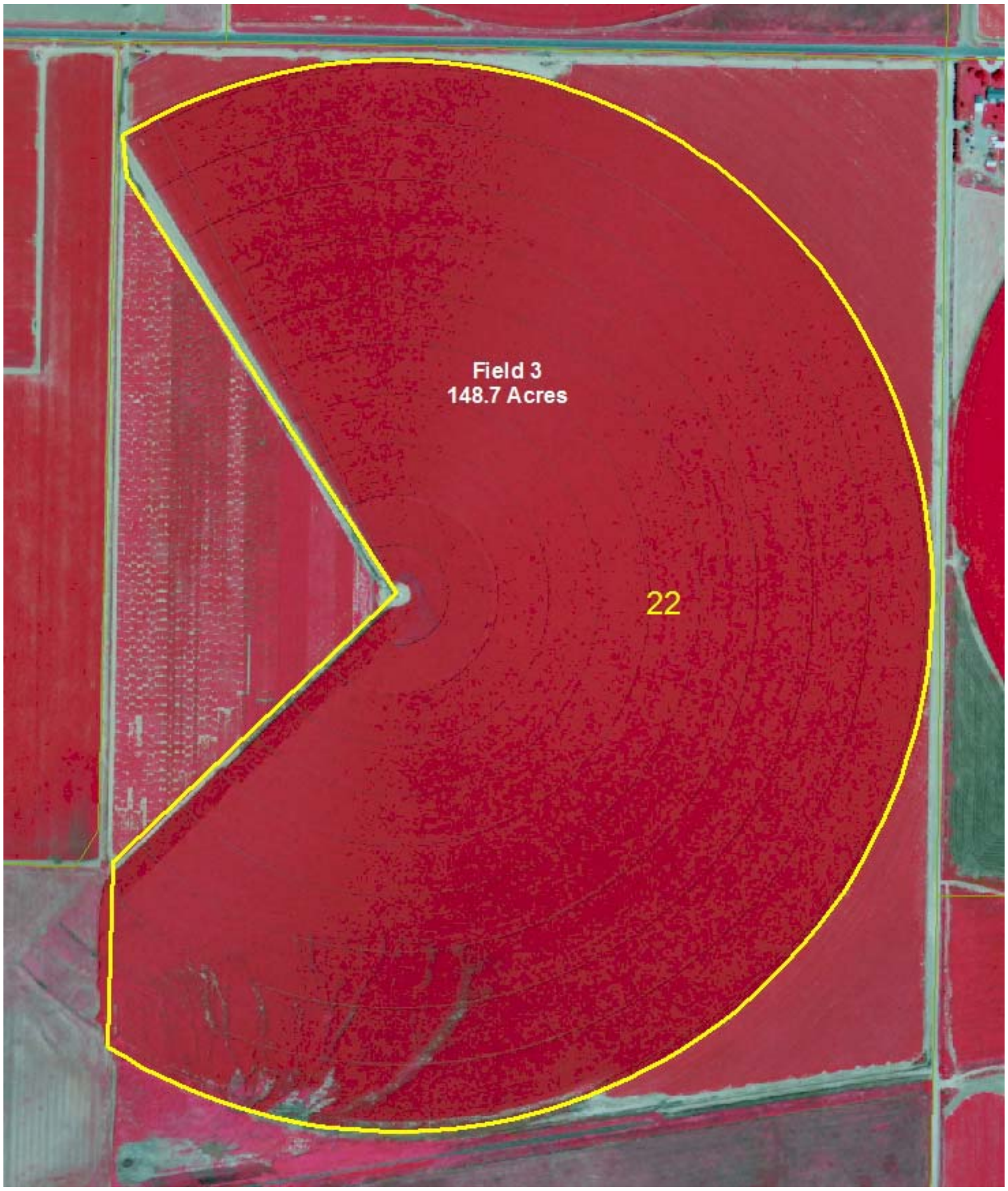
System 21


Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
500
400
300
200
100
0
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
Net returns per pound of N ($)
50
40
30
20
10
0
8.0
6.0
4.0
2.0
0.0
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 21
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 22 Description

Total system 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

System 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


Site 22, Field 2 (June 2010)

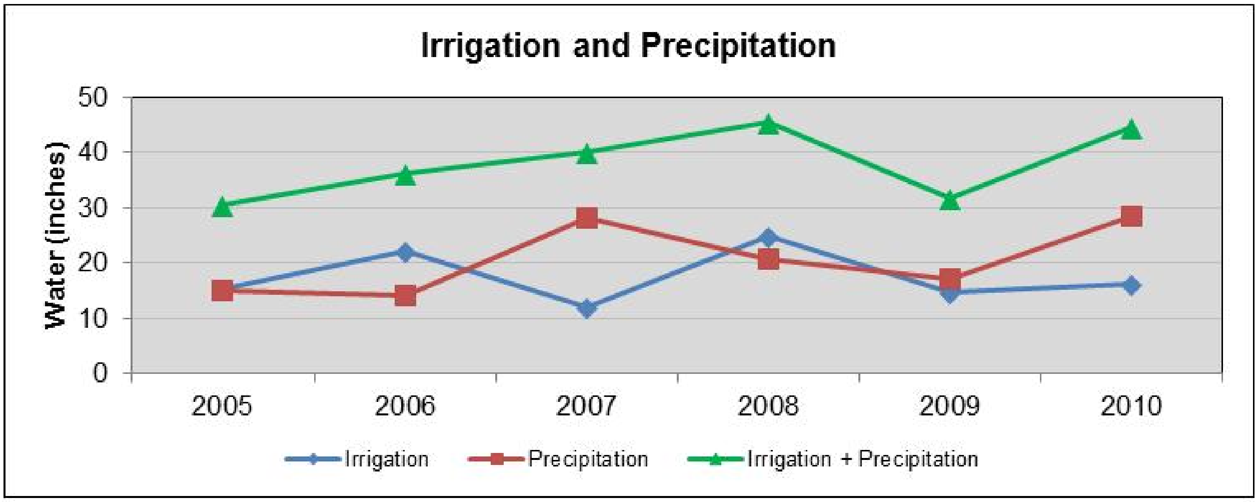

Site 22, Field 3 (June 2010)

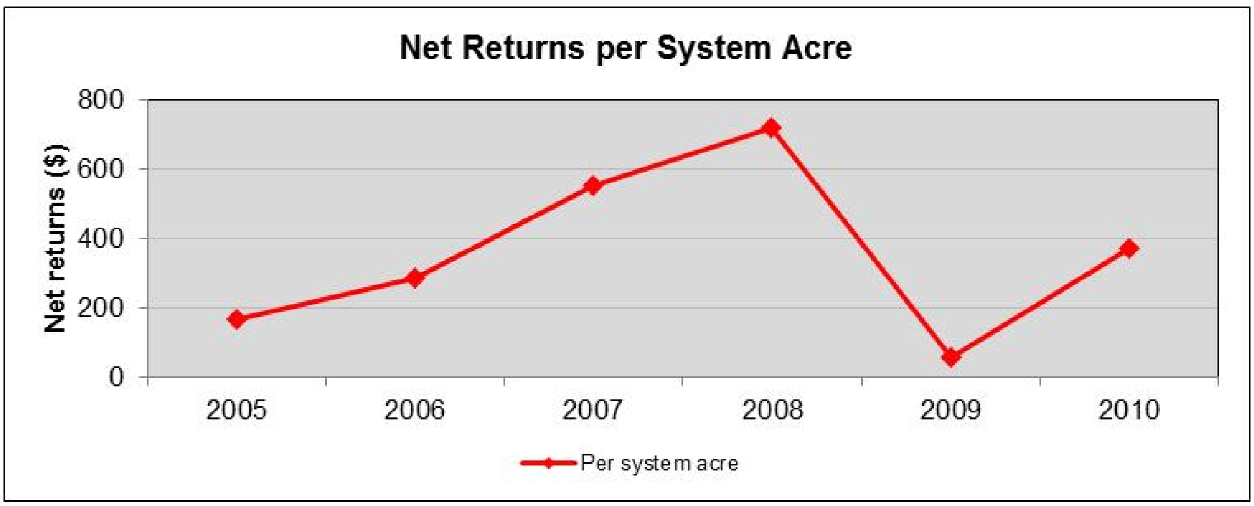

Site 22, Field 3 (July 2010)

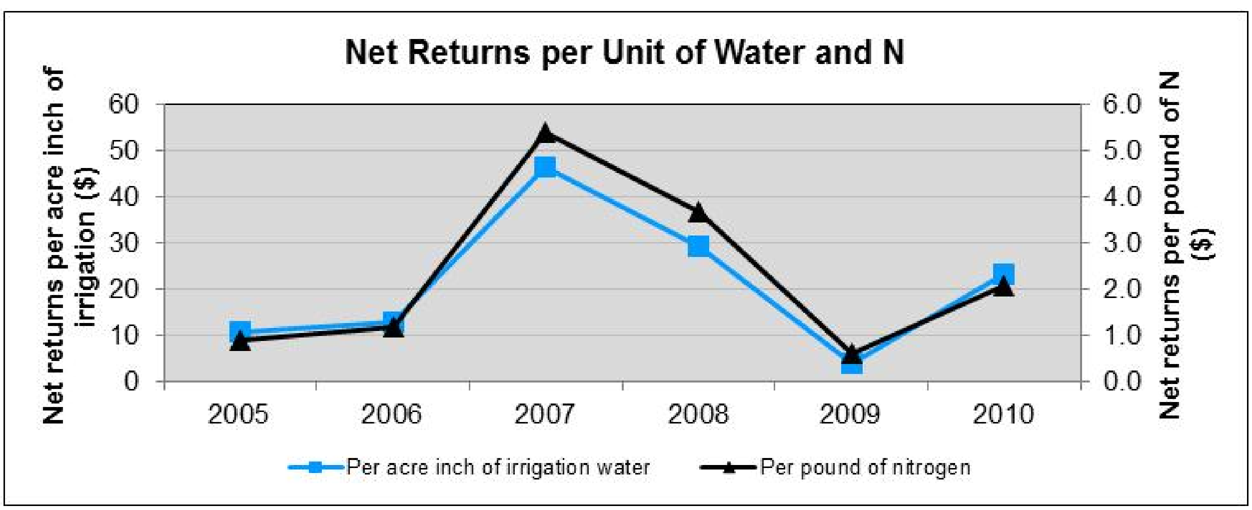

Site 22, Field 3 (August 2010)

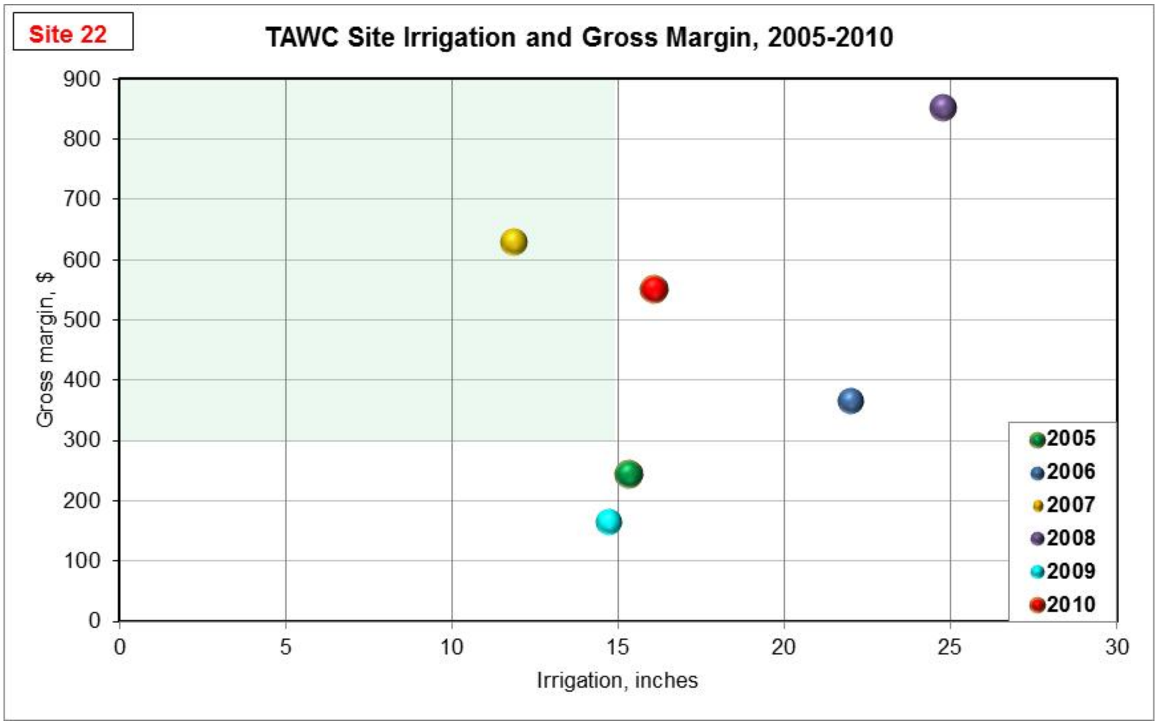
Comments: This is a pivot irrigated corn and cotton system. In 2010 both fields were planted to corn on thirty-inch centers.

System 22


Irrigation and Precipitation
Water (inches)
0
10
20
30
40
50
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
0
200
400
600
800
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
0
10
20
30
40
50
60
Net returns per pound of N ($)
0.0
1.0
2.0
3.0
4.0
5.0
6.0
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 22
TAWC Site Irrigation and Gross Margin, 2005-2010
900
800
700
600
500
400
300
200
100
0
Gross margin, $
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010

System 23 Description

Total system acres: 121.2

Field No. 6 Acres: 121.2
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: Natural gas

System 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

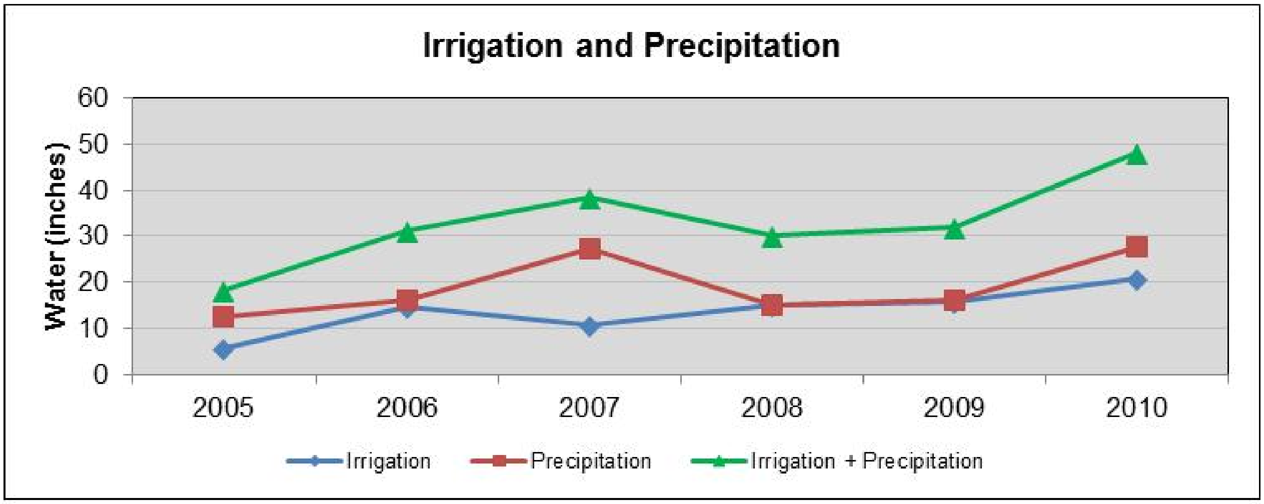

Site 23, Field 6 (March 2010)

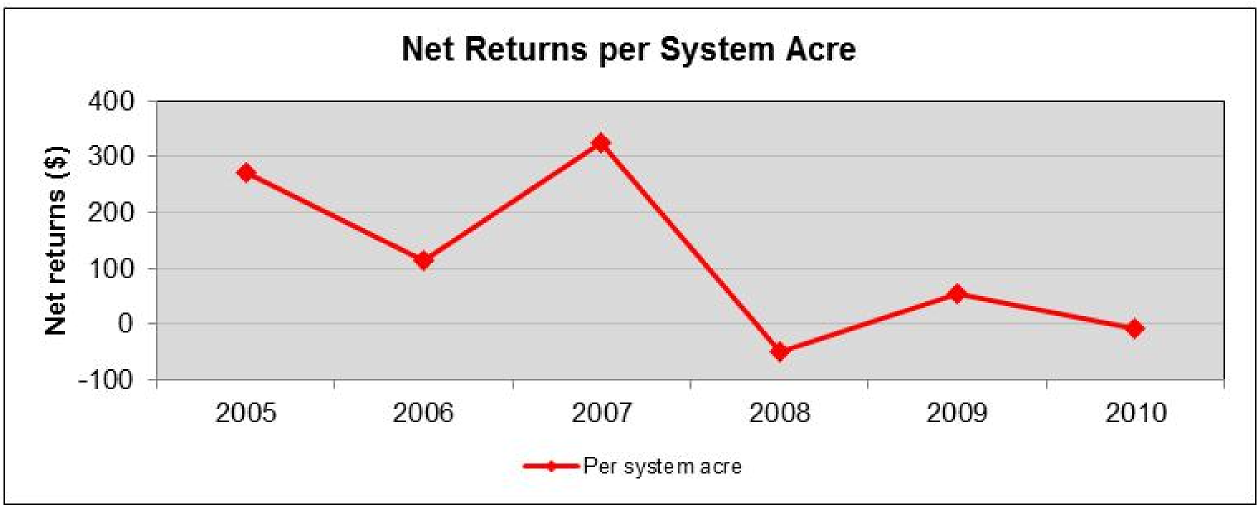

Site 23, Field 6 (June 2010)

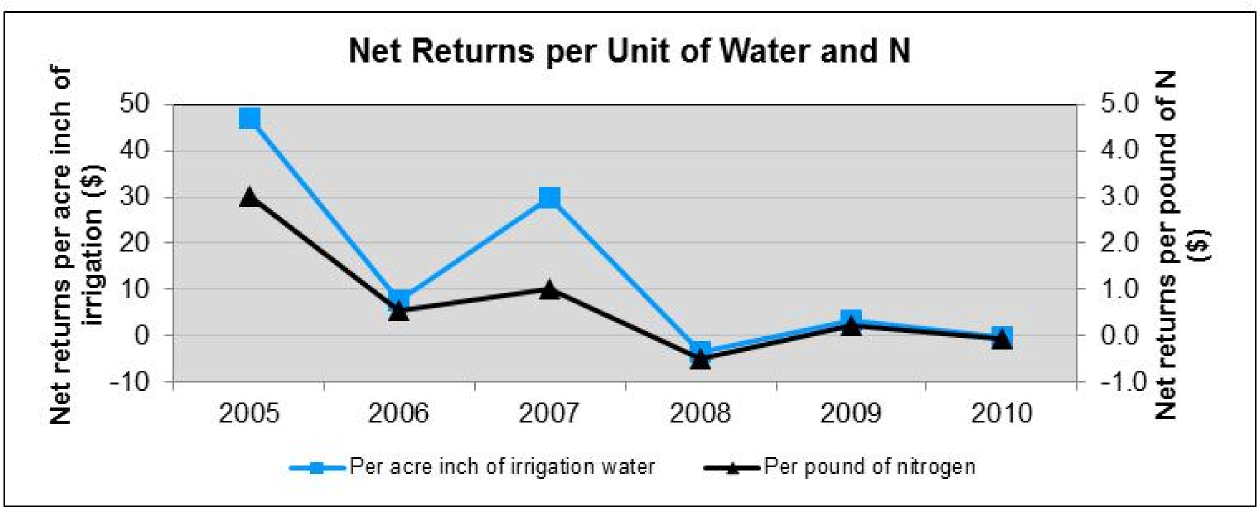

Site 23, Field 6 (August 2010)

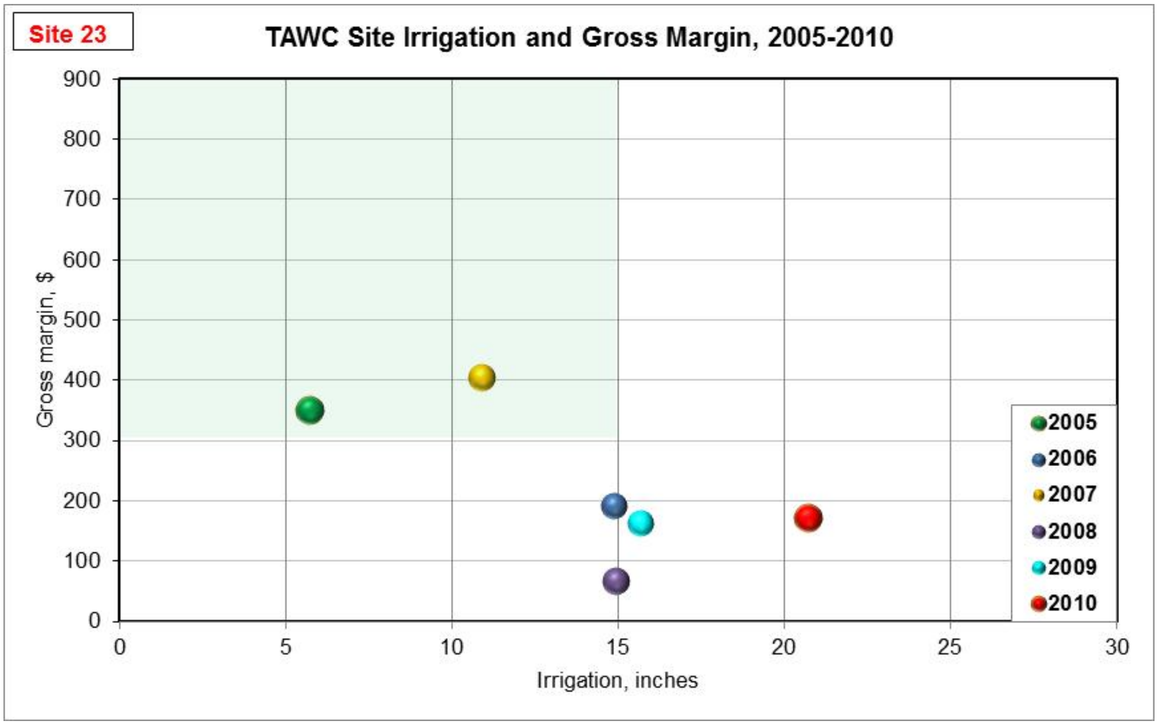
Comments: This pivot was planted to triticale then double cropped to corn with both crops being harvested for silage.

System 23

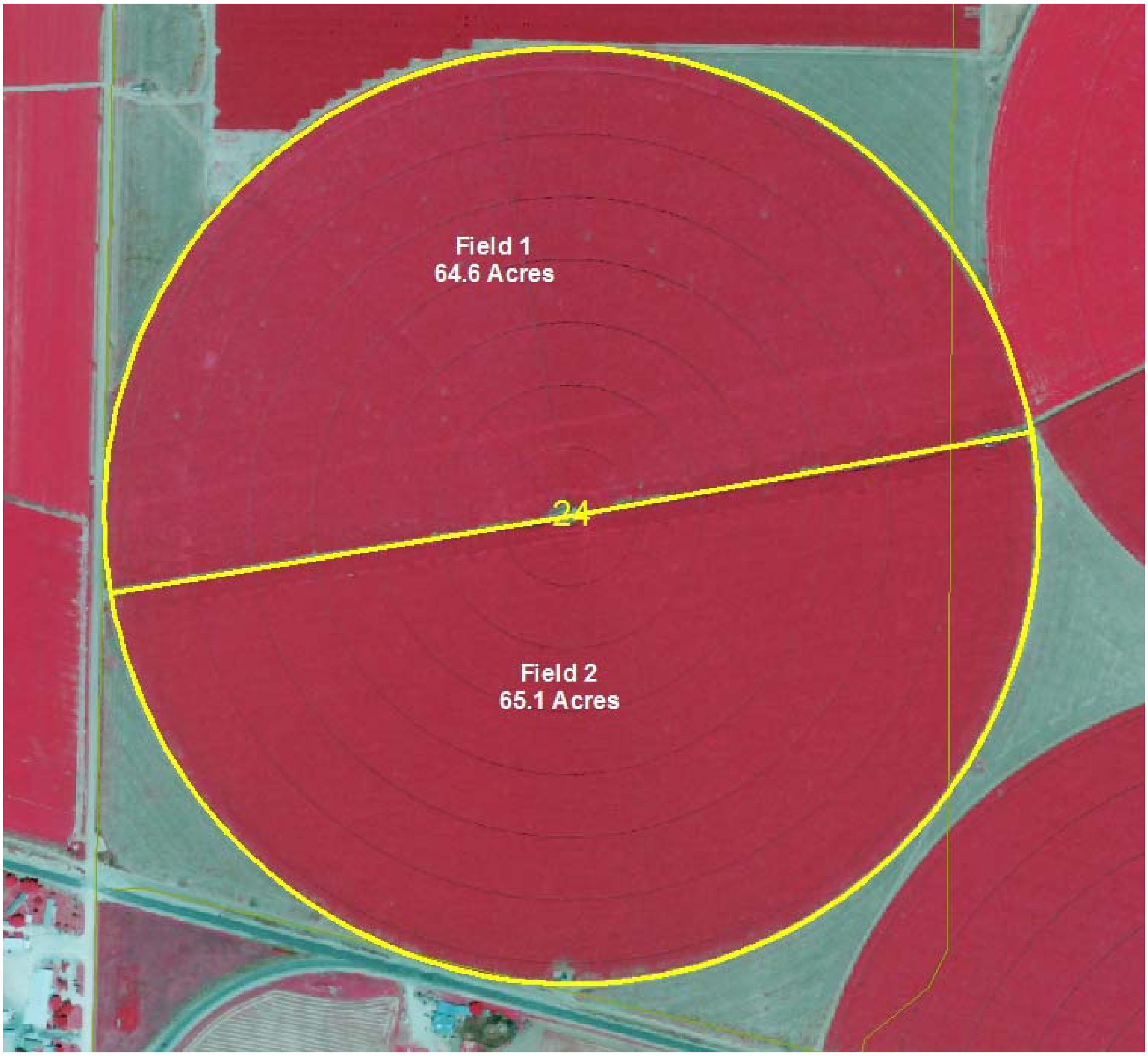

Irrigation and Precipitation
Water (inches)
60
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
400
300
200
100
0
-100
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
50
40
30
20
10
0
-10
5.0
4.0
3.0
2.0
1.0
0.0
-1.0
Net returns per pound of N ($)
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen



Site 23
TAWC Site Irrigation and Gross Margin, 2005-2010
900
800
700
600
500
400
300
200
100
0
Gross margin, $
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 24 Description

Total system 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

System 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

Site 24, Field 1 (May 2010)

Site 24, Field 1 (June 2010)

Site 24, Field 1 (August 2010)

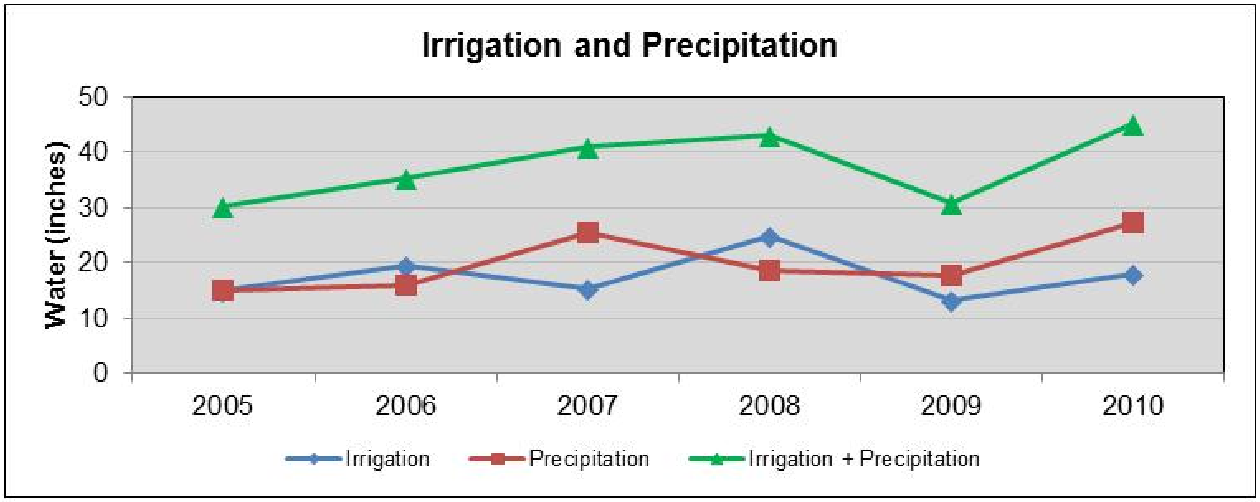
Site 24, Field 2 (May 2010)

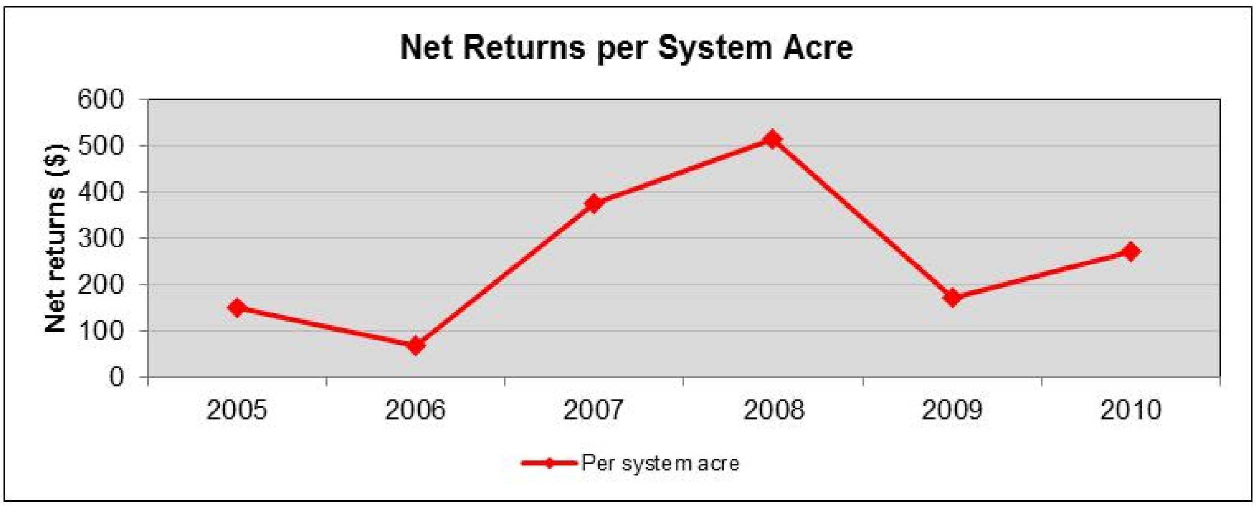
Site 24, Field 2 (August 2010)

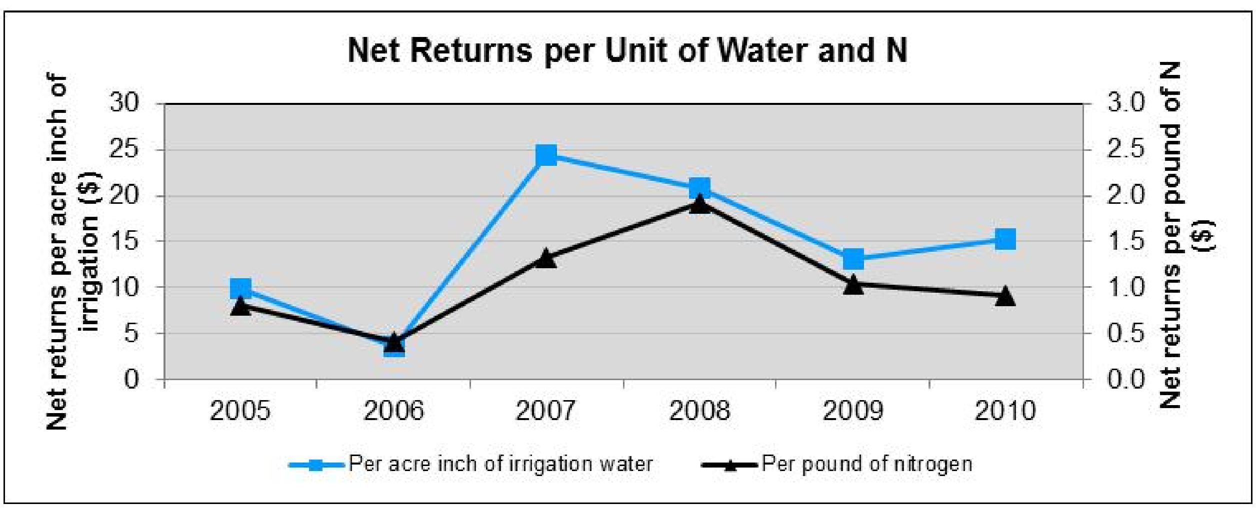
Site 24, Field 2 (August 2010)

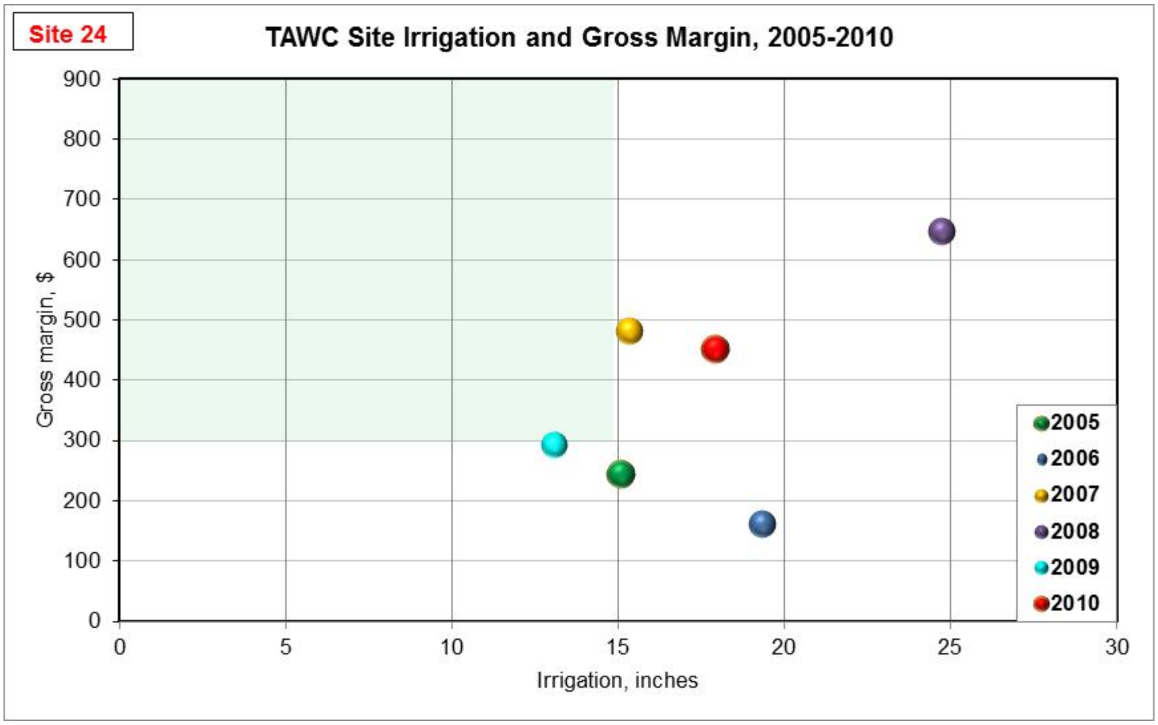
Comments: This has been a corn/cotton/sunflower pivot irrigated system using conventional tillage. In 2010 this system was planted to white food corn.

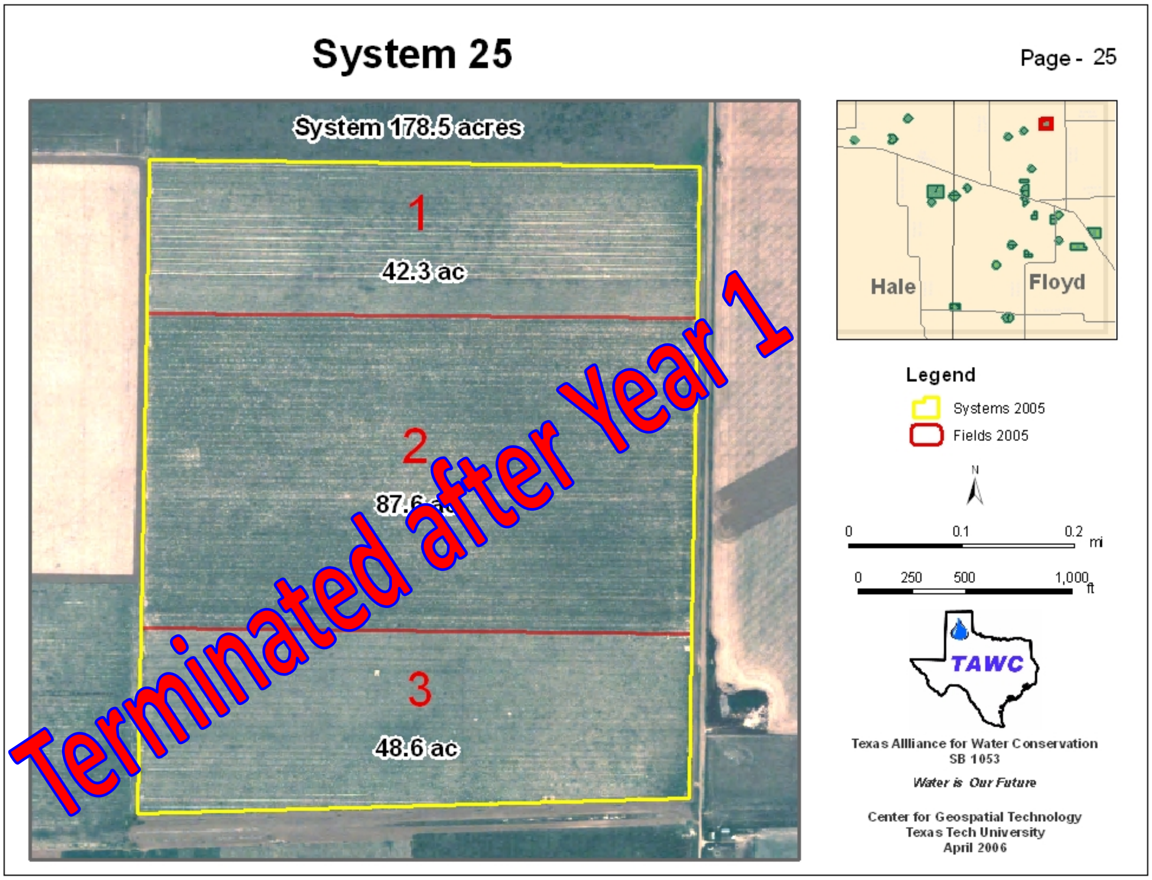
System 24


Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
600
500
400
300
200
100
0
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
30
25
20
15
10
5
0
2005
2006
2007
2008
2009
2010
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Net returns per pound of N ($)
Per acre inch of irrigation water
Per pound of nitrogen


Site 24
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 25 Description

Total system 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:

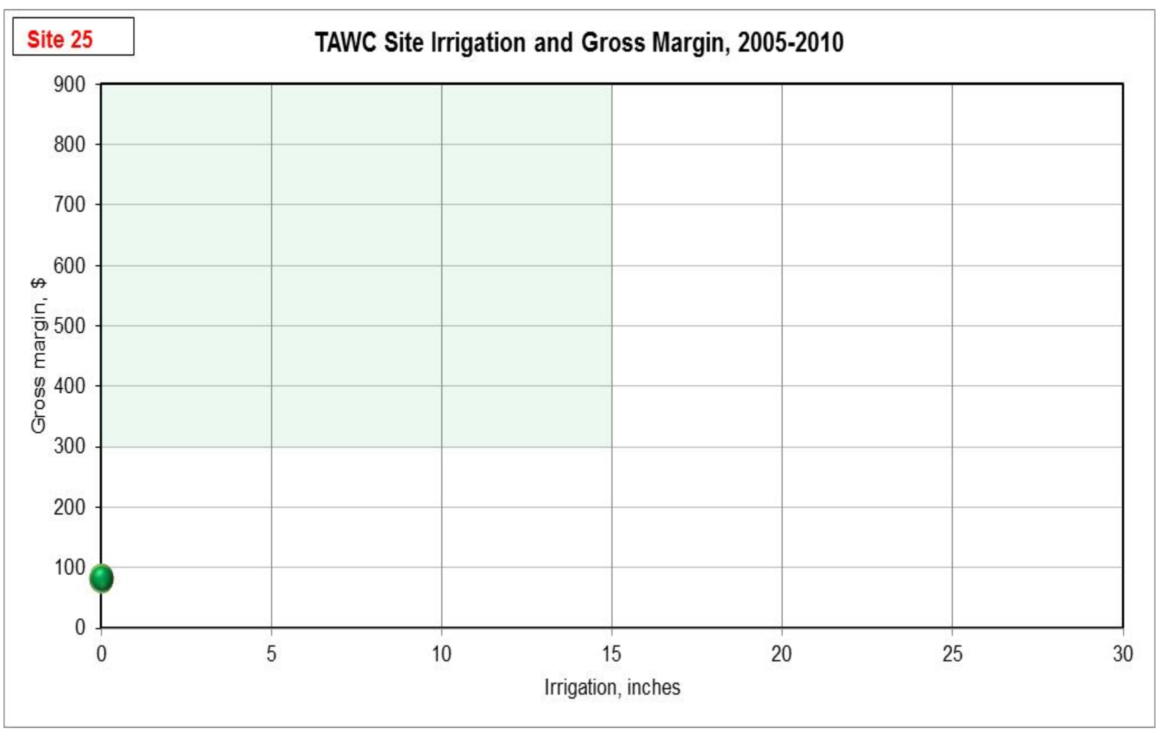
Number of wells:

Fuel source:

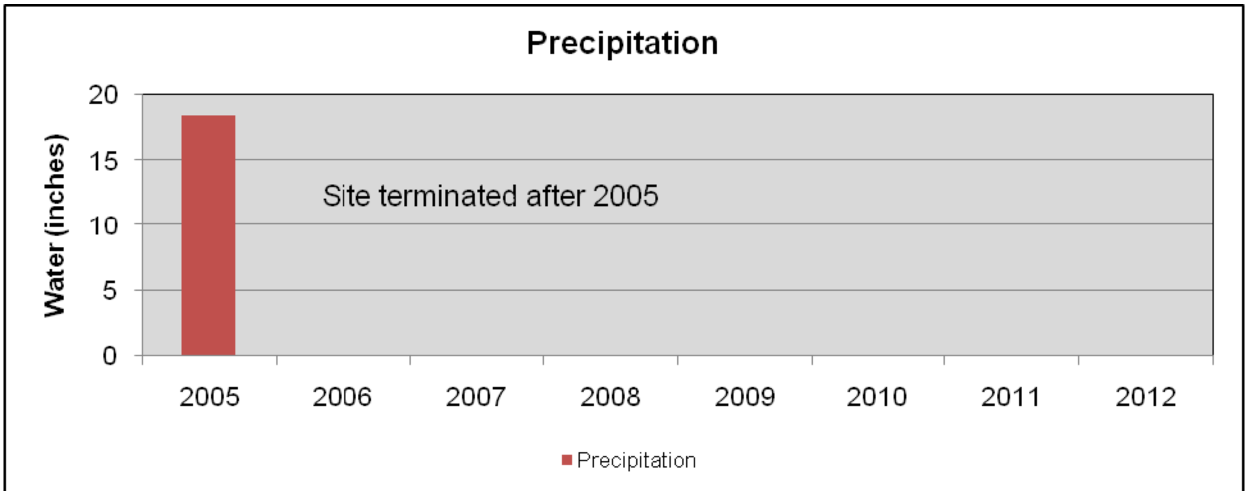
Comments: At this dryland site cotton and grain sorghum are grown in rotation. The cotton is planted in standing grain sorghum stalks. Cotton and grain sorghum are planted on forty-inch centers.

System 25

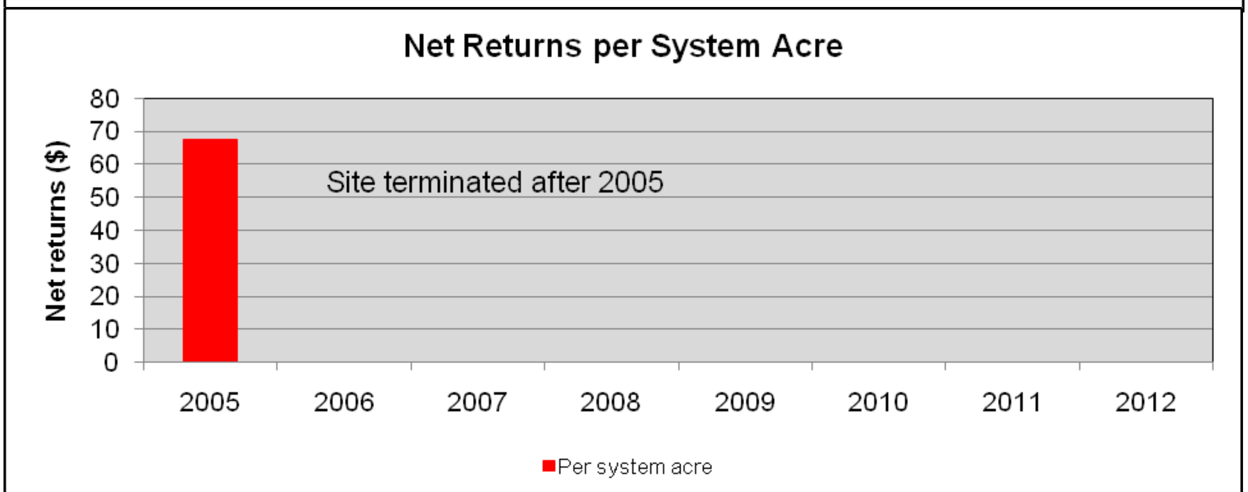
	Livestock	Field 1	Field 2	Field 3
2005	None	Cotton	Grain Sorghum	Cotton
2006	Site terminated in 2006			
2007				
2008				
2009				
2010				



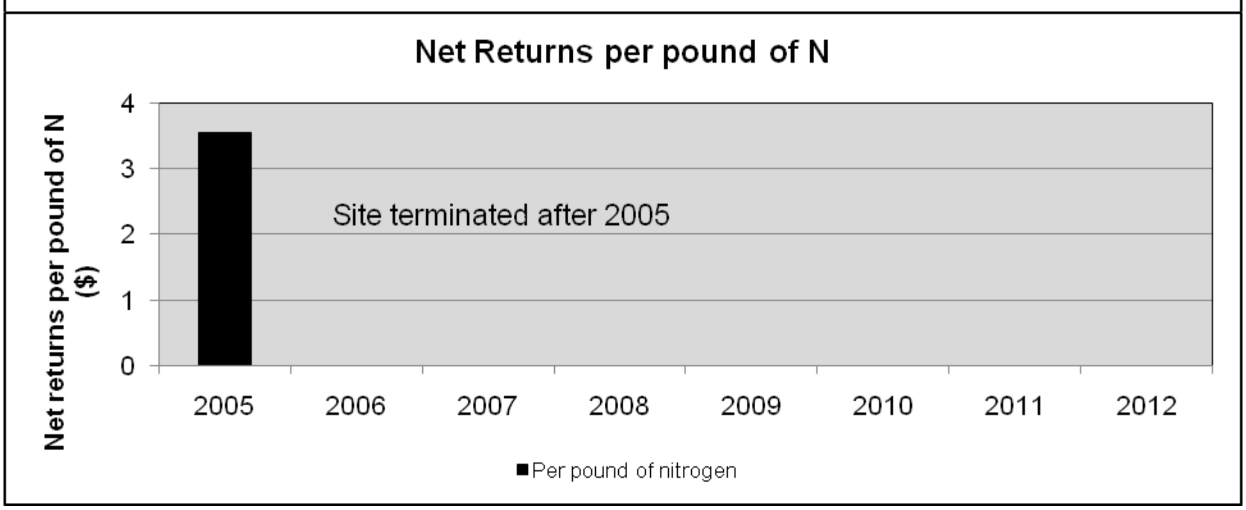
System 25



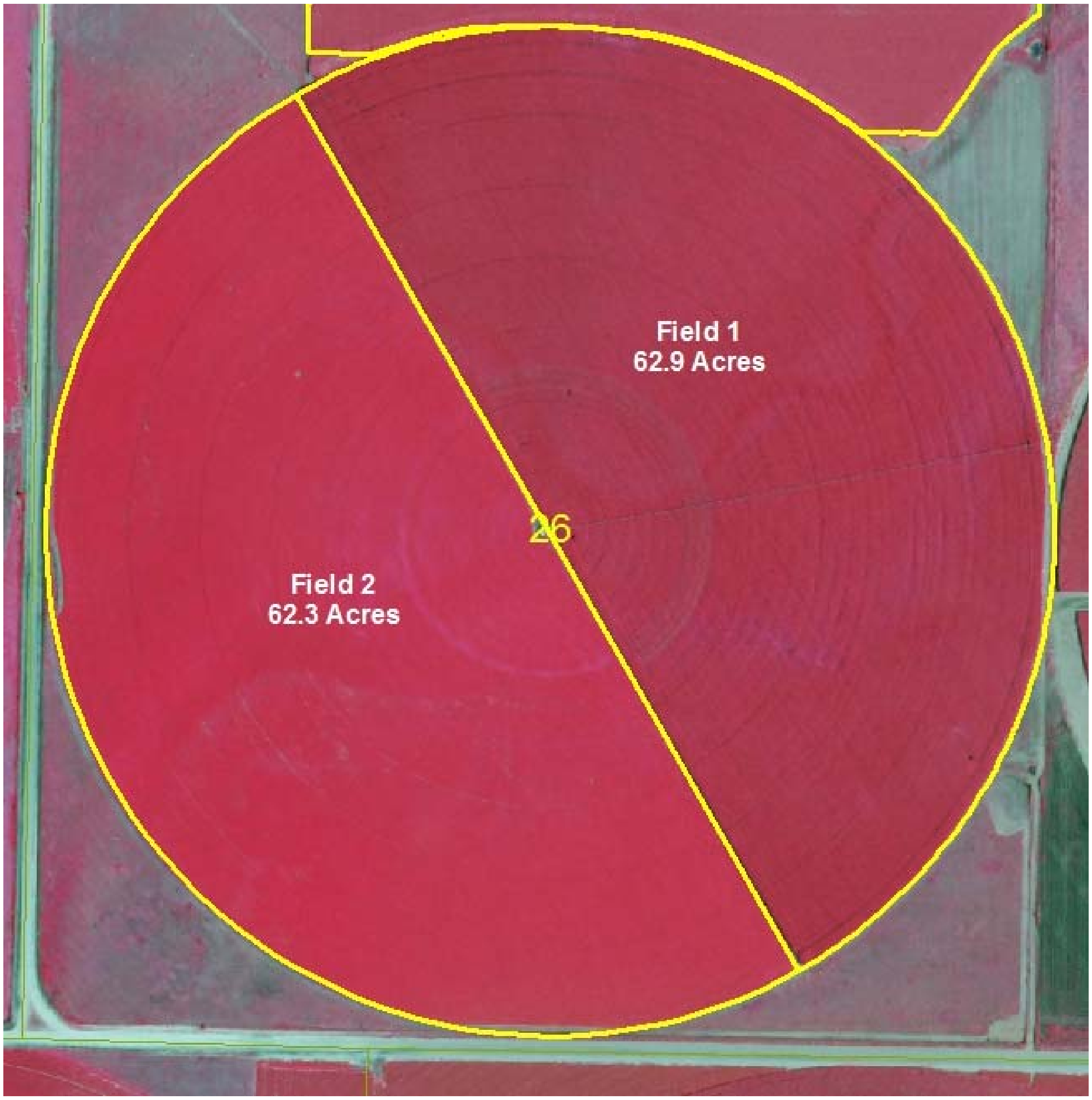
Precipitation
Water (inches)
20
15
10
5
0
Site terminated after 2005
2005
2006
2007
2008
2009
2010
2011
2012
Precipitation



Net Returns per System Acre
Net returns ($)
80
70
60
50
40
30
20
10
0
Site terminated after 2005
2005
2006
2007
2008
2009
2010
2011
2012
Per system acre



Net Returns per pound of N
Net returns per pound of N ($)
4
3
2
1
0
Site terminated after 2005
2005
2006
2007
2008
2009
2010
2011
2012
Per pound of nitrogen



System 26 Description

Total system acres: 125.2

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: 62.3
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

System 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		


Site 26, Field 1 (April 2010)


Site 26, Field 1 (May 2010)


Site 26, Field 1 (June 2010)

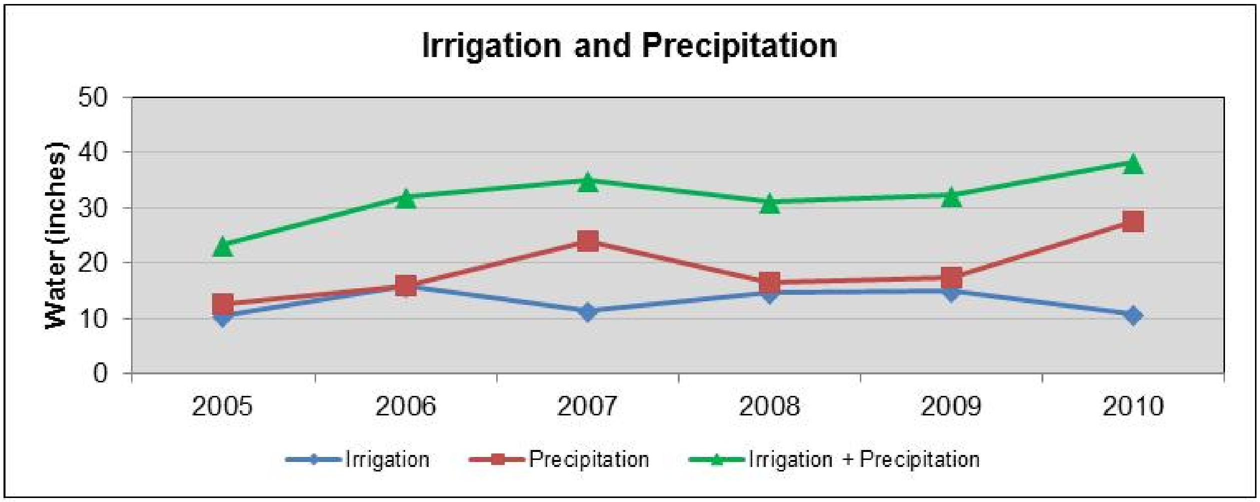

Site 26 (April 2010)


Site 26, Field 2 (May 2010)

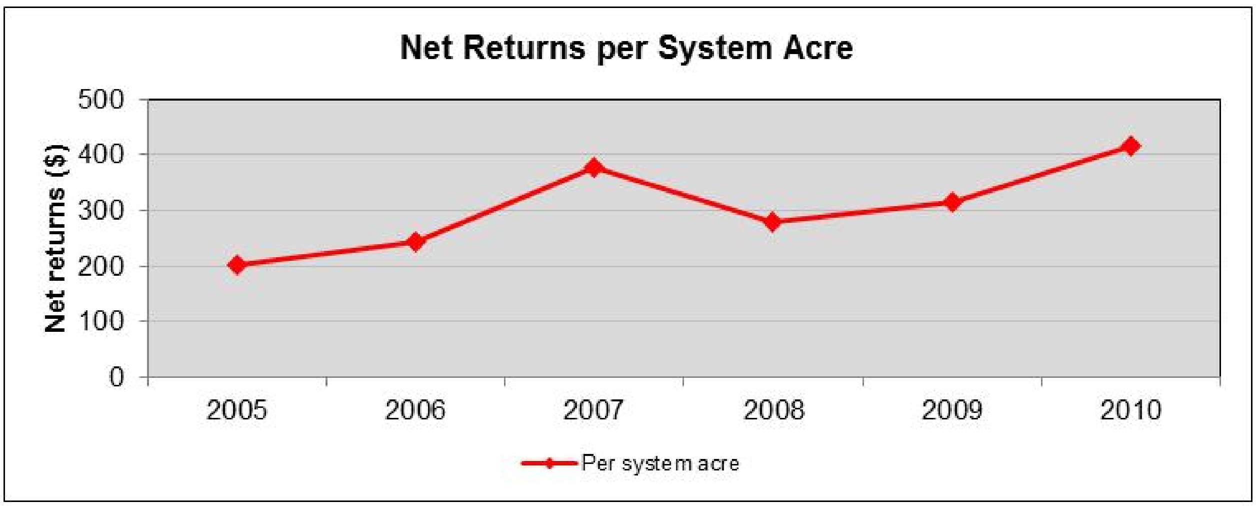

Site 26 (June 2010)

Comments: This was a cotton/wheat/corn system for 2010. After wheat harvest, corn was no-till planted. This producer plants cotton on twenty-inch centers.

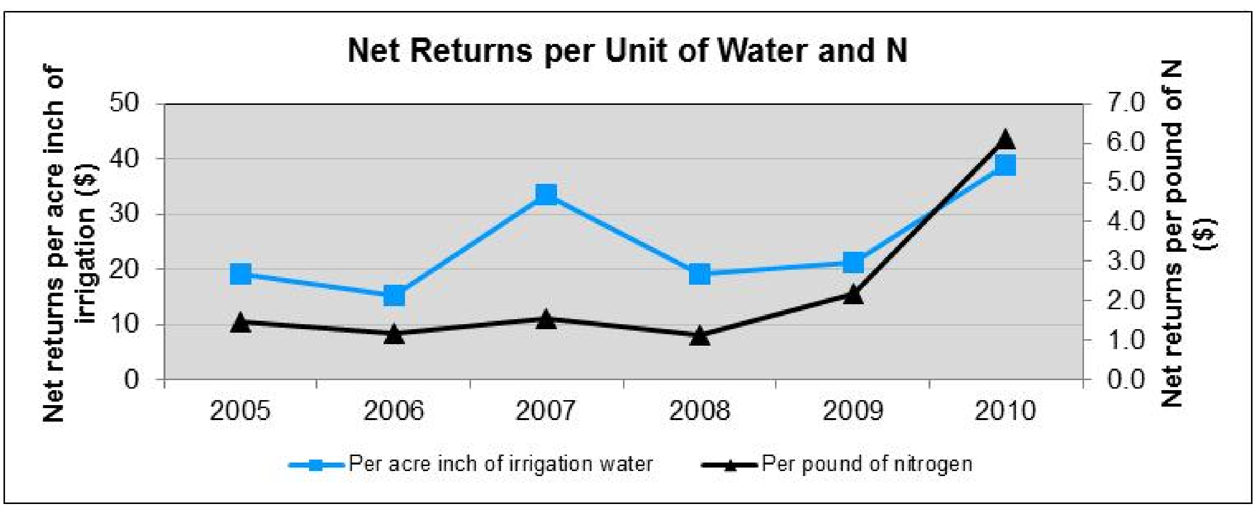
System 26



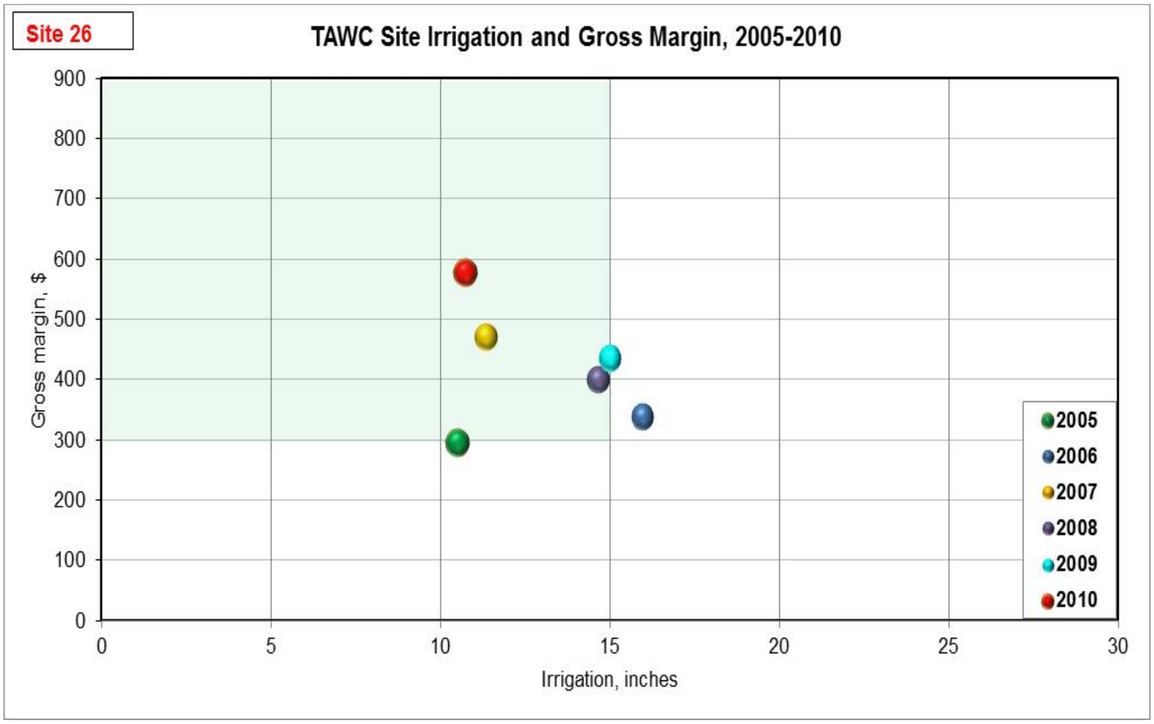
Irrigation and Precipitation
Water (inches)
50
40
30
20
10
0
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation



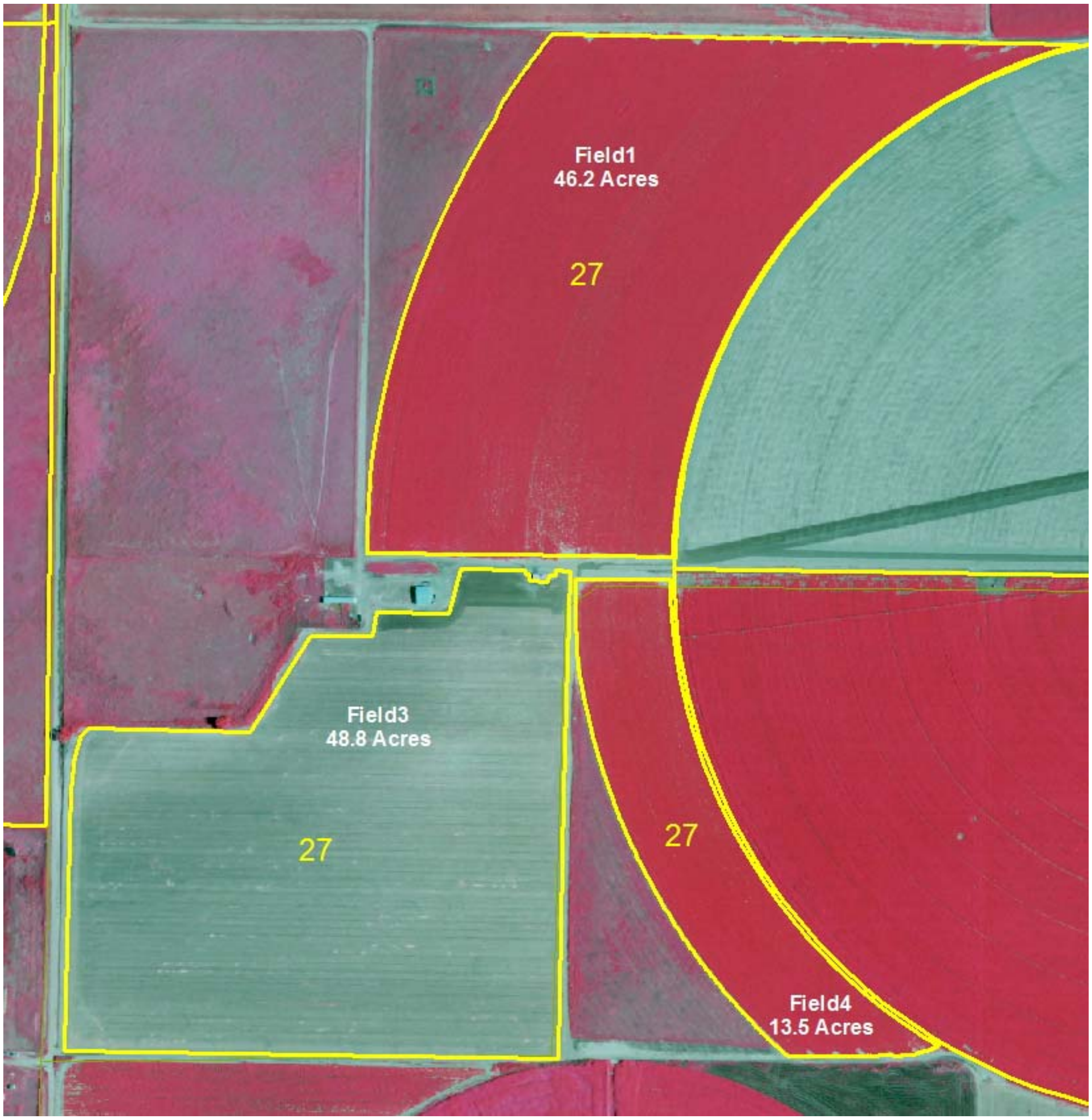
Net Returns per System Acre
Net returns ($)
500
400
300
200
100
0
2005
2006
2007
2008
2009
2010
Per system acre



Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
Net returns per pound of N ($)
50
40
30
20
10
0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen



Site 26
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2005
2006
2007
2008
2009
2010



System 27 Description

Total system acres: 108.5

Field No. 1 Acres: 46.2
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: Sub-surface Drip
(SDI, installed prior to 2006 crop year)
Pumping capacity, gal/min: 400

Number of wells: 2

Fuel source: Electric

System 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	Cotton following Wheat cover crop		
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


Site 27, Field 1 (June 2010)


Site 27, Field 1 (September 2010)


Site 27, Field 3 (April 2010)

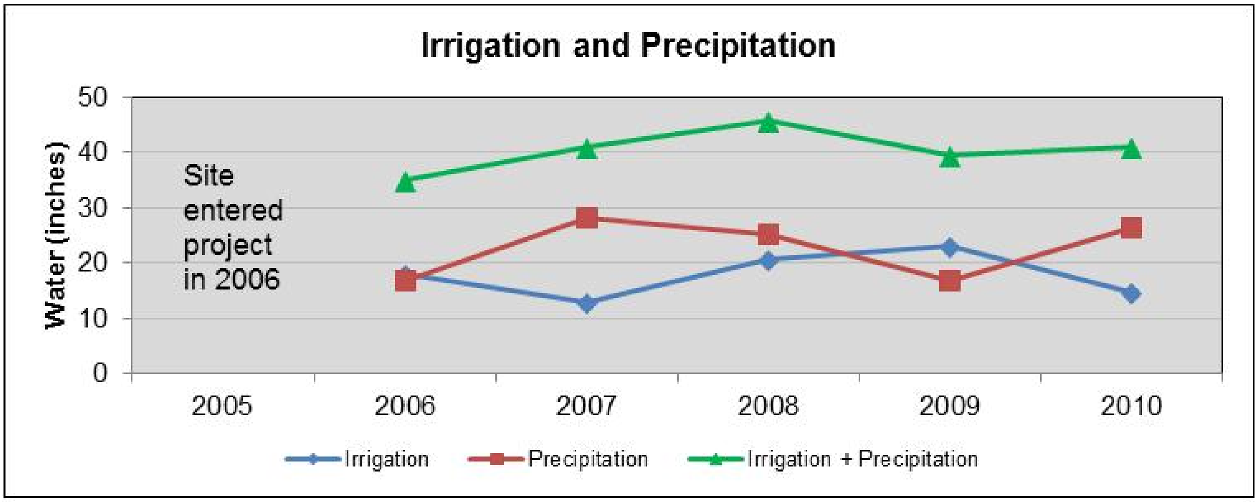

Site 27, Field 3 (June 2010)

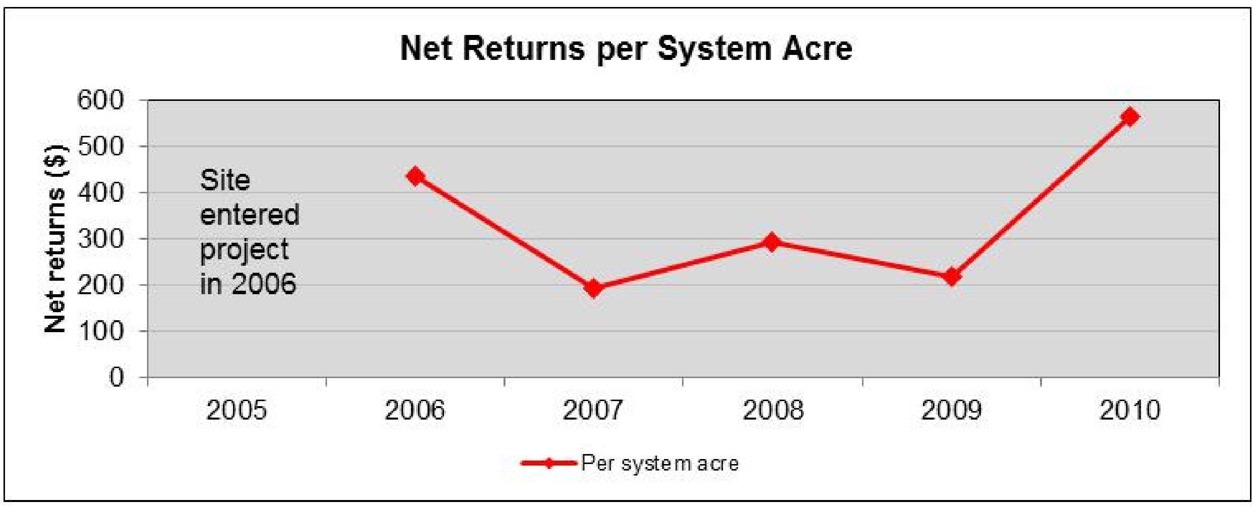
Comments:
This is the fourth year for this cotton/corn drip irrigated site. Corn is planted on twenty-inch centers with cotton planted on forty-inch centers.

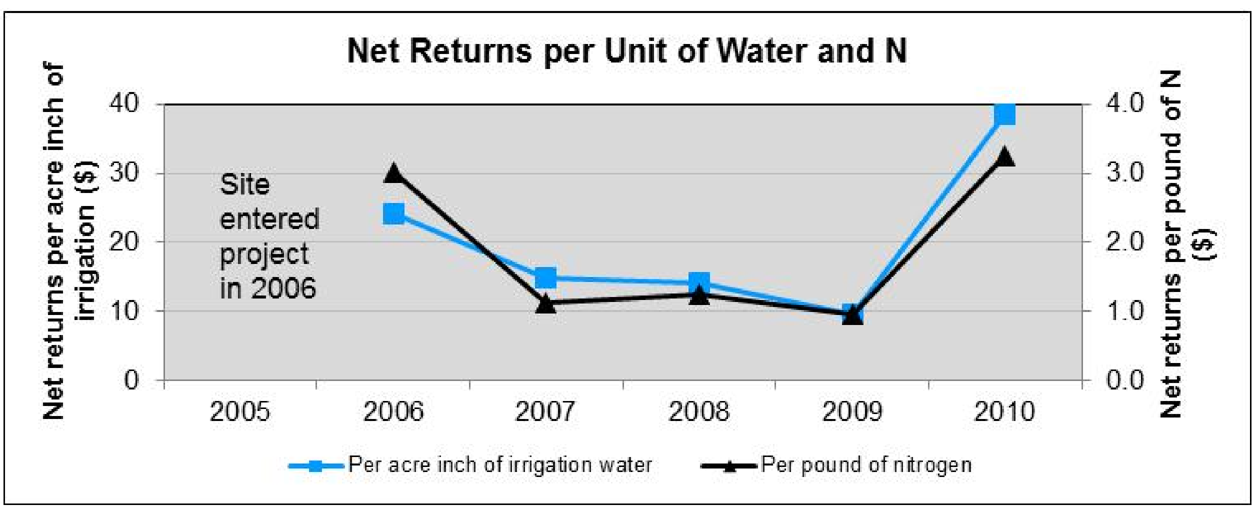

Site 27, Field 4 (June 2010)

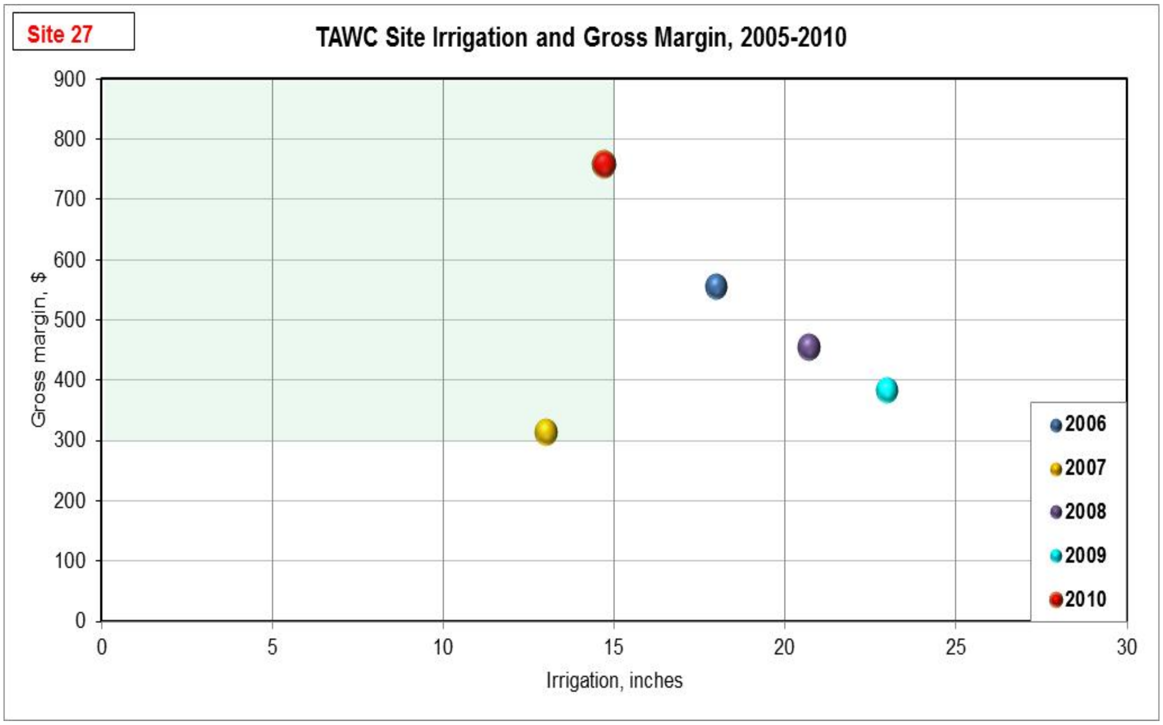

Site 27, Field 4 (August 2010)

System 27


Irrigation and Precipitation
Water (inches)
0
10
20
30
40
50
Site entered project in 2006
2005
2006
2007
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
0
100
200
300
400
500
600
Site entered project in 2006
2005
2006
2007
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
0
10
20
30
40
Net returns per pound of N ($)
0.0
1.0
2.0
3.0
4.0
Site entered project in 2006
2005
2006
2007
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen



Site 27
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2006
2007
2008
2009
2010

System 28 Description

Total system acres: 51.5

Field No. 1 Acres: 51.5
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Sub-surface Drip (SDI)

Pumping capacity, gal/min: 300

Number of wells: 1

Fuel source: electric

System 28

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

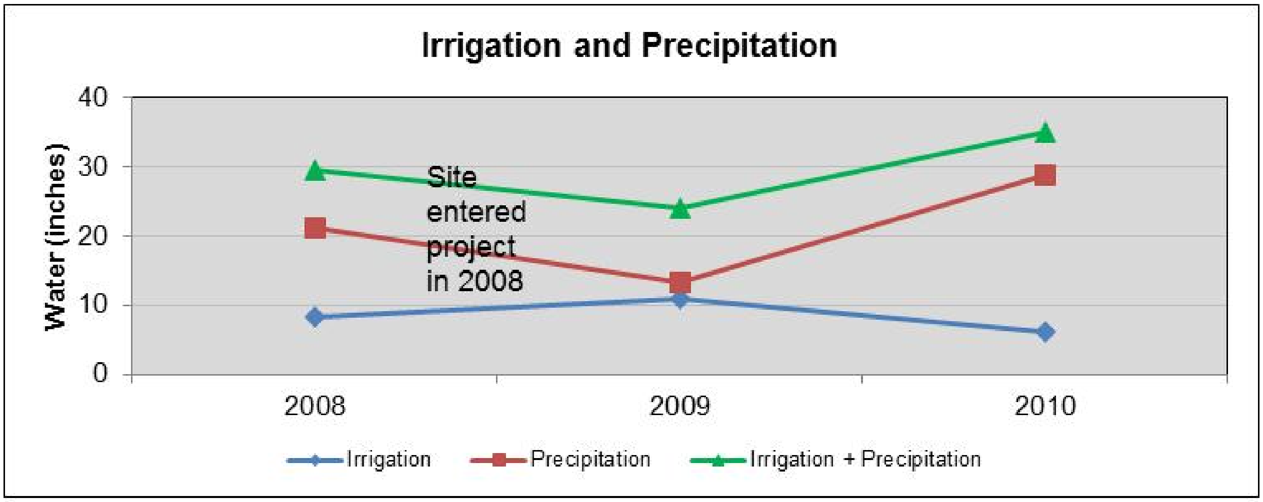

Site 28, Field 1 (April 2010)

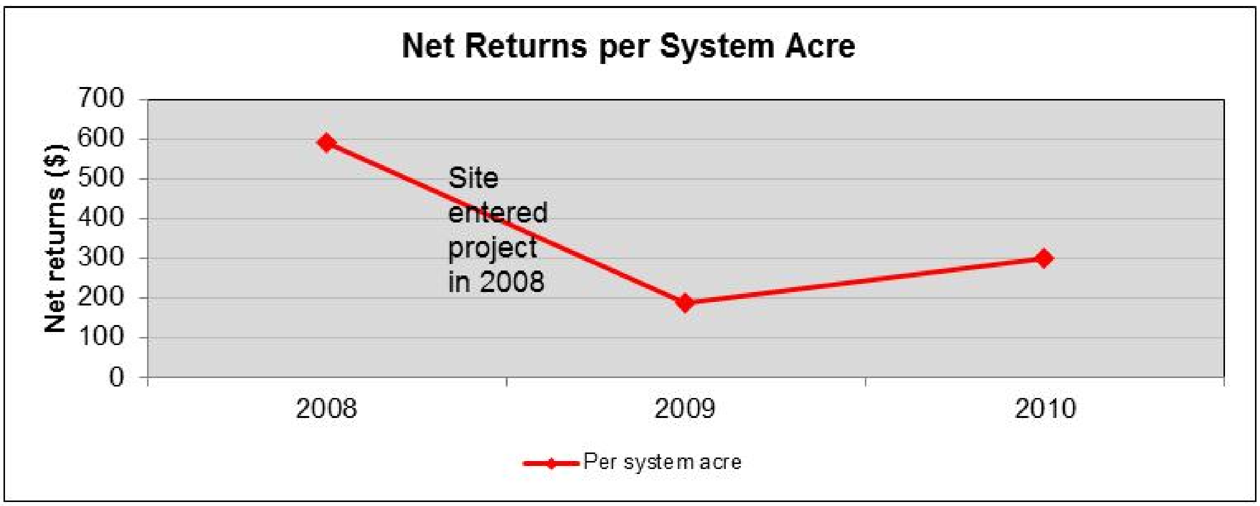

Site 28, Field 1 (June 2010)

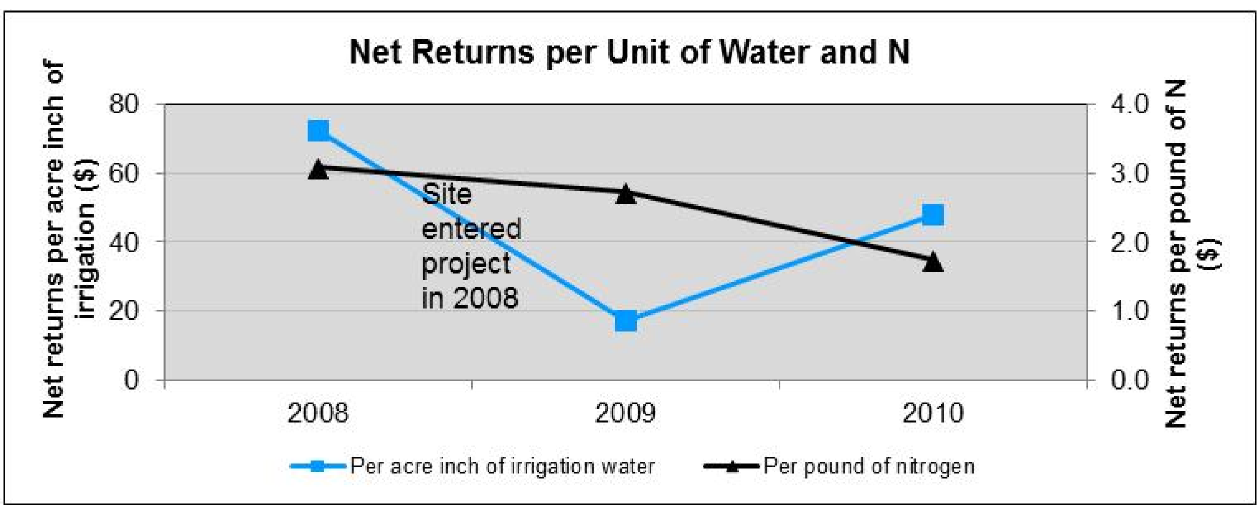

Site 28, Field 1 (August 2010)

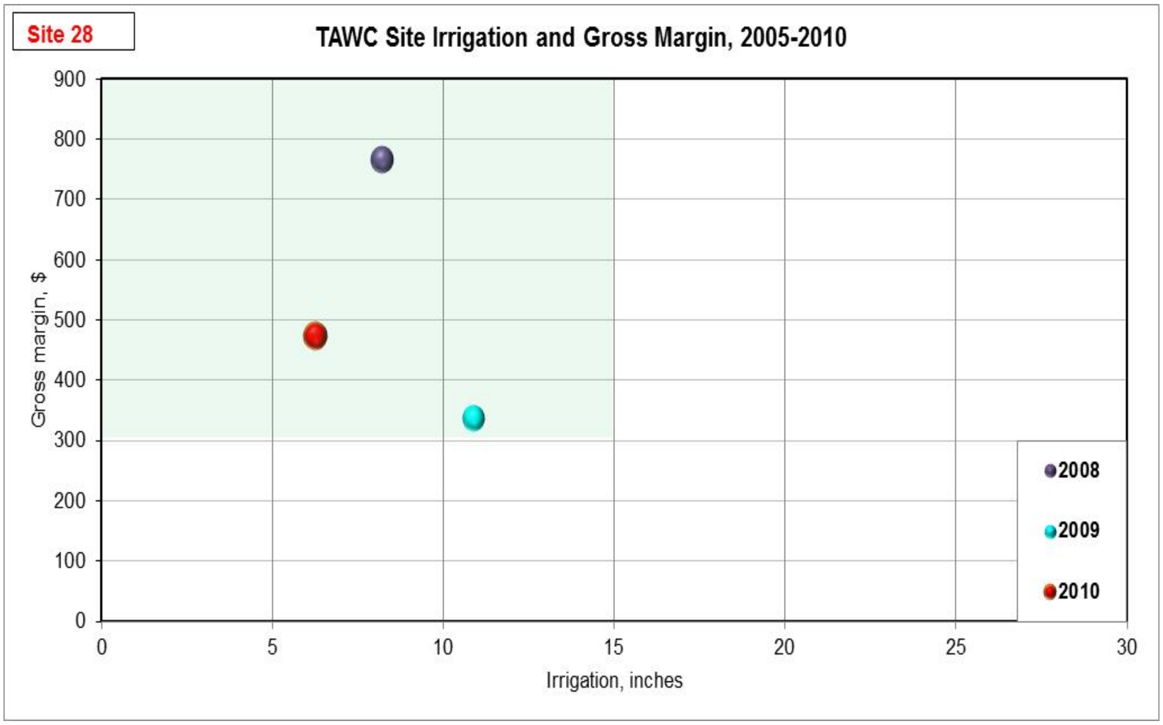
Comments: This is the third year for this drip irrigated site to be in the project. In 2010 this site was planted to cotton on forty-inch centers.

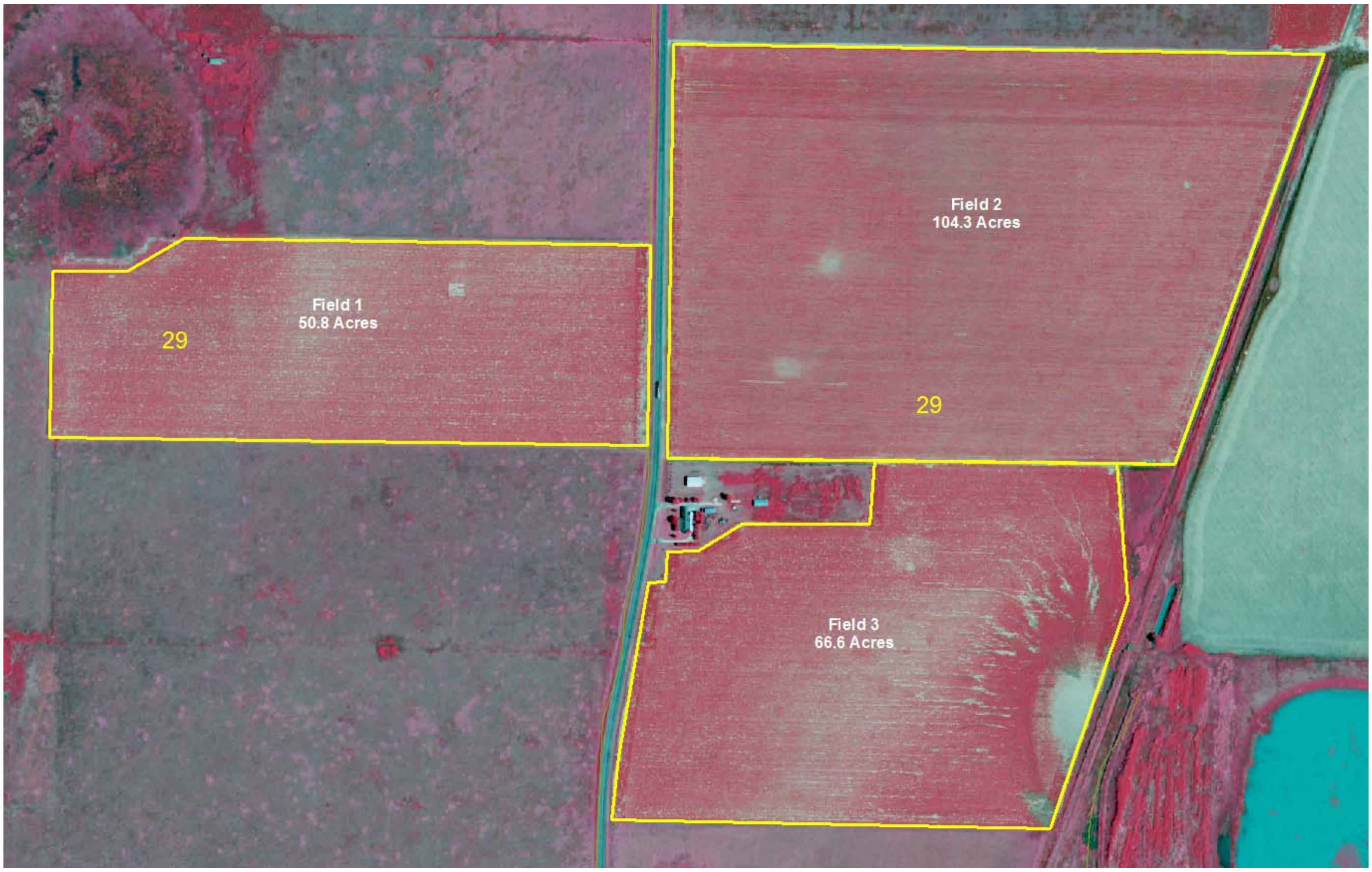
System 28


Irrigation and Precipitation
Water (inches)
40
30
20
10
0
Site entered project in 2008
2008
2009
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
700
600
500
400
300
200
100
0
Site entered project in 2008
2008
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
80
60
40
20
0
Net returns per pound of N ($)
4.0
3.0
2.0
1.0
0.0
Site entered project in 2008
2008
2009
2010
Per acre inch of irrigation water
Per pound of nitrogen


Site 28
TAWC Site Irrigation and Gross Margin, 2005-2010
900
800
700
600
500
400
300
200
100
0
Gross margin, $
0
5
10
15
20
25
30
Irrigation, inches
2008
2009
2010



System 29 Description

Total system acres:	221.7	**Irrigation**	
		Type:	Dryland
Field No. 1 Acres:	50.8	Pumping capacity, gal/min:	na
Major soil type:	Pullman clay loam; 0 to 1% slope		
Field No. 2 Acres:	104.3	Number of wells:	na
Major soil type:	Pullman clay loam; 0 to 1% slope	Fuel source:	na
Field No. 3 Acres:	65.6		
Major soil type:	Pullman clay loam; 0 to 1% slope		

System 29

	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


Site 29 (June 2010)


Site 29 (June 2010)


Site 29 (August 2010)

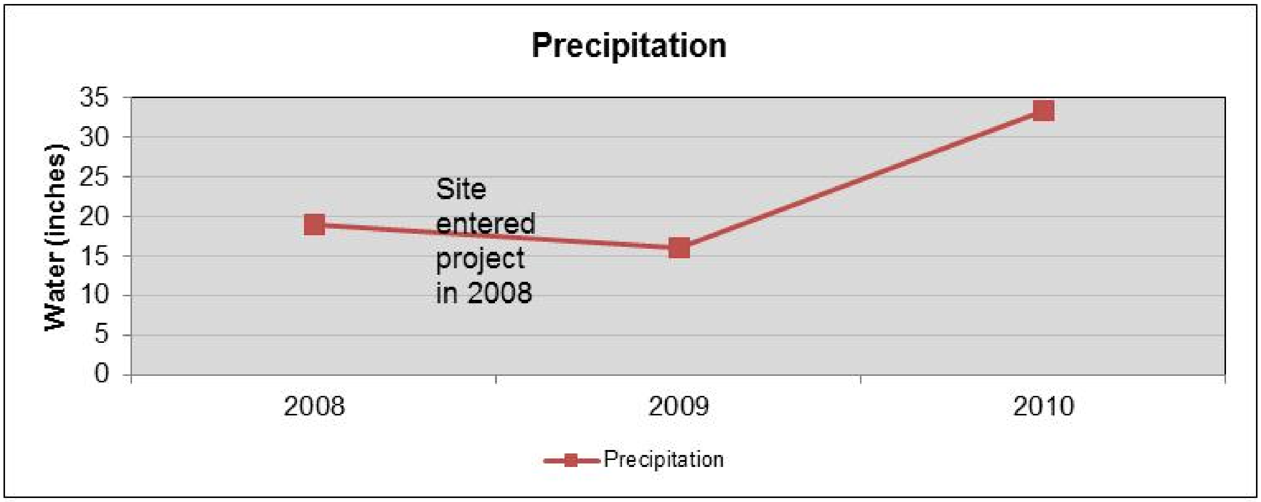

Site 29 (April 2010)

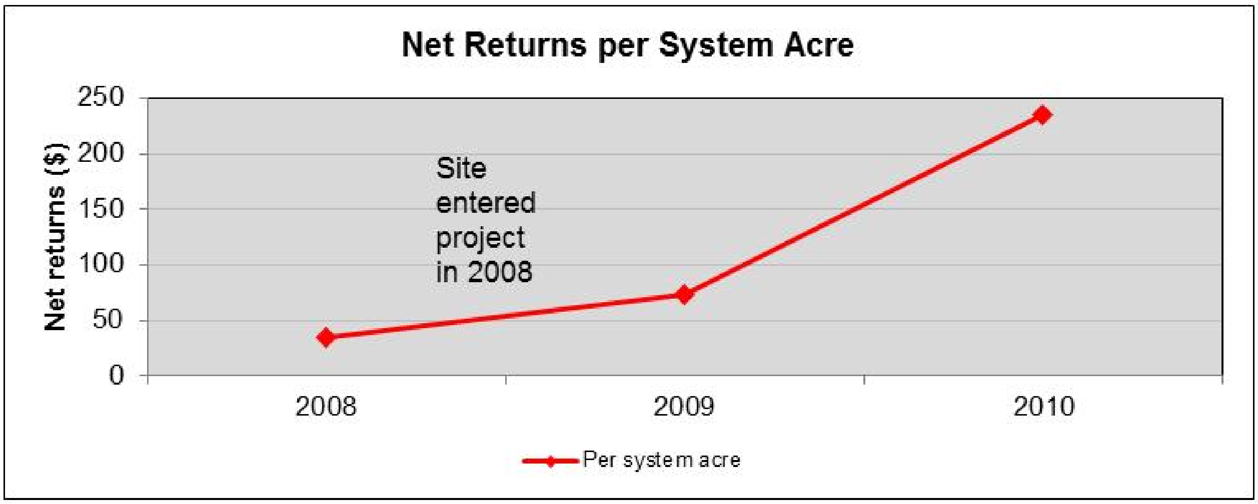

Site 29 (June 2010)

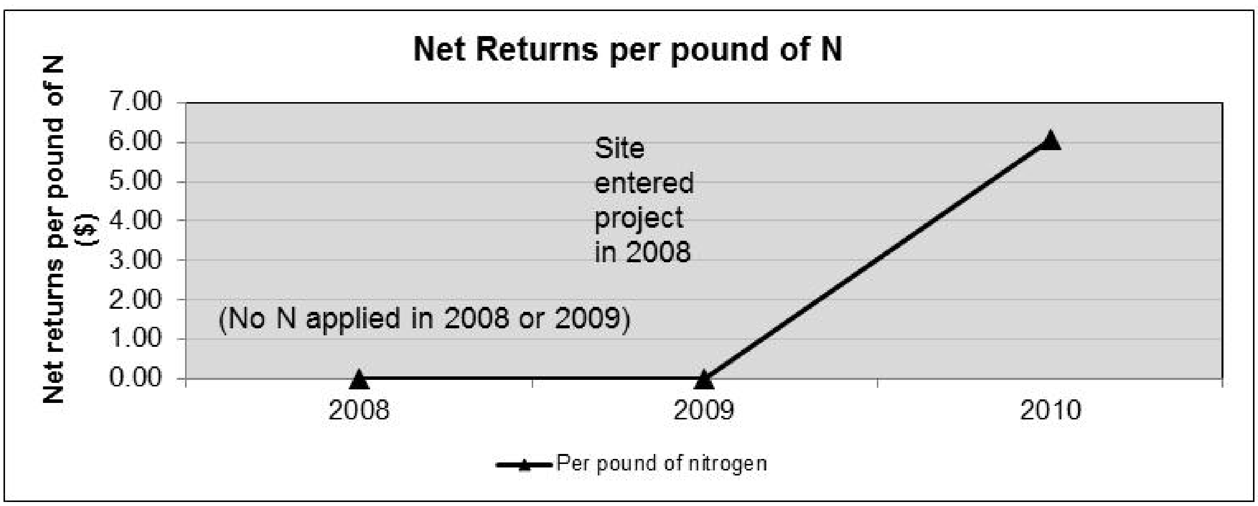

Site 29 (August 2010)

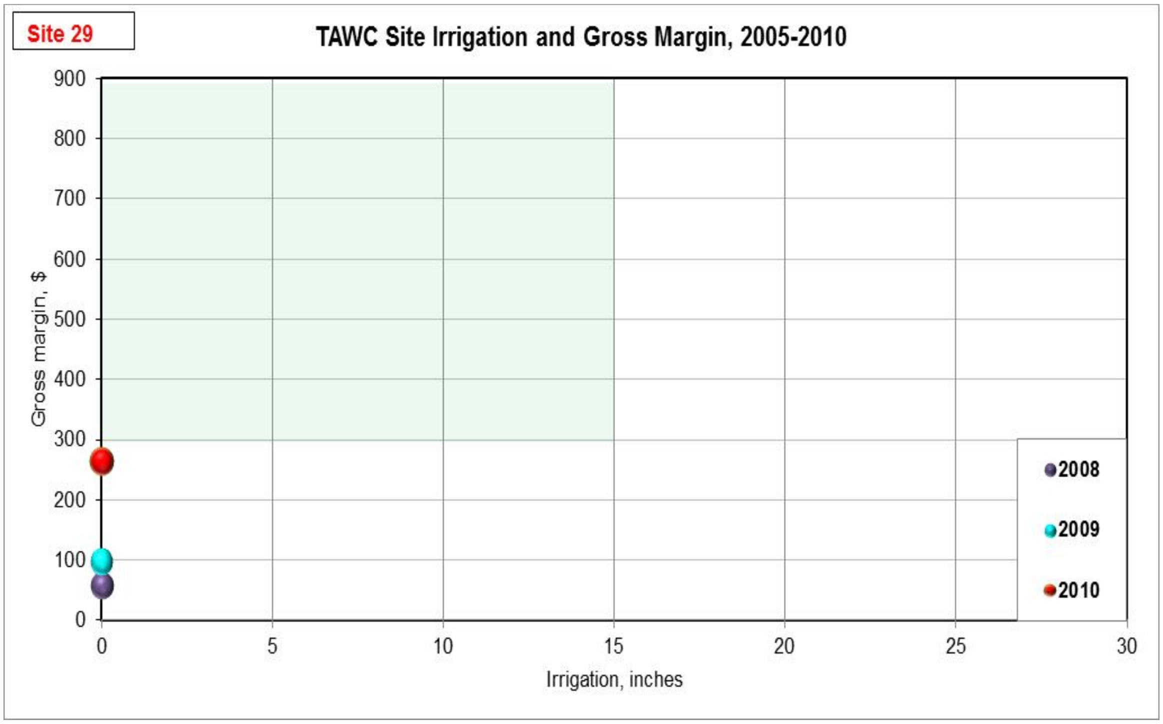
Comments: This is a conventional till dryland site using cotton and grain sorghum in rotation. Cotton and grain sorghum are planted on forty-inch centers.

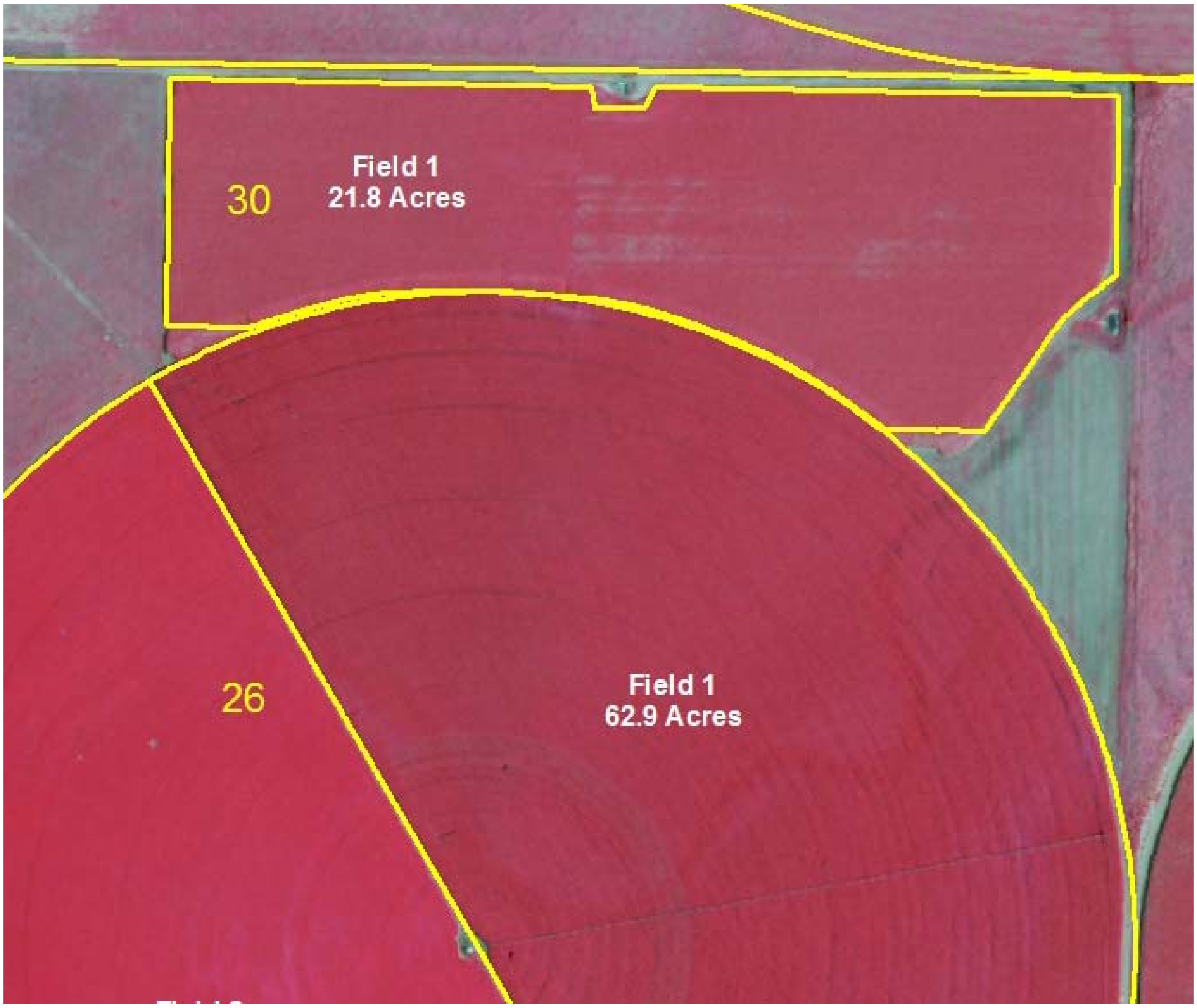
System 29


Precipitation
Water (inches)
35
30
25
20
15
10
5
0
Site entered project in 2008
2008
2009
2010
Precipitation


Net Returns per System Acre
Net returns ($)
250
200
150
100
50
0
Site entered project in 2008
2008
2009
2010
Per system acre


Net Returns per pound of N
Net returns per pound of N ($)
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Site entered project in 2008
(No N applied in 2008 or 2009)
2008
2009
2010
Per pound of nitrogen


Site 29
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2008
2009
2010



System 30 Description

Total system 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

System 30

	Livestock	Field 1
2005	Entered project in Year 5	
2006		
2007		
2008		
2009	None	Sunflowers
2010	None	Corn

Site 30, Field 1 (March 2010)

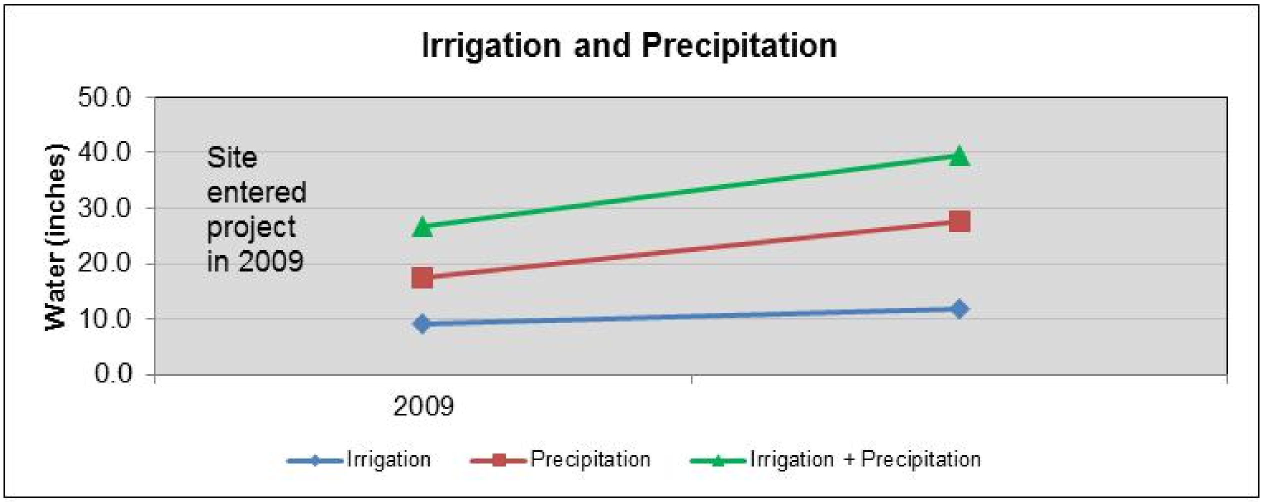
Site 30, Field 1 (June 2010)

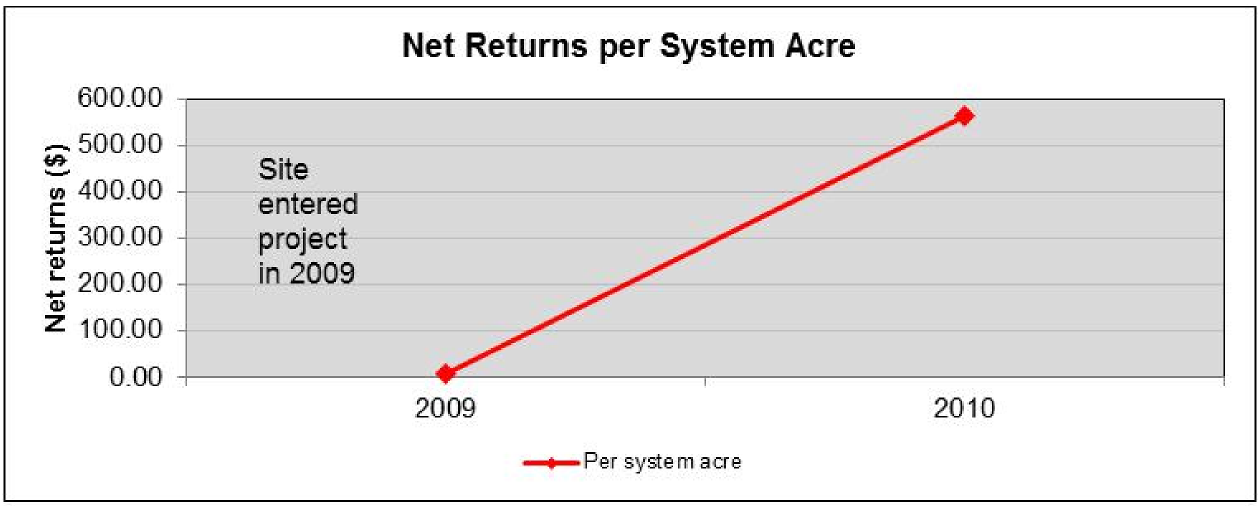
Site 30, Field 1 (June 2010)

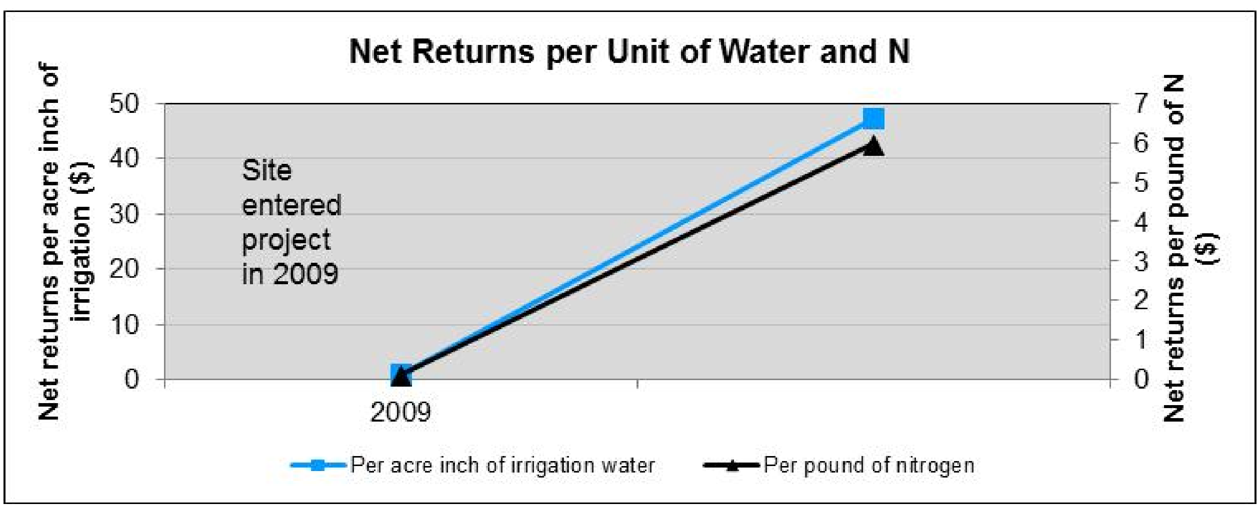
Site 30, Field 1 (August 2010)

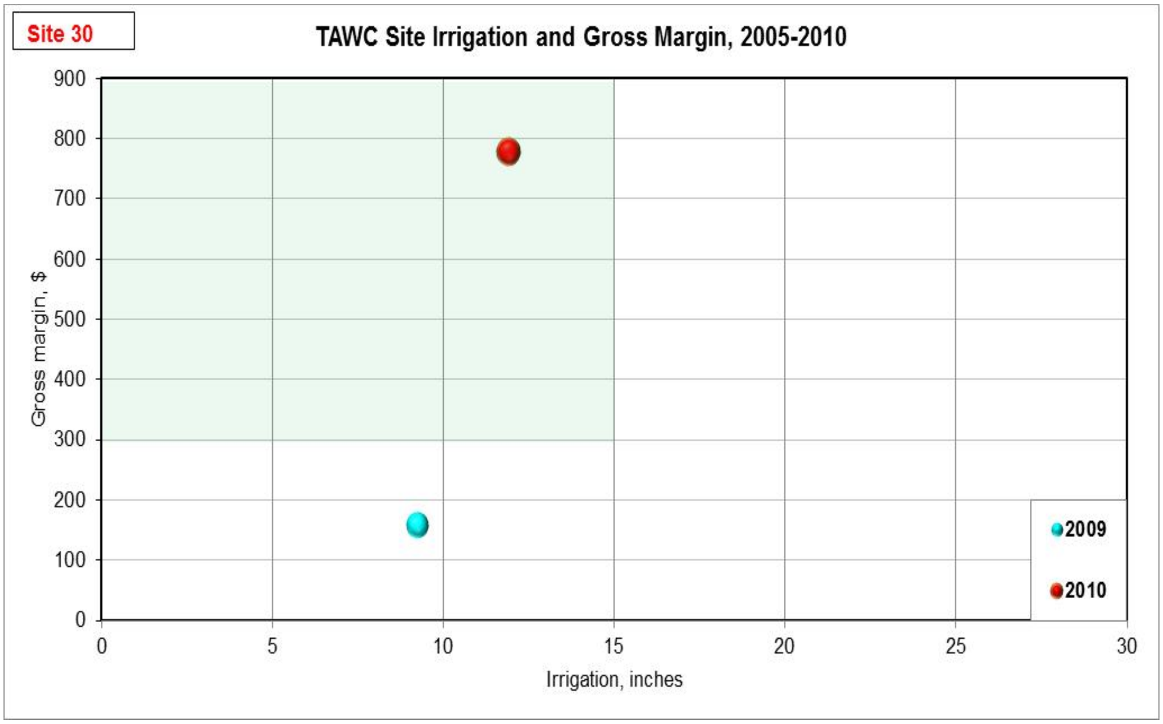
Comments: This site is drip irrigated and was planted to corn on twenty-inch centers using conventional tillage.

System 30

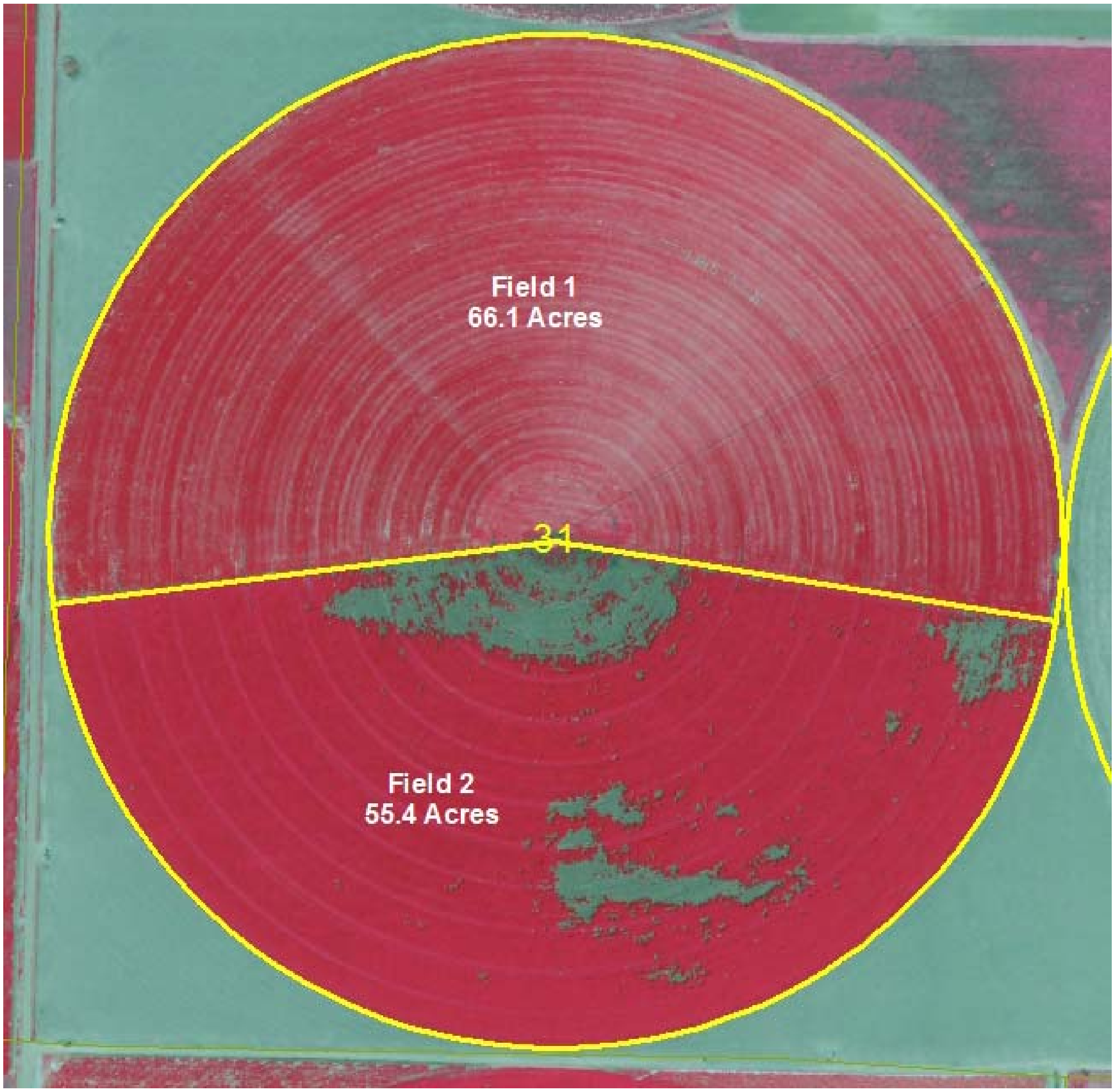

Irrigation and Precipitation
Water (inches)
50.0
40.0
30.0
20.0
10.0
0.0
Site entered project in 2009
2009
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Site entered project in 2009
2009
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
50
40
30
20
10
0
Site entered project in 2009
2009
7
6
5
4
3
2
1
0
Net returns per pound of N ($)
Per acre inch of irrigation water
Per pound of nitrogen



Site 30
TAWC Site Irrigation and Gross Margin, 2005-2010
Gross margin, $
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
Irrigation, inches
2009
2010



System 31 Description

Total system acres: 121.5

Field No. 1 Acres: 66.1
Major soil type: Pullman clay loam, 0 to 1% slope

Field No. 2 Acres: 55.4
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

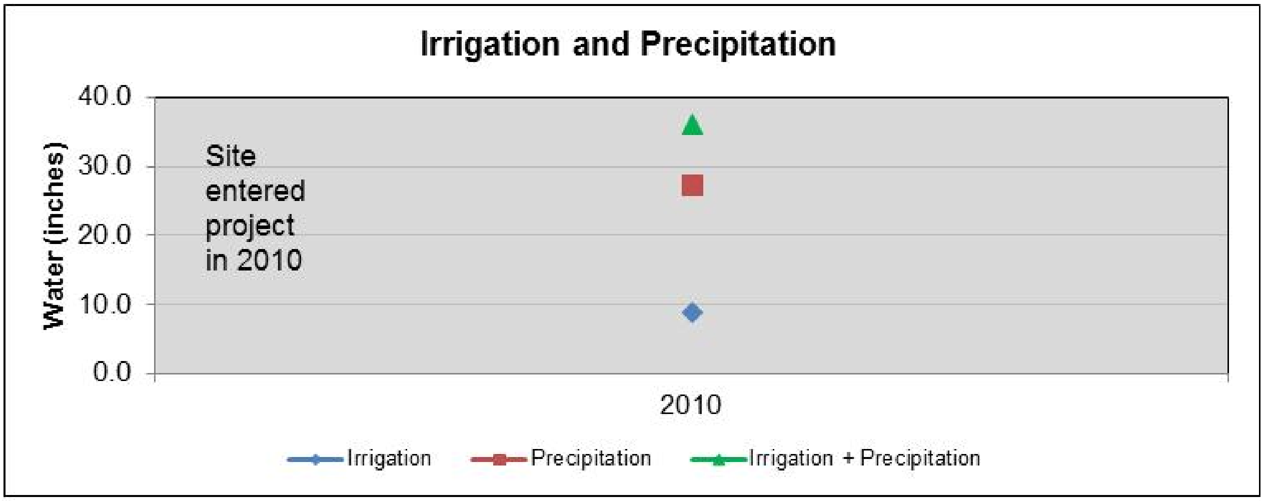
System 31

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

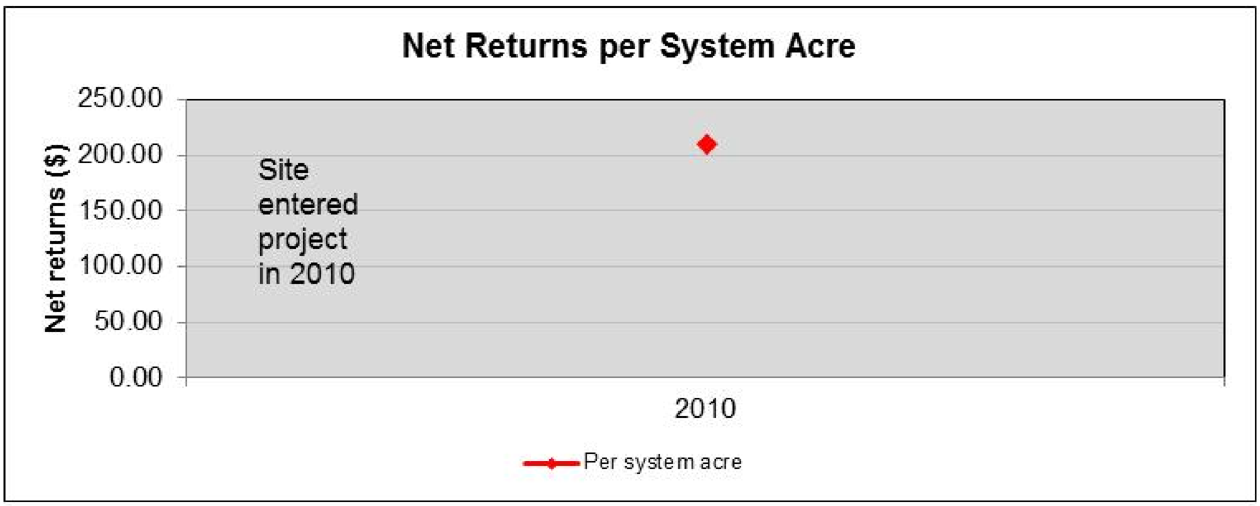
Implementation Phase, Site D-1 (31), August 2010

Comments: This is a pivot irrigated site which was planted to cotton and seed millet in 2010. Both crops were planted on forty-inch centers using conventional tillage.

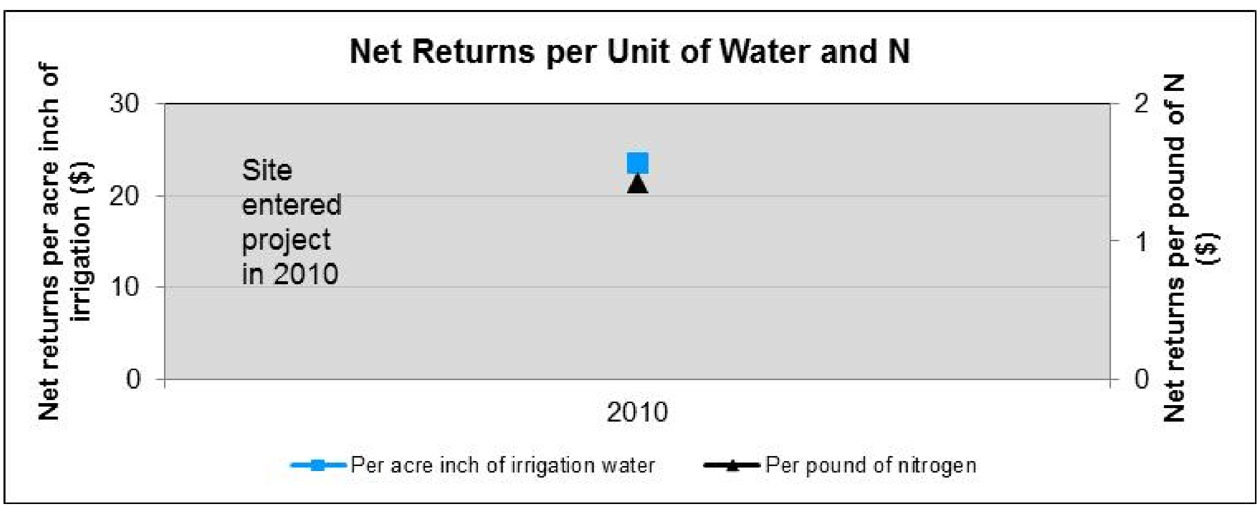
System 31



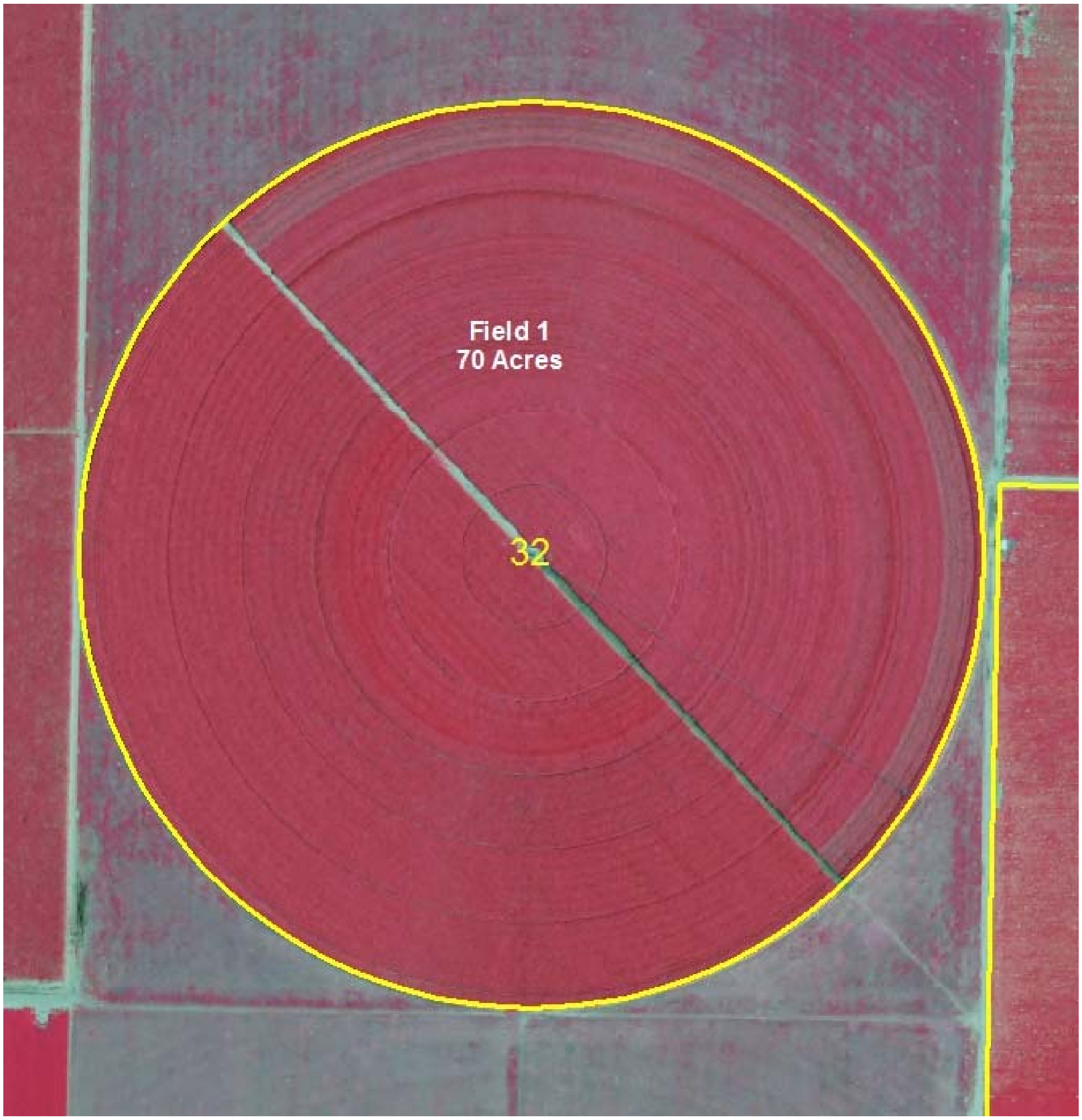
Irrigation and Precipitation
Water (inches)
40.0
30.0
20.0
10.0
0.0
Site entered project in 2010
2010
Irrigation
Precipitation
Irrigation + Precipitation



Net Returns per System Acre
Net returns ($)
250.00
200.00
150.00
100.00
50.00
0.00
Site entered project in 2010
2010
Per system acre



Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
30
20
10
0
Net returns per pound of N ($)
2
1
0
Site entered project in 2010
2010
Per acre inch of irrigation water
Per pound of nitrogen



System 32 Description

Total system 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

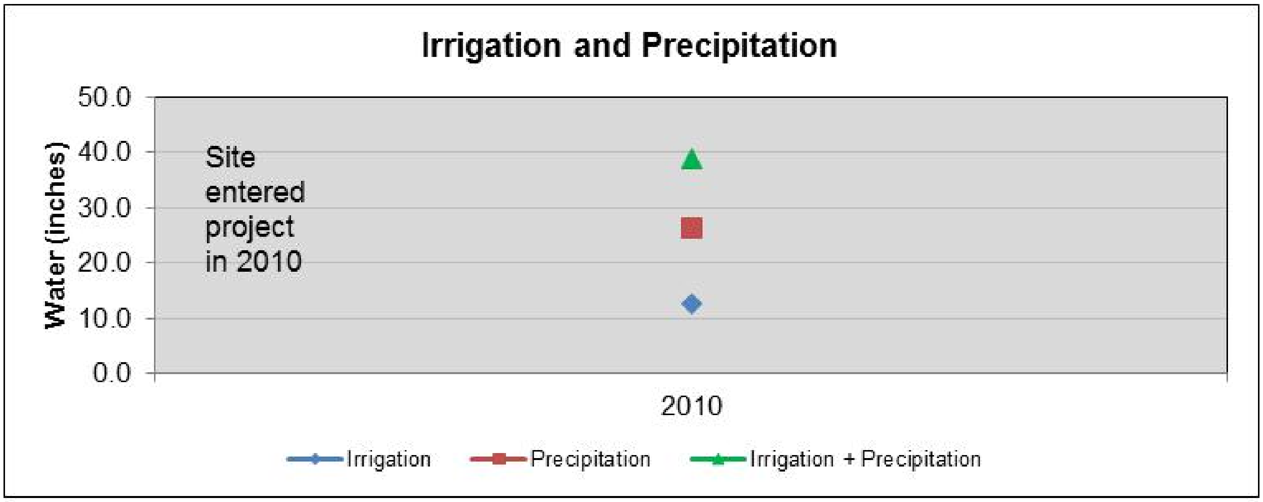
System 32

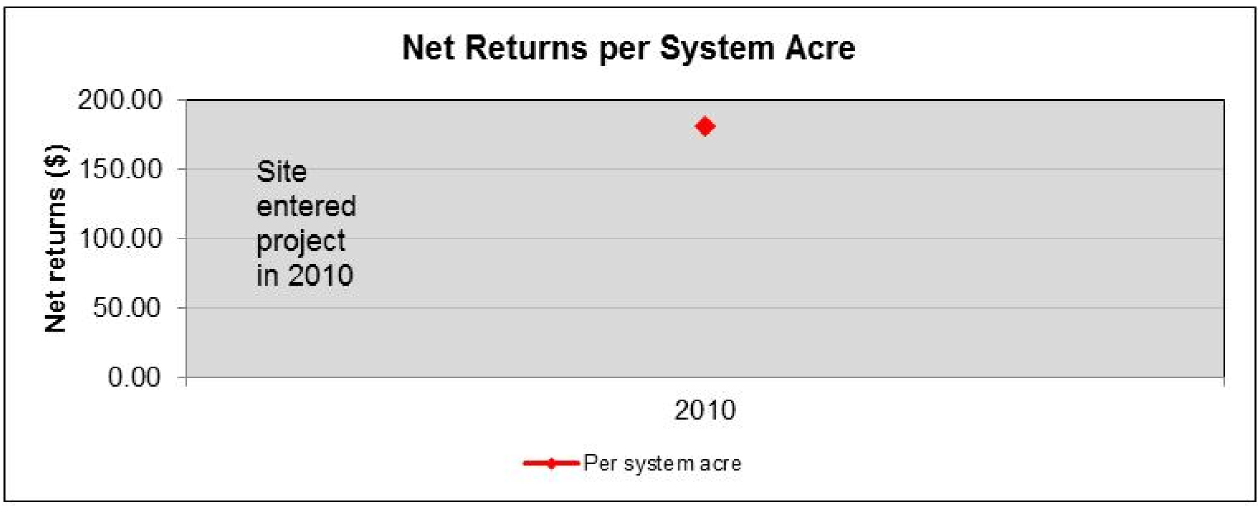
	Livestock	Field 1
2005	Entered project in Year 6	
2006		
2007		
2008		
2009		
2010	None	Corn

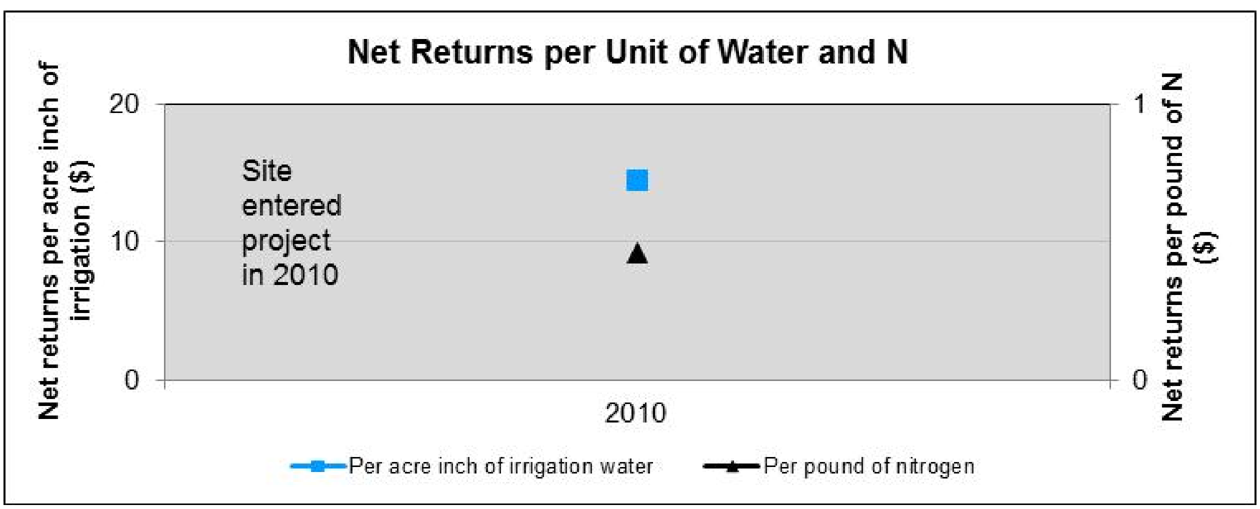
Implementation Phase, Site D-2 (32) April – August 2010

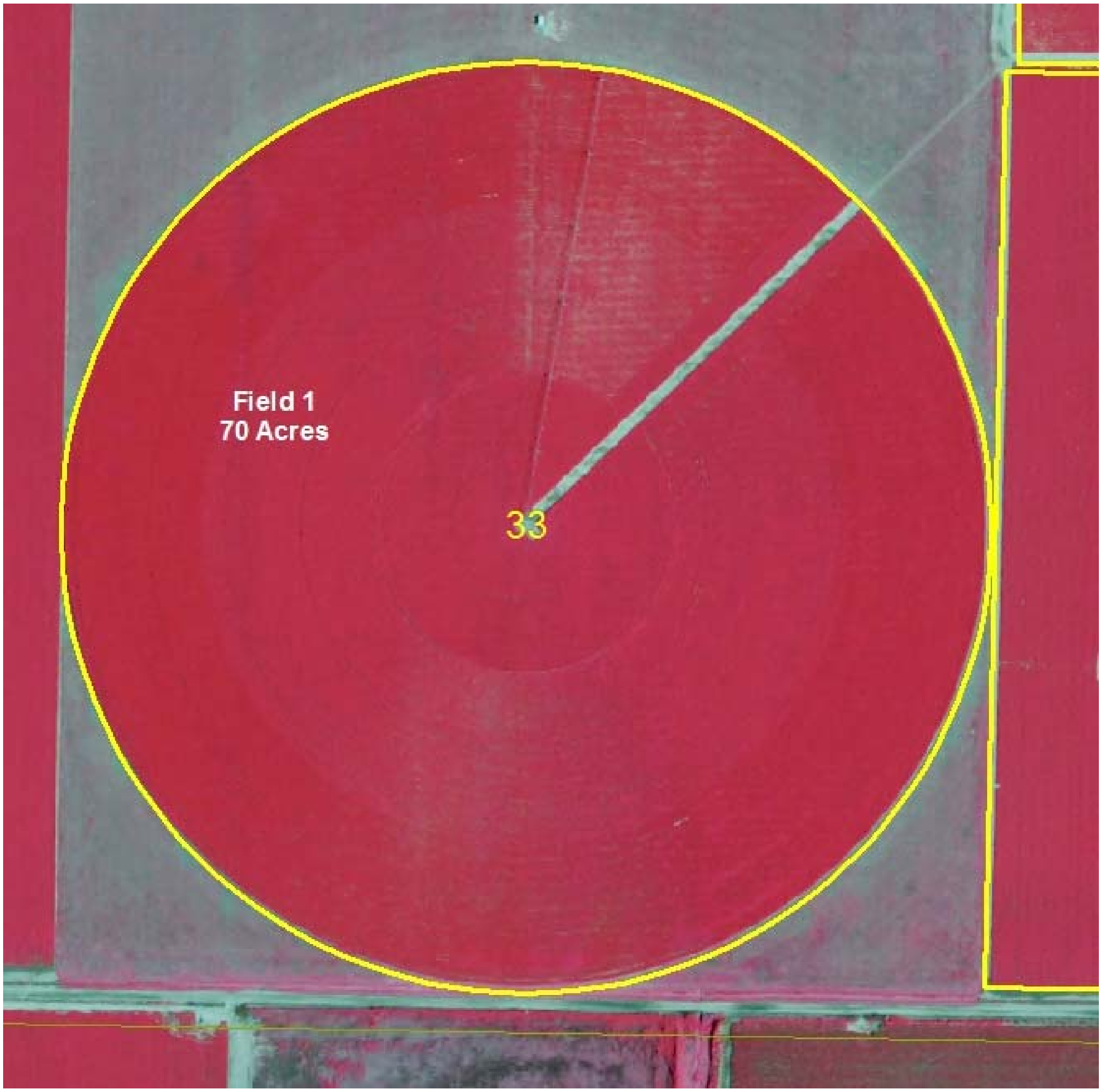
Comments: This is a pivot irrigated site which was planted to corn on twenty-inch centers for 2010. The corn was seeded at two different plant populations.

System 32


Irrigation and Precipitation
Water (inches)
50.0
40.0
30.0
20.0
10.0
0.0
Site entered project in 2010
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
200.00
150.00
100.00
50.00
0.00
Site entered project in 2010
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
20
10
0
Net returns per pound of N ($)
1
0
Site entered project in 2010
2010
Per acre inch of irrigation water
Per pound of nitrogen



System 33 Description

Total system 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

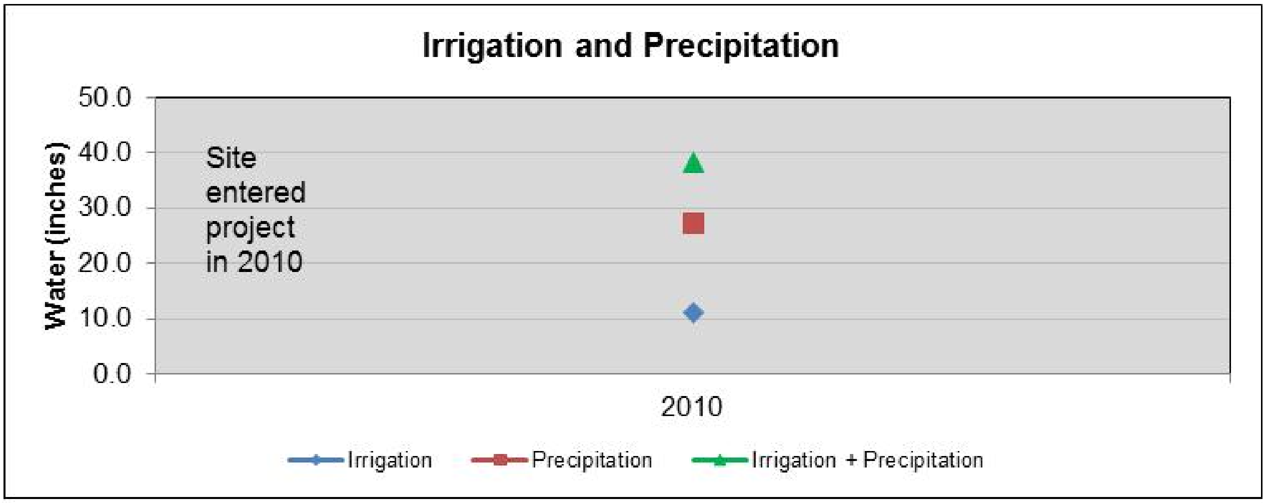
System 33

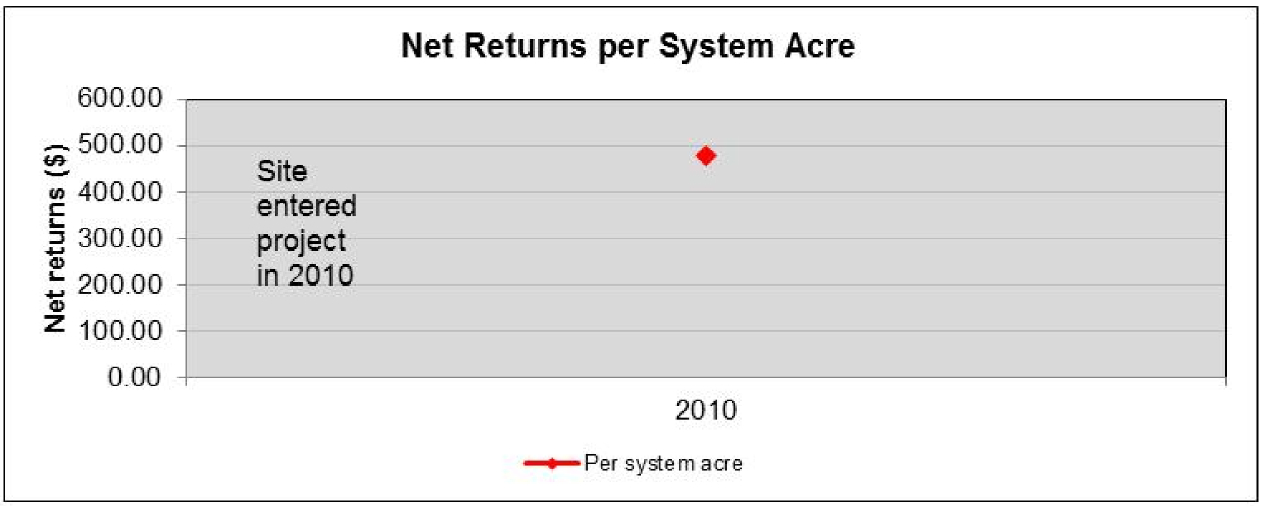
<table>
<tr><th></th><th>Livestock</th><th>Field 1</th></tr>
<tr><td>2005</td><td colspan="2" rowspan="5">Entered project in Year 6</td></tr>
<tr><td>2006</td></tr>
<tr><td>2007</td></tr>
<tr><td>2008</td></tr>
<tr><td>2009</td></tr>
<tr><td>2010</td><td>None</td><td>Cotton</td></tr>
</table>

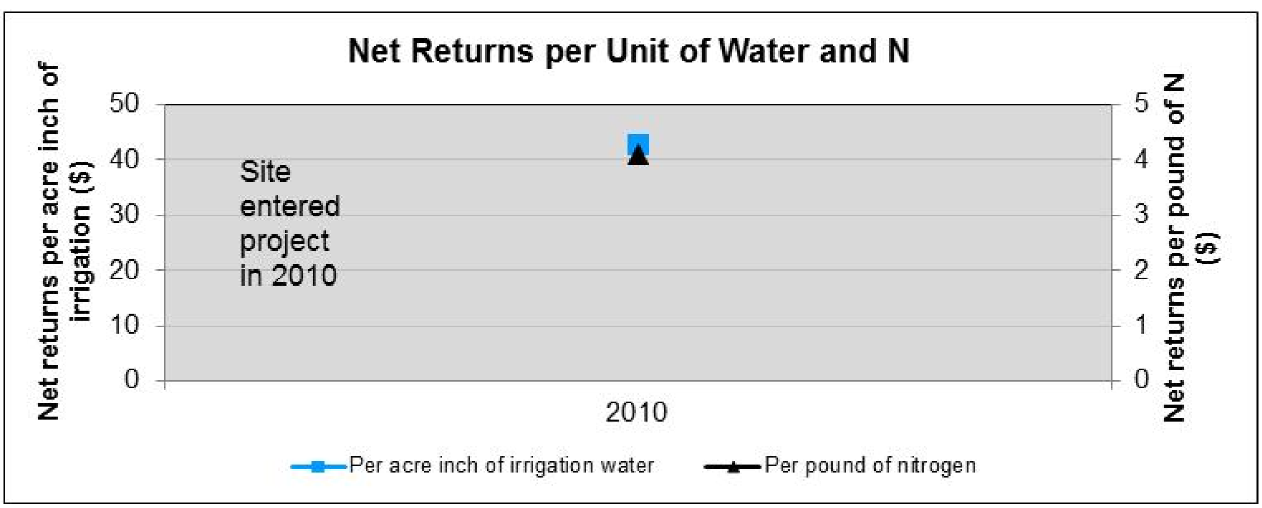
Implementation Phase, Site D-3 (33), April – August 2010

Comments: In 2010 this site was planted to two different varieties cotton on forty-inch centers using conventional tillage.

System 33


Irrigation and Precipitation
Water (inches)
50.0
40.0
30.0
20.0
10.0
0.0
Site entered project in 2010
2010
Irrigation
Precipitation
Irrigation + Precipitation


Net Returns per System Acre
Net returns ($)
600.00
500.00
400.00
300.00
200.00
100.00
0.00
Site entered project in 2010
2010
Per system acre


Net Returns per Unit of Water and N
Net returns per acre inch of irrigation ($)
50
40
30
20
10
0
Site entered project in 2010
Net returns per pound of N ($)
5
4
3
2
1
0
2010
Per acre inch of irrigation water
Per pound of nitrogen

Overall Summary of Years 1—6

The 2010 crop year was a favorable year with respect to profitability, growing season precipitation received, and irrigation requirements. Above average precipitation starting in December 2009 allowed producers to start the 2010 crop year with favorable soil moisture reserves that reduced pre-plant irrigation requirements and helped crops get off to a good start. The seasonal distribution of rainfall was favorable to both corn and cotton production. Rainfall for April through July was above average which was ideal for corn production, but returned to normal and dryer conditions into autumn which favored cotton production.

Of the six years of the project, the 2010 crop year had the most rainfall with precipitation averaging 28.9 inches across the TAWC sites (Fig. 6; Table 9). Of the 28.9 inches of precipitation received in 2010, 22.7 inches was received during the April through September growing season, which contributed to satisfactory crop yields. However, some fields did experience loss of yield potential due to high levels of rainfall that likely caused some fertility leaching, especially on fields where total fertility was applied at the beginning of the growing season, and rooting depths.

Precipitation over the six years of the project has ranged from a low of 15.0 inches (2005) to a high of 28.9 inches (2010), averaging 20.5 inches (2005-2010). Figures 8 and 9 show precipitation, irrigation applied, returns above all costs, and gross margin for both irrigated sites alone and all sites (irrigated and non-irrigated sites),

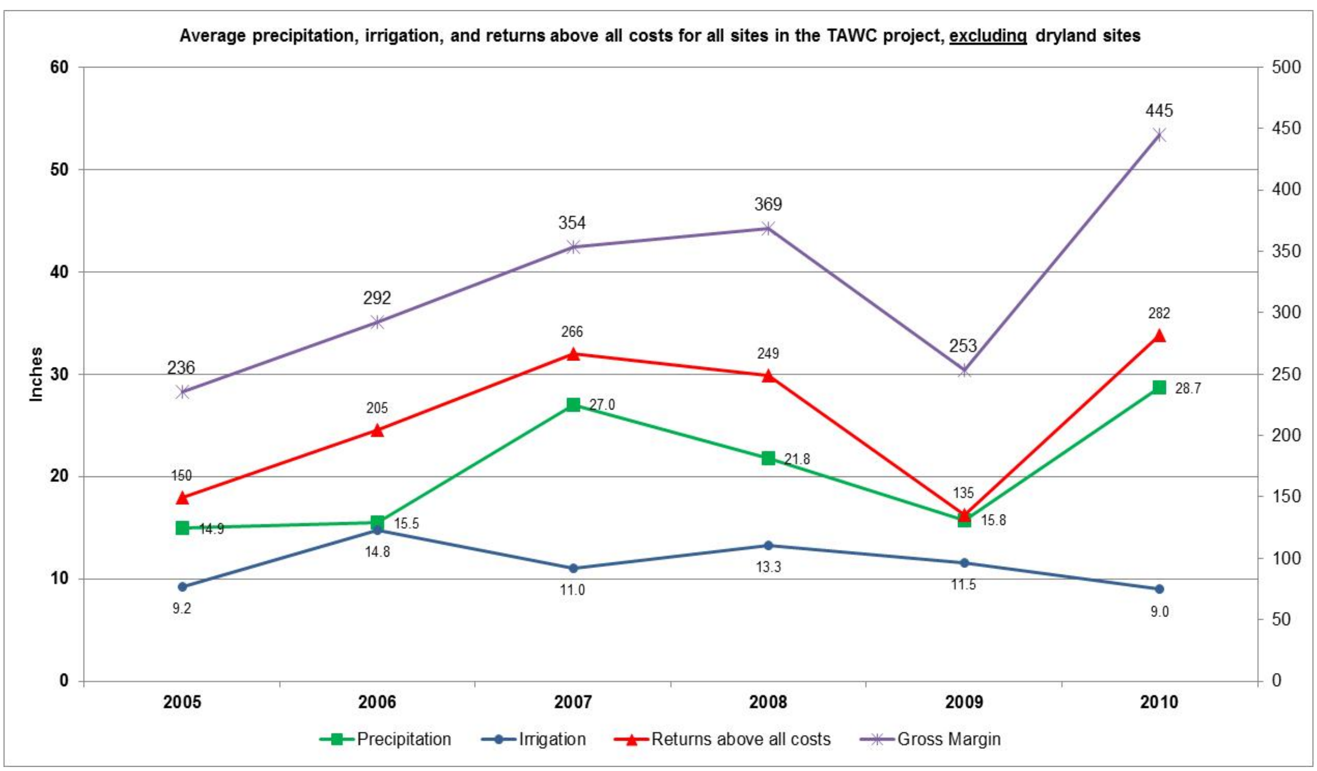


Figure 8. Average precipitation, irrigation, returns above all costs, and gross margin for irrigated sites in the TAWC Project (excludes dryland sites).

respectively. Average total irrigation applied on the irrigated sites in 2010 was 9.0 inches, which was 2.96 inches less than the mean of irrigation applied (11.96 inches) over the previous five years of the project. When all acres of all systems (both dryland and irrigated systems) were included, irrigation water applied in 2010 over the entire project area averaged 8.3 inches per project acre.

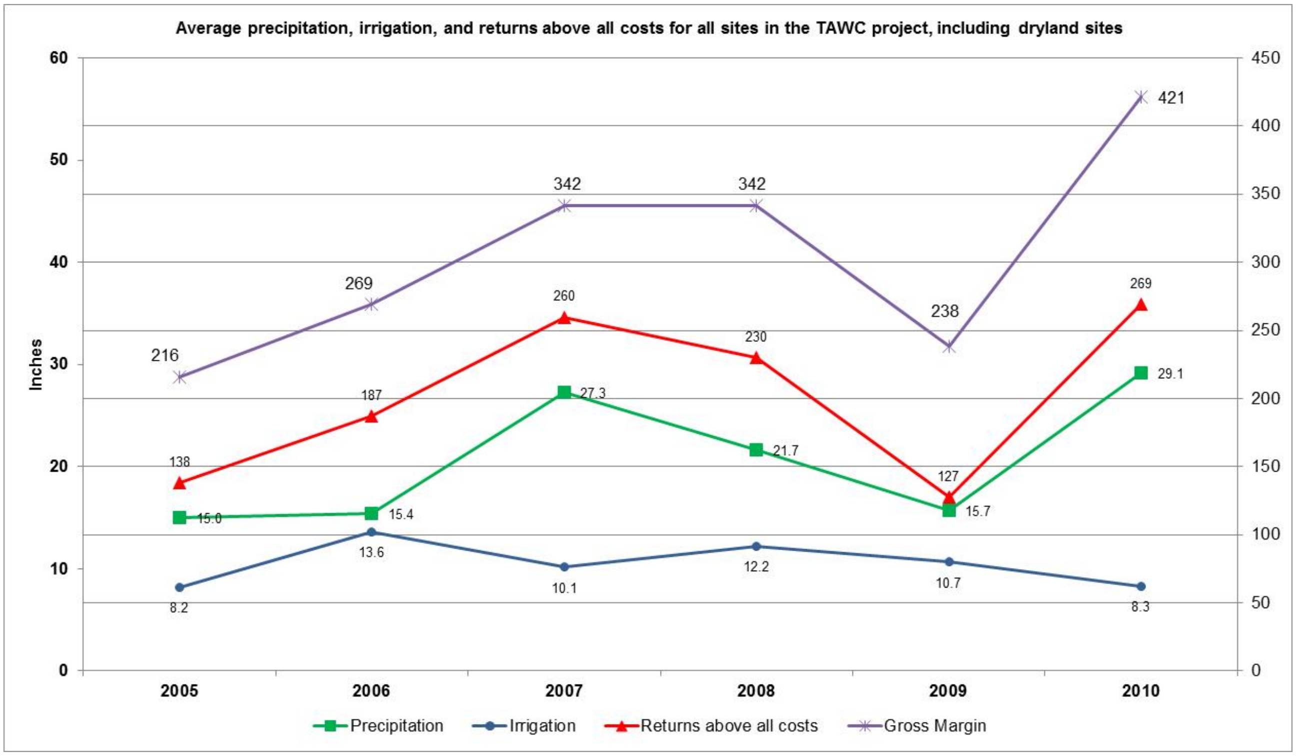


Figure 9. Average precipitation, irrigation, returns above all costs, and gross margin for all sites in the TAWC project (includes dryland sites).

Profitability in 2010 was the highest for all project years with respect to returns above all costs of production and gross margin. Returns above all cost of production in 2010 were $282 and $269 per acre for irrigated sites and all sites, respectively (Figs. 8 and 9). Gross margin was $445 and $421 per acre for irrigated sites and all sites, respectively (Figs. 8 and 9). Profitability was driven by respectable yields and increasing commodity prices, especially for cotton and corn. Price trends for the major commodities such as corn, cotton, cattle, and wheat turned upward the last half of 2010 allowing producers to take advantage of higher sale prices for the 2010 crop year. Most of the producers in the project utilize some form of forward contracting within their operation and did not receive the highest prices reached during the latter part of 2010, but were able to sell 2010 production at higher levels than 2009.

Cotton yields for all sites averaged 1,261 pounds per acre which was 33 pounds below the six year average yields. However, the cotton price increased to an average of $0.80 per pound, which was $0.24 per pound above the average price for the previous five years. This price represents the expected net price received from the PCCA Cotton Marketing Pool which is the predominate cotton marketing system used by project producers. Corn yields averaged 226.5 bushel per acre which was 18.5 bushel above the six-year average yields. The distribution of growing season rainfall was weighted more to the early months, which likely had a more positive effect on corn production versus cotton production. Corn price increased from $3.96 per bushel in 2009 to an average of $5.64 per bushel in 2010.

Production expenses increased in 2010 from 2009 levels, but were below levels for 2008. Fertilizer and chemical prices were steady to up slightly over 2009. Irrigation costs per acre inch pumped increased about 9% over 2009 due to increased energy and maintenance/repair costs. However, production costs in 2010 were below those in 2008 when increased energy prices caused cost increases for irrigation, fertilizer, chemicals and fuel. In addition, fixed costs for land and irrigation systems increased in 2010 due to higher land rents and increased investment costs for irrigation systems. Additionally, as commodity prices increased in the later part of the 2010, irrigated and non-irrigated land values increased across the region as the corresponding revenue potential per acre increased.

Each season producers in the TAWC project make their own decisions with regard to enterprise selection and production practices. Over the duration of the project, enterprise levels have varied based on the decisions producers make each year. The main factors in enterprise selection have been per acre profitability and water available for irrigation. Figures 10 and 11 show the acres and sites, respectively,

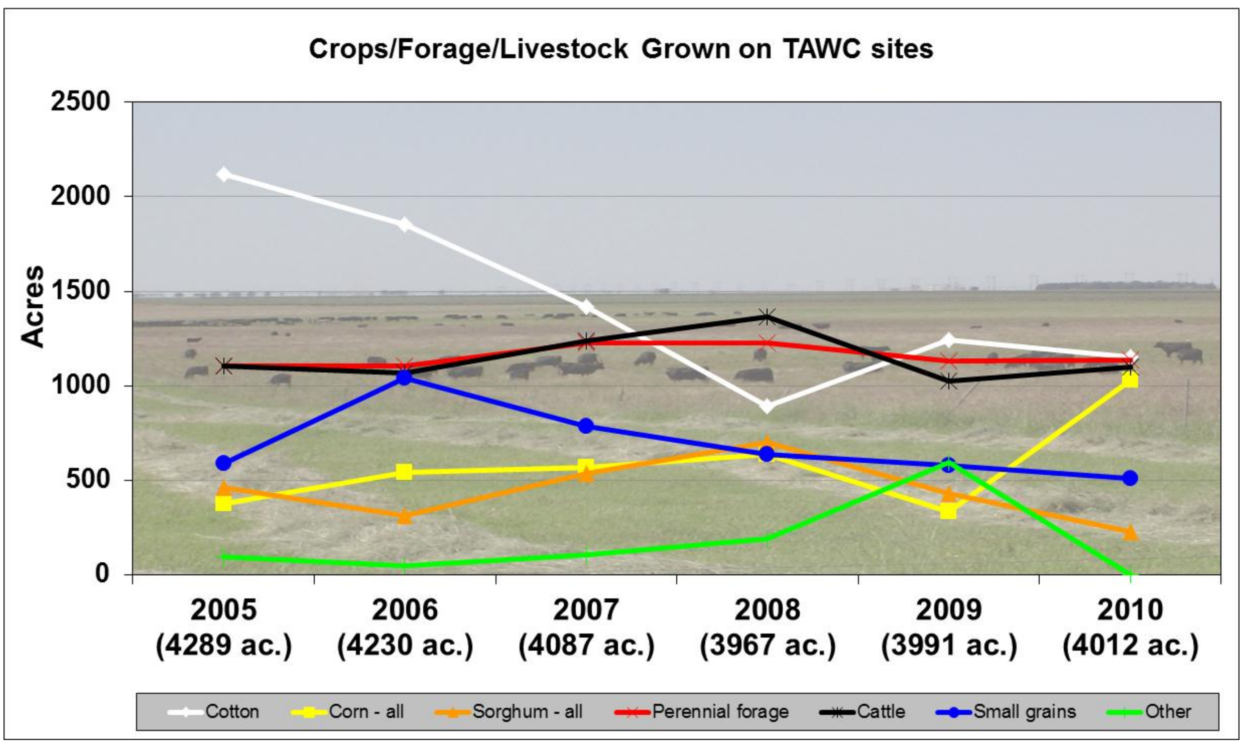


Figure 10. Number of acres that include cotton, corn, sorghum, perennial forages, cattle, small grains and other crops within the producer systems located in Hale and Floyd Counties.

that were devoted to cotton, corn, sorghum, perennial forages, cattle, small grains, and other crops within the producer systems located in Hale and Floyd Counties. (The total of enterprise acres exceeds total acres in the project in any given year due to double cropping and multi-use for livestock.) In 2010 acres in cotton, perennial forages, small grains and cattle were near 2009 levels. Acres devoted to corn production (grain and silage) increased to 1,029 acres in 2010 from 334 acres in 2009. This substantial increase in corn acres may be attributed to rising corn prices, particularly in relationship to the expected price for cotton and favorable moisture and soil profile conditions in early 2010 when planting decisions were made.

Trends in enterprise acres and sites, as shown in Figures 10 and 11, reflect producer's decision-making processes as they make year to year and multi-year production decisions. Cotton acres declined from 2,118 acres in 2005 to 891 acres in 2008 before recovering to about 1,200 acres in 2009 and 2010. This decline in cotton acres can be attributed to other commodity prices increasing relative to cotton and the high input cost of cotton production. The increase in corn acres in 2010 may have been in response to grain prices and pre-plant moisture conditions. Through 2010, acres devoted to perennial forages and cattle have been mostly stable. Perennial forages include warm-season grasses for grazing and hay production with some forages devoted to grass seed production. Within the project area, all perennial forages serve production objectives with no acres included in the Conservation Reserve Program.

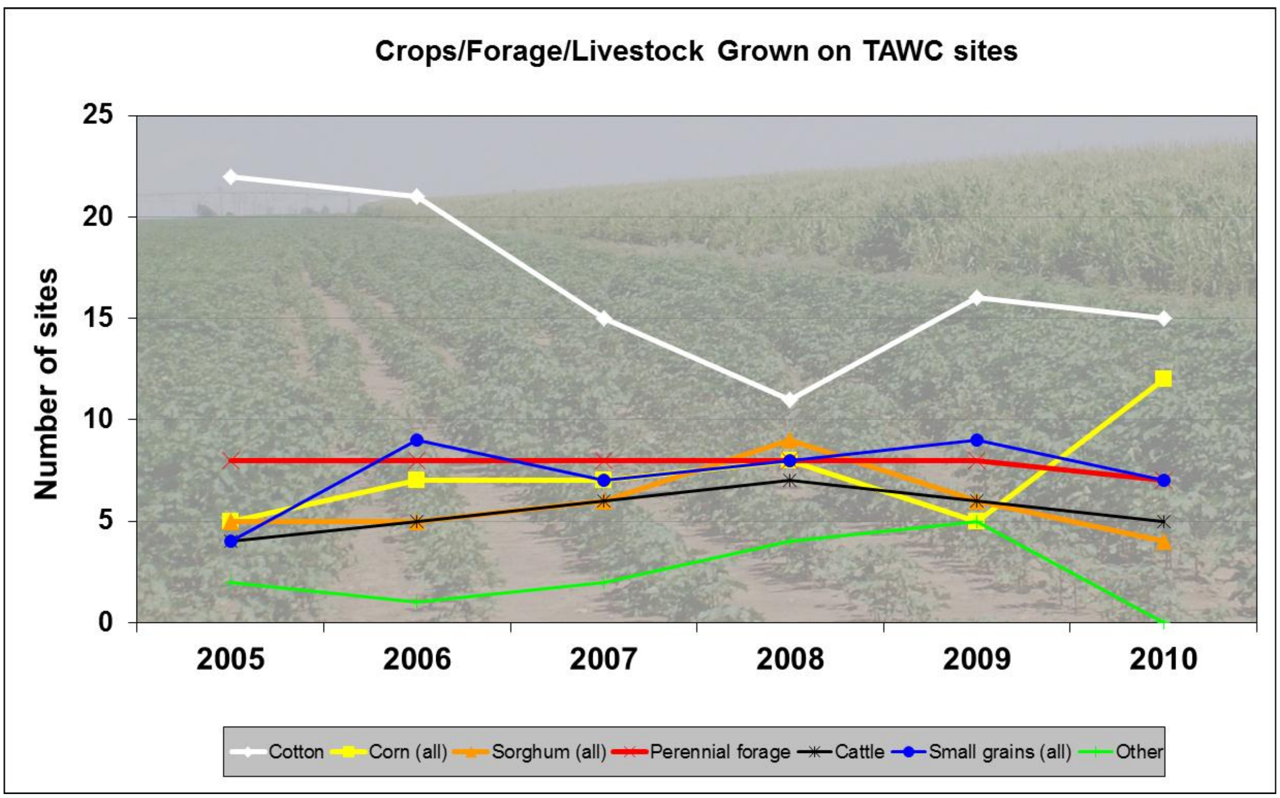


Figure 11. Number of systems (sites) that include cotton, corn, sorghum, perennial forages, cattle, small grains, and other crops within the producer systems located in Hale and Floyd Counties.

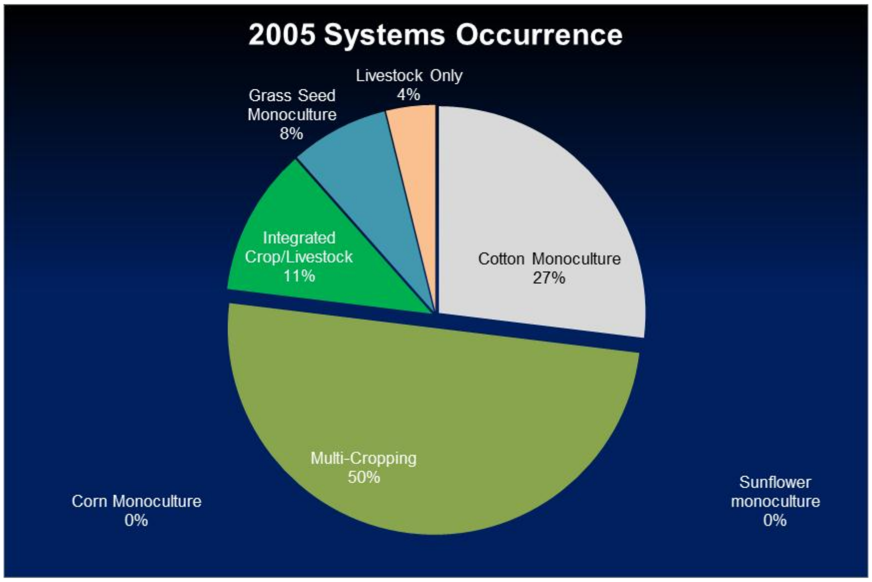


Figure 12. 2005 systems occurrence within the TAWC project sites in Hale and Floyd Counties.

Production systems within the TAWC have proven to be very dynamic in their makeup, adjusting through the life of the project to various market and climatic factors. As shown in Figure 12, 50% of the total land in the project was devoted to multi-cropping systems in 2005 while 27% was in cotton monoculture systems. There were no corn or sunflower monoculture systems initially and 11% of the area was in integrated crop/livestock systems. Grass seed monoculture and livestock (cow-calf) systems accounted for the remaining 12%. As shown in Figure 13, in 2010 multi-cropping system acres were 50%; however, cotton monoculture acres declined to 8% while corn monoculture acres were 15%. Integrated livestock systems accounted for 15% of the area.

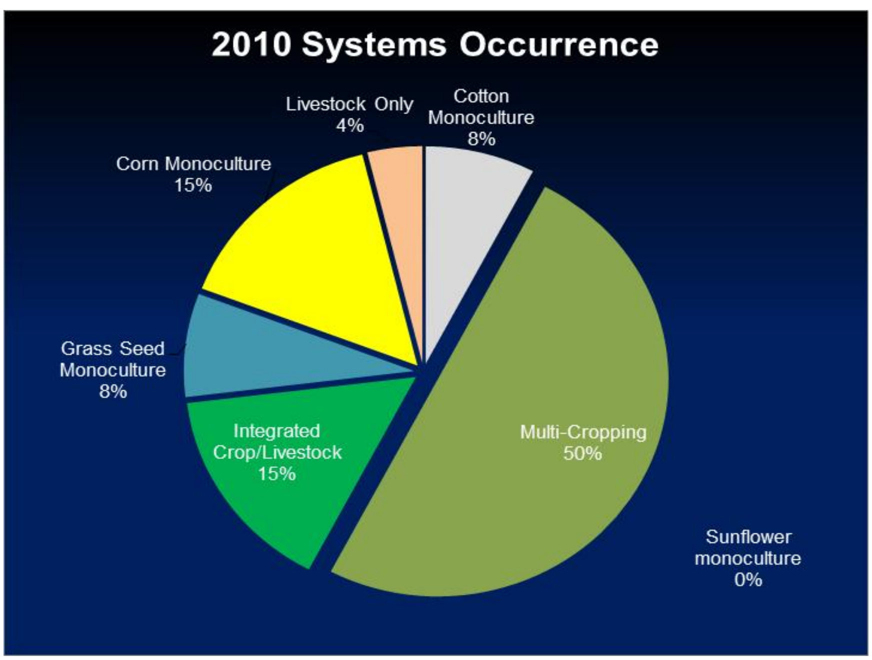


Figure 13. 2010 systems occurrence within the TAWC project sites in Hale and Floyd Counties.

Land use by producers is dynamic and reflects all of the factors that influence their decisions. Averaged over the six years of the project, cotton monocultures accounted for 20% of the systems, integrated crop/livestock systems were 16% of the systems, corn monocultures were 6%, and multi-cropping systems were on

45% of the systems (Fig. 14). Of the 21 sites that have been in the project all six years, four sites were cotton monoculture the first three project years; however, during the last three project years none of the sites have been solely cotton monoculture. Multi-crop systems, crop rotations between years, and integrated crop/livestock systems have been more prevalent as the project has progressed. It should be noted that two sites have been grass monocultures for grass seed production throughout the project. Due to the perennial nature of grass plantings, these acres, once established have generally remained in grass but can be quickly converted to crop production if conditions warrant. This in fact occurred on one site in 2010 where a long-term grass pasture was converted to corn production (Site 10). The major concern with regard to cotton monoculture systems year after year is the reduction in organic matter being put back into the soil which increases the risk of soil erosion and reduces water holding capacity in the types of soils found on the project sites. Research is currently in progress within several of these sites to document soil organic matter gains and losses within the various cropping and livestock system components.

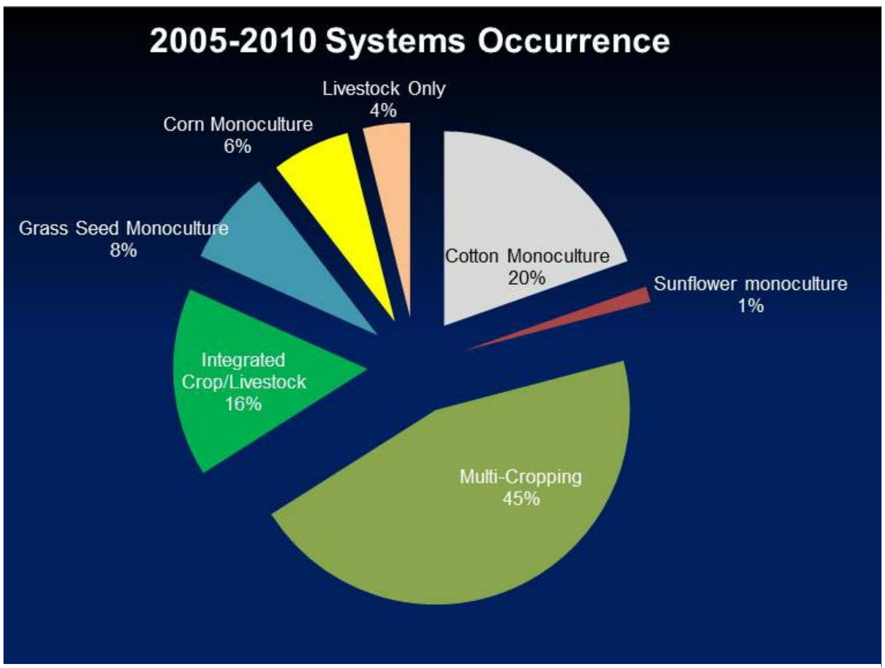


Figure 14. 2005 - 2010 systems occurrence within the TAWC project sites in Hale and Floyd Counties.

Water Use and Profitability

With six years of data, patterns are emerging in terms of total water use versus profitability. This is important because of the basic need to conserve the water resource and anticipated regulation of water use. To examine systems for meeting criteria of limited water use while maintaining profitability, we arbitrarily selected a maximum of 15 acre inches of irrigation water and a minimum of $300 per acre gross margin as a desired target area for system performance. Please note that these levels were selected only to begin this process and do not represent either the anticipated pumping limitation or the minimum amount of revenue required for agricultural operations to remain economically viable. This is simply a starting point to understand what these limits may ultimately be and to see if a pattern in systems emerges for meeting these criteria.

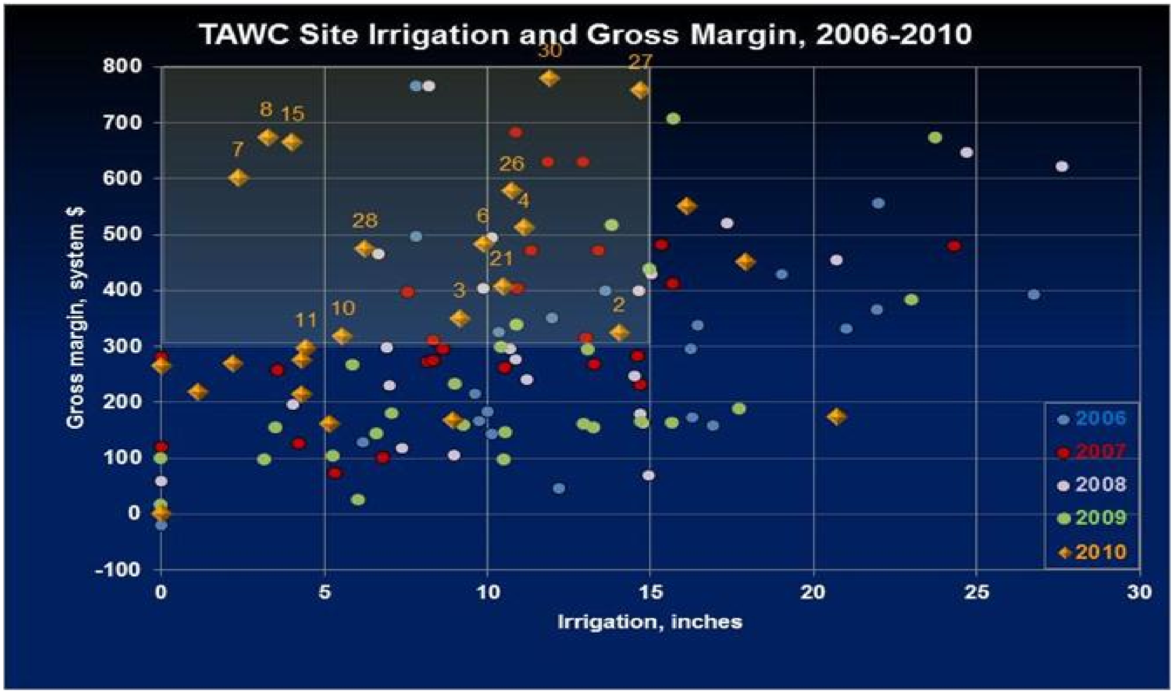


Figure 15. TAWC systems irrigation and gross margin, 2006-2010.

Average irrigation over all systems in 2010 was 8.3 acre inches (Fig. 9). When individual sites were examined, there were three sites that applied more than the 15 acre inch maximum water limit (Fig. 15). In 2007, a year of similar precipitation, three sites exceeded this 15 acre inch limit. In 2010, 14 of the 26 sites were within the 15 acre inch water limit while generating at least $300 per acre gross margin. This is the most sites to meet the criteria for any year of the project. These sites included a diversification of system types, for example: Site 8 (drip irrigated sideoats grama for seed production), Site 15 (a furrow/drip irrigated monoculture cotton system), Site 27 (a drip-irrigated corn silage/cotton multi-crop system), and Site 26 (a center pivot-irrigated wheat/corn/cotton & contract grazing integrated crop-livestock system). The high proportion of sites that met the criteria in 2010 can be attributed to the high precipitation which reduced the need for irrigation and increased commodity prices. If we reduce the minimum gross margin target to $200 per acre and the irrigation limit to 10 acre inches, 13 systems fell in this range in 2010 (Fig. 16). Again, this represented a range of systems including the two grass seed production systems, two cotton monocultures, two integrated crop/livestock systems, and seven multi-cropping systems. All of the multi-cropping systems that met these criteria included cotton in the system, but the remainder of these seven systems varied including grain sorghum, corn, wheat for grain or as a cover crop. For the two integrated crop/livestock systems, one included cotton while the other included corn as the crop. Individual profitability of the component parts of systems determines the overall system profitability, thus, selection of system components is critical to meeting objectives. Such selection, however, is based on experience and knowledge of the producer and is vulnerable to unpredictable changes in commodity and input prices as well as the vagrancies of weather.

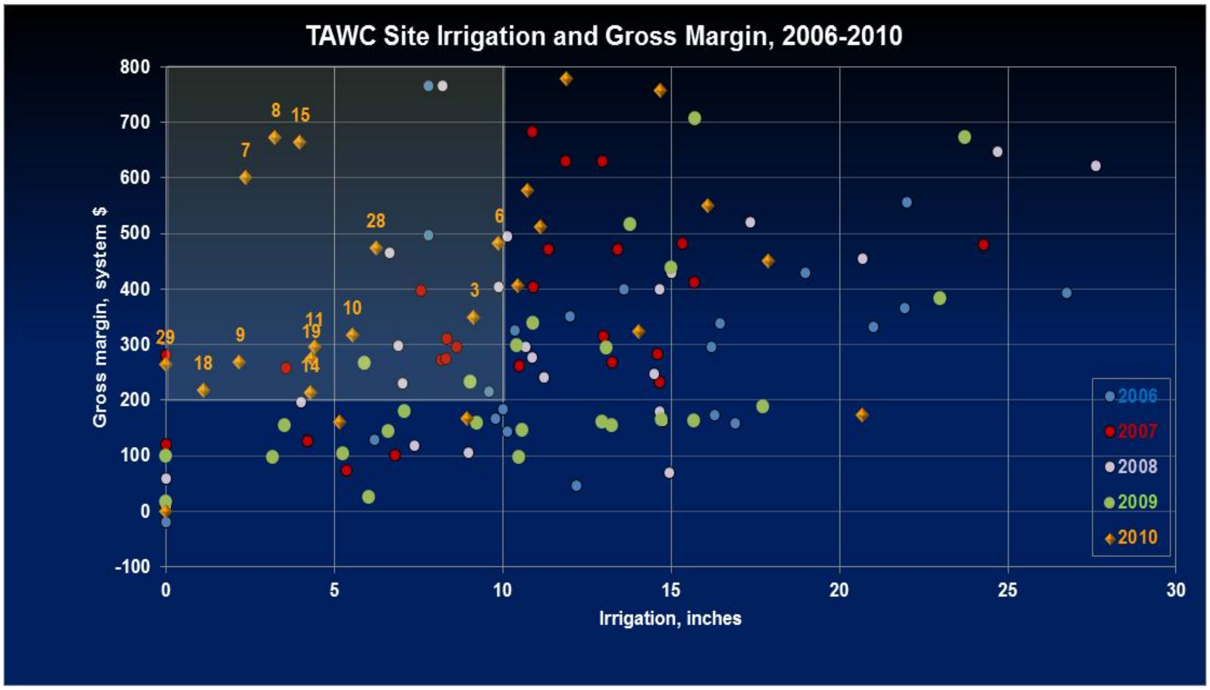


Figure 16. TAWC systems irrigation and gross margin, 2006-2010.

2010 Project Year

Grass seed production continued to have the highest average net returns per system acre at $480 (Fig. 17) and net returns per acre inch of irrigation of $174 (Fig. 18). The sites with grass seed production (Sites 7 and 8) also had the lowest applied irrigation at 2.37 and 3.25 acres inches, respectively, which was significantly below the average applied irrigation of 11 inches on these sites for the previous five years.

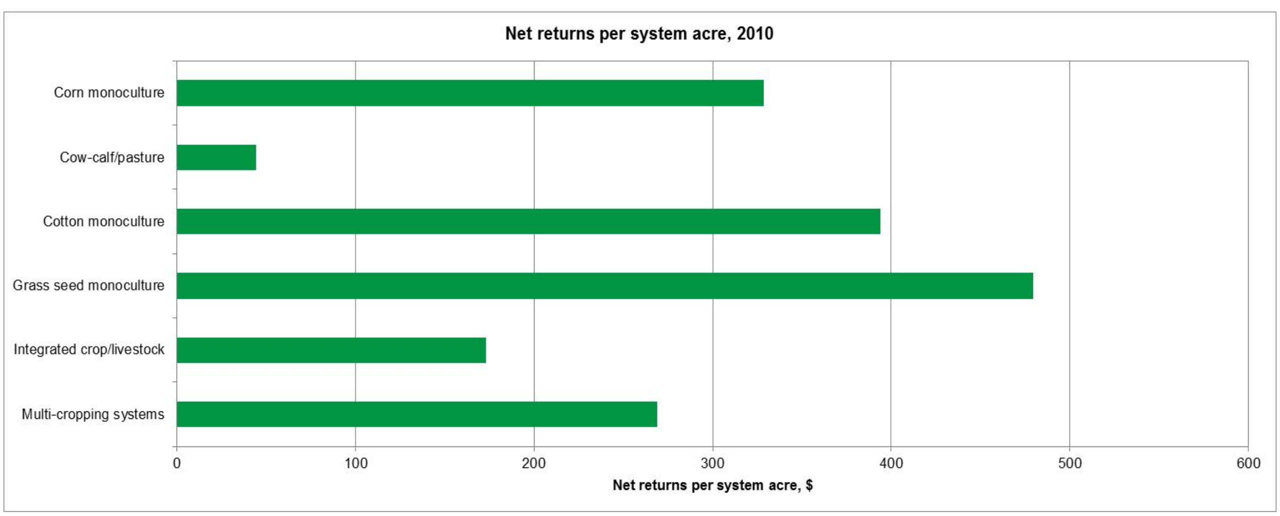


Figure 17. Net returns per system acre, 2010.

The much lower irrigation for grass seed production in 2010 can be attributed to the precipitation early in the growing season. Cotton monoculture sites had the second highest average net returns per system acre at $394 and net returns per inch of irrigation of $85. Irrigation applied on cotton monoculture sites averaged 5.11 acre inches. Corn monoculture sites had the highest average irrigation applied at 14.99 acre inches. These sites had average net returns per acre of $328 and average net returns per acre inch of irrigation of $37. Multi-crop and integrated crop/livestock systems had average net returns per acre of $269 and $173, respectively. Returns per acre inch of irrigation were similar at $32 and $31 for multi-crop and integrated crop/livestock, respectively. Multi-crop systems averaged 9.71 acre inches of irrigation, while integrated crop/livestock systems averaged 6.85 acre inches. Cow-calf pasture systems had the lowest net returns per acre and per acre inch of irrigation at $45 and $9, respectively. Irrigation applied for the cow-calf systems averaged 5.15 acre inches.

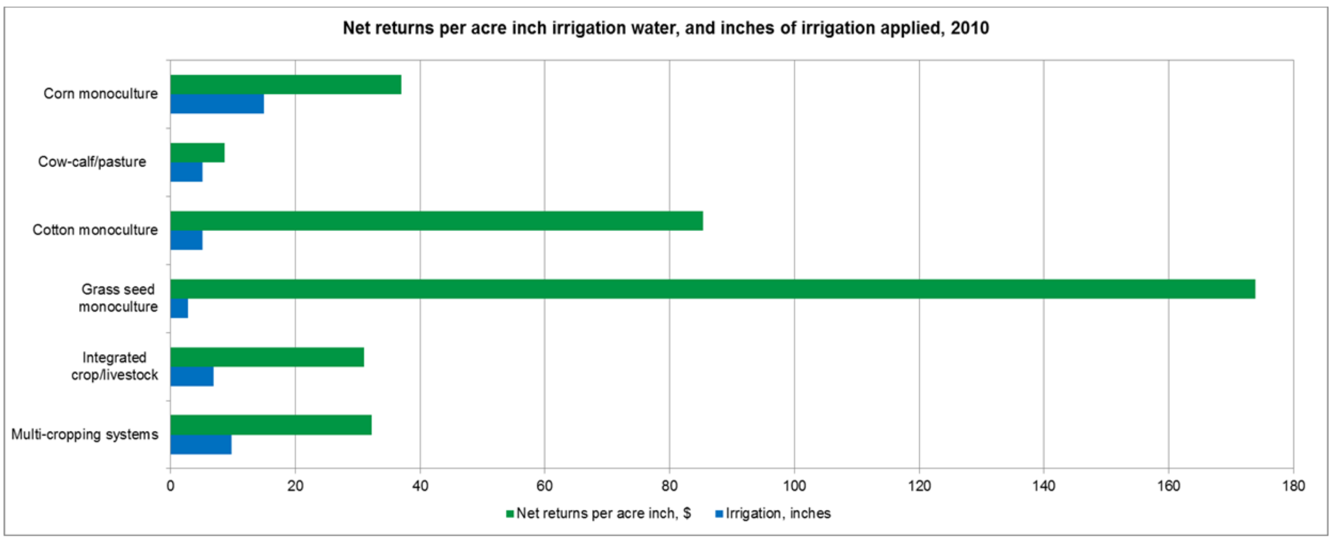


Figure 18. Net returns per acre inch irrigation water, and inches of irrigation applied, 2010.

Corn monoculture sites had the highest application rates of nitrogen fertilizer at 211 pounds (Fig. 19), with multi-crop and cotton monoculture systems at 149 and 134 pounds, respectively. Systems that are perennial grass for seed and cow-calf pasture had the lowest nitrogen application rates at 97 and 45 pounds, respectively.

The levels of irrigation applied per system acre in 2010 were less than 2008 and 2009. In 2010, average irrigation applied per system acre (Fig. 20) was less than 12 inches for all systems except for corn monoculture systems. Corn monoculture systems averaged 15 acre inches of irrigation with a range of 11.9 to 17.9 acre inches. Multi-crop systems averaged 9.7 acre inches with a range of 1.1 inches (wheat/cotton) to 20.7 inches (triticale/corn silage). The amount of irrigation per acre for multi-crop systems varied accordingly with the presence of corn acres within the system.

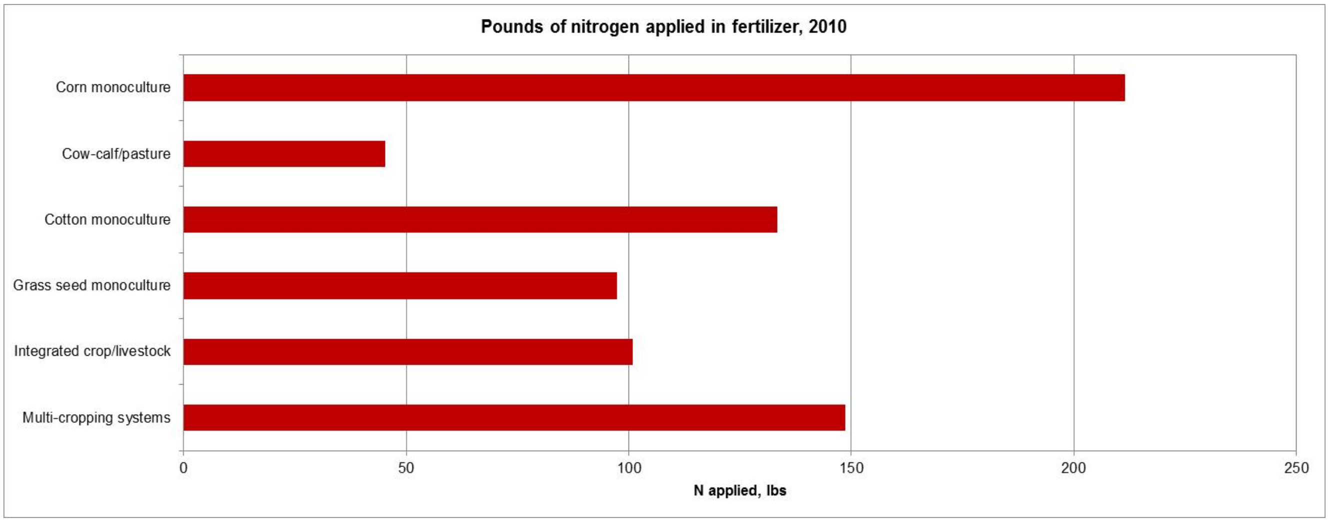


Figure 19. Pounds of nitrogen applied in fertilizer, 2010.

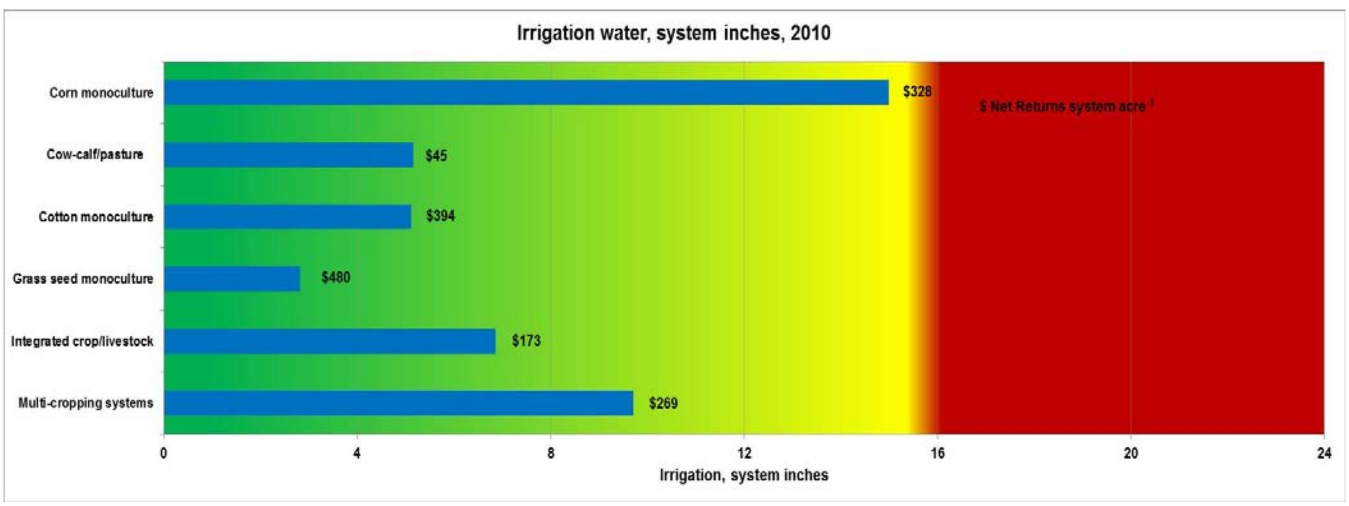


Figure 20. Irrigation water, system inches, 2010.

Implementation Sites

The project management team determined that there was a need to "implement" irrigation management practices that we have identified as having the potential to conserve water and maintain profitability. Three additional sites were identified and specifically managed during the 2010 growing season under limited irrigation scenarios. The goal was to apply less than 15 acre inches per irrigated system acre and manage irrigation scheduling using technologies which measure soil moisture, crop stress and crop evapotranspiration. As shown in Table 16, the sites consisted of a corn monoculture system (Site 32), a cotton monoculture system (Site 33), and a cotton/seed millet multi-crop system (site 31). All sites were under center pivot irrigation. As shown in Figure 21, all sites achieved the goal of less than 15 acre inches of irrigation water applied and greater than $300 per acre gross margin generated.

Table 16. Summary of Implementation Sites - 2010.

System	Site	Acres	Irrigation Ac In	Net Return $/Ac	Net Return $/Ac In	Gross margin $/Ac In
Monoculture systems						
Corn	32	70	12.44	180.67	14.52	28.99
Cotton	33	70	11.20	479.49	42.81	58.44
Multi-crop systems						
Cotton/Seed Millet	31	121.5	8.96	210.33	23.47	39.10

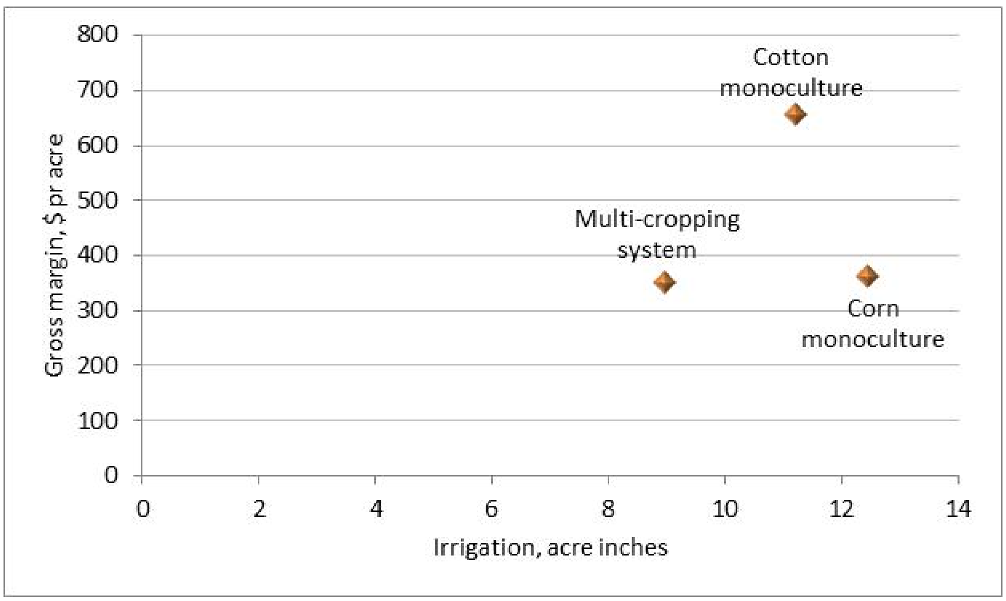


Figure 21. Irrigation and Gross Margin for Implementation Sites - 2010.

Project years 1 through 6

Average net returns per acre over the six years of the project (2005-2010) indicates that grass seed monoculture and corn monoculture were the most profitable systems at $421 and $412 per acre, respectively (Fig. 22). Irrigated cotton monoculture and irrigated multi-crop systems averaged $198 and $190 per acre net returns, respectively. Integrated crop/livestock and cow-calf pasture systems averaged $159 and $113 per acre net returns, respectively. Dryland systems had the lowest average net returns, with dryland cotton monoculture having a negative net return.

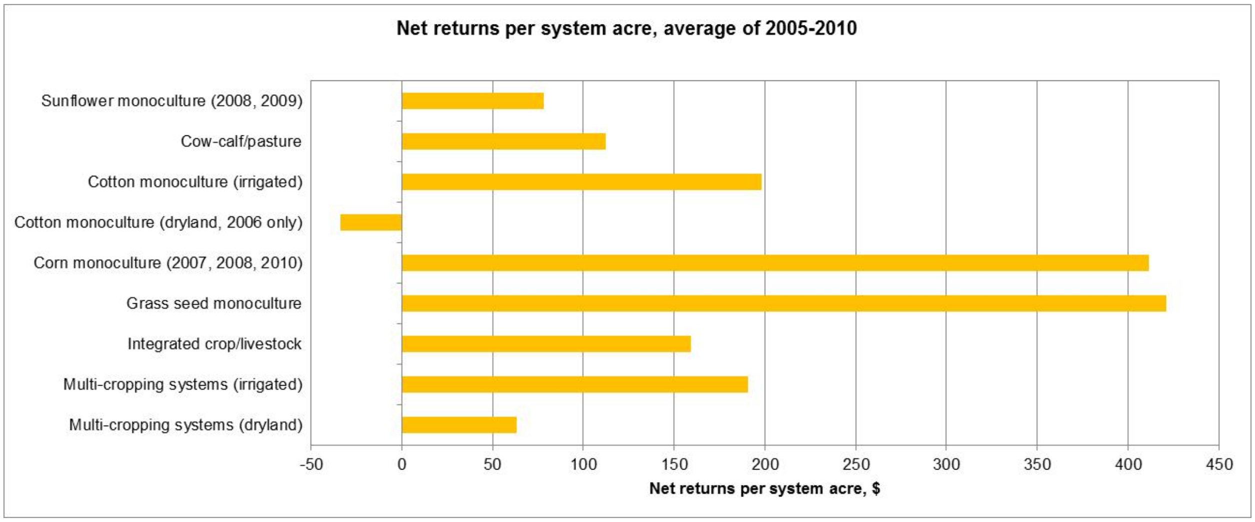


Figure 22. Net returns per system acre, average of 2005-2010.

With regard to net return per acre inch of applied irrigation, the grass seed monoculture system was the highest at $62 per acre inch (Fig. 23). Grass seed monoculture also averaged less than 10 acre inches of irrigation per year at 9.78 inches. The cow-calf pasture system was the second highest system in net return per acre inch of irrigation at $36 and the system with the lowest average applied irrigation at 5.02 acre inches. Corn monoculture systems had the highest applied irrigation at 15.76 acre inches and net returns per acre inch of $29. Cotton monoculture systems averaged 10.38 acre inches of irrigation and $26 per acre inch net returns. Multi-crop and integrated livestock systems were similar with respect to net returns per inch at $17 and $18, respectively.

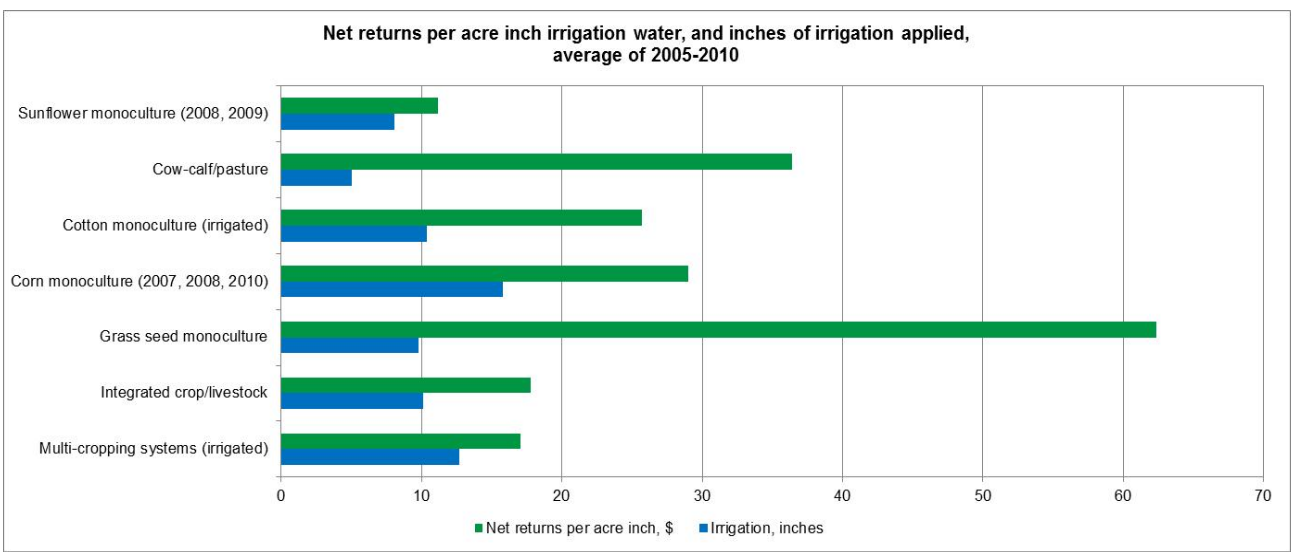


Figure 23. Net returns per acre inch irrigation water, and inches of irrigation applied, average of 2005-2010.

Corn monoculture systems had the highest levels of nitrogen fertilizer applied at an average of 227 pounds per acre (Fig. 24). All other systems with the exception of the cow-calf calf pasture system ranged from 113 to 129 pounds of nitrogen per acre. Of the irrigated systems, the cow-calf pasture system was the lowest user of applied nitrogen fertilizer at 53 pounds per acre. Dryland systems used very little applied nitrogen.

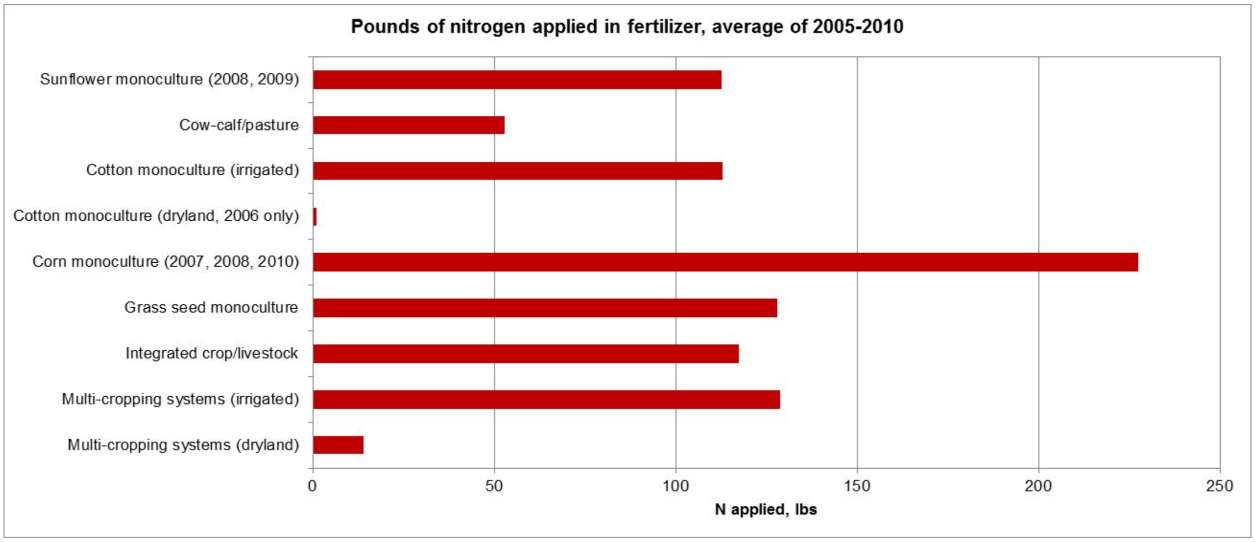


Figure 24. Pounds of nitrogen applied in fertilizer, average of 2005-2010.

Discussion

Over the six years of the project we have been able to observe a number of system configurations under varied environmental conditions, irrigation regimes, and market conditions. It has not been surprising that management is the key to how these systems behave under the extreme year to year differences in environmental conditions experienced in this region. Producers must make strategic and tactical production decisions within their operations to maintain economic viability and utilize available resources wisely. Strategic decisions relate to enterprise selection, whether it is year to year crop selection or more long- term planning. Perennial grass plantings for grass seed production, integrating livestock into an operation, or the selection of irrigation system types and technologies are examples of observed strategic decisions. Tactical decisions relate to enterprise management within the growing season, such as variety selection, fertility, and irrigation scheduling.

There are a number of irrigation management technologies such as Smart Crop, Aqua Spy and Net Irrigate that are available to irrigated producers to 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 the producers that have used these technologies has been invaluable and 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. The Water Allocation Tool is an economic-based decision aid which utilizes economic variables provided by individual producers to estimate options for cropping systems which maximize per acre profits. This tool can be used by producers to make strategic cropping decisions that consider enterprise market conditions and limitations they may have regarding water availability, whether from structural limitations due to the aquifer or irrigation systems, or from policy limitations imposed by regulatory agencies. The Irrigation Scheduling Tool is intended as an in-season tactical aid to assist producers in determining a more refined irrigation schedule utilizing weather information, rainfall, irrigation applications, irrigation efficiency, and ET estimates. This tool is designed to assist producers in making growing season decisions to manage their available irrigation to meet crop moisture demands. The tool gives producers the ability to assess information to help manage irrigation on a field by field basis utilizing ET estimates that are based on weather data from the Texas Tech Mesonet, which is an extensive network of over 60 weather stations throughout the region. These tools are free of charge to the producer and are currently available on the TAWC website.

The dissemination of results and information from the project through various outreach efforts is an important part of the project. Field days were held in August 2010 and February 2011 at Muncy. The August field day allowed 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 as well as other data aspects of the project. 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 our water resource is critical to the continued economic success of agriculture in the region. Producers face many challenges, whether they are from “mother nature” or regulatory policy. The information we are deriving from this project will assist producers in meeting these challenges and allow the region to continue to be a leader in agricultural production.

Table 17. 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
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
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
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

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

Table 18. 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
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
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
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

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

Table 19. 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
Monoculture systems							
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
Corn silage	27	62	SDI	13.00	194.40	14.95	24.18
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
Multi-crop systems							
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	11.30	191.68	16.96	23.15
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	27.74	37.16
Crop-Livestock systems							
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	4.10	48.89	11.93	30.71
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

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

Table 20. 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
Monoculture Systems							
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
Multi-crop systems							
Cotton/Wheat/Grain sorghum	3	123.3	CP	14.75	53.79	3.65	11.01
Cotton/Corn	6	122.9	CP	17.34	411.02	23.70	29.97
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	-18.72	Dryland	Dryland
Cotton/Wheat	15	95.5	Fur/SDI				
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	38.23	48.95
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	33.15	Dryland	Dryland
Crop-Livestock systems							
Wheat: cow-calf, grain/cotton/alfalfa hay	4	123.1	CP	14.51	154.85	10.67	16.99
Perennial grass: cow-calf, hay	5	628	CP	5.18	95.22	18.38	35.74
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	-66.00	-4.50	3.34
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

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

Table 21. 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
Monoculture Systems							
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
Multi-crop systems							
Cotton/Grain Sorghum	3	123.3	CP	5.89	158.51	26.91	45.35
Cotton/Corn	6	122.9	CP	10.40	182.14	17.52	28.59
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
Crop-Livestock systems							
Wheat/haygrazer; contract grazing, grain sorghum/cotton/alfalfa hay	4	123.1	CP	9.02	119.85	13.29	25.68
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

Table 22. Summary of results from monitoring 26 producer sites during 2010 (Year 6).

System	Site No.	Acres	Irrigation Type1	System inches	$/system acre	$/inch water	Gross margin per inch irrigation
Monoculture systems							
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
Multi-crop systems							
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	6,9,10	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
						32.28	
Crop-Livestock systems							
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

Table 23. Overall summary of crop production, irrigation, and economic returns within 26 production sites in Hale and Floyd Counties during 2005, 2006, 2007, 2008, 2009 and 2010.

Item		2005	2006	2007	2008	2009	2010	Crop year Average
Mean Yields, per acre (only includes sites producing these crops, includes dryland)								
Cotton								
	Lint, lbs	1,117 (22) [1]	1,379 (20)	1,518 (13)	1,265 (11)	1,223 (16)	1,261 (15)	1,293.83
	Seed, tons	0.80 (22)	0.95 (20)	1.02 (13)	0.86 (11)	0.81 (16)	0.83 (15)	0.88
Corn								
	Grain, lbs	12,729 (3)	8,814 (4)	12,229 (4)	10,829 (8)	12,613 (4)	12,685 (10)	11,649.83
	Silage, tons	30.9 (2)	28.3 (3)	27.3 (3)	-	38.3 (1)	31 (2)	31.16
Sorghum								
	Grain, lbs	4,147 (3)	2,987 (1)	6,459 (4)	6,345 (5)	6,907 (3)	4,556 (3)	5,233.50
	Silage, tons	26.0 (1)	20.4 (2)	25.0 (1)	11.3 (2)	9.975 (2)	-	18.54
	Seed, lbs	-	-	-	3507 (1)	-	-	3,507.00
Wheat								
	Grain, lbs	2,034 (1)	-	2,613 (5)	4,182 (5)	2,061 (6)	2,860 (6)	2,750.00
	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								
	Silage, tons	-	21.3 (1)	17.5 (1)	-	-	13 (2)	17.27
Sunflower								
	Seed, lbs	-	-	-	1,916 (2)	2,274 (4)	-	2,095.00
Pearl millet for seed								
	Seed, lbs	3,876 (1)	2,488 (1)	4,002 (2)	2,097 (2)	-	-	3,115.75
Perennial grass								
Dahl								
	Seed, PLS lbs	-	-	-	30 (1)	83.14 (1)	-	56.57
	Hay, tons	-	-	-	2.5 (1)	-	-	2.50
SideOats								
	Seed, PLS lbs	313 (2)	268 (2)	96 (5)	192.9 (4)	362 (3)	212.5 (2)	240.73
	Hay, tons	-	-	-	1.66 (3)	1.83 (3)	1.1 (2)	1.53
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)	8.89
Precipitation, inches (including all sites)		15.0	15.4	27.3	21.7	15.7	29.1	20.70
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)	9.0 (24)	11.47
By Crop (Primary Crop)								
Cotton		8.7 (19)	14.3 (19)	11.3 (11)	12.2 (10)	12.5 (15)	7.4 (15)	11.07
Corn grain		17.4 (3)	21.0 (4)	12.5 (4)	21.7 (8)	19.2 (4)	12.8 (10)	17.43
Corn silage		18.0 (2)	24.0 (3)	12.6 (3)	-	24.3 (1)	18 (2)	19.38
Sorghum grain		7.5 (1)	4.2(1)	6.6 (4)	12.3 (5)	9.4 (3)	6.13(2)	7.69
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)	5.32
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)	9.93
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)	-	-	7.00
Small Grain (silage)		7.5 (1)	10.2 (3)	12.9 (1)	5.5 (1)	-	-	9.03
Small Grain (hay)		-	4.9 (1)	-	-	-	-	4.90
Small Grain (all uses)		5.2 (5)	7.3 (10)	7.44(11)	8.2 (6)	-	-	7.04
Sunflower seed		-	-	-	9.6 (2)	8.9 (4)	-	9.25
Millet seed		-	-	-	9.6 (2)	-	-	9.60
Dahl								
hay		-	-	-	4.65 (1)	-	-	4.65
seed					9.4 (1)	8.9 (1)	-	9.15
grazing						4.1 (1)	-	4.10
Sideoats								
seed		-	-	-	8.0 (3)	15.3 (3)	2.8 (2)	8.70
Bermuda								
grazing		-	-	-	6.2 (1)	5.3 (1)	-	5.75
Other Perennials/Annuals								
hay		-	-	-	4.02 (1)	-	8.5 (1)	6.26
grazing		-	-	-	5.5 (1)	6.6 (1)	-	6.05
Perennial grasses (grouped)								
Seed		-	-	-	8.35 (4)	13.7 (4)	2.8 (2)	8.28
Grazing		-	-	-	5.85 (2)	5.3 (3)	2.3 (6)	4.48
Hay		-	-	-	4.33(2)	-	2.81 (2)	3.57
All Uses		6.5 (6)	8.8 (6)	7.1 (7)	6.7 (8)	10.1 (7)	2.5 (10)	6.95
Alfalfa		10.3 (1)	34.5 (1)	10.6 (1)	15.6 (1)	18.6 (1)	15.6 (1)	17.53
Income and Expense, $/system acre								
Projected returns		660.53	773.82	840.02	890.37	745.82	943.96	782.11
Costs								
	Total variable costs (all sites)	444.88	504.91	498.48	548.53	507.69	522.73	500.90
	Total fixed costs (all sites)	77.57	81.81	81.77	111.98	110.65	152.23	88.28
	Total all costs (all sites)	522.45	586.72	580.25	660.51	618.34	674.96	593.65
Gross margin								
	Per system acre (all sites)	215.66	268.91	341.54	341.84	238.13	421.22	281.21
	Per acre inch irrigation water (irrigated only)	33.50	22.53	34.01	31.17	22.95	75.17	28.83
Net returns over all costs								
	Per system acre (all sites)	138.09	187.10	259.77	229.86	127.48	269.00	188.46
	Per acre inch of irrigation water (irrigated only)	21.57	15.88	24.99	20.89	9.99	45.80	20.83
	Per pound of nitrogen (all sites)	1.62	0.81	2.34	1.48	0.87	2.44	1.42

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

REPORTS BY SPECIFIC TASK

TASK 2: PROJECT ADMINISTRATION

2.1 Project Director: Rick Kellison.

The 2010 growing season will be added to the long list of unique growing seasons. The South Plains received a large amount of snow and rain during the winter and a very wet spring and early summer. This winter and spring moisture allowed the producers to start this growing season with a full soil moisture profile, and we received timely rains through the end of July. August through November was dry and warm which allowed a timely corn harvest and allowed us to mature an excellent cotton crop. This year we had the best of both worlds, a quality crop and once in a life time commodity prices.

One of the high lights for 2010 was the release of our two, new web based irrigation and economic management tools. These tools were released to the public on February 24th at the TAWC field day held at Muncy, Texas. There were approximately eighty people in attendance. With the goal of making as many producers as possible aware of these tools, Dr. Doerfert has completed a press release for all area newspapers describing these tools. We are also doing a direct mailing to approximately five hundred participants of previous field days. We plan to continue to add additional water and crop management information to this web site (www.tawcsolutions.org). Pioneer Hybrids plan to use our ET tool in the management of their new drought tolerant hybrids.

On March 9th we held a Producer Board Meeting to determine their perspective on the implementation phase of the TAWC project. They gave input on site selection, irrigation levels, and compensation for the producers involved. Results of this meeting were shared with Senator Robert Duncan and a plan was developed to put this phase in place. Sites were selected and equipment is being installed. Bob Glodt, Glenn Schur, Ronnie Aston, Ted Young and myself met several times during the 2010 growing season. Each meeting focused on using some type of irrigation scheduling tool to reach the water budget goal that had been set for each producer field. The ET program was used for our baseline. Each producer was taught how to probe the soil to determine available soil moisture at three soil depths. This information was an aid to determine irrigation needs.

TAWC hosted two field days in 2010 and 2011. Our August 10th field day was our best attended field day to date, with one hundred twenty-one people in attendance. The feedback received indicated that the information presented was practical and timely for the producers. On February 24th we held our second field day for the physical year with approximately eighty people in attendance. Both field days were broadcast live by KFLP radio, Floydada and Amarillo.

On June 17th Dr. Allen and I attended the West Texas Ag Issues Summit in Plainview. I attended the South West Council of Agri Business meeting and Banquet on July 9th. Senator

Blanche Lincoln was the keynote speaker for the banquet. On July 27th, Dr. Maas and I hosted a tour of the cotton demonstration sites for a group from Cotton Incorporated. Three of our producers were interviewed and filmed highlighting the different management practices being used with an emphasis on water conservation. From August 30th thru September 2nd we had a film crew from SARE visit various producer sites. They met with and interviewed several of the producers. This film should air in late December, 2010.

In October, Dr. Allen, Dr. Doerfert, Dr. Maas, Dr. Johnson, Heather Morris and I made a trip to Washington D.C. The purpose of our trip was to visit with U.S.D.A. and N.R.C.S. personnel to explore future grant opportunities. We believe our trip was successful. We gained insight into future grant opportunities and some of the specifics that they are looking for. We also learned that there will be fewer grants offered in the future but they will be larger and for a longer period of time.

On November 19, 2010, Glenn Schur and I met with the North Plains Water District to review their 200/12 report. At that meeting, we discussed the possibility of TAWC and North Plains cooperating in applying for a Conservation Innovation Grant. The decision was made, and a joint proposal for a CIG grant was submitted to N.R.C.S. on March 3, 2011. We should know the outcome by early summer.

Presentations this year:

March 31, 2010	Texas Tech Forage Class
April 13, 2010	Matador Land & Cattle Co.
July 9, 2010	South West Council of Agri Business
August 10, 2010	TAWC Field Day
September 14, 2010	Floyd County Farm Tour
October 27, 2010	Texas Agricultural Lifetime Leadership Class XII
November 8, 2010	Fox News Interview
November 9, 2010	Texas Ag Industries Association Regional Meeting
January 13, 2011	High Plains Irrigation Conference
January 24, 2011	Wilbur-Ellis Company
January 25, 2011	Caprock Crop Conference
February 23, 2011	Pioneer Hybrids
February 24, 2011	TAWC Field Day

Tours this year:

May 24, 2010	David Sloane
July 27, 2010	Cotton Incorporated
August 30, 2010	SARE film crew
September 9, 2010	Brazilian group
September 24, 2010	Monty Dollar, Phil Brown, Wesley Brown, Cody Zilverberg

We have had twelve management team meetings this year.

2.2 Secretary/Bookkeeper: Angela Beikmann. *(three-quarter time position).* Year 6 main objectives for the secretarial and bookkeeping support role for the TAWC project include the following.

Accurate Accounting of All Expenses for the Project. This 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 6 of the project.

Implementation Phase of the TAWC Project. The objective of the Implementation Phase of the TAWC demonstration project is to show how to maximize economics while conserving water and other resources. As requested by the project director, a formal budget amendment, Budget Amendment #3, was prepared and submitted to TWDB for approval. This budget amendment allowed funds for the Implementation Phase, which created Task 10 of the TAWC project. This amendment request did not change the total award amount ($6,224,775). It did, however, create a new budget of $162,970 for Task 10 and a new budget category, Producer Compensation, of $52,400. To accommodate these funding changes, the original budget for communications and tuition and fees decreased, while the budget for subcontractors and capital equipment increased. Tasks 2 and 6 budgets were also decreased to create the Task 10 budget. All of these budget changes were approved by TWDB along with the scope of work for Task 10 of the project.

Work then began directly with the TTU Office for Research Services to implement these budget changes into the TTU financial system and to complete the required paperwork for the subcontract with the consultant and the professional services agreement between TTU and the Implementation Phase producers.

Digital cameras, voice recorders, capital equipment and required supplies were purchased for producers to use during this phase of the project, and producer record books were assembled and distributed to the producers involved in this phase of the project.

Administrative Support for Special Events. A Field Day was held on Tuesday, August 10, 2010 in Muncy, Texas. Pre-event planning and preparations were made, including bus, facility and supply rentals, catering services, and various correspondence. Sponsor donations were received, deposited and used for event expenses. Attended the August 10th event to assist with arrangements and presentations as requested.

Travel arrangements were made for a select group from the TAWC project and TTU to attend meetings with key personnel in Washington DC in October 2010. Although TAWC funds were not used to finance this trip, the contacts made and information learned during these meetings will be beneficial to the overall research objectives of the TAWC project.

The 2011 Production Agriculture Planning Workshop was held on Thursday, February 24, 2011 at Muncy, TX. Sponsor donations were received, deposited and used for event expenses such as catering services, facility rental and advertising. Also attended the event to assist project team members as needed.

Ongoing Administrative Support. The 5th Annual Report was completed and revised as suggested by TWDB. Electronic and printed versions of the annual report were distributed to TAWC producers, team members and participants as requested. 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. 2010 map books of the TAWC project sites were updated and distributed to TAWC team members as requested.

Quarterly reports have been assembled and forwarded to TWDB. These quarterly reports, dated May 31, 2010, August 31, 2010, November 30, 2010 and February 28, 2011, coincide with quarterly reimbursement requests submitted by TTU. Management Team meeting minutes have been recorded and transcribed for each meeting. These meetings were held on March 11, April 8, May 13, June 10, July 8, August 12, September 9, October 14, November 18, December 9, 2010, and January 13 and February 17, 2011. Daily administrative tasks include many clerical procedures and documents pertaining to a business/education setting.

TASK 3: FARM ASSISTANCE PROGRAM

Dr. Steven Klose
Jeff Pate
Jay Yates

Year 6 project progress regarding Task 3 in the overall project scope of work 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 three times per 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 most of the 2010 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 2009 demonstration data. These projections will serve as a baseline 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 2009 data. This analysis can be used by each producer to establish some economic goals for the future. 2010 analysis will be completed this summer, as yield data has only recently been finalized for the 2010 crop.

Economic Study Paper. Farm Assistance members completed a study paper utilizing the economic data on a particular site within the TAWC project. The paper compared the economic impact of sunflowers grown under center pivot irrigation to those grown under subsurface drip irrigation. The study closely examines the financial impact that would occur to the producer comparing these two irrigation methods. The results of this paper will presented at the University Council on Water Resources meeting held in Boulder, Colorado in July 2011.

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.

Field Days. Two field days were held during the year, one in the summer and another in the winter. FARM Assistance faculty were involved in both events. Topics at the events included the newest irrigation technologies, variety trials, economic yield goals, and several others meant to educate producers. Attendance at both events exceeded 220 people.

C.I.G. Grant. During the previous year and continuing into 2011 several team members of the TAWC, along with members of the North Plains Groundwater Conservation District, worked to secure additional funding in the form of a federal grant. The purpose of this funding would be to expand the size and scope of the water conservation demonstration that is being learned in the TAWC project to other areas in the North and South Plains. FARM Assistance staff were an integral part of the planning and writing of the grant application. Winning applicants of the grant will be notified by May 2011.

TASK 4: ECONOMIC ANALYSIS

Dr. Phillip Johnson
Dr. Eduardo Segarra
Dr. Justin Weinheimer
Cody Zilverberg

Objective. 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.

A major accomplishment in 2010 was the development of an online economic decision aid, the Resource Allocation Analyzer, as part of TAWC Solutions. The Resource Allocation Analyzer is a user friendly online program that may assist producers in projecting their crop selection, yield goals, and irrigation levels on a field by field basis with the objective of maximizing economic returns and water savings. It has long been known within economic theory that maximum profit does not occur at maximum yield. The concept of diminishing returns to irrigation is the basis for the decision aid allowing producers to enhance profitability under declining or limited water resources. The Resource Allocation Analyzer is a component of TAWC Solutions which are available to producers to assist them in making strategic decisions regarding the allocation of an increasingly scarce resource – water.

Major Achievements for 2010:

- 2010 represented the sixth year of economic data collection from the project sites. Data for the 2010 production year has been complied and enterprise budgets have been generated.

- An economic decision tool for agricultural producers was developed under "TAWC Solution: Decision Aids for Irrigation, Economics, and Conservation" to provide an economic planning aid for regional irrigated farmers. This unique economic decision tool uses producer input to provide field level crop allocation options which maximize net returns per acre under limited irrigation conditions. Variables such as water available for irrigation, production cost, expected commodity prices, and acreage plans are used to provide a unique output which matches available water resources and production capabilities. This tool was released to the public in February 2011 and is available free of charge on the TAWC web site.

- Field level data from the project sites has also been used to evaluate carbon emissions and energy consumption. While all row-crop systems within the project have been audited for carbon and energy, the evaluation of cotton specific sites were presented at the 2010 Beltwide Cotton Conference. The paper "Energy and Carbon: Considerations for High Plains Cotton" presented carbon and energy estimates for High Plains Cotton production, field level profitability and irrigation efficiency of each observation and irrigation technology. Results indicate that cotton grown under Low Energy Precision Application (LEPA) irrigation systems appears to be the most profitable while also maximizing irrigation efficiency. Additionally these systems proved to be the most energy efficient thus emitting the lowest amount of carbon per acre. The paper "Carbon Footprint: A New Farm Management Consideration in the Southern High Plains" presented similar results and was presented at the 2010 AAEA annual meetings in Denver.

Presentations and proceedings related to the TAWC in 2010:

- Weinheimer, J. and P. Johnson. "Carbon Footprint: A New Farm Management Consideration in the Southern High Plains" A selected paper presentation at the American Agricultural Economics annual meetings. Denver, Colorado. July 2010.

- Weinheimer J. "Texas Alliance for Water Conservation: An Integrated Approach to Water Conservation." Universities Council on Water Resources. Seattle Washington. July 2010.

- Weinheimer J., and P. Johnson, 2009. Energy and Carbon. Considerations for High Plains Cotton. 2010 Beltwide Cotton Conference, New Orleans LA, January 2010.

- Yates, J., J. Pate, J. Weinheimer, R. Dudensing, and J. Johnson. Regional Economic Impact of Irrigated Versus Dryland Agriculture in the Texas High Plains. 2010 Beltwide Cotton Conference, New Orleans, LA. January 2010.

TAWC Resource Allocation Analyzer

The following section illustrates the process of utilizing the economic decision aid "TAWC Solutions Resource Allocation Analyzer." The primary objective of this tool is to provide irrigated producers with a planning tool, ideally used in the planning stage of their annual farming operation, to aid in the decision of enterprise selection, yield goals, and utilization of irrigation resources. With changing commodity prices, input cost structures, and irrigation water availability, the decisions a producer must make with respect to their operation can become very difficult. Additionally there is a great deal of variability within production capabilities from field to field, driven by changes in soil type and fertility. Currently the tool is set up to work with the four primary crops in the region, corn, cotton, sorghum, and wheat with a specialty crop of sunflowers as an additional consideration. Other crops such as peanuts, livestock, sesame, and alfalfa are being considered as additions to the program.

This tool allows a producer to evaluate the economic potential of each field separately to account for variation in productivity. Key components to the decision process include, pumping capacity, a water budget for restricted producers, field acres, production costs, and expected price. An additional option is available if producers have a crop contracted, forcing water resources to be allocated to fill the contract, with remaining resources are allocated to the most profitable crop. The program presents results for four different scenarios. The first is the economically optimal yield and water application which maximizes the economic potential of the field. The second option presents the economic outcome if the field was evenly split between the crops considered. The final two options present various crop acreages, if applicable, that also maximize net returns. While the focus of the results is the economic viability of the field, the tool also generates the amount of irrigation that would not be applied as a result of applying water to maximize returns as opposed to maximizing yield. These values allow growers to see the amount of water that they can save by producing based on economic returns rather than maximum yields.

This tool is designed for producers within the Southern and High Plains of Texas and will work with irrigated crops as far north as southern Kansas. As the tool evolves, it is planned to add additional crops and other alternatives to help producers utilize this information over a wide variety of crops, farming systems, and growing regions.

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
Resource Allocation

To begin, move your cursor over **TAWC Tools** then, click on **Resource Allocation** as seen in Screen 1 (Figure 25). This will take you to Screen 2.

Screen 1

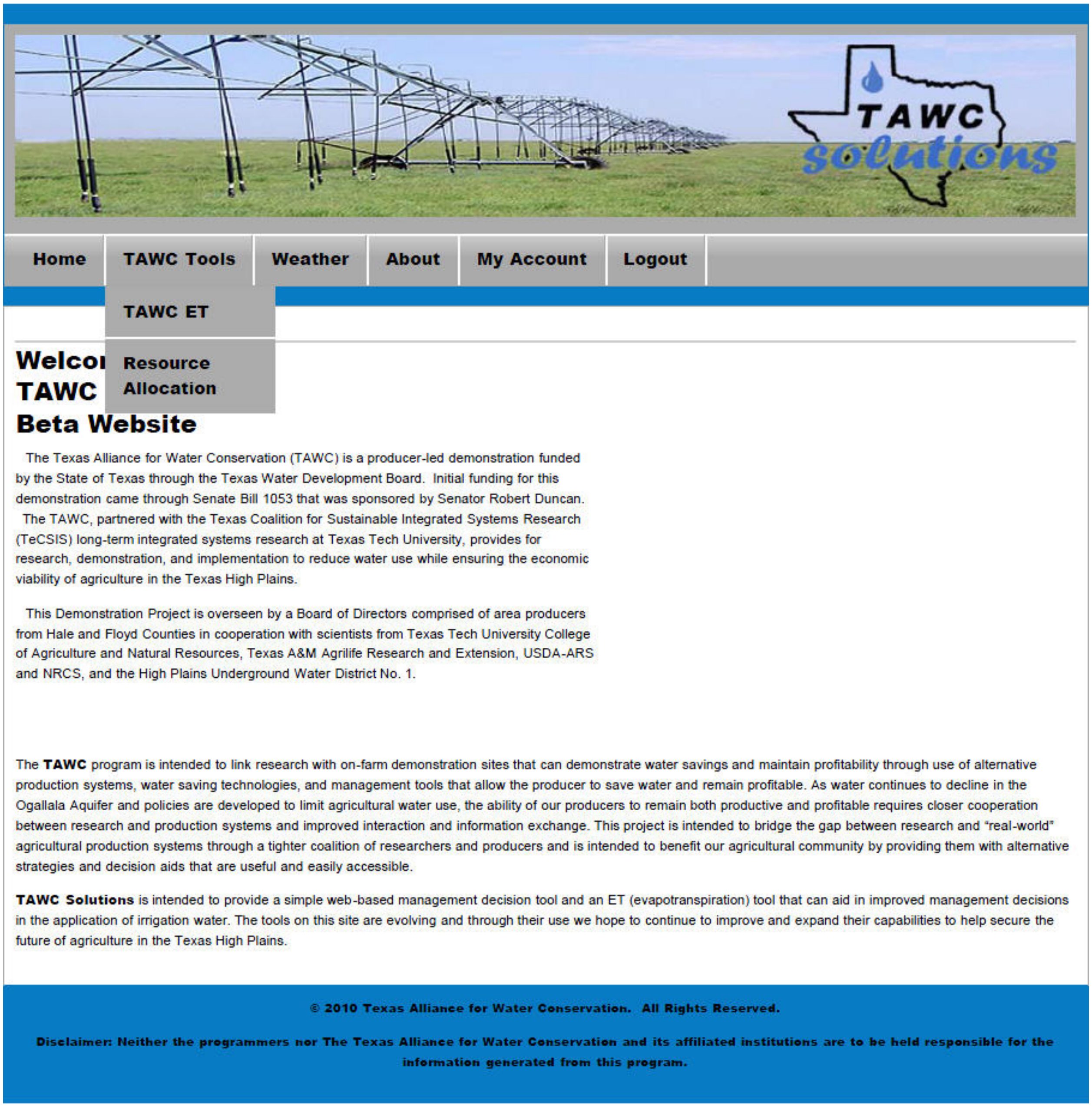


Figure 25. Screen 1: Homepage for TAWC Solutions website; first step to utilize the resource analyzer tool.

Screen 2

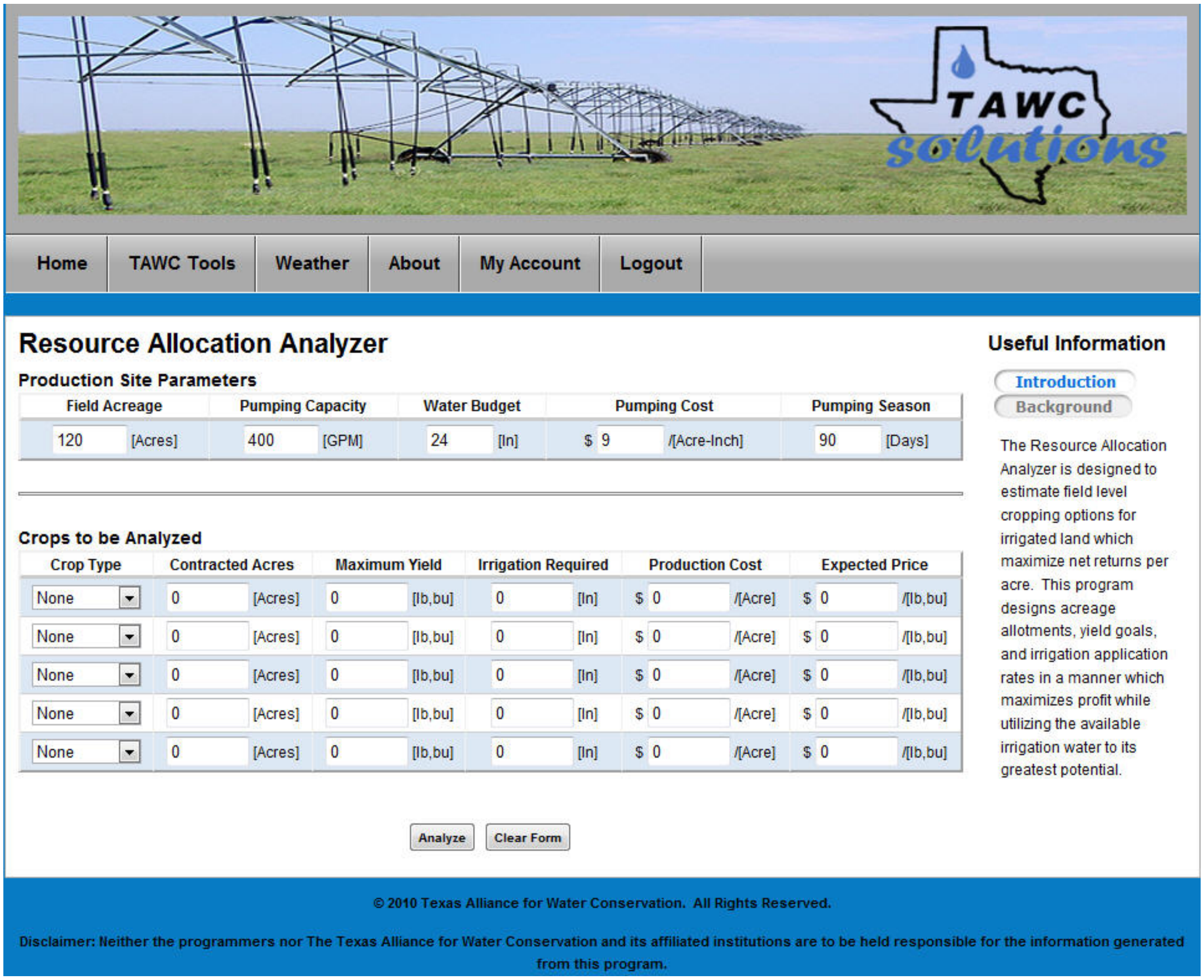
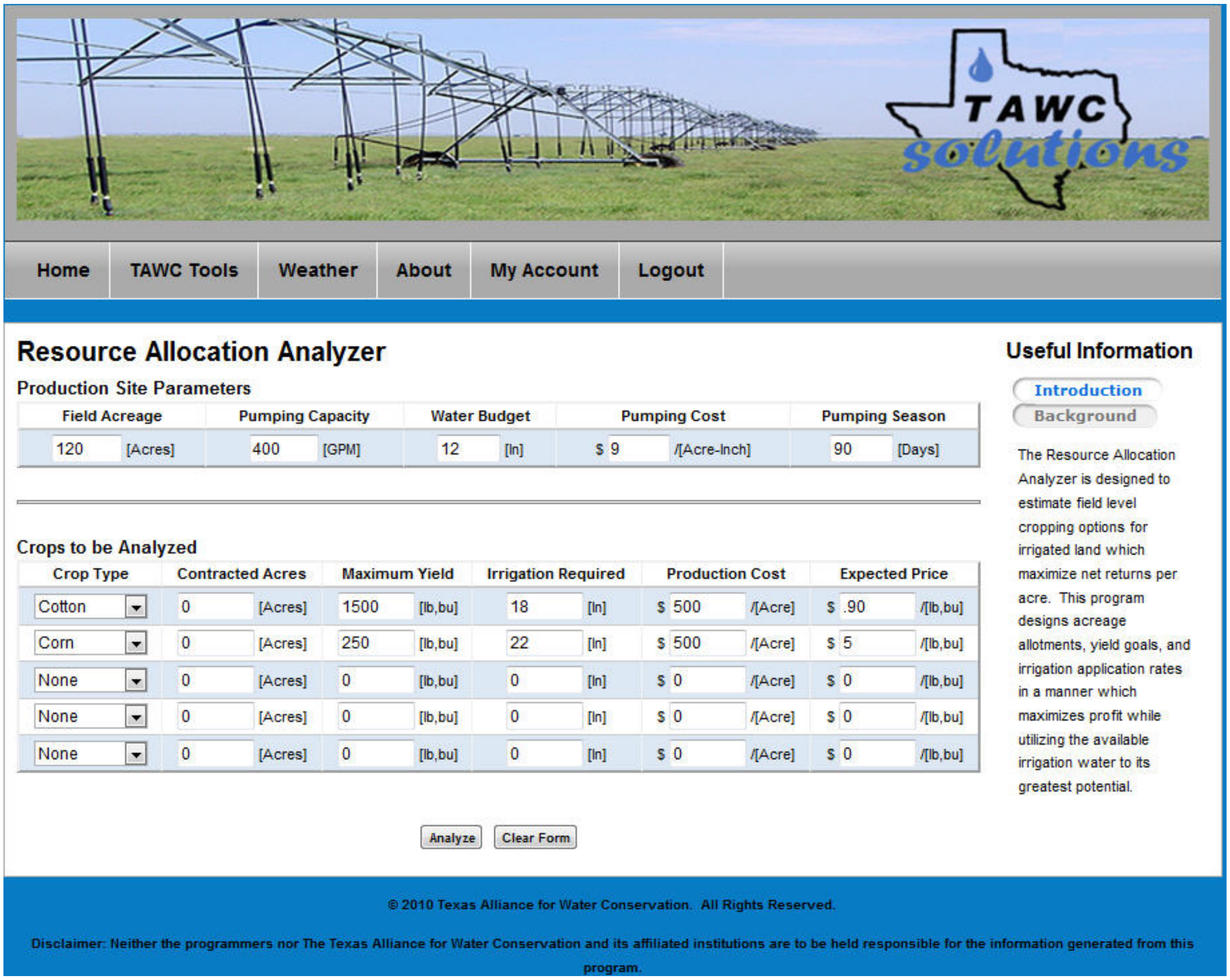


Figure 26. Screen 2: TAWC Solutions web site Resource Allocation Analyzer input page for the program.

Screen 2 (Figure 26) represents the platform from which the Resource Allocation Analyzer works. 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 214. With the Production Site Parameters set, choose one of five crops to analyze. A single crop or up to a maximum of five can be chosen for the analysis. An example of selecting corn and cotton is illustrated in Screen 3 (Figure 27).

Screen 3


TAWC solutions

Home | TAWC Tools | Weather | About | My Account | Logout

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

Introduction

Background

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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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 this program.

Figure 27. Screen 3: TAWC Solutions web site Resource Allocation Analyzer page using corn and cotton as examples.

Screen 4 (Figure 28) illustrates the output from analyzing the crops and field parameters chosen in screen 3 (Figure 27). 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 Pages 214-215. Utilizing the Back button at the bottom of the page, alternative runs can be conducted by adding or deleting crop choices 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

Figure 28. Screen 4: TAWC Solutions web site Resource Allocation Analyzer page illustrating output from analyzing crops and field parameters chosen in screen 3, Figure 27.

<u>Production Site Parameters and Input Value Descriptions</u>
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 pounds of cotton to be produced, the field analyzed may have never produced more than 1500 pounds. In this case, 1500 pounds 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.

<u>Output Definitions and Descriptions</u>
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.

TASK 5: PLANT WATER USE AND WATER USE EFFICIENCY

Dr. Stephan Maas
Dr. Nithya Rajan

During the sixth year of the TAWC Project, activities under Task 5 were directed at supporting several specific research topics that ultimately relate to the development of applications with practical benefits to producers in the region, and to strengthening our understanding of the dynamics of water-related processes in the fields of this region. These are described in the following three sections.

Long-term studies in Fields 15 and 17. In part supported by additional funding acquired from a grant from USDA-CSREES (now USDA-NIFA) entitled "A Candidate Site for Long Term Agroecosystems," sites were established in two TAWC fields to allow long-term (multiple seasons) measurement of water and carbon dynamics in dissimilar production systems. The fields selected were TAWC Field 15, which supports continuous cotton, and TAWC Field 17, which supports grass for grazing. The sites were established at the start of the 2010 growing season. Each site has a similar complement of sensors designed to measure water and carbon dioxide fluxes from the field, the components of the surface energy balance, and the above- and below-ground environmental conditions. The configuration of each site is shown in Figures 29 and 30.

Figure 29. The Field 15 long-term agroecosystem site.

Figure 30. The Field 17 long-term agroecosystem site.

Data have been collected up to the current date, except for a lapse for the Field 15 site after the 2010 harvest up to field preparation for the planting of a cover crop in that field. Preliminary results were presented at the 2010 Annual Meetings of the American Society of Agronomy at Long Beach, CA, near the end of 2010. An example is shown in Figure 31, which shows the surface CO_2 flux from Field 15 over the latter portion of the growing season. The negative values indicate absorption of CO_2 by the cotton canopy as a result of photosynthesis. A marked decrease in this carbon assimilation can be detected following the termination of irrigation on 6 September. Canopy CO_2 exchange decreases as the canopy senesces over the remainder of the growing season.

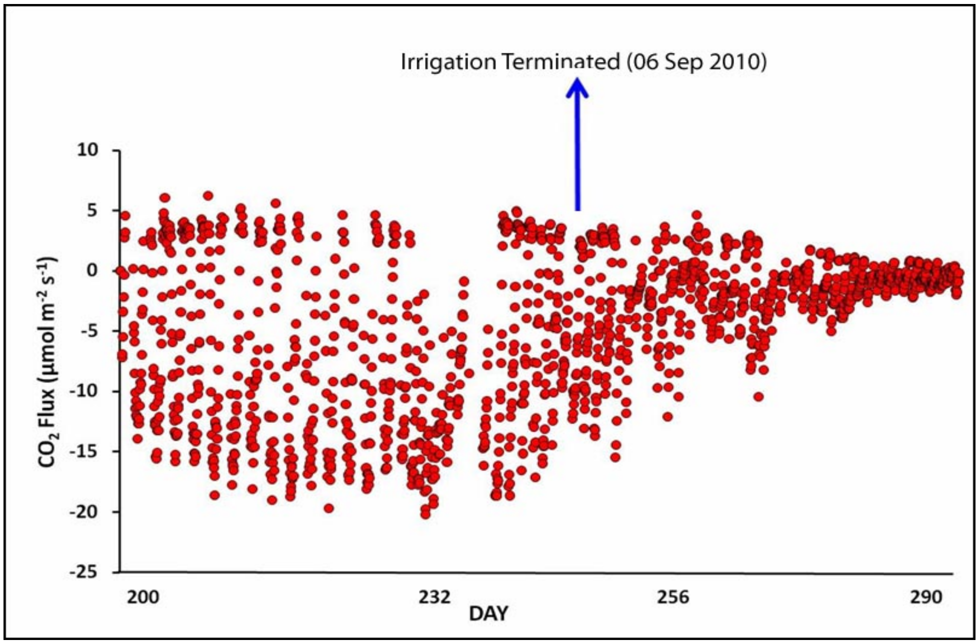

Figure 31. CO_2 flux from the Field 15 site.

Corresponding results for Field 17 are presented in Figure 32. In this situation, CO_2 exchange with the grass canopy peaks at around Day 200. The subsequent decline in CO_2 assimilation is associated with grazing of the grass canopy by cattle released into the field on 18 July. This observed decrease in canopy activity is supported by the corresponding decrease in live canopy biomass shown in Figure 33.

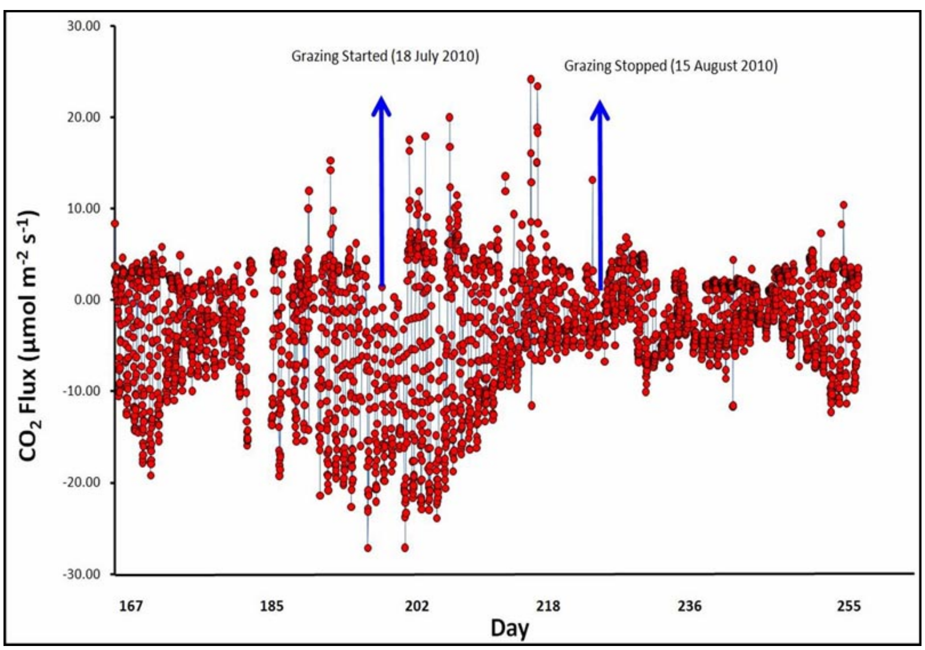

Figure 32. CO_2 flux from the Field 17 site.

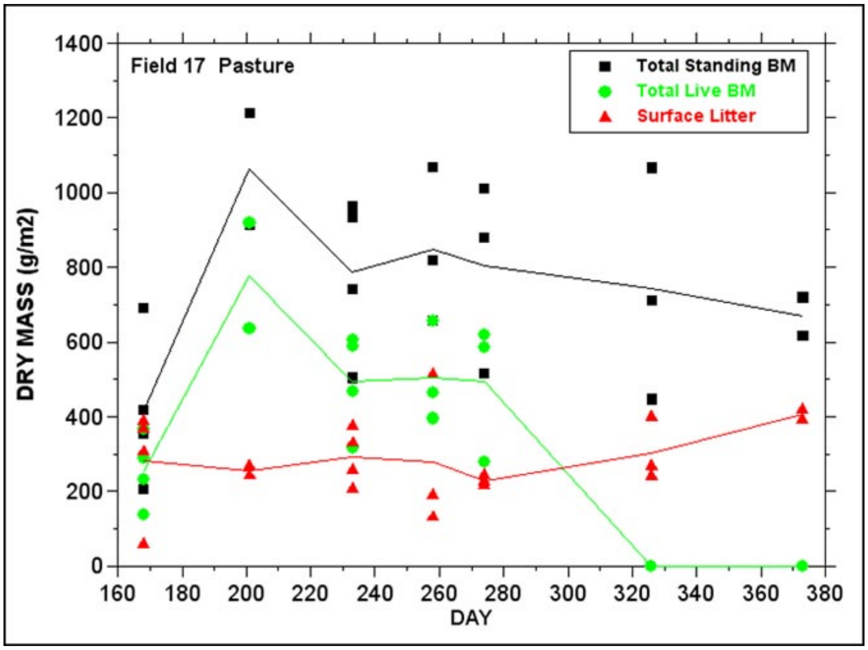

Figure 33. Biomass samples from the Field 17 site.

Environmental measurements will continue to be made at the Field 15 and Field 17 agroecosystem sites during the 2011 growing season. These findings will help in understanding the dynamics of crop growth and water use over time for production systems in TAWC.

Energy balance for Field 15. A detailed study of the energy balance during the growing season was conducted for Field 15 in 2010. The purpose of this study was to try to ascertain the contributions of various components to the overall energy balance. Sensors were set up at various locations within and above the cotton canopy to allow the quantification of not only the steady-state terms in the surface energy balance, but also the transient terms. The transient terms are usually not measured, and it was not known to what degree they affected closure of the surface energy balance.

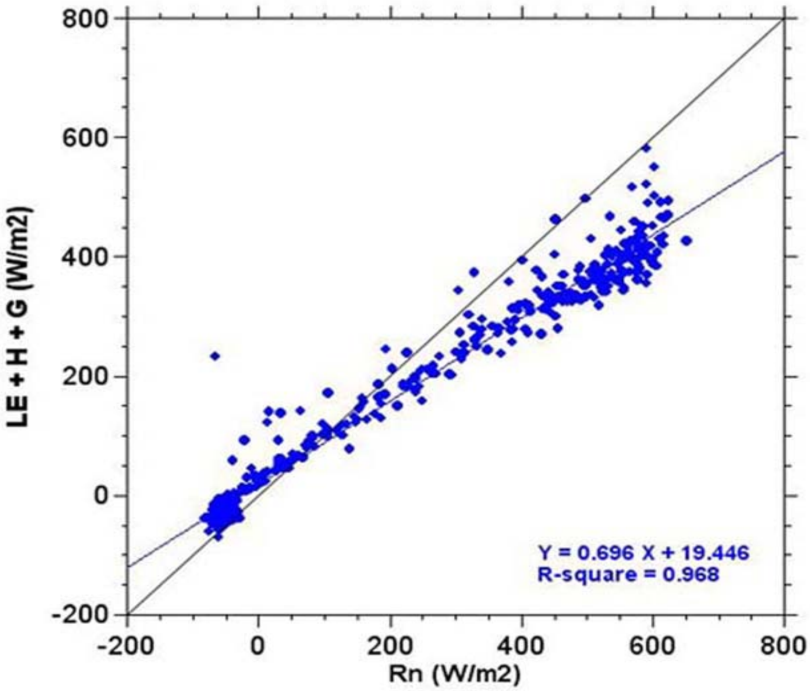

Figure 34. Energy balance closure for Field 15 considering only steady-state terms.

Figure 34 shows the results of including only the steady-state terms in the surface energy balance. Formulating the surface energy balance in this form only accounts for around 70% of the apparent energy in the system. Figure 35 shows the contributions to energy balance closure by the transient terms in the surface energy balance. Of these terms, storage of heat in the upper layer of the soil makes the greatest contribution (around 16%). Energy used in powering canopy photosynthesis, and heat stored in the plant canopy, also make small but non-negligible contributions (around 2% each). Sensible and latent heat stored in the layer of air near the surface contribute negligibly to energy balance closure. When all these terms are considered, approximately 90% of the apparent energy in the system is accounted for. The fate of the remaining 10% is uncertain. It might be related to under-estimation of the sensible and latent heat fluxes by the eddy covariance system as a result of under-measurement of large-scale convective eddies present in the air moving over the site in the summer. This possibility will be investigated during the 2011 growing season.

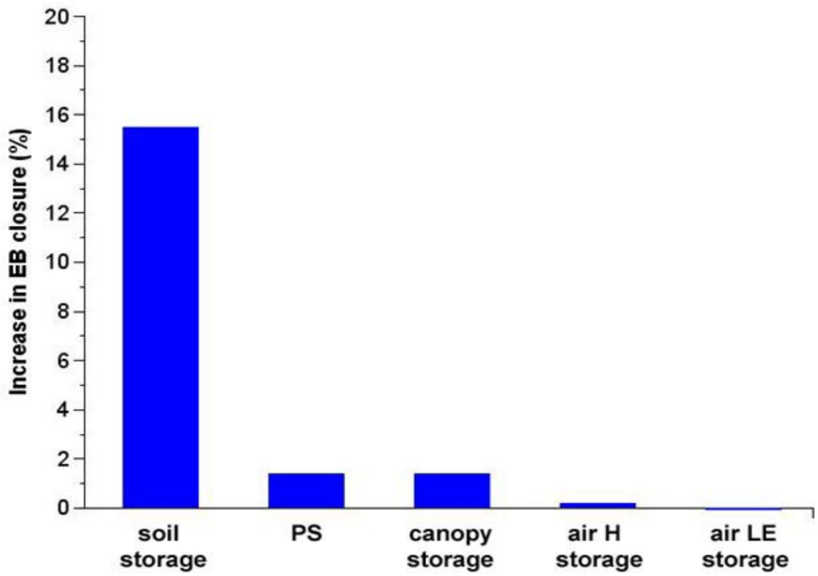

Figure 35. Contributions by transient terms in the surface energy balance for Field 15.

Satellite ground cover study. Satellite remote sensing imagery has been collected for the TAWC site since the start of the project. Five years of imagery had been collected by 2010. This archive provided a unique opportunity to analyze the imagery to visualize the seasonal change in ground cover (GC) for the various fields in TAWC. Landsat-5 and Landsat-7 images for the TAWC site were analyzed to produce values of crop GC using the procedure described by Maas and Rajan (2008, "Estimating ground cover of field crops using medium-resolution multispectral satellite imagery," Agronomy Journal, Vol. 100, No. 2, pp. 320-327). A total of 57 images were analyzed in the study (see Table 24).

Table 24. Number of Landsat images acquired each year for the TAWC study.

YEAR	Number of Images
2005	8
2006	13
2007	9
2008	15
2009	12
TOTAL	**57**

Image data needed to compute GC were extracted for each field in the TAWC study from this set of imagery. The resulting GC values were grouped according to crop type. When plotted versus the day of year, the data showed the general shape and magnitude of the seasonal GC curve for each crop. An example for corn is shown in Figure 36. This figure includes data for corn cut for silage. This can be seen in the figure by the drop in some GC to near zero at around Day 240.

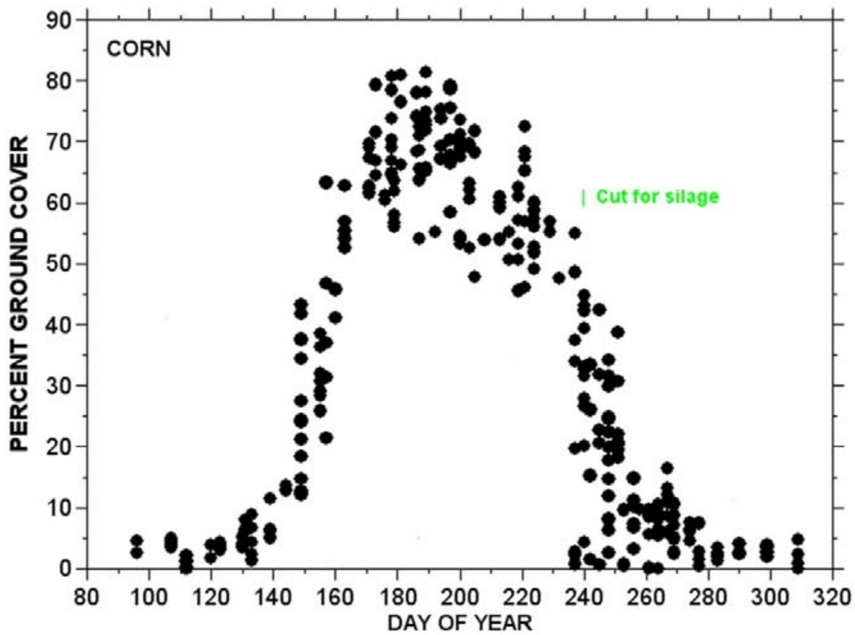

Figure 36. Seasonal GC curve for corn derived from Landsat data from 2005-2009.

In several cases, it was possible to discriminate between irrigation types in the GC data for a crop. Figure 37 shows the seasonal GC curve for cotton with values associated with subsurface drip, LEPA, and MESA irrigation indicated in different colors. Points associated with subsurface drip irrigation tend to lie along the upper portion of the seasonal distribution, while points associated with MESA irrigation tend to lie along the lower portion of the distribution. When ten-day averages of the data are calculated and plotted, the differences among the three irrigation types can be more easily visualized (see Fig. 38).

GC curves were developed in this manner for all the major warm-season crops in the TAWC Project (corn, cotton, grain sorghum, forage sorghum, sunflowers, millet, alfalfa, and pasture grass). A primary application of this information is in irrigation scheduling. Previous studies by Rajan et al. (2010, "Estimating crop water use of cotton in the Texas High Plains," Agronomy Journal, Vol. 102, No. 6, pp. 1641-1651) have shown that daily crop water use (CWU) can be estimated using the relationship,

$$\text{CWU} \approx (\text{PET})\ (\text{GC})\ (\text{Fs})$$

where PET is the daily potential evapotranspiration calculated from weather data and Fs is a stress factor. For crops that are being irrigated, Fs ≈ 1. In this relationship, GC represents a "spectral crop coefficient" that can allow the estimation of daily CWU for a given agricultural field based on remote sensing. The use of this spectral crop coefficient approach in irrigation scheduling will be investigated in the 2011 growing season.

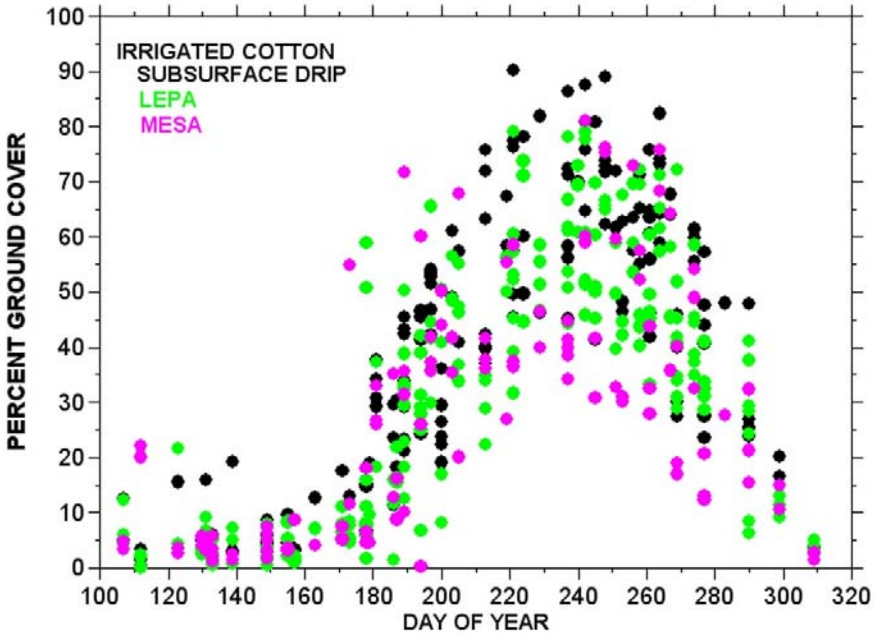

Figure 37. GC values for cotton irrigated using subsurface drip, LEPA, and MESA irrigation.

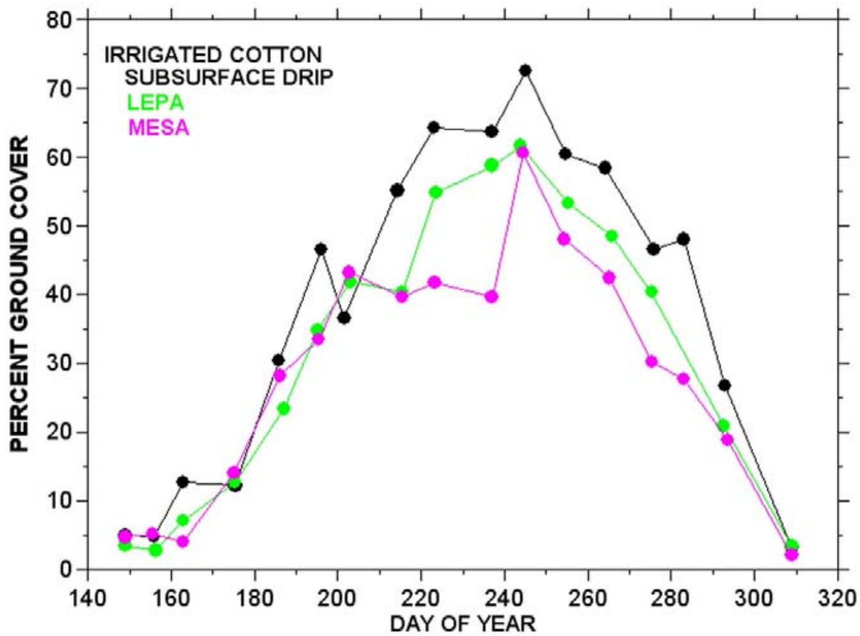

Figure 38. Ten-day average GC determined from the data in Figure 33.

PUBLICATIONS AND PRESENTATIONS RELATED TO TAWC

Maas, S. J., and N. Rajan. 2010. Normalizing and converting image DC data using scatter plot matching. Remote Sensing. 2(7):1644-1661.

Rajan, N., S. J. Maas, and J. Kathilankal. 2010. Estimating crop water use of cotton in the Texas High Plains. Agronomy Journal. 102(6):1641-1651.

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.

Maas, S. J., N. Rajan, and J. Kathilankal. 2010. Closure of surface energy balance for agricultural fields determined from eddy covariance measurements. Abstracts, Annual Meeting of American Society of Agronomy, Nov. 1-3, Long Beach, CA.

Rajan, N., S. J. Maas, and J. Kathilankal. 2010. Carbon fluxes from continuous cotton and pasture for grazing in the Texas High Plains. Abstracts, Annual Meeting of American Society of Agronomy, Nov. 1-3, Long Beach, CA.

TASK 6: COMMUNICATIONS AND OUTREACH

Dr. David Doerfert
Heather Jones
Lindsay Graber
Jennifer Zavaleta
Nichole Sullivan

During this past year, several activities were designed and implemented towards the goal of expanding the community of practice that is developing around agricultural water conservation. The most visible highlight of the year was field days conducted in August and February. Behind the scenes, steps were taken to increase the awareness and potential influence of the TAWC project beyond the region. 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

Farmer Field Day #1 (August 10, 2010). The majority of time and resources spent this past year were on planning and implementation of the TAWC farmer field days that were conducted at the Unity Center in Muncy, TX. The first of the year was conducted on Tuesday, August 10, 2010 and centered on sharing with the participants the activities of the second phase of the TAWC project—the Demonstration Phase. The goal of this phase was to determine the extent farmers can aggressively conserve their water resources while remaining economically viable. Informational topics discussed at the field day included new resources for irrigation scheduling and resource management and the latest production decision and profitability management recommendations for the following growing season. Field day participants heard from TAWC project consultants and researchers and their involvement with the latest water management technologies being tested at these sites. In addition, participants revisited the project's perennial grass species trial plots and observed the results that have occurred over the past three years.

Planning activities included development of the morning program, coordination of speakers, transportation and field site logistics (e.g. buses, signage, tent, chairs, and portable bathrooms) general meeting facilities and refreshments that included a catered lunch, and securing CEUs for participants.

In addition to planning the program, several promotional activities were conducted. These activities included placement of the save-the-date cards at agribusinesses frequented by producers, creating and mailing press releases to 113 newspaper and producer-oriented magazine sources, direct mailed invitation to 427 individuals in TAWC database, appearances on agriculture radio and TV programs (Lubbock & Plainview), and advertising on four local agriculture broadcast outlets (Lubbock, Plainview & Amarillo radio & Lubbock TV).

Through these efforts, 121 producers attended the field day. This was a 16.3% increase in attendance from the previous field day (Feb. 3, 2010) making this the largest attended field day in the history of the TAWC project. Based on post-workshop evaluation results submitted by 44 of the participants, attendees were very satisfied with all aspects of the program. Beyond the responses to each program component, it was interesting to note that those who completed the evaluation traveled as far as 420 miles to attend the program with 29 (65.9%) traveling at least 50 miles to attend the program providing evidence to the ever-expanding reach of the TAWC project.

Farmer Field Day #2 (February 24, 2011). Differing from the August 2010 field day, this field day focused on providing the types of information and tools that would facilitate producer decision-making for the 2011 growing season including water management decision-making. As such, topics included predictions on 2011 commodity prices, emerging technologies for managing water, optimal irrigation strategies to grow more with less water, and a panel to discuss the future of commodities in agriculture during 2011 and years ahead.

Similar to the August field day, many of the same logistical and promotional activities were completed. Eighty-four producers and agricultural leaders attended the workshop. Based on 24 post-workshop evaluation results submitted by the participants, attendees were very satisfied with all aspects of the program.

For the past three field days, KFLP radio has broadcasted live the indoor sessions of the field day. We have heard a few reports that farmers chose not to attend this field day but rather listened to the speakers while working on the fields. While we are pleased to hear of these reports as they indicate the program was of value, it is difficult to measure the radio audience we may have reached.

Informational Items Created & Disseminated. The 24-page document summarizing the past achievements, current activities, and future directions of the project continued to be a popular handout requiring a reprinting before an update was considered necessary.

With the TAWC project in the demonstration phase, work began on the next phase of the communication strategy that will expand the reach of the project information through new and traditional broadcast technologies. This effort includes the development and airing of eight monthly televised segments related to the project filmed by Fox 34 TV and played on their AgDay Lubbock television show. Each segment includes multiple interviews. After each segment is completed, the footage is given to the TAWC project for subsequent social media use. At the time of this report, the following three segments have been completed and aired.

- November focused on technologies used in the TAWC demonstration sites during the 2010 growing season. Interviews were completed with Dr. Justin Weinheimer of

Texas Tech's Deptartment of Agriculture and Applied Economics, TAWC producer Dan Smith, and David Sloane with AquaSpy; these were recorded and aired before the Thanksgiving holiday.

- December focused on the livestock aspects of the TAWC project with Dr. Vivien Allen being interviewed.
- February focused on economic and planting issues with interviews from production consultant Bob Glodt, agricultural economics professor Dr. Darren Hudson, farmer and TAWC producer board chair Glenn Schur, High Plains Underground Water District communications director Carmon McCain, and Farm Assist program director Jay Yates completing interviews.

The other aspect of this next strategy phase is the extension of these materials through the use of social media. Facebook, Twitter, blogs, and YouTube accounts for the TAWC project are currently being designed with the intention of releasing these in the summer of 2011.

Presentations and Project Promotions. In addition to the August field day, we collaborated with the Southwest Council on Agriculture (SWCA) and their annual meeting being held July 9, 2010 in Lubbock. As part of the event, a morning program was conducted for the SWCA meeting participants that included an overview of the TAWC and an on-site review of the related research being conducted at the Texas Tech University research farm in New Deal, TX.

Dr. David Doerfert and graduate assistants Lindsay Graber and Jennifer Zavaleta staffed an information booth at the 2010 Amarillo Farm & Ranch Show November 30 - December 2, 2010. Project descriptions and summaries of research were distributed to attendees. Approximately 100 "save the date" cards were also distributed for the 2011 TAWC Farmer Field Day.

Dr. David Doerfert and graduate assistants Lindsay Graber and Nichole Sullivan staffed the TAWC booth at the 2011 Lubbock Farm & Ranch Show February 8-10, 2011. Project descriptions and summaries of research were distributed to attendees. Approximately 30 "save the date" cards were also distributed for the 2011 field day.

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. As described earlier in the Informational Items Created & Disseminated section, the communications plan has moved into it next phase. This phase is designed to expand the awareness of the TAWC project and the use of its information and tools beyond the West Texas Region through the use of traditional (TV) and emerging broadcast channels including social media technologies. This next phase will be fully operational in 2011.

Photo documentation of the individual field sites continued with seven visits during 2010. 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. These photos will be used as existing print materials are updated with the latest research information in the summer of 2011.

Finally, a clipping service was continued to help the project monitor the extent and type of print media coverage on the TAWC project. An initial content analysis illustrated that there is very little in the extent of coverage related to water with the majority of the news content focused on urban water use. However, coverage expanded in 2010 to include news related to the potential changes in water policy through local water districts.

6.2b — Accomplishments: Research. Dr. Doerfert met with representatives from six universities in Dallas on November 19-21, 2010 to begin efforts that would secure funding to expand the social science research efforts of the TAWC project. Efforts are to target a future USDA RFP on community resiliency with water management playing a role in that research. In addition, the University of Florida is also planning to apply for USDA AFRI on climate change. Discussions included adding social science decision-making data sharing to respective projects to add a collaborative element.

Heather Jones successfully defended her thesis on March 11, 2010. The title of her thesis was The Influence of a Professional Development Workshop on Teachers' Intentions to Include Water Management Content into Their Local Agriscience Curriculum. The following is an abstract of that study.

> The purpose of this study was to determine the effectiveness of using a water management workshop to influence knowledge, beliefs, attitudes, and behaviors of Texas agriscience teachers toward the addition of water-management instruction into their local curriculum. A 90-minute Incorporating Water Management Into Your Agriscience Instruction was conducted with 28 Texas agriscience teachers that provided water-related teaching materials and demonstrated how water management and conservation could be used in a classroom setting. A 75-item questionnaire aligned with Cerveros' Continuing Professional Education and Behavior Change model was administered to voluntary participants at the conclusion of the professional development workshop. The study found that upon completion of the workshop almost all participants believed they had gained the knowledge to teach about water management, and they thought a

> workshop was an appropriate form of gaining that knowledge. The participants agreed that teaching water management and conservation is important, and they could teach water management and conservation and intend to add it to their curriculum. Based on the findings, a workshop can be a successful means of introducing a new idea to teachers.

As described earlier, we collaborated with the Southwest Council on Agriculture (SWCA) and their annual meeting that was held July 9, 2010 in Lubbock. As part of the event, a morning program was conducted for the SWCA meeting participants that included an overview of the TAWC. At the evening banquet, a brief survey was conducted to determine what the participants believed were the top issues facing the agriculture industry. This data was analyzed and will be submitted as a research poster presentation at an upcoming national meeting.

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

<u>*6.3 — Accomplishments.*</u> Building on the thesis research completed by Heather Jones, a survey of Texas agriscience teachers will be conducted during the 2011 Texas Agriscience Teacher Professional Development conference to determine the instructional material needs of these teachers as it pertains to agriculture water management and conservation. The results of this study will establish the need for future secondary-level instructional materials.

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.*

<u>*6.4 — Accomplishments.*</u> Timely quarterly reports and project summaries were provided as requested.

TASK 7: INITIAL FARMER/PRODUCER ASSESSMENT OF OPERATIONS

Dr. Calvin Trostle

Support to Producers. Visited with 13 producers during 2010 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 2010 centered on grain sorghum, wheat, sunflower, and split pivot irrigation scenarios whereby producers are choosing two different crops to spread water use (and demand) rather than require irrigation on a full circle at one time.

Field Demonstrations.

A) Lockney & Brownfield Range Grass & Irrigation Trials

See report below.

B) Wheat Grain Variety Trial

A variety trial was completed on the Jody Foster farm within the TAWC demonstration area (north of Lockney). As noted in the report below, the test emerged slowly due to seeding in no-till conditions. An additional test for 2010-2011 was initiated at R.N. Hopper farm in the southwest portion of the TAWC region.

Opportunities to Expand TAWC Objectives

Project awareness: Commented on project on four 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.

Leverage of funding: 1) Received two-year federal Ogallala Aquifer Project (OAP) in support of perennial grass trial sites ($12,500), which was implemented for the 2009 summer season.

Educational Outreach. Participated in two county Extension meetings covering the TAWC demonstration area in 2010. These included the Hale County and Floyd/Crosby Crops Conference in January (three talks; grain sorghum, 2 & wheat) and the TAWC field crop tour which visited the perennial grass trial plots August 10.

Existing TCE publications and reports were provided in the TAWC target area to at least 15 producers.

Support to Overall Project. Activities include attending six 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 the Texas Alliance for Water Conservation (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 very well seek to 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 County 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 is 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

Irrigation was implemented as noted in Table 25 with an annual rainfall in 2010 through October of 23.5" of which 20.0" fell before the first cut in early August. Irrigation was applied using a measured flow rate to apply the desired number of gallons per plot area.

Yield data for 2010 is listed in Table 26. This included our first harvest August 6, 2010 harvest for yield (only one irrigation due to rainfall), and then an additional harvest in the fall after dormancy occurred (two irrigations). Since irrigation levels are minimal for the first cut, only minor differences if any are noted for the most part at the August 6th cut (Table 26). Irrigation increases are likely more notable (up to 4" of irrigation, i.e. 2 irrigations at the 2.0" level). The yield differences, however, are not necessarily large suggesting that there still may have been use of subsoil moisture due to earlier rainfall accumulation.

The cumulative trial grass yield by species in 2010 ranged from ~2,500 lbs./A (buffalograss) to over 14,000 lbs./A (Alamo switchgrass), with old world bluestems and Indiangrass also yielding 10,000 lbs./A or more (trial average ~8,700 lbs./A when averaged across all irrigation levels, Table 26). For all grasses, the cumulative dryland grass production level averaged 5,500 lbs./A., and 3" and 6" of supplemental irrigation increased forage yields about 1,200 lbs./A for the low level or irrigation, and an additional 500 lbs./A for the moderate irrigation level. This latter yield increase based on the yield return per unit of irrigation water readily appears to not be justified, and it is poor use of limited groundwater resources. After three years the old world bluestems WWB Dahl and Caucasian, as well as bermudagrasses appeared to use incremental irrigation water more productively.

Table 25. Rainfall and irrigation levels on perennial grass trial, Lockney, TX, 2010.

2010 Lockney Rainfall *Month*	**Monthly Rainfall** *(inches)*	**Cumulative 2010 Total** *(inches)*	**Irrigation Levels** *(inches)*		
			Level 0	Level 1	Level 2
January	1.1	1.1	DRYLAND		
February	1.9	3.0			
March	1.9	4.9			
April	4.2	9.1			
May	2.4	11.5			
June	2.5	14.0		1.0	2.0
July	6.0	20.0			
August	1.2	21.2			
September	1.4	22.6		2.0	4.0
October	0.9	23.5			
November	0.2	23.7			
December	0.0	23.7			

*Harvests were conducted August 6 and December 8.

Three-year cumulative results are now available for this work. Overall irrigation levels have ranged from about 15 to 75% of the amount of rainfall among the four years. As might be expected, results can be quite variable from one year to the next as individual grass species respond differently to both amount and timing of rainfall and irrigation. Some differentiation is observed in terms of measured yield response at low level irrigation vs. an equal amount of additional irrigation (2X). Switchgrass, Kleingrass, Spar and WWB Dahl old world bluestems, and sprigged bermudagrass provided the best yield response over three years (Table 27; 2007 data excluded due to little irrigation) at low irrigation levels, whereas yield response to additional irrigation (moderate level) was less than half of what was achieved with low irrigation. Buffalograss and seeded Bermudagrass (the Giant/Common mix) in this trial have not demonstrated any meaningful response to irrigation water.

Table 26. Perennial grass trial yield results for 2010 cuttings, Lockney, Texas. Seasonal irrigation was minimal due to high rainfall through early July. Trial was established in 2006.

Perennial Grass Species	Variety	Irrigation Level^	Avg. Yield @ Target Irrigation--(dry matter, Lbs./A) Harvest 8/6/10	Harvest 12/7/10	Full season 2010	Avg. all Irrig. '10
Buffalograss	Plains	0 (None)	1,468	819	2,288	2,507
		1 (Low)	1,756	834	2,590	
		2 (Moderate)	1,797	847	2,644	
Sideoats Grama	Haskell	0	4,740	1,310	6,050	7,173
		1	6,328	1,689	8,017	
		2	5,954	1,499	7,454	
Blue Grama	Hatchita	0	5,671	1,370	7,041	7,996
		1	6,423	1,840	8,263	
		2	6,558	2,125	8,684	
NRCS Natives Blend	3 Grasses‡	0	5,417	1,566	6,982	7,279
		1	5,147	1,859	7,006	
		2	5,518	2,332	7,850	
Switchgrass	Alamo	0	10,150	2,520	12,669	14,257
		1	11,964	2,697	14,662	
		2	12,092	3,349	15,441	
Kleingrass	Selection 75	0	6,633	1,926	8,559	9,407
		1	8,036	1,703	9,739	
		2	7,926	1,997	9,923	
Old World Bluestem	Spar	0	8,366	1,585	9,951	11,062
		1	9,750	1,992	11,742	
		2	9,112	2,380	11,492	
Old World Bluestem	WW-B Dahl§	0	6,618	1,745	8,362	10,472
		1	8,862	2,201	11,064	
		2	9,389	2,602	11,991	
Old World Bluestem	Caucasian	0	7,510	1,682	9,192	9,940
		1	7,267	2,264	9,531	
		2	8,979	2,120	11,099	
Indiangrass	Cheyenne	0	8,147	956	9,103	10,012
		1	8,660	992	9,651	
		2	9,759	1,521	11,280	
Bermudagrass (sprigged)	Ozark	0	5,089	1,534	6,623	8,256
		1	7,131	2,074	9,204	
		2	6,453	2,488	8,941	
Bermudagrass (seeded)	Giant/ Common (1:1 ratio)	0	3,412	1,526	4,938	5,652
		1	4,149	1,604	5,753	
		2	4,117	2,149	6,266	
	Trial Average	**0**	**6,102**	**1,545**	**7,647**	**8,668**
		1	7,123	1,812	8,935	
		2	7,304	2,117	9,422	

		Rainfall (inches)	19.9	3.5	23.4
Irrigation	**Levels (in.)**	Dryland/low/moderate	0/1.0/2.0	0/1.0/2.0	0/3.0/6.0
		Total Moisture (inches)	19.9/20.9/21.9	3.5/5.5/7.5	23.4/26.4/29.4

P-Value (Variety)	<0.0001	<0.0001
P-Value (Irrigation)	<0.0001	<0.0001
P-Value (Variety X Irrigation)	<0.0001	0.5961
Fisher's Least Signif. Diff. (0.10)--Variety¤	601	253
Fisher's Least Signif. Diff. (0.10)--Irrigation¤	300	126
Coefficient of Variation, CV (%)	44.1	34.6

^Dryland, low, and moderate target irrigation levels.
‡50% Hatchita, 40% Haskell, 10% green sprangletop (NRCS blend for Floyd County).
¤Values in the same column that differ by more than PLSD are not statistically/significantly different at 90% confidence level.

Table 27. Perennial grass trial yield results for 2008-2010 irrigation response, Lockney, Texas. Two of four years (data not shown for 2007, no significant response to irrigation maximum of 4") recorded high rainfall hence irrigation levels were low. Grasses were initially seeded in 2006.

Perennial Grass Spec.	Variety	Irrig. Level^	Average Yield @ Target Irrigation--(dry matter, Lbs./A)			
			All 2008	All 2009	All 2010	2008-2010
Buffalograss	Plains	0 (None)	1,932	1,880	2,288	2,033
		1 (Low)	2,100	2,007	2,590	2,232
		2 (Moderate)	2,089	2,584	2,644	2,439
Sideoats Grama	Haskell	0	4,701	2,564	6,050	4,438
		1	6,119	4,607	8,017	6,248
		2	6,861	6,238	7,454	6,851
Blue Grama	Hatchita	0	5,151	3,758	7,041	5,317
		1	5,213	6,883	8,263	6,786
		2	5,558	8,783	8,684	7,675
NRCS Natives Blend	3 Grasses‡	0	4,158	3,810	6,982	4,983
		1	7,292	5,502	7,006	6,600
		2	7,136	7,538	7,850	7,508
Switchgrass	Alamo	0	16,301	3,973	12,669	10,981
		1	18,278	5,913	14,662	12,951
		2	18,116	7,062	15,441	13,540
Kleingrass	Select-- Ion 75	0	7,718	4,378	8,559	6,885
		1	9,896	7,377	9,739	9,004
		2	9,600	7,953	9,923	9,158
Old World Bluestem	Spar	0	6,492	3,258	9,951	6,567
		1	8,998	5,845	11,742	8,862
		2	11,726	6,865	11,492	10,028
Old World Bluestem	WW-B Dahl§	0	9,637	4,565	8,362	7,522
		1	12,455	6,534	11,064	10,017
		2	13,652	6,292	11,991	10,645
Old World Bluestem	Caucasian	0	8,662	5,421	9,192	7,759
		1	10,930	7,649	9,531	9,370
		2	12,226	7,058	11,099	10,128
Indiangrass	Cheyenne	0	6,490	2,926	9,103	6,173
		1	8,531	4,800	9,651	7,661
		2	8,613	6,286	11,280	8,726
Bermuda-Grass (sprigged)	Ozark	0	7,076	3,123	6,623	5,607
		1	8,913	4,959	9,204	7,692
		2	8,603	5,501	8,941	7,682
Bermuda-Grass (seeded)	Giant/Common (1:1)	0	7,908	3,111	4,938	5,319
		1	6,089	4,927	5,753	5,589
		2	5,773	5,715	6,266	5,918
Trial	**Average**	**0**	**7,186**	**3,564**	**7,647**	**6,132**
		1	**8,735**	**5,583**	**8,935**	**7,751**
		2	**9,163**	**6,489**	**9,422**	**8,358**

Rainfall	(Jan.-Oct., in.)	16.5	14.7	23.4
Irrigation (Inches)	dryland/low/mod.	0/5.0/10.0	0/7.0/14.0	0/3.0/6.0
Total Water	Total (inches)	16.5/21.5/26.5	14.7/21.7/28.7	23.4/26.4/29.4

Which grasses are simply yielding more among all irrigation levels? Though irrigation response is important, some grasses simply are yielding more in the Southern High Plains than others in this Floyd County trial. After four years Alamo switchgrass has significantly outyielded all other grasses by over 3,000 lbs./A (Table 28). Old world bluestems, Kleingrass, and sprigged Bermuda are similar in dry matter forage yields, whereas Buffalograss clearly yields far less than other grasses. Four-year results suggest that due to potential higher forage quality value, sideoats grama and blue grama could offer a nutritional advantage vs. the higher yielding forages that in turn are usually lower in quality. Forthcoming forage quality analyses will address this topic.

On a pure dryland—and keep in mind that 2007 and 2010 received substantial rainfall—to this point Alamo switchgrass and WWB Dahl and Caucasian bluestems have produced the most forage yield, about double what sideoats grama, blue grama, and the NRCS blend have produced (Table 27).

Terry County Grass Species Stand Establishment

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. With slight modification of the grasses planted at Lockney, we prepared land at Mike Timmons farm east of Brownfield in 2008. We have had significant trouble with weeds in the test area once irrigation was introduced. This test site was overseeded in May 2009, but with selected irrigation in 2010 we for the most part achieved the stands that we need moving forward to conduct the forage test. Banvel and atrazine were again applied mid-season to try to knock the weeds back and the trial site was mowed. With three years since initial establishment, we find that buffalograss, the natives blend, Kleingrass and Spar old world bluestem have established the best (Table 29). Only Alamo switchgrass has yet to achieve an adequate stand, and it will be spot seeded in 2011 to address thin spots. Grasses that have established at Brownfield, in spite of difficult conditions, give prospective producers confidence in what species may be appropriate for this sandy loam/loamy sand region.

Only seeded Bermudagrass will be added to the species, and we will compare dryland vs. only one irrigation level to simplify the comparison. Interseeding of four different legumes into stands of WWB Dahl old world bluestem will be evaluated in late summer 2011.

Table 28. Perennial grass trial yield results across all irrigation levels for each species, 2007 - 2010, Lockney, Texas. Trial was established in April, 2006.

Perennial Grass Species	Variety	Average Yield--All Irrigation Levels (dry matter Lbs./A)				
		2007	2008	2009†	2010	**2007-2010**
Buffalograss	Plains	2,551	2,041	2,949	2,507	**2,512**
Sideoats Grama	Haskell	9,174	5,894	6,583	7,173	**7,206**
Blue Grama	Hatchita	9,399	5,307	8,388	7,996	**7,773**
NRCS Natives Blend	3 Grasses‡	8,517	6,195	7,580	7,279	**7,393**
Switchgrass	Alamo	18,056	17,565	9,408	14,257	**14,822**
Kleingrass	Selection 75	14,447	9,071	9,196	9,407	**10,530**
Old World Bluestem	Spar	14,471	9,072	7,962	11,062	**10,642**
Old World Bluestem	WW-B Dahl	16,007	11,915	8,470	10,472	**11,716**
Old World Bluestem	Caucasian	13,110	10,606	8,695	9,940	**10,588**
Indiangrass	Cheyenne	5,594	7,878	6,803	10,012	**7,572**
Bermudagrass	Ozark sprigged	15,801	8,197	7,185	8,256	**9,860**
Bermudagrass	Giant/Common (1:1 ratio) seeded	14,486	6,590	6,563	5,652	**8,323**
	Trial Average	**11,801**	**8,361**	**7,482**	**8,668**	**9,078**

	Rainfall (Jan.-Oct., inches)	21.4	16.5	14.7	23.4
Irrigation Levels	Dryland/low/moderate (inches)	0/2/4	0/5/10	0/7/14	0/3/6

†Mid-August to October growth was lost; comparable growth in other years during this time ranged from ~600 lbs./A for buffalograss to ~3,500 lbs./A for switchgrass.

‡50% Hatchita, 40% Haskell, 10% green sprangletop (Natural Resources Conservation Service blend for Floyd County).

Table 29. Initial perennial grass trial stand ratings, Brownfield, 2008-2009. Trial became excessively weedy once irrigation began, and focus shifted to weed control with anticipation of reseeding.

Perennial grass species	Variety	Stand Rating‡				
		7/9/08	11/5/08	10/1/09	5/25/10	3/31/11
Buffalograss	Plains	0.5	0.1	2.0	2.3	4.8
Sideoats grama	Haskell	1.2	0.9	1.7	2.0	3.3
Blue grama	Hatchita	1.0	0.7	1.8	2.0	3.2
Natives Blend	Terry Co. NRCS Mix†	2.0	1.4	2.7	2.3	3.7
Switchgrass	Alamo	1.0	0.7	2.0	1.5	1.8
Kleingrass	Selection 75	2.3	2.8	3.0	3.0	4.5
Old world bluestem	Spar	1.0	1.8	3.0	3.0	4.5
Old world bluestem	WW-B Dahl	0.3	0.8	1.8	1.7	2.8
Old world bluestem	Caucasian	0.7	1.0	1.5	1.5	2.7
Bermudagrass	Ozark sprigged	Not yet sprigged				
Bermudagrass	Giant/Common, 1:1	Not yet seeded				
Dahl OWB for overseeding	Yellow sweet clover	Legume not yet added				
Dahl OWB for overseeding	Alfalfa	Legume not yet added				
Dahl OWB for overseeding	Overton 18 rose clover	Legume not yet added				
Dahl OWB for overseeding	Hairy vetch	Legume not yet added				

†60% sideoats grama, 30% blue grama, 10% green sprangletop
‡0 =none, 1 =poor, 2 =fair, 3 =good, 4 =very good, 5 =excellent.

Report B: Irrigated Wheat Grain Variety Trial Results, Floyd County, Texas, 2010

Irrigated grain trials for wheat were added in the fall of 2008 in Floyd County to represent the eastern South Plains. Duplicate tests occur in Yoakum, Castro, and other counties in the Texas Panhandle.

The Floyd County trial was seeded November 9 (initial irrigation for germination November 11) at the Jody Foster 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 about ¼" to perhaps 3/8" deep as best we could with the light weight experimental test plot drill. Emergence was slightly visible one month later. The test was harvested June 17, a delay of about ten days due to the inability of our small-plot combine to cleanly thresh samples until humidity was low.

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, 18.0%; we like to have tests under 15%, and tests are usually discarded if %CV > 20%). Notable results include:

1) Bearded wheat yields (34 varieties, non-Clearfield lines), yielded 40.7 bu/A, two beardless wheats averaged only 37.9 bu/A, and four Clearfield wheat varieties averaged 43.6 bu/A (Table 30). The six varieties that were currently recommended from Texas AgriLife yielded 42.2 bu/A (TAM 111, 112, 304; Hatcher, Endurance, Duster). Typically we see a yield reduction of 10-20% for beardless wheat vs. recommended grain varieties. Extension recommends that if producers believe there is a good chance you will go to grain to avoid planting beardless wheat. Many years of data demonstrate that no beardless wheats, even the newer lines like Deliver, Longhorn, and TAM 401 have sufficient yield potential to be considered for planned grain harvest.

2) Test weights were low, averaging 53.0 lbs./bu. A few wheat varieties were under 50 lbs./bu in this test would not bode well for marketing. An industry concern in 2010 was potential low protein in robust, high yielding wheat, but this in fact was not the case across the region when wheats were tested. Low test weight in this trial was potentially affected by a low level of sprouting in the head prior to the delayed harvest.

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 suggests 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 averaged 70 lbs./A (16,100 seeds/lb.), but the range of seed size was vast, from

12,600 (large seed) to small seed of 24,800 seeds per pound. 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) A seeding rate test using TAM 111 at 30, 60, 90, and 120 lbs./A was drilled. Two-year results suggest that 90 & 120 lb./A rates gave slightly higher yields. In most years for typical sized wheat seed, 60 lbs./A is adequate for full irrigation. As plantings move into November in Floyd and Hale Counties producers need to start gradually increasing their seeding rate to compensate for less tillering.

6) 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). Then the observation is recorded again by about March 1 to answer the question "Which of these wheats look like it would hold the ground from blowing?" No stand ratings demonstrated very good or exceptional ground cover.

Dryland Considerations: Of tested varieties TAM 111, TAM 112, TAM 304, Jagalene, Hatcher, and Endurance have been noted for their recent performance in strictly dryland production in other areas of West Texas. Other varieties drilled in this trial in the past have also been picks for dryland in past years including Jagger, Jagalene, and Duster.

Greenbug and Russian Wheat Aphid Resistance: Greenbug resistant TAM 110 was phased out in lieu of TAM 112 as the latter has slightly higher grain yield, better disease resistance (essentially the best available resistance to Wheat Streak Mosaic Virus, transmitted from volunteer wheat by the wheat curl mite), and better grain milling quality. Hatcher, Bill Brown, and Bond CL—and Colorado State University lines—are tolerance of RWAR though the biotype of RWAR in Colorado has changed and these varieties appear to no longer have the level of resistance once known.

Other Management Tips for 2010-2011

Seed Quality Guidelines—Test weight of ≥58 lbs./bu and germ ≥85%—is a key for South Plains wheat production especially as many acres are planted late in cooler conditions after cotton or peanut harvest.

Seeding Rate—This irrigated test included using TAM 111 for 30, 60, 90, and 120 lbs./A. No trend was observed in this first-year test. Extension suggests 60 lbs./A is a good base seeding rate for irrigated grain, but rates should increase for late plantings to perhaps 90 lbs./A if seedings occur in late November into December.

Planting Date—Optimum planting dates for wheat in the Lower South Plains should target around October 25, but about 2 to 3 weeks earlier in the northwest South Plains. I would not be concerned about seedings in the first week of November in the lower South Plains, but after that gradual risk of reduced yield potential increases. Seedings that occur in early December can provide similar yields compared to optimum planting dates in some years, but expect a long-term reduction in yield potential of ~25% (worse in some years). This notes the urgency to hasten wheat seeding after peanuts and cotton to increase chances for good stand establishment prior to lasting cold.

Nitrogen for Wheat Grain Production—Without soil test data, Texas AgriLife Extension suggests 1.2 lbs. N per bushel of yield goal. This is a reliable rule of thumb. The number may be adjusted up if residual soil N fertility is poor, down if residual N fertility is good. Topdressing N typically targets about 1/3 of N in the fall with 2/3 in the late winter/early spring BEFORE jointing (see below).

Timing of 2011 Topdress N—Extension continues to observe many producers making topdress N applications well after jointing. We will address this further over the winter, but delayed N applications much past jointing (growing point differentiates to determining maximum potential spikelets per head and seeds per spikelet; growth often becomes more erect and hollow stem is usually observed a couple days after jointing starts) have reduced the effectiveness of N to increase grain yield. Hence topdress N applications in Gaines, Yoakum, Terry, and Dawson Counties are best targeted most likely in mid-February and probably no later than early March.

Herbicide Options for Wheat—Consult the 2008 Extension small grains weed control guide at http://varietytesting.tamu.edu/wheat/otherpublications/B-6139%202008%20Weed%20Control.pdf.

For further information on recent Texas High Plains wheat variety trials, consult the multi-year irrigated and dryland summary as well as Extension's list of recommended varieties at http://lubbock.tamu.edu/wheat or contact your local county/IPM Extension staff or Calvin Trostle.

Table 30. Floyd County wheat trial, Foster farm, 2009-2010.

Floyd Co. Wheat Variety Trial, Jodie Foster Farm, 2009-2010

Conducted by Calvin Trostle, Extension agronomy, Lubbock
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Trial Averages Listed by variety type (# of varieties)		Seed Test Wt. (lbs./bu)	Visual Seed Rating†	Seeds per Lb.	Stand Rating 2/10/11	Height (in.)	Harvest Test Wt. (lbs./bu)	2010 Yield Bu/A 14%H2O	Two-Yr. Yields 09-10. Bu/A
AP06T3621	AgriPro Exptl.	56.6	3	11,800	2.8	29	51.6	34.8	
Greer (AP06T3832)	AgriPro Exptl.	54.2	2	16,000	2.4	29	50.5	37.7	36.8
Armour	Westbred	57.9	4	16,700	2.0	27	49.3	30.6	35.4
Art	AgriPro	57.2	3	19,100	2.0	29	51.0	37.6	40.6
Bill Brown	Colorado St.	61.2	3	16,800	2.1	26	54.1	44.5	46.7
Billings	Oklahoma St.	56.0	4	14,200	2.6	29	46.8	36.5	36.0
Bullet	Oklahoma St.	59.1	4	14,100	2.1	30	54.5	35.1	32.6
CJ	AgriPro	58.8	4	13,000	2.4	22	55.3	50.4	
Doans	AgriPro	53.9	1	24,800	2.3	28	57.6	43.4	36.8
Dumas	AgriPro	61.8	4	13,100	2.1	30	56.2	39.8	40.7
Duster	Oklahoma St.	60.0	4	16,700	2.5	29	48.1	37.5	35.8
Endurance	Oklahoma St.	57.2	2	17,700	2.5	29	55.9	40.2	41.6
Fannin	AgriPro	58.5	4	15,600	2.8	28	53.8	37.9	34.8
Fuller	Kansas St.	58.2	4	16,600	2.4	28	55.0	39.7	42.2
Hatcher	Colorado St.	60.6	4	14,700	2.5	29	54.3	48.2	44.4
Jackpot	AgriPro	59.1	4	13,900	2.1	28	56.7	52.0	43.0
Jagalene	AgriPro	58.5	4	17,800	2.3	28	55.7	39.7	39.9
Jagger	Kansas St.	54.8	3	17,900	2.4	28	55.3	39.1	38.2
Mace	USDA-Neb.	58.2	4	14,900	2.4	29	55.3	49.1	
OK05212	Okla. St. Exptl.	58.5	4	17,900	2.1	29	51.7	36.4	
OK05511	Okla. St. Exptl.	59.4	4	15,300	2.5	28	53.6	40.5	
OK05526	Okla. St. Exptl.	59.1	4	14,900	2.3	31	54.3	54.3	50.0
Santa Fe	Westbred	60.0	4	15,400	2.6	28	52.4	42.2	45.5
Shocker	Westbred	56.9	4	15,600	2.6	28	54.3	35.2	43.2
Sy Gold	AgriPro Exptl.	56.3	3	13,900	2.4	30	55.0	45.0	
T81	Trio	60.3	4	15,600	2.1	29	53.3	30.3	35.8
T136	Trio	53.3	0	19,600	2.4	29	54.0	36.5	37.2
T197	Trio	60.3	4	15,700	2.0	30	51.0	42.0	
TAM 111	Texas AgriLife	56.9	4	14,600	2.0	30	53.8	44.6	45.3
TAM 112	Texas AgriLife	59.7	4	14,800	2.4	29	53.1	36.0	34.7
TAM 113 (TX02A0252)	Texas AgriLife	59.4	3	18,800	2.0	30	50.4	33.7	
TAM 203	Texas AgriLife	59.4	4	15,100	2.5	28	54.3	41.9	34.3
TAM 304	Texas AgriLife	58.8	4	14,100	2.1	28	51.7	46.5	36.2
TAM W-101	Texas AgriLife	55.4	4	14,900	2.6	29	54.5	43.4	36.6
TX05A001822	TX AgriLife Exptl.	56.3	4	17,800	2.1	28	53.5	39.7	
TX06A001263	TX AgriLife Exptl.	57.2	4	20,700	2.3	29	49.2	40.8	
Winterhawk	Westbred	57.6	4	18,700	2.0	29	52.9	42.5	
Beardless Wheats									
Pete (beardless)	Oklahoma St.	58.5	4	14,300	2.5	29	48.6	37.7	
TAM 401 (beardless)	Texas AgriLife	58.8	4	19,500	2.6	27	52.4	38.2	32.9
"Clearfield" Herbicide Tolerant Wheats									
AP503CL2	AgriPro	58.2	4	16,700	1.9	29	52.8	41.6	38.5
Bond CL	Colorado St.	59.4	4	12,600	2.1	32	54.5	53.2	47.8
Okfield	Oklahoma St.	54.8	2	16,600	2.4	31	54.7	40.7	34.2
Protection CL	AGSECO	61.5	4	14,100	2.4	29	49.0	38.8	34.9

Trial Averages Listed by variety type (# of varieties)	Seed Test Wt. (lbs./bu)	Visual Seed Rating†	Seeds per Lb.	Stand Rating Feb. 10	Height (in.)	Harvest Test Wt. (lbs./bu)	Yield Bu/A at 14% H2O	
Variety Test Average--Bearded (37)						53.2	40.7	39.4
TX AgriLife Recommended Irrigated Bearded Wheats for Grain§						52.8	42.2	39.7
Beardless Wheat Average (2)						50.5	37.9	32.9
Clearfield Wheat Average (4)						52.7	43.6	38.8
Grand Total Average (43)	**58.1**		**16,100**	**2.3**	**28.0**	**53.0**	**40.8**	**39.1**
Protected Least Signif Diff. (95%)#				0.6	3	2.2	7.8	
Coefficient of Variation, CV (%)				21.3	8.8	5.2	18.0	

Seeding Rate Component

TAM 111--30 lbs./A	30				1.3	28.5	53.3	32.0	36.4
TAM 111--60 lbs./A	60				1.9	28.5	54.8	38.1	39.4
TAM 111--90 lbs./A	90				2.6	29.5	53.8	45.9	44.9
TAM 111--120 lbs./A	120				3.4	29.0	53.3	44.4	43.0

†Would Trostle buy this planting seed sample based on visual appearance?
0 = no, 1 = probably not, 2 = maybe, 3 = probably yes, 4 = yes.

§Texas AgriLife recommended varieties for irrigation in the Texas High Plains: TAM 111, TAM 112 (limited irrigation only), TAM 304, Duster, Endurance, Hatcher.

#Values in the same column that differ by more than the PLSD are not significantly different.

TASK 8: INTEGRATED CROP/FORAGE/LIVESTOCK SYSTEMS AND ANIMAL PRODUCTION EVALUATION

Dr. Vivien Allen
Philip Brown
Song Cui
Cody Zilverberg

Descriptions of sites that include livestock

Of the 30 sites in the demonstration project in 2010, five included livestock. Although the total number of sites including livestock in 2010 was the same as in 2009, Site 9 added livestock in 2010 and Site 4, that had previously included cattle, became a multi-cropping site. The total number of sites including livestock has remained relatively stable since 2005 (Fig. 11) but some individual sites have moved in and out of livestock production. Sites 5 and 10 have had cow-calf production consistently from the beginning (2005). The change in cattle numbers across the demonstration project is seen in Figure 10. While cattle numbers declined somewhat in 2009, they increased slightly in 2010.

All sites that included livestock achieved the target for using less than 15 inches total irrigation water. In fact, in 2010, no site that included livestock exceeded a system-wide average of more than 10 inches of irrigation. Two of these sites (Site 10 and 26) were within the target of using less than 15 inches of irrigation water while maintaining a minimum of $300 gross margin per system acre and one (Site 9) achieved the target of using less than 10 inches of irrigation water while maintaining at least $200 gross margin per system acre. The two remaining sites (5 and 17) were close to this target but were slightly lower than $200 in gross margin per system acre.

All sites within the demonstration project involving livestock in 2010 were beef cow-calf systems. In previous years, some sites included stocker cattle. Cattle in all systems except for system 5 (the single all-forage/cow-calf system) were handled as contract grazing at a fee of $15 per head each month of grazing. Site 5 is devoted totally to a forage base for grazing cows and calves.

Site 5. This is a purebred Angus cow-calf system that spends most of its time within the system area. Cattle have generally calved off site on wheat pasture before entering this system. This system does not contain a cropping component but hay is harvested if there is excess forage. Hay (150 bales) was harvested in 2009. The area under the center-pivot is divided into six sections and each year for the last several years, one of these sections has been renovated to improve forage production. In the year of renovation, this section is harvested for hay. This hay is stored and fed for supplemental winter feed to the cow herd. This system is evaluated as an intact grazing system with the off-site grazing for stover or wheat pasture during winter handled as contract grazing. Calves are weaned in early autumn. Steer calves are considered 'sold' by the pound at weaning about October while heifers are kept on-site within the system. Heifers are 'sold' as yearlings at 12 to 15 months as breeding stock 'by the head.' In actual fact, this producer retains steer calves past weaning and though feedlot finishing. These calves graze crop residues and wheat pasture as available until entering the feedlot for finishing. They are sorted into size groups and enter the finishing phase based on their size. Carcass data is collected and selection of cow and bull genetics is targeted to feedlot performance and carcass merit of the calves. The genetics of this herd has been steadily improved over the past years by extensive use of artificial insemination (AI) to known sires for carcass merit improvement. However, for the purposes of calculating economic return to this system for the Demonstration project, these steer calves are considered sold at weaning based on current market prices to approximate the marketing strategies most commonly practiced.

Site 10. This four-field system includes one field of WW-B. Dahl old world bluestem (Field 1) and one field of bermudagrass (Field 4) for grazing cows and calves. In previous years a third field (Field 3) was also established in WW-B. old world bluestem for grazing but in 2010, this field was converted to corn. The fourth field in this system (Field 2) was also planted to corn in 2010. The system provides a small part of the summer grazing required for registered SimmiAngus and ChiAngus cow-calf herds. Different parts of the herd are moved on and off the system as needed, and it generally provides a place for grazing of pairs and calving of older cows. If grazing is not needed, hay is harvested. Although both hay and a seed crop from the old world bluestem have been harvested in previous years, in 2010 neither hay nor grass seed were harvested. Due to the continual movement of cattle on and off the site, livestock income is calculated as contract grazing based on grazing days. In years past, Field 2 has been generally intensively cropped, often double-cropped, but is not used for grazing. When planted to forage sorghum and harvested for hay, this field can be used as supplemental winter feed for the cow herd. In 2010, Fields 2 and 3 were planted to corn and did not contribute to grazing.

Site 17. This is a cross-bred cow-calf system and is calculated as contract grazing because of movement on and off the system. Cows generally spend the majority of the year on site but in 2009 they occupied this area for only six months. Excess forage from WW-B. Dahl on field 1 and 2 is harvested as hay in some years but not in 2010. While both fields have been harvested for seed in past years, only field 1 was harvested for seed in autumn 2010. Fields 1 and 2 provide the majority of the grazing for the cows and calves. These cattle also graze forages off site generally in fall through mid-winter when grazing crop residues. Cattle are supplemented in winter with cotton burrs and hay harvested from the site. The third field (Field 3) in this system was planted to corn in 2010.

Site 26. This two-field system planted wheat for grazing cows and calves followed by corn for grain in 2010. Field 2 was planted to cotton. Cow grazed winter wheat planted in field 1 during a four-month period.

Grants and proposals

Grant proposals were either submitted or are in various stages of preparation. A USDA-SARE grant was submitted in 2010 and funded ($300,000 over 3 years) in 2011 to support the ongoing basic research on integrated crop and livestock systems at the New Deal research site. This grant contributes directly to the TAWC project through our ability to test hypotheses and answer researchable questions in a replicated research setting. Ongoing research on water use, profitability, and variables potentially contributing to climate change are being tested at both the New Deal research site and within the TAWC project. This provides an unusually robust data set from which to draw conclusions.

We are in the second year of funding by the USDA-LTAR program for 'Proof of Concept' for research on carbon cycling. This $200,000 grant will end in November, 2011. Much data is being generated within selected TAWC sites that contributes to our understanding of carbon sequestration, microbial relationships to carbon and other greenhouse gas emissions, and effects of different systems on these mechanisms. Several manuscripts are already being written for publication. This research also forms the basis for several graduate students Thesis and Dissertations.

Graduate Student Research in Integrated Crop/Forage/Livestock Systems

Song Cui has completed his PhD research on legumes that have potential for west Texas that would not increase water demands over the associated grasses. He will defend his dissertation in June, 2011 with graduation in August, 2011. Results of his research with yellow sweetclover, sainfoin, and alfalfa have now been incorporated into grazing systems research and have potential to reduce nitrogen fertilizer requirements without increasing irrigation demand.

Cody Zilverberg continues development of methods to assess the energy inputs into forage/livestock systems. Data will be applied to analysis of the Demonstration sites that include cattle. A publication entitled Energy and Carbon Costs of Selected Cow-Calf Systems has been accepted for publication in the Journal of Rangeland Ecology and Management. Cody is in the final stages of his PhD with an expected graduation date of May 2012.

TASK 9: EQUIPMENT, SITE INSTRUMENTATION, AND DATA COLLECTION FOR WATER MONITORING

Jim Conkwright
Caleb Jenkins
Gerald Crenwelge

Statement of Factors Affecting Irrigation Water Savings

Irrigation efficiency is becoming more critical over the years. Both inputs and prices are changing the economic balance annually.

The factors have been:

- The ability or inability of producers to supply irrigation water to meet total crop water demand. The majority of producers can only supplement precipitation;
- The fluctuating amount of precipitation received from one growing season to the next;
- The timeliness of precipitation;
- The intensity of precipitation;
- The occurrence of damaging precipitation, like hail, that impacts the capability to produce a crop;
- The cost of pumping underground water;
- Water quality which may limit amount of water applied to crops in a few areas;
- Historic and traditional practices which may or may not foster a willingness to accept change;
- Computerized technology that constantly challenge producers to evaluate;
- Current crop prices and the decision to alter irrigation practices to supply a particular market;
- Consciousness of water conservation while participating in conservation oriented projects;
- Continuing or consistent use of conservation practices after project conclusion and district presence is less frequent.

Water Use Efficiency Synopsis Task 9 Year 6

The total crop water demand decreased again this when compared to 2009. One obvious reason is that the rainfall during the early part of the growing season was abundant enough that additional irrigation was not necessary in many cases. The annual rainfall in the Project was about 29 inches in 2010 while it was about 15.2 inches in 2009. The average rainfall in the Project during April thru July was over 19 inches in 2010. This had a significant impact on water use in 2010.

The Total Water Efficiency Summary (Table 31) indicates that the average irrigation applied to crops in 2010 was about 7.4 inches compared to 12.5 inches in 2009. This savings was largely due to above average rainfall.

The Water Use Efficiency table (Table 32) shows that the soil started the growing season with an abundant amount of soil moisture in the spring. In most cases, the soil moisture was significantly lower at the time of harvest which means that the producers were able to utilize the soil moisture from the rain for crop production. The notable exception was the wheat which was planted during the dry period in 2009 and harvested with the abundant soil moisture from the 2010 spring rains. One field with a good crop was not able to be harvested because of the wet weather.

The Water Use Efficiency table (Table 32) also shows that the number of corn fields increased significantly to a total of about 800 acres. The total acres of corn silage almost doubled to about 280 acres. Cotton increased significantly to a total of about 1400 acres. Wheat also increased but that was partially because we were not able to capture data on some fields in 2009. The crop that deceased in 2010 was sunflowers. Several fields were double cropped in 2010. That was a major contributor to fact that the total acres increased in 2010.

Table 32 also shows that the yield per inch of total water generally increased in 2010. The yield per inch of total water for corn is about 580 pounds per inch from about 460 in 2009. The corn yield did decrease slightly from about 13500 pounds per acre in 2009 to 11700 in 2010. The yield per inch for cotton was about 87 pounds per inch from about 58 in 2009. The cotton yield increased about 150 pounds per acre from 2009 to 2010.

Table 31. Total water efficiency (WUE) summary by various cropping and livestock systems in Hale and Floyd Counties (2010).

			TOTAL WATER EFFICIENCY SUMMARY									
Year	System	Field	Crop	Application Method	Acres	Irrigation Applied (Inches per acre)	Total Crop Water (Inches per Acre)	ET Crop Water Demand (Inches per acre)	Total Water Potential Used (%)	Total Water Potential Water Demand Conserved (%)	Total Water Potential Use (inches per acre)	Total Irrigation Potentially Conserved (ac ft)
2010	2	1	corn	SDI	60.9	14.04	27.76	29.6	94%	6.22%	1.84	9.34
2010	3	1	grain sorghum	MESA	61.5	5.13	14.84	22	67%	32.55%	7.16	36.70
2010	3	2	cotton	MESA	61.8	13.15	25.67	27.82	92%	7.73%	2.15	11.07
2010	3	3	wheat	MESA	15	0	18.94	N/A	N/A	N/A	N/A	N/A
2010	4	1	cotton	LEPA	13.3	9.7	24.54	18.81	130%	-30.46%	-5.73	-6.35
2010	4	2	cotton	LEPA	65.3	9.7	24.54	18.81	130%	-30.46%	-5.73	-31.18
2010	4	4	forage Sorghum	LEPA	28.4	8.5	18.16	18.21	100%	0.27%	0.05	0.12
2010	4	4	Wheat	LEPA	28.4	4	15.23	N/A	N/A	N/A	N/A	N/A
2010	4	5	grass	LEPA	16	15.6	36.91	N/A	N/A	N/A	N/A	N/A
2010	5	1	grass	LESA	70.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	2	grass	LESA	81.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	3	grass	LESA	95.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	4	grass	LESA	89.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	5	grass	LESA	81.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	6	grass	LESA	69.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	7	grass	Dryland	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	8	grass	Dryland	32.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	9	grass	Dryland	18.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	10	grass	Dryland	16.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	11	grass	Dryland	35.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	12	grass	Dryland	5.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	6	5	corn	LESA	32.3	11.2	23.24	29.98	78%	22.48%	6.74	18.14
2010	6	6	cotton	LESA	29.9	8.6	20.6	20.43	101%	-0.83%	-0.17	-0.42
2010	6	7	corn	LESA	30.7	11.2	23.24	29.98	78%	22.48%	6.74	17.24
2010	6	8	cotton	LESA	29.9	8.6	20.6	20.43	101%	-0.83%	-0.17	-0.42
2010	7	1	sideoats	LESA	130	2.37	11.58	N/A	N/A	N/A	N/A	N/A
2010	8	1	sideoats	SDI	27.6	3.25	12.46	N/A	N/A	N/A	N/A	N/A
2010	8	2	sideoats	SDI	19.3	3.25	12.46	N/A	N/A	N/A	N/A	N/A
2010	8	3	sideoats	SDI	7.1	3.25	12.46	N/A	N/A	N/A	N/A	N/A
2010	8	4	sideoats	SDI	7.8	3.25	12.46	N/A	N/A	N/A	N/A	N/A
2010	9	2	cotton	MESA	137	3.8	12.11	18.31	66%	33.86%	6.2	70.78
2010	10	1	grass	LESA	44.3	5	25.06	N/A	N/A	N/A	N/A	N/A
2010	10	2	corn	LESA	44.5	8.5	24.59	27.88	88%	11.80%	3.29	12.20
2010	10	3	corn	LESA	42.7	8.5	24.59	27.88	88%	11.80%	3.29	11.71
2010	10	4	grass	LESA	42.1	0	20.06	N/A	N/A	N/A	N/A	N/A
2010	11	1	cotton	Furrow	45.2	2.71	14.99	18.83	80%	20.39%	3.84	14.46
2010	11	2	cotton	Furrow	24.4	5.02	17.3	18.83	92%	8.13%	1.53	3.11
2010	11	3	g.sorghum	Furrow	22.9	7.13	18.79	25.95	72%	27.59%	7.16	13.66
2010	12	1	g.sorghum	Dryland	151.2	0	8.76	24.08	36%	63.62%	15.32	193.03
2010	12	2	fallow	Dryland	132.7	0	N/A	N/A	N/A	N/A	N/A	N/A
2010	14	2	wheat	MESA	62.5	2.64	17.45	N/A	N/A	N/A	N/A	N/A
2010	14	3	cotton	MESA	61.7	5.94	18.95	27.88	68%	32.03%	8.93	45.92
2010	15	8	cotton	SDI	45.6	3.9	15.92	28.5	56%	44.14%	12.58	47.80
2010	15	9	cotton	Furrow	57.2	4.09	16.11	19.11	84%	15.70%	3	14.30
2010	17	1	grass	MESA	53.6	1.2	22.63	N/A	N/A	N/A	N/A	N/A
2010	17	2	grass	MESA	58.3	2.32	23.75	N/A	N/A	N/A	N/A	N/A
2010	17	3	corn	MESA	108.9	16.3	33.35	30.42	110%	-9.63%	-2.93	-26.59
2010	18	2	cotton	MESA	61.5	2.2	13.02	19.23	68%	32.29%	6.21	31.83
2010	19	9	cotton	LEPA	59.2	6.7	20.29	19.64	103%	-3.31%	-0.65	-3.21
2010	19	10	wheat	LEPA	117.6	2	15.38	N/A	N/A	N/A	N/A	N/A
2010	20	1	corn silage	LEPA	117.6	20	36.65	27.82	132%	-31.74%	-8.83	-86.53
2010	20	2	cotton	LEPA	115.8	12	26.06	16.21	161%	-60.76%	-9.85	-95.05
2010	20	2	triticale	LEPA	115.8	3.35	10.55	N/A	N/A	N/A	N/A	N/A
2010	21	1	corn	LEPA	61.4	13	26.52	29.98	88%	11.54%	3.46	17.70
2010	21	2	cotton	LEPA	61.2	7.9	22.26	20.43	109%	-8.96%	-1.83	-9.33
2010	22	3	corn	LEPA	148.7	16.1	27.58	30.06	92%	8.25%	2.48	30.73
2010	23	7	cotton	LESA	121.1	10.35	21.78	17.27	126%	-26.11%	-4.51	-45.51
2010	23	7	triticale	LESA	121.1	10.35	19.32	N/A	N/A	N/A	N/A	N/A
2010	24	1	corn	LESA	64.6	17.9	29.98	23.4	128%	-28.12%	-6.58	-35.42
2010	24	2	corn	LESA	65.1	17.9	29.98	23.4	128%	-28.12%	-6.58	-35.70
2010	26	1	cotton	LESA	62.9	6.25	19.12	20.21	95%	5.39%	1.09	5.71
2010	26	2	corn	LESA	62.3	6.75	17.33	29.42	59%	41.09%	12.09	62.77
2010	26	2	wheat	LESA	62.3	8.5	19.51	N/A	N/A	N/A	N/A	N/A
2010	27	1	cotton	SDI	46.2	12	24.13	20.21	119%	-19.40%	-3.92	-15.09
2010	27	3	corn silage	SDI	48.8	18	31.98	28.58	112%	-11.90%	-3.4	-13.83
2010	27	4	cotton	SDI	13.5	12	24.13	20.21	119%	-19.40%	-3.92	-4.41
2010	28	1	cotton	SDI	51.5	6.24	17.44	27.88	63%	37.45%	10.44	44.81
2010	29	1	grain sorghum	Dryland	50.8	0	13.88	20.61	67%	32.65%	6.73	28.49
2010	29	2	cotton	Dryland	104.3	0	14.12	18	78%	21.56%	3.88	33.72
2010	29	3	grain sorghum	Dryland	66.1	0	13.88	20.61	67%	32.65%	6.73	37.07
2010	30	1	corn	SDI	21.8	11.9	22.06	20.4	108%	-8.14%	-1.66	-3.02
2010	31	1	cotton	LEPA	66.1	8.14	18.15	17.69	103%	-2.60%	-0.46	-2.53
2010	31	2	millet	LEPA	54	9.94	19.66	N/A	N/A	N/A	N/A	N/A
2010	32	1	corn	LEPA	70	12.44	23.29	29.22	80%	20.29%	5.93	34.59
2010	33	1	cotton	LEPA	70	11.2	22.33	19.39	115%	-15.16%	-2.94	-17.15

Table 32. Water use efficiency (WUE) by various cropping and livestock systems in Hale and Floyd Counties (2010).

								WATER USE EFFICIENCY							
Year	System	Field	Crop	Application Method	Acres	Inches Soil Moisture at Planting (0-5 ft)	Inches Soil Moisture at Harvest (0-5 ft)	Soil Moisture Contribution to WUE	Acre Inch Irrigation Applied	Growing Season Rain (in)	Effective Rainfall (70% of Actual Rain)	Total Crop Water (Inches per Acre)	Yield (lbs/ac)	Yield Per Acre Inch Of Irrigation (lbs.)	Yield Per Acre Inch Of Total Water (lbs.)
2010	2	1	corn	SDI	60.9	9.0	8.9	-0.1	14.0	19.6	13.7	27.7	12398	883	448
2010	3	1	grain sorghum	MESA	61.5				5.1	13.9	9.7	N/A	5720	N/A	N/A
2010	3	2	cotton	MESA	61.8				13.2	17.9	12.5	N/A	1005	N/A	N/A
2010	3	3	wheat	MESA	15				0.0	27.1	18.9	N/A	1380	N/A	N/A
2010	4	1	cotton	LEPA	13.3	3.9	4.2	0.3	9.7	21.2	14.8	24.8	1514	156	61
2010	4	2	cotton	LEPA	65.3	9.7	4.4	-5.3	9.7	21.2	14.8	19.2	1514	156	79
2010	4	4	forage sorghum	LEPA	28.4				8.5	13.8	9.7	N/A	135 bales	N/A	N/A
2010	4	4	wheat	LEPA	28.4	3.8	4.3	0.5	4.0	16.0	11.2	15.7	3774	944	241
2010	4	5	alfalfa	LEPA	16	6.1	4.9	-1.2	15.6	30.4	21.3	35.7	19200	1231	538
2010	5	1	grass	LESA	70.2					27.7	19.4	N/A		N/A	N/A
2010	5	2	grass	LESA	81.6					27.7	19.4	N/A		N/A	N/A
2010	5	3	grass	LESA	95.8					27.7	19.4	N/A		N/A	N/A
2010	5	4	grass	LESA	89.2	9.3	6.1	-3.2		27.7	19.4	16.2		N/A	N/A
2010	5	5	grass	LESA	81.2					27.7	19.4	N/A		N/A	N/A
2010	5	6	grass	LESA	69.6					27.7	19.4	N/A		N/A	N/A
2010	5	7	grass	Dryland	30					27.7	19.4	N/A		N/A	N/A
2010	5	8	grass	Dryland	32.3					27.7	19.4	N/A		N/A	N/A
2010	5	9	grass	Dryland	18.8					27.7	19.4	N/A		N/A	N/A
2010	5	10	grass	Dryland	16.9					27.7	19.4	N/A		N/A	N/A
2010	5	11	grass	Dryland	35.3					27.7	19.4	N/A		N/A	N/A
2010	5	12	grass	Dryland	5.5					27.7	19.4	N/A		N/A	N/A
2010	6	5	corn	LESA	32.3	8.1	6.8	-1.3	11.2	17.2	12.0	10.7	12880	1150	1199
2010	6	6	cotton	LESA	29.9				8.6	17.1	12.0	N/A	1233	N/A	N/A
2010	6	7	corn	LESA	30.7				11.2	17.2	12.0	N/A	12880	N/A	N/A
2010	6	8	cotton	LESA	29.9				8.6	17.1	12.0	N/A	1233	N/A	N/A
2010	7	1	sideoats	LESA	130	10.3	5.1	-5.2	2.4	13.2	9.2	6.4	200	84	31
2010	8	1	sideoats	SDI	27.6	9.0	4.8	-4.2	3.3	13.2	9.2	8.3	225	69	27
2010	8	2	sideoats	SDI	19.3				3.3	13.2	9.2	N/A	225	N/A	N/A
2010	8	3	sideoats	SDI	7.1				3.3	13.2	9.2	N/A	225	N/A	N/A
2010	8	4	sideoats	SDI	7.8				3.3	13.2	9.2	N/A	225	N/A	N/A
2010	9	2	cotton	MESA	137	8.2	4.2	-4.0	3.8	11.9	8.3	8.1	1175	309	145
2010	10	1	grass	LESA	44.3				5.0	28.7	20.1	N/A		N/A	N/A
2010	10	2	corn	LESA	44.5	9.5	5.9	-3.6	8.5	23.0	16.1	21.0	11872	1397	566
2010	10	3	corn	LESA	42.7				8.5	23.0	16.1	N/A	11872	N/A	N/A
2010	10	4	grass	LESA	42.1	9.5	6.7	-2.8	0.0	28.7	20.1	17.3		N/A	N/A
2010	11	1	cotton	Furrow	45.2				2.7	17.5	12.3	N/A	721	N/A	N/A
2010	11	2	cotton	Furrow	24.4				5.0	17.5	12.3	N/A	773	N/A	N/A
2010	11	3	grain sorghum	Furrow	22.9	9.6	4.2	-5.4	7.1	16.7	11.7	13.4	6664	935	498
2010	12	1	grain sorghum	Dryland	151.2	10.0	2.4	-7.6	0.0	12.5	8.8	1.2	2509	N/A	2163
2010	12	2	fallow	Dryland	132.7				0.0	14.8	10.3	10.3	3774	N/A	N/A
2010	14	2	wheat	MESA	62.5	1.4	5.1	3.7	2.6	21.2	14.8	21.2	3900	1477	184
2010	14	3	cotton	MESA	61.7	8.7	3.8	-4.9	5.9	18.6	13.0	14.1	1059	178	75
2010	15	8	cotton	SDI	45.6	9.7	5.4	-4.3	3.9	17.2	12.0	11.6	1280	328	110
2010	15	9	cotton	Furrow	57.2	8.6	3.2	-5.4	4.1	17.2	12.0	10.7	1326	324	124
2010	17	1	grass	MESA	53.6				1.2	30.6	21.4	N/A		N/A	N/A
2010	17	2	grass	MESA	58.3	7.8	2.3	-5.5	2.3	30.6	21.4	18.3		N/A	N/A
2010	17	3	corn	MESA	108.9	9.3	6.8	-2.5	16.3	24.4	17.1	30.9	12701	779	412
2010	18	1	wheat	MESA	60.7				0.0	17.1	12.0	N/A		N/A	N/A
2010	18	2	cotton	MESA	61.5				2.2	15.5	10.8	N/A	881	N/A	N/A
2010	19	9	cotton	LEPA	59.2	9.9	4.6	-5.3	6.7	19.4	13.6	15.0	1192	178	80
2010	19	10	wheat	LEPA	117.6	6.1	6.1	0.0	2.0	19.1	13.4	15.4	2820	1410	183
2010	20	1	corn silage	LEPA	117.6	9.8	6.8	-3.0	20.0	23.8	16.7	33.7	64000	3200	1902
2010	20	2	cotton	LEPA	115.8	8.9	6.3	-2.6	12.0	20.1	14.1	23.5	2280	190	97
2010	20	2	triticale	LEPA	115.8	9.0	8.9	-0.1	3.4	10.3	7.2	10.5	28000	8358	2679
2010	21	1	corn	LEPA	61.4	10.3	2.8	-7.5	13.0	19.3	13.5	19.0	11984	922	630
2010	21	2	cotton	LEPA	61.2	7.8	5.2	-2.6	7.9	20.5	14.4	19.7	1289	163	66
2010	22	3	corn	LEPA	148.7	9.9	7.1	-2.8	16.1	16.4	11.5	24.8	12936	803	522
2010	23	7	corn silage	LESA	121.1				10.4	16.3	11.4	N/A	31000	N/A	N/A
2010	23	7	triticale	LESA	121.1	7.6	7.6	0.0	10.4	12.8	9.0	19.3	23940	2313	1239
2010	24	1	corn	LESA	64.6	9.0	7.4	-1.6	17.9	17.3	12.1	28.4	12802	715	451
2010	24	2	corn	LESA	65.1				17.9	17.3	12.1	N/A	12802	N/A	N/A
2010	26	1	cotton	LESA	62.9				6.3	18.4	12.9	N/A	1790	N/A	N/A
2010	26	2	corn	LESA	62.3	8.9	4.1	-4.8	6.8	15.1	10.6	12.5	5195	770	415
2010	26	2	wheat	LESA	62.3	2.6	8.9	6.3	8.5	15.7	11.0	25.8	3720	438	144
2010	27	1	cotton	SDI	46.2	9.6	9.4	-0.2	12.0	17.3	12.1	23.9	1625	135	68
2010	27	3	corn silage	SDI	48.8	8.8	7.8	-1.0	18.0	20.0	14.0	31.0	60000	3333	1937
2010	27	4	cotton	SDI	13.5				12.0	17.3	12.1	N/A	1625	N/A	N/A
2010	28	1	cotton	SDI	51.5	9.4	5.2	-4.2	6.2	16.0	11.2	13.2	1231	197	93
2010	29	1	grain sorghum	Dryland	50.8	8.6	2.6	-6.0	0.0	19.8	13.9	7.9	2830	N/A	359
2010	29	2	cotton	Dryland	104.3				0.0	20.2	14.1	14.1	802	N/A	57
2010	29	3	grain sorghum	Dryland	66.1				0.0	19.8	13.9	N/A	2790	N/A	N/A
2010	30	1	corn	SDI	21.8	8.3	6.4	-1.9	11.9	14.5	10.2	20.2	11727	985	582
2010	31	1	cotton	LEPA	66.1				8.1	14.3	10.0	N/A	1156	N/A	N/A
2010	31	2	millet	LEPA	54				9.9	13.9	9.7	N/A	3254	N/A	N/A
2010	32	1	corn	LEPA	70				12.4	15.5	10.9	N/A	10326	N/A	N/A
2010	33	1	cotton	LEPA	70				11.2	15.9	11.1	N/A	1544	N/A	N/A

Table 33.Irrigation Efficiency Summary by various cropping and livestock systems in Hale and Floyd Counties (2010).

IRRIGATION EFFICIENCY SUMMARY												
Year	System	Field	Crop	Application Method	Acres	Irrigation Applied (Inches per acre)	Total Crop Water (Inches per Acre)	ET Crop Water Demand (Inches per acre)	ET Provided to Crop From Irrigation (%)	Potential Irrigation Conserved (%)	Potential Irrigation Conserved (Inches per acre)	Total Irrigation Potentially Conserved (ac ft)
2010	2	1	corn	SDI	60.9	14.04	27.76	29.6	47.43%	0.53	15.56	78.97
2010	3	1	grain sorghum	MESA	61.5	5.13	14.84	22	67.45%	0.33	7.16	36.70
2010	3	2	cotton	MESA	61.8	13.15	25.67	27.82	92.27%	0.08	2.15	11.07
2010	3	3	wheat	MESA	15	0	18.94	N/A	N/A	N/A	N/A	N/A
2010	4	1	cotton	LEPA	13.3	9.7	24.54	18.81	130.46%	-0.30	-5.73	-6.35
2010	4	2	cotton	LEPA	65.3	9.7	24.54	18.81	130.46%	-0.30	-5.73	-31.18
2010	4	4	forage Sorghum	LEPA	28.4	8.5	18.16	18.21	99.73%	0.00	0.05	0.12
2010	4	4	Wheat	LEPA	28.4	4	15.23	N/A	N/A	N/A	N/A	N/A
2010	4	5	grass	LEPA	16	15.6	36.91	N/A	N/A	N/A	N/A	N/A
2010	5	1	grass	LESA	70.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	2	grass	LESA	81.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	3	grass	LESA	95.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	4	grass	LESA	89.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	5	grass	LESA	81.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	6	grass	LESA	69.6	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	7	grass	Dryland	30	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	8	grass	Dryland	32.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	9	grass	Dryland	18.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	10	grass	Dryland	16.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	11	grass	Dryland	35.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	5	12	grass	Dryland	5.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2010	6	5	corn	LESA	32.3	11.2	23.24	29.98	77.52%	0.22	6.74	18.14
2010	6	6	cotton	LESA	29.9	8.6	20.6	20.43	100.83%	-0.01	-0.17	-0.42
2010	6	7	corn	LESA	30.7	11.2	23.24	29.98	77.52%	0.22	6.74	17.24
2010	6	8	cotton	LESA	29.9	8.6	20.6	20.43	100.83%	-0.01	-0.17	-0.42
2010	7	1	sideoats	LESA	130	2.37	11.58	N/A	N/A	N/A	N/A	N/A
2010	8	1	sideoats	SDI	27.6	3.25	12.46	N/A	N/A	N/A	N/A	N/A
2010	8	2	sideoats	SDI	19.3	3.25	12.46	N/A	N/A	N/A	N/A	N/A
2010	8	3	sideoats	SDI	7.1	3.25	12.46	N/A	N/A	N/A	N/A	N/A
2010	8	4	sideoats	SDI	7.8	3.25	12.46	N/A	N/A	N/A	N/A	N/A
2010	9	2	cotton	MESA	137	3.8	12.11	18.31	66.14%	0.34	6.20	70.78
2010	10	1	grass	LESA	44.3	5	25.06	N/A	N/A	N/A	N/A	N/A
2010	10	2	corn	LESA	44.5	8.5	24.59	27.88	88.20%	0.12	3.29	12.20
2010	10	3	corn	LESA	42.7	8.5	24.59	27.88	88.20%	0.12	3.29	11.71
2010	10	4	grass	LESA	42.1	0	20.06	N/A	N/A	N/A	N/A	N/A
2010	11	1	cotton	Furrow	45.2	2.71	14.99	18.83	79.61%	0.20	3.84	14.46
2010	11	2	cotton	Furrow	24.4	5.02	17.3	18.83	91.87%	0.08	1.53	3.11
2010	11	3	grain sorghum	Furrow	22.9	7.13	18.79	25.95	72.41%	0.28	7.16	13.66
2010	12	1	grain sorghum	Dryland	151.2	0	8.76	24.08	36.38%	0.64	15.32	193.03
2010	12	2	fallow	Dryland	132.7	0	N/A	N/A	N/A	N/A	N/A	N/A
2010	14	2	wheat	MESA	62.5	2.64	17.45	N/A	N/A	N/A	N/A	N/A
2010	14	3	cotton	MESA	61.7	5.94	18.95	27.88	67.97%	0.32	8.93	45.92
2010	15	8	cotton	SDI	45.6	3.9	15.92	28.5	55.86%	0.44	12.58	47.80
2010	15	9	cotton	Furrow	57.2	4.09	16.11	19.11	84.30%	0.16	3.00	14.30
2010	17	1	grass	MESA	53.6	1.2	22.63	N/A	N/A	N/A	N/A	N/A
2010	17	2	grass	MESA	58.3	2.32	23.75	N/A	N/A	N/A	N/A	N/A
2010	17	3	corn	MESA	108.9	16.3	33.35	30.42	109.63%	-0.10	-2.93	-26.59
2010	18	2	cotton	MESA	61.5	2.2	13.02	19.23	67.71%	0.32	6.21	31.83
2010	19	9	cotton	LEPA	59.2	6.7	20.29	19.64	103.31%	-0.03	-0.65	-3.21
2010	19	10	wheat	LEPA	117.6	2	15.38	N/A	N/A	N/A	N/A	N/A
2010	20	1	corn silage	LEPA	117.6	20	36.65	27.82	131.74%	-0.32	-8.83	-86.53
2010	20	2	cotton	LEPA	115.8	12	26.06	16.21	160.76%	-0.61	-9.85	-95.05
2010	20	2	triticale	LEPA	115.8	3.35	10.55	N/A	N/A	N/A	N/A	N/A
2010	21	1	corn	LEPA	61.4	13	26.52	29.98	88.46%	0.12	3.46	17.70
2010	21	2	cotton	LEPA	61.2	7.9	22.26	20.43	108.96%	-0.09	-1.83	-9.33
2010	22	3	corn	LEPA	148.7	16.1	27.58	30.06	91.75%	0.08	2.48	30.73
2010	23	7	cotton	LESA	121.1	10.35	21.78	17.27	126.11%	-0.26	-4.51	-45.51
2010	23	7	triticale	LESA	121.1	10.35	19.32	N/A	N/A	N/A	N/A	N/A
2010	24	1	corn	LESA	64.6	17.9	29.98	23.4	128.12%	-0.28	-6.58	-35.42
2010	24	2	corn	LESA	65.1	17.9	29.98	23.4	128.12%	-0.28	-6.58	-35.70
2010	26	1	cotton	LESA	62.9	6.25	19.12	20.21	94.61%	0.05	1.09	5.71
2010	26	2	corn	LESA	62.3	6.75	17.33	29.42	58.91%	0.41	12.09	62.77
2010	26	2	wheat	LESA	62.3	8.5	19.51	N/A	N/A	N/A	N/A	N/A
2010	27	1	cotton	SDI	46.2	12	24.13	20.21	119.40%	-0.19	-3.92	-15.09
2010	27	3	corn silage	SDI	48.8	18	31.98	28.58	111.90%	-0.12	-3.40	-13.83
2010	27	4	cotton	SDI	13.5	12	24.13	20.21	119.40%	-0.19	-3.92	-4.41
2010	28	1	cotton	SDI	51.5	6.24	17.44	27.88	62.55%	0.37	10.44	44.81
2010	29	1	grain sorghum	Dryland	50.8	0	13.88	20.61	67.35%	0.33	6.73	28.49
2010	29	2	cotton	Dryland	104.3	0	14.12	18	78.44%	0.22	3.88	33.72
2010	29	3	grain sorghum	Dryland	66.1	0	13.88	20.61	67.35%	0.33	6.73	37.07
2010	30	1	corn	SDI	21.8	11.9	22.06	20.4	108.14%	-0.08	-1.66	-3.02
2010	31	1	cotton	LEPA	66.1	8.14	18.15	17.69	102.60%	-0.03	-0.46	-2.53
2010	31	2	millet	LEPA	54	9.94	19.66	N/A	N/A	N/A	N/A	N/A
2010	32	1	corn	LEPA	70	12.44	23.29	29.22	79.71%	0.20	5.93	34.59
2010	33	1	cotton	LEPA	70	11.2	22.33	19.39	115.16%	-0.15	-2.94	-17.15

BUDGET

Table 34. Task and expense budget for years 1-6 of the demonstration project.

2005-358-014		Year 1 (9/22/04 - 1/31/06)	Year 2 (2/01/06 - 2/28/07)	Year 3 (3/01/07 - 2/29/08)	Year 4 (3/01/08 - 2/28/09)	Year 5 (03/01/09 - 2/28/10)	Year 6 03/01/10 - 2/28/11
Task Budget	**Task Budget***	***revised***	***revised***				
1	4,537	4,537	0	0	0	0	0
2	2,567,169	216,998	335,287	317,317	299,727	249,163	299,550
3	675,402	21,112	33,833	80,984	61,455	56,239	28,122
4	610,565	52,409	40,940	46,329	53,602	64,124	43,569
5	371,359	42,428	40,534	47,506	38,721	51,158	27,835
6	568,773	54,531	75,387	71,106	60,257	39,595	60,473
7	306,020	37,014	22,801	30,516	25,841	11,497	14,302
8	334,692	44,629	43,089	41,243	43,927	42,084	42,984
9	623,288	145,078	39,011	35,656	82,844	52,423	65,785
10	162,970	0	0	0	0	0	86,736
TOTAL	6,224,775	618,734	630,881	670,657	666,374	566,283	669,355

Expense Budget	**Total Budget***	**Year 1** (09/22/04 - 01/31/06)	**Year 2** (02/01/06 - 02/28/07)	**Year 3** (3/01/07 - 2/29/08)	**Year 4** (3/01/08 - 2/28/09)	**Year 5** (03/01/09 - 2/28/10)	**Year 6** 03/01/10 - 2/28/11
Salary and Wages [1]	2,498,412	230,611	304,371	302,411	301,933	259,929	293,198
Fringe[2] (20% of Salary)	383,178	28,509	34,361	36,263	40,338	37,180	43,410
Insurance	199,865	13,634	26,529	25,302	25,942	21,508	23,294
Tuition and Fees	157,363	8,127	16,393	21,679	18,502	13,277	9,828
Travel	192,148	14,508	25,392	14,650	15,556	16,579	12,329
Capital Equipment	139,769	23,080	13,393	448	707	18,668	95,993
Expendable Supplies	121,185	14,277	16,100	12,205	18,288	8,614	4,802
Subcon	1,753,375	212,718	103,031	161,540	183,125	131,627	115,587
Technical/Computer	66,559	9,740	3,879	16,225	430	7,990	11,857
Communications	270,192	25,339	41,374	35,497	23,062	14,448	18,300
Reproduction (see comm)							
Vehicle Insurance	3,390	0	397	235	187	194	114
Producer Compensation	52,400	0	0	0	0	0	0
Overhead	386,939	38,192	45,662	44,202	38,302	36,270	40,644
Profit							
TOTAL	6,224,775	618,734	630,881	670,657	666,374	566,283	669,355

Cost Sharing

Table 35. Cost sharing figures for TTU, AgriLife (TAMU), and HPUWCD for years 1-6 of the demonstration project.

Cost Sharing Balance Summary

Budget	Total Cost Share Budgeted	*Actual Funds Contributed*	*Balance*
TTU		748,965.37	
TAMU		236,207.77	
HPUWCD		163,542.86	
TOTAL	1,312,000.00	1,148,716.00	163,284.00

Task Categories	Total Task Budget	*Actual Funds Contributed*	*Balance*
Task 1 - TTU		-	
Task 2 - TTU		417,192.25	
Task 3 - TAMU		213,533.83	
Task 4 - TTU		13,048.39	
Task 5 - TTU		40,612.40	
Task 6 - TTU		149,818.81	
Task 7 - TAMU		22,673.94	
Task 8 - TTU		128,293.52	
Task 9 - HPUWCD		163,542.86	
TOTAL	1,312,000.00	1,148,716.00	163,284.00

Expense Categories	Total Expense Budget	*Actual Funds Contributed*	*Balance*
Salary & Wages		244,951.49	
Fringe		67,516.18	
Overhead		436,497.70	
SubCon - TAMU		236,207.77	
$25,000/year - HPUWCD		163,542.86	
TOTAL	1,312,000.00	1,148,716.00	163,284.00

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