Water Conservation through Soil Health Improvement on the Texas High Plains

Final Report

to the

Texas Water Development Board

TWDB Contract No. 2103582571

TAWC

TEXAS ALLIANCE FOR WATER CONSERVATION

NOVEMBER 30, 2023

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Overview of TAWC operations

<u>Mission:</u> To conserve water for future generations by collaborating to identify and transfer those agricultural production practices and technologies which, when integrated across farms and landscapes, will reduce the depletion of ground water while maintaining or improving soil health, agricultural production and provide enhanced economic opportunities.

<u>Approach:</u> Conduct engagement/outreach activities to provide information to producers, industry, and communities to accomplish water savings and soil health through demonstration and education.

- Engage in partnerships with public, private, and government entities dedicated to sustaining economic viability of Texas agriculture for all agricultural commodity groups and organizations.
- Explore conservation and sustainability from both a field level as well as systems level approach.
- Generate inter-disciplinary collaborations and provide education and outreach to assist producers in irrigation management, water conservation, and improved soil health.

<u>TAWC Focus:</u> Our focus addresses improving irrigation efficiency, crop resilience to weather extremes, and the enhancement of soil health that include:

- Demonstrate methods of minimizing soil disturbance and managing multi-species cover crops to capture and store more rainfall, thereby reducing irrigation needs and conferring plant-cover resilience.
- Quantify the role of partial-field fallow and rotation of cover crop and commodity crop in conserving soil water and reducing irrigation needs.

Water conservation and soil health are intertwined in complex soil-water relationships that are complementary and vital to sustainable production agriculture. Improving aspects of soil health related to organic matter and aggregate structure can result in water savings through better soil water-holding capacity, increased water infiltration, and improved soil nutrient levels resulting in increased crop yields and economic sustainability.

<u>Long term TAWC objectives:</u>

- Monitor soil water balance and vegetative cover with crop residues and cover crops on selected producers' fields where minimum tillage, crop rotation, and multi-species cover crops are compared with conventional tillage and no cover crops.
- Analyze economic profitability of the innovative management practices at the demonstration sites by working with cooperator producers in collecting data on all crop inputs including irrigation and cover-crop costs and amount and value of crop yield.
- Ascertain the relevance of using different soil moisture sensing technologies to enhance water conservation in the region
- Demonstrate and disseminate results to area crop producers through on-farm demonstrations, field days, presentations, and on-line information guides, and instructional videos.

Potential expansion of TAWC's footprint:

- Expand the number of producer demonstration sites to a broader area throughout the Texas Southern High Plains so that producer-collaborators can have a direct influence over a wider region.
- Routinely, integrate sensor-based soil moisture assessment and irrigation scheduling to enhance water use efficiency and regional water conservation efforts.
- Incorporate further, the use of the Fieldprint Calculator from the Keystone Alliance for Sustainable Agriculture to measure energy and carbon footprints and add metrics for a water footprint feature. Documentation of water-saving practices could increase product marketability.
- Measure the potential economic benefits of sustaining long-term water use from the aquifer beyond the farm gate and on to municipalities and industries. Demonstration of economic impacts illustrates TAWC as a model for use across Texas and other semi-arid regions.

Producer Responses and Barriers to Overcome for Wide-Scale Adoption:

- The project increased farmers' understanding of soil health, water availability and improved irrigation management practices by their own monitoring of the soil and water meters and crop yield.
- Farmers can be segmented by their different approaches to using TAWC data. Adopting water-conservation practices necessitates multiple strategies for encouraging change.
- Understanding personal networks among the farmers and their willingness to adapt is crucial to increasing adoption of water conservation strategies and technologies.
- High cost of installing new technology and equipment and limited time to learn their operations are major barriers to adopting new, water-conserving technologies. This is critical for irrigation management technology companies to keep in mind when considering their customer relations priorities.
- Incomplete knowledge by crop consultants of new irrigation technologies slows adoption.

Through years of working directly with producers and building their trust, the TAWC has been able to be recognized by area producers as a reputable source striving to help educate them on the best practices and technologies to help them achieve more with less water. This has taken many years of building trust and recognition through partnerships with industry, government agencies, universities, communities, and producers.

Project report

Task Reports

Task 1: Field Demonstration and Data Collection

Understanding the inter-twined complex soil-water relationships is a vital aspect of sustainable agriculture production systems. The nexus between water conservation and soil health play an important role in such systems. This initiative seeks to revolutionize agricultural practices by enhancing soil health through the strategic use of cover crops, crop rotations, and cutting-edge irrigation technology. The synergy of these components not only fosters resilient and nutrient-rich soils but also unlocks significant water savings, thereby propelling sustainable agriculture into the future. Multi-species cover crops and reduced tillage practices can increase organic matter content in soil and improve aggregate structure that can result in water savings through better soil water-holding capacity, increased water infiltration, and improved soil nutrient levels resulting in increased crop yields.

Location and Map

The TAWC project is implemented in the Southern Texas High Plains on the area overlaying the Ogallala Aquifer. In the past, TAWC has worked with 36 growers covering over 6,000 project acres on farms constituting over 136,000 total acres. Field sites were initially located in Hale and Floyd counties but have expanded over time. Producers field sites for this project are located in the counties of Martin, Moore, Crosby, Floyd, Swisher, and Lubbock counties. Producers and stakeholders in the High Plains, including the Panhandle, are targeted for information dissemination.

Due to extremely dry summers, low rainfall and declining well capacities sometimes producers are forced to abandon large number of acres during the growing season. Further, even more acres could be destroyed prior to harvest because of very low yields. The region is largely dependent on applied irrigation for achieving good harvest which is under threat because of declining Ogallala aquifer.

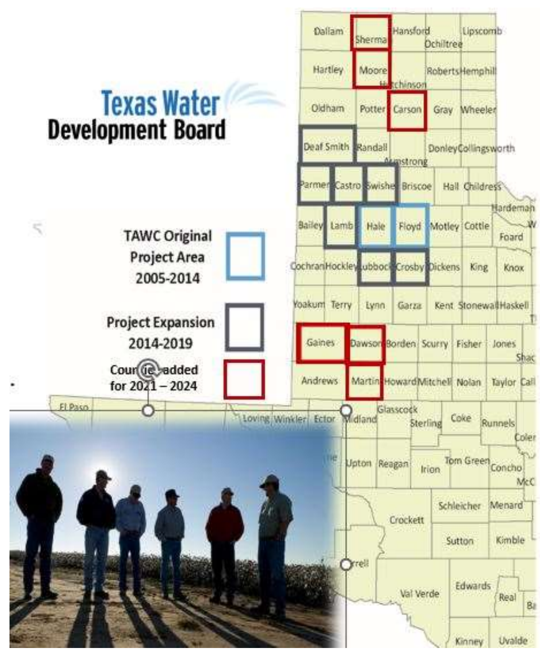


Figure 1: Counties in which Texas Alliance for Water Conservation (TAWC) operates

Crop water use and Irrigation Requirement

On average sites received 12 inches of rainfall during the growing season out of which 6 inches was effective rainfall. Our estimated annual effective rainfall was set at 50% due to extreme rain events, runoff, field conditions, and evaporation. Rainfall is one of most important factors for growing crops in the region, the distribution of this rainfall is the most critical to crop production. Net irrigation requirement for cotton was on average 22 inches while same for corn was 33 inches and for sorghum it was 22 inches (Figure 2). Similarly, crop water use determined based on crop ET was 34 inches (Cotton), 43 inches (Corn) and 32 inches (Sorghum). Irrigation requirements over the season determined using FAO's CROPWAT (Allen et al., 1998; Clarke et al., 2001). Irrigation requirements for crop peaks during the July-August period for all crops due to dry hot weather (Figure 3). Most producers used the residue of the previous year's crop as their cover. In 2022, Site 60 located in Swisher County had cotton planted into milo stubble, although no records were kept regarding the milo. At Site 72 located in Martin County, cotton was planted into terminated perennial grass, with no available records on the grass itself. Similarly, at Site 73 located in Lubbock County, cotton was planted into the stubble of the previous year's wheat crop, yet no records were maintained for the wheat. For all other sites in Moore County, cotton was planted into the residue of the previous year's corn and milo crop.

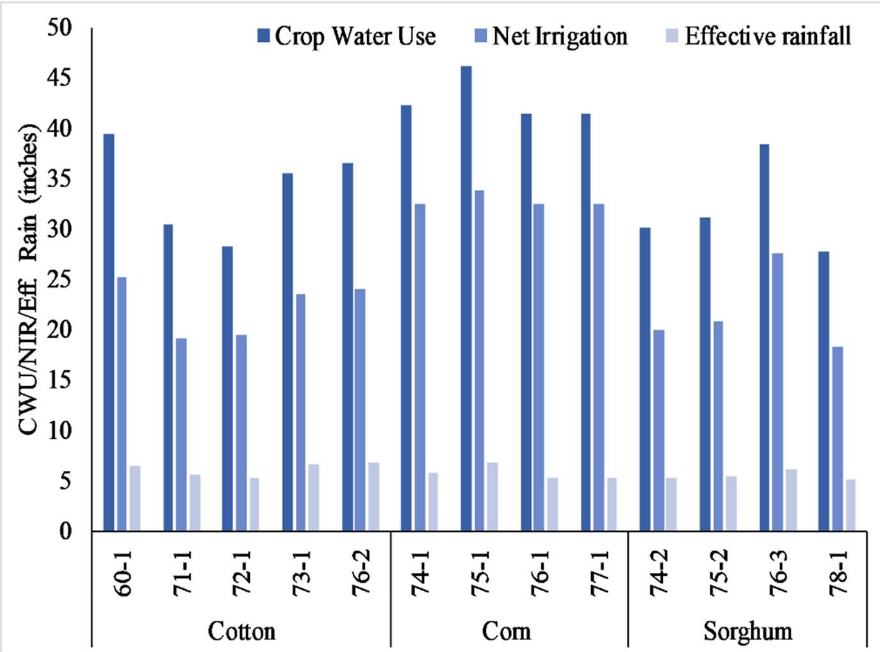


Figure 2: Crop water use, net irrigation requirement and effective rainfall at different TAWC demonstration sites. Note: Numbers in X axis indicate the field site identifiers used consistently across figures and economic analysis.

Yield and Water use efficiency

On average yield for cotton lint was 1155 lbs/acre while seed yield was 1494 lbs/acre, 11682 lbs/acre for corn and 5564 lbs/acre for sorghum. WUE of irrigation water was found to be 121 (Cotton lint), 162 (Cotton seed), 387 (Corn) and 328 lbs/inches (Sorghum). Similarly, WUE based on crop ET was 35 (Cotton lint), 46 (Cotton seed), 275 (Corn) and 182 lbs/inches (Sorghum). Yield and Water use efficiency (WUE) at different sites is presented in Figure 4.

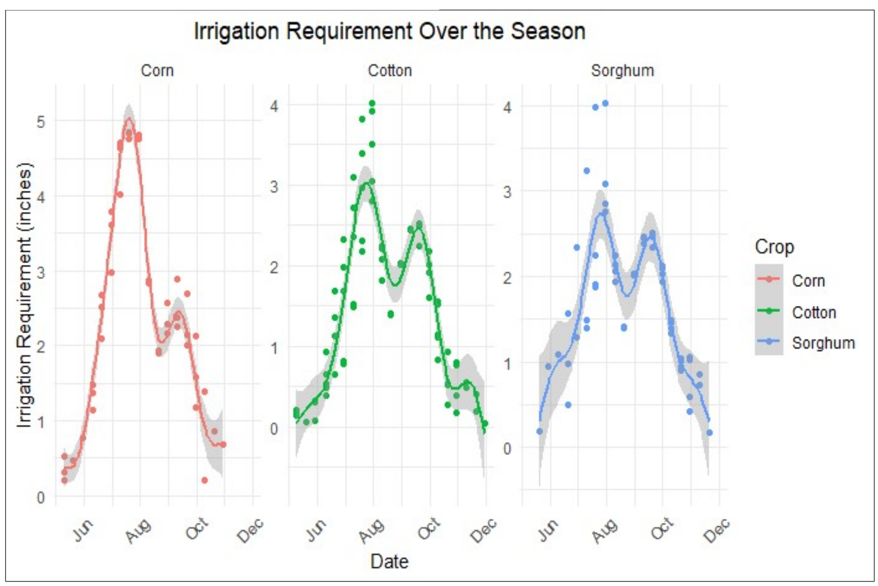


Figure 3: Irrigation requirements over the season for various crops at different TAWC demonstration sites.

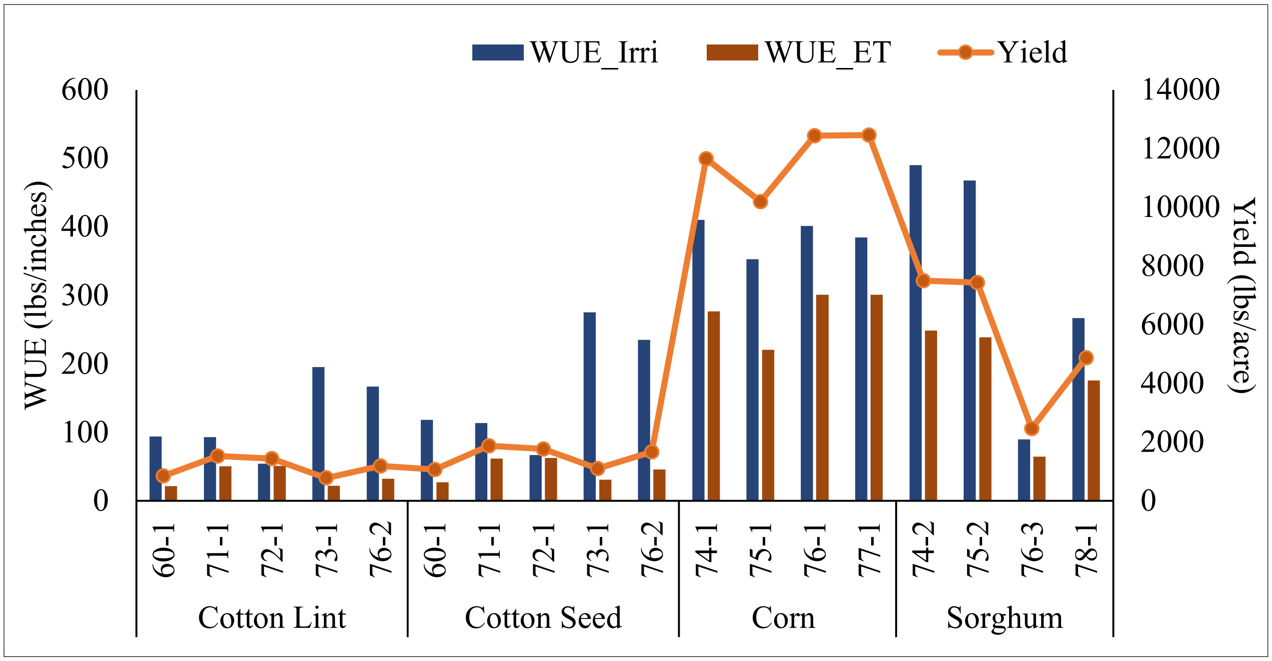


Figure 4: Yield and Water use efficiency at different TAWC demonstration sites.

Sensor based irrigation management

We had AquaSpy soil moisture sensors installed at different producers plots which were used for monitoring soil moisture and making irrigation water management decision by producers. Implementing advanced technology for precision irrigation is crucial for sustainable water use and crop management.

AquaSpy soil moisture sensors emerge as valuable tools in this endeavor, where producers were able to maintain better soil moisture profile and avoid over irrigation. These state-of-the-art sensors provide a real-time view of the soil's moisture content, enabling accurate and data-driven scheduling of irrigation. Through the use of AquaSpy sensors, farmers can obtain valuable insights about the moisture at different soil depths, allowing them to customize irrigation strategies to meet the unique requirements of their crops (Figure 5). This focused strategy makes sure that irrigation is only used when and where it is actually needed, which reduces over-irrigation. Crop productivity and health are improved, and water resources are used more effectively as a result. As part of the continuous effort to conserve water, scheduling irrigation based on sensor technologies provides a sustainable pathway forward for agriculture in the face of increasing water scarcity. Variation of volumetric water content at different depth at

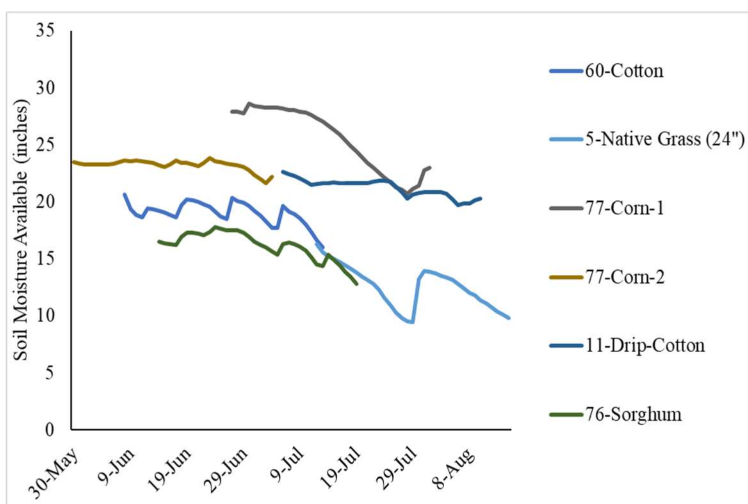


Figure 5:Available soil moisture in profile over the season at different producers' sites monitored using AquaSpy probes.

various producers' sites is presented in Figure 6. Analysis of soil nutrient and quality factors at different sites is given in Table1.

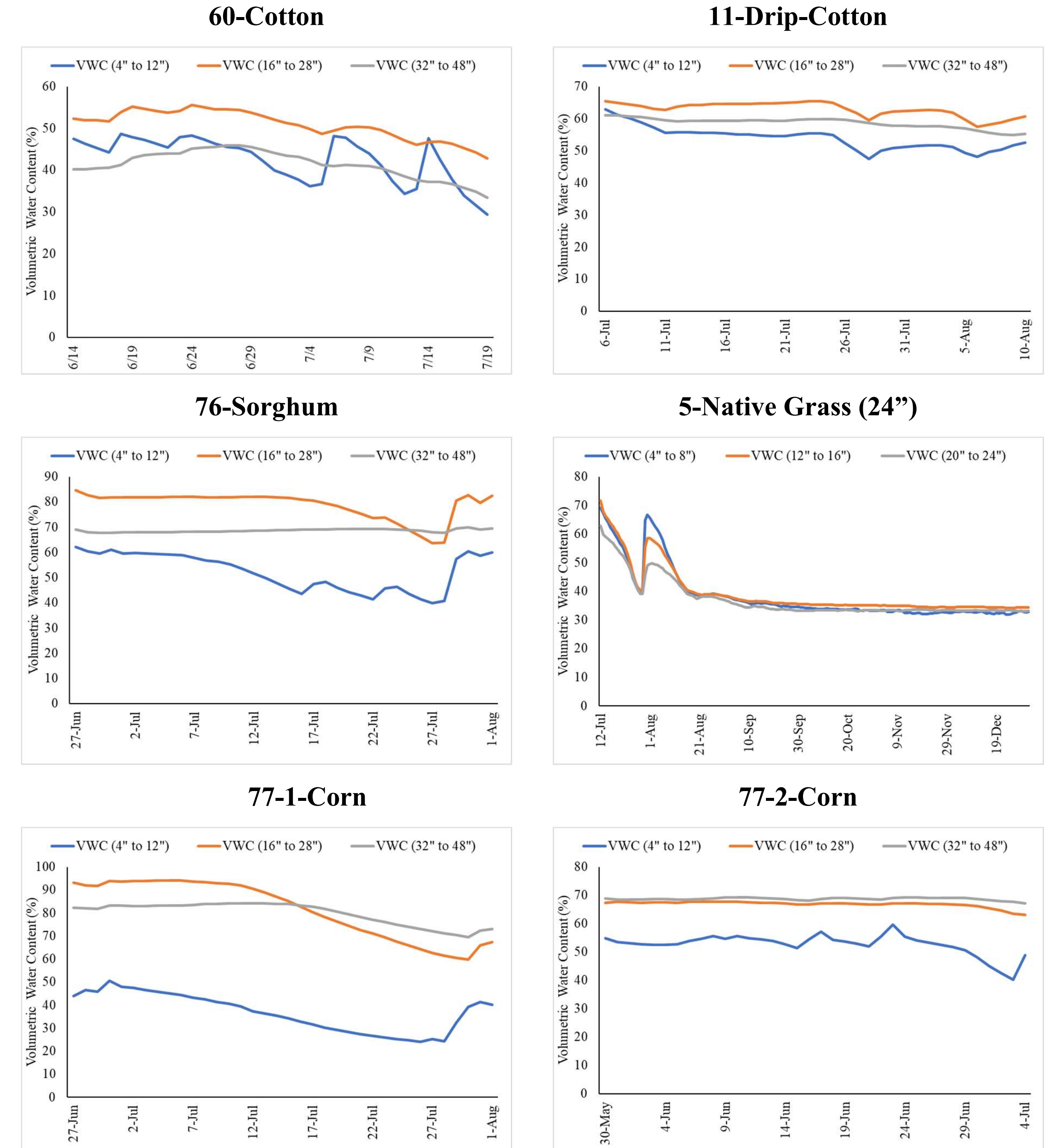


Figure 6:Volumetric water content (%) at different depths over the season at different TAWC demonstration sites.

Table 1: Soil Nutrient and Quality Factors

Site	County	N	P2O5	K2O	HT3	VAST	WEOC	C:N	P Sat	WEON	SLAN

		lbs a-1	lbs a-1	lbs a-1	mg CO2-C/kg	g water cm-3 soil	lbs a-1	ratio	%	lbs a-1	lbs a-1
21	Floyd	22.8	5.84	503.64	17.8	3	17.8	8.87	14.21	24.6	17.5
35A	Floyd	2.3	3.03	523.71	26	3	26	17.09	7.66	13.88	47.5
35B	Floyd	14	4.6	544.22	22.4	3	22.4	17.92	8.19	8.86	21.25
50	Crosby	12.8	3.48	486.53	13.8	3	13.8	17.77	5.88	13.28	18.75
73	Crosby	8.4	13.45	553.28	21.9	5	21.9	8.33	19.82	3	22.5
60	Swisher	52.7	51.95	1005.61	32.9	4	32.9	21.41	60.61	30.66	28.75
71	Martin	69.9	19.65	553	15.2	1	15.2	18.93	139.16	27.07	30
72	Martin	43.2	18.01	424.73	17.1	2	17.1	22.12	63.82	26.04	35

Note: Macronutrients nitrogen, phosphate, and muriate of potash as lbs a-1 as fertilizer credit.
HT3, measurement of CO_2 respiration used as an indicator of soil microbial population, mg CO_2-C per kg soil.
VAST- measurement of soil aggregate stability, relating to soil porosity and water infiltration, g water per cm^3 soil.
WEOC- water exractable organic carbon, measurement of C source for soil microbial population, lbs organic C per acre.
C:N ratio- estimates tendency for nitrogen immobilization or mineralization, affects N availability to crop.
P Saturation- measurement of available phosphorous as related to P held by soil.
WEON- water extractable organic nitrogen, measurement of N source available to microbial population, lbs organic N per acre.
SLAN- Solvita Labile Available Nitrogen, measure of organic N held as amino sugars.

Task 2: Economics

Economic Analysis

Record books were distributed to all growers prior to the 2022 crop season and were collected in March – April of 2023. An undergraduate researcher named Urzula Carrillo was hired to assist the economics team with data entry. She has worked on updating crop, fertilizer, chemical, and tillage price lists for the economic analysis. The economic analysis of all 2022 field sites was conducted between April and July of 2023. All crop prices were standardized with a $0.78/ lb for cotton lint, $390/ton for cottonseed, $8.20/bu for corn, and $7.15/bu for grain sorghum. Table 2 shows the per acre economic results for each site and each field. Cotton averaged $476/acre in profit compared to $609 for corn, and $449 for grain sorghum. While corn yielded more profit, cotton generated more profit per inch of water applied at $46, compared to $21 for corn and $29/acre in for grain sorghum (Table 3). Sites 74, 75, and 76 had two fields, so the economic values for each field were combined to create a “system” analysis. Site 74 had 163 acres of corn and 160 acres of failed cotton that was planted into grain sorghum. Site 76 had 118 acres of corn and 118 acres of cotton. Profit in Site 75 is noticeably less than the other two due to the increased expenses of replanting.

Table 2: Economic Analysis of Field Sites by Crop ($/acre)

Site	Gross income	Pre-Harvest VC	Total Harvest	Total Variable Cost	Gross Margin	Fixed Costs	Total Costs	Net Returns
Site 60 - Cotton	$897.77	$566.01	$182.44	$748.46	$149.31	$150.00	$898.46	-$0.69
Site 72 - Cotton	$1,620.44	$491.36	$329.30	$820.66	$799.78	$150.00	$970.66	$649.78
Site 73 -Cotton	$827.73	$334.68	$168.21	$502.89	$324.84	$150.00	$474.84	$352.89
Site 74 Field 1 - Corn	$1,705.60	$651.48	$87.36	$738.84	$966.76	$150.00	$888.84	$816.76
Site 74 Field 2 - Cotton/Grain Sorghum	$1,231.23	$559.67	$56.20	$615.87	$615.36	$150.00	$765.87	$465.36
Site 75 Field 1 - Corn	$1,492.40	$970.83	$76.44	$1,047.27	$445.13	$150.00	$1,197.27	$295.13
Site 75 Field 2 - Grain Sorghum	$948.81	$502.63	$80.87	$583.50	$365.31	$150.00	$515.31	$433.50
Site 76 Field 1 - Corn	$1,820.40	$859.35	$93.24	$952.59	$867.81	$150.00	$1,102.59	$717.81
Site 76 Field 2 - Cotton	$1,255.39	$528.88	$523.30	$1,052.18	$203.21	$150.00	$353.21	$902.18

Table 3:Economic Analysis of Field Sites by Crop ($/acre-inch)

Site	Gross income	Pre-Harvest VC	Total Harvest	Total Variable Cost	Gross Margin	Fixed Costs	Total Costs	Net Returns
Site 60 - Cotton	$99.75	$62.89	$20.27	$83.16	$16.59	$16.67	$99.83	-$0.08
Site 72 - Cotton	$98.21	$29.78	$19.96	$49.74	$48.47	$9.09	$58.83	$39.38
Site 73 -Cotton	$206.93	$83.67	$42.05	$125.72	$81.21	$37.50	$118.71	$88.22
Site 74 Field 1 - Corn	$60.06	$22.94	$3.08	$26.02	$34.04	$5.28	$31.30	$28.76
Site 74 Field 2 - Cotton/Grain Sorghum	$80.47	$36.58	$3.67	$40.25	$40.22	$9.80	$50.06	$30.42
Site 75 Field 1 - Corn	$51.64	$32.59	$2.64	$36.24	$15.40	$5.19	$41.43	$10.21
Site 75 Field 2 - Grain Sorghum	$59.67	$31.61	$5.09	$36.70	$22.98	$9.43	$32.41	$27.26
Site 76 Field 1 - Corn	$58.72	$27.72	$3.01	$30.73	$27.99	$4.84	$35.57	$23.15
Site 76 Field 2 - Cotton	$78.96	$33.26	$32.91	$66.17	$12.78	$9.43	$22.21	$56.74

Table 4: System Analysis for Sites 74-76

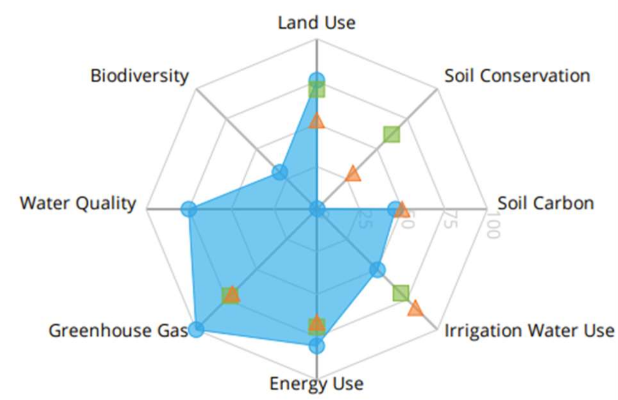
Parameter	Site 74	Site 75	Site 76
Gross Income	$1,470.62	$1,492.40	$1,537.89
Pre-Harvest VC	$606.00	$970.83	$694.11

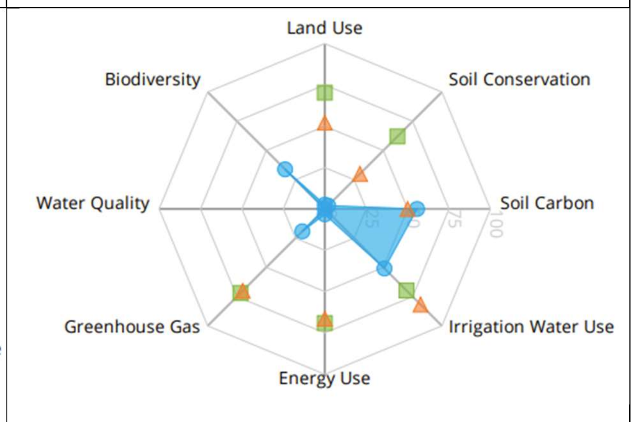
Harvest VC	$71.92	$76.44	$308.27
TVC	$677.93	$1,047.27	$1,002.39
Gross Margin	$792.69	$445.13	$535.51
Fixed Cost	$150.00	$150.00	$150.00
Total Cost	$827.93	$1,197.27	$727.90
Net Returns	$642.69	$295.13	$809.99

Fieldprint Analysis

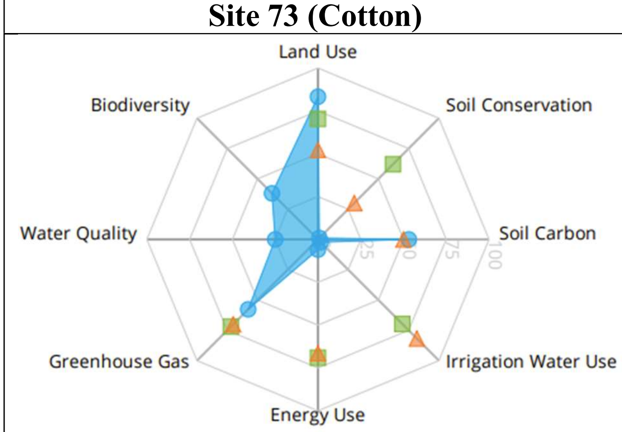
Budget data was entered into the Fieldprint Platform to assess the field level sustainability scores for each field. Sustainability is evaluated using eight metrics including: land use, soil conservation, biodiversity, water quality, greenhouse gas emissions, soil carbon, irrigation water use and energy use. Sustainability results are displayed in spidergrams, which represents the index values for all metrics. The spidergrams can be interpreted by comparing the shaded areas across sites. The indices are calculated so that smaller values indicate less resource use or environmental impact.

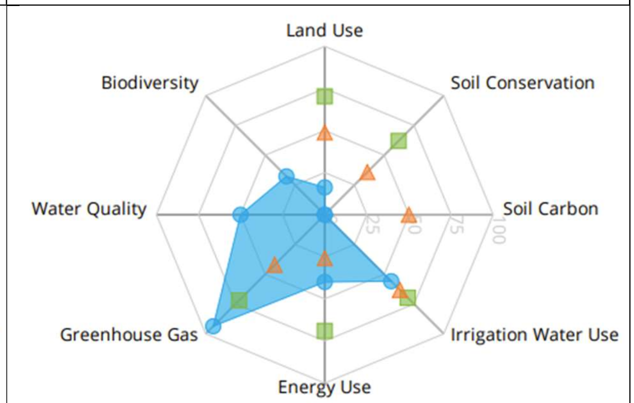
Site 60 (Cotton) | **Site 72 (Cotton)**



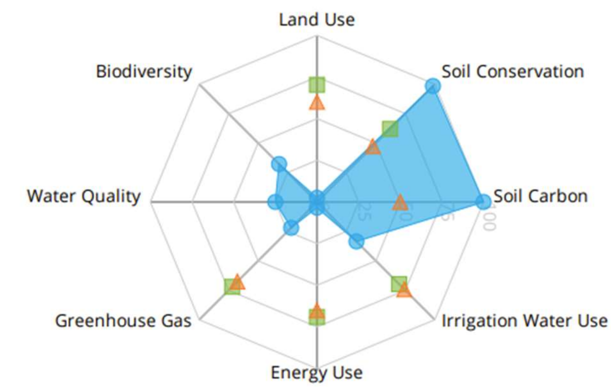


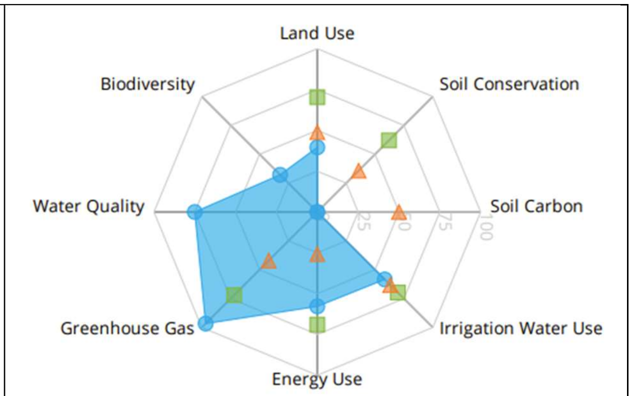
Site 73 (Cotton) | **Site 74 – Field 1**





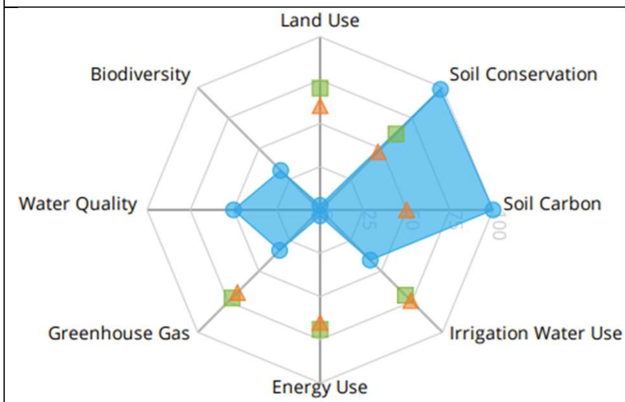
Site 74 – Field 2 | **Site 75 – Field 1**

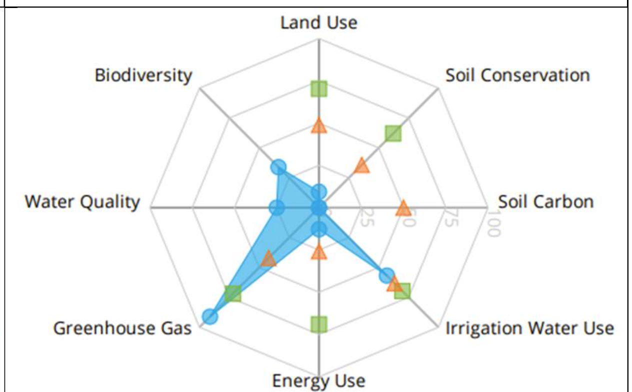




Site 75 – Field 2

Site 76 – Field 1





Site 76 – Field 2

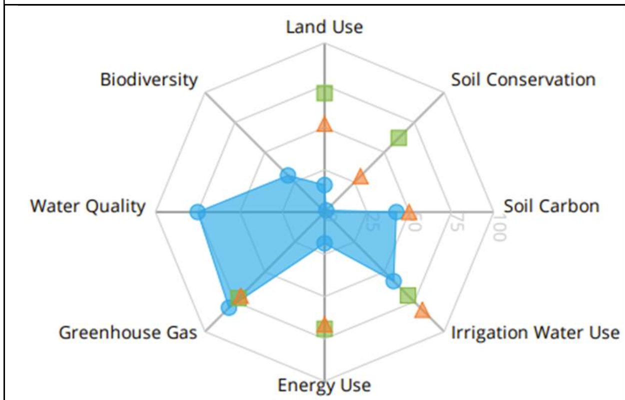


Figure 7: Fieldprint analysis of different sites

Task 3: Communication and Outreach

Water College

The 8th Annual TAWC Water College was held at the Lubbock Memorial Civic Center where approximately 150 producers, consultants, researchers and industry leaders attended. Sponsors set up information booths in the pedestrian hall of the Civic Center while presentations were given in the ballroom. Funds from sponsorships totaled $7,250 and were used for facility rental, meals, advertisements, and radio coverage. Sponsors included:

Table 5: Sponsors for the water college.

High Plains Water District
Cotton Inc
Source Agriculture
Texas Corn Producers
Texas Sorghum Producers
SNF Holding
City of Lubbock
Americot
Plains Cotton Growers
Miller Chemical
Autonomous Pivot
Hurst Farm Supply
ForeFront Agronomy
Eco-Drip
Gowan Cotton

Borgstedt did three live interviews with KDHN promoting TAWC and Water College. Rick Kellison also did an interview with KFLP Ag Report promoting TAWC and the Water College. Three Water College promotional emails were sent to distribution listed over the two weeks prior to Water College. Social media campaigns were sent daily the two weeks prior using Facebook, Twitter and LinkedIn.

A sudden rise in COVID cases throughout the Texas Tech campus and Lubbock region caused preparations to be made to hold Water College virtually; however, this back-up plan was not needed, and Water College was held in person.

Water College was broadcast and recorded by KFLP AM Radio. This station covers New Mexico, Kansas, Oklahoma, and Texas reaching about 5,000 listeners per segment. The station aired Water College live and created segments from presentations which continued to air for 3 weeks following Water College. Presentations were also uploaded to the TAWC Website.

TAWC hosts 8th annual Water College | January 2022 |PSS Newsroom | Plant and Soil Science | TTU

Agriculture industry leaders will meet at Lubbock Civic Center (kcbd.com)

Field Days

Borgstedt worked with Rick Kellison to coordinate an agenda for the TAWC Field Day. The event was held on August 17 at the FiberMax Center for Discovery in Lubbock, Texas. 65 researchers, producers, consultants, and policy leaders attended the event. Breakfast was sponsored by the High Plains Water District. Other TAWC outreach sponsors had display booths at the event including Hurst Farm Supply, Eco-Drip, Water Grows, and Texas Agricultural Irrigation Association.

Presentations included:

High Plains Economic Outlook - Darren Hudson, Combest Endowed Chair, TTU Davis CASNR

Sorghum: The Resource Conserving Crop - John Duff, Executive Vice President National Sorghum Producers

Irrigating to the Roots - Bob Glodt, Owner of Agri-Search Consulting

Weather Outlook: What's expected in the months ahead? - Mark Conder, NOAA Science & Operations Officer

Facts: Drought & the Beef Industry - Jaclyn Roberts, Executive Director of Communications & Marketing Frank McLelland, Board Member, Texas & Southwestern Cattle Raisers Association

Texas Alliance for Water Conservation Field Day set to launch on August 17 | August 2022 |PSS Newsroom | Plant and Soil Science | TTU

Producer & Field Visits

Borgstedt hosted two separate school tours on her family's irrigated cotton, wheat and market farm in Tarzan, Texas. One tour consisted of 47 pre-k through 4th graders from Grady ISD. Another visit consisted of 9 Stanton ISD Gifted and Talented 5th grade students. Each group learned about water management in agriculture and the process of growing food and fiber. They were able to walk through the cotton planted into wheat and learn of the no-till technique used. They also walked through the market farm where they were shown above ground drip irrigation and rotational farming used for soil management.

Contacts begin to be made with potential new TAWC field site producers. These farmers grow a variety of crops on various amounts of available water in areas south of Lubbock. This area has been heavily converted into dryland and minimally irrigated farmland due to lack of underground water. The soil in this area is sandier than fields north of Lubbock with a shallower depth to caliche layer.

Borgstedt hosted TAWC producers Glenn and Layton Schur to her own farm to observe and discuss farming diversification on their drip irrigated segment of farmland that is drastically declining in available water. This visit resulted in the Schur family implementing high tunnels and converting this portion of cotton farmland into a vegetable market farm. https://www.frontiermarkettx.com/

On July 14th, TAWC hosted a field walk on the farm of Lloyd and Angela Arthur. There were approximately 25 researchers, producers, and consultants in attendance examining irrigation technologies, delivery systems, and management strategies used by Arthur. Representatives from Forefront Agronomy, Autonomous Pivot, and FieldNet were all available to present their products and answer questions about performance and cost.

Rick Kellison, Jeff Pate, and Samantha Borgstedt visited the sites of Josh Tunnell, a new TAWC cooperating producer in Martin County. Moisture sensors funded through the TWDB grant were placed in Tunnell's pivot irrigation field. This is a farm with two circles that were in native grass for 10 years prior to Tunnell farming them. They are rotated year to year with one circle being irrigated while the other rests. Tunnell uses no-till management on the farm.

National Cotton Council's producer information exchange tour stopped at cooperating producer Lloyd Arthur's farm where Rick Kellison presented about the TWDB funded TAWC project. Southwest Farm Press covered the event. https://www.farmprogress.com/cotton/southeast-mid-south-producers-tour-texas-south-plains

Borgstedt worked with cooperating producer Josh Tunnell to shoot drone videos of his irrigated cotton farm. These videos were used during breaks at the Water College.

Newsletters

Newsletters were sent through email monthly from January through June to the 437 recipients in the TAWC listserv. These include researchers, producers, media outlets, consultants, and industry.

Starting July 2022, a quarterly newsletter was printed and posted online. Borgstedt interviewed TAWC cooperating consultants, producers and researchers to write pieces for the newsletters.

depts.ttu.edu/tawc/news/newsletter/summer22.pdf depts.ttu.edu/tawc/news/newsletter/fall22.pdf

PSS 4340 Water Management Seminar Series

Borgstedt and Kellison worked together to confirm speakers for Texas Tech's PSS 4340 Water Management Certification Seminar Series, which was handled by Dr Krishna Jagadish. Speakers included irrigation technology experts, consultants, producers, and commodity leaders. The seminar series provided real world knowledge on efficient and profitable management of water for agricultural purposes, with emphasis on irrigation technologies.

Borgstedt and Kellison presented to the class about the history and overview of the TAWC project. They also discussed with students their likes and dislikes regarding speakers and topics. Remarks were recorded to be used when coordinating future speakers during the next semester, which will be Spring 2024. Students were interested in hearing more from experts in viticulture and full-time producers. They enjoyed speakers that brought props and visuals to demonstrate their talking points.

https://www.depts.ttu.edu/agriculturalsciences/news/posts/2022/09/pss-krishna-jagadish-leads-irrigation-management-seminar.php

Table 6: PSS 4340 – Irrigation Management Seminar Series, speakers and the topics covered as a part the seminar series delivered to the undergraduate students at Texas Tech University.

Date	Speaker	Speaker's Job Title	Presentation Title
25-Aug	Krishna Jagadish	Thornton Distinguished Chair TTU	Class overview
30-Aug	Bob Glodt	Owner Agri-Search	Irrigation Management 101: Part 1
Sept.1	Jeff Miller	Owner Forefront Agronomy	Irrigation & Soil Management on the TX Southern High Plains
Sept. 6	Bob Glodt	Owner Agri-Search	Irrigation Management 101: Part 2
Sept. 8	Tim Cooper	Agronomy advisor Land O Lakes	Farming in 1970 vs 2022
Sept. 13	Monty Teeter	Creator of Dragonline Irrigation Technology	What is Mobile Drip Irrigation and How Does it Work?
Sept. 15	Brandt Underwood	Agronomist NRCS	Agronomy & Soil Health

Sept. 20	Russ Roberts	Salesman Diversity D irrigation technology	Crop Water Management on the TX High Plains
Sept. 22	Farris Hightower	Salesman Sound Ag	Irrigating Practically and Efficiently
Sept. 27	Kelly Jack	Owner of Jack Seed and Supply	Farming and Ranching with a Holistic Approach
Sept.29	Russ Hodges	Salesman Aquaspy irrigation technology	Efficiently using irrigation technology
Oct. 6	Jeff Pate	TAWC Producer Relations Manager	The role of TAWC and it's producers
Oct. 11	Katie Jane Seaton	Owner Farmhouse Vineyard	Water & Wine: You cannot have one without the other.
Oct. 13	Josh Tunnell	TAWC Cooperating Producer	Water Management in Production Agriculture: A producer's perspective
Oct. 18	Eric Best	Agronomist Bayer Crop Science	Cotton Water Basics on the Southern High Plains
Oct. 20	Kody Besset	CEO Plains Cotton Growers	Evolution of Federal Conservation Policy and Where It's Going
Oct. 25	Donna Mitchell	Economist TAWC - TTU	Economics of Irrigation Management
Oct. 27	Shelley Huguley	Reporter Southwest Farm Press	Relaying the Story of Ag's Water Management
Nov. 1	Craig Jones	Salesman Netafim	Netafim USA Drip Irrigation
Nov. 3	Lloyd Arthur	TAWC Cooperating Producer	Irrigation on the southern high plains of TX: A farmer's view
Nov. 8	Monty Christian	TTU Innovation Hub	Texas Tech's role in irrigation research
Nov. 10	John Duff	United Sorghum Producers	Sorghum: The conversation crop
Nov. 15	Cory Mills	Agronomist BASF	Cotton and Water Management on the southern plains of TX
Nov. 22	Russ Perkins	Tech Service Rep. Bayer Crop Science	TX High Plains: It's all about water

Nov. 29	Craig Hoelscher	Sales Manager Ecodrip	Introduction to the drip irrigation industry
Dec. 1	Daniel Pate	Owner Apical TX Vineyard Management	"We are all screwed! Unless we….." water management in TX vineyards.
Dec. 6	Sam Borgstedt & Rick Kellison	TAWC Project Director	Overview of TAWC and class feedback

References

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