Sustainable Crop/Livestock Systems in the Texas High Plains: Phase III

One can't talk about agriculture in the Texas High Plains without including "water" in the same sentence. The Ogallala Aquifer, which has kept ag production humming for nearly a century, is running low. Agriculture in the Texas Panhandle and Southern Plains is adapting to decreased water availability.

For nearly two decades, researchers and producers across the Texas High Plains have been developing integrated crop/livestock production systems that address the growing need for water conservation, while keeping soils fertile, crop yields profitable, cattle production thriving, and surrounding communities viable.

Funded through nearly $1.5 million in Southern SARE Research & Education, Large Systems, and Graduate Student grants, the results showcase long-term alternative production systems, and how those results are being translated into practical field production practices and sustainable agriculture applications.

This model of sustainable agroecosystems in the Texas High Plains is changing the face of agriculture in the region and helping to conserve water, improve soil health, boost ag profits and keep the High Plains region thriving for generations to come.

This bulletin highlights Phase III of SSARE-funded work from 2008-2010 (**LS08-202**, *Crop-Livestock Systems for Sustainable High Plains Agriculture.)*

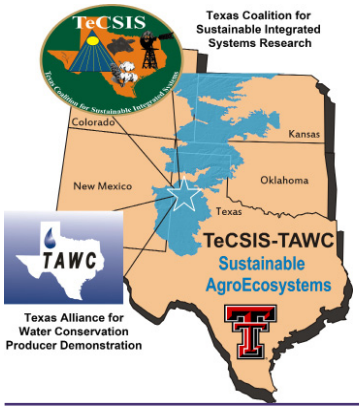

Photo credit: Texas Tech University

Introduction:

Since 1997, Texas Tech University researchers have been studying diversified production systems of crops and livestock as alternatives to monoculture crop production in the Texas High Plains in response to the growing need to conserve water and preserve the Ogallala Aquifer.

Comparisons of integrated crop/livestock systems to monoculture cotton production have shown that alternative systems use less irrigation water, less nitrogen fertilizer, increase soil organic matter, reduce soil erosion and are equal to or greater in profitability per unit of irrigation water invested.

Initial Southern SARE-funded research from Texas Tech University from 1997-2004 explored grazing stocker steers on perennial old world bluestem pastures and small grains in rotation with cotton. (See **LS97-082**, "*Sustainable Crop/Livestock Systems in the Texas High Plains"* for more information). The project continued with the addition of dryland systems and deficit-irrigated forage-livestock systems. (See **LS02-131**, *"Forage and Livestock Systems for Sustainable High Plains Agriculture"* for more information). These systems continue to remain relevant.

In the Southern SARE-funded project (**LS08-202**), "*Crop-Livestock Systems for Sustainable High Plains Agriculture*," the project continued

into Phase III with system modifications and revisions to target greater water savings and profitability, and address emerging issues.

Beginning in 2009, the original integrated systems were modified to include legumes and perennial forages for finishing beef cattle; and a sorghum monoculture system replaced the monoculture cotton system to meet the needs for grazing, silage or biofuels. In addition, the non-irrigated system established in 2002 was expanded to include an irrigated pasture to buffer the system against drought and allow for increased grazing opportunities and a grass seed harvest.

Buffer-irrigated system. Photo credit: Philip Brown

Research Summary:

Alternative production systems were modified or revised as part of the overall long-term research effort by Texas Tech University to demonstrate that diversified crop/livestock systems can be designed to conserve water and energy while maintaining or increasing economic returns over a monoculture crop production system.

Research Objectives:

More energy, water, and soil can be conserved, profitability and sustainability of agriculture can be increased, and the changing priorities and opportunities for agriculture in the semi-arid region of the Texas High Plains can be better addressed through an integrated systems approach rather than through existing monoculture agricultural systems.

The overall objective is to conserve energy, water, and soil, and maintain an agricultural industry that is economically and environmentally sustainable.

Research Results:

In the research project, integrated crop and beef cattle (stocker and forage finishing) systems (both irrigated and non-irrigated) and a forage sorghum monoculture system were compared for dependence on water (irrigation plus precipitation) and energy, and the impact on soil quality and erosion, as well as overall economic returns.

The following information is not conclusive. Research is ongoing and the systems are continually being refocused to address current, emerging issues.

Buffer-irrigated integrated cotton/livestock system

Beginning in 2009, stocking rates were increased from 0.23 to 0.36 steers/acre with the inclusion of one irrigated forage paddock into an otherwise non-irrigated system. Averaged over two years of data collected, total steer gain/acre increased from 68 to 95 lbs/acre with a mean of 1.7 inches of irrigation water. Inclusion of the irrigated paddock increased flexibility of managing the sequence-grazed paddocks and improved forage management opportunities. Excess forage in both years was present. Non-irrigated cotton produced harvestable yields in both years with a mean of 450 lb/acre.

Forage-finishing system. Photo credit: Lixa Baxter

Forage-finishing system

This system attempted to take weaned Angus calves to a finished weight and grade on pasture to help meet the growing demand for forage-fed beef. WW-B.Dahl old world bluestem was overseeded with biennial yellow sweetclover and alfalfa. Jose tall wheatgrass and alfalfa and a native grass mixture replaced the cotton/small grain rotations. The system was limited-irrigated. Steers sequence-grazed the forage mixtures from May to October when they entered the feedlot for finishing if the finished weight and grade were not accomplished on pasture.

Only one year of data was collected in 2010. Stocking rates were 0.8 steers per acre. Total gain per acre was 198 lbs with a mean of 6 inches irrigation water applied to the system. Severe drought in 2011 and 2012 impacted the research and prevented grazing, and the nature of the study was changed shortly thereafter.

Sorghum monoculture

A non-grazed system of sorghum monoculture was established to replace monoculture cotton to be harvested for hay or silage as a feeding source for cattle, while reducing water use. The sorghum system was intended to be compared to the forage finishing system. The drought of 2011, the worst on record for this region, however, also impacted research on this system.

For a more detailed analyses of the research results, visit the national SARE projects database and search by project numbers **LS97-082**, "*Sustainable Crop/Livestock Systems in the Texas High Plains,*" **LS02-131**, *"Forage and Livestock Systems for Sustainable High Plains Agriculture,"* and **LS08-202**, "*Crop-livestock Systems for Sustainable High Plains Agriculture."*

Forage sorghum under pivot irrigation. Photo credit: Rick Kellison, Texas Alliance for Water Conservation

High Plains Water Conservation Resources

General Information

Texas Coalition for Sustainable Integrated Systems (TeCSIS)
http://www.orgs.ttu.edu/forageresearch/

Texas Alliance for Water Conservation
http://www.depts.ttu.edu/tawc/

TAWC Solutions
http://www.tawcsolutions.org/

Texas Water Development Board
http://www.twdb.texas.gov/groundwater/aquifer/majors/ogallala.asp

Texas High Plains Water District
http://www.hpwd.org/

USDA-ARS Ogallala Aquifer
http://ogallala.ars.usda.gov/

Publications

High Plains Water Conservation Bulletin No. 1: Water Conservation in the Texas High Plains

High Plains Water Conservation Bulletin No. 2: Sustainable Crop/Livestock Systems in the Texas High Plains Phase I

High Plains Water Conservation Bulletin No. 3: Sustainable Crop/Livestock Systems in the Texas High Plains Phase II

High Plains Water Conservation Bulletin No. 5: Diversifying in the Texas High Plains

High Plains Water Conservation Bulletin No. 6: Agroecosystems Economics in the Texas High Plains

High Plains Water Conservation Bulletin No. 7: Soil Quality of Integrated Crop/Livestock Systems

High Plains Water Conservation Bulletin No. 8: Texas Alliance for Water Conservation

High Plains Water Conservation Bulletin No. 9: Water Use of Old World Bluestems in the Texas High Plains

High Plains Water Conservation Bulletin No. 10: Cover Crops and Cotton in the Texas High Plains

High Plains Water Conservation Bulletin No. 11: Agroecosystems Research in the Texas High Plains

Grant Projects

GS15-152 Evaluation of Winter Annual Cover Crops Under Multiple Residue Managements: Impacts on Land Management, Soil Water Depletion, and Cash Crop Productivity

LS14-261 Long-term Agroecosystems Research and Adoption in the Texas Southern High Plains: Phase II

LS11-238 Long-term Agroecosystems Research and Adoption in the Texas Southern High Plains: Phase I

LS10-229 Integrated Crop and Livestock Systems for Enhanced Soil Carbon Sequestration and Microbial Diversity in the Semiarid Texas High Plains

LS08-202 Crop-livestock Systems for Sustainable High Plains Agriculture

LS02-131 Forage and Livestock Systems for Sustainable High Plains Agriculture

GS07-056 Allelopathic effects of small grain cover crops on cotton plant growth and yields

GS02-012 Optimizing Water Use for Three Old World Bluestems in the Texas High Plains

LS97-082 Sustainable Crop/Livestock Systems in the Texas High Plains

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