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

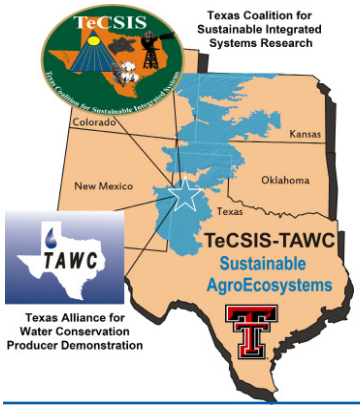
One can't talk about agriculture in the Texas High Plains without including "water" in the same sentence. The Ogallala Aquifer, which has kept ag production humming for nearly a century, is running low. Agriculture in the Texas Panhandle and Southern Plains is adapting to decreased water availability.

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 SSARE-funded work from 1997-2003 (**LS97-082**, *Sustainable Crop/Livestock Systems in the Texas High Plains*.)



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Introduction:

Crop and livestock production in the Texas High Plains generates over $8.7 billion in annual revenues but has depended on irrigation with water from the Ogallala Aquifer. Once considered to be an inexhaustible resource, the aquifer is now known to be declining at a rate that has already left many wells dry and crop production increasingly vulnerable. The importance of crops, forages, and livestock to the Texas High Plains highlights the need to develop systems that enhance profitability, improve conservation of soil and water resources, and expand marketing opportunities for a more sustainable agricultural system.

In a Southern SARE-funded project (**LS97-082**), "*Sustainable Crop/Livestock Systems in the Texas High Plains*", Texas Tech University researchers hypothesized that viable grazing systems could be developed and that by integrating crops, forage, and livestock in production systems, their complementary benefits would allow a more sustainable use of water and soil while maintaining an appropriate level of crop and livestock production.

Research Summary:

Grazing stocker steers on perennial warm-season grass pastures and on small grains in rotation with cotton required 25 percent less irrigation water, 36 percent less nitrogen, fewer pesticide inputs, and provided more flexibility in marketable products with higher net cash returns per acre than growing cotton in monoculture.

Short-term impacts included reduced soil erosion, improved water and nutrient management guidelines, reduced pesticide use, and improved cash flow and marketing opportunities. Long-term benefits included flexibility in agricultural production, reduced water use, less financial risk, long-term economic stability, and continued agricultural productivity in the High Plains region.

Research Objectives:

The overall objective was to develop environmentally sustainable and economically feasible crop and livestock systems that will assure the viability of agricultural activities in the Texas High Plains.

Research consisted of studying an integrated crop/forage/livestock system in comparison with continuous cotton.

Effects of forage plants and animals on cotton yield, forage yield, soil compaction, soil fertility and other measurements were analyzed as a randomized block design with three replications.

Research Results:

- Based on 10 years of research, the crop/livestock system reduced water use by 25 percent compared with continuous cotton. The reduction in water use was due to the favorable water use efficiency of the warm-season perennial grass, which occupied half of the land area within the system. Yield and quality of cotton did not differ between the two systems.

- The old world bluestem provided very practical winter pasture. In addition to a valuable feed source for stocker cattle, when a protein supplement was provided, the grass had excellent soil covering properties and stood up well to continuous grazing during the winter. The old world bluestem provided the majority of the grazing days, compared to rye and wheat.

- Performance of steers during both the pasture phase and the feedlot phase was excellent. Averaged over the 10 years, steers spent 185 days on pasture, from January to mid-July each year.

- Daily gains (1.7 lbs per day) during the pasture and feedlot phases met and exceeded expectations. Steers gained about 306 lbs during the time grazing was allowed and were feedlot ready. Steers averaged 1,264 lbs at the slaughter facility and graded 64 percent Choice and 35 percent Select with a dressing percentage of 64.3 percent.

- Sorghum was not a viable component of the crop/livestock system. There were two primary reasons for this. The first was water. Establishment of sorghum came at a time with the limited water available for irrigation was demanded by the growing cotton crop. Water diverted to geminate sorghum would have penalized cotton survival and growth. Secondly, the period of growth for sorghum overlapped with the need to plant rye for winter grazing. Although sorghum may be a valuable part of some systems, it did not fit within the constraints of this system and was thus discontinued after year one.

- Continuous cotton required more inputs of chemicals including nitrogen fertilizer, pesticides, and plant growth regulators than did the alternative system. Nitrogen fertilizer was reduced about 40 percent in the alternative system. This resulted not only in a lower economic cost but a lower energy input, as well.

Four demonstrable impacts emerged from the results of the study that not only have significance in the Texas High Plains, but may also have relevancy in other regions of the country facing similar environmental constraints.

1. Systems can be designed that do use less water than the cotton monoculture typical of this region.

2. Integrated crop/livestock systems can be as profitable as the cotton monoculture. Averaged over a 10-year period, both systems were comparable in profitability ($125/acre in profit).

3. Nearly year-round grazing systems can be designed for the Southern High Plains that will support at least average or above-average levels of animal performance.

4. Irrigated small grain forages do not appear to be justifiable for grazing livestock in this region. While these are high quality forages and provide needed protein, their cost in terms of water, labor, seed, and chemicals does not appear to justify their use.

For a more detailed analyses of the research results, visit the national SARE projects database and search by project number **LS97-082**, "*Sustainable Crop/Livestock Systems in the Texas High Plains*."

Published paper: Allen, V.G., C.P. Brown, R. Kellison, E. Segarra, T. Wheeler, P.A. Dotray, J.C. Conkwright, C.J. Green, and V. Acosta-Martinez. 2005. *Integrating Cotton and Beef Production to Reduce Water Withdrawal from the Ogallala Aquifer in the Southern High Plains*. Agron. J. 97:556-567.

Photo credit: Texas Tech University TeCSIS

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. 3: Sustainable Crop/Livestock Systems in the Texas High Plains Phase II

High Plains Water Conservation Bulletin No. 4: Sustainable Crop/Livestock Systems in the Texas High Plains Phase III

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 Agroecoystems 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

Journal Articles

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