Agricultural Systems to Reduce Water Use in the Texas High Plains

The Ogallala Aquifer of the Texas High Plains: A Race Against Time

Producer Challenges

1. Find economically viable alternatives to the irrigation-dependent crop monocultures that have developed in the Texas High Plains during the past 30 years.
2. Extend and improve efficiency of the short-season stocker cattle grazing system in this region.

Alternative Systems

The TeCSIS project and TAWC producer group are studying a number of alternative crop and livestock systems for the west Texas High Plains. Some of the most successful are outlined below. Note that these are generalized descriptions that producers are modifying and adapting to fit their own situation. **The information below should be used only as a starting point as you develop the system and crop mix that is best suited to your particular farm and location.**

1. Irrigated, integrated crop/livestock system (perennial grass and annual small grain/cotton rotation)

- Three-paddock, drip-irrigated system for production of stocker steers, cotton and grass seed
- Base pasture (54% of total area) is “Dahl” old world bluestem, established May 1997
- In two-paddock rotation (each is 23% of remaining area), cotton alternates each year between paddocks with both rye and wheat for grazing
- Steers sequence graze dormant bluestem (January/February) with rye, grazed out by May
- Roundup Ready cotton planted directly into Roundup-terminated rye in mid-May
- Steers move to wheat. Following graze-out, paddock fallowed until rye planted in September
- Steers then graze spring-growth of bluestem through mid-July, when steers move to feedlot
- Late summer/autumn stockpiled bluestem provides seed crop (October) and winter grazing
- Following cotton harvest in late fall, “Locket” wheat is planted into the cotton stalk stubble

Evaluation: Compared with the cotton monoculture, irrigation water use is reduced by about 25%, nitrogen fertilizer is reduced by about 40%, soil erosion is below maximum target levels, soil microorganisms and soil organic carbon are increased, pesticide use is reduced, soil-borne diseases are reduced, fossil fuel-based energy and associated carbon emissions are reduced, and the system provides more flexibility in marketable products. Over 10 years, profitability was similar between the integrated system and the cotton monoculture.

2. Dryland integrated-crop/livestock system (perennial native grass and warm-season annual grass/cotton rotation)

- Non-irrigated, three-paddock system
- Base pasture mix of buffalograss, blue grama, sideoats grama (all perennial grasses), and green sprangletop (summer annual)
- Cotton and foxtail millet in two-paddock rotation alternate annually
- Steers graze native grasses and the summer annual grass
- Stocking rate of grazed paddocks was 3.1 acres/steer

Evaluation: Steer gains per animal averaged 2.2 lbs/day (218 lbs/animal), but stocking rate and gain per acre was low. System is vulnerable to weather patterns and precipitation events.

3. Buffer irrigated, integrated crop/livestock system

- Irrigated field of "Dahl" old world bluestem (20% of total area) added to dryland system above
- Irrigated bluestem provides additional grazing and seed harvested in September or October

Evaluation: Irrigated bluestem buffers years with inadequate rainfall to sustain grazing. System is more flexible and stocking rates are increased over non-irrigated system. Bluestem seed provides additional income. System requires at least some water and infrastructure for irrigation.

4. Irrigated, perennial warm-season grass grazing system for stocker steers

- Limit-irrigated, three-paddock system, with one paddock of "Dahl" bluestem and two paddocks of "Tifton-85" bermudagrass
- As bluestem and bermudagrass begin spring growth, steers sequentially graze these forages, beginning with bluestem and ending on bermudagrass
- Excess bermudagrass harvested for hay. Bluestem seed harvested in September or October
- Stocking rate is .64 acres/steer

Evaluation: Irrigated forages increase plant and animal production compared with non-irrigated system. Bermudagrass requires more water and fertilizer than bluestem for optimal production. Steers gained 2.1 lbs/day and 282 lbs over the grazing season.

5. Warm- and cool-season perennial grass/legume and native-grass pasture system

- A three-paddock system with 54% of total area in irrigated "Dahl" old world bluestem overseeded with alfalfa and yellow sweetclover, 23% in irrigated "José" tall wheatgrass/alfalfa, and 23% in non-irrigated native grasses including blue grama, sideoats grama, and green sprangletop
- Stocker steers sequence graze forages as available from early spring to early autumn

Evaluation: Legumes reduce need for nitrogen fertilizer, improve forage quality and increase carbon sequestration. Native grasses reduce irrigation needs. Evaluation is in early stages and will require more years to evaluate animal and system performance.

Project Overview / Other Resources

Initial funding for the project featured in this video was provided by the Sustainable Agriculture Research and Education program (SARE), USDA. In all, the Texas Coalition for Sustainable Integrated Systems (TeCSIS) based at Texas Tech University has received five grants from Southern SARE:
Sustainable Crop/Livestock Systems in the Texas High Plains (1997)
Forage and Livestock Systems for Sustainable High Plains Agriculture (2002)
Crop-livestock systems for sustainable High Plains Agriculture (2008)
Building a Sustainable Future for Agriculture (2009)
Long-Term AgroEcosystems Research and Adoption in the Texas Southern High Plains (2010)

In 2004, based on the information developed from the first two SARE-funded projects, the TecSIS group obtained a $6.2 million grant from the Texas Water Development Board to test a number of alternative production systems in an on-farm demonstration project. That grant led to the creation of the Texas Alliance for Water Conservation (TAWC).

The current project features:

- 26 producers in Hale and Floyd counties;
- on-farm demonstration sites equipped to monitor total water use, water-use efficiency, productivity of crops and livestock, economic profitability, and other measures for evaluating water conservation strategies;
- producers working with a wide range of crop and livestock production alternatives; and
- successful partnership between Texas Tech, growers, Texas A&M, Texas AgriLife Extension, USDA-ARS and NRCS, the High Plains Underground Water Conservation District No. 1, industries, and policy makers.

Related links:
Texas Coalition for Sustainable Integrated Systems (TeCSIS)
Texas Alliance for Water Conservation (TAWC)
Links to **TAWC Solutions**, tools for crop decisions and irrigation management, and a developing **Water Guide** website are included within the TAWC website
TAWC YouTube Channel
Integrated Systems for the West Texas High Plains (presentation by Vivien Allen at SARE 20th Anniversary Conference, 2008)
Smart Water Use on Your Farm or Ranch (SARE Bulletin)
Video: Perspective on Systems Research (Southern SARE)