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 2007-2009 (GS07-056, “Allelopathic Effects of Small Grain Cover Crops on Cotton Plant Growth and Yields”).

Introduction:

Cotton is an important crop in the Texas High Plains; roughly 25 percent of the total U.S. cotton crop is produced in this region, using irrigation mainly from the Ogallala Aquifer. However, declining water reserves in the Ogallala Aquifer require research efforts to find solutions for alternative agricultural systems that reduce overall water use.

The use of small grain cover crops, like rye and wheat, is important across the region in reducing soil erosion, managing weeds, and retaining soil nutrients and organic matter. In long-term integrated crop/livestock production systems research where cotton was grown in alternate rotation with small grains, research results showed that rye or wheat cover crops reduced the growth and lint yield of cotton compared to a monoculture cotton production system. Researchers suspected that the production of allelopathic compounds, a known phenomenon in small grains, was suppressing cotton production.

In a Southern SARE-funded Graduate Student Grant (GS07-056), “Allelopathic Effects of Small Grain Cover Crops on Cotton Plant Growth and Yields,” Texas Tech University researchers investigated allelopathy as the possible cause of the observed suppression and livestock grazing as a means of reducing the allelopathic effects on the cotton crop.
Research Summary:

Research findings verified that allelopathy – a biological phenomenon where one plant can have a harmful effect on another plant – was suppressing growth and yield of cotton in rotation with small grain cover crops. Known allelopathic compounds in rye and wheat were detected in the soils and plants. Effects may be further pronounced in the semi-arid climate of the Texas High Plains region when water is limited because of slow decomposition in dry soils.

Grazing by livestock may offer opportunities to utilize the cover crops while reducing the allelopathic effects. In the research study, grazing the cover crops reduced the allelopathic effects and increased the yield of the cotton crop in rotation with the small grains cover crops by as much as one half a bale (250 lbs) per acre compared with cotton grown where the cover crops were not grazed, but were harvested as hay.

Research Objectives:

The overall objectives were to identify the cause of small grain cover crop suppression on the growth of cotton, and to alleviate this suppression through grazing management and/or selection of small grain species and varieties that minimize this effect.

Research Results:

The initial study was conducted within the SARE-funded, long-term integrated crop-livestock system, which began in 1997 to investigate differences between a cotton monoculture and an integrated crop/livestock production system. In the graduate student grant project, soil samples were collected from the treatment areas to detect the presence of allelopathic compounds. The collection of soils in the field, as well as off-site greenhouse studies that measured the effect of ground rye and wheat on cotton germination, were used to verify allelopathic effects of the small grains on cotton production.

In addition, the effects of grazing vs. non-grazing of rye on the growth of the following cotton crop was studied. Results showed that higher concentrations of allelopathic compounds in rye were found in the soil where rye was ungrazed, compared to grazed areas, suggesting that grazing reduced the amount of the chemical in the soil.

In both rye and wheat cover crops, and following a hail event, plant survival and initial growth of cotton were greater compared with no cover crop. However, at harvest, yields of both cotton lint and seed were higher where no cover crop was planted compared with where wheat or rye was planted.

Cotton no-till planted into a previously ungrazed rye cover crop had lower plant populations, fewer boles per plant, and lower lint yield than when cotton was planted into rye that was previously grazed during the spring by stocker steers. Livestock grazing offers opportunities to utilize the cover crops while reducing the allelopathic effect giving producers a management strategy to reduce this suppression while taking advantage of the benefits cover crops afford.

For a more detailed analyses of the research results, visit the national SARE projects database and search by project number GS07-056, “Allelopathic Effects of Small Grain Cover Crops on Cotton Plant Growth and Yields.”
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. 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. 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 Winter Annual Cover Crops Under Multiple Residue Managements: Impacts on Land Management, Soil Water Depletion, and Cash Crop Productivity in the Texas Southern High Plains

LS07-082 Sustainable Crop/Livestock Systems in the Texas High Plains

Journal Articles


