



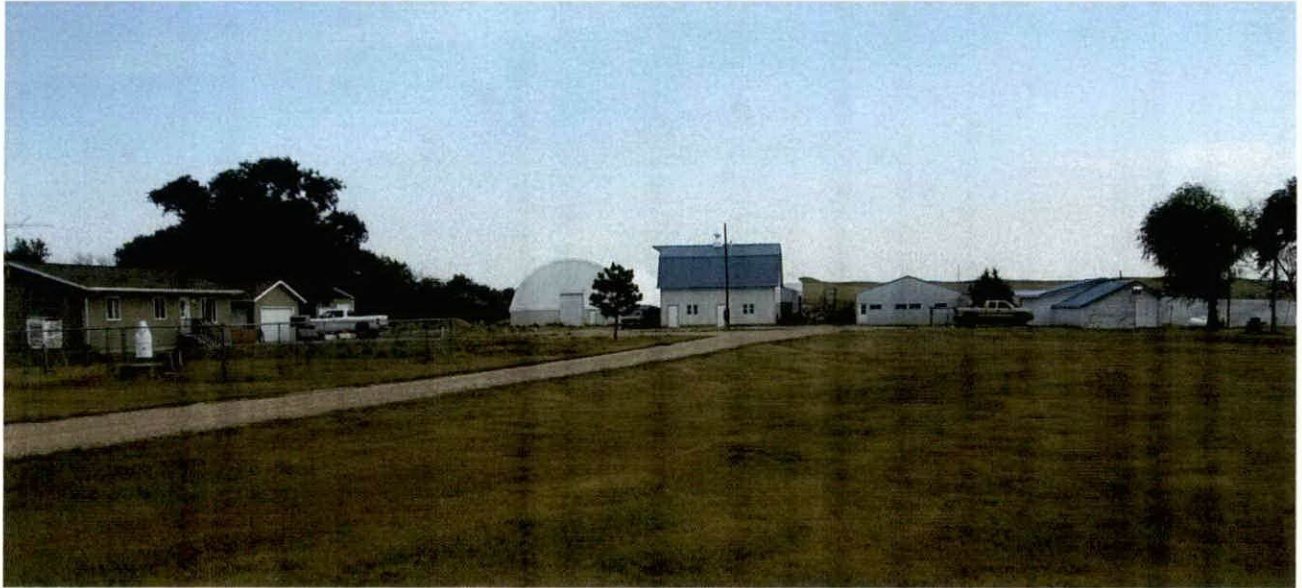
Cottonwood Research Station

Facility Improvements & Research Accomplishments



Summary Report September 2011





Background

The **SDSU Cottonwood Range and Livestock Research Station** was established in 1907 by the Agricultural Experiment Station at SDSU. Located along U.S. Hwy. 14 approximately 11 miles west of the town of Philip, this station is in the heart of South Dakota rangeland. Originally, the station included 640 acres with research focused on crops and soils. In 1940, 2,000 acres of federal land were added and research was expanded to include grazing and nutrition studies.

Today, research at this 2,640 acre facility focuses on range and cow-calf management. Recent studies have evaluated water quality issues during persistent drought, use of dried distillers' grains for supplementation, and development of heifers. The station maintains a herd of about 150 Angus-Simmental cows, which are utilized for research programs, and yearlings are purchased for additional research projects.

The vegetation at the Cottonwood Station is predominantly native plants, most of which are cool-season grasses. Western wheatgrass is the main species, but needleandthread, green needlegrass, and little bluestem are also present. Buffalograss and blue grama are the primary warm-season grasses. Introduced pastures of crested wheatgrass and Russian wildrye are also grazed. The average yearly precipitation at the Cottonwood Station is about 16.5 inches.

A long-term grazing study was initiated at the Cottonwood Station in 1942 to evaluate the impact of range condition on range ecosystem dynamics and livestock production. This ongoing study provides a rare opportunity to examine the responses of mixed-grass prairie ecosystems to a wide array of climatic conditions and grazing systems, and has resulted in scientific papers that challenge several long-held range paradigms.

Since 1907, the National Weather Service has recorded area weather at the Cottonwood Station – making it one of the oldest weather stations in the state to operate on the same site on a continuing basis. As a Climatological Bench Mark Weather Station the maximum and minimum temperatures are recorded daily, along with precipitation and evaporation data.

Since 1983 Cottonwood Station has been a monitoring site for the National Atmospheric Deposition Program. Precipitation samples are collected on a weekly

basis. Samples are sent to the Illinois State Water Survey and analyzed for pH, specific conductivity, calcium, magnesium, potassium, and other compounds.

Presently, David Gay serves as the station's superintendent. He began his tenure in October 2008 and replaced Ron Haigh, who retired from SDSU after more than 30 years of service.

The Cottonwood Research Station is one of five field research stations across the state operated by SDSU's Agricultural Experiment Station.

Range studies conducted at the Cottonwood Station by SDSU researchers have included:

- Long-term study of effects of range condition on range ecosystem dynamics and cattle production
- Evaluation of dietary thiamin for utilization of high sulfate water
- Water quality effects on consumption, production and environmental issues
- Grazing patterns for continuous season long, short duration and spring deferred grazing
- Response of individual plants to grazing
- Evaluation of switchgrass as a biofuel
- Steer response to grazing systems
- Plant community change associated with grazing systems
- Grazing ecotypes of western wheatgrass and blue grama
- Diet quality and performance of steers on introduced and native pastures
- Late summer protein supplementation
- Introduced pastures as a forage source during drought

Cow-calf studies conducted at the Cottonwood Station by SDSU researchers have included:

- Evaluation of dried distillers grains for pregnant heifers
- Response of cow-calf pairs to water high in sulfates
- Evaluation of barley vs. hay for wintering beef cows
- Calving date, weaning date and reproductive performance
- Evaluation of fecal NIR to predict dietary crude protein
- Association of serum total protein in newborn calves with later death and illness
- Evaluation of wheat midds as a supplement for cows grazing winter range
- Blood meal/corn gluten meal supplement for cows grazing native range after calving
- MGA for synchronizing beef cows
- Level of concentrate supplement for cows grazing winter range
- Effect of weaning date and winter nutrition on reproductive performance
- Source of energy on performance of replacement heifers
- Methionine addition to a urea-grain supplement for cows grazing winter range
- Body condition and reproductive performance of range cows

Overview of Facility Improvements

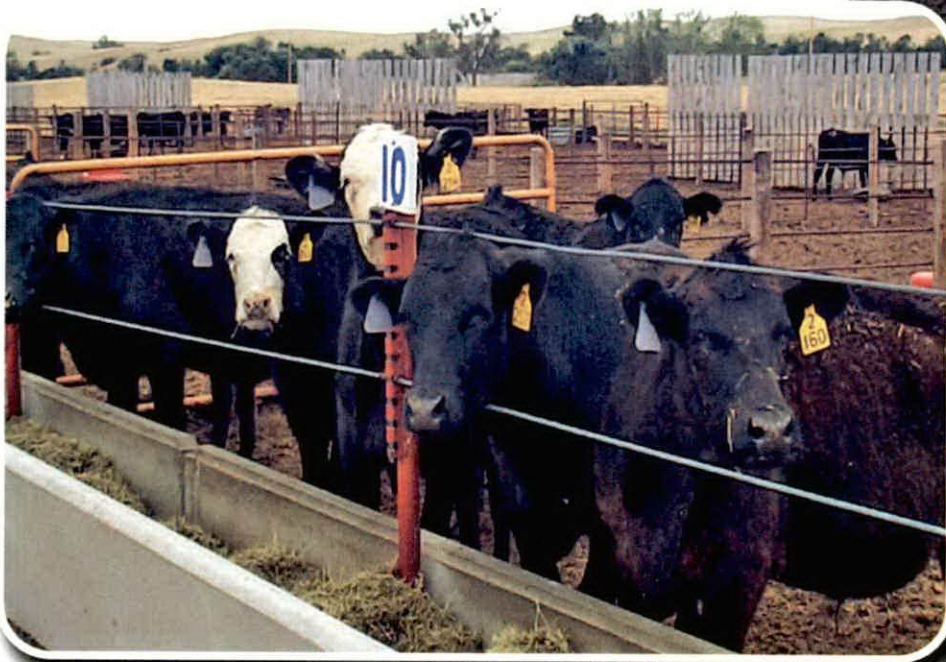
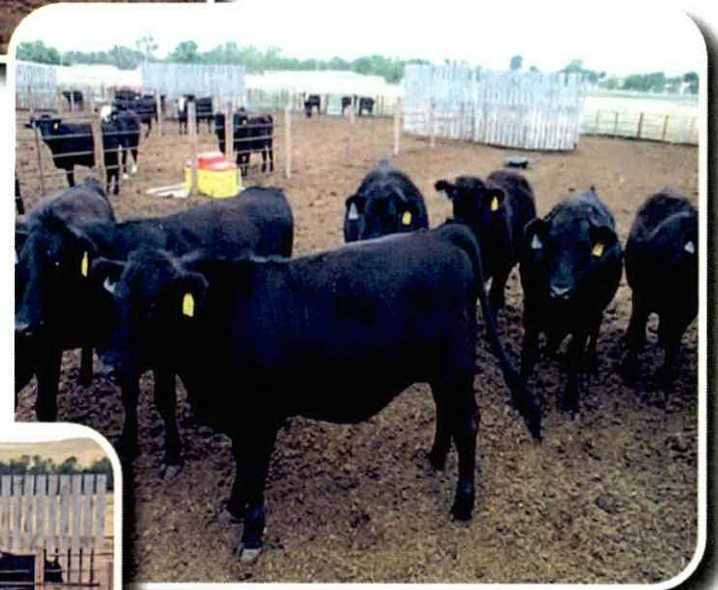
In the 1990's a generous donation was made to update the facilities at the Cottonwood Research Station to enhance livestock research efforts at the site. The donation was made by Lake Preston, SD, native and SDSU animal science alum Bill Larson (Ph.D. '69). The Cottonwood facility improvements were completed during 2000 and 2001. Specifically, the following construction projects were completed:

- **Feedlot area:** A drylot area with 12-pens, waterers and concrete feedbunks with capacity for up to 10 head per pen was constructed. On a range-based station such as Cottonwood, this facility allows for comparing livestock response to various treatments in drylot vs. grazing conditions or for studying responses to a forage-based diet in a more controlled setting than on pasture.
- **Cattle handling barn:** A pole barn was constructed and equipment including a tub, curved alley, and squeeze chute were purchased and installed so that cattle can be worked under cover.
- **Commodity shed:** The shed was constructed with two large bays so more than one feed ingredient can be stored. Both bays are ideal for holding a large supply of chopped hay.



Additional photos of the updated Cottonwood facilities are included on the following three pages.

Feedlot Area



***Photos in this report courtesy of Mindy Hubert, SDSU Research/Extension Associate, West River Ag Center

Cattle Handling Barn



Commodity Shed



Benefits to Research Efforts

The facility improvements at the Cottonwood Research Station have been beneficial in facilitating many research studies at the site over the past two decades. See page 10 for a listing of livestock and range research studies that have resulted from work conducted at the Cottonwood facilities. Two research areas of particular emphasis have included:

- 1) **Studying sulfate toxicity from livestock drinking water.** SDSU animal, range and veterinary scientists have been instrumental over the last decade in determining that sulfate in water was a cause of death loss in cattle grazing High Plains rangelands. Additionally, researchers have identified the levels of sulfate concentrations that cause a toxic dose, and focused on research to counteract the toxicity. The feedlot and commodity shed facilities at the Cottonwood Research Station have been essential to this research, and, work that involved handling cattle for the sulfate toxicity studies involved use of the cattle handling barn.

This research has been tremendously valuable for South Dakota producers and beyond. The high-sulfate water problem extends from central Canada into Mexico and the western High Plains. Even though a method to counteract the toxicity is still being sought, the knowledge of the problem and resulting research has allowed producers to understand how to identify and avoid toxic water.

- 2) **Identifying feed value of novel co-products from biofuel production.** As the ethanol industry matures and processes for extracting ethanol and other valuable products from grain emerge, novel co-products are created. Traditional distillers' grains from corn have been high in oil and moderately high in protein, making a livestock feed that is a good source of energy and protein. Recently developed modification processes remove the bran and germ (the primary source of oil) from the seed before ethanol fermentation, thus yielding a distillers' grain that is low in oil (which reduces energy content) and high in protein. SDSU researchers are evaluating the value of this new co-product as a protein supplement for gestating beef cows consuming low-quality forage (like dormant winter range or crop residue) in feeding trials in the feedlot.

This research has been important in establishing the value for this new co-product. With feed costs being a tremendous concern for livestock producers throughout the U.S., knowledge of the feeding value (so that maximum value can be obtained for the price paid) plays an important role in economic efficiency for beef cattle producers.

For the future, research at the Cottonwood facility is utilizing the cowherd for fetal programming studies led by SDSU Meat Science Assistant Professor Amanda Weaver. Weaver along with SDSU researchers Drs. Wertz-Lutz, Pritchard, Underwood and Reecy (at Iowa State), are interested in the influence of maternal nutrition on fetal growth and development, as well as the composition and meat quality of subsequent offspring.

Recently, they were awarded two grants to investigate:

- Impact of maternal nutrition on expression of genes regulating offspring growth, carcass composition and meat quality. A.D. Weaver (PI), K.R. Underwood, A.E. Wertz-Lutz, R.H. Pritchard, J. M. Reecy. 2010-2013. USDA-AFRI. \$319,883 - Funded
 - Impact of maternal nutrient restriction on phenotypic expression in different leptin genotypes of offspring and meat quality. A.D. Weaver (PI), K.R. Underwood, A.E. Wertz-Lutz, R.H. Pritchard. 2009-2011. South Dakota Beef Industry Council. \$91,757 - Funded
- Work is currently underway for these projects and will be published in the future.

Additional Comments

Ken Olson, Ph.D., current SDSU Extension Beef Specialist (West River Ag Center): “In my mind, the most important ongoing study at Cottonwood is the long-term grazing experiment that has been continuously going since the 1940s. Most research is short-term, meaning the experiment is conducted for three years at the most. Responses in agricultural systems are typically slow and dynamic, and in the rare long-term studies in existence, we often find that the long-term conclusions change dramatically from those drawn in the early years. This study is a classic example of that. Three very important scientific papers have recently been published based on that long-term dataset (Dunn et al., 2010; Smart et al., 2010; Smart et al., 2007). Although this was grazing research that was not conducted in the feedlot/commodity storage facilities, any livestock research is dependent on the livestock handling barn. Using the barn has been instrumental to the portion of this research that has been conducted since the barn was built. This research has been instrumental in developing and refining proper grazing management on western South Dakota rangelands.”

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Trey Patterson, Ph.D., former SDSU Extension Beef Specialist (West River Ag Center) and current chief operating officer, Padlock Ranch, Ranchester, Wyo.: “The improvements made to the Cottonwood Station facilities were critical in supporting my research and Extension programs at South Dakota State University. We were able to use the feeding pens to create the necessary replications needed to conduct experiments. The water quality work we accomplished using the pens and animal handling barn opened a whole new area of ‘home-grown’ data that we were able to share with our constituents. We were also able to use these facilities, including the commodity facilities, to do work with distillers grains for cows and on the drought-mitigation approach of limit feeding cows. Not only did these experiments train graduate students, but they also generated data that was real-time and useful to the people of South Dakota and the region. I know for a fact that our research and Extension programs would have been less effective without that facility to conduct experiments.”

Pat Johnson, Ph.D., current SDSU Range Science Professor: “I have conducted research at the Cottonwood Station for 25 years and can say without hesitation that the facility improvements at the station have been critical to ensuring quality research continues there. Without the feedlot pens and commodity shed, the water quality work that we conducted would have been impossible. They allowed us to evaluate the impact of various levels of sulfate on animal production and to compare animal responses to sulfate in water in both drylot and rangeland situations. Cattle, people, and data have all benefited from the cattle handling facilities that were built, and research that would not have been possible otherwise has been accomplished. The Cottonwood Station has focused on range livestock production throughout its history, however the addition of the feedlot and cattle feeding and handling facilities has dramatically improved our ability to evaluate the consequences of grazing strategies on livestock production. For too many years, we worked with old, poorly designed, and sometimes dangerous facilities when working and/or weighing cattle; the improved facilities have made the job easier and safer for both the animals and the people involved. These facilities have vastly increased the scope and quality of the research for faculty and students and the Extension programming conducted at the station in the past, and will continue to do so into the future.”

Cody Wright, Ph.D., current SDSU Animal Science Professor: “As a collaborator on the water quality research that has been done at Cottonwood, I can attest that because of the facility – the 12 drylot pens in particular – we were able to identify at what point high sulfate water becomes problematic to cattle. The cattle handling facilities were also useful for collecting liver biopsies for this work. For the future, the cow herd at Cottonwood is now involved in fetal programming research. We are just scratching the surface of this research and the pens and facilities will be integral to collecting that data.”

Amanda Weaver, Ph.D., current SDSU Meat Science Assistant Professor: “I am relatively new to utilizing the Cottonwood Research Station, however it has proven vital to the research we have initiated on fetal programming. Recently my colleagues and I were awarded two grants to investigate this area (listed on page 7). Work is currently underway for these projects with treatments imposed on the cows and calves to be weaned and transported to the SDSU Research Feedlot for the finishing phase, followed by harvest and data collection to complete the studies. We have utilized nearly all of the cows from the Cottonwood station for this project and relied on the feedlot area, working facilities, commodity storage areas, unit manager and pastures for completion of this work. It is my hope that these studies are only the beginning of much more research linking the beef production chain from conception to consumption, and I plan to continue utilizing the resources of the Cottonwood Station for this work.”

**Research Publications Generated from
Cottonwood Research Station**
Made Possible by Monetary Donation for Facility Improvements

Scientific journal articles

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