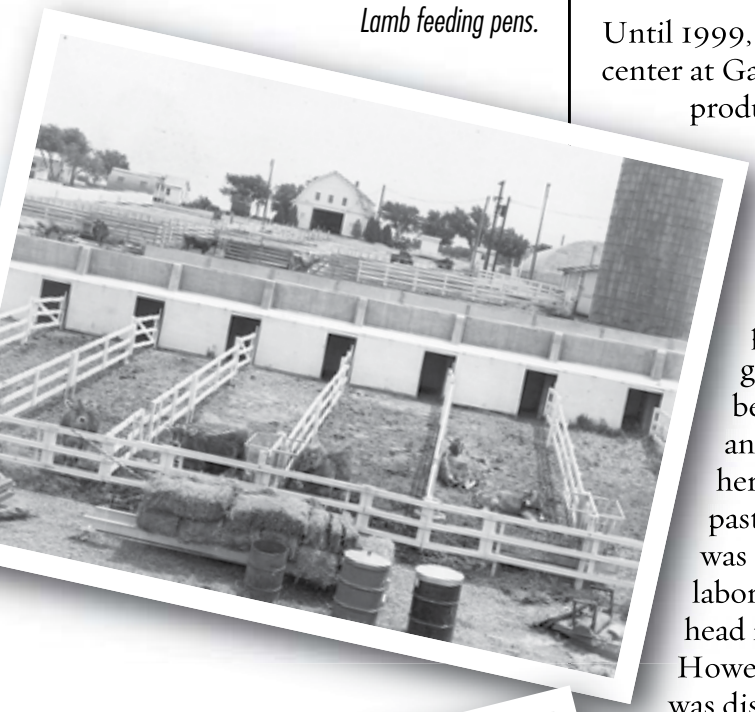
LIVESTOCK RESEARCH

Jeff Elliott

Animal scientists who have served at Garden City include: **Dudley W. Arnett** (1967-72), **George V. Davis** (1972-82), **Robert (Bob) W. Lee** (1983-85), **Robert (Bob) T. Brandt, Jr.** (1985-1988), **Arthur (Steve) Freeman** (1989-1993), and **Kelly K. Kreikemeier** (1994-1998). Early trials with lambs, dairy, swine, and turkeys were carried out in Garden City by station employees under the direction of K-State animal scientists located in Manhattan. This changed with the growth of the cattle feeding research and an animal scientist was located in Garden City.

Brown Swiss replacement heifers.

Lamb feeding pens.

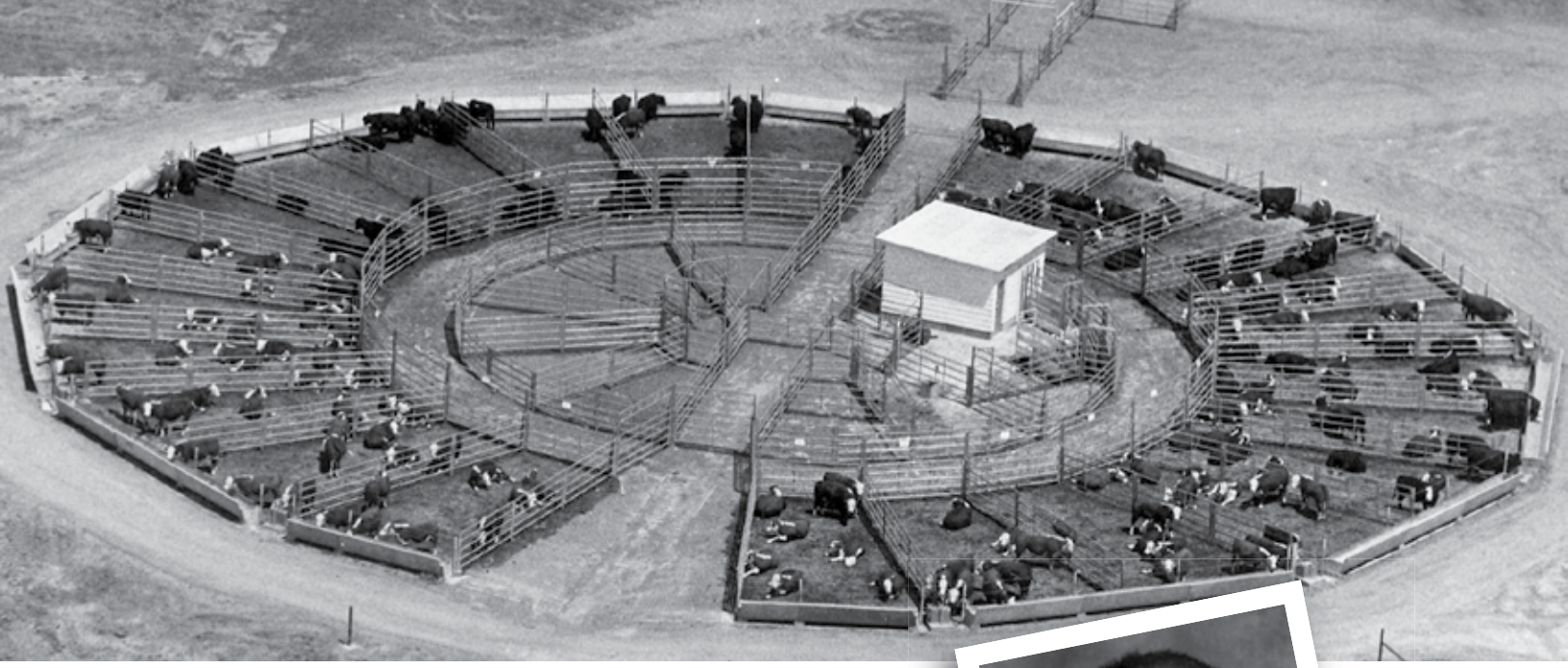


Until 1999, livestock research has been an integral part of the research center at Garden City. They provided valuable results for Kansas producers, as well as income for the experiment station.

In 1954, research on purebred **Duroc hogs** was discontinued to allow more emphasis on **dairy research,** which has had a long history at Garden City. It began with a small herd of grade Ayrshire cows in 1917. When these animals proved to be unproductive, they were replaced in 1922 with good quality, grade Holsteins. After the Brown Swiss breed became popular, the Holsteins were sold in the fall of 1940 and replaced with registered Brown Swiss. This high-quality herd was used to demonstrate the value of various irrigated pasture crops. The construction of a modern milking parlor was completed in 1963 (this building is currently utilized as a laboratory). The Brown Swiss herd grew from the original 11 head in 1940 to 145 animals, according to the 1966 annual report. However, the need for dairy research decreased, so the dairy was dispersed in the late 1960s and resources were redirected to feeding beef cattle.

Lamb feeding was an important enterprise in the Garden City area from the 1930s through the 1950s. Lambs were imported into the area to utilize crop residues from the sugar beet industry. Feeding experiments were initiated at the station in 1933 with the purchase of 250 feeder lambs. In subsequent years, approximately 600 lambs were purchased annually from Texas or New Mexico. Lamb feeding trials centered on efficient use of locally grown feedstuffs. Station researchers compared sorghum silage and other roughage sources, as well as methods of grain processing. Feed additives, including hormones, antibiotics, and even tranquilizers also were evaluated. After lamb numbers dropped in southwest Kansas, the lamb feeding trials at the experiment station were curtailed in the late 1960s.

Turkey feeding trials were conducted from 1947 through 1952, but the project was discontinued because of "lack of local interest."



Cattle feeding research has been a major venture at the research center for four decades. The 1962 Garden City Experiment Station annual report indicated the first cattle feeding trial was initiated in the fall of that year. The first four steer-feeding pens were located northwest of the present feedmill and held six head each.

In 1966, a landmark feeding study was designed to compare Colby, Garden City, Mound Valley, and Manhattan as cattle feeding locations. Calves were purchased from the Warner Hereford Ranch in Cimarron and were allotted to each of the four research stations. The cattle were fed identical rations in similar pens. Feedstuffs were grown in Garden City and shipped to each test site. This study was repeated four consecutive years. When all the data was analyzed, **feeding performance was best at the Garden City location.**

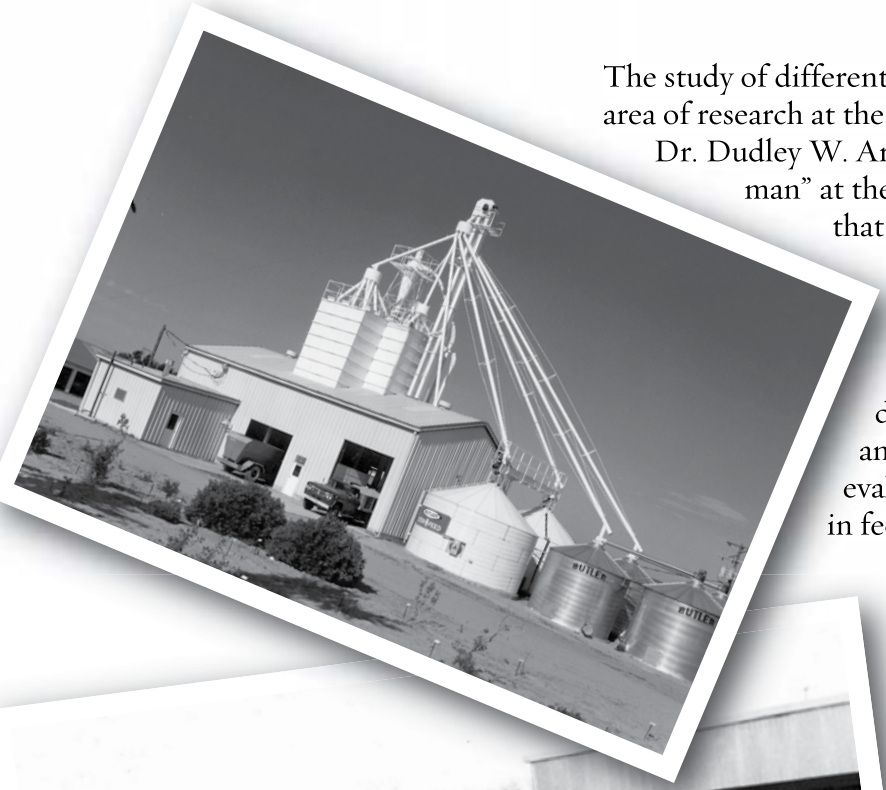
The tornado that inflicted major damage to the station on June 23, 1967, was an important catalyst in development of new cattle feeding facilities. Several of the older buildings were damaged or destroyed in the tornado, so they were replaced with updated cattle facilities. The centerpiece of the cattle feeding facilities was a **modern, state-of-the-art feedmill** with feed processing and mixing equipment together with grain and roughage storage facilities. A steam flaker was added later, which softened the grain by applying steam and then metered the grain between two large rolls to flatten the grain into "flakes." Steam flaking was found to increase feeding performance. The feeding of steam-flaked grain is now common in today's feedlots.

The "**circle pens**" were erected in 1969. These 24 pens were arranged in a circular pattern with the cattle weighing and processing facility located at the center of the circle. Feed bunks were arranged around the outside of the circle, allowing feed trucks easy access for delivery of feed. Several sets of feeding pens were constructed during the 1970s and 1980s, increasing the feeding capacity to approximately 1,000 head.

Circular cattle pens built in 1969.

Kelly Kreikemeier, Animal Scientist

Steve Freeman, Animal Scientist



The study of different **feed processing methods** has been an important area of research at the Garden City Experiment Station. In 1969, Dr. Dudley W. Arnett was hired as the first "animal husbandry man" at the station. He started an extensive feeding trial that compared grain processed by several methods, including ground grain, dry-rolled grain, steam-flaked grain, extruded grain, high-moisture milo, reconstituted corn, and whole corn. Other beef cattle research included studies designed to look at different methods for care and feeding of newly received cattle. They also evaluated roughages, buffers, and fat and urea levels in feed rations, as well as the usefulness of several feed additives in the diets. Studies on the feeding value of high-moisture corn harvested at different moisture levels were used to develop guidelines for ensiling wet grain. Garden City researchers conducted the first practical application of ammonia to crop residues to improve its feed value in conventional feedlot growing rations.

Sprinkler-irrigated pasture research was initiated in 1970. A well, pump, and center pivot sprinkler were installed on 100 acres directly south of the current office. The irrigation equipment was purchased with $40,000 donated from local businesses. Richard Henkle of Henkle Drilling spearheaded the fundraising project. Cattle were grazed on permanent pasture in early years. By the mid 1980s, a switch was made to wheat pasture. A number of studies evaluated the efficacy of supplementing the pasture grazing with hay, silage, or concentrates, as well as feed additives and implants.

The new feedmill.

First steer feeding pens.

A "**micro machine**" was installed in the feedmill in 1985. This device allowed the accurate delivery of very small amounts of nutrients or feed additives to the cattle rations. This allowed the scientist to easily compare antibiotics and other additives such as Ruminsen. A more energy efficient steam generator replaced the conventional boiler in the mid 1990s.

The last pen of cattle left the Southwest Research-Extension Center in December 1999. This ended 80 years of livestock research at Garden City. Resources were reallocated to initiate the Environmental Science project.

AGRONOMIC RESEARCH

Curtis Thompson

Agronomists at Garden City: *Crop improvement* – **Alvin E. Lowe** (1937-1958), **William (Bill) Stegmeier** (1958-1967), **William (Bill) Russell** (1968), **Merle Witt** (1969-2006); *Irrigation agronomists* – **Donald W. Grimes** (1956-1961), **Kenneth Snelling** (1961-1966), **Royal J. Swenson** (1966-1967), **Paul Penas** (1966-1967), **Mark Hooker** (1979-1987); *Soil fertility agronomists* – **George Herron** (1956-1990), **David Travis** (1964-1966), **David Newton** (1966-1967) and **Mark Hooker** (1979-1987); *Horticulture agronomists* – **Dean A. Hammond** (1958-1959), **John M. Nelson** (1962-1964), **Max E. Fogleman** (1964-1967), **Pyung Kyung Yu** (1967-1968) and **Jack H. Kyle** (1968-1977). *Tribune agronomist:* **Alan Schlegel** (1986-present)

Wheat, grain sorghum, and corn have perhaps the longest and most intensive research history of all crops researched at the experiment station during the last 50 years. Irrigated and dryland variety performance evaluations were conducted nearly every year during that period. The worst year for all crop research occurred in 1967 when two hail storms and a tornado destroyed the experiment station and its field research.

WHEAT

Irrigated wheat performance tests in the 1950s and 1960s often had top varieties yielding 55 to 60 bushels per acre (bu/a), provided hail or other natural disasters didn't destroy the experiment. Lodging and leaf and stem rust often harmed wheat plots. Over the next 50-year period, four experiments were abandoned, but the top yielding variety exceeded 60 bu/a in 27 of the years. The record irrigated wheat yield of 106 bu/a was achieved by T-81 in 2004. The 2004 trial averaged 91 bu/a, which was also a record average high.

Wheat dryland-fallow performance yields varied according to weather conditions. A record dryland wheat yield of 73 bu/a occurred in 1984. The 1984 experiment averaged 62 bu/a, which also was a record average high. In 22 of the years, the top variety yielded 40 bu/a over the 50-year average. Five dryland wheat performance tests were abandoned and an additional four trials had the top variety yielding less than 20 bu/a. This suggests that southwest Kansas experiences some adverse weather conditions for dryland wheat.

Merle Witt standing in alfalfa plots.

Monty Spangler examines seed placement by the newest plot implement—a no-till small plot planter.

Bill Stegmeier, Agronomist

Irrigated wheat fertility and nitrogen and phosphorus experiments were initiated in 1959 and continued on and off over the following decades. Wheat was not responsive to chloride fertilizers in experiments conducted during the mid-1980s. Leading edge work with irrigation management was conducted during 1957-1959. This work is still used in the Kansas wheat production handbook. Station agronomist Merle Witt evaluated the effect of temperatures on wheat. He found that during grain fill, yields were lower in plots exposed to temperatures 5°F above the ambient temperature during the night or day.

Hybrid wheat evaluation began in 1960 and continued for many years. The station evaluated a male sterile Scout in 1968 and began evaluating semi-dwarf wheat varieties that same year. Several years of the semi-dwarf wheat variety evaluations occurred before they were adopted as part of traditional wheat variety testing. A cooperative project with NASA and the National Oceanic and Atmospheric Administration (NOAA) using satellite imaging to evaluate crops was conducted from 1975 to 1978. Planting date and rate experiments were conducted off and on throughout the 50 years. Witt's evaluation of wheat planting dates throughout the winter has been especially valuable to producers who have delayed planting dates. Wheat planted November 1 has yielded 7 bu/a less than wheat planted October 1. Planting after November 1 results in declining wheat yields. Wheat planted February 1 or March 1 always vernalized, but delaying planting to April 1 resulted in wheat vernalizing only 50% of the time.

The Kansas Intrastate Nursery, Kansas Observational Nursery, and Southern Regional Performance Tests were used to evaluate experimental wheat lines prior to a variety release. Researchers at the experiment station were instrumental in wheat variety development over the entire 50 years. The Hybrid Regional Wheat Nursery was maintained several years to evaluate experimental hybrids, but such hybrids have never been widely adopted in Kansas.

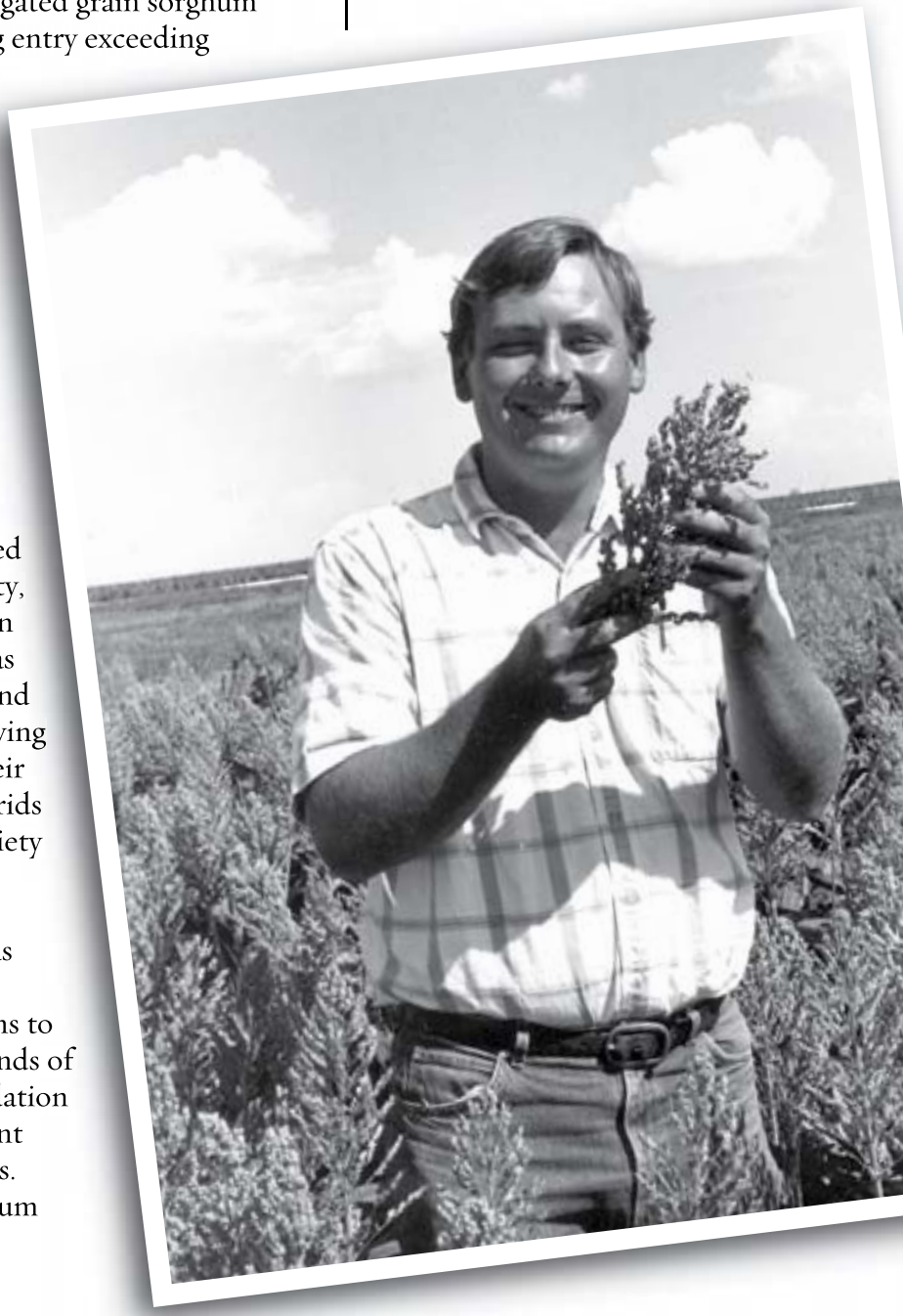
Wheat, triticale, and rye forage work was conducted intermittently throughout the 50-year period. Research involving livestock grazing on red and white wheat was conducted from 2002 to 2005.

SORGHUM

Sorghum varieties and hybrids were evaluated for grain and forage potential for most of the 50-year period. After the late 1980s, forage sorghum evaluation was more intermittent. Irrigated grain sorghum yields have been very high, with the top yielding entry exceeding 150 bu/a in 21 years and exceeding 120 bu/a in 45 years. The record irrigated grain sorghum yield was 178 bu/a in 2001; however, the highest average yield was 156 bu/a in 1993. Over the past 50 years, the irrigated grain sorghum performance test has been abandoned only four times. The dryland fallow sorghum test has been more erratic, with five years of abandonment and trial averages ranging from 20 bu/a in 1956 to 103 bu/a in 1996. The record high dryland fallow hybrid yielded 130 bu/a in 2001, apparently a great year for sorghum. As with wheat, many regional and intrastate nurseries were established at the experiment station, contributing to variety, inbred, and hybrid development. Although grain sorghum yield improvement has not increased as much as corn yield improvement, standability and stalk strength have been improved greatly, allowing sorghum growers to more efficiently harvest their sorghum crops. Waxy endosperm sorghum hybrids were evaluated during the 1960s. Tan plant variety evaluations began in 2001 and continue today.

A long-term nitrogen and phosphorus study was initiated in 1968 and conducted over a 10-year period. The experiment's final recommendations to maximize sorghum yield were to apply 120 pounds of nitrogen and 18 pounds of phosphorous. Foundation research on water use and irrigation management in sorghum was conducted during the late 1950s. That information remains in the K-State sorghum production handbook.

Alan Schlegel holding sorghum head.



Demonstration of the "hail machine" that was used to simulate hail damage to corn and other crops to evaluate yield losses due to hail damage.

CORN

From 1956 to 1981, a corn hybrid silage evaluation was conducted at the experiment station. Grain corn evaluation may be the greatest success story among all crops evaluated at the experiment station. In the irrigated corn performance tests, the first hybrid to exceed 100 bushel occurred in 1959, the first hybrid to exceed 200 bu/a occurred in 1969, the first hybrid to exceed 250 occurred in 1989. The record high for an irrigated corn hybrid was Pioneer 33P67, which yielded 303 bu/a in 2002. The 1988 trial was the first to average over 200 bu/a. From 1988 to 2006, 10 trials have had averages of 200 bu/a or more. The record trial average was 272 bu/a in 2003. The first year all hybrids yielded over 200 bu/a was in 1992. At least one hybrid has yielded 200 bu/a in 19 trials during this 50-year period. The only irrigated corn trial to be abandoned was the 1967 trial, which was lost to hail and tornado damage.

The corn performance test was hill-planted until 1979. Corn populations were increased as time passed: 17,400 plants per acre in the 1950s and 1960s to 30,000 plants after 1996. Short-season corn hybrids planted early were first evaluated in 1995 and were planted at 40,000 plants/a.

Foundation research on irrigated corn production and long-term nitrogen and phosphorus experiments also were conducted. This research had great value to the irrigated corn growers in Southwest Kansas. Evaluations found corn generally did not respond to boron, zinc, and sulfur fertilizers. However, corn did respond to zinc fertilizers at an off-station location in Haskell County where significant land leveling had occurred. Several planting date studies were conducted in the 1960s and 1970s. Generally, planting corn between May 1 and May 10 gave the highest grain yields. Corn silage yields tended to be higher with an early June planting date.

Cooperative research with National Crop Insurance that evaluated simulated hail damage in corn, wheat, and grain sorghum began in 1977 and continues today. This data has helped establish the current standards used by hail insurance adjusters across Kansas and possibly the United States.

SOYBEANS

Irrigated soybean research was initiated in 1959. The first variety performance experiment was planted twice and was still lost to jackrabbits. There have been 33 years with the top variety yielding 50 bu/a or more. The record setting irrigated soybean variety yielded 75 bu/a in 1990. The entire trial averaged 63 bu/a, which tied the record average yield set in 1986. Only six years of performance tests have had a variety yield 70 bu/a or more. These test years occurred in 1986 and in following years. In seven years the soybean test was abandoned due to rabbit damage, inadequate weed control, or high soil pH. In 2002, the first Roundup Ready soybean variety evaluation experiment was planted. The irrigated soybean variety tests have been exclusively Roundup-ready ever since. Experiments evaluating interactions of planting date, rate, and maturity group were conducted during the late '90s and beyond. This research found group III and IV varieties were best adapted for southwest Kansas.

ALFALFA

The first irrigated alfalfa variety evaluation was planted in the fall 1971. Since then, with a gap from 1978 to 1984, alfalfa variety evaluation has continued for a total of 28 years. Alfalfa yields were much higher after 1984. The record alfalfa yields occurred in 2000, with the trial averaging 13.8 ton/a. The first Roundup-ready alfalfa varieties were to be planted in the fall of 2007.

Milkweed floss. Milkweed (top) and amaranth (bottom) were evaluated as crops for this area.

OTHER CROPS

Several other crops have been evaluated during the last 50 years at the research station. A castor bean variety trial was conducted from 1958 through 1968, and sugarbeet fertility, irrigation, and production practices were researched from 1956 to 1978. Crambe and winter and spring rape were evaluated in the 1960s, while canola evaluation began in the 1990s and continues. Winter survival of winter canola varieties has serious limited its adaptability in southwest Kansas.

Irrigated and dryland winter barley varieties were evaluated annually until the mid-1970s. Pinto bean/dry edible bean varieties were evaluated well into the '70s, and comfrey was evaluated during the '70s. Work with popcorn occurred through the mid-1970s, and safflower was evaluated in the early '70s and again in the late '90s. Oil and confectionary sunflower were evaluated for a six-year period during the mid-1980s and early '90s. Cotton was evaluated in the early '90s and was not successful because of herbicide drift.

MISCELLANEOUS

An experiment to determine the value of crop residue to grain production and soil quality characteristics was initiated in 1969 and ended in 1994. The experiment was conducted with both wheat and sorghum residue. The residue treatments consisted of a burn and a physical removal of residue, resulting in surface residue being removed from two of the four treatments. A third treatment received additional residue from the treatment that had the residue physically removed, resulting in a doubling of the surface residue. The fourth treatment was a control that left the surface residue in place. All treatments were mechanically tilled and farmed. An article in *Agronomy Journal,* authored by Mark Hooker and others in 1986, suggested that yearly burning or physically removing the residue and had similar soil characteristics, including similar soil organic matter, as the treatment with double the amount of residue. This suggested that occasional burning or removal of residue had little impact on soil quality.

Work on a wheat-sorghum-fallow rotation on dryland was first mentioned in 1963. This work was conducted under conventional tillage. Later research found that this system was more sustainable under no-till management.

Some unusual research conducted by faculty at the station included a nitrogen fertility experiment on irrigated corn using nitrogen rates as high as 1,600 lb/a. Corn yields were not increased with nitrogen rates above 120 lb/a. A second experiment conducted in Lane County evaluated the addition of night lights in an irrigated field to increase corn yields. Results suggested that the slight additional yield increase would not pay for the electricity used to implement the night-light treatments.

Agronomists Curt Thompson and John Holman evaluate winter survival of canola.

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Max Fogleman making a cross between two musk melon lines in the greenhouse.

Effects of iron applications on sorghum.

George Herron operates a soil testing instrument (Atomic Absorption Spectrophotometer).