

BRESSNER PASTURE

Previous & Progress Research Proceedings



2023



K-STATE
Research and Extension

SPONSORS OF THE EVENT



Your support is greatly appreciated

CONTENTS

History and Activities of the Bressner Research Unit	4
Studies Conducted at the Bressner Unit	5
In Memory	5
Stocker Steer Gains and Fly Numbers as Impacted by Burn Date and Type of Mineral	6
Vegetative Response to Time of Burning	10
Effect of Fall Grazing on Following Summer's Gains	12
Effect of Fall Grazing on Early Intensive Grazed Pastures: Plant Changes	14
The Effect of Grazing Systems on Steers Gain (½ vs ¾ grazing seasons)	16
The Effect of ½ vs ¾ Grazing Season on Grass Composition	17
Economics of Grazing Systems on Burned Native Grass Pasture Early 1990s and 2023 values	20
Evaluation of Two Implants for Steers on Early-Intensively Grazed Tallgrass Native Range	22
Patch-burning on Tallgrass Native Prairie	24
Effects of Late-Season Sheep Grazing Following Early-Season Steer Grazing on Sericea lespedeza	28
Goat Study on Bressner Pasture to Manage for Serecea lespedeza	30
Evaluation of Water Level Monitoring Equipment for Stock Tanks	32
Limited Access Ramps for Pond Watering of Cattle	34
Tire Tank Installation Guidelines	36
Surface Water Pumping Systems for Livestock Grazing	38
Spring Development	40
Erosion Reduction at the Bressner Pastures	41
Using Drones for Making Pasture Management Decisions	42
Weather Stations and Tools for Cattle Producers	44

ABBREVIATIONS

- ADG - average daily gain
- d - day
- lb - pound
- hd - head
- BW - body weight
- DM - dry matter
- ppm - parts per million
- IU - international units
- cwt - per hundred weight



****Brand names used in this publication are illustration purposes or were used directly in research.
This is not an endorsement of products.****

HISTORY AND ACTIVITIES OF THE BRESSNER RESEARCH UNIT

Dale Lanham

Joint efforts involving Kansas State University Foundation, KSU College of Agriculture and the Woodson County Extension Service have turned a 625- acre pasture gift into an agricultural research project.

The Bressner Range Project involves adjacent half-sections of native grass near Yates Center. The KSU Foundation received this land valued at \$128,000 through Willie J. Bressner's estate distribution in 1989.

This property was donated without restrictions but, Mr. Bressner requested that it be utilized as an experimental project to study the preservation and use of native grasses.

Bill Bressner spent his entire life on the farm where he was born. His love for the land and Hereford cattle was quite obvious. He was very careful not to over graze his pastures and his cattle never heard a harsh word nor saw a whip from him. His education was limited to the eighth grade, but he developed a great interest in grass management. For those who knew Mr. Bressner, he was an extremely early riser and went to bed very early also. It is through his generous gift to KSU that research has been conducted since 1990 on this pasture.

This research pasture would have never happened without the support of his attorney Clyde Hill. Mr. Hill was not only an attorney, but was elected to State House of Representatives in the mid-50's. He retired as chairman of the House Ways and Means Committee in 1974. Unfortunately, Mr. Hill passed away prior to our first field day. His wisdom and common sense is truly missed.

One group that has helped weigh and tag cattle or helped with the annual burning included a lot of my co-workers in Extension and many of them have retired. Those who have retired or changed jobs include: Chris Petty-Bourbon Co., Darren

Hibdon-Franklin Co., Marvin Fausett- Southeast Area Economist, Dave Kehler-Butler Co., Jeff Davidson-Greenwood Co., Jim Mengarelli Crawford Co., Josh Coltrain-Crawford Co., Keith Martin-Labette Co., Mike Holder-Chase Co., Dr. Karl Harbour-Southeast Area Livestock Specialist, Warren Bell-Coffey Co., Dr. Doug Shoup- Southeast Area Crop Specialist and Dr. Frank Brazle-Southeast Area Livestock Specialist, who's research knowledge has been extremely important to this committee. Those that are still working as agents include: Darl Henson-Coffey Co., Rob Schaub and Ryan Schaub both from Frontier District, Ben Sims - Greenwood Co., and Hunter Nickell and Chad Guthrie-Southwind Extension District. I apologize to anyone that I left off of my list. When we are busy working I don't take time to write names down, and my memory is getting shorter as I get older!

My brother, Eldon and nephew Scot Lanham also have helped me on many of these projects. Others who have helped: Jared McVey-Woodson County Noxious Weed Department, Woodson County Rural Fire Department, Terry Wells and his crew, John Johnson and crew from Wildlife and Parks, Michael Old and his crew, and Dennis Klick-deceased Noxious Weed Director.

Dr. Walt Fick has been doing the range inventories for many years.

Herschel George is the man responsible for most of the water projects that we have done on this pasture over the last several years. He keeps the solar panels and water pumps operating.

People that have furnished cattle for this pasture since 1989 include: Dick Pringle-deceased, Kimbell Ranch, Edgar Beecher-deceased, Hay-Capital Feeders, Eldon & Scot Lanham, Kenneth Laymond, Ronnie Reynolds, Eric Karmann, Michael Old, Lee Robbins and the last few years Hy-Plains Feedyard. We appreciate their great support.

Without Jaymelynn Farney these reports would just be paper to look at. She is the person who interprets the numbers to give us the final results. Did the spice mineral work? Did it make money for the additional investment? Did early March burning cost producers in cattle gains? This is why

STUDIES CONDUCTED AT THE BRESSNER UNIT

- 1990 - ½ vs ¾ season grazing with stockers (replicated 9 years)
- 1992 - Field Day
- 1998 - Field Day
- 2000 - Grazing during summer and fall grazing with stockers (replicated 5 years)
- 2005 - Field Day
- 2006 - Patch burn grazing (replicated 7 years)
- 2012 - Field Day
- 2013 - Grazing sheep after double stock grazing for *S. lespedeza* control (replicated 4 years)
- 2017 - Grazing implants evaluation
- 2018 - Essential oils for cattle gains and use as fly control
- 2019 - Timing of burning and addition of essential oils for cattle gains, pasture composition changes, and fly population control (replicated 5 years)

we do the research for at least 5 years, to help even out the major weather patterns. If you stop with one year of data, it is only a reflection of that year's information. Research takes time and replications. Kansas State University Foundation is the land owner and we greatly appreciate the opportunity to conduct research on this pasture.



IN MEMORY

- Ron Wells, rancher-cattlemen, who had an untimely accident that cut his life extremely short. He was always searching for additional knowledge, especially about native grass. Ron's son, Terry is currently on the committee.
- Albert (Speck) Mann, a true lover of Hereford cattle, always wanted to do research involving cows.
- Altis Ferree, jack of all trades was a livestock producer, hay producer, pipe and water tanks salesman as well as a good crop farmer. Grandson, Michael Old is now a member on the Bressner committee.

Their knowledge and stories of the cattle industry in Woodson County was educational and always highly entertaining!

Professor Gary Kilgore, retired Southeast Area Extension Specialist, passed on June 19, 2023. Gary spent many hours doing range inventories and was instrumental in designing the original pasture layout. He was very helpful in keeping our committee grounded on the research we were doing on this pasture. Gary's body was wearing out and he was confined to a wheel chair for his transportation, but his mind was still extremely sharp. He was determined that he was going to be at the Field Day in September to enjoy "his people". His knowledge and wisdom can never be replaced because of his practicality and his ability to communicate to all people.

STOCKER STEER GAINS AND FLY NUMBERS AS IMPACTED BY BURN DATE AND TYPE OF MINERAL

Jaymelynn K. Farney, Ellie Toothaker, Maci. E. Reeb, Megan Frahm, Harley Allen, Larissa Muniz, Emily Black, Kloey Rash, Haley Gillespie, and Noelle Collins

Introduction

Essential oils/spices have been offered as a potential method to control insects in cattle (Showler, 2017; Massariol et al., 2009), alter rumen microbial population (Elcoso et al., 2019), and replace feed antibiotics, all of which may improve production responses in beef as well as dairy cattle. In feedlot studies, cattle consuming a blend of essential oils had similar average daily gain, final body weight, gain to feed ratios, and carcass characteristics as steers fed monensin with or without tylosin (Araujo et al., 2019). Grazing stocker cattle on cool-season annual grass pasture or summer pasture did not show improvements in gains when cattle received a cinnamon and garlic essential oil product by either free-choice or hand-feeding (Beck et al., 2017). However, other studies at Kansas State University have found that feeding supplements of spices in mineral have increased gain in growing cattle on grass (Farney, 2020a; Farney, 2020b).

Burning pasture in April results in about 20 pounds more gain in grazing cattle than burning a pasture in March (Owensby, 2010). Smoke management plans are important for the state of Kansas as high smoke production in April creates smoky conditions that drift to large metropolitan areas. If weight gains and plant population changes are not too different when burning in March instead of April, earlier burning would provide the opportunity to develop a smoke management plan that allows for an increased burning season to dilute a single month's smoke.

The overall objective of this study is to evaluate management practices that may impact stocker steer gains on a 90-day double-stocking grazing system in tallgrass native range. Specific objectives are to evaluate the time of burning, and the inclusion of spices in the mineral supplement, and to determine whether the effects of both treatments are additive.

Experimental Procedures

The study was conducted at the Bressner Research unit in Yates Center, KS. The unit consists of eight pastures on 625 acres of tallgrass native prairie. Two management strategies were evaluated to determine effects on stocker steer gains in a 2 × 2 factorial arrangement. The two management strategies were timing of pasture burning and free-choice mineral supplementation. Within each management strategy there were two treatments being evaluated, thus a total of four treatments were applied to the cattle at the unit. The pasture burning management strategies evaluated were burning in March or burning in April. Table 1 shows the specifics of each year for the research project.

Table 2: Nutrient composition DM basis of mineral

Item	Control mineral	Spice mineral ¹
Crude protein, %	5.69	5.50
Calcium, %	16.67	16.17
Phosphorus, %	3.33	3.44
Salt, %	22.54	22.53
Magnesium, % ²	2.51	2.48
Potassium, %	0.89	0.88
Iron, ppm	5,546	5,529
Copper, ppm ³	1,153	1,153
Zinc, ppm	3,471	3,471
Manganese, ppm	1,817	1,818
Selenium, ppm	22	22
Iodine, ppm	333	333
Cobalt, ppm	13	13
Vitamin A, IU	141,667	141,667
Vitamin D, IU	14,167	14,167
Vitamin E, IU	172	172

1 Spice mineral with similar base as control mineral with the addition of 3 pounds per ton garlic oil and 18 pounds per ton of Solace (Wildcat Feeds Inc., Topeka, KS) that replaced dried distillers grains and limestone in control mineral.

2 Nuplex Mg/K (Nutech Biosciences Inc., Oneida, NY) contributed 25% of the magnesium in the minerals.

3 Nuplex 3-chelate blend (Nutech Biosciences Inc., Oneida, NY) contributed 25% of the copper, zinc, and manganese of the total trace mineral supplied in the minerals.

Table 1: Statistics about each years treatments and grazing plan

Year	March Burn Date	April Burn Date	Grazing Start	Grazing End	Grazing Days	Initial average wt, lbs	Final average wt, lbs	Total gain, lbs	Year ADG, lbs/d
2019	3/19	4/15	4/26	7/23	87	643	901	254	2.92
2020	3/27	4/9	4/23	7/16	83	612	818	207	2.43
2021	3/3	4/11	4/19	7/16	87	573	736	163	1.89
2022	3/15	4/15	4/21	7/20	89	566	797	231	2.56
2023	3/14	4/12	4/24	7/24	90	617	814	197	2.29

The free-choice mineral supplementation strategies consisted of: (1) free-choice complete mineral (CON) where 25% of magnesium (Nuplex Mg/K, Nutech Biosciences, Inc., Oneida, NY), copper, zinc, and manganese came from chelated organic sources (Nuplex Chelate-3 blend, Nutech Biosciences); and (2) the same base mineral with the addition of spices (SPICE). The spices included were powdered forms of oils from garlic and the product Solace (proprietary blend of four spices; Wildcat Feeds Inc., Topeka, KS). The mineral analysis is listed in Table 2. The minerals were formulated for a 4 ounce/head/day intake and were offered free choice. Every week, 125% of that week's formulated mineral consumption for each pasture was placed into feeders and weighed. Any remaining mineral from the previous week was also weighed.

Gain Measures

Two hundred eighty-one steers each year (average initial weight 566 lb) were weighed individually on in late April and assigned to pasture randomly based on order through the chute. Cattle were weighed at the end of the study in mid-July for 83-90 days of grazing.

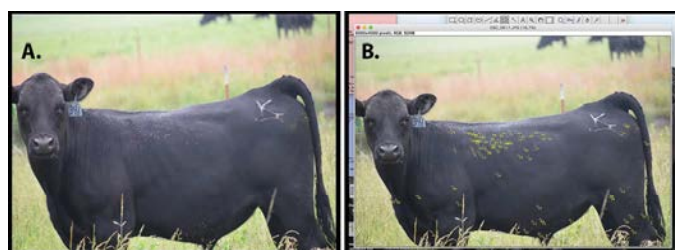


Figure 1. Illustration of the photos taken and fly count method. A. Original photo taken with Nikon camera with 300 mm zoom lens. B. Same image in ImageJ with flies highlighted in yellow.

Fly Counts and Hair Coat Score

Weekly, 33% of the steers in each pasture were photographed with a Nikon digital camera with a 300 mm zoom lens, with the photographer's back to the sun. The steers were photographed with their entire side filling the viewfinder. Then photos were processed with ImageJ and flies counted (Figure 1). Additionally, hair coat score was recorded from the photos with a score of 1–5, where a 1 was a 100% slick haired animal; 2 had 25% of body with long hair; 3 has 50% of body covered in long hair; 4 has 75% of body covered in long hair; and 5 is 100% long haired. Data collected included number of flies and hair coat scores for each week.

Results and Discussion

Performance of Steers

Averaged over the 5 years, the April-Spice treatment and the March-Control treatments had the greatest final weight, ADG, and grazing gains (Table 3). The April burned pastures where cattle grazed the control mineral had the lowest gains of all the combination of treatments. However, within year, there was quite a bit of variability of which combination of treatments resulted in the greatest ADG (Figure 2). Outside of 2020, within burn month, the Spice fed steers had an ADG advantage.

The year-to-year differences are explained to some degree by main difference effects due to burn date and subsequent moisture patterns. In 2019, April burned pastures resulted in the greater ADG; in 2022 and 2023 the March burn pastures had greater ADG; 2021 tended to have greater ADG in March burned pastures; and in 2020 no differences. In general, when there was early spring and summer rains,

Table 3: Results of combined burn date (March or April) and mineral type (Control or Spice) averaged over 5 years

Item ¹	March Control	March Spice	April Control	April Spice
Initial weight, lbs	604	607	600	600
Ending weight, lbs	819 ^a	817 ^a	798 ^b	818 ^a
Total gain, lbs	216 ^a	210 ^{ab}	198 ^b	218 ^a
ADG, lbs/d	2.48 ^a	2.41 ^{ab}	2.28 ^b	2.51 ^a

¹ abc Different superscripts within row indicate differences at P < 0.05

followed by extremely dry condition there was an advantage to March burning. For grazing seasons where the precipitation continued through the grazing period, there was no differences between in ADG. It was snowing at turnout in 2021 and overall, there was lower gains during that grazing year.

The spice mineral, averaged over the 5 years has resulted in 0.10 pounds increase in ADG (P = 0.03; Table 5) and that has been fairly consistent (2021 was the exception - overall low precipitation year and snowing at turnout, thus less overall forage produced).

Fly Counts

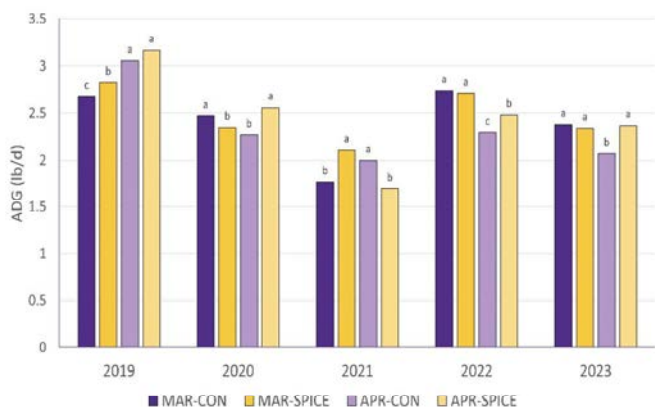
Flies increased through the summer (P < 0.001). There were no differences in fly numbers based on whether cattle consumed the mineral or based on pasture burn date (P > 0.10). There were some interactions of week x burn that were detected

(Figure 3). Overall, fly counts were greater towards the end of the grazing season with March burned pastures as compared to April burning.

Hair Score

The steers on the Spice mineral overall were slicker haired (hair score of 2.5 for Spice and 2.7 for Control). By 3 weeks on the mineral the Spice steers had shed faster than those on Control mineral.

Figure 2: Average daily gain by year, burn date, and mineral type



abc Different superscripts within year indicate differences in treatment (P < 0.05)
 - MAR-CON: March burn with Control mineral
 - MAR-SPICE: March burn and Spice mineral
 - APR-CON: April burn and Control Mineral
 - APR-SPICE: April burn and Spice mineral



Steers waiting to be weighed in pipe corrals at the unit

Table 4: Average Daily gain based on burn date

Year	March burn	April burn	P - value
2019	2.74	3.11	< 0.001
2020	2.40	2.41	0.75
2021	1.94	1.85	0.08
2022	2.70	2.40	0.01
2023	2.36	2.22	0.05
Average	2.43	2.40	0.75

Table 5: Average Daily gain based on mineral

Year	Control	Spice	P - value
2019	2.86	2.99	0.02
2020	2.37	2.45	0.04
2021	1.89	1.90	0.92
2022	2.52	2.60	0.12
2023	2.23	2.36	0.04
Average	2.37	2.46	0.03

Conclusions

Weather plays a large role in how stocker steers perform, and with the wide range of weather patterns, there was no overall difference in cattle gains when burning in March or in April. This can be beneficial when looking at managing for statewide smoke loads.

The Spice mineral results in 0.10 pounds more ADG in a double stock tallgrass native range system. There have been two other studies conducted on grazing calves (one on Bromegrass and one on tallgrass native range) and similarly have found a minimum of 0.10 lb increase in ADG. Over the 5 years of this study, the Spice/essential oil blend used cost \$0.02/head/day in a 4 ounce mineral (consumption of minerals were overall 18% higher, Figure 5). The true average cost of the minerals was \$0.0236 per head per day. Over a 90 day grazing season that is an increased cost of \$2.12/steer to feed the essential oils over plain mineral. On average the Spice fed steers gained 10 pounds

Figure 3: Average number of flies on one side of steer based on mineral and week (5-years)

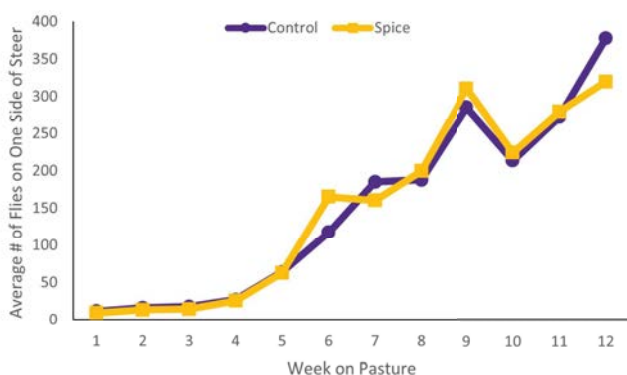
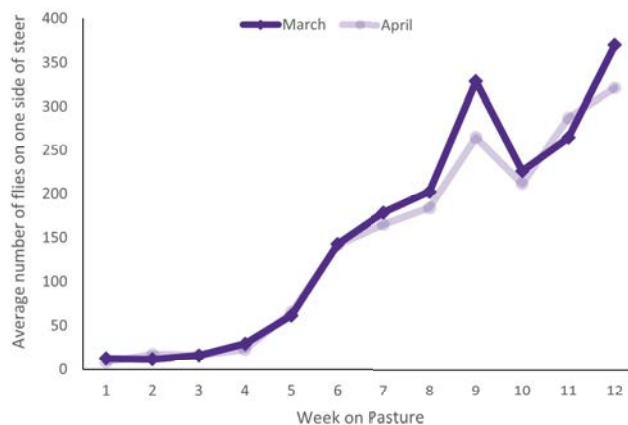
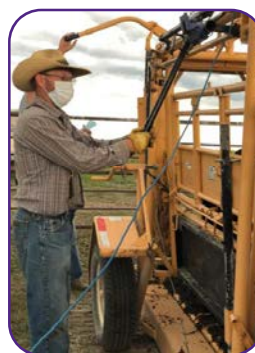


Figure 4: Average number of flies on one side of steer based on burn date and week (5-years)



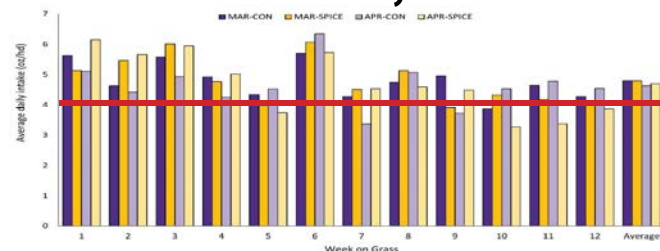
more over the 90 period. Using average feeder price over the study period (2019-2023) of \$152.94/cwt the Spice steers sold for \$15.29 more at sale. When subtracting the additional cost of the Spice in the mineral, the Spice mineral steers netted \$13.17 more.

Unfortunately, the essential oils fed and the amounts of the essential oils did not work as a method to control horn fly populations. Based on the published literature, ingestion of the essential oils have not worked to keep horn flies off of cattle. When using the essential oils as a spray, they do keep cattle freer of flies.



The agents, researchers, committee members and cattle owners still kept the project going during the COVID pandemic. Even while working cattle we maintained recommended guidelines for safety

Figure 5: Weekly average mineral intake for each burn x mineral over 5 years



Mineral was formulated for 4 ounce/head/day intake. Red line indicates formulated intake.

VEGETATIVE RESPONSE TO TIME OF BURNING

Walt H. Fick

Objective: To compare vegetation response to March and April burning.

Study Description: The study was conducted on the Bressner pastures from 2019 to 2023. Pastures 1-4 were burned each year, with an average date of March 16. Pastures 5-8 were burned in each year, with an average date of April 13. Burning was conducted prior to stocking with 550-pound animals from mid-April to mid-July using an intensive early stocking system (90 days) allowing 2 acres/head. A modified step-point method was used to collect 2 or 3, 100-point transects per pasture. The starting point of each transect was determined using GPS coordinates with about 10 feet between points. At each point, hits, closest plants, and the nearest forb or woody plant was recorded after a hit on a grass or the closest plant was a grass. Step-point sampling was conducted in the late summer/fall after the grazing period.

Results: Botanical composition varied from year to year in both the March (Table 1) and April (Table 2) burned pastures. Prior to starting the burning date

Table 3: Change in plant composition by treatment in Bressner pastures, 2018-2023

Species/Category	March Burn	April Burn	P-value
Big bluestem	0	+2.1	0.56
Indiangrass	+0.1	+2.1	0.32
Switchgrass	-2.9	+0.2	0.08
Little bluestem	0	0.3	0.88
Sideoats grama	+3.3	+1.0	0.47
Annual grasses	-12.1	-5.2	0.39
Sedge	+2.6	-4.4	0.12
Western ragweed	-0.8	0	0.74
Baldwin ironweed	-0.1	+0.5	0.30
Sericea lespedeza	+1.2	+0.2	0.43
Total forbs	+5.8	+5.4	0.98
<u>Total basal cover</u>	-0.7	-0.9	0.95

Table 1: Average percent plant composition during 2018 to 2023 on Bressner pastures 1-4 (March burn)

Category	2018	2019	2020	2021	2022	2023
Big bluestem	22.4	24.4	16.0	19.5	27.2	22.4
Indiangrass	5.5	2.2	3.0	5.2	2.2	5.6
Switchgrass	7.5	6.1	4.0	4.6	3.8	4.6
Little bluestem	12.1	11.5	11.1	8.4	9.9	12.1
Sideoats grama	1.8	1.6	1.7	3.7	2.2	5.1
Annual grasses	17.8	19.6	29.8	14.6	18.4	5.7
Sedge	8.8	12.6	8.1	13.8	12.0	11.4
Western ragweed	3.8	5.9	9.4	8.2	3.3	3.1
Baldwin ironweed	1.4	0.8	0.9	0.8	1.4	1.3
Sericea lespedeza	2.2	3.0	3.2	6.2	2.3	3.4
Total forbs	9.2	11.7	16.8	19.5	8.8	15.0
<u>Total basal cover</u>	10.2	9.9	10.3	8.2	7.1	9.5

study, the big 4 grasses (big bluestem, Indiangrass, switchgrass, and little bluestem) contributed over 47% of the basal cover in the pastures. The combined composition of these key species declined to about 34% in 2020 when annual grasses reached peak numbers. Total forbs and *Sericea lespedeza* reached maximum levels in 2021 in both March (Table 1) and April (Table 2) burned pastures.

Over the course of the study, few differences oc-

curred when comparing plant composition change between the March and April burning dates (Table 3). Switchgrass tended to decline with March burning ($p < 0.08$) and sedge tended to decline with April burning ($p < 0.12$). Total forbs are increasing similarly with both burning regimes.

The Bottom Line: Five years of burning in March or April changed plant composition very little at the Bressner pastures.



Drone photo of pastures 1 and 5. Left is April burn and right pasture is March burn. Photo taken 4/28/21.

Table 2: Average percent plant composition during 2018 to 2023 on Bressner pastures 5-8 (April burn)

Category	2018	2019	2020	2021	2022	2023
Big bluestem	27.4	25.6	16.8	23.8	29.8	29.5
Indiangrass	5.8	4.4	3.1	4.4	2.6	7.9
Switchgrass	8.0	8.5	6.9	5.4	9.7	8.2
Little bluestem	7.9	11.5	8.0	5.6	11.3	8.2
Sideoats grama	4.6	2.2	2.5	2.6	4.5	5.6
Annual grasses	12.6	19.4	33.5	31.5	22.6	7.4
Sedge	11.5	10.9	3.4	5.1	5.7	7.1
Western ragweed	4.2	3.8	4.3	5.7	3.6	4.2
Baldwin ironweed	1.0	0.9	0.8	0.6	1.1	1.5
<i>Sericea lespedeza</i>	2.2	2.4	2.5	5.0	1.5	2.4
Total forbs	10.2	8.8	9.0	13.0	7.2	15.6
Total basal cover	9.8	10.4	10.4	7.4	9.9	8.9

EFFECT OF FALL GRAZING ON FOLLOWING SUMMER'S GAINS

Frank Brazle, Dale Lanham, and Twig Marston

Introduction

Many Flint Hills stocker operations utilize Intensive Early Stocking management. This management scheme grazes native-grass pastures with stocker cattle during the first months of summer (late April to mid-July) and takes advantage of high quality forage growth. After cattle are removed from pastures, the grass plants are allowed to rest, complete their life cycles, and establish carbohydrate reserves. Oftentimes weather conditions will allow abundant plant regrowth during the last half of the summer. During late summer, the plant matures and its nutritive value declines. Many cattle producers would like to graze this low-quality forage if no harm would be done to the desirable pasture grasses or the next year's cattle performance.

Typically, the cattle used to graze this dormant native grass would be calves started in the fall, cows, and/or yearlings. Fall grazing has the potential to reduce the amount and cost associated with feeding mechanically harvested forages. However, concerns about animal performance and range conditions persist. With these facts in mind, the objective of this study was to determine if fall grazing following intensive early stocking would have an effect on the subsequent summer stocker cattle gains.

Material and Methods

Eight native grass pastures located near Yates Center, Kansas were randomly allotted to treatments. Treatments consisted of: 1) stocker cattle grazed following the guidelines of a normal Intensive Early Stocking program, or 2) stocker cattle grazed following the same guidelines as Treatment 1 plus pastures were grazed in the fall. The intended outcome of treatment 2 was to have about 800 lb of forage per acre left after fall grazing for spring pasture burning. Therefore, the methods used to determine stocking rate for fall grazing on native grass were as follows:

$$\text{Lb of D.M. of available forage/acre} - 800 \text{ lb} = \text{Lb of forage} \times .33 = (\text{harvest efficiency}) = \text{Lb of forage to be consumed by cattle/acre}$$

$$\text{Stocking rate} = \text{acres} \times \text{Lb of forage consumed} + 2\% \text{ of body weight of cattle} \times \text{days} = \text{number of cattle/pasture}$$

Example: 80 acre pasture with 1,100 lb of available forage per acre to be grazed by 500 lb steers for 60 days (October 1 to December 1).

$$1,100 \text{ lb} - 800 = 300 \text{ lb} \times .33 = 99 \text{ lb available forage for consumption}$$

$$\text{Available forage} = 80 \text{ acres} \times 99 \text{ lb} = 7,920 \text{ lb}$$

$$\text{Predicted animal consumption} = 500 \text{ lb} \times 2\% = 10 \text{ lb} \times 60 \text{ days} = 600 \text{ lb/head}$$

$$\text{Stocking rate} = 7,920 + 600 = 13 \text{ head per 80 acres (500 lb steers for 60 days)}$$

The fall grazing periods varied from 44 to 67 days and were completed in October and November. Fall grazing was accomplished in years 2001, 2002, 2003, and 2004 with 500 to 600 lb steers or heifers. Fall-grazing cattle were supplemented with 5 lb of corn gluten feed/head/day. The following spring, each pasture was stocked by predicting the AUM carrying capacity of the individual pastures.

Summer Grazing pastures Stocking Rates

The pastures were grazed with 500 to 600 lb steers for the summers of 2001, 2002, 2003, 2004, and 2005. For years 2001 to 2004, the 625 acres (8 pastures) were stocked with 313 hd steers (500 - 600 lb) and grazed from April 22 to July 15 (84 days) resulting in an average stocking rate of one steer per 1.99 acres.

Results

During the summer grazing period there was no difference in average daily gain regardless of whether pastures were grazed in the fall or not (Table 1). When steers were supplemented with 5

lb of corn gluten feed per head per day during the fall grazing period, the steers gained between 1.36 to 1.44 lb/d (Table 2). It appears from these data that cattle producers can take advantage of fall grazing to increase the production of beef per acre of pasture without compromising normal summer animal performance.

Summary

Native grass can be fall grazed (in October and November) following normal half-season grazed pasture (Intensive Early Stocking) when regrowth occurs without negative impact on the following year's summer animal performance. However, guidelines must be used in determining fall grazing stocking rates to ensure desired amount of grass so that native grass pastures can be burned in the spring.

Table 1: Summer stocker cattle performance

	Fall+ summer grazing	Summer grazing only	P- value
Starting wt, lb	544	543	
Ending wt, lb	769	770	0.67
ADG, lb	2.77	2.79	0.67

***This summary was originally printed in the 2005 proceeding meeting of the Bressner pasture. It is has been reformatted the type and style of the current proceedings report ***

Table 2: Summary of the fall grazing periods

	Year				
	2000	2001	2002	2003	2004
No. of cattle	74	62	74	77	91
No. of grazing days	62	55	67	52	44
Starting wt, lb	512	541	599	564	534
ADG, lb/d	1.41	1.44	1.39	1.47	1.36



Storm rolling in over the Bressner Pasture

EFFECT OF FALL GRAZING ON EARLY INTENSIVE GRAZED PASTURES: PLANT CHANGES

Gary L. Kilgore

Introduction

The effect of any grazing system on plant growth is very important. Ranchers wish to maximize animal performance and not reduce the composition or production of the grazed unit. So animals must be stocked with the number of animals based upon unit size, animal size, grass production, and length of grazing system.

Material and Methods

This study, conducted on the Bressner pasture, 2001 - 2004, involved stocking all 8 pastures with yearling steers from late April to July 15 (Early Intensive Grazing System). Four pastures were then restocked with yearlings each fall and grazed from 44 - 67 days completed in late October or November. The method to determine fall stocking rate is discussed in the preceding report by Dr. Frank Brazle. It had previously been determined that 800 pounds of forage dry matter per acre must be left after fall grazing to have enough fuel for a complete spring burn. This stocking rate calculation is very important for this study. One could stock too heavy and not get a complete burn the following spring. That would affect how cattle grazed and distribution of grazing the next year.

The amount of forage dry matter was determined by measurements in each pasture in early September of each year. Calculations were made and animals stocked accordingly each fall.

Range plant composition data was taken before the grazing trial began and again in June, 2005. The Step Point method was used to determine plant frequency in the clay upland range sites in each pasture. Over 1,000 points were used to evaluate plant makeup.

All data is presented in Tables 1, 2, and 3.

Results

1. Stocking rate calculations proved accurate to provide forage for fall grazing and have enough fuel left for successful spring burn.
2. Fall grazing did not result in lower grass production the following year.
3. Total perennial grass composition did not change during the trial on the fall grazed pastures. However, there was a 3.9% increase in plant numbers in pastures not fall grazed.
4. Total perennial forbs increased by 1.1% in the fall grazed pastures and decreased 4.3% in the pastures not fall grazed.
5. Big bluestem grass decreased in 3 of the 4 pastures fall grazed. But switchgrass increased in all 8 pastures.
6. Pasture number 6 showed a 2.7% increase in perennial forbs (goldenrod and ironweed) when fall grazed. The other fall grazed pastures 1, 3, and 8 showed very little change.
7. There was some difference between pastures with same grazing treatment, but when averaged by grazing treatment, very little change in plant composition occurred.
8. Based upon this research and all the methods and materials used in this study, results indicate that ranchers in this region of Kansas can double-stock their pastures and follow up with limited fall grazing and not damage their rangeland.
9. However, guidelines must be used in determining fall stocking rates to ensure that the desired amount of fuel (native grass) is present for a successful burn the following spring.

***This summary was originally printed in the 2005 proceeding meeting of the Bressner pasture. It is has been reformatted the type and style of the current proceedings report ***

Table 1: Range plant inventory, Bressner Pasture, 1998 and 2005 (%)

Year	Pasture Number															
	1*1		2		3*		4		5		6*		7		8*	
	98	05	98	05	98	05	98	05	98	05	98	05	98	05	98	05
Big Bluestem	33	36	32	38	45	40	38	38	40	45	37	29	40	43	49	39
Little Bluestem	19	14	16	11	11	12	20	14	17	14	18	15	16	19	8	10
Indiangrass	9	13	22	21	8	14	17	20	20	18	25	21	13	10	14	24
Switchgrass	29	31	14	17	18	20	13	19	10	12	8	16	8	10	13	20
Side Oats Grama	1	0	2	0.02	2	4	1	0	2	1	1	1	5	5	2	0
Sedges	2	0	1	.009	4	3	2	1	2	0	4	4	2	4	5	2
Total Perennial Grass	93	94	89	87	85	93	90	82	90	90	91	86	85	91	88	95
Total Perennial Forbs	3.1	2.9	6.8	0.9	7.5	3.4	3.0	2.0	6.4	5.0	3.6	9.5	8.7	5.0	1.0	2.0
Total Annual Forbs	1.8	1.0	1.8	1.0	3.6	1.5	4.5	1.5	1.6	2.0	1.8	2.4	3.8	2.1	4.5	3.9
% Basal Cover																
Perennial Grass	18.4	23	16.1	18	27.6	25.1	20.2	21.0	17.7	19.4	21.2	18.1	18.6	18.0	18.1	19.1
Perennial Forbs	1.1	1.0	0.7	1.0	2.2	2.0	0.5	0.1	1.6	2.0	0.6	3.3	8.7	4.1	1.0	2.4

1 * Fall grazed, in addition to spring grazing

Table 2: Change in percentage composition - 1998 to 2005

Plant	Pasture Number							
	1*1	2	3*	4	5	6*	7	8
	Change in %							
Big Bluestem	3	6	-5	0	5	-8	3	-10
Little Bluestem	-5	-5	1	-6	-3	-3	3	2
Indiangrass	4	-1	6	3	-2	-4	-3	10
Switchgrass	4	3	2	6	2	8	2	7
Side Oats Grama	-1	-1	2	-1	-1	0	0	-2
Total Perennial Grass	1	-2	8	2	0	-5	6	7
Total Perennial Forbs	-0.2	-5.9	-4.1	-1.0	-1.4	5.9	-3.7	1
% Basal Cover Change								
Perennial Grass	4.6	2	-2.5	0.8	1.7	-3.1	-0.6	1.0
Perennial Forbs	-0.1	0.3	-0.2	-0.4	0.4	2.7	-4.6	1.4

1 * Fall grazed in addition to spring grazing

Table 3: Effect of grazing system in grass change, 1998-2005

Pasture #	Total Perennial Grass	Total Perennial Forbs	Pasture #	Total Perennial Grass	Total Perennial Forbs
Fall grazed			Not Fall Graz		
1	4.6	-0.1	2	2.0	0.3
3	-2.5	-0.2	4	0.8	-0.4
6	-3.1	2.7	5	1.7	0.4
8	1.0	1.4	7	-0.6	-4.6
Average	0.0	1.1	Average	3.9	-4.3

THE EFFECT OF GRAZING SYSTEMS ON STEERS GAIN (1/2 VS 3/4 GRAZING SEASONS)

Frank K. Brazle

Material and Methods

The Bressner Pasture consists of 625 acres of native grass. In 1990, the acreage was divided into eight pastures of about 75 - 80 acres. The pastures' carrying capacity was determined by calculating the A.U.M. (Animal Unit Month) of grazing. In the Flint Hills the average native grass pasture provides about one AUM per acre. It was decided that a comparison of 1/2 season grazing with 3/4 season grazing was needed. The pastures were burned every year except 1996 when only the east pastures were burned. The west pastures were not burned because of dry conditions and the possibility of not being able to control the fire.

Average statistics for the 9 years of data:

1/2 Season

- Starting dates - April 20 - 29
- Ending dates - July 15 or 16 - average 81 days
- Stocking rate - One steer (500 - 600 lb) per 2 A.U.M. (This should be comparable to Flint Hills stocking rate of 1 steer/2 acres)

3/4 Season

- Starting dates - April 20 - 29
- Ending dates - August 15 or 16 - average 112 days
- Stocking rate - One steer (500 - 600 lb) per 3 A.U.M.

The stocking rate was adjusted once after 4 years from 241 head to 261 head because of improved range conditions.

The steers were weighed individually at the start and end of the grazing period. The steers normally were mixed breed, yearling steers that were thin in condition (English-Exotic cross with less than 1/4 Brahman blood). The pasture study was conducted from 1990 through 1998.

The steers were handled like most steers in the Flint Hill vicinity: dewormed, deloused, and implanted. A feed additive (Rumensin, Aureomycin, etc.) was added to mineral mixtures most years.

Results

The nine-year average showed 81% of the steers' gain occurred in the 1/2 season grazing systems compared to the 3/4 season grazing systems.

The best average daily gain occurred for steers grazing to July 15; but because of a longer grazing period, the most total gain per steer occurred in the 3/4 season grazing period.

Results by Shade

The two pastures to the east and two pastures to the west are almost free of trees with the four middle pastures having all the trees by the creek. Therefore, the question that arises is: Is a lot of shade needed for improving gain of grazing cattle?

The nine years (pooled across treatment) showed gains of 2.63 lb/d for four pastures with almost no trees compared to 2.62 lb/d for four pastures with a lot of trees for shade. Therefore, a lot of shade is not needed for cattle grazing native grass pastures in the Flint Hills.

Table 1: Summary of 9 years of grazing data

Items ¹	1/2 Season	3/4 Season
Steer, No.	915	1,354
Starting wt, lbs	562	562
ADG, lbs	2.78 ^a	2.48 ^b
Days	81	112
Gain/animal, lbs	225 ^b	278 ^a

¹ ^{ab} Unlike superscripts are different ($P < 0.001$)

THE EFFECT OF 1/2 VS 3/4 GRAZING SEASON ON GRASS COMPOSITION

Gary L. Kilgore

Material and Methods

Actual plant inventories were taken in June 1990, 1994 and 1998. We used the step point method and 300-400 points were taken on the clay upland range sites in each pasture at each inventory date. Specifics of stocking rates and the grazing days are reported by Brazle (pg 16).

Results

The data in Table 1 shows the actual percent composition of the major plants in each pasture taken at the start of the study in 1990, half way through in 1994 and at the end in 1998.

Table 2 shows the actual changes that occurred in each pasture during the grazing trial. Six of the eight pastures had an increase in Big bluestem. Five of the eight pastures showed a reduction in Little bluestem. Only two pastures showed a decrease in Indiangrass and four pastures showed a decrease in Switchgrass. Perennial forbs increased slightly in all pastures. One must note the tremendous increase of the perennial grasses in basal cover in all pastures. This indicates super grass health was present and grass increased in ground cover in all grazing treatments.

Table 3 presents the grass data as affected by grazing system.

During the eight years, the two grazing system resulted in maintaining the excellent range condition that existed at the start of the trial. Yes, Big bluestem actually increased in percent composition and Little bluestem decreased in both systems. Indiangrass increased greater in the 3/4 season system. Switchgrass held its own. There was no significant change in total perennial grasses in either system. However, there was a greater increase in percent basal cover in the pastures under the 1/2 season system than those pastures in the 3/4 season system.

Other Important Considerations

The following comments must be made, based upon other data collected during the trial.

1. Six years out of eight, considerable spot grazing occurred in the 3/4 season system. Had the pastures not be burned each year, considerable differences would have occurred. Burning "evened up" the pastures each spring and spot grazing did not occur in the same place each year. Had that happened, parts of the 3/4 system pastures would have been severely over grazed. Spot grazing did not occur in the 1/2 season system.
2. Clipping data showed that in five out of eight years almost no regrowth occurred after August 15. During the eight years, only 350 pounds of dry matter per acre per year was produced after cattle were removed on August 15. The 1/2 season pastures always showed an increase in dry matter between July 15 and frost. Over the eight years that system resulted in 1,100 pounds of dry matter production per acre per year after the cattle were removed.

Table 3: Effect of grazing system in grass change, 1900-1998

Plant ¹	1/2	3/4
	season	season
Change in %		
Big Bluestem	7	6
Little Bluestem	-5	-3
Indiangrass	9 ^a	4 ^b
Switchgrass	0	2
Side Oats Grama	4 ^a	-0.6 ^b
Total Perennial Grass	0	1.3
Total Perennial Forbs	2.4	2.0
% Basal Cover Change		
Perennial Grass	14.7 ^a	11.5 ^b
Perennial Forbs	1.0 ^b	2.7 ^a

¹ Different superscripts within row indicate difference at P < 0.05

Summary

The data gathered from 1990-1998 at the Bressner Pasture indicates that:

1. One-half or $\frac{3}{4}$ season grazing system did not reduce grass composition.
2. Big bluestem increased under both grazing systems but no significant difference between the systems.
3. Little bluestem decreased under both systems of grazing but no significant difference between systems.
4. Indiangrass increased under both systems and ended the study with a significant increase in the $\frac{1}{2}$ season grazing system.
5. Switchgrass did not change in either grazing system.
6. Side oats grama was reduced in both systems and was significantly reduced under the $\frac{1}{2}$ season system.
7. Total amount of perennial grass and perennial forbs increased under both systems but was not significant between the two systems.
8. Perennial grass increased in basal cover under both systems and was significantly greater in the $\frac{1}{2}$ season grazing system.
9. Perennial forbs increased in basal cover with both systems but was significantly higher under the $\frac{3}{4}$ season grazing system.
10. Annual burning is a must to reduce spot grazing,

improve animal performance and reduce brush and annual weed growth.

11. It is the opinion of the author that a $\frac{3}{4}$ season should not be used every year on the same pasture.
12. Would suggest only one or two years of $\frac{3}{4}$ season followed by two years of $\frac{1}{2}$ season grazing system. That combined with annual burn in mid-April should result in improvement in about any native rangeland in the Flint Hills area.

The $\frac{1}{2}$ season system is the best way to improve a rangeland. The $\frac{3}{4}$ season would allow the rancher to produce heavier cattle if the market desired that situation. Do not over stock either season grazing system. Continuation over several years would reduce plant productiveness. However, considerable more damage to the grass stand would occur if one overstocked the $\frac{3}{4}$ system because that grazing pressure would last until August 15. A July 15 takeout gives the rangeland plants an additional 30 days to recover before frost.

***This summary was originally printed in the 1998 proceeding meeting of the Bressner pasture. It is has been reformatted the type and style of the current proceedings report ***

Table 2: Change in percentage composition - 1990 to 1998

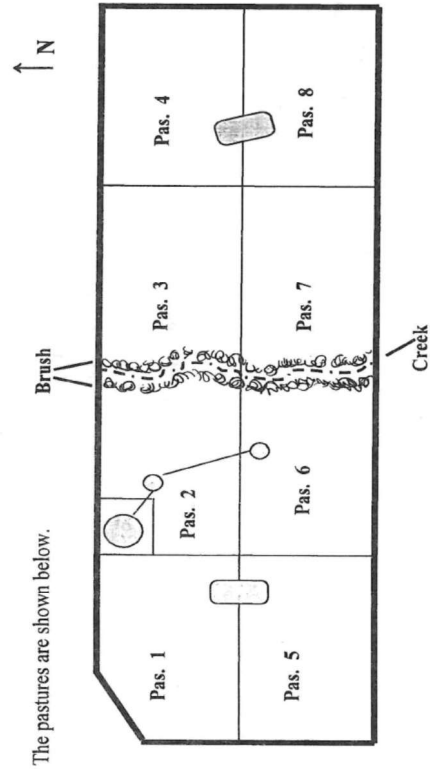
Plant ¹	Pasture Number							
	1	2	3*	4*	5*	6*	7	8
	Change in %							
Big Bluestem	7	-1	20	-8	2	14	2	15
Little Bluestem	-5	5	-6	3	-6	-9	1	-12
Indiangrass	-4	13	-4	6	12	18	2	3
Switchgrass	9	-8	4	2	0	-6	-5	-2
Side Oats Grama	0.7	-4	-6	-2	-2	-7	0	1
Total Perennial Grass	7	3	-3	-1	0	4	-1	-4
Total Perennial Forbs	1.4	1.5	3.6	1.1	3.9	1.0	4.6	0.4
	% Basal Cover Change							
Perennial Grass	12.9	10.1	16.7	12.5	13.0	16.9	10.1	12.8
Perennial Forbs	1.0	0.3	1.7	0.3	1.5	0.5	8.3	1.0

¹ Half season grazed pastures (3,4,5,6). Three quarter grazed pastures 1,2,7,8

Table 1: Range plant inventory, Bressner Pasture, 1998 and 2005 (% composition)

	Pasture Number ¹																							
	1		2		3*		4*		5*		6*		7		8									
Year	90	94	98	90	94	98	90	94	98	90	94	98	90	94	98	90	94	98	90	94	98			
Big Bluestem	26	29	33	33	31	32	25	30	45	44	36	38	38	36	40	23	29	37	38	36	40	34	24	49
Little Bluestem	24	21	19	11	23	16	17	28	11	17	24	20	23	20	17	27	21	18	15	31	16	20	23	8
Indiangrass	13	12	9	9	8	22	12	12	8	11	23	17	8	18	20	7	13	25	11	9	13	11	20	14
Switchgrass	18	25	29	22	17	14	14	14	18	11	8	13	10	14	10	14	16	8	13	11	8	15	14	13
Side Oats Grama	0.3	0	1	6	3	2	8	4	2	3	0	1	4	3	2	8	0	1	5	1	5	1	0	2
Sedges	-	7	2	-	6	1	-	5	4	-	2	2	-	4	2	-	8	4	-	5	2	-	8	5
Total Perennial Grass	88	87	93	86	86	89	88	88	85	91	94	90	90	90	90	87	85	91	86	88	85	92	87	88
Total Perennial Forbs	1.7	1.6	3.1	5.3	5.1	6.8	3.9	1.4	7.5	1.9	0.6	3.0	2.5	4.8	6.4	2.6	6.3	3.6	4.1	2.9	8.7	0.6	0.6	1.0
Total Annual Forbs	-	2	1.8	-	1.7	1.8	-	2.8	3.6	-	2.4	4.5	-	1.0	1.6	-	1.9	1.8	-	3.0	3.8	-	5.0	4.5
% Basal Cover																								
Perennial Grass	5.5	8.3	18.4	6.0	8.9	16.1	10.9	10.1	27.6	7.7	6.6	20.2	4.7	7.5	17.7	4.3	6.8	21.2	8.5	7.5	18.6	5.3	6.3	18.1
Perennial Forbs	0.1	0.1	1.1	0.4	0.1	0.7	0.5	0.0	2.2	0.2	0.0	0.5	0.1	0.0	1.6	0.1	0.0	0.6	0.4	0.2	8.7	0.0	0.0	1.0

¹ Half season grazed pastures (3,4,5,6). Three quarter grazed pastures 1,2,7,8



The illustration shows the pasture layout as published in the 1998 Field Day report

ECONOMICS OF GRAZING SYSTEMS ON BURNED NATIVE GRASS PASTURE EARLY 1990S AND 2023 VALUES

Marvin F. Fausett, Frank K. Brazle, and Dale E. Blasi

The Bressner pasture research project was designed to evaluate the livestock, agronomic and economic impact of two grazing systems. The grazing systems being evaluated are: stock at two acres per head, graze to July 15; and stock at three acres per head, graze to August 15. This paper evaluates the short run economic impact of the two systems. The livestock and agronomic results are presented in other papers in this proceeding (Brazle, pg 16). The long run economic consequences will depend on the long run agronomic effects of the systems.

The economic impact depends on the gain, the value of gain, and the cost of gain for each system. Table 1 summarizes the livestock data for the three years that was used in both sets of economic analysis.

Cost factors for 1990s and 2023 years are shown in Table 2. Grass costs were determined using the Bluestem Pasture reports. Cost and returns are summarized in Table 3 for both years of analysis.

Table 1: Performance statistics for treatments used in economics

Stocking rates	2 acres/ steers	3 acres/ steer
Grazing days	82	113
Date off pasture	July 15	August 15
Initial wt, lbs	582	588
ADG, lbs/d	2.97	2.53
Total gain, lbs	244	286
Ending wt, lbs	826	874
Pay-weight gain ¹	227	269
Ending Pay-weight	809	857

¹ 2% shrink on ending weight to determine pay-weight values

Table 3: Cost and Returns for 1990s and 2023

Sell date	1990		2023	
	July 15	Aug 15	July 15	Aug 15
Sale price ¹	\$642.67	\$676.40	\$1,706.99	\$1799.70
Initial purchase price ²	\$510.42	\$515.73	\$1,362	\$1,376
Value of gain	\$132.20	\$162.67		
Cost/hd ³	\$82.25	\$101.23	\$200.17	\$249.86
Return/hd	\$49.95	\$61.44	\$144.81	\$173.84
No. head/625 acres ⁴	312	208	312	208
Total return/625 acres	\$15,584	\$12,780	\$45,180	\$36,158
Return per acre	\$24.98	\$20.48	\$72.40	\$57.94

¹ For 2023 year \$211/cwt for July calves and \$210/cwt for August calves. For 1990 year sale values prices for 801 to 825 pound steers in July averaged \$81.69, and prices for 851 to 875 pound steers in August averaged \$81.41 for 5 years from 1987 to 1991

² Average purchase price in April 1990 was \$89.96/cwt. Average purchase price in April for 1990 was \$234/cwt.

³ From Table 2

⁴ July sale date is ½ season grazing with 2 acres/calf. The August sale date is ¾ season with 3 acres/calf.

Conclusion: For the cattleman who owns the land and the cattle, the most profitable system would have been the two acre per steer short season grazing system (aka ½ grazing season). This system provides the better return per acre. However,

for the cattleman who rents pasture, the most profitable system would have been the three acre per steer mid-season system (ie ¾ grazing season) and renting additional pasture to handle the same number of head as the short season system.

Table 2: Production costs for 1990s and 2023

Sell date	1990		2023	
	July 15	Aug 15	July 15	Aug 15
Grass ¹	\$27.00	\$40.50	\$108.00	\$148.00
Care ²	\$8.00	\$8.00		
Start Up ³	\$33.00	\$33.00	\$60.00	\$60.00
Mineral ⁴	\$4.28	\$5.85	\$7.55	\$10.40
Interest ⁵	\$9.97	\$13.88	\$24.62	\$31.46
Total cost/hd	\$82.25	\$101.23	\$200.17	\$249.86
Cost of gain, per cwt	\$36.23	\$37.63	\$88.18	\$92.88

1 Grass values are based on Bluestem Pasture reports. Kansas Ag Statistics

2 Grass plus care values are reported for 2023 year as one cost

3 Start-up costs include 450 lbs. of hay, 60 pounds of starter feed, veterinary, drugs, and supplies, death loss at 1.5%, trucking, and 0.2 hours of labor. Each years analysis was based on current prices for that given year using these specifics

4 Mineral cost for 1990s was \$450/ton. Mineral cost for 2023 was \$800/ton

5 1990s interest rate was 9%. 2023 interest rate was 6%



Loadout day in 2020

EVALUATION OF TWO IMPLANTS FOR STEERS ON EARLY-INTENSIVELY GRAZED TALLGRASS NATIVE RANGE

Jaymelynn K. Farney and Mark E. Corrigan

Introduction

Growth promoting steroids in the form of an implant can increase average daily gain by 5% in suckling calves and 14% in stocker cattle (Reinhardt and Thompson, 2016). Implants have been approved for usage since the 1950s. Most approved implants utilize a carrier that results in a biphasic payout pattern of hormone, where there is a rapid spike in blood hormone concentrations in a few days after administration of the implant that slowly dissipates over a period of several months. This pattern is seen when using implants such as Revalor-G (Merck Animal Health, Madison, NJ) that utilize cholesterol as their carrier. In the case of Synovex One Grass (Zoetis, Inc., Kalamazoo, WI), a porous polymer coating is used in the implant which extends the payout period of the implant up to 200 days.

Given the short duration of the grazing period associated with a 90 day intensive early season grazing system and the declining grass quality at the end of the grazing period, implant payout pattern may impact performance response. The objective of the study was to evaluate stocker cattle gains on intensive early double stocked native tall-grass prairie between two implants that have different lengths of effective use. The test hypothesis is that a quicker release of hormone from Revalor-G will result in greater gains early in the season, with no difference in gains between implants overall.

Experimental Procedures:

Stocker steers that were 71% black hided ($n = 281$) were purchased from auctions, vaccinated for respiratory pathogens (Bovi-Shield Gold One Shot, Zoetis Inc., Kalamazoo, MI) and wormed with an oral (Valbazen, Zoetis Inc.) and an injectable dewormer (Dectomax, Zoetis Inc.). Steers were weighed individually using electronic scales at the start, mid-point, and end of the 2017 summer grazing period after an overnight shrink on April 24, June

7, and July 24. Steers were randomly assigned to be implanted with Revalor-G or Synovex One Grass and assigned to a pasture with an equal number of calves receiving each of the implants within the pasture. The number of head in each pasture was different so as to stock appropriately for available biomass. The steers were pastured at the Bressner Research Range Unit near Yates Center, KS. The Bressner Unit was divided into eight individual pastures (approximately 79 acres each), with four pastures on the north side and four pastures on the south side. Pastures were burned April 5, 2017.

One pasture of calves were removed from the analysis ($n = 38$) due to inaccurate final weights as a result of excessive shrink associated with a water tank malfunction within 2 days of weighing. Within the Revalor-G treatment, one calf died while on pasture and one calf was not weighed on the final date because he escaped into a neighboring pasture. Therefore, 242 weights were analyzed for the intermediate time point and 241 weights recorded at the end of the study were used in analysis.

Results and Discussion

No differences ($P > 0.05$) were observed between Revalor-G and Synovex One Grass for season-long average daily gain and total body weight gain (Table 1). Average daily gain and body weight gains were not different ($P > 0.05$) between implants from the beginning of the trial through the mid-point or from the mid-point until the end of grazing. In addition, steer weights were not different ($P > 0.05$) at weigh dates (Table 1).

The implant cost spread out over gain advantage goes to the Revalor-G treatment. Based on 2017 pricing, the actual purchase price was \$1.39 per dose for Revalor-G while Synovex One Grass was \$4.95 per dose. Since body weight gains were similar for each implant treatment, the cost of gain was less with the Revalor-G implant. Some payout

likely remained on the Synovex One Grass implant and could be utilized prior to marketing cattle, but is a loss to the stocker cattle enterprise.

Forage quality affects implant weight gain responses, with higher quality forages providing a greater response. As summarized in a stocker calf implant review, other studies in Kansas tall-grass prairie rarely find differences in steer performance between implants, but do result in increased gains above non-implanted (Kuhl, 1997). Nutritional quality of cool season C3 grasses is generally assumed to be greater than warm season C4 grasses as C3 grasses have greater nonstructural carbohydrates and protein with less fiber. In a review of the literature, differences in cattle gain based on type of implant occurred more frequently in longer duration grazing studies and in cool season grasses.

Implications

Steers implanted with Revalor-G or Synovex One Grass performed the same for average daily gain and total body weight gain in an early intensive double-stocked grazing system utilized on native Flint Hills pastures.

Literature cited:

- Kuhl, G. L. 1997. Stocker cattle responses to implants. Proceedings Implant Symposium, Stillwater, OK, July. Accessed May 21, 2018. http://beefextension.com/proceedings/implant_97/97-8.pdf.
- Reinhardt, C. D., and D. U. Thomson. 2016. Growth promotant implants in suckling calves and stocker cattle: mode of action, performance response, and practical recommendations. *Bov. Pract.* 50: 40-46. doi: 10.1016/j.cvfa.2007.03.004.



Undergraduate student Macie Reeb weighing cattle at the unit

Table 1: Stocker steer weights and gains at the start, mid-point, and end of study while grazing intensive early double stocked native tallgrass prairie after being implanted with two implants

Item	Revalor-G ¹	Synovex One Grass ²	P - value
<i>Season long grazing</i>			
Initial weight (day 0), lb	554	567	0.10
Mid-point weight (day 44), lb	666	666	0.42
Final weight (day 91), lb	781	782	0.77
Average daily gain, lb	2.6	2.5	0.35
Body weight gain, lb	223	221	0.65
<i>Gain from beginning of grazing through mid-point (day 0-44)</i>			
Average daily gain, lb	2.5	2.6	0.45
Body weight gain, lb	106	108	0.58
<i>Gain from mid-point through end of grazing period (day 45 – 91)</i>			
Average daily gain, lb	2.6	2.5	0.47
Body weight gain, lb	119	115	0.48

1 Merck Animal Health (Madison, NJ) implant treatment
 2 Zoetis, Inc. (Kalamazoo, WI) implant treatment

PATCH-BURNING ON TALLGRASS NATIVE PRAIRIE

Jaymelynn K. Farney, Cade B. Rensink, Walt H. Fick, Doug Shoup, and George A. Miliken

Abstract

The purpose of this study was to determine stocker BW gain on patch-burned native tall-grass prairie while also determining plant species influenced by fire. The study was conducted in a split-block experimental design where treatments consisted of a yearly spring burn on the pastures (CON) or patch-burning of 1/3 pasture per yr (PB). Stocker steers grazed the pastures using a three-quarter season (~114 d) grazing period from about mid-April to mid-August from the yrs 2006-2012. Steer ADG, final weight, and total BW gain was not different by treatment ($P > 0.35$). However, when comparing treatment effects with precipitation classification (HIGH, AVE, LOW) cattle on PB had a greater ADG ($P = 0.02$; 0.10 kg/d), final weight ($P = 0.07$, 12 kg), and total BW gain ($P = 0.02$; 11.8 kg) in LOW precipitation yrs (2011 and 2012). Overall patch-burning provides similar BW gains as yearly burning on native tall-grass prairie, while providing a BW gain advantage in low precipitation yrs. Switchgrass (*Panicum virgatum*) declined ($P < 0.05$) on CON treatment, while other perennial grasses increased. Annual grasses, including hairy crabgrass (*Digitaria sanguinalis*) and yellow foxtail (*Setaria pumila*) increased ($P < 0.05$) under PB. Botanical composition shifts were similar on patch-burn pastures and full-burn pastures with the exception of increasing annual grasses with patch-burning.

Introduction

Burning tall-grass prairie is an effective and widely used management tool to improve weight gains and manipulate grazing distribution of cattle on native range. Traditional single fire and intensive grazing systems are commonly accepted management practices for cattle producers across the nation, and especially in the Flint Hills (Fuhlendorf and Engle, 2001; Hamilton, 2007). Numerous benefits have been associated with patch-burn grazing; however the system has been promoted primarily as a method to increase

biodiversity, heterogeneity, and wildlife habitat (Fuhlendorf et al., 2006; Bidwell et al., 2009; NPS, 2009). Patch-burning has been theorized to mimic the historical patterns of the effects of lightning and the subsequent grazing patterns of American bison resulting in a management unit with a shifting mosaic of grazing distribution (Weir et al., 2007). Since cattle production is a large component of the tall-grass prairie environment it is important to quantify cattle performance with patch-burning.

The objectives of this study were to 1. Determine stocker BW gains on patch-burned native tall-grass prairie and 2. Determine plant composition as influenced by fire and grazing.

Experimental Procedures:

Using a split-block experimental design, 2 treatments were implemented and replicated 4 times over 7 yrs (2006-2012). The two treatments consisted of control (CON) pastures which were burned and grazed every yr and patch-burn (PB) pastures which were patch-burned grazed on a 1/3 per yr basis. For the PB pastures each patch in the patch treatment was burned once in every 3-yr cycle. Therefore, in each PB pasture cattle had access to graze 1/3 of the pasture that was burned within the yr, 1/3 burned the prior yr, and 1/3 that had not been burned for 2 yrs. The pastures on the North side were assigned to the PB treatment and the South side pastures were CON. Dates of burning for all pastures for this experiment were April 13, 2006; April 9, 2007; April 9, 2008; April 14, 2009; April 12, 2010; April 12, 2011; and April 2, 2012.



Stocker steers (n = 1495 over 7 yrs; > 90% black hided) were purchased from auctions, vaccinated for respiratory pathogens, implanted, and wormed using commercially available products at each producer's operation before placement in pastures. Steers were weighed individually using electronic scales. Steers were randomly assigned to treatment using a pre-determined randomized pasture assignment based on order through the chute.

Cattle on both treatments were stocked from mid-April through mid-August and had free access to the entire area of each pasture along with free choice mineral. This grazing season is classified as a ¾ grazing season (~114-d). Cattle on all pastures were stocked at ~1 head/3 acres and average initial weight was 562 lb. These stocking rates were for a total of 114-d grazing in 2007-2010 and 2012; 113-d grazing in 2006; and 118-d grazing in 2011. Stocking rates remained the same every yr to minimize confounding effects on botanical composition due to differences in stocking rates. In 2011, 2 pastures from each treatment were removed from analysis because pasture treatment integrity was compromised due to cattle commingling between treatment pastures. There were still 2 pastures of each treatment included in analysis for 2011.

In late August through September of each yr one 100-point transect was established in each of the 1/3 portions of the PB pastures and 2 were

established in each of the CON pastures. Each 1/3 of the PB pastures represent a subplot within the pasture. Transects for the CON pastures were located on clay upland range sites. A total of 20 transects were established, 12 in PB pastures and 8 in CON.

Results and Discussion

Cattle performance

Steer ADG was not different based on pasture burning method. During the 7 years of the study, there was a wide range of precipitation amounts, thus gains were divided into precipitation amounts (LOW, AVERAGE, and HIGH). Average precipitation years were 2006, 2009, and 2010; Low precipitation years were 2011 and 2012; High precipitation years were 2007 and 2008. In LOW precipitation yrs steers on PB pastures had a 0.24 lb/d greater ADG (P = 0.02, Table 1) than steers on CON pastures. This ADG advantage tended to result in heavier final BW (P = 0.07; 26.5 lbs) and increased total BW gain (P = 0.02; 26 lbs) for PB cattle in LOW precipitation yrs. A speculated reason why the PB steers had a greater ADG was biomass availability. A common observation from the droughts in the 1980s and early 2010s is lowered biomass in pasture land (summarized by Kellner and Niyogi, 2014). Even though biomass was not measured in the current study, a logical conclusion was biomass production was a limiting factor for CON cattle BW gains. In the CON pastures the DM availability consisted of the forage that grew post fire, which was speculated to be limited due to rainfall.

Table 1: Stocker steer performance based on precipitation classification and burning of pasture either in entirety or patch-burned

Precipitation class ¹	LOW		AVE		HIGH	
Burning practice ²	CON	PB	CON	PB	CON	PB
Initial weight, lb	592	591	547	546	549	550
Final weight, lb	844	870	855	852	804	803
Total Gain, lb	251	277	308	307	255	252
ADG, lb/d	2.16	2.38	2.69	2.67	2.23	2.23

1 LOW - years 2011 and 2012; AVERAGE - years 2006, 2009, 2010; HIGH - years 2007 and 2008

2 CON - control pastures that were burned in entirety; PB - patch-burned pastures that were burned 1/3 of the pasture each year in a rotation.

Pasture composition

Major grass species were relatively stable with some year-to-year fluctuation on CON pastures (Table 2). Big bluestem tended to decline in 2009 and 2010 compared to 2006 ($P < 0.10$), but recovered by the end of the study. Other perennial grasses tended to increase ($P < 0.10$) in 2010 and 2012 (Table 2) when switchgrass was declining ($P < 0.05$). Brazle et al. (1999) in a study done at the same location from 1990 to 1998 found that big bluestem, Indiangrass, and switchgrass all increased under a full-burn treatment. Annual grasses, including hairy crabgrass, yellow foxtail, and switchgrass (*Panicum capillare*) were generally less than 10% of the botanical composition except in 2009, a yr following a wet summer.

After two PB cycles, botanical composition shifts were similar on PB pastures and CON pastures (Table 3). The only difference was the increase ($P < 0.05$) in annual grasses on the PB units. In other studies forbs have increased dramatically within recently burned and grazed patches (Hamilton, 2007).

Big bluestem decreased ($P < 0.05$) 1-yr post-burn (Table 6), but stabilized thereafter. Little bluestem and Indiangrass tended to decrease ($P < 0.10$) the yr of burn compared to the previous yr. Similar

Table 3: Change in plant composition between 2006 and 2012

Species	CON	PB
Big bluestem	-5.2	-10.7
Little bluestem	-3.8	-6.3
Indiangrass	2.1	-2.1
Switchgrass	-8.9	-7.2
Other perennial grasses	14.5	16.5
Annual grasses	-2.2	7.2
Annual forbs	1.4	2.8
Perennial forbs	1.9	-1.2
Woody	0.1	-0.7
<i>Sericea lespedeza</i>	0.3	1.5

to CON pastures, switchgrass declined over time ($P < 0.05$) with PB and other perennial grasses increased ($P < 0.05$) 2-yr post-burn. *Sericea lespedeza* (*Lespedeza cuneata*) decreased ($P < 0.05$) with the first burn but increased thereafter under PB. Cummings et al. (2007) found that *Sericea lespedeza* increased in both patch-burn and full-burn pastures, but the rate of increase was less with patch-burning.

Table 2: Average percent plant composition during 2006 to 2012 (full burn treatment)

Species	2006	2007	2008	2009	2010	2011	2012
Big bluestem	38.0	34.6	32.0	29.5	21.2	32.2	32.8
Little bluestem	11.5	11.5	9.6	11.6	16.2	8.8	7.8
Indiangrass	9.7	13.4	12.1	8.8	11.1	7.1	11.8
Switchgrass	13.3	14.8	12.2	4.5	4.5	7.6	4.4
Other perennial grasses	15.0	14.8	20.1	22.8	25.1	34.4	29.5
Annual grasses	2.6	2.0	5.1	11.6	9.1	1.8	0.4
Annual forbs	0.3	0.8	0.9	1.1	0.7	0.1	1.7
Perennial forbs	8.6	7.4	7.2	8.5	10.2	7.4	10.4
Woody	0.6	0.3	0.4	0.2	0.2	0.2	0.7
<i>Sericea lespedeza</i>	0.4	0.4	0.3	1.4	1.5	0.4	0.6

Implications

Patch-burning offers a viable option for pasture management in regards to stocker cattle performance. Patch-burning might have added benefits for cattle producers in yrs where summer drought might occur due to additional residue available for consumption, along with high quality burned patches. Botanical composition shifts were similar on patch-burn and full-burn pastures with the exception of increasing annual grasses with patch-burning.



Table 4: Percent plant composition relative to year of patch-burn

Species ¹	Year before burn	First burn	1 year post burn	2 years post burn	Second burn
Big bluestem	22.8	26.1	17.5	20.9	21.4
Little bluestem	15.1	9.9	12.9	12.5	7.1
Indiangrass	11.4	7.6	9.8	12.2	5.8
Switchgrass	6.2	10.2	4.9	4.4	2.5
Other perennial grasses	26.0	15.6	24.9	30.4	22.9
Annual grasses	6.3	10.3	16.0	9.4	18.1
Annual forbs	1.7	2.3	2.8	2.1	3.5
Perennial forbs	8.6	9.5	9.6	7.9	10.4
Woody	0.4	0.4	0.2	0.2	0.3
<i>Sericea lespedeza</i>	1.7	0.3	1.3	1.9	2.8

¹ ^{ab} Different superscripts within row indicate differences $P < 0.05$

EFFECTS OF LATE-SEASON SHEEP GRAZING FOLLOWING EARLY-SEASON STEER GRAZING ON SERICEA LESPEDEZA

Jack E. Lemmon, Walt H. Fick, Jonathan A. Alexander, Garth A. Gatson, and K. C. Olson

Introduction

Sericea lespedeza (*Lespedeza cuneata*; SL) is a high-tannin, invasive forb in the Tallgrass Prairie ecosystem. In Kansas, SL infests 980 square miles of pasture, primarily in the Flint Hills region. SL infestations reduce native grass production by up to 92% through a combination of aggressive growth, prolific reproduction, canopy dominance, and chemical inhibition (allelopathy). Herbicides retard the spread of SL, but application is laborious and expensive; moreover, herbicides are lethal to ecologically-important, non-target plant species. Increased grazing pressure on SL by domestic herbivores may slow its spread and facilitate some measure of biological control. Unfortunately, mature plants contain high levels of condensed tannins, which are a strong deterrent to grazing by beef cattle. Small ruminants have greater tolerance for condensed tannins than beef cattle. Sheep, in particular, appear less susceptible to certain plant toxins than beef cattle and may be useful to selectively pressure noxious weeds like SL. The predominant grazing management practice in the Flint Hills region of Kansas involves annual spring burning followed by intensive grazing with yearling beef cattle from April to August. During seasonal grazing, 40 to 60% of annual graminoid production is removed and pastures remain idle for the remainder of the year. Under this prevailing management practice, invasion by SL into the Tallgrass Prairie biome has steadily increased. SL flowers and produces seed in late summer from August to September. The absence of grazing pressure during this interval strongly promotes SL seed production, SL seed distribution, and continued SL invasion of the Flint Hills ecoregion. The objective of our study was to evaluate effects of late-season sheep grazing following locally-conventional steer grazing on vigor and reproductive capabilities of SL

Experimental Procedures:

The experiment was conducted during the growing

seasons from 2013 to 2016 at the Kansas State University Bressner Range Research Unit located in Woodson County, Kansas. Native tallgrass pastures (N = 8; 76.6 ± 8.9) infested with SL (initial basal frequency = 1.4%) were burned annually in early April. Pastures were assigned randomly to one of two treatments: early-season grazing with beef steers (2.7 ac/steer; initial BW = 568.8 ± 75 lb) from April 15 to July 15 followed by rest for the remainder of the year (control; STR) or steer grazing from April 15 to July 15 followed by intensive grazing with mature ewes (0.5 ac/ewe; SHP) from August 1 to October 1. Ewes (N = 808 ± 6 ; initial BW = 143.3 ± 6.8 lb) were assigned randomly to graze 4 of the 8 pastures; remaining pastures were not grazed from August 1 to October 1. Pasture treatment assignments were fixed for the 4-yr duration of the study.

Table 1: Percent of *S. lespedeza* grazed by sheep, each week in a 60 d period

Item ¹	Steer grazing only ²	Steer + sheep grazing ³
Pre-treatment ⁴	0.1 ^a	0.6 ^a
Week 1	0.5 ^a	10.6 ^b
Week 2	0.5 ^a	22.4 ^c
Week 3	0.9 ^a	50.1 ^d
Week 4	1.4 ^a	64.8 ^e
Week 5	2.5 ^a	69.3 ^e
Week 6	2.1 ^a	78.4 ^f
Week 7	3.5 ^a	85.9 ^{f,g}
Week 8	1.4 ^a	92.1 ^g

1 a,b,c,d,e,f,g Within row and column, means with unlike superscripts differ (P<0.05)

2 Steers grazed 4/15 to 7/15 annually for both treatments

3 Steers grazed 4/15 to 7/15 while ewes grazed 8/1 to 10/1

4 Percentage of plants showing evidence of defoliation immediately after yearling steers were removed and before sheep were allowed access to pastures

Vegetation responses to treatment were measured along four permanent 100-yard transects (100 × 12-in² plot points/transect) and in two permanent 16 × 16-foot grazing exclosures in each pasture (25 × 12-in² plot points/exclosure). Transect and exclosure data were collected immediately before and immediately after sheep grazing; (canopy type (i.e., grass- or forb-dominated), presence of SL (e.g., yes or no), and evidence of herbivory was noted (i.e., obvious truncation of leaves or stems). A weekly estimate of herbivory was conducted to evaluate grazing pressure on select forb species in each pasture. SL plants, pasture species composition, and soil cover were assessed annually each October using a modified step-point technique. A total of 100 mature SL plants were collected adjacent to permanent line transects in each pasture immediately after the first killing frost (approximately November 1 annually). After SL plants were dried out, seeds were separated and cleaned. Seed weight was converted to seed count assuming a density of 770 seeds/gram. Average seed production was calculated by dividing the number of seeds by the number of SL plants in each sample (n = 100).

Results and Discussion

Pasture forage biomass was not different ($P = 0.29$) between STR and SHP after steer grazing was halted and before sheep grazing began. Conversely, forage biomass on rested pastures was greater ($P = 0.01$) than that on SHP at the end of the sheep-grazing period. Herbivory of *Sericea lespedeza* was not different ($P = 0.99$) and slight in STR and SHP immediately following the steer grazing period. In contrast, *Sericea lespedeza* herbivory was greater ($P \leq 0.01$) in SHP than in STR by the end of week 1 of the sheep-grazing period

(10.6% vs. 0.5%); moreover, herbivory of *Sericea lespedeza* steadily increased ($P \leq 0.01$) over time such that 92.1% of *Sericea lespedeza* plants were grazed in SHP compared to 1.4% in STR by week 8 of the sheep-grazing period (Table 1). We interpreted these data to indicate that sheep displayed much greater preference for *Sericea lespedeza* than steers. Annual seed production by SL and total seed weight were less ($P \leq 0.01$) in SHP than in STR (Table 2). We concluded that late-season, intense grazing by sheep may be an effective means for controlling SL infestation.

Implications

We concluded that late season grazing by sheep was consistent with responsible ecosystem stewardship and could be used as part of an integrated weed management plan to control *Sericea lespedeza* and may add an additional, sustainable income stream to an existing ranching enterprise. Before implementing this management strategy, land managers should consider whether additional fencing and predator control may be needed.



Gathering sheep on Bressner pasture

Table 2: Effects of early-season grazing by beef steers followed by late-season grazing by sheep on plant weight, seed weight, and seed production of *Sericea lespedeza*

Item	Steer grazing only	Steer + sheep grazing	P-value
Whole plant DM weight, mg/plant	4,424	1,443	<0.01
Total seed weight mg/plant	1,123	148	<0.01
Seeds, #/plant	864	114	<0.01

GOAT STUDY ON BRESSNER PASTURE TO MANAGE FOR SERICEA LESPEDEZA

Jeff L. Davidson and Gary L. Kilgore

History

Sericea lespedeza (*Lespedeza cuneata*) is an introduced perennial legume that was first recognized as a potential weed problem in Southeast Kansas in the early 1980's. Since that time, *sericea* has spread profusely throughout southeast Kansas and beyond. Southeast Kansas counties began declaring it a "county option" noxious weed in the late 1980's; and July 1, 2000, it will be a statewide noxious weed in Kansas. This is the first time that a federally listed crop has been declared noxious.

Sericea lespedeza was introduced into the U.S. by the USDA in 1900 for erosion control. In the 1930's it was planted on strip mined areas in Southeast Kansas and in the 1940's and 50's was planted around State and Federal reservoirs for wildlife habitat. It is recognized for its tolerance of drought, acidity and shallow soils of low fertility. It will tolerate soils ranging from very acidic to slightly alkaline, but prefers a pH of 6.0 to 6.5. It does best on clayey and loamy soils that are deep, fertile, and well-drained, but will also grow on poor sites. *Sericea* uses water less efficiently than many other warm-season plants and does best when annual precipitation is 30 inches or more.

Most recent large scale introductions of the plant occurred with establishing native grass on Conservation Reserve Program acres, a provision of the 1985 Farm Bill. Numerous CRP fields throughout the eastern part of Kansas have been found infested with *sericea lespedeza*. The native grass seed used in these plantings was contaminated with *sericea lespedeza* seed - not recognized as a noxious or invasive weed at that time.

Forage Quality

Sericea lespedeza as a legume is recognized for its' high levels of crude protein, but this is offset by high concentrations of chemical compounds called tannins. Tannins bind with proteins, leaving

them unavailable for digestion. They also reduce the palatability and digestibility of forages. The level of tannins in *sericea* appears to increase with maturity of the plant, high air temperatures, and low rainfall. The tannins also reduce insect feeding.

Wildlife Conservation

Sericea lespedeza has been considered valuable for wildlife benefits, both as food and cover. However, this is not supported by research or practical experience. Deer will not utilize *sericea* unless it is kept short by mowing or grazing. Quail will consume the seeds in fall and early winter, but the seeds don't contain enough energy to sustain quail through adverse weather conditions. *Sericea* probably holds its greatest wildlife benefit as a source for cover, but when dormant, cover will be lacking because other plants are excluded by the *sericea*.

Competitive Characteristics

Sericea lespedeza, once established, will reduce or eliminate competing vegetation. However, it is relatively slow to establish, having a rather weak and vulnerable seedling stage. On the other hand, it is opportunistic, and will establish itself in full sun or partial shade. While it tolerates shading quite well, it doesn't seem to establish in dense shade where direct sunlight does not reach during any part of the day.

Sericea perhaps establishes best where competing vegetation is very short, and light is allowed to reach the germinating seedlings. Many legumes need good exposure to sunlight during the seedling stage. This is the situation of a burned pasture. Fire is also assumed to scarify *sericea* seed, enhancing germination. However, the fire may result in more sunlight hitting the seed and seedlings, resulting in better germination. Seedlings will also germinate and survive where ground cover and other plant competition is quite dense but at a much lower population. It has established in fence rows, brushy

and grassy areas, where fire and grazing have been excluded for years.

Once established, sericea restricts the amount of light reaching other plants because it is tall with multiple branches and dense foliage. It requires more water to produce foliage than other warm season plants, creating a "drought" for competing vegetation. It also produces allelopathic chemicals that inhibit seed germination and growth of other plants. Some of these chemicals are produced by the roots, while others come from plant residue, chiefly leaves.

Although sericea is a legume, it furnishes very little nitrogen to surrounding plants, and that amount is negated by the effects of the allelopathic toxins it produces. Rather than providing nitrogen for other plants, it actually makes it necessary to add nitrogen to maintain production of introduced forages. The shoots of grass exposed to the toxins of sericea residue have lower nitrogen content, and overcoming the loss of production caused by the toxins requires nitrogen fertilization.

Control

As with any weed problem, early detection and treatment is paramount to gaining control of this weed. Investing the time to control scattered plants and isolated patches must be done. Remedy, and Escort are the two chemicals of choice at the present time for controlling sericea lespedeza. Once it becomes established over a wide area, an integrated approach to control will be necessary. Conventional management practices such as prescribed grazing and fire have been less than effective in preventing the spread of sericea in rangelands.

Some suppression of sericea has been observed after mowing or burning followed by intensive early stocking with stocker cattle. Livestock will consume the seeds and deposit them elsewhere in manure, so it is advisable to not graze sericea infested range in fall and winter when the plants have produced seeds. Intensive early stocking provides this option. Goats will provide some control as they do eat sericea much more

readily than cattle. However, any grazing control program must be closely monitored and continued once begun. Grazing will increase the number of tillers of each individual plant. This means that if grazing is ceased, then a larger more robust, multi-tillered plant is left than if it had never been grazed and will result in increased seed production. Current research with goats indicates that they will eat sericea and reduce seed production, but have not reduced plant population.

Mowing will reduce the vigor of sericea plants if they are cut closely multiple times each year. Plants should be mowed each time they reach a height of 12-18 inches. The most damaging time to cut sericea is late in the growing season when the plants are trying to build root reserves. However, mowing will not kill sericea, and may damage desirable grasses.

Bressner Pasture Goat Study

Sericea lespedeza has increased from just a few plants to a major problem in the Bressner Pasture over the past few years. We have treated several pastures with chemicals with varied results. On Aug. 5-9, 135 goats, 59 sheep and 1 llama were put in the northeast pasture of the east half section. We increased the fencing in the following manner:

- West side --- (electric) added 2 wires at bottom for a total of 5, 2nd wire from top is ground.
- South side --- (electric) added 1 wire at bottom for a total of 4
- North & East --- (barb) added wires to bring total to 9, 7 and 5 wires at different sites. A small strip was mowed under the electric fence, to keep fencer hotter and give animals a chance to see fence before they hit it

Animal management --- Goats were wormed at turn out; most sheep were not wormed. No weights were taken. The llama was for predator control.

Vegetation management --- A small area was mowed on August 4 to see if animals could keep the small new growth under control the rest of the summer. An enclosure cage was installed on

- Aug. 12 to help monitor the site.

Originally printed in 1998 Field Day Report

EVALUATION OF WATER LEVEL MONITORING EQUIPMENT FOR STOCK TANKS

Herschel George

Water is an essential ingredient in the growth of animals. Monitoring the level of water in a tank is necessary for stewardship and producers' level of mental ease. When the tanks are not in the normal visual path of the workers, checking the tanks regularly is one of these additional chores for the day. When the tanks are a distance away from the headquarters, the travel and time are an additional expense.

Producers need to consider the type of information that they wish to know about any tank, how they want to receive the information and value of that information. Technology has made great improvements with the ability to provide current information about the tank level as well as other information about the livestock in your pasture(s). Below is a discussion of several types of water level sensors we have tried.

If "a picture is worth a 1000 words", a game camera that provides a picture of the tank could be valuable. Many game cameras take great shots, but the frequency and method by which the producer receives the photos is improving. For water level information, the timeliness of the photo becomes an important factor.

In our demonstration we used a game camera that allows us to specify a time period to photograph livestock at the stock tank. As soon as the camera takes a photo, it sends the photo to a website via the cellular phone network. The photo is stored to a website, allowing the producer to view the photo on either a computer or cell phone.

In our case, we scheduled the camera to look for livestock at the tank site between 1:00 and 1:30 pm and again between 1:30 and 2:00 pm so we had the opportunity for 2 photos each day. This camera system requires motion to activate the camera for a photo and only during our designated times. If a photo was taken, the photo is posted on the

website within 5 to 10 minutes of being taken. You may need to re-aim the camera after seeing the initial photos. Consider placing a gauge stick in the tank or height marks on the side of the tank so it is easier to evaluate the level of water in the tank from the photo.

In our case, the camera cost about \$100, and storage of the pictures on the website is FREE if we store less than 100 /month (2 or 3 photos per day).

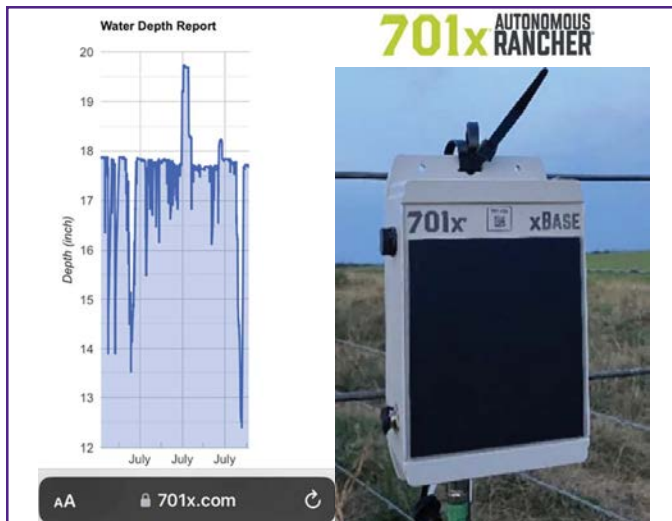
The XBASE system through 701x uses a pressure transducer in the tank to sense the depth of water above the sensor as well as the temperature of the water. Every two hours the information is uploaded to a website by cellular communication. An alert feature allows the producer to specify a minimum water level and maximum temperature. If these parameters are exceeded, a notification is sent to one or more cell phones, allowing the producer to take mitigating action if desired.

The system is calibrated during setup by slowly raising the sensor out of the water then lowering the sensor back down so it lies on the bottom of the tank.

The instruction suggests placing the cord to the pressure transducer through a conduit to protect



*Left: Trail/game camera on post pointed at water source
Top: Image captured by trail/game camera at 1 PM to evaluate water levels in tank*



it from livestock damage. The xBASE station should be fenced out so livestock cannot reach it. The xBASE station has a solar panel on the front to keep the batteries recharged and should be installed so it faces south. The cellular phone reception should be of reasonable strength for the system to perform well.

The 701x system has the capability to do many other management related tasks. The extra technology within the system may contribute to the cost of the unit. As we understand, the equipment we are demonstrating would have a cost of about \$1,000 with a yearly fee of about \$72.

The RanchSense system uses a pressure transducer to read the depth of water above the sensor (from the bottom of the tank). The system proposes to update the website about every 2 hours (depending of the satellite orbit coverage). The system has the ability to send a text message to a cell phone, if the water level drops below a producer specified level. The information is reported as a percent of tank depth, (76%).

The RanchSense uses the Low Elevation Orbit satellite system to transmit the information from the tank site back to the website to be viewed on



the computer website or a cellular phone.

The instruction suggests running the cord to the pressure transducer through a conduit to prevent livestock from messing with the installation. The RanchSense station should be placed in a protected space from livestock. The RanchSense station has a solar panel on the front with the components on the back of the panels. The solar panel front is used to keep the batteries recharged, and should be south facing.

Observations of the systems

The game camera is a simple and straight forward system. The photos can be viewed reasonably soon after the picture is taken, however if the livestock are not there, the camera may not record a photo for you. It has been suggested that a flag or banner could be placed within the photo range so the camera will more often see motion even if the livestock are not present.

The systems that use the pressure transducers seem to be accurate and there was no reason to question the accuracy of either device. This technology is emerging and the companies are still making improvements to their systems and add additional features. The timeliness of the updates and alerts was the greatest concern with both of the systems. Studying the data that is available from the website showed livestock behavior that we would have missed otherwise. It was easy to see changes in drinking times as the temperatures fluctuate. We saw some drinking after midnight a number of times.

One surprise that was not expected to see was a tank that was higher by about 2 inches in the middle of the night then went back to normal about 6:30 am. It had rained during the night.

For many producers, a photograph of the tank is all they need to see. Other producers will want to receive the notification or text to their cell phone and then check the tank level history on the website. These or similar devices will eventually allow producers to make livestock water level monitoring just another simple and easy chore.

LIMITED ACCESS RAMPS FOR POND WATERING OF CATTLE

Herschel George, Jeff Davidson, Will Boyer, and Ron Graber

Overview

Ponds are common sources of livestock water in Kansas. However, allowing unlimited cattle access to ponds can cause severe bank erosion and poor water quality.

Cattle prefer clean water and avoid steep, muddy approaches to water sources whenever possible. Developing limited cattle access ramps with a hardened surface and fencing can greatly improve cattle access to water.

Advantages

- Simple and inexpensive
- Improves livestock safety and health, (foot rot and leg injuries)
- Reduces bank erosion
- Less sediment and fewer nutrients entering ponds
- Extends pond life and improved water quality
- Applies to new or existing ponds
- Works with "Pit ponds" and exclusion fences

Limitations

- Fence maintenance required
- Options for location of watering access ramp may be limited
- Few Examples in Kansas





additional feet per 10 pair, making the total width from 25 to 30 feet for 100 pair. Fencing is required to exclude livestock from other parts of the pond and discourage congregating and loafing near the pond.

An electrified floating fence made of PVC pipe and electric fence wire can be used to restrict cattle movement to the watering access ramp. Extracted from "Water and Water System Handbook", <http://www.ksre.ksu.edu/library/lvstk2/s147.pdf>

Design Considerations

Slope of the access ramp is important. Ramps as steep as 4:1 have been used, however, a flatter slope (8:1 to 12:1) is generally better, especially when conditions are wet or icy. The ramp surface should be able to withstand heavy traffic to prevent erosion from hoof traffic. A ramp construction method using used tires (called an open bowl tire ramp) is available from authors at end of page. The width of the access ramp at the shore line should be wide enough to accommodate at least 10% of the herd at one time. The rule of thumb minimum width is 10 feet, plus 1 additional foot for every 10 head of cattle: thus a total width of 20 feet for 100 head of cattle. For cow/calf pairs consider a width of 10 foot, plus 1.5 or even 2



Limited access ramp at Bressner pasture in Pasture 1. Drone photo taken June 20, 2022

The diagram on the left shows a cross-section of a floating electric fence. It features a rock and gravel base, a 2x4 plastic pipe (sealed airtight), and electric fence wire supported by insulators and brackets. Labels include: ELECTRIC FENCE WIRE, INSULATED CONNECTING WIRE, INSULATOR, BRACE POST, CAP, BRACKET OF INSULATOR, TEE, GUIDE POST (CAN BE FIBERGLASS OR METAL POST WITH PLASTIC PIPE SLEEVE OVER IT), 2" x 4" PLASTIC PIPE (MUST BE SEALED AIR TIGHT, SO IT WILL NOT ACCUMULATE CONDENSATION), WIRE ABOUT 20"-30" ABOVE THE WATER, E. ROW, ROPE WITH SLACK, APPXIMATELY 16% BANK SLOPE, and LARGER ROCK UNDER GRAVEL (EXTEND ABOUT 15 FEET INTO WATER, DEPENDING ON SLOPE).

The middle diagram is a cross-section of a ramp made of round tires and semi-treads, showing the ramp's slope and its connection to the pond.

The right photograph shows a pond with a ramp made of round tires and semi-treads, with a fence line extending into the water.

TIRE TANK INSTALLATION GUIDELINES

Herschel George

1. Choose size of tire and type of opening.

- Small circles for drinking
- Whole tire
 - 30.5x32 combine tires
 - 48x31x20 (front tire on fertilizer trucks)
- Heavy equipment tires that have height available for at least 18 of water above the lower tire bead.
- Half tire (the large mining tires that are cut like a bagel, up to 13 ft. diameter)

2. Cut tire opening.

- Tools
 - Tire chalk
 - Reciprocating saw with metal cutting blade with 5 to 6 tpi (teeth per inch)
 - Special cleaning and lubricating fluid (mixture of Dawn dishwasher soap & water)
- Mark the desired cut line with tire chalk
- Cut tire and remove the center

3. Select site for tank.

- When placing the tank below a pond, it is ideal the site will have at least 6 ft. difference between water level in pond (bottom of the primary spillway pipe) and soil line where the bottom of the tank will set (4 ft. minimum)
- Ideally the overflow line drains to daylight

4. Plumb water lines to and from proposed site

- Ideal to have 1 ½ or 2 inch waterline to and from the waterer.
- Ideal to have flexible connector or a “swing joint” on the incoming lines below the tank.
- Ideal to have Brass nipple coming into tank to connect to float valve. I do not recommend PVC to come through the concrete and connect to the valve.
- Plumb intake line so bottom of threads on the metal pipe is even with top of concrete line (top of bead inside the tank).
- Plumb the drain and overflow so the top of the PVC collar connector is installed to be just

flush with the top of the concrete (even with the top of bead inside of the tank).

- Lightly thread a 1 ft. PVC female adapter onto intake line and the drain/overflow. Do this to prevent concrete from getting into the nipple/threads and to maintain as perfectly vertical as possible pipe placement. Do not glue these pieces; they will be removed when concrete is cured.



5. Firm, tamp and fill center of tank so there are 4 to 6 inches of space left for the concrete. There can be greater space, but it requires more concrete.

6. Level and set tire into site.

- The tank should set on a slightly elevated area.
- Ideal to have geotextile under the tank and gravel to extend the life of the gravel from sinking into mud
- Firm and tamp any gravel base under tank.
- Level tank site!!!!. 1 inch out of level is noticeable when tank is full.

7. Install a bead of silicone onto the center of the tire bead that will be in the concrete.

- Install a bead of silicone onto the incoming and outgoing lines about 2 inches down from the top of concrete line.
- An optional 2nd bead of silicone can be installed on the tire bead and on all pipes about 4 inches from the top of the concrete line (top of tire bead inside the tank).
- Put silicone on tire bead and pipe(s) immediately before adding the concrete.

- Using a finger, smear the silicone bead so that it covers a majority of the bead and the pipes.

8. Mix the concrete for the tank.

- Mix the concrete mixture (with fiber).
- The fiberglass fiber is purchased from the ready-mix concrete company. One bag is enough for 1 cu. yd. of concrete (enough for 45 sacks of pre-mixed 80# concrete mix). Cost \$5 to \$7 per bag. Add a small handful per sack of pre-mixed concrete mix.
- Place concrete into the center through the tire bead opening only.
- Work the concrete under the tire as best as possible. A trowel is useful to make the concrete move under the tire well. Hitting the tire near the bead with a hammer also helps move the cement under the tire.
- Make sure the incoming and outgoing pipes are straight.
- Continue poring concrete until area below the tire is full up to the top of the tire bead. Trowel the area. Can have a ½ inch of crown to the concrete if you desire. Check the level of the threads of the intake pipe and the top of the drain pipe collar to make sure they are at the desired depths.

9. Run water into the tire outside the concrete area, until the water softly flows across the concrete and covers the concrete by at least 2 inches.

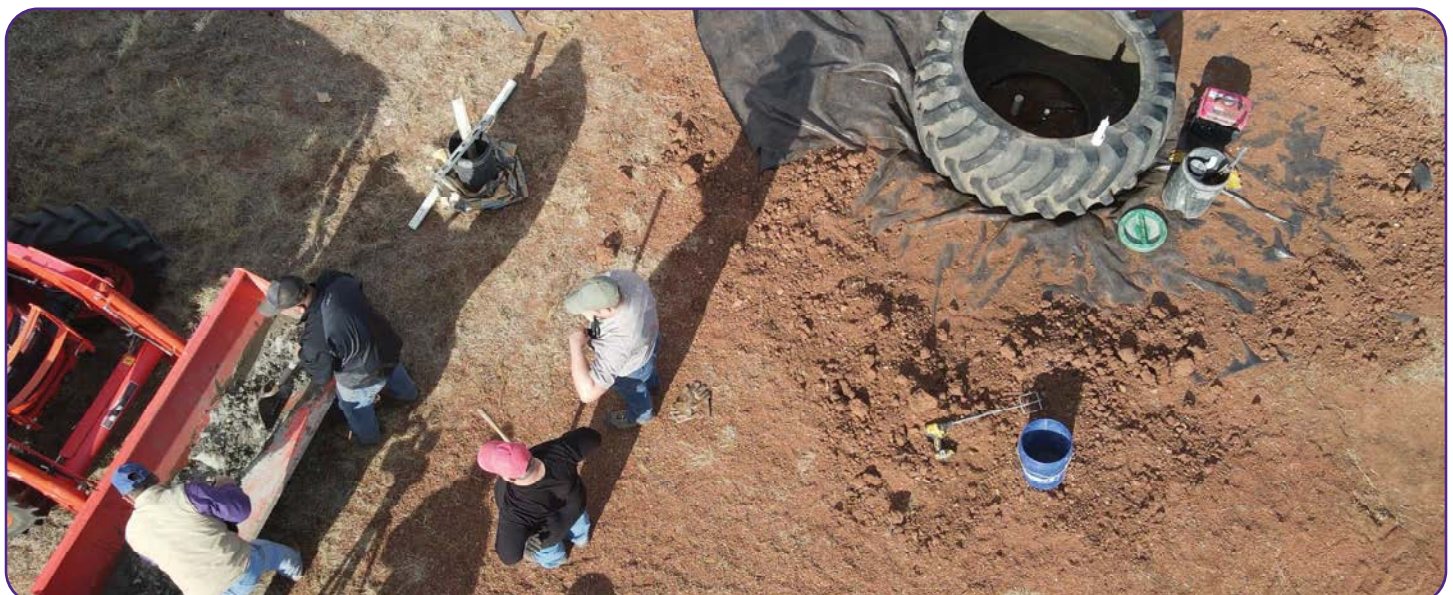
- Clean all tools.

- The tank can be filled water, but the more depth placed on the concrete, the better the base must be to withstand the pressure. If the base settles within the first few hours, there is a chance the water will leak out.
- Leave the project (with the at least 2 inches of water on the top of the fresh concrete!).

10. After the concrete cures (ideally 1 week or so), install the water level valve with float.

- Consider the refill rate of the tank when selecting a valve. Small valves cost less but may have slow flow or refill rates.
- Tanks installed using gravity flow from a pond have very low pressure, select the valve accordingly.
- Recommend stainless-steel chains on floats.
- Recommended valve: Watson Manufacturing Inc., Stock Water Control Products, P.O. Box 397, Morrill, NE 69358, 1-800-292-2987, 1-308-247-2281. <http://floatvalveusa.com/index.html>
- Where possible, install a winter minimum continuous flow valve to help prevent freezing along with an overflow drain line.
- Set the float level for the desired water level.

11. Place additional gravel onto the geotextile and up the sides of the tank, leaving at least 1ft. of tank showing above the finished gravel layer. It is best to wait at least 5 days before using equipment to put gravel around the tank.



Mixing cement at tire tank installation in South Central Kansas. Used the loader to more efficiently mix the concrete. Tire with geotextile fabric and water lines to the right of the picture.

SURFACE WATER PUMPING SYSTEMS FOR LIVESTOCK GRAZING

Herschel George, Will Boyer, and Pat Murphey

Watering livestock in remote locations for the purpose of grazing pasture and forage-based cover crops can be a challenge. In most situations in eastern Kansas, the water source is a pond, a stream or a shallow hand-dug well. The greatest need for water is during the warm months of the grass-growing season. There is also interest in water systems that can tolerate freezing weather.

This publication describes two systems which use a 100-watt Solar panel with a charge controller. Solar panels connected to a voltage controller and a deep cycle marine-type battery provide the power for the pump systems. Some solar panels are not equipped with a mounting rack. A mounting rack can be constructed from angle iron and 2-inch pipe so that the solar panels can be mounted on a steel post at 45 degrees in winter or horizontal during the summer months.



Producers are encouraged to use the power/load output portion of the charge controller to power the pump rather than connecting directly to the battery. The advantage of this configuration is that the charge controller will stop the pump if the battery level drops below 10.5 volts. Running the system at lower voltages can damage the battery or pump. Connecting to a battery directly also can run the battery out of charge in case a broken water line or overflowing tank.

System Type One:

The pump is operated on the soil surface above the surface level of the water. A positive displacement SEAFLO Model 55 or similar pump can be used. The system requires a "Deep Cycle" marine-type battery, which is available from most battery supply outlets. In a test using the SeaFlo pump, the deep cycle battery pumped 2400 gallons over 10

hours, reducing the battery from 12.5 volts to 10.75 volts which causes the charge controller to shut the system off. The pump test was conducted with 6 ft. head or lift. The system should be powered by 1 or 2 - 100 watt solar panels.

The SEAFLO Model 55 pump has an improved pressure switch system, as well as other benefits.



These include:

- ability to pump 5 gal per min
- built-in pressure shut-off system
- ability to pump 100 feet in elevation
- rated for continuous duty
- carries a 4-year warranty
- uses ½ inch NPT fittings



If a tiny leak in a hose or connection occurs, the pump will chatter (come on and off frequently). To combat this, adding an accumulation (pressure) tank will allow some leakage to occur before the pump start/stop/start/stop cycle.

For those producers who want a "plug and pump" system, the SEAFLO 55-Series Water Pump and Accumulator Tank System is available. This system has a built-in pressure gauge and mounting surfaces. A protein tub or other enclosure can be used to cover this system.



Adding a float valve to turn the pump on and off completes the system. Hudson, Jobe and Apex valves are examples of float valves which have a diaphragm shutoff system that causes them to shut-off completely when full level occurs. Other float



systems reduce the flow as the tank approaches full. The Hudson valves work from the surface of the water whereas the Jobe or Apex valves are set in the bottom of the stock tank.

Garden hose and hose connections can be used on these systems, but the intake hose must be rigid enough to avoid vacuum closure during pumping. If garden hose is used as the intake line, heavy duty $\frac{3}{4}$ inch hose is recommended. An alternative is HDPE (High density Polyethylene Pipe) or PVC pipe for the intake. Either type of pipe or garden hose can be used for the discharge (pressure) lines.



System Type Two:

The second pump system is a 12 Volt Submersible Water Pump, similar to a submersible sump pump. This system connects to a deep cycle battery and a 1 or 2 - 100-watt solar panel with charge controller. This pump is a centrifugal pump with no check valves, and has good flow rate. It is limited to a maximum lift of 8 meters (26 ft.) and has no switch to turn the pump on/off. This system requires an electrical switch for an automatic system.



A positive aspect of this pump is the ability to handle more debris, such as algae or dirt in the water, which makes the pump a good choice for pumping from ponds, streams, or shallow wells to nearby cattle.

The drain back characteristic of the pump can assist in freeze-proofing the pump. The electric 2-wire sensor switch is recommended during winter freezing conditions.

The 12-volt systems have a higher amperage draw than the 24-volt systems on other solar pump systems. A relay or continuous duty solenoid is necessary to prevent burning out the lower amperage electrical switches.



An Advanced Systems ALC 1275, switch uses two sensor wires to control the switch and pump. This switch has an 8-second time delay when powering the pump on and off, so it does not chatter (turn on and off in quick succession) when the wind blows the water waves in the stock tank against the sensor wires. This switch is rated for an output of 7 amps; so a continuous duty solenoid or switch relay must be used to prevent electrical burn out.

A relay switch connected to an electric float switch will also operate the electric circuit. The float system may be preferred because there are no probes to clean or adjust. When selecting a relay, select a holder (or pigtail), as shown in this 100 Amp relay. Relays can be purchased without the holders and in various amperages, so select a relay with sufficient amperage capacity.



The Small Stainless electric float switch has been reliable. The small wires of the float will carry 1 amp therefore a relay or solenoid is needed to carry the amperage load of the pump. A wiring diagram is located at the end of this article. These floats are sensitive to less than one inch water level and wave action in a tank can sometimes cause the pump to cycle on and off. Therefore, we have begun using timer relays to eliminate the cycling, a ten sec. time delay relay is our choice.

A simple system would be the pump wired to a Tethered (Normally Closed) float switch that could be anchored to the side of the stock tank.



Pump systems can use a quick connect, flat 10 or 12 Gauge 2 Pin Plug, similar to many 4-wheeler sprayer systems, and the plug can be purchased from a local automotive repair shop. When purchasing, request the 10 or 12-gauge wire; whenever possible. Hardwire the system so no connection other than the pump has a plug to the power supply.

An electronic version of this pump system publication is available at <https://www.kcare.k-state.edu/pubs/>

SPRING DEVELOPMENT

James W. Oler

First and most important to remember in spring development – there are no guarantees and no right or wrong way.

Old history may be the best determining factor in selecting a site. If you can find someone with the knowledge of what a site did back in the 40s or 50s, it may be your best information available. If that is not available, check out wet spots in the pasture and the grass species in the wet spots.

Below are some of the steps taken in developing this spring in 1992. Having watched this location for the past two years, we felt certain a good spring could be found. Running water could usually be found in this location. In 1992 it was extremely wet all spring, but in 1991 it was extremely dry. The backhoe worked a total of 5 hours in digging out the spring, digging water lines, and backfilling over the collection site.

Hole

The preliminary hole was 4 feet wide by 11 feet long. The hole was dug to a depth of 4 feet after water was found entering the hole at 2 feet. The bottom and sides of the hole were lined with plastic and then approximately 6 inches of gravel was put in the bottom of the hole.

Collection Pipe

The plastic collection pipe was 2 feet in diameter by 9 feet long with ½ inch holes drilled approximately every 6 inches all the way around the pipe. The ends of the pipe were covered by a steel plate with a pipe fitting on one end. The collection pipe was laid on the gravel and covered with 6 inches of gravel. The gravel was then covered with the plastic and 1 ½ feet of dirt was put over the top, filling the hole back to ground level.

Water tank

A two-inch plastic water line was laid from the end of the collection pipe to the water tank. We

probably goofed by not putting a shut-off valve in the water line. The water line feeds up the bottom of the 7-foot stock tank. Tank size is very important as there must be more holding capacity than the livestock can drink at one time. This pasture is normally stocked at 35 head of cattle.

The overflow pipe must carry the water far enough away to avoid mud problems close to the tank. The end of the overflow pipe must be protected or cattle may plug the overflow pipe and water will spill out around the tank. It was proven this June that after the cattle trample the area it is hard to find the end of the overflow pipe!

Success

The cattle had access to this spring and also ran to the creek area. The creek area is very shallow with no hole of water over 3 feet deep. The creek does run year-round and still had good water in 1991 when it was extremely dry. The cattle did appear to drink out of the spring more than they did the creek in 1992.

***This summary was originally printed in the 1992 proceeding meeting of the Bressner pasture. It is has been reformatted the type and style of the current proceedings report ***



Example of spring development. Photo from Livestock Watering Handbook KSU

EROSION REDUCTION AT THE BRESSNER PASTURES

Dale Kirkham

Native bluestem pastures are primarily managed for abundant forage production and good livestock performance. But other benefits from properly managed pastures include clean runoff water, habitat for wildlife, carbon sequestration, and scenic views. Reducing sediment and other impairments in the runoff from the Bressner pastures is important because it contributes to the drainage area for the Yates Center Reservoir.

Soil erosion is a natural process and generally not a major concern in pastureland. However, certain activities by cattle and ranchers can accelerate the process resulting in gullies started by ruts that concentrate water flows. Cattle trailing, ranch roads and feeding during wet periods are high on the list of activities that subject the prairie sod to erosion.

Cattle are creatures of habit and commonly “trail” to water, salt/mineral feeders, and shade which can form paths that lead to gullies. Gullies also start along fences where stocker cattle travel steadily during the first few days after turnout during the spring. Where small gullies have started along fences, cattle paths, and pasture roads, *placing short “kickout” berms of earthen fill will divert concentrated runoff onto good sod.*

Where cattle trail along fences, *short stub fences can be installed to direct their movements toward the center of the pasture, especially on steeper slopes.* Even those unwanted osage orange trees can be cut and placed to direct cattle traffic. At turnout time for stockers, *a low-stress handling procedure called “pitch-and-catch” will settle the cattle and minimize trailing along the fences.*

What about healing actively eroding gullies? The key is to slow the flowing water in the channel if it cannot be diverted away. Starting at the upper end of smaller gullies (often a headcut), *place available materials such as used net wrap held by rocks or tree branches at intervals to slow water flow*

and trap sediments. Annual grasses and weeds will soon establish and eventually be replaced by native species. Larger gullies often require structures made of rock or earthen fill designed by an engineer to be fully effective.

Pasture roads can also lead to gullies as repeated vehicle traffic, especially during wet times and on steeper slopes, breaks the sod cover and forms ruts. *Negative impacts can be reduced by following the contour of the land and altering routes whenever possible.* Use lightweight vehicles with broad tires such as ATVs and UTVs if available and task suitable.

Winter feeding sites are another source of sediment, minerals and bacteria in runoff. *Moving feeding locations to new areas often will alter traffic patterns, reduce spot damage to the sod, and encourage cattle to consume dormant forage in lightly used areas of the pasture. Feed in open areas away from ponds and streams during suitable weather while saving sheltered spots for extreme conditions.* Feeding supplements in larger amounts just 2-3 times per week will also reduce vehicle traffic.

Spring burns that remove both the standing dead material and the surface layer of mulch leave the soil vulnerable to sheet and rill erosion until new plant growth is sufficient to provide protection. *Whenever possible, burn native pastures when the soil and mulch layers are moist* in order to leave a protective layer on the soil surface. In the patch bum-patch graze system, the higher rates of sheet and rill erosion than may occur in the heavily grazed third of the pasture are likely offset by greater protection in the remaining two-thirds.

Remember that maintaining good grass and mulch cover will slow runoff, trap sediments and increase infiltration, thus, **Rule #1** in reducing soil erosion in pastures. **Rule #2** is to minimize livestock and human activities that lead to concentrated flows of runoff. And, YES, runoff rains will come again.

Originally printed in 2012 Bressner Field day

USING DRONES FOR MAKING PASTURE MANAGEMENT DECISIONS

Will Boyer

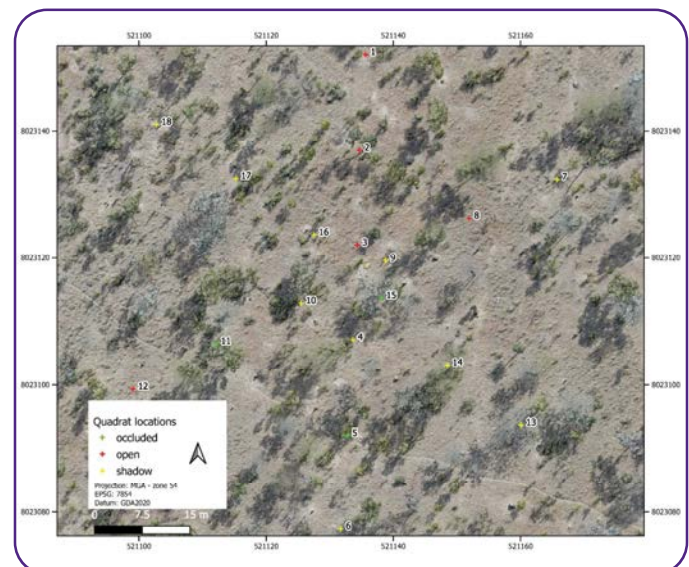
Some livestock producers are finding practical uses for drones that have simple on board cameras. Uses include finding missing animals, checking fences and water, and visualizing the extent of problem brush species. The potential certainly exists for ranchers to make pasture management decisions aided by information gathered using drones.

A decent on board camera can be used to produce highly detailed pasture aerial maps. These can be used for making accurate measurements and for monitoring change in pasture vegetation. The process of making such pasture maps from a mosaic of GPS-labeled photos is complex, but the availability of free mapping and analysis tools, along with reasonably priced online services is helpful. A three-dimensional model of the pasture and its vegetation is an intermediate product of pasture aerial photo production. Forage biomass can be estimated from a three-dimensional model of pasture forage (Merwe et al., 2020) Pasture biomass estimates can help managers set and adjust stocking rates.

A series of basic individual drone images which cover a representative area of a pasture can also aid in making pasture management decisions. SamplePoint is a well-tested free photo analysis tool that systematically samples individual pixels of photos, aiding the user in identifying percent cover (Booth et al., 2006). Photos from a low-altitude drone transect flight over a grazed cover crop field were analyzed using SamplePoint to demonstrate how percent ground cover can be used to schedule livestock removal. Similarly, SampleFreq aids the user in determining presence or absence of species of interest within areas of pre-determined sizes (Cox et al., 2021). Photos systematically selected from a pasture mapping drone mission where analyzed to demonstrate how to establish a monitoring baseline for woody plant species in a pasture.

Literature Cited

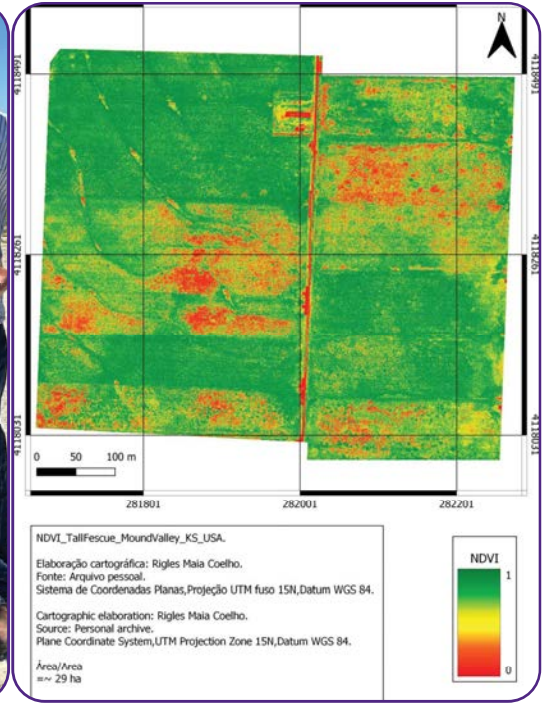
- Booth, D. T., Cox, S. E., & Berryman, R. D. (2006). Point Sampling Digital Imagery with 'Samplepoint.' *Environmental Monitoring and Assessment*, 123(1–3), 97–108. <https://doi.org/10.1007/s10661-005-9164-7>
- Cox, S. E., Booth, D. T., & Berryman, R. D. (2021). Measuring nested frequency of plants from digital images with SampleFreq. *Ecological Indicators*, 121, 106946. <https://doi.org/10.1016/j.ecolind.2020.106946>
- Merwe, D. van der, Baldwin, C. E., Boyer, W. (2020). An efficient method for estimating dormant season grass biomass in tallgrass prairie from ultra-high spatial resolution aerial imaging produced with small unmanned aircraft systems. *International Journal of Wildland Fire*, 29(8), 696–701. <https://doi.org/10.1071/WF19026>



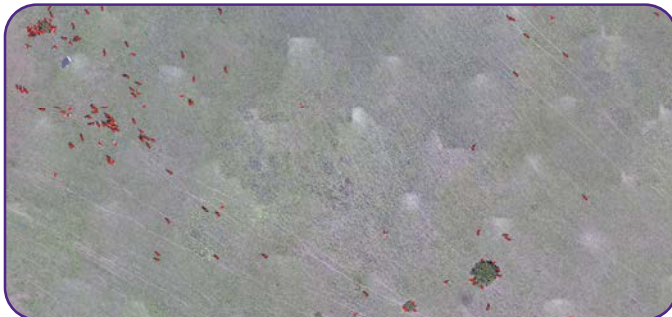
Example orthomosaic imagery of a woodland field site to highlight the extent of tree and shrub cover. Photo from Barneston et al. 2020 publication in *AgriEngineering*, 2(4), 523-543.



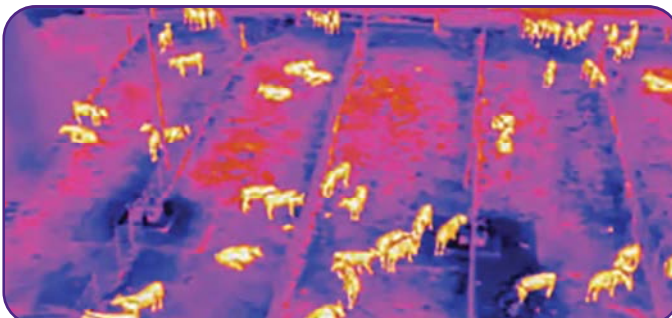
DJI Phantom 4 with NDVI camera (Left) being launched by visiting student (Middle) at Mound Valley to measure forage biomass in 14 pastures (Right).



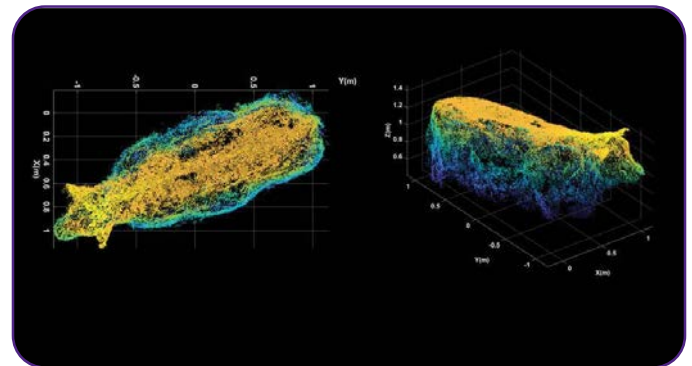
Emerging technologies that use drone footage



CattleQuants Drone-Based Inspections online software. Submit photos, AI-powered counting software returns inventory report



Drones could apply thermal imaging to identify sick livestock. Image: Texas A&M AgriLife



This graphic is created by combining drone images of a cow to estimate its volume and weight (Research being conducted at Colorado State and University of Kentucky). Photo credit: Hoagg, Jackson/Sama/Yang, printed in bbc.com

AI in Beef Cattle Face Identification

Beef **Cattle** Tag ID Information Recognized
 by Deep Learning **AI** Technology.

NDSU NORTH DAKOTA STATE UNIVERSITY
 AI-Driven Innovation in Agriculture

Using Artificial Intelligence (AI) to identify cattle by face or body type - some locations have started including drone photos and use of AI to ID animals.

WEATHER STATIONS AND TOOLS FOR CATTLE PRODUCERS

Christopher Redmond and Jaymelynn Farney

Kansas Mesonet

K-State Research & Extension weather stations are at the root of the Kansas Mesonet. These stations were established in 1986 at KSRE research centers and experiment facilities around the state. Most were co-located with National Weather Service Cooperative Observing Stations. Since that period our network has grown and we now collaborate with the Kansas Water Office, Big Bend Groundwater Management District, the Equus Beds Groundwater Management District, and the USDA Soil Climate Analysis Network.

Site Selection

Stations are located in long-term sites with exposure as recommended by the World Meteorological Organization. New locations are selected based on unavailability of automated weather data in the region. Most of the sites are located on private land with permission of the cooperating land owner (Figure 1). All weather stations use research grade instruments which are installed at the WMO

recommended standard heights. Selected weather stations have a second wind monitor at the 10m height (Figure 2).

Site Maintenance

Technicians from the Kansas State University Weather Data Library regularly visit each station a minimum of two times each year. Once during the Spring and again in the Fall. During these site visits sensor, data logger, communications, and power supply systems are inspected to ensure they are functioning according to Kansas Mesonet operation standards. When a sensor is not functioning properly it is replaced with a new one and returned to the manufacturer for repair and recalibration or recycled as electronic waste. During each visit the overall site conditions (e.g. fencing, immediate area grass cover, surrounding fetch areas) are inspected to ensure accurate and representative measurements.

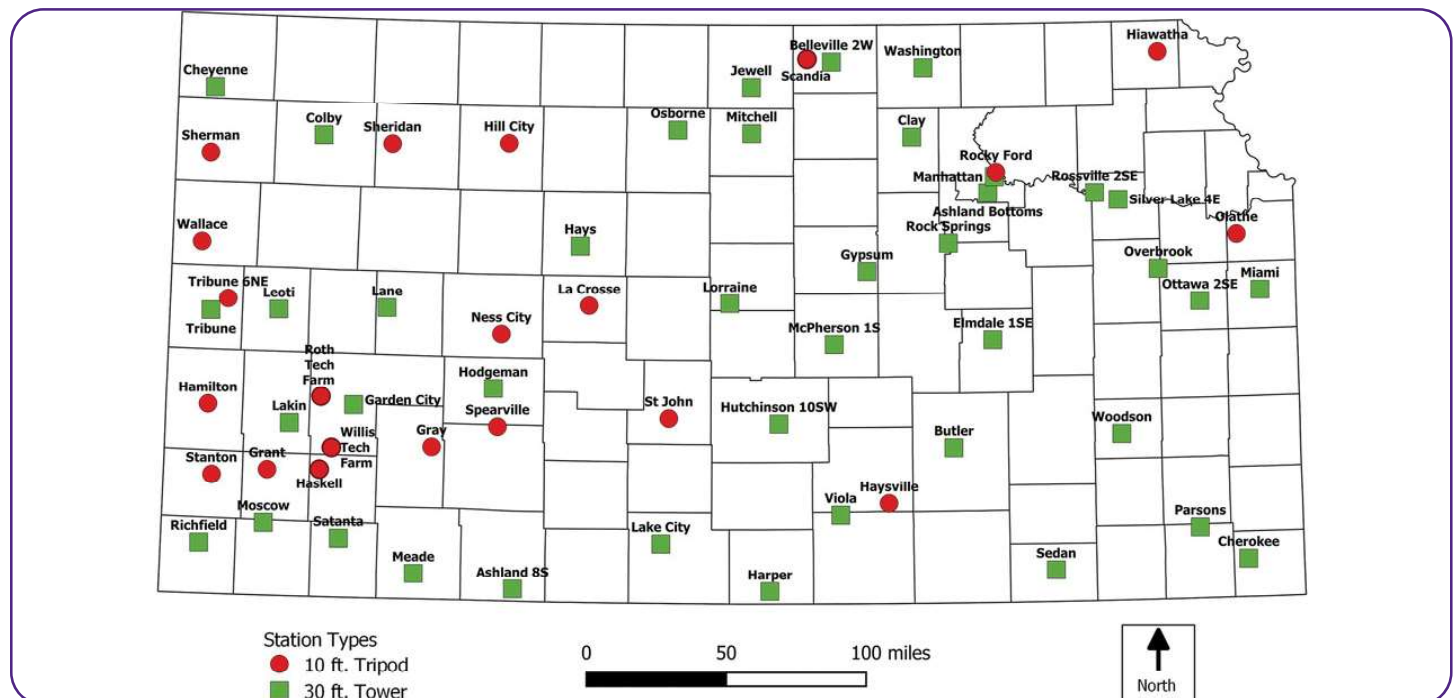


Figure 1: Locations and types of Mesonet stations around Kansas. Reprinted from Technical Overview of Kansas Mesonet, Journal of Atmospheric and Oceanic Technology (2020); Patrignani et al.

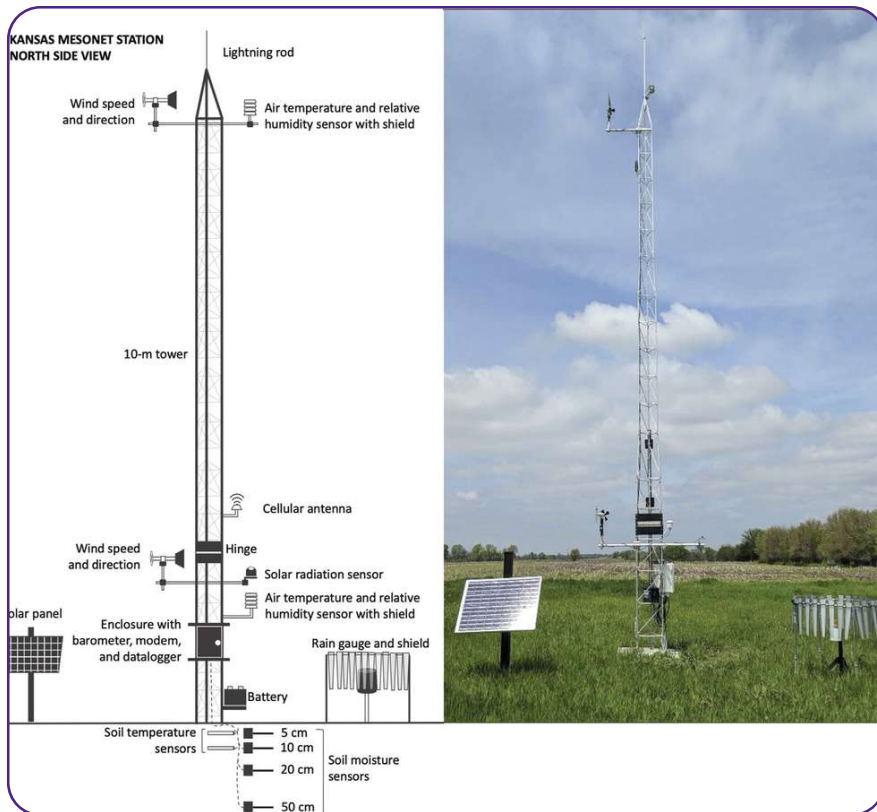


Figure 2: (left) Schematic north side view of a 10-m tower station of the Kansas Mesonet and (right) equivalent image for the Ottawa 2SE station located at the Kansas State University East Central Research Experiment Station. The air temperature sensor in the sketch was placed slightly below 2-m depth for clarity. The drawing is not to scale.

Photos from *Journal of Atmospheric and Oceanic Technology* 37, 12; 10.1175/JTECH-D-19-0214.1

Table 1: List of the products that are generated from data collected at the weather stations

Product	Description	Variables measured at the weather station
Animal Comfort Index	Air temperature is adjusted for air relative humidity, wind speed, and incident solar radiation using the comprehensive climate index to generate an index of animal comfort	Air temperature, relative humidity, wind speed, and solar radiation
Growing degrees for corn and grain sorghum	Measure of the accumulation of temperature units over a crop specific upper and lower temperature threshold for predicting the growth and development of corn and grain sorghum	Air temperature
Reference evapotranspiration	Evapotranspiration from a hypothetical grass and alfalfa reference crop 12-cm height with optimal soil moisture conditions and nonnutritional or pest-related limitations	Air temperature, air relative humidity, wind speed, and incident solar radiation
Heat index	Apparent hot temperature to the human body as the result of the combined effect of high air temperature and air relative humidity	Air temperature and air relative humidity
Wind chill	Apparent cold temperature to the human body as the result of the combined effect of low air temperature and wind speed	Air temperature and wind speed
Temperature inversions	Difference of the air temperature between 1.5-and 10-m height. An inversion is produced when the air temperature at 10 m is greater than the air temperature at 2-m height	Air temperature at 2- and 10-m height
Relative saturation	Represents the fraction of volumetric water content relative to the max volumetric soil water content at saturation	Volumetric water content at 5-, 10-, 20-, and 50-cm depth

Reprinted from *Technical Overview of Kansas Mesonet, Journal of Atmospheric and Oceanic Technology* (2020); Patrignani et al.

Cattle Comfort System in Kansas Mesonet










About the Comfort Index

Mader and co-workers at the University of Nebraska developed the Comprehensive Comfort Index to incorporate both extremes of hot and cold into one index value. It is unique in that it includes, in addition to air temperature and relative humidity, effects of wind speed and solar radiation. Development and validation of the index used data from beef and dairy cattle.

Actual animal response to temperature stress will be dependent on a number of factors not accounted for in the index. Those include, but aren't limited to, age, hair coat (winter vs summer; wet vs dry), health, body condition, micro-environment and acclimatization.

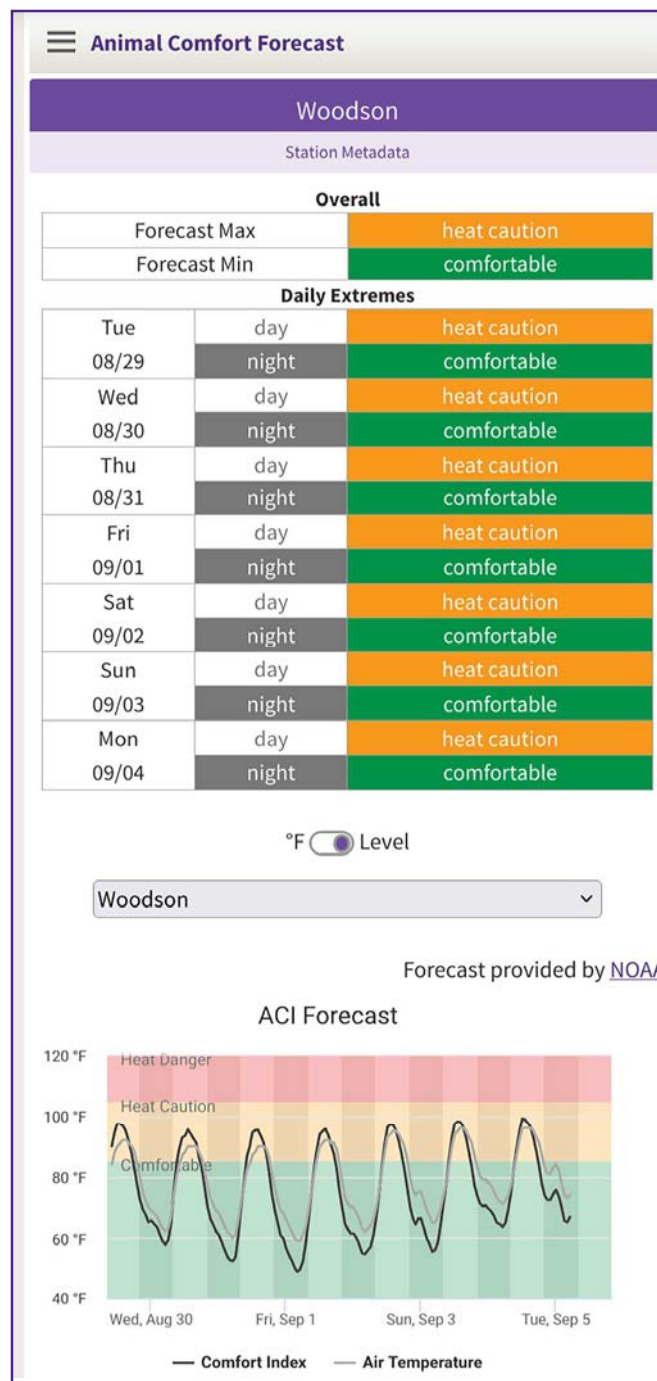
The Kansas Mesonet provides a 7-day forecast animal comfort index. This utilizes the equation found on the previous current condition page (Which is still available) and takes into consideration the National Weather Service 7-day forecast. This provides decision makers the ability to see in the future and for potential periods of both heat and cold extremes. The intent is to provide as much advanced notice so that decision makers can take proactive measures to mitigate loss.

Heat and cold stress level categories for the cattle comfort advisor:

Comfort level	Map indicator	Index Value, °F	General Interpretation
Heat Danger		> 105	Animal deaths may exceed 5%
Heat Caution		> 95 to 105	Decreased production, 20% or more Reduced conception, as low as 0%
Heat Caution		> 85 to 95	Decreased production, 20% or more Reduced conception, as low as 0%
Comfortable		77 to 85	
Comfortable		32 to 77	
Comfortable		15 to 32	
Cold Caution		< 15 to -20	18 to 36% increase in dry matter intake
Cold Danger		< -20 to -40	
Cold Danger		< -40	

Adapted from:

<https://www.mesonet.org/images/site/Using%20the%20Mesonet%20Cattle%20Comfort%20Advisor>



Screenshot of Animal Comfort Forecast tool for the Woodson County station for the week of August 29, 2023 to September 4, 2023.

mesonet.ksu.edu/agriculture/animal

