CATTLEMEN'S DAY 2023

BEEF CATTLE RESEARCH

SUMMARY PUBLICATION

K-STATE Research and Extension

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FOR YOUR 40 YEARS OF SERVICE TO THE K-STATE ANIMAL SCIENCES & INDUSTRY DEPARTMENT

We appreciate your dedication, commitment to service, professionalism and most of all your welcoming smile that greeted our attendees at every KSU ASI event. Through the years, the annual K-State Cattlemen's Day success can be attributed to your attention to detail, friendly service and hard work. Congratulations on your much deserved retirement. We wish you the best as you get to spend time with your 16 grandchildren.

- K-STATE BEEF TEAM

CATTLEMEN'S DAY 2023

BEEF CATTLE RESEARCH

Contents

Beef Cattle Management

Beef Cattle Reproduction

Meat Science

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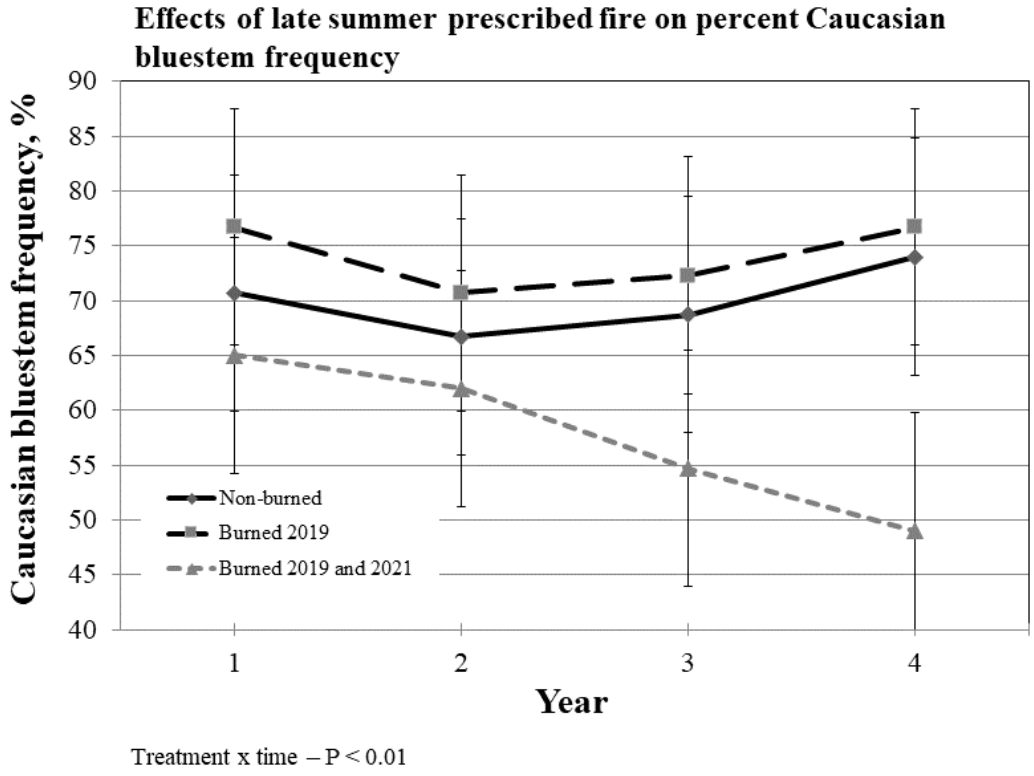
BEEF CATTLE RESEARCH

Effects of Late-Summer Prescribed Fire on Botanical Composition, Soil Cover, and Forage Production in Caucasian Bluestem-Infested Rangeland in the Kansas Smoky Hills: Year 4 of 5

Helen Giefer

Objective: Our objective was to determine effects of late-summer prescribed fire on frequency of Caucasian bluestem (*Bothriochloa bladhii*) in the Kansas Smoky Hills as well as changes in soil cover, botanical composition, and forage production associated with fire treatment.

Study description: The study was in Ellsworth County, KS. Eighteen one-acre plots were randomly assigned to one of three treatments: no burn, one burn (August 14, 2019), and two burns (August 14, 2019, and August 11, 2021). Soil cover, botanical composition, forage production, and Caucasian bluestem frequency were measured annually beginning in 2019.



Treatment x time – $P < 0.01$

The Bottom Line: These data suggests that regular application of late-summer prescribed fire may be an effective method to reduce Caucasian bluestem frequency while improving overall grass-species richness.

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BEEF CATTLE RESEARCH

Effects of Prescribed-Fire Timing on Stocker Cattle Performance, Forage Biomass Accumulation, and Native Plant Species Composition

Zachary Duncan

Objective: The objective of this experiment was to document the effects of prescribed-fire timing on stocker cattle performance, forage biomass accumulation, soil cover, and plant species composition in the Kansas Flint Hills.

Study Description: A total of 1,416 yearling stocker cattle were assigned to one of three prescribed-burn treatments: spring (April 9 ± 5.1 days), summer (August 23 ± 4.9 days), or fall (September 29 ± 8.7 days) over a 4-year period. Calves were grazed from May to August for 90 days. Individual body weights were recorded at the beginning and end of the grazing season. Native plant composition and soil cover were evaluated annually using a modified step-point method, and forage biomass was measured biannually.

Effects of prescribed-fire timing on stocker cattle performance, forage biomass, and basal cover in the Kansas Flint Hills

	Prescribed fire season				Treatment
Item	Spring	Summer	Fall	SEM[1]	*P*-value
Total BW gain,[2] lb	214[y]	204[yz]	201[z]	5.4	0.06
ADG,[3] lb/day	2.38[y]	2.27[yz]	2.24[z]	0.060	0.07
Forage biomass, lb/acre	1756	1919	1972	220.7	0.58
Basal cover, % of total basal vegetation cover					
Total grass cover	89.6	89.4	85.5	2.60	0.24
Total forb cover	9.9	9.4	13.0	2.57	0.34
Total shrub cover	0.5[z]	1.2[yz]	1.5[y]	0.44	0.07

[y,z] Within rows, means with unlike superscripts differ ($P \leq 0.10$).
[1]Standard error of the mean.
[2]Body weight.
[3]Average daily gain.

The Bottom Line: Flint Hills ranchers can employ late-summer prescribed fires to manage sericea lespedeza (*Lespedeza cuneata*) infestations without negatively impacting stocker cattle growth performance, forage biomass accumulation, or native rangeland plant species composition.

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Effects of Limit Feeding and Shade Allocation on Growing Calf Performance, Water Usage, and Animal Comfort

Zachary DeBord

Objective: The objective of this study was to evaluate the impact of limit feeding in conjunction with shade allotment on animal performance, animal comfort, and water usage during periods of heat stress.

Study Description: During the summers of 2021 and 2022, 852 heifers were assigned to one of four treatments: limit-fed high-energy ration or high-roughage ration fed for *ad libitum* intake with or without access to shade. Growth performance and water usage were measured during a 90-day growing period. Calves were fed a gut equilibration diet for 7 days to account for gut fill.

Effects of diet type and shade on growth performance, feed efficiency, and water usage

	Treatment							
	No shade		Shade			*P*-value		
Item	45[1]	60[1]	45[1]	60[1]	SEM[2]	Diet	Shade	D × S
Number of pens	20	20	20	20				
Number of animals	214	213	215	210				
Body weight, lb								
Day 0	551	551	548	549	3.0	0.90	0.22	0.76
Day 90	784	772	801	787	6.2	<0.01	<0.01	0.80
Day 97	785	799	802	811	6.3	<0.01	<0.01	0.58
Average daily gain, lb/day	2.25	2.39	2.44	2.53	0.056	<0.01	<0.01	0.47
Dry matter intake, lb/day	20.14	14.84	21.45	14.92	0.27	<0.01	<0.01	<0.01
Feed-to-gain, lb/lb	9.04	6.37	8.82	6.09	0.157	<0.01	0.03	0.76
Water usage,[3] gal/day	11.9	10.8	10.6	9.8	0.28	<0.01	<0.01	0.13

[1]45 = High-roughage diet fed for *ad libitum* intake; 60 = High-energy limit-fed diet.
[2]Standard error of the mean.
[3]Analysis of year 1 data only.

The Bottom Line: Limit feeding a high-energy ration at 2.2% of body weight daily on a dry matter basis in combination with shade can improve animal efficiency, reduce water consumption, and improve animal comfort during periods of heat stress.

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Effects of Biuret and Lasalocid (Bovatec) Inclusion into a Commercial Mineral Supplement on Growth Performance of Yearling Calves Grazing in the Kansas Flint Hills

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Objective: The objective of this experiment was to measure the effects of non-protein nitrogen (NPN; i.e., biuret) or NPN + ruminal modifier (i.e., biuret + lasalocid) inclusion in a commercial mineral mix on growth performance of yearling beef calves grazing in the Kansas Flint Hills.

Study Description: Over a two-year period, 742 crossbred steers [initial body weight (BW): 655 ± 52.2 lb] of Texas and Nebraska origin previously backgrounded at the Kansas State Beef Stocker Unit were used in this experiment. The three mineral treatments consisted of a basal supplement (Control), a basal supplement plus biuret (Biuret), and a basal supplement plus biuret and lasalocid (Bovatec; Zoetis, Parsippany, NJ) with a 4 oz/head daily mineral consumption target. Each treatment was randomly assigned to one of 18 pastures with a total of six pastures per treatment. To determine days-to-empty, mineral feeders were checked daily. Mineral feeders were also weighed weekly to determine mineral consumption. At the onset and conclusion of the experiment, pasture weights were taken to determine average initial and average final BW.

Results: Total BW gain, average daily gain (ADG), and mineral consumption did not differ ($P \leq 0.15$). However, final BW did differ between mineral treatments ($P \leq 0.03$). Likewise, there was an interaction between treatment and week for days-to-empty ($P \leq 0.05$).

Inclusion of biuret with or without Bovatec[1] on stocker cattle performance when grazing native grass

	Mineral treatments				
Item	Control	Biuret	Biuret + Bovatec	SEM[2]	*P*-value
Initial BW,[3] lb	653	652	659	6.2	0.66
Final BW, lb	816[b]	827[a]	834[a]	4.5	0.03
Total BW gain, lb/day	162	175	174	4.9	0.15
ADG,[4] lb/day	1.80	1.94	1.94	0.05	0.15
Daily mineral intake, oz/head	3.90	3.86	3.85	0.051	0.77

[ab]Within column, means with unlike superscripts differ ($P < 0.05$).
[1]Zoetis, Parsippany, NJ.
[2]Standard error of the mean.
[3]Body weight.
[4]Average daily gain.

The Bottom Line: These data were interpreted to suggest that the addition of biuret or biuret + Bovatec to a commercial mineral supplement may improve the growth performance of yearling beef cattle grazing in the Kansas Flint Hills.

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BEEF CATTLE RESEARCH

Effects of Almond Hull Inclusion on Growth Performance of Limit-Fed Growing Cattle

Zachary Duncan

Objective: The objective of this experiment was to evaluate the effects of almond hull inclusion and almond hull processing on growth performance of limit-fed growing beef cattle during a 56-day growing period.

Study Description: A total of 364 steers were assigned to one of four diets. The control diet contained (dry matter basis) 39.5% dry-rolled corn, 7.5% supplement, 40% wet-corn gluten feed, and 13% prairie hay. Almond hulls replaced prairie hay or prairie hay and dry-rolled corn and were fed at 13 and 26% of the diet, respectively. A subset of almond hulls was processed using a grinder mixer with no screen. Processed almond hulls replaced prairie hay and were fed at 13% of the diet. Diets were limit-fed for 56 days.

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Effects of almond hull inclusion of growth performance of limit-fed growing steers

	Diet[1]					Treatment
Item	CON	13AH	13PAH	26AH	SEM[2]	*P*-value
Number of pens	10	10	10	10		
Number of animals	91	91	91	91		
Body weight, lb						
Day 0	573	578	577	572	3.9	0.22
Day 56	720^{aby}	729^{a}	734^{ax}	703^{bz}	8.4	< 0.01
Average daily gain, lb/day	2.63^{a}	2.69^{a}	2.80^{a}	2.36^{b}	0.133	0.02
Dry matter intake, lb/day	13.88^{a}	13.82^{a}	13.93^{a}	13.55^{b}	0.131	0.03
Gain-to-feed, lb/lb	0.191^{aby}	0.198^{a}	0.202^{a}	0.176^{bz}	0.010	0.04

[1]CON = Prairie hay fed at 13% of dry matter; 13AH = Almond hulls fed at 13% of dry matter; 13PAH = Processed almond hulls fed at 13% of dry matter; 26AH = Almond hulls fed at 26% of dry matter.
[2] Standard error of the mean.
[a,b] Within row, means with unlike superscripts differ ($P \leq 0.05$).
[x,y,z] Within row, means with unlike superscripts tend to differ ($P \leq 0.10$).

The Bottom Line: These data were interpreted to suggest almond hulls can be utilized as an alternative to prairie hay in limit-fed growing beef cattle diets while maintaining or slightly improving growth performance.

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Assessment of Novel Semen Evaluation Technologies and Breed Comparisons in Yearling Beef Bulls

Ashley R. Hartman

Objective: The objectives were 1) to evaluate the iSperm, when conducting breeding soundness exams (BSE) on bulls by comparing sperm motility to a technician's assessment and 2) to evaluate correlations between sperm response to reactive oxygen species (ROS) and functional sperm measurements.

Study Description: Ejaculates were collected via electroejaculation from yearling bulls as part of a BSE. All BSE were conducted by one veterinarian and ejaculates were evaluated by a single technician. Additional sperm motility analysis was conducted with the iSperm analyzer. Ejaculates meeting minimum thresholds for passing a BSE were diluted and sent overnight for flow cytometry evaluation. Data were analyzed using Pearson's correlation coefficients in SAS.

Results: Both gross and progressive motilities were significantly ($r = 0.30$; 0.38; $P < 0.001$) correlated to the technician's assessment of progressive motility. Percentage of live spermatozoa with positive ROS status was correlated ($r = 0.53$; $P < 0.001$) with percentage progressive motility. Percentage of live spermatozoa with negative ROS status was moderately correlated with percentage spermatozoa exhibiting secondary abnormalities ($r = 0.33$; $P = 0.02$). Percentage live spermatozoa that had disrupted acrosomes was strongly correlated with percentage live spermatozoa with negative ROS ($r = 0.66$; $P < 0.001$) and moderately negatively correlated with percentage live spermatozoa with positive ROS ($r = -0.31$; $P = 0.04$). Percentage of live spermatozoa with positive ROS status was correlated ($r = 0.58$; $P < 0.001$) with percentage of spermatozoa with active mitochondrial membranes. Percentage of live spermatozoa with positive ROS status was strongly correlated ($r = 0.92$ $P <0.001$) with percentage of live spermatozoa with intact acrosomes.

The Bottom Line: The iSperm can be used to produce semen assessments similar to those of a trained technician and may offer a useful tool for producers to perform on-farm semen analysis. Sperm health and function continue to be related to negative ROS status.

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Delayed Timing of Insemination Relative to Estrus Improves Pregnancy to Artificial Insemination with Sex-Sorted Semen in Beef Heifers

Kolton Aubuchon

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Objective: The objective was to evaluate the effect of timing of artificial insemination (AI) relative to the onset of estrus on pregnancy outcome when using sex-sorted semen in beef heifers.

Study Description: Beef heifers were subjected to the melengestrol acetate with prostaglandin (MGA-PG) estrous synchronization protocol and visually observed for estrus every four hours for five days following injection of PG. Following detection of estrus, heifers were inseminated with semen sorted to contain X-chromosome bearing sperm cells (4.0×10^6 live cells per 0.25 mL straw of SexedULTRA 4M). Heifers were retrospectively categorized into one of three intervals from estrus onset to insemination: 1) 12.5–15.9 hours; 2) 16.5–21.0 hours; and 3) 21.4–27.5 hours.

Results: Heifers with the shortest interval (12.5–15.9 hours) from estrus onset to insemination had a similar ($P > 0.10$) AI pregnancy rate as compared with heifers with the interval from estrus onset to insemination of 16.5 to 21 hours. Heifers inseminated 21.4 to 27.5 hours following estrus onset achieved a greater ($P \leq 0.05$) AI pregnancy rate than heifers inseminated 12.5 to 15.9 hours following estrus onset.

Effect of interval from observed estrus to insemination on AI pregnancy rate using sex-sorted semen in crossbred beef heifers

Estrus onset to insemination interval[1]	Number	AI pregnancy rate
Overall	98	60.2%
12.5–15.9 hours	37	51.4%[a]
16.5–21.0 hours	33	56.3%[ab]
21.4–27.5 hours	28	75.9%[b]

[ab] Pregnancy rates without a common superscript are different ($P \leq 0.05$).
[1] Interval of time from when heifers were detected in estrus (with observation every 3 to 4 hours) to time of insemination. Average interval from estrus to insemination was 18.5 hours.

The Bottom Line: Insemination of beef heifers with sex-sorted semen later than 21 hours after estrus onset appears to improve pregnancy rate to AI when compared to earlier insemination times.

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Sire Distribution of Calves in a Beef Herd with Use of Fixed Time Artificial Insemination Followed by Immediate Bull Exposure for Natural Service in Cows and Heifers

Ashley R. Hartman

Objective: Our objective was to determine the relative percentages of calves sired by either natural service sire or fixed time artificial insemination (FTAI) sire within the same estrous period.

Study Description: During two consecutive years, heifers and cows were synchronized and inseminated using the 7-day CO-Synch + CIDR FTAI protocol. All females were exposed to natural service bulls immediately following insemination. After calving, DNA was collected from a random subset of calves born in the first 21 days of the calving season for parentage analysis. Calves born from heifers totaled 59 in Year 1 and 82 in Year 2; calves born from cows totaled 89 in Year 1 and 102 in Year 2.

Results: In Year 1, among calves born from heifers, the percentage sired by natural service was 5.1% (n = 3/59). Among calves born from cows, the percentage sired by natural service was 14.6% (n = 13/89). In Year 2, among calves born from heifers, the percentage sired by natural service was 9.8% (n = 8/82). Among calves born from cows, the percentage sired by natural service was 20.6% (n = 21/102).

The Bottom Line: If commercial producers use FTAI followed by immediate bull exposure in beef females, it can be expected that natural service bulls may sire 5 to 20% of calves born early in the calving season while reducing time and labor associated with bull turnout.

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Assessment of Kansas Beef Producers Perception and Knowledge Level of Business-to-Consumer Marketing

Katie Lybarger

Objective: The objective of this study was to assess the perception and knowledge level of Kansas beef producers regarding business-to-consumer marketing.

Study Description: A digital survey was created to assess the perception and knowledge level of business-to-consumer (B2C) marketing of Kansas beef producers. The survey was disseminated to Kansas beef producers utilizing the Shop Kansas Farms online social networking group.

Results: Results from this study showed that 25.5% of beef producer respondents (n = 41) raise another species in addition to beef. It was found that 50.0% of survey respondents sold 20 or fewer head of finished beef cattle in 2020, with 43.9% selling 100% of their beef to individual consumers. Furthermore, 61.0% of respondents reported an increase in sales to individual consumers in 2020 compared to previous years, with 75.0% indicating sales to large beef processors were about the same. An increase in individual consumer sales was classified as "very desirable" by 73.0% of respondents, and 87.1% believe sales to individual consumers are the most profitable marketing channel. There were 72.2% of respondents selling beef in a B2C market for 1–10 years, with 47.2% reporting that repeat customers make up 75% of their sales. Word of mouth was the most common method of product marketing, as indicated by 91.6% of producers. Concerns or complaints from consumers were noted by 38.9%. It was believed by 47.1% of respondents that an improvement in consumer knowledge would be "very effective" to prevent future complaints or concerns. Moreover, an increase in producer knowledge was believed by 31.03% to be "extremely effective" in preventing future complaints or concerns. Finally, it was believed that an increase in state extension resources would be "moderately" or "very" effective in improving consumer and producer knowledge by 46.9% and 33.3% of respondents, respectively.

The Bottom Line: Producers self-reported B2C marketing to be the most profitable marketing channel within their operation. However, many are not utilizing this channel to its full potential, and many have experienced consumer concerns or complaints. This study confirms the need for more state extension resources to support B2C marketing for beef producers in Kansas and sets the foundation for future research priorities.

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Evaluation of Kansas Beef Consumers' Awareness and Understanding of Business-to-Consumer Marketing

Lindsey K. Decker

Objective: The objective of the study was to determine the understanding and knowledge level of consumers purchasing beef in a business-to-consumer (B2C) format within Kansas.

Study Description: A digital survey was created to evaluate consumers' familiarity and satisfaction of buying beef in a B2C format. The survey was made available for a two-week period to consumers utilizing the Shop Kansas Farms online social media group.

Results: Results of the survey showed 93% of consumers (n = 174) reported having previously purchased beef products from a local producer or locker. Of these, 63.1% reported that their most recent purchase was their first time purchasing in a B2C format and the same percentage of consumers had been purchasing beef in a B2C format for less than five years. The most common methods of purchasing beef in a B2C format were "portion cuts" (24.5%), followed by "quarter beef" (17.0%) and "half beef" (15.1%), or a combination of at least two of these methods (20.7%). Only 5.7% of consumers experienced challenges while purchasing beef in a B2C format, yet 100% of those consumers still intended to continue purchasing beef in this format. When consumers were given options that would be useful to prevent future complaints, the most selected response was "improved consumer knowledge." The consumers (n = 82) who rated this response as "very effective" or "extremely effective" indicated that "increased state extension resources" would be at least "moderately effective" (82.9%). This indicates that increased state extension resources would be an effective way to improve consumer knowledge.

The Bottom Line: Consumers within the state of Kansas are interested in and have positive experiences with purchasing beef in the B2C format. Moreover, most consumers are new consumers to buying beef in the B2C format, indicating that there is increasing demand for beef available for purchase in this format. Results of this study support this but show room for growth within consumer understanding of purchasing beef in a B2C format. Results of this study shows the opportunity for improvement of extension and other resources for consumers.

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Consumer Color and Discoloration Thresholds for Purchase of Retail Ground Beef When Evaluating Packages of a Single Day of Display

Katie Lybarger

Objective: This study utilized a simulated retail display to investigate the impact of ground beef color and discoloration on consumer purchase intent, while identifying the best objective measurements to predict consumer preferences of ground beef on the same day of retail display.

Study Description: For this study, 180 1-lb 80% lean/20% fat ground beef loaves were assigned to a specific day of retail display (day 0–9). Consumers (n = 318) and trained descriptive panelists assessed ground beef samples, with a single day of display evaluated per consumer group. Spectral data and L^* (lightness), a^* (redness), and b^* (yellowness) values were collected. Simple linear and logistic regressions were calculated for consumer ratings. Lastly, Pearson correlation coefficients were calculated for sensory and objective measurements.

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The 50, 75, 90, and 95% likeliness thresholds for various objective quality measures for consumer purchase intent of 80% lean/20% fat ground beef

Measurement	50%	75%	90%	95%
Product sold at full price				
*L**	52.2	54.7	57.3	59.0
*a**	20.7	26.2	31.7	35.4
*b**	20.2	22.8	25.3	27.1
Metmyoglobin[1]	37.8	28.7	19.5	13.3
Oxymyoglobin[1]	57.9	67.9	77.9	84.7
Chroma[1]	29.7	35.5	41.3	45.2
Hue angle[1]	0.79	0.72	0.66	0.61
Trained sensory panel redness score[2]	60.6	82.6	-	-
Trained sensory panel discoloration score[3]	40.3	12.8	-	-
Consumer appearance score[4]	48.4	60.7	72.9	81.2
Product sold at discounted price				
*L**	50.0	52.5	55.1	56.8
*a**	17.7	22.7	27.7	31.1
*b**	19.1	21.4	23.7	25.3
Metmyoglobin[1]	45.2	36.0	26.9	20.6
Oxymyoglobin[1]	48.8	57.9	67.1	73.3
Chroma[1]	25.8	30.8	35.8	39.2
Hue angle[1]	0.84	0.77	0.70	0.66
Trained sensory panel redness score[2]	45.6	67.6	89.6	-
Trained sensory panel discoloration score[3]	79.0	42.4	5.8	-
Consumer appearance score[4]	38.8	51.0	63.2	71.5

[1]Calculated utilizing the equations presented in the AMSA Meat Color Measurement Guidelines (AMSA, 2012).
[2]Sensory scores: 0 = extremely dark red, 100 = bright cherry red.
[3]Sensory scores: 0 = no visible discoloration, 100 = complete discoloration.
[4]Sensory scores: 0 = extremely undesirable, 100 = extremely desirable.

The Bottom Line: Consumer intent to purchase ground beef at varying days of retail display can be predicted by the objective measures used in this study. Moving forward, these models can provide ground beef producers and retailers with an indication of potential consumer purchasing behaviors for ground beef at varying levels of discoloration to prevent waste and maximize profits.

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Determination of Consumer Color and Discoloration Thresholds for Purchase of Retail Ground Beef When Evaluating Multiple Days of Display Simultaneously

Katie Lybarger

Objective: The objective of this study was to identify the threshold for color and discoloration for consumers to purchase ground beef in a simulated retail display and to determine the best objective measurement to predict consumer purchase intent.

Study Description: For this study, 180 1-lb 80% lean/20% fat ground beef packages were assigned to a day of retail display (day 0–9). Consumers (n = 216) and trained descriptive panelists evaluated ground beef samples from each day of display simultaneously. Instrumental L^* (lightness), a^* (redness), and b^* (yellowness) values were collected, and spectral data were recorded. Logistic and simple linear regression models were calculated for consumer likelihood to purchase and appearance ratings. Pearson correlation coefficients were calculated for all measurements.

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The 50, 75, 90, and 95% likeliness thresholds for various objective quality measures for consumer purchase intent of 80% lean/20% fat ground beef

Measurement	50%	75%	90%	95%
Product sold at full price				
*L**	50.6	51.7	52.8	53.6
*a**	21.6	24.9	28.3	30.5
*b**	20.4	21.8	23.2	24.2
Metmyoglobin[1]	40.1	33.6	27.1	22.7
Oxymyoglobin[1]	58.5	64.9	71.4	75.8
Chroma[1]	30.5	33.9	37.4	39.7
Hue angle[1]	0.77	0.73	0.68	0.65
Trained sensory panel redness score[2]	53.6	67.4	81.1	90.4
Trained sensory panel discoloration score[3]	37.8	19.5	1.10	-
Consumer appearance score[4]	49.8	60.8	71.8	79.3
Product sold at discounted price				
*L**	49.5	50.8	52.2	53.2
*a**	17.9	21.4	25.0	27.4
*b**	18.9	20.3	21.8	22.8
Metmyoglobin[1]	47.8	40.5	33.2	28.2
Oxymyoglobin[1]	50.1	57.4	64.7	69.7
Chroma[1]	25.8	29.2	32.7	35.0
Hue angle[1]	0.84	0.78	0.72	0.68
Trained sensory panel redness score[2]	40.9	56.6	72.3	82.9
Trained sensory panel discoloration score[3]	64.0	42.0	20.1	5.20
Consumer appearance score[4]	36.9	49.1	61.3	69.6

[1]Calculated utilizing the equations presented in the AMSA Meat Color Measurement Guidelines (AMSA, 2012).
[2]Sensory scores: 0 = extremely dark red, 100 = bright cherry red.
[3]Sensory scores: 0 = no visible discoloration, 100 = complete discoloration.
[4]Sensory scores: 0 = extremely undesirable, 100 = extremely desirable.

The Bottom Line: The models generated from this study provide the ability to predict consumer willingness to purchase ground beef of varying days of retail display and provide ground beef producers an indication of potential consumer purchasing behaviors based upon objective values that are easy to measure.

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CATTLEMEN'S DAY 2023

BEEF CATTLE RESEARCH

Effects of Adding Egg Powder From Hens Immunized Against Phospholipase A2 on Ground Striploin Shelf Life

Carolina Velasco Ayala

Objective: The present study investigated the effect of incorporating three different levels of dried egg powder (EP) containing antiphospholipase α2 (aPLA2) on lipid oxidation and discoloration for its potential to extend ground striploin shelf life.

Study Description: U.S. Department of Agriculture choice striploins from ten beef carcasses were used. Impacts on beef discoloration, L* (lightness), a* (redness), and b* (yellowness) parameters, and lipid oxidation over a 7-day display period were studied. The fatty acid and phospholipid profiles of the beef patties were also examined.

Results: The EP was confirmed to contain active aPLA2. As expected, a* and b* values decreased ($P < 0.05$), and visual discoloration increased ($P < 0.05$) throughout the 7 days of retail display. However, the inclusion of EP had no effect on beef patty visual discoloration, a*, or b* ($P > 0.05$). Lipid oxidation increased ($P < 0.05$) for all treatments throughout the 7-day display period. Beef patties containing 1.6% EP had higher ($P < 0.05$) lipid oxidation than the rest of the treatments. The addition of 1.6% EP to ground striploin increased the relative percentage of C11-18:1 trans, C18:2, C18:3, C20:1, and C22:6 fatty acids, but decreased the relative percentage of C17:0, and C17:1 when compared to the other treatments ($P < 0.05$). Adding more than 0.8% EP containing aPLA2 in ground striploin altered the fatty acid profile by increasing the content of some polyunsaturated fatty acids, particularly 18:2, which likely led to the enhanced lipid oxidation in ground striploin patties. Finally, the phosphatidylcholine relative percentage was higher for the 1.6% EP treatment compared to the control, possibly due to the inhibition of PLA2 by aPLA2 activity.

The Bottom Line: These results showed that egg powder containing aPLA2 did not have any effect in extending beef shelf life when incorporated into ground striploin. Further research could introduce aPLA2 through a different vehicle to reduce interference of fatty acid composition.

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Establishing Spoilage Thresholds of Ground Beef in a Traditional Retail Case Scenario

Grace Corrette

Objective: The objective of this study was to determine spoilage in fresh ground beef and the perception of consumers regarding alteration of sensory characteristics, as well as the acceptability at different days of shelf-life.

Study Description: Ground beef loaves (n = 84) of 80% lean, 20% fat composition and aerobically packaged were stored in a simulated refrigerated retail case for 6 days. Consumers evaluated visual color, odor, touch, and taste. Instrumental color, lipid oxidation, aerobic plate count, and *Enterobacteriaceae* count were determined.

Least square means for consumers (n = 96) panel rating and percentage rated acceptable for purchase and spoilage based upon visual color. Least square means without common superscript differ ($P < 0.05$).

Least square means (log CFU/g) for aerobic plate count (APC) and *Enterobacteriaceae* (EB) counts on aerobically packaged ground beef displayed refrigerated for 6 days

Plate type	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	SEM[1]	*P*-value
APC	7.73^{d}	7.81^{cd}	7.86^{bcd}	7.88^{abc}	7.89^{abc}	7.97^{ab}	8.02^{a}	0.07	< 0.01
EB	4.76^{c}	4.77^{c}	4.95^{bc}	5.09^{abc}	5.12^{ab}	5.35^{a}	5.36^{a}	0.18	< 0.01

^{abcdef}Least square means within rows without common superscript differ ($P < 0.05$).

[1]Standard error of the least square mean.

The Bottom Line: In this study, color was shown to be the important product characteristic of spoilage to consumers' satisfaction. Overall, based on this research, ground beef can be displayed for 3 days without being perceived as spoiled by consumers.

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Consumer Sensory Evaluation of Ground Beef and Plant-Based Ground Beef Alternatives Used in a Hamburger Application

Lane A. Egger

Objective: The objective of this study was to evaluate the palatability traits and consumer acceptance of three plant-based ground beef alternatives in comparison to ground beef in a foodservice-like hamburger application.

Study Description: Three popular plant-based ground beef alternatives (GBA) and 80% lean, 20% fat composition ground beef chubs (n = 20) were selected for consumer analysis. Samples were cooked to an internal temperature of 160°F, plated on a bun and served to consumers with the opportunity to apply ketchup, mustard, cheese, lettuce, and pickles. Consumers evaluated the differences in palatability traits and purchase intent for the samples identified as: Ground Beef, Foodservice GBA, Retail GBA, and Traditional GBA.

Least squares means for consumer (n = 120) panel ratings for hamburgers with ground beef and plant-based ground beef alternatives (GBA)[1]

Trait[2]	Ground beef	Foodservice GBA	Retail GBA	Traditional GBA	SEM[3]	*P*-value
Hamburger panels[4]						
Juiciness	66.4[a]	55.3[b]	53.5[b]	39.1[c]	2.2	< 0.01
Tenderness	64.7[a]	61.4[a]	62.6[a]	48.8[b]	2.1	< 0.01
Texture	64.6[a]	55.0[b]	50.0[b]	40.5[c]	2.3	< 0.01
Overall flavor	67.7[a]	48.6[b]	43.4[bc]	37.4[c]	2.5	< 0.01
Beef flavor	66.1[a]	47.2[b]	41.0[c]	36.8[c]	2.7	< 0.01
Overall liking	67.5[a]	49.6[b]	42.3[b]	34.1[c]	2.6	< 0.01
Purchase intent[5]	63.3[a]	42.2[b]	34.5[c]	28.3[c]	2.7	< 0.01
Purchase price[6]	4.8[a]	3.2[b]	2.7[bc]	2.1[c]	0.2	< 0.01

[abc]Least squares means in the same row without a common superscript differ ($P < 0.05$).

[1]Foodservice GBA = plant-based ground beef alternative most commonly sold in foodservice establishments (restaurants).
Retail GBA = plant-based ground beef alternative most commonly sold in retail markets (grocery stores, supermarkets).
Traditional GBA = plant-based ground beef alternative most indicative of a traditional soy-based product.

[2]Sensory scores: 0 = extremely dry/tough, dislike texture/overall flavor/beef flavor/overall; 50 = neither dry nor juicy/neither tough nor tender, neither like nor dislike texture/overall flavor/beef flavor/overall; 100 = extremely juicy/tender, like texture/overall flavor/beef flavor/overall.

[3]Standard error of the means (largest) of the least square means.

[4]Consumers were served a hamburger patty on a white bun with an option to add cheese, ketchup, lettuce, mustard, and pickle to their hamburger samples.

[5]If price were not a factor, likelihood of purchase; 1 = Not Likely, 100 = Extremely Likely.

[6]Price, in US dollars, willing to be paid at foodservice for a comparable product.

The Bottom Line: This research indicates the use of ground beef and ground beef alternatives provide different eating experiences when consumed as a complete hamburger and should be marketed as such by the foodservice and retail sectors.

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BEEF CATTLE RESEARCH

Consumer Sensory Evaluation of Ground Beef and Plant-Based Ground Beef Alternatives Used in a Taco Application

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Objective: The objective of this study was to evaluate consumer preferences for palatability traits and consumer acceptability of three plant-based protein alternatives and ground beef in a taco application.

Study Description: Three commercially available plant-based ground beef alternative (GBA) treatments (n = 20) were selected based upon industry prevalence. The GBAs' were identified as the most popular in the marketing sectors of foodservice (FGBA), retail (RGBA), and traditional (TGBA). One ground beef (80% lean; 20% fat) treatment (n = 20) was selected. Samples were crumbled into a skillet and cooked to a surface temperature of 180°F. Following cooking, a generic taco seasoning was added following manufacturer's instruction. Samples were served on a flour tortilla with the opportunity to add cheese, lettuce, and tomatoes.

Least squares means for consumer (n = 120) panel ratings for tacos made with ground beef and plant-based ground beef alternatives (GBA)[1]

Trait[2]	Ground beef	Foodservice GBA	Retail GBA	Traditional GBA	SEM[3]	*P*-Value
Taco panels[4]						
Juiciness	74.3[a]	60.8[b]	66.6[b]	45.4[c]	2.4	< 0.01
Tenderness	68.6[a]	67.1[a]	65.4[a]	58.8[b]	2.2	< 0.01
Texture	70.9[a]	55.1[b]	53.7[b]	43.1[c]	2.9	< 0.01
Overall flavor	68.7[a]	51.3[b]	49.0[b]	36.0[c]	3.2	< 0.01
Beef flavor	68.3[a]	50.4[b]	46.4[b]	35.0[c]	3.1	< 0.01
Overall liking	69.7[a]	51.7[b]	47.4[b]	34.5[c]	3.3	< 0.01
Purchase intent[5]	63.7[a]	42.6[b]	39.6[b]	27.3[c]	3.4	< 0.01
Purchase price[6]	2.8[a]	1.9[b]	1.6[bc]	1.3[c]	0.2	< 0.01

[abc]Least squares means in the same row without a common superscript differ ($P < 0.05$).
[1]Foodservice GBA = plant-based ground beef alternative most commonly sold in foodservice establishments (restaurants). Retail GBA = plant-based ground beef alternative most commonly sold in retail markets (grocery stores, supermarkets). Traditional GBA = plant-based ground beef alternative most indicative of a traditional soy-based product.
[2]Sensory scores: 0 = extremely dry/tough, dislike texture/overall flavor/beef flavor/overall; 50 neither dry nor juicy/neither tough nor tender, neither like nor dislike texture/overall flavor/beef flavor/overall; 100 = extremely juicy/tender, like texture/overall flavor/beef flavor/overall
[3]Standard error (largest) of the least square means.
[4]Consumers were served samples seasoned with a taco seasoning blend on a flour tortilla with an option to add cheese, lettuce, and tomato to their taco samples.
[5]If price were not a factor, likelihood of purchase; 1 = Not Likely, 100 = Extremely Likely.
[6] Price, in U.S. dollars, willing to be paid at foodservice for comparable product.

The Bottom Line: This research indicates consumers preferred ground beef to ground beef alternatives when used as a crumbled protein ingredient in tacos. Ground beef should be marketed as a distinct eating experience to consumers at foodservice and retail when plant-based ground beef alternatives are available in similar crumbled products.

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Consumer Sensory Evaluation of the Impact of Bone-In Versus Boneless Cuts on Beef Palatability

Kaylee Farmer

Objective: The objective of this study was to determine palatability traits of beef cuts of differing bone status and quality grade.

Study Description: Paired (n = 12 pairs; 24 total/cut/grade) boneless and bone-in ribeye rolls, and short loins were procured. Short loins were fabricated into boneless strip loins with corresponding bone-in tenderloins or bone-in strip loins with boneless tenderloins. Post aging, subprimal cuts were fabricated into steaks that were randomly selected for further analysis. Consumer sensory panelists (n = 144) were recruited from Manhattan, KS, and the surrounding area and paid for their participation in the study. Panels were conducted in a lecture-style classroom at Kansas State University.

Results: In totality, bone status had a minimal impact on palatability traits. Bone state had no impact ($P > 0.05$) on consumer juiciness and overall liking for tenderloins and ribeyes, but in the strip loin, bone-in steaks were rated juicier ($P < 0.05$) and higher ($P < 0.05$) for overall liking when compared to boneless steaks. Moreover, bone state had no impact ($P > 0.05$) on consumer tenderness and flavor ratings for any of the three cuts. Bone state had no impact ($P > 0.05$) on the percentage of consumers that rated juiciness as acceptable for tenderloins and ribeyes, but in strip loins, bone-in steaks had a higher ($P < 0.05$) percentage of acceptable consumer responses than boneless cuts. The percentage of acceptable samples for tenderness and overall acceptability were not ($P > 0.05$) impacted by bone state in tenderloins and strip loins; however, in ribeyes, the percentage of acceptable consumer ratings was higher ($P < 0.05$) for bone-in cuts for both traits. Bone state also did not ($P > 0.05$) impact premium, better than everyday, and everyday quality perceptions among ribeyes; but the percentage of consumers rating ribeye samples unsatisfactory was higher ($P < 0.05$) for boneless ribeye steaks.

The Bottom Line: A similar overall eating experience could be derived from a boneless or bone-in steak from the same cut and quality grade.

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Change in Myoglobin Denaturation Among Three Degrees of Doneness of Three Muscles

Erin Beyer

Objective: The objective of this study was to determine the changes in myoglobin denaturation through cooking three different muscles to medium rare, medium, or well-done degrees of doneness.

Study Description: Strip loins (n = 12) and top butts (n = 12) were used to evaluate the physiochemical properties of the *longissimus dorsi, biceps femoris,* and *gluteus medius* for three degrees of doneness (DOD; medium rare, medium, and well-done).

CIE L*, a*, and b* and myoglobin denaturation of three degrees of doneness and three muscles

Degree of doneness	L*[1]	a*[1]	b*[1]	pH	Myoglobin denaturation,[2] %
Medium rare, 145°F	50.04	25.32[a]	20.69[a]	5.82	29.08[c]
Medium, 160°F	50.90	21.90[b]	20.68[a]	5.83	48.34[b]
Well done, 170°F	50.33	17.68[c]	19.49[b]	5.75	70.17[a]
SEM[3]	0.36	0.59	0.34	0.06	2.08
P-value	0.06	<0.01	<0.01	0.09	<0.01
Muscle[4]					
LL	53.03[a]	20.07	20.17	5.74[b]	48.85
BF	48.21[c]	21.89	20.40	5.87[a]	49.65
GM	50.03[b]	21.60	20.28	5.71[b]	49.08
SEM[3]	0.83	0.80	0.40	0.06	3.17
P-value	<0.01	0.05	0.84	0.01	0.97

[abc] Means within the same column without a common superscript differ ($P < 0.05$).
[1] L*: 0 = black, 100 = white; a*: -60 = green, 60 = red; b*: -60 = blue, 60 = yellow.
[2] Myoglobin denaturation, % = [1 - (raw - cooked) / raw] × 100.
[3] Standard Error (largest) of the least squares means.
[4] LL = *longissimus dorsi*; BF = *biceps femoris*; GM = *gluteus medius*.

Bottom Line: As expected, the myoglobin denaturation percentage increased with increasing DOD and behaved similarly to changes in the a* values. This research gives more insight into the impacts of cooking and the changes that proteins, especially myoglobin, undergo between different DOD.

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CATTLEMEN'S DAY 2023

BEEF CATTLE RESEARCH

Evaluating the Effect of Accelerated Aging at Different Temperature and Time Points on Beef Quality and Enzyme Activity of Lower Quality Beef Cuts

Haley Jeneske

Objective: This study aimed to explore the effects of four accelerated aging (AA) methods at different temperature and time points on meat quality and enzymatic activity of two lower quality beef cuts.

Study Description: Shoulder clod and top round were collected from 10 U.S. Department of Agriculture choice beef carcasses, fabricated into steaks, and assigned to one of six treatments: 3 days postmortem (control), cooler aged for 21 days, AA 120°F for 2 h, AA 120°F for 3 h, AA 130°F for 2 h, and AA 130°F for 3 h. Yield was calculated based on loss during AA and cooking loss, and purge was collected for collagen analysis. Warner-Bratzler shear force (WBSF) was determined, and purge for microbial analysis was collected from primal bags as well as the package after AA treatment. Steak surfaces were swabbed on the anterior side prior to AA treatment, then swabbed on the posterior side after treatment. Aerobic plate counts (APC) were performed on purge and swab samples. Cathepsin activity was determined through zymography. Soluble collagen content and total collagen in the purge were determined through hydroxyproline content.

Results: All AA treatments decreased APC on the steak surfaces ($P < 0.01$) and in the purge ($P < 0.05$). The 130°F samples had a lower yield after AA than the 120°F groups ($P < 0.05$). The cooler aged samples had a lower cook yield than all of the AA samples ($P < 0.01$), and shoulder clod samples displayed higher cooking yield than the top round ($P < 0.01$). The WBSF results showed that AA 120°F for 3 h samples and both AA 130°F samples displayed similar tenderness to the samples that were cooler aged for 21 days ($P < 0.01$). All the AA treatments had higher collagen in the purge than the control or cooler aged samples ($P < 0.01$). There was heightened cathepsin enzymatic activity during all treatments when compared to the control samples, and the AA at 120°F for 3 h treatment displayed the highest activity compared to other AA treatments ($P < 0.01$).

The Bottom Line: Accelerated aging has shown to be a promising technique to increase value in lower priced beef cuts through increasing enzymatic activity and tenderness without accelerating microorganism growth.

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Evaluation of Bovine Myosin Heavy Chain Isoforms and Muscle Fiber Cross-Sectional Area on the Eating Quality of 11 Different Beef Muscles

Sara Hene

Objective: The objective of this study was to investigate the contribution of muscle fiber type and size on the eating quality of 11 different beef muscles.

Study Description: Eleven different beef muscles were utilized from two separate studies. In study 1, shoulder clod, flank, knuckle, mock tender, top sirloin butt, brisket, eye of round, and ribeye were collected from 10 U.S. Department of Agriculture choice carcasses (n = 80), and each muscle was fabricated into steaks at 2 days postmortem. In study 2, strip loin, tri-tip, and heel were collected from 10 USDA low choice carcasses (n = 30). Myofibrillar proteins were extracted and analyzed by immunoblot to determine muscle fiber type. Cross sectional area (CSA) and muscle fiber diameter were determined under the microscope. An average of 400 fibers per sample were analyzed to determine CSA and muscle fiber diameter. Pearson correlation analysis was conducted to determine the relationship between muscle fiber type, CSA, and diameter with the results for the eating quality of beef as determined by a trained panel that were reported in previous studies.

Results: In study 1, there was a positive correlation between fiber type 1 and initial juiciness ($r = 0.37$; $P < 0.05$), sustained juiciness ($r = 0.39$; $P < 0.05$) and lipid flavor ($r = 0.41$; $P < 0.05$). Conversely, there was a negative correlation between fiber type 2A and initial juiciness ($r = -0.40$; $P < 0.05$) sustained juiciness ($r = -0.42$; $P < 0.05$), and lipid flavor ($r = -0.45$; $P < 0.01$). Both studies saw a negative correlation between muscle fiber CSA and diameter with connective tissue content ($P < 0.05$), but positive correlations to overall tenderness ($P < 0.05$).

The Bottom Line: This study shows that muscles predominated by type 1 fibers will likely deliver a higher eating quality experience for consumers, while muscles with more glycolytic fibers 2A and 2X will deliver a less favorable eating experience for consumers. On the other hand, these data also demonstrated that larger muscle fiber CSA and diameter are not necessarily a negative eating quality marker as muscles with those characteristics had less connective tissue and had greater tenderness scores.

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SUMMARY PUBLICATION

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