

CATTLEMEN'S DAY 2010

BEEF CATTLE RESEARCH

SUMMARY PUBLICATION



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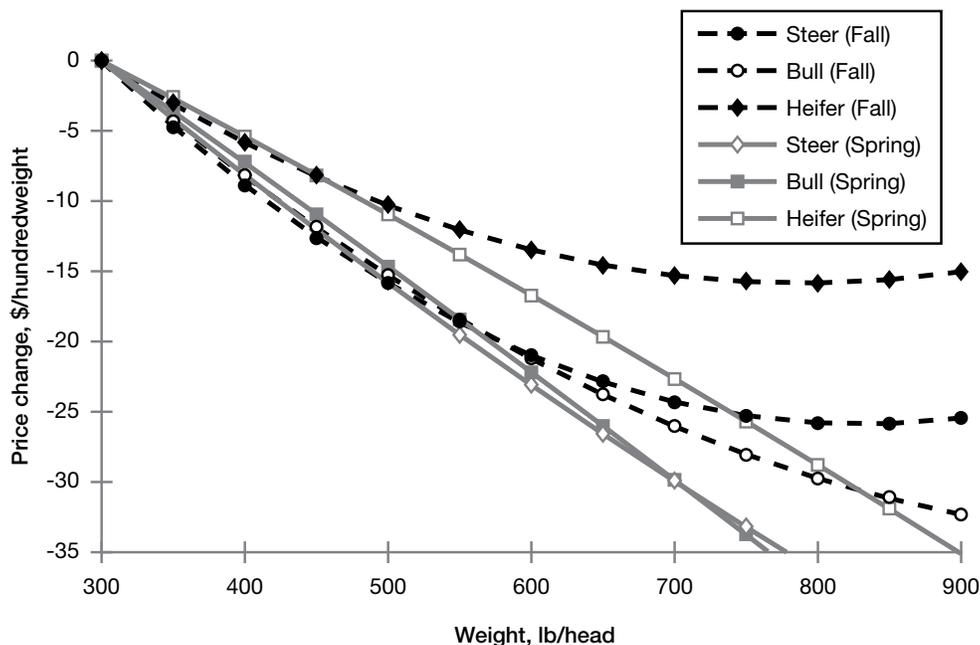
Current Factors Affecting Feeder Cattle Pricing in Kansas and Missouri Cattle Markets

Karl Harborth

Objective: Gain knowledge of the current link between market pricing and genetic, management, and marketing decisions to provide updated information regarding how the myriad of industry changes since the 1980s and 1990s has affected the characteristics that influence feeder cattle and calf prices.

Study Description: Transaction-level feeder cattle market data were collected from approximately 8,200 individual lot transactions encompassing 84,319 head. Data were collected from feeder cattle auctions in Dodge City, KS, and Carthage, MO, during November and December 2008 and March and April 2009 by trained evaluators. Data recorded for each transaction included lot size, sex, color, breed, condition, fill, muscle, frame size, weight uniformity, freshness, horn presence, time of sale, weight, and price.

Effect of Weight on Feeder Cattle Price



The Bottom Line: Cattle producers cannot affect forces that drive the cattle market, but they can control factors that affect the premiums and discounts their calves can potentially obtain. Producers should market healthy, dehorned cattle, ideally in large, uniform lots. Producers should also avoid selling cattle that are extremely thin or fat and/or extremely gaunt or full to obtain the greatest value.

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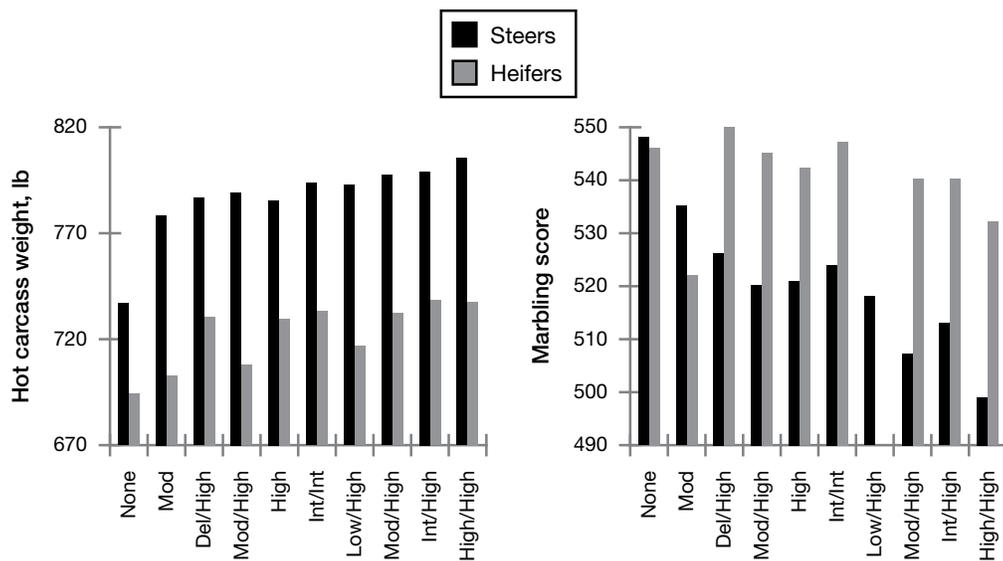
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Implant Programs Affect Performance and Quality Grade

Chris Reinhardt

Objective: Summarize the effects of different implant programs on performance and carcass quality on the basis of a cross section of available published research.

Study Description: A total of 83 studies (61 steer studies and 22 heifer studies) were included in a meta-analysis of the effects of implant program on feedlot performance (daily gain, dry matter intake, and feed conversion) and carcass traits (hot carcass weight, yield grade, and marbling score). Individual implant programs were consolidated into groups of similar dose programs. Any combinations of implant groupings used in reimplant programs were coded according to dosage (e.g., none, delayed, low, moderate, intermediate, and high). In instances when multiple implants were used, the initial implant dose appears first, followed by the terminal implant dose (e.g., Synovex-S followed by Synovex-Plus = MOD/HIGH).



The Bottom Line: Increasing dose and duration of implant increases performance in both steers and heifers, but because of physiological differences between heifers and steers, implants have a more pronounced effect on marbling score in steers than in heifers.

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Precutting Round Alfalfa and Cornstalk Bales Decreases Time and Fuel Required for Bale Breakup in a Vertical Mixer

Spencer Jones

Objective: Determine the effects of precut and conventional alfalfa and cornstalk bales on (1) mixing time in a vertical mixer, (2) influence of initial field cut method of cornstalks on mixing time, and (3) tractor fuel usage while mixing.

Study Description: The conventional baling method fed alfalfa through the header of a round baler and carried it by packer fingers into a baling chamber. The precut baling method fed alfalfa through the header of a round baler equipped with serrated knives that cut the alfalfa stems into 3- to 8-in. sections. In experiment 1, alfalfa round bales were used to evaluate differences in mixing time of alfalfa baled with different techniques (precut vs. conventional) and in different bale sizes (5 × 4 ft vs. 6 × 4 ft). In experiment 2, cornstalk round bales were used to evaluate differences in mixing time of cornstalks baled with different techniques (precut vs. conventional) and field cutting methods (swathed, flail shredded, brush hog).

Results: In experiment 1, precut bales had a shorter ($P < 0.05$) mixing time than conventional bales regardless of bale size (72 vs. 142 seconds for 5 × 4 ft and 110 vs. 237 seconds for 6 × 4 ft, respectively). Fuel usage was lower ($P < 0.05$) for 5 × 4 ft precut bales than for 5 × 4 ft conventional bales but similar between bale types for 6 × 4 ft bales. Precut alfalfa bales used less fuel ($P < 0.001$) than conventional bales. Also, the 5 × 4 ft alfalfa bales used less fuel per bale ($P < 0.001$) than the 6 × 4 ft bales. In experiment 2, precut bales had a shorter ($P < 0.001$) mixing time than conventional bales. Precut bales also used less fuel per bale ($P < 0.01$) than conventionally processed bales for each field cutting method.

The Bottom Line: Precut forage bales required less time to break apart in a vertical mixer, which translated into less fuel required per bale.

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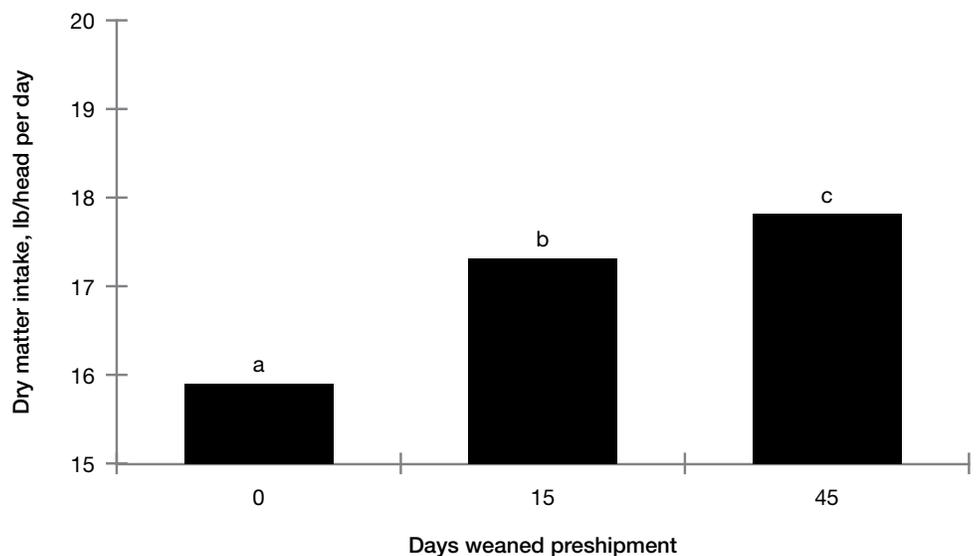
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Length of Weaning Period But Not Timing of Vaccination Affects Feedlot Receiving Performance and Health of Fall-Weaned, Ranch-Direct Beef Calves

Mike Macek

Objective: Compare the effects of vaccinating against bovine respiratory disease before weaning at the ranch of origin or after feedlot arrival for calves weaned 45, 15, or 0 days before feedlot arrival.

Study Description: Angus × Hereford calves ($n = 437$; average initial weight = 458 + 54 lb) were assigned randomly to a preshipment weaning period (i.e., 45, 15, or 0 days before shipment). Within each weaning period, calves were assigned to one of two vaccination treatments. One group was vaccinated 14 days before maternal separation and again at weaning. The second group was vaccinated on the day of arrival at the feedlot and again 14 days later. Calves were transported and commingled at a commercial auction barn, held for 12 hours, and then transported 5 miles to a feedlot. All calves were adapted to a receiving ration, and daily dry matter intakes were recorded. Cattle also were monitored twice daily for symptoms of respiratory disease.



Bars with different letters are different ($P < 0.05$).

The Bottom Line: Weaning periods longer than 15 days at the ranch of origin do not improve health or performance of calves when they enter the feedlot. This study also raises the possibility that preshipment vaccination may not improve health or performance of ranch-direct cattle relative to vaccination that is deferred until feedlot arrival.

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Comparison of Medicinal Feed Additives on Health and Growth Performance of Beef Calves Grazing Native Grass Pasture

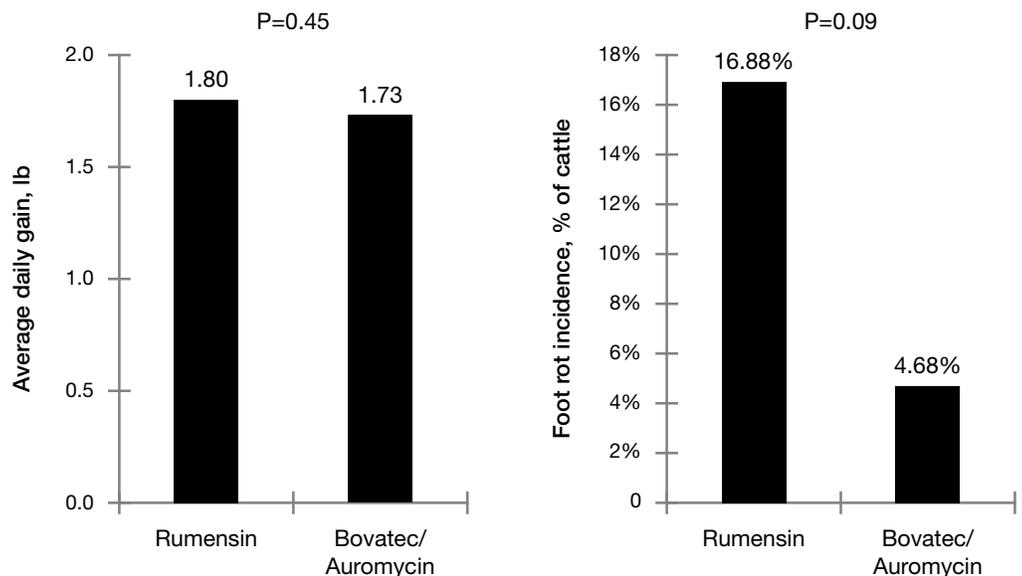
Dale Blasi

Objective: Evaluate the efficacy of mineral supplementation programs that provide medicinal feed additives for managing growth and health of stocker calves grazing native grass pastures in the Flint Hills region of Kansas.

Study Description: Stocker calves ($n = 306$, initial body weight = 582 lb) were double stocked (250 lb body weight/acre) on native grass pasture for 90 days. The two treatments consisted of a free-choice mineral formulated to contain similar concentrations of minerals but with either (1) Bovatec and Aureomycin or (2) Rumensin.

Results: Daily intake of the Rumensin mineral was only 60% of the daily consumption of Bovatec/Aureomycin mineral, but there was no difference in daily gain between treatments. There was a tendency for a reduction in foot rot in the Bovatec/Aureomycin treatment ($P < 0.09$).

Effects of Mineral Medication Treatment on Average Daily Gain and Incidence of Foot Rot in Stocker Cattle Grazing Native Flint Hills Pastures



The Bottom Line: The Bovatec/Aureomycin combination decreased incidence of foot rot but did not improve performance compared with Rumensin.

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**Feed-Based Metaphylaxis Programs Did Not Affect
 Health or Performance of High-Risk Calves Mass
 Medicated with Draxxin on Arrival**

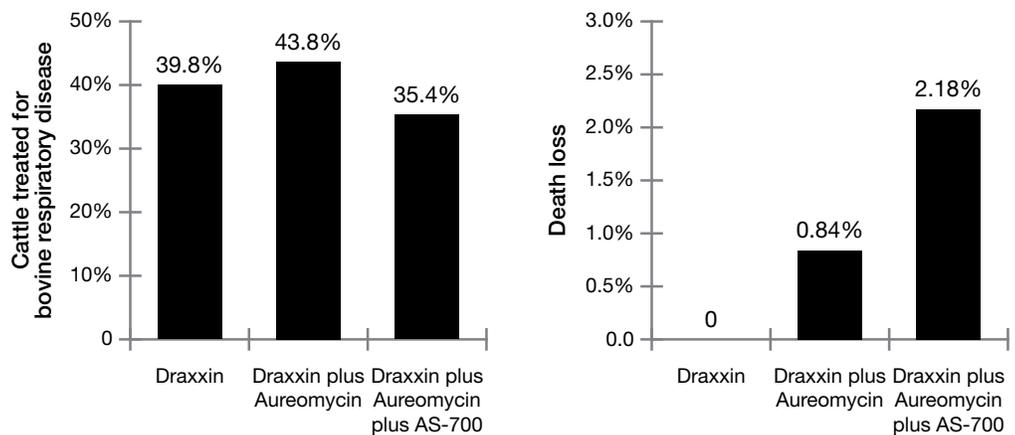
Dale Blasi

Objective: Evaluate the efficacy of metaphylaxis programs that use an injectable antimicrobial or a combination of injectable and feed-based antimicrobials.

Study Description: High-risk stocker calves were delivered to the Kansas State University Beef Stocker Unit in May 2008 (n = 313, initial body weight = 451 lb). All calves received Draxxin upon arrival. Treatments consisted of no pellets, pellets containing Aureomycin, or pellets containing Aureomycin followed by AS-700.

Results: There were no significant differences among treatments in the percentage of steers treated once, twice, or one or more times for bovine respiratory disease (P>0.30). There were no significant differences in daily gain (P=0.66), daily dry matter intake (P=0.68), or feed efficiency (P=0.50) among the three treatments.

Comparison of Mass-Medication Programs for High-Risk Calves



The Bottom Line: This experiment showed no benefit of feeding Aureomycin or a combination of Aureomycin and AS-700 when high-risk calves were mass medicated with Draxxin on arrival.

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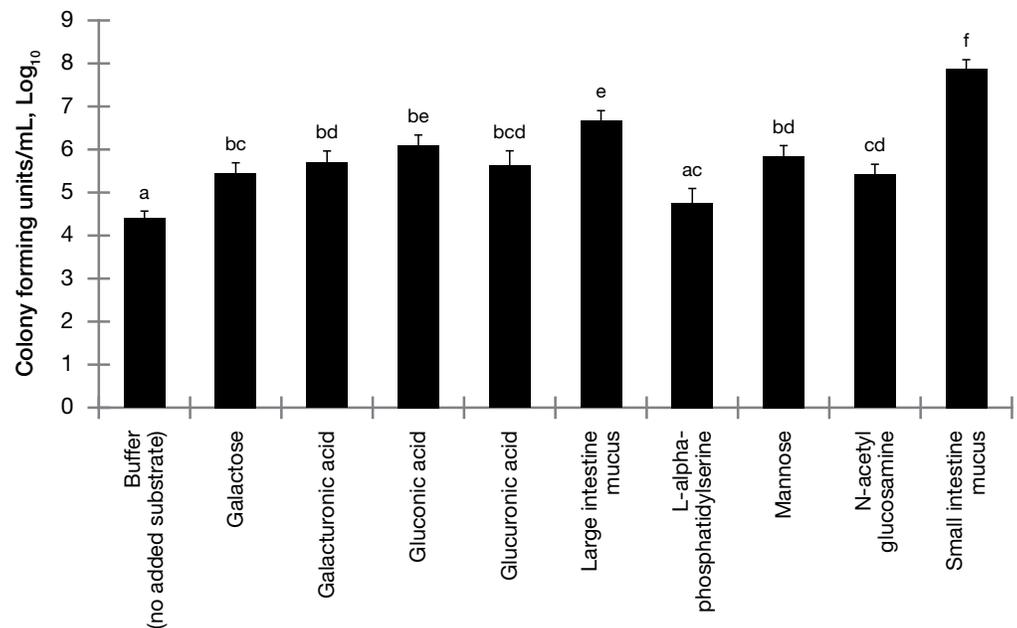
**Capacity of Bovine Intestinal Mucus
 and Its Components to Support *Escherichia coli*
 O157:H7 Growth**

Celine Aperce

Objective: Evaluate bovine intestinal mucus and mucus components in terms of their capacity to support *Escherichia coli* O157:H7 growth.

Study Description: *E. coli* O157:H7 was incubated for 0, 6, 8, or 12 hours in the presence or absence of feces to evaluate the capacity of intestinal mucus and mucus components (galactose, galacturonic acid, gluconic acid, glucuronic acid, mannose, L-alpha-phosphatidylserine, N-acetyl-D-glucosamine, and sialic acid) to support growth of the pathogen. Enzymes and enzyme inhibitors known to degrade intestinal mucus into its components also were evaluated. After incubation at 104°F, samples were diluted and plated on agar selective for *E. coli* O157:H7. Growth was expressed in Log₁₀ of colony forming units.

**Growth of *E. coli* O157:H7 After 8 Hours of Incubation
 with Small or Large Intestinal Mucus and Mucus Components**



Means without a common letter differ (P<0.05).

The Bottom Line: *E. coli* O157:H7 appears able to metabolize all fractions of mucus. However, whole mucus from the large and small intestines demonstrated a greater capacity to support growth compared with individual mucus components.

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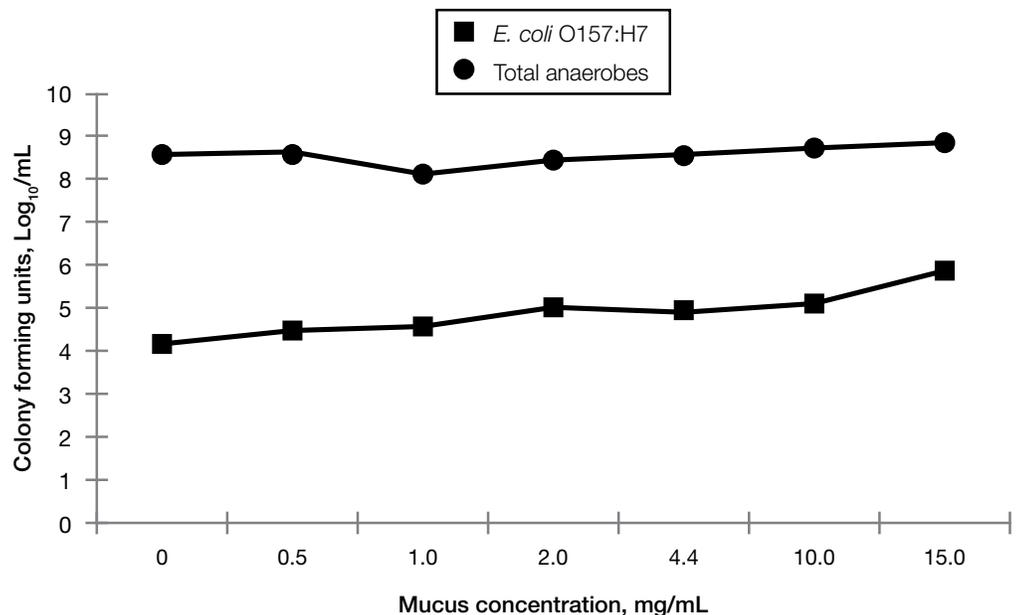
Intestinal Mucus from Cattle Stimulates Growth of *Escherichia coli* O157:H7

Jessie Heidenreich

Objective: Determine if mucus in the small or large intestine could stimulate growth of *Escherichia coli* O157:H7 in the presence and absence of competing bacteria.

Study Description: *E. coli* O157:H7 strains resistant to nalidixic acid were added to tubes containing buffer and mucus from the small or large intestine. Bovine feces were added to determine if bacterial competition affected *E. coli* O157:H7 growth. Cultures were incubated at 104°F, and samples were plated after 0, 6, 8 and 12 hours of incubation. Anaerobic fecal bacteria and *E. coli* O157:H7 counts (CFU/mL) were determined.

Results: Growth of *E. coli* O157:H7 increased linearly ($P < 0.01$) in response to increasing concentrations of mucus, but total anaerobic counts remained unchanged ($P > 0.05$). These results suggest mucus may provide a medium that favors growth of the pathogen.



The Bottom Line: Factors that influence mucus production in the gut may favor growth of *E. coli* O157:H7, providing a selective environment that may allow pathogens to outcompete other bacteria in the gut.

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Long-Term CIDR Program for Synchronization of Estrus in Beef Heifers Produces Acceptable AI Pregnancy Rates

Sandy Johnson

Objective: Compare estrous response and artificial insemination (AI) pregnancy rate in beef heifers synchronized with either the intravaginal progesterone-releasing device (CIDR)-Select or the 5-day CO-Synch timed artificial insemination + CIDR protocol.

Study Description: Yearling Angus and Angus cross heifers (n = 143) were used to compare long-term and short-term CIDR protocols for synchronization of estrus. Heifers assigned to the CIDR-Select protocol received an EAZI-BREED CIDR (1.38 g) insert for 14 days, Fertagyl (gonadotropin-releasing hormone) 9 days after CIDR removal, and Prostamate (prostaglandin F_{2α}) 7 days later. Heifers assigned to the 5-day CO-Synch + CIDR protocol received Fertagyl at the time of CIDR insertion and Prostamate 5 days later, when the CIDR was removed. Heifers observed in estrus before 60 hours after Prostamate injection were inseminated using the AM/PM rule. At 72 hours after Prostamate injection, clean-up timed AI with Fertagyl given at the time of insemination was performed on all heifers not previously observed in estrus.

Results: Interval to estrus (60.4 hours) and the proportion of heifers displaying estrus by 60 hours after Prostamate injection (34%) did not differ with treatment. Conception rate after observed estrus was higher for CIDR-Select than for 5-day CO-Synch + CIDR, as was pregnancy rate to clean-up timed AI and overall AI pregnancy rate. However, final pregnancy rate was 82% and 90% for CIDR-Select and 5-day CO-Synch + CIDR, respectively, and did not differ between estrous synchronization treatments.

The Bottom Line: The CIDR-Select protocol requires five animal handlings but results in acceptable AI pregnancy rates.

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Cornstalk Round Bale Processing Method Does Not Influence Feeding Characteristics or Feed Refusals

Spencer Jones

Objective: Determine the effects of cornstalk round bale processing methods on (1) ration uniformity, (2) particle length throughout the mixing process by bale type, and (3) effects of bale processing method on rejection of feed by cattle.

Study Description: In mid-October 2009, a portion of a cornstalk field in northeast Kansas was cut with a flail shredder and raked on a single day. Cornstalks were either conventionally baled or precut and baled. Precut bales were harvested using a round baler equipped with serrated knives that cut the forage into 3- to 8-in. sections as packer fingers moved the forage from the header to the baling chamber. The treatments were: (1) 5 × 4 ft conventionally baled cornstalks, (2) 5 × 4 ft precut cornstalks, and (3) 5 × 4 ft conventionally baled cornstalks that were later tub ground. Rations were prepared with a horizontal mixer and fed at an average of 2.45% of body weight (dry matter basis) over the 15-day evaluation period. Plastic containers (12 in. × 9 in. × 6 in.) were placed at the first, middle, and last third of the bunk line for collection of discharge location samples. Particle length was determined, and bale cores, discharge location samples, and feed refusals were analyzed for concentrations of dry matter, crude protein, acid detergent fiber, and neutral detergent fiber.

Results: Chemical analysis revealed no ($P>0.32$) mixer discharge site × bale type interactions. Different discharge locations from each of the different cornstalk treatments had similar ($P>0.11$) dry matter, crude protein, acid detergent fiber, and neutral detergent fiber. Feed refusals were similar ($P>0.25$) among all three treatments. Chemical analysis of the refusals revealed similar ($P>0.12$) levels of dry matter, crude protein, acid detergent fiber, and neutral detergent fiber among mixed rations made from forages processed by different methods.

The Bottom Line: Precutting cornstalks while baling results in responses similar to those for conventionally baled cornstalks at the dietary inclusion levels and conditions of this experiment.

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Round Bale Alfalfa Processing Method Affects Heifer Growth but Does Not Influence Wastage or Eating Preference

Spencer Jones

Objective: Determine whether precutting alfalfa during round baling affects heifer performance, forage wastage, or eating preference.

Study Description: In the conventional baling method, alfalfa was fed through the header of a round baler and carried by packer fingers into a baling chamber. In the precut method, alfalfa was fed through the header of a round baler equipped with serrated knives that cut the alfalfa stems into 3- to 8-in. sections. In experiment 1, heifers were fed either precut or conventional alfalfa hay free choice to determine performance in a 27-d study. In experiment 2, wastage was measured from precut and conventional alfalfa fed in ring feeders. In experiment 3, heifers were given a choice of eating precut or conventional alfalfa bales to determine preference.

Results: In experiment 1, average daily gain was greater for heifers consuming precut alfalfa, but calculated dry matter intake was not different between precut and conventional treatments. In experiment 2, there was no difference in hay wastage between precut and conventional alfalfa fed in ring feeders. In experiment 3, there was no difference in dry matter intake between precut and conventional round alfalfa bales.

The Bottom Line: Feeding precut alfalfa bales increased heifer gains but did not affect forage wastage in ring feeders or eating preference compared with conventional alfalfa bales. This new baling technology has the potential to positively affect producers who use round bale feeding methods.

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Round Bale Alfalfa Processing Method Does Not Influence Feeding or Mixing Characteristics in a Total Mixed Ration

Spencer Jones

Objective: Determine the effects of forage processing method on uniformity and particle length of the total mixed ration at different discharge locations throughout mixing.

Study Description: The three processing method treatments were: 5 × 4 ft conventional alfalfa bales, 5 × 4 ft precut alfalfa bales, and 5 × 4 ft conventional alfalfa bales that were later tub ground. In the conventional baling method, alfalfa was fed through the header of a round baler and carried by packer fingers into a baling chamber. In the precut method, alfalfa was fed through the header of a round baler equipped with serrated knives that cut the alfalfa stems into 3- to 8-in. sections. Rations were prepared with a horizontal mixer and fed to 75 bulls at 2.33% (dry matter) of body weight for 15 days. Total mixed ration particle length was determined, and bale cores and discharge location (first, middle, or last third of bunk line) samples were analyzed for dry matter, crude protein, acid detergent fiber, and neutral detergent fiber.

Results: Samples from different discharge locations and bale types had similar geometric mean lengths and standard deviations. Processing method did not influence ($P>0.28$) dry matter and crude protein. There was no difference in acid detergent fiber ($P>0.17$) between samples from the first and middle third, but samples from the first third tended to have higher ($P=0.07$) neutral detergent fiber. Acid detergent fiber and neutral detergent fiber levels of feed samples from the last third of the mixer discharge were greater ($P=0.03$) than those of samples from the beginning third and similar ($P>0.44$) to those of samples from the middle third.

The Bottom Line: There was more ingredient segregation in total mixed rations made from conventional or precut bales than in rations made with tub-ground forage. Precutting forages resulted in responses similar to those for conventionally baled forages at the dietary inclusion levels and conditions of this experiment.

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Botanical Composition of Diets Grazed by Beef Cows in the Kansas Flint Hills During Winter

Gregory Eckerle

Objective: Establish the validity of using direct microscopy of fecal material to quantify the botanical composition of diets grazed by mature beef cows in the Kansas Flint Hills during winter.

Study Description: Mature beef cows were allowed to graze on a single, dormant, native tallgrass pasture at the Kansas State University Cow-Calf unit. Approximately 95% of above-ground biomass on these pastures was composed of the following forage species: big bluestem, little bluestem, sideoats grama, blue grama, switchgrass, Indiangrass, lead plant, heath aster, dotted gayfeather, and purple prairie clover. Fresh fecal samples were collected after 30 days of grazing. Slides were prepared from decolorized, cleaned samples and digitally photographed on a microscope for quantification of botanical composition.

Identifiable botanical fragments in feces of beef cows that grazed Kansas Flint Hills range during winter

Species	Botanical composition, % of diet dry matter
Grasses	
Big bluestem	8.91
Little bluestem	8.07
Sideoats grama	15.06
Blue grama	8.88
Switchgrass	8.14
Indiangrass	12.95
Unidentified grasses	3.00
Forbs	
Lead plant	7.89
Heath aster	7.00
Dotted gayfeather	4.18
Purple prairie clover	13.26
Unidentified forbs	2.66

The Bottom Line: Identifiable plant fragments were composed of 65% grasses and 35% forbs. Forbs are relatively important in the diets of mature beef cattle grazing Flint Hills pasture during the winter.

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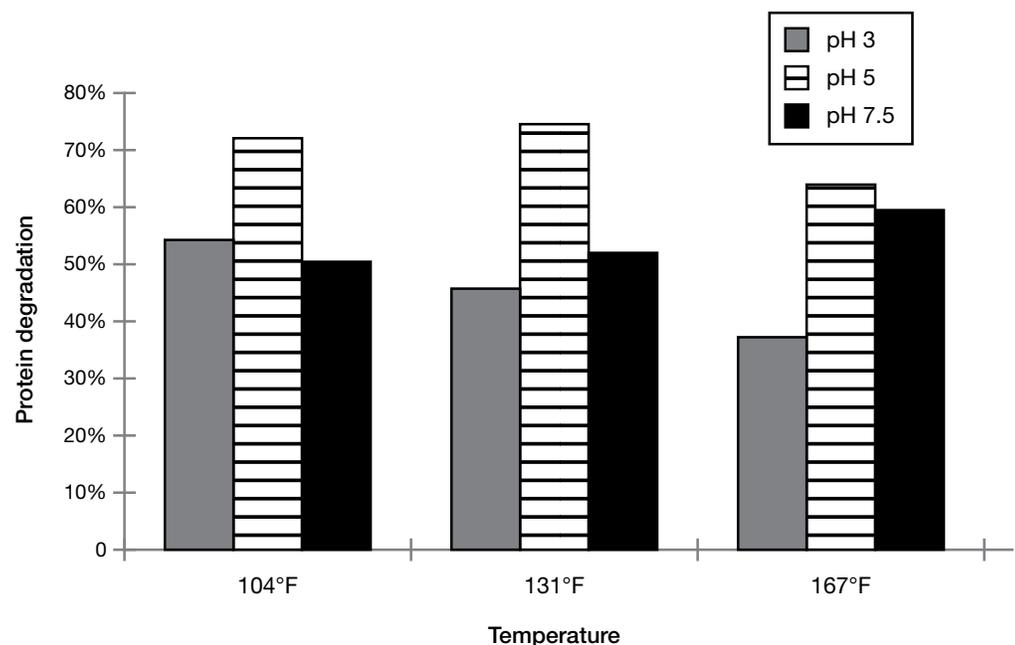
**Wheat Gluten Films Prepared at High Temperature
 and Low pH Decrease Degradation by Rumen
 Microorganisms**

Kirsty Blaine

Objective: Manufacture wheat gluten protective films that are resistant to digestion by rumen microorganisms. These films will be useful for encapsulating micro-nutrients to escape ruminal degradation.

Study Description: We conducted an in vitro study to investigate effects of three pH levels (3.0, 5.0, and 7.5) and three temperature levels (104°F, 131°F, and 167°F) of the film-forming solution on final film stability in the rumen. Acidity of film-forming solutions was altered by adding glacial acetic acid or ammonium hydroxide. Temperature of the film-forming solutions was adjusted with a hot plate, and films were held at the appropriate temperature for 10 minutes. Susceptibility of the films to digestion by bacteria was evaluated with an in vitro protein degradation assay. In vitro protein degradation was determined after 0, 2, 4, 6, and 8 hours of fermentation.

Protein Degradation of Films After 8 Hours of Ruminal Fermentation



The Bottom Line: Wheat gluten films manufactured at high temperature (167°F) and low pH (pH 3) are substantially resistant to degradation by ruminal microorganisms.

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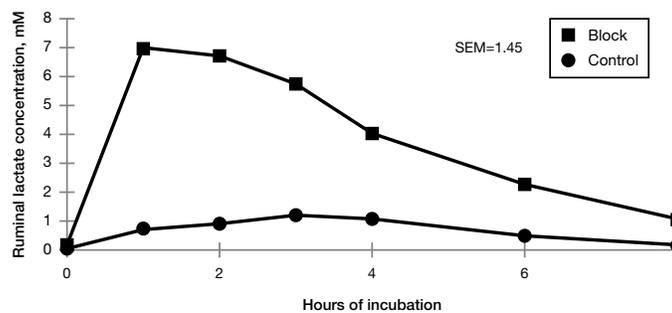
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Supplementing Fructose-Based Block Supplements to Forage-Fed Cattle Increases Capacity for Lactic Acid Metabolism

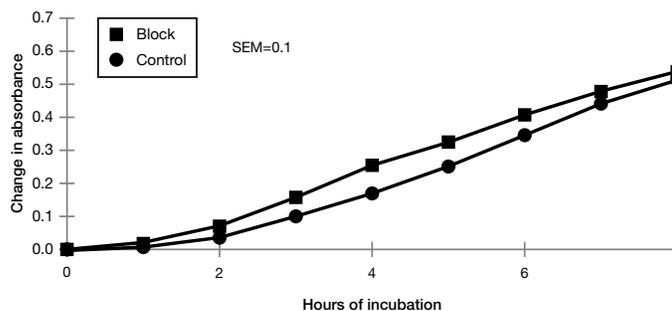
Kevin Miller

Objective: Evaluate the effects of feeding a fructose-based block supplement on ruminal lactate concentrations and subsequent proliferation of lactate-utilizing bacteria in forage-fed cattle.

Study Description: Twelve ruminally cannulated heifers were fed prairie hay and loose salt. Half of the heifers were given a 2-lb aliquot of the fructose-based block supplement via the ruminal cannula for 3 consecutive days. Ruminal fluid was collected from each animal at 30-minute intervals for 8 hours after feeding on days 1 and 3 of the experiment. Lactic acid and volatile fatty acid concentrations, ruminal pH, and growth of lactate-utilizing bacteria were measured.



Treatment effect, $P < 0.05$; treatment \times hour interaction, $P < 0.05$



Treatment \times hour interaction, $P < 0.05$

The Bottom Line: Feeding fructose-based block supplements increased lactic acid production in the rumen for a short period of time, allowing for establishment of a population of lactic-acid-metabolizing bacteria in the rumen. This research provides a basis for future development of management strategies aimed at preconditioning calves to avoid acidosis when grains are introduced into the diet.

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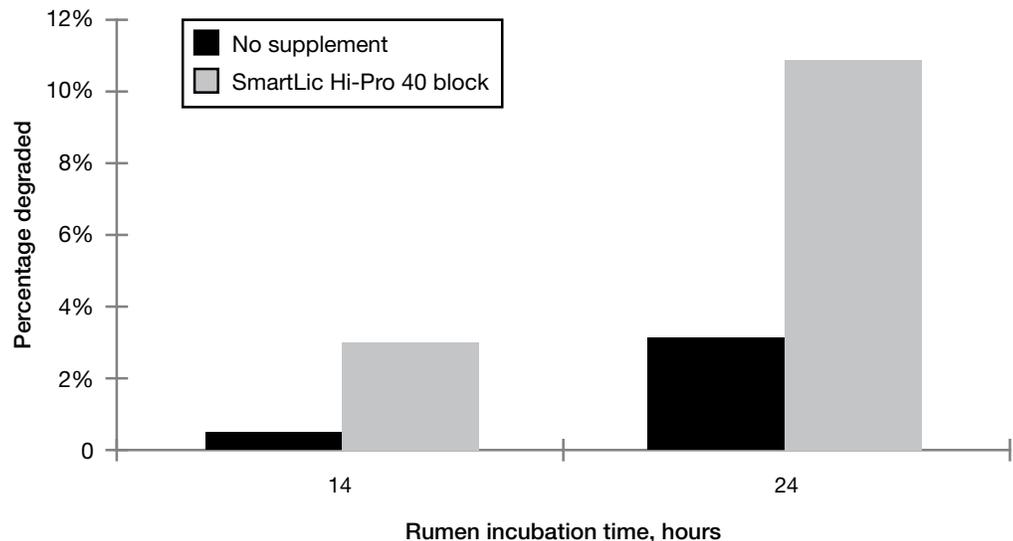
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SmartLic Hi-Pro 40 Block Supplements Improve Forage Digestion

Kathryn Derstein

Objective: Measure the effect of SmartLic Hi-Pro 40 block supplements on fiber digestion and activity of rumen microbes in cattle fed prairie hay.

Study Description: Four ruminally fistulated steers fed prairie hay were used to evaluate effects of the SmartLic Hi-Pro 40 block supplement on ruminal fermentation and microbial growth. Two of the steers were provided free-choice access to the block supplements, and the other two steers received no supplement (control). Ruminal fluid was obtained from each animal and used to compare differences in microbial populations and capacity for cellulose digestion.



The Bottom Line: Feeding SmartLic Hi-Pro 40 block supplements substantially increased microbial growth within the rumen, as evidenced by greater bacterial colonization of cellulose and increased numbers of protozoa. Furthermore, digestive activity was improved markedly, resulting in faster disappearance of cellulose from the rumen.

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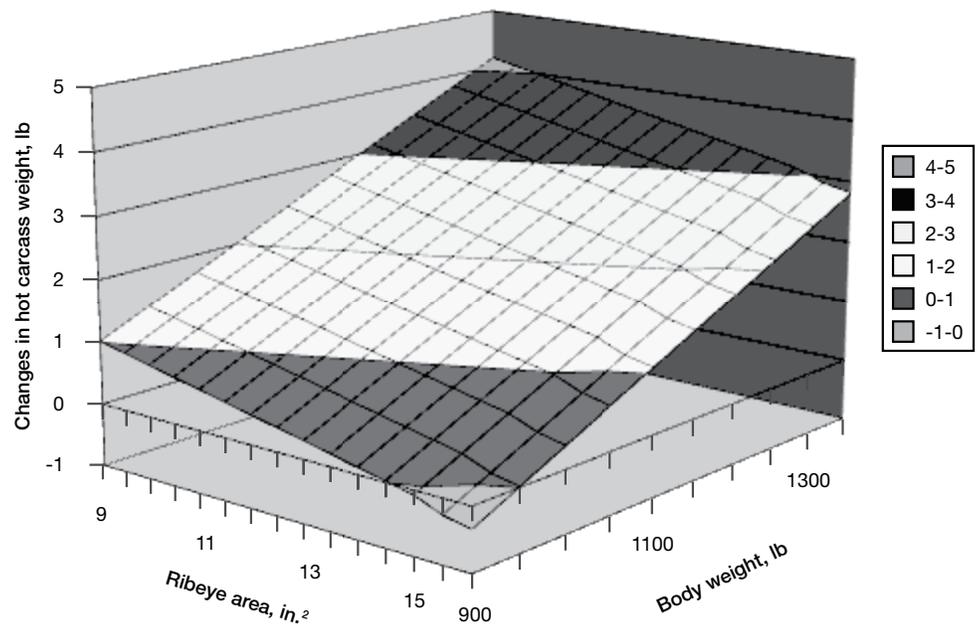
Initial Heifer Body Composition Has Little Impact on Response to Zilmax

Leanne Thompson

Objective: Determine differences in muscling, fatness, carcass weight gain, and efficiency of carcass weight gain between fat and lean heifers fed Zilmax.

Study Description: Crossbred heifers ($n = 353$, 941 lb average body weight) were used to determine effects of initial body composition on response to Zilmax. We hypothesized that fat heifers would respond more favorably to Zilmax than lean heifers. Before Zilmax was fed, cattle were weighed; an ultrasound machine was used to measure ribeye area, rump fat thickness, and 12th rib fat thickness; and hot carcass weights were estimated with a previously published mathematical formula. Zilmax was fed for 23 days followed by a 3-day withdrawal. Heifers were weighed and carcass data were collected at slaughter. Mathematical formulas were developed to describe relationships between initial carcass measurements and post-Zilmax changes in muscling, fatness, carcass weight, and efficiency of carcass weight gain.

Changes in Hot Carcass Weight as Affected
by Ribeye Size and Live Body Weight of Feedlot Heifers



The Bottom Line: Initial body composition had little impact on efficiency of carcass weight gain for heifers fed Zilmax.

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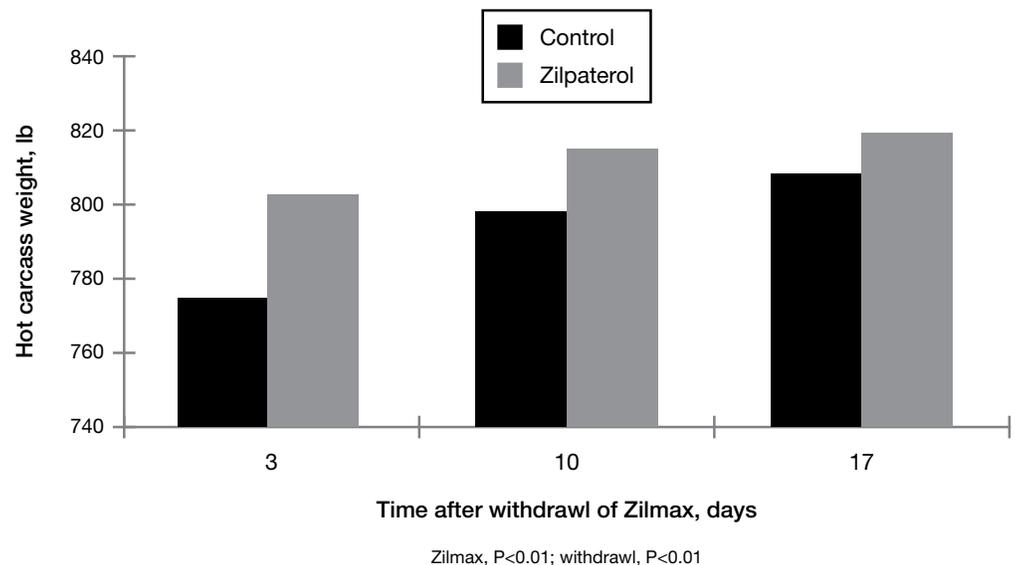
Effects of Extended Zilmax Withdrawal on Performance and Carcass Traits of Finishing Beef Heifers

Garrett Parsons

Objective: Determine whether increases in carcass weight due to Zilmax would be maintained after extended withdrawal times whether extended withdrawal times would alleviate negative effects of Zilmax on marbling scores and product tenderness.

Study Description: Crossbred heifers ($n = 450$; 1025 ± 59 lb) were blocked into two groups on the basis of initial weight. A total of 54 feedlot pens were arranged in a 2×3 factorial arrangement. Factors were Zilmax fed to provide 0 or 7.56 g of zilpaterol-HCl per ton of diet dry matter and withdrawal times of 3, 10, or 17 days. Zilmax was fed for 20 days.

Effect of Zilmax on Hot Carcass Weight



The Bottom Line: Feeding Zilmax increased carcass weights, and the greatest improvement occurred with a 3-day withdrawal time.

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ANIMAL SCIENCES AND INDUSTRY



Effect of Nitrogen Supplementation and Zilpaterol-HCl on Urea Recycling in Steers Consuming Corn-Based Diets

Derek Brake

Objective: Quantify urea recycling in growing cattle fed corn-based diets supplemented with different sources of protein with or without zilpaterol-HCl (Zilmax).

Study Description: Two sets of six steers were used to measure the effects of Zilmax and nitrogen supplementation from either dried distillers grains with solubles or urea on urea recycling. Zilmax was fed to half of the steers. Steers were fed one of three corn-based diets: control, urea, or dried distillers grains with solubles. Doubly labeled urea was used to measure urea kinetics.

Results: Unexpectedly, steers fed Zilmax had greater dry matter and nitrogen intakes. Interestingly, Zilmax had no effects on urea production or recycling of urea to the digestive tract despite the greater nitrogen intakes of steers fed Zilmax. Similar research demonstrated that increases in nitrogen intake lead to increases in urea production and urea recycling in cattle; however, Zilmax may repartition nitrogen such that more nitrogen is directed to lean tissue accretion (i.e., muscle growth). In light of the greater nitrogen intake of Zilmax-fed cattle and the lack of change in urea production and recycling, it is possible that the opposite effects of nitrogen intake and of Zilmax counteracted one another.

The Bottom Line: Understanding the effects of β -adrenergic agonists, such as Zilmax, on nitrogen recycling will allow nutritionists to formulate diets that more closely match the nutrient needs of finishing cattle.

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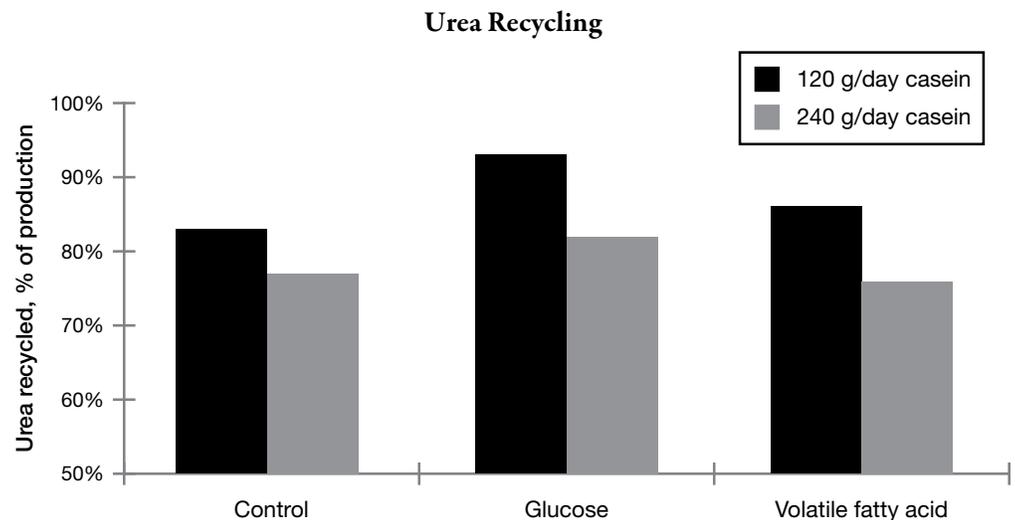
Urea Recycling in Beef Cattle Fed Prairie Hay-Based Diets

Eric Bailey

Objective: Determine the impacts of supplemental protein and energy on forage intake, digestion, and urea kinetics in growing beef cattle.

Study Description: Six cannulated steers (470 lb) were used to measure the effects of supplemental energy and protein on intake, digestion, and urea kinetics. Energy treatments were no energy, 600 g of glucose dosed once daily, and 480 g of volatile fatty acids infused over 8 hours daily. Casein (120 or 240 g) was dosed daily as a source of degradable intake protein. Steers had ad libitum access to low-quality prairie hay (5.8% crude protein). Labeled urea was infused intravenously to measure urea kinetics.

Results: In all cases, cattle fed protein-limiting diets recycled a large portion of urea to the gut (>76%). Glucose increased the percentage of urea recycled, whereas casein reduced it.



The Bottom Line: Improved ability to predict the amount of urea recycled to the gut enables more precise formulation of cattle diets.

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Effect of Nitrogen Supplementation on Urea Recycling in Steers Consuming Corn-Based Diets

Derek Brake

Objective: Determine the impact of protein supplementation on urea recycling in steers fed corn-based diets.

Study Description: Six ruminally and duodenally fistulated steers were used to measure the effects of supplemental nitrogen in the form of dried distillers grains with solubles or urea on urea recycling. Inclusion rates of urea and dried distillers grains with solubles were similar to those used commonly in corn-based diets fed to finishing cattle. Urea recycling was measured by using doubly labeled urea.

Effect of nitrogen supplementation on urea recycling in steers consuming corn-based diets supplemented with no protein (Control), dried distillers grains with solubles (DDGS), or urea

Item	Diets			P-value
	Control	DDGS	Urea	
Urea production, g/day of nitrogen	52 ^a	118 ^b	86 ^{ab}	0.09
Urea recycling, g/day of nitrogen	39	83	57	0.25
Urea recycling, proportion of ruminally available nitrogen	0.56	0.58	0.49	0.13
Microbial capture of recycled urea, % of urea production	42 ^a	25 ^b	22 ^b	0.03

Means in the same row with common superscripts are not different (P>0.05).

The Bottom Line: Improved estimates of urea recycling by cattle consuming corn-based diets will lead to more precise diet formulation and less nitrogen excretion.

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Effects of Supplemental Protein and Energy on Digestion and Urea Kinetics in Beef Cattle

Eric Bailey

Objective: Examine the effects of supplemental glucose on intake and digestion of low-quality forage in mature feeder cattle.

Study Description: We measured urea kinetics in six cannulated Angus steers (908 lb) supplemented with energy and protein. Energy treatments included no energy or 1,200 g of glucose dosed daily. Casein (240 or 480 g) was dosed daily as a source of degradable intake protein. Steers had ad libitum access to low-quality prairie hay (4.7% crude protein). Doubly labeled urea was infused intravenously to measure urea kinetics.

Results: Casein, but not glucose, reduced urea production and amount of urea recycled back to the gut. Glucose numerically increased the percentage of urea recycled, whereas casein reduced it.

Urea kinetics	240 g/day DIP ¹		480 g/day DIP	
	Control	Glucose	Control	Glucose
Production, g/day of nitrogen	88	86	137	125
Gut entry (Recycled), g/day of nitrogen	74	76	94	93
% of total production	81	85	67	73

¹ Degradable intake protein.

The Bottom Line: A better ability to predict the amount of urea recycled to the gut can enable more precise diet formulations for cattle.

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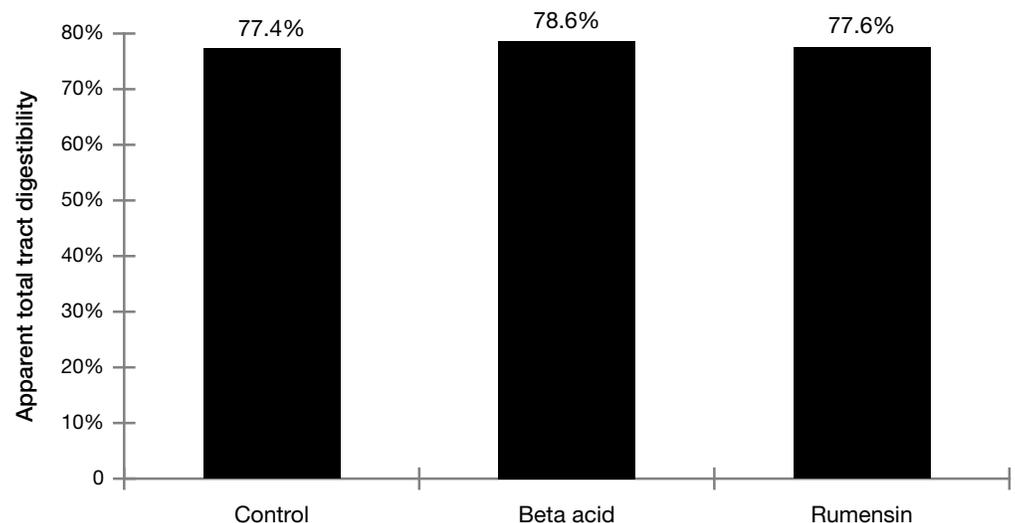
Beta Acid Extracts of Hops Have a Modest Effect on Ruminal Metabolism and Apparent Total Tract Digestibility by Steers Fed High-Concentrate Diets

Solange Uwituze

Objective: Evaluate effects of beta acid extracts of hops on ruminal fermentation and diet digestibility in cattle fed high-concentrate diets and determine response to different doses of hops extracts.

Study Description: Fourteen ruminally cannulated crossbred Angus steers were fed one of three treatments: control (no additive); Rumensin fed at 300 mg/day; or hops extracts fed at 10, 80, 160, 240, or 300 mg/day (approximately 1, 8, 16, 24, or 30 ppm, respectively). Rumensin and hops extracts were ruminally dosed once daily immediately before feeding. The diet was based on steam-flaked corn and contained 10% alfalfa hay and 15% dried distillers grains (dry basis). Four experimental periods were used, each consisting of a 21-day adaptation phase followed by a 3-day collection phase; there were two steers per treatment during each period. Chromic oxide was ruminally dosed to estimate total fecal output. Ruminal digesta and fecal samples were collected and used to investigate ruminal fermentation and diet digestibility characteristics.

Apparent Total Tract Digestibility of Diets



The Bottom Line: Hops extracts influence fermentative activity in the rumen, but the impact on diet digestibility is relatively small.

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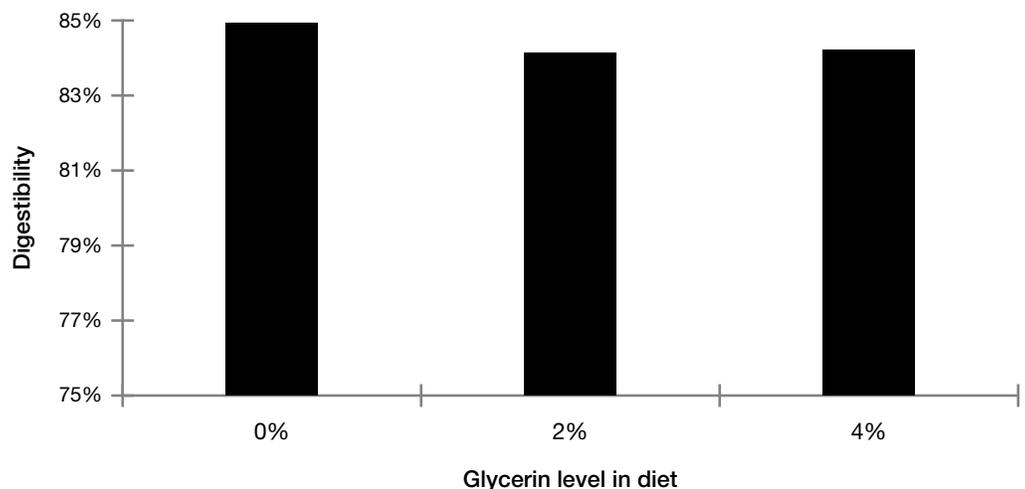
Effects of Crude Glycerin on Ruminal Metabolism and Diet Digestibility in Flaked-Corn Finishing Diets

Garrett Parsons

Objective: Determine the effects of crude glycerin on apparent total tract digestibility and measure changes in ruminal pH and ruminal concentrations of ammonia and volatile fatty acids.

Study Description: Crossbred steers ($n = 9$; $1,373 \pm 176$ lb) fitted with ruminal cannulae were used in a replicated, complete block experiment with three treatments: steam-flaked corn diets containing 0%, 2%, and 4% crude glycerin (dry matter basis). Steers had ad libitum access to finishing diets fed once daily. Periods consisted of a 10-day acclimation phase followed by a 3-day collection phase. Chromic oxide was used as an indigestible marker to estimate total fecal output.

Effect of Glycerin on Total Tract Diet Digestibility



The Bottom Line: Feeding glycerin at up to 4% of the diet has no effect on feed intake or total tract diet digestibility.

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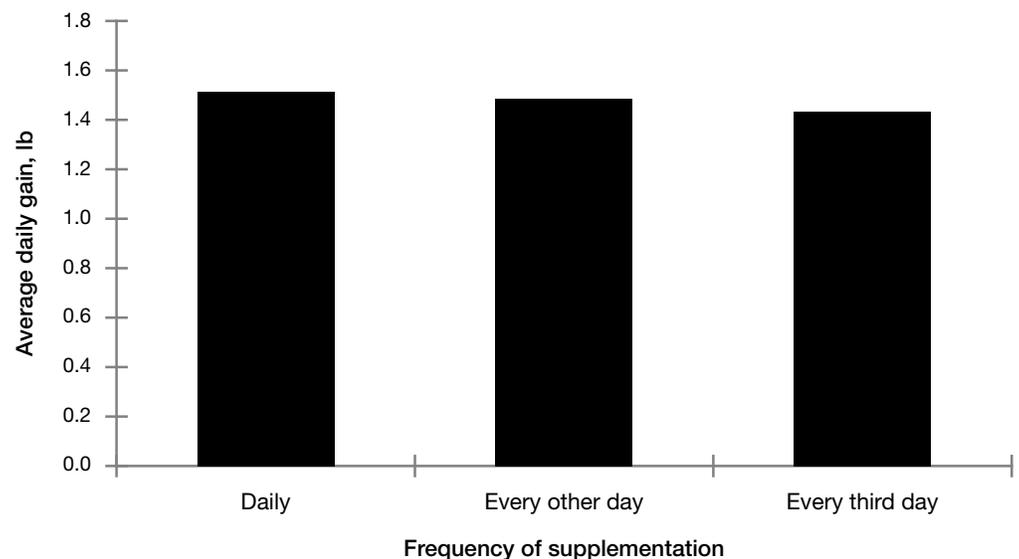
Dried Distillers Grains Supplemented at Different Frequencies to Stocker Heifers Grazing Late-Season Flint Hills Native Pastures

Dale Blasi

Objective: Determine the response to frequency of dried distillers grains supplementation of stocker calves grazing late-season native grass pastures in the Flint Hills of Kansas.

Study Description: Stocker calves ($n = 51$, initial body weight = 619 lb) grazed late-season native grass pasture for 72 days (September 1 through November 11, 2009). Treatments were three frequencies of dried distillers grains supplementation: daily, every other day, or every third day. Dried distillers grains were fed at rates equivalent to 0.33% of body weight daily (dry basis), so similar amounts of dried distillers grains were fed to each group over the 72-day grazing season.

Results: Average daily gains were similar across treatments.



The Bottom Line: With adequate grass resources, producers can reduce labor costs by supplementing dried distillers grains to cattle every second or third day without decreasing cattle performance.

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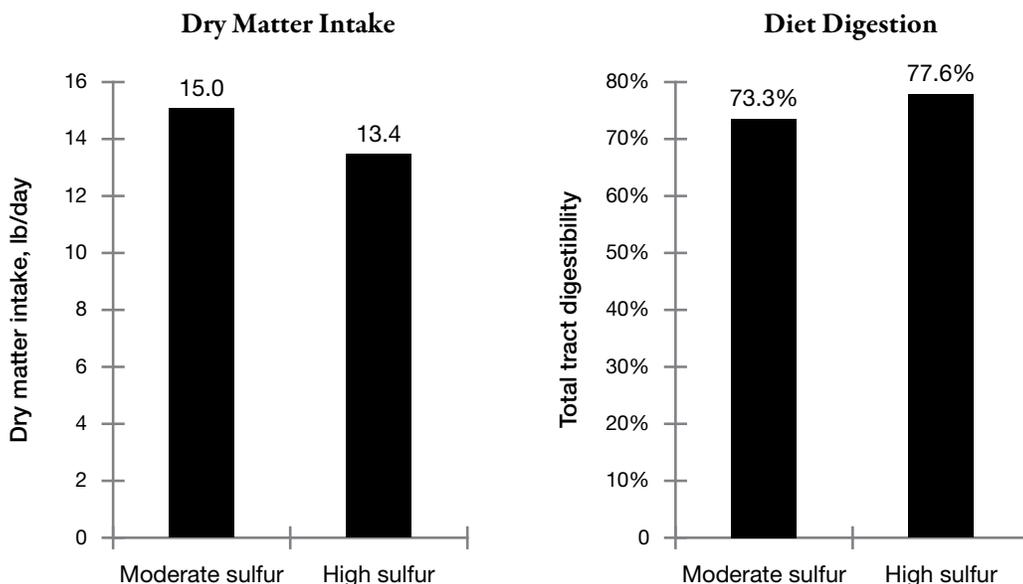
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High Sulfur Content in Distillers Grains Alters Ruminal Fermentation and Diet Digestibility in Beef Steers

Solange Uwituze

Objective: Evaluate the effects of dietary sulfur content in distillers grains with solubles on ruminal fermentation and diet digestibility in feedlot cattle.

Study Description: Twelve ruminally cannulated crossbred steers were fed finishing diets based on steam-flaked corn or dry-rolled corn containing 30% (dry matter basis) dried distillers grains with solubles. The dried distillers grains contained either 1% or 1.7% sulfur and yielded finishing diets that contained either moderate (0.42%) or high (0.65%) levels of sulfur (dry matter basis). The study was conducted in two periods, and three animals were assigned to each treatment during each period. Feed intake, diet digestion, ruminal pH, and ruminal concentrations of volatile fatty acids, ammonia, and lactate were measured.



The Bottom Line: High levels of dietary sulfur decreased feed intake, but there was a compensatory increase in diet digestibility.

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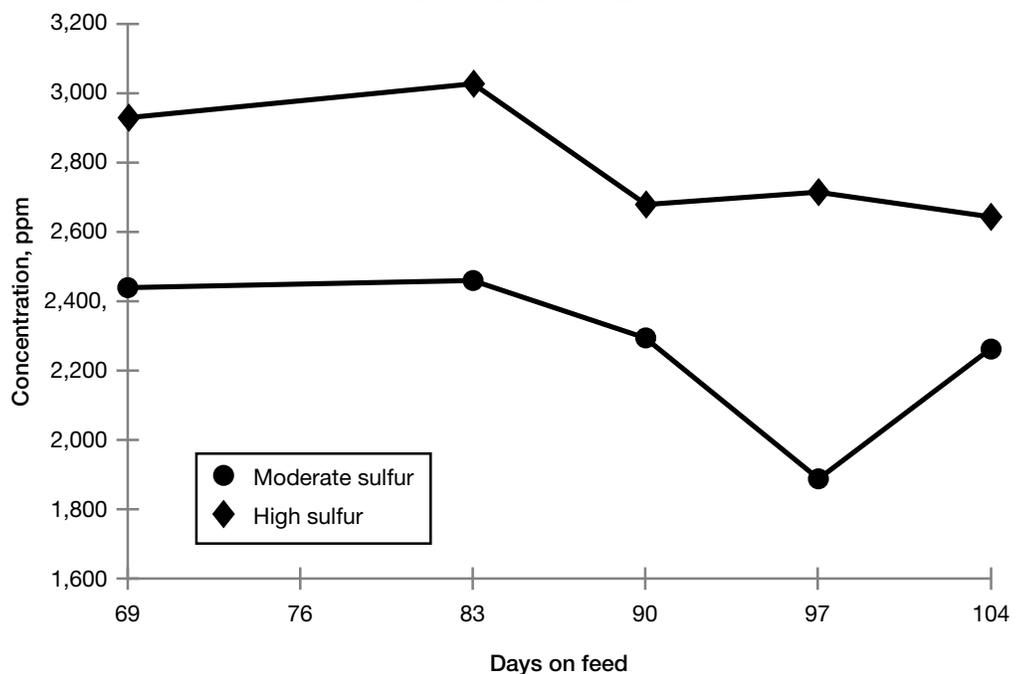
**High Sulfur Content in Distillers Grains with Solubles
 May Be Deleterious to Beef Steer Performance
 and Carcass Quality**

Solange Uwituze

Objective: Evaluate effects of sulfur content in dried distillers grains with solubles on ruminal gas concentrations, feedlot performance, and carcass characteristics of finishing steers fed diets based on steam-flaked corn or dry-rolled corn.

Study Description: Eighty crossbred yearling steers were used in a 140-day finishing trial. Steers were fed finishing diets based on steam-flaked corn or dry-rolled corn containing 30% (dry matter basis) dried distillers grains with solubles with 0.42% or 0.65% (dry matter basis) dietary sulfur. Steers were housed in individual pens. Ruminal gas samples were aspirated from the ruminal head space and analyzed for hydrogen sulfide concentration. Animals were evaluated daily for symptoms of polioencephalomalacia.

Effect of Days on Feed on Ruminal Hydrogen Sulfide Concentration in Steers Fed Finishing Diets Containing Dried Distillers Grains with Moderate or High Dietary Sulfur Concentrations



Effect of dietary sulfur, $P < 0.001$; effect of days on feed, $P < 0.001$

The Bottom Line: Feeding distillers grains with a high sulfur content decreased feed intake and compromised growth performance and carcass characteristics of feedlot cattle.

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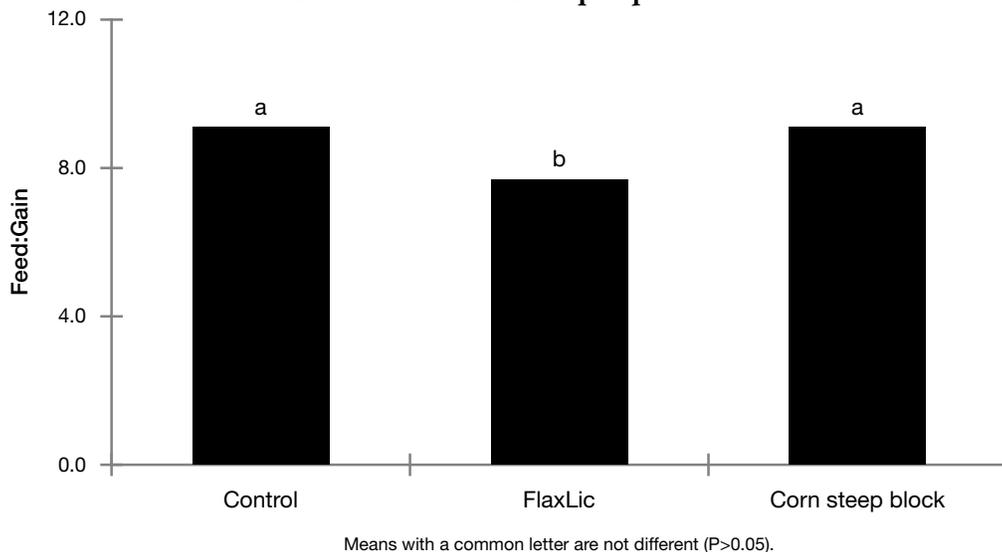
FlaxLic Supplementation Improves Growth Performance of Angus Bulls

Anna Pesta

Objectives: Evaluate effects of feeding FlaxLic, a source of omega-3 fatty acids, on breeding soundness and growth performance of bulls and compare performance of bulls supplemented with FlaxLic or an alternative block formulation containing corn steep liquor.

Study Description: Yearling Angus bulls (n = 120; initial body weight = 1,115 lb) were assigned randomly to three treatment groups: control (forage-based diet), FlaxLic (control diet with free access to FlaxLic), and corn steep block (control diet with free access to an alternative block formulation in which a portion of the molasses was replaced by corn steep liquor). Bulls were fed free choice for 70 days. Daily feed consumption was monitored using the GrowSafe electronic feed intake monitoring system. The 60-lb blocks for the FlaxLic and corn steep block treatments were placed in GrowSafe feeders for the designated pen. One pen of 40 bulls was used for each treatment. Rate of gain and feed intake were monitored, breeding soundness exams were performed, and blood and semen samples were analyzed for fatty acid composition.

**Feed Efficiency of Yearling Bulls Fed a Forage-Based Diet Supplemented
with FlaxLic or a Corn Steep Liquor Block**



The Bottom Line: Feeding FlaxLic or the corn steep block did not alter breeding soundness. However, FlaxLic increased growth performance and efficiency. Substituting 15% corn steep liquor for molasses had a negative effect on nutritional value of the corn steep block.

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Effects of *Morinda citrifolia* on Growth Performance and Health of High-Risk Calves

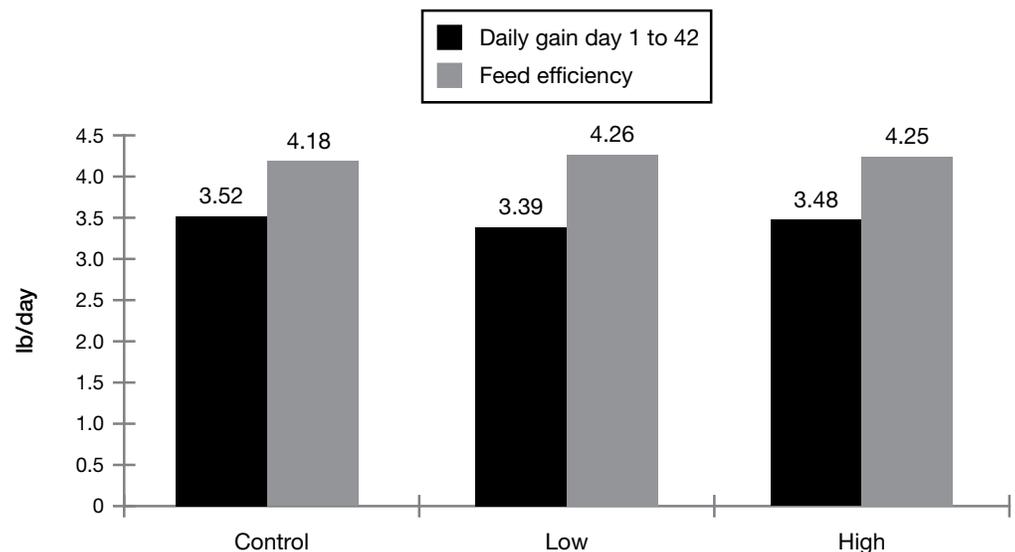
Dale Blasi

Objective: Evaluate health and performance of high-risk stocker calves receiving *Morinda citrifolia* (MorindaMax).

Study Description: High-risk stocker calves were delivered to the Kansas State University Beef Stocker Unit in May 2008 (n = 282, initial body weight = 487 lb). All calves received Excede upon arrival. Treatments consisted of a control (4 oz/head per day of water) and two levels of MorindaMax (Low, 2 oz/head per day; High, 4 oz/head per day) top-dressed on the feed.

Results: All cattle performed exceedingly well, and there was little to no health challenge from bovine respiratory disease. There were no significant differences between treatments in the percentage of steers treated once, twice, or three times for bovine respiratory disease ($P > 0.05$). There were no significant differences in daily gain ($P = 0.81$), daily dry matter intake ($P = 0.34$), or feed efficiency ($P = 0.80$) between the three treatments.

Effects of MorindaMax on Growth Performance and Health of Calves



The Bottom Line: *Morinda citrifolia* administration did not affect dry matter intake or reduce morbidity or mortality associated with bovine respiratory disease. The low morbidity levels in this experiment were likely not sufficient to adequately test this feed additive.

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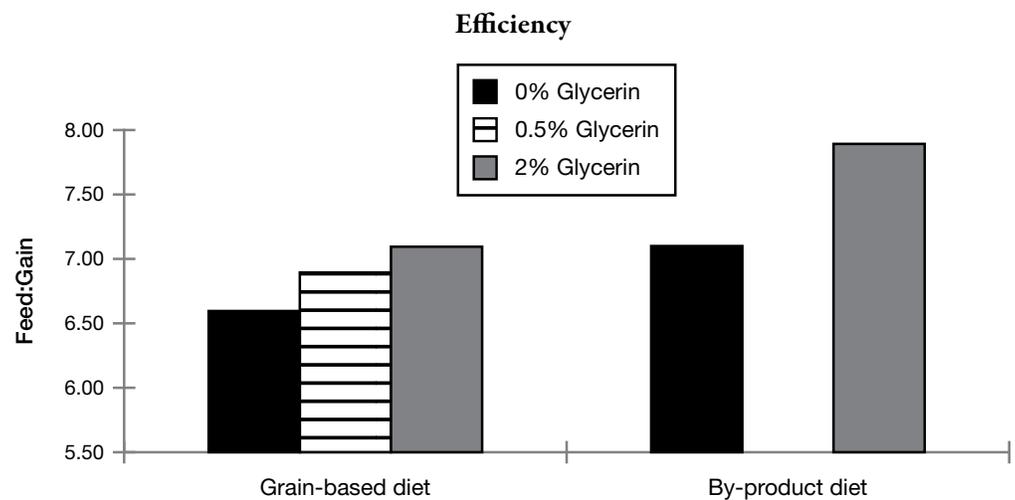
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Effects of Feeding Low Levels of Crude Glycerin on Performance and Carcass Characteristics of Feedlot Heifers

Cody Schneider

Objective: Evaluate the effects of feeding different levels of crude glycerin on feedlot performance and carcass characteristics of heifers fed grain-based diets or diets containing by-products.

Study Description: Yearling crossbred heifers ($n = 295$; 941 ± 20 lb) were fed corn-based finishing diets containing 0%, 0.5%, or 2% crude glycerin or by-product-based diets with 0% or 2% crude glycerin. All diets were based on dry-rolled corn for the first 37 days of the feeding period, after which cattle were gradually transitioned to diets based on steam-flaked corn. All final diets contained 3% alfalfa hay and 6% corn silage and provided 300 mg Rumensin, 90 mg Tylan, and 0.5 mg MGA per heifer daily. In the by-product diets, soybean meal and portions of the steam-flaked corn were replaced by adding 25% soybean hulls and 15% wet distillers grains (dry matter basis). Heifers were fed Zilmax for 21 days before harvest. Cattle were given free choice access to feed for a total of 89 days on feed.



The Bottom Line: Adding low concentrations of glycerin reduced dry matter intake in grain-based diets but had no effect in rations containing by-products.

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Supplementing Feedlot Steers and Heifers with Zilmax Increases Proportions of Strip Loin, Chuck Clod, and Top Sirloin Steaks Exceeding Warner-Bratzler Shear Force Thresholds, Whereas Aging Moderates This Effect

Heidi Claus

Objective: Determine the effects of supplementing feedlot diets of steers and heifers with Zilmax for 0, 20, 30, or 40 days before harvest and the subsequent effects of 7, 14, and 21 days of aging on tenderness of steer and heifer *Longissimus lumborum* (from strip loins) and heifer *Triceps brachii* (from chuck clods) and *Gluteus medius* (from top sirloin butts) muscles.

Study Description: The designated muscles were obtained from 117 steers and 132 heifers to evaluate the effects of Zilmax feeding duration (7.56 g/907 kg, 100% dry matter basis) and aging on tenderness. Both genders were blocked separately by initial weight into six blocks of four pens. Pens were assigned to treatments of 0 (control), 20, 30, or 40 days on Zilmax with a 3-day withdrawal. Steaks from each subprimal were vacuum aged individually for 7, 14, or 21 days; frozen; thawed, and then cooked to 158°F for Warner-Bratzler shear force (WBSF) determinations.

Results: All muscles from steers and heifers from the 30- and 40-day Zilmax treatments had higher ($P < 0.05$) WBSF than muscles from the control. The WBSF of steer *Longissimus* and heifer *Triceps brachii* from the 20-day Zilmax treatment was higher ($P < 0.05$) than the control. There were no differences ($P > 0.05$) in percentages of intramuscular fat for any muscle due to Zilmax treatment. Percentages of steer *Longissimus* and heifer *Triceps brachii* steaks with WBSF values below a threshold of 10.1 lb from the 20-day Zilmax treatment were high, whereas the percentage of heifer *Gluteus medius* muscles below 10.1 lb was low (55.5%). Correlations among *Longissimus* WBSF values for the three aging times were positive ($P < 0.01$) for steer control and 20- and 40-day Zilmax treatments, all heifer *Longissimus* treatments, and the heifer *Triceps brachii* 20-day Zilmax treatment. Feeding Zilmax for 20 days generally increased WBSF values, but mean WBSF values for steer *Longissimus* and heifer *Triceps brachii* were still acceptable.

The Bottom Line: Supplementing feedlot diets with Zilmax for 20, 30, or 40 days will increase WBSF of steer *Longissimus* and heifer *Triceps brachii* muscles, whereas supplementing with Zilmax for 30 or 40 days will increase WBSF of heifer *Longissimus* muscles. Percentages of steer *Longissimus* and heifer *Triceps brachii* muscles below a WBSF threshold of 10.1 lb from the 20-day Zilmax treatment will be quite high, but percentages of heifer *Gluteus medius* muscles below this threshold will be low.

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Needle-Free Injection Enhancement of Beef Strip Loins with Phosphate and Salt Has Potential to Improve Yield, Tenderness, and Juiciness but Harm Texture and Flavor

Brett Crow

Objective: Determine the effects of needle-free versus needle injection enhancement and calcium lactate versus phosphate solutions on meat color, instrumental tenderness, sensory traits, pump yield, and cooking loss of beef *Longissimus lumborum* muscles.

Study Description: In experiment 1, beef strip loins ($n = 15$) were halved and assigned to needle or needle-free injection enhancement with a phosphate plus salt solution to determine effects on color, water-binding capacity, and palatability. In experiment 2, strip loins ($n = 28$) were halved and assigned to one of four treatments—needle or needle-free injection with a phosphate solution or needle or needle-free injection with a calcium lactate solution—to determine effects on water-binding capacity and palatability.

Results: In experiment 1, pump yields tended ($P=0.08$) to be higher for needle-free injection enhancement. Needle-injected steaks were darker ($P<0.05$) on day 1 only. Needle-free steaks had greater instrumental tenderness and intensity of off-flavors but less cooking loss and beef flavor (both $P<0.05$). Needle-free injection resulted in a greater incidence ($P<0.05$) of off-flavors and abnormal texture. The phosphate solution resulted in greater ($P<0.05$) instrumental, myofibrillar, and overall tenderness; greater juiciness; greater incidence of off-flavors and abnormal texture; and less ($P<0.05$) connective tissue and cooking losses compared with the calcium lactate solution. The phosphate and needle-free combination had the highest pump yields and lowest cooking losses (both $P<0.05$).

The Bottom Line: Enhancing beef strip loins with phosphate and needle-free injection has potential to improve yield, tenderness, and juiciness but harm texture and flavor.

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**Packaging Systems and Storage Times Serve as
 Post-Lethality Treatments for *Listeria monocytogenes*
 on Whole Muscle Beef Jerky**

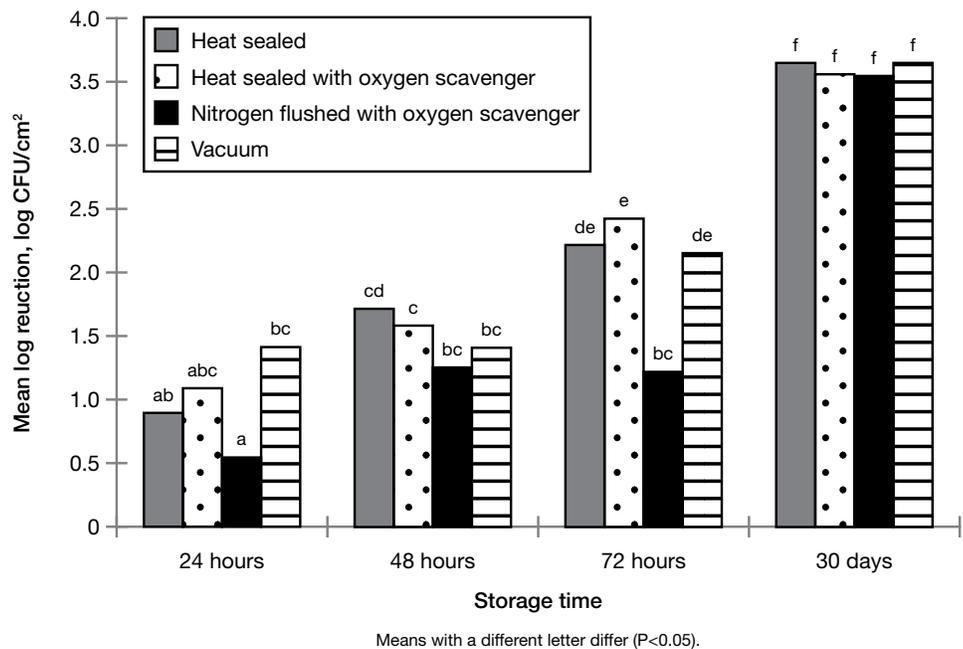
Kelly J.K. Getty

Objective: Determine the effect of four packaging methods and storage times on reducing *Listeria monocytogenes* in shelf-stable whole muscle beef jerky.

Study Description: Pieces of jerky inoculated with *L. monocytogenes* were packaged in one of four systems: heat sealed, heat sealed with oxygen scavenger, nitrogen flushed with oxygen scavenger, and vacuum. Packages were then stored at room temperature for 24, 48, and 72 hours and 30 days to determine whether storage time and packaging type would reduce *L. monocytogenes* on whole muscle beef jerky.

Results: After 24 hours of ambient temperature storage, the heat sealed with oxygen scavenger and vacuum packaging treatments achieved a 1 log reduction of *L. monocytogenes*. The heat sealed and nitrogen flushed with oxygen scavenger packaging treatments did not achieve the 1 log reduction until 48 hours after packaging.

Mean Log Reductions of *Listeria monocytogenes* on Beef Jerky Packaged in Different Packaging Systems and Stored at Room Temperature



The Bottom Line: Small and large jerky processing facilities can use any of these four packaging systems in conjunction with a storage time of at least 48 hours as *L. monocytogenes* post-lethality control treatments.

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**Packaging Systems and Storage Times Serve as
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 on Kippered Beef Steaks**

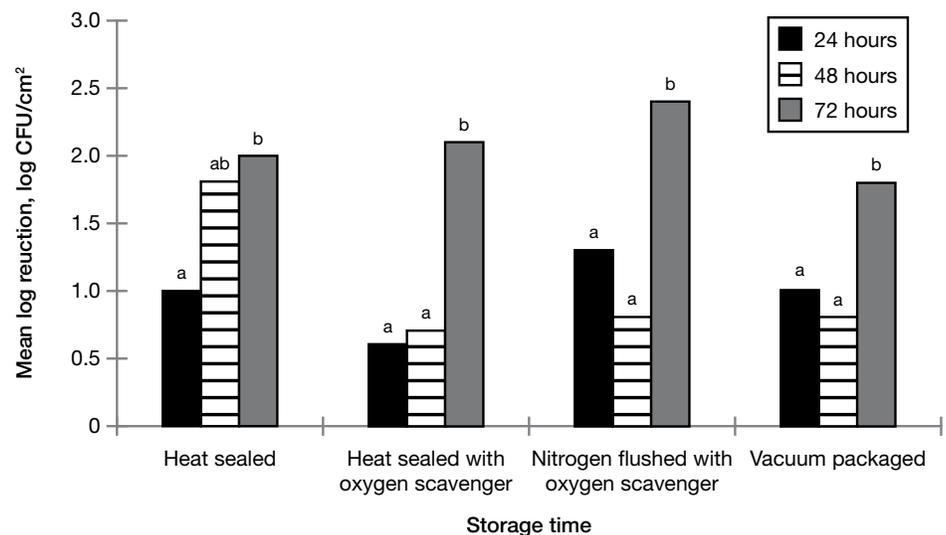
Kelly J.K. Getty

Objective: Determine the effect of four packaging methods and storage times on reducing *Listeria monocytogenes* in shelf-stable kippered beef steaks.

Study Description: Strips of kippered beef steak inoculated with *L. monocytogenes* were packaged one of four systems: heat sealed, heat sealed with oxygen scavenger, nitrogen flushed with oxygen scavenger, and vacuum. Packages were then stored at room temperature for 24, 48, and 72 hours to determine whether storage time and packaging type would reduce *L. monocytogenes* on shelf-stable kippered beef steak.

Results: After 24 hours, *L. monocytogenes* was reduced by 1 log in all packaging treatments except heat sealed with oxygen scavenger, which had only a 0.6 log reduction. After 72 hours of storage, log reductions for all packaging treatments ranged from 1.7 to 2.4.

Mean Log Reductions of *Listeria monocytogenes* on Kippered Beef Steaks Packaged in Different Packaging Systems and Stored at Room Temperature



Means with a different letter differ (P<0.05).

The Bottom Line: Processors of meat and poultry snacks could use a storage time of 72 hours prior to shipping in combination with any of these four packaging treatments to reduce potential *L. monocytogenes* populations by more than 1 log.

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SUMMARY PUBLICATION

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