

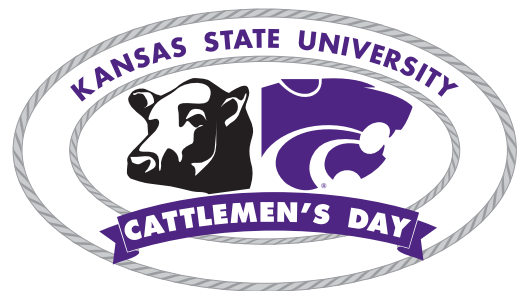
CATTLEMEN'S DAY 2012

BEEF CATTLE RESEARCH

SUMMARY PUBLICATION



KANSAS STATE UNIVERSITY
AGRICULTURAL EXPERIMENT
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CATTLEMEN'S DAY 2012



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RESEARCH



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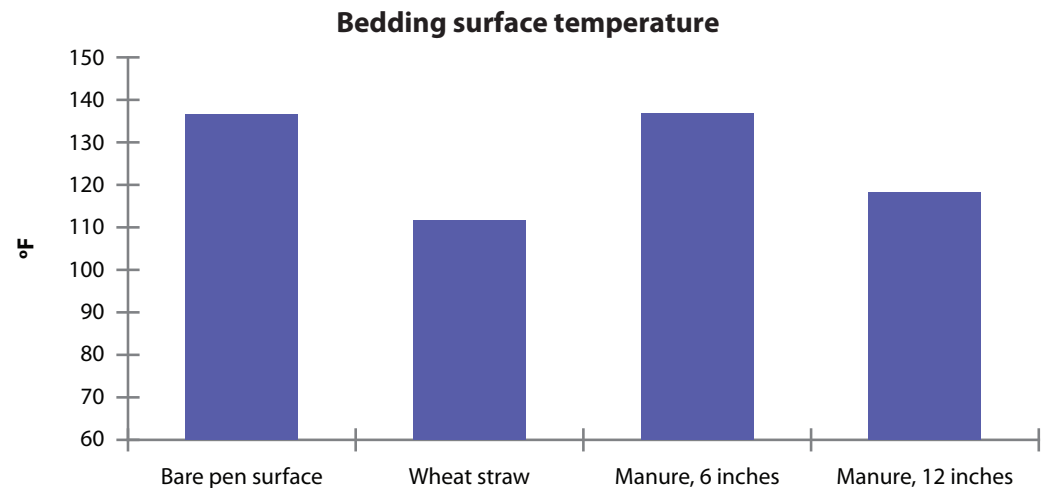
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Bedding Material in Dirt-Floor Pens Reduces Heat

D.J. Rezac

Objective: Investigate whether placing straw bedding material in a dirt-surfaced cattle feeding pen during periods of hot weather can provide cattle a cooler place to rest.

Study Description: Keeping cattle cooler during hot weather improves animal welfare and animal performance (gain). Providing straw as bedding during times of hot weather has been hypothesized to provide cooler conditions due to the lighter color of the straw and its ability to insulate animals from hot ground temperatures. Plots in a dirt-floor pen, each with a different surface material, were monitored for temperature on a 97°F day. The plots consisted of bare pen surface, 6 inches of straw bedding, 6 inches of manure, or 12 inches of manure.



The Bottom Line: Bedding pens with 6 inches of wheat straw resulted in a surface temperature that was 25°F cooler than that of the bare pen surface, potentially providing cattle a cooler place to rest during peak daytime temperatures.



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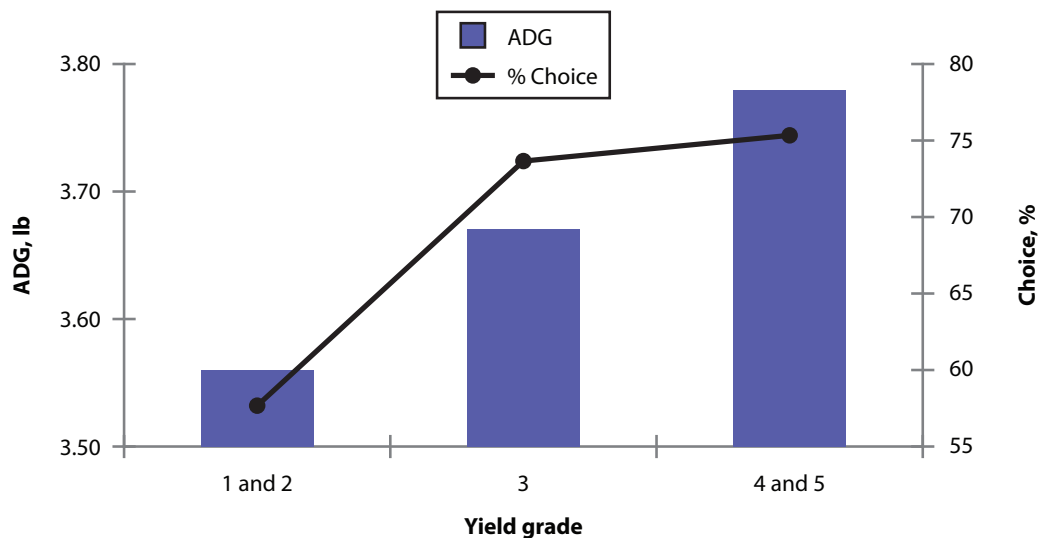
High-Grading Angus Steers Demonstrate the Greatest Average Daily Gain

Marisa Hands

Objective: Determine relationships between feedlot performance and carcass traits in Angus steers.

Study Description: Closeout data relating to health, feedlot performance, and carcass data were evaluated for 17,919 Angus steers fed in a single feedlot in south-west Kansas from 1997 through 2007.

Results: Multiple treatments for morbidity resulted in poorer average daily gain and a decreased percentage of Choice carcasses. In addition, non-treated steers that graded Prime and Choice had higher average daily gain than those that graded Select or below.



Average daily gain (ADG): Linear effect of yield grade, $P < 0.01$; SEM = 0.013.
Choice: Linear and quadratic effects of yield grade, $P < 0.01$; SEM = 0.99.

The Bottom Line: Ranchers do not need to choose between performance and grade. Avoiding factors that decrease performance, such as disease or nutrient restriction, also improves carcass quality.



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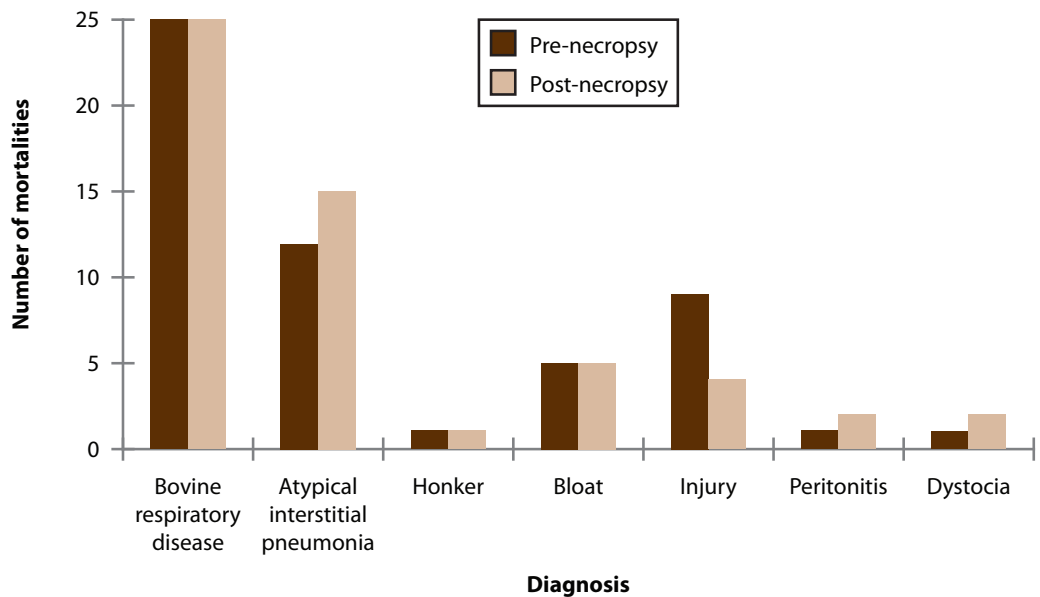
Most Feedlot Mortalities Can Be Diagnosed Without a Necropsy

Dane Ansbaugh

Objective: Determine the accuracy of pre-necropsy mortality diagnoses made by feedlot personnel compared with diagnoses made from necropsy results.

Study Description: Cause of death for 54 feedlot mortalities was diagnosed by feedlot health personnel prior to completion of a necropsy, and subsequently by Kansas State University investigators who conducted the necropsy but had no history of the dead animal's health history.

Results: Agreement between the feedlot personnel and the investigators in diagnosis of bovine respiratory disease and bloat was 100%. Feedlot personnel are capable of accurately diagnosing bovine respiratory disease or bloat without performing a necropsy. Necropsy should be performed for animals that are found dead in their pen with no history of bloat.



The Bottom Line: Necropsy is not necessary for cattle with known history of advanced bovine respiratory disease or bloat.



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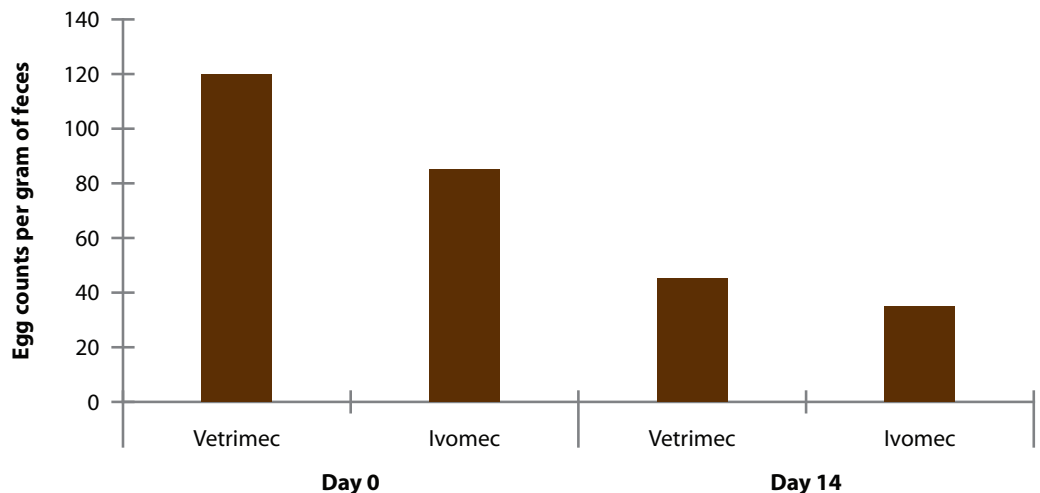
Pour-On Avermectins Are Not Effective for Elimination of Internal Parasites

A.J. Tarpoff

Objectives: Evaluate the comparative efficacy of generic versus original brand-name pour-on avermectins for elimination of internal parasites.

Study Description: Forty cattle per pen from 10 pens within a single commercial feedlot were randomly assigned to receive either Ivomec (Merial Animal Health, Duluth, GA) pour-on or Vetrimec (Norbrook Laboratories Limited, Newry, Co. Down, Northern Ireland) pour-on avermectin. Rectal fecal samples were obtained on day 0 at the time of initial processing prior to treatment, and again on day 14. Animal weights were obtained on day 0, and again at production sort date. Fecal egg counts were obtained using the modified Wisconsin technique.

Results: Cattle treated with Vetrimec pour-on avermectin had improved average daily gains compared with cattle treated with Ivomec pour-on (3.89 versus 3.74 lb/day, respectively; $P = 0.02$). No differences were observed in parasite control between generic and name-brand products in this study, and neither treatment was entirely effective at reducing internal parasite burden.



The Bottom Line: Generic and name-brand pour-on dewormers did not differ in efficacy, but neither was highly effective for reduction in internal parasites.



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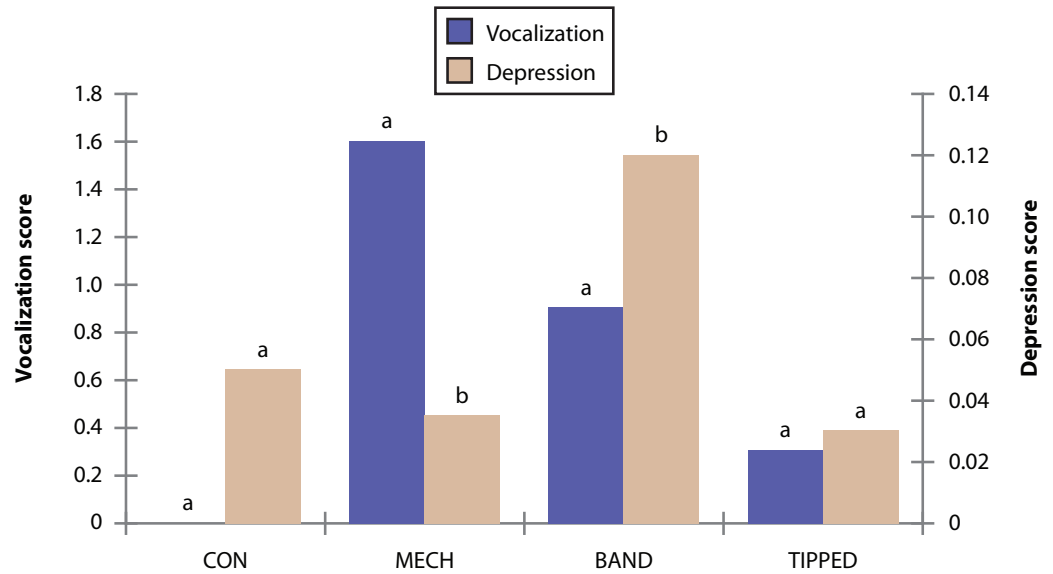
Banding of Horns is a Painful Procedure

Clem Neely

Objective: Evaluate the effects of different dehorning techniques on animal behavior and performance.

Study Description: Dehorning techniques were compared in 40 feeder calves using either no dehorning, complete mechanical removal, tipping to a 1-inch diameter, or banding using a high-tension rubber band. Behavior was monitored during the procedure and daily for 28 days following the procedure. Cattle were individually weighed prior to the procedure and on day 28.

Results: Mechanical dehorning caused the most vocalization during the procedure. Banding caused higher vocalization than tipping, which was equal to the control. Banding also caused greater depression and more abnormal gait and lying behaviors than all other treatments. Dehorning technique had no effect on average daily gain.



^{abc} Vocalization: MECH and BAND greater than CON or TIPPED ($P < 0.05$).

^{xy} Depression: BAND greater than MECH, TIPPED, or CON ($P < 0.10$).

The Bottom Line: Tipping of horns down to 1-inch diameter caused little to no measurable discomfort, but banding was not completely effective and caused abnormal behavior that lasted for several days to several weeks.



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Vaccinating with SRP *E. coli* Vaccine Technology Does Not Affect Feeder Cattle Performance, Health, or Carcass Characteristics

D.J. Rezac

Objective: Evaluate the effects of vaccinating feedlot cattle three times with SRP *Escherichia coli* vaccine on animal health, feedlot performance, and carcass traits.

Study Description: Sixty pens of feeder cattle (4,869 head; initial body weight = 728 ± 12.7 lb) housed at 4 commercial feedlots in Kansas and Nebraska were vaccinated three times (3 weeks apart) with either SRP *E. coli* O157:H7 vaccine or with sterile saline. Animal health was observed by trained feedlot personnel. Pen closeout data were provided by each respective feedlot, and carcass traits were evaluated by trained personnel at a commercial abattoir.

Effects of vaccinating feedlot cattle three times in the feedyard with SRP *E. coli* vaccine on performance, mortality, and carcass traits

| Item | CON | VAC | P-value |
|------------------------|-------|-------|---------|
| Slaughter weight, lb | 1,184 | 1,190 | 0.16 |
| Average daily gain, lb | 3.09 | 3.11 | 0.73 |
| Death loss, % | 3.2 | 3.2 | 0.98 |
| Prime/Choice, % | 46.1 | 45.3 | 0.61 |

The Bottom Line: Vaccinating feedlot cattle three times with *E. coli* vaccine did not hinder performance, health, or carcass traits.



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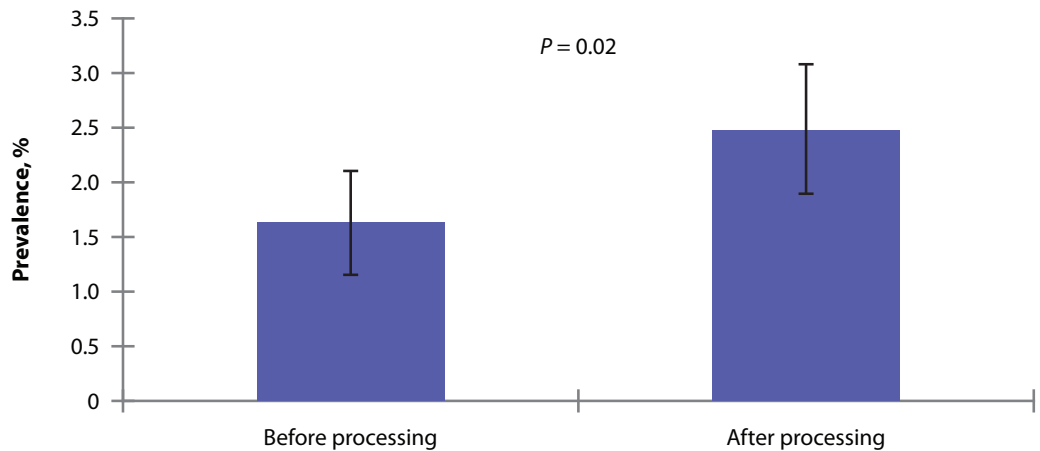
Post-Arrival Processing Causes Lameness

Taylor Green

Objective: Evaluate the causes and duration of lameness in a commercial feedyard.

Study Description: During July and August of 2009, 3,243 steers in a commercial feedlot were observed for lameness prior to processing, immediately following processing, and for 3 weeks after processing. Animals were recorded as lame based on altered gait.

Results: The proportion of cattle observed as lame before processing was 1.6% and was less ($P = 0.02$) than the proportion of cattle observed as lame after processing (2.5%). Post-processing lameness peaked immediately after processing; most lameness cases were resolved by the end of 3 weeks on feed. Cattle observed as lame at any time tended to have lower average daily gain than cattle that were not lame.



The Bottom Line: The majority of lameness appeared to be associated with handling events. Further study is warranted to determine if improved facilities or handling techniques can reduce incidence of lameness.



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Delaying Implant in High-Risk Calves Has No Benefit for Health or Feedlot Performance

Robert Munsen

Objective: Examine the effects of administering initial steroid implants at feedlot arrival or 45 days after feedlot arrival on health, performance, and carcass characteristics of feeder calves that are at relatively high risk for bovine respiratory disease.

Study Description: High-risk feeder calves (n = 1,601) were used to measure the value of delaying the initial implant in a commercial feedlot. The initial feedlot implant was given either at feedlot arrival or 45 days afterward. Health, feed intake, and feedlot performance were monitored through harvest. Carcass traits and liver and lung scores were evaluated post-harvest.

Carcass traits and carcass value for high-risk steers implanted either immediately upon feedlot arrival (Arrival) or 45 days post-arrival (Delayed)

| Item | Arrival | Delayed | SEM | P-value |
|------------------------|------------|------------|------|---------|
| Number of pens | 10 | 10 | | |
| Number of cattle | 801 | 800 | | |
| Hot carcass weight, lb | 853 | 842 | 8.0 | 0.20 |
| Choice, % | 42.8 | 44.1 | 3.00 | 0.67 |
| Premium Choice, % | 3.6 | 4.4 | 1.03 | 0.44 |
| Select, % | 52.7 | 52.2 | 3.24 | 0.87 |
| No Roll, % | 4.1 | 3.8 | 1.11 | 0.73 |
| Yield grade 1, % | 19 | 24.7 | 4.42 | 0.21 |
| Yield grade 2, % | 44.1 | 45.3 | 5.04 | 0.82 |
| Yield grade 3, % | 31.5 | 25.8 | 4.59 | 0.23 |
| Yield grade 4, % | 4.9 | 4.3 | 1.36 | 0.65 |
| Price, \$/cwt | \$92.21 | \$93.62 | 0.79 | 0.09 |
| Total sales, \$/head | \$1,109.10 | \$1,111.31 | 29.4 | 0.94 |

The Bottom Line: Delaying the initial feedlot implant had no effects on animal growth, health, carcass quality, or carcass value.



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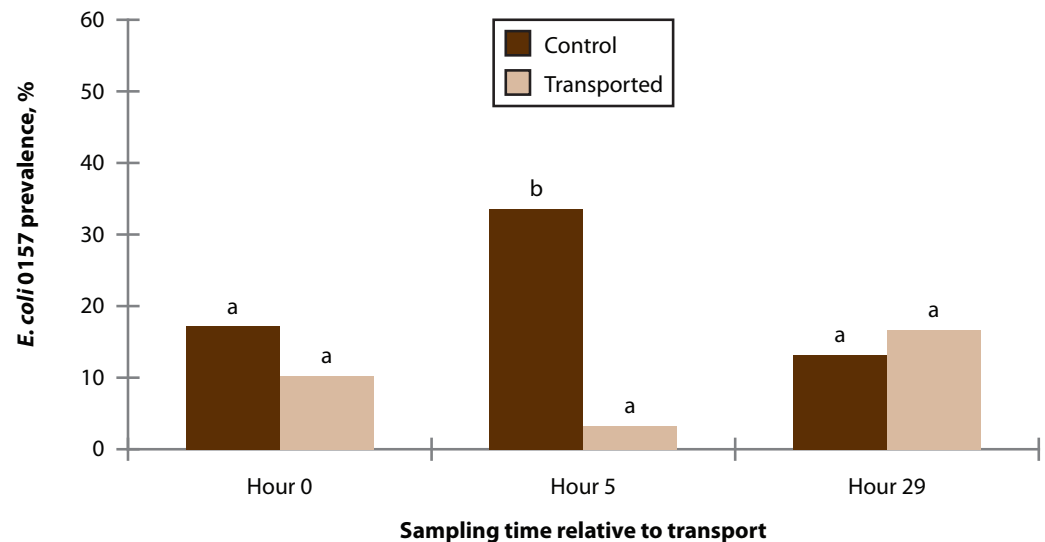
Effect of Transportation on *E. coli* O157:H7 Prevalence and Coliform Concentrations in Feces of Feedlot Cattle

Celine Aperce

Objective: Mimic stress associated with transport and lairage and evaluate effects on fecal shedding of *Escherichia coli* O157 as well as fecal concentrations of generic *E. coli* and coliforms.

Study Description: Previous studies have shown that stressed animals are more likely to shed *E. coli* O157:H7. Given the short generation intervals associated with pathogenic organisms, otherwise normal animals could become heavily colonized by foodborne pathogens as a result of stress incurred during transportation from feedlots and during lairage at abattoirs. We used two groups of cattle to evaluate the effects of transport and lairage on pathogen shedding: a non-transported group (Control) and a group that was transported on a trailer for 1 hour and subsequently held in a pen for a brief lairage period. We measured the prevalence of *E. coli* O157:H7 and enumerated generic *E. coli* and coliforms in fresh fecal pats obtained at 0, 5, and 29 hours post-transit.

Results: We observed a significant difference in shedding patterns of control and transported cattle by hour 5 after transport.



^{ab} Columns with different letters differ at $P < 0.05$.



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The Bottom Line: Transport and lairage changed the pattern of fecal shedding for *Escherichia coli* O157:H7 in this experiment. These results encourage further investigation on the prevalence pattern of *Escherichia coli* O157:H7 in transported animals to establish when cattle are at greater risk of contamination at slaughter.

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Direct-Fed Microbials for Receiving Cattle I: Effects of ProTernative Stress Formula Dose on Growth and Health Performance of Receiving Beef Heifers

Anna Siverson

Objective: Evaluate the effects of adding ProTernative SF (Lallemand Animal Nutrition, Milwaukee, WI) direct-fed microbial to receiving diets in 2 different doses on dry matter intake and incidence of respiratory disease in high-risk heifers.

Study Description: Crossbred heifers (n = 279) were purchased from sale-barn facilities in Tennessee and transported to the Kansas State University Beef Stocker Unit. Calves were fed a total mixed ration consisting of native Bluestem prairie hay, alfalfa hay, dry rolled corn, wet corn gluten feed, and a commercial premix pellet twice daily. Calves were treated once daily during the morning feeding with either water (Control) or ProTernative SF administered at a low (0.017 oz/day) or high (0.035 oz/day) dose for 44 days by means of liquid top-dress on the morning ration. Animals were observed twice daily for signs of disease or lameness.

Performance of highly stressed heifers during receiving that were orally treated with no direct-fed microbial (Control), a low dose of ProTernative SF, or a high dose of ProTernative SF direct-fed microbial

| Item | Control | Low dose | High dose | SEM |
|---------------------------|---------|----------|-----------|-------|
| Dry matter intake, lb/day | 12.52 | 12.64 | 12.80 | 0.48 |
| Average daily gain, lb | 2.81 | 2.93 | 2.98 | 0.10 |
| Feed:gain | 4.46 | 4.33 | 4.28 | 0.153 |
| Morbidity, % | 38.8 | 47.5 | 30.3 | 0.99 |

The Bottom Line: ProTernative SF direct-fed microbial delivered as a liquid suspension had no impact on dry matter intake, average daily gain, or health of high-risk beef heifers.



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Direct-Fed Microbials for Receiving Cattle II: Effects of ProTernative Stress Formula Fed in a Dry Suspension on Growth, Feed Intake, and Health of Receiving Beef Heifers

Anna Siverson

Objective: Evaluate the effects of a direct-fed microbial offered as a component of a dry ration top-dress on feed intake, average daily gain, and morbidity of highly stressed beef heifers.

Study Description: Crossbred heifers (n = 287; initial body weight = 497 lb) were purchased from sale-barn facilities in Tennessee and transported to the Kansas State University Beef Stocker Unit. Calves were fed twice daily a total mixed ration consisting of native bluestem prairie hay, alfalfa hay, dry rolled corn, wet corn gluten feed, and a commercial premix pellet. During the morning feeding, calves were treated once daily with either ProTernative SF (0.032 lb/animal daily; Lallemand Animal Nutrition, Milwaukee, WI) delivered in 0.25 lb of dried distillers grains or 0.25 lb/animal daily dried distillers grains alone by means of a top-dress. Animals were observed twice daily for signs of disease or lameness.

Performance of highly stressed heifers during receiving that were fed no direct-fed microbial, or 0.002 lb/head per day of *Saccharomyces cerevisiae boulardii* CNCM I-1079 in a dry mixture with dried distillers grains

| Item ^a | Dry matter intake | Average daily gain | Morbidity, % |
|-------------------|-------------------|--------------------|--------------|
| Control | 16.3 ± 0.16 | 4.02 ± 0.07 | 17.6 ± 0.5 |
| ProTernative SF | 16.4 ± 0.16 | 4.02 ± 0.07 | 10.9 ± 0.5 |

^aTreatment means ± SEM

The Bottom Line: Daily direct-fed microbial supplementation delivered in a dry suspension did not influence health, dry matter intake, or average daily gain in our study.



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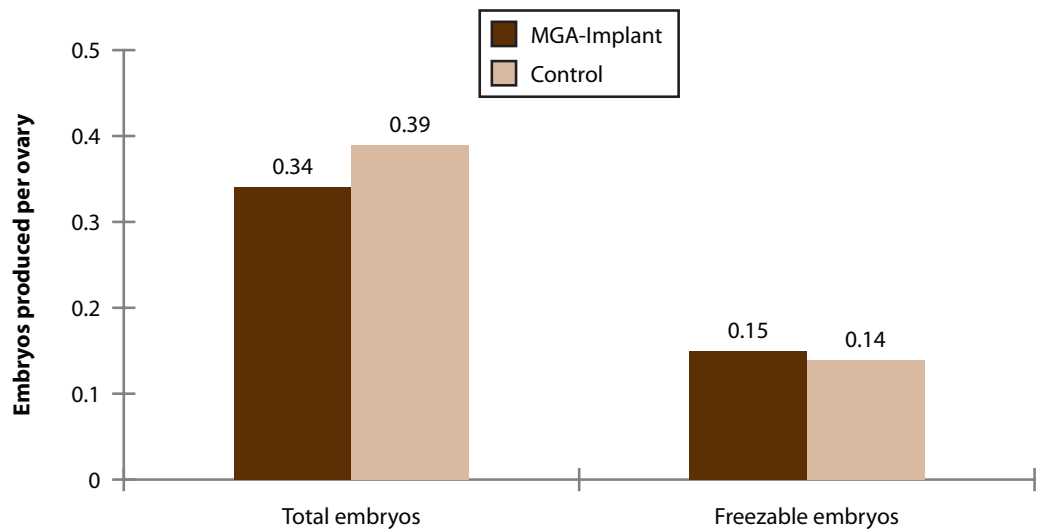
Beef Feedlot Heifers Can Serve as Viable Sources of Oocytes for *in vitro* Embryo Production

Natalie Miller

Objective: Determine if traditionally managed beef feedlot heifers fed melengestrol acetate (MGA) and implanted with growth promotants could serve as viable donors of oocytes post-slaughter for use in vitro embryo production.

Study Description: Beef feedlot heifers ($n = 172$) managed for 120 days pre-harvest were either fed MGA and implanted with growth promotants (Revalor IH, Merck Animal Health, Summit, NJ) or served as untreated controls. Heifer ovaries were obtained within 30 minutes of harvest, oocytes were collected, and *in vitro* fertilization was performed 24 hours later. Number of oocytes harvested, oocyte fertilization rate, early embryonic development, and number of freezable embryos produced were compared.

Results: Controls and MGA-Implant treatments resulted in a similar number of total embryos per ovary ($P > 0.10$). Freezable embryos per ovary were similar for both treatments ($P > 0.10$).



The Bottom Line: Feeding beef feedlot heifers MGA and implanting with growth promotants is not detrimental to production of embryos through *in vitro* fertilization.



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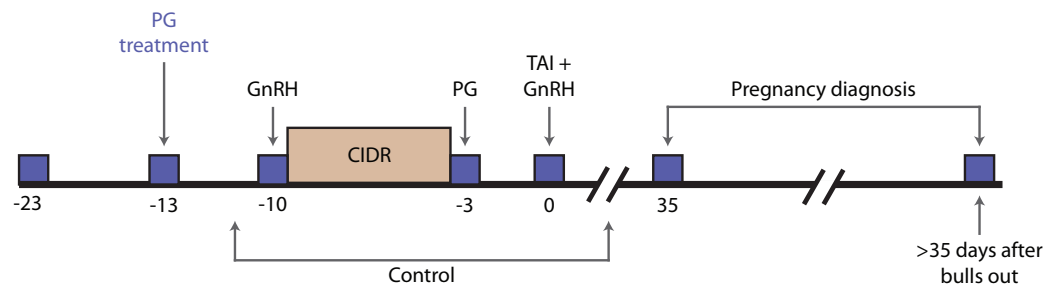
Presynchronizing PGF_{2α} Injection Before Timed Artificial Insemination CO-Synch + CIDR Program

Scott Hill

Objective: Determine pregnancy rates to timed artificial insemination after inducing estrus with a prostaglandin F_{2α} (PG) injection 3 days before applying the 7-day CO-Synch + controlled internal drug release (CIDR) protocol to suckled beef cows.

Study Description: Suckled beef cows (n = 1537) at nine locations in four states were inseminated artificially after a 7-day CO-Synch + CIDR protocol (control). Half of the cows received a PG injection 3 days (PG treatment) before initiating the synchronization program. Blood samples were collected on days -23, -13, -10, -3, and 0 to determine progesterone concentration and cycling status of cows before treatments. Body condition was scored on day -13.

Results: Consistent acceptable timed artificial insemination pregnancy rates >50% were achieved at all but one location in both treated and control cows. More multiparous cows in the PG treatment showed estrus after both PG injections, indicating that more multiparous cows were cycling and responded to PG. Timed artificial insemination pregnancy rates at day 35 were 55.6% for the PG treatment and 52.2% for the control. Pregnancy rates at the end of the breeding season did not differ between treatments. If desired, an alternative breeding option with the PG treatment could include inseminating cows detected in estrus after the PG treatment and apply the timed artificial insemination option to all remaining cows.



GnRH = gonadotropin-releasing hormone (Factrel); PG = prostaglandin F_{2α} (Lutalyse); CIDR = controlled internal drug release containing progesterone; TAI = timed artificial insemination.

The Bottom Line: PG treatment was equally effective as the control even in herds that have a large percentage of anestrous cows (35 to 84%) at the onset of the breeding season.



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Spring Burning of Native Tallgrass Pastures Influences Diet Composition of Lactating and Non-Lactating Beef Cows

Nancy Aubel

Objective: Characterize differences in diet selection between lactating beef cows suckling calves and non-pregnant, non-lactating beef cows grazing either burned or unburned native tallgrass prairie during summer.

Study Description: The study was conducted on 8 pastures in the Kansas Flint Hills; 4 of the pastures were burned in mid-April and 4 had no recent burning history. Treatments consisted of pregnant, lactating beef cows suckling calves and non-pregnant, non-lactating beef cows. Four lactating and four non-lactating cows were grouped randomly and assigned to graze a single burned or unburned pasture for 120 days.

Fecal samples were collected from each animal during each period. Samples were prepared and viewed on a microscope slide to determine the frequency of appearance of plant fragments, which was assumed to be equivalent to prevalence in grazed diets.

Diet botanical composition of beef cows grazing burned or unburned native tallgrass range during summer

| Item | Burned | Unburned | SEM | P-value |
|-------------------------------|--------|----------|------|---------|
| Grasses, % of diet dry matter | 74.2 | 71.8 | 0.52 | 0.01 |
| Forbs, % of diet dry matter | 25.8 | 28.2 | 0.52 | 0.01 |

Diet botanical composition over time of cows grazing native tallgrass range during summer

| Item | June 15 | July 15 | August 15 | September 15 | SEM | P-value |
|-------------------------------|------------|------------|--------------|-----------------|------|---------|
| Grasses, % of diet dry matter | 75.5 | 71.1 | 73.0 | 72.5 | 0.71 | < 0.01 |
| Forbs, % of diet dry matter | 24.5 | 28.9 | 27.0 | 27.5 | 0.70 | < 0.01 |

The Bottom Line: Forage selection preferences of beef cows can be altered with spring burning of native tallgrass pastures.



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Increasing Protein Supply to Pregnant Beef Cows When Energy Is Limited Does Not Improve Cow or Calf Performance

Eric Bailey

Objective: Determine the impact of providing supplemental ruminally undegraded protein to beef cows consuming low-quality forage during late gestation.

Study Description: Pregnant Angus × Hereford cows (1,160 lb) were used to examine the effects of supplemental ruminally undegraded protein on cow and calf performance. Cows were assigned to receive 1 of 3 supplements. Supplements supplied similar amounts of ruminally degraded protein (0.09% of body weight) and increasing amounts of ruminally undegraded protein: 0.05% (LOW), 0.07% (MOD), or 0.09% of body weight (HI). Cows grazed native tallgrass pasture. Supplements were fed daily from November 25 until all cows had calved.

Effects of of ruminally undegraded protein supplementation on cow and calf performance

| Item | Ruminally undegraded protein | | |
|---|------------------------------|-------|-------|
| | LOW | MOD | HI |
| Cow | | | |
| Average daily gain, lb/day | 0.22 | 0.15 | 0.04 |
| Body condition score change | -0.19 | -0.20 | -0.39 |
| Julian calving date | 68 | 66 | 64 |
| Pregnancy rate, % | 95 | 95 | 92 |
| Calving interval, day | 364 | 368 | 366 |
| Calf | | | |
| Birth weight, lb | 90 | 86 | 86 |
| Weaning weight, lb | 538 | 540 | 536 |
| Average daily gain (birth to weaning), lb/day | 2.18 | 2.18 | 2.14 |

The Bottom Line: Additional protein supplementation beyond what is needed to maximize ruminal digestion of fiber is not beneficial to mature cows before calving when energy supply is limiting.



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Effects of Corn Steep Liquor Supplementation on Intake and Digestion of Tallgrass Prairie Hay Contaminated with *Sericea Lespedeza*

Gregory Eckerle

Objective: Determine the effects of corn steep liquor supplementation on intake and digestion of tallgrass prairie hay contaminated by sericea lespedeza (*Lespedeza cuneata*).

Study Description: Twenty-four mature beef cows were individually fed tallgrass prairie hay contaminated with sericea lespedeza (approximately 30% sericea lespedeza by weight) and were supplemented corn steep liquor at the rates of 0, 1.34, 2.68, or 4.03 lb/day (dry basis), which were equivalent to as-fed feeding rates of 0, 3, 6, and 9 lb/day. All cows were individually fed tallgrass prairie hay contaminated with sericea lespedeza free-choice for 14 days. Beginning on day 15, supplemental corn steep liquor was abruptly introduced into cow diets at assigned feeding levels. Forage intake and nutrient digestion were monitored for 30 days.

Effects of increasing dose of corn steep liquor on intake and digestion of tallgrass prairie hay contaminated by sericea lespedeza

| Item | Corn steep liquor intake, lb/day (dry basis) | | | | SEM |
|-------------------------------|--|--------------------|--------------------|-------------------|-------|
| | 0 | 1.34 | 2.68 | 4.03 | |
| Feed intake, % of body weight | | | | | |
| Forage dry matter | 1.38 ^a | 1.59 ^b | 1.58 ^b | 1.63 ^b | 0.065 |
| Digestible dry matter | 0.86 ^a | 1.16 ^{ab} | 1.58 ^{bc} | 1.86 ^c | 0.062 |
| Total-tract digestibility, % | | | | | |
| Dry matter | 52.6 ^a | 55.6 ^a | 65.6 ^b | 66.3 ^b | 2.08 |
| Crude protein | - 1.5 ^a | 18.6 ^b | 51.7 ^c | 52.3 ^c | 4.53 |

^{abc} Means within a row lacking common superscripts are different.

The Bottom Line: Supplementation with corn steep liquor may increase beef cow tolerance for high-tannin forages. Supplemental corn steep liquor ameliorated the negative consequences of tannin consumption.



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Effects of Corn Steep Liquor Supplementation on Voluntary Selection of Tallgrass Prairie Hay Contaminated with *Sericea Lespedeza* and Uncontaminated Tallgrass Prairie Hay

Gregory Eckerle

Objective: The objective of our study was to determine the effects of a low level of corn steep liquor fed to beef cows on voluntary selection of tallgrass prairie hay contaminated by *sericea lespedeza* (*Lespedeza cuneata*) when uncontaminated tallgrass prairie hay was also available.

Study Description: Sixteen mature beef cows were housed in individual pens and were fed tallgrass prairie hay contaminated with *sericea lespedeza* (approximately 30% *sericea lespedeza* by weight) and uncontaminated tallgrass prairie hay simultaneously. Both sources of hay had similar crude protein (5.5 vs. 5.4%) and acid detergent fiber (41.0 vs. 39.8%) concentrations. Cows were either unsupplemented or supplemented with 1.32 lb/day corn steep liquor (dry basis; equivalent to 3 lb/day as-fed). Forage intake and diet digestion were monitored.

Effects of low-level corn steep liquor supplementation on forage intake and digestion by beef cows simultaneously offered tallgrass prairie hay that was contaminated with *sericea lespedeza* and uncontaminated by *sericea lespedeza*

| Item | Corn steep liquor, lb/day (dry basis) | | SEM | P-value |
|-------------------------------------|--|------|-------|---------|
| | 0 | 1.32 | | |
| Dry matter intake, % of body weight | | | | |
| Uncontaminated forage | 0.91 | 0.87 | 0.066 | 0.65 |
| Contaminated forage | 1.06 | 1.33 | 0.055 | <0.01 |
| Total forage | 1.97 | 2.20 | 0.086 | 0.05 |
| Digestible dry matter | 1.97 | 2.35 | 0.087 | <0.01 |
| Total-tract digestibility, % | | | | |
| Dry matter | 50.5 | 53.9 | 1.66 | 0.17 |
| Crude protein | 17.1 | 18.5 | 2.15 | 0.64 |

The Bottom Line: Results from our study were interpreted to suggest that low-level supplementation of corn steep liquor increases acceptance of and tolerance for high-tannin forages by beef cows. Corn steep liquor ameliorated some of the negative consequences of tannin consumption on digestible dry matter intake. In addition, voluntary consumption of high-tannin forage increased by 25% in supplemented compared with unsupplemented beef cows.



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Effects of Prepartum and Postpartum Bolus Injections of Trace Minerals on Performance of Beef Cows and Calves Grazing Native Range

Lauren Mundell

Objective: Evaluate the effects of pre- and postpartum bolus injections of a trace mineral solution on beef cow reproductive performance, body weight change, and body condition score change, and on performance of suckling calves.

Study Description: Mature beef cows were stratified by body condition, age, parity, and predicted calving date and assigned randomly to 1 of 2 treatments: (1) trace mineral injection containing 15 mg/mL Cu, 5 mg/mL Se, 10 mg/mL Mn, and 60 mg/mL Zn, or (2) injection of physiological saline (saline). Injections were administered to cows 105 days before the first projected calving date and again 30 days before fixed-time artificial insemination. Calves received the same treatment as their dams and were injected at birth and again at 71 ± 21 days of age. Cows grazed native pastures for the duration of the study; trace mineral supplements and white salt were available to all cattle free choice before and during the study.

Results: Change in body weight and body condition score from initiation of the study to calving and from artificial insemination to weaning did not differ ($P \geq 0.15$) between trace mineral and saline cows. Conversely, trace mineral cows had greater ($P = 0.04$) body condition score increase than saline cows between calving and artificial insemination. Calf body weight at birth, average daily gain, and age-adjusted weaning body weight did not differ ($P \geq 0.36$) between treatments. Proportion of cows with estrus cycles 17 and 8 days before ovulation synchronization was similar ($P \geq 0.51$) between treatments. Conception to artificial insemination was greater ($P = 0.05$) for cows receiving trace mineral (60.2%) than for cows receiving saline (51.2%); however, overall pregnancy did not differ ($P = 0.24$) between treatments and averaged 92%.

Effects of pre- and postpartum bolus injections of either a trace-mineral solution or physiological saline (1 mL/90 kg BW) on reproductive performance of beef cows grazing native range

| Item | Treatment | | | P-value |
|---|-----------|----------------------------|------|---------|
| | Saline | Trace mineral ^a | SE | |
| Cows cycling before timed artificial insemination, % ^b | 56.3 | 59.5 | 0.04 | 0.51 |
| Timed artificial insemination pregnancy, % ^c | 51.2 | 60.2 | 0.03 | 0.05 |
| Final pregnancy, % ^d | 89.9 | 93.0 | 0.02 | 0.24 |

^a Multimin 90, Multimin USA, Ft. Collins, CO.

^b Determined from serum samples collected 17 and 8 days before timed artificial insemination.

^c Proportion of cows classified as pregnant from timed artificial insemination only.

^d Proportion of cows classified as pregnant from timed artificial insemination or natural-service breeding.

The Bottom Line: Under the conditions of our study, pre- and postpartum trace mineral injections improved conception to fixed-time artificial insemination.

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Influence of Linpro and Dietary Copper on Performance and Meat Quality of Feedlot Cattle

Christian Alvarado

Objective: Evaluate whether feeding elevated copper concentrations in conjunction with a dietary source of omega-3 fatty acids could affect feedlot cattle performance and lipid profiles of beef.

Study Description: Supplementation consisted of dietary copper (10 or 100 ppm added copper) and Linpro (0 or 10% of diet, dry matter basis). Linpro (O&T Farms, Regina, Saskatchewan, Canada) is an extruded blend of flaxseed and field peas. Basal diets (dry basis) included 35% wet corn gluten feed, 35% cracked corn, 15.8% pelleted soybean hulls, 10% corn silage, and provided 14% crude protein. For Linpro diets, the extrudate was added at 10% of the diet dry matter, replacing soybean hulls. Cattle were harvested in a commercial abattoir where we obtained loin samples from one side of each carcass for evaluation of fat composition.

Results: We observed no interaction between Linpro and the level of copper with respect to effects on performance or fatty acid composition of beef. Feeding Linpro decreased dry matter intake compared with animals on the control diet (30.0 and 31.1 lb/day, respectively), and efficiency was improved for cattle fed Linpro.

Total fats and fatty acids in loin samples from heifers fed Control and Linpro diets

| Item, % | Control | | Linpro | | SEM | P-value | | |
|---------------------|----------|-----------|----------|-----------|-------|---------|--------|-------------|
| | 10 Cu | 100 Cu | 10 Cu | 100 Cu | | Linpro | Copper | Interaction |
| Saturated fat | 3.17 | 3.45 | 3.43 | 3.11 | 0.329 | 0.90 | 0.97 | 0.37 |
| Polyunsaturated fat | 0.36 | 0.39 | 0.45 | 0.42 | 0.019 | <0.01 | 0.94 | 0.17 |
| Omega-3 fats | 0.041 | 0.047 | 0.086 | 0.081 | 0.003 | <0.01 | 0.89 | 0.15 |
| Omega-6 fats | 0.301 | 0.317 | 0.341 | 0.318 | 0.015 | 0.19 | 0.83 | 0.20 |
| Total fatty acids | 7.24 | 7.92 | 7.80 | 7.10 | 0.743 | 0.87 | 0.99 | 0.37 |

The Bottom Line: Copper was ineffective as a strategy for improving assimilation of omega-3 fatty acids into beef tissue. Linpro can be used effectively as an energy source and to modify tissue concentrations of omega-3 fatty acids in beef.



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Dosing Heifers with *Megasphaera elsdenii* Allows for Rapid Step-Up to Finisher Diets

Kevin Miller

Objective: Determine if oral dosing of Lactipro (*Megasphaera elsdenii*; MS Biotech, Inc., Wamego, KS) upon arrival can be used to accelerate adaptation to high-grain diets without increasing risk of acidosis.

Study Description: Heifers were gathered from pastures in Cody, WY, and transported to the Kansas State University Beef Cattle Research Center. Cattle were processed 24 hours after arrival and assigned to 1 of 6 step-up regimens. Step-up diets contained 50 (step 1), 40 (step 2), 30 (step 3), and 20% corn silage (step 4). The final finishing diet contained 10% corn silage. The corn silage was replaced with dry-rolled corn in each successive step. Step-up regimes included the following diet sequences: steps 1, 2, 3, 4, finisher (1234F); steps 2, 3, 4, and finisher (234F); steps 3, 4, and finisher (34F); step 3 and finisher (3F); step 4 and finisher (4F); and starting directly on the finisher diet (F). Heifers on the 234F, 34F, 3F, 4F, and F were orally dosed with 100 mL of Lactipro at processing.

Effects of Lactipro on adjustment to step-up diets

| Item | Control 1234F | Lactipro (<i>Megasphaera elsdenii</i>) treatments | | | | |
|---------------------------|------------------|---|------|------|------|------|
| | | 234F | 34F | 3F | 4F | F |
| Dry matter intake, lb/day | 26.9 | 27.2 | 26.8 | 26.9 | 26.8 | 26.7 |
| Feed:gain | 7.29 | 7.52 | 7.52 | 7.71 | 7.36 | 7.37 |
| Hot carcass weight, lb | 838 | 834 | 833 | 826 | 830 | 838 |
| Liver abscesses, % | 15.9 | 22.2 | 7.9 | 11.1 | 8.0 | 14.3 |
| Choice and Prime, % | 68.3 | 74.6 | 73.0 | 65.1 | 74.2 | 74.6 |

The Bottom Line: Heifers orally dosed with Lactipro at processing can be stepped up to finishing diets more rapidly with no adverse effects on performance, health, or carcass traits. Aggressive step-up regimes may be warranted to realize the full potential of Lactipro.



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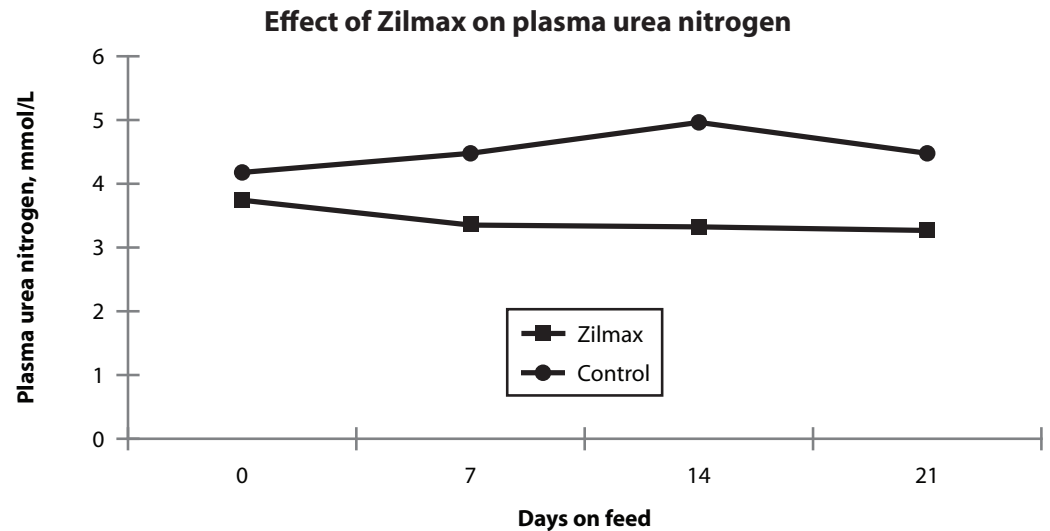
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Zilmax Alters Blood Metabolites in Finishing Cattle

Cadra Van Bibber

Objective: Assess changes in blood metabolites in response to supplementation by Zilmax.

Study Description: Crossbred steers ($n = 18$) were fed finishing diets with and without Zilmax (Merck Animal Health; Summit, NJ) for 23 days followed by a 3-day withdrawal before harvest. Steers were sorted by initial weight and randomly assigned to the two treatments. Steers were housed in individual pens containing concrete floors with feed bunks and half of the pens covered. Cattle were weighed at 7-day intervals and then again on the day of harvest. On day 0, 7, 14, and 21, blood samples were taken. A small amount of whole blood was used to analyze glucose and lactate. The rest of the blood was centrifuged and plasma was collected for analysis on glucose, lactate, plasma urea nitrogen, and non-esterified fatty acids. Carcass data were collected at harvest.



The Bottom Line: Adding Zilmax to the diets of finishing cattle 23 days prior to slaughter had a direct impact on blood metabolites, especially plasma urea nitrogen.



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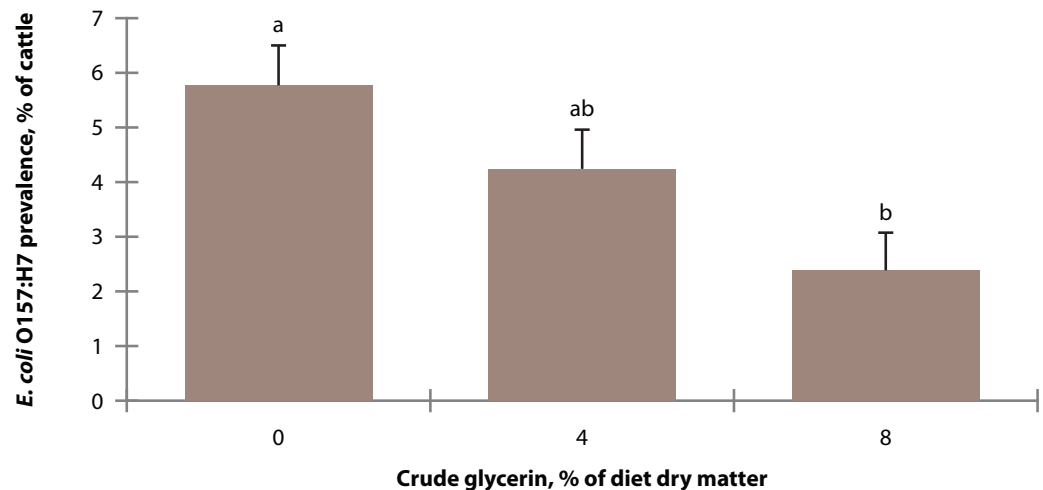
Feeding Crude Glycerin Decreases Prevalence of *E. coli* O157:H7 in Growing Cattle

Celine Aperce

Objective: Dried distillers grains with solubles have been shown to increase *Escherichia coli* O157:H7 prevalence in feedlot cattle. Our objective was to assess whether a byproduct of biodiesel production could be useful in decreasing prevalence of this pathogen when added to cattle diets.

Study Description: Fecal samples were obtained from growing cattle fed 0, 4, or 8% of the diet (dry basis) as crude glycerin and analyzed for *E. coli* O157:H7 prevalence over a 6-week period. Samples were subjected to immunomagnetic separation with beads specific for *E. coli* O157:H7. Resulting cultures were tested for indole production and O157 antigen agglutination. Positive samples for these two tests were confirmed as *E. coli* O157:H7 by latex agglutination.

Results: Inclusion of crude glycerin in the diet of growing heifers decreased the prevalence of *E. coli* O157:H7.



^{ab} Means without a common superscript differ ($P < 0.05$).

The Bottom Line: Adding crude glycerin to feedlot diets may be an effective preharvest strategy for decreasing prevalence of *E. coli* O157:H7 in feedlot cattle.



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Feeding Crude Glycerin During the Backgrounding Phase Improves Subsequent Feedlot Performance and Carcass Characteristics

Celine Aperce

Objective: To evaluate the impact of feeding crude glycerin during the backgrounding phase on performance and carcass characteristics in the subsequent finishing phase.

Study Description: Crude glycerin was included in backgrounding diets at 0, 4, and 8% (dry basis) and fed to 368 growing heifers. Animals were randomly allocated to 48 pens with 7 or 8 head per pen, providing a total of 16 pens per treatment. After 90 days backgrounding, cattle were transitioned to a common finishing diet without glycerin. Feedlot performance and carcass data were collected.

Carryover effects of glycerin fed during the backgrounding phase on performance and carcass characteristics of feedlot heifers

| Item | Glycerin, % of dry matter | | | SEM | P-value ^a |
|---------------------------|---------------------------|-------|-------|-------|----------------------|
| | 0 | 4 | 8 | | |
| Backgrounding phase | | | | | |
| Dry matter intake, lb/day | 19.58 | 19.00 | 18.81 | 0.293 | 0.069 |
| Average daily gain, lb | 3.26 | 3.33 | 3.31 | 0.055 | 0.753 |
| Feed:gain | 6.06 | 5.81 | 5.75 | 0.069 | 0.005 |
| Finishing phase | | | | | |
| Dry matter intake, lb/day | 21.25 | 21.76 | 22.18 | 0.604 | 0.025 |
| Average daily gain, lb | 2.56 | 2.76 | 2.84 | 0.119 | 0.0003 |
| Feed:gain | 8.47 | 8.00 | 7.87 | 0.132 | 0.01 |
| Final live weight, lb | 1116 | 1142 | 1153 | 21.2 | 0.009 |
| Hot carcass weight, lb | 688 | 703 | 710 | 6.4 | 0.028 |
| USDA yield grade | 2.74 | 2.67 | 2.72 | 0.093 | 0.872 |
| Choice or better, % | 82.5 | 81.0 | 87.1 | 0.034 | 0.4161 |

^a Linear effect of crude glycerin level fed during the backgrounding phase.

The Bottom Line: Crude glycerin fed during the growing period improved subsequent finishing performance and carcass characteristics.



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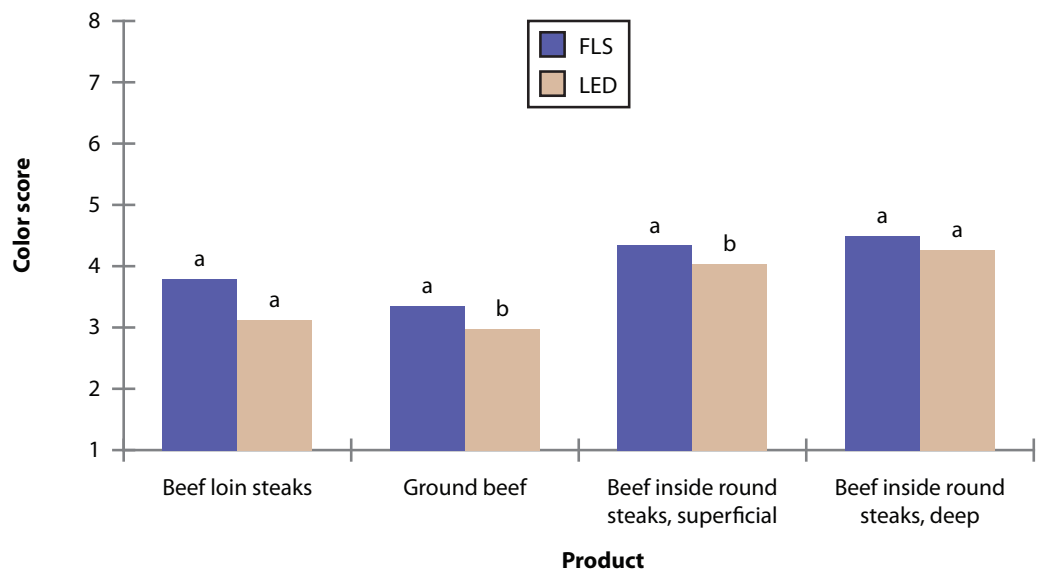
LED Lighting Extends Color Shelf Life for Three Beef Products Compared with Fluorescent Lighting

Kyle Steele

Objective: Compare effects of light emitting diode (LED) and fluorescent lighting on color stability and shelf-life properties of three beef products displayed in two retail cases set up to run at similar temperature profiles.

Study Description: Beef loin steaks, inside round steaks, and ground beef were displayed in two refrigerated retail meat display cases equipped with LED or fluorescent lighting for up to 8 days. Internal product and case temperatures were measured, and products were evaluated for visual and instrumental color, *Enterobacteriaceae* and aerobic plate counts, and oxidative rancidity.

Results: Meat retail display cases with LED lighting had lower case temperatures, leading to greater efficiency in energy use and extended fresh meat color life of products compared with products under fluorescent lighting. Microbiological growth was not affected by lighting type, but some products had increased oxidation under LED lighting.



^{ab} Columns with different letters differ at $P < 0.05$.

Beef loin steak color scale: 1 = very bright red, 4 = slightly dark red, 8 = tan to brown. Ground beef visual color scale: 1 = very bright red, 4 = slightly dark red, 8 = tan to brown. Beef insided round superficial portion steak visual color scale: 1 = very bright red, 4 = slightly dark red, 8 = tan to brown. Beef inside round deep portion steak visual color scale: 1 = very bright pinkish red, 4 = slightly dark pinkish red, 8 = tan to brown.



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The Bottom Line: Using LED lighting in retail meat display cases will save money by reducing overhead operational costs while extending the color life of beef loin steaks, ground beef, and beef inside rounds.

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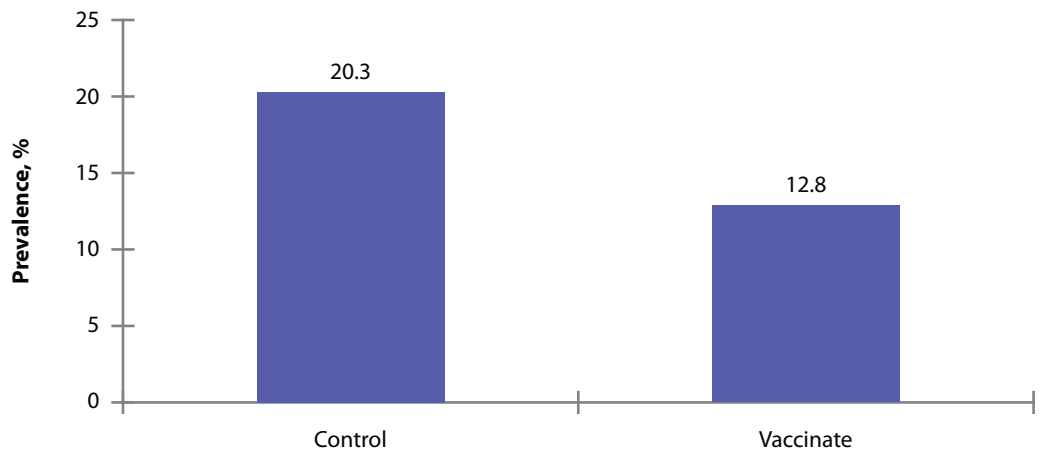
A Commercially Available SRP Vaccine Reduces Prevalence of *E. coli* O157:H7 in Feces of Beef Cattle Under Commercial Feedlot Conditions

Brooks Butler

Objectives: To evaluate the effects of vaccination with a siderophore-receptor and porin-based (SRP) vaccine for *Escherichia coli* on fecal shedding of *E. coli* O157:H7 in commercial feedlots.

Study Description: Cattle from 10 commercial feedlots located in Nebraska and Colorado were used in a field trial, with a total of 200,000 animals enrolled in the study. Feedlots were randomly assigned so cattle in that feedlot would either receive vaccination with SRP *E. coli* O157:H7 at arrival and ~100 days pre-harvest (VAC) or would not receive the vaccine (CON). Fecal samples were collected in May, June, July, and August of 2010. Pre-harvest blood samples were taken from cattle entering the packing plant.

Results: Vaccination reduced shedding of *E. coli* O157:H7 in feces and increased serum titer for the vaccine antigen.



The Bottom Line: Vaccinating feedlot cattle at arrival and 100 days pre-harvest with SRP *E. coli* vaccine reduces fecal shedding of *E. coli* O157:H7.



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CATTLEMEN'S DAY 2012



BEEF CATTLE RESEARCH

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Aging Method, USDA Quality Grade, and Endpoint Temperature Affect Eating Quality of Beef *Longissimus lumborum* Steaks

Michael Dikeman

Objective: Determine the effects of vacuum, dry, and special bag aging of USDA Choice and Select grade boneless strip loin steaks cooked to temperatures of 145°F or 160°F on yield, instrumental tenderness and color, and sensory properties of beef steaks.

Study Description: Boneless strip loins were purchased from USDA Choice (n = 9) and USDA Select (n = 9) carcasses, cut into halves, and randomly assigned to 1 of 3 aging treatments (vacuum aging, dry aging, or aging in a special bag; VAC, DRY, and SB, respectively). Loin sections were aged from the time they were received at 8 days postmortem at 4°F for 21 days. For all aging treatments, 1-inch-thick steaks were prepared and cooked to one of two endpoint temperatures (145 or 160°F) for Warner-Bratzler shear force determination and sensory analysis.

Results: VAC-aged loins had dramatically less ($P < 0.0001$) weight loss during aging than both DRY and SB aging methods (2.90% versus 15.56% and 13.48%, respectively). Quality grade did not affect trim loss, but both DRY and SB aging methods resulted in much higher ($P < 0.0001$) trim loss than VAC aging. DRY and SB aging resulted in similar combined losses, but combined losses were dramatically lower for VAC aging. Neither quality grade nor aging method affected ($P > 0.05$) Warner-Bratzler shear force; however, Warner-Bratzler shear force increased ($P < 0.0001$) from 6.42 to 7.44 lb as endpoint temperature increased. Cooking loss for steaks cooked to 160°F was about 5% higher ($P < 0.0001$) than for steaks cooked to 145°F. Quality grade and aging method did not affect ($P > 0.05$) juiciness, but steaks cooked to 145°F were juicier ($P < 0.05$) than those cooked to 160°F. Neither quality grade nor aging method affected ($P > 0.05$) myofibrillar tenderness, connective tissue amount, overall tenderness, or off-flavor intensity, but VAC-aged loins cooked to 160°F had the lowest ($P < 0.05$) myofibrillar tenderness score. Choice, VAC-aged steaks cooked to 145°F had higher ($P < 0.01$) beef flavor intensity than those cooked to 160°F.

The Bottom Line: All three aging methods improved palatability, but DRY and SB aging had excessive trim losses and required extensive labor. Our trained sensory panel revealed few, if any, differences among DRY, SB, and VAC aging.



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Combined Microwave and Convection Cooking Increases Post-Cooking Temperature Rise of Beef *Biceps femoris* Muscles More Than Convection Cooking

Alicia Gaschler

Objective: Investigate differences between convection cooking and a combination of microwave and convection cooking and endpoint temperatures to observe how these factors affect post-cooking temperature rise, cooking yields, and tenderness.

Study Description: Bottom round roasts ($n = 32$) aged 18 to 19 days after purchase were cooked in a convection/microwave oven (Amana Microwave Oven with Convection, Model AMC71597AB) that allowed for two cooking methods: convection and a combination of microwave and convection cooking. Roasts were cooked at 225°F to endpoint temperatures of 145 or 165°F. When the target temperature was reached, roasts were removed from the oven to record the post-cooking temperature rise. Roasts were then weighed and samples were taken to measure tenderness using the slice shear force procedure. Data were analyzed with a 2×2 treatment structure and means were separated ($P < 0.05$) using the Least Significant Difference procedure (SAS Inc., Cary, NC).

Results: For both endpoint temperatures, the combination of microwave and convection cooking resulted in a greater initial cooking loss and total cooking loss than convection cooking. In addition, cooking to an endpoint temperature of 165°F showed a greater cooking loss than 145°F. The combination of microwave and convection cooking showed a 14.4°F greater rise ($P < 0.05$) in post-cooking temperature than convection cooking. There was no difference in post-cooking temperature rise between roasts cooked to 145°F and those cooked to 165°F. There were no main effects or interactions for slice shear force due to cooking method; all roasts were comparatively tough.

The Bottom Line: When cooking with a combination of microwave and convection cooking, roasts should be removed from the oven at an approximately 14°F lower temperature than for convection cooking to result in the same final endpoint temperature. Using microwave and convection cooking or convection cooking methods results in similar tenderness for *Biceps femoris* roasts.



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Steam-Generation Cooking Versus Dry Heat Convection of Beef Roasts Differing in Connective Tissue

Lindsay Bowers

Objective: Compare the effects of moist-heat and dry-heat cookery on cooked yields, color, tenderness, and sensory traits of beef roasts differing in connective tissue cooked to different temperatures.

Study Description: Vacuum-packaged USDA Choice *Biceps femoris*, *Deep pectoralis*, and *Longissimus lumborum* muscles were aged 28 to 32 days. Roasts from all 3 muscles were cooked in a steam-generating CVap oven (Cook and Hold Vapor Oven; Winston Industries, Louisville, KY) to 160°F (phase I) and a Blodgett forced-air convection oven (G.S. Blodgett Co., Burlington, VT) and CVap oven (phase II). In phase II, roasts were cooked in CVap for a constant time that matched times to reach 150, 160, and 170°F for 3 muscles in the Blodgett. Roasts were evaluated for instrumental tenderness and sensory properties.

Results: Roasts cooked in the CVap in phase II were tan in color with more external surface moisture, whereas roasts cooked in the Blodgett were a dark, mahogany-red color with a more caramelized, drier surface. External fat color from the CVap cooked roasts was whiter, whereas roasts from the Blodgett were more yellow. Internal cooked color was not different. *Biceps femoris* roasts cooked using the phase II protocol to 150°F had the highest ($P < 0.05$) cooking yield, whereas roasts cooked to 160 and 170°F had the lowest ($P < 0.05$) yields. *Longissimus lumborum* roasts cooked to 150°F had the highest ($P < 0.05$) cooking yields. No difference ($P > 0.05$) was measured in cooking yields between ovens for all 3 muscles. Neither temperature nor oven type affected ($P > 0.10$) slice shear force or Warner-Bratzler shear force of *Biceps femoris* or *Longissimus lumborum* roasts. In phase II, cooking *Deep pectoralis* roasts in the Blodgett to 170°F resulted in higher ($P < 0.05$) Warner-Bratzler shear force than in the CVap; slice shear force values in the CVap decreased markedly from 150 to 170°F, but in the Blodgett, optimum tenderness appeared to occur at 160°F. *Longissimus lumborum* roasts had slice shear force values that were about half as high as those for the *Biceps femoris* and *Deep pectoralis*. *Biceps femoris* roasts cooked to 170°F in phase II in the Blodgett had a lower ($P < 0.05$) myofibrillar tenderness score than those cooked in the CVap, but there was no difference at the lower temperatures. No oven effect ($P > 0.10$) was detected for sensory scores of *Longissimus lumborum* roasts. As expected, roasts cooked to 160°F had a higher ($P < 0.05$) mean juiciness score than roasts cooked to 170°F.

The Bottom Line: Cooking *Biceps femoris* and *deep pectoralis* roasts in a CVap, steam-generation oven provides some advantages over a Blodgett dry-heat convection oven for either cooking yields and/or tenderness but no advantages for *Longissimus lumborum* roasts.

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SUMMARY PUBLICATION

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