

# Production, Management and the Environment: Beef Production I

**547 Relationships between feedlot morbidity, performance, and carcass quality in Angus steers.** M. L. Hands<sup>1</sup>, L. R. Corah<sup>2</sup>, T. T. Marston<sup>3</sup>, D. W. Moser<sup>1</sup>, and C. D. Reinhardt<sup>\*1</sup>, <sup>1</sup>*Kansas State University, Manhattan*, <sup>2</sup>*Certified Angus Beef, Manhattan, KS*, <sup>3</sup>*University of Nebraska, Norfolk*.

Performance data from Angus steers (n = 17,919) fed at a single feedlot in southwestern Kansas between 1997 and 2007 were used to evaluate the interrelationships between various demographic and phenotypic characteristics (season of arrival, geographic origin, health status, rate of gain, quality grade, and yield grade) on feedlot health, performance, and carcass traits. Cattle were not commingled before or following arrival at the feedlot and were predominantly preconditioned and backgrounded before shipment to the feedlot. Data were analyzed using a mixed model with the main and interactive effects of number of times treated per animal (0, 1, 2,  $\geq$  3) and arrival BW as fixed effects and year of arrival as a random effect. Morbidity was associated with reduced ADG (1.64 vs. 1.48 kg/d for healthy [0 times treated] vs. morbid steers [treated  $\geq$  3 times];  $P < 0.01$ ). Quality grade and initial BW decreased linearly with increasing number of treatments ( $P < 0.01$ ). In steers not treated for disease, there was little association between arrival BW and percentage Choice (68.3 vs. 70.2% for steers with arrival BW  $< 295$  vs.  $> 409$  kg; linear  $P = 0.02$ ). Morbid steers had a lower percentage Choice vs. healthy steers (69 vs. 57% Choice for healthy vs. morbid steers;  $P < 0.01$ ); however, in steers marketed at yield grade 3, the difference in percentage Choice narrowed (73.1 vs. 64.0% Choice for healthy vs. morbid steers;  $P < 0.01$ ). Also, in yield grade 3 steers, there was no difference in ADG (1.65, 1.69, and 1.64 kg/d; SEM = 0.051) or HCW (375, 377, and 375 kg; SEM = 4.8) between Prime, Choice, or Select carcasses; although compared with Choice-grading cattle, ungraded cattle had lower ADG (1.49 vs. 1.69 kg/d;  $P < 0.01$ ) and HCW (368 vs. 377 kg;  $P < 0.01$ ). Morbidity dramatically reduced feedlot performance and quality grade, but the reduction in quality grade and HCW was less severe by marketing morbid cattle at yield grade 3.

**Key words:** morbidity, quality grade, feedlot

**548 Impact of beef heifer development systems on ADG, reproduction, and feed efficiency.** S. P. Weber\*, A. F. Summers, T. L. Meyer, and R. N. Funston, *University of Nebraska, West Central Research and Extension Center, North Platte*.

Two experiments were conducted to evaluate the effect of winter management strategies during heifer development on growth and reproductive performance. In Exp. 1, 299 weaned crossbred Angus heifers, from a 3 year study, were randomly assigned to one of 2 treatments: (1) to graze winter range then be fed in a dry lot (DL;  $248 \pm 4$  kg) or (2) placed on corn residue (CR;  $247 \pm 4$  kg). In Exp. 2, 118 AI pregnant heifers from each year of Exp. 1 (yr 1 = 40; yr 2 = 38, yr 3 = 40) were stratified by weight and winter development system into pens and individually fed during late gestation. In year 1 of Exp. 2, diets contained 90% grass hay (11% CP; DM basis) and 10% supplement (21.8% CP; DM basis). In years 2 and 3 of Exp. 2 heifers received one of 3 dietary supplements: no supplement; a distillers grain based supplement; or a dried corn gluten feed supplement. Supplements in yr 2 and 3 were designed to be isonitrogenous (29% CP), isocaloric, but differed in RUP. In Exp. 1 heifer BW and ADG did not differ ( $P = 0.48$ ) during winter treatment. After winter treatment, DL tended to have increased ADG ( $P = 0.057$ ) and differences in BW were greater ( $P = \leq 0.01$ )

for DL compared with CR heifers. Pre-breeding BW and breeding BW were also greater ( $P = 0.02$ ;  $P = 0.03$ , respectively) for DL compared with CR ( $350$  vs.  $313 \pm 9$  kg;  $374$  vs.  $350 \pm 12$  kg). Percent of heifers cycling pre-breeding, AI conception, AI pregnancy, and overall pregnancy rates were similar ( $P \geq 0.41$ ) between treatments. DMI, ADG, and G:F in Exp. 2 were not different ( $P = 0.32$ ) for heifers developed on CR or DL, although final weight of CR ( $493 \pm 3$  kg) was lower ( $P = 0.03$ ) than DL ( $503 \pm 3$  kg) approximately one month before calving. These data indicate that although heifers developed on CR have decreased ADG and BW through breeding, there is no difference in reproductive performance compared with DL developed heifers. These findings also provide evidence for reducing input costs for developing heifers without sacrificing reproductive performance.

**Key words:** beef cattle, heifer development, pre-breeding weight

**549 Late gestation supplementation impacts primiparous beef heifers and progeny.** A. F. Summers\*, S. P. Weber, T. L. Meyer, and R. N. Funston, *University of Nebraska, West Central Research and Extension Center, North Platte*.

A 2-yr study utilizing primiparous crossbred beef heifers (yr 1 = 38; yr 2 = 40) was conducted to determine the effects of protein supplement during late gestation on cow and progeny performance. Pregnant heifers were stratified by heifer development system, initial BW, and service sire. Heifers were individually fed meadow hay (11.3% CP) from early November to mid February and provided no supplement (CON; yr 1 = 12; yr 2 = 13), 0.91 kg/d of a dried distillers grain based supplement (HIGH; yr 1 = 13; yr 2 = 14) or 0.91 kg/d of a dried corn gluten feed based supplement (LOW; yr 1 = 13; yr 2 = 13). Supplements were designed to be isonitrogenous (29% CP), isocaloric, but differ in RUP with HIGH (59% RUP) having greater levels of RUP than LOW (34% RUP). After the individual feeding period, heifers were placed in a dry lot for calving. All heifers were bred using a fixed-timed AI protocol and pairs moved to a commercial ranch in the Nebraska Sandhills for summer grazing. Approximately 10 d after AI, a bull was placed with the cows for 60 d. Pregnancy rates were determined via rectal palpation at weaning and calves placed in a feedlot. Feeding period initial age, initial BW and midterm BW did not differ ( $P \geq 0.57$ ) among groups. Final off test BW was greater ( $P = 0.05$ ) for supplemented heifers compared with CON heifers ( $509$  vs.  $434$  kg  $\pm$  4 kg). Supplemented heifers had greater ( $P \leq 0.06$ ) ADG, NE DMI, and G:F during the individual feeding period compared with CON heifers. The following calf data are only for the first year. Calving date and calf birth BW did not differ ( $P \geq 0.24$ ) among groups. Weaning calf BW and BW at feedlot entry were greater ( $P \leq 0.07$ ) for LOW compared with CON calves ( $261$  vs.  $239$  kg  $\pm$  7 kg;  $275$  vs.  $255 \pm 7$  kg) and feedlot entry BW tended ( $P = 0.13$ ) to be greater for HIGH ( $273 \pm 7$  kg) compared with CON ( $255 \pm 7$  kg) calves. Re-implant interim feedlot BW and ADG did not differ ( $P > 0.30$ ) among groups. Protein supplementation improved heifer ADG and G:F and calves from heifers fed lower levels of RUP had greater weaning BW and feedlot entry BW compared with calves from non supplemented dams.

**Key words:** beef cattle, maternal nutrition, protein supplementation

**550 Cattle performance comparison in three feedlot facility designs in South Dakota.** B. P. Holland\*, E. R. Loe, and R. H.

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The Opportunities Farm, located in southeastern South Dakota, contains 3 feedlot facility designs. Each facility design contains 4, 80 head pens. The open (OPN) design has concrete bunk aprons and mounded earthen pen floors and provides 25.5 m<sup>2</sup>/head. The partially covered (PTL) design has a monoslope building over the feed alley and 6 m of pen, and the remainder of the pen is mounded earthen surface (20.0 m<sup>2</sup>/head). The Confined (CON) pens are completely roofed in a monoslope building (11 m deep) with concrete floors (4.3 m<sup>2</sup>/head) and are managed with deep pack bedding. All pens contain 24.3 m of bunk space. Beginning in 2004, cattle were sourced by lot (204 to 252 cattle/lot; 6,615 total) and randomly allotted at arrival to one pen in each housing facility. Yearling or backgrounded cattle (28 lots; BW = 215 ± 93; range = 285 to 455 kg) were managed similarly as to diet, health and implant protocols, and days on feed (117 to 226 d) across facilities within lot. Lots were closed during quarter 1 (Jan-Mar; n = 8), 2 (Apr-Jun; n = 8), 3 (July-Sep; n = 6), and 4 (Oct-Dec; n = 6). Closeout data were analyzed using mixed models with main effects of facility design, quarter closed, and their interaction. Lot was included as a random effect. Facility design × quarter closed interactions were significant ( $P < 0.01$ ) for final BW, ADG, and G:F. Quarter 1 final BW and ADG were lowest ( $P < 0.01$ ) for OPN compared with PTL and CON (600, 616, 617 kg and 1.45, 1.54, and 1.56 kg, respectively), and G:F was lowest for OPN (0.125), intermediate for PTL (0.134) and greatest for CON (0.138). Similarly, quarter 2 ADG and G:F were lowest for OPN compared with PTL and CON (1.66, 1.71, and 1.72 kg and 0.152, 0.159, 0.158, respectively). Performance was similar across facilities during quarters 3 and 4. Overall performance for OPN, PTL, and CON, respectively were: ADG 1.61<sup>b</sup>, 1.66<sup>a</sup>, 1.64<sup>a</sup> ± 0.03 kg ( $P = 0.003$ ); DMI 11.1, 11.1, 11.0 ± 0.17 kg ( $P = 0.18$ ); and G:F 0.145<sup>b</sup>, 0.150<sup>a</sup>, 0.149<sup>a</sup> ± 0.002 ( $P < 0.001$ ). Averaged over the year, cattle gained faster and were more efficient when finished with protection of a building, but advantages in performance are dependent on quarter closed.

**Key words:** beef cattle, feedlot, housing

**551 Season of arrival affects feedlot performance, health, and carcass traits of Angus steers.** M. L. Hands<sup>1</sup>, T. T. Marston<sup>2</sup>, L. R. Corah<sup>3</sup>, D. W. Moser<sup>1</sup>, and C. D. Reinhardt<sup>\*1</sup>, <sup>1</sup>*Kansas State University, Manhattan*, <sup>2</sup>*University of Nebraska, Norfolk*, <sup>3</sup>*Certified Angus Beef, Manhattan, KS.*

Performance data from Angus steers (n = 17,919) fed at a single feedlot in southwestern Kansas between 1997 and 2007 were used to evaluate the interrelationships between various demographic and phenotypic characteristics (season of arrival, geographic origin, health status, rate of gain, quality grade, and yield grade) on feedlot health, performance, and carcass traits. Cattle were not commingled before or following arrival at the feedlot and were predominantly preconditioned and backgrounded before shipment to the feedlot. Season of arrival was categorized as winter (December, January, and February), spring (March, April, and May), summer (June, July, and August), or fall (September, October, and November). Data were analyzed using a mixed model with the main and interactive effects of season and arrival BW as fixed effects and year of arrival as a random effect. Steers which arrived during fall had the lowest ADG and those which arrived during the summer had the greatest morbidity ( $P < 0.01$ ), but there were also interactions between the effects of season and arrival BW ( $P < 0.01$ ) on quality grade and ADG. There was a range of 20

percentage units from the greatest to lowest percent Choice by season of arrival in the light steers (295–330 kg; 62 vs. 82% for spring and summer, respectively), an 11 unit range in the medium steers (331–375 kg; 68 vs. 79% for spring and summer, respectively) and only a 3 unit range in the heavy steers (>375 kg; 74 vs. 77% for winter vs. fall, respectively). A similar interaction was noted for ADG; there was a 0.23 kg/d range in the light steers (1.51 vs. 1.74 kg/d for fall vs. spring, respectively) and a 0.11 kg/d range in heavy steers (1.63 vs. 1.74 kg/d for fall vs. winter, respectively). Season of arrival was associated with differences in performance and carcass quality, but the degree of the seasonal impact diminished with increasing arrival BW.

**Key words:** feedlot, season, morbidity

**552 Relationships between feedlot performance, yield grade, and quality grade in Angus steers.** M. L. Hands<sup>1</sup>, T. T. Marston<sup>2</sup>, L. R. Corah<sup>3</sup>, D. W. Moser<sup>1</sup>, and C. D. Reinhardt<sup>\*1</sup>, <sup>1</sup>*Kansas State University, Manhattan*, <sup>2</sup>*University of Nebraska, Norfolk*, <sup>3</sup>*Certified Angus Beef LLC, Manhattan, KS.*

Performance data from Angus steers (n = 17,919) fed at a single feedlot in southwestern Kansas between 1997 and 2007 were used to evaluate the interrelationships between various demographic and phenotypic characteristics (season of arrival, geographic origin, health status, rate of gain, quality grade, and yield grade) on feedlot health, performance, and carcass traits. Cattle were not commingled before or following arrival at the feedlot and were predominantly preconditioned and backgrounded before shipment to the feedlot. Data were analyzed using a mixed model with the main effects of quality grade (Prime, Choice, Select, or Ungraded), yield grade group (yield grade 1 and 2, yield grade 3, and yield grade 4 and 5), daily gain (<1.36, 1.36 to 1.55, 1.56 to 1.81, and > 1.81 kg/d), and arrival BW group (295–330, 331–375, > 375 kg) and the interactions between quality grade, yield grade, and daily gain with arrival BW as fixed effects and year of arrival as a random effect. Increasing yield grade from 1 and 2 to yield grade 3 increased percentage Choice by 12.1 points ( $P < 0.01$ ); there was no additional gain in quality grade moving to yield grade 4 and 5 (quadratic  $P < 0.01$ ). More rapidly gaining steers had greater final BW, HCW, and yield grade at marketing ( $P < 0.01$ ) and had greater quality grade ( $P < 0.01$ ) in all but steers with initial BW >375 kg. Average daily gain did not differ greatly among cattle which graded Prime, Choice, and Select (1.61, 1.68, and 1.63 kg/d, respectively; SEM = 0.025), although ADG was lower for cattle which were ungraded (1.50 kg/d;  $P < 0.01$ ). These data suggest that producers do not need to choose between performance and quality grade; instead, much of the difference in quality grade can be explained by differences in yield grade.

**Key words:** feedlot, performance, quality grade

**553 Relationship of feed efficiency of replacement beef heifers to subsequent feed efficiency as 3-year old suckled beef cows.** T. E. Black<sup>\*1</sup>, K. M. Bischoff<sup>1</sup>, V. R. G. Mercadante<sup>1</sup>, G. H. L. Marquezini<sup>1</sup>, C. C. Chase Jr.<sup>2</sup>, S. W. Coleman<sup>2</sup>, and G. C. Lamb<sup>1</sup>, <sup>1</sup>*North Florida Research and Education Center, University of Florida, Marianna*, <sup>2</sup>*USDA-ARS, SubTropical Agricultural Research Station, Brooksville, FL.*

We determined the correlation between Residual Feed Intake (RFI) measured as post-weaned growing heifers (phase 1) and RFI measured as lactating beef cows (phase 2) in the same cohort. Individual performance and daily DMI were evaluated in 74 yearling heifers, and

were subsequently reevaluated upon the birth of their second calf. For both phases, a 14-d acclimation period preceded a 70 d test using the GrowSafe System (GrowSafe Systems Ltd., Alberta, Canada) to record individual feed intakes. Forage-based diets fed in both phases were formulated to support 1 kg/d in phase 1 and lactation maintenance requirements in phase 2. Cattle were weighed every 14 d and for phase 2 cows were milked on d 14 (lactation d  $28 \pm 7$ ) and d 70 (lactation d  $84 \pm 7$ ) to determine energy corrected milk (ECM) production. Fat thickness over the 13th rib (BF) and ribeye area (REA) were determined by ultrasound. Heifers were ranked by RFI and placed into Low ( $<0.5$  SD;  $n = 24$ ), Med ( $<0.5$  SD  $>$ ;  $n = 24$ ), and High ( $>0.5$  SD;  $n = 26$ ) RFI groups. Daily DMI differed for all groups ( $P < 0.0001$ ) and was greatest ( $10.82 \pm 0.23$  kg/d) for High; intermediate ( $9.63 \pm 0.24$  kg/d) for Med; and lowest ( $8.47 \pm 0.24$  kg/d) for Low RFI heifers. Phase 2 RFI model included d 28, d84 ECM and d 84 BF which explained 36%, 11%, and 3%, respectively, of the variation in DMI not explained by ADG and MBW. Cows which were most efficient as heifers (Low) had lower ( $P < 0.05$ ) daily DMI and RFI values ( $13.6 \pm 0.6$ ;  $-1.17 \pm 0.5$  kg/d, respectively) than cows ranked as Med ( $15.5 \pm 0.6$ ;  $0.8 \pm 0.5$  kg/d) or High ( $15.7 \pm 0.6$ ;  $0.24 \pm 0.46$ ) as heifers. In addition, cows which were least efficient as heifers (High) had the greatest d28 and d84 ECM ( $6.27 \pm 0.36$ ;  $5.4 \pm 0.31$  kg/d) compared with cows that were more efficient heifers ( $4.66 \pm 0.38$  and  $4.58 \pm 0.33$  kg/d Low;  $4.66 \pm 0.38$  and  $4.0 \pm 0.33$  kg/d Med). Pearson rank correlation between heifer and cow RFI was  $r = 0.19$  ( $P = 0.12$ ). We conclude that ECM and BF are important sources of variation affecting evaluation of RFI in lactating beef cows and heifers ranked as more efficient subsequently consumed less as cows.

**Key words:** residual feed intake, beef cows, dry matter intake

**554 Effect of injectable trace minerals on the humoral immune response to multivalent vaccine administration in beef calves.** J. D. Arthington<sup>\*1</sup> and L. J. Havenga<sup>2</sup>, <sup>1</sup>University of Florida, Range Cattle Research and Education Center, Ona, <sup>2</sup>Multimin USA Inc., Fort Collins, CO.

The objective of this experiment was to investigate the effects of injectable trace minerals (ITM) on humoral responses of calves receiving a viral vaccination. Steer calves ( $n = 99$ ; average BW =  $302 \pm 4.2$  kg), seronegative for bovine herpesvirus-1 (BHV-1) and bovine viral diarrhoea virus, genotypes 1 and 2 (BVDV-1 and BVDV-2) were sourced from 2 locations. All calves, except 15 non-vaccinated (sentinel) calves, received a single dose of a multivalent modified live vaccine (Titanium 5; AgriLabs, St. Joseph, MO) containing BHV-1, BVDV-1, BVDV-2, bovine parainfluenza virus type 3, and bovine respiratory syncytial virus. Among the vaccinated calves, 2 treatments were concurrently and randomly applied; including, 1) ITM ( $n = 42$ ; 7 mL s.c.; MultiMin, Fort Collins, CO) containing 15, 40, 10 and 5 mg/mL of Cu, Zn, Mn (all as disodium EDTA salts) and Se (as Na selenite), or 2) saline-injected control (Control;  $n = 41$ ). Neutralizing antibody titers were measured on d 0, 14, 30, 60 and 90 relative to vaccine and treatment administration. All calves were seronegative for each of the 3 viruses on d 0 and sentinel calves remained seronegative throughout the study. Serum mineral concentrations were evaluated on d 0 and 14. No differences ( $P \geq 0.30$ ) in serum Cu, Zn, Mn, or Se were observed between treatments on d 0. Control steers had a decrease ( $P < 0.001$ ) in serum Zn and Se and ITM steers had an increase ( $P = 0.007$ ) in serum Cu on d 14 relative to d 0 values. On d 14, serum Zn and Se concentrations were greater ( $P < 0.01$ ) in ITM compared with Control steers. All vaccinated calves experienced increases in neutralizing antibody titers by d 30 following vaccine administration. Calves receiving ITM

at the time of vaccination had greater ( $P \leq 0.003$ ) neutralizing antibody titers to BHV-1 on d 14, 30, and 60 compared with Control. These results demonstrate that the ITM formulation evaluated in this study does not impair humoral immune responses in beef calves. Further, concurrent administration of ITM and BHV-1 vaccine may enhance the production of neutralizing antibodies to BHV-1 in previously naïve beef calves.

**Key words:** trace mineral, vaccine, calves

**555 The effect of beta-agonists on feedlot performance and carcass merit in yearling steers.** R. K. Peterson<sup>\*1</sup>, J. J. Wagner<sup>1</sup>, T. E. Engle<sup>1</sup>, and T. C. Bryant<sup>2</sup>, <sup>1</sup>Colorado State University, Fort Collins, <sup>2</sup>JBS Five Rivers Cattle Feeding, Greeley, CO.

Yearling steers ( $n = 864$ ; BW = 347 kg) were used to study the effects of  $\beta$ -agonist (BA) treatment on feedlot performance and carcass merit. Steers arrived at the feedlot in 2 groups and were ranked by BW within each group and divided into 4 BW blocks. Within each BW block, each successive set of 12 ranked steers were randomly assigned to 1 of 12 pens of 9 head. After an average of 111 d on feed, steers were weighed and all 96 pens were ranked by BW and each pen was assigned to 1 of 8 BW blocks (12 pens/BW block). Within each BW block, pens were randomly assigned to 3 BA treatments (32 pens/treatment). Treatments included: 1. Control (no BA), 2. Optaflexx (OPT, 200 mg/hd/d for 28 d), and 3. Zilmax (ZIL, 8.33 mg/kg diet DM about 75 mg/hd/d for 20 d). A 3 d withdrawal from ZIL was used. All steers were fed steam-flaked corn based finishing diets 2X daily. Cattle were started on their respective BA treatments and slaughtered in 3 groups by BW block. Average final BW and ADG the final 28 d for steers treated with BA were greater ( $P < 0.01$ ) than no BA supplemented steers. Treatment had no effect on DMI and gain-to-feed ratio was improved ( $P < 0.001$ ) during the final 28 d by 35% for steers fed BA compared with no BA. There was no difference in final BW for OPT versus ZIL. Least squares means for HCW, adjusted for BW at the initiation of the BA feeding, were heavier ( $P < 0.01$ ) for ZIL compared with no BA and heavier ( $P < 0.05$ ) for ZIL than OPT. Dressing percentage (DP) was higher ( $P < 0.001$ ) for steers fed ZIL compared with OPT and no BA (64.4, 63.2, and 63.4%, respectively). Yield grades (YG) were similar for OPT and ZIL steers and both were reduced ( $P < 0.05$ ) compared with no BA. Average marbling score for no BA carcasses was greater ( $P < 0.01$ ) than BA carcasses but was similar for OPT and ZIL. Carcasses from steers receiving no BA had a greater likelihood ( $P < 0.01$ ) of grading low choice or higher than steers fed BA. The effect of OPT and ZIL on BW appears similar; however, an increase in DP for ZIL as compared with OPT or no BA resulted in a 5.8 and 9.2 kg heavier HCW for ZIL as compared with OPT and no BA, respectively.

**Key words:** beta-agonists, ractopamine, zilpaterol

**556 Moderate exercise alters blood constituents, growth performance, and carcass characteristics in finishing heifers.** A. D. Stickel<sup>1</sup>, L. N. Edwards<sup>1</sup>, T. A. Houser<sup>1</sup>, J. R. Jaeger<sup>2</sup>, T. G. Rozell<sup>1</sup>, L. D. Hollis<sup>1</sup>, S. Uwituz<sup>1</sup>, C. L. Van Bibber<sup>1</sup>, K. A. Miller<sup>1</sup>, J. J. Higgins<sup>1</sup>, and J. S. Drouillard<sup>\*1</sup>, <sup>1</sup>Kansas State University, Manhattan, <sup>2</sup>Kansas State University, Hays.

Crossbred heifers ( $n = 30$ ;  $448 \pm 27$  kg initial BW) were used in an randomized complete block experiment to assess impact of exercise regimen on serum IGF-1 and insulin, plasma glucose and lactate, feedlot performance, and carcass characteristics. Heifers were stratified by initial BW and body condition and assigned randomly, within strata,

to Sedentary and Exercised groups. Cattle were housed in individual pens (1.5 m X 6.5 m) and fed a finishing diet consisting of 93% concentrate and 7% roughage. Each Mon, Wed, and Fri, Exercised cattle were removed from their pens and moved by a caretaker at a pace of 5 to 6 km/h (20 min/d for the first 2 wk, 30 min/d for the next 2 wk, and 40 min/d thereafter). Blood samples were collected via jugular puncture before exercise on d 0, 28, and 60; ultrasound measures of LM depth, 12th rib fat thickness, and marbling were collected on d 0 and 60; and heifers were harvested on d 62. Data were analyzed using Proc Mixed of SAS, with fixed effect of exercise regimen and random effects of strata and exercise regimen x strata. Study day and the interaction between study day and exercise regimen were included as fixed effects for repeated measures. Exercise decreased insulin (exercise x d interaction,  $P = 0.06$ ; exercise effect,  $P = 0.01$ ), but had no effects

( $P \geq 0.10$ ) on IGF-1, glucose, or lactate, or ultrasound measures of LM depth and marbling. Exercised cattle had poorer ADG (0.79 vs 1.14 kg/d), DMI (8.98 vs 10.06 kg/d), and gain:feed (0.083 vs 0.111) compared with Sedentary cattle ( $P \leq 0.05$ ), but yielded similar HCW (312 vs 321 kg;  $P \geq 0.10$ ), marbling (Slight<sup>74</sup> vs Small<sup>01</sup>;  $P \geq 0.10$ ), LM area ( $P \geq 0.15$ ), and KPH ( $P \geq 0.80$ ), and had less 12th rib fat (1.09 vs 1.45 cm;  $P \leq 0.01$ ) and lower yield grades (2.22 vs 2.86;  $P \leq 0.01$ ). Feed intakes were not different between days of exercise and rest ( $P \geq 0.10$ ). Response to exercise was highly variable, and decreased performance was largely attributable to 2 heifers that gained no BW during the 62-d trial. Moderate physical activity in feedlot cattle alters insulin concentrations, feed intake, gain, efficiency, and carcass fatness.

**Key words:** exercise, cattle, feedlot