BEEF SPECIES: STOCKER AND FEEDLOT

0137 Effect of crude protein levels and metaphylaxis on growth and performance of newly received stocker calves. T. J. Braud[*1], B. B. Karisch[1], D. R. Smith[1], C. L. Huston[1], R. Vann[2], and S. G. Genova[1], [1]*Mississippi State University, Mississippi State,* [2]*MAFES-Brown Loam, Mississippi State University, Raymond.*

Newly received stocker calves may have low feed intake and are at risk for bovine respiratory disease (BRD) and other causes of morbidity and mortality. The objectives of this study were to evaluate the effects of: 1) metaphylactic antibiotic administration (none or Excede on arrival); and 2) receiving diet CP levels (12% or 18%) on respiratory disease incidence, mortality, and growth performance of beef calves received into a stocker calf system. Steer calves ($n = 244$) were stratified by weight and randomly assigned to 20 pens. Treatments were randomly assigned to pen in a 2×2 factorial study design. Cattle were examined daily for signs of BRD and fed once daily (NEg = 0.94 MCal/kg). Cattle receiving metaphylactic treatment were not treated for BRD during the first 7 d; otherwise, BRD was diagnosed at the first clinical signs and body temperature $> 40°C$. Calves were weighed at arrival and every 14 d through d 55 of the 60-d trial. Days at risk for BRD was the number of days from arrival until a calf: 1) first diagnosed with BRD, 2) died, or 3) finished the trial. Overall, 176 calves were treated for BRD over 6410 d at risk (BRD incidence density $= 27.4/10^3$ calf-days). The effects of metaphylaxis and diet on BRD incidence density were tested by Poisson regression, accounting for clustering by pen. Cattle receiving metaphylaxis were 60% less likely to be diagnosed with BRD (RR = 0.4, $P < 0.0001$) and every additional 45 kg at arrival reduced incidence of BRD 45% (RR = 0.54, $P = 0.004$). Neither diet nor the interaction between diet and metaphylaxis were significantly associated with BRD incidence. The effects of metaphylaxis, diet, and incoming BW on mortality from all causes were tested in a log-binomial model, accounting for clustering by pen. Mortality totaled 32 calves (13%). Neither diet, metaphylaxis, nor incoming BW were significantly associated with risk for mortality. The effects of metaphylaxis and diet on ADG were tested in a generalized estimating equations model, accounting for clustering by pen. Overall, for the 212 cattle finishing the trial, ADG was 0.72 kg/d. Accounting for metaphylaxis, cattle receiving 18% protein gained an additional 0.19 kg/d ($P = 0.008$). Metaphylaxis did not affect ADG ($P = 0.10$). Metaphylactic treatment reduced the incidence of BRD and increasing CP in the receiving ration to 18% resulted in higher ADG.

Key Words: beef cattle, BRD, metaphylaxis

0138 Effect of growth rate and placement weight of stocker-feeder cattle on subsequent finishing performance and carcass characteristics: A meta-analysis. P. A. Lancaster*, C. R. Krehbiel, and G. W. Horn, *Oklahoma State University, Stillwater.*

Many studies have been conducted evaluating the effect of forage species, stocking rate, supplementation strategies, and length of grazing on subsequent finishing performance and carcass characteristics; however, it is still difficult to ascertain the impact of stocker programs on subsequent finishing performance. The objective of this study was to use meta-analysis methods to determine the effect of 2 important factors of stocker programs, ADG, and placement BW on subsequent finishing performance and carcass characteristics. Following a literature search, a data set was compiled of 24 studies comprising 29 research trials, where stocker treatments differed significantly in rate of gain by ≥ 0.10 kg/d during the stocker phase. Regression analyses were conducted using a mixed model (PROC MIXED of SAS) that included ADG or placement BW as fixed effects, and intercept by ADG or placement BW cross product terms, when slopes differed among trials, as random effects and trial as the subject. The squared standard error for the dependent variable was used as a weighting factor to compute regression coefficients. Stocker ADG and placement BW had a negative relationship ($P < 0.10$) with finishing G:F; but when both ADG and placement BW were included in the model, neither were significant ($P > 0.10$). Stocker ADG and placement BW had positive relationships ($P < 0.05$) with LM area but not 12th-rib fat thickness or yield grade. When both ADG and placement BW were included in the model for rib fat-adjusted marbling score, neither were significant ($P > 0.10$). However, addition of HCW to the model indicated that HCW had a positive relationship ($P < 0.05$) with rib fat-adjusted marbling score, even though ADG and placement BW were included. Stocker ADG had a negative relationship ($P < 0.05$) with rib fat-adjusted HCW, whereas placement BW had a positive relationship ($P < 0.05$). These data suggest that slower rates of gain during the stocker phase, but with longer grazing periods to increase placement BW, can increase rib fat-adjusted HCW and marbling score.

Key Words: carcass characteristics, finishing performance, stocker-feeder cattle

70

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0139 Performance impacts of feeding bermudagrass (*Cynodon dactylon*) or ryegrass (*Lolium multiflorum*), plus rye (*Secale cereale*) baleage to weaned crossbred beef calves. R. M. Martin[*,1,2], R. Walker[3], B. Buttrey[3], and C. C. Williams[4], [1]*Louisiana State University, Baton Rouge, [2]School of Animal Sciences, LSU AgCenter, Baton Rouge, [3]LSU AgCenter, Hill Farm Research Station, Homer, [4]LSU AgCenter, Baton Rouge.*

Two hundred forty Angus and Angus × Charolais cross calves (BW = 217 ± 20.6 kg) were used to evaluate performance and ruminal pH from feeding bermudagrass (*Cynodon dactylon*) or ryegrass (*Lolium multiflorum*), and rye (*Secale cereale*) baleage in hay rings. Calves were stratified by BW, age, gender, and breed, and assigned to 1 of 12 paddocks (0.40 ha each) with 4 treatment diets and fed for a 7-d adaption and 60-d backgrounding period. Diets included: early boot stage bermudagrass harvested for hay, CP = 8.2%, TDN = 59.9%, and DM = 88.8%, (BERH); early boot stage ryegrass and rye harvested for baleage, CP = 12.8%, TDN = 64.5%, and DM = 37.2%, (ERRG); bloom stage ryegrass and rye harvested for baleage, CP = 9.2%, TDN = 62.7%, and DM = 55.7%, (LRRG); and early boot stage bermudagrass harvested for baleage, CP = 9.2%, TDN = 57.4%, and DM = 49.1%, (BERB). Calves on BERH, LRRG, and BERB had free-choice access to a 34% CP (as-fed basis) liquid protein supplement. Two-day BW were collected on d -1, 0, 29, 30, 59, and 60 for comparison of BW, BW gain, and ADG. Ruminal pH was measured from randomly selected calves (n = 5/paddock) on d 0, 30, and 60. There was a treatment by day interaction ($P < 0.01$) for BW and ruminal pH. Initial BW was similar among treatments ($P > 0.05$). Calf BW was heavier ($P < 0.05$) for LRRG compared with BERB and BERH, and heavier ($P = 0.01$) for ERRG compared with BERB on d 60, respectively. Body weight gain and ADG were greater ($P < 0.01$) for calves fed LRRG (34.6 ± 1.2 kg and 0.58 ± 0.02 kg), compared with calves fed ERRG (27.9 ± 1.2 kg and 0.46 ± 0.02 kg), BERH (22.2 ± 1.2 kg and 0.37 ± 0.02 kg), and BERB (19.2 ± 1.2 kg and 0.32 ± 0.02 kg). The BW gain and ADG were greater ($P < 0.01$) for ERRG compared with BERB and BERH, but similar among BERB and BERH, respectively. There was a treatment effect for ruminal pH where ERRG calves had higher ($P < 0.01$) pH compared with LRRG, BERH, and BERB calves. Performance of backgrounded calves fed ryegrass and rye baleage with or without supplementation, based on harvest stage, was improved over feeding bermudagrass hay with supplementation.

Key Words: backgrounding, baleage, beef cattle

0140 Early metabolic imprinting for improvements in finishing feed efficiency and beef carcass characteristics. J. K. Smith[*], M. D. Hanigan, S. P. Greiner, and M. A. McCann, [1]*Virginia Polytechnic Institute and State University, Blacksburg.*

Recent research has indicated the ability of early nutritional intervention to metabolically imprint beef steers for enhanced carcass marbling. As such, metabolic imprinting (IMP) has been suggested as an alternative management strategy to enhance beef quality. The objectives of this experiment were to evaluate the impact of early IMP on finishing average daily residual feed intake (RFI), residual ADG (RADG), and carcass characteristics of backgrounded steers. Angus- and Simmental-sired steer progeny from 4 calving seasons were stratified by sire and age within contemporary group and randomly assigned to metabolically imprinted (MI; weaned at 105 ± 18 d of age; n = 63) or conventionally weaned (CW; weaned at 210 ± 18 d of age; n = 42) treatment groups. Following weaning, MI steers were adapted to and received a concentrate-based ration in a feedlot setting for 105 ± 45 d immediately before commingling with previously unsupplemented CW steers at the time of conventional weaning. Commingled steers were then backgrounded for 150 ± 60 d before being finished on a concentrate-based ration for 110 ± 34 d. Finishing ADFI and metabolic body weight collected at 28-d intervals were used to calculate RFI and RADG. Steers were harvested in groups on reaching an ultrasound-predicted common 12th rib subcutaneous fat thickness (SFT) of ~1 cm. Hot carcass weight was measured immediately before chilling. Chilled (24 h) carcasses were evaluated by a trained panel of analysts to determine ribeye area, SFT, KPH, and marbling score, as well as to calculate yield grade. All statistical analyses were conducted using the Fit Model procedure of JMP Pro. Analysis of a compiled data set for main effects of treatment revealed that IMP resulted in an improvement in RFI ($P < 0.05$; -0.13 vs. 0.19 kg of TDN for MI and CW steers, respectively) without affecting RADG ($P = 0.50$; -0.01 vs. 0.01 kg for MI and CW steers, respectively). Although ribeye area, SFT, KPH, marbling score, and yield grade did not differ ($P > 0.05$) for carcasses of MI steers when compared with those of CW steers, IMP increased HCW ($P < 0.05$; 341 vs. 332 kg). Collectively, interpretation of these results suggests the ability of IMP to increase HCW and decrease the amount of TDN required by finishing steers without negatively impacting ADG.

Key Words: beef, efficiency, imprinting

0141 Linear and nonlinear estimates of the efficiency of metabolizable energy use for maintenance and gain in beef cattle. C. A. Old[*1] and H. A. Rossow[2], *[1]A3 Cattle Company, Le Grand, CA, [2]Veterinary Medicine Teaching and Research Center, University of California, Tulare.*

Efficiencies of ME utilization for maintenance (k_m) and gain (k_g) have historically been determined using ordinary least squares (OLS); these differ from efficiencies determined from known biochemical pathways. We evaluated the relationship between retained energy (RE) and ME intake, using OLS and nonlinear (NL) regressions, using the data set from which the California Net Energy System (CNES) was developed. Parameter estimates from OLS regression were similar to classical estimates. In the nonlinear estimate, ME required for maintenance (ME_m) was a first order function of ME intake; efficiency of ME used for maintenance was calculated as the first derivative of that function. Efficiency of ME use for gain was linear and calculated as (ME intake– ME_m) $\times$ k_g. Parameter stability was evaluated using Markov Chain Monte Carlo (MCMC) simulation for both linear and nonlinear estimates. Linear and nonlinear estimates of ME_m, k_m and k_g were different ($P < 0.05$); the nonlinear equation fit the data better ($R^2 = 0.850$) than the linear equation ($R^2 = 0.777$). Linear estimates of ME_m, k_m and k_g were $0.133BW^{0.75}$ (a static estimate), 0.588, and 0.432, respectively. A lack of fit F test indicated that the OLS model was correctly specified. However, parameter estimates for OLS solutions, determined by MCMC simulation, were highly unstable, an indication that the model is incorrectly specified. Nonlinear estimates of ME_m were dynamic and, on average, greater than OLS estimates. Efficiency of ME use for maintenance was 0.382, a value similar to the efficiency of ATP synthesis. Efficiency of ME use for gain was 0.614; theoretical estimates of gain for growing beef cattle are from 0.70 to 0.75. A lack of fit F test indicated that the NL model was correctly specified. Nonlinear parameter estimates were stable, indicating that the model is correctly specified. While it was possible to describe the NL relationship used in this study in the 1960s, the solution of that equation was extremely difficult to perform due to the lack of computing power at that time. This analysis indicates that, while OLS models are adequate to the task for which they were developed, prediction of animal output from feed input, and vice versa, efficiencies calculated for these models are not in concert with animal biology. Efficiencies determined for NL models are similar to those calculated for biochemical pathways and may improve prediction of animal performance.

Key Words: efficiency, metabolizable energy, nonlinear

0142 Relationships among feeding behaviors and performance traits of growing and finishing phase Red Angus cattle. M. McGee[*1], C. M. Welch[1], J. A. Ramirez[2], G. E. Carstens[2], W. Price[1], J. B. Hall[3], and R. A. Hill[1], *[1]University of Idaho, Moscow, [2]Texas A&M University, College Station, [3]University of Idaho, Carmen.*

The progeny ($n = 37$) of Red Angus bulls were performance evaluated during both growing and finishing phase residual feed intake (RFI) tests. Data for RFI evaluation and 7 behavior traits were collected, using a feed intake monitoring system (GrowSafe Systems) over standard 70-d RFI test periods for both phases (BW growing: initial 331 ± 28 kg, final 451 ± 37 kg; finish: initial 499 ± 39 kg; final 587 ± 44 kg). Seven feeding behavior traits: bunk visit frequency (BVFREQ), bunk visit duration (BVDUR), feed bout frequency (FBFREQ), feed bout duration (FBDUR), meal frequency (MFREQ), meal duration (MDUR), and average meal intake (AMINT), and their relationships with RFI, DMI, and ADG were evaluated. Dry matter intake was correlated with BVDUR and FBDUR ($r = 0.44$; $P = 0.01$ for both behaviors) during the growing phase. Residual feed intake and BVDUR or FBDUR showed little to moderate correlations in growing phase ($r = 0.30$, $P = 0.07$; and $r = 0.27$, $P = 0.10$, respectively). There were no significant correlations between ADG and the 7 behavior traits during the growing phase RFI test. However, during the finishing phase RFI test, ADG was correlated with BVFREQ and FBFREQ ($r = 0.43$, $P = 0.01$ for both behaviors). Neither DMI nor RFI were correlated with any of the 7 feeding behavior traits during the finishing phase RFI test. Combining correlated traits into the RFI base model to predict DMI reduced the mean standard error by 13% for growing phase and 17% for finishing phase RFI tests. As these animals were offered different diets during growing and finishing phases (roughage-based vs. concentrate, respectively), the relative contribution of feeding behaviors in predicting DMI may be partially diet-type dependent. Inclusion of correlated feeding behaviors improved feed intake prediction by 13 to 17%, providing evidence that the study of behavior traits has potential to improve our understanding of the biological drivers of feed intake.

Key Words: feeding behavior, Red Angus, RFI

0143 Phenotypic relationships between residual measurements of finishing feed efficiency and visceral organ mass of backgrounded beef steers. J. K. Smith[*1], A. R. Murray[1], D. D. Harmon[2], M. D. Hanigan[2], S. P. Greiner[1], and M. A. McCann[2], *[1]Virginia Tech, Blacksburg, [2]Virginia Polytechnic Institute and State University, Blacksburg.*

Residual measurements of feed efficiency for beef cattle have recently gained popularity among producers, breed associations, and researchers, alike. Efforts devoted toward identify-

ing the underlying physiological mechanisms have been met with limited success. Visceral organs play major roles in nutrient digestion, absorption, and metabolism, and are considered to be substantial contributors to animal energy requirements for maintenance. As such, an experiment was conducted to determine phenotypic relationships between individual visceral organ mass (VOM) and residual measurements of finishing feed efficiency of backgrounded beef steers. Conventionally and early-weaned steer progeny ($n = 105$) from 4 calving seasons within a single herd were finished on a concentrate-based ration for 110 ± 34 d within contemporary group, immediately following a 150- $\pm$ 60-d backgrounding period. Finishing ADFI and BW were collected at 28-d intervals throughout the duration of the finishing period and used to calculate average daily finishing residual feed intake (RFI) and residual ADG (RADG), using a relatively large sample population. A subsample of steers ($n = 28$) from the sample population used to determine RFI and RADG were harvested on reaching an ultrasound-predicted 12th rib subcutaneous fat thickness of 1 cm and used to measure emptied and cleaned individual VOM. Visceral organs measured included heart, liver, gallbladder, lungs, kidneys, spleen, rumen, reticulum, omasum, abomasum, small intestine, pancreas, cecum, and colon and rectum. All statistical analyses were conducted using JMP Pro. Multivariate analysis of VOM and RFI, as well as VOM and RADG using the multivariate and correlations procedure, revealed inverse relationships ($P < 0.05$) between RFI and mass of lungs, spleen, and rumen ($r = -0.57, -0.44$, and -0.46, respectively), as well as a correlation ($P < 0.05$) between RADG and lung mass ($r = 0.42$). No relationships existed ($P > 0.05$) between RFI and mass of the heart, liver, gallbladder, kidneys, reticulum, omasum, abomasum, small intestine, pancreas cecum, and colon and rectum, or between RADG and mass of the heart, liver, gallbladder, kidneys, spleen, rumen, reticulum, omasum, abomasum, small intestine, pancreas, cecum, and colon and rectum. Collective interpretation of these results suggests a direct phenotypic relationship between mass of the lungs and residual measurements of finishing feed efficiency for backgrounded steers. Further research is necessary to evaluate the metabolic implications of the lungs and spleen to nutrient metabolism, cattle growth, and feed efficiency.

Key Words: beef, efficiency, intake