862 Comparison of methods to calculate metabolizable protein requirements of growing beef cattle. Andrea K. Watson*[1], Terry J. Klopfenstein[1], Vic A. Wilkerson[2], Galen E. Erickson[1], and Jim C. MacDonald[1], *[1]University of Nebraska, Lincoln, NE, [2]Purina Animal Nutrition, Forest Grove, OR.*

Data from 3 trials were compiled to calculate microbial CP (MCP) production and MP requirements of growing calves on high forage diets. Individually fed steers (n = 335; 256 ± 15.6 kg midpoint BW) were utilized, each trial lasted 84. Diets consisted of 44% sorghum silage, 44% corn cobs, and 12% protein supplement. Source of protein within the supplement varied and included urea, meat and bone meal, soybean meal, feather meal, poultry by-product meal, or corn gluten meal. All trials included a urea only treatment. Dry matter intake of all calves within a trial was held constant, as a percent of BW, established by the urea supplemented group. The base diet was MP deficient, composition of the protein supplement varied with increasing amounts of test protein replacing urea. As protein in the diet increased, ADG plateaued. This methodology was used by Wilkerson et al. (1993) and is the basis of performance models used by the NRC (1996). Gain ranged from 0.19 to 0.56 kg/d, averaging 0.37 kg/d. Three microbial efficiencies were used to calculate MP. Maximum gain was then regressed against calculated MP to determine MP requirement for maintenance and gain. Method 1 (based on a constant 13% microbial efficiency suggested by the NRC, 1996) predicted an MP requirement of 3.4 g/kg $BW^{0.75}$ for maintenance and 461 g/kg gain ($r^2 = 0.55$). Method 2 (based on an equation developed by Patterson et al., 2006) predicted MP requirements of 2.9 g/kg $BW^{0.75}$ and 483 g/kg gain ($r^2 = 0.56$). Method 3 (based on an equation developed by Galyean et al., 2014) predicted MP requirements of 2.6 g/kg $BW^{0.75}$ and 449 g/kg gain ($r^2 = 0.59$). The factorial method of calculating MP maintenance requirements accounts for scurf, endogenous urinary, and metabolic fecal protein losses and averaged 4.2 ± 0.10 g/ kg $BW^{0.75}$, for the 3 trials summarized here. Factors affecting MCP production include TDN, RDP, and microbial efficiency. Dietary TDN and RDP have been measured on a variety of feedstuffs; microbial efficiency is not well defined and is a crucial component in calculating MCP production and MP requirements of growing cattle.

Key Words: beef cattle, metabolizable protein, microbial crude protein

863 The effect of zilpaterol hydrochloride supplementation on gain efficiency, harvest yields and carcass grading of steers fed a maintenance intake. Lee-Anne J. Walter*[1], N. Andy Cole[2], Jenny S. Jennings[3], John P. Hutcheson[4], Beverly E. Meyer[2], Angela N. Schmitz[1], DeMetris D. Reed[1], and Ty E. Lawrence[1], *[1]West Texas A&M University, Canyon, TX, [2]USDA ARS, Bushland, TX, [3]Texas A&M AgriLife Research and Extension Center, Amarillo, TX, [4]Merck Animal Health, Summit, NJ.*

A trial was conducted to examine gain efficiency, harvest yields and grading characteristics of steers fed only to maintenance intake (MI) and supplemented with zilpaterol hydrochloride (ZH). Beef steers (n = 20; 463 ± 14 kg) blocked (n = 5) by weight and source were individually fed and adapted to MI {[(BW×0.891)$^{0.75}$ × 0.077]/diet NE_m, BW d −1 and 1} for 21 d before ZH (90 mg/hd/d) or non-ZH treatment for 20 d (455 ± 14 kg, SOT). During the 21d maintenance period, MI was adjusted based on BW (d −1, 1 vs. 4, 5, 9, 10, 14, 15, 19 and 20) after 10h water and feed withdrawal (no feed remained for any animals at start of withdrawal periods). Intakes were not adjusted during 20 d treatment period but steers were weighed on d1, 2, 11, 12, 17, and 18 of ZH treatment and on d 1, 2, 5, and 6 of withdrawal. Cattle were harvested after a 6 d withdrawal and carcasses graded 24 h post-harvest. Data were analyzed as a mixed model with fixed effect of ZH and random effect of block. Gain efficiency, ADG and end of ZH BW was not different between treatments ($P > 0.10$). Control cattle lost more BW ($P < 0.01$; 9 vs. 2 kg, respectively) than ZH fed cattle during the maintenance collection period (d12–16 of ZH) while BW loss of ZH fed cattle was greater ($P < 0.01$; 9 vs. 4 kg, respectively) during fasting heat production period (FHP; d18–19 of ZH, 4-d total fast). Harvest BW, exsanguinated BW, empty body weight (EBW) and harvest yields (g/kg EBW) were not different between treatments ($P > 0.10$). Supplementation of ZH did not improve HCW ($P = 0.12$) but did increase dressed carcass yield ($P = 0.02$; 62.12 vs. 60.65%, respectively). Feeding ZH improved LM area ($P = 0.02$; 77.81 vs. 70.90 cm^2) and tended to lower USDA calculated yield grade ($P = 0.06$; 1.8 vs. 2.2). Marbling, 12th rib fat depth and calculated empty body fat did not differ ($P > 0.10$) between treatments. Results from this trial indicate that ZH supplementation alters carcass traits in steers fed reduced energy intakes by improving dressed carcass yield and LM area ($P = 0.02$) and exhibiting a tendency to improve yield grade ($P = 0.06$).

Key Words: feed efficiency, carcass grading, zilpaterol

864 The effect of zilpaterol hydrochloride supplementation on apparent nutrient digestibility and carbon-nitrogen retention of steers fed at maintenance intake. Lee-Anne J. Walter*[1], N. Andy Cole[2], Jenny S. Jennings[3], John P. Hutcheson[4], Beverly E. Meyer[2], Angela N. Schmitz[1], DeMetris D. Reed[1], and Ty E. Lawrence[1], *[1]West Texas A&M University, Canyon, TX, [2]USDA ARS, Bushland, TX, [3]Texas A&M AgriLife Research and Extension Center, Amarillo, TX, [4]Merck Animal Health, Summit, NJ.*

A trial was conducted to examine apparent nutrient digestibility and carbon (C) -nitrogen (N) retention of cattle supplemented zilpaterol hydrochloride (ZH). Beef steers (n = 20; 463 ± 14 kg) blocked (n = 5) by weight and source were individually fed and adapted to maintenance intake (MI; {[(BW×0.891)$^{0.75}$ × 0.077]/diet NE_m, BW d −1 and 1}) for 21 d before ZH (90 mg/hd/d) or non-ZH treatment for 20 d (455 ± 14 kg, SOT). During the 21d maintenance period, MI was adjusted based on BW (d −1, 1 vs. 4, 5, 9, 10, 14, 15, 19 and 20) after 10h water and feed withdrawal (no feed remained for any animals at start of withdrawal periods). Intakes were not adjusted during 20 d treatment period. Feces and urine was collected at MI (d12–16 of ZH period) with daily feed and fecal samples analyzed for proximate analysis, ADF, NDF, starch and C; urine was analyzed for C and N. Data were analyzed as a mixed model with fixed effect of ZH and random effects of block and chamber. Dry matter (DM) intake, DM digestibility, fecal or urine output did not differ ($P > 0.10$) between treatments. Intake, fecal excretion and apparent digestibility of NDF, starch or ether extract did not differ ($P > 0.10$) between treatments. Control cattle excreted more ($P < 0.05$) N in urine (39.8 vs. 32.4 g/d, respectively) and tended ($P < 0.07$) to excrete more N daily than ZH treated cattle. Cattle fed ZH tended to have increased absolute N retention ($P = 0.07$; 22.14 vs.14.12 g/d) and increased N retention as a percentage of digested N ($P = 0.06$; 39.73 vs. 25.49%) while apparent N digested did not differ ($P > 0.10$) between treatments. Total C loss via, urine, fecal, or CH_4 did not differ ($P > 0.10$) between

treatments but ZH treated cattle lost more C via CO_2 than control cattle ($P = 0.04$; 1036.9 vs. 974.3 g, respectively). Total C digested and retained did not differ between treatments ($P > 0.10$). Results from this trial indicate that ZH treatment does not alter apparent digestibility of nutrients or C retention but does tend to increase N retention ($P = 0.07$) while increasing C loss through CO_2 production ($P = 0.04$)

Key Words: beef, carbon nitrogen retention, zilpaterol

865 The effect of zilpaterol hydrochloride supplementation on energy metabolism of steers at maintenance and fasting intake levels. Lee-Anne J. Walter*[1], N. Andy Cole[2], Jenny S. Jennings[3], John P. Hutcheson[4], Beverly E. Meyer[2], Angela N. Schmitz[1], DeMetris D. Reed[1], and Ty E. Lawrence[1], *[1]West Texas A&M University, Canyon, TX, [2]USDA ARS, Bushland, TX, [3]Texas A&M AgriLife Research and Extension Center, Amarillo, TX, [4]Merck Animal Health, Summit, NJ.*

An indirect calorimetry trial examined the energetic efficiency of cattle supplemented zilpaterol hydrochloride (ZH). Beef steers (n = 20; 463 ± 14 kg) blocked (n = 5) by weight and source were individually fed and adapted to maintenance intake (MI; {[(BW×0.891)$^{0.75}$ × 0.077]/diet NE_m, BW d −1 and 1}) for 21 d before ZH (90 mg/hd/d) or non-ZH treatment for 20 d (455 ± 14 kg, SOT). During the 21d maintenance period, MI was adjusted based on BW (d −1, 1 vs. d 4, 5, 9, 10, 14, 15, 19 and 20) after 10h water and feed withdrawal (no feed remained for any animals at start of withdrawal periods). Intakes were not adjusted during 20 d treatment period. Respiration chambers were used to quantify energetics for maintenance (d12–16 of ZH period) and fasting heat production (FHP; d19–20 of ZH period, total 4d fast). Daily feed and fecal samples were analyzed for gross energy (GE); urine was analyzed for nitrogen and GE was calculated from the energetic value of urea. Data were analyzed as a mixed model with fixed effect of ZH treatment and random effects of block and chamber. No difference in DMI, O_2 consumption or CH_4 production ($P > 0.10$) was detected between treatments but ZH cattle had higher CO_2 production ($P = 0.04$; 2325 vs. 2185 L/steer; 23.6 vs. 22.4 L/kg BW$^{0.75}$). During FHP, O_2 consumption was not affected ($P > 0.10$) by treatment whereas CO_2 production (L/steer) increased with ZH treatment ($P = 0.04$; 1423 vs. 1338 L/steer). Gross energy, fecal energy, digestible energy and methane energy did not differ between treatments ($P > 0.10$), however urinary energy was higher ($P = 0.05$; 0.091 vs. 0.074 Mcal) in control cattle. There was no difference in metabolizable energy between treatments ($P > 0.10$). Heat production tended ($P = 0.09$) to increase for ZH treated cattle (12.44 vs. 11.69 Mcal, respectively) on an absolute basis, but not on a BW$^{0.75}$ basis ($P = 0.12$; 0.126 vs. 0.120, respectively). No difference in FHP was detected between treatments ($P = 0.32$). Results from this trial indicate that ZH treatment tends ($P = 0.09$) to modify heat production during maintenance by increasing CO_2 production ($P = 0.04$).

Key Words: beef, energy metabolism, zilpaterol

866 Effects of chromium propionate in combination with yeast on growth performance and carcass quality of finishing steers. Cadra L. Van Bibber-Krueger*, Justin E. Axman, John M. Gonzalez, and Jim S. Drouillard, *Kansas State University, Manhattan, KS.*

A combination of chromium propionate and yeast supplement (CrY; TruMax, Varied Industries Corp., Mason City, IA) was added to diets of crossbred steers (n = 504; 402 ± 5.8 kg initial BW) to evaluate the effect on feedlot performance and carcass quality. Steers were selected on the basis of initial plasma glucose concentrations ≤6.0 m*M*, stratified by initial BW, blocked into heavy (H; 420 kg BW) and light (L; 384 kg BW) groups, and assigned to treatments of 0 (CON) or 3.3 g/d CrY (provided 0.5 mg Cr/kg diet DM) with 6 pens/diet within each block. Body weights were measured at 21-d intervals. Finished cattle were weighed and transported to a commercial abattoir where severity of liver abscesses and HCW were collected at harvest, and yield and quality grades, LM area, and 12th rib subcutaneous fat thickness were determined after 36 h of refrigeration. There were no CrY × time × weight block interactions for ADG, DMI, and G:F ($P = 0.36$; $P = 0.49$; $P = 0.41$, respectively), and no CrY × block interactions for ADG and DMI ($P = 0.06$; $P = 0.75$, respectively), but a CrY × block interaction ($P = 0.03$) was observed for G:F; CON-L had poorer efficiency compared with other groups. Yield grade and marbling score tended to be less ($P > 0.07$) for CrY compared with CON, but other carcass measurements were unaffected by treatment ($P > 0.30$). Chromium propionate in combination with yeast may improve feed efficiency of lighter cattle, but other effects were minimal.

Table 1 (Abstr. 866). Feedlot performance and carcass traits of steers

Item	CON-L	CrY-L	CON-H	CrY-L	SEM
DMI, kg/d	12.57	12.29	13.00	12.83	0.17
ADG, kg/d	1.70	1.76	1.88	1.84	0.03
G:F[1,3]	0.1349	0.1430	0.1445	0.1434	0.0023
HCW, kg	398	400	408	407	3.65
LM area, cm^2	88.13	90.06	93.10	92.97	0.96
12th rib fat, cm	1.30	1.22	1.27	1.24	0.43
Yield grade[2,3]	2.79	2.53	2.66	2.66	0.07
Marbling score[3,4]	459	453	430	414	6.54

[1]CrY × weight block interaction ($P = 0.03$).
[2]CrY × weight block interaction ($P = 0.08$).
[3]Effect of CrY ($P \leq 0.08$).
[4]Marbling score determined by camera imaging; Small = 400 to 499.

Key Words: beef cattle, chromium propionate, glucose

867 The influence of supplemental Zn-amino acid complex and Optaflexx feeding duration on growth performance and carcass characteristics of finishing beef cattle. Olivia N. Genther-Schroeder*[1], Mark E. Branine[2], and Stephanie L. Hansen[1], *[1]Iowa State University, Ames, IA, [2]Zinpro Corporation, Eden Prairie, MN.*

Previous research indicates that finishing steer ADG and G:F increases linearly with increasing dietary Zn-amino acid complex supplementation. The objective of this study was to determine the influence of supplemental Zn-amino acid complex on growth performance and carcass characteristics of finishing steers fed Optaflexx (OPT; ractopamine hydrochloride) for 0, 28, or 42 d before harvest. This study was organized as 2 groups (Grp) of steers fed concurrently, for 91 (Grp 1) or 84 d (Grp 2). A total of 324 steers (463 ± 23.4 kg) were fed a corn-based finishing diet supplemented with 60 mg Zn/kg diet DM (as $ZnSO_4$). Steers were blocked by weight (6 steers per pen) and assigned to receive either 0 (CON) or 60 mg supplemental Zn/kg DM from a Zn amino-acid complex (ZnAA; n = 27 pens per treatment). Receiving ZnAA for 49 (Exp 1) or 42 d (Exp 2) before start of OPT feeding had no effect on growth of steers ($P \leq 0.30$). Forty-two days before harvest, pens were equally assigned within CON or ZnAA treatments to receive OPT at 300 mg·steer^{-1}·d^{-1} for 0, 28 (28-OPT) or 42 d (42-OPT) before harvest, creating 6 final treatments (n = 9 pens per treatment). All steers within an experiment were harvested on the same day. Pen was the experimental unit, and the SAS model included the fixed effects of

ZnAA, OPT, and block nested within group, and the random effect of pen. Optaflexx supplementation increased carcass-adjusted ADG (P = 0.004), final BW (P = 0.004), HCW (P = 0.004), and ribeye area (P = 0.007). There was an effect of ZnAA within 28-OPT and 42-OPT where carcass-adjusted ADG ($P \leq 0.10$), final BW ($P \leq 0.05$), and HCW ($P \leq 0.05$) were greater in ZnAA supplemented vs. CON steers. However, when steers did not receive OPT there was no effect of ZnAA on final BW (P = 0.78), ADG (P = 0.98), or HCW (P = 0.78). In conclusion, there appears to be a synergistic effect of ZnAA on OPT-induced cattle growth, as supplementing 60 mg Zn/kg DM from ZnAA to cattle fed OPT improved overall growth and HCW.

Key Words: beef cattle, Optaflexx, zinc

868 Residual feed intake in ad libitum and limit-fed steers.
Roberto D. Sainz*, *University of California, Davis, CA.*

To determine if nutritional restriction alters the fundamental relationships between intake, growth and efficiency, 60 Angus-Hereford steers (310 ± 33 d of age, 263 ± 33 kg BW) were randomly assigned to 2 intake groups (IG): ad libitum (AL) or limit-fed (LF, 80% of ad libitum) and fed in individual pens. Intakes were monitored weekly, and steers were weighed monthly. Steers were harvested when they reached a minimum of 12.5 mm backfat, determined by ultrasound at each weighing. Carcass composition was determined from specific gravity. Residual feed intake (RFI) was calculated as the residual of the regression of DMI on average metabolic BW and ADG, with intake group included as a fixed effect; slopes were not found to be heterogeneous ($P > 0.05$). The model was: DMI (kg/d) = IG + 0.0737 $BW^{0.75}$ + 3.296 ADG, where IG = −0.12 (AL) or −1.11 (LF). RFI groups were defined as Low (RFI < −0.5 SD from mean), Medium (−0.5 SD < RFI <0.5 SD) or High (RFI >0.5 SD). Data were analyzed by regression and ANOVA, including IG and RFI groups as main effects; no interactions were significant. (Minitab Inc., State College, PA). Days on feed were greater ($P < 0.0001$) in LF (198 d) than in AL (175 d) steers, however final BW were not different (455 kg; $P > 0.10$) between AL and LF groups. DM intakes were lower ($P < 0.0001$) in LF than in AL steers, both in absolute and relative terms (8.71 and 6.60 kg/d and 2.37 and 1.93% of BW, respectively). RFI groups also differed ($P < 0.001$) in DMI, both in absolute and relative terms (8.08, 7.91 and 6.97 kg/d and 2.29, 2.16 and 1.99% of BW, for High, Medium and Low RFI groups, respectively). Gain:feed was different among IG (0.0952 and 0.0868 for AL and LF, respectively, P = 0.003) and RFI groups (0.0806, 0.0888 and 0.1036 for High, Medium and Low RFI, respectively; $P < 0.001$). Carcass fat contents were not different ($P > 0.10$) among RFI groups, but tended to be lower (P = 0.064) in LF than in AL (28.3 and 30.3%, respectively). These results confirm that nutritional restriction limits rate and efficiency of gain and prolongs the finishing period in beef cattle, and tends to produce leaner carcasses. The lack of any difference in the slopes of the equation used to predict intake between ad libitum- vs. limit-fed steers indicate that feed restriction did not alter the fundamental relationships between intake, metabolic weight and rate of gain.

Key Words: efficiency, limit-fed, steer

869 Behavioral evaluation when using wet corn gluten feed or wet distillers grains plus solubles to adapt cattle to finishing diets.
Lauren A. Ovinge*[1], Jhones O. Sarturi[1], Rick A. Stock[2], Galen E. Erickson[3], and Terry J. Klopfenstein[3], *[1]Texas Tech University, Lubbock, TX, [2]Cargill Wet Milling, Blair, NE, [3]University of Nebraska-Lincoln, Lincoln, NE.*

Behavioral responses to adaptation diets using wet corn gluten feed branded Sweet Bran (SB-WCGF) or wet distillers grains plus solubles (WDGS) were evaluated. Six ruminally cannulated steers (300 ± 22 kg) at 11 mo of age were assigned randomly using a CRD experiment to one of 2 adaptation strategies including either SB-WCGF or WDGS. Steers were fed a series of 6 diets: 4 adaptation steps, a finishing, and a finishing blend diet. The first step included 87.5% DM of either SB-WCGF or WDGS, with 0% dry rolled corn (DRC), and was reduced to 35% of the finishing diet over a period of 4 steps (7 d each), and increasing the level of DRC to 52.5%. Diets also included 7.5% alfalfa hay and 5% supplement. Blend diet (50:50) contained WDGS and SB-WCGF (17.5% of each, DM basis). Behavioral status (24 h) was recorded by video cameras strategically located on top of individual pens. Behavior was evaluated every 5 min during d-4 of each period, and it was noted whether the steers were resting or ruminating, as well as standing up or lying down, eating, or drinking. Data were analyzed using the GLIMMIX procedures of SAS, and blend diet was used as a covariate. Steers fed SB-WCGF strategy spent more time ($P < 0.10$) ruminating while lying down than WDGS in steps 1 and 4 (223 vs. 93; 289 vs. 77 min/d, respectively); and tended ($P \leq 0.15$) for similar pattern for total rumination in steps 1, 2, and 4 (259 vs. 105; 323 vs. 129; and 321 vs. 65 min/d, for SB-WCGF and WDGS strategies, respectively). Steers fed SB-WCGF strategy also spent more time ($P < 0.10$) ruminating per percentage unit of NDF in step 4 (11.38 vs. 2.29 min-d/%NDF, respectively), as well as tended ($P \leq 0.15$) to spend more time chewing (ruminating plus eating activities) than WDGS strategy in step 4 (418 vs. 227 min/d). Steers fed WDGS strategy had greater ($P < 0.10$) time resting while standing up in steps 2 and 3 (267 vs. 174; 283 vs. 211 min/d; respectively). Overall, the SB-WCGF adaptation strategy shows a more desirable rumination pattern during adaptation to DRC-based finishing diets in feedlot steers than strategy using WDGS.

Key Words: adaptation, behavior, coproduct

870 Effects of *Megasphaera elsdenii* on ruminal pH, VFA, and lactate during transition from 60 to 80% concentrate diet.
Jake D. Thieszen*[1], Cadra L. Van Bibber-Krueger[1], Justin E. Axman[1], Celine C. Aperce[2], James S. Drouillard[1], and Kevin A. Miller[2], *[1]Kansas State University, Manhattan, KS, [2]MS Biotec, Wamego, KS.*

Our objective of this study was to evaluate changes in ruminal pH, concentrations of VFA and lactate in cattle during a transition from 60% to 80% concentrate diet. *Megasphaera elsdenii* culture (ME; Lactipro, MS-Biotec, Wamego, KS) was administered by oral drench to crossbred heifers (n = 240; 498 ± 18 kg initial BW) at rates of 0, 25, 50, 75, or 100 mL immediately before transition from 60 to 80% concentrate diet. Cattle were fed in pens of 8 head each, and ruminal contents of animals in one pen/treatment were obtained via rumenocentesis for estimation of ruminal pH and concentrations of VFA and lactate at 5, 10, 15, 20, 25, and 30 h after dosing and introduction of the 80% concentrate diet. Lactate concentrations were unaffected by treatment and were <1 mM ($P > 0.10$). Differences in pH and VFA concentrations were not apparent until 20 to 25 h after dosing, and were characterized by lower propionate production and increased A:P ratios for the 75- and 100-mL dosages compared with other treatments. *Megasphaera elsdenii* may help to avoid pH decline frequently associated with transition to high-concentrate diets.

Contd.

Table 1 (Abstr. 870). Ruminal pH in heifers receiving an oral drench of *Megasphaera elsdenii* (ME) culture (0, 25, 50, 75, or 100 mL)

	ME, mL						
Hour	0	25	50	75	100	SEM	*P*-value
5	6.03	5.80	6.08	5.73	5.89	0.101	0.06
10	5.83	5.78	5.83	5.82	5.78	0.101	0.80
15	6.02	6.10	5.95	6.16	5.93	0.095	0.36
20	5.91^{ac}	6.13^{bc}	5.76^{a}	5.93^{abc}	6.20^{b}	0.101	0.01
25	6.23^{a}	6.12^{a}	6.24^{ab}	6.58^{bc}	6.59^{c}	0.101	0.01
30	5.54	5.60	5.72	5.61	5.75	0.095	0.47

^{abc}Within a row, means without a common superscript differ ($P < 0.05$).

Key Words: *Megasphaera elsdenii*, feedlot, acidosis.

871 Dry matter intake patterns of feedlot cattle. R. B. Hicks[1], R. P. Lake[2], and F. N. Owens*[3], *[1]Oklahoma State University, Goodwell, OK, [2]Hitch Consulting Services, Guymon, OK, [3]DuPont Pioneer, Johnston, IA.*

Most intake equations for feedlot cattle strive to predict mean intake for the total feeding period. Yet, DMI of feedlot cattle typically plateaus after 2 to 4 wk on feed and declines steadily thereafter. Consequently, dietary requirements change over time. To quantify intake patterns, weekly DMI data were compiled from 2,329 pens (minimum of 50 steers per pen) fed high concentrate diets an average of 158 d in one southern Great Plains feedlot. Intake of DM differed with initial weight ($P < 0.01$), so pens were grouped by initial weight (216 to 443 kg) into 10 sets. Adjusted for death loss and sick pen days, DMI averaged 9.56 kg/d. Within weight groups, DMI later (wk 8 to 17) was correlated ($R^2 = 0.77$) with DMI earlier (wk 4 through 7). Based on DMI and steer weights, ME realized by each pen of steers was calculated (mean ME = 3.45 ± 0.18 Mcal/kg). Based on initial weight and ME intake, mean weight of steers within each pen each week was calculated. Following 3 wk for diet adaptation, Intake of DM as a percentage of mean weight (DMIpc) was lower for pens of steers with greater initial weight and decreased linearly over time (DMIpc = 2.954 – 0.04776 × week on feed – 0.000859 × initial weight, kg); calculated DMI was related to observed DMI ($R^2 = 0.79$; RMSE = 0.61 kg). Pens of cattle with greater initial weights had greater DMI and ADG but lower DMIpc and feed-to-gain ratios. Adjusted for initial weight, and DMIpc, expressed as a fraction of current body weight, was greater ($P < 0.05$) during October and November than in January through May or during a summer intake slump (July and August). The dietary CP percentage required, assuming a 64% efficiency of retention of CP intake, added to inevitable N losses was greater for lighter cattle, peaked early, and declined steadily (CP = 17.1 – 0.1407 × week – 0.0142 × initial weight; $R^2 = 0.80$). In conclusion, later DMI can be predicted from DMI early in a feeding period. Because DMI and performance vary with initial weight and time on feed, data on interim pen weights, DMI, and ADG should permit nutrient requirements to be predicted more precisely than DMI means for the total feeding period.

Key Words: intake, feedlot, protein requirement

872 Effect of backgrounding system on beef calf performance. Jordan L. Cox*[1], Kristin E. Hales[2], Kristen M. Ulmer[1], Rick J. Rasby[1], Steven D. Shackelford[2], Harvey C. Freetly[2], and Mary E. Drewnoski[1], *[1]University of Nebraska-Lincoln, Lincoln, NE, [2]USDA-ARS, US Meat Animal Research Center, Clay Center, NE.*

In the Midwest opportunity to integrate cattle production into cropping systems abounds. Two winter forage sources are corn residues and double cropped cool season annuals planted after corn silage harvest. The objective of this study was to evaluate backgrounding spring born calves using these feed resources. Composite MARC II steers (n = 355) were stratified by BW (277.6 ± 0.52 kg) and genetic line and assigned to 1 of 3 treatments: (1) corn residue grazing with distillers supplementation (CRD), (2) oat-brassica forage grazing (OBF) or (3) drylotting on a grower ration (DGR). Each treatment had 4 replicates. Calves on CRD were supplemented 6 d a week with 2.77 kg DM/hd of a dried distillers grains mix containing 2% limestone (DM basis). The OBF was planted in early September and the forage produced was 28% purple top turnip, 14% daikon radish and 59% oats (DM basis). The initial forage mass of OBF was 3516 ± 121 kg DM/ha and calves were stocked at 1538 ± 37 kg DM/hd. Both CRD and OBF calves were given access to a free choice mineral containing 1.32 mg monensin per g. The grower ration consisted of 25% alfalfa hay, 51% corn silage, 20% wet distillers grains and 4% supplement containing 732 mg monensin/kg (DM basis). All calves consumed the grower ration before initial weights. The CRD and OBF calves were removed from grazing after 64 d when the OBF biomass was 1445 ± 104 kg DM/ha and calves were fed the grower ration for 6 d and then weighed. The free-choice mineral intake of the CRD calves (173 g/hd/d) was greater ($P < 0.01$; SEM ± 9.6) than OBF calves (121 g/hd/d). The backgrounding phase of DGR calves ended after 54 d when they reached 365 kg BW. Intake of DGR calves during backgrounding was 8.27 ± 0.031 kg/hd. During the backgrounding phase the ADG of the DGR calves (1.57 kg/d) was greater ($P < 0.01$; SEM ± 0.034) than both OBF (1.00 kg/d) and CRD (0.75 kg/d) and ADG of OBF was greater ($P < 0.01$) than CRD. Although the calves drylotted and fed a grower ration had a greater rate of gain, the lower cost of gain associated with the grazing systems make these backgrounding methods economically competitive.

Key Words: backgrounding calves, brassicas, corn residue

873 Gene expression of the hypothalamus in steers fed high-concentrate diet upon entering feedlot phase. Jason E. Griffin*[1], Zhongde Wang[2], Jeffrey A. Clapper[1], Robbi H. Pritchard[1], Keith R. Underwood[1], and Michael G. Gonda[1], *[1]South Dakota State University, Brookings, SD, [2]Utah State University, Logan, UT.*

Finishing diets used in beef feedlots are high in energy to allow for rapid growth and fat deposition. Previous studies have shown that the use of high concentrate post-weaning diets changes expression of genes in the hypothalamus involved with regulating feed intake, metabolism, signaling, and neuronal communication. The objective of this study was to investigate whether expression of key growth and developmental genes in the hypothalamus can be altered by feeding a high concentrate diet when calves enter the feedlot. Predominantly Angus steers (n = 12) were randomly allocated to 1 of 2 treatment groups: (1) high energy/high concentrate (HE/HC), a diet fed to provide 1.33 mcal/kg NE gain; or (2) traditional backgrounding/finishing (B/F), fed to provide 1.10 mcal/kg NE gain for the first 84 d on feed (DOF) and 1.43 mcal/kg NE gain for the remaining 118 DOF. Growth at d28 ($P < 0.01$) was greater for the HE/HC treatment group; however, no difference between treatments was observed at the beginning ($P > 0.14$) and end ($P > 0.13$) of the feeding trial. At slaughter, hypothalami were dissected and frozen for RNA extraction. RNA was extracted and expression differences between treatments were measured by RNA-seq. Carcass characteristics and composition, and Warner-Bratzler shear force (WBSF) analysis were conducted. Kidney, pelvic, heart fat percentage was higher ($P <$

0.04) in HE/HC steers; however, no difference in other carcass traits ($P > 0.10$) and WBSF ($P > 0.22$) were detected. One hundred and 30 one genes were expressed only in the B/F steers, while 195 were only expressed in the HE/HC steers. Nine genes were expressed in both treatments; 3 genes had higher expression in the HE/HC steers and 6 genes had higher expression in B/F steers. Gene Ontology terms involved with differentially expressed genes included virus immune response, cell cycle regulation, signaling pathway regulation, and hydrogen and oxygen transport pathways. Feedlot calves fed a high concentrate diet upon entering the feedlot have altered gene expression in the hypothalamus, with many differentiated genes involved with signaling and metabolic pathways.

Key Words: bovine, hypothalamus, expression