wheat grain-fed cows than in other cows. Treatments did not affect milk protein; changes in body condition score; total time spent eating, ruminating, and chewing; blood levels of urea nitrogen, cholesterol, and phosphorous; fecal pH; and calving difficulty. Therefore, the prepartum provision of WG (18% on a dry matter basis) instead of BGW proved effective in the simultaneous improvement of calcium and energy states, and thereby, in easing the periparturient stress in Holstein cows.

Key Words: Holstein Cow, Periparturient Stress, Wheat grain

Ruminant Nutrition: Intake and Performance - Beef

657   Factors affecting residual feed intake in feedlot steers. J. W. Homm*, L. L. Berger, and S. L. Rodriguez-Zas, *University of Illinois*, *Urbana*.

Profitability in beef production is a function of both inputs and outputs. The beef industry has focused on outputs such as weight, gain, and carcass merit. Feed costs are estimated to be approximately 60% of the total cost of production, and therefore represent an opportunity to increase profitability through improving feed efficiency. Four hundred six steers ($330.1 + 47.07$ kg) originating from four different sources and from 29 different Simmental, Angus, and Simmental X Angus sires were used to determine factors affecting feed efficiency in feedlot steers. Seven dietary treatments were used that were composed primarily of corn, corn-based co-products and/or soy hulls. Daily individual animal intakes were recorded by the Growsafe® feed monitoring system. All steers were weighed and ultrasound measurements of marbling score, backfat thickness, and ribeye area were taken approximately every 28 d through 146 d. A total pen collection method established the digestible energy (DE) content of each diet. Residual feed intake (RFI, Mcals of DE/d) was not ($P > 0.05$) correlated to body weight (BW) or average daily gain. However, RFI was highly positively correlated to DE intake (Mcals/d) and average daily dry matter intake (ADDMI). RFI was negatively correlated to gain to feed (G:F) and was lowly, but significantly correlated to empty body fat. G:F was highly correlated to BW, average daily gain (ADG), ADDMI, and DE intake. Dietary treatment accounted for the majority of the variation (43%) in RFI. Dietary treatment and ADG accounted for approximately 51% of the variation in intake over maintenance requirements. Steers that ate more than 15 Mcals of DE per day over their maintenance requirements were less efficient than those eating less than 15 Mcals of DE per day over their maintenance requirements. Sire effects accounted for 9% of the variation in RFI. The range of RFI for progeny of the 29 sires was -2.10 to 2.22 Mcals of DE per day.

Key Words: residual Feed Intake, Steers, Feed Efficiency

658   The effect of residual feed intake rank in beef cows on forage intake and pasture carrying capacity. A. Meyer*, R. Kallenbach, M. Kerley, and K. Ladyman, *University of Missouri*, *Columbia*.

During the summer of 2005, residual feed intake (RFI) was calculated for 42 purebred Hereford heifers using the GrowSafe feed intake system. The heifers were ranked by RFI and split into low RFI (highly efficient), mid RFI, and high RFI (lowly efficient). After their first calving season, the low and high RFI groups were used to determine the difference in their grazed forage intake. Each group was split into two reps and grazed non-endophyte infected tall fescue-based pastures (1.8-2.4 ha/paddock) for 84 d. The cows were weighed on d 0, 21, 42, 63, and 84 and body condition scored (BCS) on d 0, 42 and 84. At the beginning of the experiment and every 21 d thereafter, the grazed pastures were sampled for DM on offer. To measure forage accumulation, each paddock had 10 exclosures that were sampled for forage DM and moved every 21 d. Rising plate meter (RPM) readings were taken weekly, and paddock size was adjusted as needed to keep forage availability similar between groups. RPM readings and date of experiment were used in a stepwise model selection to predict forage DM yield. These yields and exclosure growth data were then used to calculate dry matter intake (DMI). Low and high RFI groups did not differ (P>.05) in BW change or BCS change over the trial (19.5 vs. 22.1 kg and 0.11 vs. 0.10 BCS). The average DM yield for all paddocks was 2336 kg DM/ha. The average NDF, ADF, and CP were 72.1, 42.4, and 6.8%, respectively. Low RFI cows had a 21% numerically lower DMI than high RFI cows (12.4 vs. 15.6 kg, P=0.23). The average acres needed per paddock over the trial was numerically less for low RFI than high RFI cows (1.71 vs. 1.82 ha, P=0.35). The average DM on offer over the trial tended to be lower for low RFI than high RFI cows (4215 vs. 4376 kg, P=0.06). Although differences seen between low and high RFI cows were not statistically different, this could be due to the difficulty of measuring forage intake during the growing season and the low number of replications. Additional studies are necessary to confirm these differences.

Key Words: Beef Cows, Feed Efficiency, Forage Intake

659   Evaluation of feed efficiency in Santa Gertrudis steers and relationships with temperament and feeding behavior traits. R. R. Gomez*[1], B. M. Bourg[1], Z. D. Paddock[1], G. E. Carstens[1], P. A. Lancaster[1], R. K. Miller[1], L. O. Tedeschi[1], D. K. Lunt[2], S. A. Moore[3], and D. S. DeLaney[3], [1]*Texas A&M University*, *College Station*, [2]*Texas A&M University*, *McGregor*, [3]*King Ranch*, *Kingsville, TX*.

The objectives of this study were to characterize feed efficiency traits in growing calves, and to examine their relationships with temperament and feeding behavior traits. DMI and feeding behavior traits were measured over a 70-d period using a GrowSafe® feeding system, following a 28-d adaptation period, in Santa Gertrudis steers (n = 118, initial BW = 308.8 ± 27.8 kg). Meal duration (min/d) and meal frequency (meals/d) were averaged over the 70-d period. Body weights were measured at 14-d intervals. Steers were fed a roughage based diet (ME = 2.26 Mcal/kg DM). Chute scores (1 to 5) were recorded and exit velocity (EV) measured as the rate of distance traveled (m/s) while exiting a confined area on days -28, 0, and 70. Residual feed intake (RFI) was calculated as the residual from the linear regression of DMI on mid-test $BW^{0.75}$ and ADG. Overall mean (±SD) of ADG, DMI and RFI were 0.84 ± 0.16, 9.44 ± 0.99, and 0.0 ± 0.86 kg/d respectively. RFI was correlated (P < 0.05) with DMI (0.86) and feed conversion ratio (FCR; 0.50), but not with ADG or MBW. Steers with low RFI consumed 19.1% less DMI and had 18.7% lower FCR than steers with high RFI. Meal duration was not correlated with ADG or FCR, but was moderately correlated (P < 0.05) with DMI (0.35) and RFI (0.34). Meal frequency was not correlated with ADG, FCR, DMI

or RFI. Initial CS and EV were both correlated (P < 0.05) with ADG (-0.26, -0.28), but not with DMI. Initial CS tended to be correlated (P < 0.10) with FCR (0.17) but not with RFI. Initial EV was not correlated with any other performance, efficiency, or feeding behavior traits. Initial CS was correlated with meal duration but not meal frequency. These results suggest that initial temperament traits may be predictive of subsequent performance of growing calves.

Key Words: Temperment, Feeding Behavior

660   Relationships of feed efficiency with carcass and non–carcass tissue composition in Angus bulls and heifers. F. R. B. Ribeiro*[1], G. E. Carstens[1], P. A. Lancaster[1], L. O. Tedeschi[1], and M. E. Davis[2], [1]*Texas A&M University*, *College Station*, [2]*The Ohio State University*, *Columbus*.

Objectives of this study were to characterize feed efficiency traits and examine their relationship with carcass and non-carcass tissue composition in Angus bulls and heifers. Individual DMI were measured in Angus bulls (n = 16) and heifers (n = 16) fed a corn-based diet (ME = 2.85 Mcal/kg) for 70 d using Calan gates. BW was measured at 14-d intervals. Residual feed intake (**RFI**) was computed as the residual from the linear regression of DMI on mid-test $BW^{0.75}$ and ADG within gender. Low RFI calves consumed 17% less feed than high RFI calves, but had similar ADG and BW. Within bulls and heifers, calves were separated into two groups: high and low RFI (n =8/gender). Upon harvest, gastrointestinal tract (**GIT**) and visceral organs were removed, dissected, and weighed. The 9-11th rib tissue was analyzed for protein and lipid content. There were no significant differences between low and high RFI groups for final BW (360.7 ± 42.4 kg), HCW (259.5 ± 44 kg) and empty BW (**EBW**; 384.3 ± 61.5 kg). There were also no significant difference for total internal fat (82 ± 20.1 g/kg EBW), and carcass lipid (30.3 ± 6.8 %), however low RFI calves had greater (P < 0.05) carcass protein content than high RFI calves (15.7 vs. 15.1 %). RFI groups had similar liver (13.5 ± 1.3 g/kg EBW) and heart (3.8 ± 0.3 g/kg EBW), however low RFI calves had smaller empty GIT than high RFI calves (99.3 vs. 103.6 ± 1.52 kg). As expected, heifers had more carcass lipid (35.3 vs. 25.9 ± 1 %) and IF (101.1 vs. 65.98 ± 2.2 g/kg EBW) than bulls. These results showed that RFI had minimal effects on carcass and non-carcass tissue composition.

Key Words: Carcass, Non–Carcass, Residual Feed Intake

661   The effects of sorting steers by weight into calf-fed, summer yearling and fall yearling feeding systems. D. R. Adams*, T. J. Klopfestein, G. E. Erickson, M. K. Luebbe, and M. A. Greenquist, *University of Nebraska*, *Lincoln*.

Cattle are commonly sorted at weaning into different production systems. Our objective was to determine if sorting cattle by BW decreases variation in HCW and decreases overweight carcasses (431 kg). Steers (n=288) were purchased from two ranches in the fall. All the cattle were assigned randomly into sorted or unsorted groups (n=144). The unsorted group was then assigned randomly to one of three feeding times: calf-fed, summer yearling or fall yearling. The calf-feds were fed from November to May. The summer and fall yearlings grazed cornstalks together through the winter until spring and then grazed cool season grass until May. The summer yearlings entered

the feedlot in May and were fed until October. The fall yearlings grazed pasture until September when they entered the feedlot and were fed until January. In the sorted group, the heaviest 1/3 were fed as calf-feds. When the cattle were brought off of grass in May, the heaviest 1/2 of the remaining sorted group were fed as summer yearlings, while the lightest 1/2 went to pasture and then were fed until January. Both the sorted and unsorted groups were treated as one group during grazing. When entering the feedlot, the cattle were assigned randomly into six pens per group per feeding time and pen was experimental unit. Sorting cattle did not affect overall performance. There was no affect on HCW, ADG, gain efficiency, yield grade 4 and higher, fat thickness, and marbling (P > 0.21). Sorting cattle decreased the variation in HCW and the number of carcasses over 431 kg. Carcass weights were 389 kg, S. D. = 30 kg for sorted cattle compared to 390 kg, S. D. = 48 kg for unsorted cattle. The unsorted group had 20.8% of the carcasses heavier than 431 kg while only 7.04% of the carcasses were over 431 kg in the sorted group. Sorting cattle decreased the variation of HCW and the number of overweight carcasses without affecting fat thickness.

Key Words: Carcass Characteristics, Feedlot Cattle, Sorting

662   The effect of Bos Koolus fed during summer on the feedlot performance and carcass characteristics of steers. I. Loxton[1], T. Grant[2], D. Reid[3], R. Lawrence*[4], and N. Kempe[5], [1]*Beef Support Services*, *Yeppoon, Queensland, Australia*, [2]*Department of Primary Industries and Fisheries*, *Theodore, Queensland, Australia*, [3]*Department of Primary Industries and Fisheries, Rockhampton, Queensland, Australia*, [4]*Integrated Animal Production*, *Toowoomba, Queensland, Australia*, [5]*Feedworks*, *Burleigh Heads, Queensland, Australia*.

Feedlot cattle over summer experience high heat load events that increase core body temperature, reduce feed and water intake, depress animal performance and increase morbidity. Mortalities may result. To manage the consequences of high heat load, the dietary inclusion of betaine, an osmolyte was studied. In an unreplicated pilot study, 32 Angus and Angus crossbred steers were fed a diet with or without 20 g/d betaine incorporated as a Bos Koolus (BK) supplement for 100 days over summer from December 2005 to March 2006 in a central Queensland, Australia feedlot research facility. All steers had access to shade. Nineteen of the steers (10 Control and 9 BK) were surgically implanted with Sirtrack digital temperature transmitters adjacent to the peritoneum at a paralumbar site. Animal measurements included growth, core body temperature at 15 minute intervals, and carcase attributes at slaughter. Climatic parameters were measured in an unshaded environment every 30 minutes enabling calculation of Accumulated Heat Load Units (AHLU). Three significant heat load events, with AHLU to 130 were recorded during the study. Bos Koolus inclusion showed some evidence of increased overall steer growth (1.21±0.07 SEM vs. 1.17±0.07 SEM kg/d), increased exit liveweight (598.6±6.7 SEM vs. 594.4±5.2 SEM kg) increased carcase weight (314.0±4.3 SEM vs. 306.1±2.2 SEM kg), increased subcutaneous fat depth (16.6±1.1 SEM vs. 14.4±0.7 SEM mm, P8 site), while overall DMI (9.92 vs. 9.67 kg/d) and water consumption (37.0 vs. 33.3 L/d) increased, compared with Control. The average core body temperatures of both Control and Bos Koolus treated steers were similar. Therefore, Bos Koolus has shown potential to ameliorate the effects of heat stress in feedlot cattle.

Key Words: Beef Cattle, Betaine, Heat Tolerance

663   Effect of Ractopamine HCl on growth and carcass traits of finishing heifers fed to slaughter. S. B. Laudert*, G. J. Vogel, A. L. Schroeder, and W. J. Platter, *Elanco Animal Health, Greenfield, IN*.

Two studies were conducted at research facilities in TX and KS to evaluate the effects of ractopamine hydrochloride (RAC) on growth performance and carcass traits of finishing heifers. The studies consisted of 3 treatments (0, 200 mg•hd^{-1}•d^{-1} and 30.3 ppm RAC), 14 replications per treatment and 3405 cattle (492.8 kg). Days on feed averaged 142 and 185, with the RAC diets fed for the last 28 and 32 d prior to slaughter at the TX and KS sites, respectively. Rations were representative of the geographic area of the studies and met or exceeded National Research Council nutrient requirements of finishing heifers. Rumensin®, Tylan® and MGA® were fed at label dosages. TX heifers received an initial Revalor® IH followed by Revalor H re-implant approximately 77 d pre-slaughter. KS heifers received a Revalor 200 at processing and were not re-implanted. Heifers were slaughtered at commercial beef facilities and standard carcass data collected. Data were analyzed using a mixed model procedure of SAS with pen as the experimental unit and initial weight as a covariate. Feeding RAC at 200 mg•hd^{-1}•d^{-1} or 30.3 ppm increased live weight gain, lowered feed intake and improved feed conversion. Heifers fed the RAC diets had heavier carcass weights, and increased dressing percentages and LM areas compared to heifers fed the control diet. Dietary RAC treatment did not impact marbling score, fat thickness, KPH, or yield grade. Feeding RAC to heifers for the final 28 to 32 d of the finishing period increased live weight and carcass gain and improved feed efficiency with no impact to carcass quality.

Table 1. Effect of Ractopamine on finishing heifers

Item / RAC Treatment	0	200 mg	30.3 ppm	SE
RAC intake, mg•hd^{-1}•d–^{1}	0	200	234	
Final weight, kg	525.2[a]	528.6[b]	531.2[c]	.9
DM intake, kg	7.99[a]	7.76[b]	7.76[b]	.21
ADG, kg	1.07[a]	1.19[b]	1.27[c]	.03
F:G	7.62[a]	6.70[b]	6.26[b]	.23
G:F	.133[a]	.151[b]	.162[c]	.015
HCW, kg	336.8[a]	341.4[b]	342.9[b]	.7
% dress	64.17[a]	64.63[b]	64.55[b]	.04
12th rib fat, cm	1.27	1.24	1.27	.03
KPH, %	2.10	2.07	2.09	.01
LM area, cm^2	91.4[a]	92.8[b]	92.9[b]	.58
Yield grade	2.55	2.49	2.51	.04
Marbling score	Slight[96]	Slight[95]	Slight[94]	3.6

[abc] (P < .05)

Key Words: Ractopamine, Heifer, Growth and Carcass

664   Plasma urea-N response to dosages and delivery patterns of Estradiol 17-beta and Trenbolone Acetate. S. L. Parr*, R. H. Pritchard, and K. W. Bruns, *South Dakota State University, Brookings*.

Two experiments were used to assess the effect of implant dose and delivery pattern on anabolic status via plasma urea-N (PUN) concentrations when steers were fed finishing diets. In Exp.1 crossbred steers (n=64; BW=368 kg) received the following implant dosages (IMP) of estradiol (E) and trenbolone acetate (TBA) in milligrams given on d 0; 1) 0E/0TBA; 2) 8E/40TBA; 3) 16E/80TBA; and 4) 24E/120TBA. Blood was drawn (n=40) on d 0, 2, 7, 14, 21, 28, 42 and 70. Implants increased 136 d ADG (1.2[c], 1.4[b], 1.4[b], and 1.6[a] kg/d; $P < 0.05$) and HCW (330[c], 347[b], 345[b], and 362[a] kg; $P < 0.05$). Concentrations of PUN averaged across days 28, 42 and 70 were higher for IMP 1 than IMP 2 or 4 (9.5[a], 7.7[b], 8.1[ab] and 7.4[b]; $P < 0.05$) and tended to be higher than IMP 3 ($P < 0.10$). In Exp.2 steers (n=192; BW=372 kg) received one of 4 IMP treatments, IMP A) 0E/0TBA and 3 implanted strategies which resulted in equal cumulative dosages of E and TBA: IMP B) 8E/40TBA given on d 0, 42, and 84; IMP C) 12E/60TBA on d 0 and 63; and IMP D) 24E/120TBA on d 0. Steers were sorted to IMP within frame size (FSL=large; FSS=small). Blood was drawn (n=72) on d -1, 41, 62, 83 and d 125. Implanted cattle had greater ($P < 0.05$) 133 d ADG and HCW than control. Concentrations of PUN increased from d 0 to 125 (6.4, 7.7, 8.9, 10.2, and 10.5 mg/dl; $P < 0.05$). At d 41, implants lowered PUN concentrations (8.5[a], 7.7[b], 7.2[b] and 7.4[b] mg/dl; $P < 0.05$). At d 62 PUN concentrations were lower for IMP B and C compared to control; IMP D PUN concentration were intermediate (9.8[a], 8,3[b], 8.4[b] and 9.0[ab] mg/dl; $P < 0.05$). A FS x IMP interaction existed at d 83 and d 125. In FSL, IMP did not affect PUN (10.4 mg/dl; $P > 0.10$) at these times. However, in FSS the PUN concentrations were lower for IMP B and C than IMP A or D (11.6[a], 9.5[b], 9.1[b], 11.0[a] mg/dl; $P < 0.05$). In Exp.2 smaller framed steers did have an increased response to implant delivery patterns that involved repeated lower dosing. The observed changes in PUN concentrations were responsive to time but not to dosage.

Key Words: Anabolic Implant, Estradiol 17-beta, Trenbolone Acetate

665   Using programmed feeding to manage young beef cows. J. D. Shockey*, P. A. Beck, P. Gregorini, C. B. Stewart, and S. A. Gunter, *University of Arkansas Division of Agriculutre, SWREC, Hope*.

On 10 November 2005, 52 non-lactating cows (BW = 434 ± 1.3 kg) of mostly Angus breeding were stratified by BCS, parity, BW, and distributed randomly into four 0.81-ha drylots. The cows were bred to calve in February 2006 for the first (n = 37) or second (n = 15) time. Cows in 2 pens were program fed a high-concentrate diet during 2 feeding periods, gestation (84 d) and lactation (56 d). The diet was fed in amounts to meet the cows' NEm requirements at each stage of production as described by the NRC (2000). The diet was formulated to be 12.1% chopped corn stalks, 67.8% hominy feed, 1.5% cottonseed meal, 2.3% minerals, 0.5% urea, and 15.9% water on an as fed basis (79% DM; 12.3% CP, 2.1 Mcal of NEm/kg [DM basis]). Cows in the other 2 drylots were fed long-stem bermudagrass hay (9.4% CP, 1.1 Mcal of NEm/kg [DM basis]) plus a hominy feed based supplement. Cow BW after the first 84 d tended (P ≤ 0.09) to be improved by programmed feeding (430 kg) compared to hay feeding (474 kg); but no difference was noted (P = 0.20) after 56 d of lactation. Body condition score did not differ (P ≥ 0.36) before calving, but BCS (9 point scale) was higher (P = 0.05) during lactation for program-fed cows (6.1) than hay fed (5.3). Total DMI was reduced 27% or more (P < 0.03) for cows that were program fed compared to hay fed cows during gestation and lactation. Program-fed cows had a pregnancy rate of 92% compared to 80% for hay-fed cows (P = 0.37; SE = 7.8). Milk samples were collected March 30 and May 11; percentage protein and fat did not differ (P ≥ 0.34) between treatments. Calving date, calf birth weight, agility, vigor, and calving ease did not differ (P ≥ 0.42) between treatments. On March 30, May 11, and July 6, calves from program-fed cows tended (P ≥ 0.14) to be heavier than the

calves nursing hay-fed cows. These data suggests that calves nursing program-fed cows probably had a higher plain of nutrition and performed better than calves nursing hay-fed cows.

Key Words: Beef Cows, Programmed Feeding, Hominy

666   Performance of beef cows fed free-choice whole cottonseed and hay during winter. G. M. Hill*[1], M. H. Poore[3], M. E. Pence[2], and B. G. Mullinix, Jr.[1], [1]*University of Georgia, Tifton*, [2]*University of Georgia Vet. Diagnostic Ctr., Tifton*, [3]*North Carolina State University, Raleigh*.

In a 2-yr experiment, beef cows were fed supplemental whole cottonseed [WCS; DM, CP, crude fat, (% DM), respectively, 92.2, 23.5, 17.8], and free-choice bermudagrass hay [DM, CP, NDF (% DM), respectively, 90.9, 10.2, 77.8] in hay rings on dormant pastures (n=6, 0.89 ha each). Non-pregnant cows (n=84, 42/yr) were of Breed Type 1 (BT1, Angus =32, Polled Hereford =9) or Breed Type 2 (BT2, Brangus=28, Braford=15). Cows were ranked by BW within BT, and randomly assigned to dietary treatments: Low WCS (LCS; 0.25 % initial BW); Medium WCS, (MCS; 0.5 % initial BW), and WCS fed free-choice (FCS) for 63d (2005) and 70d (2006). Initial and final BW were means of consecutive daily unshrunk BW. On d 1 and d 63 (2005), d 70 (2006), 13th rib ultrasound fat (UR, cm) and rump (URP, cm) were determined. Initial BW, cow age (CA), initial UR, and initial URP for 2005 and 2006, respectively, were: 517.4 ± 99.2, 578.9 ± 78.4 kg, $t = 3.15$, $P < 0.05$; 3.67 ± 1.87, 6.33 ± 2.88 yr, $t = 5.02$, $P < 0.01$; 0.60 ± 0.43, 0.78 ± 0.27 cm; 0.55 ± 0.61, 0.51 ± 0.22 cm, and these values were used as covariates. The DMI of WCS, hay and total diet (kg) on LCS, MCS, and FCS, respectively, were: 1.4c, 9.5b, 10.9b; 2.4b, 11.5a, 13.9a and 4.1a, 10.4ab, 14.4a; within WCS, hay or diet, means with uncommon letters differ ($P < 0.01$). The ADG for cows in 2006 was adjusted to 63 d, and the 2-yr 63-d ADG (Table) was higher for FCS. Cow UR and URP changes were greater in 2006 than 2005, and URP had greater positive changes for MCS and FCS than LCS. Positive changes in UR occurred for MCS and FCS, and negative changes for LCS. Cow ADG and UR were affected by BT × CA interactions ($P < 0.10$) with ADG (kg) and UR (cm), respectively, for CA < 3 yr at 0.44, 0.01 vs. 0.63, 0.07 for BT1 vs. BT2; and CA > 4 yr at 0.41, 0.12, vs 0.44, -0.02 for BT1 vs. BT2, SE 0.07, 0.05. Feeding WCS free-choice increased cow ADG, and MCS and FCS resulted in increased cow body condition.

Table 1.

Item	2005	2006	SE	P <	LCS	MCS	FCS	SE	P <
63-d ADG, kg	0.54x	0.43y	0.05	0.10	0.36r	0.45r	0.59q	0.04	0.05
UR change, cm	-0.06b	0.15a	0.04	0.01	-0.08s	0.07rs	0.14q	0.05	0.05
URP change, cm	0.01b	0.32a	0.05	0.01	0.04b	0.21a	0.25a	0.04	0.01

Key Words: Cow, Cottonseed, Ultrasound

667   Evaluation of NRC (1996) model energy requirement and DMI equation accuracy and precision for wintering beef cows in western Canada. J. L. Bourne[1], H. C. Block*[1], H. A. Lardner[2], and J. J. McKinnon[1], [1]*University of Saskatchewan, Saskatoon, SK, Canada*, [2]*Western Beef Development Centre, Humboldt, SK, Canada*.

Three years of winter feeding trials using 90 Angus cows (15 pens of six) fed typical wintering diets formulated to stage of pregnancy were used to evaluate NRC (1996) energy requirement and DMI equation accuracy and precision. Data collection included pen DMI, individual cow weights, body condition scores, calving dates and weights, and daily temperature and wind speed. Diet energy density was estimated from nutrient analysis of composited weekly feed samples. Equation evaluations compared observed and predicted DMI and conceptus corrected ADG for the second and third trimesters using regression, means comparison, concordance correlation coefficient (CCC), and total deviation index (TDI) methods. Across all three years, second trimester DMI was over predicted ($P<0.01$) with low precision (CCC = 0.24, 90% TDI = n/a) using actual environmental conditions, but not ($P=0.34$) when assuming thermal neutral (TN) conditions, although precision remained low (CCC = 0.25, 90% TDI = 1.91 kg/d). Third trimester DMI was also over predicted ($P<0.01$) with low precision (CCC = 0.12, 90% TDI = 1.57 kg/d) using actual environmental conditions, but was largely under predicted ($P<0.01$) with worse precision (CCC = -0.01, 90% TDI = 2.34 kg/d) when assuming TN conditions. Across all three years, second trimester ADG was largely under predicted ($P<0.01$) with low precision (CCC = 0.50, 90% TDI = 0.58 kg) using actual environmental conditions, but over predicted ($P<0.01$) with similar precision (CCC = 0.51, 90% TDI = 0.50 kg) when assuming TN conditions. Third trimester ADG predictions using actual environmental conditions were inaccurate ($P<0.01$) with low precision (CCC = 0.20, 90% TDI = 0.70 kg) and worsened (CCC = -0.01, 90% TDI = n/a) when assuming TN conditions where ADG was over predicted ($P<0.01$). These results indicate a lack of accuracy and precision with the current NRC (1996) model energy requirement and DMI equations that was not addressable by assuming TN conditions. Future research should be targeted at alternate DMI equations and refinements to maintenance and gain requirements.

Key Words: NRC Evaluation, Nutrient Requirements, Wintering Beef Cows

668   Improving fecal near-infrared reflectance spectroscopy predictions of botanical composition of ruminant diets. J. W. Walker*, B. S. Engdahl, E. S. Campbell, and C. J. Lupton, *Texas Agricultural Experiment Station, San Angelo, TX*.

Near infrared reflectance spectroscopy of fecal samples (FNIRS) can be used to predict the botanical composition of herbivore diets. FNIRS has been used to predict the percentage sagebrush, leafy spurge, and spotted knapweed in sheep diets; and juniper and leafy spurge, in goat diets. Calibrations were developed using fecal diet pairs from feeding trials where the percentage of the species of interest was known. Calibration statistics consistently show that useful calibrations can be developed. However, the results of independent validations show a loss precision and a considerable reduction in accuracy. The objective of this research is to conduct a meta analysis to determine the strengths and limitations of FNIRS for predicting botanical composition of herbivore diets. Independent validation statistics compared to calibration and cross-validation statistics indicate that the coefficient of variation is reduced by 30 – 50 percent and the bias is increased 2 – 4 fold. Predictions of samples that are different from calibration samples should be considered an interval scale of measurement. Microhistological estimates of botanical composition are less precise than independent validations, which limits the use of this technique as a standard analytical procedure. Predictions of botanical composition

are affected by the design of the feeding trial. Trials should include 4 or more different background forages and 4 levels of the target plant, including 0. Dried forages, even those species with high levels of volatile secondary plant compounds, appear to provide calibrations as accurate and precise as calibrations using fresh or frozen plant material. The addition of samples to the calibration equation from animals on the same base forage but with 0 levels of the predicted species as animals being predicted can improve the precision and accuracy of predictions significantly. Animal variables such as breed, sex and age can affect fecal spectra but not necessarily the prediction of the target plant.

Key Words: Goat, Sheep, Microhistological

Sheep Species: Biology and Management of Low-input Lambing Management in Easy-Care Systems

669   Genetic and physiological effects on maternal behavior and lamb survival. C. M. Dwyer*, *SAC, Edinburgh, UK.*

Failure in the development of the ewe-lamb bond has been implicated in 80% of lamb pre-weaning deaths. Increased shepherding inputs have been used to improve lamb survival. However, a better understanding of the ewe-lamb bond and applying management and genetic techniques to improve this relationship provide a sustainable route to reduce lamb mortality. Appropriate expression of maternal behavior by the ewe (licking the lamb, low-pitched bleating, udder acceptance) can be disturbed in primiparous ewes, and in ewes undernourished in pregnancy. In addition, using two breeds of sheep (Scottish Blackface, Suffolk), we have shown that significant variation exists between breeds in both the quality of maternal behavior (e.g. percent time spent licking lamb in 2 hours after lamb birth: Blackface = 60.7%, Suffolk = 43.8%, s.e.d. = 2.6%, $P < 0.001$), and lamb vigor (e.g. time to stand after birth (min, means with 95% confidence intervals): Blackface = 15.3 (12.1 to 19.4), Suffolk = 25.7 (20.3 to 32.6), $P < 0.001$). Embryo transfer between breeds demonstrates that these behavioral differences are intrinsic to the breed and are not influenced by partner behavior. The observed behavioral differences result in higher lamb mortality in the Suffolk breed compared to Blackfaces (14% vs. 3%, $P < 0.001$). Investigation of maternal physiology showed higher circulating concentrations of estradiol, and estradiol:progesterone ratio, in Blackface ewes in late gestation in comparison to Suffolk ewes (estradiol concentration (pg.ml): Blackface = 11.4, Suffolk= 7.9, s.e.d. = 0.9, $P < 0.001$), and estradiol concentration was correlated with maternal licking and low-pitched bleating ($r^2 = 20\%$, $P < 0.005$). These data suggest that genetic differences in maternal behavior in sheep may be mediated by variation in the physiological processes underpinning the onset of maternal care. In addition to breed differences in behavior, significant sire effects within breed exist for lamb vigor, and lamb behaviors are heritable ($h^2 = 0.15$ to 0.35). Taken together these data suggest there is considerable potential to improve lamb survival by selection and management to improve ewe maternal behavior, and by genetic selection for lamb vigor.

Key Words: Maternal Behavior, Neonate Survival, Sheep

670   Management of maternal-offspring behaviour to improve lamb survival in low input systems. J. Everett-Hincks* and K. Dodds, *AgResearch, Invermay Agricultural Centre, Mosgiel, Otago, New Zealand.*

This paper provides an investigation into the environmental and management effects on lamb survival on high performing sheep farms in New Zealand. Improved lambing percentage is the biggest contributor to higher profits on New Zealand sheep farms. Many sheep breeders have selected and bred ewes for increased fecundity over the last four decades. Lamb survival is an important issue in highly fecund sheep flocks. The increased proportion of ewes having triplets is of concern to farmers and to industry as lamb mortality in the 24 hours post-partum is highest in triplets. The majority of lamb deaths occur in the first three days after birth and range from 5 to 30% for individual sheep flocks. These losses are unacceptable from animal welfare and production perspectives. The ability of a lamb to survive to weaning is determined by the successful execution of a number of processes. These are driven by genetics, behaviour, physiology and the environment, including on farm management practices. This study investigated the effects of dam body condition in pregnancy, weather over lambing, lamb birth weight and maternal behaviour on single, twin and triplet lamb viability at birth and survival through to weaning for 24 industry flocks (28525 lambs; 3474 singles, 18510 twins, and 6541 triplets) from 2003 to 2005. Ewes with higher body condition scores in mid pregnancy had heavier lambs at birth. Lambs weighing 6 to 8 kg at birth were more likely to be viable at birth and survive to weaning than heavier or lighter lambs. Weather conditions during late pregnancy proved as important as conditions during lambing in determining lamb viability and survival through to weaning. Older ewes and ewes with triplets require considerably more attention for farmers to realise their production potential. This paper explores the effect of environmental and management factors on lamb birth weight and survival and uses this information to formulate appropriate management programmes to improve lamb survival rates under low-input farming systems.

Key Words: Lamb Survival, Management, Sheep

671   Evaluation of Dorper, Dorset, Katahdin, and Rambouillet crossbred ewes in high- and low-input production systems. K. A. Leymaster*, *USDA-ARS, U.S. Meat Animal Research Center, Clay Center, NE.*

The primary objective was to evaluate wool (Dorset, Rambouillet) and hair (Dorper, Katahdin) dam breeds for their ability to complement Romanov germplasm as crossbred ewes managed in distinct production systems. Romanov ewes were mated with 18 rams of each dam breed to produce crossbred ewes for evaluation through 3 yr of age in two production systems. In the high-input system, labor and harvested feed were provided for sheep in confinement facilities and ewes were limited to rearing two lambs with additional lambs reared artificially. Ewes in the low-input system lambed on pasture and were responsible for rearing all lambs. No labor or supplemental feed were provided before weaning. A total of 830 crossbred ewes produced 1,962 litters and 4,171 lambs from 2,172 multisire exposures to two terminal sire