

Production, Management and the Environment: Beef

782 An evaluation of residual feed intake estimates obtained with computer models versus empirical regression. C. B. Williams*, C. L. Ferrell, and T. G. Jenkins, *USDA, ARS, U.S. Meat Animal Research Center, Clay Center, NE.*

Data on individual daily feed intake, bi-weekly BW, and carcass composition were obtained on 1,212 crossbred steers, in Cycle VII of the Germplasm Evaluation Project at the U.S. Meat Animal Research Center. Within animal regressions of cumulative feed intake and BW on linear and quadratic days on feed were used to quantify average daily feed intake (ADFI) and ADG over a 120-d period. Residual feed intake (RFI) was estimated from predicted values of expected feed intake obtained by, a) empirical regression of ADFI on ADG and average BW^{0.75} (RFI_{REG}), b) Cornell Value Discovery System (RFI_{CVDS}), c) National Research Council 2000 beef model (RFI_{NRC}), and d) Decision Evaluator for the Cattle Industry (DECI, RFI_{DECI}). Observed data on growth and carcass composition were used as input to the 3 computer models. Phenotypic correlations ($r = 0.95, 0.87, 0.78$) for RFI_{REG} with RFI_{CVDS}, RFI_{NRC}, RFI_{DECI}, respectively, suggest that RFI_{DECI} may be a different trait from RFI_{REG}. Additionally, RFI_{REG}, RFI_{CVDS}, RFI_{NRC}, and RFI_{DECI}, respectively, were correlated with ADG ($r = 0.00, -0.20, -0.41, -0.48$), and ADFI ($r = 0.58, 0.50, 0.27, 0.09$). These results show further differences between RFI_{DECI} and RFI_{REG}, and similarity between RFI_{CVDS} and RFI_{REG}, with RFI_{NRC} in between. Some animals that eat very little and grow slowly were identified as efficient based on their RFI_{REG} values, but ranged from less efficient to inefficient based on their RFI_{CVDS}, RFI_{NRC}, and RFI_{DECI} values, respectively. These results may be due to the fact that computer models predict performance on an individual animal basis in contrast to empirical regression. Also, the formulation of maintenance in DECI results in increasing maintenance requirements with increasing BW and ADFI. Animals with very low ADFI have lower maintenance requirements with DECI and in some cases, this results in expected feed intake being lower than ADFI. Finally, the results suggest that selection for RFI_{DECI} would tend to increase ADG with no change in ADFI.

Key Words: computer models, feed efficiency, beef cattle

783 Influence of feed management on random herd curves from random regression test-day model. M. Caccamo*¹, R. F. Veerkamp², J. D. Ferguson³, R. Petriglieri¹, F. La Terra¹, and G. Licitra^{1,4}, ¹*CoRFi-LaC, Regione Siciliana, Ragusa, Italy*, ²*Animal Breeding and Genomics Centre, ASG, WageningenUR, Lelystad, The Netherlands*, ³*University of Pennsylvania, Kennett Square*, ⁴*D.A.C.P.A. University of Catania, Italy*.

Earlier studies identified large between-herd variation in lactation curve parameters in Ragusa province. The objective of this study was to identify sources of variation that explain these differences between herds in milk production curves, by estimating effect of animal breed (Holstein Friesian vs Brown Swiss), feeding system (separate feeding vs TMR), and TMR chemical composition on milk and milk components yield herd curves. Data for test day (TD) milk (Kg), fat (g), and protein (g) production from 1,287,019 TD records of 148,951 lactations of 51,489 cows in 450 herds, recorded from 1992 through 2007 were processed using a random regression TD model. Random herd curves (HCUR) for milk, fat, and protein yield were estimated for each herd per year from the model using 4-order Legendre polynomials. Information on herd management practices was monthly collected from 37 farms in Ragusa province from March 2006 through December 2007. TMR

samples were collected every 3 months and analyzed for dry matter (DM), ash, crude protein (CP), soluble nitrogen (SN), acid detergent lignin (ADL), sequential NDF (NFDS), sequential acid detergent fiber (ADFS), and starch. The traits used to describe the curves were: peak, DIM at peak, persistency, and mean. Influence of feeding system and animal breed on herd curve traits was investigated using the GLM procedure of SAS. Influence of TMR chemical composition on HCUR traits was investigated using multivariate analysis with SAS REG and stepwise option. Feeding system had the largest influence ($P < 0.05$) on HCUR peak and mean for all traits and parities, with higher values for TMR. Animal breed had the largest influence ($P < 0.05$) on HCUR persistency, with higher values for Brown Swiss herds. Results from multivariate analysis showed that CP had the largest impact on HCUR peak and mean for all traits and for all parities, whereas the interaction between CP and DM had the largest impact on persistency for all traits and for all parities.

Key Words: herd curve, feeding management, test day model

784 Effects of programmed growth on yearling Brangus and Angus heifers. I. Performance and body composition. B. R. Austin, M. J. Hersom*, and J. V. Yelich, *University of Florida, Gainesville.*

The objective of this study was to examine the effects of programmed growth with deferred supplementation on BW gain and body composition of yearling Brangus and Angus heifers consuming Tifton 85 bermudagrass round bale silage (RBS; CP=7.9%, IVDMD=45.5%). Sixty heifers (n=30, Angus; n=30, Brangus) were stratified by initial BW, breed, and age and randomly allocated to 12 pens. Pens were randomly assigned to one of two treatments: 1) RBS and dried distillers grains (DDG) supplemented 3 d/wk for duration of experiment (174 d, CON) or, 2) RBS ad libitum for the first 88 d and RBS and DDG supplemented 3 d/wk from d 89–174 (L–H). CON heifers were provided supplement to gain 0.75 kg/d. When supplemented, L–H heifers were supplemented to gain 1.5 kg/d. Full BW and hip heights (HH) were obtained on d 0, 89, and 174. Ultrasound measurements of ribeye area (REA) and rump fat were obtained on d 16, 89, and 174. Data were analyzed using the MIXED procedure of SAS. Total DDG intake was greater ($P < 0.05$) for L–H (1,662 kg) compared to CON (1,442 kg). Total RBS offered was greater ($P < 0.05$) for CON (7,966 kg) compared to L–H (6,606 kg). ADG for the first 89 d of the trial was greater ($P < 0.05$) for CON (0.57 kg/d) compared to L–H (0.003 kg/d). The ADG for the last 85 d of the trial tended ($P = 0.07$) to be greater for the L–H (0.74 kg/d) compared to CON (0.61 kg/d). HH on d 174 was greater ($P < 0.05$) for CON (122.8 cm) compared to L–H (119.6 cm). The CON had greater ($P < 0.05$) REA compared to L–H on d 89 (18.4 vs 13.8 cm²) and on d 134 (20.6 vs. 17.8 cm²), respectively. Rump fat was greater ($P < 0.05$) for CON (0.42 cm) compared to L–H (0.31 cm) on d 89 but were similar ($P > 0.10$) for CON (0.43 cm) compared to L–H (0.38 cm) on d 174. Programmed growth with deferred supplementation of yearling heifers fed low-quality forage and supplemented with DDG had negative effects on growth patterns and body composition.

Key Words: beef heifers, supplementation, growth

785 Effects of programmed growth on yearling Brangus and Angus heifers. II. Puberty and reproductive performance. B. R. Austin, M. J. Hersom*, and J. V. Yelich, *University of Florida, Gainesville.*

The objective of this study was to examine the effects of programmed growth with deferred supplementation on the onset of puberty, estrous synchronization response, and pregnancy rates of yearling Brangus and Angus heifers consuming bermudagrass round bale silage (RBS, CP=7.9%, IVDMD=45.5%). Sixty heifers (n=30, Angus; n=30, Brangus) were stratified by initial BW, breed, and age and randomly allocated to 12 pens. Pens were randomly assigned to one of two treatments: 1) RBS and dried distillers grains (DDG) supplemented 3 d/wk for duration of experiment (174 d, CON) or 2) RBS ad libitum for the first 88 d and RBS and DDG supplemented 3 d/wk from d 89–174 (L–H). Blood samples were collected on d –2, 8, 79, and 89 to determine plasma progesterone concentrations and onset of puberty. Weekly blood samples were collected from d 89–174 to determine plasma progesterone concentrations to determine onset of puberty. Heifers were synchronized for AI on d 174 with a CIDR concomitant with GnRH (100 ug; i.m.) with CIDR removal and PG (25 mg; i.m.) 7 d later. Estrus was detected using HeatWatch for 72 h after PG, and heifers were AI 8–12 h after the onset of estrus. Heifers not exhibiting estrus by 72 h were timed–AI + GnRH. Estrous detection and AI continued for 30 d after synchronization. Heifers were divided by breed and exposed to clean-up bulls for 30 d. Pregnancy was diagnosed by ultrasonography 31, 62, and 95 d after PG. Percentage of heifers that attained puberty on d 89 (13 vs 3%) and at initiation of breeding (33 vs 7%) was greater (P<0.01) for CON compared to L–H, respectively. Estrous response (73 vs 40%), 30–d AI pregnancy rates (83 vs 56%), and overall pregnancy rates (93 vs 66%) were greater (P<0.05) for CON compared to L–H, respectively. Synchronized pregnancy rates (46 vs 33%) and conception rates (50 vs 53%) were similar (P>0.05) between CON and L–H, respectively. Programmed growth with deferred supplementation of yearling heifers fed low-quality forage and supplemented with DDG had negative effects on reproductive performance.

Key Words: beef heifer, supplementation, reproduction

786 Predicting the success of fixed-time AI from passive monitoring of body temperature in beef heifers. J. A. Small*^{1,4}, A. D. Kennedy², L. M. Pfeifer³, and J. Singh³, ¹*Agriculture and Agri-Food Canada, Brandon, MB, Canada*, ²*University of Manitoba, Winnipeg, MB, Canada*, ³*University of Saskatchewan, Saskatoon, SK, Canada*, ⁴*Nova Scotia Agricultural College, Truro, NS, Canada*.

The objective was to determine if the body temperature (Trr) and number of monitoring events (ME) from passive acquisition of data logged by transponder boluses differed between heifers that were, retrospectively, pregnant (PR, N=30) or not-pregnant (NP, N=33) to fixed-time artificial insemination (TAI). Yearling heifers (12.5 ± 0.5 mo., 421 ± 32 kg body weight, 5.4 ± 1.2 mm backfat thickness) with magnetic, inductively coupled full duplex RFID transponder boluses containing thermistors (Phase IV Engineering Inc., Boulder, CO) were housed in one pen with two panel readers in an outdoor shed-lot facility and provided a mixed ration (59% dry matter) at 1500h daily. Fencing was arranged for water motivated acquisitions by one panel reader, and activity motivated acquisitions by the other (Small et al. *Can. J. Anim. Sci.* 88:225–235, 2008). All heifers were administered estradiol benzoate (1 mg im) on the 8th d after the second of two doses of PGF (500 ug im) given 11 d apart, two groups were given progestin inserts (1/2 Cue-mate) removed concurrent with PGF (25 mg im; 1100h, Day 0), and a third group was given a temperature recording device (HOBO ProV2) anchored in the

vagina and programmed to record temperature (Tv) every 15 min from Day –7 to Day 7; all received pLH (12.5 mg im) concurrent with TAI 54h after PGF (Day 0). Current Trr and Tv were compared to the previous 3-d baselines for each window of time. For PR, Tv decreased to nadir within 24h of PGF and peaked above baseline at 58h (Day 2) returning to baseline at 78h (Day 3); for NP peaks occurred 78 to 90h returning to baseline at 96h (Day 4). Mean Trr was 0.3°C higher (P<0.05) for pregnant than non-pregnant heifers at 60h (Day 2) and vice-versa at 114h (Day 4). The number of Trr ME was greater (P<0.05) for PR than NP at 30, 36 and 60h windows after PGF (7.9 vs 12.8 ± 0.8 ME/6h at 60h). Passive monitoring of Trr could improve the efficacy of TAI in heifers by facilitating a management decision to re-inseminate or observe for return to estrus.

Key Words: body temperature, beef heifers, fixed-time artificial insemination

787 Does fertility-associated antigen on sperm collected from Nellore (*Bos indicus*) bulls affect fertility at first-service timed AI? J. C. Dalton*¹, L. Deragon², J. L. M. Vasconcelos³, and A. Ahmadzadeh⁴, ¹*University of Idaho, Caldwell*, ²*Alta Genetics Brazil, Uberaba, MG, Brazil*, ³*FMVZ-UNESP, Botucatu, SP, Brazil*, ⁴*University of Idaho, Moscow*.

The objective was to determine whether the presence of fertility-associated antigen (FAA; a 31 kDa heparin binding protein) on sperm collected from Nellore bulls can be used to assess potential fertility of sperm for use at first-service timed AI (TAI). Following determination of FAA status by use of a lateral flow cassette, 6 Nellore bulls (4 to 7 yr old) were selected based on FAA status (FAA-negative: n = 3; FAA-positive: n = 3) and their ability to produce neat semen with characteristics equal to or greater than 70% morphologically normal sperm and 60% estimated progressive motility before cryopreservation. Ejaculates were collected by artificial vagina and were extended to 120×10⁶ sperm/mL. The extended semen was packaged and cryopreserved in 0.25-mL straws (30×10⁶ sperm). Multiparous lactating Nellore cows (n = 835) at a commercial beef farm in Mato Grosso do Sul, Brazil, were evaluated for body condition score (BCS; 1–5 scale) and enrolled in a first-service TAI program. On d 0 cows began the synchronization protocol with an intravaginal progesterone device (CIDR) + an injection of 2.0 mg of estradiol benzoate. On d 9, the CIDR was removed, 12.5 mg of PGF_{2α} + 0.5 mg of estradiol cypionate were administered, and calves were removed for 48 h until TAI. Two technicians performed TAI, with each technician using semen from each bull. Fertility, as measured by pregnancy/TAI (P/TAI), was not different between FAA-positive and FAA-negative bulls (41.5% vs. 39.3%, respectively). There was an effect of AI technician on P/TAI (36.0% vs. 43.9%; n = 375 and n = 460, respectively; P<0.05); however, there was no AI technician by FAA status (treatment) interaction. BCS affected P/TAI (P<0.05). Cows with BCS < 2.5 were three times less likely to become pregnant to first TAI compared with cows with BCS ≥ 2.5. In this study using a limited number of bulls, there was no effect of FAA status on fertility at first-service TAI.

Key Words: sperm, timed AI, fertility

788 Mastitis in beef bulls caused by *Arcanobacterium pyogenes*. S. C. Nickerson*¹, E. Rollin², D. T. Ensley², and R. D. Berghaus², ¹*University of Georgia, College of Agricultural and Environmental Sciences, Department of Animal and Dairy Science, Athens*, ²*University*

of Georgia, College of Veterinary Medicine, Department of Population Health, Athens.

As part of a trial at a university bull test station, data were collected from 101 animals 7 to 10 mo of age including daily weight gain, scrotal circumference, and body frame score. In the process of measuring scrotal circumference, technicians observed that teats of 2 bulls were swollen and leaking a thick pus-like fluid. Upon subsequent culture by university personnel 2 mo later, 14 of 58 bulls sampled (24.1%) were observed to have abnormal, swollen teats, and an examination of teat skin surfaces revealed the presence of scabs and abrasions typical of those caused by horn flies. The culture of teat skin scabs revealed numerous coagulase-negative staphylococcal (CNS) species. No systemic clinical signs were observed, but affected bulls exhibited expressible mammary secretions ranging from a clear, serum-like fluid to a viscous, pus-like secretion. A total of 19 mammary secretion samples were collected for culture, plated on blood agar, and identified following procedures recommended for the

diagnosis of mastitis in dairy cows. Results demonstrated the following distribution: Uninfected- 26.3%, *Arcanobacterium pyogenes*- 52.6%, gram-negative rods- 10.5%, CNS- 5.3%, and dual infections with CNS/ environmental streptococci- 5.3%. Approximately 1 mo later, 21 of 97 bulls (21.6%) were found to have mastitis, and 26 mammary secretion samples were collected with the following distribution: Uninfected- 11.2%, *A. pyogenes*- 57.7%, gram-negative rods- 7.7%, CNS- 7.7%, *Staphylococcus aureus*- 7.7%, and environmental streptococci- 8%. Although a limited number of *A. pyogenes* infections was treated, teat infusions with a cephalosporin-based nonlactating cow product was ineffective, but infusion of 2% chlorhexidine digluconate resulted in a cure in one bull. Because *A. pyogenes* mastitis is known to be initiated by horn flies in dairy cows and heifers, greater control of these insect vectors may be necessary to manage this form of mastitis in beef bulls.

Key Words: *Arcanobacterium pyogenes*, beef bulls, mastitis

Ruminant Nutrition: Dairy 3

789 Short-term changes in forage dry matter affect milk production responses in dairy cows. D. R. Mertens*¹ and P. Berzaghi², ¹US Dairy Forage Research Center, Madison, WI, ²University of Padua, Italy.

Our goal was to quantify the effect of one-day changes in forage DM on ration imprecision and milk responses. Forty eight cows (days of lactation = 121 ±52d; BW = 591 ±63 kg) were blocked in 12 groups for parity and milk production and two were assigned to a control (CON) or treatment (TRT) group. The TRT consisted of changing forage DM to simulate a rain event on a bunker silo and feeding an imprecise ration based on as-fed ratios of ingredients for one day of each week. The CON ration was adjusted to maintain DM ratios of ingredients on that day. Each period consisted of three days for baseline, one day (d4) with ration differences, and three days of recovery. The ration changes were repeated 5 times by changing DM of corn silage or alfalfa silage or both by 8%-units. Production was recorded and samples were taken at each milking (2 ×/d) between days 2 and 6 of each period. Milk production and composition during days 4 to 6 were expressed as difference from those of the baseline period. Forages, TMR and refusals were sampled daily and concentrates were samples weekly. Chemical composition (DM, CP, NDF) of samples were determined by NIR after updating in-house calibrations with 58 samples from the experiment. Data were analyzed using Proc Mix of SAS with cow-within-block and TRT group as random variables. The DMI of TRT was reduced (P<0.01) on d4 (-2.2 kg) compared to the baseline, but cows returned to baseline level during recovery. Overall DMI was similar between CON and TRT (25 kg/d). Compared to baseline, milk production, but not composition, of TRT was affected (P<0.001) in the two days following d4 (-0.86 kg/d) compared to an increase (P<0.05) of 0.43 kg/d in the CON group. On d5, TRT milk depression averaged 1 kg and remained depressed (-0.7 kg) on d6. Using DMI change as a covariate (P<0.001), the loss of one kg of DMI on d4 resulted in 0.57kg/d less milk in each of the following two days. We concluded that improving ration precision by adjusting rations for forage DM changes enhances DMI and milk production.

Key Words: dry matter, intake, precision feeding

790 Meta-analysis of influence of dietary NDF on energy partitioning in dairy cows. D. Sauvart*¹, O. Martin¹, and D. Mertens², ¹Agroparistech-INRA, Paris, France, ²US Dairy Forage Center, Madison, WI.

The objective of this study was to evaluate the influence of dietary NDF on dairy cow energy intake and partitioning. A database of 88 published experiments (nexp) with 219 treatments (n) where dietary NDF was the factor (34.9 ±8.6, min = 28.8, max = 40.0%DM) was compiled. Experiments were selected that measured diet organic matter digestibility (OMD = 70.7 ±5.9, min = 54.6, Max = 83.6%) to predict as accurately as possible dietary metabolizable energy intake (MEI). Milk yield ranged from 9.2 to 45.2 kg/d (27.6 ±7.8). Milk fat content ranged from 2.1 to 5.1% (3.7 ±0.6). Energy secreted in milk (Emilk) and in milk lactose (Elact), protein (Eprot) and fat (Efat) was calculated using 4.0, 5.6 and 9.3 Mcal/kg, respectively. Data were analyzed using GLM to separate inter- and intra-experiment variances. Daily MEI (48.7 ±9.9 Mcal/d) was negatively linked to the dietary NDF (MEI = 72.3 - 0.693 NDF, n = 219, nexp = 88, R² = 0.90, RMSE = 15.3). Energy secreted as lactose was linearly linked to MEI (Elact = 2.40 + 0.0665 MEI, n = 80, nexp = 34, R² = 0.98, RMSE = 0.22), and the regression was similar for Eprot (Eprot = 1.18 + 0.074 MEI, n = 197, nexp = 78, R² = 0.98, RMSE = 0.23). The global and inter-experiment regressions were not statistically different, thus, the marginal efficiency of MEI transformation to Elact and Eprot is of 6.7 and 7.4% respectively. For energy secreted as fat, the relationship was curvilinear (Efat = - 3.20 + 0.45 MEI - 0.0038 MEI², n = 219, nexp = 88, R² = 0.95, RMSE = 0.59). Marginal efficiency of MEI to Efat decreased from 26% (MEI = 25) to - 8% (MEI = 70). Therefore the milk energy response was curvilinear (Emilk = 2.49 + 0.48 MEI - 0.0027 MEI², n = 219, nexp = 88, R² = 0.98, RMSE = 0.78). Energy balance (EB) was also curvilinearly related to MEI (EB = -3.3 - 0.23 MEI + 0.0062 MEI², n = 219, nexp = 88, R² = 0.94, RMSE = 1.09), and EB of zero was achieved for MEI = 50 Mcal/j. In conclusion, dietary NDF strongly influences energy partitioning in dairy cows through its impact on MEI.

Key Words: NDF, milk energy, energy partitioning