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SYMPOSIA AND ORAL SESSIONS

Beef Species II: Feed Intake and Efficiency

931 Energy cost of cows' grazing activity: Estimation in large plots. A. Brosh*, Z. Henkin, E. D. Ungar, A. Dolev, A. Orlov, Y. Shabtay, Y. Yehuda, and Y. Aharoni, *Beef Cattle Section, Newe Yaar Research Center*, *ARO, Israel*.

This study of 17 grazing beef cows on the herbage range was designed to compare previously published data of total daily energy expenditure (EE) and the energy cost of various activities measured in medium-size plots of 28 ha to those determined in larger plots of 145.8 and of 78 ha. Data were obtained by continuously monitoring EE using the heart-rate method and simultaneously monitoring the cows' location and activity with Global Positioning System (GPS) collars with motion sensors. The cows were monitored through March (lactating cows on high quality herbage), May (non-lactating cows on low quality herbage), and September (non-lactating cows on low quality herbage supplemented with poultry manure). These data were compared to previously published data that were determined on smaller plots. Three statistical models were evaluated, including one which was designated as a stepwise model. Across seasons the cows total daily EE (kJ•kgBW$^{-0.75}$•d^{-1}) ranged from 644 in September up to 1014 in March, and all activities together (grazing, standing and walking) ranged respectively from 58 to 66. The cows` daily vertical and horizontal locomotion ranged from 85 to 124 m and from 2.51 to 3.44 km, respectively. The time spent standing and grazing ranged from 6.6 to 9.0 h and from 7.4 to 11.7 h respectively; horizontal distance traveled while grazing ranged from 1551 to 2327 m/d. These data ranges and effect of month were similar to those measured in comparable months in medium plots. Plot size did not directly affect the duration of time the cows spent on each activity and consequently the energy cost of these activities. However, when the herbage was dry, cows in larger plots grazed longer and expended more energy on grazing activity, and probably consumed more herbage of significantly better quality than in medium plots, as was expressed by the greater daily energy expenditure.

Key Words: Grazing Cows, Energy Cost, Global Positioning System

932 Relationships among exit velocity, cortisol, and carcass characteristics of beef heifers. R. R. Reuter[1,2], J. D. Dailey*[2], J. A. Carroll[2], M. S. Brown[3], and M. L. Galyean[1], [1]*Texas Tech University*, *Lubbock*, [2]*USDA-ARS Livestock Issues Research Unit*, *Lubbock, TX*, [3]*West Texas A&M University*, *Canyon*.

One hundred ninety-nine crossbred beef heifer calves (205 ± 7.9 kg initial BW) were used in a 44-d receiving trial with 2 dietary treatments (9 pens/treatment) in a completely randomized design. Heifers were weighed and bled on d 0, 16, 30, and 44 after arrival. Blood was collected by jugular venipuncture, and serum was analyzed for cortisol, several cytokines, and 2 acute-phase proteins. Exit velocity was recorded by an electronic infrared timer system each time heifers were weighed. Animals were brought to the processing facility in pen groups of 10 to 12, and no effort was made to control processing sequence of individual animals. Exit velocity was not related ($P = 0.71$) to processing sequence. Repeatability of exit velocity was 77%. A trend was evident for a negative linear relationship between average exit velocity and 44-d ADG ($P = 0.08$) and for positive linear relationships between exit velocity and serum cortisol ($P = 0.10$) and interferon-gamma concentrations ($P = 0.13$). At d 44, the heifers were transported to a commercial feedlot, fed for 200 d, and individual carcass data were collected at slaughter. After controlling for treatment and pen effects, exit velocity, averaged over the 4 measurement times, was not related to carcass characteristics ($P > 0.23$) nor to ADG over the entire 240-d trial ($P = 0.92$). Although exit velocity measured during the receiving period seemed to be associated with increased serum cortisol and decreased ADG during the receiving period, it was not associated with ADG or carcass measurements after an extended feeding period. Thus, further research is needed to determine whether extended feeding periods during which cattle are not handled might mitigate deleterious effects of exit velocity on cattle performance.

Key Words: Beef Cattle, Carcass, Cortisol

933 Evaluation of a mathematical model to estimate total feed required for pen-fed animals based on performance and diet information. B. M. Bourg*[1], L. O. Tedeschi[1], and M. S. Brown[2], [1]*Texas A&M University*, *College Station*, [2]*West Texas A&M University*, *Canyon*.

The Cattle Value Discovery System (CVDS) was developed to predict growth and body composition based on animal, diet, and environment information, and to allocate feed to individual cattle fed in pens. The objective of this study was to evaluate the adequacy of CVDS in predicting total DM required (DMR) of pen-fed steers, based on either mean BW method (MBWM) or using the dynamic iterative growth

model (DIM). Steers (N= 1,314) used in this evaluation were fed in 173 pens for an average of 133 days on test, across 8 studies conducted at West Texas A&M University. Diet ME values ranged from 2.78 to 3.13 Mcal/kg DM. The CVDS model was used to predict individual DMR and to estimate total DMR of each pen. Model adequacy was analyzed using the Model Evaluation System (MES). The mean of observed DM allocated to pens was 10,258 kg and the mean pen DMR predicted by the CVDS was 10,630 and 10,267 kg for MBWM and DIM methods, respectively. The regression of observed on predicted values indicated a high precision of both methods (r^2 of 0.97) and no outliers were identified. The intercept and slopes of the regressions differed from zero and one simultaneously. Both methods had great accuracy based on the Cb value of 0.98 and 0.99 for MBWM and DIM methods, respectively. The mean biases were -3.5% ($P < 0.01$) and -0.08% (P=0.83) for MBWM and DIM methods, respectively. The balance analysis revealed that both methods tended to overpredict DMR for pens with greater than average DMI. The mean square error of prediction (MSEP) for the MBWM indicated that 26% of the error was attributed to mean bias, 30% to systematic bias, and only 44% to random error. For the DIM method, these values were 0.025%, 23%, and 77%, respectively. These results suggested that the CVDS model using either MBWM or DIM was highly precise and accurate in predicting DMR for pen-fed steers, but further work is needed to decrease mean and systematic biases when using the MBWM method and account for more of the random variation for the DIM method.

Key Words: Modeling, Feed Intake, Simulation

934 Genetic trends for feed intake, average daily gain, mid-test weight and residual feed intake in a population of Angus cattle selected for feed efficiency. D. P. Kirschten*[1], E. J. Pollak[1], D. R. Strohbehn[2], and D. Warden[3], [1]*Cornell University*, *Ithaca, NY*, [2]*Iowa State University*, *Ames*, [3]*Wardens Farm*, *Council Bluffs, IA*.

Wardens Farm of Council Bluffs, IA provides Angus bulls to area purebred and commercial breeders and AI companies. In business since 1964, Wardens Farm has tested yearling bulls for feed efficiency (FE) since 1981, accumulating feed intake (FI) records on over 450 animals. Wardens Farm uses a multiple trait approach to yearling bull evaluation with independent culling levels. Selection criteria are: weight per day of age (off test): > 1.36 kg, frame score: < 6.5, Ultrasound (US) fat thickness: < 1.02 cm, US intramuscular fat: > 3.0%, US ribeye area: > 80.6 cm2, FE ratio: > 100, birth weight: < 43 kg, and scrotal circumference: > 36 cm. Genetic parameters for FI, average daily gain (ADG), mid-test weight (MW) and residual feed intake (RFI) were estimated using records from 309 bulls with a pedigree population of 782 animals. Animals born before 1991 were not included in the genetic trend charts. Genetic trends for FI and RFI were variable until key sires were identified through progeny testing that were favorable for FE, while at the same time several sires were identified that were unfavorable for FE and were culled which allowed genetic trends to become evident. Also, increased capacity to measure FI in recent years has resulted in rapidly decreasing trends for FI and RFI. Selection has resulted in animals with increased genetic merit for ADG and MW with increased genetic merit (decreasing trends) for FI and RFI.

Table 1. Genetic Trends for Feed Intake, Residual Feed Intake, Average Daily Gain and Mid-test Weight, kg

Year	FI	RFI	ADG	MW
1991	-0.054	-0.008	0.002	0.09
1992	-0.057	-0.055	0.00	-1.15
1993	-0.143	-0.105	0.006	1.71
1994	-0.055	-0.064	0.01	1.16
1995	0.017	0.031	0.009	4.41
1996				
1997	0.00	-0.086	0.025	6.55
1998				
1999	0.042	-0.051	0.015	9.96
2000	-0.104	-0.187	0.00	7.47
2001	-0.069	-0.127	0.051	3.99
2002	0.039	-0.104	0.021	10.52
2003	-0.68	-0.217	0.081	9.90
2004	-0.182	-0.313	0.057	10.31

Records previous to 1991 and for the years 1996 and 1998 were not available for analysis.

Key Words: Feed Intake, Feed Efficiency, Beef Cattle

935 Relationship between residual feed intake and ultrasonic measures of body composition in yearling performance tested bulls. T. L. Perkins*, J. L. Drury, and A. Rimal, *Missouri State University*, *Springfield*.

Feed input is the greatest cost in livestock production. Residual feed intake is a measure of growth that can be used to select breeding animals, to reduce feed cost. Residual feed intake compares actual consumption and estimated feed consumption. Low or negative RFI values are present in animals that are efficient feed converters. The objectives of this study were to examine the relationship between residual feed intake (RFI) and ultrasound measurements taken at yearling weigh off period in performance tested bulls. One hundred forty-four registered bulls (n=144) were scanned ultrasonically for ribeye area (REAU), fat thickness (FTU), and percent fat (%FatU) at the conclusion of a 112 d feed test. The cattle used in this study were from the Greensprings Bull Test Station in Nevada, Missouri. Ultrasound measurements were taken at approximately one year of age at the end of the 112 d weigh off. All ultrasound measurements were taken by an Ultrasound Guidelines Council (UGC) field and laboratory certified technician using the Beef Image Analysis (BIA) image capturing software. All captured images were sent to and interpreted by the National CUP Lab in Ames, Iowa. Means and standard deviations for 112 d measures for on test weight (ONWT), off test weight (OFFWT), RFI, REAU, FTU, and %FatU were 384.95 ± 57.36 kg, 577.95 ± 63.30 kg, -0.20 ± 2.14, 93.87 ± 12.21 cm^2, 0.76 ± 0.26 cm, and 4.07 ± .87 %, respectively. Pearson correlations between RFI and OFFWT, REAU, FTU and %FatU 0.03, 0.08, 0.22 and 0.18, respectively; whereas, the correlation between RFI and feed consumption (KG FEED) was higher and more significant at 0.55. These coefficients indicate that RFI is a better indicator of yearling fat measures (FTU and %FatU) than muscle (REAU).

Key Words: Ultrasound, Residual Feed Intake, Bulls

936 Characterization of residual feed intake and relationships with serum insulin-like growth factor-I in growing Brangus heifers. P. A. Lancaster*[1], G. E. Carstesn[1], J. G. Lyons[1], T. H. Welsh, Jr.[1], R. D. Randel[2], and T. D. A. Forbes[3], [1]*Texas Agricultural Experiment Station*, *College Station*, [2]*Texas Agricultural Experiment Station*, *Overton*, [3]*Texas Agricultural Experiment Station*, *Uvalde*.

The objective of this study was to characterize residual feed intake (RFI) and examine phenotypic correlations with serum insulin-like growth factor-I (IGF-I) in growing heifers. Average (± SD) initial age and BW of Brangus heifers (Camp Cooley Ranch) were 225.8 ± 9.1, 236.0 ± 10.7 and 235.6 ± 14.6 d, and 285.1 ± 28.0, 268.5 ± 23.8 and 267.8 ± 25.8 kg for year 1 (N=114), 2 (N = 115) and 3 (N = 119), respectively. Heifers were individually fed a roughage based diet (ME = 2.1 Mcal/kg DM) using Calan gate feeders for 70 d. Weekly BW were measured and ultrasound measures of 12th rib fat thickness (BF) and longissimus muscle area (LMA) obtained at d 0 and 70. Whole blood was collected at weaning, and at d 0 and 70 of the intake measurement period, and serum assayed in duplicate aliquots for IGF-I by EIA procedures (IDS, Inc., Fountain Hills, AZ). RFI was computed as actual minus predicted DMI, with predicted DMI determined by linear regression of DMI on mid-test BW$^{.75}$ and ADG with year as a random effect using a variance component covariance structure (R2 = 0.57). Overall ADG, DMI and RFI were 0.90 ± 0.15, 1.06 ± 0.16 and 1.00 ± 0.13 kg/d, 9.10 ± 1.11, 9.47 ± 1.04 and 9.92 ± 1.06 kg/d, and 0.00 ± 0.75, 0.00 ± 0.68 and 0.00 ± 0.70 kg/d for year 1, 2 and 3, respectively. ADG was strongly correlated with FCR (-0.67), but not with RFI, whereas, DMI was correlated with both RFI (0.67) and FCR (0.17). In addition, RFI was strongly correlated with FCR (0.60). Heifers with low RFI (< 0.5 SD; n = 112) consumed 16% less (P < 0.01) DMI and had 15% lower (P < 0.01) FCR than heifers with high RFI (> 0.5 SD; n = 98), even though ADG and final BW were similar. Overall IGF-I concentrations were 113.3 ± 27.4, 121.0 ± 29.6 and 116.6 ± 28.7 ng/ml for weaning, d 0 and d 70 sampling times. RFI was not correlated with IGF-I concentration at any of the sampling times. However, weaning IGF-I concentration was weakly correlated (P < 0.05) with ADG (-0.11) and final BF (0.11) and LMA (0.17), but not with DMI or FCR. These data suggest serum IGF-I concentration may be indicative of growth, but not feed intake or efficiency in Brangus heifers.

Key Words: Residual Feed Intake, IGF-I

937 Feed efficiency and residual feed intake of Nelore young bulls selected for yearling weight. R. Almeida*[1], R. F. Nardon[2], A. G. Razook[2], L. A. Figueiredo[2], and D. P. D. Lanna[3], [1]*Universidade Federal do Paraná*, *Paraná, Brazil*, [2]*Instituto de Zootecnia*, *São Paulo, Brazil*, [3]*ESALQ/USP*, *São Paulo, Brazil*.

A Nelore herd at the Sertãozinho Experimental Station, São Paulo, Brazil has been selected for yearling weight for more than 25 years. The feedlot test used 72 young bulls from the 12-13-14th progenies of the Selection Program for Zebu Breeds. Thirty-six intact males from the Selected Nelore (NeS) line and 36 from the Control Nelore (NeC) line, with the same initial age of 13 months, were transferred to the feedlot and fed a high roughage diet and slaughtered at a similar age (19 months). Predicted DM intake and residual feed intake (RFI) were calculated from average intakes regressed on metabolic mid-test body weight, average daily gain and 9-11th rib fat content. RFI mean was 0.00 ± 0.41 kg/d, with minimum and maximum of -0.73 and +0.95 kg/d. Results confirm there is considerable variability for this trait in *Bos indicus*. NeS young bulls were heavier (P<0.01) at the beginning and at the end of the trial and grew faster (P<0.01) than NeC. NeS bulls had greater (P<0.01) DM intakes than NeC bulls: 8.18 vs 7.03 kg/d and 92.5 vs 87.5 g/kg BW$^{0.75}$. DMI expressed as a % of BW was not different (P>0.10) between NeS and NeC lines (2.08 vs 2.03% BW). When efficiency was analyzed as feed conversion, there were no (P>0.10) differences between the two lines. However, for RFI the NeS young bulls were less eficient and ate 0.263 kg/d more (P<0.05) than NeC. There were no (P>0.10) differences for EBW fat content between the two lines, compared at the same age, but NeC were much lighter than NeS (428 and 481 kg, respectively). Consequently, the estimated energy retained was similar (P>0.05): 5.23 and 5.27 Mcal/kg EBWG, respectively for NeC and NeS. While NeS young bulls retained 11.7% more energy per day, their heat production was 17.9% larger than NeC. Thus, NeS bulls had greater (P<0.10) maintenance requirements than the control line: 78.6 and 68.0 kcal/kg BW$^{0.75}$, respectively. In conclusion, results suggest that selection for yearling weight may increase heat production and maintenance requirement. Is is also shown that selection changes RFI, but it does not change feed conversion efficiency, when animals are fed to the same fat endpoint.

Key Words: Feed Conversion, Zebu Breed

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938 Genetic parameters estimation for Test Day Model evaluation in Italy. F. Canavesi* and S. Biffani, *ANAFI*, *Cremona, Italy*.

In November 2004 the first Italian genetic evaluation based on Test day random regression model (TDRRM) was published. The model is a Multiple-Trait-Multiple-Lactation model including four traits and three lactations for each trait. The four traits evaluated are milk, fat and protein kg and somatic cell counts. Genetic parameters used in the current model were estimated in 2003 (Muir et al, 2007). The estimated parameters were close to the parameters estimated for the same model in Canada. Heritability was close to the one used for the Lactation Repeatability model used in the past for official evaluations. Genetic correlations within trait and across traits were very similar to the parameters estimated for the same model in Canada. Research is ongoing in order to improve the stability of proofs over time and the predictive ability of the model. Pre adjustment of test day for number of days of pregnancy and the inclusion of the effect of single years in the fixed effect structure showed better results in residual analysis and a slight reduction in proof variability. The new model with pre-adjusted data was used to estimate genetic parameters with a four and three traits analysis. The three trait analysis did not consider somatic cell count. Estimations of genetic parameters of variances and covariances for the two models were achieved by Bayesian methods using the Gibbs sampler as described by Jamrozik and Schaeffer (2003). The four traits analysis resulted in very similar correlation within and across traits and a lower heritability (0.25) than the current used (0.30). The three traits analysis resulted in a higher correlations within traits across lactations very similar to correlations from single trait analysis (Muir, 2004) which may lead to a decrease in variability of proofs from run to run. Correlations between first and second lactation increased by about 0.06 and correlations between first and third lactation increased by 0.10. The new parameters are under test to verify their impact on stability of proofs.

Key Words: Genetic Parameters, Test Day Model, Multiple Trait