1 Trends in postweaning intake, gain and conversion of feed by young bulls in two herds over 28 years. C.J. Brown, Z. Johnson, O.T. Stallcup and A.H. Brown. Department of Animal Sciences, University of Arkansas, Fayetteville 72701.

Trend lines for average daily TDN intake, kg/d, (F), average daily gain, kg/d, (G) and the ratio of TDN intake to gain, kg/kg, (F/G) were developed for Hereford and Angus bulls that were individually fed in 140 day postweaning performance tests. Bulls were fed in 39 tests over a period of 28 years. All bulls were station reared with equal opportunity to develop prior to test. No supplemental feed was received prior to weaning. Weaning was near 210 days of age. The postweaning pretest adjustment was about 21 days. Records of 766 Angus and 636 Hereford bulls were analyzed. They were progeny of 39 Angus sires and 32 Hereford sires with two or more sons tested. In both herds sire selection procedures gave equal emphasis to preweaning gain, postweaning gain and feed conversion. Estimates of effects were obtained separately for each breed from a mixed model analysis with tests considered fixed, sires considered random and the linear effects of age and the linear and quadratic effects of initial weight included as covariates. The heritability estimates for F, G and F/G were .18±.06, .28±.07 and .20±.06 for Angus and .11±.08, .19±.09 and .36±.10 for Herefords, respectively. The trend of these performance traits were obtained from regression of test means from the above analysis on test number. The regression coefficients for F, G and F/G on test number were .0159±.0023, .0089±.0006 and -.0270±.0026, respectively for Angus and were .0048±.0018, .0101±.0006 and -.0369±.0019, respectively for Herefords. Associated with these indicators of improved performance was an increase in final weight. The regression of final test weight on test number was 1.47±.08, 2.20±.13 kg for Angus and Hereford, respectively. These trend lines indicate the change in F, G and F/G realized from selection emphasizing these traits.
KEY WORDS: Feed Intake, Feed Conversion, Beef Bulls, Postweaning Gain.

2 Predicting voluntary forage intake. J.P. Pienaar and C.Z. Roux, ADSRI, Irene, Republic of South Africa.

Voluntary forage intake can be obtained from a single equation involving rumen fill, passage and fermentation rates. Passage and fermentation rates, expressed in terms of mean retention times (MRT's), are combined mathematically to give a single estimate of MRT. Intake may then be calculated as the mass of OM in the rumen divided by the MRT of OM in the rumen. Gamma probability distributions are used to describe curves of marker passage and *in sacco* or *in vitro* fermentation curves and to calculate MRT's for these methods. The gamma MRT mathematical model has the advantage of an easy and unbiased method of fitting the curves and sufficient flexibility to accommodate a phase of increasing activity. This is in contrast with other methods which use a dead phase which changes instantaneously into a first-order phase of maximum activity. Formulas have been derived for the gamma function which accommodates simultaneous disappearance by means of passage and fermentation from a single pool of potentially fermentable substrate. For purpose of prediction, estimates of rumen fill may be obtained from the judicious use of its relationship with live mass. Reliable estimates of fermentation rates may be obtained by *in sacco* methods. In some cases outflow rates may be approximated by constant values.
KEY WORDS: Mathematical Model, Gamma Function, Voluntary Intake.

3 Relationship of body composition and feed intake of beef steers. J.C. Hyer, J.W. Oltjen and F.N. Owens. Oklahoma State University, Stillwater 74078.

Feed intake trends of feedlot steers were analyzed with respect to days on feed, body weight and body composition, with particular reference to the observed decline in feed intake which occurs as cattle near finished weight. Body composition was simulated using a dynamic computer growth model. Observations of dry matter intake and body weight were taken at 14 day intervals for 444 pens of beef steers. Growth model inputs included initial feedlot weight, condition score, frame size, sex, time on feed, energy concentration of the ration, an implant factor and feed intake. Pens of steers were grouped into five weight classes based on mean initial feedlot weight (228, 279, 322, 363 and 418 kg) and regression analysis was used to relate feed intake with days on feed, body weight and predicted body composition for each weight class. For all classes, feed intake increased to a plateau which was higher for steers with heavier starting weights ($P<.01$). Plateaus began at 63, 48, 45, 44 and 47 days for the 228, 279, 322, 363 and 418 kg groups, respectively. Intake declines were noted for all classes except the 228 kg class. Feed intake declined with fewer days on feed for steers with heavier initial weights ($P<.05$). Feed intake decreased at lower body weights for steers put on feed at lower initial weights. Intakes for all classes except the 228 kg group declined within a narrow range of predicted empty body composition: 31.6, 32.1, 33.1 and 31.5% fat for the 279, 322, 363 and 418 kg groups, respectively. These results suggest that body fat stores exert feedback control to reduce feed intake within narrow ranges of body composition in beef steers, regardless of initial starting weight.
KEY WORDS: Growth Model, Empty Body Fat, Feed Intake, Body Weight

4 Effects of diet fed in the growing period on feed intake and performance of finishing beef cattle. N.R. Merchen, D.E. Darden, L.L. Berger, G.C. Fahey, Jr., E.C. Titgemeyer and R.L. Fernando. University of Illinois, Urbana.

Two experiments were conducted to evaluate utilization of three crude protein sources (urea, soybean meal, corn gluten meal) in diets based on either corn silage (high energy, 2.71 Mcal ME/kg) or grass hay (low energy, 2.16 Mcal ME/kg). In each experiment 168 Simmental-cross steer calves (251 kg in Exp. 1, 227 kg in Exp. 2) were allotted to 12 diets, representing all combinations of energy level and protein source at 10.5 or 12% crude protein in a 2 x 2 x 3 factorial arrangement. In both experiments, steers fed the high energy level or 12% crude protein had improved ($P<.01$) daily gains and feed:gain over 84 d. Protein source had no effect ($P>.1$) on performance. Steers were fed experimental diets to a common weight (375 kg in Exp. 1, 364 kg in Exp. 2) and switched to a single 85% concentrate diet. One half of the steers fed each growing diet were slaughtered at each of two different times and finishing phase performance data were adjusted to a constant fat thickness. Energy level fed in the growing period had no effect ($P>.05$) on daily gain in the subsequent finishing period. However, cattle fed low energy diets in the growing period in both experiments consumed more ($P<.05$) feed (10.2 vs 9.2 kg DM/d in Exp. 1; 9.0 vs 8.3 kg DM/d in Exp. 2) and had poorer ($P<.05$) feed:gain (7.75 vs 6.87 in Exp. 1; 6.47 vs 5.61 in Exp. 2) in the finishing period than those fed high energy diets. Protein level and protein source fed in the growing period had no effect ($P>.05$) on performance in the finishing period.
KEY WORDS: Steers, Growing, Finishing, Energy, Feed Intake.

5 Bypass protein and rumen parameters in winter grazing beef cows. J.L. Miner, M.K. Petersen, R.W. Dunn and K.M. Havstad. Montana State University, Bozeman.

The effect of alternate day winter supplementation with rumen-degradable and rumen-bypass protein on rumen parameters was examined using 16 March calving range beef cows. Cows were allotted to four groups and supplemented with (g/d): none (control); 570 soybean meal (SOY); 450 soybean meal and 230 blood meal (SOY+BM); or 140 soybean meal, 16 urea and 450 corn gluten meal (SOY+CGM). Fecal output was measured via chromic oxide dilution and total collection. Each month in situ NDF fermentation rate of grazed forage was measured via nylon bags. Cobalt EDTA and Cr mordant were used to measure ruminal dilution rates. Ruminal ammonia and pH were measured with a meter at the intervals nylon bags were removed. Results indicated that bypass protein affected rumen parameters by a means other than recycled urea.

Item	Control	SOY	SOY+BM	SOY+CGM	SE
Winter 1: pH	6.9	6.8	6.4	6.4	.08
Ammonia, mg/dl	6.7	8.4	9.2	11.5	1.03
Fluid dilution, %/h	7.7	11.4	8.4	6.7	1.47
Fluid volume, liters	38.9	15.7	34.4	32.7	6.55
NDF fermentation, %/h	1.8	2.3	2.6	2.8	.18
Fecal output, % body wt/d	.54	.68	.86	.59	.04
Winter 2: pH	6.7	6.7	6.5	6.6	.08
Fluid dilution, %/h	9.0	8.7	6.9	7.2	1.01
Fluid volume, liters	27.6	33.8	41.3	42.1	5.00
Particulate dilution, %/h	3.1	3.5	2.3	2.7	.40
NDF fermentation, %/h	4.1	4.2	4.3	4.9	.27

6 Effect of limit feeding on performance of steers and heifers. R.B. Hicks, F.N. Owens, D.R. Gill, J.J. Martin and C.A. Strasia. Oklahoma State University, Stillwater 74078.

Two experiments were conducted to determine the effect of limit feeding on the performance of feedlot cattle. In experiment 1, 72 head of yearling steers (374 kg) were fed either ad libitum (AL) or 85% of ad libitum (LF) of a high wheat ration for 149 days. Actual observed DM intakes over the trial were 11.98 and 10.3 kg/hd/day, respectively for AL and LF steers. Restricted feeding reduced daily gains by 12.9% ($P<.10$), 4.5 and 7% respectively during the first 56 days, next 84 days and total 149 days. Gains for the total trial were 1.36 and 1.27 kg/hd/day, respectively for AL and LF. Feed conversion was decreased by 4.8% over the first 56 days and improved ($P<.05$) by 13.1% over the next 84 days. Overall, feed conversion was improved by 8.9% with restricted feeding (8.80 vs 8.02 kg feed/kg gain). The estimated ME value of the diet increased ($P<.10$) by 6.5% with restricted feeding. In experiment 2, 80 head of yearling heifers (328 kg) were fed either ad libitum or 89% of ad libitum of a high corn diet for 140 days. Actual observed DM intakes during the trial were 9.68 and 8.60 kg/hd/day for AL and LF heifers, respectively. Daily gains were reduced ($P<.10$) by 9.7% during the first 56 days and increased ($P<.05$) by 9.4% over the next 77 days. Over the total trial, gains were reduced by 3.1% with limit feeding (1.63 vs 1.58 kg/day). Feed efficiency was not affected during the first 56 days, but was improved ($P<.05$) by 19.8% during the next 77 days. Efficiency was improved ($P<.10$) by 8.7% over the total trial (5.96 vs 5.44 kg feed/kg gain). The estimated ME value of the diet was

increased (P<.10) by 6.4% with limit feeding. These studies indicate that limit feeding can improve feed efficiency of feedlot cattle.
KEY WORDS: Cattle, Feedlot, Limit Feeding, Wheat, Corn.

7 Repeatability and heritability of dry matter intake and production traits. J.M. Rakes and O.T. Stallcup, Animal Science Department, University of Arkansas, Fayetteville.

Feed intake and production data were analyzed on 204 Holstein and 103 Jersey cows milking in the University herds over a period of several years. Average dry matter intake (DMI) was 16.4±2.4 kg and 12.8±1.9 kg for Holsteins and Jerseys, respectively. Dry matter intake as a percent of body weight (DMBW) averaged 3.1±.5 and 3.4±.5 for Holsteins and Jerseys, respectively. Fat percent (FP) averaged 3.5±.4 and 5.3±.6. Body weight divided by 100 to milk ratio (BW:M) was 3.7±.8 and 3.4±.9 for Holsteins and Jerseys. Body weight divided by 100 to fat ratio (BW:F) was .14±.08 and .19±.08 for Holsteins and Jerseys. Correlations are reported in order: Pooled, Holstein and Jersey. Dry matter intake was correlated with (DMBW) r=.32, .55 and .75; Milk production (MP) r=.67, .46 and .50; (FP) r=-.53, .10 and .02; Fat per day per Kg body weight (FPBW) r=.41, .49 and .51; (BW:M) r=.28, .25 and .29; (BW:F) r=-.14, .21 and .08, respectively for Pooled, Holstein and Jersey data. Dry matter intake per Kg body weight was correlated with (DMI) r=.32, .55 and .75; (MP) r=.01, .13 and .41; (FP) r=.21, -.06 and .03; (FP:BW) r=.21, .11 and .45; (BW:M) r=.47, .51 and .54; (BW:F) r=.29, .21 and .23, respectively for Pooled, Holstein and Jersey data. Repeatabilities are reported, Holstein and Jersey; (DMI)=.56 and .56; (DMBW)=.52 and .63; (MP)=.58 and .58; (FP)=.26 and .08; (FPBW)=.26 and .59; (BWMP)=.47 and .54. Heritability of (DMI) calculated from full sibs using pooled data was h=.71; Holstein h=.38 and Jersey h=.88.
KEY WORDS: Dry Matter Intake, Body Weight, Production, Heritability, Repeatability.

8 Factors influencing dry matter intake in lactating cows. O.T. Stallcup, J.M. Rakes and Z. Johnson. Department of Animal Sciences, University of Arkansas, Fayetteville, 72701.

A digestion and milk production trial was conducted by individual feeding of 10 Holstein cows producing 21.4 kg milk/day for three-two week periods (N=30). Dry matter intake (DMI) averaged 3.27% of body weight (BW). DMI (kg/100kg BW)=7.57-.0360 $BW^{.75}$+.0574(Mcal DE intake -(.044x% digestion of energy). R^2=.98. Digestible energy intake (DEI, Mcal/day)=1.51+(.758x% digestion of energy)-(.194xgrain as % of DMI)+(.655xMcal energy in milk). R^2=.68. Data from individual feeding of 156 cows on high roughage diets containing hay, silage and grain were summarized and the following equations derived: DMI (kg/day)= 5.46+.0127 BW (kg)+.378(kg solids corrected milk(SCM)/day)-(.248xADG)-(.493xgrain as % of DMI). R^2=.67. DMI (kg/day)=.53+10.7(BW/1000)+.058$BW^{.75}$+.33 SCM (kg) R^2=.65. DMI (kg/day) =8.57+.011 BW (kg)-(.265 ADG)-(.0805x grain as % of DMI)+.359 SCM (kg/day)-(.085x% CF in DM)+.0247(Mcal DEI). R^2=.69. A predictive equation derived from individual feeding of 93 Holstein cows (N=413) was: DMI (kg/day)= 33.2+.0090 BW (kg)-(.160 ADG)-(.274x grain as % of DM)+.205SCM (kg/day)-(.903x% CF in DM)+.0886 (Mcal DEI). R^2=.68. A predictive equation derived from data on individual feeding of 63 Jersey cows (N=364) was: DMI (kg/day)=5.08+.0151 BW (kg)-(.67xADG)-(.148xgrain as % of DMI)+.691 SCM (kg/day)-.0056(Mcal DEI). R^2=.78. The coefficient of variation (CV) of DMI (kg/cow/day) was 11.8% and 14.3% for Holstein (N=413) and Jersey (N=364), respectively. The CV for DMI (% BW) was 18.2% and

12.0% for Holstein (N=413) and Jersey (N=364) cows, respectively. The data also indicate that CF, CP and grain as a % of ration DM have a curvilinear relationship to DMI (kg/day), with low to medium R^2 values. Cow responses to DMI are quite variable at any given level of CF, CP or grain as a % of DM due to combination and/or interaction of a number of factors including stage of lactation.
KEY WORDS: Dry Matter Intake, Lactating Cows, Milk, Body Weight

9 Meal attributes of cattle offered various hays. R.R. Worley, W.C. Ellis, D.B. McCarthy, J.M. LaBore and C.E. Gates. Texas A&M University, College Station 77843.

Meal attributes were measured during four, 12 hr feeding intervals (FI) utilizing seven crossbred yearling steers offered seven diets in a Youden Square design with 3 periods. Steers (230 kg) were offered chopped hay at 0700 and 1800 h consisting of either bermuda-grass hay (BG; 1st cutting); 3rd cutting BG (B2); B2 plus 600 g soybean meal/d (SBM); B2 previously treated with 3% NH_3 (B2N); B2N plus SBM; sorghum hay (S); S plus SBM. Measurements were collected utilizing feeders suspended from weigh cells connected to an Apple IIe computer. Weights were recorded into memory when 20 consecutive weights were within a specified range and if the mean weight (MW) differed from the previous MW and written to disc. Ten weights (wt) recorded at the initial and final periods of 10 min intervals were selected to correspond to other observations of jaw movements. The period wt data within each FI was then successively smoothed by: 1) rejecting weights which exceeded by 2.5 standard deviations (SD) the value in time predicted by a sixth order polynomial expressing weight vs. time; 2) rejecting individual weights exceeding 3.0 SD from the mean of the weight period; 3) repeating step 2 using 2.5 SD from the remaining weights; and 4) computing a mean weight of the remaining weights for each weight period. Termination of a meal was defined as no weight change over two consecutive weight periods. A difference in number of meals was observed due to diet (D), FI and an animal (A)*Period (P) *D interaction. Average duration of meals (MD) was affected ($P<.05$) by A, and the mean quantity of meals (MQ), mean intake/12 h and mean time spent eating differed ($P<.05$) for A, D, P, A*D*P and F. Animal, diet and P*A*D differences were observed ($P<.05$) for the MD and MQ of the first meal of each FI. Eating rate (g/min) was affected ($P<.05$) by P, A and D with no interactions observed. Results indicate complexity of factors affecting meal attributes.
KEY WORDS: Intake, Meals, Eating, Cattle.