period lengths decreased ATS_0 significantly, but not ATS_1. Binomial cusum charts with period lengths of 3 days detected true changes in pregnancy rate in general earlier than any other design or chart. For the 100-cow herd, ATS_1 (ATS_0 365 d) were 273 (B), 104 (C), 212 (D), and 106 (E) d. ATS_1 (ATS_0 730 d) were 422 (B), 127 (C), 332 (D), and 127 (E) d. For the 1000-cow herd, ATS_1 (ATS_0 365 d) were 130 (B), 53 (C), 78 (D), and 53 (E) d. ATS_1 (ATS_0 730 d) were 172 (B), 57 (C), 93 (D), and 57 (E) d. Binomial cusum charts should be considered when early detection of a true change in pregnancy rate is important.

Key Words: Statistical process control, Monitoring, Pregnancy rate

666 Weaning at the onset of the breeding season fails to improve hind performance traits in Red Deer. R. D. Randel*, S. A. Mozisek, D. A. Neuendorff, and A. W. Lewis, *Texas A&M University Agricultural Research & Extension Center, Overton, Texas USA*.

Suckling stimulus suppresses rebreeding performance in beef cows. This experiment was designed to determine if performance of Red Deer females was similarly altered. Twenty two lactating Red Deer hinds were randomly assigned to be weaned (W; n=11) or suckled (S; n=11) from September 25 (time of introduction of the breeding male) through November 20 (end of breeding season) with half of each group in one of two breeding pastures. Body weight, body condition score and a blood sample for progesterone analysis by RIA were collected at weekly intervals from September 4 through November 20. Body weights of the fawns were collected from September 25 (1st weaning date) through November 20 (2nd weaning date). All hinds were maintained on Coastal bermudagrass pastures and supplemented with .91 kg/hind/d of 2:1 ground corn:soybean meal and Coastal bermudagrass hay as needed. Weaned fawns grazed Coastal bermudagrass pastures overseeded with ryegrass and were supplemented with .45 kg/fawn/d of 2:1 corn:soybean meal. The fertile males were equipped with marking harnesses and the females were examined daily for estrus activity. Pregnancy was determined by ultrasonography 45 d after ending the breeding season. Weaning of the fawns on September 25 failed to improve ADG (W= -.11±.02 kg/d; S= -.12±.02 kg/d) or body condition (W =.02±.24; S = -.18±.24 units) of the hinds during the breeding season (P>.10). Pregnancy rates were identical (100%) in W and S hinds. Days from beginning stag exposure to conception were 15.4±3.5 d in W compared with 21.6±3.5 d in S (P=.23). Fawn ADG during the 56 d period of the breeding season was not different between W (.072±.012 kg/d) and S (.074±.011 kg/d) groups with all fawns gaining at similar rates. Early weaning failed to improve performance in the Red Deer female with 100% of each group conceiving during the 56 d breeding season. This may be related to the strong seasonality and possible male effect from the stag.

Key Words: Red Deer, Suckling, Reproduction

Ruminant Nutrition: Metabolism - modeling

667 Evaluation of empirical equations to predict microbial efficiency. A. M. Mueller*, L. M. Lake, M. R. Ellersieck, and M. S. Kerley, *University of Missouri-Columbia*.

The maximum efficiency of microbial growth in the rumen is a function of dilution rate (DR). The Beef NRC calculates microbial efficiency (MOEFF) based on the maintenance rate of the bacteria, the digestion rate of a feedstuff, and the theoretic maximum yield of the bacteria. The purpose of this study was to compare the experimentally determined MOEFF to the Beef NRC model prediction and a prediction calculated using particulate passage rate (PPR). Four ruminally fistulated and duodenally cannulated crossbred beef steers (591 ± 39 kg) were used in a 4x4 Latin square design. Treatment diets were pelleted, contained 77 % ground corn, 15 % cottonseed hulls, 0.4 % urea, and differed in source of supplimental protein. The diets contained 1) 7.4 % soybean meal (SBM); 2) 5.4 % fishmeal (FM); 3) 3.8 % bloodmeal (BM); or 4) 5.6 % corn gluten meal (CGM). Treatments were formulated to be isonitrogenous and isocaloric. Treatments had no affact ($P > 0.05$) on dry matter (DMI) or nitrogen (NI) intake, apparent total track dry matter digestability (DMD), true DMD, PPR, MOEFF (expressed as g bacterial N / kg organic matter truely fermented), ammonia-N, or VFA concentrations. The experimentally determined PPR was used to calculate MOEFF, which was not significantly ($P > 0.05$) different from the measured MOEFF. The Beef NRC predicted MOEFF was greater ($P < 0.07$) than the measured MOEFF. Using PPR to predict MOEFF more accurately estimated MOEFF than did the Beef NRC model.

Key Words: Microbial efficiency, Dilution rate, Beef NRC

668 Effect of RDP and roughage level on microbial efficiency in continuous culture. C. A. Willis* and M. S. Kerley, *Univeristy of Missouri-Columbia*.

Feeding strategies can manipulate the rumen environment to control volatile fatty acid (VFA) production and potentially alleviate the need for roughage in the diet. Six diets were evaluated using a continuous culture system to determine the effects of high or low rumen degradable protein (RDP) level with or without roughage on VFA production, digestibility, and microbial efficiency. All diets were corn-based, either cracked (CC) or ground (GC) corn. The RDP level was controlled by the addition of soybean meal (SBM). Low RDP diets contained no SBM and yielded an RDP of 4%. SBM was added to achieve a 14% RDP level, which coincides with the NRC guidelines for feedlot diets. Diets consisted of: 1) 4% RDP with CC and 15% hay, 2) 14% RDP with CC and 15% hay, 3) 4% RDP with CC, 4) 14% RDP with CC, 5) 4% RDP with GC, and 6) 14% RDP with GC. Cultures were acclimated to their diet for ten days and then followed by three days of sample collection. Concentrations of VFA and ammonia were determined and microbial efficiency calculated. The high RDP treatments resulted in higher VFA concentrations as compared to their low RDP counterparts ($P < 0.01$). Microbial efficiencies were greater for high RDP treatments versus low RDP treatments ($P < 0.01$). Diets that did not contain the 15% hay had significantly improved microbial efficiencies ($P < 0.01$). RDP level can be used to control organic acid production which could potentially reduce problems associated with feeding a 0% roughage diet. Removing roughage from the diet unexpectedly improved microbial efficiency.

Key Words: Microbial efficiency, RDP, No-roughage

669 Measuring ruminal pool size and duodenal flow of protozoal N using real-time PCR. J. T. Sylvester*[1], S. K. R. Karnati[1], M. L. M. Lima[2], J. L. Firkins[1], Z. Yu, and M. Morrison[1], [1] *The Ohio State University, Columbus, OH, USA*, [2] *Universidade Federal de Goiás, Goiânia, GO, Brasil*.

Studies evaluating the effects of protozoal ecology on ruminal N recycling and microbial N flow have been limited by availability of a protozoal marker. Current procedures have been either too laborious, not specific to protozoa, or have needed by-difference calculations using multiple markers with their own potential errors. The current objectives are 1) to evaluate a molecular-based assay using the 18S rRNA gene as a protozoal specific marker and 2) to report rumen N pool measurements and protozoal N flow predictions from two cows fed low (LF; 16%) or high (HF; 21%) forage NDF. Rumen pool size was determined from the average of two evacuations; duodenal DM flow, by INDF; and liquid dilution rate (LDR), from a pulsed dose of Li Co-EDTA. Rumen and duodenal samples were composited over 4 d. Rumen samples were quantitatively fractionated for protozoal enumeration and for enrichment of protozoa followed by DNA extraction. Ciliate protozoal specific PCR primers were used to amplify a 1.5-kb fragment of the 18S rRNA gene by conventional PCR for each sample and quantified for use as a standard. A second set of internal primers was used to amplify an approximate 300-bp fragment using real-time PCR to quantify the rDNA copies (i.e., amplicons) present in each ml of sample. Rumen protozoal N pool predictions were determined gravimetrically (i.e., protozoa/ml x ruminal fluid volume) and by multiplying the pool size or duodenal flow of rDNA copies x N/copies ratio of enriched protozoa. The bacterial N pool size and duodenal flow were determined by subtracting protozoal purines from the total purines [protozoal N x (purine/N in enriched protozoa)]. More replications are needed for further verification of the molecular method.

	Rumen N, g				Duodenal N flow, g/d	
	Protozoa		Bacteria		Protozoa	Bacteria
	Molecular	Gravimetric	Molecular	Gravimetric	Molecular	Molecular
LF	7.2	15.3	143.0	135.8	20.8	337.2
HF	27.4	23.8	189.8	192.8	49.9	366.9
SE	4.0	0.8	27.7	35.9	1.9	16.9
P value	0.07	0.08	0.35	0.46	0.06	0.43

Key Words: Rumen N pool, Protozoal N flow, Real-time PCR

670 Ruminal urease activity and fermentation traits as affected by urease-containing feed sources.

Q. X. Meng*[1] and X. M. Min[1], *China Agricultural University*.

Two in vitro experiments (Expt. 1 and Expt. 2) were conducted to determine the effect of urease-containing feed sources on ruminal urease activity and fermentation traits. In Expt 1, the traditional titration and the spectrophotometric assays were prepared in assessing urease activity of different origin of soybean products. The result showed that mean variations of urease activity for high activity samples were similar between two assays, whereas the variation for low activity samples was smaller (P<0.05) with spectrophotometric assay than titration assay. Using the latter assay, some feeds and rumen fluid samples available in the laboratory were ranged according to their urease activities: dehulled soybean> whole soybean> rumen fluid> soyhulls> alfalfa hay. In Expt 2, the effects of addition of urease-containing feed source on ruminal urease activity and ruminal fermentation traits were investigated using an in vitro gas production experiment. Raw soybean seeds meal and deactivated soybean seeds meal were mixed at ratio of 0%, 33%, 67% and 100%, and used as substrates of rumen fermentation. The incubation was lasted for 12 h. During incubation, urease activity for 0% raw soybean maintained smooth levels, while the activities for 33%, 67% and 100% raw soybean samples decreased with progressed incubation time. During the first 8 h inoculation, urease activities at all time points were significantly different among four treatments (P<0.006), suggesting a linear (P = 0.001) decrease in ruminal urease activity with incremental levels of raw soybean seeds. However, when incubation lasted up to 10 h, ruminal urease activities were almost kept equal levels for four treatments (P = 0.29). As raw soybean inclusion level increased, theoretically maximum gas production decreased (linear; P = 0.004) and gas producing rate increased (linear; P = 0.001). The inclusion of raw soybean seeds had no effect on digestibility of DM, pH values, NH_3-N concentrations and individual VFA profile (P>0.06).

Key Words: Urease activity, Rumen fermentation, Raw soybean seeds

671 Nutritional improvement of rice husks.

J. Vadiveloo, *MARA University of Technology*.

The objective of the study was to ascertain if the nutritional value of rice husks could be improved by chemical or biological means for feeding to ruminants.
Ground and whole husks were treated with 4% urea or 4% NaOH solution for 21 days at room temperature. Samples were dried to constant weight at 60°C and analysed for total ash (TA), neutral detergent fibre (NDF), ash insoluble in neutral detergent solution (IA), crude protein (CP) and in vitro dry matter digestibility (IVD). Untreated husks served as a control.
Ground and whole husks were fermented by the edible fungus, *Pleurotussajor-caju* without a nitrogen supplement (U), with palm kernel cake (PKC) or rice bran (RB) at 200g supplement/kg substrate or urea (UR) at 100g supplement/kg substrate. Standard mineral solution was added to achieve a moisture content of 70%. After incubation for 10 or 25 days at 25°C in the dark, the spent waste was dried analysed as above. Husks not inoculated with the fungus served as a control.
Untreated and urea-treated ground husks did not differ significantly in TA (13%), NDF (80%), IA (6%) or IVD (16%) but NaOH treatment reduced NDF (61%) and IA (3%) and improved IVD (49%). Urea treatment increased CP from 3% to 5% but NaOH treatment reduced CP to 2%. Differences between ground and whole husks were small.
Pleurotus grew only on the U, PKC and RB treatments, grew better on ground husks than whole husks and better after 25 days than 10 days. The TA, NDF, IA, IVD and CP of the U treatment of ground husks was respectively 15%, 81%, 9%, 17% and 3% at 0 days and 14%, 75%, 6%, 26% and 6% at 25 days. Between 0 and 25 days, the PKC treatment reduced NDF from 84% to 73%, IA from 7% to 5%, increased IVD from 16% to 29% but did not improve CP (5%). The RB treatment reduced NDF from 73% to 68%, IA from 6% to 5%, increased IVD from 23% to 34% and CP from 4% to 7%.
Pre-treatment with NaOH may not be practical because of cost and difficulties in handling. Solid-state fermentation retained organic matter and improved digestibility and protein content (U and RB treatments) or digestibility only (PKC treatment). Refinements in fermentation conditions may elicit further improvements in nutritional value.

Key Words: Rice husks, fermentation

672 Does level of dietary protein inclusion influence the ruminal degradability of the protein.

L. R. Legleiter* and M. S. Kerley, *Department of Animal Science, University of Missouri, Columbia*.

This experiment was designed to test the effect of undegradable protein (RUP) inclusion rate on ruminal degradability of the protein. Five ruminally and duodenally cannulated steers were used to measure site and extent of digestion. The five diets were basal (B) with no supplemental protein, basal + 2.4 % blood meal (BM-L), basal + 4.8 % blood meal (BM-H), basal + 4.3 % soybean meal (SBM-L) and basal + 8.6 % soybean meal (SBM-H). The BM-L and SBM-L diets were formulated to be isonitrogenous; likewise, BM-H and SBM-H were isonitrogenous. The experiment consisted of five, 10-d experimental periods, including a 7-d acclimation period followed by 3-d of sampling for each period. Steers were weighed at the beginning of each period and fed 1.9 % of BW per day to minimize orts. Chromium oxide, ytterbium-labeled cracked corn and cobalt-EDTA markers were used to determine digestibility, solids dilution rate and liquid dilution rate, respectively. Ruminal and duodenal samples were taken every 6-h with sampling times advanced 2-h each day so that every 2-h were represented over a 24-h period. Ruminal ammonia concentration was higher (P < 0.05) for SBM-H due to increased degradable protein. Treatment did not affect microbial efficiency (g of N/ kg OM truly digested) with averages of 15.4, 16.8, 15.4 and 22.1 for BM-L, BM-H, SBM-L and SBM-H, respectively. Proteolytic activity, VFA production, and digestibility were not affected (P > 0.05) by treatment. Solids dilution rate was not affected (P > 0.05) by level of protein, however, liquid dilution rate was lowest for BM-H. The % RUP of BM-L was not different (P > 0.05) from the % RUP of BM-H with values of 61.7 % and 54.8 % respectively. Likewise, the % RUP was not different (P > 0.05) for SBM-L at 47.7 % than SBM-H at 45.9 %Ẇe concluded that increasing dietary inclusion rate of RUP would not influence the RUP value of the protein source.

Key Words: Bloodmeal, Rumen undegradable protein, Digestibility

673 Dry matter and protein digestibility of alfalfa hay or silage in the rumen and intestine of steer measured by mobile nylon bag technique.

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The present study was carried out to evaluate DM and CP digestibility of alfalfa hay and alfalfa silage (treated with urea and/or sulfuric acid). Second cut alfalfa (about 27% DM) was harvested, left on the ground for 8 h before ensiling or 2 days for drying. The chopped alfalfa was ensiled with urea (0.0 and 1%,DM) and/or sulfuric acid (0.0 and 1.5%,DM) in a complete randomized design (T_1: alfalfa silage, T_2:T_1+ 1.5% acid, T_3: T_1+ 1% urea, T_4:T_1+ 1% urea+ 1.5% acid,T_5: alfalfa hay). The ruminal and post ruminal disappearances of DM and CP were determined using the mobile nylon bag technique in four Holstein steers (40015,kg) fitted with rumen fistula and T- shaped cannnula. For each treatment, ten bags (3×6 cm, 1.2 g DM of each sample) incubated in the rumen for 12 h. Then,the bags were removed and washed in running cold water. The bags containing intact samples (10 bags for each treatment) were inserted into small intestine, via the cannnula (one bag every 30 min), then removed from the voided feces, washed in cold running water. Finally, the bags were dried in a forced air oven (58°C, for 24 h) and weighed to determine DM disappearance. The Ruminal and intestinal disappearance results are shown in the Table. Both ruminal DM and protein digestibility of afalfa were significantly influencd by the teatments (P< 0.05). It seems that urea and sulfhuric acid may influence the digestible parameters of alfalfa silage in both rumen and intestine. So, it has been concluded that they might be used as good preservatives in alfalfa silage.

Items	T_1	T_2	T_3	T_4	T_5	SEM	P
Disappearance in Rumen							
DM	444	456	479	451	531	38	*
Protein	858	839	738	815	703	69	*
Disappearance in Intestine							
DM	426	435	382	427	441	37	ns
Protein	917	909	922	930	902	42	ns

* $P<0.05$

Key Words: Alfalfa silage, Additives, Digestibility

674 Rumen degradation and intestinal digestibility of crude protein and amino acids from tropical forages. L. Miranda*[1], N. Rodriguez[2], R. Sainz[3], E. Pereria[4], M. Gontijo Netto[5], C. Veloso[6], A. Queiroz[7], and P. Fernandes[8], [1]*FEAD-Minas, Brazil,* [2]*Universidade Federal Minas Gerais, Brazil,* [3]*University of California-Davis, USA,* [4]*Universidade Estadual Oeste Parana, Brazil,* [5]*EMBRAPA Gado de Corte, Brazil.*

Ruminal degradation and intestinal digestibility of rumen undegradable protein (RUDP) and individual amino acids (AA) were determined in leaves of perennial soybean (PS) (Neonotonia wightii) and leucaena (L) (Leucaena leucocephala). In situ ruminal degradation was determined at 6, 18 and 48 hours incubation times and intestinal digestibility of the RUDP was determined on the 18 h residue by a three-stage procedure. All samples were analyzed by HPLC after acid hydrolysis or peroxidation followed by acid hydrolysis. L showed the largest amount of RUDP consequently, lower degradation of the AA among the forages. PS was the forage that showed a high intestinal digestibility of CP and total and individual AA. Therefore, one of the reasons for the low intestinal digestibility of the residues of rumen incubation could be due to the high ruminal degradation of the forages. The forage that supplied the largest content of RUDPD (percentage CP or g/kg DM) was the leucaena, due to the ruminal escape, and to the intestinal digestibility (23.56 percentage). In PS the intestinal digestibility of total amino acids was larger than that of the protein, however in L they were similar (24.04 and 23.56, respectively). Histidine and Cystine were the amino acids that showed the largest intestinal digestibility in L (48.79 percentage) and PS, respectively. Results demonstrate that the intestinal digestibility of the CP does not always predict with accuracy the intestinal digestibility of individual AA. The perennial soybean presented the highest intestinal digestibility for histidine (76.40 percentage of CP). Results showed that protein and AA non-degraded in the rumen have variable intestinal digestibilities.

Key Words: Amino acid, Tropical forage, ADIP amino acid profile

675 A model of net removal of amino acids from blood and absorptive supplies by portal drained viscera in the cow. M. D. Hanigan*[1], C. K. Reynolds[2], F. E. Standaert[1], and J. D. Sutton[2], [1]*Purina Mills, LLC, St. Louis, MO,* [2]*The University of Reading, Reading, UK.*

A more complete understanding of amino acid (AA) metabolism by the various tissues of the body is required to improve upon current prediction systems. Models of rumen, liver, and mammary AA metabolism have been constructed. The objective of this work was to construct and parameterize a model of net AA absorption and utilization by the portal-drained viscera (PDV). Six catheterized, late lactation cows fed grass silage, grass pellets, and concentrate (20:20:60, DM basis, 15.4% CP) were infused abomasally (via a rumen cannula) with 0, 200, 400, or 600 g of casein for 10 d in a 6 X 4 Latin Square design with 3 wk periods. Net PDV flux of amino acids was measured hourly (n=6) on the last day of each infusion. A net uptake model was derived from that described by Hanigan et al. (1998): $C_P = (C_A F_A + DC_D C_D F_D + DC_I C_I F_I) / (K + F_A)$, where C, F, and DC represented concentration, flow, and digestion coefficient, respectively. K represented the rate parameter for net removal by PDV, and the subscripts A, D, I, and P represented arterial, duodenal, infusate, and portal, respectively. F_D was predicted using the model of Clark et al. (1992) and C_D was derived from the literature. K was derived for each AA by fitting to observed portal AA concentrations where C_A, F_A, C_I, and F_I were measured inputs. Milk yield (14.8 kg/d: $P<0.04$) and milk protein (41.4 g/kg; $P<0.07$) responded quadratically to infusion amount. Arterial concentrations of a number of essential AA increased linearly ($P<0.10$) with respect to infusion amount. When assuming $DC_I=0.95$, the minimum value for DC_D was found to be 0.8. PDV removal of AA was linearly related to supply ($P<0.01$), and extraction percentages ranged from 0.5 to 7.25% for essential AA. Prediction errors for CP ranged from 4 to 9%. When setting $DC_D=0.8$, net removal of AA by PDV was adequate to support endogenous losses at the terminal ileum that were 21% of total ileal protein flow if 100% of the total net losses to the PDV appeared at the ileum.

Key Words: Portal-drained viscera, Amino acid, Model

676 A concordance coefficient to compare model predictions to observed data. N. R. St-Pierre*[1], *The Ohio State University, Columbus.*

Mathematical models are frequently used to quantify complex systems. The validation of such models is done by comparing model predictions to observed data. Various statistical methods have been used to assess a model's validity: the Pearson correlation coefficient, the paired t-test, the least-square analysis of slope (=1) and intercept (=0), and the coefficient of variation or the intraclass correlation coefficient. None of these can completely assess the desired reproducibility characteristics. The Pearson correlation coefficient only measures precision of a linear relationship, not accuracy. Both the paired t-test and least squares analysis can falsely reject (accept) the hypothesis of high agreement when the residual error is small (large). The coefficient of variation and the intraclass correlation coefficient assume a dependent and an independent variable. More importantly, they fail to recognize the duality (interchangeability) of predictions with observations. Both are transforms of measurements. Both have random errors from measurements and parameter estimates. And both have structural errors due to the simplification of the complex real world. The relevant question is not whether a model predicts observed data but whether the model and the observation method measure the same thing. This requires a joint assessment of precision and accuracy. A single scaled statistic called concordance correlation coefficient (CCC) is suggested. Let Y_1 be the observed values and Y_2 be the predictions. The concordance correlation coefficient $\rho^c = 1 \# \{E(Y_1\text{-}Y_2)^2 / E[(Y_1 - Y_2) — Y_1, Y_2 \text{ are uncorrelated}]\} = 2 \sigma_{12} / [\sigma^2{}_1 + \sigma^2{}_2 + (\mu_1 - \mu_2)^2] = \rho_{12} \chi_{12}$, where $\mu_1 = E(Y_1)$, $\mu_2 = E(Y_2)$, $\sigma^2{}_1 = Var(Y_1)$, $\sigma^2{}_2 = Var(Y_2)$, and $\sigma_{12} = Cov(Y_1, Y_2) = \sigma_1 \sigma_2 \rho_{12}$. The CCC is a product of two components: precision (ρ_{12}) and accuracy (χ_{12}), where $\chi_{12} = 2 \sigma_1 \sigma_2 / [\sigma^2{}_1 + \sigma^2{}_2 + (\mu_1 - \mu_2)^2] = [(\nu_{12} + 1/\nu_{12} + u^2{}_{12}) / 2]^{-1}$, with $\nu_{12} = \sigma_1 / \sigma_2$ representing scale shift, and $u_{12} = (\mu_1 - \mu_2) / (\sigma_1 \sigma_2)^{1/2}$ representing location shift relative to the scale. Application to the NRC(2001) dataset of measured and predicted microbial N flow to the duodenum shows that measurements and predictions are concordant but lack precision.

Key Words: Concordance coefficient, Model validation