W256 Temperament, assessed upon feedlot entry, did not impact performance of Texas A&M Ranch to Rail steers. K. O. Curley, Jr.*[1], J. J. Cleere[2], J. C. Paschal[3], T. H. Welsh, Jr.[1], and R. D. Randel[4], [1]*Texas Agricultural Experiment Station*, *College Station*, [2]*Texas Cooperative Extension*, *College Station*, [3]*Texas Cooperative Extension*, *Corpus Christi*, [4]*Texas Agricultural Experiment Station*, *Overton*.

As poor temperament negatively impacts multiple facets of cattle production an investigation of the linkage between cattle behavior and economic endpoints within the beef industry is warranted. The objective of this study was to identify any relationship of exit velocity (EV) measures obtained at entry to the feedlot with subsequent growth performance. Exit velocity measured during processing of 161 steers at a south Texas feedlot was utilized to identify calm (C; those slower than 0.5 SD below the mean EV; n = 55) and temperamental (T; those faster than 0.5 SD above the mean EV; n = 49) steers. At this time the cattle were weighed, tagged, implanted, vaccinated and sorted by weight (45 kg increments) into lots for feeding. Cattle were evaluated for USDA frame and muscle score and assigned an initial value. Animals were from various ranches (n = 6) and of variable breed types, both ranch of origin and Brahman influence (identified as greater than 1/8) were incorporated into statistical analyses. Linkage between temperament and stress physiology was confirmed as serum cortisol concentrations differed ($P < 0.01$; C = 6.40 ± 1.59, T = 11.77 ± 1.59 ng/ml) with temperament. Initial BW differed ($P < 0.01$) with temperament as the calm steers were heavier upon arrival to the feed yard (C = 310 ± 17, T = 256 ± 17 kg). The length of the feeding period differed ($P < 0.05$) with temperament as temperamental steers were fed longer (C = 207.0 ± 2.0, T = 214.0 ± 2.0 d). Weight gain of the steers differed with temperament ($P < 0.01$; C = 280 ± 15, T = 324 ± 15 kg), but the final BW did not ($P = 0.53$). While the initial value was greater for the calm steers ($P < 0.02$; C = $576.65 ± 27.30, T = $508.11 ± 27.30) the compensatory gain exhibited by the temperamental cattle contributed to no difference ($P = 0.94$) in the net income received from each of the temperament groups. Although temperament appraisals at weaning have been identified as a possible indicator of post-weaning growth, exit velocity measured upon arrival to the feedlot was not indicative of steer performance during the feeding period.

Key Words: Temperament, Exit Velocity, Feedlot Performance

W257 Effect of frame score on performance and carcass characteristics of steers finished in the feedlot or backgrounded for various time on pasture and finished in the feedlot. H. Koknaroglu[1], T. Akunal[1], T. Purevjav*[2], and M.P. Hoffman[2], [1]*Suleyman Demirel University*, *Isparta, Turkey*, [2]*Iowa State University*, *Ames*.

A three-year study integrating pasture and drylot feeding systems was used to examine effect of frame score on performance and carcass characteristics of steers. Each year, 84 fall-born and 28 spring-born calves of similar genotypes were used. Fall-born and spring-born calves were started on test in May and October, respectively. Treatments were: 1) fall-born calves directly into feedlot; 2 and 3) fall-born calves put on pasture with or without an ionophore and moved to the feedlot at the end of July; 4 and 5) fall-born calves put on pasture with or without an ionophore and moved to the feedlot at the end of October; 6 and 7) spring-born calves put on pasture with or without an ionophore and moved to the feedlot at the end of October. Frame scores were determined by taking steersâ€™ age and live weight into consideration. Cattle that grazed the same duration on pasture were regarded as the same treatment regardless of whether they received an ionophore or not. In the feedlot, steers were provided an 82% concentrate diet containing whole-shelled corn, ground alfalfa hay, and a protein, vitamin and mineral supplement containing ionophore and molasses. Pens of cattle were harvested at approximately 522 kg. Cattle having a higher frame score at the entry to pasture and grazed until July and October tended to have higher and lower daily gain on pasture than those having lower frame score, respectively ($P>0.05$). Fall-born and spring-born cattle grazed until October, which had higher frame scores at the entry to pasture tended to have higher daily gain in the feedlot showing a compensatory growth. In the feedlot, within each treatment cattle having higher frame score tended to have higher daily gain ($P>0.05$) and had higher dry matter intake ($P<0.05$). Results showed that cattle with higher frame scores had higher growth potentials in the feedlot and if the grazing season is extended then daily gain of cattle having higher frame score decreases.

Key Words: Feedlot Cattle, Frame Score, Pasture

Ruminant Nutrition III

W258 Biological treatment of peanut hay as ruminant feed. B. Borhami*[1], S. Soliman[2], M. EL-Adawy[1], E. Ghonaim[2], M. Yacout[3], and H. Gado[4], [1]*Department of Animal Production, Faculty of Agriculture, Alexandria Univ.*, *Alexandria, Egypt*, [2]*Central Lab for food and Feed (CLFF), Ministry of Agriculture, Dokki*, *Gizza, Egypt*, [3]*Animal Production Research Institute, Ministry of Agriculture, Dokki*, *Gizza, Egypt*, [4]*Department of Animal Production, Faculty of Agriculture, Ain Shams Univ.*, *Cario, Egypt*.

This work was carried out to evaluate the effect of two biological treatments on the nutritive value of peanut hay (PNH). Three Barki rams and three ewes (fitted with permanent rumen fistula) were used for the digestibility and rumen fermentation trials, respectively. Six crossbred Friesian cows were used for the lactation trial. All animal were fed a restricted amount of commercial concentrate and ad libitum PNH either untreated (control) or treated with Tricoderma viride or ZAD probiotic. Higher crude protein content and higher losses in fiber, except for hemicellulose, were observed with the treated PNH. Total digestible nutrients ranged between 55.8 and 64.62% for control or fungi treated diets, respectively. Highest values of nitrogen balance were observed with the ZAD probiotic diet and the lowest value was observed in sheep fed the control diet. Rumen ammonia concentration and its rates of production were significantly ($P<0.05$) higher with ZAD probiotic. VFA were significantly higher ($P<0.05$) with fungi treatment than other diets. Milk production was increased with the fungi and ZAD diet. Biological treatment leads to increase milk fat and total solids compared with the control diet. Long term feeding of such material with analysis of metabolites (blood and milk) of animals fed such material is necessary.

Key Words: Biological, Sheep, Peanut Hay

W259 Predicting intake of maize stover by sheep using near infrared reflectance spectroscopy. S. Fernandez-Rivera*, D. Negassa, J. Hanson, and G. Gebremariam, *International Livestock Research Institute*, *Addis Ababa, Ethiopia*.

Near infrared reflectance spectroscopy (NIRS) equations were developed to predict digestible organic matter intake (DOMI, g/kg $LW^{0.75}$) of maize stover by sheep. Stover or husk from eight maize cultivars grown in three field replicates in 2003 and stover from 12 cultivars grown in four field replicates in 2004 were used in three growth trials of 83-98 d. Diets consisted of 80% stover or husk and 20% supplement, contained 10.5% CP and were offered ad libitum to allow stover refusals of 20-25%. Nine or 12 individually fed sheep were used per cultivar (three sheep per field replicate). Sixty-eight diets were used for calibration and 28 for validation. Three samples were prepared for each diet: 1) WS, consisting of whole stover or husk; 2) SS, consisting of WS sieved to remove the exact proportion of stover refused in an attempt to account for the effect of diet selectivity; and 3) SS+S, made of SS and supplement in the proportions consumed by the sheep. Absorbance was determined from 1100 to 2498 nm at intervals of 2 nm in a FOSS NIR System Model 5000. Principal component analyses using a mathematical treatment 1, 4, 4, 1 were used for calibration. Best calibration parameters were obtained with WS (Table 1). Validation R^2 and SE of predictions (SEP) were 0.82 and 2.81 for WS; 0.82 and 3.04 for SS; and 0.87 and 2.34 for SS+S. DOMI of validation diets was predicted with acceptable levels of precision using WS. No gain in precision was observed by using SS, but R^2 increased by 0.05 and SEP decreased by 0.47 by sieving the residue and adding the supplement in the proportions consumed.

Table 1.

	WS	SS	SS+S
n	68	68	67
SEC	1.98	2.29	2.18
R^2	0.89	0.85	0.85
SECV	2.06	2.40	2.34

SEC=SE of calibration; SECV=SE of cross-validation

Key Words: Maize, NIRS, Sheep

W260 Energy costs of steam-flaking corn with different chemical grain conditioning agents. A. T. Moore*[1], C. R. Richardson[1], J. M. Harris[2], G. V. Pollard[3], and D. C. Boyles[1], [1]*Texas Tech University*, *Lubbock*, [2]*Westway Feed Products, Inc.*, *Tomball, TX*, [3]*Texas State University*, *San Marcos*.

The effects of the addition of water only, or grain conditioning agents on the electrical and gas energy costs to steam-flake corn were determined in a randomized block design. Treatments were: A-water; B-Sur-Flake®; C-whey plus Sur-Flake; D-glycerol plus Sur-Flake; and E-whey plus glycerol plus Sur-Flake. Treatments were evaluated by time block during days (A.M. and P.M. blocks) and were randomly steam-flaked across five days, for a total of 50 determinations. U.S. No. 2 grade corn was obtained in one quantity through the local grain trade in the High Plains area of Texas. Corn was cleaned with a scalper cleaner prior to the conditioning and steam-flaking. All treatments were added to 45.5 kg batches of corn by mixing of six percentage points of moisture and left to stand for 18 h before steam-flaking. The conditioned grains were steamed for 20 min in a 15.24 cm diameter round chamber. Immediately after steaming, treatments were flaked and electrical energy usage was measured. Gas used for generating steam was the same ($.862 per 45.5 kg) for each treatment batch and was used to calculate total energy costs for processing. Electrical energy costs for flaking were not different (P = 0.845) as analyzed by SAS. In conclusion, type of grain conditioning agent may affect rate of moisture uptake, economics of the flaking process, and durability of flakes. Results from this experiment show that electrical energy costs of flaking varied by as much as 11%.

Table 1. Total electrical and gas cost ;per 45.5 kg

Treatment	Block A	Block B
A	$.991	$1.009
B	$.984	$.986
C	$1.007	$1.007
D	$.996	$.996
E	$1.006	$1.002

Key Words: Steam-Flaking, Corn, Grain Conditioners

W261 Determining optimum density of steam-flaked corn for feedlot heifers. M. L. May*, M. J. Quinn, B. E. Depenbush, and J. S. Drouillard, *Kansas State University*, *Manhattan*.

The purpose of the experiment was to determine optimum density (FD) of steam-flaked corn for beef finishing diets. Diets consisted of corn flaked to densities of 360, 411, or 462 g/L (28, 32 or 36 lb/bu, respectively). Cattle were randomly allotted to 48 feedlot pens (16 pens per treatment) with 6 to 8 animals in each pen (n=358; initial BW = 337 ± 1.22 kg). Animals were fed finishing diets for 115 d. There were no significant differences among treatments with respect to DMI; ADG; efficiency; carcass weight; dressing percent; quality grade; yield grade; fat over the 12th rib; kidney, pelvic, and heart fat; or longissimus muscle area (P > 0.10), though performance was numerically decreased when corn was less extensively processed. Mill efficiency improved as density of flaked grain increased (P < 0.01), which was driven primarily by increases in mill throughput. Particle size of processed corn and the complete diets increased as FD increased (P < 0.01). Percentages of available starch were 46.73, 39.27, and 34.87 for FD of 360, 411, and 462 g/L, respectively (P < 0.01). The increase in mill production would support increasing FD; however decreases in animal performance, though small, may offset economic benefits attributed to greater mill capacity.

Table 1.

Item	28	32	36	SEM	P-Value
DMI, kg	7.63	7.67	7.70	0.08	0.81
ADG, kg	1.29	1.27	1.27	0.04	0.55
G:F	0.169	0.166	0.161	0.004	0.31
HCW, kg	308	307	305	2.27	0.72
Choice, %	61.0	54.5	58.2	4.98	0.65
Yield grade, avg	2.69	2.62	2.75	0.06	0.29
Processing, kg/hr	2224	2536	3397	281.08	<0.01
Diet particle size, µm	2290	4420	4565	284.08	<0.01
Flake particle size, µm	6163	6565	7000	55.23	<0.01

Key Words: Steam-Flaked Corn, Finishing Cattle

W262 Influence of dietary crude protein concentration on pancreatic α-amylase and trypsin activities in feedlot steers. K. C. Swanson*, H. Salim, Y. Wang, S. Holligan, M. Z. Fan, and B. W. McBride, *University of Guelph*, *Guelph, ON, Canada*.

Twenty-four yearling beef steers (initial BW=510±4.9 kg) predominately of Angus breeding were used in a randomized complete block design to determine the effect of dietary CP concentration on pancreatic α-amylase and trypsin activities. Treatment diets were formulated to contain 8.8, 11.0, 13.2, and 15.4% CP. Soybean meal and TOP SOY™ (bypass soybean meal) were used as supplemental protein sources to assure that metabolizable protein intake was increased with increasing dietary CP concentrations. Steers were individually fed at 2.5×NE_m requirement using Calan gates. Steers were penned in groups of four (1 per treatment) and fed experimental diets for 28 d before tissue collection. Four steers (1 pen) were slaughtered per wk. Pancreata were weighed, subsampled, frozen in liquid N, and stored at -80°C until analyses for protein, and α-amylase, and trypsin activities. Pancreatic weight (g and g/kg BW) did not differ between treatment groups. Pancreatic protein (mg/g and g/pancreas) increased linearly (P≤0.09) with increasing dietary CP concentration. Pancreatic α-amylase activity (U/g, U/g protein, U/pancreas, and U/g pancreas/kg BW) increased linearly (P≤0.01) with increasing dietary CP concentration. Pancreatic α-amylase activity (U/g, U/g protein, U/pancreas, and U/g pancreas/kg BW) also tended to respond quadratically (P≤0.15) with the greatest α-amylase activity observed in the 13.2% CP treatment. Pancreatic trypsin activity (U/g, U/g protein, U/pancreas, and U/pancreas/kg BW) increased linearly (P≤0.09) with increasing dietary CP concentration. These data indicate that increasing dietary CP concentration increases the concentration and content of pancreatic α-amylase and trypsin activities which may increase the capacity to digest starch and protein in the small intestine. However, this response may plateau for α-amylase as high dietary CP concentration (15.4% CP) did not elicit an additional increase in the concentration or content of α-amylase.

Key Words: Feedlot Cattle, α-Amylase, Trypsin

W263 Effects of dexamethasone administration and Revalor-S® on growth, carcass characteristics and visceral organ and fat mass of finishing beef steers. S. E. Kitts*, C. C. Taylor-Edwards, D. B. Edwards, J. B. Cannon, A. F. Beckemeyer, K. E. Earing, D. L. Harmon, E. S. Vanzant, and K. R. McLeod, *University of Kentucky*, *Lexington*.

Administation of dexamethasone (DEX), a synthetic glucocorticoid, has been shown to alter site and rate of fat accretion in several mammalian species, including cattle. Accordingly, this experiment was designed to determine the potential interaction between DEX and trenbolone acetate/estradiol (Revalor-S®) administration on growth performance, carcass characteristics and visceral organ and fat mass of finishing beef steers. One hundred forty-four crossbred steers (428 ± 4 kg) were assigned randomly to a 2 x 2 factorial arrangement of treatments consisting of either no implant or Revalor-S® implant on d 1 and either no or i.m. injection of 0.09 mg/kg BW DEX on d 1, 28, and 56. Steers received ad libitum amounts of a 90:10 concentrate-forage diet during the feeding period and were slaughtered (n=112) on d 84 for determination of carcass quality. A subset of steers (8/treatment) was slaughtered on d 84 and 86 for determination of visceral organ and fat mass. Over the feeding period, DMI (0.4 kg/d) and efficiency of gain (16%) were greater ($P \leq 0.05$) in steers receiving implant compared to those receiving no implant. In the presence of implant, DEX reduced ADG, whereas in the absence of implant, DEX had no effect (interaction, $P = 0.05$). There were no effects of treatment on carcass characteristics except DEX tended to increase ($P = 0.10$) dressing percentage. Steers receiving implants tended ($P = 0.10$) to have heavier rumen + reticulum weights as a percentage of empty BW compared to those receiving no implant. Administration of DEX increased ($P \leq 0.05$) liver and pancreas weights as a function of empty BW and increased omental fat mass for steers in the absence, but not the presence of implant (interaction, $P = 0.006$). In summary, Revalor-S® increased DMI and efficiency of gain; however, DEX partially attenuated the positive effects of implant on ADG and increased omental fat mass in the absence of implant.

Key Words: Cattle, Dexamethasone, Implant

W264 Effects of ractopamine HCl and steroid implants on feedlot performance and carcass characteristics of cull beef cows. K. W. Harborth*, T. T. Marston, J. A. Unruh, and B. J. Johnson, *Kansas State University*, *Manhattan*.

The marketing of cull cows can potentially contribute 10-25% of cow/calf operations gross income. Increasing the lean tissue and quality grade of cull cows could increase their market potential profitability. A study was conducted utilizing thirty-two open crossbred cows in a 2 × 2 factorial experiment to determine the effects of feeding ractopamine HCl (Optaflexx®, Elanco, at 300 mg•head- 1•d-1 for 28 d) and steroid implants (Revalor® 200, Intervet, 60d) on feedlot performance and carcass composition. Cows were blocked by weight (heavy and light) and randomly assigned to one of four serial slaughter groups. Following a warm-up period cows were individually fed an ad libitum 86% concentrate diet (CP = 14.63%, NEm = 2.12 Mcal/kg, NEg = 1.46 Mcal/kg) for 60 d. Within slaughter groups cows were allotted to treatment combinations. The combinations were: 1) Control (no implant or ractopamine HCl); 2) Implant (implanted only); 3) ractopamine HCl (ractopamine fed only); or 4) Combination (implanted and fed ractopamine). There were no significant differences in average daily. Implanted cows had greater dressing percentages (P = 0.06), and red meat yields 10 kg greater than non implanted cows (P = 0.06). Optaflexx treated cows had greater kidney, pelvic, heart fat percentages (P = 0.05). This study showed that implanting cull cows with Revalor-200 and/or feeding ractopamine HCl during the last 28 days on feed had minimal effects on performance and carcass characteristics of cull cows fed a high concentrate diet for 60 d.

Key Words: Cull Cows, Ractopamine, Steroid Implants

W265 Effect of age on feedlot performance and carcass characteristics of cull beef cows. K. W. Harborth*, T. T. Marston, J. A. Unruh, and B. J. Johnson, *Kansas State University*, *Manhattan*.

Data from thirty-one open crossbred cull beef cows fed a high concentrate diet for 60 d was used to investigate the effect of cow age on live animal performance, carcass composition, and subprimal yield. Cows were sorted into two age groups young (≤ 5 years of age, n= 16) and mature (≥ 6 years of age, n = 15). Mature cows were only slightly heavier than young cows initially. Young cows gained 0.9 kg/d more

than mature cows (P = 0.001). Young cows had greater DDMI, and feed efficiencies (P ≤ 0.05) during the duration of a 60 d feeding period. Young cows had heavier hot carcass weights (P < 0.001), and greater dressing percentages (P < 0.001) than older cows. Young cows had larger longissimus muscle area (P < 0.001) than mature cows. There were no differences between young and mature cows for adjusted 12th fat rib fat thickness and USDA yield grade. Young cows had greater quality grades (P = 0.001) primarily because of lower maturity scores (P < 0.01). Young cows also had greater ribeye roll, strip loin, tenderloin, inside round, outside round, eye of round, and knuckle weights when compared to mature cows. While there was no difference in lean trim weights (P = 0.51) between mature and young cows, young cows had significantly greater fat trim weights (P = 0.02) which may have influenced the difference in dressing percentage. Mature cows had greater initial values due to their weight advantage (P < 0.01), but younger cows had lower cost of gains (P < 0.01), greater final live market (P < 0.01) and net values (P < 0.01) when compared to the mature cows. These data indicate young cull cows were more profitable in a 60 d feeding period than older, mature cows.

Key Words: Cull Beef Cows, Age, Feedlot Performance

W266 Adding neem oil to a feedlot diet modulated proportions of volatile fatty acids and increased microbial protein synthesis in a continuous culture. W. Z. Yang*[1], J. Laurain[2], and B. Ametaj[3], [1]*Research Centre, Agriculture and Agri-Food Canada*, *Lethbridge, Alberta, Canada*, [2]*National Engineering School of Agronomy and Food Sciences*, *Nancy, France*, [3]*Department of Agricultural, Food and Nutritional Science, University of Alberta*, *Edmonton, Alberta, Canada*.

Neem oil is a commercialized product that has been shown to have antibacterial, antifungal and antiparasitic activities in different species. A dual effluent continuous culture system was used to investigate the effects of addition of neem oil in a feedlot diet on rumen fermentation, digestibility and microbial protein synthesis. The experiment was designed as a replicated 3 x 3 Latin square with the following treatments: control (no neem oil), low (3%) and high (6%) level of neem oil (DM basis). The experimental diet consisted of 84% barley grain, 9% barley silage, and 7% supplement (DM basis). Mean ruminal pH (6.08) and total VFA (82.1 m*M*) concentration were not affected by supplementation of neem oil. However, increasing the amount of neem oil tended to decrease ($P < 0.10$) proportion of acetate (45, 44, and 40%), increased ($P < 0.09$) proportion of butyrate (6.3, 6.9, and 9.5%) and had no affect on proportion of propionate (45%) for control, low and high levels of neem oil, respectively. As a result, the ratio of acetate to propionate decreased numerically ($P < 0.15$) with increasing the amount of neem oil. Ruminal digestibilities of DM (79, 77, and 70%), NDF (65, 64, and 56%) and starch (89, 85 and 82%) decreased ($P < 0.01$), whereas degradability of N (66, 82, and 74%) was increased ($P < 0.06$) in relation to the amount of neem oil added. Supplementing 3% neem oil increased microbial protein synthesis by 25% with no further increase with the addition of 6% neem oil. These results indicate that adding 3% neem oil in a feedlot diet modulated VFA profiles as well as increased ruminal N degradation and microbial protein synthesis. Increasing further the amount of neem oil (i.e., at 6%) had no beneficial effect on ruminal digestion.

Key Words: Neem Oil, Fermentation, Continuous Culture

W267 Fat tissue deposition and plasma hormone concentrations in early Angus–Nellore cattle treated with recombinant bovine somatotropin (rbST). C. L. Martins, R. C. Cervieri, M. D. B. Arrigoni, A. C. Silveira, C. A. Oliveira, D. D. Millen*, R. D. L. Pacheco, H. N. Oliveira, and L. A. L. Chardulo, *FMVZ/UNESP Botucatu*, *São Paulo, Brazil*.

The objective was to study the response of rbST on fat tissue deposition and plasma concentrations (PC) of thyroid hormones (T3 and T4), IGF–I and leptin (LE) in early Angus–Nellore cattle. We used 40 male calves, 20 d old, supplemented with creep feed until weaning (WE), and divided in two groups(n=20, 0.10mg/hd/d, every 14 d; n=20, not treated). The animals were weaned at 210 d old and fed in feedlot (FE), where they were housed and divided in four treatments keeping the same dose every 14 d until 100 d prior to slaughter (n=10, treated with rbST before and after WE; n=10, treated with rbST until WE; n=10, treated with rbST after WE; n=10, not treated with rbST). Back fat thickness (BFT) by ultrasound and PC were measured every 28 d. BFT did not differ (P>0.05) in the WE and FE periods (1.0 and 5.3mm, respectively). Treated calves presented higher (P<0.05) IGF–I and T4 PC (282.38 vs. 171.88ng/ml and 8.16 vs. 7.22µg/dL, respectively) than animals not treated in the end of the WE period, but PC in the FE period did not show significance for any treatments. For LE, no significant effect of the treatments and theirs interactions were observed (P>0.05), showing a constant PC during the experimental period. But, the LE concentration increased from the beginning to the end of the experiment (P<0.05), independent of treatments (3.098 vs. 7.996ng/mL) and fat tissue amount (P<0.05), from 18.7% (WE period) to 30.4% (FE period). T3 concentration did not differ (rbST=2.563 vs. Control=2.227µg/dL) in the WE period, but differed (P<0.05) in the FE period, when the animals which received rbST in the WE period presented a lower T3 concentration. We did not observe a correlation among BFT, T3, T4, IGF–I and LE in the periods tested. In the WE period the rbST showed advantage for not altering the fat tissue deposition. The hormones studied showed normal secretion as the animals got older, with increasing LE concentration as the BFT got thicker. Leptin showed to be a good metabolic indicator of animal adiposity, being able to be utilized to predict body condition score.

Key Words: Hormones, rbST

W268 Influence of concentrate supplements on performance of grazing growing steers during the dry season, in tropical pastures. R. H. T. B. Goes*[1], R. P. Lana[2], D. D. Alves[3], A. B. Mancio[2], and T. B. Freitas[2], [1]*Universidade Federal da Grande Dourados*, *Dourados, MS, Brasil*, [2]*Universidade Federal de Viçosa*, *Viçosa, MG. Brasil*, [3]*Universidade Estadual de Montes Claros*, *Janauba, MG, Brasil*.

The experiment was conducted to evaluated the effects of supplements on performance of growing cattle, in *Brachiaria brizantha* cv Marandu pasture during the dry season. Fifty-four crossbred, castrated steers, with initial weight of 271 kg, were distributed at random in five paddocks of 60.000 m^2. The supplements were fed at crescent levels of 0, 0.4, 0.80, 1.8 and 2.60 kg of supplement/animal/day, and were based in a mineral mixture (100, 16, 8.0, 4.0 and 2.0%), urea (0, 18, 17, 7 and 7 %), soybean meal and corn meal. The protein sources were used in the amount necessary to reach approximately a diet of 13% of crude protein. The animals were weighted at intervals of the 21 days. The average daily gain (ADG) in function of the supplement levels presented a linearly response (ADG = 0.132x + 0.151, $r^2 = 0.84$), with

the supplemetal levels affecting positively the average daily gain of the animals, in order of the 0.132 kg/animal/day. The supplement efficiency (kg of supplement as fed/kg of ADG), obtained by a reciprocal of the coefficients of the linear regressions, were 7.6:1. The pasture intake (IP) were linearly reduced by the crescent supplemental levels (IP = 4.87 - 3.10x, r^2 = 0.84), by the way the total dry matter intake didn't not influenced by the concentrated levels, with a medium value of 4.8 kg/animal/day. The high cost of concentrate feeds compared to the pasture and the low efficiency of the concentrated conversion in weight gain even under tropical pastures can explain the use of concentrate by Brazilian farmers, which can have a greater probability for a low cattle performance.

Key Words: Cattle, Concentrate Conversion, Growth Rate

W269 Energy levels in multiple supplements for finishing beef cattle grazing *Brachiaria brizantha* pasture during the rainy to dry transition season. M. F. L. Sales, M. F. Paulino, P. V. R. Paulino*, M. O. Porto, and S. de Campos Valadares Filho, *Universidade Federal de Viçosa*, *Viçosa, MG, Brazil*.

The effects of increasing energy levels in multiple supplements for finishing beef cattle grazing *Brachiaria brizantha* cv. Marandu on performance and nutritional parameters were evaluated, during the rainy to dry transition season of the year 2004. For the performance trial, twenty four crossbred bulls, 18 month old and 330 kg of initial body weight (BW), were used, being distributed, randomly, into four paddocks of 1.5 ha each. Four treatments were evaluated: mineral salt (MS) and corn and whole soybean based supplements offered in 3 increasing allowance levels: 1.0; 1.5 and 2.0 kg/head/d, allowing TDN intake of, respectively, 0.832; 1.163 and 1.496 kg/head/d. There was detected a positive linear effect of the energy levels in the supplements on the average daily gain and on the final body weight (P<0.10). The nutritional parameters were assessed in a concomitant trial, in which four crossbred steers, 300 kg BW, fitted with esophageal, ruminal and abomasal cannula, and fed similar diets of those of the performance trial were used. There was not observed any effect of supplementation (P>0.05) on dry matter intake (DMI), although it was detected a linear reduction in forage intake (P<0.05) as the supplementation allowance increased. The organic matter intake of the pasture and the NDF intake of the total diet and of the pasture decreased linearly (P<0.05) as the energy level of the supplementation increased. There were no effects (P>0.05) of supplementation levels on the apparent digestibilities of any nutrients, except for crude protein (CP), which showed a quadratic response (P<0.05) to increasing level of supplementation. Additional weight gain, ranging from 20 to 30%, can be obtained in beef cattle supplemented with increasing amounts of energy during the period herein analyzed. However, those gains are due to substitution of supplement for forage.

Key Words: Beef Cattle, Supplementation, Pasture

W270 Effect of two buffers on nutrient digestibilities and rumina fermentation in Holstein steers. O. D. Montañez-Valdez*[1], E. O. Garcia-Flores[2], J. R. Barcena-Gama[3], S. S. Gonzalez- Muñoz[3], M. E. Ortega-Cerrilla[3], J. G. Peralta-Ortiz[3], and J. H. Avellaneda-Cevallos[4], [1]*Centro Universitario del Sur de la Universidad de Guadalajara*, *Ciudad Guzmán, Jalisco, México*, [2]*Centro Universitario del la Costa Sur de la Universidad de Guadalajara*, *Autlán, Jalisco, México*, [3]*Colegio de Postgraduados*, *Montecillos, Estado de México, México*, [4]*Universidad Técnica Estatal de Quevedo*, *Quevedo, Los Ríos, Ecuador*.

The effect of sodium bicarbonate (SB) and a commercial buffer (Acid Buf® AB; *Lithothamnium calcareum*; Celticsea Minerales. Srano Farm, Currabinny, Carrigaline, Co. Cork, Irlanda) on the *in situ* digestibility of DM, NDF and ruminal fermentation was evaluated. Five Holstein steers (BW 450±15 kg) fitted with rumen cannula were randomly assigned to a 5 × 5 latin square and housed in individual pens. Each period was 15 d, 10 d for adaptation to diets and 5 d for samples collection. Diet had 70% concentrate (47% ground sorghum, 8% soybean meal, 7% molasses cane, 6.8% corn gluten meal and 1.2% mineral premix) and 30 % forage (15% alfalfa hay and 15% corn silage) with addition of SB or AB. The treatments were: T1) control; T2) 1% SB; T3) 0.35% AB; T4) 0.50% AB; T5) 0.65% AB. There were no differences (P> 0.05) among treatments on *in situ* digestibility of DM, NDF or cellulolityc bacteria concentration. The ruminal pH was different among treatments (P≤ 0.05), the highest pH values were for T3 (6.35), as compared with T1 (5.98) and T2 (6.14). The rumen protozoa concentration was increased by AB (P≤ 0.05) in T3 ($7.71x10^6$) as compared with SB treatment (5.26×10^6) and control treatment (5.06×10^6). The use of these buffers on concentrate diets did not affect the *in situ* digestibility of MS and NDF, but improved ruminal pH and enhanced the rumen protozoa development.

Key Words: *In Situ* Digestibility, Diets, Buffers

W271 Phase feeding strategies to meet metabolizable amino acid requirements of calf-fed Holstein steers. R. A. Zinn[1], J. F. Calderón[2], L. Corona[3], A. Plascencia[2], M. F. Montaño[2], and N. Torrentera*[2], [1]*University of California, Davis*, *El Centro*, [2]*Universidad Autonoma de Baja California*, *Mexicali, B.C. Mexico*, [3]*Universidad Autonoma de Mexico*, *Mexico, D.F.*

One hundred eight Holstein steer calves (114 kg) were used to evaluate effects of phase feeding metabolizable amino acids (**MAA**) on growth performance and carcass characteristics. Three feeding strategies were evaluated: 1) control, single phase feeding (single urea-based growing finishing diet that meets MAA requirements for the overall feeding period); 2) two-phase feeding (diet formulated to meet the average MAA requirements for the first 112 d on feed, and thereafter, finished on the control urea-based diet) and 3) three-phase feeding (two diets during the first and second 56-d feedlot feeding periods, and thereafter cattle were finished on the urea-based diet). Growth performances among different phases were not different (P > 0.20). Multiple-phase feeding increased ADG (18%, P< 0.01), DMI (4%, P<0.05) and observed/expected dietary NE (16%, P<0.01) during the first 112 d of the study. From d 112 to slaughter there were no treatment effects (P > 0.20) on growth performance. However, multiple-phase feeding increased overall (351-d) ADG (6.3%, P < 0.01), DMI (3.7%, P < 0.10), gain efficiency (2.8%, P < 0.01), and observed/expected dietary NE (3.4%, P < 0.01). Multiple phase-feeding increased hot carcass weight (5.2%, P < 0.01), dressing percentage (1.0%, P < 0.10), fat thickness (25%, P < 0.05) and longissimus muscle (LM) area (8.8%, P < 0.05). Thus, observed dietary NEg was similar (96%) to expected for the two- and three-phase programs during the first 112 d, while it was only 83% of expected for the single-phase program. It is concluded that a two-phase feeding program, where diets for calf-fed

Holstein steers are formulated to meet the average MAA requirements for optimal growth rate, until 280 kg live weight, and from 280 kg until slaughter will enhance overall ADG, gain efficiency, and energetic efficiency compared with a conventional single-phase feeding program. Methionine, lysine and histidine appear to be the first limiting amino acids during the first feeding phase. During the second phase (280 kg to slaughter), supply of all MAA acids will exceed requirements, even where urea is the sole source of supplemental N.

Key Words: Amino Acid, Holstein Steer, Phase Feeding

W272 Relationships between feed efficiency, carcass and ultrasound traits in Angus beef cattle divergently selected for serum IGF–I concentration. 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 phenotypic correlations with carcass and ultrasound traits in Angus bulls and heifers divergently selected for serum IGF–I concentration. Individual DMI were measured in Angus bulls (n = 27) and heifers (n = 29) fed a corn-based diet (ME = 2.85 Mcal/kg) for 70 d using Calan gates. Body weight was measured at 14–d intervals. Ultrasound back fat (**UBF**) and *longissimus* muscle area (**ULMA**) were measured on start and end of test. Cattle were harvested at the end of the test and carcass longissimus muscle area (**CLMA**) and back fat (**CFT**) were collected. Residual feed intake (**RFI**) was computed as the residuals from the linear regression of DMI on mid-test $BW^{0.75}$ and ADG with gender and interactions in the model. Overall mean (± SD) ADG, DMI and RFI were 1.78 ± 0.26, 10.47 ± 1.22, and 0.0 ± 0.70 kg/d for bulls and 1.30 ± 0.15, 9.43 ± 1.14, and 0.0 ± 0.64 kg/d for heifers, respectively. There were no significant differences in ADG, DMI, BW or feed efficiency traits between low and high IGF–I lines. Calves selected for low IGF–I had less (P<0.05) UBF, but similar ULMA at the end of the test than high IGF–I calves. As expected, heifers consumed less feed, grew slower, had a greater feed conversion ratio (**FCR**), and were fatter than bulls. Residual feed intake was correlated with DMI (0.57), and FCR (0.53) but not ADG. Initial BW (0.50) and UBF (0.29) were correlated with FCR, but not RFI, suggesting that calves with lower FCR were lighter and leaner at the start of the test. Final UBF and ULMA were not correlated with RFI or FCR, however carcass marbling score (0.44) was correlated to FCR. These results suggest that RFI was less influenced by rate and composition of growth, and BW compared to FCR. Divergent selection for serum IGF–I had no effect on performance or feed efficiency in Angus calves.

Key Words: Ultrasound, Residual Feed Intake, Feed Conversion Ratio

W273 Feed efficiency of beef cows and its progeny during the preweaning interval[1]. T. Z. Albertini[2], S. R. de Medeiros[3], R. A. de A. Torres, Jr.[3], A. R. D. L. Sousa[3], F. A. Biberg[3], and D. P. D. Lanna*[2], [1]*Fapesp, Embrapa*, [2]*ESALQ-USP*, *Piracicaba, SP, Brazil*, [3]*Embrapa Beef Cattle*, *Campo Grande, MS, Brazil*.

In this experiment the feed efficiency of non-pregnant lactating beef cows and their progeny was determined. Cow/calf pairs were individually fed from just after birth (17±5 d SD) to weaning at 211 d. Adult cows evaluated were 10 Caracu × Nelore and 10 Angus × Nelore that were bred to Red Angus and Canchim (5/8 Charolais) bulls, respectively. The diet (2.30±0.04 Mcal ME/kg and 12.4±0.9% CP) was fed in variable amounts and adjusted every 28 d in order to maintain weight and body scores. The same diet was offered *ad libitum* to the calves. Milk production was determined by milking each cow at 47, 75, 104, 132, 160, 188 and 216 d postpartum. Correlations among efficiency indexes were evaluated using MANOVA option of Proc GLM in SAS. The model included the effects: time at start of feeding period, genetic group, sex and age of calf at beginning of the experiment. Metabolizable energy intake (MEI) means for the progeny, derived from milk and from the solid diet, were 1504.3 (± 170.5 SD; 11.3% CV) and 595.0 Mcal (± 121.8 SD; 20.5% CV), respectively. Efficiency of calves was 85.1 g LWG_{210d}/Mcal of total MEI (milk+solid diet; ± 6.8 SD; 8.0% CV). Efficiency of cow/calf pairs was 34.9 g LWG_{210d}/Mcal MEI (± 4.3 SD; 12.3% CV) using total cow and calf solid diet intake. Phenotypical correlations showed association between the efficiency of calves and MEI from milk (r=-0.73; P<0.01) and between progeny efficiency and total MEI (intake of milk+solid diet; r=-0.74; P<0.01). Moreover, there was correlation (y = -0.0548x + 60.95) between the live weight of cows and the efficiency of cow/calf (r=-0.69; P<0.01). There was correlation between ME for maintenance (Mcal ME/$BW^{0.75}$) and BW of cows (r=0.58; P<0.05). In conclusion, heavier cows were associated with greater maintenance requirements and lower cow/calf pair efficiencies. It was also demonstrated a negative association between calf milk consumption and calf efficiency.

Key Words: Growth, Bioenergetics, Milk

W274 Body composition and net protein and energy requirements of steers from four zebu and zebu × B. taurus crossbreds[1]. R. Silva Goulart[2], E. Benno Pott[3], M. Mello de Alencar[3], G. Maria da Cruz[3], R. Tullio[3], and D. Pazzanese Duarte Lanna*[2], [1]*FAPESP, USP, Embrapa*, [2]*ESALQ/USP*, *Piracicaba, SP, Brazil*, [3]*Embrapa*, *Sao Carlos, SP, Brazil*.

The objective of this study was to determine body composition and net protein and energy requirements of four genetic groups: purebred Nelore (NE) and Aberdeen Angus × Nelore (AN), Canchim (5/8 Charolais) × Nelore (CN) and Simmental × Nelore (SN) crossbreds. Forty seven steers, 22 mo of age and 310 kg of BW, were evaluated in a completely randomized design. The comparative slaughter method was used with 16 animals slaughtered for baseline. EB composition was estimated from the 9-11th rib cut composition using specific equations developed for each genetic group. Diet was based on corn silage, corn and soybean meal, with 13.3% CP and 68.7% TDN, and was fed for a 101-d period. Data were analyzed by proc GLM of SAS, with effects of genetic groups. Results are presented in Table. There was no difference (P>0.05) between AN (428±9 kg) and SN (410±12 kg) in final empty body weight; also weight of CN (389±10 kg), NE (390±11 kg), and SN (410±12 kg) were similar. Steers of AN and SN groups had a greater proportion of ether extract and a smaller percentage of water in the empty body at slaughter. Cattle from SN and AN groups presented greater protein requirements than CN and NE. Steers of the AN group had the highest requirements of net energy for gain. Aberdeen Angus x Nelore cattle needed more energy and more protein than purebred Nelore steers.

Table 1. Empty body composition of Nelore (NE) and crossbreds (Angus, AN; Canchim, CN; and Simmental, SN) steers

Variables	AN	CN	NE	SN	Standar Error
Composition					
Water (%)	56.8[b]	58.1[a]	58.3[a]	55.5[b]	.46
Ether extract (%)	22.6[a]	20.6[b]	20.4[b]	22.3[a]	.54
Protein (%)	16.6[c]	17.1[b]	^17.1[b]	17.8[a]	.07
Ash (%)	4.1[c]	4.2[b]	4.2[b]	4.4[a]	.01
Energy (Mcal/kg)	3.1[a]	2.9[b]	2.9[b]	3.1[a]	.04
Net requirements for gain					
Energy (Mcal/kg of EBW)	4.70[a]	4.45[bc]	4.08[c]	4.50[b]	.16
Protein (kg/kg of EBW)	0.14[a]	0,142[c]	0.153[b]	0,164[a]	.003

[abc] Means with different superscripts differ (P<.05)

Key Words: Body Composition, Nelore Crossbred, Tissue Deposition Rates

W275 Relationship between residual feed intake, water intake and ultrasound body composition traits in Angus bulls. G. R. Hansen*[1], G. E. Carstens[2], and D. G. Riley[3], [1]*University of Florida NFREC*, *Marianna*, [2]*Texas A & M University*, *College Station*, [3]*USDA-ARS STARS*, *Brooksville, Fl.*

The objective was to examine the relationship between residual feed intake (RFI), water intake (WI), feed conversion ratio (FCR), initial feed consumption (IFC—total intake for first 2 wk prior to 70-d trial) and real time ultrasound body composition traits (RTUS) in 9-mo-old Angus bulls (n=126). Bulls were produced using embryo transfer at a private farm and moved to a GrowSafe feeding facility in summer 2006. Individual daily feed intake (DMI), daily WI and BW (every 2 wk) were obtained during a 70-d feeding trial. RTUS were measured on d 70. RFI was calculated by regressing dry matter intake on ADG and mid-test $BW^{.75}$. Bulls were assigned to high (bull RFI > mean + 0.5 SD), medium (bull RFI between mean ± ? 0.5 SD) and low (bull RFI < mean – 0.5 SD) RFI groups. ADG, DMI and RFI were 1.54 ± 0.28 kg/d, 10.63 ± 1.73 kg/d and 0.00 ± 1.39, respectively. Low, medium and high RFI groups differed (P<0.05) for IFC. Low RFI bulls consumed 19.9 % less feed (P<0.001) and 32.4 % less water (P<0.001) than high RFI bulls. There were no differences for ADG, % IMF, or ribeye area among RFI groups. Beginning scrotal circumference (d -14) was greater (P<0.05) in high RFI bulls than low or medium groups. Residuals were generated for traits by adjusting for pen, age, sire and dam effects. Residual correlations were calculated using residual values. FCR was associated with RFI using simple (0.61) and residual (0.40) correlations.

Table 1. Correlations among traits for Angus bulls

	RFI	WI	Ribfat	DMI	IFC
RFI	--	0.43	0.44	0.73	0.59
WI	0.33	--	0.23	0.40	0.23
Ribfat	0.33	0.29	--	0.33	0.38
DMI	0.52	0.40	0.27	--	0.71
IFC	0.38	0.24	0.37	0.58	--

Simple correlations above diagonal and residual correlations below diagonal

Key Words: Feed Efficiency, Residual Feed Intake, Carcass Traits

W276 Effect of yeast culture on 28-day performance of newly weaned, low-stress beef calves. C. R. Belknap*[1], R. R. Scott[2], and J. C. Forcherio[2], [1]*Diamond V Mills*, *Cedar Rapids, IA*, [2]*LongView Animal Nutrition Center*, *Gray Summit, MO*.

The objective of this study was to determine the effect of yeast culture (Diamond V XPC™ Yeast Culture, Diamond V Mills) on 28-d post-weaning performance when fed to ranch-weaned calves that had previously received creep feed for 111 d. Seventy-four Angus x Charolais calves were removed from their dams, weighed, vaccinated and held in dry lot overnight with access to hay and water. The next morning, calves were reweighed and assigned to one of five weight blocks. Within weight blocks, calves were equally distributed to one of two treatment pens based on sex and age of dam. Treatments consisted of: Control (C) or 0.25% Diamond V XPC Yeast Culture (YC). The basal diet consisted of a coarse textured complete feed (88% DM) containing cracked corn, cottonseed hulls and supplemental pellet. Both treatments contained chlortetracycline and sulfamethazine (Aureo S-700®, Alpharma Animal Health) at 77 g/ton and 0.0084% respectively. Yeast culture was provided in the supplemental pellet for the YC treatment. Calves were fed twice daily and brought up on feed the initial 5 d, then allowed to consume feed ad libitum. DMI was recorded daily. Initial and final weights (28 d) were averaged from two consecutive weights. After the 5-d step-up period, calves fed YC had numerically higher DMI the remaining days on trial (data not shown) and DMI tended to be increased (P<0.19) compared to C (Table 1). Final BW and ADG were increased (P<0.01) by the addition of YC to the weaning diet. These data indicate that Diamond V XPC Yeast Culture will increase ADG of low-stress, ranch-weaned calves when fed in conjunction with chlortetracycline and sulfamethazine.

Table 1. Effect of yeast culture on 28-d post-weaning performance.

	Control	Yeast Culture	P <
Initial BW, kg	270	270	NS
Final BW, kg	319	323	0.01
DMI, kg/d	6.70	7.07	0.19
ADG, kg/d	1.67	1.81	0.01
F/G, kg/kg	4.00	3.91	NS

Key Words: Beef Cattle, Yeast Culture, ChlortetraCycline

W277 Effects of an intratracheal challenge with *Mannheimia haemolytica* on intake and N balance in fed or fasted steers. L. O. Burciaga-Robles*[1], C. R. Krehbiel[1], D. L. Step[2], B. P. Holland[1], M. Montelongo[2], A. W. Confer[2], J. N. Gilliam[2], and C. L. Goad[3], [1]*Department of Animal Science*, [2]*Center for Veterinary Health Sciences*, [3]*Department of Statistics. Oklahoma State University*, *Stillwater*.

The objective was to determine acute (5 d) and longer-term (2 wk) effects of an intratracheal challenge with *Mannheimia haemolytica* on DMI and N balance in fed or fasted steers. Twenty-two steers (BW = 320±24 kg) were assigned to one of four treatments: 1) fed ad libitum and not challenged (FED/CON); 2) fed ad libitum and challenged (d 0) with *M. haemolytica* (FED/CH); 3) fasted for 72 h and not challenged (FAST/CON); or 4) fasted for 72 h and challenged (d 0) with *M. haemolytica* (FAST/CH). Feed, total urine and feces were collected for three (d -3, -2, and -1), five (acute response on d 0, 1, 2, 3, and 4;

wk 1), three (d 6, 7, and 8; wk 2), and three (d 14, 15, and 16; wk 3) days. Challenge with *M. haemolytica* increased (P < 0.05) antibody concentration of the whole bacteria on day 15. In the acute model, DMI responded with a diet*challenge*day interaction (P = 0.02). After the 72 h fast, FAST/CON steers consumed a similar amount of DM as FED/CON. Steers challenged with *M. haemolytica* had lower (P < 0.05) DMI during the first 2 (FED) and 4 (FAST) d. In the long-term model a diet*challenge*week interaction was observed (P = 0.002). FED/CON steers generally had constant DMI in comparison with FAST/CON and FED/CH. No difference was observed (P > 0.10) in DMI among FED/CON, FAST/CON, and FED/CH during wk 2 and 3 of the experiment. FAST/CH steers had lower (P < 0.05) N retention than FED/CON steers 4 d after the challenge (diet*challenge*day interaction, P = 0.09). Nitrogen retention of FAST steers was lower (P = 0.006) compared with FED steers. Steers challenged with *M. haemolytica* tended (P = 0.10) to retain less N during the acute response. For the longer-term model no statistical difference was observed (P = 0.20) for N balance. Our data suggest that cattle that are fasted and challenged with a bovine respiratory pathogen retain less N for up to 4 d following the insult.

Key Words: Diet, *M. haemolytica*, N Balance

W278 Feedlot performance and rumen parakeratosis incidence in *Bos indicus* type bullocks fed high-grain diets and monensin or polyclonal antibody preparations against rumen bacteria. D. D. Millen*, R. D. L. Pacheco, M. D. B. Arrigoni, M. Parrili, S. A. Matsuhara, M. V. Fossa, L. M. N. Sarti, C. L. Martins, J. P. S. T. Bastos, and T. M. Mariani, *FMVZ/UNESP–Botucatu*, *São Paulo, Brazil*.

Oral dosing of polyclonal antibody preparations (PAP) against *Streptococcus bovis* or *Fusobacterium necrophorum* enhanced feedlot performance of *Bos taurus* cattle. This study, conducted at the São Paulo State University feedlot, Botucatu Campus, Brazil, was designed to test PAP against *S. bovis*, *F. necrophorum*, and several strains of proteolytic bacteria (RMT) on performance and parakeratosis incidence of *Bos indicus*-based types. The experiment was designed as a 3 X 2 factorial, replicated thrice (4 bullocks/pen), in which 24 9-mo-old bullocks (297 kg) of each of three *Bos indicus*-based types: 3-way cross (1/2 Brangus, 1/4 Angus, 1/4 Nellore; TC), Canchim (5/8 Charolais, 3/8 Nellore; CC), or Nellore (NE) were fed one of two diets containing either monensin (MO) at 300 mg/d or RMT at 10 mL/d. Bullocks were fed ad libitum twice daily and, at harvest, rumen parakeratosis was scored on the entire washed rumen using a scale of 0 (no lesions noted) to 10 (severe ulcerative parakeratosis). Diets contained 50% high moisture corn, 21% cracked corn, 10% soybean meal, 10% sugarcane bagasse, 5% corn silage and 4% supplement (DM basis). There were no interactions (P > 0.05) between breed type and feed additive. Bullocks fed RMT had similar (P > 0.05) ADG (1.34 vs. 1.30 kg), DMI (8.28 vs. 8.02 kg/d) and DM required/kg gain (6.17 vs. 6.17 kg) as those fed MO. When analyzed as percentage of BW, bullocks fed RMT consumed (P< 0.05) more feed than those fed MO (2.20 vs. 2.14%). Bullocks fed RMT tended (P = 0.09) to have lesser rumen parakeratosis scores than those fed MO (55.6% vs. 45.7% of the rumens from bullocks fed RMT and MO scored between 0 and 1, respectively). Crossbred cattle (TC and CC) had greater (P < 0.05) DMI and ADG, and better (P < 0.05) feed conversion than purebred NE. Rumens from NE bullocks had greater (P < 0.05) parakeratosis scores than those of crossbreds. Feeding RMT enhanced intake of *Bos indicus*-based bullocks fed high-grain diets while maintaining rumen health, and permitting performance similar to that of bullocks fed monensin.

Key Words: PAP, Monensin, Performance

W279 Effects of a saccharin-containing additive (SUCRAM) on total tract digestibility, plasma metabolites, and urine organic acid excretion by steer calves. C. H. Ponce*[1], M. S. Brown[1], J. C. Silva[1], P. Schlegel[2], and W. Rounds[3], [1]*West Texas A&M University*, *Canyon*, [2]*Pancosma, SA*, *Geneva, Switzerland*, [3]*Prince Agri Products*, *Quincy, IL*.

Previous data suggest that SUCRAM C-150 (97% sodium saccharin; Pancosma SA) may improve growth performance by stressed beef calves. Fifteen steers (261 +/- 28 kg BW) were used to evaluate the effects of SUCRAM C-150 on total tract digestibility, plasma metabolite concentrations, and urine monoamine metabolite concentrations. Treatments included ad libitum access to a 60% concentrate diet (NC), ad libitum access to NC + 180 g of SUCRAM C-150/ton of DM (AS), and NC + 180 g of SUCRAM C-150/ton of DM with feed intake paired to NC (PS). Steers were adapted to treatments for 28 d before a 5-d collection of total feces and urine excreted. Jugular blood samples were collected on the last day of collection period. Steer DMI during the metabolism period did not differ (P > 0.15) between PS and NC (93 and 97 +/- 4 g/kg of $BW^{0.75}$, respectively), but DMI tended (P = 0.14) to be greater for AS (105 g/kg of $BW^{0.75}$) than for NC. Treatments did not alter (P > 0.15) apparent total tract DM, OM, CP, or NDF digestibility. Plasma homocysteine concentration was reduced (P < 0.03) by feeding PS or AS (0.57, 0.39, and 0.44 +/- 0.04 ug/mL for NC, PS, and AS, respectively). No differences were detected (P > 0.15) in plasma concentrations of tryptophan, large neutral amino acids, branched chain amino acids, or in the ratio of tryptophan to either large neutral or branched-chain amino acids. Urinary concentration (mmol/mol creatinine) of ethylmalonic acid, vanillymandelic acid (0.68, 1.65, and 1.47 +/- 0.23 for NC, PS, and AS, respectively), and 5-hydroxyindolacetic acid were greater (P < 0.06) for steers receiving AS than for steers receiving NC; steers fed PS had a greater (P = 0.02) urine vanillymandelic acid concentration than steers fed NC and tended (P < 0.12) to have a greater urinary concentration of ethylmalonic and 5-hydroxyindolacetic acid. The volume and mass of urine excreted did not differ (P > 0.32). Data suggest that saccharin-specific alterations in metabolism by calves may include reduced plasma homocysteine and increased excretion of vanillymandelic acid.

Key Words: Saccharin, Sweetener, Monoamine Metabolites

W280 Evaluation of feeding behavior of young cattle from different genetic groups fed with high concentrate diets with different NDF levels. L. M. N. Sarti, R. D. L. Pacheco*, D. D. Millen, M. D. B. Arrigoni, M. V. Fossa, S. A. Matsuhara, M. Parrili, C. L. Martins, H. N. Oliveira, T. M. Mariani, J. P. S. T. Bastos, and L. F. S. Niero, *FMVZ/UNESP–Botucatu*, *São Paulo, Brazil*.

The objective was to evaluate the feeding behavior of young cattle from different genetic groups (GG) with different zebu percentage in their compositions fed high concentrate diets with different NDF levels. The study had 3 GG (3 way cross – 1/2 Braunvieh, 1/4 Angus,

1/4 Nellore (TC); Canchim – 5/8 Charolais, 3/8 Nellore (CC) and Nellore (NE)) evaluated with four different diets (DD) with varying concentrate and NDF levels (Concentrate (%) = 58, 73, 82 and 85; NDF (%) = 38.1, 30.9, 27.7 and 23.0; respectively). We evaluated grams per hour feeding efficiency of dry matter (FEDM) and NDF (FENDF) and rumination efficiency of dry matter (REDM) and NDF (RENDF). The experiment was conducted at the experimental feedlot of the Veterinary Medicine and Animal Science College, São Paulo State University, Botucatu campus (UNESP), Brazil. Twelve 8–month–old TC, CC and NE bulls (297±84 kilos) were fed from creep feeding for 135 d, with 4 animals per group tested. For FEDM (g/hour) we found an effect (P<0.05) for GG and DD (TC=4183.66^{b}, CC=3037.81^{a}, NE=2280.24^{a}; 1=2482.99^{c}, 2=2511.20^{c}, 3=3385.01^{d}, 4=4289.74^{d}) but there was no interaction among them. Regarding FENDF, REDM and RENDF, we found effects for GG, DD and an interaction. TC was more efficient (P<0.05) than NE and CC for FENDF in the diets tested (TC=1354.12, CC=954.33, NE=713.70). For REDM, the TC was better (P<0.05) when compared to NE, but the CC did not differ when compared to TC and NE in the four diets tested (TC=1668.54, CC=1378.20, NE=1149.80). For RENDF, the TC was more efficient (P<0.05) than NE, but the CC did not differ when compared to TC and NE for all diets evaluated (TC=526.58, CC=440.47, NE=366.08). In conclusion, the TC and NE were more and less efficient, respectively, regarding the feeding behavior efficiencies evaluated. As zebu percentage in the GG composition gets lower, the concentrate level of the diets could be increased and vice versa, showing a grain adaptation in animals with low zebu percentage in GG composition.

Key Words: Feeding Behavior, FDN, Efficiency

W281 Beet pulp as a non-roughage fiber source in a total concentrate diet fed growing heifers. A. D. Faleiro, A. Ferret*, X. Manteca, J. L. R. de la Torre, and S. Calsamiglia, *Universitat Autonoma de Barcelona*, *Bellaterra, Spain*.

Eight rumen fistulated Holstein heifers (140 ± 24 kg, initial BW) were used to study the effect of using beet pulp as a non-roughage fiber source in a high concentrate diet. The variables studied were intake, ruminal fermentation and growth. All heifers were fed *ad-libitum* a concentrate composed of (DM basis) barley (31.4%), corn (32.2%), soybean meal (8%), corn gluten feed (9%), beet pulp (16%), and a mineral and vitamin compound (3.4%). The chemical composition of the concentrate was: 2.9 Mcal/kg ME, 14.9% CP, 24.2% NDF, 11.4% ADF, on DM basis. Four animals received barley straw as a roughage supplement (Diet A), while the other 4 did not (Diet B). The experiment was performed in six 28-d periods, and sampling was carried out in the last week of each period. Intake was recorded during five consecutive days. Feed and refusal samples were taken to determine DM, CP and NDF content. Ruminal samples were collected over 3 d at 0, 4, 8, and 12 hours post-feeding to measure pH, and VFA and NH3-N concentrations. Body weight was recorded on 1 d of each period. Data were analyzed using the generalized mixed model adequate for repeated measures. The model contained the effect of diet, period, and their interaction as fixed effects. Period was used as a repeated factor, and animal as a random effect. Barley straw intake in heifers fed diet A was 0.5kg/d. There were no statistical differences in concentrate DM intake (6.8 ± 0.42 kg/d) or CP intake (1.1 ± 0.07 kg/d). In contrast, there were statistical differences (P < 0.001) in ADF intake (kg, Diet A = 0.852, Diet B = 0.582), ruminal pH (Diet A = 6.0, Diet B = 5.5), total VFA (mM, Diet A = 134.3, Diet B = 153.4), propionate proportion (mol/100 mol, Diet A = 21.7, Diet B = 33.4), and acetate to propionate ratio (Diet A = 2.6, Diet B = 1.4). The ruminal concentration of NH3-N was not different (5.2 ± 0.84 mg/100 mL). Diets had no effect on ADG, (1.3 ± 0.06 kg/d). Results indicate that beet pulp as a non-roughage fiber source affected ruminal fermentation but did not change performance in a feedlot compared to a high-concentrate diet supplemented with barley straw.

Key Words: Beet Pulp, Concentrate Diet, Growing Heifers

W282 Post weaning performance of Holstein dairy heifers fed diets differing in forage quality and supplemented with a low moisture block. H. Chester-Jones*[1], D. Ziegler[1], R. Larson[2], B. Ziegler[2], J. Linn[3], M. Raeth-Knight[3], and G. Golombeski[3], [1]*University of Minnesota Southern Research and Outreach Center*, *Waseca*, [2]*Hubbard Feeds*, *Mankato, MN*, [3]*University of Minnesota Southern Research and Outreach Center*, *St. Paul*.

Ninety-six dairy heifers were used in a 112-d study to evaluate feed intake and performance from 9 to 25 weeks of-age. Heifers (92.3 ± 0.93 kg BW) were randomly assigned to 1 of 4 grower diets (6 heifers/pen, 4 pens/treatment). Heifers were each fed a cracked corn and pellet grain mix (16%CP) limit-fed to 2.72 kg/d (as fed) from d 1 to 14 and to 1.82 kg/d from d 15 to 112 with free choice hay. Treatments were: 1) LOW: alfalfa hay (19.3% CP; 100 RFV); 2) LOWB: alfalfa hay and low moisture molasses-based block (30% CP); 3) MED: alfalfa hay (19.6 % CP; 130 RFV); and 4)HIGH: alfalfa hay (18.6 % CP; 154 RFV). Using the low moisture block increased ADG by 4.0% and feed efficiency (FE) by 2.3% for the LOWB as compared to the LOW treatment. Feeding a higher quality hay increased ADG by 9.0% and FE by 3.0% for the MED compared to the LOW and LOWB treatments. Heifers receiving the highest quality hay (HIGH) had increased ADG (1.4%) and FE (5.9%) compared to heifers fed the MED treatment. Final BW for heifers fed LOW (188.9 kg) and LOWB (193.1 kg) were lower (P < 0.05) than heifers fed MED (198.9 kg) and HIGH (202.0 kg), respectively. Over the 112 d study, ADG (kg/d), grain DMI (kg), hay DMI (kg/d) and FE (kg feed/kg gain) were 0.87, 1.70, 2.41, 4.78; 0.91, 1.70, 2.36, 4.62; 0.96, 1.70, 2.68, 4.59; 0.97, 1.70, 2.49 and 4.33 kg for heifers fed LOW, LOWB, MED, and HIGH treatments, respectively. Under the conditions of the study, performance of all heifers was acceptable and an economic comparison should be the criteria to select the hay of choice when limit feeding grain mixes. The study demonstrated that feeding up to 2.72 kg daily of a 16% CP grain mix for the first 14 d followed by 1.82 kg/d from d 15 to 112 with access to FC alfalfa hay provides sufficient energy and protein for acceptable heifer growth.

Key Words: Dairy Heifers, Grain Mixes and Forage Quality, Performance

W283 Performance of Holstein dairy heifers fed whole-shelled corn and protein pellet diets differing in protein levels. D. Ziegler*[1], M. Raeth-Knight[2], J. Linn[2], G. Golombeski[2], R. Larson[3], B. Ziegler[3], and H. Chester-Jones[1], [1]*University of Minnesota Southern Research and Outreach Center*, *Waseca*, [2]*University of Minnesota*, *St. Paul*, [3]*Hubbard Feeds*, *Mankato, MN*.

Ninety-six dairy heifers (93.8 ± 0.77 kg BW) were used in a 112-d study to evaluate feed intake and performance from 9 to 25 weeks of age when offered limit (LF) or full-fed (FF) whole-shelled corn and pellet (WCP) diets varying in protein level, with or without access to free choice (FC) hay. Heifers were randomly assigned to 1 of 4 grower diets (6 heifers/pen, 4 pens/treatment). Treatments from d 1 to 56 were 1) 16LF: 16% CP WCP, LF to 2.72 kg/calf (as-fed) and FC alfalfa hay (19.7% CP, DM basis); 2) 13FF: 13% CP WCP, FF with no hay; 3) 16FF: 16% CP WCP, FF with no hay; and 4) 19FF: 19% CP WCP, FF with no hay. Day 57 to 112 all heifers were LF their respective WCP up to 2.27 kg daily with FC hay. Day 1 to 56, heifers fed 16LF had the lowest (P <0.05) daily gain (1.01 kg/d) and highest feed/gain (3.64) vs. FF diets, which averaged 1.25 kg/d and 3.13 kg feed/kg BW gain, respectively. From d 57 to 112, heifers fed 16LF had 10.2% higher (P <0.05) ADG (1.08 kg/d) compared to the 13FF, 16FF and 19FF diets which averaged 0.97 kg/d. Total gain over 112-d for 16LF heifers (116.6 kg) was 6.2% lower than the other treatments which averaged 124.4 kg. Daily gain (kg/d) and feed/gain for the 112-d study were 1.04, 4.42; 1.10, 4.29; 1.11, 4.11; 1.13, and 4.03 kg for 16LF, 13FF, 16FF, and 19FF heifer groups, respectively. Initial hip heights (HH) averaged 105.3 cm with similar (P > 0.05) HH gains (20.8 cm) for all heifer groups over the 112-d. Body condition score gain for 16LF heifers was +0.77 being 9.4% less than the other heifer groups (+0.85). Under the conditions of this study, all treatments resulted in adequate heifer growth. The results will allow for further refinement of protein levels to use in grain mixes.

Key Words: Dairy Heifers, Concentrate Protein Levels, Performance

W284 Effects of amount and composition of concentrate on silage and total DM intake of dairy cows. P. Huhtanen*[1], M. Rinne[2], and J. Nousiainen[3], [1]*Cornell University*, *Ithaca, NY*, [2]*MTT-Agrifood Research*, *Finland*, [3]*Valio Ltd*, *Finland*.

Dry matter intake (DMI) explains most of the variation in nutrient supply and milk production. DMI is regulated by animal, diet and management factors and their complex interactions. Our objective was to develop a DMI model describing the relative intake potential of the diet. A data set of 960 diets from 204 production trials with dairy cows was collected. The effects of concentrate feeding on silage DMI were investigated in 168 comparisons including 610 diets. The data was further divided into sub-sets: level of concentrate, and CP, NDF and fat concentration of concentrate. Within each comparison the same forage was fed ad libitum. A mixed model regression analysis was used to estimate the relationships between silage DMI (SDMI) and independent variables. SDMI decreased quadratically with increased concentrate DMI (CDMI). The substitution rate increased with increasing relative SDMI potential. An increase in concentrate CP concentration in response to replacement of energy substrates with protein feeds (e.g. soybean or rapeseed meal) was associated with quadratic increases in silage and total DMI. Replacement of starchy ingredients with fibrous by-products in concentrate slightly increased DMI, whereas fat supplementation had a negative effect on DMI. The effects of different components (CDMI, CP, NDF and fat concentration and interaction CDMI Ã— SDMI potential) were combined to create a relative CDMI index. Relative CDMI index predicted the intake responses within a study precisely as indicated by a low mean squared prediction error (MSPE = 0.33 kg) between predicted and observed DMI adjusted for random study effect. The total DMI (TDMI) index calculated as CDMI + SDMI indexes predicted TDMI within a study precisely (MSPE = 0.37 kg, n = 960). One TDMI index point corresponded to a 0.103 kg DMI, i.e. very close to the default value of 0.10. Marginal responses in TDMI of grass silage based diets to changes in diet composition can be predicted accurately and precisely, but predicting absolute intakes needs a better characterization of the animal's intake potential.

Key Words: Intake Prediction, Grass Silage, Modelling

W285 Please see abstract # 278.

W286 Effects of feeding monensin and brown midrib corn silage on milk production and rumen fermentation. C. R. Mullins*, A. M. Gehman, P. J. Kononoff, and B. N. Janicek, *University of Nebraska*, *Lincoln*.

An experiment was conducted to compare rations including brown midrib corn silage (*bm3*) and a control dual purpose hybrid (DP) on milk production and rumen fermentation. The effect of monensin in these rations was also examined. Twenty multiparous Holstein cows (4 ruminally cannulated) averaging 101 ± 34 DIM (mean ± SD) and 674 ± 77 kg BW were assigned to one of five 4 × 4 Latin squares, using a 2 X 2 factorial arrangement of treatments. Cows were fed one of four treatments during each of the four 28-d periods: 1) C-*bm3*, 0 mg/d monensin and *bm3*, 2) C-DP, 0 mg/d monensin and DP, 3) M-*bm3*, 300 mg/d monensin and *bm3*, and 4) M-DP, 300 mg/d monensin and DP. Diets were formulated to maintain energy, neutral detergent fiber, and non-fiber carbohydrate concentrations across treatments. Diets containing *bm3* contained more corn silage than those containing DP (54 vs. 49 % DM). *In vitro* 30 h neutral detergent fiber digestibility was higher for *bm3* than DP (61.0 vs. 49.1 ± 0.62 %). Monensin tended ($P = 0.07$) to increase rumen pH (5.89 vs. 5.79 ± 0.07) compared to the control treatment. In addition, diets containing *bm3* resulted in a decrease ($P < 0.01$) in rumen pH (5.72 vs. 5.98 ± 0.07). Monensin had no effect on molar concentration of acetate, propionate, or butyrate. In contrast, monensin increased ($P < 0.01$) branched chain volatile fatty acids. Diets containing DP resulted in a higher ($P < 0.01$) concentration of propionate (27.4 vs. 26.3 ± 1.77 mol/100 mol) and tended to have a higher ($P = 0.07$) acetate concentration (56.0 vs. 55.2 ± 1.30 % mol/100 mol). Cows consuming diets containing *bm3* tended ($P = 0.08$) to have higher dry matter intake (21.3 vs. 20.2 ± 0.63 kg/d) but was not affected by monensin. No differences were observed in 3.5% fat-corrected milk, averaging 38.0 ± 2.09 kg/d. In addition, no differences were observed for fat and protein yield, averaging 1.34 ± 0.08 and 1.13 ± 0.06 kg/d respectively. Monensin supplementation increased rumen pH, without affecting dry matter intake or milk production. Diets containing *bm3* were consumed in greater amounts but did not affect milk production or composition.

Key Words: Brown Midrib Corn Silage, Monensin, Dairy Cow

W287 Effects of mixing red clover silage with grass silage on the fatty acid and sensory properties of milk from dairy cows. J. M. Moorby*[1], D. R. Davies[1], W. J. Fisher[1], N. M. Ellis[1], N. D. Scollan[1], and G. R. Nute[2], [1]*Institute of Grassland and Environmental Research*, *Aberystwyth, UK*, [2]*University of Bristol*, *UK*.

Twenty-four multiparous mid-lactation Holstein-Friesian dairy cows were used in a replicated 4×4 Latin square changeover design experiment to test the effects of changing from ryegrass silage to red clover silage in graded proportions on milk fatty acid (FA) profiles and organoleptic qualities. Four diets were offered comprising ad libitum access to 1 of 4 forage mixes plus 4 kg dairy concentrates per d. The forage mixes were, on a DM basis: 1) 100% ryegrass silage (GS), 2) 66% GS:34% red clover silage (RCS), 3) 34% GS:66% RCS, and 4) 100% RCS. Each experimental period comprised 21 d for adaptation to diets and 7 d of measurements. Milk FA profiles were hardly affected by diet, with no significant effects on $C_{18:2}$ and $C_{18:3}$ FAs. Similarly, and perhaps because of this, there was little effect of diet on organoleptic qualities of pasteurised milk as assessed by taste panel analysis, with no effects on milk aroma, aftertaste, or overall liking. The appearance of milk was thicker ($P < 0.001$ linear effect) and more cream-coloured ($P < 0.001$ linear effect) when cows were fed GS compared to when fed RCS. The flavour of milk was largely unaffected by diet, apart from a quadratic ($P < 0.05$) effect of diet on the sour flavour characteristic, with milk from cows on the two extreme diets scoring higher than milk from cows on the two mixed silage diets, and a small but significant ($P = 0.010$) linear effect of treatment on the boiled milk flavour, with an increasing score as the proportion of RCS in the diet increased. In conclusion, increasing the proportion of RCS in the diet of dairy cows had little effect on milk FA profiles or on milk organoleptic characteristics.

Key Words: Red Clover Silage, Milk Fatty Acids, Taste Panel

W288 Effects of mixing red clover silage with grass silage on feed intake and milk output from dairy cows. J. M. Moorby*, D. R. Davies, W. J. Fisher, N. M. Ellis, and N. D. Scollan, *Institute of Grassland and Environmental Research*, *Aberystwyth, UK*.

Twenty-four multiparous mid-lactation Holstein-Friesian dairy cows were used in a replicated 4×4 Latin square changeover design experiment to test the effects of changing from ryegrass silage to red clover silage in graded proportions on feed intakes, milk production, and milk composition. Four diets were offered comprising ad libitum access to 1 of 4 forage mixes plus 4 kg dairy concentrates per d. The forage mixes were, on a DM basis: 1) 100% ryegrass silage (GS), 2) 66% GS:34% red clover silage (RCS), 3) 34% GS:66% RCS, and 4) 100% RCS. Each experimental period comprised 21 d for adaptation to diets and 7 d of measurements. Total dry matter intakes ($P < 0.001$) increased linearly as the proportion of RCS in the diet increased (16.7, 17.8, 18.3, 19.0 kg/d, SED = 0.024). Milk yields also increased with inclusion of RCS in the diet (25.2, 26.1, 26.5, 26.1 kg/d, SED = 0.47, $P < 0.05$ linear effect, $P < 0.05$ quadratic effect) but the increase was not as great as the DMI increase so that the efficiency of milk production (kg milk/kg DMI) decreased linearly ($P < 0.001$). Concentrations of milk fat and protein decreased linearly ($P < 0.001$) as the proportion of RCS in the diet increased, but yields of fat were unaffected. There was a significant ($P < 0.01$) quadratic effect on protein yield, with the highest yields from the two mixed diets. In conclusion, increasing the proportion of RCS in the diet of dairy cows increased feed intakes and milk yields, with the highest milk and milk protein yields from the 34% GS:66% RCS diet. However, including RCS in the diet decreased milk fat and protein concentrations and milk production efficiency.

Key Words: Red Clover Silage, Milk Production, Feed Intake

W289 Intake, digestibility and milk production and composition of dairy cows fed sugar–cane based diets corrected with soybean meal or different levels of urea. A. H. do Nascimento Rangel*[1], J. M. de Souza Campos[2], S. de Campos Valadares Filho[2], A. Barbosa[2], and P. V. R. Paulino[2], [1]*Universidade Federal Rural do Semi–Árido*, *Mossoró, RN, Brazil*, [2]*Universidade Federal de Viçosa*, *Viçosa, MG, Brazil*.

The mixture of sugar–cane and urea was been widely used by dairy cattle producers in Brazil, mainly during the dry season of the year. However, more research is needed in order to determine the most appropriate level of urea to be included in this kind of diet. Thus, the objective of this work was to evaluate the effect of sugar–cane based diets, corrected with soybean meal based concentrate (SM) or different levels of urea, on the intake, digestibility and milk production and composition of dairy cows. Twelve pure and crossbred Holstein cows were used, being arranged in three 4 × 4 Latin squares, distributed according to lactation period. The diets were formulated to be isonitrogenous, containing 14% crude protein on the dry matter (DM) basis. The daily supply of concentrate was fixed at 0.5 kg for each kg of milk produced. The urea levels tested were 0.4, 0.8 and 1.2%, on the natural matter basis. Following the analysis of variance, it was performed the decomposition of sums of squares for treatments into non–orthogonal contrasts, comparing the sugar cane diet corrected with SM based concentrate with the diets in which the different urea levels were used. Linear and quadratic effects of the three urea levels were also tested. There were no differences among the diets ($P > 0.05$) in the intakes of dry matter (DM), organic matter (OM), ether extract (EE), total carbohydrates (CHO), non–fiber carbohydrates (NFC) and neutral detergent fiber (NDF). A decreasing linear effect ($P<0.05$) was found for NDF intake among diets containing different urea levels. No effect of diet was observed ($P > 0.05$) for the apparent digestibility coefficients of DM, OM, CP, EE, NDF and NFC. A linear effect was detected ($P<0.05$) for the total carbohydrates digestibility and for the TDN content of the diet, which increased as the urea level increased. Milk production, corrected or not for 3.5% of fat, and milk composition did not differ ($P>0.05$) among the diets tested. The mean value of milk production, corrected for 3.5% of fat, was 20.07 kg/d. The diets containing urea were more profitable than the diet containing soybean meal, justifying its use by the producer in order to reduce feeding costs of the herd.

Key Words: Holstein, Sugar-Cane, Urea

W290 Performance and nutritional parameters of replacement dairy heifers fed corn silage or sugar–cane based diets supplemented with increasing concentrate levels. A. H. do Nascimento Rangel*[1], J. M. de Souza Campos[2], P. V. R. Paulino[2], A. J. de Assis[2], and A. S. de Oliveira[2], [1]*Universidade Federal Rural do Semi–Árido*, *Mossoró, RN, Brazil*, [2]*Universidade Federal de Viçosa*, *Viçosa, MG, Brazil*.

This study evaluated the response of replacement dairy heifers to a corn silage based diet, supplemented with 1.3 kg/day of concentrate, and to three sugar–cane based diets, corrected with 1% of the mixture urea and ammonium sulphate (9:1), and supplemented with 1.3; 2.0 and 2.7 kg/d of concentrate, respectively. Twenty animals were used (12 Holstein and 8 Brown Swiss heifers), with initial body weight (BW) of 176 kg. The experiment was arranged in a randomized block design, with 5 blocks, considering each animal as an experimental unit and the blocks formed on the basis of initial BW and breed. Dry matter

intake (DMI), organic matter (OM) intake and neutral detergent fiber (NDF) intake did not differ (P>0.05) among the diets. Higher intake of ether extract (EE) (P<0.05) was found for the corn silage based diet compared to the sugar–cane based diets. There was detected difference in the total carbohydrate (CHO) intake and in the non–fiber carbohydrate (NFC) intake between the corn silage diet and the sugar–cane based diets supplemented with 1.3 and 2 kg of concentrate. The heifers fed the sugar–cane diet supplemented with 2.0 kg of concentrate had the lowest TDN intake (2.89 kg/d) whereas the animals fed the corn silage diet had the highest (3.62 kg of TDN/d). Dry matter, organic matter and non–fiber carbohydrates digestibilities were not different (P>0.05) among diets. The digestibility of the crude protein (CP) of the corn silage diet was lower (P<0.05) than the CP digestibility of the three sugar–cane based diets (62.93 vs 75.10 %). No significant difference was detected (P>0.05) for total weight gain (TWG, kg) and average daily gain (ADG, kg/d) between the corn silage based diet and the sugar–cane diet supplemented with 2.7 kg of concentrate, with mean values of 71.22 kg and 0.847 kg/d. The other two sugar–cane based diets provided the lowest ADG (0.629 kg/d). Rumen pH, measured at 0 and 3 hours after feeding, did not differ (P>0.05) among the experimental diets. N-NH_3 , measured three hours after feeding, was lower (P<0.05) for the animals fed corn silage based diet compared to those fed sugar–cane based diets.

Key Words: Dairy Heifers, Rumen, Sugar-Cane

W291 Use of NutriDense corn variety for corn and corn silage in diets fed to high producing dairy cows. J. Sampson and J. Spain*, *University of Missouri*, *Columbia*.

This study evaluated a hybrid corn variety for corn silage and corn grain fed to high producing dairy cattle. Sixty-three lactating Holsteins were paired based on parity, stage of lactation, milk production, and body weight and randomly assigned to one of three dietary treatments. Control (CC) cows received total mixed ration (TMR) containing control corn silage (CS) and control corn grain. Group NDC received TMR containing NutriDense (ND) CS and control corn grain. Group NDND received TMR containing ND CS and ND corn grain. All three dietary treatments were formulated to meet NRC requirements for a 636 kg cow producing 41 kg milk/day containing 3.75% fat. Cows were fed twice daily with weights and feed refusals recorded. Cows were fed using electronic feeding gates (Calan Gates, American Calan, Inc.). Cows were fed assigned diets for 50d. Cows were milked twice a day and milk samples were taken weekly and submitted to DHIA to measure fat, protein, MUN and SCC. Body weights and condition scores were measured and recorded weekly. Blood samples were collected weekly to measure plasma glucose and urea nitrogen (PUN). A second experiment was conducted to evaluate ruminal fermentation of dietary treatments. Diets were subjected to digestion using standard in situ and in vitro techniques. Data collected were ruminal pH, optical density, and NH3-N concentrations as well as dry matter and nitrogen disappearance. Data were analyzed by Proc Mixed procedures of SAS. Average daily DMI was different (P=0.05; 22.03, 21.02, and 20.22 kg for CC, NDC, and NDND, respectively). FCM, milk fat, protein and SCC were not different (P=0.36, P=0.70, P=0.26, P=0.40, respectively). MUN and PUN were different by treatment (P=0.01, P<0.05, respectively) and by treatment over time (P=0.1, P<0.05, respectively). In situ N disappearance was also different due to treatment (P=0.0383), with higher values for NDND than CC or NDC (73.3%, 71.4%, and 71.9%, respectively). Ruminal NH3 concentrations were higher (P=0.02) for NDND than CC or NDC with values of 6.6, 5.9, and 6.2, respectively. Milk production efficiency was improved by ND hybrid.

Key Words: Corn Silage, Hybrid, Milk Production Efficiency

W292 Comparative effects of wild-type, *bmr*-6, *bmr*-12 and stacked sorghum: Sorghum stover digestibility. H. M. Dann*[1], A. M. DiCerbo[1], J. F. Pedersen[2], and R. J. Grant[1], [1]*William H. Miner Agricultural Research Institute*, *Chazy, NY*, [2]*USDA, ARS, NPA Wheat, Sorghum and Forage Research, University of Nebraska*, *Lincoln*.

Samples of wild-type 'Atlas' and its brown midrib near-isolines containing *bmr*-6, *bmr*-12, and stacked *bmr*-6 and *bmr*-12 genes were used to assess the effect of *bmr* mutations on in situ digestion kinetics of sorghum stover. Forage sorghum was grown in 2004 at Mead, Nebraska. Panicles were removed from sorghum before harvest. Wild-type, *bmr*-6, *bmr*-12, and stacked sorghum stovers had a neutral detergent fiber (NDF) content of 52.7, 53.1, 50.9, and 53.9%, respectively and a lignin content of 5.3, 3.8, 3.6, and 3.6%, respectively. Ruminal in situ digestion kinetics of dry matter (DM) and NDF of sorghum stover were determined with 4 ruminally cannulated multiparous lactating Holstein cows used in a 4×4 Latin square design. Samples of sorghum stover were incubated in N-free polyester in situ bags (5 g sample/bag) for 0, 6, 12, 24, 48, and 96 h and removed simultaneously at 0 h. Residues were analyzed for DM and NDF with residual ash (using α-amylase and without sodium sulfite). Digestion kinetics [lag, fractional rate of digestion (k_d), and potential extent of digestion (PED)] for DM and NDF were calculated. Data were analyzed by ANOVA. Dry matter lag (2.0 h), DM k_d (0.036 h_{-1}), NDF lag (2.8 h), and NDF k_d (0.036 h_{-1}) were similar ($P > 0.10$) among sorghum stovers. The PED of DM and NDF differed ($P < 0.05$) among sorghum stovers. The PED of DM was 52.1, 55.6, 64.3, and 73.2% and the PED of NDF was 53.1, 54.7, 65.3, and 74.1% for wild-type, *bmr*-6, *bmr*-12, and stacked sorghum stovers, respectively. Digestibility of NDF (% of NDF) was higher for stacked than wild-type sorghum stover at 24 h ($P < 0.10$; 49.0 vs. 39.1%) and 48 h ($P < 0.05$; 65.0 vs. 52.8%). In summary, there was more digestible DM and NDF in *bmr*-6, *bmr*-12, and stacked sorghum stovers than wild-type sorghum stover. The stacked *bmr*-6 and *bmr*-12 mutations had the greatest positive impact on digestibility.

Key Words: Sorghum, *bmr*, Digestibility

W293 Impact of the brown midrib (BMR) mutant gene on the nutritive value of sudangrass fed as forage to lactating dairy cows. D. N. Ledgerwood*, E. J. DePeters, P. H. Robinson, S. J. Taylor, and J. M. Heguy, *University of California*, *Davis*.

The BMR gene causes changes in lignin concentration and composition that have been demonstrated to increase fiber digestion in ruminants. Our objective was to assess potential benefits of the BMR mutant of Sudangrass, compared to the Piper variety, on production performance and digestibility in lactating dairy cows. The total mixed rations (TMR) contained 18% shredded Sudangrass hay, 18% sliced alfalfa hay with the remaining 64% representing the concentrate portion. The proportion of Piper to BMR in the TMR was varied as: 100:0, 66:34,

34:66, or 0:100. Four lactating dairy cows (251 ± 30 days in milk), fitted with ruminal and duodenal cannulas, were used in a 4x4 Latin square design with 14d adjustment and 7d sample collection phases. Individual feed intake and milk yield were measured daily during the collection phase, with fecal and duodenal samples collected 5 times over the last 3d of the collection phase. As the proportion of Piper to BMR decreased in the TMR, yields of milk and milk protein were highest at intermediate inclusion levels (Q: P=0.06/0.07), but milk fat, protein, and lactose contents, as well as dry matter intake, did not vary. Ruminal and total tract digestibility of ash-free NDF, organic matter, and cellulose did not vary as well. The optimal Piper:BMR Sudangrass ratio in this TMR with 18% Sudangrass was 66:34.

Table 1. Yield and NDF Digestibility

Diet [1]	100:0	66:34	34:66	0:100	S.E.	L[2]	Q[3]
Yield (kg/d)						P	P
Milk	29.9	32.3	30.8	30.3	0.68	0.91	0.06
Protein	0.95	1.02	0.97	0.95	0.03	0.68	0.07
NDF digestibility [4]							
Ruminal	53.6	54.8	52.2	57.3	3.93	0.64	0.63
Total Tract	60.4	60.3	61.9	64.9	2.55	0.23	0.56

[1] Piper : BMR = Proportion of Piper Sudangrass to BMR Sudangrass.
[2] L = Linear effect. [3]Q = Quadratic effect. [4] % of ash-free NDF intake.

Key Words: BMR, Sudangrass, Digestibility

W294 Use of computer simulation model to teach systems approach to metabolism. H. A. Johnson*, C. C. Calvert, and R. L. Baldwin, *University of California*, *Davis*.

Using a systems approach as embodied in the computer simulation model of a dairy cow, Molly (Baldwin, 2005) is ideal for teaching nutrition because there are many quantitative interactions among nutrients supplied and metabolic processes. Using Molly, undergraduate animal science students are able to observe effects of changing diets, altering genetic potential (e.g., milk production potential) and manipulating metabolism on whole cow metabolism. The objective is to show how Molly can be used in the classroom to teach a systems approach to nutrition using example simulations with and without administrating bovine somatotropin (BST) to cows at 2 levels of milk production (high and low), fed two different diets (Diet1 and Diet2). The table below shows results of the 8 simulations. BST increases milk production approximately 3000 kg, increases milk protein output 90-100 kg and increases milk fat yield 120-130 kg over 308 days. Diet2 results in higher milk production (300-400 kg) and higher milk protein (12-26 kg) compared to Diet1. Diet2 is higher in starch (2%) and insoluble protein (2%) which contributes to higher lactose (GlLmV) production increasing milk production and milk protein production. Higher producing cows respond less to BST in milk and milk protein production than lower producing cows. Diet causes little change in milk fat synthesis (AcTmV) relative to BST and increasing milk production. But, both increasing milk production potential and BST decrease lipogenesis (AcTsF, FaTsF) and increase adipose breakdown (TsFaF1) increasing the availability of fatty acids for milk fat synthesis (FaTmV). Therefore, BST increases udder synthetic capacity for milk lactose (GlLmV), milk protein (TAaLaV, TAaPmV) and milk fat (AcTmV and FaTmV). From these simulations, students are able to observe how manipulation of metabolism through diet, BST and genetic potential to produce milk changes milk production and whole body metabolism. Classroom handouts describing model settings, model output and the model program (Windows 98, 2000 or XP) are available at http://animalscience.ucdavis.edu/research/molly.

Table 1. Molly simulation results at 84 days

Parameter (mole/d)	Diet1, low, no BST	Diet2, low, no BST	Diet1, high, no BST	Diet2, high, no BST	Diet1, low, BST	Diet2, low, BST	Diet1, high, BST	Diet2, high, BST
AcTsF	12.0	13.1	7.27	8.02	8.71	9.39	5.06	5.60
FaTsF	6.37	6.39	5.76	5.81	6.22	6.26	5.51	5.58
TsFaF1	8.59	8.58	8.96	8.93	8.90	8.89	9.28	9.25
AcTmV	27.5	27.7	38.8	39.3	31.4	31.7	42.3	42.8
FaTmV	3.25	3.24	4.54	4.50	3.74	3.72	5.11	5.06
TAaPmV	11.2	11.7	14.2	14.7	12.4	12.7	15.4	15.9
GlLmV	11.6	11.9	14.5	15.0	12.6	13.0	15.7	16.2
TAaLaV	0.841	0.858	1.05	1.08	0.910	0.937	1.14	1.17

Key Words: Computer Model, Systems, Teaching

W295 Energy dilution of growing heifers' diet as a tool for induced negative energy balance in cattle. A. Arieli*[1], O. Eshel[1], U. Moallem[2], and Z. Uni[1], [1]*Hebrew University of Jerusalem*, *Rehovot, Israel*, [2]*Agricultural Research Organization*, *Bet Dagan, Israel*.

Our objective was to determine if energy dilution of growing heifers' diet is an appropriate model for inducing NEB in cattle. Four non-pregnant, non-lactating Holstein heifers (initial BW = 410 kg) were used in a 4 × 4 Latin square design trial with 21d periods to evaluate the effects of dietary energy dilution on: feed intake, energy balance and metabolic traits. Diets were based on a heifers mix (HMIX, 13% CP, 53% NDF, 1.35 Mcal NEL/kg DM). Control heifers (CON) were fed with diet containing 65% HMIX, 31% wheat straw and 4% SBM. The other diets contained 55% HMIX, 27% wheat straw, 3% SBM and 15% of either corn grains, barley grains or soy hulls supplements (COR, BAR and SOH diets, respectively). Blood samples were obtained weekly, 2 hours before morning feeding. Feed intake was monitored daily. Total tract digestibility was assessed by using indigestible NDF as a digestive marker, and energy values were based on DE. Intakes of DM and BW changes were similar among treatments and averaged 9.7 and 0.35 kg/d, respectively. Intake of DE, dietary concentration of DE, and ME intake above maintenance requirements were higher ($P < 0.05$) in supplemented diets than in CON (26.8 vs. 21.8 Mcal/d, 2.65 vs. 2.45 Mcal DE/kg of DM, and 11.9 vs. 7.3 Mcal ME/d). Blood NEFA and PUN were lower ($P<0.001$) and blood glucose was higher ($P<0.04$) in COR than in CON cows (105 vs. 185 meq/l, 8.3 vs. 9.9 mg/dl, and 85 vs. 80 mg/dl, respectively). Intermediate values were obtained for the corresponding blood metabolite concentration of BAR and SOH cows. Blood BHBA was similar among treatment, averaging 2.6 mg/dl. Significant correlations were found between ME intake above energy requirements and dietary DE concentration ($r = 0.75$. $P< 0.001$), and blood NEFA ($r = 0.68$, $P < 0.01$), indicating that NEB balance could be reached with diets diluted to less than 2.0 Mcal DE/kg of DM. These data indicate that energy dilution of growing heifers diet can be used as a tool for induced NEB in cattle.

Key Words: Heifers, Energy Balance, Dietary Energy Dilution

W296 Negative exponential models to predict dry matter intake of dairy heifers. P. C. Hoffman*, K. A. Weigel, and R. R. Wernberg, *University of Wisconsin*, *Madison*.

Daily pen dry matter intakes (DMI, n=9273) were collected over a 28 month period at the Integrated Dairy Research Facility of the University of Wisconsin-Madison. Forty, 4.5 × 9.0 m pens containing eight Holstein or Holstein × Jersey crossbred heifers were bedded with sawdust and provided access to 0.75 m of bunk space/heifer. Diets were formulated bi-monthly and fed to a common bunk score, with dietary nutrient densities, ambient temperature, and nutrient intakes recorded daily. Heifers were weighed at 60 d intervals, and mean pen body weights (BW) were adjusted for the number of days between the weigh intervals using average daily gain during the interval as a regression coefficient. Prediction of DMI was evaluated using first and second order random effects mixed models or non-linear models using the MIXED or NONLIN procedures of SAS, respectively. The effects of breed, BW, temperature and NDF deviation (from predicted mean dietary NDF for that BW) were considered as independent variables. Dietary NDF deviation was considered because dietary nutrients densities are codependent with BW. Preliminary mixed models suggested that NDF deviation was an independent source of DMI variance. The best DMI prediction was achieved with negative exponential non-linear models for Holstein and crossbred heifers. For Holsteins (R^2=0.87), the prediction equation was: DMI (kg/d) = 15.7930 * (1 - exp(-0.00210 * BW)) - 0.0820 * NDF deviation, where: NDF deviation = (dietary NDF as a % of DM) - (22.07020 + (0.08714 * BW) - (0.00007383 * $(BW)^2$)). For crossbred heifers (R^2=0.87), the prediction equation was: DMI (kg/d) = 13.4770 * (1 - exp(-0.00271 * BW)) - 0.0824 * NDF deviation, where: NDF deviation = (dietary NDF as a % of DM) - (23.11235 + (0.07968 * BW) - (0.00006252 * $(BW)^2$)). Alternative negative exponential DMI models when dietary NDF is unknown were also developed. The Holstein DMI equation (R^2=0.83) was: DMI(kg/d) = 15.3642 * (1 - exp(-0.00220 * BW)), where as the crossbred DMI equation (R^2=0.82) was: DMI(kg/d) = 12.9139 * (1 - exp(-0.00295 * BW).

Key Words: Heifers, Intake, Prediction

W297 Impact of corn particle size and forage source on nitrogen digestibility and partitioning in lactating Holstein dairy cows. N. E. Brown*, V. A. Ishler, T. W. Cassidy, K. Heyler, and G. A. Varga, *The Pennsylvania State University*, *University Park*.

The utilization of dietary nitrogen and the efficiency in which it is converted into milk protein has tremendous implications on productivity, profitability and environmental stewardship of dairy operations. A replicated 4 × 4 Latin square design was conducted to evaluate the effects of forage source and corn particle size on N digestibility, N partitioning and ammonia (NH_3) volatilization from manure in mid-lactation Holstein dairy cows. The four treatments were: 1) grass silage (G) with fine (F) ground corn (GF), 2) G with coarse (C) ground corn (GC), 3) alfalfa silage (A) with F (AF) and 4) A with C (AC) in diets for lactating cows. Diets were 50% forage on a DM basis with the treatment forage comprising 50% of the forage DM and corn silage making up the remaining forage. Approximately 40% of the coarse corn and 100% of the fine corn was able to pass through or remaining on a 16 inch sieve screen. Cows that were fed A based rations consumed and deposited greater N in milk (780 and 176 g/d respectively) compared to cows consuming G based rations (612 g/d and 142 g/d). The A based ration showed a trend (P < 0.09) for greater CP digestibility (57%) compared to grass based rations (53%); fecal N excretion for cows fed A based rations (347 g/d) was greater than cows fed G silage based rations (291 g/d). A trend (P<0.07) was observed for greater urinary N excretion for cows fed A based rations (272 g/d) compared to G based rations (243g/d). More of the dietary N was converted into milk protein for the G based rations (26%) compared to the A based rations (22%). Corn particle size had no significant impact on the digestibility or the partitioning of N into milk. Based upon NH_3 emissions measured, a total of 655 animals and 569 animals could be maintained on the G and A based rations respectively, resulting in the production of 100 lbs of ammonia, the threshold upon which dairy operations may be regulated.

Key Words: Corn particle Size, Nitrogen Partitioning, Ammonia Emission

W298 Evaluation of a corn replacement product in diets fed to lactating dairy cows. D. J. Rincker*[1], N. A. Janovick Guretzky[1], P. H. Doane[2], and J. K. Drackley[1], [1]*University of Illinois*, *Urbana*, [2]*ADM Animal Nutrition Research*, *Decatur, IN*.

Our objective was to determine the efficacy of a prototype product designed to replace corn grain in diets for lactating cows. The corn replacement product (CRP) was prepared by treating corn stover with CaO and water in an enclosed twin screw continuous mixer (Readco® Continuous Processor). The treated stover then was mixed with distillers grains (3:1 ratio) and pelleted. Multiparous and primiparous Holsteins (n = 13 per diet) were used in a complete randomized design trial with a 14-d standardization period and 33-d experimental period. Diets contained (DM basis) 40.0% corn silage, 10.0% alfalfa silage, 5.5% soybean hulls, and concentrates. Replacement of approximately 50% (Low; LCRP) or nearly all (High; HCRP) corn grain resulted in diets containing 11 or 22% of DM as CRP. Diets were isonitrogenous and isocaloric (if CRP was effective) with the control diet, which contained 16.5% CP and 1.71 Mcal NEL/kg. Dietary NDF was 33.3, 38.2, and 42.5% of DM for control, LCRP, and HCRP, respectively. The DMI decreased linearly (P < 0.001) as CRP increased (19.8, 16.7, and 14.3 kg/d for control, LCRP, and HCRP). Intake of NDF was similar for all diets (6.8, 6.1, 6.3 kg/d). Milk yield decreased (P =0.05) when CRP was fed (27.1, 23.6, 23.7 kg/d). Milk fat percentage was not affected by treatment (P > 0.20), but milk protein percentage and yields of milk solids decreased linearly with CRP (P < 0.01). Body weight was less for cows fed LCRP and HCRP versus control (P < 0.05), probably because lower DMI for CRP diets decreased gut fill. Calculated energy balance decreased linearly with CRP inclusion. Total tract apparent digestibilities of DM and energy were greater (P < 0.05) for LCRP than for control or HCRP. A combination of chemically treated corn stover and DDGS was not an effective replacement for corn grain in diets fed to mid-lactation cows.

Key Words: Corn Replacement, Corn Stover, Dairy Cows

W299 Effect of feed energy source on milk components in dairy cattle. M.-C. Ferland*[1], D. Lefebvre[2], and K. M. Wade[1], [1]*McGill University*, *Montreal, QC, Canada*, [2]*Valacta*, *Ste. Anne de Bellevue, QC, Canada*.

The objective of this study was to evaluate the effect of three different energy sources on the milk composition of dairy cattle. These energy sources were corn grain (CG), high-moisture corn (HMC) and Commercial concentrate (CONC). A total 9,163,240 test-day records from 570,083 Holstein cows from 5191 different herds, and 434,018 test-day records from 27,110 Ayrshire cows from 652 different herds covering a period of five years were obtained from the Québec dairy herd improvement agency (Valacta). In addition to test-day records, information on lactation, feed composition and feeding systems was also available. Diets with only one of the three sources as the sole source of energy supplement were included. For both breeds, cows consuming diets with HMC and CG tended to have higher milk yield, higher fat and protein content and lower MUN concentration then cows consuming diets with a CONC. Milk yield averages were 28.92 kg/day, 27.34 kg/day and 26.22 kg/day (for Holsteins) and 23.64 kg/day, 22.51 kg/day and 21.70 kg/day (for Ayrshires) for HMC, CG and CONC respectively. The equivalent fat % values were 3.87%, 3.87% and 3.76% (for Holstein) and 4.09%, 4.03% and 4.02% (for Ayrshires) for HMC, CG and CONC respectively. Milk protein % in Holsteins was higher on HMC and CG diets (3.35% and 3.34% respectively) compared to CONC diets (3.25%). There were negligible differences in the overall milk-protein values for Ayrshires; however, similar trends to those seen in Holsteins were observed from 75 to 305 DIM. The MUN content was higher for CONC compared to HMC and CG in both breeds. Holstein averages of MUN were 10.51 mg/dL, 10.86 mg/dL and 11.93 mg/dL while Ayrshire averages of MUN were 11.04 mg/dL, 11.20 mg/dL and 13.03 mg/dL for HMC, CG and CONC respectively.

Key Words: Feed Energy Source, Milk Components, Dairy Cattle Nutrition

W300 The effect of dry chopped alfalfa hay content on eating behavior, milk yield and components, and rumen fermentation in lactating dairy cows. D. D. Maulfair* and A. J. Heinrichs, *The Pennsylvania State University*, *University Park*.

The objective of this experiment was to evaluate the inclusion of dry chopped alfalfa hay in lactating dairy cow rations on eating behavior, milk yield and components, and rumen fermentation. Eight multiparous Holstein cows (79 ± 18 DIM initially; 660 ± 87 kg BW) were randomly assigned to replicated 4 × 4 Latin Squares. One square consisted of cannulated cows and the other, non-cannulated cows. During each of the four periods, cows were fed one of four diets that were chemically similar but varied in dry chopped alfalfa hay level. The forage DM content of each ration consisted of 50% corn silage and 5, 10, 20, or 40% dry chopped alfalfa hay. The remaining forage DM content was alfalfa silage (45, 40, 30, and 10% respectively). The other ingredients of the ration included: ground corn, canola meal, roasted soybeans, bypass protein blend, and a mineral/vitamin mix. The forage level for each ration was between 58 and 59% and the total ration DM was 49, 50, 52, and 56% for the 5, 10, 20 and 40% rations respectively. No significant differences ($P< 0.05$) were found in feed sorting, milk yield and components, DMI, and rumen pH among the four rations. This experiment indicates that there is opportunity to include dry chopped alfalfa hay in lactating dairy cow rations at rates up to 40% of the forage DM content (approximately 23% of total ration DM) without adverse effects on eating behavior, milk yield and components, and rumen fermentation.

Key Words: Forage Level, Feed Sorting, Ruminal pH

W301 Evening feeding improves nutrient digestibility and nitrogen balance in lactating cows. A. Nikkhah*, J. C. Plaizier, C. J. Furedi, A. D. Kennedy, G. H. Crow, and K. M. Wittenberg, *Department of Animal Science*, *Winnipeg, MB, Canada*.

The primary objective was to evaluate the impact of feed delivery at either 2100 h or 0900 h on nutrient digestibility and nitrogen (N) partitioning. Four multiparous and four primiparous midlactation Holsteins were used in a cross-over design with two 6-week periods. Each period consisted of 3-wk adaptation. Cows were offered a TMR containing 50% concentrate (DM basis). Total fecal and urine were collected during week-4 to determine the total tract nutrient digestibility and N partitioning. Dry matter intake and milk yield were also recorded. Data were analyzed as a Mixed model with the fixed effects of feeding time, parity, and the interaction. Compared with morning feeding, evening feeding improved ($P<0.05$) the apparent total tract digestibility of dry matter (63 vs. 60), N (65.5 vs. 63%), NDF (49 vs. 44%), and ADF (44 vs. 41%). Provision of fresh TMR at 2100 h instead of 0900 h increased N intake by primiparous cows (562 vs. 510 g/d). Urinary and milk N outputs, % of digested N, were lower ($P<0.05$) with evening vs. morning feeding suggesting improved body N retention. Consequently, N balance was improved by providing fresh TMR at 2100 instead of 0900 h (55 vs. -3.5 g/d). Milk protein percent (2.82 vs. 3.12%, $P<0.10$) and not yield (1.0 vs. 1.1 kg/d) was numerically lower in multiparous, but not in primiparous, cows fed at 2100 vs. 0900 h. Treatments did not significantly affect rumen microbial protein synthesis. Results suggest beneficial impacts of evening feeding on nutrient digestibility and N retention in lactating cows. Reduce N excretion via urine and feces by evening feed delivery may have environmental implications.

Key Words: Evening Feeding, Digestibility, Nitrogen Balance

W302 Time of feed delivery: A determinant of post feeding patterns in feed intake of lactating cows. A. Nikkhah*, J. C. Plaizier, C. J. Furedi, G. H. Crow, and A. D. Kennedy, *Department of Animal Science*, *Winnipeg, MB, Canada*.

We examined the effects of providing a higher (HC) or a lower concentrate (LC) total mixed ration at either 2100 h or 0900 h on post feeding patterns in feed intake of dairy cows. Four primiparous and four pluriparous tie-stall-housed Holsteins were used in a 4×4 Latin square design with four 3-week periods. Cows were not heat stressed at any time during the experiment. Each period consisted of 2-week adaptation. The concentrate portion was 62% for HC and 51% for LC diet (DM basis). Feed intake was monitored continuously for the entire trial using a data acquisition system (Grow-Safe 4000 Hardware). Data for week-3 of each period were analyzed as a Mixed Model. Time of feed delivery had no effects on total feed consumed. Feeding at 2100 h instead of 0900 h, however, remarkably increased the amount consumed within 3-h post feeding from 26 to 37% of total daily intake ($P<0.01$). The amount consumed within 6-h and 9-h post feeding were similar in 0900 h- and 2100 h-fed cows. By 12-h post feeding, however, 0900 h-fed cows had eaten 75% of their daily intake compared with 68% in 2100 h-fed cows ($P<0.01$). This difference remained significant at 21-h post feeding (83 vs. 76%), as well. Parity and diet did not interact with feeding time on diurnal feed intake patterns. Results introduce the time of feed delivery as a main determinant of post feeding patterns in feed intake of lactating cows.

Key Words: Feed Delivery Time, Feed Intake Pattern, Lactating Cow

W303 Feed sorting in dairy cattle: effects of forage content and dietary change. T. J. DeVries*[1], K. A. Beauchemin[1], and M. A. G. von Keyserlingk[2], [1]*Agriculture and Agri-Food Canada*, *Lethbridge, AB, Canada*, [2]*University of British Columbia*, *Vancouver, BC, Canada*.

The objective of this study was to determine whether the amount of forage in a TMR influences feed sorting by cows and whether the extent of this sorting changes as they adapt to a new diet. Six lactating Holstein cows, individually fed once per day, were provided in a crossover design with 2 diets (DM basis): 1) high forage diet (HF; 62.3% forage), and 2) low forage diet (LF; 50.7% forage). DMI, feeding behavior, and sorting activity were monitored for each cow on each diet for 7 d. Fresh feed and orts were sampled daily for each animal and subjected to NDF and particle size analysis. The particle size separator contained two screens (18 and 9 mm) and a bottom pan resulting in 3 fractions (long, medium and short). Sorting activity (for each fraction, NDF and physically effective fiber: peNDF) was calculated as the actual intake expressed as a percentage of the predicted intake. To determine if sorting occurred, each variable was tested for a difference from 100%. Cows on the LF diet had higher DMI (22.2 vs 19.9 kg/d; P=0.03), but they spent less time feeding (193.3 vs 220.5 min/d; P=0.02), which translated into a higher intake rate (0.15 vs 0.11 kg/min; P=0.02) compared with cows on the HF diet. Overall, sorting activity was greatest on the LF diet (P<0.001) with cows sorting for short particles (106.1%; P< 0.001), but against long particles (74.2%; P<0.001), medium particles (98.3%; P=0.001), NDF (97.1%; P<0.001), and peNDF (90.1%; P<0.001). On the HF diet, cows sorted against long particles (93.7%; P=0.07), NDF (98.9%; P=0.009), and peNDF (96.8%; P=0.03) and sorted for short particles (103.5%; P=0.001). Treatment*day interactions (P<0.1) occurred for sorting for short particles and against peNDF because it took cows 1 d to adjust their sorting behavior to the LF diet. These results indicate that cows rapidly adjust their sorting behavior when subjected to a dietary change and they exhibit more sorting for short particles and against long particles, NDF and peNDF when fed a LF diet.

Key Words: Sorting, Forage, Particle Size

W304 Understanding feed sorting by dairy cows. W. Z. Yang* and K. A. Beauchemin, *Research Centre, Agriculture and Agri-Food Canada*, *Lethbridge, AB, Canada*.

The sorting behaviour of lactating dairy cows was examined by compiling results from various studies. The diets in these studies contained alfalfa silage (AS), barley silage (BS) or corn silage (CS) cut coarsely or finely and mixed with either barley- or corn-based concentrate. Particle size of each TMR was determined using the Penn State Particle Separator with a top sieve (19-mm, long particles), middle sieve (8-mm) and pan. The physical effectiveness factors (pef; top + middle fractions) for the TMRs containing fine and coarse silages were (DM basis): 0.36 and 0.53 for AS diets, 0.33 and 0.41 for BS diets, and 0.30 and 0.56 for CS diets. The difference in the proportion of long particles between the TMR and the orts indicates whether cows select against or in favor of long forage particles. For AS diets, the proportion of long particles in the orts (19 and 25%) was higher (P < 0.01) than in the original TMR (6 and 10%) containing coarse or fine silages, respectively. The pef was also greater (P < 0.01) for orts (0.64 and 0.44) than for TMRs containing coarse and fine silages, respectively. However, for BS diets, the proportion of long particles (0.9 and 0.5%) and the pef (0.33 and 0.28) of the orts were smaller (P < 0.05) than in the original TMRs. For CS diets, the proportion of long particles in the orts (6.3 and 0.2%) was smaller (P < 0.01) than in the TMR (8.6 and 7.0%) for coarse and fine cut silages, respectively, when barley grain was fed. In contrast, the proportion of long particles in the orts (13.6 and 3.7%) was greater (P < 0.01) than in the TMR (7.6 and 2.3%) for coarse and fine silage, respectively, when corn grain was fed. Mean ruminal pH, measured using indwelling probes, was 6.29 for AS, 5.65 for BS, 5.49 for CS with barley grain and 6.04 for CS with corn grain diets. Dairy cows sort against long particles when fed AS or corn grain-based diets, but not when fed diets that lower ruminal pH. In the case of low ruminal pH, cows intentionally select long particles to meet their need for physically effective fiber.

Key Words: Physically Effective Fiber, Sorting, Dairy Cow

W305 Susceptibility of lactating dairy cows to ruminal acidosis depends on the proportion of forage in the diet. F. Dohme[1], T. J. DeVries[2], K. A. Beauchemin*[2], K. M. Krause[3], and K. S. Schwartzkopf-Genswein[2], [1]*Agroscope Liebefeld-Posieux, Research Station ALP*, *Posieux, Switzerland*, [2]*Agriculture and Agri-Food Canada*, *Lethbridge, AB, Canada*, [3]*West Virginia University*, *Morgantown*.

An experiment was conducted to determine the effects of the physically effective fiber content of the diet on susceptibility of cows to ruminal acidosis. Eight lactating ruminally cannulated cows were assigned to one of 2 diets (DM basis): high fiber (HF, 60% forage) or low fiber (LF, 45% forage). Following a 2-wk adaptation, ruminal pH was measured continuously for 9 d to determine the effects of an acidosis challenge. Total acidosis was defined as pH < 5.8 and moderate acidosis as pH < 5.5. After a 3-d baseline measurement period, feed was restricted to 50% *ad libitum* intake for 24 h. Following this restriction period, cows were provided with 4 kg of ground barley/wheat followed by *ad libitum* allocation of TMR (challenge day). Throughout the experiment, pH profiles were higher (P < 0.05) for cows fed HF compared with LF. During the baseline period, cows fed HF had higher mean pH (6.28 vs 5.85; P = 0.01) and shorter duration of total (2.2 vs 9.5 h/d; P = 0.003) and moderate acidosis (0.6 vs 3.1 h/d; P = 0.05). Both groups responded to the challenge in a similar manner as there were no day × diet interactions (P > 0.05) for any of the pH variables measured. Relative to the baseline period, pH drastically dropped on the challenge day, recovering 2 days later. On the challenge day, mean pH dropped by 0.25 pH units (P < 0.001), duration of total acidosis increased by 6.4 h/d (P < 0.001) and moderate acidosis increased by 5.9 h/d (P < 0.01) relative to baseline. Higher baseline ruminal pH profiles of cows fed HF helped reduce the extent of pH depression during the acidosis challenge. These results suggest that diets containing higher levels of physically effective fiber help maintain a higher ruminal pH, which helps prevent severe acidosis from occurring as a result of improper feed delivery.

Key Words: Acidosis, Ruminal pH, Physically Effective Fiber

W306 Diagnosis of acidosis in dairy cattle using milk fatty acid profiles. M. Craninx*[1], A. Beeckman[1], H. Van Laar[2], J. Martin-Tereso[2], and V. Fievez[1], [1]*Laboratory for Animal Nutrition and Animal*

Product Quality, Ghent University, *Ghent, Belgium*, [2]*Nutreco Ruminant Research Centre*, *Boxmeer, The Netherlands*.

Acute and/or subacute ruminal acidosis (SARA) manifests with low-roughage high-concentrate diets and sudden changes in diet or dry matter intake pattern. SARA is characterised by prolonged periods of depressed ruminal pH, which can be linked to a modified rumen microbial population. Previous experiments showed that the milk fatty acid (MFA) pattern can be used to assess rumen function, particularly the odd and branched-chain MFA as they are of microbial origin. Further, accumulation of biohydrogenation intermediates are dependent of rumen conditions. Results from experiments with high concentrate diets showed a rapid increase in trans-10 C18:1 (> 5 g / kg milk fat) when the average daily ruminal pH drops below 5.8. Milk C17:0 + C17:1 cis-9 and C15:0 are negatively, whereas iso C14:0 and iso C15: 0 are positively correlated with the rumen pH. This was applied for the interpretation of the MFA pattern of a cow in a feeding trial that became sick in the 3rd week of lactation, because of a severely disturbed roughage and concentrate intake pattern. The animal was fed a diet high in concentrate and ad libitum a forage mixture containing grass and hay silage. MFA (g/kg milk fat) in weekly pooled samples of the first 4 weeks showed a peak concentration of trans-10 C18:1 (0.31, 0.25, 2.55, 0.47) and trans-10 cis-12 CLA (0.008, 0.009, 0.035, 0.012) in week 3, which rapidly decreased when the cow was offered a standard Dutch dairy diet based on concentrate/grass silage/maize silage in week 4. Apparently, these MFA show potential as indicators of acute acidosis. The odd and branched-chain MFA pattern already showed changes in terms of an increased C17:0 + C17:1 cis-9 (0.83, 1.42, 0.94, 0.97) and a decreased iso C14:0 (0.076, 0.034, 0.033, 0.038) concentration before clinical symptoms of digestive disorders were obvious. These results are currently further explored for the development of an early-diagnosis-model for acidosis, based on the MFA.

Key Words: Acidosis, Milk Fatty Acids, Detection

W307 Subacute ruminal acidosis increases milk fat depression with diets supplemented with polyunsaturated fatty acids. O. AlZahal*, M. R. Or-Rashid, S. L. Greenwood, M. S. Douglas, and B. W. McBride, *University of Guelph*, *Guelph, Ontario, Canada*.

The objective of this study was to investigate the effect of subacute ruminal acidosis (SARA) and dietary soybean oil (SBO) interaction on milk fat content and yield. Six rumen-fistulated lactating Holstein dairy cows (639 ± 51 kg body weight) were used in the study. Cows were allocated into blocks based on DIM (early 80 d, moderate 135 d, and late lactation 206 d). Two dietary treatments, control diet (% DM, 40% corn silage, 27% mixed haylage, 7% alfalfa hay, 18% protein supplement, 4% ground corn, and 4% wheat bran) and SARA diet (% DM, 31% corn silage, 20% mixed haylage, 5% alfalfa hay, 15% protein supplement, 19% ground wheat, and 10% ground barley) were randomly assigned to each block. The trial consisted of a 4-wk pre-SBO period, a 3-wk SBO period, and a 3-wk post-SBO period. The control (n=3) and SARA (n=3) diets were fed throughout the trial and SBO (2% of previous week average DM intake) was added into the rumen through the fistula during the SBO period. Ruminal pH was continuously recorded and milk samples were taken 3 d per wk. Milk yield and DM intake were recorded daily. Data were averaged by week and analyzed by SBO period using PROC MIXED of SAS with repeated measures. The effect of SBO was tested by the contrast describing time (wk) and time by diet interaction. During pre-SBO period, time below pH 5.8, pH 6.0, and pH 6.2 and mean pH was different ($P < 0.05$) between control and SARA cows. Soybean oil addition depressed milk fat for both SARA and control cows (table 1). However, the significant interaction (table 1) denoted that the SARA cows had a greater milk fat depression. By wk 3 of SBO; milk fat % dropped 21% and 42% and fat yield dropped 21% and 49% for control and SARA cows; respectively.

Table 1. Effect of SBO on milk fat % and milk fat yield

	Control			SARA				*P* Value	
Item/wk	1	2	3	1	2	3	SEM	T[1]	T[1] × Diet
Fat, %	4.19	3.88	3.25	4.42	3.61	2.55	0.12	<.0001	<.0001
Fat, kg/d	1.22	1.21	0.96	1.36	1.12	0.75	0.06	<.0001	<.0001

[1] Linear effect of time.

Key Words: SARA, Milk Fat, Soybean Oil

W308 The effect of buffering dairy cow diets with limestone, Acid Buf or sodium bicarbonate + limestone on production response and rumen parameters. C. W. Cruywagen*[1], S. J. Taylor[2], and M. M. Beya[1], [1]*Stellenbosch University*, *Stellenbosch, South Africa*, [2]*Celtic Sea Minerals*, *Cork, Ireland*.

A high concentrate TMR, formulated to be potentially acidotic, was used to construct three dietary treatments in which Acid Buf, the skeletal remains of the seaweed *Lithothamnium calcareum*, was compared against limestone (Control) and sodium bicarbonate plus limestone. The diets contained 4 g/kg of Acid Buf or 3.5 g/kg limestone (Control) or 3.7 g/kg of limestone plus 8 g/kg of sodium bicarbonate, respectively. The response to treatment was measured using 6 rumen cannulated lactating Holstein cows allocated to treatments according to a 3 × 3 (n=2) balanced Latin square design, with three treatments and three periods. The total experimental period was 66 days in which every cow received each diet for a period of 15 days prior to a data collection period of 7 days. Rumen pH was monitored continuously every 10 minutes for 2 days using a portable data logging system and in-dwelling electrodes. During each data collection period, milk was collected and analysed for its solids and mineral content. Feed dry matter consumption was also recorded. The impact of treatment on rumen acidity was clearly visible, especially during the period from mid day to midnight when pH dropped to below 5.5 for a longer period (13 h) in the Control (limestone) treatment than in the Sodium Bicarbonate (7.7 h) and Acid Buf (4 h) treatments. The minimum rumen pH was lower for the Control (5.19) than for the Acid Buf treatment (5.42), while the pH for the Sodium Bicarbonate treatment (5.37) did not differ from the other treatments. Daily milk yield was 27.6^{a}, 29.1^{a} and 31.6^{b} liters/cow for the Control, Sodium Bicarbonate and Acid Buf treatments, respectively, with milk containing 38.6^{a}, 41.8^{b} and 42.1^{b} g/kg fat and 34.3, 33.8 and 34.7 g/kg protein. The trial indicated that supplementing the diet of dairy cows with approximately 90 g/day of Acid Buf may have a greater impact on rumen acidity and milk production than 180 g/day of sodium bicarbonate and that sub-clinical rumen acidosis could reduce daily milk output by 4 liters/cow.

Key Words: Acid Buf, Buffers, Rumen Parameters

W309 Ruminal temperature may aid in the detection of subacute ruminal acidosis. O. AlZahal*[1], E. Kebreab[1], J. France[1], M. Froetschel[2], and B. W. McBride[1], [1]*University of Guelph*, *Guelph, Ontario, Canada*, [2]*Edgar L. Rhodes Center for ADS, University of Georgia*, *Athens*.

Subacute ruminal acidosis (SARA) is a common condition in early lactating cows that is difficult to diagnose. The objective of this study was to investigate the relationship between ruminal pH and temperature (T) and to develop a predictive equation that may aid in the diagnosis of SARA. Six rumen-fistulated lactating Holstein dairy cows (639 ± 51 kg body weight) were used in the study. Cows were randomly allocated to one of two dietary treatments, control diet (%DM, 40% corn silage, 27% mixed haylage, 7% alfalfa hay, 18% protein supplement, 4% ground corn, and 4% wheat bran) and SARA diet (%DM, 31% corn silage, 20% mixed haylage, 5% alfalfa hay, 15% protein supplement, 19% ground wheat, and 10% ground barley). The trial consisted of 1 wk of adaptation and 1 wk of collection. During wk 2, ruminal pH and temperature were continuously recorded (every minute) for 4 d by an indwelling system. Daily average ruminal pH and temperature (table 1) was analyzed using PROC MIXED of SAS with repeated measures. The relationship between lowest pH point of the day and associated temperature was investigated using PROC MIXED considering intercept and slope for each cow as random effects and with repeated measures. SARA cows had greater ($P < 0.05$) average daily ruminal temperature and time (min/d) above 39.2 and 39.0 °C than control cows. Ruminal temperature had a negative relationship with ruminal pH and the random effect of cow was not significant:
pH = (16.9 ± 2.04) + (– 0.29 ± 0.052 T), $R^2 = 0.77$, n = 22, $P < 0.0001$.

Table 1. Ruminal pH and temperature summary

	Control	SARA	SE	*P* Value
pH				
Mean	6.17	5.84	0.05	<0.01
Max	6.68	6.54	0.05	0.09
Min	5.51	5.09	0.06	<0.01
[1]< 5.6	60	412	38	<0.01
< 5.8	174	687	74	<0.01
< 6.0	405	907	91	<0.01
Temp., °C				
Mean	38.54	39.21	0.22	0.05
Max	39.87	40.44	0.32	0.21
Min	36.70	36.75	0.23	0.89
[1]> 39.4	139	561	156	0.07
> 39.2 °C	263	723	149	0.04
> 39.0 °C	418	884	158	0.05

[1] Time (min/d) spent below () a given critical cut-off point.

Key Words: Dairy Cow, SARA, pH

W310 Evaluation of an intraruminal pH probe. B. A. Crooker*[1], W. J. Weber[1], S. C. Denham[2], and J. L. Vicini[2], [1]*University of Minnesota*, *St. Paul*, [2]*Monsanto Company*, *St. Louis, MO*.

Studies were conducted to compare rumen pH measurements from an intraruminal pH probe (IRP) to those obtained from a standard pH meter (M). Functional life and ability of IRP to detect changes caused by alterations in diet and feeding management were evaluated. The IRP (Well Cow, LTD, Bedford, UK) were calibrated prior to insertion and the M (Thermo Electron Corp., Beverly, MA) was calibrated before each use. Frequency (1 or 10 min) of measurement and data download from IRP were controlled through software on an external computer. The IRP (n = 2 or 3) were placed in the reticulum (R) or rumen of 3 lactating and 1 non-lactating cows for up to 28 d (Study 1). Measurements by M were obtained from R and ventral (V), caudal-ventral (CV) and caudal-dorsal (CD) sacs on d 0 to 5, 11, 23, and 27. Study 2 had three, 3-wk periods in which cows were fed a basal diet with sodium bicarbonate (B) 1X/d (continuous access to feed) and pH in R was compared with that of cows fed a) B with extra starch 1X/d, b) B as two discrete (3h) meals/d, or c) B without bicarbonate 1X/d. Each period had a 7 d transition (all cows fed B) and 14 d of treatment. The IRP (n = 2) were placed in R of 12 lactating cows blocked (n = 3) by DIM and milk yield. Results from IRP and M were compared using restricted maximum likelihood mixed model analysis. Means differed if $P < 0.05$. Mean pH by M differed by site (6.37, 6.28, 6.19, and 6.13 ± 0.04 in R, V, CV and CD, respectively) and time with no interaction (Study 1). When IRP functioned correctly, IRP and M values differed by less than 0.1 units but this was significant. Life of IRP was shorter (24.8 ± 1.5 and 28.6 ±3.6 d for Study 1 and 2, respectively) and overall failure (50% by 28 d) greater than expected. Daily mean pH was not altered by treatment. Mean daily decline in pH after feeding was greater in cows not fed bicarbonate (-0.57 vs. -0.44 ± 0.01). The minimum pH per day was less for cows fed 1X/d than 2X/d (6.29 vs. 6.44 ± 0.07). The IRP have potential to provide accurate, prolonged measurements of pH but their functional life needs to be increased.

Key Words: Intraruminal Probe, pH, Cow

W311 Role of effective fiber in reducing milk fat depression in lactating cows fed Rumensin. D. R. Mertens*, *U.S. Dairy Forage Research Center*, *Madison, WI*.

It is unclear how Rumensin (R) and effective fiber interact with high concentrate diets that lead to milk fat depression (MFD). Goals were to determine the effects of R when added to a milk fat-depressing diet and the role of effective fiber in alleviating MFD. Sixty-five cows were fed a typical dairy ration for one week, and then given a ration that was low in fiber for four weeks. After four weeks, 60 cows were blocked into fifteen groups based on parity, days in lactation, MFD, 4.0% FCM, and body weight. Cows were assigned diets in a randomized complete block design with a 2×2 factorial arrangement of treatments: two levels of NDF in the ration each fed with 0 or 14.6 g of R per ton of ration DM for 12 weeks. Low-fiber diets contained high moisture corn (HMC) and were formulated to contain 27% aNDF and 19% peNDF. Added effective fiber was 5% wheat straw, which was substituted for HMC. Amylase and sodium sulfite were used to measure amylase-treated NDF (aNDF). Physically effective fiber (peNDF) was calculated as (aNDF) × (fraction of DM retained on sieves with 1.18mm or greater apertures). Cows were milked twice daily and fed individually. Milk samples were taken every 3 to 4 days. Chewing activity was recorded during weeks 4, 9, and 12. Data was analyzed using PROC MIXED. Added fiber increased (P=.003) and R decreased (P=.039) milk fat. A fiber by R interaction (P=.022) was related to R having minimal effect on milk fat when the low-fiber diet was fed and adding 5% chopped wheat straw increasing milk fat less when R was fed. Compared to low-fiber diets, adding 5% chopped straw did not alleviate milk fat depression, with (2.61 vs 2.85%) or

without (2.69 vs 3.30%) R. Neither added fiber nor R affected milk yield, 3.5% FCM, SCM, weight gain, or DMI. Minutes of chewing per day were increased by added fiber. Rumensin decreased eating time, but increased rumination time. In conclusion, low-fiber diets (27% aNDF and 19% peNDF) containing >27% readily fermentable starch from HMC require more than 23% peNDF in the diet to achieve normal milk fat, especially with Rumensin.

Key Words: Monensin, Effective Fiber, Milk Fat

W312 Validation of an on-farm tool (Z-Box) for determining a physical effectiveness factor using a bioassay based on chewing activity and ruminal fermentation in lactating dairy cows. H. M. Dann*[1], K. W. Cotanch[1], M. P. Carter[1], C. S. Ballard[1], T. Eguchi[2], and R. J. Grant[1], [1]*William H. Miner Agricultural Research Institute*, *Chazy, NY*, [2]*Zen-Noh National Federation of Agricultural Co-operative Associations*, *Tokyo, Japan*.

A study was conducted to determine 1) the agreement of on-farm and laboratory methods for determining a physical effectiveness factor (pef) and 2) the effects of pef and physically effective neutral detergent fiber (peNDF) content of diets on intake, chewing activity, and ruminal fermentation in dairy cows. Sixteen lactating Holstein cows (4 ruminally fistulated) were fed diets (control, fine, medium, and coarse) in a replicated 4×4 Latin square design with 14-d periods. Diets varied in pef and peNDF content by altering the particle size and inclusion level of oat hay. The pef of the diets was determined with a laboratory dry vertical sieving method (standard) and an on-farm, as-fed method (Z-Box). The $pef_{Z\text{-}Box}$ was in agreement with the $pef_{Standard}$ with no mean bias ($P = 0.55$) or slope bias ($P = 0.65$) with regression analysis. Based on ANOVA, intake of peNDF, chewing time, and eating time differed among diets ($P < 0.05$). The relative change in cow chewing response between the control and treatment diets resulted in a pef (pef_{Chew}) that agreed with the sieving-derived pef for the fine and coarse diets. Diet did not affect > 0.05) mean ruminal pH (6.1) or ruminal concentration of total volatile fatty acids (132 m*M*). In summary, the Z-Box method provides pef values that are similar to the standard method and appears to be useful for predicting cow chewing response.

Table 1.

Item	Control	Fine	Medium	Coarse
$pef_{Standard}$	0.58	0.55	0.60	0.63
$pef_{Z\text{-}Box}$	0.53	0.56	0.58	0.61
pef_{Chew}	-	0.54	0.40	0.65
$peNDF_{Standard}$, %	16.7	19.0	21.2	23.1
$peNDF_{Z\text{-}Box}$, %	15.3	19.4	20.5	22.2
Intake, kg peNDF/d	3.9^{d}	4.4^{c}	4.8^{b}	5.2^{a}
Chewing, min/d	726^{b}	775^{a}	762^{ab}	795^{a}
Eating, min/d	260^{b}	284^{ab}	291^{a}	307^{a}
Ruminating, min/d	466	491	471	488
Chewing, min/kg peNDF	189^{a}	173^{b}	161^{bc}	153^{c}
Eating, min/kg peNDF	68^{a}	63^{ab}	62^{ab}	59^{b}
Ruminating, min/kg peNDF	122^{a}	110^{b}	100^{bc}	94^{c}

[abcd] Means within a row with unlike superscripts differ ($P < 0.05$)

Key Words: pef, peNDF, Fiber

W313 Use of a caliper to measure skinfold thickness in multiparous Holstein cows and its relationship to body condition score. H. M. Dann* and J. K. Drackley, *University of Illinois*, *Urbana*.

Skinfold thickness measurement is a quick, inexpensive, and commonly used technique for indirectly measuring subcutaneous fat in humans and might be useful for indirectly measuring subcutaneous fat in dairy cows. Seventy-four multiparous Holstein cows were used to 1) evaluate changes in skinfold thickness at seven locations from dry-off to 8 wk postpartum and 2) compare skinfold thickness to body condition score (BCS). Skinfold thickness (mm) was determined weekly with a caliper (The Body Caliper; The Caliper Company, Inc., Las Vegas, NV) on the thigh region of the leg, rear udder attachment, tailhead, 12th rib, shoulder, neck, and dewlap. All measurements were made on the left side of the cow except for the udder measurement. Hair was clipped with a size 40 surgical blade to eliminate variation associated with hair coat thickness. Body condition score was determined weekly. Skinfold thickness measurements and BCS were analyzed by ANOVA using the MIXED procedure of SAS to evaluate the effect of time. The CORR procedure of SAS was used to determine Pearson correlation coefficients between skinfold thickness measurements and BCS. Skinfold thickness of the dewlap, rib, shoulder, and tailhead and BSC changed ($P < 0.01$) from dry-off to 8 wk postpartum with higher values prepartum than postpartum. Skinfold thickness of the leg and neck did not change ($P > 0.05$). Skinfold thickness of the udder increased around parturition and then decreased as lactation progressed ($P < 0.01$). Measurements of skinfold thickness at the rib (r = 0.11), shoulder (r = 0.26), and tailhead (r = 0.46) were correlated positively with BCS ($P < 0.01$). Skinfold thickness measurements of the dewlap, leg, and neck were not correlated with BCS ($P > 0.05$). A skinfold thickness score, calculated as the sum of the skinfold thickness of the rib, shoulder, and tailhead, was correlated positively with BCS (r = 0.48; $P < 0.01$). Skinfold thickness is an objective measurement that can be used in addition to BCS to assess the body fat reserves of dairy cows.

Key Words: Skinfold Thickness, Body Condition Score, Dairy Cow

W314 Development of a method for measuring forage fragility. K. W. Cotanch*[1], R. J. Grant[1], J. Darrah[1], H. M. Wolford[1], and T. Eguchi[2], [1]*William H. Miner Agricultural Research Institute*, *Chazy, NY*, [2]*Zen-Noh National Federation of Agricultural Co-operative Associations*, *Tokyo, Japan*.

A method to determine forage fragility was developed using a ceramic ball mill to elucidate the relationship among resistance to physical breakdown, neutral detergent fiber digestibility (NDFd) and animal chewing response of various forages. The objective of this study was to 1) develop a ball mill method to quickly and accurately determine forage fragility based on particle size reduction and 2) investigate the relationship between forage fragility and NDF digestibility at 24 h ($NDFd_{24}$). A series of preliminary tests were run to determine optimal sample size relative to jar volume, amount of ceramic balls, and the length of milling time. Fragility was determined as percentage reduction in the physical effectiveness factor (pef), percentage of dry matter larger than 1.18 mm after ball milling, as determined by dry vertical sieving compared to that of the original sample. The final ball mill method required 600 ml of sample dried overnight at 55°C, 900 g of ceramic balls (n = 40) in a 5.5 L jar for 6 h of milling. A set

of 10 forages was assayed for NDF, acid detergent fiber (ADF), acid detergent lignin (ADL), and $NDFd_{24}$using the Ankom system. Samples included two corn silages, three haycrop silages, alfalfa hay stems, grass hay first and second cut, oat hay and wheat straw. Forage fragility (x) was moderately related to $NDFd_{24}$ (y) with $R^2 = 0.34$ and regression equation of y = 1.04x + 11.74. Forage fragility as determined with this ball mill method is moderately related with NDFd but has yet to be compared with actual cow chewing data.

Key Words: pef, peNDF, Forage Fragility

W315 Near infrared spectroscopy can be used to predict pH and concentrations of volatile fatty acids in fermented feeds. D. P. Casper*, D. Spangler, J. Horst, S. Gravert, and K. Thompson, *Agri-King, Inc.*, *Fulton, IL*.

The concentrations of volatile fatty acids (VFA's) and pH of ensiled feeds are routinely measured to determine the extent and quality of the ensiling process. Measurement of pH and VFA's in ensiled feeds can be slow and time consuming using wet chemistry methods. This preliminary study was conducted to determine if NIRS technology could be used to rapidly predict pH and concentrations of VFA's in ensiled feeds. Samples being submitted to Agri-King's analytical laboratory for determination of pH and VFA's via wet chemistry techniques (pH meter and capillary electrophoresis) were selected for this study. Samples were forced air dried at 55°C and ground through a .8 mm screen before being scanned by a Foss NIRS 5000 instrument. The paired data were subjected to a *t*-test using the proc means procedure of SAS. This preliminary study demonstrated that NIRS technology can be used to rapidly determine the pH and VFA concentrations in fermented feeds (Table 1).

Table 1. The wet chemistry (Lab) and NIRS predicted measurements of pH and VFA's in different ensiled feeds

Feed/Variable	# Obs	Lab	NIRS	Difference	P > t*
Haylage, pH	519	4.88	4.80	.08	.01
Lactic, %	489	5.62	5.69	.08	NS
Acetic, %	499	2.30	2.38	.01	NS
Corn Silage, pH	429	4.02	3.92	.10	.01
Lactic, %	417	4.80	4.80	<.01	NS
Acetic, %	405	2.31	2.25	.06	NS
Small Grain Silage, pH	148	4.46	4.41	.05	NS
Lactic, %	143	4.82	4.86	.04	NS
Acetic, %	143	2.30	2.17	.13	NS
High Moisture Corn, pH	39	4.92	4.88	.04	NS
Lactic, %	37	.67	.72	.05	NS
Acetic, %	40	.20	.16	.04	NS

*NS = $t > .10$.

Key Words: pH, Volatile Fatty Acids, NIRS

W316 Effect of lignin type, acid detergent lignin or Klason lignin, on rate and extent of NDF digestion. E. Raffrenato*, M. E. Van Amburgh, J. B. Robertson, and P. J. Van Soest, *Cornell University*, *Ithaca, NY*.

Lignification is widely known to negatively affect the extent of NDF digestion. However, it is not well known if lignin affects the rate of NDF digestion and further there is little known about the effect of soluble phenolics on the rate of NDF digestion. Therefore the objective of this study was to determine the relationship between acid detergent lignin (ADL) and Klason lignin (KL) with in vitro NDF digestion (IVNDFd) and rates of degradation (IVNDFd kd) among various forage types. Eighty five forages of various families (alfalfa, corn silage and grasses) were analyzed for NDF, ADL, KL and IVNDFd. Digestibility was measured at 6, 24, 30, and 96 hr. Correlations were estimated for all forage types between lignin type, lignin and extent of IVNDFd, and lignin type and IVNDFd kd and tested for significance ($P < 0.05$). Among all forage types, the correlation between ADL and KL was high and positive (0.77 to 0.90, $P < 0.05$). Within and among all forages, only ADL was consistently negatively correlated with IVNDFd at 24, 30 and 48 hours (-0.54 to -0.94). Results varied when relationships were analyzed between KL and IVNDFd. Correlation among forages for IVNDFd kd and lignin type were not consistent. Among all forages, KL was negatively correlated with IVNDFd and IVNDFd kd, and this was particularly true for bmr corn silages and mature grasses and less for conventional corn, early cut grasses, and alfalfa. The correlation between IVNDFd and ADL increased, as fermentation time increased among all forages (0.24 to 0.90), however, the correlation of KL and IVNDFd was greater early in the fermentation period (especially for Alfalfa and mature grasses), suggesting that the soluble phenolics affected both the rate and extent of IVNDFd. Compared with ADL, KL disappeared during IVNDF fermentation in alfalfas and grasses compared to corn silages. This data suggests that the acid soluble lignin potentially dilutes the NDF solubles and might impact the apparent energy content of the forage and will vary by forage type and maturity.

Key Words: Lignin, Digestibility, Neutral Detergent Fiber Rate of Digestion

W317 Estimating NDF rate of digestion: a comparison of different approaches for use in a first order model application. E. Raffrenato*, M. E. Van Amburgh, P. J. Van Soest, and J. B. Robertson, *Cornell University*, *Ithaca, NY*.

Digestion in ruminants can be empirically and mechanistically described by models of varying complexity. In models like the Cornell Net Carbohydrate and Protein System (CNCPS), rate of NDF digestion (kd) is an input variable in the feed library. However, estimation of kd as a commercial laboratory procedure has not been achieved, in part, because of lengthy analyses and statistical interpretation of fiber digestion. Most rates of NDF digestion have been computed assuming that digestion is complete at 96 hours and using nonlinear models. However, Chandler et al. (1980) estimated the indigestible NDF fraction as lignin times 2.4/NDF ($U_{2.4}$), after fermentation up to 120 d. The objective of this work was to compare non-linear and linear regression (ln-linear) approaches using the same time point fermentations, with and without estimation of the unavailable pool, and to present a mathematical approach for determining rates of digestion using a minimum of time points for commercial laboratory application. Data used for rate estimations were in vitro NDF fermentation residues, fermented for 6, 24, 30, 36, 48 and 96 hr from 90 forages. The ln-linear regression was applied to the data using 96 hr residue as the endpoint or the $U_{2.4}$ as the unavailable NDF fraction. The non-linear model resulted in simultaneous estimation of all parameters (lag, rate, available and

indigestible pools) when using 96 hr as an endpoint or was constrained to rate and lag when forced through $U_{2.4}$. The Levenburg-Marquardt algorithm was used to derive estimates for the non-linear models and uses the Gauss-Jordan procedure for the matrix inverse required in each iteration. The nonlinear approach was considered the least biased and correlations were compared to the nonlinear solutions. The correlation was high between the two nonlinear approaches (0.88) and ranged between 0.31 to 0.93 between the non-linear and ln-linear approaches. The single time point ln-linear approach provided the highest correlation with the non-linear approach when $U_{2.4}$ was used to estimate the available pool.

Key Words: Neutral Detergent Fiber Rate of Digestion, Modeling

W318 Urinary creatinine concentration during the periparturient period and the effect of correcting urinary creatinine concentration for DM content on the ability to predict total urinary output. G. Chibisa*[1], G. B. Penner[2], G. N. Gozho[1], and T. Mutsvangwa[1], [1]*University of Saskatchewan*, *Canada*, [2]*University of Alberta*, *Canada*.

The objectives of this study were to characterize changes in urinary creatinine excretion during the periparturient period and to determine if correcting urinary creatinine excretion for DM content improves the prediction for urine output. Sixteen pregnant cows were randomly assigned to one of two diets: 1. control (total mixed ration, TMR); and 2. TMR top-dressed with 600 ml/d of propylene glycol. Diets were fed from d -14 to d 49 relative to calving. Total urine output was collected using Foley catheters for 5 d starting on d -14 ± 5, d 15 ± 0, and d 38 ± 0 relative to calving. There were no effects of diet on any of the dependent variables measured (($P > 0.05$); therefore, the data were pooled to characterize changes relative to calving. Body weight decreased ($P < 0.01$) throughout the duration of the study, with mean values of 754, 658, and 635 kg at d -14, d 15 and d 38, respectively, relative to calving. An interaction between parity and day relative to calving was detected for urine output ($P = 0.01$) as both primiparous and multiparous had similar pre-partum urinary output (12.7 vs. 16.3 kg/d), whereas multiparous animals had greater urinary output at d 15 (26.7 vs. 18.1 kg/d) and d 38 (30.8 vs. 19.5 kg/d) compared to primiparous cows. Urinary DM content (mean 6.42%) was not affected by day relative to calving. Urinary creatinine concentration (mg/dl) corrected for DM was highest ($P < 0.01$) pre-partum and decreased until d 38 relative to calving. When urinary creatinine concentration was corrected for urinary DM content pre-partum, we observed a higher correlation coefficient ($r^2 = 0.50$) between creatinine concentration and total urine output when compared to using uncorrected (as-is) creatinine concentration ($r^2 = 0.35$). However, correlation coefficients at d 15 (0.73 vs. 0.69) and d 38 (0.72 vs. 0.69) postpartum were not different. These data indicate that physiological state affects creatinine excretion and that correcting creatinine excretion for DM content improves the ability to predict urinary output in cows.

Key Words: Urinary Output, Creatinine, Periparturient Period

W319 New analytical method indicates that purine metabolites may interfere in estimates of microbial flow. S. M. Reynal* and G. A. Broderick, *US Dairy Forage Research Center*, *Madison, WI*.

A new HPLC method was developed to determine concentrations of the purines adenine (A) and guanine (G) and their metabolites xanthine (X) and hypoxanthine (HX) in omasal digesta and bacterial samples and to assess the effect of using either purines or purines plus metabolites as microbial markers for estimating flows of N fractions from the rumen of dairy cows. Four ruminally-cannulated lactating dairy cows (mean DMI 25.6 kg/d) were assigned to a 4x4 Latin square and fed 16.7% CP diets supplemented with increasing amounts of sucrose (0, 2.5, 5, and 7.5% of DM) and decreasing amounts of starch (7,5, 5, 2.5, and 0% of DM). Digesta flow from the rumen was quantified using an omasal sampling technique and a triple-marker method. Individual purines and metabolites were separated using a C18 column with gradient flow rate and two mobile phases. The CV within assay ranged from 0.6 to 3.1%. Recovery of 4 purine bases from added nucleosides averaged 101% (nucleoside hydrolysis), 103% (bacterial isolates), and 104% (omasal digesta). Mean concentrations of A, G, X, and HX were, respectively, 53, 58, 2.8, and 3.5 µmol/g of DM in omasal bacteria and 10, 12, 7.5, and 7.5 µmol/g of DM in omasal digesta. Omasal N flows were not significantly affected by diet. Omasal flows of microbial and non-microbial N (g/d), and true ruminal digestibility of N (%) averaged, respectively, 284, 467, and 32 when estimated using purines; 449, 302, and 56 when estimated using purines plus metabolites; and 413, 209, and 69 when predicted by the NRC model. These results suggest that when total purines are used as a microbial marker, both purines and their metabolites should be determined and used in the calculations. Due to substantial differences in their extinction coefficients, concentrations of purines and metabolites should be determined individually by HPLC, precluding the use of the most common Zinn and Owens (1986) method. However, a portion of these compounds may be of dietary origin and their use as markers may result in biased estimates of microbial flow.

Key Words: Microbial N, Purines, Omasal Flow

W320 Comparative characterization of reticular and duodenal digesta in dairy cows and possibilities to estimate microbial outflow from the rumen based on reticular sampling. A. N. Hristov*, *University of Idaho*, *Moscow*.

The objective of this experiment was to investigate the possibility of estimating outflow of nutrients and microbial protein from the rumen based on sampling reticular contents as an alternative to duodenal sampling. Microbial protein flow estimates were also compared to a third method based on sampling of ruminal contents. Reticular and duodenal digesta and ruminal contents were recovered from 4 cows used in a 4×4 Latin square design experiment, in which the ruminal effects of four exogenous enzyme preparations were studied. Large and small particulate and fluid markers were used to estimate digesta flow in a triple-marker model; ^{15}N was used as a microbial marker. Reticular and duodenal digesta was segregated into small and large particles (SP and LP) and fluid phase and ruminal digesta - into particulate and fluid phases. Compared with digesta recovered at the duodenum, reticular digesta had lower OM ($P < 0.001$) and higher NDF content ($P < 0.001$ and $P = 0.031$; SP and LP, respectively). The proportion of microbial N was notably greater in the fluid phase of reticular digesta (by 78%; $P < 0.001$). Ruminal outflow of DM and OM were greater (by 17 and 28%; $P = 0.034$ and 0.028) and that of NDF lower (by 14%; $P = 0.020$) when estimated from duodenal than from reticular samples. There was no difference ($P = 0.315$ to 0.501) in the estimated flow of starch and non-ammonia and microbial N

(305 and 325 g/d, respectively) between the reticular and duodenal techniques. Microbial N flow estimated based on ruminal sampling was similar (P = 0.315) to those based on duodenal and reticular sampling. The ruminal method, however, grossly overestimated flow of DM, OM, and NDF. This study supports the concept that microbial protein outflow from the rumen can be measured based on sampling of ruminal or reticular digesta. The reticular sampling technique can also provide reliable estimates for ruminal digestibility of OM, N, and fiber fractions.

Key Words: Dairy Cow, Reticular Digesta, Microbial Protein Synthesis

W321 Kinetics of milk production as a function of energy and protein supplementation. R. P. Lana*[1,2], D. C. Abreu[1,2], P. F. C. Castro[1], B. Zamperline[1], and B. S. B. C. Souza[1], [1]*Universidade Federal de Viçosa*, *MG, Brazil*, [2]*CNPq*, *Brasília, DF, Brazil*.

Three experiments aimed to evaluate the effects of energy and protein supplementation on milk production by cows at the end of lactation, with suckling calves and consuming tropical grasses (6% CP and 2 Mcal ME/kg DM) during the dry season. Twelve-crossbred Holstein-Zebu cows (520 kg) were allotted in three-4×4 Latin squares, in four periods of seven days. The treatments consisted of increased levels of corn meal-CM (0.0, 0.85, 1.7 and 3.4 kg/cow/day), soybean meal-SM (0.0, 0.65, 1.3 and 2.6 kg) and grinded soybean grain-SG (0.32, 0.65, 1.3 and 2.6 kg). The concentrate supplements were fed twice a day, at milking time, and mineral salt was offered free choice. The experiments were analyzed as Latin square design including effects of treatments, animal and period. Although there were no treatment effects (P>.05), the mean data of milk production presented a curvilinear response to supplement levels, following a Michaelis-Menten relationship of enzyme systems, according to the next equations of Lineweaver-Burk:

Exp. 1: $1/Milk = 0.0384*(1/CM) + 0.168$ $r^2 = 0.91$

Exp. 2: $1/Milk = 0.0181*(1/SM) + 0.1956$ $r^2 = 0.99$

Exp. 3: $1/Milk = 0.0140*(1/SG) + 0.1165$ $r^2 = 0.98$

The theoretical maximum milk production (1/a) were 5.9, 5.1 and 8.6 kg/animal/day and the calculated amounts of supplements to reach marginal cost-benefit zero were 0.95, 0.6 and 0.9 kg for CM, SM and SG, respectively. The marginal increase in milk production reduced with increasing supplementation (0.97, 0.41 and 0.37 kg of milk/kg of CM; 0.79, 0.42 and 0.15 kg of milk/kg of SM; and -0.56, 0.81 and 0.37 kg of milk/kg of SG). The 2001 dairy NRC considers linear response of 2.3 kg of milk/kg of concentrate for both net energy of lactation and metabolizable protein supplementation, but models of saturation kinetics are more appropriate to explain these effects and to make nutrient recommendations.

Key Words: Energy, Protein, Supplement

W322 Effects of inoculation of ryegrass at ensiling on production of milk from dairy cows and whole body N partitioning. J. M. Moorby*, D. R. Davies, W. J. Fisher, and N. M. Ellis, *Institute of Grassland and Environmental Research*, *Aberystwyth, UK*.

To investigate the effect of inoculating grass at ensiling on subsequent feed intake and production characteristics of dairy cows, 18 multiparous mid-lactation Holstein-Friesian cows were used in a 3×3 Latin square design changeover experiment. Two silages were prepared from a single ryegrass dominated sward, with alternate trailer loads at harvest being left untreated or treated with an inoculant comprising a blend of bacteria and cellulytic enzymes before being used to fill two separate bunkers. Three dietary treatments were investigated, based on ad libitum access to ryegrass silage with 4 kg dairy concentrate/d: 1) the untreated grass silage, 2) a 1:1 mix (fresh) of the two silages, and 3) the inoculated grass silage. Of the 18 cows, half also underwent procedures to measure whole animal N partitioning and apparent whole-tract diet digestibilities. Results are in order of untreated, mixed, and inoculated silage treatments. There was very little difference in the composition of the forages (DM: 29.3, 28.4, 28.2 %; CP in DM: 21.3, 21.2, 21.3 %; NDF in DM: 48.1, 49.9, 49.9 %). Silage (and thus total) DM intakes were highest ($P < 0.05$) on the untreated silage (15.4, 14.7, 14.9 kg silage DM/d), although milk yields were not significantly affected by treatment (mean 26.8 kg/d). Milk fat % was lowest ($P < 0.05$) on the mixed diet (4.03, 3.92, 4.02 %), while protein % was highest ($P < 0.05$) on the inoculated silage diet (3.11, 3.15, 3.19 %). Nitrogen intake was highest ($P < 0.01$) on the untreated silage diet (644, 618, 594 g N/d) but daily outputs of N in urine, faeces and milk were all unaffected by treatment. Nitrogen balance was very significantly ($P < 0.001$) affected by treatment (121, 96, 58 g N/d). In conclusion, cows offered the inoculated silage ate slightly less food but produced the same amount of milk (with a higher protein %) as cows offered the untreated silage, while those offered the untreated silage accreted significantly more body N. Results from cows offered the mixed silage diet generally fell between the two extremes.

Key Words: Diary Cows, Ryegrass Silage, Inoculation

W323 Nitrogen utilization and nutrient digestibility in dairy cattle fed brown midrib corn silage and monensin. A. M. Gehman*, P. J. Kononoff, and B. N. Janicek, *University of Nebraska*, *Lincoln*.

Twenty Holstein cows (101 ± 34 DIM and 674 ± 77 kg BW) were used to compare rations containing brown midrib corn silage (*bm3*) to a control dual purpose hybrid (DP) on N intake and utilization. The effect of monensin in these rations was also examined. Animals were assigned to one of five 4 x 4 Latin squares with treatments arranged in a 2 x 2 factorial. Cows were fed one of four treatments during each of the four 28-d periods: 1) C-*bm3*, 0 mg/d monensin and *bm3*, 2) C-DP, 0 mg/d monensin and DP, 3) M-*bm3*, 300 mg/d monensin and *bm3*, and 4) M-DP, 300 mg/d monensin and DP. Indigestible acid detergent fiber was used as an internal fecal marker to determine nutrient digestibility, and urinary purine derivatives were used to estimate rumen microbial protein synthesis. N digestibility was ($P < 0.01$) lower for *bm3* compared to DP (61.9 vs. 65.6 %). Dry matter, acid detergent fiber, ether extract digestibility were ($P < 0.05$) and organic matter digestibility tended to be ($P = 0.07$) lower for *bm3* than DP. Neutral detergent fiber digestibility was not different (40.5 ± 2.42 %). There was no effect of hybrid on purine derivative:creatinine ratio (1.68 ± 0.07) or microbial protein synthesis (1140.1 ± 56.1 g/d). Cows consuming *bm3* tended to have ($P = 0.06$) higher N intake than those on DP (630.4 vs. 587.9 g/d). More ($P < 0.01$) fecal N was excreted by cows consuming *bm3* (240.5 g/d and 38.2 % N intake) than those consuming DP (204.1 g/d and 34.4 % N intake), however urinary N

(211.1 g/d and 35.8% N intake) and total manure N (431.5 g/d and 71.9% N intake) were not different. There was no effect of monensin or hybrid x monensin interaction on any measurements. The reduction in the digestibility of nutrients for *bm3* was probably attributed to increased dry matter intake observed for cows consumed *bm3*. This increase in dry matter intake appeared to have negatively affected N digestibility but not neutral detergent fiber digestibility. This resulted in a greater amount of N excreted in feces but did not affect total manure N excreted.

Key Words: Brown Midrib Corn Silage, Monensin, Nitrogen

W324 Effect of carbohydrates or amino acid infusions on plasma ghrelin in early and late lactating cows. I. Schei*[1,2] and H. Volden[1], [1]*Department of Animal and Aquacultural Sciences, Norwegian University of Life Sciences*, *Ås, Norway*, [2]*TINE BA*, *Ås, Norway*.

The objective was to study the effect of abomasal or intravenous infusions of wheat starch, glucose (CHO) or a mixture of amino acids (AA) on plasma ghrelin concentrations of dairy cows with different genetic capacity. Eight cows from two genetic lines selected for low (L) and high (H) milk production were used in a 4×4 Latin square design. The mean differences in pedigree index between the two groups were 1639 kg milk and 55 kg protein yield based on 305 d lactation. Infusions were: 1) starch in the abomasum (SP), 2) glucose in the blood (GB), 3) AA in the abomasum (AP), and 4) AA in the blood (AB). The experiment was conducted in early lactation (start: 57±4 and 52±2 d postpartum, 31.3±2.8 and 34.7±1.4 kg milk for L and H cows, respectively) and repeated with the same animals and treatments in late lactation (start: 168±4 and 162±2 d postpartum, 21.0±1.9 and 23.8±0.7 kg milk for L and H cows, respectively). Average daily amounts infused were 354 and 258 g in early and late lactation, respectively. The cows were fed a basal diet consisting of concentrate and grass silage (55:45 on DM basis) fixed to 95 % of the energy requirements for milk yield. Blood samples from the jugular vein were drawn at 0500, 0800 and 1200. Genetic group or genetic group × infusion interaction showed no effect (P>0.10) on plasma ghrelin concentration in early or late lactation. Across genetic group, average concentrations in early and late lactation were 560 (±17.2) and 512 (±19.7) pg\ml, respectively. In early lactation, the GB infusion tended to (P=0.10) be lower in plasma ghrelin concentration compared to the SP and AP infusions, but no effect (P>0.10) of infusion was found in late lactation. On restricted feed intake, plasma ghrelin concentration was similar for all cows when they were infused with starch or AA post-ruminal or intravenously but ghrelin concentration was slightly lower when glucose was infused intravenously in early lactating dairy cows.

Key Words: Genetic Capacity, Glucose, Starch

W325 Depression in feed intake by a highly fermentable diet is related to plasma insulin concentration and insulin response to glucose infusion. B. J. Bradford* and M. S. Allen, *Michigan State University*, *East Lansing*.

Effects of dietary starch fermentability on feed intake and nutrient digestibility were evaluated in a crossover study designed to identify factors that predict individual variation in feed intake response to starch fermentability. Thirty-two multiparous Holstein cows (121 ± 48 d in milk, 44 ± 7 kg/d milk yield; mean ± SD) were fed a diet intermediate to the treatments during a preliminary period and assigned randomly to treatment sequence. Treatments were dry ground corn grain (DG) and high moisture corn (HM) harvested from the same field. Treatment periods were 14 d, with the final 4 d used for data and sample collection. Diets included corn silage and alfalfa silage at a 2:1 ratio and were ~26% neutral detergent fiber, 17% crude protein, 32% starch, and 3.5% fatty acids. HM decreased dry matter intake (DMI) by 8% ($P < 0.001$), but did not significantly alter digestible DMI. Individual DMI responses to treatment were highly variable, ranging from an increase of 0.9 kg/d to a decrease of 6.0 kg/d when starch fermentability was increased. Variables from preliminary period propionate challenge tests, glucose tolerance tests, and hepatic mRNA analysis were assessed as potential predictors of DMI depression from increased dietary starch fermentability. Of the covariates tested, only plasma insulin concentration and insulin response to glucose tolerance test were significant predictors of DMI response to treatment. Higher plasma insulin concentration was related to greater depression in DMI with increased fermentability ($r^2 = 0.28$, $P < 0.01$); conversely, greater insulin secretion in response to glucose infusion was related to lower depression in DMI ($r^2 = 0.32$, $P < 0.01$). These insulin variables were independent predictors of DMI response ($r^2 = 0.001$). Consistent with past results, increased dietary starch fermentability decreased DMI. Significant correlations between insulin variables and individual DMI response warrant further investigation.

Key Words: Starch Fermentability, Insulin, Feed Intake

W326 Effect of weaning age on calving age, milk yield, and milk composition in the first lactation. J. A. Elizondo Salazar*, S. I. Kehoe, G. I. Zanton, C. D. Dechow, and A. J. Heinrichs, *The Pennsylvania State University*, *University Park*.

Average weaning age of dairy calves in the United States is approximately 8 wk. However, with proper management it has been shown that calves can be weaned as early as 3 to 6 wk saving time, labor, and cost. Research from many labs has shown that calves weaned at 4 to 6 wk were not different from calves weaned conventionally in feed intake, average daily gain, and feed efficiency. However, little is known about any effects that this could have on milk yield and composition. A retrospective analysis was used to determine effects of early weaning on calving age, milk production, and milk composition. The database included 40 Holstein heifer calves from 2 trials that studied effects of weaning age and milk feeding frequency on calf growth, health, and rumen parameters. Treatments consisted of weaning at 3, 4, 5, or 6 wk. In trial 1, calves were fed at 5% of birth BW, twice daily until 1 wk prior to weaning; and 5% once daily during the wk before weaning. For trial 2, calves were fed at 5% of birth BW twice daily until 14 d of age, then fed 10% of birth BW in the morning until 1 wk prior to their respective weaning age, at which time milk replacer was reduced to 5% of birth BW. After this time, calves were raised in the PSU Dairy Herd under a standard protocol. For the data analysis, DHIA records were compiled for age at calving, milk production and composition. Data were analyzed using the GLM procedure of SAS. Least squares means were calculated using sire, dam PTA fat%, and PTA fat% as covariates. No differences were detected in calving age or first lactation performance of calves weaned at 3 to 6 wk or fed once or twice daily. We conclude that weaning age or feeding system did not have any long term impacts on calving age or production.

Table 1. Calving age, milk yield, and milk composition in the first lactation of dairy cows in relation to weaning age

Item	Weaning Age (wk) 3	4	5	6	SEM	*P*
Number of calves	9	10	12	9	-	-
Age at calving, mo	24.1	23.2	23.1	23.2	0.40	NS
Milk, kg (305 ME)	13,212.6	12,771.2	13,856.2	14,754.3	545.7	NS
Fat, %	3.72	3.87	3.73	3.99	0.08	NS
Fat, kg	488.7	495.6	516.5	591.1	24.62	NS
Protein, %	2.92	3.05	3.02	3.00	0.05	NS
Protein, kg	385.5	388.9	417.3	440.8	15.20	NS

Key Words: Dairy Cows, Weaning Age, Milk Production

W327 Effects of dietary AflaDetox on aflatoxin M1 residue in milk of dairy cows. M. Denli*[1], J. C. Blandon[1], S. Salado[2], J. F. Perez[2], and S. Calsamiglia[1], [1]*Animal Nutrition, Management and Welfare Research Group, Universitat Autònoma de Barcelona*, *Barcelona, Spain*, [2]*Adiveter S.L. Agro-Reus*, *Tarragona, Spain*.

This study was conducted to evaluate the efficacy of a dietary mycotoxin adsorbent (AflaDetox, ADIVETER, S.L.) in reducing the excretion of aflatoxin M1 (AFM1) in milk of lactating dairy cows. Twenty five lactating Holstein cows from a commercial dairy farm were fed aflatoxin B1 (AFB1) contaminated feed in three experimental periods. AFB1 concentration in the total mixed ration (TMR) was 21 ppb. In Periods 1 and 3, animals were fed the TMR without AflaDetox, and in Period 2 animals were supplemented with AflaDetox at 1% (DM basis). Each experimental period consisted in 15 days adaptation and 3 days for sampling. Animals were fed a 55:45 forage (corn and triticale silage) to concentrate diet (17.9% CP, 32% NDF), respectively. Differences were declared at $P < 0.05$. Most of parameters studied were not affected by the inclusion of AflaDetox ($P>0.05$). Following values are average for the three periods; DM intake (21.9 kg/animal/day), milk production (27.9 ± 0.32 L/day), fat (3.85 ± 0.24%), protein (3.19 ± 0.27%) or somatic cell counts (290,700 ± 134.7 cells/mL), and serum activities of alanine amino transferase (33.8 ± 9.1 U/L), aspartate amino transferase (108.0 ± 19.4 U/L) and glutamly-transferase (16.9 ± 3.7 U/L). However, the addition of AflaDetox to the AFB1 contaminated diet reduced the concentration of AFM1 in milk from 250 to 100 ppt. Results from our experiment demonstrated that 1% AflaDetox in the diet can reduce up to 60% the concentration of AFM1 into milk of lactating cows fed AFB1 contaminated feed.

Key Words: Aflatoxin M1, Mycotoxin Adsorbent, Carry-Over

W328 *In vitro* aflatoxin binding efficiency of several sequestering agents in water or rumen fluids. F. Masoero[1], A. Gallo[1], D. E. Diaz*[2], G. Piva[1], and M. Moschini[1], [1]*Catholic University of Piacenza*, *Piacenza, PC, Italy*, [2]*Utah State University*, *Logan*.

The aflatoxins (AFs) are a group of mycotoxin produced primarily by *Aspergillus flavus* and *A. parasiticus*. Aflatoxin B1 (AFB1), the most frequently occurring and most studied of the AF is a Group 1 carcinogen and a potent hepatotoxin. Aflatoxin M1, a direct metabolite of AFB1, appears in milk of lactating dairy cows soon after consumption of AFB1 contaminated diets. The objective of this experiment was to measure the *in vitro* AFB1 binding efficiency of several sequestering agents used at different level of inclusion in water or rumen solutions. Three commercial sequestering agents, two clay based (clay 1 and clay 2) and a yeast cell wall derivate (CWD), were used at three different ratio with AFs (1:5000, 1:50000 and 1:500000 AFs:B) in water (CTR) or in rumen fluid (RF). The AFB1 was extracted from a natural contaminated corn meal (82.21±0.01 ppm), then added (0.205µg) to the binder suspension. Samples were incubated at 39°C for one hour under a light shake. Then, three 10 mL sub-samples were obtained, cooled down at 4°C to stop fermentation activity and centrifuged at 3500g for 15 minutes. The supernatant was recovered and the precipitate was suspended into 10 mL water before centrifugation. The step was cycled three times and the recovered supernatant was analyzed by HPLC for AFB1 content. Data were analyzed with factorial arrangement. Main effects (agent, substrate, dose), agent × dose and agent × substrate first order interactions and agent × dose × substrate second order interaction were significant at $P<0.01$.

Table 1. Sequestering agent (B) efficiency at different ratio with AFB1 (AFs:SA - 1:5000, 1:50000, 1:500000) in water (CTR) and rumen fluid (RF)

Solution	AFs:B	B Clay 1	Clay 2	CWD	SE	Main effect (P) B	Solution	AFs:B
CTR	1:5000	49.8	28.3	9.0	2.36	<0.0001	0.0088	<0.0001
	1:50000	66.0	53.5	33.9				
	1:500000	88.2	87.6	35.5				
RF	1:5000	57.6	15.9	14.8				
	1:50000	86.4	69.6	17.1				
	1:500000	99.7	98.1	20.7				

Key Words: Aflatoxin, Sequestering Agent, *In Vitro*

W329 Early lactation production, body condition, and incidence of disease in multiparous Holstein cows fed a low potassium diet supplemented with SoyChlor®16-7 prepartum. J. Siciliano-Jones[1], P. W. Jardon[2], M. Kucerak[2], and M. B. de Ondarza*[3], [1]*F.A.R.M.E. Institute*, *Homer, NY*, [2]*West Central®*, *Ralston, IA*, [3]*Paradox Nutrition, LLC*, *West Chazy, NY*.

The objective of the trial was to determine if feeding a chloride and protein supplement (SoyChlor 16-7) with a low potassium diet (<1.20% DM) for three weeks prior to calving would effect production, body condition, and incidence of disease during the first 90 DIM. Two hundred multiparous Holstein cows were paired based on expected calving date and estimated mature equivalent 305-day production and assigned to: 1) control treatment consisting of a low potassium diet with a forage base of straw and corn silage or 2) a low potassium diet with a forage base of straw and corn silage supplemented with SoyChlor16-7 (5.3-7.6% DM). Cows were housed in separate pens and fed differing rations for the prepartum period (-21 to 0 DIM) but were co-mingled after calving. Mean urine pH during the prefresh period was 6.61 and 8.02 for SoyChlor 16-7 and control cows, respectively. Plasma calcium levels in presumptively normal cows were significantly higher ($P<0.05$) for SoyChlor 16-7 cows than for the low potassium controls at 0 and 7 DIM (9.12 and 8.78 mg/dl serum, respectively). SoyChlor 16-7 supplementation had no effect on disease incidence

or body condition loss (P>0.20). SoyChlor 16-7 positively affected production of milk, milk protein, and milk solids (P<0.10). Significant treatment by parity interactions were noted for milk production, protein yield, and milk solids yield (P<0.10). These results suggest an improved transition for cows fed a SoyChlor 16-7 anionic ration compared with a low potassium control especially for third and greater lactation cows.

Table 1.

	Treatment Mean			P-value	
	Control	SoyChlor	SEM	Treatment	Trt*Parity
Milk, kg/d	41.2	41.8	0.346	0.0674	0.0712
Fat, %	3.60	3.59	0.037	0.7537	0.9478
Protein, %	2.79	2.79	0.017	0.9752	0.1299
Protein, kg/d	1.13	1.15	0.008	0.0218	0.0011
Milk Solids, kg/d	2.59	2.64	0.021	0.0980	0.0358

Key Words: Chloride, Urine pH, Transition Period

W330 Intake of oral histidine does not alter milk or milk component production in dairy cattle. N. G. Purdie*, A. Krueger, V. R. Osborne, and J. P. Cant, *University of Guelph*, *Guelph, Ontario, Canada*.

This experiment was designed to test the hypothesis that a sufficient proportion of amino acid included in the drinking water of lactating cows will bypass the rumen to have an effect on milk or milk component production. Histidine was selected as the amino acid to investigate as it has previously been shown to affect milk synthesis and it is an essential amino acid so that an increase in absorption of it from the intestine will be mirrored in its plasma concentration. Eight high-producing, early lactation, dairy cows were assigned to either 0 or 2.5 g/L histidine in the drinking water in a crossover design of 2 seven day periods. Cows were offered a corn and alfalfa silage-based TMR for ad libitum intake. Water was provided ad libitum to each cow in an individual automatic drinking bowl with a flow meter attached. Based on previous estimates of rumen bypass of ingested water, the histidine treatment was calculated to supply a bypass of 30 g/d histidine. Water intakes and milk yields were recorded, and milk samples were collected for compositional analysis, on each of the last 3 d of each period. Plasma samples were obtained on the last day of each period. Water intakes increased from 83 to 94 L/d (P = 0.014). Plasma histidine concentrations increased from 14.6 to 21.6 μM (P = 0.060) by the addition of histidine to the drinking water. Though inclusion of histidine in the drinking water elevated plasma histidine concentrations, there were no effects on milk, fat, protein or lactose yields or percentage composition of milk. The 7 μM increase in plasma histidine concentration indicates a lower rumen bypass of the drinking water than expected.

Key Words: Histidine, Rumen Bypass, Water

W331 Meta-functional genomics of the rumen biome. S. C. Fernando[1], H. T. Purvis, II[1], F. Z. Najar[2], G. Wiley[2], S. Macmil[2], L. O. Sukharnikov[2], T. G. Nagaraja[3], C. R. Krehbiel[1], B. A. Roe[2], and U. DeSilva*[1], [1]*Oklahoma State University*, *Stillwater*, [2]*University of Oklahoma*, *Norman*, [3]*Kansas State University*, *Manhattan*.

Microorganisms within the rumen play an important role in nutrient digestion. The synergistic relationship between the microflora and the animal provides the animal with nutrients that are not available to monogastric animals. The interaction between the animal and rumen microflora is a complex relationship which directly impacts the animal's efficiency and performance. Hence, understanding the relationships between the host animal and rumen microflora as well as understanding the functional role of these bacteria within the rumen is of critical importance. However, the current understanding of the functional role of rumen bacterial species is very limited. As a first step towards understanding the relative abundance of rumen microbial mRNA species and thus the putative function of rumen bacteria, we have sequence analyzed ~58,000 individual rumen microbial mRNA species. Initial sequencing results demonstrate a complex metabolic function within the rumen with <18% redundancy and only 11% of the transcripts with valid functional annotation suggesting significant diversity in microbial metabolism within the rumen. Out of the 11% transcripts that could be annotated, 57% show association with metabolic function where transcripts associated with carbohydrate metabolism, amino acid metabolism and glycan biosynthesis/metabolism predominate. Further, analysis of the poly-adenylated mRNA species reveals the functional role of eukaryotes within the rumen. This approach should greatly facilitate future studies of the rumen microbial function.

Key Words: Rumen, Functional Genomics, Bovine

W332 A meta-analysis on the effects of feeding malate to ruminants. E. M. Ungerfeld* and R. A. Kohn, *University of Maryland*, *College Park*.

Malate is an intermediate of propionate formation in the rumen. Malate addition to ruminant diets can benefit production by decreasing methane production in the rumen through the incorporation of reducing equivalents in its conversion to propionate. In addition, malate stimulates the uptake of lactate by *Selenomonas ruminantium*, which can result in an amelioration of lactic acidosis that occur when rapidly fermentable diets are offered to ruminants. The objective of this study was to examine the effects of malate on ruminant digestion, metabolism and performance through a meta-analysis of published studies where malate was added to beef, dairy or sheep diets. Random effects of experiment and its interactions with main effects were included in models, and data were weighted by the reciprocal of their coefficient of variation scaled to one. There were no effects of malate supplementation on DM intake. Average daily gain increased with malate addition until about 0.5% malate in DM and then declined. Gain over feed tended to slightly decline with more than 0.4% malate in DM. Total VFA concentration in the rumen tended to increase with malate, although the opposite response was observed in one experiment. Acetate molar percentage tended to increase and propionate unexpectedly to decrease with malate supplementation, and butyrate was unaffected. Also unexpectedly, high levels of malate supplementation increased ruminal lactate concentration, even though its addition increased ruminal pH as well as DM and ADF digestibility. There were no effects on N digestibility. There was a tendency toward lower blood glucose concentration with malate supplementation,

and no effects on blood urea-N or lactate concentrations. From this analysis, malate amelioration of rumen acidosis may not always be explained by lower lactate or VFA concentration. Changes in VFA profile differed from in vitro results and make it doubtful that added malate could have been a quantitatively important electron sink in vivo. Research is needed on mechanisms by which malate affects pH, and on the metabolism of added malate in the rumen.

Key Words: Rumen, Fermentation, Malate

W333 A multiple regression approach to explore the contribution of 2-hydroxy-4-methylthio butanoic acid or ruminally protected DL-methionine to production parameters for lactating dairy cows reported in the literature. G. R. Bowman*[1], M. Vázquez-Añón[1], and L. M. Rode[2], [1]*Novus International, Inc.*, *St. Louis, MO*, [2]*Sage Biosciences, Inc.*, *Alberta, Canada*.

A vast amount of research has been conducted on lactating dairy cow response to supplemental 2-hydroxy-4-methylthio butanoic acid (HMTBa) and ruminally protected DL-methionine (RPM). The objective of the study was to compile the research over the past 40 years and utilize a nutrient modeling program to explore predictive response equations for milk production, fat corrected milk (FCM), milk component constituents, and dry matter intake (DMI). There were 46 total studies in the database; 23 studies with 62 treatment comparisons used HMTBa and 23 studies with 48 treatment comparisons evaluated RPM. A step-wise multiple regression analysis was used to identify variables that significantly ($P < 0.1$) contributed to the prediction equation. Variables found to be significant were used to predict final equations for HMTBa and RPM independently using mixed model procedures. The average milk production, FCM, and DMI responses over control for HMTBa and RPM were; 0.23 kg, 0.83 kg, and 0.05 kg; and -0.28 kg, 0.09 kg, and 0.03 kg, respectively. HMTBa and RPM supplementation increased milk fat % (0.14 and 0.06 % units), milk fat production (0.05 and 0.01 kg), milk protein % (0.02 and 0.06 % units) and milk protein production (0.02 and 0.01 kg) over the control. Supply of HMTBa in the diet positively contributed ($P < 0.1$) to predicting FCM production, milk fat %, fat production, and protein production responses over control. Supply of RPM ($P > 0.1$) in the diet did not contribute to predicting any production responses. Dietary ether extract significantly improved ($P < 0.1$) and physically effective fiber ($P < 0.1$) and non-fiber carbohydrates ($P < 0.1$) significantly reduced HMTBa and RPM production parameters. In conclusion, HMTBa supplementation improved milk, FCM, milk fat and protein yield, where as RPM predicted production responses were not influenced by amount of RPM supplemented.

Key Words: HMTBa, DL-Methionine, Multiple Regression Analysis

W334 Effect of a phytase on *in vitro* digestibility and finishing Criollo lambs fed a high sorghum diet. G. Buendía–Rodríguez[1], G. D. Mendoza–Martínez[2], S. S. González*[1], E. Aranda–Ibáñez[1], L. Miranda–Romero[3], L. Melgoza–Contreras[2], and J. H. Avellaneda–Cevallos[4], [1]*Colegio de Postgraduados*, *Montecillo, Edo. México, México*, [2]*UAM Xochimilco*, *México D.F.*, [3]*Universidad Autónoma Chapingo*, *Chapingo, Edo. México, México*, [4]*Universidad Técnica Estatal de Quevedo*, *Quevedo, Ecuador*.

The objective of this trial was to evaluate the effect of a phytase (Natuphos-5000G, BASF Mexicana) on *in vitro* digestibility and performance of finishing Criollo lambs. For the *in vitro* digestibility trial a completely randomized design was used and treatments (0 or 0.15 mg phytase/g sorghum or corn) were compared with Tukey test ($P \leq 0.05$). For the *in vitro* digestibility trial, results for residual phosphorus concentration were as follows ($P \leq 0.05$): a) 0.061a, 0.055a sorghum, and 0.129a, 0.030b corn (for 0 and 0.15 mg phytase, respectively) at 24 h; b) 0.059a, 0.033b sorghum, and 0.093a, 0.032b corn (for 0 and 0.15 mg phytase, respectively) at 48 h. For the finishing trial, treatments (0, 150, 300, 450 g phytase/t DM) were randomly allotted to 32 Criollo lambs (21.47 ± 2.24 kg initial BW) fed a 70% sorghum grain diet and housed in individual metabolic cages during 60 d. Treatment means were compared with Tukey test. There were no significant differences ($P \geq 0.05$) between treatments for ADG (201, 220, 194, 198 g/d), DMI (995, 1166, 1078, 1149 g/d) or feed conversion (5.02, 5.39, 5.69, 6.03). It may be concluded that phytase improved only *in vitro* phosphorus availability but it did not change finishing lamb performance.

Key Words: Phytase, *In Vitro* Digestibility, Criollo Lambs

W335 Digestibility and blood parameters in growing goats offered high concentrate diets with different rice straw particle size. X. G. Zhao[1], B. Zeng[1], S. X. Tang[1], Z. H. Sun[1], Z. L. Tan*[1], Z. H. Cong[1], and G. O. Tayo[1,2], [1]*Institute of Subtropical Agriculture, The Chinese Academy of Sciences*, *Changsha, P.R.China*, [2]*Babcock University*, *Ikeja Lagos, Nigeria*.

This work had the objective of evaluating the effect of different particle sizes of rice straw (geometric mean: 0.97cm, SRS; 1.98 cm, MRS1; 3.93 cm, MRS2; 7.79 cm, LRS) on the total tract digestibility of NDF, ADF and CP, and blood variables of growing goats. Four goats at 6 months of age and an average weight of 24.5 kg were used in a 4 × 4 Latin square experimental design with 4 periods of 16 d each. The diets consisted of 40.0, 37.0, 9.4, 8.0, 2.0, 0.8, 0.2, 2.0 and 0.6% rice straw, corn grain, soybean meal, wheat bran, rapeseed meal, urea, salt, vitamin premix and dicalcium phosphate (DM basis), respectively. All goats were offered the feed at 90% of ad libitum intake to maintain no orts during the experimental period. About 20 ml of blood were collected from the jugular vein at the end of each experimental period for each goat. Apparent digestibility of NDF (P=0.04) and ADF (P=0.05) were higher for MRS1 than for SRS and LRS. Total tract digestibility of CP was not influenced by the particle size of rice straw. Goats offered the SRS diet had higher (P=0.02) serum insulin when compared with goats offered MRS1 and LRS (36.8 vs 28.0 and 28.4 μU/ml). Serum glucagon concentration was lower in goats fed MRS1 diet than those fed MRS2 (258.4 vs 319.4 pg/ml). There were no differences in blood glucose, urea nitrogen and growth hormone concentrations among the four treatments (P >0.05). It was concluded that the particle size of dietary rice straw probably affected fiber digestion but did not influence serum biochemical parameter concentrations.

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Key Words: Digestibility, Blood Parameter, Particle Size