The effect of increased feed intake during mid-gestation on performance of pregnant sows and progeny growth: a preliminary study. A. Cerisuelo1, R. Sala2, J. Coma1, D. Carrón1,2, J. Gasa1, and M. Bausells1, 1Universitat Autònoma de Barcelona, Spain, 2Agrocesa, S.A., Spain, 3PIC España, S.A., Spain.

The effect of increased feed intake during mid-gestation (secondary fiber hyperplasia period) on sow performance and progeny growth was studied. A total of 101 pregnant sows of different parity were assigned to two dietary treatments: Control, C (n=48) were fed at a level routinely used on commercial farms (3.16 kg d⁻¹) and Experimental, E (n=53) received 1.75 times C from d 50-85 of gestation. Body weight was recorded at d 45 of gestation, at 48 ± 24h post-partum and at weaning. Backfat thickness at P2 was determined on d 45, 84 and 110 of gestation and on d 18 of lactation. Increases in P2 from d 45-80 of gestation were higher (P<0.05) in E sows. Moreover body weight losses in lactation period were lower in E sows (P<0.10), while decreases in P2 were similar between treatments. Average piglet weight when weaned at about d 23 was not affected by treatment (P>0.05). Castrated males (n=460) were used for a post-weaning study. Animals were divided by treatment (C vs E) into five weight groups each and daily gains were recorded for six weeks postweaning. Growth rate of E group was greater than that of the C group being statistical significant from day 30 post-weaning (Table 1). The greatest differences in growth rate were observed in the lightest groups of pigs. Results suggest that increasing sow feed intake during mid-gestation may improve postnatal growth rate of piglets. More studies are needed in order to check the long term influence in sow performance.

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<tr>
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Key Words: Sow Performance, Growth, Maternal Nutrition

Ruminant Nutrition III

W80 The Effect of Distillers Dried Grains with Solubles as the Protein Source in a Creep Feed. P. Lancaster, J. Williams*, J. Corners, L. Thompson, D. McNamara, and M. Ellersieck, University of Missouri, Columbia.

A study was conducted to evaluate the effect of Corn Distillers dried grains with solubles (D) vs. soybean meal (S) as the protein source in a creep feed over 2 years. In yr 1 and 2, thirty-six steer calves (avg. 159.9 kg ± 26.9 in yr 1; 184 kg ± 12.7 in yr 2) were used to compare the effects of D and S on the performance of calves to traditionally weaned calves prior to (68 d) and after weaning (112 d). Steers were randomly allotted by age to 6 endophyte-free tall fescue pastures in yr 1 (C) calves prior to (68 d) and after weaning (112 d). Steers were ran-

Key Words: Mannan Oligosaccarides, Birth and Weaning Weight, Lactating Sows

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Key Words: DDGS, Creep Feeding, Rumen Undegradable Protein

W81 Effects of sire marbling EPD and creep feeding on feedlot performance and carcass characteristics of Hereford calves. J. E. Rossi1, T. D. Pringle2, and J. K. Bertrand2, 1University of Georgia, Tifton, 2University of Georgia, Athens.

Five-month old nursing Hereford calves (forty-six heifers and forty-one steers; initial BW = 166.6 ± 4.4 kg) were used to determine the effects of sire marbling EPD and creep feeding on feedlot performance and carcass characteristics. Treatments were arranged in a 2 x 2 factorial with factors being sire marbling EPD (high +2.8 or low -2.3) and creep or no creep feeding. Cows and calves were allotted to 8 fescue/bermudagrass mixed pastures with 2 pastures per treatment. Heifers and steers were evenly allotted among pastures within each sire marbling group. Calves were creep fed a 50:50 mixture of ground corn and corn gluten feed for 90 days. All calves were then mingled into a single group and pre-conditioned for 45 days prior to finishing on a 90% concentrate diet. Heifers were fed 169 days and steers were fed 183 days. Calves that were creep fed consumed 2.45 kg (DM basis) of creep feed per day. Daily gains during the creep feeding period were greater (P < .01) for calves that were creep fed (1.26 kg/d) versus non-creep fed (0.95 kg/d). Daily gains during the creep feeding period were not affected (P = 0.37) by sire marbling EPD. Feedlot ADG was not affected (P > 0.38) by creep feeding or sire marbling EPD. Carcass marbling scores were 10% greater (p =
0.06) for calves creep fed compared with calves not creep fed. Marbling score was not affected by sire marbling EPD (P = 0.70). Fat thickness was 12% greater (P < 0.05) for creep fed versus non creep fed calves and was 12% greater (P < 0.05) for calves sired by a low versus high marbling EPD bull. Ribeye area and dressing percentage was not affected (P > 0.10) by creep feeding or sire marbling EPD. Yield grade was greater (P < 0.01) for creep fed (3.34) versus non creep fed calves (3.04), and greater (P < 0.01) for calves sired by low (3.36) versus high (3.01) marbling EPD bulls. Carcass marbling scores were increased by creep feeding but were not affected by sire marbling EPD.

Key Words: Calves, Creep Feeding, Carcass Characteristics

**W82**  
Effects of feeding byproducts on animal performance and carcass characteristics of finishing beef cattle grazing tropical grass during dry season. A. A. Souza*, C. Boin, M. Q. Manella, and J. J. Lourenço*, 1ESALQ/USP, Brazil, 1Unesp, Brazil.

This study has evaluated the effects of feeding byproducts on animal performance and carcass characteristics of Nellore cattle grazing tropical pastures during the dry season. The trial was conducted at Instituto de Zootecnia in Nova Odessa, São Paulo state in Brazil. The performance of 128 Nellore steers was evaluated in a random block design, with four treatments and four replications. The treatments were: Control, leucaena, Supl1 = Leucaena leucocephala + protein bank (Leucaena leucocephala) + 1.8 kg citrus pulp + 0.8 kg Wet corn gluten feed + mineral supplement (animal/day); Supl2 = Brachiaria brizantha pasture + 1.8 kg citrus pulp + 0.8 kg Wet corn gluten feed + 0.45 kg soybean meal + mineral supplement (animal/day); Supl3 = Brachiaria brizantha pasture + 1.8 kg citrus pulp + 0.8 kg Wet corn gluten feed + 0.1 kg soybean meal + mineral supplement (animal/day); Supl4 = Brachiaria brizantha pasture + 1.8 kg citrus pulp + 0.8 kg Wet corn gluten feed + 0.9 kg soybean meal + mineral supplement (animal/day). The initial and final live weight was 416-434; 399-475; 395-490 and 395-488 kg for treatments control, leucena, supl1 and supl2, respectively. After 5 months of trial, animals that had at least 3 mm back fat measured by ultrasound were slaughtered at a commercial plant. The average daily gains were 0.114; 0.528; 0.638 and 0.613 kg/animal/day for control, leucena, Supl1 and 2, respectively (table 1). There were greater carcass yields for the supplemented animals of the treatments leucaena, Supl1 and 2. The results of backfat have been like the yield carcass results (table 1). The use of byproducts as grazing supplements may finish grazing animals, with greater backfat thickness. Table 1. Average daily gains and backfat after chilled for different treatments.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Kg/animal/day</th>
<th>Backfat</th>
<th>Carcass Yield (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0.114a + 0.051</td>
<td>3.30b + 0.20</td>
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<tr>
<td>Leucaena</td>
<td>0.528b + 0.042</td>
<td>4.24c + 0.31</td>
<td>55.6b</td>
</tr>
<tr>
<td>Supl1</td>
<td>0.638c + 0.035</td>
<td>4.75b + 0.33</td>
<td>55.6b</td>
</tr>
<tr>
<td>Supl2</td>
<td>0.613a + 0.031</td>
<td>4.87b + 0.40</td>
<td>56.1b</td>
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</table>

*Means with unlike superscripts are different (P < 0.05)

Key Words: Beef, Creep Feed, Byproducts, Backfat Thickness

**W83**  

The objective of this experiment was to evaluate the effects of supplements of self feed on the efficiency of microbial protein synthesis and excretion of N contents - urea on steers grazing Brachiaria decumbens, in the rainy season, in the west-central region of Brazil. Four crossbred steers, fasted in the morning, abomasum and esophagus, with average initial weight of 426 kg, were used for evaluating nutritional parameters, by 4x4 latin square. Mineral salt (SALT) and supplements based on: urea, mineral mix, ground corn grain and soybean meal (SBM); urea, mineral mix, soybean meal and corn gluten meal (SBMCG); and urea, mineral mix, wheat bran and soybean meal (WBSBM), with average protein content of 53.60% CP, were fed daily, at level of 1.0 kg/animal, at 10:00 hours. The microbial protein production was calculated by purine determination on rumen and abomasum samples, used purine basis as marker added a N-purine:N-total of 0.117. The urea excretion on urine was determined by urine spot collected 4 hours after supplementation. The animals supplemented excreted higher N content - urea in the urine (95.28 g/day)(P<0.05) than the control animals (46.90 g/day). No effect of treatments on the efficiency on microbial protein synthesis in the g CP/microbial/100 g TDN, was observed, with average values of 11.75 g CP/microbial/100 g TDN.

Key Words: Microbial Nitrogen, Supplementation, Steers

**W84**  

The ability of CLA to modify beef body composition and the mechanism by which it alters lipid metabolism are poorly understood. Objectives of this study were to evaluate basal energetic and temporal metabolic patterns in response to epinephrine, insulin, and glucose challenges in cattle fed rumen protected (RP) CLA. Twenty British x Continental beef steers (280 ± 29 kg BW) were fed isoenergetic steak-flaked corn based diets containing equal amounts of FA (5.74 vs 6.25% EnerGII), a RP palm oil and RP CLA, respectively for 45 d. The CLA supplement contained 71.4% FA of which 40.0% were CLA isomers (5.4% t-8, c-10; 48.4% c-9, t-11; 7.6% t-10, c-12; and 8.4% c-11, t-13 CLA). Controls were pair-fed with CLA steers in order to minimize caloric intake variability. All steers were fitted with indwelling jugular catheters on d 14, 28, and 42. Epinephrine (1.4 μg/kg BW), insulin (3.0 μg/kg BW), and glucose (0.3 g/kg BW) challenges were conducted and blood samples collected on d 15, 30 & 45, 16, 31 & 44, and 17, 32 & 45, respectively. Subcutaneous adipose tissue was collected from the tailhead region in 10 randomly selected steers (n=5/trt) on d 45. Production variables (ADG, G/F, BW, DMI and DMI as %BW) did not differ (P>0.15) between treatment groups. Dietary CLA did not alter basal circulating plasma NEFA or glucose concentrations. In addition, there were no CLA effects on metabolic responses to the aforementioned homeostatic signals. On d 45, adipose tissue of CLA-fed steers had increased (P<0.03) concentrations of c-9, t-11 CLA (0.78 vs 0.52%), t-10, c-12 CLA (0.21 vs 0.08%) total CLA (2.85 vs 0.97%), and total t-18:1 FA (8.92 vs 5.70%). There were no effects on the Δ2-desaturase index (45.3) or the total saturated and unsaturated levels (45.7 and 54.3%), respectively. These data indicate that short term CLA supplementation did not alter basal or stimulated NEFA or glucose parameters, but has the ability to dramatically increase CLA content in bovine adipose tissue.

Key Words: CLA, Beef, Lipid Metabolism

**W85**  

The objective of the experiments with cattle and lambs was to produce high quality beef and lamb meat under different feeding conditions and to accumulate the concentration of n-3 fatty acids and CLA in muscle. In total 33 German Holstein bulls (initial liveweight= 205 kg) were fed on either an indoor concentrate system or a period of summer pasture feeding followed by an indoor finishing. Bulls were slaughtered at 620 kg. Pasture feeding caused significant increased relative contents of linolenic acid (C18:3n-3) and long-chain n-3 fatty acids in muscle. Relative proportion of CLAcis-9,trans-11 was significantly (P#88040.05) higher in grass fed bulls. The absolute content was not affected by the diet. The main CLAcis-9,trans-11 of muscle lipids measured by HPLC decreased adipose tissue from 73.5 % in concentrate fed bulls to 65.0 % in grazing bulls. The second most abundant CLA isomer in pasture fed bulls was CLAtrans-11,cis-13 and the isomer CLAtrans-7,cis-9 in concentrated fed
bulls. There was a feeding influence on the relative proportion of all C18:1 trans isomers. The absolute amount of C18:1 trans-11 was only in tendency increased in grazing bulls (66.2 mg/100 g fresh muscle vs 101.7 mg/100 g). In total 13 male lambs (Black Head x Gotland) were divided into two feeding groups at 24 kg live weight. Lambs (n=6) were kept either on pasture on CRINA 5 (salt grass) or in stable on concentrate diet. The latter grass accumulated a higher C18:3n-3 content and the sum of n-3 fatty acids in muscle lipids. The relative content of CLA cis-9,trans-11 (1.9 % vs 1.1 % in muscle) was significantly (P<0.05) higher by grazing on pasture compared to concentrate feeding. The analyses of CLA iso-

mers (Ag+HPLC analysis) showed no differences between feeding sys-
tems for CLA cis-9,trans-11. The percentage of the CLA trans-10,trans-12 isomer was five times higher in concentrate fed lambs vs pasture feeding. The main C18:1 trans isomers of intramuscular fat in lambs were C18:1trans-11, cis-18:1trans-14, C18:1trans-15 and C18:1trans-16. Grass feeding increased significantly the percentage of C18:1trans-11.

Key Words: n-3 Fatty Acid, CLA Isomers, Muscle

W86 Effect of CRINA RUMINANTS, a mixture of essential oil components, on continuous culture fermentation and milk production of lactating cows. G. Varga1, E. Block2, P. Williams3, T. W. Cassidy4, and R. Losa5. 1The Pennsylvania State University, University Park, 2Church & Dwight Co., Inc, Princeton, NJ, 3Akzo Nobel, Inc, Davis, CA, 4CRINA S.A., Gland, Switzerland.

Objectives of this trial were to test two levels CRINA RUMINANTS (CRINA) fed in a TMR to continuous culture fermenters and to lactating cows. The TMRs used were identical across treatments for fermenters and cows except for the inclusion of CRINA. TMR was formulated for a high producing cow to meet NRC requirements (2001). CRINA inclusion was at 1.2 g/cow/d for the treatment group, which was equivalent to 4mg/d in the fermenters. Inoculum for the fermenters was obtained from cows in the production trial. An additional fermenter treatment containing 12mg/d CRINA was also evaluated. In fermenters, pH tended to be higher with increasing CRINA and was higher for CRINA diets than the control (P<0.08). Concentrations and molar proportions of acetate, propionate, valerate, isovalerate and the A:P were either signif-

icantly, or tended to be lower for fermenters supplemented with 4 mg/d CRINA. Nutrient digestibility was not affected, however, there was a trend (P=0.15) for increased NDF digestibility in CRINA treat-

cents versus the control. There was a trend (P<0.09) for CRINA diets to have higher bacterial protein synthesis versus control. A commercial dairy herd was used to test CRINA supplementation on milk yield for a four month period. All cows in the high group pen at the farm were split into two sub pens and fed identical diets except that Pen A contained CRINA at the rate of 1.2 g/cow/d while Pen B contained no CRINA. Daily milk yield and weekly composition were collected for every cow. Milk samples were assayed by DHIA. Results for cows that began and finished the trial during the feeding period showed that those in Pen A (n=82) produced 3.6 lb/day more milk (p<0.05) than Pen B (n=88). For all cows, including those that were in trial pens for only part of the trial period, the milk increase by cows in Pen A was 1.4 lb/day (p<0.07; n= 248 and 257 in CRINA supplemented and control group, rep.

). No differences in milk composition were observed. CRINA RUMINANTS can improve milk yield in cows, which can be explained by modification of rumen microbial populations.

Key Words: Essential Oils, Dairy Cows, Continuous Culture Fermentation

W87 Milk production and milk fatty acid profiles of cows fed different carbohydrate sources and soybean oil. E. C. Eifert1, 2, R. P. Lanal.2, 1J. M. S. Campos1, D. P. D. Lanna3, P. B. Arcuri4, M. I. Leo5, and R. D. Valadares6, 1Universidade Federal de Viçosa-D2O, Viçosa, MG, Brazil, 2CNPq, Brasília, DF, Brazil, 3LNCA-ESALQ/USP, 4CNPFLG-EMBRAPA.

This study was carried out to evaluate the effect of different carbohydrate sources and soybean oil supplementation on milk production and fatty acid profiles of lactating dairy cows. Twelve Holstein cows, pure-

bred and crossbred with Zebu, were used in a 3x3 Latin square design with four replicates. The treatments consisted of 55% of corn silage and 45% of concentrate with corn (CN), wheat bran (WB) or citric acid (CP) as energy sources, and associated with soybean oil in the concentrate (0 and 2.25%). Dry matter intake (18.4 kg/day) and milk production (23.5 kg/day) did not differ among CN, WB or CP, but WB diets showed the lowest total NDF and organic matter digestibility (P<0.05). Microbial synthesis was not affected by carbohydrate source or soybean oil (239.4 g microbial N/day). Soybean oil-containing diets showed lower DMI (17.8 vs 19.0 kg/day), milk lactose (4.33 vs 4.49%) and milk fat (3.13 vs 3.20%) than did control diets (P<0.07). Soybean oil-containing diets increased the milk protein:fat ratio (1.00 vs 0.94) (P<0.05). Fatty acid profile was not influenced by carbohydrate source, but concentration of short and medium chain fatty acids decreased by 27.3 and 28.8%, respectively; while concentration of long-chain fatty acids increased by 44.5% in cows fed soybean oil (P<0.01). Soybean oil additionally increased cis-9 trans-11 CLA by 230% and trans-CLA by 220% (P<0.01). Trans-11 C18:1 was the main trans C18:1 isomer and an interaction between oil and carbohydrate source was observed for trans-10 C18:1 (P<0.05). This fatty acid was similar in CN, WB or CP, but in combination with soybean oil, concentration of trans-10 C18:1 in CN and WB diets was greater than in CP diet, indicating bio-hydrogenation activities through different pathways. The elevated trans-10 C18:1 content was consistent with reduction in milk fat and CP had higher potential than CN or WB to supply trans-11 C18:1 for endogenous CLA synthesis by Δ9-desaturase.

Key Words: Bio-Hydrogenation, CLA, Fatty Acids

W88 Effects of increasing doses of a specific blend of essential oils on rumen nitrogen metabolism and fermentation profile in continuous culture system. L. Castillete1, S. Calsamigilia2, A. Ferret3, and R. Losa4, 1Universidad Autonoma de Barcelona, Spain, 2AKZONOBEL/CRINA SA, Gland Switzerland.

Eight dual flow continuous culture fermenters (1320 ml) were used in two periods (6 d of adaptation and 3 d of sampling) to study the effects of increasing doses of a specific blend of essential oils (EOB, CRINA RUMINANTS) on rumen nitrogen metabolism and fermentation profile. Temperature (39°C), pH (6.4), and liquid (10%/h) and solid (5%/h) dilution rates were maintained constant. Fermenters were fed 95 g/d of DM of a 60 to 40 forage to concentrate diet (18% CP; 30.2% NDF) in three times per day. Treatments were: Control (no EOB), D1 (5 mg/L of EOB), D10 (50 mg/L of EOB) and D100 (500 mg/L of EOB), and were randomly assigned to fermenters within periods. A sample was taken daily 2 h after the morning feeding for the determination of ammonia N and volatile fatty acids (VFA). During the last 3 days, samples were taken at 6, 2, 4 and 6 h after the morning feeding and analyzed for peptide, aminoacid and ammonia N concentrations. Total VFA (mM) tended (P = 0.06) to be higher for D1 (129.1) compared with Control (120.4). Acetate proportion (mol/100mol) tended (P = 0.06) to be higher for D1 (63.6) compared with Control (58.0). Propionate proportion (mol/100ml) was lower for D1 (16.9) and D10 (17.5) compared with Control (20.6). Valerate proportion (mol/100ml) was lower for D1 (3.26%) compared with Control (3.22%). Branch-chain VFA concentration (mM) was higher for all EOB treatments (average of 5.19) compared with Control (3.10). The average peptide N concentra-

tion (mg/100ml) was lower for D1 (4.88) compared with Control (5.98). The aminoacid and ammonia N concentrations were similar across treatments. The treatment with 5 mg/L of EOB increased by 7% total VFA, increased by 5 percentage units the acetate proportion, and decreased by 4 percentage units the propionate proportion. The decrease in peptide N concentration suggested that the treatment with 5 mg/L of EOB inhibited proteolysis.

Key Words: Essential Oil Blend, Rumen Microbial Fermentation, Nitro-
gen Metabolism


The objective of this study was to investigate the effect of essential oils (EO) on ruminal fermentation in vitro. Ruminal fluid enriched with particle-associated microorganisms was recovered from two lactating dairy cows fed an alfalfa hay/cereal silage/concentrate diet one hour before feeding. The in vitro media contained: ruminal inoculum, reducing agent, (15NH4)2SO4, and nutrients (glucose, maltose, sucrose, soluble starch, crystalline cellulose, and hydrolyzed and native casein) dissolved in buffer. Treatments of DM of a 60 to 40 forage to concentrate diet were: Control, D1 (3.26%), D2 (6.52%), D3 (9.78%) and D4 (13.04%). Branch-chain VFA concentration (mM) was higher for all EOB treatments compared with Control (15.9). The average peptide N concentration (mg/100ml) was lower for D1 (4.88) compared with Control (5.98). The aminoacid and ammonia N concentrations were similar across treatments. The treatment with 5 mg/L of EOB increased by 7% total VFA, increased by 5 percentage units the acetate proportion, and decreased by 4 percentage units the propionate proportion. The decrease in peptide N concentration suggested that the treatment with 5 mg/L of EOB inhibited proteolysis.
were also incubated at 5 ppM and 0.2%, respectively. Compared to a Blank (no addition of EO), SL increased (P < 0.001) media pH (6.66 vs. 6.82, respectively). A number of EO reduced (P < 0.05) media pH. Both, SL and M reduced (P < 0.001) ammonia concentration compared to the Blank (1.81, and 1.89 vs. 2.30 mmol/L, respectively). Compared to the Blank, results of the pre-incubation levels, only one of the tested EO slightly reduced (P = 0.058) ammonia concentration to 2.11 mmol/L. Many EO increased (P < 0.05) media total VFA concentration by 8 to 13%. SL, but not M, reduced (P < 0.05) total VFA concentration (74.9 ± 83.2 mmol/L, respectively). Acetate and propionate concentrations were reduced (P < 0.05) compared to the Blank. Several EO and SL increased (P < 0.05) acetate to propionate ratio from 1.93 (Blank) to 2.05-2.07; M had no effect (P > 0.05) on this variable. 15N-enrichment of ammonia N was greater (P < 0.001) in SL and M compared to the Blank (by 38 and 28%, respectively), suggesting reduced deamination of amino acids with the former treatments. EO had no effect on this variable. The EO tested in this experiment did not affect ammonia concentration in vitro, but some oils increased total VFA concentration and acetate to propionate ratio and reduced media pH.

Key Words: Essential Oil, Rumen Fermentation, Ammonia

W90 The conjugated linoleic acid and ω-3 fatty acids in milk and cheese from cows fed calcium salts of fish oil alone or in combination with soybean products. S. L. Allred1, T. R. Diham1, C. P. Brennan1, R. C. Khanal1, D. J. McMahon2, and N. D. Luchini2, 1Utah State University, Logan, 2Bioproducts, Inc., Fairlawn, OH.

Twenty Holstein cows were used in a completely randomized block design to determine the influence of feeding a total mixed ration (CTR), CTL diet supplemented with 2.7% calcium salts of fish oil (FO), FO plus 5% extruded full-fat soybeans (FOSEM), or FO plus 0.70% soybean oil (FOSO), respectively. Results from the present study suggest that calcium salts of fish oil alone or in combination with soybean products can be used to enhance the CLA and ω-3 fatty acid content of milk and cheese with minimal negative impact on flavor characteristics.

Key Words: Milk and Cheese, Conjugated Linoleic Acid, ω-3 Fatty Acids

W92 Milk fat conjugated linoleic acid in selected commercial dairies of Utah and Idaho. R. C. Khanal and T. R. Diham, Utah State University, Logan.

A two-year study was conducted to investigate the conjugated linoleic acid (CLA) content of milk on 2 commercial dairies (Farms A and B) in Utah and 2 dairies in Idaho (Farms C and D). Farms A, B, C, and D had 80, 150, 400, and 500 milking cows, respectively. Cows on farms A and B were grazed on pasture and supplemented with 7.0 kg/cow per day of sunflower oil and fed conserved forage and grain during winter. Cows on Farm C were fed a total mixed ration (TMR) containing conserved forage and grain year-round, with 10% of diet DM as fresh cut grass during summer. Cows on Farm D were fed TMR during winter. During the summer one-third of the cows on Farm D grazed on pasture and were supplemented with TMR and the remaining cows received only TMR. Milk samples were collected every month from the bulk tank and twice per year (during summer and winter) from selected individual cows (15% of the milk cows on the farm or a minimum of 20 cows) for fatty acid analysis. Milk CLA contents (C18:2 cis-9,trans-11 isomer) were 0.66±0.07, 0.75±0.04 and 0.58±0.04% for bulk tank samples and 0.73±0.07, 0.43±0.05% of fat for individual cow samples from Farms A, B, C, and D, respectively. Milk fat CLA content was higher (P < 0.01) during summer compared with winter (0.79±0.04) for bulk tank and 0.78±0.04% of fat for individual cows during summer and winter, respectively. Milk fat CLA contents for individual cows varied from 0.16 to 2.22% of fat across farms. Individual cow variation in milk CLA content was larger for Farms A and B than for Farms C and D. The bulk tank CLA content of milk varied from 0.27 to 1.35% of fat across farms. Total daily yields of CLA/cow were higher on Farms A and B even though total milk yield was less than that of cows from Farms C and D. Results from this study suggest that CLA levels of milk from dairies that utilized some grazing practices had 47% higher CLA than dairies with no grazing. In addition, individual cow variation in milk CLA content is higher when cows are grazing on pasture.

Key Words: Conjugated Linoleic Acid, Cow, Pasture

W93 Synthesis of trans fatty acids and isomers of conjugated linoleic acid in the rumen of cows fed grass sludge based diets supplemented with incremental levels of sunflower oil. K. J. Shinglefield1, S. A. Ahvenjärvi2, V. Toivonen1, P. Hultman1, and M. J. Grinari2, 1MTT Agrifood Research Finland, Jokioinen, 2University of Helsinki, Finland.

Based on the potential benefits of conjugated linoleic acid (CLA) for human health there is a need to develop effective strategies for enhancing CLA concentrations in milk and meat. Cis-9, trans-11, the predominant CLA isomer in ruminant tissues, is derived from two sources: ruminal biohydrogenation of C18:2 (n-6) and endogenous conversion of trans-11 C18:1. Most evidence to date suggests that endogenous synthesis is the most important source of CLA. Four lactating cows fitted with rumen cannula were used in a 4 x 4 Latin square with 14 d experimental periods to examine the effects of dietary C18:2 (n-6) supplementation on ruminal CLA synthesis. Cows were offered a basal diet consisting of grass silage and a cereal based-concentrate (60:40 forage:concentrate ratio, DM basis) supplemented with 0, 250, 500 or
750 g/d of sunflower oil (C, S1, S2 and S3, respectively). The flow of fatty acids leaving the rumen was assessed using the osmolar sampling technique and a triple indigestible marker method. Lipid supplementation had no effect on DMI, but shifted (P<0.001) rumen fermentation towards propionate at the expense of acetate, and increased linearly (P<0.001) the flow of C18:0 (237, 408, 514 and 672 g/d for C, S1, S2 and S3, respectively), trans C18:1 (30, 67, 118 and 226), C18:2 (n-6) (5.5, 8.7, 8.7 and 12.5) and total CLA (2.5, 5.0, 9.7 and 12.4) entering the omasal canal. While trans-11 was the predominant isomer (15, 30, 55 and 126 g/d for C, S1, S2 and S3, respectively), the flow of all trans C18-1, including trans-10 (1.3, 4.1, 8.6 and 20.6) and trans-13/14 (4.5, 10.5, 16.9 and 22.6) were enhanced (P<0.05). cis-9, trans-11 was the most abundant CLA isomer (1.6, 3.9, 8.0 and 9.9 g/d), but sunflower oil supplementation also resulted in linear increases (P<0.05) in ruminal trans-10, cis-12 CLA, trans-8, trans-10 CLA, trans-9, trans-11 CLA and trans-10, trans-12 CLA synthesis. It is concluded that ruminal synthesis is a significant source of cis-9, trans-11 CLA that can be enhanced with dietary supplements of C18:2 (n-6).

**Key Words:** Ruminal Biohydrogenation, Conjugated Linoleic Acid, Trans Fatty Acids

**W94 Effect of fish oil and sunflower oil supplements offered alone or in varying combinations on milk fatty acid composition in cows fed maize silage based diets.** K. J. Shingfield1, C. K. Reynolds2, D. J. Humphries3, B. Lopolii, V. Toivonen3, A. S. Grummet4, and D. E. Power5

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Based on the potential benefits of conjugated linoleic acid (CLA) for human health there is a need to develop effective strategies for enhancing CLA concentrations in milk. Five dairy cows in mid-lactation were used in a 5 x 5 Latin Square experiment with 3 week periods to examine the effects of feeding fish oil (FO) or sunflower oil (SO) separately, or in combination, on milk fatty acid composition. Cows were offered 18 kg DM/d of a TMR based on maize silage (65:35 forage:concentrate ratio; DM basis) supplemented (g/kg DM) with FO (15), [FO (15) and SO (15) (FLS)], [FO (15) and SO (30) (FMS)], [FO (15) and SO (45) (FHS)] or SO (60). Lipid supplements were fed during the last 14 d of each period. Treatments had no effect (P>0.05) on DMI, milk yield or milk fat or protein content, but milk fat concentrations were low for all diets (26.3, 26.6, 24.5, 22.9 and 23.6 g/kg, for FO, FLS, FMS, FHS and SO, respectively). Levels of total CLA as determined by GLC and Ag+ HPLC were higher (P<0.05) for FO, FLS, FMS, FHS and SO, respectively. Increasing the amount of SO in combination with a fixed amount of FO resulted in a progressive increase in milk trans-11 C18:1 content (8.6, 11.3 and 13.5 g/100g fatty acids, for FLS, FMS and FHS), but caused levels of trans-11 C18:1 to decrease in milk (5.6, 5.2 and 2.9). Levels of trans-10 and trans-11 C18:1 were 5.0 and 4.2 for FO and 11.0 and 2.1 for SO. It is concluded that sunflower oil enhances the milk CLA response to fish oil in cows fed maize silage based diets, but high levels induce shifts in ruminal biohydrogenation towards trans-10, cis-11 and the expense of trans-11 C18:1.

**Key Words:** Conjugated Linoleic Acid, Trans Fatty Acids, Fish Oil

**W95 Effects of rumen-protected fatty acid saturation on ruminal and total tract nutrient digestion in lactating dairy cows.** K. J. Harvatine* and M. S. Allen, Michigan State University, East Lansing.

Saturated and unsaturated rumen-protected fat sources were evaluated for effects on ruminal digestion kinetics, and ruminal and post-ruminal nutrient digestion. Eight early lactation ruminally and duodenally cannulated cows (77±12 DM, mean±SD) were used in a replicated 4x4 Latin square design with 21 d periods. Treatments were control and a linear titration of 2.5% added rumen-protected FA (RPF) varying in saturation: saturated (SAT); prilled hydrogenated free FA (Energy Booster 100®), intermediate mix of SAT and unsaturated (UNS; calcium soaps of long-chain FA, Megalac®), and UNS FA. Experimental diets were 40% forage and contained 27.5% NDF, 30% starch, and 2.5% rumen available vegetable oil (13.5% cottonseed). SAT linearly decreased ruminal digestibility of DM and OM because of a linear reduction in ruminal neutral detergent fiber (NDF) digestibility. The reduction in ruminal NDF digestibility was because of a linear decrease in digestion rate and a linear increase in passage rate of potentially digestible NDF for SAT. Total OM digestibility was not different between treatments because of compensatory post-ruminal digestion. Ruminal FA and C18 FA digestibility tended to increase linearly with UNS, and post-ruminal C18 FA digestibility increased with UNS. SAT linearly decreased ruminal OM digestibility and decreased intestinal long-chain FA digestibility, although differences in FA digestibility may be partially explained by FA intake. Addition of rumen-protected FA may not increase energy intake because of decreased DM intake and negative associative effects on ruminal digestion.

**Key Words:** Rumenal, Digestibility, Fatty Acid

**W96 Effect of Ca salts of palm and fish oils on lactation and reproduction of dairy cows under heat stress.** R. G. S. Bruno1, K. N. Galvao3, S. O. Juchem1, W. W. Thatcher2, E. J. DePeters1, D. Luchini3, and J. E. P. Santos1

1University of California Davis, Tulare, 2University of Florida, Gainesville, 3Bioproducts, Inc, Fairlawn, OH.

Multiparous Holstein cows, 331, were randomly assigned to two of the two treatments at calving after blocking according to parity and previous lactation milk yield. Treatments consisted of a diet containing either tallow (TA; 1.3% DM) or a Ca salt of palm and fish oils (CaPFO; 1.5% DM), to provide equal amounts (350 g/d) of fatty acids (FA) from 20 to 130 d in milk (DIM). The Ca salt provided 18 g/d of eicosa- tenoic and docosahexaenoic FA combined. The study was conducted from May to December of 2003 and only cows calving during the hot months (May-August) were enrolled. Cows were milked 3 times daily and production of milk and milk components were measured every two weeks. All cows were subjected to the Presynch/Ovsynch protocol and timed AI was performed between 60 and 70 DIM. Pregnancy was diagnosed at 38 d after AI by ultrasound and reconfirmed 4 weeks later by palpation per rectum. Cows were milked twice daily and milk samples collected over 10 d at 24 and 48h and pooled for total FA analysis. Culture media was collected at 48h (from 20 to 68 h after seeding) with either no FA added (control) or 1 mM of palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), linolenic (C18:3), eicosapentaenoic (C20:5), docosahexaenoic (C22:6) acid, or a physiological FA mix (NEFA; 15% C18:0, 30% C16:0, 45% C18:1, 5% C16:1, and 5% C18:2). These results suggest that feeding Ca salts of palm and fish oils did not influence lactation or reproduction of cows under heat stress, but reduced concentrations of protein, lactose and solids nonfat in milk.

Supported by NRI/USDA Grant 2003-02742.

**Key Words:** Dairy Cows, Fatty Acids, Milk Production

**W97 Modulation of bovine hepatic lipid metabolism by fatty acids.** J. A. A. Pires1, R. R. Grummer2, D. G. Mashek1, S. J. Bertics1, D. Pirazzi3, and U. Bernabucci2

1University of Wisconsin, Madison, 2University della Tuscia, Viterbo, Italy.

The objective was to investigate the metabolism of different fatty acids (FA) by bovine hepatocytes cultured in monolayer. Hepatocytes were isolated from three 7 to 10 d old male Holstein calves and treated for 48h (from 20 to 68 h after seeding) with either no FA added (control) or 1 mM of palmitic (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), linolenic (C18:3), eicosapentaenoic (C20:5), docosahexaenoic (C22:6) acid, or a physiological FA mix (NEFA; 15% C18:0, 30% C16:0, 45% C18:1, 5% C16:1, and 5% C18:2). Culture media was collected at 24 and 48h and pooled for total β-hydroxybutyric acid (BBHA) analysis. Total triglycerides (TG) was extracted from citrate and quantified. Data were analyzed using Mixed Procedure of SAS. The model included fixed effect of treatment, random effect of calf, and residual error term.
Adding C16:0 or 18 carbon FA caused an increase in TG accumulation. Among 18 carbon FA, increasing unsaturation led to lower levels of TG accumulation. Incubation with C20:5 or C22:6 did not result in TG accumulation. However, adding C20:5 or C22:6 increased BHBA production relative to control, which shows that these FA were being absorbed and oxidized. C18:2 caused the lowest BHBA production of all FA treatments but TG accumulation was similar to all other C18 FA and NEFA. These results show that FA are metabolized differently by bovine hepatocytes. Treatment differences may be related to changes in cell membrane properties, differential absorption of FA, suitability of FA as substrates for enzymes or effects on gene expression of key enzymes in lipid metabolism.

### W98 Milk fatty acid composition and lactation performance of cows fed linseed oil or fish oil in combination with sunflower seeds


This study was conducted to determine the effect of feeding linseed oil or fish oil on production of conjugated linoleic acid (CLA) in milk of cows fed sunflower seeds. Eight primiparous and four multiparous Holstein cows averaging 112 DIM were used in a 4 × 4 Latin square with 4-wk periods. Treatments were: 1) control diet (no oilseeds), 2) 2.5% fat from sunflower seeds, 3) 2% fat from sunflower seeds plus 0.5% fat from fish oil, and 4) 2% fat from sunflower seeds plus 0.5% fat from fish oil (F). Treatments were designed to be a 50% (dry basis) concentrate mix, 25% corn silage, 12.5% alfalfa hay and 12.5% haylage. Cracked sunflower seeds replaced corn and soybean meal in the sunflower diets. Treatments averaged 16.6% CP, 29.6% NDF, and 20.1% ADF. Ether extract sunflower seeds replaced corn and soybean meal in the sunflower and fish diets. Ether extract sunflower seeds (S), 3) 2% fat from sunflower seeds plus 0.5% fat from fish oil (S+F), and 4) 2% fat from sunflower seeds plus 0.5% fat from fish oil (F). The percentage of trans-6, 9, 10, and 11 conjugated linoleic acid (CLA) in milk was highest (P < 0.05) for cows fed F. Similarly, milk vaccenic acid (TVA) increased (0.60, 3.25, and 2.56) was lower for cows fed F (P < 0.05). Milk fat percentage (3.28, 3.20, and 2.96) was highest (P < 0.05) for cows fed F.

### Key Words: Fatty Acids, Hepatic Metabolism, Bovine

### W100 Feeding encapsulated ground full-fat soybean or sunflower oil gel containing tocopheryl acetate to increase tocopherol and linoleic acid levels in lamb carcass

J. H. Lee*, 2, S. L. Melton1, and J. C. Waller1, 2, University of Tennessee, Knoxville, 2Fort Valley State University, Fort Valley, GA.

This study investigated the effect of encapsulated ground full-fat soybean (EGFS) or sunflower oil gel (SOG) containing tocopheryl acetate (TA) on tocopherols and fatty acids in feeder lambs. The EGFS were prepared by ground full-fat soybean (GFS) with either acetaldehyde (AC) or diacetyl (DA) to form gels. The SOG contained sunflower oil, TA, defatted soy flour, and DA. In trial 1, lambs (n = 18) were divided into 3 groups (6 heads in 2 pens/group). Groups were fed randomly assigned diets for 9 wk: control (BD+GFS), BD (BD+EGFS-AC), and DA (BD+EGFS-DA) diets. The BD contained corn, alfalfa, and oat. Each lamb was fed daily 0.7 kg of BD and 0.5 kg of GFS to supply same amounts of tocopherols (64 IU). In trial 2, lambs (n = 24) were divided into 3 groups (2 pens of 8 lambs), and the 3 groups were fed randomly assigned diets for 12 wk: BD (control), BD (0.7 kg/lamb/d)+TA (250 IU/lamb/d), and 1/3BD+SOG (0.5 kg/lamb/d). The a-tocopherol levels of longissimus muscle (LD) and pelvic fat (PF) from each lamb in trial 1, as well as LD, gluteus medius (GM), psoas major (PM) and brisket fat (BF) from trial 2, were determined. Tocopherol concentrations of LD were also analyzed. All data were analyzed as a completely random design. In trial 1, lambs fed the control diet had a lower (P < 0.05) level of a-tocopherol in the PF (2.1 µg/g fat) than lambs fed the AC- or DA-diet (3.0 or 3.3 µg/g fat). Compared with lambs fed the control, lambs fed the EGFS had a higher (P < 0.05) level of a-tocopherol in LD, GM, PM, and BF (3.2, 3.2, 2.2, and 3.2 µg/g, respectively) than lambs fed BD+TA (3.2, 6.1, 6.0, and 12.2 µg/g) or BD+SOG (4.2, 7.6, 7.4, and 12.6 µg/g). Compared with lambs fed BD, lambs fed BD+SOG had a higher (P < 0.05) level of a-tocopherol in LD (13.0 vs. 7.2%). The results imply that both EGFS and SOG supplements may enhance the absorption of tocopherols and increase tocopherol levels in ruminants.

### Key Words: Tocopherol, Tocopheryl Acetate, Linoleic Acid

### W95 The effect of dilution rate and pH on the conversion of stable isotopically labeled oleic acid to trans monoenes in continuous cultures.

L. E. Chase, and W. J. Cox, Clemson University, SC.

A previous in vitro study using batch cultures of mixed ruminal microorganisms showed that oleic acid was converted to trans monoenes isomers. This study was conducted to determine if a similar conversion can occur under different rumen environmental conditions. Four dual-flow continuous fermenters were used to determine the effects of pH and liquid dilution rates on microbial biohydrogenation of 13C-labeled oleic acid to trans monoenes. A 4 × 4 Latin square design with a factorial arrangement of treatments was used, with four 11-d consecutive periods. Treatments were 1) pH 6.5 and 10 h-1 dilution rate, 2) pH 6.5 and 0.05 h-1 dilution rate, 3) pH 5.5 and 10 h-1 dilution rate, and 4) pH 5.5 and 0.05 h-1 dilution rate. Fermenters were fed twice daily (22g/d) a TMR diet consisting of 40% alfalfa, 45% corn silage (DM basis). The 13C-labeled oleic acid (250 mg) dissolved in 5 ml of 95% ethanol was added into fermenters after the morning feeding on d-10 of each period. Samples of digesta were taken at 0 h (before adding 13C-labeled oleic acid) and at 24 h after adding 13C-labeled oleic acid. Both pH and dilution rate affected trans monoenes formation from oleic acid. At pH 5.5, 13C enrichment was not detected on the trans double bonds between carbons 11 and 16 and compared with pH 6.5. Similarly, at 0.05 h-1 dilution rate 13C enrichment was not detected on the trans double bonds between carbons 12 and 16 compared with 0.10 h-1 dilution rate. The percentage of trans-9 and 10 produced from oleic acid was not affected by pH (P > 0.05). The percentage of trans-9, 10, and 11 produced from oleic acid was higher (P < 0.05) at 0.10 h-1 dilution rate compared with 0.05 h-1 dilution rate. The percentage of stearic acid produced from oleic acid was not affected by dilution rate (P > 0.05) and it was higher (P < 0.05) at pH 5.5 (72%) compared with pH 6.5 (26%). The results of this study show that conversion of oleic acid to trans monoenes was reduced under low dilution rate and pH conditions.

### Key Words: pH, Dilution Rate, Biohydrogenation

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*LSM ± SEM. **LSM, pooled SEM=3.96.

LSM and SEM are presented as ug/ug DNA.
31% NDF), and were balanced to meet or exceed NRC requirements. Fifty-six cows were fed for 56 days. Dry matter intake of cows fed BMR and leafy hybrid TMR was higher than those fed the other hybrids. Differences in milk production reflected the differences in intake. Cows fed BMR (41.7 kg d\(^{-1}\)) and leafy hybrid (42.1 kg d\(^{-1}\)) TMRs were not different from each other in milk production, but had higher (P < 0.05) body weight as lactation progressed. The maintenance parameter that resulted in the best fit to the data was 0.08 Mcal/kg BWT\(^{-0.75}\). For first-lactation cows, a modified version of the NRC growth expenditure equation was added into the energy balance equation: 0.0038 (BW\(^{0.96}\)) \(\times \) bodyweight was predicted as right of the line of the body-weight prediction throughout lactation for each data set was determined. The average LS\(^{\text{a}}\) maintenance parameter for the 21 data sets was 0.096 Mcal/kg BW\(^{0.75}\), with a standard deviation of 0.0182. Average maintenance energy parameters estimated weekly for an NE balance of 0 Mcal/d were determined and plotted against week of lactation. Average maintenance energy expenditure at the onset of lactation was approximately 0.085 Mcal/kg BW\(^{0.75}\). This value increased until week 15 of lactation where it plateaued at approximately 0.100 Mcal/kg BW\(^{0.75}\). At #8805 40 weeks of lactation it decreased. Standard deviation between data sets of weekly maintenance parameter estimates throughout lactation was large but consistent at approximately 20% of the mean. In conclusion, maintenance energy expenditures during lactation appear to be lower than expected, but are higher than the conventional 0.08 Mcal/kg BW\(^{0.75}\) and expenditures during lactation appear to change, increasing up to approximately week 15 of lactation, maintaining an elevated level until approximately week 40 of lactation and then declining again.

**Key Words:** Maintenance Energy Expenditures, Energy Balance, Lactation

### W1013
**Effect of an amino polysaccharide on production and composition of milk of Holstein and Jersey cows in México.** G. González-Luna\(^{1}\), J. Sánchez-Meraz\(^{2}\), S. S. González\(^{3}\), J. Pinos-Rodríguez\(^{2}\), R. Bárcecama\(^{2}\), M. E. Ortega-Cenlria\(^{1}\), and S. Pino\(^{3}\). \(^{1}\) Instituto de Investigaciones en Agricultura de la Selva, Chapingo, México. \(^{2}\) Universidad Autónoma de San Luis Potosí, México.

The main objective of this research was to determine the effect of an amino polysaccharide (Aminoglucolite, Química Foliar, México) on milk production and composition of Holstein and Jersey cows in México. Two trials were performed: one using Holstein cows at San Carlos ranch, State of San Luis Potosí, and the second with Holstein cows at Ojo de Agua ranch, State of Guanajuato. Trials I and II lasted 56 and 20 weeks, respectively, with three groups of cows in each trial (control, 40 g Aminoglucolite/d/cow (mixed with the concentrate); experimental design was completely randomized and data were analyzed using repeated measurement procedure (SAS), and covariance analysis. In trial 1, Aminoglucolite (vs control; P < 0.10) increased milk production (31.9 vs 26.3 L/d), protein (4.1 vs 3.9% at 14 d; 4.2 vs 3.9% at 42 d), lactose (5.1 vs 4.6% at 56 d), non-fat solids (9.7 vs 9.4% at 14 d; 9.7 vs 9.5% at 42 d), but it decreased milk fat (5.4 vs 4.7%, and urea-N (8.4 vs 9.1 mg/dL), and rumen pH (6.89 vs 7.29), and increased milk protein. In trial 2, Aminoglucolite increased fat corrected milk (23.4 vs 20.8 L/d; P < 0.05) and solid corrected milk (20.7 vs 19.0 L/d; P < 0.10) in the sixth week; there were no differences (P > 0.10) for concentration of fat (%), protein (%), lactose (%), nonfat solids (%), and urea-N (mg/dL) in milk. Somatic cell count (SCC) was decreased by Aminoglucolite: 944 000 to 555 000/mL in trial 1, and 615 000 to 266 000/mL in trial 2. Results suggest that addition of this amino polysaccharide to dairy cows diets may improve milk production and composition, and decrease SCC.

**Key Words:** Amino Polysaccharide, Milk Production and Composition, Dairy Cows

### W104
**Replacing chopped alfalfa hay with alfalfa silage in barley grain and alfalfa based total mixed rations for lactating dairy cows.** J. C. Plaizier*, Department of Animal Science, University of Manitoba, Canada.

The effects of replacing chopped alfalfa hay with alfalfa silage in a fine barley grain and alfalfa based total mixed ration (TMR) were evaluated using 12 multiparous Holstein cows in a 3 x 3 Latin square design. Diets contained (DM basis) 53.0% commercial energy supplement, 10.3% commercial protein supplement, and 9.7% corn silage. Diets varied in inclusion of chopped alfalfa hay and alfalfa silage, and contained either 0.0% chopped alfalfa hay and 7.0% alfalfa silage (H), 10.0% chopped alfalfa hay and 17.0% alfalfa silage (HS), or 27.0% alfalfa silage (S). Ruminal fluid was collected using an oral probe between 4 and 5 hr after feeding. Contents of protein and fibre did not differ among diets. Replacing chopped alfalfa hay with alfalfa silage increased dietary dry matter (DM), and increased dietary soluble protein (SP). Replacing chopped hay with silage reduced the proportion of TMR passing through the 8 and 19 mm screens of the Penn State Particle Separator (PSPS) from 27.6 to 37.9%, increased the physical effective NDF calculated as the proportion of dietary NDF retained by the two screens of the PSPS (peNDF\(^{3}\), from 13.3 to 15.6% DM, and increased the proportion of DM retained by a 1.18 mm screen after dry sieving multiplied by dietary NDF (peNDF\(^{3}\,1.18\)) from 23.4 to 25.6 %DM. Proportions of TMR retained by the PSPS screens were lower than recommended. Replacing chopped alfalfa hay with alfalfa silage did not affect dry matter intake, rumen pH, rumen VFA, blood lactate, milk fat, and milk protein, but decreased blood glucose, tended to increase blood urea and numerically decreased milk yield. A wider range in peNDF\(^{3}\) and peNDF\(^{3},1.18\) and a higher inclusion of corn silage might have resulted in greater differences in rumen fermentation and milk production among diets. The pH of rumen fluid samples varied from 5.90 to 5.98, and milk fat percentage varied from 2.50 to 2.60% among diets. These values suggest that subacute ruminal acidosis (SARA) was induced by all diets.

<table>
<thead>
<tr>
<th>Diet</th>
<th>Diet H</th>
<th>Diet HS</th>
<th>Diet S</th>
<th>SE</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM</td>
<td>71.4</td>
<td>63.4</td>
<td>57.3</td>
<td>0.75</td>
<td>NS</td>
</tr>
<tr>
<td>CP</td>
<td>20.5</td>
<td>20.5</td>
<td>20.7</td>
<td>0.39</td>
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</tr>
<tr>
<td>SP</td>
<td>5.5</td>
<td>6.5</td>
<td>7.7</td>
<td>0.23</td>
<td>NS</td>
</tr>
<tr>
<td>NDF</td>
<td>34.6</td>
<td>33.9</td>
<td>34.6</td>
<td>1.46</td>
<td>NS</td>
</tr>
<tr>
<td>Retained by PSPS screens, %</td>
<td>31.7</td>
<td>29.7</td>
<td>25.7</td>
<td>0.10</td>
<td>NS</td>
</tr>
<tr>
<td>peNDF(^{3}), %DM</td>
<td>13.3</td>
<td>15.1</td>
<td>15.6</td>
<td>0.61</td>
<td>NS</td>
</tr>
<tr>
<td>peNDF(^{3},1.18), %DM</td>
<td>23.4</td>
<td>24.0</td>
<td>25.6</td>
<td>0.32</td>
<td>NS</td>
</tr>
<tr>
<td>DSM, kg d(^{-1})</td>
<td>23.1</td>
<td>24.0</td>
<td>22.2</td>
<td>1.04</td>
<td>NS</td>
</tr>
<tr>
<td>Rumen pH</td>
<td>5.90</td>
<td>5.99</td>
<td>5.98</td>
<td>0.05</td>
<td>NS</td>
</tr>
<tr>
<td>Blood glucose, mM L(^{-1})</td>
<td>4.41</td>
<td>4.37</td>
<td>4.17</td>
<td>0.10</td>
<td>NS</td>
</tr>
<tr>
<td>Blood urea, mM L(^{-1})</td>
<td>6.89</td>
<td>7.29</td>
<td>7.74</td>
<td>0.46</td>
<td>NS</td>
</tr>
<tr>
<td>Milk yield, kg d(^{-1})</td>
<td>39.0</td>
<td>38.3</td>
<td>37.6</td>
<td>0.45</td>
<td>NS</td>
</tr>
<tr>
<td>Milk fat, %</td>
<td>2.50</td>
<td>2.63</td>
<td>2.60</td>
<td>0.13</td>
<td>NS</td>
</tr>
<tr>
<td>Milk protein, %</td>
<td>3.17</td>
<td>3.16</td>
<td>3.15</td>
<td>0.08</td>
<td>NS</td>
</tr>
</tbody>
</table>

**p** = P < 0.01, *P* = P < 0.05, **P** = P < 0.10, NS = not significant.

**Key Words:** Physically Effective NDF, Sub-Acute Ruminal Acidosis, Dairy Cows
**W105** Soybean hulls and corn gluten feed for replacing corn silage neutral detergent fiber in total mixed rations of lactating cows. M. Lima*, L. G. Nussio*, and W. Mattos†, 1Universidade do Estado do Rio de Janeiro, Escola de Veterinária, DPA, Goiania, GO, Brazil, 2Escola Superior de Agricultura Luiz de Queiroz, Padua Dias, Pracitaba, SP, Brazil.

Four ruminally and duodenally cannulated Holstein cows were used in a 4x4 Latin square design with 14-d periods to evaluate fiber effectiveness of pelleted soybean hulls (PSH) and corn gluten feed (CGF). Four isonitrogenous and isoinergetic diets were formulated, and low (LF) and high forage (HF) diets [14% and 22% of dietary DM from corn silage (CS) NDF, respectively] were compared to diets formulated to contain 14% CS NDF plus 8% of DM from PSH NDF or CGF NDF. Dry matter, CP and NDF were 28.2%, 9.2% and 44.5%; 88.8%, 10.3% and 68.2%; 89.1%, 27.2% and 38.8%, respectively for CS, PSH and CGF. The NDF intake was lower (P<0.05) for cows fed LF (3.52 kg/d) diets than those fed HF, PSH and CGF diets (4.55 kg/d). Dry matter intake (16.9 kg/d), milk yield (19.9 kg/d) and milk crude protein (3.17%) did not differ among diets, but milk fat was higher for cows fed HF (3.80%) and CGF (3.70%) diets (P<0.05) than those fed LF (3.27%) and PSH (3.17%) diets. Fat correct milk (3.5%) was significantly lower (P<0.05) for cows fed the PSH (18.3 kg/d) diet than those fed HF and CGF diets (20.8 kg/d). Mean rumen pH was higher (P<0.05) for cows fed HF (5.95) than those fed the other diets (5.74). Total VFA concentration did not differ among cows fed experimental diets, but propionic acid (mol/100 mol) was higher (P<0.05), and acetic acid (mol/mol) and acetate:propionate ratio were lower (P<0.05) for those fed PSH and CGF diets than for HF diet. Ruminating (min/d and min/kg of NDF) and chewing (min/d and min/kg of NDF) activities were lower (P<0.05) for cows fed the PSH and CGF diets than those fed LF and HF diets. Rumen mat consistency (cm/s) was also lower (P<0.01) for cows fed the PSH and CGF diets than those fed LF and HF diets. Ruminating (min/d and min/kg of NDF) and chewing (min/d and min/kg of NDF) activities were lower (P<0.05) for cows fed the PSH and CGF diets than those fed HF diet. Under our condition, PSH NDF or CGF NDF were not as effective as CS NDF to keep mean rumen pH and chewing activities, and these responses can increase the risk of acidosis for cows fed PSH and CGF diets.

**Key Words:** Fiber Effectiveness, Mean Rumen pH, Chewing Activities

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**W106** Effects of dietary forage and non-fiber carbohydrate concentrations on apparent B-vitamin synthesis in dairy cows. E. Schwab*, C. G. Schwab, C. L. Girard*, R. D. Shaver†, D. E. Putnam*, and N. L. Whitehouse†, 1University of Wisconsin, Madison, 2University of New Hampshire, Durham, 3Dairy and Swine R&D Center, AAC, QC, Canada, 4Balchem Encapsulates, New Hampton, NY.

Eight Holstein cows (four primiparous, four multiparous) were fitted with ruminal and duodenal cannulas to test the effects of dietary forage (F) and NFC concentrations on B-vitamin apparent synthesis (AS). Cows were used in a replicated 4x4 Latin square design balanced for carryover effects with a 2x2 factorial arrangement of treatments. Each square contained two multiparous and two primiparous cows and periods were 21 d in length. Experimental diets with 35 or 60% (DM basis) forage (corn silage, alfalfa hay, and grass hay) were formulated to contain either 30 or 40% NFC (DM basis). The concentrate portion of the diets was composed of varying proportions of soybean hulls, beet pulp, corn grain, rolled barley, soybean meal, blood meal, Smartamine-M®, vitamins, and minerals. Apparent B-vitamin synthesis is defined as the difference between duodenal vitamin flow and vitamin intake. This estimate does not consider potential ruminal microbial metabolism (use or destruction) or ruminal absorption of the vitamins. There was a significant F effect on AS for all B-vitamins except pyridoxal (PAL). Apparent synthesis of B-vitamins was largely unaffected by NFC content, however AS of B12 and PAL were both influenced by dietary NFC content. A FxNFC interaction existed only for thiamin AS. Negative AS values for pyridoxal is not consistent with the form of vitamin B6 was either ruminally destroyed or utilized, absorbed through the rumen wall, or converted to another B6 form.

**Key Words:** Physically Effective NFC, Digestibility, Rumen pH

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**W107** Effects of physically effective NDF on chewing activity and rumen pH of dairy cows fed diets based on corn silage. W. Z. Yang* and K. A. Beauchemin, Research Center, Agriculture and Agri-Food Canada, Lethbridge, AB.

A study was conducted to investigate the effects of physically effective (pe) NDF content of dairy cow diets containing corn silage on chewing activity and rumen pH. The study was designed as a double 3x3 Latin square using six lactating dairy cows with ruminal cannulas. Three levels of dietary peNDF (high, medium and low) were compared. The three levels of peNDF were obtained using corn silage as originally prepared, corn silage rechopped once, or corn silage rechopped twice. The peNDF content of the diets was determined as the proportion of the TMR (as-fed) retained on the 0.75" and 0.31" screens of the Penn State Particle Separator multiplied by dietary NDF content (DM basis). The peNDF contents were 11.5, 10.3 and 8.9%, for the high, medium and low peNDF diets, respectively. Ruminating time (494, 472 and 441 min/d, for high, medium or low, respectively) was linearly affected by intake of peNDF. Eating time (273, 315 and 258 min/d, for high, medium or low, respectively) and total chewing time (767, 787 and 700 min/d for high, medium or low, respectively) were quadratically increased with increasing peNDF intake. Mean pH, area between the curve and pH 5.8 or 5.5, and time that pH was below 5.8 or 5.5, were not affected by peNDF intake. Intake of peNDF was not correlated to eating time, but was correlated to ruminating time (r=0.49, P<0.05). In contrast, mean rumen pH was not significantly correlated to intake of peNDF (r=-0.39). Ruminating time (r=-0.45, P<0.05). These results indicate that increasing the peNDF content of diets increases chewing time. However, increased chewing time does not always improve rumen pH status. Although increasing chewing time is expected to increase salivary secretion, the increase may not fully overcome the effects of feed digestion and the production of fermentation acids that lower rumen pH. Models that predict rumen pH need to include both peNDF and fermentable OM intake.

**Key Words:** B-Vitamin, Synthesis, Cow

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**W108** Effects of physical and heat processing of cottonseed on chewing activity of Holstein dairy cows. A. R. Foroughi*, A. A. Naserian, R. Valizadeh, and M. Danesh mesgaran, Ferdowsi University of Mashhad, Tehran, Iran.

Based on chewing response, whole cottonseed (WCS) appears to be the most effective fiber source from byproduct feeds. Eight multiparous Holstein dairy cows averaging 84.50±10.34 days in milk and 36.10±4.46 milk yield (MY) were used in a 4x4 Latin Square design. Cows were divided into four dietary treatment groups. Dietary treatments were: 1) WCS; 2) ground cottonseed; 3)GCS heated in 140°C and steeped for 2.5 minute (GHC51); or 4) GCS heated in 140°C and steeped for 20 minute (GHC52). Total mixed diets were fed individually free choice twice daily. Diets were formulated to contain 20% alfalfa hay, 17% corn silage, 14% different processed cottonseed and 49% concentrate and had the following composition, dry matter 79.5%, NDF 35.2%, CP 18.5%, and NEL 1.58 (Mcal/KgDM). Each period consisted of 21 days and the last 7 days were used for dry matter intake (DMI). Chewing activity

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<table>
<thead>
<tr>
<th>Item</th>
<th>Thiamin AS</th>
<th>Folic acid AS</th>
<th>PAM AS</th>
<th>PAL AS</th>
<th>PYR AS</th>
</tr>
</thead>
<tbody>
<tr>
<td>mg/d</td>
<td>70</td>
<td>20</td>
<td>117</td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td>mg/d</td>
<td>55</td>
<td>23</td>
<td>84</td>
<td>46</td>
<td>15</td>
</tr>
<tr>
<td>mg/d</td>
<td>48</td>
<td>15</td>
<td>83</td>
<td>40</td>
<td>7</td>
</tr>
<tr>
<td>mg/d</td>
<td>53</td>
<td>18</td>
<td>63</td>
<td>43</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>0.01</td>
<td>NS</td>
<td>&lt;0.01</td>
<td>NS</td>
<td>&lt;0.01</td>
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<tr>
<td>0.02</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
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</tr>
</tbody>
</table>

5NS=not significant (P<0.05) PAM=pyridoxine
were estimated through a visual observation method at 5-minute intervals during 24h at 18d of each period. The mean DMI was significantly \( (P<0.01) \) affected by diets and in treatments 1,2,3 and 4 were 25.97, 27.24, 27.63, and 27.63 (kg/d), respectively. The mean rumination times between treatments (min/kg NDF intake) were significantly different and for treatments 1.2 and 3.4 were 54.02, 45.63, 44.24, and 46.97, respectively. This represented a 15% decrease between 1 and 2. However, chewing activity was similar for four treatments averaging 279 min/24h. Significant differences were not observed in eating activity min/24h and min/kg NDF Intake and ruminating activity (min/24h). Grinding and heat treatment of cottonseed did not affect of chewing activity of dairy cows.

**Key Words:** Whole Cottonseed, Grinding and Heat Treatment, Chewing Activity

**W109** Relationship between TMR, corn silage particle size and manure evaluation in dairy cows. G. Mancin\(^1\), V. Dell’Orto\(^2\), and G. Savoini\(^*2\), \(^1\) Dept of Morphology, Biochemistry, Physiology and Animal Productions University of Messina, Italy, \(^2\) Dept. of Veterinary Sciences and Technologies for Food Safety, University of Milan, Italy.

The aim of the trial was to study the correlation between TMR, corn silage particle size and manure evaluation in order to give some useful tools to dairy farmers to improve milk production efficiency. Five dairy farms were involved in the trial that lasted 60 days. Corn silage particle size were evaluated every two weeks by Penn State Particle Separator (PSPS). Ten fresh cows per farm were selected for manure appearance and particle size evaluation. Faecal samples were collected every two weeks and rinsed with water into a strainer with 1.6 mm openings. Faecal undigested fractions were classified by score from 1 (no large fibre particles, no ground grain) to 5 (large fibre particles, abundant ground grain). Data were analyzed by Pearson correlation. TMR average particle size distribution was quite different compared to PSPS guidelines, indeed the percentage of TMR retained on the upper sieve (15.97%) was greater compared to PSPS guidelines, this is probably due to the high quantity of forage used in our rations (average NDF=37.4%, SS and greater length of hay and grass silage particles. Corn silage particle size distribution was in accordance with the PSPS guidelines, for this reason significant positive correlations were observed between corn silage and TMR percentages retained on mid, low and bottom sieves. Positive correlations were observed among rations NDF and TMR particles retained on upper and middle sieves \( (r=0.19; \text{vs}=0.29) \); moreover significant positive correlation was observed between eNDF and TMR particle size on upper sieve \( (r=0.47) \). Significant positive correlation was observed among milk production and TMR particles retained on middle sieve \( (r=0.56) \) and faecal undigested fraction \( (r=0.39) \). TMR particle size distribution and manure evaluation are useful tools to improve milk production efficiency, indeed the TMR particles retained on middle sieve is positively correlated to milk production and faecal undigested fractions.

**Key Words:** TMR, Manure Evaluation, Milk Production Efficiency

**W110** Intake and milk production of cows fed diets that differed in dietary NDF and NDF digestibility. C. Kendall\(^*\) and D. K. Combs, University of Wisconsin, Madison.

This study evaluated how intake and milk production were affected by feeding diets that differed in dietary NDF concentration and NDF digestibility. Twelve rumin cannulated, multiparous Holstein cows averaging 39 DIM and producing 39.5 kg/d of milk, were used in a replicated 4 x 4 Latin Square design with 28 d periods. Treatments were arranged in a 2 x 2 factorial with 28% or 32% dietary NDF concentration (DM basis) and two levels of straw NDF digestibility: 1) untreated wheat straw (control, 77 % NDF, 41% NDFD), and 2) anhydrous ammonia-treated straw (76% NDF, 62% NDFD, DM basis). All diets consisted of alfalfa silage, corn silage and a concentrate mix of cracked corn grain, corn gluten meal, 48% soybean meal, vitamins and minerals. Wheat straw comprised 8.5% DM of the 28% NDF diets and 16% DM of the 32% NDF diets. Cows were offered TMR twice daily and fed ad-libitum. Milk and FCM production were higher on the low NDF diets. Milk and FCM also increased when NDF digestibility of the diets was increased. Intake of DM was greater when cows consumed the 28% NDF diets, but intake of total NDF was greater in the 32% NDF diets. Intakes of DM and total NDF were not affected by NDF digestibility. Milk production and DM were not affected by the interaction of dietary NDF and NDF digestibility. These results suggest that dietary NDF and NDF digestibility improved milk production additively. Intake was improved by reducing dietary NDF, but DM and total NDF intakes were not affected by NDF digestibility.

**Dietary NDF**

<table>
<thead>
<tr>
<th>Wheat Straw</th>
<th>Control</th>
<th>Treated</th>
<th>Control</th>
<th>Treated</th>
<th>SEM</th>
<th>NDF</th>
<th>NDFD</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg/d</td>
<td>39.3</td>
<td>40.8</td>
<td>36.5</td>
<td>38.6</td>
<td>2.4</td>
<td>.0002</td>
<td>.0038</td>
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<tr>
<td>kg/d</td>
<td>35.9</td>
<td>37.4</td>
<td>33.0</td>
<td>34.6</td>
<td>2.7</td>
<td>.0001</td>
<td>.0130</td>
</tr>
<tr>
<td>kg/d</td>
<td>22.8</td>
<td>23.4</td>
<td>21.7</td>
<td>22.3</td>
<td>0.8</td>
<td>.0288</td>
<td>.2412</td>
</tr>
</tbody>
</table>

**Total NDFI, kg/d**

| 6.3 | 6.4 | 6.8 | 6.9 | 0.2 | .016 | .5425 |

**Total NDF1, kg/d**

| 6.3 | 6.4 | 6.8 | 6.9 | 0.2 | .016 | .5425 |

**Total NDF2=Total NDF Intake, Dig.NDF1=Digestible NDF Intake**

**Key Words:** NDF, NDF Digestibility, Milk Production

**W111** Effect of physical forms of concentrate on milk composition and milk production of lactating Holstein cows. J. Teixeira\(^*\), B. Madeira, L. Teixeira\(^*\), and M. Santos, Universidade Federal de Lavras, Lavras, MG, Brazil.

Twenty seven lactating Holstein cows averaging 20 kg of milk yield (50 days lactation) were used in a 3x3 Latin square design trial, with three treatments and three periods of 15 days each. The three treatments were: 1) the physical forms of concentrate (T1) pellets; (T2) mealled and (T3) extruded. The diets showed the same chemical composition. This trial was undertaken in Bela Vista Farm, in Curvelo, MG, Brazil. The objective of this trial was to determine the effect of these three different physical forms of concentrate on milk composition and milk production of lactating cows in a free stall. The cows were selected based on milking production and number of lactation. Each experimental period consisted of 9 days of adaptation and six days of milk collection. All cows were fed with napier grass and tifton grass haylage. Were collected and weighed milk samples of two milking per day in every 6 days. The following milk components were determined: fat, total solids, lactose, crude protein and urea using infrared method. The treatments did not affect \( (P<0.05) \) milk composition, however the extruded form \( (P<0.05) \) decreased urea levels \( \text{mg/dl} \) (T1) 21.88; (T2) 21.15; (T3) 19.16 and increased the milk production and milk production corrected by 4% fat. Average milk production (kg) were (T1) 17.32; (T2) 17.35; (T3) 18.31 and (T1) 15.66; (T2) 15.78; (T3) 16.81 respectively.

**Key Words:** Milk Production, Milk Composition, Physical Forms of Concentrate

**W112** Daily and diurnal variations in fecal ratios of n-alkanes concentrations in lactating cows grazing a tropical pasture. D. E. de Oliveira\(^*\), S. R. de Medeiros\(^1\), L. M. Aroeira\(^2\), and D. P. D. Lanna\(^3\), \(^1\) FAPESP, \(^2\) Agroceres Nutrio Animal, \(^3\) Embrapa Gado de Corte, \(^4\) Embrapa Gado de Leite, \(^5\) USP/ESALQ.

The objective of this study was to measure the daily and/or diurnal variation in the fecal concentration of the n-alkanes \( C_{31}, C_{32}, \) and \( C_{33} \) in Holstein x Gir cows used, ten were individually fed 150g of CLA-60 and the other ten 150g of Megalac, mixed in the morning concentrate (4.0 kg/day). The animals were dosed orally with a controlled-release capsule containing the n-alkanes \( C_{32}, C_{33} \) and managed in a rotational grazing system on Stargrass (Cynodon nlemfuensis). After seven days of capsule delivery, faecal samples of cows were collected and weighed milk samples of two milking per day in every 6 days. The following milk components were determined: fat, total solids, lactose, crude protein and urea using infrared method. The treatments did not affect \( (P<0.05) \) milk composition, however the extruded form \( (P<0.05) \) decreased urea levels \( \text{mg/dl} \) (T1) 21.88; (T2) 21.15; (T3) 19.16 and increased the milk production and milk production corrected by 4% fat. Average milk production (kg) were (T1) 17.32; (T2) 17.35; (T3) 18.31 and (T1) 15.66; (T2) 15.78; (T3) 16.81 respectively.

Eleven cows were used in a 50 d experiment to study the influence of turning cows out to and withdrawal from pasture on fatty acid (FA) profile and vitamin E levels in milk. Prior to the start of the experiment cows received a total mixed ration (TMR) containing 50% conserved forage and 50% grain. Milk samples were collected from a.m. and p.m. milkings during the first 2 d of the experiment (Phase 1) while cows were fed TMR. On day 3, cows were turned out to the pasture and remained on pasture until day 36 of the experiment (Phase 2). Cows were acclimatized to pasture gradually (25, 50, and 75% pasture for 2 d each) over a period of 1 wk. On day 37 cows were withdrawn from the pasture and remained on the experiment until day 50 (Phase 3) on a TMR diet similar to phase 1. Milk samples from both a.m. and p.m. milkings were collected on alternate days during phases 2 and 3 for FA analysis. Milk samples from day 28 during phase 2 and day 50 of phase 3 were analyzed for vitamin E (α plus γ tocopherol). Cows produced 31.4 ± 3.7, 17.5 ± 4.6, and 19.0 ± 6.8 kg milk/d with 3.64 ± 0.02, 4.02 ± 0.37, and 3.65 ± 0.16% fat in phases 1, 2, and 3, respectively. The conjugated linoleic acid (CLA) and C18:1 trans11 (TV) contents of milk were 0.63 and 4.09% of fat during phase 1 and reached a maximum of 2.28 and 7.36% on day 32 of turning cows out to pasture (P < 0.05), respectively. The C18:3 n-3 maximized at day 14 (P > 0.05) on pasture. Total ω3-FA were 0.38% of milk fat during phase 1 and increased to 1.12% of fat by day 16 (P < 0.05) on pasture. The vitamin E level of milk was higher (P < 0.001) when cows were grazing on pasture during phase 2 as compared to consuming conserved forage and grain during phase 3 (0.44 vs. 0.24 µg/ml). Cows grazing on pasture exhibit higher CLA, ω-3, and vitamin E levels in milk compared with cows consuming a forage plus grain diet. In addition, cows moving from a conventional diet to grazing on pasture with a 1 wk transition period may require a minimum of 4 wk to maximize stabilize CLA, TVA, and ω fatty acid levels in milk.

Preparation of fresh forage for in vitro and in sacco incubations. A. V. Chaves1, G. C. Waggoner*2, and I. M. Brookes1, 1Institute of Food, Nutrition and Human Health, Massey University, Palmerston North, New Zealand, 2Dexcel Limited, Hamilton, New Zealand.

In vitro and in sacco procedures are well established and are usually carried out on forage prepared by freeze drying and grinding through a 1 mm screen. This may be appropriate for grains and high dry matter material, but is not necessarily suitable for ruminants grazing fresh pasture. Ideally the sample preparation for in vitro and in sacco incubations of fresh forages to determine digestion characteristics should mimic the particle distribution resulting from chewing during eating and rumination. The objective of this work was to compare the particle size distribution of the rumen contents of animals fed forages and ryegrass prepared using a mincer. Frozen ryegrass at different stages of maturity were chopped into approximately 2 cm lengths (scissors) and minced in a Kreft Compact meat mincer R70 fitted with a screen plate with 12 mm holes. The mincer components were placed in a freezer prior to mincing to ensure the grass remained frozen and this enabled the forage to be macerated rather than squeezed and prevented excessive cell wall rupture during mincing. The process was designed to mimic effects of chewing by ruminants as far as possible. Samples of minced forage were retained for measurement of particle size distribution by wet sieving. Mincing enabled 37% of DM able pass a 0.25 mm sieve and 31% was unable to pass a 2 mm sieve. This distribution is similar to that of rumen contents in sheep and cattle fed forages but the soluble (A) fraction from ryegrass accounted for a slightly higher proportion of DM than identified by sieving. The higher value for A fraction supports studies showing chewing ruptured 60% of the fresh forage cells. The technique for measuring particle size and release of cell contents may contribute to these anomalies. The mincing preparation used for in vitro and in sacco incubations showed a high degree of uniformity and the proportional distribution of DM across particle sizes resemble these for chewed forage and rumen contents. The preparations used here provide sufficient large particles which are important in forage incubations and mimic mastication by ruminants.

Preparation, Forage, Incubations

Inducing subacute ruminal acidosis (SARA): Effects on ruminal pH, DMI, and milk production. K. M. Krause* and G. R. Oetzel, School of Veterinary Medicine, University of Wisconsin, Madison.

Data from trials in which SARA was induced in lactating dairy cows (DIM 154±118) were evaluated in order to investigate the effectiveness of the induction protocol and its effect on production parameters. For 13 cows in three trials, ruminal pH was measured continuously and recorded each minute; dry matter intake and milk yield was recorded daily. Milk composition data were obtained from 9 cows in two of these trials. The SARA induction protocol included four separate Periods: four days of Baseline (normal TMR fed), one day of 50% Restricted feeding, one or two day of Challenge feeding (addition of 4-5 kg wheat/barley pellet to normal TMR), and two days of Recovery measurements when feeding normal TMR. Data were analyzed including Period, Trial, and their interaction in the model. Mean comparisons were by least significant difference method after a significant (P < 0.05) Period effect was found. All reported differences are significant (P < 0.05). The SARA induction protocol lowered mean ruminal pH from 6.29 during the Baseline period to 5.86 during the Challenge period; pH remained below Baseline level during the Recovery period (6.15). Mean ruminal pH was highest (6.57) during the day of Restricted feeding. Nadir ruminal pH decreased from Baseline to Challenge period (5.73 vs. 5.17). Hours below pH 5.6 increased from 1.4 to 8.3 per d from Baseline to Challenge period and area below 5.6 (pH x min/d) increased from 18 to 198. Dry matter intake was not affected by SARA induction. Milk yield dropped from 35.2 kg/d during Baseline to 31.7 kg/d during the Challenge period and did not return to Baseline level during the Recovery period (31.3 kg/d). No depression in milk fat percentage was observed when SARA was induced. Yield of fat was highest during the Restricted feeding period (1.47 kg/d) and was lower during the Recovery period than during the Baseline period (1.12 vs. 1.31 kg/d). Protein percentage was unaffected by the protocol. The protocol successfully induced SARA (low ruminal pH) on the Challenge day. Milk yield was substantially reduced and did not recover within two days after the challenge.

Preparation, Subacute Ruminal Acidosis, Dry Matter Intake, Milk Production

The effects of monensin on feed intake patterns during induced sub-acute ruminal acidosis (SARA)
in Holstein dairy cows fed a total mixed ration (TMR). The experiments were conducted as a two-treatment, two-period crossover design with a 7-d adaptation period before induction of SARA, a 10-d SARA period and a 7-d post SARA recovery period using six multiparous Holstein cows (630.5 ± 53.4 kg BW; 81.2 ± 49.6 DM; experiment 1 and 667.7 ± 46.2 kg BW; 150.2 ± 53.2 DM; experiment 2). In experiment 1, monensin was administered as a controlled-release capsule (Rumensin® CRC) (32 g of monensin sodium blended into a hexaglycerol distearate matrix core) whereas in experiment 2, monensin was added as Rumensin® Premix (22 ppm of dry matter) using soybean hulls as carrier. In both experiments, the control diet was identical to the monensin treatment diet except it did not contain monensin. Feed intake patterns were monitored continuously over 24 hrs using a weigh cell system within the manger and meal size and meal duration recorded by a computer hooked to the system. SARA was induced by restricting TMR intake to 85% of ad libitum intake and replacing the remaining 15% with a grain pellet consisting of 50% wheat and 50% barley. In both experiments, the number of meals consumed during SARA were lower (P < 0.05) than during the adaptation and recovery periods suggesting the animals might have been attempting to attenuate SARA by reducing intake. In experiment 1, CRC had no effect (8.7 vs. 8.7, P = 0.96) on feed intake patterns although there was a tendency (7.4 vs. 8.0, P = 0.19) for number of meals consumed on CRC during SARA to be higher. In experiment 2, the premix significantly increased the overall number of meals consumed (7.5 vs. 8.1, P = 0.01); number of meals consumed during SARA (6.0 vs. 7.2, P = 0.04) and number of meals consumed during the recovery period (7.5 vs. 9.0, P = 0.004). These results suggest monensin may increase meal frequency in lactating dairy cows when under conditions of SARA. However, potential differences in the mode of action between monensin delivered in a Rumensin or Premix merits further research.

Key Words: Dairy Cows, Ruminal Acidosis, Monensin

W117 Diet digestibility and rate of passage in Jersey and Holstein Friesian cows during transition. P. C. Aikman1, A. Boydelli2, A. Le Gallaïs3, D. J. Humphries1, C. K. Reynolds1, and D. E. Beever1. 1CEDAR, The University of Reading, UK; 2BOCM PAULS Ltd, Bristol, UK; 3Jersey Milk Marketing Board, St. Saviour, NJ; 4The Ohio State University, Wooster.

The effect of breed on diet digestibility and rate of passage (ROP) was measured in six Jersey (J; initial BW 462 ± 18 kg) and six Holstein Friesian (HF; initial BW 678 ± 18 kg) third parity cows at wk 5 before expected calving date (ECD) and wk 5 and 14 postpartum. From drying-off until wk 3 before ECD cows were fed a TMR (660 g grass silage, 220 g grass hay and 120 g concentrates/kg DM; 146 g CP and 523 g NDF/kg DM) according to BW. From calving, cows were fed ad libitum a TMR (311 g corn silage, 311 g grass silage and 378 g concentrates/kg DM; 173 g CP and 386 g NDF/kg DM). Digestibility was assessed by total faeces collections for 5 d. To determine ROP a dose of Cr-mordanted grass silage (1% of DM) was fed at the start of each period and Cr concentration in faeces measured at regular intervals for 120 h post-dosing. Transit time (TT; h to first appearance of Cr in faeces) and rate constants describing the proportion of feed passing out of the rumen (k1) and hindgut (k2) per hour were estimated. HF had higher (P < 0.001) DM, OM, starch, NDF and ADF intakes (18.12, 16.88, 2.91, 6.92 and 4.18 kg/d, respectively) than J (12.26, 11.41, 1.86, 4.82 and 2.94 kg/d, respectively). Breed did not affect digestibility of DM, OM, starch or ADF (respectively mean values: 712, 733, 941 and 538 g/kg). NDF digestibility was higher (P < 0.008) in J compared to HF (629 and 602 g/kg respectively). k1 was higher (P < 0.016) in J than HF (0.031 vs 0.627), k2 tended to be higher in J than HF (0.078 vs 0.074, P < 0.106), but TT did not differ (12.19 ± 13.46 h, J and HF respectively, P > 0.377). Fiber digestibility and TT declined (P < 0.001) in both breeds as DM increased postpartum, but the decrease in TT was less in J (P < 0.050). In conclusion, k1 was greater for J than HF at equal DM/kg BW. NDF digestibility was higher for J cows despite faster ROP from the rumen, which may reflect differences in mastication and particle size reduction.

Key Words: Jersey Cows, Digestibility, Rate of Passage

W118 The effects of glucogenic supplements prepartum and calcium soap of fatty acids postpartum on production and peripartum metabolites in high producing dairy cows. U. Moallem1*, H. Lehoviz1, M. Katz1,2, and D. Skin1. 1Department of Dairy Cattle, Institute of Animal Science, ARO, Israel; 2Animal Science Department, Faculty of Agriculture, Hebrew University, Rehovot, Israel.

This study examined the effects of feeding supplements containing glucogenic precursors prepartum and calcium salt of fatty acids (CSFA) postpartum until 120 DIM, on production and blood metabolites. Twenty-four dry and 250 d pregnant cows were housed in an open barn with electronic individual feeding system and were divided on the basis of previous milk production and parity to one of two treatments: control: dry cow diet (NRC requirements) 2) treatment diet 4) to be dressed with 550 g of a commercial glucogenic supplement (ProGlyc; PG). After calving each prepartum group was subdivided to groups that were fed either the control lactating diet or the control supplemented with 550 g CSFA. After calving cows were milked and weighed three times a day. BCS was determined weekly and blood samples were taken 3 times a week until 70 DIM. Insulin, glucose, beta-hydroxybutyrate (BHB), triglycerides (TG), cholesterol and aspartate amino transferase (AST) were determined in blood until 30 DIM. The PG supplementation decreased DMI by 6% pre and postpartum and postpartum CSFA decreased DMI by 2.3%. Milk production was decreased by 6.4%, fat percentage was not changed and protein was enhanced by 4% in cows fed PG prepartum. BCS was increased earlier after calving in cows fed PG prepartum. Feeding PG prepartum enhanced insulin, glucose and cholesterol plasma concentrations throughout (P < 0.004) and decreased BHB and AST pre and postpartum. Postpartum CSFA decreased glucose and increased cholesterol plasma concentrations with no change in BHB, AST and TG. Significant interactions were observed between prepartum PG and postpartum CSFA in reducing BHB (P < 0.007). In conclusion, supplementation of glucogenic precursors pre-calving improved body condition and the metabolic status of dairy cows, pre and post partum.

Key Words: Transition Cow, Glucogenic Precursors, Calcium Soap of Fatty Acids

W119 Physiological responses of Holstein cows fed rations with glucogenic supplements during the transition period. T. I. Belloso1*, M. J. Hayen1, M. Liboni1, M. S. Guly1, F. Valdez2, and H. H. Head1. 1University of Florida, Gainesville; 2Kemin Americas, Lancaster, OH.

Multiparous Holstein cows (n=124) were used to evaluate effects of supplementing glucogenic compounds in daily TMR fed during the transition period (-3 wk to +4 wk). Treatments (TTRT) were 1) control (CON), none, n=29; 2) NutroCal (NUT; Kemin Americas1,3), 0.114 kg/d, n=33; 3) Metaxerol (MET; Pestell America1,3), 0.454 kg/d, n=31; and 4) propylene glycol (PPG), 0.300 kg/d, n=31. Supplements were added to ~13kg of close-up TMR (-3 wk to calving) or lactating TMR (calving to +14 d). TMR prepartum (ECD) and postpartum (PP) were calculated (P < 0.007). In conclusion, supplementation of glucogenic precursors pre-calving improved body condition and the metabolic status of dairy cows during transition period.

Key Words: Transition Cow, Glucogenic Precursors, Calcium Soap of Fatty Acids
**W120** Ruminal and plasma responses in dairy cows to drenching or feeding glycerol. P. L. Linder, J. M. DeFrai1, A. R. Hippen, and P. V. Jordon1
1 South Dakota State University, Brookings, West Central Soy, Ralston, IA.

Four Holstein dairy cows (137 DIM, 60 kg milk/d) were used in a Latin square design with 1-week periods to evaluate the effects of oral delivery of glycerol on ruminal VFA and plasma glucose and insulin. All cows were fed only grass hay for ad libitum consumption during 12 h before the experiments. At the start of the experiment, all cows were fed 5 kg of cracked corn. Treatments were: 1) control (C), no glycerol; 2) fed glycerol (F), 1 kg of glycerol solution (80% glycerol) added to the corn; 3) drench glycerol (D), 1 kg of glycerol solution in 1 L of water and delivered as oral drench; and 4) tube delivery of glycerol (T), 1 kg of glycerol solution in 9 L of water and delivered via an esophageal tube. Rumens were sampled at 0, 2, 4, and 6 h. Aceta decreased (P < 0.05) in rumens of cows given glycerol, reaching nadir at 4 h (53.3, 44.9, 44.6, and 43.0 mol% for C, F, D, and T). Propionate and butyrate were increased (P < 0.05) in plasma of D and T compared with C, reaching peak concentrations at 4 h (26.4, 28.7, 30.4, and 30.4 mol% for C, F, D, and T). Insulin concentrations in plasma were increased (P < 0.05) for D and T reaching peak concentrations (97 and 115 pg/ml over baseline) at 1.4 and 1.1 h for D and T respectively. Glucose concentration expressed as area under the curve (AUC) over baseline for 8 h was greater (P < 0.05) for D and T compared with C (9.4, 23.6, 54.6, and 58.1 mg/dl for C, F, D, and T). Insulin concentrations in plasma were increased (P < 0.05) for D and T reaching peak concentrations (97 and 115 pg/ml over baseline) at 1.4 and 1.1 h for D and T respectively. 8-h AUC for insulin concentrations were greater (P < 0.05) for D and T than for F and C (80, 67, 244, and 270 pg/ml for C, F, D, and T). These data demonstrate that the ability of glycerol to increase plasma concentrations of glucose and insulin is dependent upon rapid delivery.

**Key Words:** Glucogenic Compounds, Blood Measures, Liver Fat

1 AGROKOMPLEX C. S., Zichyafalu, Hungary, 2Veszpréim University, Keshtely, Hungary, 3Szent Istvan University, Budapest, Hungary, 4Provimi Research and Technology Centre, Brussels, Belgium.

The aim of this experiment was to study the effect of rumen protected choline (RPC) on metabolism during the periparturient period. Thirty high producing multiparous Holstein cows were paired by parity, body condition score and previous lactation performance and randomly assigned to one of two groups. Cows were fed 0 control (100 g/d) RPC group, equivalent to 25 g/d choline chloride) from an average of 21 d prepartum and 0 or 200 g/d RPC (equivalent to 50 g/d choline chloride) from calving to 60 d postpartum. RPC was a fat encapsulated product therefore hydrogenated palm oil was used to equalize fat intake in the control diet. All cows were offered a TMR of identical ingredient composition (corn silage 300 g/kg DM, alfalfa hay 160 g/kg DM, wet brewers grain 50 g/kg DM, corn, soybean meal based concentrate 490 g/kg DM). Body condition (BCS) was scored and liver biopsies were taken at -21, 7, 35 and 60 d relative to calving and milk samples were collected on d 7, 35 and 60 postpartum for measurement of choline concentration. BCS and BCS change did not differ between treatments. Total lipid content of the liver varied considerably between cows but was significantly (P<0.05) lower in RPC group (control vs. RPC, g/kg wet weight: 145.8 vs 81.7 (day 7 after parturition), 84.9 vs. 49.6 (day 35)). Glycogen concentration differed significantly only on 35 d sampling; it was higher in the RPC group (control 27.9 vs. RPC 35.8 g/kg wet weight). Milk total choline concentration was significantly (P<0.01) higher in RPC group (control vs. RPC 0.77 vs. 1.15 g/kg milk). Milk lactose, protein and solids not fat content remained unaffected. Milk yield was 44.6 (SD 8.7) kg/d overall and CrP increased milk yield by 2 kg/d or 4 % during the first 90 DIM. Milk fat yield was 92 to 95 % of control on CaP and CrP, the difference is approximately the same as the reduction in lipolysis. Milk lactose, protein and solids not fat were not different among treatments. The data are consistent with the theory that providing a small amount of glucogenic precursors can reduce net lipolysis from adipose tissue and increase glucose output from which some of the nutrients are partitioned to milk. Additional dietary Cr may be acting through the glucose transporters to increase glucose flux into adipocytes and stimulate more lipogenesis and reduce lipolysis.

**Key Words:** Adipose, Glucogenic precursors, Lipolysis


Experiments were conducted to determine if supplemental choline could prevent or alleviate fatty liver in dairy cattle. In experiment 1, 24 cows between 45 and 60 d prepartum were blocked according to body condition and randomly assigned to control or 15 g choline/d in a ruminally protected form (RPC; Reashure, Balchem Encapsulates). From d 0 to 6, all cows were fed 1.4 kg of concentrate/d (without RPC), forage was consumed ad libitum, and samples were obtained for covariate analysis. On CaP, BCS and BCS change did not differ between treatments. On RPC, BCS and BCS change did not differ between treatments. Total lipid content of the liver varied considerably between cows but was significantly (P<0.05) lower in RPC group (control vs. RPC, g/kg wet weight: 145.8 vs 81.7 (day 7 after parturition), 84.9 vs. 49.6 (day 35)). Glycogen concentration differed significantly only on 35 d sampling; it was higher in the RPC group (control 27.9 vs. RPC 35.8 g/kg wet weight). Milk total choline concentration was significantly (P<0.01) higher in RPC group (control vs. RPC 0.77 vs. 1.15 g/kg milk). Milk lactose, protein and solids not fat content remained unaffected. Milk yield was 44.6 (SD 8.7) kg/d overall and CaP increased milk yield by 2 kg/d or 4 % during the first 90 DIM. Milk fat yield was 92 to 95 % of control on CaP and CrP, the difference is approximately the same as the reduction in lipolysis. Milk lactose, protein and solids not fat were not different among treatments. The data are consistent with the theory that providing a small amount of glucogenic precursors can reduce net lipolysis from adipose tissue and increase glucose output from which some of the nutrients are partitioned to milk. Additional dietary Cr may be acting through the glucose transporters to increase glucose flux into adipocytes and stimulate more lipogenesis and reduce lipolysis.

**Key Words:** Choline, Cow, Liver

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**Blood Measure**

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*abc* Means with different letters within rows differed (P<0.10)
of energy requirements following induction of fatty liver. Twenty-eight cows between 45 and 60 d prepartum were blocked according to body condition and assigned to treatment. Fatty liver was induced by feeding 1.4 kg concentrate/d (without RPC) and restricting forage intake so cows consumed 30% of maintenance energy requirements for 10 d. For the next 4 d, cows were fed 1.4 kg concentrate with 6.0% CP and forage was consumed ad libitum. Treatments were not applied during fatty liver induction, however, liver for cows assigned to control and RPC contained 6.8 and 12.7 μg TG/μg DNA following feed restriction. Measurements obtained prior to treatment served as covariates for statistical analysis. During the depletion phase, plasma glucose and NEFA were not affected by treatment. Liver TG, expressed as a percentage of that after induction and prior to treatment, was 60.4 ± 52.2 (SE = 6.0) on d 3 and 48.5 ± 29.9 (SE = 6.5) on d 6 of the depletion phase for control and RPC (P = 0.12 for treatment, P = 0.07 for treatment x time). RPC can prevent and possibly alleviate fatty liver induced by feed restriction.

Key Words: Choline, Fatty Liver

W124 Feeding soybeans and rumen-protected choline to dairy cows during the periparturient period and early lactation. 1. Effects on production and energy balance. W. A. Oelrichs*, M. C. Lucy, M. S. Kerley, and J. N. Spain, University of Missouri - Columbia.

This study was designed to investigate the effects of soybeans (SB) and rumen-protected choline (RPC: ReashureTM Choline; Balchem, Slate Hill, NY) fed during the periparturient period and early lactation on intake and production of dairy cows. Sixty-four Holsteins were blocked by parity and expected calving date and randomly assigned within block to one of six experimental diets. Dietary treatments were fed from 28 days prepartum to 100 days in milk. Cows were assigned to treatments in a 3 x 2 factorial arrangement. Cows received no SB, SB beginning at calving, or SB for the duration of the study. SB were fed as raw, cracked beans at feeding rates of 1.9 and 2.8 kg DM per cow per day during pre- and postpartum periods, respectively. RPC were top-dressed at a rate of 0 or 15 g dietary choline per cow per day. Cows were individually feed restricted.


Eight multiparous Holstein dairy cows were used to evaluate the effects of monensin (M) inclusion during the transition period on ruminal VFA and plasma glucose kinetics. Cows were fed a TMR containing 0, 150, or 300 mg M/d, or without M. Cows received M from d -30 prepartum (Pre) to d +5 postpartum (Post). Cows received the same diet consisting of 58:42 forage:concentrate (F:C) Pre or of 51:49 (F:C) Post. Isotopic tracers (1-13C2Na, 1-13C3Na, 1-13C4Na) at 12% enrichment were bolused and intrarinserally infused. Tracers were infused on d 13 ± 1.97 prior to calving and on d 19 ± 1.60 after parturition. Three days prior to sampling, cows were fed every 4 h for 2 d followed by 2 h feeding intervals 1 d prior to and the day of sampling. Sampling times were -30, -20, -10, 5, 10, 15, 25, 35, 45, 60, 75, 90, 110, 130, 150, 170, 210, 230, 260, 290, and 320 min relative to tracer infusion time. A dose of 45 mg of 1-13C-Glucose (Gluc) was injected into the jugular vein. Blood was sampled 20 times during 8 h after tracer administration. WinSAAM simulation program, which assumed a 12-compartment model, was used to analyze Glu and VFA 13C Enrichment Curves with Time (ECT). ECT (Ac) conversion to Butyrace (Bu) was higher Post (2.36mmol/min vs 1.33mmol/min; Post vs Pre). Similarly, Pr incorporation to Glu pool was 0.86mmol/min vs 0.24mmol/min (Post vs Pre) and did not differ between treatments. Propionate (Pr) production rate was numerically higher in M cows (P=0.24) Pre, whereas Glu clearance rate was lower in M cows (4.88mmol/min vs 8.75mmol/min; P=0.001). Glu input rates from other sources than Pr was lower in M vs C (1.79mmol/min vs 3.04mmol/min; Pre, 6.90mmol/min vs 13.37mmol/min; Post). ECT shown that each individual VFA acts kinetically as a single pool. This study suggests that inclusion of M may affect VFA and Glu kinetics, and may also spare glucose to reduce metabolic diseases such as ketosis as the cow transitions into lactation.

Key Words: Transition Cows, Soybeans, Rumen-Protected Choline

W127 Effect of level of prepartum alimentation in dairy cows on milk production, mRNA expression for gluconeogenic enzymes, and liver triglyceride concentration. J. R. Townsend* and S. S. Donkin, Department of Animal Sciences, Purdue University, West Lafayette, IN.

Dry matter intake depression in prepartum dairy cows has been implicated in impaired performance and health. To determine the impact of prepartum DMI on performance and metabolic parameters thirty multiparous Holstein cows were blocked by calving date and randomly assigned to the following treatments: fitted with rumen cannulae and force fedorts during the final 14 days of gestation (force fed, FF), intake restricted during the final 14 days of gestation to 75% of ad libitum DMI (restricted, R), or fed for ad libitum intake during the final 14 days of gestation (control, C). From 28 through 15 days prior to expected calving goats were given ad libitum access feed (1.61 Mcal NEL/kg) and similarly following parturition (1.67 Mcal NEL/kg). Liver biopsy and fed diets as total mixed rations using electronic feeding gates. Blood samples were collected once weekly prepartum, at days 3, 0, and +3 relative to calving, and twice weekly postpartum. Plasma were analyzed for NEFA, glucose, γ-hydroxybutyrate, and progesterone. Cows were estrous synchronized for oxytocin challenge and timed AI. Plasma obtained during oxytocin challenge were analyzed for 13, 14-dihydroxy 15-κeto prostaglandin F2α (PGFM). Feeding RPC increased plasma progesterone concentrations during first synchronized estrous cycle, and improved conception and pregnancy rates. Feeding SB beginning either prepartum or on the day of calving had little influence on reproduction. Plasma progesterone concentrations, interval to first estrous cycle, plasma PGFM concentrations during oxytocin challenge, and rates of cyclicity, ovulation, conception and pregnancy were not different due to feeding SB. However, during the first synchronized estrous cycle, cows fed SB beginning at 28 days prepartum or on the day of calving had fewer small (< 5 mm) follicles and tended to have more medium follicles (6 to 9 mm) than cows fed the control diets. Other studies have reported a more dramatic improvement in reproductive performance.

Key Words: Monensin, VFA, Glucose Kinetics
blood samples were obtained on days -28, -14, -7, +1, +7, +14, +28, and +56 relative to calving. DMI from day -14 to day +1 differed (P < .05) among treatments and was 13.0, 9.8, 11.4 kg/d for C, R, and FF respectively. Postpartum DMI during the first 28 days of lactation was greater (P<0.5) for C (18.3±0.6 kg/d) compared with either R or FF, (15.0±0.9 kg/d and 15.6±0.7 kg/d, respectively). Control cows produced more milk (P<0.05) from 1 through 28 DIM than either R or FF (39.0, 32.4, 34.3 kg/d for C, R, and FF). Milk production from 29 through 56 DIM tended (P<0.10) to be higher for control cows (47.6, 41.3, 42.7 kg/d for C, R, and FF). Plasma NEFA, PUN, and BHBA levels followed typical periparturient patterns but did not differ among treatments nor did liver triglyceride (TG), glycogen and TG:glycogen ratio. Liver mRNA for pyruvate carboxylase (PC) peaked at calving and phosphoenolpyruvate carboxykinase (PEPCK) peaked postcalving. PEPCK mRNA was upregulated greater (P<0.01) in control than in sodium L-threonine (NA) supplemented cows. Liver mRNA for pyruvate carboxylase (PC) peaked at calving and phosphoenolpyruvate carboxykinase (PEPCK) peaked postcalving. PEPCK mRNA was not affected by treatment but PC mRNA was elevated (P<0.05) for FF compared with C. The data suggest that a depression in feed intake as part of the natural transition to lactation is not detrimental to postpartum performance but that imposed feed restriction reduces performance.

**Key Words:** Transition Cow, Feed Intake, Liver

**W129 Nicotinic acid supplemented at a therapeutic level minimizes prepartum feed intake depression in dairy cows. P. D. French*, Oregon State University, Corvallis.**

Nicotinic acid has been used successfully to treat hyperlipidemia in humans for several decades. However, nicotinic acid (NA) supplementation has not been effective in decreasing plasma non-esterified fatty acids (NEFA) around the time of parturition in dairy cattle. The objective of the current experiment was to determine the effect of therapeutic nicotinic acid supplementation on prepartum feed intake and plasma NEFA. Beginning 30 d prior to calving date, 14 multiparous Jersey cows were blocked by expected calving date and assigned at random to one of two treatments: no supplemental NA (control; C) or 48 g NA/d. The level of NA supplementation was based on human dosages adjusted for weight and predicted rumen stability. Cows were group housed and fed individually via Calan® doors beginning 30 d prior to calving date. Cows were offered a TMR once daily and NA was topdressed to ensure a daily consumption of 48 g. The TMR contained 34% (DM basis) corn silage, 14% alfalfa hay, 14% oat hay, 19% corn/barley, 9% soybean meal/corn distillers, 3% molasses, and 7% mineral/vitamin premix. Nicotinic acid supplementation and data collection began 24 d prior to expected calving date. Data were analyzed as repeated measures using the MIXED procedure of SAS. Body weight and body condition score were similar for C and NA. Dry matter intake differed for treatment by day (P<0.01) and was greater the day prior to parturition for cows receiving NA compared to C; 10.0 and 6.7 kg, respectively. Dry matter intake decline, calculated as the change in DMI versus 21 d average, the last week of gestation was greater (P<0.05) for C (20.5%) compared to NA (4.7%). Plasma non-esterified fatty acids were greater (P<0.01) the day of parturition (1244 and 491 µmol/l for C and NA, respectively) and the day after parturition (716 and 328 µmol/l for C and NA, respectively) for C compared to NA. Results show that NA reduces plasma NEFA by 65% at parturition, and a cause and effect relationship between plasma NEFA and feed intake depression has been established.

**Key Words:** Feed Intake, Nicotinic Acid, Prepartum

**W129 The effects of supplemental anionic salt fed during the periparturient period: Implications of milk production and feed intake for high producing dairy cows. J. Spain, R. J. Vogel*, and J. D. Sampson, University of Missouri - Columbia.**

The objective of this study was to determine the effect of a sulfur-based anionic salt fed during late gestation on intake, health, and production of Holsteins. Twenty-six mature cows were paired by expected calving date, lactation number, milk production potential, and body weight. Cows within pair were then randomly assigned to one of two diets. The dietary treatments were control (C) and supplemental anionic salt (A). Cows were fed the experimental diets as TMR via electronic feeding gates. The following diet was formulated to achieve a Dietary Cation-Anion Difference (DCAD) of +20 mEq/100 g dry matter. Control diet was predicted to provide 70g of calcium per cow per day. The treatment group was fed 454g per cow per day of a commercially formulated anionic salt supplement which lowered the DCAD level to -10 mEq/100 g dry matter. Treatment diets were formulated to provide a daily intake of 150g of calcium per cow per day. Diets were fed 30 days prior to expected day of calving. At calving, cows were fed standard lactation TMR for the first 6 weeks of lactation. Feed intake was measured daily. Urine pH was monitored twice each week using an electronic pH meter. Blood samples were collected weekly prepartum as well as on day -3 and day of calving. Postpartum blood samples were collected on day 1, 3, 7, 10 and 14 of lactation and then weekly until day 42. Blood samples were analyzed for Ca and NEFA. Daily milk yields and weekly milk component data were also collected. These data were analyzed for significance using SAS Proc Mixed. Cows fed anionic salts had lower urine pH compared to control cows (6.78 vs. 8.29; P<0.0001). Blood calcium was higher for anionic salt fed cows compared to control cows (8.87 vs. 8.63 g/dl; P=0.05). Plasma NEFA were lower for cows fed anionic salt diet (292 vs. 402 µg/l; P<0.01). Milk was greater over time for cows fed anionic salts versus control cows (P=0.05). Supplementation with sulfur based anionic salt improved calcium and energy balance associated with significant increase in milk production.

**Key Words:** Anionic Salt, DCAD, Transition Cows


Holstein cows (n=67) on two commercial dairy farms and producing at least 27 kg/d of milk at approximately 60-d prior to expected parturition were used to determine whether dry period length affects milk yield, milk composition, and metabolic indices during the subsequent lactation. At 60-d prior to expected parturition, cows were assigned randomly to receive either 60-d dry (actual 57 ± 5 d), 40-d dry (actual 41 ± 7 d), or 0-d dry. Milk yield and composition data were collected for the first six monthly test days of the subsequent lactation. Interactions of farm by treatment were not significant (P > 0.05) for all variables measured. Cows managed for 60- and 40-d dry periods had comparable yields of milk, fat, 3.5% fat-corrected milk (FCM), and true protein during the first 6 months of the subsequent lactation. Cows managed for 0-d dry periods produced approximately 10 kg/d less milk than cows managed for 40 or 60-d dry periods during the first 6 months of the subsequent lactation. Yields of milk fat, true protein, and 3.5% fat-corrected milk by cows managed for 0-d dry periods were decreased compared to those managed for 40 or 60-d dry periods. Concentrations of B-hydroxybutyrate (BHBA) in single plasma samples collected on d 5 to 20 postpartum were not affected (P > 0.15) by treatment. Overall, performance and health during the subsequent lactation of cows managed for 60 or 40-d dry periods were comparable in this experiment; cows managed for 0-d dry had substantially decreased milk yield during the subsequent lactation.

<table>
<thead>
<tr>
<th>Item</th>
<th>60-d dry</th>
<th>40-d dry</th>
<th>0-d dry</th>
<th>SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk, kg/d</td>
<td>47.1a</td>
<td>46.3a</td>
<td>37.1b</td>
<td>1.8</td>
</tr>
<tr>
<td>Fat, %</td>
<td>3.52</td>
<td>3.58</td>
<td>3.32</td>
<td>0.14</td>
</tr>
<tr>
<td>Fat, kg/d</td>
<td>1.67a</td>
<td>1.61a</td>
<td>1.24b</td>
<td>0.09</td>
</tr>
<tr>
<td>3.5% FCM, kg/d</td>
<td>48.0a</td>
<td>46.2a</td>
<td>30.7b</td>
<td>2.0</td>
</tr>
<tr>
<td>Protein, %</td>
<td>2.73a</td>
<td>2.84a</td>
<td>2.83a</td>
<td>0.06</td>
</tr>
<tr>
<td>Protein, kg/d</td>
<td>1.30a</td>
<td>1.30a</td>
<td>1.06b</td>
<td>0.04</td>
</tr>
<tr>
<td>BHBA, mg/dl</td>
<td>11.1</td>
<td>10.3</td>
<td>9.4</td>
<td>0.7</td>
</tr>
</tbody>
</table>

*Means within row with different superscripts differ, P < 0.05.

**Key Words:** Dairy Cow, Dry Period

**W131 Effects of Tri-Lution™ on immune response in the pre-fresh dairy cow. D. Jones*, D. Spangler, and R. Arendt, Agri-King, Inc, Fulton, IL.**

Fifty-six cows were utilized in a completely randomized design to evaluate Tri-Lution™ (a patented probiotic manufactured by Agri-King, Inc.) on colostral immunoglobulin titers, calf blood immunoglobulin...

To investigate the effect of feeding a high protein forage to dry cows on N partitioning and blood metabolites during the dry period (DP), and on subsequent lactational performance, 48 Holstein-Friesian dairy cows were offered ad libitum access to either red clover silage (RC; 22.4% DM, 18.9% crude protein [CP]) or ryegrass silage (RS; 28.0% DM, 17.2% CP) for the last 4 wk of the DP. After calving, all cows received the same diet of ad libitum ryegrass silage (29.2% DM, 18.1% CP) or ryegrass silage (RS; 28.0% DM, 17.2% CP) for the first 60 DIM compared to cows fed the control TMR.

Feed-Trilution™ resulted in similar IgG and IgM titers in colostrum. However, colostral IgA titers were significantly higher when Pre-Fresh cows were fed Tri-Lution™ (625 vs 892 mg/100 ml for the control and Tri-Lution™ treatments, respectively, P < 0.05) compared to cows fed the control TMR. Serum IgG titers in the calves were similar between treatments during the day following colostrum consumption. The SCC of milk from control cows increased 6% from period 1 (199,000 cells/ml) to period 2 (211,000 cells/ml), while the SCC from Tri-Lution™ fed cows decreased 47% (262,000 to 138,000 cells/ml) over the same time period, although the differences were not statistically significant (P < 0.10). This study demonstrated that Pre-Fresh dairy cows fed Tri-Lution™ before calving have lower SCC during the first 60 DIM compared to cows fed the control TMR. Feeding Tri-Lution™ to Pre-Fresh dairy cows enhanced colostral IgA concentrations.

Key Words: Tri-Lution™, Immune, Dairy


A mechanistic approach has been adopted by several models (NRC, CNCPS) for more accurate nutritional estimations for high producing cows. Since we found that evaluation by the NRC model (dairy cattle, 2001) sometimes showed a lower value than actual milk production, we tried to analyze the factor of the underestimation by comparing with the CNCPS model (ver. 5, 2003). Four groups of multiparous cows (17 to 20 cows for each group) were assigned to diets with different CP and RDP levels having timothy hay, alfalfa hay, corn grain, cottonseed, beet pulp, soybean meals (or soy PLUS), and several other by-product feeds. Actual DMI, and milk composition (fat, protein) were input into the model, but the tabular values in each model were used for the feed compositions except the forage CP contents. Actual milk yield during 15 weeks after parturition was around 40 kg/d for each group. Body weight slightly increased during the experiment (5 to 20 kg). For the CNCPS evaluation, ME was always limiting for the production, and ME allowable milk correctly predicted the actual yield (0.2 to 1.2 kg/d of difference). For the NRC evaluation, however, MP was limiting for 3 groups (B, C and D), and MP allowable milk was below the actual yield (4.1 to 8.1 kg/d lower). For these groups, estimations of MP from bacteria by the NRC model were lower than those by the CNCPS model, and these lower values could be mainly attributed to the exclusion of the recycled N from the NRC model. Even endogenous MP, a new additional parameter of the NRC model, could not compensate for it. These results suggest that the NRC model would underestimate milk yield when the ruminal N balance is negative and MP is limiting.

Table 1. Estimations of milk production by the NRC and CNCPS models

<table>
<thead>
<tr>
<th>Cow group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRC (dairy cattle, 2001) ME allowable milk (kg/d)</td>
<td>40.8</td>
<td>41.7</td>
<td>40.8</td>
<td>38.7</td>
</tr>
<tr>
<td>MP allowable milk (kg/d)</td>
<td>47.1</td>
<td>38.2</td>
<td>34.0</td>
<td>31.3</td>
</tr>
<tr>
<td>MP - Bacterial (g/d)</td>
<td>1334</td>
<td>1226</td>
<td>1192</td>
<td>1157</td>
</tr>
<tr>
<td>MP - RUP (g/d)</td>
<td>1452</td>
<td>1149</td>
<td>1059</td>
<td>1060</td>
</tr>
<tr>
<td>MP - Endogenous (g/d)</td>
<td>116</td>
<td>116</td>
<td>117</td>
<td>113</td>
</tr>
<tr>
<td>Ruminal N balance (g/d)</td>
<td>40</td>
<td>-29</td>
<td>40</td>
<td>-38</td>
</tr>
<tr>
<td>Actual Milk yield (kg/d)</td>
<td>40.9</td>
<td>42.3</td>
<td>40.6</td>
<td>39.5</td>
</tr>
</tbody>
</table>

W134 Prediction of nutrient supply to dairy cows from concentrates. Comparison of the National Research Council-2001 model with the Dutch system (DVE/OEB). P. Yu*, Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, Canada.

The objective of this study was to compare the DVE/OEB system (DVE = truly absorbed protein in the small intestine; OEB = degraded protein balance) and the NRC-2001 model in the prediction of supply of protein to dairy cows from selected concentrates: malting-type barley (cv. Harrington), feed-type barley (cv. Valier), field tick beans (Vicia faba), white albus lupines (Lupinus albus), whole soybeans and horse beans (Vicia faba cv. Alfréd). The two barleys were processed by coarse (Roller miller, 0.533 mm gap) and fine (Hammer mill, 2 mm screen) processes. The field tick beans were dry roasted at various conditions. The soybeans and horse beans were pressure-treated at the temperature 100, 118, 136°C for 3, 7, 15 and 30 min at

Key Words: Digestibility, Nitrogen Partitioning, Plasma Metabolites
WI135 Nutritive value of processed field tick beans predicted by two dairy models (NRC and DVE/OEB). P. Yu\textsuperscript{1}, B. J. Leury\textsuperscript{1}, and A. R. Egan\textsuperscript{2}. 1Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, Canada. 2School of Agriculture and Food Systems, University of Melbourne, Australia.

The objective of this study was to compare the Dutch DVE/OEB system and the NRC-2001 model in the prediction of supply of protein to dairy cows from processed field tick beans. Comparisons were made in ruminal and small intestinal digestion of 1) ruminally synthesized microbial protein, 2) truly absorbed protein in the small intestine, and 3) degraded protein balance. The results showed that the predicted values from the DVE/OEB system and the NRC-2001 model had significant correlations with \( R^2 > 0.90 \) values. However, using the DVE/OEB system, the overall average microbial protein supply based on available energy was 16% higher and the truly absorbed protein in the small intestine was 9% higher than that predicted by the NRC-2001 model. The difference was also found in the prediction of the degraded protein balances, which was 16% higher than that estimated based on data from the NRC-2001 model. These differences are due to considerably different factors used in calculations in the two models, although both are based on similar principles. This indicates that further refinement is needed for a modern protein evaluation and prediction system.

**Key Words:** NRC Dairy Model, DVE/OEB System, Protein Evaluation

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WI136 Application of manure screening as an on farm tool to evaluate the animal / diet interface. M. J. Jerred\textsuperscript{1}, T. G. Brion\textsuperscript{1}, S. R. Burghardi\textsuperscript{1}, K. A. Ruppell\textsuperscript{2}, and M. A. Messman\textsuperscript{1}. \textsuperscript{1}Cargill Animal Nutrition, Elk River, MN. \textsuperscript{2}Cargill Animal Nutrition, Albany, NY.

Animal performance is dependant on digestion of ingredients in the daily ration allotted to the animal. To better understand ration digestion on farm we have constructed a three screen manure separating apparatus for visual appraisal of manure. Manure evaluation along with knowledge of nutrient and particle size of the diet fed can help diagnose lack of conformity to nutrition model predictions. Sizes of the three screens are: 0.57, 0.31, and 0.16cm in diameter. A representative sample of fresh manure from eight to twelve cows in a pen of cattle is collected and washed through the series screens. Fecal samples from 29 commercial dairy farms were evaluated with the manure screener. The top screen averaged 18% (SE 1.6) by volume fecal particles, the middle screen averaged 30% (SE 4.5) by volume fecal particles and the bottom screen averaged 52% (SE 4.6) by volume fecal particles. The top screen whole cottonseed, fiber particles and kernels of grain were typically observed. The middle and bottom screens typically contained fiber particles and co-product ingredients. To further evaluate the manure screener 4 no forage diets were fed. The top screen averaged 55% (SE 4.1) by volume fecal particles, the middle screen averaged 18% (SE 3.6) by volume fecal particles and the bottom screen averaged 27% (SE 2.6) by volume fecal particles. A T-test was used to compare volume of particles retained on screens between normal and no forage diets. Feces from the no forage diet contained more (P = 0.001) particles on the top screen, fewer on the middle (P = 0.052) and bottom (P < 0.001) screens than diets that contained forage. Increased fecal particles in the top screen may have resulted from increased ruminal particle passage because of reduced ruminal mat formation when the no forage diet was fed. A tool to screen manure to evaluate passage of dietary ingredients can be an aid in determining the source of model non-conformance.

**Key Words:** Manure Evaluation, Digestion, Ration Evaluation

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WI137 Prediction of urine N excretion from creatinine and milk urea nitrogen in primiparous and multiparous cows. S.A. Flis\textsuperscript{1} and M.A. Watiaux, University of Wisconsin-Madison.

Urinary nitrogen (UN) excretion is an integral part of predicting N usage by an animal and formulating a farm N management plan. The objective of this research was to compare two UN prediction methods to observed values. Foley catheters were used to collect total urine excretion for 3 days from 8 lactating cows (4 multiparous and 4 primiparous) in a split-plot Latin square. Cows were fed one of four diets ranging from 0 to 20% excess N based on NRC 2001. Cows were weighed twice each period. The first prediction method was according to Kauffman and St-Pierre, UN (g/d) = 0.0259 x BW (kg) x MUN (mg/dL). The second method was based on UN concentration multiplied by the urine volume (l/d) predicted as (2.9 x BW (kg))/creatinine concentration in the urine. Both an AM and a PM spot sample of urinary protein and the urine were used in predicting UN in this method. Cow BW ranged from 435 - 724 kg. The UN and volume predicted from both methods were lower in the primiparous cows (P < 0.001), but there was no parity by prediction method interaction (P = 0.6), indicating that the method of prediction is the same for both parity. Although the observed urine volume averaged 26.5 l/d, the predicted values averaged 34.7 l/d for the PM samples, but 28.7 l/d for the AM samples. The PM prediction value was different from both the AM and the observed urine volumes (P = 0.01). The prediction of UN based on the AM and PM samples was 226 and 278 g/d respectively; with the observed UN at 208 g/d. Again the PM prediction of UN was different (P = 0.01) from both the AM and the observed values. In this trial, parity did not affect MUN, and the prediction of UN from MUN was 188 g/d. This prediction differed from the urine screening methods (P < 0.001), but was not different from the observed values. These results suggest that the prediction of UN should be done from MUN values or AM samples of urine, but not PM samples. Diurnal variation, sampling time relative to feeding or other factors may have contributed to the bias in estimating UN from PM urine samples. MUN values are easier to obtain suggesting that the use of MUN to predict UN is the best approach.

**Key Words:** MUN, Creatinine, Urine Nitrogen

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W182 Identifying dairy farms facing challenges in P management. V. A. Ihle\textsuperscript{1} and L. E. Lanyon, Pennsylvania State University, University Park.

Reducing dietary P levels with the goal of minimizing P accumulation on dairy farms has been widely emphasized. Although there is opportunity to improve rations, this tactic alone may not solve the nutrient-loading problem for the most challenging situations, nor will it indicate when P accumulation is a problem. Herds required to comply with P-basin nutrient management for crop production in the future or those planning expansions should look closely at the amount of P in manure that is or will be in excess of the local crop utilization potential. Herd size, ration composition, and ingredient source information was collected from eleven diverse Pennsylvania herds along with records of milk production. Accumulating P was determined by subtracting P exported from the farm and the home-grown crop P from total diet P. Dietary P on all eleven farms was very close to animal requirements, averaging 0.40% P (DM basis) with a range from 0.38% to 0.44%. However, purchased P ranged from 37% to 88% of the total P fed. Accumulating P (g/cow/d) was linearly related to percent purchased P, but was not related to diet P composition. Farms with potential P problems could be readily identified by this purchased P relationship. The ration P levels on farms with potential P problems were close to animal P requirements and not