further investigation as well as the T3 response to OSe vs MSe during gestation.

Key Words: Selenium, Post-Puberty, Gilts

W78 The effect of mannan oligosaccharides on reproductive performance in sows. P. Medel*[1], C. Piñeiro[2], A. Kocher[3], F. Baucells[1], and M. I. Gracia[1], [1]*Imasde Agropecuaria, S.L., Spain,* [2]*PigChamp Pro Europa, Spain,* [3]*Alltech Inc, Ireland.*

This study was conducted to determine the effect of including mannan oligosaccharides (MOS, Bio-Mos®) in diets fed to gestating and lactating sows on their productivity. A total of 80 gestating sows (Landrace × Large White), selected two weeks before the expected farrowing, were randomly allotted to one of two treatment groups taking into account their parity number. The two treatments were as follows: 1) basal diet (control), 2) basal diet with a source of MOS at 2 g/kg in gestation and 1 g/kg in lactating diets. Diets were formulated to contain 18.5% CP and 2.4 Mcal NE/kg. During lactation, all sows were allowed ad libitum access to their treatment diets. Feeding the experimental diets began two weeks before farrowing and continued until weaning of piglets. Sow BW was measured at 107 d of gestation and at weaning. Backfat depth was measured using ultra sound 24 h and 14 d after farrowing, and at weaning. ADFI was recorded daily. Pigs were weighed 24 h after birth and at weaning. Number of piglets born alive, pre-wean mortality and ADG were recorded. Sow weight change, backfat depth change, and ADFI did not differ between treatments (P>0.05). Also, the number of pigs born (11.2 *vs* 11.9) and pre-wean mortality (1.00 *vs* 0.88) did not differ between control and MOS supplemented sows (P>0.05). However, piglet birth (1.54 *vs* 1.70 kg) and weaning weights (6.52 *vs* 7.12 kg) were 0.16 and 0.60 kg heavier, respectively (P<0.05) for MOS supplemented sows when compared to control sows. These data suggest that MOS supplementation of sow diets during the end of gestation and lactation increases both piglet birth and weaning weights.

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

W79 The influence of feed intake during mid-gestation on performance of pregnant sows and progeny growth: a preliminary study. A. Cerisuelo[1], R. Sala[1], J. Coma[2], D. Carrión*[3], J. Gasa[1], and M. Baucells[1], [1]*Universitat Autonoma de Barcelona, Spain,* [2]*Agrocesa, S.A., Spain,* [3]*PIC 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.

Body weight throughout the weaning period.

Days post-weaning	Body weight, kg Control	Exp.	Treatment dif., g/pig	P-value
0	6.5	6.5	0	NS
14	7.8	8.0	-189	0.12
22	9.9	10.2	-253	0.11
30	13.5	14.1	-580	0.015
42	19.9	20.6	-722	0.014

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 a 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 (C) 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 and blocked by age within sire and randomly assigned to 3 of the same pastures in yr 2. The dietary supplements consisted of a cracked corn / soyhull mix with the protein source and were formulated to contain 14.2 % CP and 1.39 Mcal/kg of NEg. In both years, steers were placed in open drylots upon weaning and adjusted to a receiving diet of cracked corn, soyhulls, and fescue hay with D and S treatments continued, while the C treatment received S as the protein source. After 112 d, steers were placed on a common urea based finishing diet. In yr 1 and 2, creep-fed calves had greater (P < .01) ADG than non-creep-fed calves during pasture phase (1.03 vs. 0.72 and 1.03 vs. .88 kg/d for year 1 and 2, respectively). In yr 1, the feed / extra gain was similar among treatments, while cost / kg of extra gain for D was lower (P < .05) than S (0.88*vs*.1.89, respectively). Weaning weight was greater (P < .05) for creep-fed than non-creep-fed calves (231.0 vs. 206.6 kg, respectively). There was a trend for creep-fed steers to have a greater (P = .09) ADG than non-creep-fed steers during the feedlot phase (1.66 vs. 1.57 kg/d, respectively). Creep-fed steers had greater (P < .05) final and hot carcass weights than non-creep-fed steers (537.2 vs. 496.7 and 329.2 vs. 300.0 kg for final and carcass weights, respectively). In yr 2, DMI, feed / extra gain, and cost / kg of extra gain were similar but total feed costs were lower (P < .01) for D than S during the pasture phase (13.88*vs*.18.31, respectively). Final performance and carcass data for yr 2 will be presented later. In conclusion, protein source had no effect on ADG, however DDGS reduced feed costs.

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. Rossi*[1], T. D. Pringle[2], and J. K. Bertrand[2], [1]*University of Georgia, Tifton,* [2]*University 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 commingled 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 <0.01) for calves that were creep fed (1.26 kg/d) versus not 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) verus 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*[3], C. Boin[1], M. Q. Manella[1], and A. J. Lourenço[2], [1]*ESALQ/USP, Brazil,* [2]*Instituto Zootecnia, Brazil,* [3]*UNESP, 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 conduced 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 = *Brachiaria brizantha* + mineral supplement; Leucena = *Brachiaria brizantha* + protein bank (*Leucaena leucocephala*) + 1.8 kg citrus pulp + 0.8 kg Wet corn gluten feed + mineral supplement (animal/day); Supl1 = *Brachiaria brizantha* pasture + 1.8 kg citrus pulp + 0.8 kg Wet corn gluten feed + 0.45 kg soybean meal + mineral supplement (animal/day); Supl2 = *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 leucena, 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.

Treatments	Kg/animal/day	Backfat	CarcassYield (%)
Control	0.114^{a} + 0.051	3.30^{a} + 0.20	53.9^{a}
Leucena	0.528^{b} + 0.042	4.24^{ab} + 0.31	55.6^{b}
Supl1	0.638^{c} + 0.035	4.75^{b} + 0.33	55.6^{b}
Supl2	0.613^{c} + 0.031	4.87^{b} + 0.40	56.4^{b}

*Means with unlike superscripts are different (P< 0,05)

Key Words: Beef Cattle, Byproducts, Backfat Thickness

W83 Effect of supplements of self feed on efficiency of microbial protein synthesis and excretion of N contents - urea on steers grazing Brachiaria decumbens, in the rainy season. J. Tilemahos Zervoudakis*[1], M. Fonseca Paulino[2], L. Cabral[1], E. Detmann[3], S. de Campos Valadares Filho[2], E. Henrique Bevitori Kling de Moraes[2], and A. Lima de Souza[1], [1]*Universidade Federal de Mato Grosso, Fernando Correa da Costa, Cuiaba-MT-Brazil,* [2]*Universidade Federal de Viñosa,Vicosa, MG, Brazil ,* [3]*Universidade Estadual Norte Fluminense, Campos dos Goytacazes-RJ, Brazil.*

The objetive this work was evaluate the effect of supplements of self feed on the efficiency of microbial protein synthesis and excretion of N contents - urea in the urine of steers grazing Brachiaria decumbens, in the rainy season, in the west-central region of Brazil. Four crossbred steers, fistulated in the rumen, 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, grounded 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 adoted a N-purine:N-total of 0.117. The urea excretion on urine was determined by urine spot colleted 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/100g TDN.

Key Words: Microbial Nitrogen, Supplementation, Steers

W84 Effects of CLA on tissue response to homeostatic signals and plasma lipid metabolism variables in growing beef steers. O. B. Mendivil*, C. E. Moore, H. C. Hafliger III, S. R. Sanders, G. C. Duff, and L. H. Baumgard, *The University of Arizona, Tucson.*

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 metabolite 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 steam-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; 6.3% *c*-9, *t*-11; 7.9% *t*-10, *c*-12; and 8.2% *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 & 43; 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 Δ^9-desaturase index (43.3) 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 Dietary effect on n-3 fatty acids, CLA and C18:1trans isomers in beef and lamb meat. K. Nuernberg*[1], D. Dannenberger[1], G. Nuernberg*[1], N. Scollan[2], W. Zupp[3], and K. Ender[1], [1]*Research Institute of the Biology of Farm Animals, Dummerstorf, Wilhelm-Stahl-Allee, Germany,* [2]*Institute of Grassland and Environmental Research, Aberystwyth, UK,* [3]*Research Institute of Agriculture and Fishery Mecklenburg-Pomerania, State Institute for Animal Production, Dummerstorf, Wilhelm-Stahl-Allee, Germany.*

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 on grass following 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 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 C18:1trans isomers. The absolute amount of C18:1trans-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 (salt grass) or in stable on concentrate (n=7). Lambs fed grass accumulated a higher C18:3n-3 content and the sum of n-3 fatty acids in muscle lipids. The relative content of CLAcis-9,trans-11 (1.9 % vs 1.1 % in muscle) was significantly (P#88040.05) higher by grazing on pasture compared to concentrate feeding. The analyses of CLA isomers (Ag+-HPLC analysis) showed no differences between feeding systems for CLAcis-9,trans-11. The percentage of the CLAtrans10,trans-12 isomer was five times higher in concentrate fed lambs vs pasture feeding. The main C18:1trans isomers of intramuscular fat in lambs were C18:1trans-11, C18:1trans-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. Varga[1], E. Block*[2], P. Williams[3], T. W. Cassidy[1], and R. Losa[4], [1]*The Pennsylvania State University, University Park,* [2]*Church & Dwight Co., Inc, Princeton, NJ,* [3]*Akzo Nobel, Inc, Davis, CA,* [4]*CRINA 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<.08). Concentrations and molar proportions of acetate, propionate, valerate, isovalerate and the A:P were either significantly, or tended to be lower for fermenters supplemented with 4 mg/d CRINA. Nutrient digestibility was not affected, however, there was a trend (P>.15) for increased NDF digestibility in CRINA treatments versus the control. There was a trend (P<.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, resp.). 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. Eifert*[1,2], R. P. Lana[1,2], J. M. S. Campos[1], D. P. D. Lanna[3], P. B. Arcuri[4], M. I. Leo[1], and R. D. Valadares[1], [1]*Universidade Federal de Viosa-DZO, Vicosa, MG, Brazil,* [2]*CNPq , Brasilia, DF, Brazil,* [3]*LNCA-ESALQ/USP,* [4]*CNPGL-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, purebred 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 citrus pulp (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<.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 3.34%) than did control diets (P<.07). Soybean oil-containing diets increased the milk protein:fat ratio (1.00 vs 0.94) (P<.05). Fatty acid profile was not influenced by carbohydrate source, but concentration of short and medium chain fatty acids decreased by 27.3 and 26.8%, respectively; while concentration of long-chain fatty acids increased by 44.5% in cows fed soybean oil (P<.01). Soybean oil also increased *cis*-9 *trans*-11 CLA by 230% and *trans*-C18:1 by 229% (P<.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<.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 Δ^9-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. Castillejos[1], S. Calsamiglia*[1], A. Ferret[1], and R. Losa[2], [1]*Universidad Autonoma de Barcelona, Spain,* [2]*AKZONOBEL/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 (39C), 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 0, 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/100mol) was lower for D1 (16.9) and D10 (17.5) compared with Control (20.6). Valerate proportion (mol/100mol) was lower for D1 (3.25) compared with Control (4.22). Branch-chained VFA concentration (mM) was higher for all EOB treatments (average of 5.19) compared with Control (3.10). 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.

Key Words: Essential Oil Blend, Rumen Microbial Fermentation, Nitrogen Metabolism

W89 Effect of essential oils on ruminal fermentation *in vitro*. A. N. Hristov, J. K. Ropp, and A. Melgar*, *Department of Animal and Veterinary Science, University of Idaho, Moscow.*

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, $(^{15}NH_4)_2SO_4$, and nutrients (glucose, maltose, sucrose, soluble starch, crystalline cellulose, and hydrolyzed and native casein) dissolved in buffer. Three, 4-h incubations were conducted within a 2-wk period. Forty EO were tested at two concentrations, 10 and 100 ppm (final media concentration). Monensin-Na (M), and sodium laurate (SL)

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 and across application 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 *vs.* 83.2 mmol/L, respectively). Acetate and propionate concentrations were reduced ($P < 0.05$) by SL compared to the Blank. Several EO and SL increased ($P < 0.05$) acetate to propionate ratios from 1.93 (Blank) to 2.05-2.07; M had no effect ($P > 0.05$) on this variable. ^{15}N-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. Allred*[1], T. R. Dhiman[1], C. P. Brennand[1], R. C. Khanal[1], D. J. McMahon[1], and N. D. Luchini[2], [1]*Utah State University, Logan,* [2]*Bioproducts, Inc., Fairlawn, OH.*

Twenty Holstein cows were used in a complete randomized block design to determine the influence of feeding a total mixed ration (CTL), CTL diet supplemented with 2.7% calcium salts of fish oil (FO), FO plus 5% extruded full-fat soybeans (FOESM), or FO plus 0.75% soybean oil (FOSO), on fatty acid composition and flavor characteristics of milk and cheese. Total fatty acid intake was 0.93^{b}, 1.28^{a}, 1.42^{a}, and 1.29^{a} kg/day for CTL, FO, FOESM, and FOSO diets, respectively. There was no difference in feed DM and NE_L intakes, or in milk yield or milk composition among treatments. Milk fat conjugated linoleic acid (CLA) and *trans*-11 $C_{18:1}$ (TVA) contents for cows fed CTL, FO, FOESM, and FOSO diets were 0.61^{b}, 1.27^{a}, 1.44^{a}, and 1.82^{a}; and 3.29^{c}, 4.66^{bc}, 6.30^{ab}, and 7.80^{a} % of fat, respectively. Total ω-3 fatty acid content was 0.62^{b}, 0.69^{a}, 0.69^{a}, and 0.67^{ab} % of fat for CTL, FO, FOESM, and FOSO diets, respectively. The ratio between ω-3 and ω-6 fatty acids was not different among diets. Concentrations of CLA and TVA in cheese were 0.63^{d}, 1.14^{c}, 1.41^{b}, and 1.70^{a}; and 2.98^{d}, 4.91^{c}, 6.00^{b}, and 7.00^{a} % of fat for CTL, FO, FOESM, and FOSO diets, respectively. Total ω-3 fatty acid contents in cheese were 0.62^{b}, 0.73^{a}, 0.74^{a}, and 0.71^{a} % of fat for CTL, FO, FOESM, and FOSO diets, respectively. No difference in flavor scores was detected by a trained sensory panel for milk (n = 7) and cheese (n = 10), except for acid flavor in cheese ($P < 0.05$), which was 4.30^{ab}, 3.87^{b}, 4.43^{a}, and 4.39^{ab} for CTL, FO, FOESM, and FOSO diets, 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

W91 Evaluation of the degree of rumen inertness and bioavailability of *trans*-10, *cis*-12 CLA in a lipid encapsulated supplement. A. L. Lock*[1], J. W. Perfield II[1], D. E. Putnam[2], and D. E. Bauman[1], [1]*Cornell University, Ithaca, NY,* [2]*Balchem Encapsulates, New Hampton, NY.*

The efficacy of *trans*-10, *cis*-12 conjugated linoleic acid (CLA) in reducing milk fat synthesis in dairy cows has been well documented. CLA has potential as a management tool for reducing milk fat in a controlled manner, which may be useful during times of inadequate nutrient intake or in areas where a milk fat quota exists. In order to maximize CLA absorption it must be protected from biohydrogenation by bacteria in the rumen. This requires a rumen-protected product that is optimized for protection from metabolism in the rumen as well as subsequent bioavailability in the small intestine. The objective of this study was to evaluate the degree of rumen inertness and bioavailability of CLA in a lipid encapsulated supplement (LE-CLA). Three rumen fistulated lactating Holstein cows (212±31DIM) were randomly assigned in a 3 X 3 Latin square experiment. Treatments were: 1) no supplement (control), 2) rumen infusion of LE-CLA (80 g/d), and 3) abomasal infusion of LE-CLA (80 g/d). CLA treatments were designed to provide 7.8 g/d of *trans*-10, *cis*-12 CLA which was either infused into the rumen or abomasum four times a day in equal amounts. Treatment periods were 5 d with a 7 d interval between periods. Milk yield, DMI and milk protein yield were unaffected by treatment. Rumen and abomasal infusions of LE-CLA significantly reduced milk fat content by 13% and 29%, and milk fat yield by 11% and 28% (P<0.001), respectively. The reduction in milk fat yield was due to decreases in both de novo fatty acid synthesis and uptake of preformed fatty acids with the pattern of reductions similar for rumen and abomasal infusions. Milk fat content of *trans*-10, *cis*-12 CLA was <0.01, 0.06 and 0.15 g/100 g of fatty acids for the control, rumen and abomasal treatments, respectively (P<0.001). In conclusion, both rumen and abomasal infusions of a LE-CLA supplement caused a reduction in milk fat content and yield while having no effect on DMI, milk yield or other milk components.

Key Words: Conjugated Linoleic Acid, Milk Fat Depression, Rumen Protection

W92 Milk fat conjugated linoleic acid in selected commercial dairies of Utah and Idaho. R. C. Khanal* and T. R. Dhiman, *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 grain in summer and were 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 ($C_{18:2}$ *cis*-9, *trans*-11 isomer) were 0.66^{b}, 0.75^{a}, 0.40^{d} and 0.58^{c} % for bulk tank samples and 0.73^{a}, 0.75^{b}, 0.43^{c} and 0.55^{a} % 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^{a} and 0.42^{b} for bulk tank and 0.78^{a} and 0.40^{b} % 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. 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 on 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 silage based diets supplemented with incremental levels of sunflower oil. K. J. Shingfield*[1], S. Ahvenjärvi[1], V. Toivonen[1], P. Huhtanen[1], and M. J. Griinari[2], [1]*MTT Agrifood Research Finland, Jokioinen,* [2]*University 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 trans C18:1 and 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 omasal 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<0.05) 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. Shingfield*[1], C. K. Reynolds[1], D. J. Humphries[1], B. Lupoli[1], V. Toivonen[2], A. S. Grandison[3], M. J. Griinari[4], and D. E. Beever[1], [1]*Centre for Dairy Research, University of Reading, UK,* [2]*MTT Agrifood Finland, Jokioinen,* [3]*School of Food Biosciences, University of Reading, UK,* [4]*University 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. 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 and FMS than SO (2.63, 3.04, 2.87 and 1.57 g/100g fatty acids), whilst the response to FHS was intermediate (2.18). For all diets, cis-9, trans-11 was the predominant isomer of CLA (proportionately 0.84, 0.82, 0.81, 0.68 and 0.62 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-10 C18:1 content (8.6, 11.1 and 13.5 g/100g fatty acids, for FLS, FMS and FHS), but caused levels of trans-11 C18:1 to decline (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 C18:1 at 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 DIM, 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-R®), 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-tract 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: Ruminal, 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. Bruno*[1], K. N. Galvao[1], S. O. Juchem[1], W. W. Thatcher[2], E. J. DePeters[1], D. Luchini[3], and J. E. P. Santos[1], [1]*University of California Davis, Tulare,* [2]*University of Florida, Gainesville,* [3]*Bioproducts, Inc, Fairlawn, OH.*

Multiparous Holstein cows, 331, were randomly assigned to one 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 eicosapentaenoic 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. Continuous and binomial data were analyzed by the MIXED and LOGISTIC procedures of the SAS (2001) program. Group DM intake averaged 25.7 kg/d. Yields (kg/d) of milk, 3.5% fat-corrected milk and milk fat did not differ (P>0.15) and were (kg/d), respectively, 44.8, 45.5, and 1.58, for cows fed CaPFO, and 45.51, 46.24, and 1.62 for cows fed TA. Percent of true protein and lactose in milk were reduced (P<0.05) in cows fed CaPFO (2.73% and 4.81%) compared with cows fed TA (2.76% and 4.86%), and solids nonfat tended to be reduced for CaPFO compared with TA (8.37 vs 8.45%; P<0.06). Because of the lower true protein content in milk, protein yield was reduced in cows fed CaPFO (1.22 vs 1.26 kg/d; P=0.04). Conception rates for cows fed CaPFO and TA were similar at d 38 (26.9 vs 25.9%; P=0.85) and 60 (24.1 vs 24.5%; P=0.95) after AI. Similarly, pregnancy loss from d 38 to 60 of gestation did not differ between CaPFO and TA (9.7 vs 4%; P=0.41). 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.

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Key Words: Dairy Cows, Fatty Acids, Milk Production

W97 Modulation of bovine hepatic lipid metabolism by fatty acids. J. A. A. Pires*[1], R. R. Grummer[1], D. G. Mashek[1], S. J. Bertics[1], D. Pirazzi[2], and U. Bernabucci[2], [1]*University of Wisconsin, Madison,* [2]*Université 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 (BHBA) analysis. Total triglycerides (TG) was extracted from cells 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.

	TG*	BHBA**
Control	$3.15^{cd} \pm 0.19$	1.37^{d}
C16:0	$23.81^{ab} \pm 4.19$	7.60^{b}
C18:0	$37.47^{a} \pm 8.70$	12.66^{a}
C18:1	$32.48^{a} \pm 6.75$	8.24^{b}
C18:2	$23.65^{ab} \pm 3.38$	2.71^{c}
C18:3	$15.94^{b} \pm 2.01$	8.53^{b}
C20:5	$2.51^{d} \pm 0.38$	7.33^{b}
C22:6	$4.11^{c} \pm 0.63$	9.74^{ab}
NEFA	$21.62^{ab} \pm 8.33$	7.28^{b}

^{abcd} Means within a row with unlike superscripts differ ($P<0.05$.
*LSM ± SEM. **LSM, pooled SEM=3.96.
LSM and SEM are presented as ug/ug DNA.

Key Words: Fatty Acids, Hepatic Metabolism, Bovine

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

K. F. Kalscheur*, A. R. Hippen, and D. J. Schingoethe, *South Dakota State University, Brookings*.

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 (S), 3) 2% fat from sunflower seeds plus 0.5% fat from linseed oil (L), and 4) 2% fat from sunflower seeds plus 0.5% fat from fish oil (F). Diets were composed of 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. Diets averaged 16.6% CP, 29.6% NDF, and 20.1% ADF. Ether extract and NE_L increased from 2.7% and 1.57 Mcal/kg for the control diet, to 5.1% and 1.64 Mcal/kg for the fat supplemented diets, respectively. Dry matter intake (26.9, 27.9, 24.6, and 26.0 kg/d for diets 1 through 4) did not differ ($P > 0.05$). Milk production (38.5, 39.4, 40.7, and 43.8 kg/d) was highest for cows fed F ($P < 0.05$). Milk fat percentage (3.28, 3.25, 3.23, and 2.96) was lower for cows fed F ($P < 0.01$). Addition of supplemental fat did not affect milk protein percentage, MUN, or milk component yields. Concentrations of milk *cis*-9, *trans*-11 CLA (0.53, 0.68, 0.71, and 1.35 g/100 g fatty acids for diets 1 through 4) increased with the inclusion of sunflower seeds, and was highest ($P < 0.01$) when fed with fish oil. Similarly, milk vaccenic acid (TVA) increased (0.60, 0.97, 0.91, and 2.12 g/100g fatty acids) with the addition of sunflower seeds, and was highest ($P < 0.05$) for cows fed F. Cows fed sunflower seeds with fish oil increased milk production and milk CLA and TVA more than cows fed the control or non-fish oil diets. Feeding linseed oil with sunflower seeds did not increase lactation performance or increase milk CLA or TVA.

Key Words: Conjugated Linoleic Acid, Vaccenic Acid, Milk Fatty Acids

W99 The effect of dilution rate and pH on the conversion of stable isotopically labeled oleic acid to trans monoenes in continuous cultures.

A. A. AbuGhazaleh*, M. B. Riley, and T. C. Jenkins, *Clemson University, SC*.

A previous in vitro study using batch cultures of mixed ruminal microbes showed that oleic acid was converted to trans monoene 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 ^{13}C-labeled oleic acid to trans monoenes. A 4 χ 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 0.10 h^{-1} dilution rate, 2) pH 6.5 and 0.05 h^{-1} dilution rate, 3) pH 5.5 and 0.10 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 55% alfalfa, and 45% concentrate mix (DM basis). The ^{13}C-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 ^{13}C-labeled oleic acid) and at 24 h after adding ^{13}C-labeled oleic acid. Both pH and dilution rate affected trans monoene formation from oleic acid. At pH 5.5, ^{13}C enrichment was not detected on the trans double bonds between carbons 11 and 16 compared with pH 6.5. Similarly, at 0.05 h^{-1} dilution rate ^{13}C 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-6, 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

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

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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), AC (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 α-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. Fatty acid compositions 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 α-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 linoleic acid (18:2) in LD (6.6 vs. 4.8%). In trail 2, lambs fed the BD had lower ($P < 0.05$) levels of α-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 higher ($P < 0.05$) levels of 18:2 in LD (13.0 vs. 7.2%). The results imply that both EGFS and SOG supplements may enhance the absorption of tocopherols and increase linoleic acid levels in ruminants.

Key Words: Tocopherol, Tocopheryl Acetate, Linoleic Acid

W101 Corn silage hybrid quality effects on milk production in dairy cows.

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Higher milk production is the promised outcome for selecting corn hybrids with various traits that impact forage quality. Our objective was to select a set of hybrids most likely to exhibit differences in forage quality and evaluate milk production of cows fed a high forage ration. Four hybrids were selected for the feeding trial: a leafy hybrid (Mycogen TMF 100), a brown-midrib (Mycogen BMR F407), and two hybrids with a range in fiber digestibility (Pioneer 36B08 and Pioneer 35P12). Diets were formulated to provide 1.05% of BW as forage NDF (approx.

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 ($P<0.05$) milk production than 35P12 (39.2 kg d^{-1}) and 36B08 (39.0 kg d^{-1}). Higher intake by cows fed BMR TMR than 35P12 and 36B08 TMRs is likely the result of higher digestibility. While the leafy hybrid tended to be higher in digestibility than 35P12 and 36B08, it is likely that lower forage:concentrate ratio of the leafy hybridy TMR than the other TMR also contributed to its higher intake. Ruminal concentrations of propionate were higher in cows fed BMR than those fed other hybrids, which could also result in higher milk production. Corn silage hybrids selected for improved forage quality can result in higher milk production by cows fed the improved hybrids in high forage diets.

Key Words: Corn Silage, Digestibility, Milk Production

W102 Variation throughout lactation and between herds in maintenance energy expenditures of dairy cows estimated from energy balance data.

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Maintenance energy expenditures and between-herd variation in maintenance energy expenditures for Holstein dairy cows were evaluated from average weekly NE balance estimates in 21 herds throughout lactation. NE balance was calculated from observed intake, growth and milk production data according to NRC as DMI*NE(l) feed - FCM*0.749 0.08*$BW^{0.75}$. For first-lactation cows, a modified version of the NRC growth expenditure equation was added into the energy balance equation: 0.0103*$(BWT* 0.96)^{0.75}$. Bodyweight was predicted as 0.203 times NE balance if the balance was negative and 0.195 times balance if positive. When the NRC maintenance parameter 0.08 Mcal/kg $BWT^{0.75}$ was used in energy balance calculation, bodyweight was over-predicted, with an increasing difference between predicted and observed bodyweight as lactation progressed. The maintenance parameter that resulted in the least residual sum of squares (LSS) for bodyweight prediction throughout lactation for each data set was determined. The average LSS maintenance parameter for the 21 data sets was 0.096 Mcal/kg BWT $^{0.75}$, 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 $BWT^{0.75}$. This value increased until week 15 of lactation where it plateaued at approximately 0.100 Mcal/kg $BWT^{0.75}$. 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 vary considerably, but are higher than the conventional 0.08 Mcal/kg $BWT^{0.75}$, 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 Eexpenditures, Energy Balance, Lactation

W103 Effect of an amino polysaccharide on production and composition of milk of Holstein and Jersey cows in México.

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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 Jersey cows at San Carlos ranch, State of San Luis Potosí, and the second with Holstein cows at Ojo de Agua ranch, State of Guanajuato. Trial 1 lasted 56 d with two groups of 30 cows each; days on milk (used as a covariable) were 89 d for treated and 74 d for control cows; a complete mixed ratio (50:50 forage:concentrate) was used. Trial 2 lasted 60 d with two groups of 25 cows each; a complete mixed ratio (70:30 forage:concentrate) was used. For both trials, treatments were 0 (control) or 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 13.8 mg/dL). In trial 2 (vs control), 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.

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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 20.0% 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). Rumen 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 decreased 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 ($peNDF_{NDF}$), 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 ($peNDF_{>1.18}$) 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 mater 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 $peNDF_{NDF}$ and $peNDF_{>1.18}$, 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.

	Diet H	Diet HS	Diet S	SE	P
DM, %	71.4	63.4	57.3	0.75	
CP, %DM	20.5	20.5	20.7	0.39	
SP, % DM	5.5	6.5	7.7	0.23	
NDF, %DM	34.6	33.9	34.6	1.46	
Retained by PSPS screens, %	27.6^{c}	33.4^{b}	37.1^{a}	0.63	**
$peNDF_{NDF}$, %DM	13.3^{b}	15.1^{a}	15.6^{a}	0.61	*
$peNDF_{>1.18}$, %DM	23.4^{b}	24.0^{b}	25.6^{a}	0.32	*
DMI, kg d^{-1}	23.1	22.0	22.2	1.04	NS
Rumen pH	5.90	5.99	5.98	0.05	NS
Blood glucose, mM L^{-1}	4.41^{a}	4.37^{a}	4.17^{b}	0.10	*
Blood urea, mM L^{-1}	6.89	7.29	7.74	0.46	
Milk yield, kg d^{-1}	39.0	38.3	37.6	0.45	NS
Milk fat, %	2.50	2.63	2.60	0.13	NS
Milk protein, %	3.17	3.16	3.15	0.08	NS

** = $P < 0.01$, * = $P < 0.05$, = $P < 0.10$, 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*[1], L. G. Nussio[2], and W. Mattos[2], [1]*Universidade Federal de Goiás, Escola de Veterinária, DPA, Goiania, GO, Brazil,* [2]*Escola Superior de Agricultura Luiz de Queiroz, Padua Dias, Pracicaba, SP, Brazil.*

Four ruminally and duodenally cannullated Holsteins cows were used in a 4 x 4 Latin square design with 14-d periods to evaluate fiber effectiveness of pelleted soybean hulls (PSH) and corn gluten feed (CGF). Four isonitrogenous and isoenergetic 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 GGF. The NDF intake was lower (P<.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<.05) than those fed LF (3.27%) and PSH (3.17%) diets. Fat correct milk (3.5%) was significantly lower (P<.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<.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 ml) was higher (P<.05), and acetic acid (mol/100 mol) and acetate:propionate ratio were lower (P<.05) for those fed PSH and CGF diets than those fed the HF diet. Ruminating (min/d and min/kg of NDF) and chewing (min/d and min/kg of NDF) activities were lower (P<.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<.05) for cows fed 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

W106 Effects of dietary forage and non-fiber carbohydrate concentrations on apparent B-vitamin synthesis in dairy cows. E. C. Schwab*[1], C. G. Schwab*[2], C. L. Girard[3], R. D. Shaver[1], D. E. Putnam[4], and N. L. Whitehouse[2], [1]*University of Wisconsin, Madison,* [2]*University of New Hampshire, Durham,* [3]*Dairy and Swine R&D Center, AAC, QC, Canada,* [4]*Balchem 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 4×4 Latin square design balanced for carryover effects with a 2×2 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 signficant 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 B_{12} and PAL were both influenced by dietary NFC content. A F×NFC interaction existed only for thiamin AS. Negative AS values for pyridoxine (PYR) suggest that this form of vitamin B_6 was either ruminally destroyed or utilized, absorbed through the rumen wall, or converted to another B_6 form.

Item	Diets 3530	3540	6030	6040	SEM	Effect (P<)[5] F	NFC	F×NFC
Thiamin AS mg/d	70	55	48	53	6	0.01	NS	0.02
Folic acid AS mg/d	20	23	15	18	2	0.01	NS	NS
B_{12} AS mg/d	117	84	83	63	6	<0.01	<0.01	NS
PAM[6] AS mg/d	50	46	40	43	4	<0.01	NS	NS
PAL AS mg/d	6	15	7	15	3	NS	<0.01	NS
PYR AS mg/d	-21	-24	-29	-27	3	0.01	NS	NS

[5]NS=not signficant (P<0.05)[6]PAM=pyridoxamine

Key Words: B-Vitamin, Synthesis, Cow

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 3 x 3 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 negatively correlated to intake of peNDF (r=-0.39, $P<0.15$) and ruminating time (r=-0.45, $P<0.15$). 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: Physically Effective NDF, Chewing, Rumen pH

W108 Effect 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 multiparious Holstein dairy cows averaging 84.50±10.34 days in milk and 36.10±4.46 milk yield (MY) were used in a 4 4 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 (GHCS1); or 4) GCS heated in 140°C and steeped for 20 minute (GHCS2). 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

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 of 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 1,2,3 and 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. TMR and 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 ration NDF and TMR particles retained on upper and middle sieves (r=0.19; r=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 rumen 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 DMI 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 Wheat Straw	28 Control	28 Treated	32 Control	32 Treated	SEM	p-value NDF	NDFD
Milk, kg/d	39.3	40.8	36.5	38.6	2.4	.0002	.0038
FCM, kg/d	35.9	37.4	33.0	34.6	2.7	.0001	.0130
DMI, kg/d	22.8	23.4	21.7	22.3	0.8	.0288	.2412
Total NDFI,kg/d	6.3	6.4	6.8	6.9	0.2	.0016	.5425
Dig. NDFI,kg/d	3.0	3.3	3.1	3.7	0.1	.0011	.0001

Total NDFI=Total NDF Intake, Dig.NDFI=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 tested were the physical forms of concentrate: (T1) pelleted, (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 in 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 (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 plant. D. E. de Oliveira*[2], S. R. de Medeiros[3], L. J. M. Aroeira[4], and D. P. D. Lanna[5], [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}, C_{33}. The ratios of C_{31}:C_{32} and C_{33}:C_{32}, used in estimation of forage intake were also evaluated. Twenty lactating Holstein x Gir cows were 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} and C_{36} and managed in a rotational grazing system os Stargrass (Cynodon nlemfüensis). After seven days of capsule delivery, samples of feces were collected from rectum, every morning and afternoon of the next five days. The forage samples were collected by the

hand plucking method. The n-alkanes were extracted by direct saponification and analyzed by gas chromatography. The variations in the individually fecal concentrations of the n-alkanes and ratios, between the morning and afternoon and among days of collection were done by the Proc Mixed procedure (SAS, 2001). There were treatment effects (CLA=226.9 mg vs. MEG=211.3 mg, P=0.01), of time of day (morning=203.3 mg vs. afternoon=235.1 mg, P=0.0001) and a linear effect of day of collection (-9.6 mg/day) on the fecal concentration of C_{31}. For the fecal concentration of the n-alkane C_{32} there were effects of time of day (morning=102.5 mg vs. afternoon=109.4 mg, P=0.0001) and a quadratic effect of day of collection (P=0.0001). The fecal concentration of C_{33} varied between time of day (morning=304.4 mg vs. afternoon=338.7 mg, P=0.0001). The C_{31}:C_{32} fecal concentrations ratio varied between time of day (morning=2.16 mg vs. afternoon=2.33, P=0.0007). For C_{33}:C_{32} ratio there were differences for time of day (morning=2.96 mg vs. afternoon=3.19 mg, P=0.0009) and a quadratic effect for day of collection (P=0.0001). The variations observed for fecal ratios of n-alkanes concentrations would have important influence on forage intake estimates.

Key Words: Alkanes, Grazing Cows, Tropical Plant

W113 Changes in milk fatty acids during transition of dairy cows from diets based on conserved forage and grain to pasture. G. Aguiar, T. R. Dhiman*, A. L. Ure, S. F. Porter, and L. L. Jeffs, *Utah State University, Logan.*

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 $\pm$ 3.7, 17.5 $\pm$ 4.6, and 19.0 $\pm$ 6.8 kg milk/d with 3.64 $\pm$ 0.02, 4.02 $\pm$ 0.37, and 3.65 $\pm$ 0.16% fat in phases 1, 2, and 3, respectively. The conjugated linoleic acid (CLA) and $C_{18:1}$ *trans*-11 (TVA) contents of milk were 0.63 and 4.09% of fat during phase 1 and reached a maximum of 2.28 and 7.30% on day 32 of turning cows out to pasture ($P < 0.05$), respectively. The $C_{18:3}$ maximized at day 14 ($P > 0.05$) on pasture. Total ω-3 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.

Key Words: Cow, Pasture, Fatty Acid

W114 Preparation of fresh forage for *in vitro* and *in sacco* incubations. A. V. Chaves[1], G. C. Waghorn*[2], and I. M. Brookes[1], [1]*Institute of Food, Nutrition and Human Health, Massey University, Palmerston North, New Zealand,* [2]*Dexcel 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 maturiry 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.

Key Words: Preparation, Forage, Incubations

W115 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$\pm$118) were evaluated in order to investigate the effectiveness of the induction protocol and its effect on production parameters. For 13 cows in three trials, ruminal pH was measured continuously and recorded each minute; dry matter intake and milk yield was recorded daily. Milk composition data were obtained from 9 cows in two of these trials. The SARA induction protocol included four separate Periods: four days of Baseline (normal TMR fed), one day of 50% Restricted feeding, one or two day of Challenge feeding (addition of 4-5 kg wheat/barley pellet to normal TMR), and two days of Recovery measurements when feeding normal TMR. Data were analyzed including Period, Trial, and their interaction in the model. Mean comparisons were by least significant difference method after a significant ($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 k/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.

Key Words: Subacute Ruminal Acidosis, Dry Matter Intake, Milk Production

W116 The effects of monensin on feed intake pattern during sub-acute ruminal acidosis in dairy cows. D. E. Lunn[1], T. Mutsvangwa[1], N. E. Odongo*[1], T. F. Duffield[2], R. Bagg[3], P. Dick[3], G. Vessie[3], and B. W. McBride[1], [1]*Department of Animal and Poultry Science, University of Guelph, Ontario, Canada,* [2]*Department of Population Medicine, University of Guelph, Ontario, Canada,* [3]*Elanco Animal Health Division, Eli Lilly Canada Inc, Guelph, Ontario, Canada.*

The objective of this study was to determine 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 multiparious Holstein cows (630.5 ± 35.4 kg BW; 81.2 ± 49.6 DIM; experiment 1 and 667.7 ± 46.2 kg BW; 150.2 ± 53.2 DIM; 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 (7.3 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® CRC or in Rumensin® 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. Aikman*[1], A. Boydell[2], A. Le Gallais[3], D. J. Humphries[1], C. K. Reynolds[4], and D. E. Beever[1], [1]*CEDAR, The University of Reading, UK,* [2]*BOCM PAULS Ltd, Bristol, UK,* [3]*Jersey Milk Marketing Board, St. Saviour, NJ,* [4]*The 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 6 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 collection for 5 d. To determine ROP a dose of Cr-mordanted grass silage (1% of DMI) 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 (k_1) and hindgut (k_2) 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 (respective 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). k_1 was higher (P < 0.016) in J than HF (0.031 v 0.027), k_2 tended to be higher in J than HF (0.078 v 0.074, P < 0.106), but TT did not differ (12.19 v 11.46 h, J and HF respectively, P > 0.377). Fiber digestibility and TT declined (P < 0.001) in both breeds as DMI increased postpartum, but the decrease in TT was less in J (P < 0.050). In conclusion, $k_1$was greater for J than HF at equal DMI/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. Moallem*[1], H. Lehrer[1], M. Katz[1,2], and D. Sklan[2], [1]*1Department of Dairy Cattle, Institute of Animal Science, ARO, Isreal,* [2]*2Animal Science Department, Faculty of Agriculture, Hebrew University, Rehovot, Isreal.*

This study examined the effects of feeding supplements containing glucogenic precursors prepartum and calcium salts 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 fed the control diet + top dressed with 550 g of a commercial glucogenic supplement (ProGlyc 55; PG). After calving each prepartum group was subdivided to groups that were fed either the control lactating diet or the control diet 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, betahydroxybutyrate (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. Belloso*[1], M. J. Hayen[1], M. Liboni[1], M. S. Gulay[1], F. Valdez[2], and H. H. Head[1], [1]*University of Florida, Gainesville,* [2]*Kemin 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 (TRT) were 1) control (CON), none, n=29; 2) NutroCal (NUT; Kemin Americas™), 0.114 kg/d, n=33; 3) Metaxerol (MET; Pestell America™), 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 +4 wk) fed in a.m. Blood samples were taken 3x a week and analyzed for concentrations of insulin, IGF-I, glucose, NEFA, β-HBA, and calcium in plasma. Total liver fat (wet weight basis) ∼-21 d, around calving, and +14 and +28 d postpartum was determined on biopsies taken from a subset of 10 cows/TRT. Overall, blood measures followed expected patterns for Holstein cows during this time period. No incidences of fatty liver or treatment effects on percentage liver fat were detected. However, liver of NUT supplemented cows had numerically greater fat percentage (∼30%) compared to CON and PPG supplemented cows, and ∼58% more than MET supplemented cows. There was a biopsy day effect (P=0.002) on total liver fat; greatest percentages in liver were on d +14 (9.9%). Adding glucogenic compounds to TMRs fed to transition cows did not alter expected changes in plasma insulin, IGF-I, metabolites or liver lipids around calving but differences in changes were detected due to supplement included in TMR during this period.

Blood Measure		Treatment CON	NUT	MET	PPG
IGF-I (ng/mL)	Prepartum	259.1^{b}	256.3^{b}	229.8^{a}	255.3^{b}
	Postpartum	139.9^{a}	144.6^{a}	142.7^{a}	165.1^{b}
NEFA (μeq/L)	Prepartum	154.5^{ab}	149.6^{a}	192.3^{c}	185.0^{bc}
	Postpartum	515.7^{b}	529.4^{b}	477.6^{ab}	430.3^{a}
β-HBA (mg/dL)	Prepartum	4.09	4.20	4.18	4.16
	Postpartum	8.24^{b}	8.64^{b}	7.12^{ab}	6.24^{a}
Glucose (mg/dL)	Prepartum	71.4	70.9	70.3	70.5
	Postpartum	61.8	61.5	63.3	65.0
Insulin (ng/mL)	Prepartum	0.72^{ab}	0.77^{b}	0.67^{a}	0.76^{ab}
	Postpartum	0.41	0.41	0.41	0.45
Calcium (mg/dL)	Prepartum	8.39^{a}	8.68^{ab}	8.74^{b}	8.45^{ab}
	Postpartum	8.58	8.71	8.73	8.53

^{abc} Means with different letters within rows differed (P<0.10)

Key Words: Glucogenic Compounds, Blood Measures, Liver Fat

W120 Ruminal and plasma responses in dairy cows to drenching or feeding glycerol. P. L. Linke*[1], J. M. DeFrain[1], A. R. Hippen[1], and P. W. Jardon[2], [1]*South Dakota State University, Brookings,* [2]*West Central Soy, Ralston, IA.*

Four Holstein dairy cows (137 DIM, 60 kg milk/d) were used in a Latin square design with 1-wk periods to evaluate the effect of methods 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 experiment. 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. Blood samples were collected at -1, -0.5, 0, 0.25, 0.5, 0.75, 1, 1.5, 2, 4, 6, 8, 12, and 24 h after administering glycerol. Rumen samples were collected at 0, 2, 4, and 6 h. Acetate 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 ($P < 0.05$) by glycerol with peak concentrations at 4 h (26.4, 28.7, 30.4, and 30.4 and 14.1, 20.0, 20.3, and 21.5 mol%, respectively). Glucose was increased ($P < 0.05$) in plasma of D and T compared with C, reaching peak concentrations (21.3 and 18.5 mg/dl over baseline) at 1.5 and 3 h for D and T, respectively. Glucose response 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. The 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: Glycerol, Metabolites, Volatile Fatty Acids

W121 Adipose tissue metabolism, feed intake and milk production in response to dietary calcium propionate and chromium propionate from 21 days prepartum to 35 days postpartum in Holstein dairy cattle. J. P. McNamara*[1] and F. Valdez[2], [1]*Washington State University, Pullman,* [2]*Kemin Industries, Inc, Des Moines, IA.*

The objective was to determine the action of calcium propionate and chromium propionate on rates of lipogenesis and lipolysis in adipose tissue, dry matter intake and milk production when fed to Holstein dairy cattle 21 days prepartum to 35 days postpartum. Twelve animals each were assigned to treatments: Control, CaP (.125 kg/d); CrP (10 mg trivalent Cr/d) and both CaP and CrP. Dry matter intake and milk production was determined daily from 21 to 90 d. Biopsies of adipose tissue were taken at 7, 14, 28 and 56 d from calving. In control cows, rates of lipogenesis dropped to 98 % of 7 d rates and stayed there through d 56. Lipogenesis in cows treated with either CaP or CrP was 25 to 140 % faster (1.25 to 14 times as fast) at 14 and 28 d postpartum and had returned to prepartum rates by 56 d. Rates of lipolysis in vitro doubled from 7 to 28 d but were not different at 14 and 56 d from 7 d. On CaP, lipolysis was 94, 79, 53 and 243 % of control and on CrP: 84, 97, 81 and 150 % of control at d 7, 14, 28 and 56. Dry matter intake averaged 11.2 (SD 1.85) and 21.8 (SD 3.7) kg/d from 21 to 1 and 1 to 90 days about calving. CaP increased DMI 11 and 13 % pre and postpartum; CrP increased DMI 10 and 16 % ($P < 0.05$); the combination had no effect. 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 gluconeogenic precursors can reduce net lipolysis from adipose tissue and allow increased feed intake, 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, Gluconeogenesis, Lipolysis

W122 Effect of rumen protected choline on liver metabolism in periparturient dairy cows. P. Elek*[1], F. Husvéth[2], T. Gaál[3], and J. R. Newbold[4], [1]*AGROKOMPLEX C. S. Co., Zichyujfalu, Hungary,* [2]*Veszprém University, Keszthely, Hungary,* [3]*Szent István University, Budapest, Hungary,* [4]*Provimi 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) or 100 g/d RPC (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, mg/kg milk: 86.2, 109.4; 97.1, 143.0; 115.3, 137.2; for days 7, 35 and 60, respectively), which proves the better choline supply of RPC supplemented cows. Feeding RPC during the periparturient period had a positive effect on liver metabolism as evidenced by lower total lipid and higher glycogen content.

Key Words: Choline, Cow, Liver

W123 Supplemental choline for prevention and alleviation of fatty liver. R. R. Cooke, R. R. Grummer*, S. J. Bertics, D. Z. Caraviello, M. H. Ramos, and N. Silva del Rio, *University of Wisconsin-Madison.*

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. During fatty liver induction (d 7-17), cows were fed 1.4 kg concentrate/d with or without RPC and forage intake was restricted so that cows consumed 30% of maintenance energy requirements. During fatty liver induction, RPC did not affect blood glucose (P = 0.42), but did decrease plasma nonesterified fatty acid (NEFA, 703 vs 562 uEq/L, SE = 40, P = 0.003) and liver triglyceride (TG) (16.7 vs 9.3 ug/ug DNA, SE = 2.0, P = 0.015). Experiment 2 was conducted to determine if RPC could alter the rate of TG depletion from liver when cows are fed in excess

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 6 d, cows were fed 1.4 kg concentrate/d with or without RPC 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 ug TG/ug 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 and 52.2 (SE = 6.0) on d 3 and 48.5 and 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; Reashure^{TM} 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 was top-dressed at a rate of 0 or 15 g dietary choline per cow per day. Cows were individually fed diets as total mixed rations using electronic feeding gates. Body weights and body condition scores were measured weekly throughout the study. Cows were milked 2x daily, and milk yields were recorded. Blood samples were collected weekly prepartum, at days -3, 0, and +3 relative to calving, and twice weekly postpartum. Plasma were analyzed for NEFA, glucose and γ-hydroxybutyrate. Cows fed RPC consumed significantly more DM as a percent of BW over the entire study period. Feeding RPC increased milk yield with little or no change in BW or BCS. Plasma NEFA and γ-HBA concentrations were lower in cows fed RPC. Cows may use energy for milk production more efficiently when fed RPC. Cows fed SB during the prepartum period had lower postpartum DMI than cows fed the other diets. Feeding SB beginning at 28 days prepartum resulted in reduced milk production throughout the study. Cows fed SB beginning either 28 days prepartum or at calving had more positive energy balance, reflected in lower plasma NEFA and higher plasma glucose concentrations. Although SB can be used as an alternative energy source, these results suggest that feeding should not be initiated until after calving.

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

W125 Feeding soybeans and rumen-protected choline to dairy cows during the periparturient period and early lactation. 2. Effects on reproduction. 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 reproductive performance 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. TRPC was top-dressed at a rate of 0 or 15 g dietary choline per cow per day. Cows were individually 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-dihydro 15-keto 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: Transition Cows, Soybeans, Rumen-Protected Choline

W126 Estimation of VFA and Glucose Kinetics on Transition Dairy Cows provided monensin. X. Markantonatos*[1], Y. Aharoni[3], T. Cassidy[1], R. K. McGuffey[2], L. F. Richardson[2], and G. A. Varga[1], [1]*The Pennsylvania State University,* [2]*ELANCO Animal Health, Greenfield, IN,* [3]*ARO, Newe Yaar Research Center, Israel*.

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. Treatments were a TMR top-dressed with 300 mg M/d, or without M. Cows received M from d -30 prepartum (Pre) to d +56 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-$^{13}C_3$Na, 1-$^{13}C_2$Na, 1-$^{13}C_4$Na) at 12% enrichment were bolused and intraruminally infused. Tracers were infused on d 13 $\pm$ d 1.97 prior to calving and on d 19 $\pm$ 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 U-^{13}C-Glucose (Glu) 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 ^{13}C Enrichment Curves with Time (ECT). Acetate (Ac) conversion to Butyrate (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 8.78mmol/min; P<.0001). 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: Monensin, VFA, Glucose Kinetics

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 fed orts 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 cows were given ad libitum access feed (1.61 Mcal NEL/kg) and similarly following parturition (1.67 Mcal NEL/kg). Liver biopsy and

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±0.7, 15.6±0.7 kg/d, respectively). Control cows produced more milk (P<.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<.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 not affected by treatment but PC mRNA was elevated (P<.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

W128 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 following experiment was to determine the effect of therapeutic NA 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(r) 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 14 to 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. Control 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 μeq/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

W130 Effects of dry period length on performance and health of dairy cows during the subsequent lactation.

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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.

Item	60-d dry	40-d dry	0-d dry	SEM
Milk, kg/d	47.1^{a}	46.3^{a}	37.1^{B}	1.8
Fat, %	3.52	3.58	3.32	0.14
Fat, kg/d	1.67^{a}	1.61^{a}	1.24^{b}	0.09
3.5% FCM, kg/d	48.0^{a}	46.2^{a}	36.7^{b}	2.0
Protein, %	2.73^{a}	2.84^{b}	2.83^{b}	0.06
Protein, kg/d	1.30^{a}	1.30^{a}	1.06^{b}	0.04
BHBA, mg/dl	11.1	10.3	9.4	0.7

^{ab} Means within row with different superscripts differ, P < 0.05.

Key Words: Dairy Cow, Dry Period

W131 Effects of Tri-Lution^{TM} on immune response in the pre-fresh dairy cow.

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

titers and 60 d milk production. Pre-Fresh dairy cows (28 per treatment) were randomly assigned to one of two treatments starting three weeks before expected calving date. Treatments were a control ration or the same TMR containing 68 grams per head per day of Tri-Lution^{TM}. Following parturition all cows were fed the same milk cow ration (i.e. Tri-Lution^{TM} feeding stopped at parturition). Colostrum was collected at milking and frozen. A 50 ml aliquot was used to measure immunoglobulin (IgG, IgM, and IgA) titers. Blood from new born calves was collected the day following consumption of colostrum and analyzed for IgG titers. Milk production, components, and SCC were monitored for the first 60 days after parturition on a weekly basis. Milk data was analyzed using two different time periods. Period 1 consisted of 0 to 30 DIM and period 2 from 30 to 60 DIM. Feeding Tri-Lution^{TM} resulted in similar IgG and IgM titers in colostrum. However, colostral IgA titers were significantly higher when Pre-Fresh cows were fed Tri-Lution^{TM} (625 vs 892 mg/100 ml for the control and Tri-Lution^{TM} treatments, respectively, $P < 0.05$) compared to cows fed the control TMR. Serum IgG titers in the calves were similar between treatments 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^{TM} 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^{TM} before calving have lower SCC during the first 60 DIM compared to cows fed the control TMR. Feeding Tri-Lution^{TM} to Pre-Fresh dairy cows enhanced colostral IgA concentrations

Key Words: Tri-Lution^{TM}, Immune, Dairy

W132 Effect of feeding red clover or ryegrass silage to dry dairy cows on nitrogen balance and blood metabolites.

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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) with a grain based concentrate (24% CP) at 6 kg/d. A subset of 2 cows per treatment were housed in a metabolism unit for 6 to 8 d of N partition and feed digestibility measurements at about 2 wk before calving, and 3 wk after calving. Blood samples were collected from all cows for metabolic profile measurements at wk 1, 3, 5, 7 and 9 of lactation. Before calving, N intake was higher ($P<0.01$) in RC cows (376 vs. 349 g N/d), but apparent N digestibility was lower (60.7% vs. 66.8 %; $P<0.001$) so that feces N output was higher. There was no difference in urine N output due to DP treatments, nor whole body N balance (mean 58 g N/d). Whole tract DM digestibility was lower ($P<0.001$) in RC (62.6% vs. 73.2%). After calving, there was no effect of the prior DP treatment on feed N partitioning or N balance. Mean whole tract diet DM digestibility was 62.2%. Plasma albumin concentrations tended to be higher ($P<0.1$) in cows fed the DP diet based on RS (44.8 vs. 46.8 g/l), but there were no differences in plasma concentrations of urea, glucose, BHBA or NEFA. The N supplied by the DP diet of RC was used less efficiently than that of the RS, and so the digestible N supply to the cows during the DP did not differ between treatments. Lower plasma albumin concentrations in RC cows after calving indicate a smaller body protein pool than that of RS cows, despite similar N balances during the DP, indicating increased fetal N utilization.

Key Words: Digestibility, Nitrogen Partitioning, Plasma Metabolites

W133 Estimations of milk production by the NRC and the Cornell models when ruminal N balance was negative and MP was limiting.

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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

		Cow group A	B	C	D
NRC (dairy cattle, 2001)	ME allowable milk (kg/d)	40.8	41.7	40.8	38.7
	MP allowable milk (kg/d)	47.1	38.2	34.0	31.3
	MP - Bacterial (g/d)	1334	1226	1192	1157
	MP - RUP (g/d)	1452	1149	1059	1060
	MP - Endogenous (g/d)	116	116	117	113
	Ruminal N balance (g/d)	40	-29	-40	-38
CNCPS (ver. 5, 2003)	ME allowable milk (kg/d)	39.7	41.5	41.0	39.7
	MP allowable milk (kg/d)	49.9	45.8	41.0	41.2
	MP - Bacterial (g/d)	1583	1604	1572	1518
	(MP from recycled N, g/d)	202	316	345	321
	MP - RUP (g/d)	1496	1253	1142	1182
	Ruminal N balance (g/d)	70	-16	-47	-43
Actual Milk yield (kg/d)		40.9	42.3	40.6	39.5

W134 Prediction of nutrient supply to dairy cows from concentrates: Comparison of the National Research Council-2001 model with the Dutch system (DVE/OEB).

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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. Alfred). The two barleys were processed by coarse (Roller miller, 0.533 mm gap) and fine (Hammer mill, 2 mm screen) processing. The field tick beans and white albus lupines were dry roasted at various conditions. The soybeans and horse beans were pressure-toasted at the temperature 100, 118, 136°C for 3, 7, 15 and 30 min at

Wageningen Processing Centre. Comparisons were made in terms of 1) ruminally synthesized microbial protein, 2) truly absorbed protein in the small intestine, and 3) degraded protein balance, based on 46 samples. The results showed that the predicted values from the DVE/OEB system and the NRC-2001 model had significant correlations with. However, using the DVE/OEB system, the overall average microbial protein supply based on available energy was 10% lower and the truly absorbed protein in the small intestine was 8% lower 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 a further refinement is needed for a modern protein evaluation and prediction system.

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

W135 Nutritive value of processed field tick beans predicted by two dairy models (NRC and DVE/OEB). P. Yu*[1], B. J. Leury[2], and A. R. Egan[2], [1]*Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, Canada,* [2]*School 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 terms of 1) ruminally synthesized microbial CP, 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 high R (> 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 (DPB), which was 5% lower than that predicted 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.

Key Words: NRC-2001 Model, DVE.OEB System, Field Tick Bean

Production, Management and the Environment: Nutrition and Environment

W136 Application of manure screening as an on farm a tool to evaluate the animal / diet interface. M.J. Jerred*[1], T. G. Brion[1], S. R. Burghardi[1], K. A. Ruppel[2], and M. A. Messman[1], [1]*Cargill Animal Nutrition, Elk River, MN,* [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 conformance 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. On 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

W137 Prediction of urine N excretion from creatinine and milk urea nitrogen in primiparous and mulitparous cows. S.A. Flis* and M.A. Wattiaux, *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 urine were used in predicting urine volume 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 sampling 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

W138 Indentifying dairy farms facing challenges in P management. V. A. Ishler* 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-based 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 milk 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 concentration. Farms with potential 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