870 A ring test of in vitro neutral detergent fiber digestibility: analytical variability and sample ranking. M. B. Hall* and D. R. Mertens, *U. S. Dairy Forage Research Center, USDA-ARS, Madison, WI.*

In vitro neutral detergent fiber (NDF) digestibility (NDFD) is an empirical measurement used to describe fermentability of NDF by rumen microbes. Variability is inherent in assays and affects the precision that can be expected for replicated samples. The study objective was to evaluate variability within and among laboratories (labs) of 30 h NDFD values measured in repeated runs. Subsamples of alfalfa (n = 4), corn silage (n = 5), and grass (n = 5) ground to pass a 6 mm screen were sent to 10 labs on 3 occasions over a 12 mo period. Subsamples passed a test for homogeneity. Labs ground the samples and ran 2 or 3 replicates of each sample within run, and analyzed 2 or 3 sets of samples. A lab that did not provide in-run replicate data was not included in evaluation of standard deviations (SD). Mean and SD for sample within run within lab were calculated. Factors in the statistical model were lab, run within lab, sample, and lab by sample. All factors affected NDFD ($P < 0.01$ for all) and within-run SD of NDFD ($P < 0.03$ for all). The lab by sample effect suggests against a simple lab bias. Labs used 2 NDFD procedures: 8 labs used a procedure similar to Goering and Van Soest, 1970 (GVS) using fermentation vessels or filter bags, and 2 used a procedure with pre-incubated inoculum (PInc.). Among GVS labs, NDFD results were affected by all factors ($P < 0.01$ for all; mean 48.5%, range 42.7 to 53.2%, SED = 0.98). For PInc., mean NDFD was 30.7% (range: 31.8 to 29.6%); GVS and PInc. NDFD differed ($P < 0.01$, SED = 0.95). Mean within-run SD were 1.9% (range: 0.5 to 3.4%) for GVS and 2.6% (range 1.8 to 3.4%) for PInc. The mean SD for all labs of 2.0% indicates that 95% of results for a sample within a run would be within a range of 8.0% NDFD. Labs ranked samples similarly within forage type. Spearman correlation coefficients between average rankings and those reported by labs were 0.83 for alfalfa, 0.70 for corn silage, and 0.90 for grass ($P < 0.01$ for all). It is concluded that across all labs an average precision of 8% NDFD can be expected for a single analysis within run. Differences between GVS and PInc. suggest using results in contexts appropriate to each procedure.

Key words: NDF, digestibility

871 Effects of supplemental Smartamine or MetaSmart in moderate-energy close-up diets on peripartal liver tissue composition and blood metabolites. J. S. Osorio*, P. Ji, J. K. Drackley, and J. J. Loor, *University of Illinois, Urbana.*

Twenty-eight multiparous Holstein cows were fed a control diet (ME, n = 11; 1.49 Mcal/kg DM prepartum and 1.67 Mcal/kg DM postpartum), ME plus MetaSmart (MS, n = 9; Adisseo France S.A.S.), or ME plus Smartamine (SA, n = 8; Adisseo France S.A.S.). All cows received a common diet (1.30 Mcal/kg DM) during the far-off period [-50 to −21 d in milk (DIM)]. Treatments started at −21 DIM and continued through 30 DIM. MetaSmart (0.19% of DM prepartum and 0.18% of DM postpartum) and SA (0.07% of DM prepartum and postpartum) were top-dressed on the ME diet. Blood samples were collected at −17, −10, 7, 14, and 21 DIM. Whole blood phagocytosis (Phagotest) was assessed at d −10, 3, and 21. Total liver lipid and triglyceride content (Biopsy) were evaluated at −10, 7, and 21 DIM. Data were analyzed using the MIXED procedure of SAS with the preplanned contrasts ME vs. SA+MS and SA vs. MS. Treatments did not affect total lipid and triglyceride concentrations in liver. In contrast to MS and SA, however, the slope of total lipid % between d 7 and 21 for ME was significant ($P = 0.04$) suggesting that supplemental Met prevented increased lipid accumulation during that time-frame. Serum NEFA (0.511 mEq/L) and glucose (54.0 mg/dL) concentrations did not differ due to treatment. Although slopes of NEFA concentrations were negative for all treatments between 7 and 21 DIM, only those of Met-supplemented cows were significant ($P = 0.02$) suggesting that Met decreased NEFA more rapidly after calving. Analysis of whole blood phagocytosis after calving revealed an increase (treatment × time $P = 0.005$) due to MS and SA vs. ME. Energy corrected milk (ECM) was greater ($P = 0.05$) for MS+SA vs. ME (46.4 vs. 42.8 kg/d). Close-up and postpartal DMI did not differ. Enhanced ECM due to MS or SA was associated with a faster decline in serum NEFA and lack of additional lipid accumulation between 7 and 21 DIM. The overall effect of Met supplementation to peripartal cows is encouraging but more conclusive evidence would require increased sample size.

Key words: transition cows, methionine, immune function

872 Effect of supplemental Smartamine or MetaSmart in moderate-energy close-up diets on peripartal cow performance. J. S. Osorio*, P. Ji, J. K. Drackley, and J. J. Loor, *University of Illinois, Urbana.*

Peripartal cows are in negative methionine (M) balance due to increased requirements of tissues for methylated compounds and M for milk protein production. Decreased dry matter intake (DMI) during early lactation aggravates the supply of nutrients such as M. Therefore, supplementation of rumen-protected M during the peripartal period may improve yield of milk and protein. Forty multiparous Holstein cows were fed a controlled-energy diet (1.30 Mcal/kg DM) during the far-off dry period [-50 to −21 d in milk (DIM)]. During the close-up dry period (−21 to 0 DIM), cows were fed a higher-energy diet (1.49 Mcal/kg DM) without (ME, n = 14) or with 0.07% of DM Smartamine (SA, Adisseo France S.A.S.; n = 15) or 0.19% of DM MetaSmart (MS, Adisseo France S.A.S.; n = 11). Supplementation of M continued until 30 DIM. Body weight (BW), body condition score (BCS), DMI, milk yield and composition, and energy corrected milk (ECM) were recorded during the study. Data were analyzed using the MIXED procedure of SAS with the preplanned contrasts ME vs. SA+MS and SA vs. MS. No differences in close-up DMI were observed (average of 12 kg/d). When comparing SA+MS vs. ME, DMI through the first 30 DIM was significantly greater ($P = 0.04$) for M-supplemented cows (14.7 kg/d vs. 12.2 kg/d). Milk yield with SA+MS (41.5 kg/d) was greater ($P = 0.06$) compared with ME (37.7 kg/d). Although milk protein % during wk 2 through 4 did not differ between SA+MS vs. ME, supplemental MS resulted in greater ($P = 0.05$) milk fat % than SA (4.68% vs. 4.09%). There was a tendency ($P = 0.11$) for greater ECM when feeding SA+MS vs. ME (46.0 kg/d vs. 42.8 kg/d). The positive response to MS or SA on milk production seemed to be associated with greater (treatment × time $P = 0.02$) ECM/DMI, at least during the first wk postpartum. The present results suggest that increasing the availability of Methionine in moderate-energy close-up feeding systems may improve lactational performance and DMI.

Key words: methionine, transition cow, amino acid

873 Determining the effectiveness of proteases on production variables in lactating Holstein cows. E. Sucu*[1,2], A. Nayeri[1], M. V. Sanz-Fernandez[1], N. C. Upah[1], S. C. Pearce[1], and L. H. Baumgard[1], *[1]Department of Animal Science, Iowa State University, Ames, [2]Department of Animal Science, Uludag University, Bursa, Turkey.*

Ninety-six multiparous lactating Holstein dairy cows (2.7 ± 1.6 parity, 153.8 ± 103.7 DIM, 40.3 ± 5.9 kg milk/d, 624 ± 62 kg BW) housed in a free stall barn were blocked by parity, days in milk and previous milk production and randomly assigned to a control TMR or a TMR containing a blend of supplemental protease enzymes (4 g/cow/d; Rumagentin, Feed Sources LLC, Alta Loma CA). The TMR consisted primarily of corn silage, alfalfa hay, dried distiller grains, and concentrate and did not contain supplemental by-pass protein. Cows were housed 24 to a pen (4 pens total) and thus pen was the experimental unit in a crossover design with 2 21 d experimental periods. Two pens received the supplement during period 1 and the other 2 pens received the control. Pens then switched treatments during period 2 and there was a 7 d washout between periods. The 7 d immediately before period 1 were used as a covariate in the statistical analysis (repeated measures in the Proc Mixed procedure of SAS). Daily pen milk yield and DMI were recorded and milk composition from all cows was determined on d 15, 17, 19 and 21 of each period. All data was condensed into weekly means. There was no treatment effect on milk yield (37.6 kg/d), but supplemental enzyme-fed cows had less DMI (0.93 kg/d; $P < 0.05$) compared with controls and therefore tended ($P = 0.08$) to have improved (13%) feed efficiency (solids corrected milk/DMI). Protease treatment had no effect on milk fat (3.53%) or milk protein (3.24%), but tended ($P = 0.08$) to increase milk lactose (4.73 vs. 4.76%). Feeding supplemental enzymes tended ($P = 0.10$) to decrease milk urea nitrogen levels (15.1 vs. 14.6 mg/dl) but had no effect on milk SCC. In conclusion, supplementing a proprietary blend of protease enzymes improves feed efficiency and may enhance feed nitrogen utilization in lactating dairy cows.

Key words: protease enzymes, feed efficiency, feed intake

874 Effects of supplementing a mixture of plant extracts to lactating dairy cows on milk and methane production. G. F. Schroeder*[1], D. Bravo[2], M. Jerred[1], and B. D. Strang[1], *[1]Cargill Animal Nutrition, Innovation Campus, Elk River, MN, [2]Pancosma S.A., Geneva, Switzerland.*

The goal of this study was to determine the effects of supplementing a mixture of plant extracts containing cinnamaldehyde, eugenol, and garlic on milk production and composition, DMI, and methane production in lactating dairy cows. Six rumen-cannulated Holstein cows (100 DIM) were used in a replicated 3 × 3 Latin square design with 3 25-d periods (18 d for adaptation and 7 for data collection). Cows were housed in individual tie-stalls and received the same diet (46.2% DM, 18.7% CP, 31.1% NDF, 3.8% EE, and 37.3% NFC) twice daily. Treatments consisted in the supplementation (top-dress) with: none (Control), 300 mg/d monensin (MON), or 300 mg/d of plant extract mixture (PEM). Milk production and DMI was measured daily and milk composition was determined twice during the last 7 d of each period. Methane production was measured using the SF6 tracer technique during the last 4 d of each period. Although milk yield and DMI were not statistically different among treatments, supplementing with PEM increased feed efficiency respect to the Control. Both monensin and PEM reduced milk fat concentration and PEM also reduced milk protein concentration, but total production of those components was not affected. Methane production was not significantly affected but either additive. Total VFA concentration (99.4 mM), acetate to propionate ratio (2.43) and rumen pH (5.9) were similar among treatments. Results of this study indicate that the mixture of plant extracts evaluated can be a valid alternative to increase feed efficiency in lactating dairy cows. Further research is needed to better determine the optimal dose of PEM.

Table 1

	Control	Mon	PEM	SEM	*P* =
Milk, kg/d	37.7	39.0	39.6	2.34	0.57
DMI, kg/d	25.0	24.9	24.1	0.79	0.37
Efficiency, kg/kg	1.50[b]	1.57[ab]	1.65 [a]	0.06	0.06
Milk fat, %	3.29[a]	3.09[b]	3.06 [b]	0.15	0.10
Milk fat, kg/d	1.22	1.19	1.21	0.10	0.84
Milk protein, %	2.89[a]	2.86 [a]	2.72 [b]	0.07	0.08
Milk protein, kg/d	1.07	1.11	1.07	0.06	0.58
CH4, g/d	411.1	408.6	382.3	25.6	0.72
CH4, g/kg milk	10.9	10.5	9.67	0.42	0.95

Key words: plant extracts, methane, efficiency

875 Effects of feeding hay and baleage on growth and rumen parameters in prepubertal Holstein heifers. T. S. Dennis*, J. E. Tower, and T. D. Nennich, *Purdue University, West Lafayette, IN.*

Although ensiled forages are commonly included in diets of growing dairy heifers, little research has been conducted to evaluate feeding baleage as a primary forage source. The objectives of this study were to evaluate the effects of feeding dry hay or baleage to prepubertal dairy heifers on growth, feed efficiency, and rumen parameters. Thirty-six Holstein heifers (age = 189.3 ± 9.3 d; BW = 185.3 ± 1.3 kg) were randomly assigned to 1 of 12 pens and fed a 60:40 forage-to-concentrate diet (DM basis) containing either dry hay (H) or baleage (B) as the only forage source. Heifers were weighed biweekly and hip and withers heights, heart girth circumference (HGC), and body condition scores (BCS) were measured monthly. Blood was collected monthly for plasma urea nitrogen and glucose analysis. Rumen fluid was collected from 24 heifers at the start and end of the study via esophageal tube and measured for pH and rumen ammonia. Rumen fluid was also collected to evaluate in vitro cellulose digestion and total gas production. Data were analyzed as repeated measures using the MIXED procedure of SAS with pen as the experimental unit. Heifers fed H were 6.7 kg heavier ($P < 0.01$) than heifers fed B at the conclusion of the study. Heifers fed H also gained 0.63 kg/d compared with 0.56 kg/d for heifers fed B ($P < 0.05$). Overall, heifers fed H consumed 0.30 kg more DM/d than B ($P < 0.01$), resulting in a tendency ($P < 0.10$) for a 5.4% improvement in gain to feed ratios for H compared with B. Hip and withers heights, HGC, and BCS were similar ($P > 0.10$) between treatments. Plasma urea nitrogen and glucose concentrations were similar between treatments ($P > 0.10$), as was rumen pH ($P > 0.10$). Cellulose disappearance tended to be 9.4% greater for H compared with B ($P < 0.10$); however, total in vitro gas production was similar between treatments. Rumen ammonia concentrations were similar between H and B ($P > 0.10$), though ammonia concentrations declined significantly from 16.3 to 13.2 mg/dL over the entire study ($P < 0.05$). In summary, feeding baleage decreased BW gain, but did not alter skeletal growth or rumen parameters in prepubertal dairy heifers.

Key words: dairy heifer, baleage, hay

876 Direct enumeration of metabolically active yeast from the rumens of lactating dairy cows. H. C. Bruns*[1], A. R. Hippen[1], M. Witt[2], and J. M. Tricarico[2], *[1]South Dakota State University, Brookings, [2]Alltech, Lexington, KY.*

Four ruminally cannulated Holstein cows were used to evaluate the potential for direct enumeration of metabolically active yeast from rumens. A diet devoid of supplemental yeast was individually fed once daily at 1000 h. The diet contained 54% forage and 46% concentrate mix. All ruminal liquid samples were collected directly under the fibrous mat, strained into a thermos and immediately transported to the laboratory. Samples were diluted in 1% Bacto Peptone NaCl solution ranging from 10^{-2} to 10^{-4} and plated onto Dichloran Rose Bengal Chloramphenicol agar. Yeast colonies were enumerated after incubation at 30°C for 48 h. A logarithmic transformation (base 10) was applied on yeast counts before analysis. No yeast was recovered from cows consuming the basal diet or 24 h after dosing with supplemental yeast. A second study examined if the daily pattern of yeast recovery varied between cows. All cows were dosed intraruminally with 25×10^9 colony forming units (cfu) of *Saccharomyces cerevisiae* (Yea-Sacc, Alltech Inc., Nicholasville, KY). Samples were collected at 0.5, 1, 2, 4, and 6 h after dosing on 3 d. Average yeast counts were: 5.17, 5.33, 4.85, 4.34, and 3.95 log cfu per g of rumen contents at 0.5, 1, 2, 4, and 6 h after dosing, respectively. The fractional rate of yeast disappearance from the rumen was similar between cows and averaged 0.052^{h-1}. Lastly, a 4 × 4 Latin square was used to examine the quantitative recovery 1 h after dosing with increasing supplemental yeast (0, 5, 25, or 125×10^9 cfu). Polynomial contrasts were used to examine linear and nonlinear trends. Yeast counts from rumen fluid increased linearly with dose (0, 4.22, 4.89, and 5.83 log cfu per g, respectively; $P < 0.01$). Percent yeast recovery also increased linearly with dose (43.5, 47.0, and 52.6%, for 5, 25, and 125×10^9 cfu, respectively). Assuming metabolically active yeast can be enumerated with this culture-based procedure, we estimate that 25×10^9 cfu of supplemental metabolically active yeast will no longer be detectable 12 h after dosing (limit of detection 10^2 cfu/g) and will no longer be present in rumen fluid of lactating dairy cows 19 h after dosing.

Key words: dairy cows, enumeration, yeast

877 Evaluation of dry hay and baleage for transitioning post-weaned, prepubertal dairy heifers to higher forage diets. L. N. Pereira*, T. S. Dennis, J. E. Tower, and T. D. Nennich, *Purdue University, West Lafayette, IN.*

Dairy heifers often undergo rapid diet changes as they transition from the post-weaned phase to the growing period. Feeding strategies during this transition period have the potential to improve feed efficiency and growth performance of dairy heifers. The objective of this study was to determine whether feeding dry or ensiled forages during the transition period improved heifer performance and rumen parameters. Sixty Holstein heifers (141.9 ± 1.2 kg BW) were randomly assigned to 1 of 12 pens for a 4 wk period. Individual pens were assigned to 1 of 2 treatments: dry hay (H) or baleage (B) and were fed diets containing 40% hay or baleage (on a DM basis). Heifers were weighed weekly, with hip heights, withers heights, heart girth circumference (HGC), and body condition score (BCS) measured every 2 wk. Blood was collected every 2 wk and analyzed for plasma urea nitrogen (PUN), amylase and glucose. During this same collection time, rumen fluid was collected via an esophageal tube from 2 heifers in each pen and analyzed for pH, rumen ammonia, and cellulose disappearance. Data were analyzed as repeated measures using the Proc Mixed procedure of SAS. Average daily gain (ADG) was greater ($P = 0.04$) for H than for B (1.01 and 0.89 kg/d, respectively), though final BW were similar ($P = 0.26$). Heifers fed H had gain to feed ratios of 0.071 compared with 0.037 kg/kg for B during wk 4 ($P = 0.03$), and DMI were similar between treatments over the study ($P = 0.44$). Hip height, withers height, HGC, and BCS were similar between treatments. Rumen pH was greater for B than for H at wk 2 (6.85 and 6.58, respectively; $P = 0.01$), and rumen ammonia ($P < 0.01$) levels were greater for H at wk 2 with levels of 15.5 and 11.7 mg/dl for H and B, respectively. Cellulose disappearance was similar between treatments ($P = 0.25$). Plasma urea nitrogen was greater for H at both wk 2 and 4 ($P = 0.02$). Blood amylase was similar between treatments, but there was a trend ($P < 0.10$) for blood glucose levels to be greater in H at wk 2. Diets containing dry hay resulted in greater ADG than heifers fed ensiled forage during the transition period.

Key words: baleage, dairy heifer, transition

878 Rumen fill score was not related to feed intake response of fresh cows to a less filling diet. K. A. Kurtz, S. E. Stocks*, and M. S. Allen, *Michigan State University, East Lansing.*

Feed intake is likely controlled by mechanisms unrelated to ruminal distention for cows immediately postpartum but as lactation advances, control of feed intake likely begins to be dominated by ruminal distention. We conducted a switchback design experiment with 31 multiparous lactating cows to determine if a visual scoring system for rumen distention (1 = least, 5 = greatest) can be used to predict response in DMI to a less filling diet. We hypothesized that DMI of cows with a higher rumen fill score when fed a higher fill diet (HF, 34% NDF) would respond more positively to a lower fill diet (LF, 29% NDF). Cows ranged between 7 and 27 d postpartum and were blocked by calving date. Treatment diets were fed for 3 d each in the sequence HF-LF-HF for a total of 9 d per block. Cows were fed once and milked twice per day. Feed intake, milk yield, and milk components were measured daily throughout the experiment. Rumen fill score was observed 30 min before feeding (RS-BF) and 8 h later (RS-AF) each day in period 1. Rumen fill score ranged from 1.3 to 3.5 for RS-BF and from 1.6 to 4.3 for RS-AF among cows, was 0.73 units higher after feeding compared with before feeding, and RS-BF and RS-AF were highly correlated ($r = 0.8$, $P < 0.0001$). Response to diet was determined as the response for LF (period 2) minus the mean response for HF (periods 1 and 3) and ranged from −4.9 to 5.1 kg/d for DMI and −11.6 to 9.1 kg/d for milk yield. Response was greatest for the first day following the diet switch with 1.8 kg higher DMI for LF compared with HF, which decreased to 0.20 kg/d for d 2 and −0.30 kg/d for d 3. DMI response was not related to RS-BF, RS-AF, or their difference ($P > 0.71$) nor was it related to days in milk, BW, BCS, or DMI in period 1 ($P > 0.33$). Although response to diet was highly variable among cows for both DMI and milk yield, responses for DMI and milk yield were not related ($P = 0.73$). Further research is needed to assess the usefulness of rumen fill score for moving cows from the fresh diet to the high-group diet.

Key words: intake control, grouping cows, transition period

879 Effects of abomasal dosing of ferrous or ferric sulfate on short-term iron status of lactating dairy cows. O. N. Genther*, J. A. Zyskowski, T. H. Herdt, and D. K. Beede, *Michigan State University, East Lansing.*

The majority of Fe in feeds is in the ferric (Fe^{3+}) state, and poorly absorbed by ruminants. We hypothesize that the majority of Fe naturally occurring in drinking water is in the more bioavailable ferrous (Fe^{2+}) state. Therefore, Fe from drinking water, though present in lower concentrations, could have a greater impact on Fe status and potential toxicity than feed Fe. Our objective was to evaluate the difference in short-term effects of Fe^{2+} and Fe^{3+} when administered at concentrations to simulate total daily Fe intake from high-Fe drinking water. Six mid-lactation Holstein cows were assigned in a replicated 3 × 3 Latin Square balanced for treatment sequences. There were 7 d between experimental periods. Treatments were: 1) 0 mg Fe; 2) 1.5 mg Fe from ferrous sulfate/kg BW; and, 3) 1.5 mg Fe from ferric sulfate/kg BW. Treatments were iso-sulfate. The Fe^{2+} treatment approximated total Fe intake from water containing 9 ppm Fe, and the Fe^{3+} treatment provided the same Fe concentration. Treatments were infused in ~1 min directly into the abomasum via the ruminal fistula in 1.5 L of deionized water to avoid ruminal effects on Fe valence. Six hourly blood samples were taken before dosing; and, post-dosing hourly for 12 h each period. Liver biopsies were 0 (before dosing), 18 and 36 h of each period. Mean of pre-dosing blood samples was used as a covariate for each dependent variable in statistical analysis. There were no treatment by time interactions ($P > 0.10$) for serum Fe, unsaturated iron-binding capacity (UIBC), total iron-binding capacity (TIBC), percent Fe saturation, Zn, and for liver Fe, Cu and Zn. There was no main effect of treatment for any response variables. There was an effect of hour pooled across all treatments for serum Fe ($P = 0.014$), TIBC ($P = 0.043$), Fe saturation ($P < 0.0001$) and Cu ($P = 0.033$). There was a treatment by time interaction for serum α-tocopherol ($P = 0.016$) and Cu concentration ($P = 0.091$). Results indicate that dosing of amounts of Fe used in this study do not impact short-term Fe status of lactating dairy cows.

Key words: iron, lactating dairy cows, iron status

880 Evaluation of total mixed rations fractions retained on the Penn State Particle Separator as additional variables to influence milk production and composition. A meta-analysis. I. Schadt*[1], M. Caccamo[1], G. Azzaro[1], and G. Licitra[1,2], *[1]CoRFiLaC, Regione Siciliana, Ragusa, Italy, [2]DISPA, Catania University, Catania, Italy.*

Determination of forage and total mixed ration (TMR) fractions retained on the Penn State Particle Separator (PSPS) has become a widely used application on dairy farms and in research. The objective of this study was to evaluate the following variables on milk yield and percentage fat and protein: PSPS TMR fractions (% of total); chemical composition of TMR, [dry matter (DM % of as-fed), crude protein, neutral detergent fiber], and forage content (all as % of DM); average days in milk and average dry matter intake. A data file containing 109 treatment means was generated from 28 published research papers and one unpublished study conducted at the CoRFiLaC dairy research center. The variables, squared variables and possible interactions were tested, using the backward-forward elimination, stepwise selection option in PROC REG, multi-regression procedure using SAS statistical software. Models were calculated both ways, excluding and including PSPS fractions as variables and interactions where PSPS fractions were involved. A total of 150 or 108 variables were allowed to determine either predicting models including or excluding PSPS variables. Corrected R^2 values for the prediction models of milk yield were 0.95 and 0.91 when PSPS fractions were either admitted or not, involving 34 and 32 model terms, respectively. The models for milk fat prediction contained 32 and 26 possible terms, and corrected R^2s were 0.86 and 0.75 when PSPS variables were either included or not. Models to predict milk protein selected 18 and 17 terms either including or excluding PSPS variables, and respective R^2s were 0.79 and 0.58. These results suggest that for adequate formulation of dairy rations we might be able to eliminate some of the chemical analysis of feeds, which are currently recommended by some nutrition models. The consistent improvement in R^2 of predictive models suggests that physical measurements such as particle TMR fractions retained on the PSPS would provide additional information for dairy ration formulation, especially for milk composition.

Key words: TMR, feed evaluation, particle size

881 Effect of supplementary concentrate type on energy balance and blood metabolites in early lactation dairy cows offered grazed pasture. K. M. Pierce*, S. J. Whelan, J. J. Callan, and F. M. Mulligan, *School of Agriculture, Food Science and Veterinary Medicine, University College Dublin, Belfield, Dublin 4, Ireland.*

This experiment evaluates the effect of supplementary concentrate type on energy balance and blood metabolites in early lactation dairy cows offered a perennial ryegrass pasture. Forty 8 cows of mixed parity were assigned to 1 of 4 concentrate types in a randomized block design. Cows received perennial ryegrass plus 3 kg twice daily of the following concentrate types: Hi-Pro (18% CP), Lo-Pro (14% CP), Lo-Pro+ Meth (14% CP, with added methionine) and Lo-Pro Maize (14% CP). Hi-Pro, Lo-Pro and Lo-Pro+ Meth contained rolled barley, whereas Lo-Pro Maize contained stone ground maize as the main starch source. Blood was collected on d 14, 21, 28 and 35 post-calving for analysis of urea, non esterified fatty acids (NEFA), β-hydroxy butyric acid (BHBA) and glucose (GL). Pasture DMI was determined on wk 6 and 10 post calving. Data was analyzed using PROC MIXED of SAS. Dietary energy intake (18.23 ± 0.054 UFL/d) was not affected ($P > 0.05$) by treatment. A greater ($P < 0.05$) portion of dietary energy was recovered in the milk for Lo-Pro+ Meth (0.638 ± 0.034 of UFL intake) vs. Hi-Pro (0.535 ± 0.034 of UFL intake); Lo-Pro and Lo-Pro Maize were not different ($P > 0.05$) from other treatments. BHBA was higher ($P < 0.05$) for Hi-Pro (0.73 ± 0.045 mmol/L) vs. Lo-Pro Maize (0.58 ± 0.045 mmol/L); Lo-Pro and Lo-Pro+ Meth were not different from other treatments. NEFA were lower ($P < 0.05$) for Lo-Pro Maize (0.39 ± 0.058 mmol/L) vs. other treatments (0.59 ± 0.058 mmol/L). GL was higher for Lo-Pro Maize (3.34 ± 0.051 mmol/L) vs. Hi-Pro (3.14 ± 0.051 mmol/L); Lo-Pro and Lo-Pro+ Meth were not different from other treatments. Blood urea (1.39 ± 0.108 mmol/L) was not affected by treatment. Reducing concentrate CP and offering supplementary methionine improved energy efficiency. Reduced concentrations of GL, NEFA and BHBA in Hi-Pro vs. Lo-Pro Maize may be due to better energy balance.

Key words: supplementary concentrates, blood metabolites, dairy cows

882 Effect of total mixed rations particle fractions retained on the Penn State Particle Separator on milk yield lactation curves using a random regression animal model. M. Caccamo*[1], J. D. Ferguson[2], R. F. Veerkamp[3], I. Schadt[1], R. Petriglieri[1], G. Azzaro[1], A. Pozzebon[1], and G. Licitra[1,4], *[1]CoRFiLaC, Regione Siciliana, Ragusa, Italy, [2]University of Pennsylvania, PA, [3]WageningenUR Livestock Research, Animal Breeding and Genomics Centre, Lelystad, the Netherlands, [4]DISPA, Catania University, Catania, Italy.*

Several studies reported influence of diet on milk production. As part of a larger project aiming to develop management evaluation tools

based on results from test-day (TD) models, the objective of this study was to estimate the effect of total mixed rations (TMR) particle fractions estimated using the Penn State Particle Separator (PSPS) on milk, fat, and protein yield curves. A random regression TD animal model was fitted to a full data set (134,579 test-day records) to obtain variance components. The model included parity, days in milk (DIM), age at calving, year and season at calving, days dry, calving interval and stage of pregnancy as fixed effects. The term DIM was modeled using 9-order Legendre polynomial. Animal, sire and maternal grand sire effects were modeled using 3-order Legendre polynomials. Model fitting was carried out using ASREML. Then, the same model with fixed variance components was used on a subset containing 46,531 TD milk yield records from 2006 through 2008 from 3,554 cows in 27 herds in southeastern Sicily where TMRs were sampled immediately before or right after the TD. In these herds, TMR samples were collected every 3 mo, sieved using a PSPS including 19 (upper), 8 (middle), and 1 (lower) mm sieves and an additional bottom pan and proportions were measured. All sieve proportions and their interaction with DIM were included in the model as fixed effects. Conditional Wald F statistic on fixed effects revealed significant effects ($P < 0.001$) for all sieves on milk, fat, and protein yield, except upper sieve on fat and lower sieve on protein production. In particular, pan and lower sieve proportions were negatively related whereas those retained on the middle sieve were positively related to fat production at the beginning of the lactation. Furthermore, the correlations between milk curve shape and middle and lower sieve proportions were positive and negative, respectively, throughout the whole lactation, suggesting that PSPS sieve fractions could represent an additional important parameter for the formulation of dairy rations.

Key words: particle size, test-day model, total mixed ration