807 Effects of dietary conjugated linoleic acid (CLA) on growth, carcass characteristics and meat quality of heavy pigs. C. Corino[1], V. Bontempo*[2], S. Magni[1], G. Pastorelli[1], R. Rossi[1], D. Sciannimanico[1], and J. Mourot[3], [1]*University of Milan/Italy,* [2]*University of Molise/Italy,* [3]*INRA, Saint-Gilles/France.*

A study was conducted to determine the effect of conjugated linoleic acid (CLA) synthesized from sunflower oil on growth, carcass characteristics and meat quality of heavy pigs. Thirty-six pigs, half barrows and half females, averaging 97 kg L.W., allotted within weight and sex to a randomized complete experimental design, were fed diets supplemented with different CLA levels: 0.5% lard (C), 0.25% lard and 0.25% of CLA (T1), 0.5% of CLA (T2). CLA oil contained 65% CLA isomers (Conlinco, Inc., Detroit Lakes, Minnesota 56502 USA). The pigs were slaughtered at 172 kg L.W.. No significant differences were observed on ADG, FI, FE, dressing percentage, backfat tickness, pH and color of loin and ham. Fatty acid composition of ham fat was significantly affected by dietary CLA. Higher levels of saturated fatty acids (C=38.5^A, T1=43.7^B and T2=41.2^B SEM=0.754), lower levels of monounsaturated fatty acids (C=46.7^A , T1=42.1^B and T2=43.7^B SEM=0.854) and higher CLA content (C=0.54^A, T1=1.01^B and T2=0.92^B SEM=0.107) were observed on fat of pigs fed CLA. These data suggest that conjugated linoleic acid have no effects on growth performances, carcass characteristics and meat quality of heavy pigs during the last fattening period. The influence of CLA on fatty acid composition of ham adipose tissue may be very important from a technological point of view for the higher content of saturated fatty acids and from a nutritional point of view for the higher CLA content.

Key Words: Dietary conjugated linoleic acid, heavy pig , carcass characteristics

ASAS/ADSA Ruminant Nutrition: Byproducts

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810 Effect of feeding a raw soybean hull-corn steep liquor pellet on the metabolism and performance of lactating dairy cows. J. M. DeFrain*[1], J. E. Shirley[1], E. C. Titgemeyer[1], A. F. Park[1], and R. T. Ethington[2], [1]*Kansas State University, Manhattan,* [2]*Minnesota Corn Processors, Inc.*

Eighteen multiparous Holstein cows (148 ± 35 DIM) averaging 41.5 kg/d ECM were used in six 3 × 3 Latin squares with 28-d periods to evaluate the effect of a raw soybean hull-corn steep liquor pellet (SHSL) on the performance of lactating dairy cows. Cows were blocked by pretreatment BW and ECM and assigned to control (C), SHSL (20% of diet DM), or pelleted raw soybean hulls (SH, 15% of diet DM). C contained 30% alfalfa hay, 15% corn silage, 34% corn, 9.3% whole cottonseed, 5% soybean meal (SBM), 2% fish meal, 0.5% blood meal, 1% wet molasses, and 3.2% vitamin/minerals. SHSL replaced 6.2% alfalfa hay, 3.7% corn silage, 6.6% corn, 3.3% SBM, and 1.7% expeller SBM replaced solvent SBM to maintain similar dietary RUP levels. SH replaced 6.2% alfalfa hay, 3.7% corn silage, and 5.1% corn. Diet CP % and energy density (Mcal/kg NEL) were 16.6 and 1.78, 16.3 and 1.73, 17.1 and 1.71 for C, SHSL, and SH, respectively. DMI of cows fed SHSL were similar to C and SH, but cows fed SH consumed more ($P < 0.05$) DM than cows fed C. Milk and ECM were similar for cows fed SHSL and SH, but lower ($P < 0.05$) for those fed C. Production efficiencies (ECM/DMI) were not affected by diet, but CP output in milk/CP intake was highest ($P < 0.05$) for cows fed SHSL and similar between those fed SH and C. Milk fat percent and SCC were similar for cows fed SHSL and SH but higher ($P < 0.05$) for those fed C. Milk fat yield and milk protein percent were not affected by diet, but feeding SHSL and SH increased ($P < 0.05$) milk protein yield, MUN, and PUN. BW, BCS, milk N distribution, and glucose, NEFA, and triacylglycerol in plasma were not influenced by diets. Cows fed SHSL and SH had higher ($P < 0.05$) total alpha-amino N in plasma, but individual amino acids in plasma were similar. SHSL can replace a portion of the forage, grain, and SBM in diets for lactating dairy cows without decreasing production.

Key Words: Soybean hulls, Steep liquor, By-product

811 The impact of feeding a raw soybean hull-corn steep liquor pellet on induced subacute ruminal acidosis in lactating cows. . J. M. DeFrain*[1], J. E. Shirley[1], E. C. Titgemeyer[1], A. F. Park[1], and R. T. Ethington[2], [1]*Kansas State University, Manhattan,* [2]*Minnesota Corn Processors, Inc.*

We used four ruminally canulated, multiparous Holstein cows (690 kg; 21 kg/d milk) in a 2-period cross-over design to determine the impact of feeding a raw soybean hull-corn steep liquor pellet (SHSL) on induced subacute ruminal acidosis (SARA) in lactating cows. Cows were fed control (30% alfalfa hay, 15% corn silage, 34% corn, 9% whole cottonseed, 5% soybean meal (SBM), 2% fish meal, 0.5% blood meal, 1% wet molasses, and 3.5% vitamin/minerals) or SHSL (20% of diet DM) diets as TMR. SHSL replaced 6.2% alfalfa hay, 3.7% corn silage, 6.6% corn, 3.3% SBM, and 1.7% expeller SBM replaced solvent SBM to maintain similar dietary RUP levels. Periods were 15 d (10 d adaptation, 2 d for pre-challenge measures, and 3 d of SARA challenge). During d 7 to 12 cows were fed once daily at a common DMI (3.2% of BW) dictated by the cow consuming the least. Cows were fasted 12 h prior to the first SARA challenge. For each SARA challenge (d 13, 14, and 15), cows were offered 75% of their daily diet at 0600 h. The remaining 25% of diet DM was replaced by ground corn which was mixed with orts remaining 2 h after feeding and placed into the rumen at that time. Rumen fluid was collected before and 3, 6, 9, and 12 h after feeding during d 11 to 15. Ruminal pH declined linearly with time after feeding ($P < 0.01$), and this decrease was greater during the SARA challenges ($P < 0.01$). Ruminal lactate was essentially 0 on d 11 and 12 and increased linearly ($P < 0.05$) with repeated SARA challenges. Concentrations of total ruminal VFA increased linearly ($P < 0.01$) after feeding, and increases were greater on challenge days than on d 11 and 12. There were no differences due to SHSL inclusion. These data suggest the model used to induce SARA was successful and the partial replacement of alfalfa, corn silage, corn, and SBM by SHSL did not influence the response to SARA challenges.

Key Words: Acidosis, Soyhulls, Steep liquor

812 Relative nutritive value of dried versus wet brewers' grain for dairy cows. T. R. Dhiman[1], M. S. Zaman*[1], I. S. MacQueen[1], and H. D. Radloff[2], [1]*Department of Animal, Dairy and Veterinary Sciences, Utah State University, Logan, UT 84322-4815,* [2]*A-L Gilbert Company, Oakdale, CA.*

Twenty-four lactating cows (699 41.1 kg BW; 56 25.3 days in milk) were used to study the nutritive value of dried and wet brewers' grain for dairy cows. Twenty intact and four cows fitted with a rumen cannula were blocked according to milk yield and randomly assigned to two treatments. Each treatment had ten intact and two cows fitted with a rumen cannula. Cows were fed a total mixed ration (TMR) twice a day containing either dried or wet brewers' grain at 15% of the dietary DM. The diet contained 43% forage and 53% concentrate. The experimental design was a switch back with two periods. Each period was 5 wk. First 2 wk in each period were considered as an adaptation to the diets and data from the last 3 wk were used for treatment comparisons. Total duration of the experiment was 10 wk. Once a week milk samples were analyzed for chemical compositions. Ruminal pH, ammonia-N and VFA concentrations were measured in the rumen-cannulated cows. Dried and wet brewers' diets contained 68.0 and 66.5% DM; 16.9 and 16.9% CP; 40.4 and 42.0% NDF; 24.4 and 24.5% ADF, respectively. The feed DM intake were 25.4 and 24.8 kg/d and 3.5% fat corrected milk (FCM) yield 39.8 and 40.1 kg/d for cows fed dried and wet brewers' grain, respectively. Cows fed dried or wet brewers' grain had similar ($P > 0.05$) feed intake, milk yield, energy intake, milk composition, feed efficiency (FCM/DMI), ruminal pH, ruminal ammonia-N and ruminal total VFA concentrations. The results suggest that the performance of cows fed either dried or wet brewers' grain at 15% of dietary DM was similar when the TMR had the same amount of DM. The storage of wet brewers' grain for a lengthy time is always a concern especially in summer. However, based on milk yield response and drying cost, it might be beneficial to feed wet brewers' grain in areas close to the brewery.

Key Words: Cow, Brewer's grain, Milk

813 Effects of mechanical treatment of high-moisture rye and wheat grains on ruminal fermentation and nutrient digestibilities in steers . K.-H. Sdekum[1], A. Schrder[1], C. Idler[2], T. Hoffmann[2], M. Klein[1], and C. Frll[2], [1]*University of Kiel, Germany,* [2]*ATB, Potsdam, Germany.*

In maritime climates cereal grains are often harvested at dry matter (DM) concentrations below 86% that prevent direct storage as food or feed ingredient. Airtight storage without additives of high-moisture, rolled grain containing > 80 and < 86% DM has emerged as a low-cost alternative to additive-supported storage. We studied effects on nutrient digestibilities and ruminal fermentation in steers of mechanical treatments applied to wheat and rye grains after storage. Wheat and rye grains were harvested at approximately 82% DM, rolled and stored airtight in a bunker silo. Each grain type was fed in three different physical forms to six mature, ruminally cannulated steers: Rolled prior to storage (ROLLED),ROLLED plus ground prior to feeding in a mill with a 6-mm sieve, and ROLLED plus ground prior to feeding in a mill with a 3-mm sieve. Steers were fed at 1.3 times maintenance energy requirements on forage:concentrate diets (30:70, DM basis) containing > 45% starch twice daily at 0700 and 1900 h. Wheat and rye were fed in two separate trials each according to a replicated 3 × 3 Latin square design. The same 30:70 forage:concentrate diet containing a dry-ground wheat-and-rye (50:50) mix (88% DM) was fed to the same group of six steers in a separate trial. Across all trials, organic matter (OM) and starch digestibilities were not affected ($P > 0.10$) by grain type or mechanical treatment. Average whole-tract OM and starch digestibilities were 80 and 99%, respectively. As a general observation, ruminal pH values were above 6.0 for almost all hours during the 24-h cycle. On an average, ruminal pH was 0.2 pH units higher with the wheat than with the rye diets, indicating a more rapid fermentation of rye. Grain source affected ruminal pH values more than did mechanical treatment. Rolling high-moisture wheat and rye grains prior to airtight storage appears sufficient to ensure complete starch digestion while maintaining a favorable ruminal environment.

Key Words: Cereal grain, Digestibility, Ruminal fermentation

814 Dehydrated bermudagrass pellets (DBP) produced with swine lagoon effluent as a substitute for cottonseed hulls (CSH) in diets for backgrounding steers. . M.H. Poore*, B.A. Hopkins, and G.A. Benson, *North Carolina State University, Raleigh.*

Production of DBP might be an option for removing high quality forage from swine sprayfields. This trial evaluated two batches of DBP (2 and 4 wk maturities) for growing cattle. Respective nutrient concentrations for the 2 and 4 wk were; CP, 19.7 and 16.5; NDF, 66.3 and 66.9; ADF, 32.6 and 35.7; and nitrate ion, 1.20 and 0.89%. Fifty-six steers (initial wt 294 kg) were individually fed for 84-d. The control diet was (DM basis) 25% corn silage (CS), 25% CSH, 20% corn, 18.5% soybean hulls (SH) and 10.7% soybean meal (SBM). Each source of DBP was substituted for 1/3, 2/3 or all the CSH to make 7 diets (control, 1/3 2 wk, 2/3 2 wk, 3/3 2 wk, 1/3 4 wk, 2/3 4wk and 3/3 4 wk = diet 1, 2, 3, 4, 5, 6 and 7, respectively). SH and SBM were adjusted to maintain CP at 13% and NDF from roughage at 43%. Substituting 2 wk DBP for CSH resulted in a linear (L, P<.01) and quadratic (Q, P<.03) effect on DMI while 4 wk had no influence (10.3, 11.0, 10.1, 8.9, 9.9, 10.1 and 9.8 kg/d for diet 1, 2, 3, 4, 5, 6 and 7, respectively). Average daily gain response to 2 wk was L (P<.04) while the response to 4 wk was both L (P<.08) and Q (P<.05; 1.91, 1.86, 1.74, 1.72, 1.65, 1.68 and 1.71 kg/d for diet 1, 2, 3, 4, 5, 6, and 7, respectively). Feed efficiency showed a Q response to 2 wk (P<.05) while the response to 4 wk tended (P=.16) to be Q (.186, .171, .173, .196, .167, .168 and .174 for diet 1, 2, 3, 4, 5, 6 and 7, respectively). An economic analysis was conducted assuming a value of .110, .138, .22, .039 and .088 $/kg for CSH, corn, SBM, CS and SH, respectively, and an initial and final cattle value of 1.76 and 1.56 $/kg shrunk wt. Assuming no value for the DBP, return over feed cost response was L to 2 wk (P<.01) while for 4 wk the response was both L (P<.01) and Q (P<.03), showing the DPB had value. Calculated value of DBP was .058, .193, .140, -.063, .027 and .113 $/kg in diet 2, 3, 4, 5, 6 and 7, respectively. This study showed that DPB has potential in this type of diet, especially at the higher inclusion levels.

Key Words: Bermudagrass, Cottonseed Hulls, Cattle

815 Effects of replacing dietary high moisture corn with dried molasses on production of dairy cows. G. A. Broderick* and W. J. Smith, *U.S. Dairy Forage Research Center, Madison, WI.*

Eight primiparous and 40 multiparous (8 with rumen cannulae) Holsteins were blocked by parity and DIM, randomly assigned to 4 blocks of 12 and fed TMR containing (DM basis): 40% alfalfa silage, 20% corn silage, 8% soybean meal, 2% added fat, 1% minerals and vitamins, and 18% CP. Dietary sugar was varied by replacing rolled high moisture shelled corn (HMSC) with dried molasses. The 4 diets were: 0% molasses, 29% HMSC; 4% molasses, 25% HMSC; 8% molasses, 21% HMSC; or 12% molasses, 17% HMSC. Cows were fed the 0% molasses diet for a 2-wk covariate period, experimental diets for 8 wk, then the 0% molasses diet for another 2 wk covariate. Milk yield and DMI were measured daily. Yield of milk components was determined one day in both covariates and every 2-wk in the 8-wk trial. Rumen sampling was in trial wk 4 and 8. The statistical model included block and covariate average. LS means are reported below. There was a linear increase in DMI and linear decreases in milk/DMI and milk N/NI with increasing dietary sugar. There were quadratic responses in yield of FCM and fat, and rumen NH_3, with increasing sugar; FCM and fat yield maxima and rumen NH_3 minimum occurred at about 6% molasses. Several cubic responses were noted that were related to similar milk and protein yields at 0 and 8% molasses. Replacing readily fermented starch with dietary sugar primarily increased fat yield.

Item Molasses, %	0	4	8	12	SE	L[1]	Q[1]	C[1]
HMSC, %	29	25	21	17				
DMI, kg/d	25.1	25.8	26.2	26.0	0.3	0.04	0.16	0.83
Milk, kg/d	38.0	37.5	38.9	36.7	0.6	0.34	0.16	0.04
Milk/DMI	1.51	1.46	1.48	1.43	0.02	0.03	0.99	0.17
Milk N/NI	0.255	0.244	0.254	0.231	0.006	0.02	0.29	0.03
3.5% FCM, kg/d	41.4	42.0	43.4	39.5	1.0	0.33	0.04	0.20
Fat, %	4.07	4.26	4.11	4.06	0.10	0.65	0.24	0.33
Fat, kg/d	1.54	1.59	1.63	1.47	0.04	0.34	0.03	0.36
Protein, %	3.12	3.09	3.11	3.04	0.04	0.29	0.61	0.45
Protein, kg/d	1.19	1.14	1.23	1.09	0.03	0.10	0.11	0.01
True protein, kg/d	1.14	1.09	1.17	1.05	0.03	0.11	0.19	0.02
SNF, kg/d	3.38	3.30	3.49	3.18	0.08	0.25	0.18	0.05
Rumen NH_3, mM	11.3	9.1	10.7	10.7	0.5	0.86	0.05	0.03

[1]Probability of linear (L), quadratic (Q) and cubic (C) effects.

Key Words: Molasses, High moisture corn, Milk yield

816 Effects of pea silage as a forage source in high concentrate diets on ruminal metabolism and total tract nutrient utilization of steers. S. G. Wielgosz*, A. F. Mustafa, D. A. Christensen, and J. J. McKinnon, *University of Saskatchewan, Saskatoon, Saskatchewan, Canada.*

A study was conducted to determine the feeding value of pea silage (PS) relative to alfalfa silage (AS) and barley silage (BS) in high concentrate diets of beef steers on ruminal fermentation and total tract nutrient utilization. Nine steers, six of which were equipped with ruminal cannulae were used in a randomized complete block design. Finishing diets were formulated to contain 90% barley-based concentrate and 10% forage, which included either PS, AS or BS. All diets were formulated to be isonitrogenous. Steers fed PS and AS as forage sources had a similar dry matter (DM) intake (average 11.5 kg), which was greater ($P < 0.05$) than that of steers fed BS (9.5 kg). Total tract digestibility of DM and gross energy was higher ($P < 0.05$) for steers fed PS (80.9 and 80.0%, respectively) than for those fed AS (78.6 and 77.9%, respectively) or BS (77.6 and 77.0%, respectively). Forage source had no effect on total tract digestibility of crude protein, neutral detergent and acid detergent fiber. Ruminal pH was higher ($P < 0.05$) for steers fed PS relative to steers fed AS or BS while ruminal ammonia nitrogen concentration was higher ($P < 0.05$) for steers fed PS and BS compared with those fed AS. Total ruminal volatile fatty acid concentration was not affected by forage source. However, molar proportions of acetate and butyrate were higher ($P < 0.05$) while that of propionate was lower ($P < 0.05$) for

steers fed PS and BS relative to steers fed AS. It was concluded that the inclusion of PS as a forage source in finishing diets of beef steers can increase feed intake and improve nutrient utilization when compared with AS and BS.

Key Words: Pea Silage, Nutrient utilization, Ruminal metabolism

817 Prediction of the in vivo digestibility of grass silage from gas production kinetics. P. Huhtanen*[1], M. Ots[2], S. Ahvenjrvi[1], and M. Rinne[1], [1]*MTT Agrifood Research Finland,* [2]*Estonian Agricultural University.*

The objective of this study was to compare in vivo OM (OMD) and NDF digestibility (NDFD) determined in sheep and those predicted from in vitro gas production data using a rumen model. Fifteen silages were made from 1st cut timothy-meadow fescue sward at different stages of maturity over three years. The rate and extent of gas production was measured using computerized gas monitoring system with pressure transducers and electric valves to release overpressure. Triplicate incubations of 72 h were made using 500 mg samples of the whole forage and NDF residue. Kinetic parameters were estimated using two-pool Gompertz model. Potential NDF digestibility (pNDFD) was determined by 12 d in situ incubation in nylon bags. Rumen digestibility of digestible NDF (RDpNDFD)was predicted using a two compartmental rumen model assuming a 50 h retention time in the fermentation compartments. In vivo NDFD was predicted as pNDFD × RDpNDFD. In vivo OMD was estimated from the predicted NDFD and applying the Lucas equation for cell solubles (OM-NDF). Total gas production (TGP) was not correlated (R^2=0.001) with in vivo OMD (range 61.3-83.2%). However, there was a good relationship between TGP and in vivo NDFD (R^2=0.90), and between TGP and pNDFD (R^2=0.94). Based on the Lucas equation, the true digestibility of cell solubles was 100% and metabolic faecal OM output was 96 g per kg DMI. A combination of predicted NDFD and parameters from the Lucas equation for cell solubles was a good predictor of in vivo OMD (Y = -0.74 + 1.003X, R^2=0.99; se.est 0.85). This approach was better than using kinetic parameters estimated for the whole forage (Y = -5.50 + 1.092X, R^2=0.99; se.est 1.41). Gas production method is a useful tool to estimate digestion kinetic parameters to be used in rumen models to predict in vivo NDFD and OMD of silages. The results suggest that using NDF rather than whole forage in incubations predicts feeding value of forages more accurately.

Key Words: Forage Digestibility , Gas Production, Modelling

818 Comparison of Novartis corn silage hybrids for yield, nutrient traits, and lactational performance by high producing dairy cows. E. D. Thomas[1], C. S. Ballard*[1], P. Mandebvu[1], C. J. Sniffen[1], M. P. Carter[1], and J. Beck[2], [1]*W. H. Miner Agricultural Research Institute, Chazy, NY,,* [2]*Novartis Seeds, Inc., Golden Valley, MN.*.

Novartis N29-F1 (N29-F1), a dual-purpose 90-d relative maturity corn hybrid, and Novartis NX3018 (NX3018), a 90-d relative maturity leafy corn silage hybrid planted in replicated 15.2 x 351-m plots were compared. Parameters measured from N29-F1 and NX3018, respectively, prior to ensiling were DM yield (t/ha): 14.7, 13.7 (SE=0.69; P=0.407); 30-h in vitro true DM disappearance (IVTDMD) (%): 77.8, 79.9 (SE=1.04; P=0.228); 30-h IVNDFD (%): 49.2, 53.9 (SE=1.13; P=0.044); starch (%DM): 40.6, 37.0 (SE=1.34; P=0.202); and NDF (%DM): 39.6, 41.6 (SE=1.33; P=0.405). Plant fractions expressed as a proportion of whole plant on DM basis for N29-F1 and NX3018, respectively, were grain: 53.4, 49.8 (SE=0.88; P=0.005); leaves: 10.2, 12.3 (SE=0.21; P=0.0001); and stalks: 22.5, 25.1 (SE=0.81; P=0.026). The IVTDMD for plant fractions on DM basis for N29-F1 and NX3018, respectively, were grain: 97.6, 98.9 (SE=0.14; P=0.022); leaves: 71.6, 77.4 (SE=0.85; P=0.041); and stalks: 42.7, 53.4 (SE=2.68; P=0.107). The lactation study was conducted as a crossover design with two 28-d periods. Nutrient parameters of N29-F1 and NX3018 corn silages, respectively, used in the lactation trial were NDF (%DM): 40.6, 40.7; starch (%DM): 35.6, 34.6; IVTDMD (%): 77.0, 81.1; and IVNDFD (%): 45.7, 55.3. Thirty-eight mid-lactation multiparous Holstein cows (7823.0 DIM; 47.28.87 kg/cow average daily milk yield) were blocked and assigned randomly to one of two TMR containing on DM basis approximately 26% N29-F1 or NX3018 corn silage. The TMR which were formulated using the CPM Dairy® nutrition model, had a forage to concentrate ratio of 44 to 56%, and contained 36.5% NDF, and 17.8% CP on DM basis. Cows were group-fed TMR for ad libitum intake. Measurements collected from the cows fed N29-F1 and NX3018 corn silage-based TMR, respectively, were milk yield (kg/d): 45.1, 46.6, (SE=0.45; P=0.024); 3.5% FCM yield (kg/d): 47.2, 48.9 (SE=0.61; P=0.059); milk fat (%): 3.90, 3.89 (SE=0.078; P=0.973); milk CP (%): 3.08, 3.06 (SE=0.012; P=0.222); SCC (x1000/ml): 143, 215 (SE=33.9; P=0.991); and body condition score: 3.09, 3.12 (SE=0.022; P=0.332). The average daily DMI across treatments was about 28.2 kg/cow. In conclusion, NX3018 was more leafy and more digestible in vitro compared to N29-F1, and cows that were fed NX3018 produced more milk than cows fed N29-F1.

Key Words: corn silage hybrids, DM yield and digestibility, dairy cow and milk yield

819 Crop processing and chop length effects in brown midrib corn silage on dry matter intake and lactation performance by dairy cows. E. C. Schwab* and R. D. Shaver, *University of Wisconsin, Madison, WI.*

Brown midrib-3 corn silage was harvested at three-quarter milkline stage of maturity using a crop-processing harvester with rolls set at 2 mm clearance (PR) or unprocessed (UP). Theoretical lengths of cut (TLC) were 13 and 19 mm for unprocessed corn silage treatments (13UP and 19UP), and 19 and 32 mm for the processed corn silage treatments (19PR and 32PR). Corn silage treatments were stored in four separate silo bags. Dry matter, NDF, and ADF concentrations (DM basis) of the corn silage treatments averaged 39%, 37%, and 23%, respectively. Mean particle size of 13UP, 19UP, 19PR, and 32PR corn silage treatments were 9.7, 12.0, 9.7, and 10.8 mm, respectively. Twenty-four multiparous Holstein cows averaging 102±17 DIM at trial initiation were used in a replicated 4 X 4 Latin square design with 28-d periods. Orthogonal contrasts were used to evaluate TLC (13UP vs. 19UP and 19PR vs. 32PR) and crop processing (19UP vs. 19PR) effects. Diets formulated to contain 18% CP were fed twice daily as a TMR comprised of 40% respective treatment corn silage, 20% alfalfa silage, and 40% concentrate (DM basis). The DM, NDF and ADF concentrations (DM basis) of the four treatment diets averaged 56%, 26%, and 16%, respectively. Increasing TLC reduced ($P < 0.05$) DMI in unprocessed (25.5 kg/d for 19UP vs. 26.6 kg/d for 13UP) and processed (25.1 kg/d for 32PR vs. 25.9 kg/d for 19PR) corn silage treatments. Chop length did not affect milk and 3.5% FCM yields or milk protein percentage and yield. Crop processing did not affect DMI or milk yield, but there was a trend ($P < 0.10$) for reduced 3.5% FCM in the 19 mm TLC processed corn silage treatment (40.6 kg/d for 19PR vs. 41.8 kg/d for 19UP). Milk fat percentage (3.11 vs. 3.35%) and yield (1.35 vs. 1.43 kg/d) were reduced ($P < 0.05$) by crop processing of the 19 mm TLC corn silage treatment. In this trial with brown midrib corn silage fed to mid lactation dairy cows, there were no benefits from crop processing or increasing TLC on DMI or lactation performance.

Key Words: crop processing, chop length, corn silage

820 Neutral Detergent Fiber Concentration in Corn Silage Influences Dry Matter Intake, Diet Digestibility, and Performance of Growing British and Holstein Steers. K.E. Tjardes*, D.D. Buskirk, M.S. Allen, and R.J. Tempelman, *Michigan State University, East Lansing, MI.*

Twelve British (237 ± 13 kg) and 12 Holstein (235 ± 15 kg) steers were used to determine if a corn silage-based diet high in NDF depresses DMI as steers increase in body weight and to determine if a diet high in NDF has the same influence on British and Holstein steers. Steers were randomly assigned to individual slatted-floor pens and used in a crossover design consisting of six 14-d periods. Experimental diets contained corn silage from a normal hybrid (low-fiber; **LF**) and its male-sterile counterpart (high-fiber; **HF**). The LF and HF diets contained 33.8 and 50.8% NDF. The HF diet reduced ADG (0.99 vs 1.15 kg/d; P<0.01) and consistently decreased steer DMI during each period (P<0.01). Holsteins consumed 14.4% more DM, and gained 14.3% faster than British steers (P<0.01). There was a fiber level × breed interaction (P<0.10) for efficiency of gain. British steers receiving HF were more efficient than British steers consuming LF (0.188 vs 0.173); however, Holsteins consuming LF were more efficient than those receiving HF (0.186 vs 0.174). The HF treatment increased total-tract digestibility of NDF and ADF (9.4 and 8.4%; P<0.01), but reduced digestibility of DM and GE (4.6

and 4.5%; $P<0.01$), and decreased DE intake 20.5% ($P<0.01$). Holsteins had similar digestibility of DM and GE, but had greater DE intake ($P<0.01$) when compared to British steers. Change in DM digestibility was negatively correlated to change in DMI (r = -0.48; $P<0.01$) for LF vs HF within British steers, but not Holsteins ($P=0.42$). There were fiber level × breed interactions for digestibility of NDF and ADF ($P<0.10$). When comparing Holstein to British steers, digestibility of NDF and ADF was 4.1 and 3.4% lower for LF, but was only 1.1 and 0.6% lower for HF, respectively. Results from this trial suggest that high NDF corn silage diets may reduce intake of both British and Holstein steers by physical fill, and this reduction in DMI continues as steers increase in body weight from 240 to 330 kg.

Key Words: Fiber Level, Physical Fill, Male-sterile Corn

ASAS/ADSA Ruminant Nutrition: Fiber

821 Measuring neutral detergent fiber in feeds and forages. D. R. Mertens*[1] and D. Sauvant[2], [1]*US Dairy Forage Research Center, Madison, WI,* [2]*INRA-Institut National Agronomique, Paris-Grignon.*

Neutral detergent fiber (NDF) is an important characteristic for measuring the nutritive value of feeds and forages. For ruminants, fiber can be defined as the indigestible or slowly-digesting components of feeds that occupy space in the gastrointestinal tract, which indicates that fiber can be determined only by the animal. Measurement of fiber is a compromise between the theoretical concept and the utility of using chemical methods to isolate and measure fractions that closely resemble it. The method used to isolate it, in effect, defines a specific type of fiber; therefore, it follows that fiber methods must be followed exactly to obtain results that are valid and reproducible. The NDF method was originally designed to measure fiber in forages and has acquired the reputation of being variable and difficult to use with other feeds. However, the greatest source of variability in NDF is related to various modifications and alternative procedures. In addition, laboratories sometimes modify fiber methods for convenience or speed without understanding how these changes affect results. Many factors can affect the determination of fiber and it is important to understand the conditions and steps in fiber methods that must be followed closely to obtain accurate results. Among these are: subsampling, drying, grinding and amount of the sample, standardization of reagents, pretreatment with acetone, removal of starch and nitrogen contamination, timing and temperature of refluxing, soaking, washing and transferring of fibrous residues, type of filtration vessel, method of weighing, and correction for ash or protein. Use of heat-stable amylase to remove starches and sulfite or proteases to remove nitrogen have significant impact on NDF determinations. They also affect soluble carbohydrate estimates that are calculated by difference. The amylase-treated NDF (aNDF) method, which uses both amylase and sulfite, solves most of the problems associated with measuring NDF, and with appropriate modifications can be used to measure fiber in protein, starch, pectin and fat-containing materials.

Key Words: Fiber methods, NDF, Feed evaluation

822 Fiber requirements for finishing beef cattle - a commercial feedlot perspective. R.S. Swingle*, M.E. Branine, and K.K. Karr, *Cactus Feeders and Cactus Research, Ltd., Amarillo, TX.*

It is generally accepted that dietary fiber is necessary in diets for finishing beef cattle to maximize net energy intake above maintenance and to lessen the risk of metabolic disorders. Fiber functions primarily to assist in maintaining ruminal pH above a critical threshold. Therefore, fiber requiremenents must be considered in the context of the physical nature of the fiber, fermentability of diet organic matter and meal size and frequency. Finishing diets typically contain only minimal fiber (5 to 15% roughage on a DM basis) and a high concentration of readily fermentable organic matter, which magnifies the importance of feeding management for influencing feed intake patterns to minimize daily fluctuations in ruminal pH. Concepts used to optimize NDF in diets for lactating dairy cows may be useful for refining fiber requirements for feedlot cattle but have not been tested extensively. Progress in this area is hindered by a lack of consensus on appropriate response criteria for assessing fiber status and a paucity of fiber equivalency values for diet formulation. Effects of fiber source, fiber level or organic matter fermentability treatments on rate of gain might be a practical indicator of fiber adequacy under research conditions due to the direct relationship between rate of gain and net energy intake. Because particle size distribution is a major determinant of fiber effectiveness, establishing the critical particle length for fiber in finishing diets and a more complete catalogue of particle size distributions and variation in common diet ingredients would be useful. Economic and operational realities continually provide incentives to minimize fiber in finishing diets; the challenge is to develop procedures that will more precisely determine the minimum level that is compatible with production and economic objectives of specific feeding operations.

Key Words: Feedlot Cattle, Fiber Requirements, Effective Fiber

823 Digestible fiber from forages for lactating cows. M. S. Allen*, M. Oba, and J. A. Voelker, *Michigan State University, East Lansing.*

Coarse dietary fiber benefits lactating cows through selective retention of digestible organic matter in the rumen, more consistent supply of absorbed fuels within a day, and moderation of ruminal pH. However, energy density of neutral-detergent fiber (NDF) is lower and forage NDF is more filling than other dietary components; diets with high forage NDF can reduce energy intake by mechanisms related to ruminal distention. Forage NDF that is highly digestible is less filling and allows greater energy intake. Distention becomes a dominant mechanism limiting feed intake as milk yield increases, thus response to increased in vitro NDF digestibility is positively related to milk yield of cows. Maximum extent of digestion of forage NDF is negatively related to NDF lignification and is determined by environmental conditions during growth, plant genetics, and maturity at harvest. Digestibility of NDF in vivo is further determined by ruminal retention time and rate of digestion. Rate of NDF digestion is limited by low ruminal pH, high starch diets, and availability of nutrients for microbial growth. Although digestibility of forage NDF measured in vitro or in situ is positively related to feed intake and milk yield within a forage family, grass NDF digests and passes from the rumen more slowly than legume NDF and is therefore more filling despite its generally higher digestibility. Digestibility of NDF measured in vitro or in situ is negatively related to the filling effects of NDF, but is not necessarily an index of energy content. Forages with higher in vitro NDF digestibility allow greater DMI for cows with fed intake limited by physical fill, but reduced ruminal retention time decreases differences in NDF digestibility in vivo. Although DMI and NDF digestibility are positively related, DMI by cows is less limited by distension in the gastrointestinal tract as NDF digestibility increases, and therefore diminishing returns are expected for DMI. This presentation will discuss factors affecting NDF digestibility of forages, measurement and prediction of NDF digestibility, and benefits of highly digestible forage NDF.

Key Words: NDF digestibility, lactating cows, forage

824 Empirical modeling of ruminal pH from dietary NDF and mean particle size. D. Sauvant*[1] and D. Mertens[2], [1]*Institut National Agronomique Paris-Grignon - INRA,* [2]*US Dairy Forage Research Center.*

Accurate prediction of rumen pH is a challenge in ruminant nutrition. Numerous experiments have studied some aspects of the effects of the chemical and physical characteristics of fiber on ruminal pH. The results of these studies were combined for a meta-analysis of fiber-related factors affecting ruminal pH. Two databases were compiled, the first one consisted of trials where NDF content was the experimental factor and its mean value was <50% DM (35 publications, 46 experiments, 120 treatments; NDF = 32.2 6.2% DM (mean standard deviation or sd). The second database consisted of data from experiments where dietary mean particle size (MPS) was the primary experimental factor (12 publications, 19 experiments, 51 treatments; MPS = 2.59 1.48 mm). Ruminal pH were similar between the two bases (pH = 6.16 0.30, n = 120 and pH = 6.25 0.32, n = 51). A GLM model of variance-covariance was used for statistical analysis that allowed relationships