586 Effects of feeding triticale dried distillers grains with solubles as a N source on productivity of lactating dairy cows. M. Oba* and T. D. Whyte, *University of Alberta*, *Edmonton, AB, Canada*.

The objective of this study was to evaluate the effects of replacing protein sources that are commonly used in North America with triticale dried distillers grains with solubles (TDDGS) as a source of dietary N on the productivity of lactating dairy cows. Experimental diets contained 17.1% TDDGS, 17.5% Corn DDGS (CDDGS), 13.1% canola meal (CM), or 10.2% soybean meal (SBM) on a DM basis so that each feedstuff supplied 30% of total dietary crude protein (CP). All diets, which were formulated to contain 17.2% CP and 21.2% forage neutral detergent fiber (NDF), were fed to twelve multiparous Holstein cows (130 ± 40 days in milk) in a replicated 4 × 4 Latin square design with 21-d periods. Plasma concentrations of arginine, lysine, and threonine were greater for cows fed CM or SBM compared to those fed TDDGS or CDDGS ($P < 0.01$) while plasma concentrations of leucine and phenylalanine were lower for cows fed CM or SBM compared to those fed TDDGS or CDDGS ($P < 0.05$). Dry matter intake and milk yield were not affected by treatment (25.5 and 35.5 kg/d, respectively). Cows fed CDDGS had a lower plasma glucose concentration ($P = 0.04$; 49.3 vs. 53.5 and 52.6 mg/dL, respectively), and decreased yields of milk CP ($P < 0.01$; 1.01 vs. 1.17 and 1.14 kg/d, respectively), and milk lactose ($P = 0.03$; 1.43 vs. 1.66 and 1.59 kg/d, respectively) compared to cows fed CM or SBM. Cows fed TDDGS had similar plasma glucose concentration (53.5 mg/dL), and milk CP (1.10 kg/d), and milk lactose (1.57 kg/d) yields as cows fed CM or SBM. Furthermore, cows fed TDDGS or SBM had a greater body weight gain compared to cows fed CDDGS ($P = 0.05$; 514 and 390 vs. -290 g/d, respectively). These data suggest that TDDGS can replace CM or SBM in the diets of lactating dairy cows without adverse effects on production, and may be better N source than CDDGS.

Key Words: Triticale, Dried Distillers Grains with Solubles, Milk Protein Production

587 Nutritional profile of distillers dried grains with solubles from 40 ethanol plants. Y. Zhang*, J. Sido, and B. Wrenn, *National Corn-to-Ethanol Research Center*.

One of the barriers to broader use of distillers dried grains with solubles (DDGS) in animal feed is concern regarding nutritional variability of materials produced by different plants and temporal variations within a single plant. The nutritional variability of DDGS was investigated in a broad-based study involving samples collected from 40 ethanol plants over a period of one year. These 40 plants represent one third of the dry-grind plants in the U.S., and their geographical distribution was similar to the national distribution. The moisture, crude protein (CP), crude fat (CF), neutral-detergent fiber (NDF) and fermentable sugars (FS) were measured using either American Feed Industry Association (AFIA) recommended methods or modified AOAC methods. The results are shown in Table 1.

The use of recommended analytical methods for DDGS reduced the variability caused by analytical testing. Plant processing conditions and the characteristics of the corn also contribute to variability among DDGS samples. The correlation between plant processing parameters, such as fermentation time, the fraction of thin stillage recycled to process water, and dryer type, and the characteristics of DDGS were evaluated. These factors were most correlated with variations in the moisture and fermentable sugar concentrations of DDGS. Variations in crude protein, crude fat, and NDF were controlled primarily by corn composition, but two important performance metrics, the ratio of CP to NDF and CF to NDF, were not correlated with the geographical distribution of ethanol plants.

Table 1. Summary of Proximate Analysis of DDGS from 40 Ethanol Plants in the U.S. (%, dry basis)

	Moisture	CP	CF	NDF	FS
Mean	10.8	30.8	10.5	29.4	8.9
Range	7.8 – 14.7	26.7 – 38.3	7.4 – 13.3	23.2 -37.6	5.2 – 17.8

Key Words: Distillers Dried Grains with Solubles (DDGS), Nutritional Profile, Nutritional Variability

588 Digestibility of rumen undegraded amino acids estimated in cecectomized roosters and the modified three-step in vitro procedure. S. E. Boucher*[1], S. Calsamiglia[2], M. D. Stern[3], C. M. Parsons[4], and C. G. Schwab[1], [1]*University of New Hampshire*, *Durham*, [2]*Universitat Autònoma de Barcelona*, *Bellaterra, Spain*, [3]*University of Minnesota*, *St. Paul*, [4]*University of Illinois*, *Urbana*.

Three soybean meal (SBM), 3 SoyPlus®, 5 dried distillers grains with solubles (DDGS), and 5 fishmeal (FM) samples were obtained from FeedAC, Inc. to evaluate the modified three-step in vitro procedure (TSP) for estimating digestibility of rumen undegraded (RU) amino acids (AA). Each sample was incubated in situ for 16 h in the rumen of 4 cows averaging (mean ± SD) 48 ± 4 d in milk, fed a 55% forage, 45% concentrate diet. Rumen undegraded residues were collected and pooled by feed sample, and sub-samples were analyzed for AA. A sub-sample of each residue was also tube fed to cecectomized roosters (4 birds per sample), and endogenous AA losses were estimated from fasted birds. Total excreta were collected for 48 h post-intubation and analyzed for AA. Standardized digestibility (STD) of RUAA was calculated. Sub-samples of each residue were also analyzed via the modified TSP. Five g of residue was weighed in duplicate into polyester bags (pore size of 50 µm) which were then heat sealed and placed into Daisy^{II} incubator bottles. A pepsin/HCl solution was added, and the residues were incubated in constant rotation at 38°C for 1 h. The solution was drained from the bottles, and the bags were rinsed and returned to the bottles. A pancreatin solution was added, and the residues were incubated in constant rotation at 38°C for 24 h. Bags were rinsed, dried, weighed, and undigested residues were analyzed for AA. Digestibility of RUAA was calculated based on disappearance from the bags. Digestibility of RU lysine, methionine, total AA, and total essential AA were correlated to STD estimates measured in the roosters ($R^2 = 0.94$, 0.83, 0.93, and 0.92, respectively). In conclusion, the modified TSP may be a good approach for predicting RUAA digestibility in SBM products, DDGS, and FM.

Key Words: Amino Acid Digestibility, Modified Three-Step In Vitro Procedure, Rumen Undegraded Protein

589 In situ degradation characteristics of extruded-expelled cottonseed meal-based supplements. S. J. Winterholler*, T. K. Dye, C. P. McMurphy, C. J. Richards, and D. L. Lalman, *Oklahoma State University*, *Stillwater*.

Eight ruminally cannulated steers (BW=753 ± 48) were used to evaluate in situ DM, N, and neutral detergent fiber (NDF) degradation characteristics of supplements for beef cows consuming low quality prairie hay. Experimental supplements included (DM basis) 1) extruded-expelled cottonseed meal (ECSM; 33% CP and 55% NDF), 2) extruded-expelled cottonseed meal with linters (ECSML; 25% CP and 59% NDF), 3) solvent extracted cottonseed meal (CSM; 44% CP and 40% NDF), and 4) a blend of 76% wheat middlings with 18% CSM (WMCSM; 22% CP and 40% NDF). Chopped prairie hay (5.8 % CP, 61 % NDF; DM basis) was provided *ad libitum* and steers received 0.38 kg/100kg BW WMCSM daily. Calculated N, NDF and DM fractions included A (immediately soluble), B (degradable at a measurable rate), and C (undegradable). The ECSML supplement had the highest concentration of C fraction N (10.4%; P<0.01), a high concentration of B fraction N (82.7%; P<0.01) and the slowest B fraction degradation rate (1.73%/hr; P<0.01). These characteristics resulted in the lowest estimated RDP (39%; P<0.01) for ECSML. In contrast, ECSM had the highest concentration of A fraction N (41%; P<0.01), and the lowest percentage of N in the B fraction (52%; P<0.01). Rate of B fraction degradation was intermediate for ECSM (2.76%/h; P<0.01). These characteristics resulted in the highest RDP estimate (77%; P<0.01) for ECSM. Extent of NDF disappearance was greatest for CSM (56%; P<0.01), similar for ECSML and WMCSM (41%; P=0.63) and lowest for ECSM (28%; P<0.01). Dry matter disappearance was most extensive (P<0.01) for CSM and WMCSM (64 and 59%, respectively) and lowest (P<0.01) for ECSM (36%) and ECSML (40%). Ruminal N degradation characteristics of ECSM were similar to more traditional supplements containing CSM and CSM with wheat middlings. Rumen degradability of ECSML N was low, indicating this potential supplemental N source may need to be blended with other ingredients containing higher concentrations of degradable N, particularly in situations where forage RDP is low.

Key Words: Byproduct, In Situ, Nitrogen

590 Feeding two corn milling co-products to dairy cattle: Nutrient digestibility, purine derivatives excretion, and nitrogen utilization. A. M. Gehman* and P. J. Kononoff, *University of Nebraska*, *Lincoln*.

The objectives of this experiment were to examine effects of feeding dairy cattle different types of corn milling co-products, modified wet distillers grains plus solubles (WDGS) and wet corn gluten feed (WCGF). Multiparous (n = 20) and primiparous (n = 20) cows averaging 93 ± 29 DIM were used in a replicated 5 × 5 Latin square in which cows were blocked by parity and milk production. During each 20-d period, cows were offered one of 5 rations: 1) CONT, 0% co-products; 2) 15WDGS, 15% WDGS; 3) 15WCGF, 15% WCGF; 4) 15MIX, 7.5% WDGS and 7.5% WCGF; and 5) 30MIX, 15% WDGS and 15% WCGF. Rations were similar in crude protein and metabolizable energy and protein. Fecal and urine samples were collected on d 17 – 20. Nutrient digestibility was estimated using indigestible ADF, and urinary purine derivatives were used to indicate effects of treatments on microbial protein synthesis. Compared to other treatments, 30MIX had (P < 0.01) reduced digestibility of DM (54.6 vs. 63.3%), NDF (34.4 vs. 46.4%), N (58.0 vs. 65.8%), and OM (57.9 vs. 65.9%). Excretion of urinary purine derivatives was higher (P = 0.04) for 15WDGS, 15MIX, and 30MIX than CONT and 15WCGF (396.8, 399.7, and 400.5 vs. 361.0 and 387.3 mmol/d). Fecal N was (P = 0.02) greater for 30MIX (295.0 g/d) than 15WCGF and 15MIX (260.3 and 237.1 g/d) but was not different from CONT or 15WDGS (267.1 and 269.4 g/d). Urinary N was (P = 0.03) higher for 30MIX (330.0 g/d) than for CONT and 15WDGS (308.5 and 312.2 g/d) but not different from 15WCGF and 15MIX (319.3 and 320.5 g/d). Total manure N was (P < 0.01) highest for 30MIX compared to other treatments. Results of this experiment suggest the inclusion of corn milling co-products in dairy rations may negatively affect total tract digestibility but have positive effects on microbial protein synthesis.

Key Words: Nitrogen, Digestibility, Purine Derivatives

591 Milk urea concentration as an indicator of ammonia emission from dairy cow houses in a situation with restricted grazing. G. van Duinkerken*[1], M. C. J. Smits[1], G. André[1], P. F. G. Vereijken[2], L. B. J. Sebek[1], A. Bannink[1], and J. Dijkstra[1], [1]*Wageningen University and Research Center*, *Lelystad, The Netherlands*, [2]*Wageningen University and Research Center*, *Wageningen, The Netherlands*.

Milk urea concentration was evaluated to assess its potential as an indicator of ammonia emission from dairy cow houses in a situation with restricted grazing. An experiment was carried out with a herd of on average 52 Holstein–Friesian dairy cows. The herd was housed in a naturally ventilated barn with cubicles and a slatted floor and each day was allowed 8.5 hours grazing. The experiment was designed as a 1 × 3 factorial trial and repeated three times. The experimental factor was the bulk milk urea level which was adjusted to levels of 15, 35 and 55 mg urea per 100 g milk, respectively, by changing the level of N fertilization of the pasture, the herbage mass and grass regrowth age, and the level and type of feed supplement. Ammonia emission from the barn was measured using SF6 as a tracer gas. A dynamic regression model was used to predict ammonia emission from bulk milk urea concentration, temperature and a slurry mixing index. The total model accounted for 66% of total variation in ammonia emission and showed that emission from the barn increased with 2.6% when temperature increased with 1°C. Furthermore, ammonia emission increased exponentially with increasing milk urea concentration. At a level of 20 mg urea per 100 g milk, ammonia emission increased with about 2.5% when milk urea concentration increased with 1 mg/100 g. At a level of 30 mg urea per 100 g milk ammonia emission increases with about 3.5% when milk urea concentration is increased with 1 mg/100 g. The study showed that bulk milk urea concentration is a useful indicator for ammonia emission reduction from dairy barns.

Key Words: Ammonia Emission, Milk Urea, Restricted Grazing

592 A meta-analysis of the effects of protein concentration and degradability on milk N efficiency in dairy cows. P. Huhtanen*[1], A. N. Hristov[2], and M. Rinne[3], [1]*Cornell University*, *Ithaca, NY*, [2]*Pennsylvania State University*, *State College*, [3]*MTT-Agrifood Finland*, *Jokioinen, Finland*.

Data sets from North European (NE, 998 diets) and North American (NA, 739 diets) feeding trials with dairy cows were evaluated to investigate the effects of dietary CP concentration and ruminal degradability on the efficiency of milk N production (MNE). NE diets were

based mainly on grass silage, barley grain, and soybean and rapeseed meals. NA diets were based on corn silage, alfalfa silage and hay, corn and barley grains, and soybean meal. Diets were evaluated for RDP and RUP concentrations according to NRC (2001). The average DMI and milk yield (kg/d), dietary CP, RDP, RUP concentrations (g/kg DM), ruminal CP degradability and MNE (g/kg) were 17.9, 25.4, 165, 120, 45, 0.73 and 277 for NE diets. The corresponding values for NA diets were 22.0, 31.3, 178, 122, 56, 0.68 and 245, respectively. A mixed model regression analysis with random study effect was used to evaluate relationships between dietary CP concentration and degradability and MNE (milk N/N intake; g/kg). The following prediction models were derived: MNE = 475 – 1.21CP (NE diets), and MNE = 497 – 1.40CP (NA diets). Residual mean square errors were 9.1 and 14.9 g/kg, respectively. Effects of CP degradability and RDP/RUP on MNE were significant in both models, but the prediction errors were not decreased. Akaike′s information criteria were moderately improved by inclusion of CP degradability variables in the models. Mean prediction error of MNE in NE diets using NA CP model was 13.2 g/kg with bias, slope, and random errors proportionally accounting for 0.54, 0.10 and 0.36, respectively. The corresponding values for validating the NE CP model with NA diets were: 18.9 g/kg, 0.48, 0.06, and 0.46, respectively. Including CP degradability variables did not improve predictions. In conclusion, improved MNE and consequently decreases in N emissions can be obtained by decreasing diet CP concentration, while manipulation of CP degradability is less efficient.

Key Words: Meta-Analysis, N Efficiency, Crude Protein

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