280 Effects of feeding raw and roasted sunflower seed on rumen fermentation and total tract nutrient utilization by lactating dairy cows. P. Sarrazin*[1], A. F. Mustafa[1], P. Y. Chouinard[2], and V. Raghavan[1], [1]*McGill University, Ste-Anne-De-Bellevue, QC, Canada,* [2]*Universite Laval, Pavillon Paul-Comtois, QC, Canada.*

Three multiparous ruminally cannulated lactating Holstein cows (DIM 169 34 d) were used in a 3x3 Latin square experiment to determine the effects of feeding raw and roasted sunflower seeds on ruminal fermentation and whole-tract digestibility of dairy cows. Treatments were a control diet with no added sunflower seed, raw sunflower seed diet, and roasted sunflower seed diet. Sunflower diets contained 7.5% (DM basis) raw or roasted sunflower seed. All diets were fed ad libitum as TMR. Ether extract content was 2.5% for the control, 5.5% for the raw sunflower and 5.6% (DM basis) for the roasted sunflower diet. Results showed that dietary treatments had no effect on ruminal pH or ruminal ammonia nitrogen concentrations. Dry matter intake tended (P = 0.07) to be lower for cows fed the sunflower diets than the control diet. Apparent DM (average 75.6%), OM (average 72.6%), CP (average 73.5%), NDF (average 53.1%), starch (average 94.0%) and gross energy (71.2%) digestibilities were similar among dietary treatments. Apparent ether extract digestibility was higher for cows fed the sunflower diet relative to those the control diet. We concluded that the inclusion of raw or roasted sunflower seeds in dairy cow diets up to 7.5% of the diet DM has no adverse effects on ruminal fermentation or total tract nutrient utilization.

Key Words: Sunflower seed, Rumen fermentation, Total tract nutrient utilization

281 Effects of feeding glyphosate-tolerant canola meal on lamb growth, meat quality and apparent feed digestibility. K. Stanford*[1], T.A. McAllister[2], J. Aalhus[3], M. Dugan[3], and R. Sharma[2], [1]*Alberta Agriculture, Food and Rural Development, Lethbridge, AB,* [2]*Agriculture and Agri-Food Canada, Lethbridge, AB,* [3]*Agriculture and Agri-Food Canada, Lacombe, AB.*

Consumer awareness of transgenic crops in the food chain is increasing. This study evaluated the effects of including meal from glyphosate-tolerant (Roundup-Ready®) canola (RRC) in barley-based diets (6.5%, DM basis) for lambs. Four diets were prepared, differing only in the type of canola meal they contained (two commercially available sources, COM1 and COM2; the parental line from which the glyphosate-tolerant canola was derived, PAR; or the transgenic RRC). The diets were isonitrogenous and formulated to exceed the lambs' nutritional requirements. Experiment 1 involved 60 early-weaned Canadian Arcott lambs (30 ewes; 30 wethers; initial age approximately 2 mo; initial weight 21.5 ± 1.0 kg). The lambs were individually penned, blocked by weight and gender for assignment to treatments ($n = 15$), and fed the diets until reaching or exceeding 45 kg BW. Intake of DM by the lambs was similar among COM1, COM2 and PAR diets, and among COM2, PAR and RRC (COM1 > RRC, $P < 0.05$). Diet did not affect ($P > 0.05$) ADG or feed efficiency. Carcass yield grade was higher ($P < 0.05$) for COM1 or COM2 diets than for PAR or RRC, although saleable meat yield did not differ ($P > 0.05$) among treatments. Canola source did not affect ($P > 0.05$) meat tenderness, as determined by shear force, or intramuscular fat content. Meat color differences were not detected between RRC-fed lambs and those in the other three groups. In Exp. 2, apparent digestibilities of the four diets were determined using eight mature wethers (67.8 ± 2.3 kg) in a replicated Latin square. No aspect of digestibility (DM, fibre, or nitrogen balance) was influenced by canola source. In this study, including canola meal prepared from glyphosate-tolerant canola did not alter diet digestibility, feed efficiency or growth performance of the lambs, carcass characteristics or meat quality.

Key Words: Transgenic Canola, Lamb Growth, Meat Quality

Ruminant Nutrition
Protein

282 Quantifying the metabolisable methionine contribution of a liquid or powder presentation of 2-hydroxy-4 (methyl thio) butanoic acid isopropyl ester (HMBi). J.C. Robert, T. d'Alfonso, G. Etave, E. Depres, and B. Bouza, *Aventis Animal Nutrition, Antony, France.*

Three products were tested : HMBi (L) containing 93% of HMBi monomers, liquid form ; HMBi (P) : HMBi (L) mixed with a clay (powder presentation : 31.5% HMBi monomers) and a coated methionine : Smartamine^{TM} M(Sm M). Four non lactating rumen cannulated Holstein cows were used. The four treatments were randomly assigned in a latin square design (4 x one week periods). Each product was given orally as a single dose at the start of each experimental period : T1 : 69.6g HMBi (L) ; T2 : 220.8g HMBi (P) ; T3 : 353.5g HMBi (P) ; T4 : 68.1g Sm M. T4 was supplied at 1600h the first day (D1) of each experimental period and T1, T2 and T3 the second day (D2) at 0800h. Blood samples for blood plasma methionine determination (BPMC mg/100g) were obtained for T1, T2 and T3 on D2 of each experimental period, every 30 mn, starting at 0800 until 1100h, then at 1300, 1500,1800 and 2200h and on D3 at 0600, 0800, 1100 and 1500h. For T4, blood samples were collected, every 2 hours, on D2 starting at 0600 until 2200h and thereafter every 3 hours from 0600 until 1500h on D3 and D4. BPMC basal line values were measured on D1. The metabolisable methionine contribution (Y) was determined using the equation : Y=26.14 Ln (1+X/15.94) (Robert et al, 2001)*** where X= Area Under the Curve (AUC **). Metabolisable methionine contribution from an oral single dose was 50% for HMBi (L) and 56.5% for HMBi (P). The bioavalability of methionine from Sm M : 81%, is in good agreement with literature values.

Treatment	T1	T2	T3	T4	SED	source p<
Methionine equivalent g*	50	50	80	50		
Base line BPMC (mg/100g)	0.29	0.32	0.30	0.30	0.02	NS
AUC**	25.5b	32.2b	69.6a	59.4a	6.2	0.001
Metabolisable methionine g.***	24.9b	28.8b	43.9a	40.3a	2.0	0.0002
Bioavailability****	50b	58b	55b	81a	3.5	0.0005

*based on methionine equivalent concentration in HMBi monomers : 0.78
**taking into account base line
****metabolisable methionine/methionine equivalent ingested

Key Words: Ruminants, Dairy cows, Methionine, Bioavailability

283 Effects of metabolizable undegradable protein and methionine and lysine on production parameters and nitrogen efficiency of Holstein cows in early and mid-lactation. Sarah Ivan* and Normand St-Pierre, *The Ohio State University, Columbus, OH.*

Excessive N excretion by dairy cows can have a negative effect on the environment. We hypothesized that targeted dietary changes to the N-intake pools, or the N available in the feed, would improve N efficiency by dairy cows, thus reducing negative environmental impact from milk production. Forty multiparous and 22 primiparous Holstein cows were used in a 2 x 2 factorial arrangements of treatments to determine the effects of 1) metabolizable rumen undegradable protein (M-RUP): 100% (LoM-RUP) or 110% (HiM-RUP) of the requirements stated by the National Research Council (2001), and 2) Met and Lys supplementation: control levels of 6.15% and 1.80% Lys and Met (LoAA), respectively, or supplementation at 6.65% and 2.22% Lys and Met (HiAA), respectively. The Lys to Met ratio was set at 3.0:1.0 in the HiAA diets and 3.4:1.0

in the LoAA diets. Cows were assigned randomly to one of four dietary treatments 14 to 21 d postpartum and continued on their assigned diet for 25 wk. There was no effect ($P > 0.05$) of treatment on DMI, milk yield, or milk true protein production. Lys and Met supplementation in the HiAA diets significantly ($P = 0.042$) increased milk true protein concentration from 3.02% to 3.14%. High M-RUP levels significantly depressed milk fat concentration ($P = 0.022$) and production ($P = 0.036$) from 3.35% to 3.03% and 1.45 kg/d to 1.32 kg/d, respectively. Lower levels of M-RUP, combined with lower Lys and Met supplementation, significantly ($P < 0.05$) decreased MUN and urinary N excretion. Cows were numerically more efficient at converting intake N to milk N in the HiAA diets with a higher quality Lys to Met ratio. Dietary manipulation of N fractions can reduce the impact of intensive dairy production on the environment without adversely affecting milk or component production.

Key Words: Metabolizable undegradable protein, Methionine, Lysine

284 Lactational responses of early lactation cows to two crude protein levels in corn silage and alfalfa silage based diets. K.L. Karg* and M.A. Wattiaux, *University of Wisconsin-Madison.*

Forty eight multiparous Holstein cows were used to evaluate the effects of primary forage source (alfalfa silage (AS) or corn silage (CS)) and CP level (16.5% (LP) or 17.9% (HP)) to test the hypothesis that lower dietary CP may not be detrimental to early lactation cows performance. Cows were blocked by calving date and assigned to dietary treatments in a 2 x 2 factorial. A covariate diet was fed the first 3 weeks of lactation and treatment effects were measured for the following 11 weeks. Diets were fed as TMRs including 55% forage (DM basis; 14% CS and 41% AS or 14% AS and 41% CS). A variety of non structural carbohydrates and protein sources were used to complement forage nutrients. According to NRC 2001, the ME allowable milk was 45 kg/d for all diets, and MP allowable milk was 45 kg/d on LP diets and 50 kg/d on HP diets. Predicted MP balance was 14, 229, 47 and 256 g/d for ASLP, ASHP, CSLP, and CSHP diets respectively. Milk production and DMI were recorded daily. Milk samples were taken weekly for composition analysis. Cows were weighed and body condition scored at the beginning and at the end of the trial. Data were analyzed with the MIXED procedure of SAS and differences between forage sources and protein levels were tested with orthogonal contrasts. Protein level did not influence production parameters (see Table). However, cows on CS diets produced higher milk yields than those on AS diets (P=.03). There was a tendency for fat yield to be greater in AS diets (P=.07), but protein yield tended to be higher in CS diets (P=.06). In this trial, cows produced as much milk on 16.5% than 17.9% CP diets; the proportion of AS and CS in the diet had a greater impact on lactation response than dietary protein level.

	Treatments					p-value		
Item	ASLP	ASHP	CSLP	CSHP	SEM	For-age	Pro-tein	FxP
DMI (kg)	24.4	25.2	24.1	23.9	0.6	.16	.62	.42
Milk (kg)	45.0	45.3	48.8	46.6	1.2	.03	.44	.30
Fat (g/d)	1576	1558	1418	1460	70	.07	.88	.66
Protein (g/d)	1246	1228	1289	1291	29	.06	.78	.74
BW change (kg)	-17.1	-16.1	+17.3	-20.4	20.2	.45	.35	.33
BCS change	-.12	-.29	-.14	-.18	.07	.55	.16	.34

Key Words: Forage, Environment

285 Urea-nitrogen recycling and nitrogen balance in lambs fed a high-concentrate diet and infused with differing proportions of casein in the rumen and abomasum. K. C. Swanson*, H. C. Freetly, and C. L. Ferrell, *USDA, ARS, U.S. Meat Animal Research Center.*

Twenty-five wether lambs (34 ± 0.9 kg) fitted with ruminal and abomasal infusion catheters were used in a completely randomized design to determine the effects of differing proportions of ruminal and abomasal casein infusion on urea-N recycling and N balance in lambs fed a high-concentrate diet (1.6% N, DM basis) for ad libitum intake. Wethers were infused with 0 (control) or 10.4 g/d of N from casein with ratios of ruminal:abomasal infusion of 100:0, 67:33, 33:67, or 0:100%, respectively, over a 14-d period. Over the last 4 d, urea kinetics were examined by continuous infusion of [15N15N]-urea into the jugular vein and measurement of [15N15N]-urea enrichment in urine using gas chromatography/mass spectrometry. Feed, orts, feces, and urine were collected over the last 5 d. Total nitrogen intake, N excretion, urea-N production, and urea-N recycled to the gastrointestinal tract was greater ($P < 0.01$) in lambs infused with casein as compared to controls. Nitrogen retention, however, did not differ ($P = 0.66$; 6.9, 5.5, 7.6, 9.0, and 7.2 g/d; pooled SEM = 0.9) in lambs infused with casein as compared to controls, suggesting N requirements were met without casein supplementation. Total nitrogen intake (24.7, 25.3, 26.9, and 25.1 g/d; pooled SEM = 1.3) and total N excretion (19.2, 17.7, 17.9, and 17.9 g/d; pooled SEM = 1.2) did not differ ($P > 0.10$) between casein infusion treatments. Urinary N excretion decreased linearly ($P = 0.07$; 14.2, 12.6, 12.1, and 11.7 g/d; pooled SEM = 0.9) with decreasing ruminal infusion of casein. Urea-N recycled to the gastrointestinal tract increased ($P = 0.01$; 16.8, 17.2, 22.6, and 23.1 g/d; pooled SEM = 2.0) with decreasing ruminal infusion of casein. These data indicate that decreasing the rumen degradability of supplemental protein, above that required to maximize N retention, results in decreased urinary excretion of N and increased urea-N recycling to the gastrointestinal tract.

Key Words: Sheep, Nitrogen, Urea Recycling

286 Use of 2-hydroxy-4-[methylthio]-butanoic acid (HMB) by lactating dairy cows. H. Lapierre*[1], J.J. Dibner[2], M. Vazquez-Anon[2], D. Parker[2], P. Dubreuil[3], M. Babkine[3], G. Zuur[4], and G.E. Lobley[5], [1]*Dairy and Swine R&D Centre, Lennoxville, QC, Canada,* [2]*Novus International Inc, St Louis, MO, USA,* [3]*Coll. Vet. Med., U. Montreal, St-Hyacinthe, QC, Canada,* [4]*Biomathematics and Statistics Scotland, Aberdeen, UK,* [5]*Rowett Research Institute, Aberdeen, UK.*

Four multicatheterized cows (31.3 kg milk/d; 17.7 kg DMI/d) were used in a cross-over design each of 2 1-week periods to determine the effect of HMB on HMB and methionine (MET) metabolism. Over the last 2 d, cows were infused (intra-jugular) with saline or HMB (Alimet® feed supplement, Novus International Inc.) at the rate of 1.5 g/h. During the last 8 h, the HMB infusion was substituted by equimolar [1-^{13}C]HMB plus [methyl^{2}H$_3$]MET (200 mg/h). During the last 4 h, hourly samples were collected to determine plasma flows plus the isotopic enrichments (IE) and concentrations of HMB (^{13}C) and MET (both ^{13}C and ^{2}H$_3$) in plasma from the artery, portal, hepatic and mammary veins. The IE of [^{13}C] and [^{2}H$_3$] MET were also determined in milk protein taken over the last h of infusion. In HMB-infused cows, whole body plasma flux of MET increased (17.9 vs 24.4 1.53 mmol/h, P=0.03) with 15% of the flux (3.7 mmol/h; 42% of the HMB dose infused) derived from HMB (assessed by synthesis of [1-^{13}C]MET). Although the portal-drained viscera (PDV), liver and mammary gland (MG) extracted 11, 37 and 3.5% respectively of the infused HMB, tissue net MET fluxes were unchanged across the PDV and the MG while liver removal increased (-8.4 vs -15.3 0.72 mmol/h; P <0.01). HMB infusion decreased (P = 0.05) net post-splanchnic supply of MET from 7.0 to 2.9 mmol/h, compared with needs for milk output of 7.6 and 8.1 mmol/h, respectively. HMB provided the equivalent of 22% of the total MET utilization by the MG (0.9 mmol/h from synthesis within the gland and 2.0 mmol/h from extraction of MET produced in other tissues). Intracellular conversion of HMB in other tissues spared their needs for dietary MET which was then used by the MG to support milk protein output. Absorbed HMB therefore produces and spares MET for use by the MG.

Key Words: lactating cows, HMB, methionine

287 Effect of a jugular infusion of essential amino acids on splanchnic metabolsim in dairy cows fed a protein deficient diet. R. Berthiaume*[1], M.C. Thivierge[2], G.E. Lobley[3], P. Dubreuil[4], M. Babkine[4], and H. Lapierre[1], [1]*Dairy and Swine R&D Centre, Lennoxville Quebec, Canada,* [2]*Universit Laval, Quebec, Canada,* [3]*Rowett Research Institute, Aberdeen, UK,* [4]*Coll. Vet. Med., U. Montreal, St-Hyacinthe Quebec, Canada.*

Six lactating Holstein cows were used to measure the effect of a jugular infusion of essential amino acids (AA) on splanchnic metabolism in dairy cows fed a protein deficient diet, according to a cross-over design. A total mixed ration was fed in twelve equal meals per d (mean DMI = 17.0 kg/d). Indwelling catheters had been surgically implanted in the mesenteric artery, the portal and hepatic veins for blood collection, and in two distal branches of the mesenteric vein to allow infusion of ρ-aminohippurate to determine blood flow. After five days of infusion

of saline or of AA, six hourly blood samples were collected to determine plasma concentrations of AA. Yields of milk (29.2 vs 31.3 ± 0.46 kg/d) and protein (912 vs 1047 ± 21.7 g/d) were increased ($\rho \leq .05$) with AA infusion. Infusion of AA increased arterial concentrations of infused AA. The net flux across the portal-drained viscera was not affected but the infusion of AA increased hepatic extraction by more than the level of infusion. Why in such a case did milk production increase with AA infusion remains unclear. Although the demand of peripheral tissues has an effect on liver catabolism of AA, the regulation of AA extraction by the liver seems also regulated by factors independant of the demand by the mammary gland and related to high concentrations of AA in peripheral circulation.

Key Words: Amino acid, Splanchnic metabolism, Protein

288 Minimum dietary protein required for lactating dairy cows fed different amounts of alfalfa and corn silage.

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The response of lactating dairy cows to dietary protein level under various alflafa to corn silage programs was determined. Three trials were conducted using 100 : 0, 50 : 50, or 25 : 75 alfalfa to corn silage ratios. Each trial used 16 Holsteins (117± 33 DIM) in a replicated 4 X 4 Latin square design with 3-wk periods (2-wk adjustment followed by 1-wk collection). All diets consisted of 50 : 50 forage : concentrate and were formulated to contain 15.00, 16.25, 17.50, or 18.75% CP. Increasing dietary CP did not affect milk yield, but increased milk urea nitrogen (MUN). Cows yielded more milk when corn silage constituted more of the forage. Reducing dietary CP and optimizing alfalfa to corn silage ratio can be used to improve N utilization.

Item	15.00	16.25	17.50	18.75	SEM	*P*
Alfalfa : corn silage = 100 : 0						
DMI, kg/d	22.9	23.3	22.6	23.1	0.34	0.59
Milk, kg/d	31.5	32.0	32.2	32.5	0.58	0.68
MUN, mg/dl	9.8	10.2	11.8	13.3	0.53	0.01
Alfalfa : corn silage = 50 : 50						
DMI, kg/d	24.8	24.4	24.5	24.0	0.40	0.65
Milk, kg/d	37.4	35.5	36.5	36.5	1.53	0.86
MUN, mg/dl	12.2	13.0	12.6	14.0	0.39	0.02
Alfalfa : corn silage = 25 : 75						
DMI, kg/d	25.8	26.4	25.9	25.7	0.40	0.57
Milk, kg/d	39.3	38.4	39.8	38.8	0.50	0.22
MUN, mg/dl	11.2	12.7	14.2	15.1	0.33	0.01

Key Words: Protein, Milk urea nitrogen, Forage

289 Amino acid profiles of tropical forages and of their residues after incubation in the rumen, phosphate-borate buffer and intestinal digestion.

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Amino acid (AA) profiles of several feed protein fractions were determined for foliage from leucaena (*Leucaena leucocephala*), perennial soybean (*Neonotonia wightii*), manioc (*Manihot esculenta*), ramie (*Boehmeria nivea*), and guandu (*Cajanus cajan*) using *in situ* and *in vitro* procedures. Fractions included total feed protein; (rumen) undegradable intake protein (UIP), the residue after an 18h rumen incubation in nylon bags; phosphate-borate buffer (PBB) insoluble residue; and (intestinal) indigestible protein, the residue after a three-stage procedure. These were analyzed by HPLC after acid hydrolysis or peroxidation followed by acid hydrolysis. There was no difference ($P>0.05$) in the AA profile of any of the protein fractions of guandu and ramie. For leucaena, several AA (Lys, Met and Thr) contents differed between the total protein and the PBB residue. The same was true for perennial soybean (Iso, Leu, Met, Thr, and Val) and manioc (Arg, Iso, Leu and Lys). The essential AA profile of the total feed protein was similar to the essential AA available for intestinal absorption for ramie and guandu, but not for leucaena, perennial soybean and manioc leaves. The use of the AA profile of the feed to formulate rations must be viewed with caution.

Key Words: amino acids, protein fractions, tropical forages

290 Effects of a slow-release urea product on nitrogen metabolism in lactating Holstein dairy cattle.

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The purpose of this study was to evaluate the impact of polymer-coated urea (Optigen 1200) on nitrogen retention, rumen microbial growth, and milk production and composition. Slow-release urea has the potential to be incorporated more efficiently than unprotected urea by rumen microorganisms because it is released in synchrony with available carbohydrates. Thus, slow-release urea would be expected to improve efficiency of N utilization and reduce N excretion in dairy cows. Eight cows were offered each of three diets in a randomized cross-over design. Diets consisted of corn silage, mixed grass/legume haylage, alfalfa hay, corn meal, protein, vitamin and mineral supplements and were fed *ad libitum*. Diets 1, 2, and 3 contained 17.9%, 18.1% and 16.4% crude protein (CP) and 0%, 0.77%, and 0.77% Optigen 1200, respectively. Individual feed intakes were measured, and a total fecal and urine collection was conducted. Cows were milked twice daily and the milk sampled for composition and milk urea N analysis. Dry matter intakes averaged 23.5 ± 0.2 kg/d and were not altered by diet ($p>.05$). Also, milk fat and true protein were not altered by diet ($p>.05$) and averaged 3.72 ± .05% and 3.07 ± .02%, respectively. Milk yields were 35.6, 34.8, and 33.8 kg/d for cows consuming diets 1, 2, and 3 respectively (S.E. = 0.44). Significant differences were observed in N intake and excretion in urine, feces, and milk between dietary treatments. Cows fed diet 3 consumed 11% less N than in treatment 1. Cows fed diet 2 showed the highest excretion of N in urine, and together with treatment 3, the lowest N excretion in feces. N excretion in milk was lower for cows fed diet 3. Calculated N balances were not significantly different between treatments, nor were they significantly different from zero. Efficiency of N capture in milk protein as a function of N intake was higher for animals on treatment 3. Urinary excretion of purine derivatives was used to estimate microbial CP flows to the duodenum, which were similar between diets. Optigen 1200 was not effective at reducing nitrogen excretion by dairy cattle.

Key Words: Nitrogen excretion, Nitrogen balance, Urea

291 Effects of protein supplementation during lactation on milk yield of primiparous Holstein cows.

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Corn distillers solubles (CDS) is a liquid byproduct of the dry corn milling process. A commercial liquid supplement, Alcomp®, includes CDS with additions of urea, ethyl alcohol, and minerals being added. Corn distillers solubles and Alcomp® can be used as protein sources in livestock diets. The objective of this study was to compare feeding CDS with ethyl alcohol, Alcomp®, and a control SBM-urea protein mix to primiparous cows from 1 to 182 days in milk. Cows were assigned to 1 of 3 dietary treatments by calving date and housed in a tie-stall barn. Feed intake, health, and milk production data were recorded daily. Milk composition was determined biweekly. The diet composition was: 39% corn silage, 12% chopped alfalfa hay, and 49% concentrate, on a dry matter basis. The protein supplements were added to their respective diet treatment to achieve an isonitrogenous diet (17.2% crude protein). Alcomp® and CDS were included in their respective diets at 2% of the diet dry matter. Nutrient composition of the diets (dry matter basis) was: 32.1% neutral detergent fiber, 18.2% acid detergent fiber, 3.4% ether extract, and 37.7% nonfibrous carbohydrate. Dry matter intake (DMI), body weight (BW), body condition score (BCS), milk production, and milk components were not different ($P>0.1$) for the 3 dietary treatments. Body weight average was numerically highest for cows fed Alcomp®, but not different ($P>0.05$) than cows fed CDS or control SBM-urea diets.

	Alcomp®	CDS	SBM	P-value
N	14	16	14	
DMI, kg/d	20.0	19.5	20.1	0.603
BW, kg	537.3	531.9	507.1	0.098
BCS	2.9	3.0	2.9	0.580
Milk, kg/d	34.3	31.4	33.1	0.134
Fat, kg/d	1.1	1.0	1.0	0.288
Protein, kg/d	1.0	0.9	1.0	0.107
Lactose, kg/d	1.7	1.6	1.7	0.143
Fat, %	3.4	3.3	3.2	
Protein, %	3.0	3.0	3.0	
Lactose, %	4.9	4.9	4.9	

Key Words: Corn distillers solubles, Ethyl alcohol, Dairy

292 Effects of replacing soybean meal with secondary protein nutrients in silage-based diets for growing beef steers. S.R. Freeman*[1], M.H. Poore[1], G.B. Huntington[1], and T.F. Middleton[2], [1]*North Carolina State University, Raleigh, NC,* [2]*AgPro Visions, LLC, Kenansville, NC.*

Because nutrient recycling is a prime concern for the poultry processing industry, the feeding value of secondary protein nutrients (SPN, preliminary analysis: 92.9% DM, 47.4% CP, 11.5 % ash, 26.7% EE), a byproduct of wastewater treatment, was examined in an 84-day feeding trial. Sixty Angus steers averaging 255 kg were blocked by weight into groups of 12 and fed individually with Calan gates. Two steers per pen were randomly assigned to one of six corn silage-based diets containing graded levels of SPN, giving ten steers per treatment. One treatment group received no supplemental CP and served as a negative control (NC). The other groups received diets containing 0, 25, 50, 75, or 100% of their supplemental CP as SPN with the remaining portion being supplied by soybean meal. This resulted in SPN being 0, 2.5, 5.0, 7.6, and 10.0% of diet dry matter, respectively. The steers were weighed following the removal of feed and water overnight at the beginning and end of the trial. Blood from each animal was sampled two hours after feeding via jugular venipuncture for determination of blood urea nitrogen. Analysis of diets NC, 0, 25, 50, 75, and 100% SPN showed that they contained 7.6, 10.4, 10.4, 11.0, 10.5, and 11.1% CP, respectively, on a dry basis. DMI, ADG, feed:gain ratio, and BUN were all different ($P<.01$) when NC steers were compared to protein-supplemented steers. DMI and ADG responded linearly ($P<.01$) and quadratically ($P<.01$; $P<.02$, respectively) to the replacement of soybean meal with SPN. LS means and SEM for DMI were 5.31, 6.77, 7.33, 6.89, 6.05, and 5.22 ± 0.20 kg/d, respectively for the NC, 0, 25, 50, 75, and 100% SPN diets. ADG were 0.54, 1.26, 1.21, 1.11, 0.94, and 0.66 ± 0.05 kg/d, respectively. Feed:gain and BUN showed a linear relationship ($P<.01$) when SPN replaced soybean meal in the diet. LS means for feed:gain were 10.13, 5.37, 6.12, 6.32, 6.62, and 8.28 ± 0.418 for the respective diets. LS means for BUN levels were 1.12, 5.75, 4.83, 4.24, 3.49, and 3.45 ± 0.363 mM, for the respective diets. These results indicated that SPN shows potential as a protein source in silage-based diets.

Key Words: Protein Supplements, Cattle, Poultry Processing Byproducts

293 Comparative evaluation of the protein values of soybean and rapeseed meals by *in vivo*, *in situ*, and laboratory methods. K.-H. Suedekum*[1], D. Nibbe[1], P. Lebzien[2], H. Steingass[3], and H. Spiekers[4], [1]*University of Kiel, Germany,* [2]*Federal Agric. Res. Center, Braunschweig, Germany,* [3]*Hohenheim University, Stuttgart, Germany,* [4]*Chamber of Agric. for Rhineland, Bonn, Germany.*

The protein values of soybean (SBM) and rapeseed meals (RSM) were compared. Ten samples of RSM were taken from German oil mills and 7 samples of SBM, 4 of which were produced in German oil mills and one each from Brazilian, Argentine and Dutch oil mills. Protein value characteristics (total flow of crude protein [CP] to the duodenum and ruminally undegraded CP [RUP]) were estimated for all 17 meals using the following methods: *in situ*; *in vitro* with ruminal fluid using either the ammonia concentration and gas production or a modification of the first stage of the Tilley and Terry procedure; *in vitro* with a protease from *Streptomyces griseus*; and chemically, using fractionation of the CP based on the Cornell Net Carbohydrate and Protein System. Two samples each of RSM and SBM, which after the first *in vitro* findings displayed the highest and lowest extent of CP degradation in the rumen, were selected for *in vivo* experiments on dairy cows with duodenal cannula in Braunschweig. The CP contents of RSM ranged from 37.6 to 42.9% of dry matter and those of SBM from 47.5 to 51.8%. The methods used to estimate the RUP content produced uniform results to the effect that the average RUP content of RSM was higher (35% of CP at 0.05 h^{-1} ruminal outflow rate) and that of SBM lower (23%) than previously reported. The experiments performed *in vivo* to determine the total CP flow to the duodenum and the RUP proportions of the four meals yielded hardly plausible values. There was a high compliance with the other methods to the extent that *in vivo* too, the RSM samples displayed a RUP content of the CP at least as high as that of the SBM samples, the classification of 'higher' and 'lower' RUP contents within RSM and SBM could be confirmed, and the overall protein value confirmed the smaller difference between RSM and SBM derived from the laboratory methods. In conclusion, current commodities of RSM are a better protein feed than previously reported.

Key Words: Protein, Degradation, Rumen

294 Estimating the protein value of protected protein feeds by *in situ* and laboratory methods. K.-H. Suedekum*, *University of Kiel, Germany.*

Several chemical and physical methods have been identified as being efficient in increasing the proportion (% of total crude protein [CP]) of ruminally undegraded feed protein (RUP) of a feedstuff, yet there is a continuing need for methods to be established that allow degree of protein protection from ruminal degradation to be estimated with acceptable expenditure of labor and other costs. In this study, 12 protein feeds (number of samples in brackets: soybean meal [5], soybeans [1], rapeseed meal [4], rapeseed expeller [1], fishmeal [1]), eight of which had been processed by different technical treatments to elevate the proportion of RUP of total CP, were subjected to standardized ruminal *in situ* incubations and four different laboratory methods to estimate the proportion of RUP as one of the key variables that determine the overall protein value of feedstuffs. Laboratory methods included those with and without the use of rumen fluid as an inoculum. Additionally, intestinal digestibilities of the CP and RUP of each feedstuff were estimated using a mobile bag technique. As a general observation, all treated feeds contained more RUP as a proportion of total CP than the four feeds that were only subjected to standard treatments, i.e., extraction of oil and drying ('toasting'). The *in situ* RUP values (0.05 h^{-1} ruminal outflow rate) of the protected protein feeds ranged from 62 to 80% of CP, whereas those of the conventionally treated feeds ranged from 39 to 55%. All laboratory methods were capable to distinguish treated and untreated feeds. Moreover, ranking of feeds in terms of RUP content was similar among laboratory and *in situ* methods. There is a choice of laboratory methods available which appear similarly useful for estimating the RUP of differently treated soybean and rapeseed (meal, seeds, expeller) commodities. Intestinal digestibilities of all but two feedstuffs were greater than 80%, indicating that no major impairment of postruminal CP digestion had occurred due to technical treatments of the feedstuffs.

Key Words: Protein, Degradation, Rumen

295 Effects of degradable intake protein on plasma hormone and metabolite concentrations in periparturient beef cows fed native prairie hay. W.W. Dvorak*, M.L. Bauer, G.P. Lardy, and J.S. Caton, *North Dakota State University, Fargo.*

Thirty-two Angus crossbred cows (670 ± 60 kg initial wt) were used to evaluate effects of degradable intake protein (DIP) supplementation on plasma hormone and metabolite concentrations in beef cows fed native prairie hay. Treatments were control (C; corn-based supplement), urea (U), steep liquor (L), and sunflower meal (S) based supplements. Supplements were fed at 0.280, 0.283, 0.296, and 0.296% of BW during gestation, and 0.589, 0.598, 0.625, and 0.633% of BW during lactation for C, U, L, and S, respectively. Supplements provided similar NE_m during gestation (5.85 Kcal/kg BW) and lactation (12.31 Kcal/kg BW). Control supplements provided 44.0 g DIP/kg DM during gestation and 44.9 g DIP/kg DM during lactation. Protein supplements were formulated to provide 131.6 g DIP/kg DM during gestation and 116.2 g DIP/kg DM during lactation. Prairie hay (7.2% CP) was offered daily in Calan gates for ad libitum consumption. Jugular plasma samples were obtained daily during six 7-d collection periods, for mo 7, 8, and 9

of gestation and mo 1, 2, and 3 of lactation. Samples were composited for each cow within period. Glucose was similar among treatments ($P > 0.10$) and greater ($P < 0.001$) during gestation compared with lactation (4.33 vs 3.88 $\pm$ 0.09 mM). NEFA was unaffected by treatment ($P > 0.10$), however NEFA was greater ($P = 0.001$) during gestation compared with lactation (641.51 vs 534.98 $\pm$ 40.93 μEq/L). There was a period x treatment interaction ($P = 0.01$) for plasma urea nitrogen (PUN). PUN was higher ($P < 0.05$) for U, L, and S compared to C for mo 8, 9, 1, 2, and 3. Insulin was similar among treatments and tended to be greater ($P = 0.07$) during lactation compared with gestation (1.51 vs 1.33 $\pm$ 0.13 μIU/mL). These data suggest that DIP supplementation had no effect on blood metabolites, with the exception of PUN which was higher for U, L, and S, and insulin in beef cows consuming native prairie hay.

Key Words: Degradable Intake Protein, Beef Cows, Plasma Metabolites

Sheep Species

296 Pregnancy rates in sheep after traversing the cervix with a new transcervical artificial insemination instrument. M. C. Wulster-Radcliffe[1] and G. S. Lewis*[2], [1]*Fort Dodge Animal Health,* [2]*USDA, ARS, U.S. Sheep Experiment Station.*

The difficulty of traversing the cervix limits the use of transcervical (TC) AI in sheep. So we developed a new TC AI instrument to help remedy this. The instrument does not affect pregnancy rates through d 3 of pregnancy, but its effects on pregnancy rates after d 3 are not known. Thus, we determined whether the TC AI instrument or using the instrument for TC AI affects pregnancy rate. At 48 to 52 h after removal of progestogenated pessaries and eCG injection, estrus ewes were artificially inseminated with fresh, diluted semen, or each ewe was mated with one of several rams. Experiment 1 had three groups: 1) TC intrauterine AI using the new TC AI instrument + sham intrauterine AI via laparotomy (n = 29 ewes); 2) sham TC AI + intrauterine AI via laparotomy using a laparoscopic AI instrument (n = 29); and 3) sham TC AI + intrauterine AI via laparotomy using the new TC AI instrument (n = 30). Uteri were flushed approximately 14 d after AI. Transcervical intrauterine AI reduced pregnancy rate (17 vs 61%; [ewes with conceptus ÷ number ewes] × 100; P < 0.05), but intrauterine AI via laparotomy using the TC AI instrument improved pregnancy rate (77 vs 45%; P < 0.05). Experiment 2 had two groups: 1) sham cervical manipulation (n = 40) and 2) cervical manipulation via simulated TC AI (n = 40). Immediately after treatment, rams were allowed to breed ewes. Experiment 3 had two groups: 1) TC AI (n = 99) and 2) laparoscopic AI (n = 99). On approximately d 25 and 56 in Exp. 2 and 3, pregnancy was diagnosed ultrasonically. In Exp. 2, the TC AI instrument did not affect pregnancy rate (overall mean = 66%). In Exp. 3, pregnancy rate was less after TC AI (5 vs 45%; P < 0.01). In summary, simulated TC AI before natural service, when large numbers of undiluted sperm cells are deposited, did not affect pregnancy rate, but TC intrauterine AI, with diluted sperm, reduced pregnancy rate. Thus, TC AI with our new TC AI instrument seems to increase sperm numbers required for acceptable pregnancy rates.

Key Words: Artificial Insemination, Cervix, Sheep

297 Reproductive performance of anestrous ewes treated with used-CIDR devices and estrogen. M. Knights*, Q. S. Baptiste, and P. E. Lewis, *West Virginia University, Morgantown, West Virginia.*

Inadequate amounts or duration of progestogen pre-treatment increase the amount or estrogen required for inducing estrous behavior. Two experiments were conducted to evaluate the effects of estrogen (E) and weaning (W) on reproductive performance of ewes during the non-breeding season (early July) pre-treated with a used-controlled internal drug releasing (CIDR) device. In experiment 1, used CIDR devices (5 days) were applied to ewes for five days before introduction to rams (15:1 ewe to ram ratio). Weaned (n =105) and lactating ewes (2-3 months; n = 53) received either 0 (corn oil) or 30 ug estrogen (estradiol benzoate) 1 day after insert removal/ram introduction (IRRI). Pregnancy diagnosis was conducted by transrectal ultrasonography on d 25-30 after IRRI. Pregnancy rate to the first (PR1; 59 5 and 38 7 %) and second (PR2; 74 7 and 44 8 %) service period, percentage of ewes lambing (81 4 and 44.6 %) and lambing rate (LR; lambs born per ewe exposed, 1.26 .08 and 0.61 .11) was significantly higher in weaned ewes (P < 0.05) than in lactating ewes, respectively. LR was higher (P < 0.05) in estrogen treated than ewes treated with corn oil only, 1.1 0.1 and 0.8 0.1, respectively. Experiment 2 was similar to experiment 1 except weaned ewes (N =106) were treated with 0, 15 or 30 ug of E and lactating ewes (N = 44) were treated with either 15 or 30 ug of E. The estrous response, PR1 and percent ewes lambing and LR was significantly higher in weaned (P < 0.05) than in lactating ewes 95 5 and 73 6 %; 76 8 and 27 9 %; 82 8 and 27 9 %; 1.25 0.14 and 0.31 16, respectively. Dose of E did not modify any of the variables measured in lactating ewes. In weaned ewes E increased PR1 and percent of ewes lambing (P < 0.05). Weaning, and the use of small doses of estrogen can improve reproductive performance of ewes bred out-of-season.

Key Words: Anestrous Ewe, CIDR, Estrogen

298 Effect of dosage of Follicle Stimulating Hormone (FSH), vehicle and time of injection on ovulation rate and prolificacy in anestrous ewes. M. Knights*, Q. S. Baptiste, A. B. Dixon, E. K. Inskeep, and P. E. Lewis, *West Virginia University, Morgantown, WV.*

The effects of dosage of FSH, vehicle and time of injection on ovulation rate and prolificacy in ewes bred during the anestrous period was evaluated. During May to July, 2000, ewes (N = 445) of mixed breeding on 4 farms were treated with a CIDR-G device for 5 days and exposed to raddled rams upon removal of the insert. A 3 X 2 X 2 factorial arrangement of treatments was used to test the main effects of dosage of FSH (Folltropin; 0, 42 or 68 mg NIH-FSH-P1), vehicle (saline/propylene glycol 1:4, v:v (PGL), or 50 % polyvinnylpyrrolidone K 29-32, (PVP)) and time of injection (12 or 36 h before CIDR withdrawal/ram introduction, IRRI, d0). Growth and development of follicles were monitored by transrectal ultrasonography in a randomly selected group of ewes (n = 4/treatment group) at injection of FSH, at IRRI, and on days 1, 2, and 3 post IRRI. All ewes marked by rams were examined by transrectal ultrasonography on Days 10 to 14 and 26 to 31 to determine ovulation rate and pregnancy, respectively. Ewes were reexamined 20 to 25 days later (Days 46 to 51 after IRRI) to detect pregnancies from the second service period. The number of small follicles (4 mm) did not change over the scanning period and was not affected by any treatment. The number of medium follicles (5 mm) declined (P < 0.05) between FSH injection (1.5 0.2) and Days 1 (0.8 0.2), 2 (0.9 0.2) and 3 (0.5 0.2). The number of large follicles (> 5mm) increased from FSH injection (0.6 0.3) to IRRI (1.4 0.3; P < 0.05), and increased further between IRRI and Day1 (2.3 0.3; P < 0.05), then declined between Days 1 and 3 (0.6 0.3; P < 0.05). The number of large follicles was greater in ewes given 68 (1.9 0.2; P < 0.01) or 42 (1.5 0.2; P < 0.05) mg of FSH than in ewes not receiving FSH (0.8 0.3). Mean ovulation rate was (2.12 0.05) and was increased by increasing dosages of FSH when given 12 but not 36 h before CIDR removal (Dosage X Time, P < 0.05). Fertility variables (estrous response, conception rate, percentage of ewes lambing or prolificacy) was not affected by treatment. Dosages of FSH previously shown to induce superovulation in a portion of ewes during the breeding season failed to increase ovulation rate in different time and vehicle combinations during anestrus.

Key Words: Ovulation rate, Anestrus, FSH

299 Libido and biological parameters of mature Awassi, Awassi x Charollais and Awassi x Romanov rams. R. T. Kridli*[1], M. Momani Shaker[2], A. Y. Abdullah[1], and I. Sada[2], [1]*Jordan University of Science and Technology, Irbid/Jordan,* [2]*Czech University of Agriculture, Prague/Czech Republic.*

This study was conducted in September to compare sexual performance and biological parameters of 2-yr-old, sexually nave rams of different genotypes. Charollais and Romanov rams were imported to Jordan to improve meat production and fertility of Awassi sheep. Four rams of each Awassi (A), F1 Awassi x Charollais (AC) and F1 Awassi x Romanov (AR) genotype were subjected to sexual performance tests by being individually exposed to two estrous Awassi ewes for five 20-min periods, each 2 d apart. Body weight, body condition score (BCS) and