

within the two groups, leptin was decreased ( $p=0.04$ ), but only in pregnant cows. Given the lipolytic effect of bST, a decrease of leptin blood concentrations has been expected; the lack of reaction in non-pregnant cows needs further investigation to elucidate whether metabolic and/or endocrine changes related to pregnancy do explain for it.

**Key Words:** Leptin, Growth hormone, Bovine

**265 Plasma leptin concentrations during early pregnancy in the dairy cow.** GE Mann<sup>\*1</sup>, MD Fray<sup>2</sup>, and D Blache<sup>3</sup>, <sup>1</sup>University of Nottingham, School of Biosciences, Sutton Bonington, Loughborough, LE12 5RD, UK, <sup>2</sup>Institute for Animal Health, Compton, Newbury, RG20 7NN, UK, <sup>3</sup>Animal Science, Faculty of Agriculture, University of Western Australia, Nedlands 6907, Australia.

In dairy cows, poor progesterone secretion following mating is an important cause of early embryo mortality. The aim of the present study was to determine whether a link exists between circulating leptin concentrations and progesterone secretion at this critical time. In study 1, carried out in 20 normally cycling lactating Holstein - Friesian cows, a single plasma samples was collected on day 5 following first insemination. Progesterone concentration was lower in cows failing conceive than in those becoming pregnant ( $1.7\pm0.1$  vs.  $2.4\pm0.3$  ng/ml;  $p<0.05$ ) and increased significantly with increasing plasma leptin concentration ( $r^2 = 0.40$ ;  $p<0.005$ ). In study 2, daily plasma samples were collected from 33 non-lactating Holstein - Friesian cows commencing 72h after induction of luteolysis with prostaglandin (day 1) until day 16. Cows were inseminated 72 and 96h following prostaglandin ( $n=23$ ) or remained as unseminated controls ( $n=10$ ). On day 16, cows were slaughtered and the reproductive tract flushed to collect the embryo, if present, and to determine uterine concentrations of embryonic interferon tau. There was no change in plasma leptin concentration through the sampling period in any group. Furthermore, plasma leptin concentrations were not different between pregnant ( $2.8\pm0.6$  ng/ml), inseminated not pregnant ( $2.2\pm0.3$  ng/ml) and control ( $2.7\pm0.6$ ng/ml) cows. There was no correlation between plasma leptin and plasma progesterone. Furthermore, in the pregnant cows, there was no relationship between plasma leptin and embryonic production of interferon tau. The results demonstrate that while a relationship may exist between leptin and progesterone in lactating cows, in the absence of the high metabolic load of milk yield there appears to be no relationship between leptin and either plasma

progesterone or early embryo development. Supported by MAFF, MDC and Intervet UK.

**Key Words:** leptin, cow, progesterone

**266 Study of histology and histochemistry of secretory structures of distal parts of digestive tract of Persian sturgeon *Acipenser persicus*.** T. Sheibani\*, Dept. of Basic Sciences, Faculty of Vet. Med. University of Tehran.

Regarding to the importance of the digestive system from the view of variety of secretions following the previous study of the author on anatomy and some microscopic studies on sturgeons and especially on this species, this study was carried out on a total number of ten fresh adult sturgeons from Caspian Sea. Specimens at one centimeter were taken from different parts of the tract. After fixation in phosphate- buffered formalin, they were transferred into the tissue processor, then thin sections of five microns were cut. The sections were subjected to routine and special staining methods such as; Hematoxylin and Eosin, P.A.S , orange G, Alcian blue and Toluidine blue or Johnson's methods. They were then studied under light microscope. The preintestinal regions including the secretory stomach and the pylorus possess an epithelium of pseudostratified columnar. Mucus secretions of columnar cells are shown by special staining methods such as P.A.S. -Hematoxylin - orange G which provide a protection from autolysis with a thick surface covering mucus. Such secretions with a less viscosity are seen in the mucus neck cells of gastric glands. These branched tubular glands synthesize and secrete gastric Juice containing hydrochloride acid and digestive enzyme, pepsin, which hydrolyses proteins into polypeptide fragments. Presence of gastric glands in forestomach suggest that here chemical digestion by pepsin with concentration of 25-35 units per miligrams of protein at pH 3-4 initiates. In pyloric caecum, intestines and rectum the epithelium of mucosa and their glands is of pseudostratified associated with secretory and goblet cells. Their cytoplasm have coarse eosinophilic granules synthesizing and secreting mucus due to presence of a thick glycocalyx. Numerous of mastocytes with metachromatic granules containing glycosaminoglycans and some neutral proteases showing by toluidine blue methods are present in intestinal mucosa.

**Key Words:** Histology, Sturgeons, Digestive tract

**Ruminant Nutrition  
Growing Cattle and Byproducts**

**267 The effect of feeding three milk replacer regimens on calf intake, body weight gain, and animal performance.** C. S. Ballard<sup>\*1</sup>, H. M. Wolford<sup>1</sup>, C. J. Sniffen<sup>1</sup>, M. P. Carter<sup>1</sup>, P. Mandebvu<sup>1</sup>, T. Sato<sup>1,2</sup>, Y. Yabuuchi<sup>2</sup>, and M. Van Amburgh<sup>3</sup>, <sup>1</sup>W. H. Miner Agricultural Research Institute, Chazy, NY, <sup>2</sup>Zen-Noh National Federation of Agricultural Co-operative Associations, Tokyo, Japan, <sup>3</sup>Cornell University, Ithaca, NY.

Sixty Holstein heifer calves at two farms were blocked at birth and randomly assigned to one of three treatments formulated on DM basis: 1) 27% CP/20% Fat fed at 1.5% BW for first week, 2.25% BW from 8 days through 5 weeks, and 1.25% BW from 6 weeks to weaning; 2) 27% CP/20% Fat fed at 200g 2x/day for 2 weeks, 250g 2x/day through weaning; or 3) 27% CP/15% Fat fed at 1.5% BW for first week, 2.25% BW from 8 days through 5 weeks, and 1.25% BW from 6 weeks to weaning. Milk replacer was reconstituted at 12-15% solids. Calf starter (22% CP) and water was available at all times and no forage was offered until weaning. Calves were weaned after consuming 0.7 kg starter for three consecutive days. Feed intake and growth parameters were measured weekly from birth through 10 weeks. Fecal scores and medical treatments were recorded daily. Results are shown in table. Calves fed milk replacer as a percent of BW had a higher total DMI and greater rate of growth for all parameters measured. Calves fed a fixed rate were weaned at an earlier age and had fewer days treated for illness.

Item		Treatment					Contrasts	
		1	2	3	SEM	P	2 vs (1+3)	1 vs 3
Wt, kg	birth	42.4	41.2	42.6	0.92	0.884	-	-
	Wk 10	98.9	92.7	102.2	5.66	0.004	<0.001	0.100
WH <sup>1</sup>	Wk 10	91.3	88.8	91.5	0.56	<0.001	<0.001	0.557
HH <sup>2</sup>	Wk 10	95.5	92.6	95.6	0.64	<0.001	<0.001	0.625
SP <sup>3</sup>	Wk 10	96.6	93.6	97.8	0.74	<0.001	<0.001	0.131
Chest <sup>4</sup>	Wk 10	39.7	38.7	40.0	0.34	0.007	0.002	0.272
Wean age, d		51.1	36.8	49.0	1.55	0.015	<0.001	0.331
Wean wt, kg		78.9	57.5	79.2	1.86	<0.001	<0.001	0.911
DMI <sup>5</sup> ,	Wk 4	2.08	1.86	2.31	0.10	0.021	0.014	0.135
	Wk 10	2.61	3.08	2.83	0.13	0.046	0.034	0.223
BCS	Wk 1	2.26	2.12	2.22	0.06	0.245	-	-
	Wk 10	2.76	2.70	2.96	0.09	0.055	0.086	0.076
Treatment	d <sup>6</sup>	3.84	0.74	2.58	0.52	<0.001	<0.001	0.103

<sup>1</sup>Wither height in cm; <sup>2</sup>Hip Height in cm; <sup>3</sup>Length from shoulder to pin in cm; <sup>4</sup>Depth of chest in cm; <sup>5</sup>Dry matter intake as %BW; <sup>6</sup>Days calves treated with electrolytes/antibiotics.

**Key Words:** Calf, Milk replacer, Crude protein and fat

**268 Plasma glucagon, IGF-1 and metabolite concentrations in Hereford and Senepol steers on orchardgrass or endophyte-infected tall fescue.** . R. Browning, Jr., Y. G. Myles, and T. L. Payton, *Tennessee State University, Nashville, TN, USA.*

Yearling Hereford (n = 30; H) and Senepol (n = 28; S) steers were fed endophyte-infected tall fescue (TF) or orchardgrass (OG) to assess hormone and metabolite responses to endophytic fescue in heat sensitive and heat tolerant breeds. All steers were fed OG hay before being placed on TF hay and seed or a different source of OG hay with OG seed. The study was conducted from mid-June to mid-October, 2000 with experimental diets started in mid-July. Blood was sampled every 2 wk for 4 mo. Weight changes and insulin concentrations were presented previously [Browning et al., 2001. J. Anim. Sci. 79(Suppl. 1):118]. Glucagon concentrations were not affected by a breed×diet×time interaction (P > 0.7). Glucagon was affected (P < 0.01) by a diet×time interaction. Plasma glucagon increased (P < 0.01) for OG steers from 95 ± 3 pg/mL pretreatment to 115 ± 3 during 1 and 2 mo of treatment. For TF steers, glucagon did not change from pretreatment to 1 and 2 mo on treatment (90, 88, and 98 ± 3 pg/mL, respectively). Plasma IGF-1 was unaffected (P > 0.5) by breed×diet×time or diet×time interactions. Breed influenced (P < 0.01) IGF-1 as S had higher concentrations than H (171 vs. 88 ± 6 ng/mL). Plasma glucose was not affected (P > 0.45) by breed×diet×time or diet×time interactions. Breed influenced (P < 0.01) plasma glucose as S had higher concentrations than H (74 vs. 69 ± 1 mg/dL). A moderate breed×diet×time interaction affected (P = 0.14) triglyceride concentrations. Plasma triglyceride increased (P < 0.01) from pretreatment to 1 mo of treatment for HOG (81 vs. 90 ± 2 mg/dL). Triglycerides during the same periods did not differ for HTF (83 vs. 79), SOG (87 vs. 84), or STF (83 vs. 80 ± 2 mg/dL). Total cholesterol was affected (P < 0.01) by a breed×diet×time interaction. Plasma cholesterol from pretreatment to 1 mo of treatment did not change for HOG (115 vs. 122 ± 3 mg/dL). Cholesterol during the same periods decreased (P < 0.01) for HTF (122 vs. 100), SOG (117 vs. 106), and STF (112 vs. 100 ± 3 mg/dL). Shifts in metabolic function may play a role in reduced steer performance on endophyte-infected tall fescue, particularly in heat sensitive breeds.

**Key Words:** Fescue Toxicosis, Cattle Breeds, Metabolites

**269 Pearl millet grain supplements for growing beef cattle.** G. M. Hill\*<sup>1</sup>, W. W. Hanna<sup>2</sup>, A. C. Coy<sup>1</sup>, B. C. Hand<sup>1</sup>, W. B. Forlow<sup>1</sup>, and B. G. Mullinix<sup>1</sup>, <sup>1</sup>University of Georgia, Tifton, GA/USA, <sup>2</sup>USDA-ARS, Tifton, GA/USA.

Growing cattle were fed either corn silage (S) or Tifton 85 bermudagrass hay (H) with pearl millet grain (PM) supplement treatments (TRT) to determine effects on post-weaning performance. Supplements (SUP) contained rolled corn, soybean meal, PM (89% DM, 12.5% CP; finely ground), and premix, respectively (%): CSB=87.8, 10.0, 0.0, 2.2; CPM=43.8, 5.0, 49.0, 2.2; PM=0.0, 0.0, 97.8, 2.2. The SUP contained DM, CP, and TDN (% DM), respectively: CSB=89.8, 14.7, 84; CPM=89.8, 13.8, 84; PM=89.6, 13.2, 83. Each SUP had salt (0.75%), CaCO<sub>3</sub> (0.75%), and provided premix vitamins A, D and E (24,000, 8,000, and 400 IU/d, respectively), lasalocid (150 mg/d) and Se (2.0 mg/d). Cattle were ranked by BW, randomly assigned to TRT, and initial and final BW were means of consecutive daily unshrunk weights. Exp.1. Steers (n=48; 16/TRT; age 9 mo; BW 322.5 ± 17.9 kg) of British, Charolais × British (C×B), British × Brahman breeding (C×B higher initial BW, P < .10) were fed each SUP (2.29 kg DM/d) with free-choice S (32.7% DM; 8.5% CP) in a feedlot. Although DMI was higher on PM than CSB, higher ADG and lower DM/gain occurred on CSB than on CPM and PM (see table). Exp 2. Heifers (n=60; 20/TRT; age 8 mo; BW 245.6 ± 31.1 kg) of C×B or Angus and Hereford breeding (C×B higher initial BW, P < .08) grazed six dormant pastures in autumn. Each SUP (2.04 kg DM/d) was fed with free-choice H (93% DM, 12.9% CP). Heifer ADG and DMI tended to be lower, and DM/gain was higher for PM than for CSB and CPM (see table). Higher cattle performance occurred with CSB than with PM SUP in both corn silage and hay diets.

	Exp. 1 Steers fed silage (42-d)					Exp. 2 Heifers fed hay (85-d)				
Item	CSB	CPM	PM	SE	P<	CSB	CPM	PM	SE	P<
Initial										
BW, kg	321	322	322	4.64	ns	246	245	246	6.56	ns
ADG, kg	0.94	0.70	0.71	0.08	0.24	0.70	0.70	0.54	0.04	0.14
DMI, kg	6.84	7.23	7.56	0.03	0.01	6.18	6.18	6.06	0.24	0.93
DM/gain	7.30	10.46	10.63	1.01	0.23	8.90	8.80	11.34	0.55	0.13

**Key Words:** Cattle, Gain, Hay

**270 Using allantoin in spot urine samples to predict bacterial protein production in finishing heifers.** R.A. McDonald\*, T.J. Klopfenstein, G.E. Erickson, C.N. Macken, and K.M. Whittet, *University of Nebraska-Lincoln, Lincoln, NE.*

A trial was conducted to determine if differences in bacterial crude protein (BCP) production could be predicted by measuring allantoin in spot urine samples. One hundred twenty heifers were blocked by initial weight (BW=349 kg) and individually fed in a 3 x 5 factorial arrangement of treatments. The high-moisture corn (HMC) diet (DM basis) consisted of 88.3 percent HMC, 6.7 percent cottonseed hulls, and 5.0 percent dry supplement. The BRAN diet was identical to the HMC diet except 20.0 percent corn bran replaced HMC. Five levels of urea were fed with these two diets at 0, 0.45, 0.90, 1.35, and 1.8 percent of the diet. The BRAN diet was also fed with five levels of SBM at 0, 3.89, 7.78, 11.67, and 15.56 percent of the diet. Spot urine samples were collected on days 19, 20, and 21 and on days 61, 62, and 63 and analyzed for both allantoin and creatinine with the average used in statistical analyses. There were no significant interactions or main effects of level for any of the response variables. Main effects of diet are included in the table. Diet affected (P<0.05) ADG, DMI, feed efficiency (ADG/DMI), allantoin in mmol/day, and allantoin in mmol/kg DMI. Heifers fed HMC gained more (P=0.02) compared to heifers fed BRAN but not (P=0.74) SBM with SBM being higher (P=0.01) than BRAN. Heifers consumed less of the HMC diet than BRAN (P=0.04) or SBM (P<0.01) diets. Feed efficiency (ADG/DMI) was higher for HMC than for BRAN (P<0.01) or SBM (P=0.07) with SBM being higher (P=0.01) than BRAN. Allantoin in mmol/d or mmol/kg DMI was higher for HMC compared to BRAN (P=0.01 and P<0.01) and SBM (P=0.02 and P<0.01). BRAN and SBM were similar for both allantoin variables. These data show that allantoin follows feed efficiency and may predict differences in BCP production due to energy.

Variable	HMC	BRAN	SBM	SEM
ADG, kg/d	1.28	1.17	1.30	.03
DMI, kg/d	8.39	8.78	9.01	.13
ADG/DMI	.152	.133	.144	.003
Allantoin, mmol/d	149	134	136	4
Allantoin, mmol/kg DMI	15.9	14.2	14.1	.5

**Key Words:** Allantoin, Bacterial Crude Protein, Cattle

**271 Effect of previous liveweight gain on acid/base balance, blood flow, and oxygen consumption by splanchnic tissues during adaptation to a high-grain diet in steers.** M. J. Hersom\*, C. R. Krehbiel, G. W. Horn, and J. G. Kirkpatrick, *Oklahoma State University, Stillwater, OK.*

Ten fall weaned Angus x Hereford steers (BW = 324 ± 45 kg, age = 395 ± 11 d) were used in a completely random design to determine the effect of compensatory growth on blood gas, blood flow, and oxygen consumption across splanchnic tissues during adaptation to a high-grain diet. Treatments were high (HG; 1.25 ± 0.14 kg/d) or low (LG; 0.73 ± 0.13 kg/d) daily BW gain while grazing wheat pasture. After steers were grazed for 69 d, surgery was performed to place chronic catheters in the portal vein, a hepatic vein, and a mesenteric artery and vein. Blood flow and oxygen consumption by portal-drained viscera (PDV) and liver were measured on 0, 14, 28, 42, 64, and 92 d of a high-grain feeding period. Compensatory growth was evident in LG steers (30% by d 28); ADG was greater (P=0.01) during the first 28 d (2.13>1.31 ± 0.18 kg/d) and was greater (P=0.06) during the entire feeding period (1.28>1.06 ± 0.07

kg/d). Similarly, ADG:DMI was greater ( $P=0.01$ ) for LG steers during the entire feeding period ( $0.19 > 0.14 \pm 0.01$  kg ADG/kg DMI). Arterial blood pH did not differ and was 1.5 and 1.3% greater than portal and hepatic blood pH. Arterial base excess tended to be greater ( $P=0.08$ ) in LG steers than HG steers ( $3.83 > 2.94 \pm 0.32$  mmol/L) but calculated  $^{-}\text{HCO}_3$  (mmol/L) was similar ( $P=0.17$ ) between treatments. Hepatic blood flow in LG steers was greater ( $P=0.05$ ) than HG steers ( $756 > 654 \pm 40$  L/h) and increased ( $P<0.001$ ) with days on feed. Arterial  $\text{O}_2$  concentration did not differ among treatments but increased ( $P<0.001$ ) with DOF. Across the feeding period, total splanchnic tissue (TST) oxygen consumption was greater ( $P=0.03$ ) in LG than HG steers ( $780 > 603 \pm 68$  mmol/h). Steers that had low BW gain prior to high-grain feeding exhibited increased hepatic blood flow and increased TST oxygen consumption when adapted to high-grain diet. This increase in energy demand by TST did not prevent compensatory growth by LG steers.

**Key Words:** Blood flow, Oxygen consumption, Cattle

**272 Increasing intake of milk replacer by preruminant Holstein calves increases body tissue gain without affecting composition of gain.** K. S. Bartlett\*, F. K. McKeith, and J. K. Drackley, *University of Illinois, Urbana, IL.*

Male Holstein calves were used to quantify responses of body composition and component gains to increasing energy intake from milk replacer. Calves purchased during the first week of life were fed whole milk at 10% of body weight (BW) for a 2-wk adaptation period. Calves then were randomly assigned to either an initial slaughter group or to experimental diets. In this portion of the study, 20 calves were fed an all-milk-protein milk replacer (reconstituted to 12.5% solids) that contained 24.8% CP, 18.9% fat, and 4.6 Mcal ME/kg at 10% ( $n = 6$ ), 14% ( $n = 6$ ), or 18% ( $n = 8$ ) of BW, adjusted weekly as calves grew. No starter was offered but calves had free access to water. Calves remained on experiment for 5 wk. Intake of milk replacer dry matter (0.65, 0.99, and 1.28 kg/d), average daily gain (0.36, 0.70, 1.03 kg/d), and gain:feed (0.55, 0.71, 0.81) increased linearly ( $P < 0.001$ ) as feeding rate increased from 10 to 14 to 18% of BW, respectively. Increasing feeding rate resulted in linear increases ( $P < 0.001$ ) in total gains of water, protein, fat, ash, and energy. Increasing feeding rate resulted in the final body containing slightly greater percentages of fat (5.1, 6.6, 7.6%; linear,  $P < 0.001$ ) and slightly less water (73.2, 71.5, 71.3%; linear,  $P < 0.001$ ) and protein (18.2, 18.0, 17.6%; linear,  $P < 0.03$ ). The composition of whole-body gain was not altered significantly ( $P \geq 0.18$ ); fat was 11.9, 12.8, and 13.0% and water was 65.2, 64.7, and 66.5% of gain, respectively. The concentration of urea in plasma (11.6, 8.9, 8.3 mg/dl) decreased linearly ( $P < 0.05$ ) as feeding rate increased. We reported previously (J. Dairy Sci. 84:1560) that increasing the crude protein content of milk replacer from 14% to 24.8% had marked effects on composition of whole-body gain. We conclude that increasing the feeding rate of a milk replacer with adequate crude protein content exerts pronounced effects on growth rate and feed efficiency but has little impact on composition of gain.

**Key Words:** Body Composition, Milk Replacer, Dairy Calves

**273 Soybean hulls for replacing corn silage in total mixed rations of lactating cows.** J. Miron\*, E. Yosef, E. Maltz, and D. Ben-Ghedalia, *ARO, Bet Dagan, Israel.*

The potential of soybean hulls for replacing forage NDF in TMR of lactating cows was examined in this study. Forty lactating cows were divided into two groups and individually fed ad libitum for eight weeks one of two experimental diets: (I), a TMR containing 18% forage NDF, the corn silage - CS TMR; and (II), a similar TMR in which the corn silage component (16.5% of the DM) was replaced by soybean hulls - the SH TMR, that contained only 12% forage NDF. Total NDF content was 39% and 36% in the SH and CS TMR, respectively. Average voluntary DMI was 25.8 and 25.1 kg for the CS and SH groups, respectively; the SH group ingested more NDF than the CS group ( $p<0.1$ ). Average milk fat, 3.5% FCM and ECM yields were higher in the SH than in the CS group ( $P<0.05$ ). Efficiency of feed utilization for milk and FCM production was slightly better in the SH group. In vitro digestibility data showed higher digestibility ( $P<0.05$ ) of organic matter, NDF, hemicellulose and cellulose components in the SH TMR as compared to the CS diet. Despite the digestibility differences, milk fatty acids profiles, including the conjugated linoleic acid (CLA), were similar in both treatments. Thus, NRC (2001) recommendations regarding minimal forage NDF inclusion

in TMR of cows, can be extended even to diets containing as low as 12% forage NDF, under conditions similar to that of the SH TMR.

**Key Words:** Soybean hulls, Forage NDF replacement, Dairy cows performance

**274 Feeding high free fatty acids cottonseed to lactating dairy cows.** H. M. Sullivan\*, J. K. Bernard<sup>2</sup>, H. E. Amos<sup>1</sup>, and T. C. Jenkins<sup>3</sup>, <sup>1</sup>*University of Georgia, Athens, GA/USA*, <sup>2</sup>*University of Georgia, Tifton, GA/USA*, <sup>3</sup>*Clemson University, Clemson, SC/USA.*

Twenty-four cows were used in a 10 wk randomized block design trial to evaluate the effects of feeding whole cottonseed containing elevated concentrations of free fatty acids (FFA) on DM intake, milk yield and composition, fatty acid composition of milk, and nutrient digestibility. After a 2-wk preliminary period, cows were assigned randomly to one of four treatment diets, differing in free fatty acid concentrations, for 8 wk. Whole cottonseed containing either 3 or 12% free fatty acids were blended to provide 3, 6, 9, or 12% free fatty acids and fed at the rate of 12.5% of dietary DM. Experimental diets were fed twice daily as a TMR behind Calan doors. Intake and digestibility were determined during wk 5 of the experimental period. There were no differences ( $P > 0.10$ ) in DMI, milk yield and percentage of milk protein, lactose, or SNF. Percentage milk fat was lower ( $P < 0.01$ ) for the diet containing 6% FFA, likely due to the numerically higher milk yield for this diet. Concentrations of C6:0 decreased linearly whereas C16:1 increased linearly ( $P < 0.02$ ) as FFA increased. Concentrations of C8:0 ( $P < 0.05$ ), C10:0 and C12:0 ( $P < 0.01$ ) exhibited a cubic response with concentrations highest for 6% FFA and lowest for 9% FFA compared with 3 or 12% FFA. Intake of ADF increased linearly ( $P < 0.02$ ) as FFA increased, but no differences were observed in DM, CP, or NDF intake. Apparent digestibility of DM was similar for all treatments, but CP digestibility was highest ( $P < 0.01$ ) for 3 and 9% FFA where as NDF digestibility was highest ( $P < 0.05$ ) for 6 and 12% FFA. Digestibility of ADF increased linearly ( $P < 0.01$ ) as FFA increased. Results of this study indicate that feeding whole cottonseed containing up to 12% FFA does not negatively impact intake or production. Differences in milk fatty acid composition and nutrient digestibility suggest potential changes in ruminal fermentation, however these changes did not impact production at the FFA levels fed in this experiment.

**Key Words:** Cottonseed, Free Fatty Acids, Milk Yield

**275 Effect of feeding wet corn gluten feed and a raw soybean hull-corn steep liquor pellet on the performance of lactating dairy cows.** E.E. Ferdinand\*, J.E. Shirley, E.C. Titgemeyer, J.M. DeFraire, and A.F. Park, *Kansas State University, Manhattan, KS.*

Forty-six multiparous Holstein cows were used in a randomized incomplete block design to evaluate the effect of wet corn gluten feed (WCGF) and a raw soybean hull-corn steep liquor pellet (SHSL) on the performance of lactating dairy cows. Cows were blocked by calving date and assigned to control (C), WCGF (20% of diet DM), or SHSL (20% of diet DM). Diets were administered at the first feeding postpartum. C contained (DM basis) 30% alfalfa hay, 15% corn silage, 32% corn, 9.3% whole cottonseed, 4.4% solvent soybean meal (SBM), 3.3% expeller SBM, 1.3% fish meal, 1% wet molasses, and 3.7% vitamins/minerals. WCGF replaced 10% alfalfa hay, 5% corn silage, 5% corn grain, and expeller SBM replaced solvent SBM to maintain diet RUP. SHSL replaced 10% alfalfa hay, 5% corn silage, 3% solvent SBM, and 2% corn. Diet CP% and energy density (Mcal/kg, NEI) for C, WCGF, and SHSL were 18.5, 1.70; 18.3, 1.76; 19.1, 1.74; respectively. Data were analyzed using PROC MIXED of SAS with previous mature milk equivalent as a covariate. Milk, ECM, DMI, and production efficiency (ECM/DMI) were not affected by diet during the first 91 d of lactation, but there was a diet by week interaction ( $P < 0.05$ ) for production efficiency. Cows fed C were more efficient during the first two weeks postpartum than cows fed WCGF and SHSL, likely due to increased fat mobilization from adipose tissue. Milk fat, SNF, protein, and lactose yield and percent, and MUN were similar among diets. Plasma albumin, glucose, NEFA, total amino acids, triacylglycerol, and urea were not affected by diet. WCGF and SHSL can successfully replace a portion of the alfalfa hay, corn silage, and corn grain in lactating dairy cattle diets.

**Key Words:** Wet corn gluten feed, Soybean hulls, Steep liquor

**276 Effects of dietary sunflower seeds (SS) and protein on digesta physico-chemical parameters in small intestine and on plasma cholecystokinin (CCK) in lambs.** P.S. Mir\*, M. Ivan, G.J. Mears, C.M. Ross, and Z Mir, <sup>1</sup>*Agriculture and Agri-Food Canada, Lethbridge, AB.*

A 2 x 2 factorial experiment with 12 lambs per treatment was conducted to measure the effects of dietary SS and protein on plasma CCK, and on digesta viscosity, protein, fat and amylase activity in different parts of the small intestine. The experiment lasted 140 d and comprised of four treatments, two with low protein (12%) and two with high protein (16%) diets. Within each protein level one diet was without (control) and one with SS supplement (14% of dietary DM). The diets were based on corn silage and rolled corn grain, with soybean meal used to achieve desired dietary protein. Concentrations of CCK were determined in jugular plasma in samples obtained from each lamb (4 h after feeding) six weeks after the initiation of the experiment. After the end of the experiment all lambs were killed and digesta sampled 15 min later from 50-cm sections of proximal, mid jejunal and distal small intestine. Dietary SS increased ( $P < 0.05$ ) plasma CCK concentrations and reduced ( $P < 0.05$ ) digesta viscosity in the proximal section. The viscosity remained lower ( $P < 0.05$ ) in the jejunal and distal sections of lambs fed the SS in low protein diet, but SS increased the viscosity with the high protein diet. In lambs fed the low protein diet with SS digesta fat content was increased ( $P < 0.05$ ) in jejunal but not in the proximal or distal sections. Dietary SS increased ( $P < 0.05$ ) digesta protein by 41 and 36% in lambs fed the low and high protein diets, but amylase activity was increased (19%) due to SS only in lambs fed the high protein diet. Dietary SS, was effective in altering digesta factors such as viscosity and protein in lambs irrespective of protein content of the diet, but the activity of the amylase was substantially increased by higher dietary protein.

**Key Words:** Sheep, Sunflower seed, Intestinal digesta, Viscosity, amylase activity

**277 The effect of feeding wet corn gluten feed and a raw soybean hull-corn steep liquor pellet on digestibility and rumen parameters.** E.E. Ferdinand\*, J.E. Shirley, E.C. Titgemeyer, J.M. DeFrain, and A.F. Park, *Kansas State University.*

Four ruminally cannulated and two intact multiparous Holstein cows were used in a 3 x 3 replicated Latin square design to evaluate the effect of feeding wet corn gluten feed (WCGF) and a raw soybean hull-corn steep liquor pellet (SHSL) on diet digestibility and rumen parameters. Cows were fed control (C), WCGF (20% diet DM), or SHSL (20% diet DM) as a TMR at 0700 and 1800. C contained 30% alfalfa hay, 15% corn silage, 32% corn, 9.3% whole cottonseed, 4.4% solvent soybean meal (SBM), 3.3% expeller SBM, 1.3% fish meal, 1% wet molasses, and 3.7% vitamins/minerals. WCGF replaced 10% alfalfa hay, 5% corn silage, 5% corn grain, and expeller SBM replaced solvent SBM to maintain diet RUP. SHSL replaced 10% alfalfa hay, 5% corn silage, 3% solvent SBM, and 2% corn. Periods were 14 d (10 d adaptation, 4 d collection). Diet and ort samples were collected and composited on d 10 to 12 and d 11 to 13, respectively. Fecal grab samples were collected every 6 h, advanced by 2 h each d, beginning at 0700 on d 11 and ending at 0500 on d 14. Acid insoluble ash was used to estimate fecal output. Cows were pulse dosed with Co-EDTA at 0700 on d 11 for estimation of liquid dilution rate, and rumen fluid samples were obtained just prior to dosing and 3, 6, 9, 12, and 24 h following. DMI and total tract digestibilities of DM, OM, NDF, ADF, and CP were not different among diets and averaged 17.2 kg/d, 71.7%, 73.2%, 63.1%, 58.5% and 73.0%, respectively. Liquid dilution rate, ruminal pH, and ruminal concentrations of total VFA and ammonia were not influenced by diet and averaged 13%/h, 6.2, 100.3 mM, and 8.9 mM, respectively. The molar ratio of acetate to propionate was higher ( $P < 0.05$ ) for C (3.38) than for WCGF (2.79) and SHSL (2.89). These data show that our substitution of WCGF and SHSL into diets did not greatly affect digestibility and rumen parameters.

**Key Words:** Wet corn gluten feed, Soybean hulls, Steep liquor

**278 Effects of level of substitution of pelleted beet pulp for high-moisture corn on production and digestion in lactating dairy cows.** J. A. Voelker\* and M. S. Allen, *Michigan State University.*

Effects of increasing levels of dried, pelleted beet pulp substituted for high-moisture corn were evaluated with 8 ruminally and duodenally cannulated multiparous Holstein cows in a duplicated 4x4 Latin square design with 21-d periods. Cows were  $79 \pm 17$  (mean  $\pm$  SD) DIM at the beginning of the experiment. Experimental diets with 40% forage (corn silage and alfalfa silage) and 60% concentrate contained 0%, 6.1%, 12.1%, or 24.3% beet pulp (0BP, 6BP, 12BP, and 24BP, respectively) substituted for high-moisture corn on a DM basis. Diet contents of NDF and starch were 24.3% and 35.4% (0BP), 26.2% and 31.2% (6BP), 28.0% and 27.0% (12BP), and 31.6% and 18.6% (24BP), respectively. Substituting BP for corn tended to cause a quadratic response in 3.5% FCM yield ( $P = 0.07$ ), with treatment means of 37.4, 38.4, 38.0, and 36.8 kg/d as BP increased. Treatment did not affect mean rumen pH (5.96), daily minimum pH, or daily variation in pH ( $P > 0.60$ ). Increasing BP in the diet caused a linear decrease in DMI ( $P < 0.05$ ) though rumen DM pool decreased ( $P < 0.05$ ). As BP increased, potentially digestible NDF was digested more extensively ( $P < 0.01$ ) and at a faster rate ( $P < 0.001$ ) in the rumen, resulting in increased total tract NDF digestibility ( $P < 0.0001$ ) and decreased NDF turnover time ( $P < 0.001$ ). Passage rate of indigestible NDF increased with added BP ( $P < 0.05$ ), but passage rate of potentially digestible NDF was unaffected ( $P > 0.60$ ). Although true rumen starch digestibility decreased when more BP was fed ( $P < 0.01$ ), whole tract starch digestibility was not affected ( $P > 0.10$ ) because of compensatory digestion of starch in the small intestine. Because of more thorough digestion of fiber as BP increased, total tract digestibility of DM tended to increase ( $P < 0.10$ ) and intake of digestible DM was not affected ( $P > 0.40$ ). Partial substitution of high-fiber beet pulp for high-starch high-moisture corn can improve milk production by increasing fiber digestibility without reducing starch digestion.

**Key Words:** Beet pulp, High-moisture corn, Fiber digestion

**279 Effects of increasing level of dietary soybean hulls on ruminal characteristics and serum urea nitrogen of Boer-cross goats.** J. A. Moore, A. T. Maye, M. H. Poore\*, and J-M Luginbuhl, *North Carolina State University, Raleigh.*

Soybean hulls or husks (soyhulls) contain highly digestible fiber and may be an economical substitute for high-quality hay in diets for meat goats. This study evaluated diets containing 0, 25, 50, or 75% soyhulls (20 %CP, 54% NDF, 37% ADF) fed to 8 ruminally cannulated Boer-cross does (BW = 46 kg) with 10% refusal (ad libitum). The remaining portion of the diet was orchardgrass hay (13.2 %CP, 67% NDF, 36% ADF) chopped to an average length of 10 cm and offered in a hay feeder above the soyhull feeder. The 14-d periods in the double 4x4 Latin square design had 9-d adaptation followed by 4 d of intake measurement and 1 d of sampling. Ruminal fluid was removed via the cannula at 0, 4, 8, 12, 16, 20, and 24 hr postfeeding. Blood was collected via jugular venipuncture at 0, 4, and 8 h postfeeding. One doe had problems throughout the study and was eliminated, leaving 7 goats; least squares means are presented. Hay DMI decreased linearly ( $P < .01$ ) from 960 to 190 g/d as soyhull intake increased (linear,  $P < .01$ ). Total DMI increased linearly ( $P < .01$ ) from 970 to 1280 g/d. Ruminal pH decreased linearly ( $P < .05$  except 12 h, for which  $P = .07$ ) at all time points, averaging 6.47, 6.32, 6.25, and 6.15 for the 0, 25, 50, and 75% soyhull diets, respectively. Ruminal  $\text{NH}_3$  increased linearly ( $P < .04$ ) at all times after 0 h, averaging 6.8, 8.9, 12.7, and 14.2 mM; the increase is most likely due to the elevated CP in the soyhulls used in this study. Serum urea nitrogen increased linearly ( $P < .02$ ) at 4 and 8 h, averaging 2.9, 3.2, 4.6, and 4.3 mM for the 0, 25, 50, and 75% soyhull diets, respectively. Total VFA increased linearly ( $P < .04$ ) at all time points, averaging 86, 93, 110, and 114 mM. Acetate:propionate ratio showed a quadratic response ( $P < .04$ ) for hours 4 through 20, with the average for those 5 time points being 3.3, 4.1, 4.0, and 3.6 for the 0, 25, 50, and 75% soyhull diets, respectively. Data indicate soyhulls are readily consumed and produce a ruminal environment that would not promote acidosis.

**Key Words:** Soybean Hulls, Goats, Ruminal Environment

**280 Effects of feeding raw and roasted sunflower seed on rumen fermentation and total tract nutrient utilization by lactating dairy cows.** P. Sarrazin<sup>\*1</sup>, A. F. Mustafa<sup>1</sup>, P. Y. Chouinard<sup>2</sup>, and V. Raghavan<sup>1</sup>, <sup>1</sup>*McGill University, Ste-Anne-De-Bellevue, QC, Canada*, <sup>2</sup>*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<sup>\*1</sup>, T.A. McAllister<sup>2</sup>, J. Aalhus<sup>3</sup>, M. Dugan<sup>3</sup>, and R. Sharma<sup>2</sup>, <sup>1</sup>*Alberta Agriculture, Food and Rural Development, Lethbridge, AB*, <sup>2</sup>*Agriculture and Agri-Food Canada, Lethbridge, AB*, <sup>3</sup>*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<sup>®</sup>) 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  $21.5 \pm 1.0$  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 ( $67.8 \pm 2.3$  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<sup>TM</sup> 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 bioavailability 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<sup>\*</sup> 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