and fat reduction content, along with the milk fatty acids profile made the cashew nut utilization a good alternative for obtaining milk with a better nutraceutic value.

Key Words: fatty acids, by-product

362 Effect of dietary n-3 polyunsaturated fatty acids (PUFA) on gene expression of the insulin-like growth factor (IGF) system in the bovine uterus. G. S. Coyne*[1,2], D. A. Kenny[2], and S. M. Waters[1], [1]*Animal Bioscience Centre, Teagasc, Grange Beef Research Centre, Dunsany, Co. Meath, Ireland*, [2]*School of Agriculture, Food Science & Veterinary Medicine, University College Dublin, Belfield, Dublin, Ireland*.

Nutrition plays a key role in reproduction and there is evidence to suggest that dietary long chain n-3 PUFA may improve reproductive performance in cattle. Furthermore, localised IGF signalling in the uterine endometrium may play a role in influencing the initiation and maintenance of pregnancy. The objective of this study was to examine the effects of dietary supplementation of n-3 PUFA on the expression of genes involved in the GH-IGF signalling system in the bovine uterine endometrium. Reproductively normal crossbred beef heifers were fed a straw and barley/beet pulp based concentrate diet supplemented with a rumen protected source of either saturated fat or high n-3 PUFA, for 45 days. Animals were slaughtered on day 18 of the estrous cycle. Endometrial tissue was harvested and total RNA extracted from animals on the high (n=7) and low PUFA (n=7) diets. RNA was reverse transcribed into cDNA. Primers were designed to amplify specific fragments of genes involved in the GH-IGF signalling axis. The relative expression of each gene was analyzed using real time RT-PCR. Animals supplemented with the high PUFA diet showed a 6 fold decrease in IGF-1 ($P<0.05$) and a 1.5 fold increase in IGF-2 gene expression compared with the low PUFA diet ($P<0.05$). Animals offered the high PUFA diet also showed an 11 fold decrease in IGFBP-3 and a 4 fold decrease in IGFBP-6 compared to the low PUFA diet ($P<0.05$). IGF-1 and IGF-2 are both associated with key reproductive events such as preimplantation and placental development. IGFBPs can have an inhibitory effect by competing with IGF-1R for IGF binding; thus down-regulation of IGFBPs could indicate an increase in available IGF-1 for IGF-1R binding. IGFBP-3 is suggested to regulate local IGF bioavailability and transport of IGFs across the endometrium while IGFBP-6 has a higher affinity for IGF-2, inhibiting its effects, including cellular proliferation and differentiation. Differential gene expression of IGF-1, IGF-2 and the IGFBPs in the endometrium may positively influence reproductive efficiency by providing a more suitable environment for embryo survival.

Key Words: PUFA, IGF, uterus

Ruminant Nutrition: Ruminant Nutrition 1

363 Oats grain as an alternative to corn in beef cattle diets. J. A. Marcenac[1], H. M. Arelovich*[1,2], M. F. Martínez[1], M. I. Amela[1], and R. D. Bravo[1,2], [1]*Dto. Agronomía-Universidad Nacional del Sur*, [2]*Comisión de Investigaciones Científicas de la Provincia de Buenos Aires (CIC); CERZOS, Bahía Blanca, Argentina*.

Although corn is used for beef cattle feeding in Argentina, its availability is limited in semiarid areas. This experiment was designed to evaluate the effect of replacing corn with oats on beef cattle performance. Eight Aberdeen Angus calves (229 kg initial BW) were individually housed and fed a mixed diet. The treatments were: 1) Oats grain diet (OGD): 20% hay plus 80% oats-pellet, and 2) Corn grain diet (CGD): 20% hay plus 80% corn-pellet. The hay was an alfalfa-grass mixture, and the pellet ingredients were 75.0, 14.4, 7.0, and 0.06% in OGD; and 75.0, 11.05, 10.0, and 0.45% in CGD of grain, wheat middlings, sunflower meal and urea respectively. Pellets also included 1.5% NaCl, 1.0% $CaCO_3$, and 1.0% mineral-vitamin mix with monensin.The average chemical composition of both diets was 14.6, 36.9, 17.5, and 9.8% of DM for CP, NDF, ADF, and ash, respectively. The treatments OGD and CGD were randomly allotted to 4 individually fed calves/treatment, fed ad libitum once daily at 0900 h for 62 d. Performance measurements included DMI, ADG, feed-to-gain ratio (FC), and total tract apparent DM digestibility (DIG). Blood samples collected via jugular venipuncture were analyzed for glucose (GLU), total protein (TP), and non-esterified fatty acids (NEFA). Data were analyzed by ANOVA as a completed randomized design. Results are reported in the table. The DMI and ADG were increased by CGD ($P < 0.05$); however, no differences were found for FC, probably because total DDMI was similar for the 2 diets. Blood measurements were not affected by treatments, remaining within standard reference values. As far as FC is concerned, oats seems to effectively replace corn in diets for growing beef cattle.

Table 1.

Item	OGD	CGD	SEM	P =
Performance,				
DMI kg/d	7.1	7.9	0.20	0.03
DIG, %	77.5	74.1	0.37	0.17
DDMI, kg/d[1]	5.5	5.9	0.20	0.22
ADG, g	1225	1412	18	0.0003
FC	5.8	5.6	0.10	0.26
Blood serum,				
GLU, g/L	1.41	1.19	0.17	0.26
TP, g/100 mL	6.79	6.53	0.09	0.14
NEFA, mEq/L	0.40	0.44	0.06	0.66

[1]DDMI: digestible DM intake, computed from DIG x DMI

Key Words: oats, corn, beef cattle

364 The effect of steam-flaked corn storage method on enzymatic starch availability and in situ dry matter disappearance. K. L. Neuhold, J. J. Wagner*, T. E. Engle, S. L. Archibeque, and K. S. Sellins, *Colorado State University*, *Fort Collins*.

The objective of this study was to investigate the effect of steam-flaked corn (SFC) storage method (SM) on in situ DM disappearance and enzymatic starch availability (SA). Steam-flaked corn was sampled immediately off the roller for five consecutive days and immediately prior to feeding on the following day. Two SM for SFC were evaluated: 1. stored overnight in an enclosed metal bin (HOT) or 2) stored overnight on a concrete slab allowing SFC to cool (COOL). Samples of SFC collected pre- and post-storage for each SM were submitted to a commercial laboratory for SA analysis. Additional samples were collected and prepared for in situ work through a 2mm screen. Dacron

bags were filled with ground SFC at 10mg/cm^2 surface area. Bags were placed sequentially into the rumen of 2 steers to allow fermentation times of 0, 2, 4, 8, 12, 24, 48, and 72 hr. After removal from the rumen, bags were washed manually and then dried in a 60°C forced air oven for 48 hr. Polynomial curves, pre- and post-storage, were generated over incubation time for each SM and day. The area under each curve was calculated and used for statistical analysis of the in situ data. Starch availability was higher ($P < 0.01$) for SFC stored under COOL conditions as compared with HOT (44.8 versus 34.2 mls). Post storage samples had lower ($P < 0.0001$) SA as compared with pre-storage samples (29.7 versus 49.3 mls). The interaction between SM and time of sampling (pre- versus post-storage) was not significant. Storage method differences for in situ DM disappearance were not significant averaging 53.95 versus 54.23% for the HOT and COOL treatments, respectively. In situ DM disappearance was reduced ($P < 0.08$) during storage from 57.93% to 51.25%. Interactions between SM and time of sampling were not significant. Reductions in DM disappearance during storage that were observed for each SM varied widely from day to day. Enzymatic SA estimates were reduced for SFC stored HOT. In situ DM disappearance from SFC was not affected by SM.

Key Words: steam-flaked corn, starch, retrogradation

365 Effect of type and length of dietary fiber on growth, efficiency and carcass quality of feedlot cattle. M. J. Baker*, D. E. Hogue, M. L. Thonney, and D. J. Ketchen, *Cornell University, Ithaca, NY.*

High fiber ingredients often are included in diets for feedlot cattle, but the fermentability of the fiber necessary to maintain rumen function is seldom considered. The purpose of this study was to evaluate how level of fermentable fiber and fiber length affect feed intake, growth, and carcass characteristics of feedlot cattle. Crossbred yearling heifers (n = 36, BW = 388 kg) were blocked by weight and randomly assigned to three diets. All cattle were fed diets with 70% whole shelled corn. Two diets included either chopped hay (CH) or ground hay (GH) as 20% of the diet with a premix of protein, minerals, vitamins, and Rumensin in pellet form at 10% of the diet. The third diet included a pellet composed of high NDF grain byproducts (BP) and a premix similar to that for the hay diets at 30% of the diet. Each diet was formulated to contain 21% NDF. The BP diet was expected to contain 17% potentially fermentable NDF (pfNDF) and the hay diets were expected to contain 12% pfNDF. The formula for pfNDF was NDF-[100-TDN-Metabolic fecal loss]. The cattle were fed for 82 d in 9 slatted floor pens (4/pen), with 3 pens per diet. Diet analysis showed that NDF was 23% and 21%, calculated pfNDF was 15% and 14%, and TDN was 80% and 81% for BP and hay diets, respectively. For BP, CH, GH, there were no significant differences due to fiber source or fiber length on the rapid ADG (1.9, 1.8, 1.8 ± 0.04 kg), or on final weight (550, 548, 542 ± 8.9 kg), DMI (11.8, 12.3, 12.0 ± 0.19 kg), or gain:feed (159, 150, 149 ± 5.8 g/kg). Rumen epithelia showed no evidence of degradation related to diet. There were no condemned livers. There were no statistical differences due to diet for carcass measurements with the exception of marbling (MRB). Cattle fed BP had higher ($P < 0.05$) MRB than cattle fed hay diets (4.2 vs 3.8 ± 0.20) and cattle fed CH had lower ($P < 0.03$) MRB than cattle fed GH (3.4 vs. 4.1 ± 0.20). These results suggest that cattle fed a diet with 15% pfNDF, regardless of fiber source or length, are expected to have equal performance.

Key Words: beef, particle size, fermentable fiber

366 Effect of nitrogen supplementation on urea kinetics and microbial use of recycled urea in steers consuming corn-based diets. D. W. Brake*[1], E. C. Titgemeyer[1], M. L. Jone[2], and D. E. Anderson[2], [1]*Department of Animal Sciences and Industry, Kansas State University, Manhattan*, [2]*Department of Clinical Sciences, Kansas State University, Manhattan*.

We analyzed effects of N supplementation as distiller's grains with solubles (DDGS) or urea to steers consuming corn-based diets. Six ruminally and duodenally cannulated steers (244 kg) were used in a replicated 3×3 Latin square and fed 1 of 3 corn-based diets: control (CON; 10.2% CP), UREA (11.4% CP), or DDGS (12.7% CP). Periods were 14 d with 10 d for adaption and 4 d for collection. Steers were in metabolism crates for collection of urine and feces. Venous infusions of $^{15}N^{15}N$-urea with measures of $^{15}N^{15}N$-urea and $^{14}N^{15}N$-urea in urine were used to measure urea kinetics. Dry matter intake (6.0 kg/d) was not affected by treatment, but N intake differed (99, 151, 123 g/d for CON, DDGS, and UREA). Urea-N synthesis tended to be greater for DDGS (118 g/d) than for UREA (86 g/d), which in turn tended to be greater than CON (52 g/d). Urea-N excreted in the urine was greater ($P<0.05$) for DDGS (35.1 g/d) and UREA (28.6 g/d) than for CON (12.6 g/d). Gut entry of urea-N was numerically greatest for DDGS (83 g/d), intermediate for UREA (57 g/d), and least for CON (39 g/d). The amount of urea-N returned to the ornithine cycle tended to be greater for DDGS (47 g/d) than for UREA (27 g/d) or CON (16 g/d). The fraction of recycled urea-N that was apparently used for anabolism tended ($P=0.09$) to be greater for CON (0.60) than for DDGS (0.31) or UREA (0.46), but no differences were observed among treatments in the amount of urea-N utilized for anabolism ($P=0.71$). The fraction of total microbial N derived from recycled urea-N tended ($P=0.11$) to be greater for DDGS (0.28) than for UREA (0.18) or CON (0.15). The fraction of urea production that was captured by ruminal bacteria was greater ($P<0.05$) for CON (0.37) than for DDGS (0.20) or UREA (0.18). Urea kinetics in cattle fed grain-based diets were related to the amount of N consumed. *This project was supported by National Research Initiative Competitive Grant no. 2007-35206-17848 from the USDA Cooperative State Research, Education, and Extension Service.*

Key Words: cattle, recycling, urea

367 Effects of a slow-release urea product on the N balance of growing cattle fed steam flaked corn. B. M. Bourg*[1], T. A. Wickersham[1], L. O. Tedeschi[1], and J. M. Tricarico[2], [1]*Dept. of Animal Science, Texas A&M University, College Station*, [2]*Alltech Inc., Nicholasville, KY.*

An experiment was conducted to determine the impact of source, urea (U) or Optigen II (O), and level of NPN on N balance of growing cattle fed steam-flaked corn. Five ruminally-cannulated Holstein steers in a 5 × 5 Latin square design were used in the study. Steers were fed a steam-flaked corn based diet with either no supplemental NPN, 0.75% U or N equivalent O, or 1.5% U or N equivalent O. Intake was measured, and feed, orts, urine, and fecal samples were obtained and composited for each steer by period. Data were analyzed using PROC mixed of SAS. Orthogonal contrasts were used to evaluate differences between O and U, and high and low level of NPN. Steers fed O tended ($P = 0.06$) to have lower N intake than those fed U, with high treatments (TRT) having greater N intake than low for both U and O. There were no differences in DMI among any of the TRT. However, steers fed O had lower TDOMI ($P = 0.05$) than steers fed U, but there were no differences in TDOMI between high and low levels of U or O. Steers fed high O tended ($P = 0.08$) to have greater fecal N excretion than low O; 46.8 and 36.3 g/d, respectively. There were no differences in fecal N excretion between

U and O TRT. As expected, for both U and O, high TRT levels had greater urinary N excretion (P < 0.05) than low TRT, while urinary N did not differ between U and O. N absorption differed (P < 0.05) for both source and level of NPN. N retention did not differ between high O and low O (58.0 vs 46.0 g/d), while steers fed high U tended (P = 0.08) to have greater N retention than steers fed low U (78.3 vs 55.9 g/d). There was no difference (P = 0.09) in N retention between U and O TRT. The ratio of N absorbed to N intake differed between high and low U (P = 0.03), but not between high and low O or between U and O. In summary, high levels of either NPN source had greater N intake and urinary N excretion, as well as N absorption and no major differences were observed between O and U, suggesting that O can replace U at different levels of N intake.

Key Words: slow-release urea, N balance

368 Effects of a slow-release urea product on performance and carcass characteristics of growing cattle fed steam-flaked corn. B. M. Bourg*[1], L. O. Tedeschi[1], J. M. Tricarico[2], T. A. Wickersham[1], and W. K. Krueger[1], [1]*Dept. of Animal Science, Texas A&M University, College Station,* [2]*Alltech Inc., Nicholasville, KY.*

The impact of source, urea (U) or Optigen II (O), and level of dietary NPN on performance of growing cattle was examined on 60 Angus crossbred steers (initial BW = 353 ± 13.9 kg), fed 1 of 3 steam-flaked corn based diets: U (T1, 1.2% NPN), O (T2, 1.3% NPN), or O without cottonseed meal (T3, 3.1% NPN). T1 and T2 contained cottonseed meal and NPN as CP sources, while T3 contained only NPN. T1 and T2 were isonitrogenous (CP = 13.2%) and isoenergetic (ME = 2.58 Mcal/kg DM), while T3 had more CP (14.8%). Steers were blocked by post-weaning BW and assigned to treatments (TRT) and pens within block (5 pens/TRT). BW was collected bi-weekly and ultrasound carcass measurements were collected at the start and end of the 105-d trial. Six steers from each TRT were harvested and carcass and organ measurements were obtained. Cumulative animal performance was evaluated in 3 periods (0-35, 0-70, and 0-105 d) using a mixed model with initial BW as a covariate. Orthogonal contrasts were used to evaluate differences between T1 and T2, and T1 plus T2 with T3. There were no differences in initial BW, final BW, ADG, or DMI among TRT for any of the periods. However, for period 1 steers on T3 had lower F:G than T1 (5.71 vs. 7.39; P = 0.03), and steers fed T2 tended to have lower F:G than those fed T1 (6.07 vs. 7.39; P = 0.07). In period 2, T3 had lower F:G than T1 (5.58 vs. 6.56; P = 0.03), but did not differ from T2 (5.97). There were no differences in F:G for the entire trial. Steers fed T3 were leaner (P = 0.04) than T1 and T2 (1.04 vs. 1.21 and 1.16 cm fat thickness, respectively). Steers fed T3 had lighter heart and kidney weights than T1 and T2 combined (P < 0.05; heart: 1.59, 1.57, and 1.42 kg, respectively, and kidney: 0.93, 0.85, and 0.76 kg, respectively). Liver and spleen weights and 9-11 rib chemical composition did not differ among TRT. In summary, no major differences on performance and carcass composition were observed between U and O diets. Steers had better initial F:G when O was used as the only source of feed N (T3), suggesting that O may replace both NPN and true protein feeds in finishing cattle diets.

Key Words: slow-release NPN, urea

369 Dose and release pattern of anabolic implants affects growth of finishing beef steers. S. L. Parr*[1], K. Y. Chung[1], J. P. Hutcheson[2], W. T. Nichols[2], D. A. Yates[2], M. N. Streeter[2], R. S. Swingle[3], M. L. Galyean[1], and B. J. Johnson[1], [1]*Texas Tech University, Lubbock,* [2]*Intervet / Schering-Plough Animal Health, De Soto, KS,* [3]*Cactus Research Ltd., Amarillo, TX.*

Three experiments evaluated the effect of implant dose and release pattern on steer performance and carcass traits. In Exp. 1, steers (n = 2,153; 4 to 7 pens/treatment; BW = 315 kg) were fed an average of 173 d. Treatments were: 1) no implant (NI); 2) Revalor-S (120 mg trenbolone acetate [TBA] and 24 mg estradiol 17β [E_2]; REVS); 3) Revalor-IS followed by REVS (cumulatively 200 mg TBA and 40 mg E_2; reimplanted at 68 to 74 d; REVISS); and 4) Revalor-XS (200 mg TBA and 40 mg E_2; REVX). Carcass-adjusted final BW was greater (P < 0.05) for REVX and REVISS than for REVS (610, 609, and 598 kg respectively). Daily DMI did not differ (P > 0.10) among the 3 implant treatments, but carcass-adjusted G:F was greater (P < 0.05) for REVX and REVISS than for REVS (0.197 and 0.195 vs. 0.188). Both HCW and LM area were greater (P < 0.05) for REVX and REVISS than for REVS. Marbling scores were greatest (P < 0.05) for NI and REVS and least (P < 0.05) for REVISS. In Exp. 2, steers (n = 5,773; 10 pens/treatment; BW = 391 kg) were fed an average of 131 d, with treatments of REVS, REVISS (reimplanted at 44 to 47 d), and REVX. Carcass-adjusted final BW (598 kg), ADG (1.6 kg), DMI (9.4 kg), G:F (0.17), and HCW did not differ (P > 0.10) among treatments. Yield grade was greatest for REVS and least for REVISS (P < 0.05), and quality grade was less (P < 0.05) for REVISS than for REVS and REVX. In Exp. 3, steers (n = 1,833; 10 pens/treatment; BW = 277 kg) were fed an average of 197 d and received either REVISS (reimplanted at 90 to 103 d) or REVX. Carcass-adjusted final BW (625 vs. 633 kg) and ADG (1.81 vs. 1.76 kg) were greater (P < 0.05) for REVX-implanted steers. Daily DMI did not differ between treatments, but G:F tended (P < 0.10) to be increased and HCW was greater (P < 0.05) for REVX than for REVISS. These data indicate that when TBA/E_2 dose is equal, the altered release rate associated with REVX may improve performance and marbling score, but these effects seem to depend on the length of the feeding period.

Key Words: beef steers, estradiol 17β, trenbolone acetate

370 Nutritional and management methods to decrease nitrogen losses from beef feedlots. G. E. Erickson* and T. J. Klopfenstein, *University of Nebraska, Lincoln.*

Nitrogen losses from open lots are a concern. Methods that increase manure N while decreasing losses to the air would be beneficial in open lot beef operations. Twelve or more pens have been dedicated to N research whereby N intake, retention, and excretion are quantified, and a mass balance conducted using manure, runoff, soil balance, and loss quantities. The objective has been to decrease N losses and increase manure N. Dietary CP impacts N excretion and N losses. Four experiments across two years compared industry average CP (13%) to diets that were phase-fed to not exceed protein requirements (12.1 to 10.9%). Phase fed cattle excreted 12 to 21% less (P<0.01) and N losses were reduced 15 to 33% (P<0.01). In 2 other experiments, phase fed diets were formulated to recycle undegradable intake protein. Steer G:F was similar (P=0.18) or improved (P=0.09) while N excretion and N losses were reduced (P<0.11) and N in manure was not affected (P>0.35) compared to cattle fed 13% CP. Feeding less protein did not impact manure N, suggesting manure N from open lots is related to other factors. A series of experiments have evaluated increasing OM on the pen surface to increase N in manure. Feeding less digestible diets using fiber increased manure N (P<0.01) and decreased (P<0.10) N losses in two experiments conducted from November to May, but did not impact (P>0.30) manure N or losses during two summer experiments. Adding bedding (OM) increased manure N in the winter as well. Another method evaluated was increasing pen cleaning frequency, which decreased N losses by 19 to 44% and increased manure N by 26 to 41% across 3

experiments. Other methods such as acidifying manure by manipulating dietary cation anion difference, clinoptilite zeolite clay addition, and feeding different amounts of byproducts have had variable impacts on N losses. No treatments have markedly impacted runoff N, which is <5% of excreted N. Dietary protein impacts N losses but not manure N. Other factors such as OM on the pen surface impact manure N. Cleaning manure frequently, which decreases exposure, decreases losses. Treatments should be evaluated across seasons due to seasonal effects.

Key Words: beef cattle, loss, nitrogn

371 Increasing dietary concentration of coconut oil reduces enteric methane emission from lactating Holstein cows. M. Hollmann*[1], W. J. Powers[1,2], A. Fogiel[1], N. M. Bello[1,3], J. S. Liesman[1], and D. K. Beede[1], [1]*Department of Animal Science, Michigan State University, East Lansing*, [2]*Department of Biosystems Engineering, Michigan State University, East Lansing*, [3]*College of Agriculture and Natural Resources Statistical Consulting Center, Michigan State University, East Lansing*.

To examine the effects of dietary coconut oil (CO; source of medium-chain fatty acids) on enteric methane emission, 24 lactating Holstein cows in two blocks of 12 cows each were allocated randomly in a balanced design to 12 possible dietary treatment sequences in 2 periods of 35 d each. Dietary treatments were 0.0 (Control), 1.3, 2.7, or 3.3% CO, dry basis. Other dietary components included corn and alfalfa silages, ground dry corn, heat-processed soybean meal (SoyPlus™), soy hulls, wheat middlings, minerals, and vitamins. Control diet contained 16.5% crude protein (60% from RDP), 34% NDF (71% from forage), and 31% starch, dry basis. Cows were housed, fed, and milked individually in environmentally-controlled chambers from d 22 through 35. Air flux and respective temperature and relative humidity of each chamber were measured during a 5.5-min cycle every 3 h. Simultaneously, an Innova™ photoacoustic analyzer detected methane concentrations in inlet and outlet air 3 to 6 times, adjusted to standard temperature and pressure. Methane emitted was computed from the difference in concentrations of inlet and outlet air, and flux. Subsequently, data were averaged within cycle and the average was weighted by the number of observations. Statistical analyses were conducted using mixed effects models, including the fixed effects of period, block, dietary treatment, potential carryover effects, day, and time of day, and relevant 2- and 3-way interactions; random effects were fitted to account for appropriate experimental units of each fixed effect factor. Results are presented in the Table as least-squares means. Dietary CO reduced methane emission per unit of FCM yield. (L: linear; Q: quadratic)

Table 1.

	CO, % of DM					Contrast
Item	0.0	1.3	2.7	3.3	SE	(*P* <)
CH_4, L/d[a]	644	622	406	349	0.04906	0.01,Q
DMI, kg/d	23.0	21.5	17.9	17.1	0.69	0.01,L
__CH_4/DMI, L/kg[a]	29.9	30.5	24.4	22.8	0.03407	0.02,Q
MY, kg/d	37.7	37.0	33.7	33.3	1.04	0.01,L
__CH_4/MY, L/kg[a]	18.2	17.6	12.9	11.5	0.04778	0.03,Q
FCMY, kg/d	34.2	35.5	27.3	26.3	1.12	0.01,L
__CH_4/FCMY, L/kg	20.4	19.2	16.5	14.5	0.70	0.01,L
Milk fat, %	3.39	3.67	2.74	2.67	0.109	0.01,Q
Milk fat, kg/d	1.27	1.37	0.92	0.88	0.054	0.01,Q
Milk protein, kg/d	1.07	1.05	0.91	0.93	0.034	0.01,L

[a] SE from natural log transformed data reported.

Key Words: methane, dairy cow, medium-chain fatty acid

372 Effects of two strains of *Saccharomyces cerevisiae* on methane emissions from Holstein dairy cattle. Y.-H. Chung*[1], S. M. McGinn[1], N. Walker[2], and K. A. Beauchemin[1], [1]*Agriculture and Agri-Food Canada, Lethbridge, AB, Canada*, [2]*Lallemand Animal Nutrition, Montréal, QC, Canada*.

The objective of this study was to measure the efficacy of supplementing diets with strains of *Saccharomyces cerevisiae* on reducing methane (CH_4) emissions from Holstein dairy cattle. Fifteen ruminally cannulated, nonlactating, and nonpregnant cows were blocked by dry matter intake (DMI) and randomly assigned to: (1) control: no yeast, (2) yeast strain 1 (Levucell SC), and (3) yeast strain 2 (Test A). Both of the yeast strains were provided as active dried products (Lallemand Animal Nutrition, Montréal, QC) to provide 1×10^{10} cfu/head/d. Yeast products were dosed via the rumen cannula daily at the time of feeding (1×feeding/d). Cows were fed a barley-based total mixed ration (50:50 forage to concentrate ratio) formulated to meet the nutrient requirements of a dairy cow producing 30 kg/d of milk. The experiment consisted of a 35-d yeast feeding period and CH_4 gas was collected daily using the sulphur hexafluoride tracer gas technique (halter/PVC yoke) during the last 4 d of the experimental period. Feeding the two yeast strains did not affect ($P > 0.10$) DMI or BW during the entire feeding period. Total CH_4 emissions were not affected ($P > 0.10$) by yeast feeding and averaged 264 g/d. However, there was a tendency ($P = 0.07$) for yeast strain 2 to reduce CH_4 emissions by 6.5 or 5.5% (vs. control) after adjusting CH_4 emissions for DMI or gross energy (GE) intake, respectively. Cows that received yeast strain 2 produced CH_4 at 15.7 g /kg of DMI or 5.2% of GE intake compared with the control at 16.8 g CH_4 /kg of DMI or 5.5% of GE intake and yeast strain 1 at 17.5 g CH_4/kg of DMI or 5.8% of GE intake. The study provides evidence that strains of yeast vary in their ability to mitigate CH_4 emissions from cattle and demonstrates the feasibility of developing commercial yeast strains that could be used to reduce greenhouse gas emissions from livestock production.

Key Words: yeast culture, methane emissions, sulphur hexafluoride tracer gas technique

373 The effect of pre-grazing herbage mass on growth rate and methane emissions of grazing beef cattle. T. M. Boland*, K. J. Hart, K. M. Pierce, B. M. Lynch, R. McDonnell, D. Murphy, A. K. Kelly, and D. A. Kenny, *School of Agriculture, Food Science and Veterinary Medicine, University College Dublin, Belfield, Dublin, Ireland*.

Irish beef production systems are predominantly grass based with over 80% of the animals energy requirements provided by pasture. The Irish beef herd (including dairy replacements) accounts for 60% of enteric CH_4 production and subsequently 8.1% of total national GHG emissions. Therefore, any CH_4 mitigation strategies must focus on pasture management. Pre grazing herbage mass (HM) is one of the main determinants of sward quality. The objective of the current study was to examine the effect of pre-grazing HM on growth rate and CH_4 emissions of grazing beef heifers. Thirty Limousin X heifers were blocked on the basis of bodyweight (346±34kg) and allocated to one of two treatments (n=15). Animals were offered a low (L: 1900kg DM/ha) or high (H: 3800 kg DM/ha) target pre-grazing HM. Methane was determined over a five day period on three occasions using the SF_6 tracer gas technique during a 126 day grazing period. Rumen fluid was sampled on the fifth day of each CH_4 measurement period using an oesophageal sampler and analysed for concentration of volatile fatty acids (VFA). Animals were weighed on a fortnightly basis. Data were analysed using the MIXED procedure in SAS. Actual pre-grazing HM across the grazing period were 2103 and 3841 kg DM/ha for L and H respectively. Average daily

gain was higher (P<0.001) on L as were total concentrations of ruminal VFA (P=0.06). Treatment had no effect (P>0.05) on proportion of individual VFA. Treatment had no effect (P>0.05) on daily CH_4 emissions overall or within any individual period. There was a trend (P=0.10) for lower CH_4 emissions per kg ADG for animals on L (143 v. 166 g CH_4/kg ADG). These results show that reducing pre-grazing HM will lead to increased animal performance, and thus may lead to reduced CH_4 emissions in beef production systems where cattle are slaughtered at a target live-weight. A data modelling approach is required to fully quantify these effects.

Key Words: beef cattle, methane, pasture quality

Small Ruminant: Symposium: Organic and Grass-Fed Small Ruminant Challenges and Opportunities

374 Obstacles to organic and grass fed small ruminant production in the U.S. J. M. Burke*, *USDA, Agricultural Research Service*, *Booneville, AR*.

Certified organic and grass fed production systems must align to standards defined by the USDA Agricultural Marketing Service. There is very little research being conducted on organic livestock systems in the U.S. by land grant colleges or federal research agencies. The demand for organic, grass fed, locally-grown, and natural products is strong and there is a desire to increase the sustainability of farming systems, which is perceived to occur by using organic and grass fed management. Obstacles to becoming certified organic include increased record keeping, increased risks, limited awareness of organic farming system practices, lack of processing facilities, lack of certified organic feeds, and inability to capture market share. In many environments, internal parasite control remains a large barrier. Small ruminants must be managed to minimize internal parasite infection. Also, growing animals must only graze certified organic pastures or feed. The latter is limited by availability and may not be sustainable because of dependency on off-farm inputs. These same obstacles do not necessarily apply to grass fed management. Grass fed ruminants are defined as those provided a diet solely from forage with the exception of milk before weaning. This standard applies to animals destined for slaughter, but not necessarily breeding animals. Both management systems are in need of basic and applied research to optimize production and maximize profitability. Research should follow a systems-oriented approach that applies organic or grass fed principles. Priorities have been identified and include development of effective parasiticides, parasite management strategies, development of emergency and preventative health care strategies, development of improved genetics to fit the system, and environmental impact studies. In addition, research is needed on forage management to optimize growth of weaned animals. A case study will be presented.

Key Words: goat, sheep, systems research

375 Ecology as a model for organic dairy production. F. Thicke*, *Radiance Dairy*, *Fairfield, IA*.

Natural ecosystems are characterized by biodiversity, self sufficiency, and the conservation and recycling of nutrients. The diversity of a natural ecosystem precludes off-site pollution because the waste of each species is recycled as substrate for other species. By contrast, industrial crop and livestock systems are characterized by monocultures and requirements for high external inputs. The inability of monoculture systems to efficiently process waste *in situ*, combined with practices that disrupt ecological integrity, result in leakage of materials (e.g., nutrients, pesticide residues and eroded soil) from these systems to become pollutants to off-farm resources. An organic, grass-based dairy mimics the ecosystem of prairie plants and bison which created the highly productive soils of parts of North America. In that prairie ecosystem, prairie grasses and forbs produced massive growth, both above-ground and below-ground. Migrating bison herds periodically grazed off the above-ground plant growth, resulting in the plants sloughing root mass off into the soil to balance their reduced photosynthetic capacity. Repeated growth-and-grazed cycles pulsed organic matter deep into the soil, creating the productive, high-organic-matter soils of the prairies. Similarly, organic grazing systems that are designed and managed in accord with ecological principles can enhance the farm resource base (soil quality, water quality, air quality, and wildlife habitat) as well as promote good animal health, reduce reliance on fossil-fuel energy and other external inputs, and minimize pollution-causing leakages. A case study will be presented of an Iowa monoculture-crop farm that was converted to an organic, grass-based dairy that processes milk on the farm and markets finished dairy products locally. The farm design and management will be discussed as a model of an ecologically based farming system.

Key Words: dairy, organic, graze

376 Successful organic dairy systems. K. J. Soder*, *USDA-ARS, Pasture Systems & Watershed Mgmt. Research Unit*, *University Park, PA*.

Demand for organic dairy products has continually increased and at times outpaced supply for a number of years, creating favorable milk pricing for certified organic dairy farmers. This stability in organic milk prices has provided organic dairy farmers with a security not found in the conventional milk marketing system. Many organic dairy farmers transitioned organic production to implement philosophies of the organic production system. Others transitioned in an effort to increase profitability. However, even with relatively high premiums paid for organic milk, transitioning to organic production does not guarantee profitability. There are many challenges unique to organic milk production, including accessing markets for milk pickup, sourcing organic feeds and veterinary care. Additionally, the recently volatile input prices have significantly challenged the sustainability of organic dairies. While organic dairy systems are primarily forage-based systems, emphasizing high-quality pasture, supplementation is still an important component for many farms. Organic feed prices have increased at a greater rate than conventional feed prices, in part due to demand outpacing supply as an increasing number of dairies transitioned to organic production in recent years. Some organic farmers have opted to decrease, eliminate, or find alternative supplementation strategies to decrease feed costs. Others produce more of their feeds on-farm. This presentation will provide an overview of the organic dairy industry. Data will be presented showing recent trends in organic dairy production, including recent growth of the