684 Leptin intramammary infusion alters the gene expression profile of prepubertal bovine mammary parenchyma. B. E. Etchebarne*, L.F.P. Silva, G.J.M. Rosa, P. M. Coussens, M. S. Weber Nielsen, and M. J. VandeHaar, *Michigan State University*.

Increased body fatness in prepubertal heifers is associated with impaired mammogenesis. Leptin, a hormone produced by adipocytes, reduces proliferation of bovine mammary epithelial cells in vitro and in vivo. Our objective was to identify key genes mediating this inhibition. Leptin was infused via the streak canal into 2 quarters of 6 prepubertal Holstein heifers at 100 μg/quarter per d; control quarters received saline plus BSA or saline plus IGF-I. After 7 d, heifers were killed and mammary parenchymal tissue was collected. Leptin decreased the percentage of epithelial cells in the S-phase by 48% in IGF-I-treated and 19% in saline-treated quarters, as reported in a separate abstract. To date, the gene expression profile of total parenchymal mRNA from each quarter of 2 animals has been examined using a bovine-specific cDNA microarray containing 796 unique expressed sequence tags and 539 amplicons representing known genes. A loop design was used with cDNA from each quarter of each cow labeled with Cy3 or Cy5 dyes prior to microarray hybridization. Gene expression data were normalized for dye intensity biases using control genes. Significance levels of differential gene expression among treatments were assessed using a mixed model approach with the procedures LOESS and MIXED of SAS. Leptin upregulated 50 genes at $P < 0.01$; at least 30 of these had clear links to pathways mediating cell proliferation. The upregulated genes included 3 promoters of apoptosis: dynamin 2, CCAAT/enhancer-binding beta protein, and ribosomal protein S3A; 3 cell cycle regulators: nucleoporin p62, ubiquitin-like protein NEDD, and protein kinase CDK9; several transcription factor regulators; and several cellular reorganization proteins, all with fold changes from 1.5 to 4.5 ($P < 0.008$). We are currently evaluating the other 4 animals in the study, verifying changes with real-time PCR, and employing laser capture microdissection to measure expression profiles of epithelial and stromal cell types separately. We conclude that leptin infusion into prepubertal bovine mammary parenchyma induces changes in expression of genes regulating apoptosis, cell cycling and transcriptional machinery. These molecular changes might help explain the impaired mammogenesis of fat heifers.

Key Words: Leptin, Mammary development, Microarray

685 Intramammary infusion of leptin decreases proliferation of mammary epithelial cells in prepubertal heifers. L.F.P. Silva*[1], J. S. Liesman[1], M. S. Weber Nielsen[1], and M. J. VandeHaar[1], [1]*Michigan State University*.

Excessive body fatness is associated with impaired mammogenesis in prepubertal heifers. Leptin, a hormone produced by adipocytes, reduces IGF-I-stimulated proliferation of bovine mammary epithelial cells in vitro. Our objective was to determine if leptin also reduces proliferation of mammary epithelial cells in vivo before puberty. Recombinant ovine leptin (>98% purity) was infused via the streak canal into two quarters of six prepubertal Holstein heifers at 100 ug/quarter per d with or without rhIGF-I at 10 mg/quarter per d. The N-terminus of roLeptin was homologous to native oLeptin. Contralateral quarters were used as controls and received saline plus BSA with or without IGF-I. After 7 d of treatment, bromodeoxyuridine (BrdU) was infused intravenously at 5 mg/kg BW, and heifers were killed 2 h later. Samples from three parenchymal regions (proximal, intermediate, and distal to the teat) were collected, fixed, sliced, and incubated with BrdU monoclonal antibody to identify cells in the S-phase of the cell cycle. Total number of epithelial cells and BrdU-labeled cells were quantified in three microscopic fields from each slide section so that 2700 cells were counted in each quarter. Leptin infusion decreased BrdU-labeling 48% in IGF-I-treated quarters (4.1 vs. 7.9%, $P < 0.01$), and 19% (5.0 vs. 6.2%, $P = 0.01$) in saline-treated quarters. Treatment effects were likely not associated with an immune response as we used sterile technique, mammary tissue was visually normal, and endotoxin was not detected in the infusates using a commercial kit sensitive to 0.006 ng/ml. We conclude that intramammary infusion of leptin inhibits proliferation of mammary epithelial cells in prepubertal heifers and completely blocks the stimulatory effect of IGF-I on mammary epithelial cells. These results suggest that leptin may mediate the inhibitory effects of high-energy intake on mammary gland development in heifers. If so, perhaps we can prevent nutritional impairment of mammogenesis by simply managing body condition of young heifers.

Key Words: Heifer, Mammary development, Leptin

686 Compensatory growth during late gestation and its effects on metabolic status and health of transition heifers. M. S. Laubach*, D. B. Carlson, W. L. Keller, and C. S. Park, *North Dakota State University, Fargo ND/USA*.

Ten pregnant Holstein heifers averaging 499 kg of body weight and 60 d of gestation were divided into two treatments to determine if a one stair-step gestational nutrition regimen affects metabolic status and lactation potential during the transition period. The control group was fed a diet containing 14.0% crude protein and 22.4 Mcal of ME per d for the entire 210 d of the trial. During the restriction period, the treatment group was fed a diet containing 18.5% crude protein and 14.5 Mcal of ME per d until d 180 of gestation; the diet was changed to 14.0% crude protein and 29.0 Mcal of ME per d for the realimentation period. Control heifers were restricted-fed to obtain an ADG of 0.68 kg per d, while treatment heifers were restricted to less then 0.1 kg per d of gain during the restriction period. During realimentation, treatment heifers were allowed to gain 0.91 to 2.26 kg per d. Heifers were weighed for three consecutive days at the start, at 180 d of gestation, and within one wk before calving; BW was not different at initiation, at 180 d of gestation, or one week before parturition. Blood was drawn on d 14, 11, 9, 7, 5, 4, 3, 2, and 1 before parturition; within 3 h of calving; and on d 1, 2, 3, 4, 5, 7, 9, 11, and 14 after parturition to monitor glucose, insulin, triglycerides, NEFA, and the immune status. Glucose, insulin, triglycerides, and NEFA were not different between groups before or after parturition. Total leukocytes were significantly higher ($P = 0.05$) in the treatment group before parturition; however, after parturition there was no difference between groups. Milk production was not different (control, 8,571 kg; treatment, 8,453 kg). Milk fat percentage was increased in the treatment group (4.2% vs 4.1%, $P = 0.05$); however, milk protein percentage was the same in both groups (2.9%). The results suggest that compensatory growth during the last trimester of gestation does not affect the metabolic status of prepartum heifers or subsequent milk production.

Key Words: Heifer, Transition, Blood metabolites

Production, Management, & the Environment

653 A system to characterize feeding behavior of dairy cows and feeding behavior of periparturient and mid-lactation cows. M. A. DeGroot* and P. D. French, *Oregon State University, Corvallis*.

The objectives of the following research were to develop a system to describe feeding behavior of group housed dairy cows and characterize feeding behavior of periparturient and mid-lactation cows. In experiment 1, 8 periparturient Holstein and Jersey cows were used to determine feeding behavior for the three weeks before and after parturition. Cows were group housed and fed individually via Calan® doors. Behind each door was a feed tub that rested on a digital scale, equipped with a RS232 bi-directional interface. Scales were connected to a computer and a software program collected date, time, and weight events. Variables measured were meals/day, total meal duration/day, individual meal duration, daily DMI, DMI/meal, and meal efficiency (kg DM/min). Data were analyzed using the MIXED procedure of SAS. From 21 to 1 d prepartum, total meal duration decreased linearly ($P<0.01$) from 284 to 136 min/d, individual meal duration decreased linearly ($P<0.07$) from 32 to 17 min/d, DMI decreased linearly from 11.5 to 7.3 kg/d, and meal DMI decreased linearly ($P<0.01$) 1.4 to 0.9 kg. From 1 to 21 d postpartum, total meal duration and individual meal duration increased linearly ($P<0.05$) from 100 to 278 min/d and 12 to 26 min/meal, respectively. Total meal duration was positively correlated with prepartum DMI (r=0.62) and postpartum DMI (r=0.80). Meals (10.2 meals/d) and efficiency (0.06 kg DM/min) were similar for the prepartum and postpartum periods. In experiment 2, 8 Holstein and Jersey cows were used to characterize feeding behavior of mid-lactation cows (17334 days in milk). Overall, cows consumed 8.5 meals/d, total meal duration was 250 min/d, and efficiency was 0.09 kg DM/min. Daily DMI, DMI/meal,

and efficiency were greater ($P<0.01$) for Holsteins compared to Jerseys. Jerseys consumed more ($P<0.05$) meals/day than Holsteins. Results indicate that periparturient DMI is affected by the amount of time spent at the feed bunk. Therefore, strategies that increase individual meal duration may increase DMI during this critical period.

Key Words: Periparturient, Feeding behavior, Meals

654 Effect of supplementing intensely grazed late gestation and early lactation dairy cows with chromium-L-methionine. M. A. Bryan[1], M. T. Socha*[2], and D. J. Tomlinson[2], [1]*Central Southland Veterinary Services Limited, Winton, Southland, New Zealand,* [2]*Zinpro Corporation, Eden Prairie, Minnesota, USA.*

Two hundred and thirty-two cows were assigned to a study to determine the effect of feeding 0 or 6.25 mg chromium/d from MiCroPlex® chromium-L-methionine (Zinpro Corporation, Eden Prairie, MN) on lactation and reproductive performance. Cows received treatments from 6 weeks precalving through 21 weeks postpartum. Precalving, treatments were incorporated into a pelleted grain mixture and group-fed. Postcalving, cows received treatments via an individual oral drench once a day. Grazed herbage was the primary diet constituent for lactating cattle. Trial evaluators were blinded to treatment assignment until collection and analysis of data was completed. Blood was collected from a predetermined group of cows prior to and immediately after calving. Approximately every 6 weeks during the treatment period and at two timepoints following the treatment period, milk yield was recorded and samples collected for determination of composition. Chromium supplementation tended to reduce ($P\leq0.15$) yield of 3.5% fat-corrected milk (FCM) and milk solids during the treatment period and tended to reduce 3.5% FCM yield over the entire lactation ($P\leq0.15$). There was no effect of treatment on milk solids yield over the entire lactation. Chromium supplementation reduced plasma non-esterified fatty acid (NEFA) concentration ($P\leq0.05$). There was no effect of treatment ($P\geq0.15$) on plasma β-hydroxybutyrate or glucose concentrations. Chromium supplementation tended to reduce ($P\leq0.15$) percentage of cows open 48 days after the planned start of mating and days from calving to conception. Results indicate that chromium-L-methionine supplementation of intensely grazed, late gestation and early lactation dairy cattle tended to reduce lactation performance, reduced plasma NEFA concentrations and tended to improve fertility.

Key Words: Chromium, Lactating dairy cattle, Reproduction

655 The buffering activity of a potassium clinoptilolite zeolite in steers fed a high concentrate steam flaked grain- corn silage diets. K. S. Eng*[1], R. Bectel[2], and D. P. Hutcheson[3], [1]*Eng, Inc., San Antonio, Texas, USA,* [2]*Advance Agricultural Testing, Baden, Ont. Canada,* [3]*Animal-Agricultural Consulting, Inc., Amarillo, Texas, USA.*

Subclincial acidosis can be a problem on high concentrate wheat and corn diets when low levels of corn silage serve as the only roughage. Previous studies have indicated potassium clinoptilolite zeolite (CZ) may have buffering capabilities in feedlot diets. In 4 separate feedlot finishing trials, the rumen pH of steers on a control ration containing Rumensin and Tylan or a similar ration containing 1.2% CZ in place of an equal amount of grain were compared. The diets in each study were composed of approximately 87% steam flaked corn and wheat, 6% corn silage and 7% premix (DMB). The experimental cattle were yearling steers of English- Continental cross breeding. There were 8 animals/rep and 8 to 11 reps/treatment in each of the four trials. Approximately 90 days after the cattle were placed on full feed, one animal from each rep or total of approximately 40 animals for the four separate experiments were sampled for rumen pH. Rumen samples were obtained using a Geishauser Probe and pH was measured immediately thereafter. The rumen pH for the control verses the treatment steers are shown in Table 1. In each of the four trials and on an overall basis, CZ increased rumen pH. The overall average difference was statistically significant ($P\leq .08$).

Effect CZ on rumen pH

Trial	Control	1.2%CZ
1	6.02	6.33
2	6.30	6.62
3	6.51	6.79
4	6.51	6.71
Mean	6.34	6.61

Key Words: Potassium clinoptilolite zeolite, Rumen buffering, Steam flaked corn

656 Effect of prepartum dietary cation-anion difference on subsequent milk production and plasma metabolites in dairy cattle. S. B. Puntenney, K. N. Higgs, M. A. DeGroot, and P. D. French, *Oregon State University, Corvallis.*

The objectives of this research were to determine the effect of an anionic supplement (Animate®) on prepartum feed intake, periparturient plasma metabolites, and subsequent milk yield. Twenty eight Holsteins and 20 Jerseys were blocked by expected calving date and assigned at random to one of two treatments beginning 28 days prior to expected calving date. Main effects were breed (Holstein or Jersey) and dietary cation-anion difference (DCAD; -13 or +23 meq/100 g DM). Negative DCAD was achieved through the addition of Animate® (-712 meq/100 g DM) to the prepartum diet. Cows were individually fed a TMR once daily beginning 21 days prepartum and received a common TMR from parturition to 21 days postpartum. Data were analyzed as repeated measures using the MIXED procedure of SAS®. Prepartum and postpartum body weight and body condition score was similar for DCAD level. Three Jerseys receiving the positive DCAD diet were treated for milk fever after parturition. Urine pH was lower for cows receiving negative DCAD (6.2 vs 8.2; $P < 0.05$). Prepartum DMI was similar for DCAD level and postpartum DMI was greater for cows that received negative DCAD (16.0 vs 14.9 kg/d; $P < 0.05$). Holsteins that consumed negative DCAD produced more energy correct milk (46.0 vs 41.7 kg/d; $P < 0.05$) compared to Holsteins that consumed positive DCAD. Prepartum DCAD did not affect energy correct milk yield of Jersey cows. Plasma Ca was greater for cows receiving negative DCAD (7.7 vs 6.7 mg/dL; $P < 0.05$). Prepartum DCAD did not affect plasma β-hydroxybutyrate, glucose, or free fatty acids. In conclusion, negative prepartum DCAD increased postpartum DMI and energy corrected milk yield of Holstein cows through improved Ca balance after parturition.

Key Words: Cation-anion difference, Prepartum diet, Milk fever

657 Effect of grazing growth rate on subsequent feedlot and carcass traits in cattle. J. J. Cleere*[1], A. D. Herring[2], J. W. Holloway[3], C. R. Long[1], H. Lippke[3], M. F. Miller[4], W. E. Pinchak[5], F. M. Rouquette[1], and B. G. Warrington[3], [1]*Texas Agricultural Experiment Station, Overton,* [2]*Texas A&M University, College Station,* [3]*Texas Agricultural Experiment Station, Uvalde,* [4]*Texas Tech University, Lubbock,* [5]*Texas Agricultural Experiment Station, Vernon.*

Braunvieh cross steers (n = 91) were assigned to various stocking rates at the Texas Agricultural Experiment Stations at Uvalde (UVL), Overton (OVT), and Vernon (VRN) to create different growth rates. Steers were stocked on TAM 90 annual ryegrass (RG) at UVL, Maton rye and RG at OVT, or TAM 202 wheat at VRN from January to May 2002. Cattle were placed on feed at the Texas Tech University Alltech research feedlot at termination of the grazing period to determine the influence of grazing growth rate (GGR) on feedlot and carcass traits. Steers were assigned to pens within location, stocking rate, and weight with 4 to 6 animals per pen. Animals were classified as very low (VL), low (LO), moderate (MD), moderately high (MH), and high (HI) GGR groups based on ADG. Grazing period ADG was different between the VL, LO, MD, MH, and HI GGR groups (-0.01, 0.55, 0.77, 0.90, and 1.02 kg/d, respectively; $P < 0.0001$). The statistical model included GGR and location with initial grazing weight as a covariate. Initial feedlot weights were different between VL, LO, MD, MH, and HI steers (316, 366, 383, 397, and 406 kg, respectively; $P < 0.01$). Feedlot ADG was similar among the GGR groups with the exception of a difference ($P = 0.02$) between the LO and MD steers (VL = 1.73, LO = 1.81, MD = 1.65, MH = 1.72, HI = 1.68 kg/d). The VL steers had lighter hot carcass weights (HCW) than LO, MD, MH, and HI steers (302 vs. 338, 340, 354, 351 kg, respectively; $P < 0.0001$). The LO steers had lighter HCW than MH

and HI steers ($P < 0.05$) and MD steers had lighter HCW than MH and HI steers ($P < 0.05$). The VL steers were on feed longer than LO, MD, MH, and HI steers (113 vs. 111 d; $P < 0.05$). Adjusted fat thickness, kidney pelvic heart fat, marbling scores, and yield grades were similar among the GGR groups. The VL steers had smaller ribeye areas than the LO, MD, MH, and HI steers (79.9 vs. 89.1, 88.8, 88.1, and 90.0 cm^2, respectively; $P < 0.01$). Lower GGR steers had lighter HCW due to failure to compensate for differences in initial feedlot weight and GGR had a slight effect on carcass quality.

Key Words: Feedlot performance, Carcass, Beef cattle

658 Use of FEB-200™ to increase productivity of cattle grazing fescue pasture. D. G. Ely*[1], D. K. Aaron[1], J. Wyles[1], and V. Akay[2], [1]*University of Kentucky, Lexington, KY,* [2]*Alltech, Inc., Nicholasville, KY.*

Ninety-two Angus and Angus x Beefmaster cow/calf pairs were randomly allotted to nine, 10.5-ha KY 31 tall fescue endophyte-infected (> 90%) pastures on May 1 in two consecutive years to evaluate the potential of FEB-200™ (modified glucomannan, Alltech, Inc., Nicholasville, KY) to increase productivity. Three replicate pastures were randomly assigned each year to three treatments: CONT (control, no supplement); CS (corn supplement, 0.45 $kg \cdot hd^{-1} \cdot d^{-1}$ ground shelled corn); FEB [0.45 $kg \cdot hd^{-1} \cdot d^{-1}$ supplement (96.6% ground shelled corn + 4.4% FEB-200™)]. Initial cow and calf weights were taken on two consecutive days (May 1, 2). Cows averaged 5.2 yr, 511 kg, and 6.0 body condition score (BCS) when the experimental period began each year. Initially, calves were 68 d of age and weighed 101 kg. Interim weights, BCS, and rectal temperatures of cows and weights of calves were taken at 35-d intervals until weaning on September 17 (consecutive day weights, September 17, 18). Cow weight changes from May 1 to July 12 were not different. Cows consuming FEB gained more ($P < 0.05$) from July 12 to September 17 than CONT and CS cows (5.5 vs. -4.5 and -1.8 kg/hd). Changes in BCS were not different from May 1 to July 12. Cows in the FEB treatment maintained higher ($P < 0.05$) BCS than CONT and CS cows from July 12 to September 17. No differences in rectal temperatures were found. Overall (139 d), calf ADG (kg) were higher ($P < 0.05$) for FEB (0.95) than CONT (0.90) and CS (0.88). Greater cow gains, maintenance of higher cow BCS, and faster calf gains indicate consumption of FEB-200™ has the potential to alleviate some of the endophyte toxicosis associated with this forage during July, August, and September.

Key Words: Fescue, Cows, Calves

659 Cow tympanic temperature response to supplementation with FEB-200™. D. K. Aaron*[1], D. G. Ely[1], J. Wyles[1], and V. Akay[2], [1]*University of Kentucky, Lexington, KY,* [2]*Alltech, Inc., Nicholasville, KY.*

Fifty-four mature Angus and Angus x Beefmaster cows, grazing endophyte-infected KY 31 tall fescue, were used in a 2-yr study to evaluate the potential of a modified glucomannan (FEB-200™, Alltech, Inc., Nicholasville, KY) for reducing deep body temperature effects associated with fescue toxicity. Each year three cows were randomly selected from each of nine pastures previously allotted (May 1) to three treatments: CONT (control, no supplement); CS (corn supplement, 0.45 $kg \cdot hd^{-1} \cdot d^{-1}$ ground shelled corn); FEB [0.45 $kg \cdot hd^{-1} \cdot d^{-1}$ supplement (96.6% ground shelled corn + 4.4% FEB-200™)]. Tympanic temperatures were continuously measured at 30-min intervals during a 72-h period in mid-June, July, and August each year. Each cow's maximum, minimum, and average tympanic temperatures were found for each day of each period. Daily diurnal ranges and daily differences between maximum and average tympanic temperatures (partial differences) were calculated. Average maximum and minimum ambient temperatures were 30.6 and 19.2, 30.5 and 19.7, and 28.1 and 16.1 °C for the June, July, and August periods in 2001. Corresponding values for 2002 were 29.3 and 15.1, 31.4 and 19.5, and 32.7 and 25.3 °C. No significant year x treatment interaction was found. Maximum tympanic temperatures (°C) were lower ($P < 0.05$) for FEB than CONT cows in all months (June: 39.3 vs. 39.5; July: 39.2 vs. 39.4; August: 39.1 vs. 39.4). Daily diurnal ranges and partial differences (°C) were lower for FEB than CONT cows in June (1.29 and 0.72 vs. 1.46 and 0.88; $P < 0.10$), July (1.24 and 0.67 vs. 1.37 and 0.82; $P < 0.10$), and August (1.23 and 0.63 vs. 1.47 and .82; $P < 0.01$). Although not statistically significant, temperature differences between FEB and CS cows also tended to support FEB-200™ supplementation as a potential means of alleviating the problem of elevated body temperature associated with fescue toxicosis.

Key Words: Fescue, Temperature, Cows

660 Corn silage and haylage variability within bunker silos. W. C. Stone*, L. E. Chase, and T. L. Batchelder, *Cornell University. Ithaca, NY.*

Eleven corn silage and nine haylage bunker silos from nine dairies located in New York state were evaluated to estimate the degree of variability occurring within bunker silos. Samples were collected on six dairies with a backhoe, on two dairies with a loader bucket, and on one dairy with a face remover. Sample collection was designed to reflect the feed that would be obtained if a feeder obtained a loader bucket of feed from a region (upper, middle, or lower) of the silo as compared to a bucket obtained from the entire height of the silo face. Silos above (n = 15) approximately four meters in height were split into thirds for sampling, while those less (n = 4) than approximately four meters were split into halves. Experimental feed within each section was thoroughly mixed and sampled for subsequent analyses. Within each silo, deviations from the minimum analytical result for DM, ADF, NDF, CP, and VFA were determined.

Haylage varied more than corn silage, although there were examples of extreme variation in DM in both crops. In some situations a feeder could be delivering an entirely different ration from one load of feed to the next if care is not taken in forage obtainment from the silo. Dairy feed personnel need to be aware of this variation, and of the difference it can make to the final ration delivered to the cow. Techniques to minimize forage variation, such as obtaining each bucket of feed from the height of the silo face or the premixing of forages obtained from across the entire face of the silo, should be part of feeding standard operating procedures on dairies.

Haylage results	DM	CP	ADF	NDF	NEL	Lactate	Acetate	Total VFA
Minimum deviation, %	5.2	3.3	1.1	5.4	1.6	5.2	25	7
Maximum deviation, %	44.7	52.1	20.0	24.8	20.0	646	163	287
Average deviation, %	21.0	17.6	10.7	14.7	9.9	112	72	69
Median deviation, %	19.4	9.5	9.9	14.4	9.3	57	50	38
Corn silage results								
Minimum deviation, %	1.3	2.5	2.3	.5	1.4	3.8	11.2	.1
Maximum deviation, %	55.0	29.5	18.3	18.6	5.6	48.7	131	41.3
Average deviation, %	12.3	11.0	8.4	8.6	3.1	25.6	53.7	20.5
Median deviation, %	8.3	10.0	8.6	8.4	2.8	26.0	29.9	21.4

Key Words: Forage variability, Bunker silos

661 Performance of market cows consuming hay and various levels of rice bran. D. W. Sanson*[1], S. M. DeRouen[2], and D. H. Foster[3], [1]*LSU Ag. Center, Rosepine Reserch Station, Rosepine,* [2]*LSU Ag. Center, Hill Farm Reseach Station, Homer,* [3]*U.S. Market News Service, Baton Rouge.*

Ninety thin cows were purchased from area sale barns each of two years to evaluate the effects of different levels of rice bran in the diet. Cows were purchased during 3 to 4 weeks in late October and early November each year. After purchase, cows were transported to the Rosepine Research Station where they were weighed and scored for condition, treated for internal parasites, and identified with an ear tag. In Year 1, cows were fed one of four rice bran based supplements. Cows were fed 1.1, 2.3, 3.4, or 4.5 kg of rice bran daily in addition to hay free-choice. Supplements were formulated with cottonseed meal so that the supplements provided equal levels of protein. There were 2 replicates of each of the four treatments and the trial lasted 110 d. In Year 2, cows were fed rice bran at either 2.3 kg, 3.4 kg, or free-choice in addition to hay free-choice. There were 2 replicates of each of the three treatments and the trial lasted for 105 d. Cows were weighed on two consecutive days and scored for condition at the beginning and end of each trial.

On the last day of each trial, cows were transported to a local auction barn and sold. In Trial 1, cows that received the 3.4 or 4.5 kg of rice bran plus cottonseed meal gained (P < .05) more weight than cows that received 1.1 or 2.3 kg of rice bran plus cottonseed meal. Body condition score also tended to be higher for cows that received the higher levels of rice bran. There was no difference (P > .05) between weight gain of cows that received 3.4 kg of rice bran and those that received 4.5 kg of rice bran. There was no difference (P > .05) among treatments in the purchase price or the sale price. Average purchase price of the cows was \$34.98 ± .4 per cwt and average sale price was \$49.93 ± .9 per cwt. There was no effect (P > .05) of level of rice bran supplementation on weight gain or condition score change in Trial 2. Cows fed rice bran free choice had an average consumption of 5.2 kg of rice bran per head per day. Neither purchase price nor sell price was affected (P > .05) by supplemental treatment in Trial 2. The average purchase price was \$35.80 ± .9 per cwt and the average sell price was \$47.33 ± 1.5.

Key Words: Beef cow, Rice bran, Supplementation

662 Effects of calving date and weaning age on cow and calf production in the Northern Great Plains. E. E. Grings*, R. E. Short, and R. K. Heitschmidt, *USDA-ARS, Fort Keogh LARRL, Miles City, MT.*

A 3-year study evaluated late winter (**Feb**), early spring (**Apr**), and late spring (**Jun**) calving systems (**CS**) on beef cow and calf performance. Crossbred cows were randomly assigned to 1 of 3 CS (avg n · CS^{-1} · $year^{-1}$ = 148) and 1 of 2 weaning times (Wean 1, 2) within each CS. Feb and Apr calves were weaned at 6- and 8-mo of age; Jun calves were weaned at 4- and 6-mo of age. Breeding by natural service occurred in a 32-d period that included estrus synchronization. Early weaned steers were housed in feedlots while half of the early weaned heifers grazed improved pastures and half were housed in feedlots. Early weaned calves were weighed on approximately the same day as late weaning. Weaning weight of calves adjusted to a constant date (October 19) was decreased ($P < 0.01$) as calving time became later (273, 229, and 181 kg for Feb, Apr, and Jun calves, respectively). Jun calves (203 kg) were lighter ($P < 0.01$) than Feb (224 kg) and Apr (221 kg) calves at 190 d of age. A CS x Wean interaction ($P < 0.01$) occurred for calf gains between Wean 1 and 2. Gains for early weaned calves averaged 0.71, 0.56, and 0.56 and for late weaned calves averaged 0.75, 0.47, and 0.56 kg · d^{-1} for Feb, Apr, and Jun, respectively. Between weanings, suckled cows gained less (Feb: Wean 1, 23.0 kg vs Wean 2, 6.0 kg) or lost more than non-suckled cows in all herds ($P < 0.01$). Cow weight change between Oct (Wean 1) and Dec (Wean 2) did not differ for Apr and Jun (-1.7 kg) non-suckled cows, but loss was greater for suckled Jun (-35.0 kg) than Apr (-15.4 kg) cows (CS x Wean interaction, $P < 0.01$). Time of weaning did not affect ($P > 0.10$) subsequent year's cow or calf performance at weaning. Pregnancy rates (87.9%) were not affected ($P > 0.10$) by CS. Season of calving and weaning age have significant impacts on outputs from rangeland-based beef cattle operations.

Key Words: Beef cattle, Calving season, Rangelands

663 The effect of early calf weaning on performance and measures of stress during the feedlot receiving period. J. D. Arthington*[1] and J. W. Spears[2], [1]*University of Florida - IFAS, Ona,* [2]*North Carolina State University.*

Forty crossbred steers (Brahman x English) were weaned at two ages, 1) early weaned (EW; n = 20), and 2) normal weaned (NW; n = 20). Calves averaged 89 and 300 d of age at the time of EW and NW, respectively. Early weaned calves were kept on-site and grazed on annual and perennial pastures until the time of normal weaning. During this time, EW calves were provided a commercial feed (16% CP) at 1.0% of BW daily. Upon NW, all calves were loaded onto a commercial livestock trailer and transported to the North Carolina State University Research Feedlot, Butner (1200 km). Upon arrival, calves were randomly allotted to 4 pens per weaning age treatment, such that each weaning treatment had two pens of light and two pens of heavy calves. Individual calf BW and blood samples were collected at weaning, upon arrival to feedlot (d 1; 24-h following weaning), and d 3, 7, 14, 21, and 28 of the receiving period. Calves were offered a complete, corn silage-based receiving ration at rates to ensure ad libitum consumption. During the first 3 d, all calves were provided access to long stem grass hay. Feed intake by pen was measured daily. As an estimate of stress, plasma was harvested from blood samples and analyzed for ceruloplasmin and haptoglobin concentrations. Early weaned calves were lighter (P = 0.03) at normal weaning than NW calves (223 vs 277 kg). By d 28, BW did not differ (244 vs 280 kg for EW and NW calves, respectively; P = 0.11). Overall, EW calves gained an average of 0.59 kg/d more (P = 0.02) than NW calves. Intake was similar (P = 0.36) between weaning ages (ADFI = 5.3 and 4.9 kg DM for EW and NW, respectively). Feed efficiency was higher (P < 0.02) for EW than NW calves (F:G = 6.4 vs 13.0). Ceruloplasmin concentrations increased in NW, but not EW calves, peaking on d 7 (27.6 and 34.2 mg/100 mL for EW and NW calves, respectively; P < 0.05). Haptoglobin concentrations increased in both groups and were highest (P < 0.05) in NW calves on d 3 (7.63 vs 14.86 HpB/100 mL). These data suggest that early-weaned calves that are maintained on-site prior to shipping, are more stress-tolerant and productive during an initial 28-d feedlot receiving period.

Key Words: Calves, Weaning, Stress

664 Fertility and greenhouse gas emissions in dairy cows. P.C. Garnsworthy*, *University of Nottingham, Loughborough, UK.*

Dairy cows are estimated to account for 20% of methane and ammonia emissions worldwide. The aim of this study was to quantify the effects of fertility on gas emissions. Improved fertility increases mean annual milk yield per cow because a greater proportion of milk is produced in early lactation and the proportion of cows in their first lactation is smaller. Increased milk yield means higher feed intakes and gas production per cow. On the other hand, improving fertility means fewer replacements are needed, thereby reducing emissions. A model was constructed to calculate combined emissions from cows and their replacements. Heat detection (HD) and conception rate (CR) were used in a decision tree to calculate pregnancy probabilities for a Markov chain that determined calving intervals, herd structure and replacement rate. NRC equations were used to calculate nutrient intakes, which determined methane and ammonia emissions. Annual milk yield was set at 10,000 liters for a cow in second lactation, with a 15% reduction for first lactation and a 10% increase for third and subsequent lactations; days to first service was set at 75 and TMR feeding was used for all cows and heifers. Using values of HD 40% and CR 30%, methane and ammonia emissions per 100 cows (plus replacements) were 19.3 and 5.1 t/yr respectively, equivalent to 20.6 and 5.4 g/l milk. A modest improvement in fertility (HD 50%; CR 50%) decreased emissions to 17.4 and 4.5 t/yr (17.0 and 4.4 g/l). Good fertility levels (HD 70%; CR 60%) gave emissions of 16.8 and 4.3 t/yr (15.5 and 4.0 g/l). At the low level of fertility (HD 40%; CR 30%), replacements accounted for 30% of herd emissions; at good fertility levels (HD 70%; CR 60%), replacements accounted for 10% of herd emissions. These results demonstrate the impact of fertility on greenhouse gas emissions from dairy herds. Moving from low to high fertility status can reduce herd methane and ammonia emissions by 13 and 16% respectively, which equates to a 25% reduction per liter of milk.

Key Words: Dairy cows, Fertility, Environmental emissions

665 Early detection of a change in pregnancy rate with control charts. A. de Vries*, *University of Florida.*

The objective of this study was to estimate the average time to detection of a true change in pregnancy rate monitored with statistical process control charts. Pregnancy rate is an important measure of the success of a reproductive program. An unexpected true change needs to be detected soon, but the rate of false alarms should be kept at an acceptable level. The performance of control charts, measured as the average time to signal (ATS), is the time between false alarms when only normal variation is present (ATS_0) or the time to first detection of a true change in pregnancy rate (ATS_1). A stochastic dynamic simulation model was used to simulate daily performance of cows over time. Default estrous detection efficiency (EDE) was 65% and default conception rate (CR) was about 0.40. Pregnancy checks resolved all inseminations 42 days after breeding. Five scenarios were simulated (n=400 runs): no change (scenario A), decrease in EDE to 55% (B), decrease in EDE to 35% (C), 25% decrease in CR (D), and both a 25% decrease in CR and decrease in EDE to 45% (E). Period lengths were 1, 3, 7, and 21 d. Herd sizes were 100 and 1000 cows. Control charts used were a Shewhart chart, a binomial cusum chart, and a non-parametric cusum chart. Control limits were set such that the ATS_0 were near 365 or 730 d. Additionally, traditional 3-sigma limits were used for the Shewhart chart. Three-sigma limit Shewhart charts with 21 day periods failed to signal changes in pregnancy rate in the 100-cow herd in all cases. For the 1000-cow herd, ATS_1 were 5818 (A), 3154 (B), 90 (C), 1106 (D), and 94 (E) d. Smaller

period lengths decreased ATS_0 significantly, but not ATS_1. Binomial cusum charts with period lengths of 3 days detected true changes in pregnancy rate in general earlier than any other design or chart. For the 100-cow herd, ATS_1 (ATS_0 365 d) were 273 (B), 104 (C), 212 (D), and 106 (E) d. ATS_1 (ATS_0 730 d) were 422 (B), 127 (C), 332 (D), and 127 (E) d. For the 1000-cow herd, ATS_1 (ATS_0 365 d) were 130 (B), 53 (C), 78 (D), and 53 (E) d. ATS_1 (ATS_0 730 d) were 172 (B), 57 (C), 93 (D), and 57 (E) d. Binomial cusum charts should be considered when early detection of a true change in pregnancy rate is important.

Key Words: Statistical process control, Monitoring, Pregnancy rate

666 Weaning at the onset of the breeding season fails to improve hind performance traits in Red Deer. R. D. Randel*, S. A. Mozisek, D. A. Neuendorff, and A. W. Lewis, *Texas A&M University Agricultural Research & Extension Center, Overton, Texas USA*.

Suckling stimulus suppresses rebreeding performance in beef cows. This experiment was designed to determine if performance of Red Deer females was similarly altered. Twenty two lactating Red Deer hinds were randomly assigned to be weaned (W; n=11) or suckled (S; n=11) from September 25 (time of introduction of the breeding male) through November 20 (end of breeding season) with half of each group in one of two breeding pastures. Body weight, body condition score and a blood sample for progesterone analysis by RIA were collected at weekly intervals from September 4 through November 20. Body weights of the fawns were collected from September 25 (1st weaning date) through November 20 (2nd weaning date). All hinds were maintained on Coastal bermudagrass pastures and supplemented with .91 kg/hind/d of 2:1 ground corn:soybean meal and Coastal bermudagrass hay as needed. Weaned fawns grazed Coastal bermudagrass pastures overseeded with ryegrass and were supplemented with .45 kg/fawn/d of 2:1 corn:soybean meal. The fertile males were equipped with marking harnesses and the females were examined daily for estrus activity. Pregnancy was determined by ultrasonography 45 d after ending the breeding season. Weaning of the fawns on September 25 failed to improve ADG (W= -.11±.02 kg/d; S= -.12±.02 kg/d) or body condition (W =.02±.24; S = -.18±.24 units) of the hinds during the breeding season (P>.10). Pregnancy rates were identical (100%) in W and S hinds. Days from beginning stag exposure to conception were 15.4±3.5 d in W compared with 21.6±3.5 d in S (P=.23). Fawn ADG during the 56 d period of the breeding season was not different between W (.072±.012 kg/d) and S (.074±.011 kg/d) groups with all fawns gaining at similar rates. Early weaning failed to improve performance in the Red Deer female with 100% of each group conceiving during the 56 d breeding season. This may be related to the strong seasonality and possible male effect from the stag.

Key Words: Red Deer, Suckling, Reproduction

Ruminant Nutrition: Metabolism - modeling

667 Evaluation of empirical equations to predict microbial efficiency. A. M. Mueller*, L. M. Lake, M. R. Ellersieck, and M. S. Kerley, *University of Missouri-Columbia*.

The maximum efficiency of microbial growth in the rumen is a function of dilution rate (DR). The Beef NRC calculates microbial efficiency (MOEFF) based on the maintenance rate of the bacteria, the digestion rate of a feedstuff, and the theoretic maximum yield of the bacteria. The purpose of this study was to compare the experimentally determined MOEFF to the Beef NRC model prediction and a prediction calculated using particulate passage rate (PPR). Four ruminally fistulated and duodenally cannulated crossbred beef steers (591 ± 39 kg) were used in a 4x4 Latin square design. Treatment diets were pelleted, contained 77 % ground corn, 15 % cottonseed hulls, 0.4 % urea, and differed in source of supplimental protein. The diets contained 1) 7.4 % soybean meal (SBM); 2) 5.4 % fishmeal (FM); 3) 3.8 % bloodmeal (BM); or 4) 5.6 % corn gluten meal (CGM). Treatments were formulated to be isonitrogenous and isocaloric. Treatments had no affact ($P > 0.05$) on dry matter (DMI) or nitrogen (NI) intake, apparent total track dry matter digestability (DMD), true DMD, PPR, MOEFF (expressed as g bacterial N / kg organic matter truely fermented), ammonia-N, or VFA concentrations. The experimentally determined PPR was used to calculate MOEFF, which was not significantly ($P > 0.05$) different from the measured MOEFF. The Beef NRC predicted MOEFF was greater ($P < 0.07$) than the measured MOEFF. Using PPR to predict MOEFF more accurately estimated MOEFF than did the Beef NRC model.

Key Words: Microbial efficiency, Dilution rate, Beef NRC

668 Effect of RDP and roughage level on microbial efficiency in continuous culture. C. A. Willis* and M. S. Kerley, *Univeristy of Missouri-Columbia*.

Feeding strategies can manipulate the rumen environment to control volatile fatty acid (VFA) production and potentially alleviate the need for roughage in the diet. Six diets were evaluated using a continuous culture system to determine the effects of high or low rumen degradable protein (RDP) level with or without roughage on VFA production, digestibility, and microbial efficiency. All diets were corn-based, either cracked (CC) or ground (GC) corn. The RDP level was controlled by the addition of soybean meal (SBM). Low RDP diets contained no SBM and yielded an RDP of 4%. SBM was added to achieve a 14% RDP level, which coincides with the NRC guidelines for feedlot diets. Diets consisted of: 1) 4% RDP with CC and 15% hay, 2) 14% RDP with CC and 15% hay, 3) 4% RDP with CC, 4) 14% RDP with CC, 5) 4% RDP with GC, and 6) 14% RDP with GC. Cultures were acclimated to their diet for ten days and then followed by three days of sample collection. Concentrations of VFA and ammonia were determined and microbial efficiency calculated. The high RDP treatments resulted in higher VFA concentrations as compared to their low RDP counterparts ($P < 0.01$). Microbial efficiencies were greater for high RDP treatments versus low RDP treatments ($P < 0.01$). Diets that did not contain the 15% hay had significantly improved microbial efficiencies ($P < 0.01$). RDP level can be used to control organic acid production which could potentially reduce problems associated with feeding a 0% roughage diet. Removing roughage from the diet unexpectedly improved microbial efficiency.

Key Words: Microbial efficiency, RDP, No-roughage

669 Measuring ruminal pool size and duodenal flow of protozoal N using real-time PCR. J. T. Sylvester*[1], S. K. R. Karnati[1], M. L. M. Lima[2], J. L. Firkins[1], Z. Yu, and M. Morrison[1], [1] *The Ohio State University, Columbus, OH, USA*, [2] *Universidade Federal de Goiás, Goiânia, GO, Brasil*.

Studies evaluating the effects of protozoal ecology on ruminal N recycling and microbial N flow have been limited by availability of a protozoal marker. Current procedures have been either too laborious, not specific to protozoa, or have needed by-difference calculations using multiple markers with their own potential errors. The current objectives are 1) to evaluate a molecular-based assay using the 18S rRNA gene as a protozoal specific marker and 2) to report rumen N pool measurements and protozoal N flow predictions from two cows fed low (LF; 16%) or high (HF; 21%) forage NDF. Rumen pool size was determined from the average of two evacuations; duodenal DM flow, by INDF; and liquid dilution rate (LDR), from a pulsed dose of Li Co-EDTA. Rumen and duodenal samples were composited over 4 d. Rumen samples were quantitatively fractionated for protozoal enumeration and for enrichment of protozoa followed by DNA extraction. Ciliate protozoal specific PCR primers were used to amplify a 1.5-kb fragment of the 18S rRNA gene by conventional PCR for each sample and quantified for use as a standard. A second set of internal primers was used to amplify an approximate 300-bp fragment using real-time PCR to quantify the rDNA copies (i.e., amplicons) present in each ml of sample. Rumen protozoal N pool predictions were determined gravimetrically (i.e., protozoa/ml x ruminal fluid volume) and by multiplying the pool size or duodenal flow of rDNA copies x N/copies ratio of enriched protozoa. The bacterial N pool size and duodenal flow were determined by subtracting protozoal purines from the total purines [protozoal N x (purine/N in enriched protozoa)]. More replications are needed for further verification of the molecular method.