

of each period decreased the summary rate. The end censoring assumption more closely approximated the rates calculated from mid interval censoring. Bias introduced by the timing of the censoring assumption (beginning or ending of an interval) cumulate over intervals when one is calculating a summary hazard.

Key Words: Survival Analysis, Reproduction, Pregnancy Rate

175 Effect of elapsed time between initial thawing of multiple 0.5-mL semen straws and AI on conception rates in dairy cattle. J. C. Dalton*¹, A. Ahmadzadeh², B. Shafii², W. J. Price², and J. M. DeJarnette³, ¹University of Idaho, Southwest Research and Extension Center, Caldwell, ID, ²University of Idaho, Moscow, ID, ³Select Sires, Inc., Plain City, OH.

To facilitate the AI of numerous cows in a timely manner, AI technicians routinely thaw multiple semen straws simultaneously. The objective of this study was to determine the effect of elapsed time between initial thawing of multiple 0.5 mL semen straws and AI on conception rates in dairy cattle. Eight dairies (located in ID, WA, CA and OH), 4 with professional AI technicians (PAI) and 4 with herdsman-inseminators (HI) participated in the study. Initial data recorded included beginning thaw time, cow identification number, and time of AI. Herd records were retrieved following pregnancy diagnosis. The average elapsed time from initial thaw to first, second, third, and fourth AI (N=884) was 6.2 ± 0.2, 7.8 ± 0.2, 9.3 ± 0.3, 11.0 ± 0.3 minutes, respectively. The average time from initial thaw to completion of fourth AI was similar for PAI and HI. Conception rates for first, second, third, and fourth straws for PAI were: 46%, 44%, 34%, 42%, respectively. Conception rates for first, second, third, and fourth straws for HI were: 24%, 20%, 33%, 30%, respectively. Within PAI and HI, neither straw number nor elapsed time affected conception rate. However, average conception rate of straws (1 to 4) differed between PAI and HI (P < 0.01; 42 vs. 27%, respectively). Although the average conception rate differed between PAI and HI, elapsed time and straw number had no effect on conception rate

within inseminator group. Therefore, PAI and HI may thaw four straws simultaneously without compromising conception rates.

Key Words: Artificial insemination, Multiple semen straws, Elapsed time

176 Factors affecting prepartum dry matter intake of pregnant nonlactating Holstein and Jersey cows in late gestation. P. D. French*, Oregon State University.

An experiment was conducted using 15 multiparous Holstein and 15 multiparous Jersey cows to determine if DMI and plasma parameters differed between breeds. Cows were blocked by expected calving date and received a TMR beginning 30 d prior to expected calving date. The TMR contained (dry matter basis) 35% corn silage, 21% oat hay, 16% alfalfa hay, 18% ground corn grain, 7% soybean meal, and 3% mineral-vitamin premix. Diet dry matter concentrations of crude protein and NDF were 14% and 35%, respectively. Blood samples were collected at 21, 14, 11, 9, 7, 5, 3, 2, 1 d prior to expected calving date and on two consecutive days following parturition. Plasma was analyzed for β -hydroxybutyrate, glucose, growth hormone, and NEFA. Data were analyzed using the MIXED procedure of SAS to determine if differences exist between Holsteins and Jerseys. Mean DMI the last 21 d of gestation was 13.9 kg/d for Holsteins and 11.0 kg/d for Jerseys. The magnitude of decline in DMI as parturition approached was greater for Holsteins (breed by day interaction; P < 0.01). Dry matter intake declined 39% for Holsteins and 24% for Jerseys the day prior to parturition compared to 21 d prior to parturition. Plasma NEFA was greater (P < 0.01) for Holsteins (439±27 mM) compared to that of Jerseys (323±27 mM). Glucose (60.5±0.6 mg/dl for Holsteins and 60.5±0.7 mg/dl for Jerseys), β -hydroxybutyrate (6.48±0.19 mg/dl for Holsteins and 6.61±0.20 mg/dl for Jerseys), and growth hormone (4.43±1.02 ng/ml for Holsteins and 4.78±1.03 ng/ml for Jerseys) did not differ between breeds. This experiment confirms previous reports that the decline in DMI is less for Jerseys compared to that of Holsteins. Future investigations are necessary to determine the cause and effect relationship between breed differences in DMI depression and NEFA.

Key Words: Jersey, Dry matter intake, Nonesterified fatty acids

Ruminant Nutrition Feedlot

177 Effect of source of energy and rate of gain on performance, carcass characteristics, ruminal fermentation, and glucose and insulin profiles of early-weaned steers. J. P. Schoonmaker*¹, M. J. Cecava², D. B. Faulkner³, F. L. Fluharty¹, H. N. Zerby¹, and S. C. Loerch¹, ¹The Ohio State University, ²Archer Daniels Midland, ³University of Illinois.

Seventy-three crossbred steers (initial BW 170.5 ± 5.5 kg) from The Ohio State University (experiment 1) and 216 crossbred steers (initial BW 135.4 ± 4.4 kg) from the University of Illinois (experiment 2) were used to determine the effect of source of energy and rate of gain on performance, carcass characteristics, and glucose and insulin profiles in early-weaned steers. Cattle were weaned at an average age of 119 d in both experiments, and allotted by age, weight, and breed to one of 4 diets: high-concentrate, fed ad libitum (ALC), high concentrate, fed to achieve a gain of either 1.2 kg/d (1.2C) or 0.8 kg/d (0.8C), or high-fiber, fed ad libitum (ALF). At 218 d of age all steers were placed on the high concentrate diet and fed ad libitum until slaughter. Steers were implanted with Compudose at the initiation of both experiments, and with Revalor-S when cattle were estimated to be 100 d from slaughter. When steers in experiment 1 averaged 181 and 279 d of age, serum samples were collected to determine glucose and insulin concentrations on 10 steers per treatment. Steers were slaughtered when a terminal fat thickness of 1.27 cm was reached (experiment 1) or after 273 d on feed (experiment 2). *Experiment 1:* Days in the feedlot (P<0.01) and age at slaughter (P<0.01) were lowest for ALC and ALF steers, intermediate for 1.2C steers, and greatest for 0.8C steers. ALC steers gained the fastest from 119 d of age until slaughter, followed by ALF and 1.2C; 0.8C steers gained the slowest (P<0.01). Final weight was low (504 kg), but did not differ (P>0.57) among treatments. At 181 d of age, insulin was elevated (P<0.10), and at 218 d of age, ALC had a higher percentage (P<0.07) of intramuscular fat, as measured by ultrasound, compared to cattle on the other diets. *Experiment 2:* ADG from 119 d of age until

slaughter (P<0.06) and final body weight (P<0.04) were greatest for ALC and lowest for 1.2C and 0.8C; ALF were intermediate, and did not differ from ALC or 1.2C and 0.8C. Growing phase diet did not affect subsequent marbling score at 218 d of age or at slaughter (P>0.81). Controlling growth by limit feeding a high concentrate diet for only 100 d does not extend the growth curve, or enhance intramuscular fat deposition at slaughter compared to ad libitum intake of a high concentrate or high fiber diet, respectively.

Key Words: Beef cattle, Early-weaning, Marbling

178 Beef cattle can successfully be fed 80% potato waste in the finishing diet. J.L. Duynisveld* and E. Charmley, Crops and Livestock Research Center, AAFC, Nappan NS.

One hundred finishing beef steers were used to assess the effect of level of potato waste in the diet on feed intake, rate of gain, feed conversion efficiency, carcass grade and size, and meat quality, texture, color and sensory characteristics. Potato waste was comprised of potato steam peel, cull french fries and steamed cull potatoes, with proportions varying over the feeding period. Potato waste had on average 18% DM, 9.7% CP and 52.2% starch. Cattle were backgrounded for 90 d at a rate of gain of 1.2 kg/d before being assigned to one of five treatments. All rations comprised of 20% grass silage and 80% concentrate. Treatments were formulated by altering the proportion of potato waste to barley in the concentrate, with potato waste included at 0, 25, 50, 75, and 100% of the concentrate. Two pens, each of 10 animals, were assigned to each ration, which was fed for either 79, 107, or 135 d. Increasing the proportion of potato waste in the diet had few effects on any parameters measured, indicating that even very high levels of potato waste can be successfully fed to finishing cattle. Rate of gain showed a quadratic response (P<0.05) to potato waste inclusion, being higher (1.7 kg/d) for the 50% inclusion rate than for 0 or 100% inclusion rates (1.5 kg/d). Dry

matter intake decreased linearly ($P < 0.05$) as the proportion of potato waste increased, and was 20% lower in the 100% potato diet vs the 0% potato diet. Feed conversion efficiency was improved by 15% in the 100% potato waste ($P < 0.05$) over 0% potato waste treatment. Carcass characteristics were similar, regardless of inclusion level of potato waste. Diet had no effect on meat color, tenderness, or cooking losses. Increasing time on feed reduced rate of gain, but had little effect on carcass grade characteristics. Beef was more tender the longer cattle were on feed, but there were no other major effects associated with time on feed, nor were there significant diet x time on feed interactions on any parameters studied. We conclude that potato waste can be fed at very high levels, but optimum performance is realized at more moderate inclusion levels.

Key Words: Beef, Potato Waste, Finishing Cattle

179 Effect of Roundup Ready® corn (event NK603) on performance in beef feedlot diets. J. J. Simon¹, K. J. Vander Pol^{*1}, G. E. Erickson¹, T. J. Klopfenstein¹, C. N. Macken¹, E. P. Stanisiewski², and G. F. Hartnell², ¹University of Nebraska-Lincoln, Lincoln, NE, ²Monsanto Company, St. Louis, MO.

A 144-day feeding trial was conducted utilizing 200 backgrounded steer calves (321 kg) to evaluate effects of glyphosate-tolerant corn (Event NK603) upon performance and carcass characteristics of finishing steers. Treatments consisted of either Roundup Ready® Event NK603 (RR) corn, a non-transgenic control corn hybrid RX670 (PAR), or one of two non-transgenic commercial hybrids [RX740 (COM1), DK647 (COM2)]. Cattle were randomly allocated with ten steers per pen, using a CRD (5 pens/trt). Diets (DM basis), consisted of 10% steep liquor, 7.5% ground alfalfa, 3.0% dry supplement, and 79.5% of the individual corn hybrids respectively. The experiment was designed to contrast the RR hybrid versus the average of the two commercial hybrids and to contrast the RR hybrid versus the PAR hybrid. Dry matter intake (kg/d) for the RR, PAR, COM1, and COM2, corn hybrids were 10.9, 10.9, 10.9 and 11.1 respectively. Average daily gain was not different across hybrids and averaged 1.78, 1.87, 1.78, and 1.84 kg/d for the RR, PAR, COM1, and COM2, respectively. Further, feed efficiency, measured as ADG/DMI, was 0.163, 0.172, 0.163, and 0.166 for RR, PAR, COM1, and COM2 hybrids, respectively. No significant differences were observed between the RR hybrid and the average of the COM1 and COM2 hybrids (COM) on initial weight, final weight, DMI, ADG, or feed efficiency. Also, no differences ($P > 0.05$) were detected between the RR hybrid and the PAR hybrid for initial weight, final weight, DMI, ADG, and feed efficiency. Similarly, no differences in carcass characteristics or meat composition were observed when RR was contrasted with the other hybrids. Overall, RR event NK603 was shown to be substantially equivalent to the control and commercial hybrids when fed to finishing cattle.

Key Words: Cattle, Feedlot, Transgenic corn

180 Effect of corn root worm protected corn (event MON863) on performance in beef feedlot diets. K. J. Vander Pol^{*1}, G. E. Erickson¹, C. N. Macken¹, M. P. Blackford¹, T. J. Klopfenstein¹, E. P. Stanisiewski², and G. F. Hartnell², ¹University of Nebraska-Lincoln, Lincoln, NE, ²Monsanto Company, St. Louis, MO.

A 112-day feeding trial was conducted utilizing 200 yearling steers (365 kg) to evaluate the effects of corn root-worm protected corn (*Bt*, Event MON863) upon performance and carcass characteristics of finishing steers. Treatments consisted of either *Bt* Event MON863 corn (*Bt*), a non-transgenic hybrid RX670 (PAR), or one of two non-transgenic commercial hybrids [RX740 (COM1), DK647 (COM2)]. Cattle were randomly allocated with ten steers per pen, using a CRD (5 pens/trt). Diets (DM basis), consisted of 10% steep liquor, 7.5% ground alfalfa, 5.0% dry supplement, and 77.5% of the respective corn hybrids. The experiment was designed to contrast the *Bt* hybrid versus the average of the two commercial hybrids, and to contrast the *Bt* hybrid versus the PAR hybrid. Dry matter intake (kg/d) for the *Bt*, PAR, COM1, and COM2 corn hybrids were 12.7, 12.4, 12.7, and 13.1 respectively, with the COM2 corn hybrid having a significantly higher ($P < 0.05$) DMI than the other three corn hybrids. Average daily gains (kg/d) were not significantly different (2.25, 2.14, 2.12, and 2.20), for the *Bt*, PAR, COM1, and COM2 corn hybrids. Further, feed efficiency, measured as ADG/DMI, was 0.176, 0.172, 0.166, and 0.169 for *Bt*, PAR, COM1, and COM2 hybrids, respectively. When using the preplanned contrasts, cattle fed *Bt* were more efficient ($P < 0.05$) than cattle fed either PAR or the

two commercial hybrids. No other significant differences were observed for ADG, DMI, final weight, 12th rib fat thickness, or marbling score, among corn hybrids. Overall, feeding *Bt* corn with event MON863 in this study elicited similar gains and DMI with improved feed efficiency compared with other hybrids, suggesting comparable feeding attributes for feedlot cattle.

Key Words: Cattle, Feedlot, Transgenic Corn

181 Impact of grain processing and forage on microbial protein synthesis in beef cattle fed barley-based diets. K. M. Koenig^{*1}, K. A. Beauchemin¹, and L. M. Rode², ¹Agriculture and Agri-Food Canada, Research Centre, Lethbridge, AB, Canada, ²Rosebud Technology, Ltd., Lethbridge, AB, Canada.

Effects of the degree of grain processing and the amount of forage in barley-based feedlot diets on microbial protein synthesis (MPS), ruminal pH, and nutrient digestibility were evaluated using four Jersey steers (initial BW 442 ± 15 kg) with ruminal and duodenal cannulas. The experiment was designed as a 4×4 Latin square with four periods of 21 d. Dietary treatments were arranged as a 2×2 factorial with two levels of barley silage (20 and 5% DM basis) and two degrees of barley grain processing (processing index (PI) of 86 and 61%). Thus, the four dietary treatments were: high forage (20%) and barley grain with a PI of 86%, low forage (5%) and barley grain with a PI of 86%, high forage and barley grain with a PI of 61%, and low forage and barley grain with a PI of 61%. Decreasing the amount of forage in the diet from 20 to 5% and increasing the concentrate from 80 to 95%, increased the amount of rumen fermentable starch ($P < 0.05$), but there was no corresponding increase in MPS ($P > 0.15$). This was due in part to reduced efficiency of MPS when the 5% forage diets were fed ($P = 0.009$). The extent of grain processing had no effect on ruminal starch fermentation, MPS, or microbial efficiency ($P > 0.15$), but when 5% forage was combined with the more extensively processed grain, ruminal fiber digestibility was reduced ($P < 0.06$). Despite, the lack of effect of forage and grain processing on MPS, intake and ruminal escape of feed protein were greater and, hence, protein delivery to the intestine was improved for the low forage diets. Ruminal pH tended to be lower for the low forage diets ($P = 0.13$), but it did not negatively affect feed intake. In conclusion, barley grain rolled to a PI of 61 to 86% and combined with 5 to 20% barley silage in finishing diets had little effect on MPS. Nutrient intake and utilization were maximized when the amount of forage in the diet was limited to 5%.

Key Words: Barley, Grain processing, Forage, Microbial protein synthesis, Beef cattle

182 Effect of growth promotants on physiological characteristics of feedlot cattle exposed to hot and cold conditions. W.M. Kreikemeier^{*1}, T.L. Mader¹, and J.B. Gaughan², ¹University of Nebraska-Lincoln, Northeast Research and Extension Center, ²University of Nebraska-Lincoln, Northeast Research and Extension Center, ³The University of Queensland-Gatton Campus.

Six British x cross steers and six British x cross heifers (BW = 396 ± 29 kg) were utilized in a metabolism trial to determine the effects of growth promotant implants on respiration rate (RR; breaths/min), pulse rate (PR; beats/min) and rectal temperature (RT; °C) when animals were exposed to thermoneutral (THN), hot (HOT) or cold (CLD) conditions. Steers and heifers were randomly assigned to one of three treatments (T) 1) estrogenic implant (E) 2) trenbolone acetate implant (TBA) and 3) E+TBA. The main effects of heifers implanted with E had higher RT (39.19; $P < .01$) and PR (71) when compared to TBA (38.71 and 70) and E+TBA (38.39 and 67). Similarly, main effects of steers implanted with E had higher RT (39.55; $P < .01$) and TBA had the lowest (38.96) when compared to E+TBA (39.23). Steers implanted with E+TBA had the highest PR (81; $P < .01$) when compared to E and TBA steers (71 and 74, respectively). When exposed to HOT and CLD, implanted steers had RR of 123 and 23 (SE = 4.6), respectively; implanted heifers, had RR of 105 and 28 (SE = 4.2), respectively. Steers implanted with E and exposed to CLD had the lowest ($P < .10$) PR (69), while steers implanted with E + TBA and exposed to HOT had the highest ($P > .10$) PR (85). The PR among heifer implant treatments were similar. The implant*stress interaction of RT and PR on steers and heifers are reported in the table. Implanting steers and heifers with E increased RT under both HOT and CLD when compared to implanting with TBA. Differences in RR and PR among implant treatments were less definite.

Treatment*sex interactions for rectal temperature and pulse rate

	Steers			Heifers		
	E	TBA	E+TBA	E	TBA	E+TBA
Rectal Temperature						
THN	39.26 ^b	38.67 ^a	38.72 ^a	38.77 ^{bc}	38.50 ^b	38.37 ^b
HOT	39.97 ^d	39.39 ^b	39.61 ^c	39.86 ^e	39.20 ^d	39.28 ^d
COLD	39.41 ^{bc}	38.82 ^a	39.36 ^b	38.94 ^{cd}	38.43 ^b	37.51 ^a
Pulse Rate						
THN	69.4 ^a	73.5 ^{abc}	84.4 ^d	69.8	67.7	67.0
HOT	74.5 ^{bc}	77.4 ^c	85.3 ^d	72.1	73.9	69.7
COLD	69.4 ^a	71.7 ^{ab}	73.2 ^{abc}	70.6	68	65.5

^{abcd}Means within a sex are different $P < 0.10$.

Key Words: Implants, Environmental Stress, Feedlot

183 Effects of dietary cobalt source and concentration on performance, vitamin B₁₂ status, and ruminal and plasma metabolites in growing and finishing steers. M.E. Tiffany^{*1}, J.W. Spears¹, and F.R. Valdez², ¹North Carolina State University, ²Kemin Industries, Des Moines, IA.

An experiment was conducted to determine the effects of cobalt (Co) source and concentration on performance, vitamin B₁₂ (B₁₂) status, and plasma and ruminal metabolites in steers. Angus-cross (n = 120) steers were stratified by weight and randomly assigned to treatment. Treatments consisted of 0 (control, analyzed 0.05 mg Co/kg), 0.05, 0.10, and 1.0 mg of added Co (as propionate, KemTRACE[®] Co)/kg DM, or 0.05 and 0.10 mg of added Co (as carbonate)/kg DM. A cottonseed hull-corn-soybean meal based growing diet was fed for 84 d followed by a high concentrate finishing diet. Performance was not affected by Co supplementation during the growing phase. During the finishing phase, ADG ($P < 0.05$) and ADFI ($P < 0.10$) were higher in steers receiving Co supplementation. Cobalt source did not affect performance. Plasma B₁₂ was higher ($P < 0.05$) in Co supplemented steers by d 84, and plasma methylmalonic acid (MMA) was lower ($P < 0.02$) throughout the growing phase. Increasing supplemental Co from 0 to 0.05 mg/kg or from 0.10 to 1.0 mg/kg during the finishing phase increased ($P < 0.10$) plasma B₁₂. Control steers had higher ($P < 0.10$) plasma MMA and succinate (SUC) concentrations during the finishing phase than steers supplemented with 0.05 mg Co/kg. During the growing phase, as supplemental Co increased from 0 to 0.05 and from 0.05 to 0.10 mg/kg, liver B₁₂ increased ($P < 0.05$ and 0.08 respectively). During the finishing phase, liver B₁₂ increased ($P < 0.02$) at each level of supplementation. Steers supplemented with 0.10 mg Co/kg from Co propionate had higher ($P < 0.10$) ruminal propionate and lower ruminal butyrate molar proportions than those fed a similar amount of Co from carbonate, during the growing phase. During the finishing phase, Co supplementation resulted in lower ($P < 0.10$) ruminal acetate and butyrate percentage and higher ($P < 0.10$) propionate percentage. These results suggest that moderate Co deficiency reduces performance and vitamin B₁₂ status of finishing steers.

Key Words: Cattle, Cobalt, Vitamin B₁₂

184 Corn-based diets for cattle: effects of dry- vs steam-rolling, and two combinations of antibiotics. D.J. Gibb^{*1}, T.A. McAllister¹, and M.N. Streeter², ¹Agriculture and Agri-Food Canada, Lethbridge, AB, ²Alpharma Inc., Fort Lee, NJ.

Rumensin[®] and Tylan[®] are commonly included in high grain finishing diets to improve feed efficiency and reduce the incidence of liver abscesses, which often result from feeding these diets. Processing grains affects their digestibility and may also encourage liver abscess. Using 240 British cross steer calves (332 23 kg) in 16 pens, growth performance on dry-rolled (DR) vs steam-rolled (SR) corn-based finishing diets medicated with 12 ppm laidlomycin propionate + 42.2 ppm chlortetracycline hydrochloride (Cattlyst[®] + Aureomycin[®]) or with 30.4 ppm monensin sodium + 10.5 ppm tylosin phosphate (Rumensin[®] + Tylan[®]) was evaluated. Treatments were arranged in a 2 × 2 factorial (n = 4). Individual bunk attendance was monitored via radio frequency identification in one pen per diet. Diets were fed for 125 d following a 27-d adaptation from 65% to 91% concentrate. In the first 56 d and overall, DMI was higher ($P < 0.05$) with Cat+Aur than with Rum+Tyl (8.8 vs 8.3 and 9.2 vs 8.8 kg/d), but DMI did not differ ($P = 0.69$) between DR and SR. Cattle fed Cat+Aur tended toward more rapid gain ($P = 0.11$) than those fed

Rum+Tyl (1.54 vs 1.47 kg/d). Processing method did not affect ($P = 0.29$) rate of gain, but SR tended ($P = 0.06$) to improve feed/gain as compared to DR (5.84 vs 6.08). Steers fed Cat+Aur spent more ($P < 0.001$) time at the bunk than those fed Rum+Tyl (125 vs 120 min/d). On DR diets, bunk visits were more frequent ($P = 0.03$) and eating intensity (time with head down/time at bunk) was higher ($P < 0.001$) with Rum+Tyl than with Cat+Aur. On SR diets, however, eating intensity was higher ($P < 0.001$) with Cat+Aur. Carcasses tended ($P = 0.07$) to be heavier with Cat+Aur than with Mon+Tyl, but no other differences in carcass traits were observed. Liver abscess rates were 14% with Cat+Aur and 6% with Rum+Tyl ($P = 0.14$). Severely abscessed livers followed the same trend, also unaffected ($P = 0.17$) by treatment. Feeding Cat+Aur may increase DMI and ADG compared to Mon+Tyl, but its effects on liver abscess are less clear.

Key Words: Laidlomycin, Chlortetracycline, Liver Abscess

185 The effects of supplementing fish oil into the drinking water of dairy cows on lactation performance and milk fatty acids. V. R. Osborne^{*1}, B. W. McBride¹, R. R. Hacker¹, S. Radhakrishnan¹, A. R. Hill¹, and J. K. Kramer², ¹University of Guelph, Ontario, Canada, ²Agriculture and Agri-food Canada, Guelph, Ontario, Canada.

Previous experiments have shown that drinking water can be used as a vehicle to transfer nutrients to dairy cattle. An experiment was conducted to determine if fish oil supplemented into the drinking water of lactating dairy cattle had similar effects on milk production and composition as when oil was delivered in the feed. Sixteen multiparous Holstein cows (60 DIM) were randomly allocated in a repeated measures design to receive either, refined Menhaden oil top dressed (216 ml) on their TMR daily, or oil metered into their drinking water (2g/L). Feed and water intakes, and milk yield and composition were monitored for a 7-d covariate period followed by 28 d of oil supplementation. Water intake (105.2 vs 102.5 L/d), DM intakes (22.4 vs 21.7 kg/d) and milk yield (38.6 vs 39.0 kg/d) were similar for the water and feed supplemented oil treatments respectively. Milk fat composition was also not affected by treatment with both groups experiencing a 17-20 % decline in fat percentage. The route of fish oil delivery had no effect on eicosapentaenoic acid concentration. However, docosahexaenoic acid levels (% of total fatty acids) were higher in cows supplemented with fish oil in the water than through the feed (0.041 vs 0.027 $P < 0.01$), and conversely the total conjugated linoleic acid isomers were higher in milk from cows supplemented with oil in feed (1.224 vs 1.502 $P < 0.01$, oil in water vs feed respectively). These results indicate that drinking water can be an effective method for supplementing fish oil into the diets of lactating dairy cows.

Key Words: fish oil, drinking water, milk fatty acids

186 A longitudinal study to describe the presence of *Escherichia coli* O157:H7 and *Salmonella* spp. in feedlot cattle pens. D. R. Smith^{*1}, R. A. Moxley¹, S. Hinkley¹, L. L. Hungerford¹, J. D. Folmer¹, G. E. Erickson¹, and T. J. Klopfenstein¹, University of Nebraska, Lincoln, NE.

A longitudinal study was conducted to describe the presence of *Escherichia coli* O157:H7 and *Salmonella* spp. in 31 pens of commercial feedlot cattle for each week of their summer feeding period. Pens were tested for the presence of the organisms by bacterial culture of 1) a composite of 20 fresh fecal pats from the pen floor and 2) seven devices prepared from rope available overnight for cattle to rub or chew. The difference in the proportion of positive-testing pens was tested by chi-square analysis. The mean population of the pens was 157 cattle (59-282). The mean feeding period was 20 weeks (15-26). Pens were monitored for a total of 627 pen-weeks. Of these, 95 pen-weeks (15%) were positive for *E. coli* O157:H7 by culture of composite feces, and 274 pen-weeks (44%) were positive by culture of the rope devices. *Escherichia coli* O157:H7 was recovered at least once from the composite feces of 27 pens (87%) and at least once from the ropes of all 31 pens (100%). Twenty-four of 31 pens (77%) were rope-positive for *E. coli* O157:H7 the first week the pen was sampled, however, only 14 of 35 pens (40%) were rope-positive the week of marketing ($p < 0.005$). *Salmonella* spp. was recovered from the composite fecal samples of 21 pens-weeks (3%) and 142 pen-weeks (23%) were positive for *Salmonella* spp. by culture of the rope devices. *Salmonella* spp. was recovered at least once from the composite feces of 18 pens (58%) and at least once from the ropes of 27 pens (87%). Two

of 31 pens (6%) were rope-positive for *Salmonella* spp. the first week the pen was sampled, however, 11 of 35 pens (31%) were rope-positive the week of marketing ($p < 0.05$). Culture of the rope devices identified both organisms in a greater proportion of pen-weeks than culture of the composite feces. The pattern of appearance of the *E. coli* O157:H7 and *Salmonella* spp. over the course of the feeding period was not similar.

Key Words: *E. coli* O157:H7, *Salmonella*, Feedlot cattle

187 Effect of implanting during summer grazing and (or) finishing on feedlot performance and carcass characteristics of steers. L.J. McBeth^{*1}, D.R. Gill¹, and C.R. Krehbiel,¹ *Oklahoma State University.*

The effects of implantation with Ralgro during summer grazing and (or) Revalor S during finishing on feedlot performance and carcass characteristics were determined. Non-implanted crossbred steers ($n = 180$; BW = 280 17.3) were randomly assigned to one of three treatments. Treatments were: 1) no implant during summer grazing or finishing (CON; $n = 20$); 2) no implant during summer grazing and Revalor S implantation during finishing (IMPLF; $n = 80$); or 3) Ralgro implantation during summer grazing and Revalor S implantation during finishing (IMPLGF; $n = 80$). Steers grazed native range for 74 d prior to finishing. Upon arrival at the feedlot, steers were blocked by weight and randomly assigned to 36 pens (18 pens/block; 5 hd/pen). The heavy and light blocks were fed for 132 and 147 d, respectively. Steers that received Ralgro during summer grazing had 9.8% greater ($P < 0.01$) ADG (1.32 vs 1.19 kg/d, respectively), and entered the feedlot heavier (346 vs 337 kg; $P < 0.01$) than steers not implanted. However, by d 56 IMPLF steers (445 kg) had similar ($P > .10$) BW compared with IMPLGF steers (450 kg), and IMPLF and IMPLGF steers had greater ($P = 0.01$) BW than CON (428 kg). Steers that received an implant during finishing had greater ($P < 0.01$) ADG throughout the feeding period (1.74, 1.85, and 1.46 kg/d for IMPLGF, IMPLF, and CON, respectively). Dry matter intake did not differ ($P = 0.36$) across the entire feeding period (avg = 12.0 kg); however, DMI was greater ($P = 0.05$) for IMPLF and IMPLGF steers from d 84 through 112 (8.4%) and d 112 to the end of the feeding period (11.7%) compared with CON steers. Steers that received an implant during finishing had higher ($P < 0.01$) ADG:DMI. No significant differences ($P > .10$) were observed for dressing percent, kidney pelvic and heart fat, marbling, rib eye area, yield grade or tenderness among treatments. However IMPLF and IMPLGF steers had greater ($P < 0.01$) hot carcass weight (370, 374, and 340 kg for IMPLGF, IMPLF, and CON, respectively) and 12th rib fat thickness ($P = 0.01$) than CON steers. In this experiment, performance advantages gained by implanting during the summer grazing period were compensated for by d 56 of the finishing period by cattle that received an implant in the feedlot.

Key Words: Implant, Feedlot, Steers

188 Effects of vitamin E supplementation on feed intake and febrile responses of beef cattle challenged with infectious bovine respiratory virus. J. D. Rivera^{*1}, G. C. Duff², M. L. Galyean³, L. A. Stalker¹, M. M. Reed¹, and B. R. Mitchell¹, ¹New Mexico State University, Las Cruces, NM, ²University of Arizona, Tuscon, AZ, ³Texas Tech University, Lubbock, TX.

Sixteen crossbred steers (average BW = 270 ± 16 kg) were used to determine effects of supplemental vitamin E on DMI and metabolic responses following infection with infectious bovine respiratory virus (IBRV). Cattle were acquired from a local auction in Clayton, NM, given a modified live IBRV vaccine on receiving, transported to Las Cruces, NM, and trained to use Calan Gates (American Calan, Northwood, NH). On arrival at Las Cruces, individual BW were recorded and jugular blood samples were collected. Ten days before the IBRV challenge, steers were stratified by BW, assigned to one of four treatments (four steers/treatment) and given ad libitum access to feed (steam-flaked corn based). Treatments were 0, 285, 570 or 1,140 IU/animal daily of vitamin E top dressed to the feed and were initiated 7 d before the IBRV challenge. On d 0, steers were weighed, a blood sample obtained, and rectal temperatures (RT) recorded for each animal, after which, each steer was given an intranasal 4-mL dose (2 mL per nostril) of IBRV (Cooper Strain, Lot 97-11). After the challenge, RT were recorded daily for 5 d and on d 7. Blood samples were obtained on d 1, 2, 3, 5 and 7. A treatment x time effect was noted for RT ($P = 0.04$). A linear effect of vitamin E was noted for RT with cattle receiving 1,140 IU/d of vitamin E, having the highest RT on d 2 ($P = 0.02$) and 3 ($P = 0.11$)

following challenge. No differences ($P > 0.10$) were noted for BW, ADG, or DMI during this period; however a trend ($P = 0.12$) for a decreased DMI with increasing vitamin E during the wk of the IBRV challenge was noted. Changes in RT and DMI are interpreted to suggest that supplemental vitamin E might enhance the inflammatory response to an IBRV challenge in steers.

Key Words: Beef cattle, Vitamin E, Febrile response

189 Performance and carcass characteristics of steers fed different feeding levels and implant strategies during the growing period. G. Scaglia^{*1}, L. W. Greene¹, F. T. McCollum III¹, and T. H. Montgomery², ¹Texas A&M University Agricultural Research and Extension Center, Amarillo, Texas, ²West Texas A&M University, Canyon, Texas.

Ninety-six growing steers (270 kg) were assigned to 12 pens in a completely randomized design. Implant and feeding level (FL) treatments were randomly assigned to a pen of steers in a 2 x 2 factorial arrangement. Factors were: A) Synovex-S (I) or no implant (NI), and B) FL to gain 0.7 (L) or 1.4 (H) kg/d during the growing period. Steers were fed a diet consisting of 65% steam rolled corn (SRC), 25% alfalfa pellets and 10% supplement (S). After 91 and 59 d for L and H, respectively, steers were transitioned to ad libitum consumption of a high concentrate finishing diet consisting of 80% SRC, 10% cottonseed hulls and 10% S. During the finishing period, all cattle were implanted with Synovex-S and reimplanted with Revalor-S. Steers were harvested when the average fat thickness of the steers in the pen was 12 mm as measured by ultrasound. There was an interaction between implant and FL for ADG ($P = 0.10$) and feed conversion (FC; $P = 0.05$). The interactions occurred due to a higher ADG and FC (gain/feed) in implanted steers fed H but not L diets. Implant treatments did not affect subsequent ADG or FC during the finishing period. Steers fed H gained more ($P = 0.04$) than those fed L from reimplant to harvest (1.21 vs. 0.95 kg/d). Treatment did not affect marbling score, quality grade, fat thickness or yield grade. An interaction occurred between implant and FL for hot carcass weight (HCW; $P = 0.083$) and rib eye area (REA; $P = 0.029$). Implanting L steers increased HCW but not in H steers. In steers fed L, I increased REA compared to NI (88.2 vs. 82.9 cm², respectively), but not when steers were fed H (86.5 vs. 89.0 cm², respectively). Implant during the growing period did not affect subsequent performance in the finishing period.

Key Words: Implant, Feeding Level, Steers

190 Insulin responsiveness improved as glucogenic potential increased in protein supplements fed to young post-partum range beef cows. R.C. Waterman^{*1}, J.E. Sawyer¹, F. Valdez², J. Horton², and M.K. Petersen¹, ¹New Mexico State University, Las Cruces NM USA, ²Kemin Industries, Inc. Des Moines, IA USA.

Cattle grazing dormant range show yearly variation in response to supplementation. This variation may be partially due to changes in tissue responsiveness to insulin, which is altered by nutritional status. A study at the Corona Range and Livestock Research Center during a normal (2000) and a drought year (2001) evaluated supplements differing in source and quantity of glucogenic precursors. Protein supplements (36% CP) were fed to 2-year-old postpartum beef cows at 908 ghd⁻¹d⁻¹ and provided 327 g CP, 118 g UIP (Loglu); 327 g CP, 157 g UIP (Midglu); or 327 g CP, 163 g UIP + 100 g propionate salt (Higlu; NutroCalTM, Kemin Industries, Inc.). Supplements were individually fed on Fridays and Mondays for 90 d postpartum. A glucose challenge was conducted 65 d postpartum via a jugular indwelling cannula at a rate of 0.5 mlkg⁻¹ BW of a 50% dextrose solution, and serum was collected for 180 minutes. Area under the curve (AUC) was determined for both serum insulin and glucose concentrations using the trapezoidal summation method. Serum glucose half-life was determined by calculating the time required for a 50% decrease in peak serum glucose concentrations. Data were analyzed by using supplement, year, and supplement by year as model variables. No treatment by year interactions were detected. Area under the curve for insulin was similar ($P > 0.1$; 300 51) for all cows; however, glucose AUC was lowest ($P < 0.1$) for Higlu and Midglu-fed cows when compared to Loglu (13189 1004, 14615 898, and 16055 1004, respectively). Glucose half-life was less ($P < 0.1$) in Higlu-supplemented cows (100, 69, and 56 14 min for Loglu, Midglu, and Higlu, respectively). Insulin sensitivity improved as glucogenic potential increased in supplements

fed to postpartum beef cows, and may serve as a tool to improve young cow productivity.

Key Words: Insulin, Glucose, Supplementation

191 Effects of delayed implant protocols on performance, carcass characteristics and meat tenderness in Holstein steers. J.L. Beckett*¹ and J. Algeo², ¹Cal Poly State University, ²Algeo Nutrition Consulting.

One hundred eighty-six Holstein steers (156 kg) randomly assigned to one of five treatment groups (n = 38) were used to investigate the effects of delaying the onset of implant treatment during the early and intermediate feeding phases on growth and carcass characteristics. Implants contained Zeranol (Z), trenbolone acetate (TBA) or estradiol (E₂). Treatment descriptions are listed in the following table. Animals were weighed at 30-d intervals and weight gain, average daily gain (ADG), and feed efficiency were calculated. Steers were harvested after 288 d on feed and carcass measurements were collected. All implanted groups had heavier (P<0.05) average final live weights and improved ADG (P<0.05) than non-implanted controls, but did not differ (P>0.05) within implanted treatments. Average REA were greater (P<0.05) for all implanted groups compared with the control group, but did not differ (P>0.05) by implant. The percents of carcasses with USDA quality

grade of Choice or better were significantly lower (P<0.05) for treatments B and C (27.0 and 31.6%, respectively) compared with treatment E (57.9%). Treatments A and C (40.5 and 52.8%, respectively) were intermediate and were not different (P>0.05) from other treatments. Warner-Bratzler shear force values did not differ (P>0.05) between treatments. However, sensory evaluation indicated less desirable tenderness in delayed implant groups compared with the control treatment (P<0.05). Based on these data, delayed initiation of implants during the early growth phase of Holstein steers does not adversely affect growth and improves quality grade compared with early implants, but may decrease tenderness in the resulting meat.

Treatment	Day 0	Day 60	Day 120	Day 180
A	Z(36)	TBA (80) +E ₂ (16)	None	TBA (120) +E ₂ (24)
B	None	TBA (80) +E ₂ (16)	None	TBA (120) +E ₂ (24)
C	None	Z(36)	Z(36)	TBA (120) +E ₂ (24)
D	None	None	Z(36)	TBA (120) +E ₂ (24)
E	None	None	None	None

Key Words: Holstein steers, Implants, Tenderness

Breeding and Genetics

Applications of Random Regression Models in Animal Breeding

192 Random regression models in animal breeding. L. R. Schaeffer*¹, ¹CGIL, Dept. Animal & Poultry Sci, Guelph, Ontario, Canada N1G 2W1.

Random regression models (RRM) have become common for the analysis of longitudinal data or repeated records on animals over time. The best known application of RRM has been to genetic evaluation of dairy cattle using test day production records. Other applications include growth traits in all species, feed intake, body condition scores, and conformation traits. A general description of a RRM is given with a simple example. Some unique applications of RRM have been to the analysis of survival data and to the study of genotype by environment interactions. Examples of these applications are provided and discussed. RRM allow the researcher to study changes in genetic variability with time and allow selection of animals to alter the general patterns of response over time.

Key Words: random regressions, applications, dairy cattle

193 Implementation issues for Markov Chain Monte Carlo methods in random regression test-day models. J. Jamrozik*, University of Guelph, Guelph, ON, Canada.

Markov Chain Monte Carlo (MCMC) methods make it possible to estimate parameters for complex random regression (RR) test-day models. Models evolved from single-trait with one set of random regressions to multiple-trait applications with several random effects described by regressions. Gibbs sampling (GS) is used for models with linear (with respect to coefficients) regressions and normality assumptions for random effects. Efficient, model-specific algorithms based on iteration on data and block sampling have been applied for problems with up to 4 million levels in the mixed model equations and more than 3000 dispersion parameters. General-purpose software is currently also available. Difficulties associated with implementations of MCMC schemes include lack of good practical methods to assess convergence, slow mixing caused by high posterior correlations of parameters and long running time to generate enough posterior samples. Those are illustrated through comparison of GS schemes for single-trait RR test-day models with different model parameterisations, different functions used for regressions and posterior chains of different sizes. Orthogonal polynomials showed better mixing properties in comparison with 'lactation curve' functions of the same number of parameters. Increasing the order of polynomials resulted in a smaller number of independent samples for covariance components. GS under hierarchical model parameterization had a lower level of autocorrelation and required less time for computation. Posterior means and

standard deviations of genetic parameters were very similar for chains of different size (20,000 - 1,000,000) after convergence. Minimal length of the chain for a specific parameter and a given level of Monte Carlo error can be determined using estimates of the posterior standard deviation and the number of independent samples from a shorter chain after burn-in. Single-trait RR models with large data sets can be analysed by MCMC methods in relatively short time. Multiple-trait (lactation) models are computationally more demanding and better algorithms are still required.

Key Words: Gibbs sampling, Random regression models, Test-day data

194 Accuracy of genetic evaluation of beef cattle for growth fitting a random regression model. K. Meyer*¹, ¹Animal Genetics and Breeding Unit, University of New England.

A simulation study was carried out to assess the potential improvement in accuracy of genetic evaluation of beef cattle for growth by replacing the current multi-trait (MT) analysis comprising birth, weaning, yearling and final weights with a random regression model (RRM) analysis. Data were simulated assuming a cubic regression on Legendre polynomials of age for direct and maternal, genetic and environmental effects and heterogeneous error variances for ages from birth to 730 days, maintaining the original data and pedigree structure for three data sets. Set I comprised records from an experimental herd with monthly weight recording. Data sets II and III were field data, selecting a subset of herds with ≥ 55% animals with at least four weights recorded, and all herds for a breed. Each data set was analysed fitting a RRM using all records available (RR), a MT model using up to four records per animal, and a RRM (RR*) using the same subset of records as the MT analysis. Accuracy of evaluation (ρ) was calculated as correlation between true and estimated breeding values at target ages and averaged over replicates. Across all animals, ρ for RR* was consistently larger than for MT due to more appropriate modelling of variances. For data sets II and III, RR yielded little additional gain. For data set I, the overall ρ increased by 0.026 to 0.037 equivalent to 4.2 to 6.3% for 200, 400 and 600-day breeding values (RR vs. MT), and 0.024 or 4.1% for 200-day maternal genetic effects. Gains were largest for bulls with few progeny, ranging up to 9.3%.

Key Words: Random regression model, Genetic evaluation, Beef cattle