

(WNT, AXIN, FZD), immune system (CXCL, IL, MX), adhesion (MYH, MMP), and genes involved in the regulation of vitamin B molecules (FOLR1, TCII) are being analyzed from the endometrial biopsies. In conclusion, strategic dietary vitamin B supplementation during the transition and early lactation did not affect major outcomes of production and reproduction in lactating dairy cows. Benefits of vitamin B in fertility might potentially be linked to endometrial and conceptus gene expression; however, no major differences were observed in production or metabolic parameters.

**Key Words:** conceptus, cows, dairy, endometrium, gene expression, milk production, nutrition, reproduction, rumen protected, Vitamin B complex

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## RUMINANT NUTRITION: WESTERN SECTION

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### 1664 WS Effect of crude protein supplementation on performance of cow-calf pairs and replacement heifers grazing late growing season forage.

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Concurrent experiments were conducted to evaluate the effect of protein supplementation to beef cattle grazing warm-season shortgrass forage during the late growing season. Cattle in all experiments grazed adjacent shortgrass pastures dominated by Buffalograss (*Buchloe dactyloides*) and Blue Grama (*Bouteloua gracilis*). Stocking rates ( $\geq 2.3$  ha/animal) were maintained such that forage availability was not limiting throughout the experiment. Precipitation in the area during the experiment was 176% of normal. For all Exp., treatments consisted of a supplemented group (1.32 kg per head of a 39% CP range cube fed 3 times a week) and a non-supplemented control group. Supplemented animals were fed a daily average of 0.22 kg of CP. In Exp. 1, 45 multiparous cow-calf pairs (initial BW  $646 \pm 13$  kg) were individually weighed and body condition scored every 14 d. Forage clippings were taken simultaneously with BW measurements. Cow measurements and forage clippings began July 6 and concluded September 28. Cow final BW ( $P = 0.24$ ) and ADG ( $P = 0.38$ ) were not affected by treatment. There was no difference ( $P = 0.97$ ) in cow final BCS regardless of treatment. Calf ADG ( $P = 0.54$ ) and weaning weight ( $P = 0.45$ ) were not affected by treatment. In Exp. 2, 26 primiparous cows (initial BW  $546 \pm 12$  kg) were supplemented and measurements obtained in the same manner as Exp.1. Cow final BW ( $P = 0.39$ ) and final BCS ( $P = 0.81$ ) did not differ between treatments. Cow ADG ( $P = 0.07$ ) tended to be greater when supplemented with 0.22 kg CP per day. Calf ADG ( $P = 0.50$ ) and weaning weight ( $P = 0.11$ ) did not differ between treatments. In Exp. 3, 25 replacement heifers (initial BW  $412 \pm 9$

kg) were observed for BW and forage clippings were obtained every 14 d. Heifer final BW ( $P = 0.17$ ) was not different between treatments. Heifer ADG ( $P = 0.02$ ) was greater for supplemented heifers. Supplementing protein to cattle grazing late season medium quality forage is advantageous for increasing ADG in replacement heifers and potentially beneficial to improve condition in lactating primiparous cows. Repeating this experiment under varied precipitation patterns, as is normal for short-grass regions, would be beneficial to further examine the impact of late growing season protein supplementation on cow-calf pair/replacement heifer performance.

**Key Words:** beef cows, forage quality, supplementation

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### 1665 WS Effect of corn-based supplementation on gas emissions, performance, and energetic losses of steers grazing wheat pasture.

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Thirteen Angus-cross steers (initial BW =  $436 + 24$  kg) were used in a crossover design to evaluate the effects of corn supplementation on gas emissions, performance, and energetic losses of steers grazing wheat pasture. Steers were allowed ad libitum access to wheat pasture (1.2 steers/ha), and were individually supplemented one of two treatments daily for two 30 d periods. Treatments included either 0.2 kg of pelleted wheat middlings (CON), or a dry-rolled corn supplement fed at 0.5% of BW plus 0.2 kg of pelleted wheat middlings (SUPP). After initial 30 d period, treatments were alternated and steers were supplemented an additional 30 d. Fecal output was determined with titanium dioxide ( $\text{TiO}_2$ ) as an external marker. Beginning on d 14 of each period 15 g of  $\text{TiO}_2$  was added to each steers supplement. In vitro analysis of wheat forage was determined to estimate DM digestibility of the wheat forage for each 30 d period. Forage intake was calculated using the determined fecal output and estimated forage digestibility. Ruminal  $\text{CH}_4$  and  $\text{CO}_2$  fluxes were measured using a GreenFeed (C-Lock Inc., Rapid City, SD) system. Urine energy loss was assumed to be 1.4% of GE intake. Oxygen production was estimated from  $\text{CO}_2$  production, assuming a respiratory quotient of 1.05. Forage intake as percent of BW did not differ ( $P = 0.15$ ) between CON (3.22%) and SUPP (3.61%). Average daily gain for CON and the SUPP averaged 1.4 kg and 1.3 kg, respectively, and was not influenced ( $P = 0.54$ ) by supplementation. There were no differences ( $P \geq 0.63$ ) among treatments for OM digestibility (CON: 84.9%; SUPP: 84.6%) and NDF digestibility (CON: 82.5%; SUPP: 83.1%). Carbon dioxide excreted (CON: 9.8 kg/d; SUPP: 10.5 kg/d) tended to be less ( $P = 0.08$ ) for CON. No differences ( $P = 0.43$ ) were observed in  $\text{CH}_4$  emissions among CON and the SUPP supplement (334 and 351 g  $\text{CH}_4$ /d,

respectively). Corn supplementation decreased ( $P = 0.02$ )  $\text{CH}_4$  g/kg of DMI by 20.5%. Methane as percent of GE intake was decreased ( $P = 0.02$ ) by 21.6% when steers consumed the SUPP compared to CON. Heat production as a percent of GE intake decreased ( $P = 0.03$ ) when steers consumed the SUPP. Under the conditions of this experiment, cereal grain supplementation reduced  $\text{CH}_4$  emissions.

**Key Words:** energetic losses, methane, wheat pasture

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**1666 WS Effects of rumen protected arginine supplementation to cows during early or late gestation on progeny glucose tolerance.**

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Our hypothesis was calves gestated by dams supplemented rumen protected arginine during early or late gestation would have improved glucose tolerance. To test this hypothesis, a two yr study was conducted. Dams were randomly assigned to one of three treatments; 1) grazing native range plus dried distillers grain (Control), or grazing native range plus dried distillers grain and Arg fed to provide 180 mg L-Arg/kg BW either during 2) early gestation (EARG) or 3) late gestation (LARG). In yr 1, 16 yearling calves (heifers  $n = 8$ , steers  $n = 8$ ) and in yr 2, 24 (heifers  $n = 10$ , steers  $n = 14$ ) yearling calves underwent a glucose tolerance test (GTT). On the days of the GTT, cattle were fed at 0600 h and indwelling jugular catheters were inserted at 0700 h. A 50% dextrose solution was injected at 0.5 mL/kg BW via the jugular catheter and subsequent 6 mL blood samples were collected at -5, -2, 0, 3, 6, 9, 12, 15, 20, 40, 60, 80, 100, and 120 min relative to the dextrose infusion. Glucose half-lives were estimated by regressing the logarithmically transformed glucose concentrations over time and area under the curve was determined using the trapezoidal summation method. Glucose area under the curve (AUC) did not differ ( $P = 0.13$ ) between treatment groups; however, overall glucose concentration (conc.) tended ( $P = 0.06$ ) to be lower for calves of arginine supplemented dams when compared with non-supplemented dams. There were no differences between treatment groups in reference to insulin AUC ( $P = 0.57$ ), insulin half-life ( $P = 0.85$ ), or overall insulin concentration ( $P = 0.47$ ). In conclusion, rumen protected arginine supplementation to cows during varying times in gestation tends to affect overall glucose concentration in progeny during a glucose tolerance test; however, does not affect glucose or insulin AUC, half-life, or overall insulin concentration.

**Key Words:** arginine, glucose AUC, glucose half-life

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**1667 WS Effects of administering Ralgro to Holstein calves during the hutch period on growth performance.**

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We hypothesized that early administration of a Ralgro implant to 1 d old Holstein calves will improve growth performance. One thousand two hundred and forty-eight 1 d old Holstein steer calves (initial BW  $41.2 \pm 0.2$  kg) were utilized in a completely randomized block designed experiment with truck load serving as the block (6 loads). On d 0, calves were individually weighed, tagged with an electronic identification tag, and vaccinated with Vision CD-T with Spur during initial processing. Calves were randomly assigned within block to receive one of two treatments: 1) growth implant containing 36 mg Zeranol ( $n = 584$ ) or no growth implant ( $n = 598$ ). Calves were individually housed in wood hutches and provided ad libitum access to grain starter (17.2% CP, 4% fat and NEM 0.49 Mcal/kg and NEg 0.34 Mcal/kg) and water. In addition, calves were offered two 1.9-L bottles of milk replacer two times daily (25.5% CP and 22.5% fat, DM basis). Implanted calves had greater DMI ( $P < 0.01$ ) compared to non-implanted calves over the 92-d period. Likewise, ADG was greater ( $P < 0.01$ ) when calves were implanted at 1 d of age versus non-implanted calves. However, due to the increase in DMI and ADG for calves receiving implants, G:F tended to differ ( $P = 0.08$ ) between treatments. Overall, implanting calves with 36 mg of Zeranol did not appear to have any adverse effects on intake or feed efficiency in 1 d old calves during the hutch phase and improved ADG by 6%.

**Key Words:** calf, growth, hutch, implants, Zeranol

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**1668 WS Effects of protein concentration and degradability on performance and carcass characteristics of finishing heifers receiving 0 or 400 mg ractopamine hydrochloride.**

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This study evaluated if excess protein decreases performance and carcass quality of finishing cattle fed diets with or without ractopamine hydrochloride (RH). Heifers were assigned to 48 pens in a randomized complete block design and pens of cattle were randomly assigned to 3 protein and 2 RH (0 vs. 400 mg/day) treatments. Protein treatments were steam-flaked corn-based diets containing 13.9% CP, 8.8% RDP, and 5.0% RUP (CON), 20.9% CP, 13.4% RDP, 6.1% RUP (High RDP), or 20.9% CP, 9.1% RDP, 10.4% RUP (High RUP). Cattle were weighed at initiation of RH and at shipping. No RH  $\times$  CP

interactions ( $P \geq 0.11$ ) occurred for performance or carcass traits. Excess CP did not affect ( $P \geq 0.12$ ) final BW or ADG. Carcass-adjusted final BW and ADG tended to be greater ( $P = 0.06$ ) for cattle receiving High RDP than High RUP and CON. Water intake, DMI, G:F, and carcass-adjusted G:F were not different ( $P \geq 0.12$ ) among CP treatments. Hot carcass weight tended to be greater ( $P = 0.06$ ) for cattle receiving High RDP than High RUP and CON. Dressing percentage was lower ( $P < 0.01$ ) for cattle fed High RUP than High RDP and CON. Marbling score, 12th rib fat depth, LM area, and yield grade were not different ( $P \geq 0.16$ ) among CP treatments. Heifers receiving High RUP tended to have lower ( $P = 0.10$ ) KPH than CON. Percentage choice tended to be greater ( $P = 0.09$ ) for heifers receiving High RDP vs. High RUP. Water and DMI were not different ( $P \geq 0.36$ ) for RH vs. no RH. Cattle receiving RH had greater ( $P < 0.01$ ) final BW, ADG, carcass-adjusted final BW, and carcass-adjusted ADG, and lower ( $P < 0.01$ ) G:F and carcass-adjusted G:F compared with no RH. Hot carcass weights were greater ( $P < 0.01$ ) and dressing percentage tended to be greater ( $P = 0.09$ ) for cattle receiving RH, while marbling score was not affected ( $P = 0.11$ ) by RH. Twelfth-rib fat depth tended to be lower ( $P = 0.08$ ), and KPH was lower ( $P = 0.02$ ) for RH vs. no RH. The LM area was greater ( $P = 0.03$ ) for cattle receiving RH vs. no RH. Excess CP does not negatively impact performance or carcass traits of finishing cattle, and no interactions between CP and RH suggest that CP requirements are not affected by RH.

**Key Words:** cattle, protein, ractopamine hydrochloride

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**1669 WS Evaluation of *Eragrostis tef* (Zucc.) as a forage option for grazing beef cattle in the Southern High Plains.** D. Sugg<sup>\*1,2</sup>, <sup>1</sup>Texas Tech University, Lubbock, <sup>2</sup>Angelo State University, San Angelo, TX.

To assess the potential of *Eragrostis tef* to provide a late summer supply of forage for livestock production in the Southern High Plains, four 2.66 ha paddocks equipped with subsurface drip irrigation were seeded with *Eragrostis tef* ('Tiffany' teff) at a rate of 3.72 kg/ha. Each paddock was stocked with commercial beef steers ( $n = 5$ ;  $289 \pm 30.38$  kg initial shrunk BW) at 51 d post-seeding resulting in an initial forage allowance of 202 kg DM/100 kg BW. Weekly samples of whole plant and canopy structure were obtained to describe DM, OM, and fiber concentrations. Appropriate sample height of canopy for the purposes of estimating selection quality was determined at the most proximal grazing site to each quadrat toss by recognition of a tiller with at least one leaf possessing the flat defoliation pattern characteristic of an ungulate bite. Biweekly samples included analysis of CP and IVTD. Leaf percentage of entire plant was quantified at 21 d intervals. Available DM and OM peaked at Day 28 and was lowest at Day 56 ( $P < 0.01$ ). Whole plant and canopy DM ( $P < 0.01$ ), OM ( $P < 0.01$ ), NDF ( $P < 0.01$ ), ADF ( $P < 0.01$ ), and CP ( $P < 0.01$ ) differed by day. Only in vitro true digestibility was not affected by maturation

of either whole plant ( $P = 0.12$ ) or canopy structure ( $P = 0.61$ ). Leaf proportion of whole plant structure aligned with times of peak forage mass availability ( $P < 0.01$ ). Teff grass stocked at a moderate rate with growing beef calves achieved adequate production with minimal inputs forage with minimal inputs to provide a quality forage base for approximately 2 mo of grazing in the Southern High Plains.

**Key Words:** digestibility, forage quality, grazing, teff, water

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**1670 WS Salivary cortisol concentrations affect rumen microbial fermentation and nutrient digestibility in vitro.** K. L. Samuelson<sup>\*1</sup>,

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This study investigated effects of cortisol on fermentation and digestibility of nutrients by rumen microorganisms. Four dual-flow continuous culture fermentor (2700 mL) systems were used in a  $4 \times 4$  Latin square design with 4 periods and 4 treatments. Each experimental period consisted of 13 d, which allowed 7 d for microbial adaptation, 3 d for cortisol treatment application, and a 3 d post-treatment period. Treatments consisted of 0, 3, 6, or 9 ng/mL of cortisol mixed into artificial saliva and continuously infused at a rate of  $1.55 \pm 0.05$  mL/min. For the 3 d treatment period and the 3 d post-treatment period samples were collected at 0, 3, 6, 9, 12, 24, 36, 48, 60, and 72 h and were analyzed VFA, and  $\text{NH}_3$ . During the 3-d sampling period effluent was composited for analysis of OM, NDF, and CP digestibility. During cortisol treatment, cortisol  $\times$  h ( $P \leq 0.01$ ) was observed for acetate and valerate, total VFA and isobutyrate tended to increase from 0 to 3 ng/mL, but were not different among 3, 6, and 9 ng/mL (quadratic,  $P \geq 0.12$ ), butyrate tended to decrease from 0 to 3 ng/mL cortisol, and was not different among 3, 6, and 9 ng/mL (quadratic,  $P = 0.07$ ), and isovalerate was not different among 0, 3, and 6 ng/mL, but decreased from 6 to 9 ng/mL of cortisol (quadratic,  $P = 0.06$ ). Digestibility of OM (g/d and % of intake) tended to be lower (quadratic,  $P = 0.12$ ), and NDF digestion (g/d and % of intake) was lower (quadratic,  $P = 0.09$ ) for 9 ng/mL cortisol compared to 0, 3, or 6 ng/mL. Digestibility of CP (g/d and % of intake) was not different ( $P \geq 0.23$ ) among treatments. In the period after cortisol treatment, a cortisol  $\times$  h ( $P = 0.03$ ) was observed for isobutyrate,  $\text{NH}_3$  decreased linearly ( $P = 0.04$ ) with increasing cortisol, valerate tended to increase linearly ( $P = 0.14$ ) with increasing concentrations of cortisol, and isovalerate was lower for 9 ng/mL than 0, 3, and 6 ng/mL cortisol (quadratic,  $P = 0.10$ ). Digestibility (g/d and % of intake) of OM, NDF, and CP were not different ( $P \geq 0.51$ ) among treatments. Results indicate that cortisol may influence rumen microbial fermentation and digestion when

present in saliva at 9 ng/mL.

**Key Words:** cortisol, fermentation, rumen

#### 1671 **WS Shifting the paradigm of liver abscess**

**dogma in USA feedlots.** Z. Bester<sup>\*1</sup>, M. Hubbert<sup>2</sup>, R. E. Carey<sup>1</sup>, K. L. Samuelson<sup>1</sup>, and C. A. Loest<sup>1</sup>,  
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Liver abscesses in feedlot cattle are a major economic, welfare, and production concern to the cattle feeding industry. Severe liver abscesses (LA) reduce ADG by as much as 0.20 kg, DMI by 5%, trimming loss by 0.43%, carcasses grading choice by 7%, and HCW by 36 kg. In processing facilities, LA introduce operational and food safety concerns. These include a reduction in processing efficiency, lost time as a result of line stoppages, and offal condemnation in addition to the consumer risk associated with LA contamination of edible meat. Tylosin phosphate, a macrolide antibiotic, has been shown to reduce LA by 75% and level of *Fusobacterium Necrophorum* in the rumen by 80 to 90%. During this initial observational study, a total of 83 feedlot pens (each individual feed yard exceeding 40,000 head capacity) within three geographical regions (Arizona, Colorado, and the Texas Panhandle) were sampled. Feedlot pen data were collected within 1 wk before harvest and cattle were traced to the packing plant. Every third rumen and its matching liver were tagged (if condemned only). Rumen were scored for consolidation, scars, moderate and acute lesions, and a sample was taken. Livers were scored based on an adaptation of the Elanco Liver Check scoring system. Holstein cattle had a greater ( $P < 0.05$ ) percentage of LA than beef breeds (30.3 vs. 20.0%). Additionally, Holstein cattle had 11% severe LA (A+) compared with 4% for beef breeds ( $P < 0.05$ ). No geographical difference ( $P \geq 0.10$ ) were detected for liver abscess prevalence and averaged 23, 25, and 26% for the Texas Panhandle, Arizona, and Colorado regions, respectively. Liver abscess rate and severe LA (A+) incidence differed between feedlots ( $P < 0.05$ ) with within feedlot variation. A correlation was observed for LA% and days on feed ( $R^2 = 0.22$ ;  $P = 0.04$ ) and for LA % and breed ( $R^2 = 0.29$ ;  $P = 0.01$ ). No correlation was observed between LA percentage and tylosin phosphate, and between LA percentage and rumen lesions ( $P \geq 0.10$ ). These data indicated no association between LA and rumen damage as a result of acidosis. Rumen lesions averaged 12.2%, of which 9.3% were consolidated, 2.4% scar tissue, and the remainder moderate and acute lesions. This study justifies further investigation of feedlot soil and manure as the source of LA causing pathogens to evaluate the within feedlot variation observed for in LA percentage in cattle.

**Key Words:** cattle, feedlot, liver abscess

## SMALL RUMINANT

#### 1672 **Protein supplementation and herbage allowance for pregnant ewes grazing low-quality pasture.**

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Protein supplements mixed with mineral salt have been widely used in beef production in tropical countries, but few studies have been performed to test their use with sheep or pregnant animals. This study assessed the effect of protein supplementation under two herbage allowances aiming at overcoming ewe undernutrition during gestation and lactation in low-quality pastures during winter. At approximately fifty days of gestation, 36 ewes carrying singletons and of similar stage of pregnancy were chosen from a group of 50 using an ultrasound technique. Ewes were allocated into four treatments in a randomized block design with three replications, where each paddock with 3 ewes was considered the experimental unit. The treatments were arranged in 2 x 2 factorial design of two herbage allowances: 1) low (LH) 10 kg<sup>-1</sup> dry matter (DM) per 100 kg liveweight (LW) and 2) high (HH) 20 d<sup>-1</sup> DM per 100 LW; and two supplements: 1) protein plus a mineral salt mix (PS) and 2) mineral salt alone (S). Both supplements were offered in ad libitum amounts. Due to differences in daily nutrients requirements and pasture quality, the trial was divided into two periods: pregnancy and lactation. Animals grazed a low-quality *Brachiaria arrecta* cv. Napier (crude protein: 67 g kg<sup>-1</sup>, neutral detergent fiber: 710 g kg<sup>-1</sup>) pasture. Animal performance was assessed every 21 d. Other variables such as herbage structure and composition, lamb birth weight, daily supplement intake, and placenta weight were also measured. There was no effect ( $P \geq 0.05$ ) of PS on ewe average daily gain (ADG), placenta weight, lamb birth weight or lamb ADG. Protein supplement intake was greater ( $P \leq 0.05$ ) than mineral salt intake in both reproductive stages, being greater during lactation, but it was not enough to increase the productive performance of ewes during the last third of pregnancy or during lactation. In conclusion, regardless of herbage allowance, the use of protein supplements on low-quality pastures does not improve the nutritional status of ewes or lambs before weaning. **Key Words:** fetal development, maternal nutrition, sheep