

yield grade, with lower yield grades in progeny from dams on CON-R or R-CON treatments vs. CON-CON. Differences in gene expression, animal performance, and carcass characteristics indicate MP restriction during mid- and late-gestation may impact developmental programming.

Key Words: beef cattle, MP restriction, gene expression

ASAS WESTERN SECTION UNDERGRADUATE STUDENT POSTER COMPETITION

0019 Development of an immunohistochemical technique to determine presence and localization of glucose transporter GLUT3 in bovine utero-placental tissues from days 16 to 50 of gestation.

J. Osei*, M. S. Crouse, K. J. McLean, J. A. Flaten, P. P. Borowicz, L. P. Reynolds, J. S. Caton, and C. R. Dahlen, *Department of Animal Sciences, North Dakota State University, Fargo.*

Before the establishment of transplacental exchange, nutrients must be transported to the embryo via nutrient transporters. Glucose transporter *GLUT3* is known as a higher affinity, facilitated diffusion glucose transporter found in high glucose demanding tissues such as the brain, placenta, sperm, pre-implantation embryos, and some cancers. The objectives of our current study were (1) develop an immunohistochemistry technique to localize *GLUT3* in bovine utero-placental tissues, and (2) confirm the presence and location of *GLUT3* in bovine utero-placental tissues. We hypothesized that *GLUT3* would be present in utero-placental tissues from d 16 to 50 of gestation. To test this hypothesis, crossbred Angus heifers ($n = 49$), were synchronized, bred via AI, randomly assigned to nutritional treatment beginning at AI (CON; heifers receiving 100% of requirements to gain 0.45 kg daily) or (RES; 60% of CON), then ovariohysterectomized on d 16, 34, or 50 of gestation ($n = 6$ to 7/d/treatment), or were not bred and ovariohysterectomized on d 16 of a synchronized estrous cycle ($n = 6$) to serve as nonpregnant (NP) controls. Uterine cross-sections were obtained from the pregnant horn, fixed in neutral buffered formalin, and embedded in paraffin for histology. Rabbit primary antibody for *GLUT3* (Abcam) followed by fluorescently labeled, goat nonrabbit secondary antibody (Alexa Fluor 633; Abcam) was used to localize *GLUT3* transporter. A DAPI stain was used to counterstain cell nuclei. Photomicrographs were taken with a Zeiss Imager.M2 epifluorescence microscope using a 10 \times objective and AxioCam HR camera with a Zeiss piezo automated stage. To describe localization of *GLUT3*, the mosaic image of a large tissue area covering the whole cross-section of the uterus with fetal membranes (12 \times 3 pictures) on the slide was taken using the MosaiX module of Zeiss AxioVision software. We localized *GLUT3* in fetal membrane [chorioallantois], uterine endometrium [caruncles

and intercaruncular endometrium] interglandular (stromal) tissue, superficial glands, deep glands, as well as myometrium in NP, CON, and RES tissues on d 16, 34, and 50. These results accomplished our objectives and clearly supported our hypothesis that *GLUT3* is present in uterine tissues from d 16 to 50 of gestation. Further research and more detailed measurements using fluorescence intensity in utero-placental tissues across day and treatments is needed to determine impacts of maternal nutrition status and day of early gestation on localization as well as concentration of the *GLUT3* transporter within utero-placental tissues.

Key Words: bovine, glucose, immunohistochemistry, utero-placental tissue

0020 Do ewes born with a male co-twin have greater longevity with lambing over time? D. N. Grogan^{*1}, J. A. Brown¹, and J. B. Taylor², ¹*Wingate University, Wingate, NC*, ²*USDA, ARS, Rangeland Sheep Production Efficiency Research, Dubois, ID.*

Based on a recent analysis of historical records, ewes born co-twin to a ram had greater lifetime reproductive performance than ewes born co-twin to an ewe. We are interested in determining what component(s) of lifetime reproductive performance may be associated with a ewe's co-twin sex. As an initial indicator of longevity in the flock, we hypothesized that co-twin sex will affect the age at which ewes consistently appear in the lambing records (i.e., recorded as having lambed). Therefore, the objective was to determine the percentage of ewes, born with a female or male co-twin, that appear in the lambing records at ages 1 to 7 yr. Using the USDA-ARS, U.S. Sheep Experiment Station database, lambing records from 1994 to 1997 were queried for ewes that were either born with a male or female co-twin. A total of 4442 ewes were identified, and breeds included Columbia ($n = 417$), Polypay ($n = 627$), Rambouillet ($n = 446$), and Targhee ($n = 427$). For each age class, Chi square analysis was used to compare the expected percentage of ewes lambing that were either born to a female or male co-twin. Of ewes born as a twin and subsequently recorded as having lambed, we expected that, within each age class (1 to 7 yr), 50% of the ewes were originally born as a co-twin to a female (FF) and 50% born as a co-twin to a male (FM). The observed percentage of FF (52.7%) or FM (47.3%) ewes did not differ, regardless of age or breed; $P > 0.10$). Within breed, no differences between percentages were observed in Columbia (FF = 53.8% and FM = 46.2%; $P > 0.10$), Rambouillet (FF = 55.2% and FM = 44.8; $P > 0.60$), and Targhee (FF = 46.3% and FM = 53.7%; $P > 0.30$) ewes regardless of age. However, in 2-yr-old Polypay ewes, there were more FF ewes recorded as having lambed compared with FM ewes (FF = 55% and FM = 45%; $P < 0.01$), but no differences were found at any other age. We suggest that the percentage of ewes having a female or male co-twin did not vary from the expected percentage, thus ewes having a male

co-twin did not have greater longevity with lambing compared with ewes with a female co-twin.

Key Words: co-twin, longevity, lambing

0021 Effect of postweaning brewers grain supplementation on growth and reproductive performance of angus and red angus heifers.

S. E. Butterfield*, J. M. Wisniewski, D. A. Daley, S. P. Doyle, and K. L. DeAtley, *California State University, Chico.*

Objectives of this study were to determine the effects of supplemental brewers grain on growth performance and reproductive characteristics of Angus and Red Angus heifers in a 3-yr study. A total of 85 spring-born, weaned heifers were randomized via gate cut and placed on an 84 d supplementation trial. Treatment groups were either control (CON; $n = 43$; initial BW = 311.90 ± 8.57 kg) or wet brewers grain (WBG; $n = 42$; initial BW = 309.43 ± 8.57 kg) groups. Heifers were housed on adjacent improved pastures (TDN, 56.5%; CP, 11.19%; NDF, 64.8%) and supplemented once daily at 1800 with either the control (CON, alfalfa hay + corn silage; TDN, 52.4%, CP, 8.2%, NDF, 65.6%) or WBG (Alfalfa hay + corn silage + wet brewers grain; TDN, 53.6%, CP: 9.8%, NDF, 66.2%) ration. Diets were balanced to target 0.68 kg ADG/head and were offered on an ad libitum basis. Fifteen days after supplementation period, heifers were synchronized using the 14 d controlled internal drug release-PG + heat detection + timed AI protocol. Traits collected were: BW at d 0, 28, 56, and 84; total gain; ADG; response to synchronization protocols; and ultrasound pregnancy rate. During yr 2, weekly blood serum samples were collected via jugular venipuncture for determination of serum progesterone concentration. Age at puberty was defined as heifer age in days on date of second consecutive progesterone values > 1 ng/mL. Growth performance measures were analyzed as a completely randomized block design (block = year of study) and age at puberty was analyzed as a completely randomized design. No difference ($P > 0.05$) was detected between the control and treatment groups for heifer BW on d 28 (325.97 ± 8.88 vs. 324.86 ± 8.88 kg), d 56 (341.54 ± 8.57 vs. 341.84 ± 8.57 kg), d 84 (361.42 ± 8.21 vs. 360.38 ± 8.21 kg), and ADG (0.14 ± 0.01 vs. 0.14 ± 0.01 kg). Age of puberty did not differ ($P > 0.05$) between treatment groups. Results indicate that heifers supplemented with brewer's grain showed no deviation in development compared with heifers fed the control ration. Cumulative results suggest that WBG could be used as part of a heifer development ration to help offset costs associated with diet ingredients; however, economic analyses of ration and development costs need to be investigated further.

Key Words: heifer development, growth, supplementation

0022 Growth performance and feed efficiency of commercial and half-blood lowline-angus steers in backgrounding and finishing phases.

G. E. Woodmansee*, S. P. Doyle, J. M. Wisniewski, D. A. Daley, and K. L. DeAtley, *California State University, Chico.*

Objectives of this study were to measure growth performance and feed efficiency of commercial ($n = 20$) and half-blood Lowline-Angus ($n = 20$) steers during the backgrounding and finishing growth phases. A total of 40, spring-born steers were delivered to the CSU, Chico cattle feeding facility 30 d postweaning and randomly assigned to three 7×18 m pens equipped with GrowSafe feed intake system for a 28 d adaptation period. Commercial ($n = 20$) and half-blood Lowline-Angus ($n = 20$) steers were fed a forage-based backgrounding ration (CP, 15.6%; TDN, 56.22%; NDF, 52%, DM basis) for 58 d and allowed ad libitum access to feed and water. Cattle were transitioned to the finishing ration (CP, 11.9%; TDN, 72.58%; NDF, 20.21%, DM basis) over a 16 d period. Finishing phase trial was 72 d and weights were taken on d 0, 1, 35, 71, and 72. Data were analyzed as a randomized block design (block = pen). Breed \times pen effect was not significant ($P > 0.05$). In the backgrounding phase, dry matter intake tended ($P = 0.06$) to be greater for commercial steers (DMI; 9.16 ± 0.36 kg) compared with half-blood Lowline-Angus (DMI; 8.17 ± 0.36 kg) steers. ADG, metabolic mid-weight, residual feed intake and feed conversion ratio were not different ($P > 0.05$) between breed groups in the backgrounding phase. In the finishing phase, commercial and half-blood Lowline-Angus steers had different ($P < 0.05$) ADG (1.82 ± 0.05 kg vs. 1.53 ± 0.05 kg), metabolic mid-weight (MMWT; 72.30 ± 1.18 kg vs. 68.16 ± 1.18 kg), DMI (10.12 ± 0.20 kg vs. 8.65 ± 0.20 kg), residual feed intake (RFI; 0.24 ± 0.13 kg vs. -0.22 ± 0.13 kg) and end weight (464.41 ± 9.28 kg vs. 423.16 ± 9.25 kg). Results indicate that backgrounding phase performance may not be an accurate predictor for finishing phase performance. Lack of significance in the backgrounding phase between breed groups may be a function of half-blood steers being F1 generation. Further research should be conducted to assess feed efficiency performance during the backgrounding phase in commercial and half-blood Lowline-Angus steers.

Key Words: GrowSafe, growth performance, steer

0023 Utilization of wet brewers grain as a winter feed supplement for beef cows grazing native annual grasslands.

K. N. Bohn¹, S. P. Doyle¹, J. Davy², D. K. Flavell³, N. Schweitzer³, K. L. DeAtley¹,
¹California State University, Chico, ²University of California, Cooperative Extension Service, Red Bluff, ³University of California, Cooperative Extension Service, Browns Valley.

Objectives of this study were to determine the effects of wet brewers grain (WBG) as a winter supplement on cow and calf performance while grazing native annual grasslands. The study was conducted at the Sierra Foothill Research and Extension Center (Browns Valley, CA) during 2014–2015 and 2015–2016 winter grazing seasons (i.e., November through January). A total of 92, fall-calving Angus × Hereford cows grazing native annual pastures (12.12 ha/pair for 84 d; 3.56% CP, 39.3% TDN, 75.3% NDF) were supplemented with either molasses low moisture protein block, available ad libitum (CON; $n = 28$; CP, 26%) or WBG (fed 3 times/wk; formulated to offer 0.68 kg CP head/d on DM basis; CP, 26%). Treatment groups were housed in adjacent pastures during the 84 d supplementation period and weights were taken in 28 d intervals. Dependent variables included: cow and calf BW and cow BCS. Data were analyzed as a randomized block design where block = year of study. Treatment × block interaction was not significant ($P > 0.05$). Calves were born before beginning of study each year and calf date of birth was fit as a covariate. Brewers grain supplemented cows were heavier on d 56 compared with CON cows (560.63 vs. 529.86 ± 13.99 kg; $P = 0.03$). Similarly, WBG calves were also heavier on d 56 compared with CON calves (117.97 vs. 110.06 ± 3.72 kg; $P = 0.03$). Calves born to WBG supplemented cows tended ($P < 0.10$) to be heavier than those of CON supplemented cows on d 0 (57.96 vs. 58.81 ± 2.73 kg) and d 86 (141.64 vs. 152.03 ± 3.74 kg). Results indicate that cows and calves supplemented with WBG recovered weight more quickly than those consuming liquid protein supplement. Therefore, WBG may have considerable potential as a winter protein supplement on California grasslands; however, economic analyses need further investigation.

Key Words: annual grasslands, feed supplementation, wet brewers grain

0024 Derivation of economic values for feedlot performance traits in commercial and lowline-influenced angus steers.

L. C. Huffaker*, K. L. DeAtley, J. N. Brimlow, and S. P. Doyle,
California State University, Chico.

Feed costs and market volatility make identifying cattle biological types and performance traits with significant economic impact at the feedlot imperative. Thus, the objective of this study was to determine the economic values of feedlot performance traits in commercial Angus ($n = 20$), half-blood

Lowline-influenced Angus ($n = 20$), and full-blood Lowline Angus ($n = 8$) steers. Steers were fed for 72-d after a 28-d adjustment period at the CSU, Chico Agricultural Teaching and Research Center's beef cattle feeding facility. Upon delivery, steers were randomly assigned to three, 7 × 18 m pens, each fitted with two GrowSafe feed nodes and allowed ad libitum access to water and finishing ration (CP = 11.9%, TDN = 72.58%, NDF = 20.20%). After the 72-d GrowSafe trial, steers continued in their assigned GrowSafe pens until slaughter. Feedlot performance traits with significant economic impact were identified using stepwise, multiple-trait linear regression of net revenue onto residual feed intake (RFI), ADG, DMI, slaughter weight, and dummy variables representing breed type. Net revenue was defined as gross revenue minus feed costs. Gross revenue for each steer was determined by multiplying each animal's slaughter weight by market price at the time of sale (\$3.26/kg). Costs included yardage (\$.50/hd/d), billed daily feed consumption, and average feeder price (\$3.68/kg) multiplied by delivery weight. Average net revenue (±SD, USD) for the commercial Angus, half-blood Lowline-influenced and full-blood Lowline Angus steers were \$10.13 ± 86.97, \$-44.30 ± 69.98, and \$-105.05 ± 86.97, respectively. Multiple linear regression results identified slaughter weight, DMI, and ADG as significant predictors of feedlot net revenue ($R^2 = 0.41$; $P < 0.05$). Coefficients representing economic values for slaughter weight, DMI and ADG were \$0.66, \$-32.92, and \$71.30, respectively. Results suggest that slaughter weight, DMI, and ADG are key predictors of feedlot net revenue, and deserve consideration in the development of breeding objectives with the goal of improving feedlot profitability.

Key Words: economic values, feedlot cattle, performance

**ASAS WESTERN SECTION
YOUNG SCHOLARS**

0025 Effects of organic or inorganic Co, Cu, Mn, and Zn supplementation to late-gestating beef cows on productive and physiological responses of the offspring.

R. Marques¹, R. F. Cooke¹, M. C. Rodrigues¹, B. I. Cappelozza¹, R. R. Mills², C. K. Larson³, P. Moriel⁴, and D. W. Bohnert¹,
¹Oregon State University–EOARC Burns, Burns,
²Oregon State University Extension Service, Pendleton,
³Zinpro Corporation, Eden Prairie, MN,
⁴UF/IFAS Range Cattle Research and Education Center, Ona, FL.

Eighty-four multiparous, nonlactating, pregnant Angus × Hereford cows were ranked by pregnancy type (AI = 56, natural service = 28), BW, and BCS, and allocated to 21 drylot