

# Production, Management and the Environment: Beef, Swine, Sheep

**T210 Management and facility factors that affect mortality in grow-finishing pigs.** P. S. Agostini<sup>\*1,2</sup>, A. G. Fahey<sup>2</sup>, E. G. Manzanilla<sup>1</sup>, J. V. O'Doherty<sup>2</sup>, C. de Blas<sup>3</sup>, and J. Gasa<sup>1</sup>, <sup>1</sup>Universitat Autònoma de Barcelona, Bellaterra, Spain, <sup>2</sup>University College Dublin, Belfield, Dublin, Ireland, <sup>3</sup>Universidad Politécnica de Madrid, Madrid, Spain.

The objective of this study was to investigate the effect of some on-farm production and management factors on the mortality rate of grow-finishing pigs. In total 316 batches from 246 growing-finishing farms, including 459,148 pigs, using a Pietrain male finisher and belonging to 8 Spanish companies were used. All data were collected by survey during 2008 and 2009. Survey information included season of placement, sex segregation by pens, number of pig origins, frequency of antibiotic treatments, water source in the farm, initial and final body weight (IBW and FBW), percentage of the barn utilized, floor, feeder, ventilation and number of animals placed. A multivariate linear mixed regression model was used including factors that had a  $P$ -value  $< 0.25$  in a univariate regression model. These factors were then included in the multivariate model and the final model was determined using a stepwise selection method. The company was considered as a random factor but it was not significant ( $P > 0.05$ ) and thus not included in the final model. The average rate of mortality was  $4.13 \pm 2.65\%$ . There was a significant increase in mortality when: a) batches were placed between October and March ( $P < 0.01$ ), b) pigs were obtained from multiple origins versus a unique origin ( $P < 0.05$ ), c) pigs were treated  $\geq 3$  times with antibiotics versus those treated  $< 3$  times ( $P < 0.01$ ), d) fed in a multi-space feeder compared with single-space ( $P < 0.01$ ) and finally e) in farms with more than 800 pigs placed ( $P < 0.05$ ). Moreover, a quadratic effect of IBW ( $P < 0.05$ ) was observed showing that pigs with lower and higher IBW had higher mortality. An interaction between IBW and type of feeder was found ( $P < 0.01$ ) and it showed that pigs fed through multi-space feeder and with IBW lower and higher than 21 kg presented higher and lower mortality, respectively, compared with single-space and single-space with drinker. Total variability of mortality explained by the model was 26%. This study indicates that farms may reduce mortality by improving some farm facilities and/or modifying some management practices.

**Key Words:** grow-finishing pigs, factors, mortality

**T211 Housing and management factors that affect feed conversion ratio in grow-finishing pigs.** P. S. Agostini<sup>\*1,2</sup>, A. G. Fahey<sup>2</sup>, E. G. Manzanilla<sup>1</sup>, J. V. O'Doherty<sup>2</sup>, C. de Blas<sup>3</sup>, and J. Gasa<sup>1</sup>, <sup>1</sup>Universitat Autònoma de Barcelona, Bellaterra, Spain, <sup>2</sup>University College Dublin, Belfield, Dublin, Ireland, <sup>3</sup>Universidad Politécnica de Madrid, Madrid, Spain.

The objective of this study was to investigate the effect of some on-farm production and management factors on the feed conversion ratio (FCR) of grow-finishing pigs. In total 316 batches from 246 growing-finishing farms, including 459,148 pigs, using a Pietrain male finisher and belonging to 8 Spanish companies were used. All data were collected by surveys during 2008 and 2009. Survey information included: season of placement, sex segregation by pens, number of pig origins, frequency of antibiotic treatments, water source in the farm, initial and final body weight (IBW and FBW), percentage of the barn utilized, floor, feeder, ventilation and number of animals placed. A multivariate linear mixed regression model was used that included factors that had a  $P$ -value

$< 0.25$  in a univariate model and then selected by stepwise procedure in the multivariate model. Company was considered as a random factor but it was not significant ( $P > 0.05$ ) and thus not included in the final model. The mean FCR was  $2.71 \pm 0.15$ . Averages of FCR were lower when batches: a) were placed between April and September ( $P < 0.01$ ), b) pigs were segregated by sex in pens (entire male versus female) ( $P < 0.01$ ), c) the proportion of the floor covered by slats was reduced to less than 50% ( $P < 0.05$ ), d) were fed in a single space feeder with an incorporated drinker ( $P < 0.01$ ), e) treated 3 or more times with antibiotics than those treated less than 3 times ( $P < 0.01$ ), f) pigs had a lower FBW at slaughtering ( $P < 0.01$ ) and finally g) had a higher percentage of the barn utilized ( $P < 0.01$ ). Moreover, a quadratic effect of IBW ( $P < 0.01$ ) was observed showing that pigs with lower and higher IBW had higher FCR. An interaction between IBW and trimester of placement was also found ( $P < 0.01$ ) and it showed that pigs placed between July and September and with IBW lower and higher than 19 kg had higher and lower FCR, respectively, compared with pigs placed in other months. Total variability of FCR explained by the model was 31%. This study indicates that farms may reduce FCR by improving some farm facilities and/or modifying some management practices.

**Key Words:** grow-finishing pigs, factors, feed conversion ratio

**T212 Management and facility factors that affect the variability of average daily gain in grow-finishing pigs.** P. S. Agostini<sup>\*1,2</sup>, A. G. Fahey<sup>2</sup>, E. G. Manzanilla<sup>1</sup>, J. V. O'Doherty<sup>2</sup>, C. de Blas<sup>3</sup>, and J. Gasa<sup>1</sup>, <sup>1</sup>Universitat Autònoma de Barcelona, Bellaterra, Spain, <sup>2</sup>University College Dublin, Belfield, Dublin, Ireland, <sup>3</sup>Universidad Politécnica de Madrid, Madrid, Spain.

The objective of this study was to investigate the effect of some on-farm production and management factors on the average daily gain (ADG) of grow-finishing pigs and explain the variability found between companies. Information from 275,936 pigs from Pietrain male finisher, distributed in 190 batches belonging to 5 Spanish companies (ranging from 19 to 59 batches for each company), was collected by survey during 2008 and 2009. ADG was defined as the total average weight gain per pig (kg) divided by the length of the grow-finishing period (days). A multivariate linear mixed regression model was used and factors were considered to have a significant effect when  $P < 0.05$ . The company was considered as a random factor and batch and herd effects as the residual factor. The mean ADG was  $0.632 \pm 0.048$  kg. Animals placed from July to December had higher ADG than batches placed in other months ( $P < 0.01$ ). Pigs fed in a single-space feeder with incorporated drinker had higher ADG than single and multi-space without drinker ( $P < 0.05$ ). Small batches (less than 800 pigs placed) had higher ADG ( $P < 0.01$ ) and pigs raised a higher final body weight (FBW) at slaughtering also had higher ADG ( $P < 0.01$ ). An interaction between FBW and feeder was found ( $P < 0.05$ ) showing that pigs fed through single-space feeder with drinker and with FBW lower and higher than 102 kg had lower and higher ADG respectively compared with other feeders. When no fixed effects were included in the model (null model), about 33% of the variability was registered between companies, meanwhile when fixed effects were included (full model), companies only explained 8% of the variance. The total variance explained by the full model was 26%. Companies may have important specific factors affecting the ADG which have not been considered in this study; among them some approaches

of health status, biosecurity conditions or nutrition programs should be included in future studies.

**Key Words:** grow-finishing pigs, factors, average daily gain

**T213 Effects of herb supplementation on growth performance, litter performance, and diarrhea occurrence in lactating sows and piglets.** J. H. Jung,\* J. P. Lee, and I. H. Kim, *Department of Animal Resource and Science, Dankook University, Cheonan, Choongnam, South Korea.*

This study was conducted to evaluate the effects of herb supplementation on growth performance, litter performance, and diarrhea occurrence in lactating sows and piglets. A total of 30 sows (Landrace × Yorkshire) and their litters were employed in this study. Sows were allocated to 1 of 3 treatment groups. Dietary treatments included: 1) CON, basal diet, 2) A, basal diet + 0.01% (*Scutellaria baicalensis* + *Astragalus membranaceus*), and 3) B, basal diet + 0.01% (*Codonopsis pilosula* + *Angelica gigas*). The experiment started 7 d before farrowing and lasted for 28 d. Within 24 h after parturition, numbers of piglets were adjusted equally per sow. Backfat thickness was evaluated at 3-d before farrowing and weaning day (21d). No differences ( $P > 0.05$ ) were observed in ADFI and backfat thickness throughout the experimental period. However, backfat loss was lower ( $P < 0.05$ ) in CON treatment than that in A and B treatments. No significant difference ( $P > 0.05$ ) was found in the estrus interval and fecal moisture content among dietary treatments. No significant difference ( $P > 0.05$ ) was observed in the birth BW, 14 d BW, and 21 d BW (weaning weight) of piglets among treatments. No difference ( $P > 0.05$ ) was observed in diarrhea occurrence of sucking piglets by dietary supplementation with herb. No significant difference ( $P > 0.05$ ) was noted in total number of piglets born, number of weaned piglets, and mortality of piglets. In conclusion, no effect of herbs was observed on the performance of lactating sows and diarrhea occurrence in piglets. Further studies should be conducted to confirm the positive effect of dietary supplementation with herbs in lactating sows.

**Key Words:** herb, piglet, sow

**T214 Wood to feed: Diversifying income opportunities by increasing the livestock feeding value of woody plant species.** T. R. Whitney\*<sup>1</sup>, J. W. Walker<sup>1</sup>, W. C. Stewart<sup>1</sup>, R. J. Ansley<sup>2</sup>, B. D. Lambert<sup>3</sup>, A. F. Cibils<sup>4</sup>, C. B. Scott<sup>5</sup>, J. L. Johnson<sup>6</sup>, T. Bader<sup>7</sup>, W. Winters<sup>8</sup>, L. O. Tedeschi<sup>9</sup>, G. E. Carstens<sup>9</sup>, and J. P. Muir<sup>3</sup>, <sup>1</sup>Texas AgriLife Research, San Angelo, <sup>2</sup>Texas AgriLife Research, Vernon, <sup>3</sup>Texas AgriLife Research, Stephenville, <sup>4</sup>New Mexico State University, Las Cruces, <sup>5</sup>Angelo State University, San Angelo, TX, <sup>6</sup>Texas AgriLife Extension, Stephenville, <sup>7</sup>Cedar Beetle, Concan, TX, <sup>8</sup>Novas Wood Group, Houston, TX, <sup>9</sup>Texas A&M University, College Station.

The primary goal of this project is to develop the technology and knowledge base necessary to convert invasive woody biomass material into a viable ruminant feed ingredient. Woody species such as *Juniperus* and *Prosopis* occur on millions of acres of rangelands in the US and continue to increase at rapid rates, reducing forage productivity, water resources, wildlife habitat, and ecosystem health. Treatments to manage these woody species are generally not cost-effective. However, increasing the value of woody biomass through conversion to animal feed or biofuels will provide cost-effective management options, while concurrently increasing grass production and ecosystem health. Although not unique to the livestock industry, current drought and escalating fuel and fertilizer prices have drastically increased feed costs and interest in using non-traditional feeds. Use of woody biomass as feed is not a novel idea, with

research conducted in the early 1920s and late 1950s evaluated the feeding value of sawdust and mesquite wood in cattle diets. Limited adoption of mesquite as livestock feed probably occurred because of the relative costs of traditional feed ingredients was not great enough to justify the risk of using a novel feed and conversion of wood to feed was not very efficient. However, both of these conditions have changed. Thus, Texas AgriLife Research faculty, colleagues, and industry collaborators have renewed “wood to feed” efforts and have been successfully incorporating ground woody material into ruminant livestock diets. A recent study from our laboratory showed that ground juniper can replace ground oat hay in lamb feedlot diets without negatively affecting DMI, ADG, or G:F ( $P > 0.05$ ). Even though a renewed interest in “wood to feed” has surfaced, livestock producers are reluctant to move forward because many questions still remain about how to integrate individual systems components into a profitable and sustainable operation. Therefore, to increase the adoption of technologies to cost-effectively harvest and utilize woody biomass as ruminant feeds, we are creating a web-based “Wood to Feed” Center where multidisciplinary scientists work directly with ranchers, landowners, and industry representatives to integrate expertise and novel ideas.

**Key Words:** woody plants, roughage, natural resources

**T215 Effect of body size on feed intake and methane emissions from ewes offered fresh ryegrass.** M. D. Fraser, H. Fleming, V. J. Theobald, and J. M. Moorby,\* *Institute of Biological, Environmental and Rural Sciences, Aberystwyth University, Aberystwyth, UK.*

Sheep production in the UK is stratified into systems that utilize smaller, hardier breeds in the hills, their crossbreds in the uplands, and heavier, more productive breeds and their crossbreds in the lowlands. This experiment tested the hypothesis that body mass and associated allometric relationships, rather than breed type, determines enteric methane production in sheep. Methane emission measurements were made on mature, barren ewes of 4 different breed types: Welsh Mountain (WMO), Scottish Blackface (SBF), Welsh Mule (WMU), and Texel (TEX) ( $n = 8$  per breed). The mean live weights for the different breeds were 46 ( $\pm 2.9$ ), 62 ( $\pm 6.2$ ), 71 ( $\pm 4.4$ ) and 78 ( $\pm 3.8$ ) kg, respectively. Following a 3-week adaptation period, the ewes were housed in methane chambers and zero-grazed on herbage cut from an intensively managed perennial ryegrass sward. They were fed on an ad libitum basis, with 2 equal portions offered at 0900 and 1600 h. Data were collected for 3 consecutive days for each animal. There was a significant treatment effect of breed type on voluntary intake, with mean DM intake recorded as 1.08, 1.02, 1.30 and 1.55 for WMO, SBF, WMU, and TEX respectively (SED = 0.111 kg;  $P < 0.001$ ). However, there was a relatively poor relationship between metabolic body weight (BW) and DM intake ( $R^2 = 0.30$ ); consequently body mass was a poor indicator of methane emissions ( $R^2 = 0.17$ ). There was a stronger correlation between DM intake (g/d) and methane emitted ( $R^2 = 0.57$ ). In conclusion, BW was a relatively poor indicator of DM intake and therefore a poor predictor of methane emissions from sheep of different breed sizes when offered fresh ryegrass.

**Key Words:** breed size, methane, sheep

**T216 Fifty years of the Wyoming ram test: How have sheep changed?** D. J. Burton,\* P. A. Ludden, R. H. Stobart, and B. M. Alexander, *University of Wyoming, Laramie.*

Production characteristics of white-faced rams have been systematically evaluated over a 140 d test for gain and wool characteristics in the

Wyoming white-faced ram test since 1961. Records from this test are predominantly from Rambouillet rams but records from other breeds such as Columbia and Targhee are included. Individual production traits from test records ( $n = 3941$ ) from 1961 through 2010 were analyzed to determine how sheep have changed over the last 50 years. Although age of rams on test has remained stable at  $354 \pm 0.6$  d, both weight-on and -off test have increased linearly ( $P < 0.001$ ) since 1961 with weight-off test increasing 22.7 kg over this time frame. This larger body size likely contributed to a linear increase ( $P < 0.001$ ) in clean fleece weight. Rate of gain also increased linearly ( $P < 0.001$ ) with rams gaining approximately  $0.23 \pm 0.01$  kg/d in the early years to a current rate of gain of  $0.39 \pm 0.01$  kg/d. Although wool characteristics remain an important component to the test index, spinning count, a measure of wool diameter, did not change in a linear manner ( $P > 0.05$ ), and has remained stable at a 62 spinning count. Market forces may influence breed characteristics over time, and thus correlates to market prices were determined with a 0, 2 and 5 yr time lag. Average daily gain was strongly correlated ( $r > 0.6$ ) with feeder lamb price, and had the strongest correlation with a 2 year ( $r = 0.76$ ) time lag. Sheep inventory negatively correlated ( $r = 0.87$ ) with average daily gain but correlated similarly with a 0, 2 or 5 year time lag. Wool price did not correlate ( $r < 0.1$ ;  $P \geq 0.5$ ) with spinning count at any of the time lags. Rambouillet rams have increased in size over the last 50 years with an increase in efficiency of production. Although clean fleece weight has increased proportionally to ram size, fiber diameter has remained largely unchanged and did not correlate to market wool price. This suggests that market influences on white-faced ram selection have largely affected growth traits while avoiding any negative effect on wool quality.

**Key Words:** ram, production, wool

**T217 The environmental and economic impact of removing growth-enhancing technologies from United States beef production.** J. L. Capper<sup>1</sup> and D. J. Hayes<sup>\*2</sup>, <sup>1</sup>Washington State University, Pullman, <sup>2</sup>Iowa State University, Ames.

This study quantified the environmental and economic impact of withdrawing growth-enhancing technologies (GET) from the US beef production system. A deterministic model based on the metabolism and nutrient requirements of the beef population was used to quantify resource inputs and waste outputs per  $454 \times 10^6$  kg of beef. System boundaries extended from manufacture of cropping inputs to delivery of live animals at the slaughterhouse. Two production systems were compared – one using GET (steroid implants, in-feed ionophores, in-feed hormones and  $\beta$ -adrenergic agonists) where approved by the FDA at current adoption rates; the other without GET use. Both systems were modeled using characteristic management practices, population dynamics and production data from US beef systems. The economic impact and global trade and carbon implications of GET withdrawal were calculated based on feed savings from the environmental model. Withdrawing GET from US beef production reduced productivity (growth rate and slaughter weight) and increased the population size required to produce  $454 \times 10^6$  kg beef by  $385 \times 10^3$  animals. Feedstuff and land use were increased by  $2,830 \times 10^3$  t and  $265 \times 10^3$  ha respectively by GET withdrawal, with  $20,139 \times 10^6$  more liters of water being required to maintain beef production. Manure output increased by  $1,799 \times 10^3$  t as a result of GET withdrawal, with an increase in carbon emissions of 714,515 t per  $454 \times 10^6$  kg beef. The projected increased costs of US beef produced without GET resulted in the effective implementation of an 8.2% tax on beef production, leading to reduced global trade and competitiveness. To compensate for the increase in US beef prices and maintain worldwide beef supply it would be necessary to increase

beef production in other regions, with a projected cumulative increase in global carbon emissions of  $3,147 \times 10^6$  t of CO<sub>2</sub>-equivalent from 2009 to 2023. It is clear that withdrawing GET from US beef production would reduce both the economic and environmental sustainability of the industry.

**Key Words:** productivity, carbon footprint, growth-enhancing technology

**T218 Drought management: Replacing hay with a field pea/co-product supplement fed daily or on alternate days.** D. G. Landblom<sup>\*1</sup> and S. Senturkl<sup>2</sup>, <sup>1</sup>North Dakota State University-Dickinson Research Extension Center, Dickinson, <sup>2</sup>Canakkale Onsekiz Mart Universitesi, BMYO, Canakkale, Turkey.

One hundred seven, 3- to 10-yr-old, third trimester to early-lactation cows were randomized to treatment and weight blocks, in a 110.5 d study to evaluate a 25% hay reduction and a blended RDP-RUP supplement replacement for hay fed either daily (C) or on alternated days (Alt-D) as a drought management strategy. Cows were fed an all mixed hay control diet (Alfalfa-Bromegrass; 10.2% CP) (C) or a mixed hay and wheat straw (4.7% CP) diet in which the amount of hay fed per cow was reduced 25% and replaced with a field pea/co-product supplement (22.8% CP) that was fed either daily (D) at 0.25% of initial BW or 0.50% of initial BW on alternate days (Alt-D). The 0.635 cm pelleted supplement contained a blend of RDP and RUP from field peas (70.0% RDP), distillers dried grains with solubles (65.0% RUP), and barley malt sprouts (64.0% RDP). Data were analyzed using MIXED procedures of SAS. Unsupplemented C cows were fed an average 16.5 kg of mixed hay daily compared with supplemented cows that were fed 9.57 kg of hay, 1.5 kg wheat straw, and 1.52 kg of the pea/co-product supplement totaling 12.66 kg daily (as-fed). Using the blended RDP-RUP supplement as a replacement for hay, fed either D or on Alt-D, did not affect ending cow weight ( $P = 0.89$ ), body condition score ( $P = 0.19$ ), 12th rib fat depth ( $P = 0.19$ ), or pre-breeding estrous cyclicity ( $P = 0.68$ ). Subsequently, hay conserving strategies did not affect fall calf weaning weight ( $P = 0.63$ ), gain ( $P = 0.62$ ), or ADG ( $P = 0.64$ ). Daily cost per cow was \$1.13, \$1.19, and \$1.185 for the C, D and Alt-D methods, respectively. The data suggest that blending the selected RDP and RUP ingredient sources supplied sufficient ammonia nitrogen to the rumen on the non-supplementation day and appeared to provide adequate nutrient flow when fed on alternate days; and proved to be an effective drought management strategy. Conversely, when hay is plentiful the conservation strategy would be a cost effective method for stockpiling hay as a hedge against drought or to make hay available as a cash crop.

**Key Words:** beef cattle, field pea, RDP-RUP

**T219 Effect of grazing stockpiled perennial forages on beef cow performance, nutrient intake and soil nutrients.** H. A. Lardner<sup>\*1,2</sup> and D. Damiran<sup>1,2</sup>, <sup>1</sup>Western Beef Development Centre, Humboldt, Saskatchewan, Canada, <sup>2</sup>Department of Animal and Poultry Science, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.

An experiment was conducted to evaluate the effects of grazing stockpiled perennial forages in field paddocks or round bale hay fed in drylot pens on beef cow performance, estimated dry matter intake (DMI), nutrient intake and soil nutrient levels. Winter feeding systems were (i) field grazing [meadow bromegrass (*B. riparius*)-alfalfa (*M. sativa*)] stockpiled perennial forage (SPF) (TDN = 55.4%; CP = 11.6%) and (ii) similar grass-legume round bale hay fed in drylot pens (DL) (TDN = 56.9%; CP = 11.7%). Dry, pregnant Black Angus cows ( $n = 60$ ; mean

BW = 620 ± 1.1 kg) were randomly allocated to one of 2 replicated (n = 3) winter feeding systems. In SPF, cows were allocated swathed forage in field paddocks on a 3 d basis and supplemented (rolled barley grain+ wheat dried distillers grains with solubles; TDN = 84.0%, CP = 18.4%) at 0.2% of BW. Soil nutrient levels were determined on each treatment site following winter grazing. The DMI was measured for each treatment using the herbage weight disappearance method. Cow BW, body condition score, and rib and rump fat were measured at start and end of the experiment. Statistical analysis was conducted as a one way ANOVA using the Proc Mixed Model procedure of SAS. Measured forage biomass was not different ( $P > 0.05$ ) between DL and SPF systems, 4341 and 4910 ± 200 kg/ha, respectively. Forage utilization was lower ( $P < 0.05$ ) in SPF than in DL (57.8% vs. 93.0%) system. Cows on SPF consumed less ( $P < 0.05$ ) DM (8.8 vs. 12.5 kg/d), CP (1.04 vs. 1.47 kg/d), and ME (17.7 vs. 25.7 Mcal/d) from stockpiled forages than cows fed hay in DL. However, total DMI (forage + supplement) and corresponding nutrients were not different ( $P > 0.05$ ) between systems. Cow BW (634.9 and 634.7 ± 1.5 kg), rib fat (3.3 and 3.4 ± 0.4 mm), rump fat (3.7 and 3.5 ± 0.4 mm) and calf birth weight (40.1 and 39.9 ± 0.9 kg) were similar ( $P > 0.05$ ) between DL and SPF systems, respectively. Soil nutrient levels at the 0–60 cm depth were similar ( $P > 0.05$ ) on the feeding sites, except SO<sub>4</sub> which tended to be lower ( $P = 0.06$ ) on SPF (35.9 kg/ha) compared with DL sites (422.3 kg/ha). These results suggest it is possible to manage beef cows grazing stockpiled perennial forages during winter in western Canada.

**Key Words:** stockpiled forage, winter grazing, beef cow

**T220 The environmental, economic and social implications of improving yield and average daily gain in beef production.** R. R. White\* and J. L. Capper, *Washington State University, Pullman.*

A deterministic model of the US beef industry was developed to quantify changes in environmental impact (EI), profitability and social acceptability resulting from either increasing average daily gain (ADG) by 15% or increasing yield per animal by 15%, with the goal of producing 1 billion kg of beef. Both treatments were compared with a baseline scenario representative of the average growth rate (0.69 - 0.8 kg/d for stockers and 1.22–1.37 kg/d for finishers) and finishing weight (544 kg for heifers and 635 kg for steers) in the US beef industry. Metrics for EI included land, water and feedstuff use, as well as greenhouse gas (GHG) emissions and manure production with system boundaries extending from cropping inputs to animal slaughter. Profitability was calculated by enterprise budgets for current cattle and feed prices sourced from the National Agricultural Statistics Service. The consumer perception of the value (price-dependent) received from purchasing beef was the metric of social acceptability. When ADG increased, land, water and feed use per billion kg of beef were reduced by 2%, 13% and 4%, respectively and GHG emissions and manure production per billion kg of beef were reduced by 7% and 4%. Increased ADG increased whole-industry profitability by 7% which subsequently led to a 5% improvement in consumer's perceived value of purchased beef. Increased yield also reduced EI: land, water and feed use per billion kg of beef were reduced by 3%, 16% and 9%, respectively compared with controls, and GHG emissions and manure production per billion kg of beef were reduced by 10% and 8%. Industry profitability increased by 13.5%, resulting in a 15.8% improvement in consumer's perceived value of beef purchased. Given that sustainability is an environmental, economic and social construct, these conclusions suggest that the sustainability of beef production can be achieved by either increasing yield or increasing ADG. This research supports the assertion that, within the

beef industry, management practices centered on improving efficiency will also improve sustainability.

**Key Words:** beef, sustainability, environmental impact

**T221 Body development and endocrine relations at puberty in crossbred heifers.** J. O. J. Barcellos\*<sup>1</sup>, C. McManus<sup>1</sup>, L. C. Canellas<sup>1</sup>, E. R. Prates<sup>1</sup>, S. R. Menegassi<sup>1</sup>, J. Braccini Neto<sup>1</sup>, and R. P. Oaigen<sup>2</sup>, <sup>1</sup>Federal University of Rio Grande do Sul, Porto Alegre, RS, Brazil, <sup>2</sup>Federal University of Para, Belém, PA, Brazil.

The objective of this study was to determine the age and live-weight at puberty of crossbreed heifers from various Nelore (N)-Hereford (H) genetic groups (GG) (25%N-75%H; 37.5%N-63.5%H; 43.7%N-56.3%H; 50%N-50%H; 75%N-25%H) submitted to 4 average daily gains (ADG; kg/d) from weaning to puberty: 0.5 (L; n = 32), 0.75 (M; n = 32), 1.00 (H; n = 29) and 1.25 (VH; n = 27). Puberty was defined as estrus followed by formation of a corpus luteum. Backfat thickness (BF = mm) at the start and at the end of the experimental period was determined by ultrasound. Mean age and liveweight at puberty (LWP) were 388.0 ± 1.9 d and 331.4 ± 1.3 kg, respectively. Heifers with higher post weaning average daily gain were heavier at first estrous and had a lower age at puberty ( $P = 0.028$ ). However, there was an interaction ( $P = 0.012$ ) between growth rates and breed composition. The 75% Nelore were heavier, older and taller at puberty than 25%, 37.5%, and 43.5% N heifers ( $P = 0.034$ ). The phenotypic correlation between body condition score, backfat thickness and puberty age were -0.37 and -0.58, respectively ( $P = 0.041$ ). A linear effect ( $P = 0.011$ ) was observed between the ratio weight:height at 11 mo of age (WH11) and age at puberty (AP). Heifers submitted to higher ADG showed the greater follicle diameter at 10 mo age ( $P = 0.031$ ) and were younger at puberty ( $P = 0.033$ ). The IGF-I blood serum levels were 206, 234, 308 and 312 ng/ml at puberty for L, M, H, and VH ADG, respectively. The IGF-I levels were associated ( $P = 0.019$ ) with AP in heifers because they influenced follicular growth (FG) at 10 mo of the age. There was no multicollinearity among the variables evaluated in the model. A multiple regression analysis found a linear model ( $P = 0.017$ ) to estimate puberty: AP = 437.96 - FG10 × 1.66 + GG × 0.46 + LWP × 0.71 - WH11 × 42.67 - BF × 9.95 - ADG × 47.59 - LW11 × 0.35 ( $r^2 = 0.87$ ). Variables related to body development were better than endocrine predictors of puberty in beef heifers.

**Key Words:** puberty, beef heifers, follicular growth

**T222 Effects of prepartum grouping strategy on health, reproductive, and productive parameters of dairy cows.** P. R. B. Silva\*<sup>1,2</sup>, J. G. N. Moraes<sup>1,2</sup>, L. G. D. Mendonça<sup>1</sup>, A. A. Scanavez<sup>1</sup>, G. Nakagawa<sup>1</sup>, M. I. Endres<sup>2</sup>, J. Fetrow<sup>1</sup>, and R. C. Chebel<sup>1</sup>, <sup>1</sup>Department of Veterinary Population Medicine, University of Minnesota, St Paul, <sup>2</sup>Department of Animal Science, University of Minnesota, St Paul.

Objectives were to evaluate the effect of an “all-in-all-out” (AIAO) prepartum grouping strategy on health, productive, and reproductive parameters of Jersey cows. Cows (254 ± 7 d of gestation) were paired by gestation length and assigned randomly to AIAO or control treatments. In the AIAO (n = 259) treatment groups of 44 cows were moved into a pen where they remained for 5 wk, whereas in the control treatment (n = 308) approximately 10 cows were moved into a pen weekly to maintain stocking density (44 cows/48 headlocks). Pens were identical in size and design and each of the pens received each treatment a total of 3 times, totaling 6 replicates. Cows were examined at enrollment, calving (d0), d28, and d56 for lameness and on d 1, 4, 7, 10, and 14

for retained fetal membranes (RFM) and metritis. Cows were observed daily for displacement of abomasum (DA) and mastitis until d60. Cows were examined by ultrasound for detection of corpus luteum (CL) on d 39 and 56. Cows were observed daily for estrus starting on d 50 and pregnancy exam was conducted 38 and 66 d after AI. Milk production and components were measured monthly and energy corrected milk yield was calculated for the first 3 tests. Data were analyzed by MIXED procedure and the fixed effect was treatment (AIAO vs control) and the random effect was treatment within pen and replicate. Treatment had no effect on incidence of lameness on d 0 ( $P=0.75$ ), 28 ( $P=0.45$ ), and 56 ( $P=0.35$ ). Similarly, treatment had no effect on incidence of RFM ( $P=0.84$ ), metritis ( $P=0.35$ ), acute metritis ( $P=0.54$ ), DA ( $P=0.92$ ), and mastitis ( $P=0.47$ ). Percentage of cows with a CL on d 39 ( $P=0.17$ ) and 56 ( $P=0.96$ ) were not affected by treatment. Similarly, percentage of cows inseminated in estrus ( $P=0.52$ ) and percentage of cows pregnant after first AI ( $P=0.47$ ) were not affected by treatment. Finally, treatment had no effect on milk ( $P=0.82$ ) or energy-corrected milk ( $P=0.66$ ) yield and on linear somatic cell score ( $P=0.28$ ). In conclusion, AIAO grouping strategy did not reduce incidence of peripartum diseases and did not improve reproductive and productive performance.

**Key Words:** prepartum cow, grouping strategy, performance

**T223 Effects of prepartum grouping strategy on body condition score and metabolic parameters of peripartum dairy cows.** P. R. B. Silva<sup>\*1,2</sup>, J. G. N. Moraes<sup>1,2</sup>, L. G. D. Mendonça<sup>1</sup>, A. A. Scanavez<sup>1</sup>, G. Nakagawa<sup>1</sup>, M. I. Endres<sup>2</sup>, and R. C. Chebel<sup>1</sup>, <sup>1</sup>Department of Veterinary Population Medicine, University of Minnesota, St Paul, <sup>2</sup>Department of Animal Science, University of Minnesota, St Paul.

Objectives were to evaluate the effect of an “all-in-all-out” (AIAO) prepartum grouping strategy on body condition score (BCS) and metabolic parameters of peripartum Jersey cows. Cows ( $254 \pm 7$  d of gestation) were paired by gestation length and assigned randomly to AIAO or control treatments. In the AIAO treatment ( $n=259$ ) groups of 44 cows were moved into a pen where they remained for 5 wk, whereas in the control treatment ( $n=308$ ) groups of approximately 10 cows were moved into a pen weekly to maintain stocking density (44 cows/48 headlocks). Pens were identical in size and design and each of the pens received each treatment a total of 3 times, totaling 6 replicates. Cows received a BCS at enrollment, calving (d0), d28, and d56. Blood samples were collected from all cows on d -21, -14, -7, 0, 7, 14, and 21 for determination of nonesterified fatty acid (NEFA) concentration. Blood was sampled weekly from d-14 to d 14 from a subgroup of cows ( $n=34$ /treatment) to determine concentration of glucose. Cows were classified according to NEFA concentration as above or below 0.10 mmol/L on wk 3 and as above or below 0.18 mmol/L on the week preceding calving, because, based on the data from the current study, these were the criteria that predicted occurrence of displacement of abomasum with the best sensitivity and specificity. Data were analyzed by MIXED procedure and the fixed effect was treatment (AIAO vs control) and the random effect was treatment within pen and replicate. Treatment did not affect BCS on d -21 ( $P=0.67$ ), 0 ( $P=0.64$ ), 28 ( $P=0.59$ ), and 56 ( $P=0.90$ ). Glucose concentration was not affected by treatment ( $P=0.28$ ) or by the interaction between treatment and day ( $P=0.11$ ). Similarly, treatment ( $P=0.17$ ) and the interaction between treatment and day ( $P=0.11$ ) did not affect NEFA concentration. Percentage of cows with NEFA  $>0.10$  mmol/l on wk 3 before calving ( $P=0.19$ ) and percentage of cows with NEFA  $>0.18$  mmol/l on wk 1 before calving ( $P=0.99$ ) were not affected by treatment. In conclusion, AIAO prepartum grouping strategy did not

improve metabolic parameters of peripartum dairy cows compared with a conventional grouping strategy.

**Key Words:** prepartum dairy cow, grouping strategy, metabolic parameter

**T224 Heterosis of productivity rates in the breeding cycle of pure and crossbred Hereford and Angus cattle grazing native pastures at low and high allowances.** A. C. Espasandin<sup>\*1,3</sup>, M. do Carmo<sup>1</sup>, C. R. López-Mazz<sup>1,2</sup>, M. Carriquiry<sup>1</sup>, and P. Soca<sup>1,3</sup>, <sup>1</sup>Udelar School of Agronomy, Department of Animal and Grass Production, School of Agronomy, Udelar, Uruguay, <sup>2</sup>Estación Experimental Bernardo Rosengurt, Cerro Largo, Uruguay, <sup>3</sup>Estación Experimental, Paysandú, Uruguay.

Uruguayan extensive cow-calf systems are based in native pastures with low offers of dry matter (DM), especially in the winter. Hereford cows represent 70% of the genetic resources of Uruguayan herds. Productivity of the breeding cycle in these systems is extremely dependent on weather conditions, reaching about 70 kg of calf weaning weight per breeding female per year. The objective of this experiment was to study the productivity of heterosis of crossed (F1; reciprocal F1) and purebred (PB) Hereford and Angus cattle, for 3 breeding cycles (2007 to 2009) in native pastures offered high (H) and low (L) forage allowances (2.5 and 4 kg DM/kg BW, respectively). Animals ( $n=120$ -year) were located in 2 blocks with 4 plots each one (treatments): F1 cows in High allowance (HF1) or Low allowance (LF1), and Pure breed in High (HPB) and low (LPB) allowance. Productivity rate (PR) was estimated as the weight (kg) of a 4th month old weaned calf weaned per breeding female per year (WW) x weaning rate (WR; number of calves weaned/female exposed in the breeding season). Mixed models with cow nested in treatment were used to analyze WW and WR. Weaning rate was higher ( $P<0.05$ ) in F1 than PB cows (individual heterosis). Weaning weight was greater ( $P<0.05$ ) for calves of F1-H cows with  $128 \pm 3.4$  kg, whereas F1-L, and PB-H and -L did not differ significantly (112, 115 and  $107 \pm 3.5$  kg, respectively). Consequently, PR was superior in F1-H and inferior in PB-L treatments, weaning 111 kg and 81 kg of calf per breeding cow per year, respectively. The PR did not differ between PB-H and F1-L with 93 kg and 92 kg, respectively, per breeding cow per year. The management of forage allowance and genetic resources can lead to improved productivity of cow-calf systems based on grazing of native pastures.

**Key Words:** forage allowance, heterosis, productivity

**T225 Effects of dried distillers grains fed for programmed rate of body weight gain in beef heifers grazing native rangelands prior to breeding on growth and reproductive performance.** N. P. Miller,\* R. C. Dunlap, S. H. Cox, M. M. Marricle, D. M. Hallford, and E. J. Scholljerges, New Mexico State University, Las Cruces.

The objective of this study was to evaluate effects of dried distillers grains plus solubles (DDGS) on growth and reproductive performance of beef heifers fed at a programmed rate of BW gain. Eighty-two beef heifers (initial BW =  $249 \pm 3.2$  kg) grazing native range (2 pastures per treatment; 4% CP, 42% NDF, DM basis) were used in a completely randomized designed experiment and assigned to 1 of 3 treatments 49 d before breeding. Treatments were: 1) high level of DDGS (1.81 kg/heifer daily) to provide gain at (0.36 kg/d) for 28 d and then fed (0.68 kg/heifer daily) to achieve a low rate of gain (0.18 kg/d) up to breeding (HL); 2) a low rate of gain for the first 28 d and the high rate of gain up to breeding (LH); 3) moderate rate of gain (0.27 kg/d) throughout the

feeding period by feeding (1.13 kg/heifer daily) (MOD). Heifers were weighed every 14 d, at which time blood was collected via coccygeal venipuncture and serum progesterone concentrations were determined. Heifers were synchronized at the end of the feeding period using the CO-Synch + CIDR (progesterone insert) with fixed-time AI. Heifers received an injection of GnRH (100 µg, i.m.) and a CIDR was inserted at d -7 relative to timed AI. At d 0, CIDR was removed and heifers received 25 mg of PGF<sub>2α</sub>. Heifers were observed for estrus and bred 12 h after observation of estrus. All heifers not bred by 54 h after CIDR removal were given GnRH (100 µg, i.m.) and AI. Heifers were joined with bulls for 60 d. No difference ( $P = 0.11$ ) in ADG was noted in the first 28 d of supplementation, however, ADG was greater ( $P = 0.01$ ) for HL and MOD groups during the second period of the experiment. Days to reach puberty tended to be less ( $P = 0.08$ ) for the LH treatment compared with the MOD and HL treatment. The LH treatment also tended to have a greater ( $P = 0.06$ ) percentage of pubertal heifers at breeding compared with MOD. Treatment did not affect ( $P = 0.35$ ) overall pregnancy rates. Despite the fact that HL and MOD treatments had greater ADG, the LH growth program increased the percentage of heifers that were pubertal at breeding.

**Key Words:** heifers, puberty, reproduction

**T226 Beef heifer growth and reproductive performance responses to stockpiled fall forage allowances.** B. L. Bailey,\* K. M. Krause, and T. C. Griggs, *West Virginia University, Morgantown.*

The objective of this study was to compare heifer growth and reproductive performance following 2 patterns of gain during the fall grazing season. Three 5-ha fields were selected as blocks in a randomized complete block design for application of grazing treatments. All fields had been in long-term hay and/or pasture and contained cool-season grass-legume mixtures. Spring born heifers (year 1,  $n = 71$ ; year 2,  $n = 64$ ) of primarily Angus background and 248 kg mean BW were allocated to 2 grazing treatments each replicated 3 times per year (11 hd/replicate of a treatment) for 193 and 188 d in years 1 and 2, respectively. The fall grazing treatment consisted of daily herbage dry matter (DM) allocation of 3.5 (LOW) or 7.0 (HIGH) % of BW. During the winter feeding period haylage (6.5 kg DM/hd/d, yr 1; 5.4 kg DM/hd/d, yr 2) and soybean hulls (1.7 kg DM/hd/d, yr 1; 1.5 kg DM/hd/d, yr 2) were fed. Heifers were grazed continuously (as one group) throughout the spring during both years. Individual BW and blood samples were collected. In both years, heifers were synchronized and artificially inseminated (AI) utilizing a single sire. A cleanup bull was used for 35 d. Mean ADG was greater for HIGH heifers (0.45 kg/d) than LOW heifers (0.16 kg/d) during the fall grazing period ( $P < 0.05$ ). During the winter feeding period, ADG were 0.03 kg/d and 0.36 kg/d ( $P < 0.05$ ) for LOW vs HIGH heifers. During the spring grazing period, ADG were 1.6 kg/d and 1.5 kg/d ( $P = 0.05$ ) for LOW vs HIGH heifers. Proportion of heifers that reached puberty at the onset of the breeding season did not differ (42% and 44%,  $P = 0.81$  for LOW vs HIGH), although LOW heifers had lower BW at the time of breeding (345 kg vs 362 kg,  $P < 0.05$  for LOW vs HIGH). No treatment differences occurred for overall pregnancy rates by AI (28% vs 37%,  $P = 0.34$ ), bull (42% vs 38%,  $P = 0.70$ ), or overall (70% vs 75%,  $P = 0.56$ ) for LOW vs HIGH heifers. We interpret these results to indicate that delaying the majority of weight gain until late in heifer development may decrease costs of winter feeding without detrimental effects on reproductive performance.

**Key Words:** beef heifers, grazing, reproductive performance

**T227 Effects of climate and moon illumination on grazing activity of weaned beef calves during early summer.** S. Gadberry\*<sup>1</sup>, W. Whitworth<sup>2</sup>, G. Montgomery<sup>2</sup>, and K. Simon<sup>1</sup>, <sup>1</sup>*University of Arkansas, Little Rock,* <sup>2</sup>*University of Arkansas, Monticello.*

How environmental conditions influence day and nighttime grazing behavior may be beneficial to intensive grazing management and understanding the dynamics of foraging behavior. The objective of this study was to examine the effects of climate and moon illumination on the grazing activity of weaned beef calves during early summer. Seven calves were equipped with 3-axis accelerometer dataloggers. Logger activity was recorded for 35d beginning June 13, 2011. Logger x, y, and z tilt positions differed by activity (Wilks  $P < 0.001$ ). Activity (grazing, lying, and standing/walking) was predicted using linear discriminant analysis based on 2, 3h observation periods. A random sample representing 50% of observed activity was used for model training. Prediction based on a single model among calves did not differ from predictions based on within calf models ( $P = 0.50$ ). Model sensitivity and specificity was 0.79 and 0.94, respectively. Hourly climate measurements [temperature (T), relative humidity, rainfall, and solar radiation] were recorded from a weather station located on the research facility. Relative humidity was calculated at T above 26.7 C. Moon illumination data (MOON) was downloaded from the US Naval Observatory. Grazing activity was separated into periods of day (DG) and night (NG) as determined by weather station solar measurements. Days ( $n = 3$ ) with rainfall exceeding 1 cm over multiple h was removed. Dependent variables examined included the proportion of NG to DG, the number of grazing events during DG and NG, mean event duration, and NG:DG ratio for events and durations. NG was estimated at 37.9% (SE 0.01%). Proportion NG was correlated with average daytime T (0.57,  $P < 0.01$ ) and heat index (0.42,  $P < 0.01$ ) but not solar radiation (0.006,  $P = 0.93$ ). NG was also correlated with MOON (0.23,  $P < 0.01$ ). Number of NG events was not correlated with daytime T (-0.02,  $P = 0.72$ ). However, mean duration per NG event was correlated (0.25,  $P < 0.001$ ). Ratios of NG to DG duration  $>1$  were associated with lower daytime T [30.8 vs 32.3 (SE 0.27);  $P = 0.02$ ] but 6.7% (SE 2.8%) greater humidity ( $P = 0.02$ ) and no difference in moon illumination ( $P = 0.24$ ). These results suggest weather may be more of a determinant of NG activity than moon illumination.

**Key Words:** beef cattle, grazing activity, weather

**T228 Riparian management practices in the Manitoba landscape: Off-stream watering systems for beef cattle.** A. A. Rawluk\*<sup>1</sup>, G. H. Crow<sup>1</sup>, D. M. Veira<sup>2</sup>, P. Bullock<sup>1</sup>, L. A. Gonzalez<sup>3</sup>, and K. H. Ominski<sup>1</sup>, <sup>1</sup>*University of Manitoba, Winnipeg, Manitoba, Canada,* <sup>2</sup>*Agriculture & Agri-Food Canada, Agassiz, British Columbia, Canada,* <sup>3</sup>*Commonwealth Scientific and Industrial Research Organisation, Townsville, Queensland, Australia.*

Livestock are attracted to riparian areas as they offer shade, forage, and water. However, their presence can be detrimental to these sensitive ecosystems. This study aims to determine the impact of off-stream waterers and natural barriers on animal performance and distribution. The study was replicated at 2 experimental locations in Manitoba, Killarney and Souris, with each site being replicated in 2 grazing seasons. At each location the pasture was divided into 3 treatments: no off-stream waterer or barriers (CON), off-stream waterer with barriers along the river band to deter cattle from watering at the river (BAR), and off-stream waterer without barriers (NOBAR). Cows and calves (25 pairs/treatment) were weighed on the first and last day of each 28-d period. Visual observations were recorded at 5 min intervals from dawn until dusk for 4-d of each period to determine the preferred drinking location of cows in BAR and NOBAR. Treatment had no significant effect ( $P$

> 0.05) on cow and calf weights averaged over the summer periods, with the exception of calf weights in Souris in 2010 ( $P < 0.0001$ ). The average weight of cows in Souris was  $612.3 \pm 26.7$  kg and the average weight of calves is  $131.4 \pm 6.0$  kg, considering both years. Likewise the average weight of cows at the Killarney location was  $509.5 \pm 22.3$  kg and the average weight of calves is  $122.7 \pm 5.6$  kg, again considering both years. From visual observations in Killarney, the recorded usage of off-stream waterer varied between 100% in Period 1, 93% in Period 2, and 100% in Period 3 in BAR, and from 50% in Period 1, 38% in Period 2, and 40% in Period 3 in NOBAR. In Souris, the recorded usage of off-stream waterer varied between 85% in Period 1, 31% in Period 2, and 7% in Period 3 in BAR, and from 44% in Period 1, 33% in Period 2, and 0% in Period 3 in NOBAR. These results indicate that the presence of off-stream waterers do not create significant differences in weights among cows and calves. Furthermore, cattle did not drink exclusively from the off-stream waterers, however, they will use when available, possibly attracting them away from the riparian area.

**Key Words:** riparian areas, off-stream waterer, animal performance

**T229 Effects of injectable trace minerals on the humoral immune response to porcine red blood cell challenge and fertility in beef heifers.** P. Moriel<sup>1</sup>, P. G. M. A. Martins\*<sup>1</sup>, G. C. Lamb<sup>2</sup>, L. J. Havenga<sup>3</sup>, and J. D. Arthington<sup>1</sup>, <sup>1</sup>University of Florida, Range Cattle Research and Education Center, Ona, <sup>2</sup>University of Florida, North Florida Research and Education Center, Marianna, <sup>3</sup>MultiMin USA Inc., Fort Collins, CO.

Our objective was to evaluate the effects of injectable trace minerals (ITM; MultiMin 90, MultiMin USA Inc., Fort Collins, CO) on mineral status, humoral immune response, and measures of performance in Brahman  $\times$  British beef heifers ( $n = 33$ ; age =  $296 \pm 22$  d) grazing established limpgrass pastures. Heifers were randomly allotted to 1 of 2 treatments; (1) ITM ( $n = 17$ ); 3.0 mL s.c., containing 90, 10, 15, and 5 mg/mL of Zn, Mn, Cu, and Se, on d 0, 51, 83, and 127, and (2) Control ( $n = 16$ ); 3.0 mL of sterile saline s.c. on the same days. Heifer shrunk BW was determined on the beginning (d 0) and end of the study (d 177). Plasma P4 concentrations were assessed monthly in blood samples collected on a 10 d interval for determination of puberty. All heifers received an i.m. injection of a 25% porcine red blood cell (PRBC) solution on d 51 and neutralizing antibody titers were measured in blood samples collected on d 0, 3, 7, 14, and 21, relative to PRBC injection. Liver biopsy samples were collected on d 177 from 24 heifers (12/treatment) for determination of trace mineral status. Throughout the study, heifers remained in a single group, were provided free-choice access to salt with no supplemental minerals and were exposed to a single Angus bull from d 83 to 177. Heifer BW did not differ at the beginning ( $208 \pm 8.0$  kg) and end of the study ( $259 \pm 8.4$  kg), but ADG was greater ( $P < 0.06$ ) for ITM compared with saline-injected heifers ( $0.31$  vs.  $0.26$  kg, respectively; SEM = 0.018). Heifers receiving ITM had greater ( $P < 0.06$ ) PRBC neutralizing antibody titers on d 7, 14, and 21 following challenge, compared with saline-injected heifers. Liver concentrations of Se were greater ( $P < 0.01$ ) in ITM heifers vs. saline-injected heifers at the end of the study (d 177;  $0.88$  vs.  $0.48$ ; SEM = 0.06). Liver concentrations of Cu, Zn, and Mn were adequate for all heifers and did not differ between treatments ( $P > 0.25$ ). There were no differences in age at puberty or overall pregnancy rate (average =  $427 \pm 49$  d and  $57.6\%$ , respectively). These results demonstrate that ITM may increase BW gain, humoral immune responses, and Se status in growing heifers reared on pastures without access to supplemental trace minerals.

**Key Words:** heifer, immunity, trace minerals

**T230 Effect of propionate salt inclusion in postpartum supplementation on young cow reproductive performance.** J. A. Walker,\* G. A. Perry, and K. C. Olson, South Dakota State University, Brookings.

Two-year-old cows were supplemented with propionate salt to evaluate animal and reproductive performance. Sixty cows were allocated to one of 3 treatments at calving. Propionate salt was incorporated in a protein supplement (30% CP, 73% TDN) at rates of 0, 80 or 160 g/d of propionate salt (Ca-propionate). Cows were individually supplemented twice weekly at 1.14 kg/d. Cows had access to a native range pasture (121.4 ha). Blood was collected weekly to determine postpartum anestrus interval based on serum progesterone ( $\geq 1$  ng/ml). Body weight and BCS were determined at calving, end of supplementation, start of breeding season, and weaning. No differences in cow BW ( $P = 0.28$ ) and BCS ( $P = 0.77$ ) were found between treatments. Cow BW changed throughout the study ( $P < 0.01$ ;  $379 \pm 5.2$ ,  $361 \pm 5.2$ ,  $397 \pm 5.2$  and  $444 \pm 5.2$  kg for calving, end of supplementation, start of breeding season and weaning, respectively). Cow ADG differed by period ( $P < 0.01$ ): cows lost weight from calving to end of supplementation ( $-0.32 \pm 0.14$  kg/d), and gained from end of supplementation to breeding ( $5.11 \pm 0.14$  kg/d) and breeding to weaning ( $0.38 \pm 0.14$  kg/d). Cow BCS changed throughout the study ( $P < 0.01$ ;  $3.94 \pm 0.06$ ,  $4.11 \pm 0.06$ ,  $4.10 \pm 0.06$ , and  $4.66 \pm 0.06$  for calving, end of supplementation, start of breeding season and weaning, respectively). Calf BW was not different ( $P = 0.98$ ) between treatments. Calf BW increased throughout the study ( $P < 0.01$ ;  $35.6 \pm 2.2$ ,  $91.8 \pm 2.2$ , and  $197.9 \pm 2.2$  kg at birth, start of breeding season, and weaning, respectively). Postpartum anestrus interval ( $P = 0.70$ ), percentage of cows initiating estrous cycles before the breeding season ( $P = 0.54$ ), conception rate to AI ( $P = 0.68$ ), and season long pregnancy rates ( $P = 0.87$ ) were not different between treatments. Propionate salt did not influence cow BW, cow BCS, calf BW, or cow reproductive performance.

**Key Words:** propionate salt, young beef cows

**T231 Metabolizable protein supply alters pregnancy and subsequent retention rate during heifer development while grazing dormant winter forage.** J. T. Mulliniks\*<sup>1</sup>, D. E. Hawkins<sup>2</sup>, K. K. Kane<sup>1</sup>, S. H. Cox<sup>1</sup>, L. A. Torell<sup>1</sup>, E. J. Scholljegerdes<sup>1</sup>, and M. K. Petersen<sup>3</sup>, <sup>1</sup>New Mexico State University, Las , <sup>2</sup>West Texas A&M University, Canyon, <sup>3</sup>USDA-ARS, Fort Keogh Livestock and Range Research Laboratory, Miles City, MT.

Type of heifer development system can have major effect on the future productivity and retention rate of the cowherd. Therefore, the objective of this experiment was to determine growth, reproductive performance, retention rate, and economic efficiency of heifer's developed in a range raised (with 2 CP treatments) or high input (feedlot developed) heifer development system. Spring-born, crossbred heifers ( $n = 191$ ) were stratified to 1 of 3 treatments at weaning: (1) 0.9 kg/d of a 36% CP supplement containing 64% RDP (CSM), (2) 0.9 kg/d of a 36% CP supplement containing 50% RDP (RUP), or (3) a concentrate diet fed in dry lot (CONC) to gain 0.68 kg/d. Supplementation was initiated in February and terminated at the onset of a 45-d breeding season in May. Heifer BW and hip height (HH) were taken monthly from initiation of supplementation until breeding and again at weaning. Females were removed from the herd for failure to reproduce or wean a calf. Percent of heifers becoming pregnant and remaining in the herd at start of each breeding season was recorded to determine retention rate throughout their 3rd calf crop. Breeding BW was greater ( $P < 0.01$ ) for the CONC than CSM or RUP developed heifers. Hip height at breeding was greater ( $P < 0.01$ ) in RUP and CSM relative to CONC heifers. However, palpation BW and HH was similar ( $P \geq 0.24$ ) for all heifer development

treatments. At breeding, RUP and CSM heifers reached 51% of mature BW ( $P < 0.01$ ) compared with CONC heifers at 58% of mature BW. Pregnancy rates were 94, 88, and 84% for RUP, CSM and CONC heifers ( $P = 0.10$ ). Net return was \$99.71 and \$87.18 per developed heifer greater for RUP and CSM heifers, respectively compared with CONC heifers due to differences in pregnancy and development costs. Retention rate at age 4 was greatest ( $P < 0.01$ ) for RUP heifers. This study indicates that range developed heifers can be as reproductively successful as heifers developed in a dry lot, while improving future productivity. Furthermore, metabolizable protein supply improves reproduction in heifers developed on dormant native range.

**Key Words:** beef heifers, heifer development, retention rate

**T232 Winter growing rate of gain on subsequent growth of beef steers grazing a subtropical pasture in summer.** J. I. Arroquy<sup>\*1,3</sup>, A. E. Fumagalli<sup>1</sup>, D. Kuckseva<sup>2</sup>, and P. Vispo<sup>2</sup>, <sup>1</sup>INTA EEA Santiago del Estero, Santiago del Estero, Argentina, <sup>2</sup>INTA EEA Colonia Benitez, Resistencia, Chaco, Argentina, <sup>3</sup>CONICET, Santiago del Estero, Argentina, <sup>4</sup>FAyA-UNSE, Santiago del Estero, Argentina.

Eighty Braford steers (initial BW:  $149.5 \pm 3.0$  kg; initial hip-height:  $110.5 \pm 0.3$  cm; 6 mo old) were allotted by BW to one of 4 growing-phase diets (4 pens/treatment) to evaluate the effect of winter animal performance on summer growing rate grazing Guineagrass. Diets were: 1) ad libitum access to low-quality Guineagrass hay plus protein supplementation (GHPS); 2) same as treatment 1 plus energy supplementation (GHPG); 3) limit fed high concentrate diet to achieve a gain of 0.7 kg/d (LFHC); and 4) ad libitum corn-silage diet (CS). Immediately after winter phase (130 d), steers grazed Guineagrass pasture for 123 d. Winter feeding treatments and grazing summer steers were evaluated by average daily gain (ADG), hip-height (cm), 12th-rib fat (mm) and ribeye area (cm<sup>2</sup>; ultrasonic evaluations). In winter growing phase, ADG was significantly greater in CS diet than the others ( $P < 0.01$ ), LFHC had greater ADG than GHPS and GHPG ( $P < 0.05$ ), and GHPS and GHPG did not differ. ADG for winter growing phase were: 257, 298, 438, and 647 g/d for GHPS, GHPG, LFHC and CS, respectively. ADG in summer did not differ among treatments (494, 568, 600, and 496 g/d for GHPS, GHPG, LFHC and CS, respectively). Hip-height had similar response to feeding treatment as ADG. CS fed steers were taller than other treatments ( $P < 0.05$ ). Final summer BW was higher in CS and LFHC than GHPS and GHPG ( $P < 0.05$ ). Final fat thickness for winter growth was superior in LFHC and CS (2.05 and 2.15 mm, respectively) compared with GHPS and GHPG ( $P < 0.05$ ; 1.66 and 1.70, respectively), whereas fat thickness at the end of summer period did not differ among treatments ( $2.33 \pm 0.13$  mm). Ribeye area was larger for CS and LFHC than the others ( $P < 0.05$ ) at the end of winter and summer period. In conclusion, even though compensatory growth in summer reduced differences among winter feeding treatments, moderate winter ADG increased final summer liveweight, hip-height as well as ribeye area.

**Key Words:** winter growing phase, guineagrass, summer growing phase

**T233 Effects of weaning age and winter development environment on heifer performance.** N. L. Hojer<sup>\*1</sup>, M. B. Hubert<sup>2</sup>, P. S. Johnson<sup>2</sup>, M. H. Price<sup>3</sup>, and K. C. Olson<sup>2</sup>, <sup>1</sup>South Dakota State University, Brookings, <sup>2</sup>South Dakota State University, Rapid City, <sup>3</sup>South Dakota School of Mines & Technology, Rapid City.

Our objective was to determine if early weaning (about 125 d) versus normal weaning (about 250 d) and wintering replacement heifers in drylot versus rangeland affected heifer growth and reproductive

performance. Heifer calves from the 2009 and 2010 calf crops ( $n = 104$  and 73, respectively) were allocated to the 2 weaning treatments and then stratified by age into the 2 winter development treatments forming a 2 by 2 factorial of treatments. Heifers wintered in drylot received mixed grass and alfalfa hay (yr 1: 11.6% CP, 52.5% TDN; yr 2: 12.3% CP, 53.4% TDN) plus 1.8 kg of a dried distiller's grain (DDGS)-based supplement/hd/d (yr 1: 22.7% CP, 75.8% TDN; yr 2: 25.4% CP, 76.7% TDN). Heifers wintered on rangeland also received 1.8 kg/hd/d of the same supplement. Over the winter, each treatment was allocated to a separate pen or pasture. After estrus synchronization and timed AI, all heifers were placed on rangeland to graze through the summer. During the summer of yr 1 heifers were allocated by winter treatment to 2 pastures, and in yr 2 all 4 treatment combinations were allocated to separate pastures. Responses measured were BW, ADG, puberty at initiation of estrus synchronization, and pregnancy detection. Pubertal status was indicated by serum progesterone  $\geq 1$  ng/ml. A winter by weaning treatment interaction affected ( $P < 0.001$ ) BW and ADG both years. During the winter months, range heifers were lighter and grew slower than drylot, but BW did not differ due to winter treatments by the end of the summer. However, early weaned heifers remained lighter than normal weaned heifers at the end of the summer. Weaning treatment affected ( $P = 0.03$ ) fall pregnancy rate ( $93.2\% \pm 4.0$  and  $74.7\% \pm 7.98$  for early- and normal-weaning, respectively) in yr 2. In yr 1, there was a difference ( $P = 0.006$ ) between drylot and range heifers ( $92.7\% \pm 3.52$  and  $72.8\% \pm 6.47$ , respectively) in the proportion that obtained puberty before estrus synchronization. In conclusion, a producer needs to consider important interactions between weaning and winter management practices when establishing a replacement heifer development program that best fits the goals of their operation.

**Key Words:** beef heifer development, weaning, heifer performance

**T234 Blended byproduct feeds in finishing rations on performance, carcass, and fecal characteristics of yearling heifers.** B. T. Johnson,\* C. L. Maxwell, B. K. Wilson, J. J. Wagner, S. L. Roberts, B. W. Woolfolk, C. J. Richards, and C. R. Krehbiel, Oklahoma State University, Department of Animal Science, Stillwater.

This study compared inclusion levels of a 1:1 blend of Sweet Bran (SB) and dried distiller's grains (DDGS) byproducts in a dry-rolled corn feedlot ration on performance, carcass merit, and fecal characteristics. Heifers ( $n = 108$ ; initial BW =  $324 \pm 13.6$  kg) were blocked by BW, randomized to treatment, and fed for 142 d. Treatments were control (CONT, 8% DDGS), intermediate with 22% SB and 22% DDGS (INTER), and all byproduct with 44% SB and 44% DDGS (ALL). During d 28 to 55, a time of severe environmental heat with an average Temperature Humidity Index (THI) value of 80, ALL increased ADG and G:F ( $P < 0.02$ ) by 12.2% and 16%, respectively. Average daily gains were similar for all other periods. There was a trend ( $P = 0.09$ ) for increased overall G:F with ALL using live final BW, and increased ( $P < 0.01$ ) G:F on a carcass adjusted final BW basis. Heifers fed ALL had a 1.81% increase ( $P < 0.05$ ) in dressing percentage. There was a trend ( $P = 0.08$ ) for increases in HCW for the INTER (3.5%) and ALL (2.5%) compared with CONT, with no other differences in carcass characteristics. These data indicate that replacing dry-rolled corn in a finishing diet with a 1:1 blend of SB and DDGS increases feed efficiency and HCW without altering ADG. Rectal fecal samples were taken every weigh period for pH, fecal scoring, and DM content. Further analysis by treatment was compared by taking concrete bunk pad samples at every weigh period and determining sample DM and density. Fecal pH and scores increased ( $P < 0.05$ ) throughout the study for ALL, indicating a more viscous structure. A linear decrease in fecal DM was noted as level

of byproduct inclusion increased ( $P < 0.05$ ) for each sampling period. Pad sample DM decreased linearly ( $P \leq 0.05$ ) on d 56, 112, and 142. Data indicate replacing corn with a 1:1 blend of SB and DDGS also increases fecal pH, fecal score and decreases fecal DM and DM of the pad (more water in manure on the pad/pens). During high temperatures, the ALL diet may have additional performance benefits.

**Key Words:** byproduct, performance, fecal characteristics

**T235 Transit effects on fecal *E. coli* O157:H7 prevalence and coliform concentrations in feedlot cattle.** C. C. Aperce,\* C. A. Alvarado, C. L. Van Bibber, K. A. Miller, and J. S. Drouillard, *Kansas State University, Animal Sciences and Industry, Manhattan.*

Our objective was to evaluate effects of transportation on fecal shedding of *E. coli* 4 and 24 h after hauling. The study was a randomized complete block with 20 steers per block (10/treatment), 3 blocks (days), and 2 treatments: a non-transported group, and transported steers that were placed in a trailer, hauled for 1 h, and subsequently allowed to rest. Fecal samples were taken pre-transport, and at 5 and 29 h post-transport. Fecal samples were collected from both groups at h 0, 5, and 29 from freshly voided fecal pats. One gram of feces was transferred to a PBS tube, serially diluted, and plated on Petrifilm for enumeration of total coliforms, and another sample (1 g) was added to gram-negative broth with cefixime, cefsulodin, and vancomycin, and subjected to immunomagnetic separation. Resulting beads were plated onto MacConkey agar with sorbitol, cefixime, and tellurite. Non-sorbitol fermenting colonies were picked and tested for indole production and O157 antigen agglutination. Results were confirmed by API 20E kit. Prevalence of *E. coli* O157 was transient across replications ( $P = 0.002$ ). *E. coli* O157 occurrence in the transported group was constant across the 3 sampling times (10, 3.3, and 16.7%, for h 0, 5, and 29, respectively;  $P = 0.43$ ); however, a significant increase in its prevalence was observed in the control group at h 5 (33%) compared with h 0 (17%,  $P = 0.06$ ) and 29 (13%,  $P < 0.02$ ). Numbers of coliforms remained constant across sampling day ( $P > 0.1$ ). There were no significant correlations between prevalence of *E. coli* O157 and coliform concentrations. Coliform concentrations of control steers remained stable from 0 to 29 h post-transit. Transported animals had lower coliform concentrations at hour 5 (3.2 log cfu/gram;  $P < 0.02$ ), but returned to pre-transport levels of 4.5 log cfu at h 29. Results suggest that shedding patterns are influenced by transportation, and that shedding can vary greatly within a period of 29 h. Additional post-transit sampling times may be useful to determine more precisely the pathogen shedding patterns associated with transportation.

**Key Words:** *E. coli* O157:H7, hauling

**T236 Cattle anthelmintic resistance testing and training in North Carolina.** N. C. Whitley<sup>1</sup>, M. L. Alley<sup>2</sup>, R. M. Kaplan<sup>3</sup>, S. Howell<sup>3</sup>, K. Moulton<sup>1</sup>, R. A. Franco\*<sup>1</sup>, and A. E. Cooper<sup>1</sup>, <sup>1</sup>*North Carolina A&T State University, Greensboro*, <sup>2</sup>*North Carolina State University, Raleigh*, <sup>3</sup>*University of Georgia, Athens.*

The objective was to investigate the presence of anthelmintic resistance in gastrointestinal nematodes (GIN) on cattle farms while providing parasite management training to agricultural professionals. Fecal egg count reduction testing was used as a training tool on 3 beef cattle farms using no treatment (CON) or labeled doses of moxidectin (Cydectin; pour on—CPO, 3 farms; injectable—CI, 1 farm), fenbendazole (Safeguard; SAFE; 3 farms), CPO and SAFE combined (CS; 1 farm) or levamisole (Prohibit; P; 1 farm) with a total of 346 calves used at weaning. Fecal samples were collected from calves 1 to 2 weeks before the start of the

study, on d0 (d of treatment) and d14. A Modified McMasters technique was used to determine fecal egg counts (FEC; eggs per gram, ep<sub>g</sub>) with a sensitivity of 4 or 8 ep<sub>g</sub>. Fecal co—proculture for GIN speciation was conducted on d14 fecal samples collected randomly from calves in each treatment group. Animals were assigned to treatment groups for similar mean preliminary BW and FEC. Percentage reduction (RED) of FEC was calculated as:  $[1 - (\text{mean d-14 treatment FEC}/\text{mean d-14 CON FEC})] \times 100\%$ . Only calves with a minimum d0 FEC of 40 ep<sub>g</sub> were used in RED calculations (17/trt for Farm 1; 28 to 30/trt for Farm 2; 25 to 32/trt for Farm 3). Statistical means and standard errors were calculated using SAS Proc Means. Mean d0 FEC for Farm 1, 2 and 3 were  $62 \pm 7$ ,  $204 \pm 12$  and  $222 \pm 13$  ep<sub>g</sub>, respectively. Farm 1 RED were 84.9% for CPO and 99.3% for SAFE. Farm 2 RED for CPO, SAFE, CS and P were 91.4, 96.9, 99.8 and 95.8%, respectively. Farm 3 RED for CPO, CI and SAFE were 16.5, 39.6 and 99.8%, respectively. Larvae from CON fecal cultures on all farms were primarily *Cooperia* with *Ostertagia ostertagi* also present at 40% for Farm 1 and *Hemonchus* in very low numbers on all 3 farms. For those treatments not considered effective, *Cooperia oncophora* and *Cooperia* spp. were the predominant GIN, except for P (*O. ostertagi*). These findings indicate that anthelmintic resistance in GIN of cattle is present in NC; 10 professionals were trained and the awareness of more NC agents and producers to this potential problem has increased.

**Key Words:** anthelmintic, cattle, resistance

**T237 Effects of temperament on physiological responses, feedlot performance, and carcass characteristics of Nelore steers.** C. L. Francisco<sup>1,4</sup>, A. M. Jorge\*<sup>1</sup>, F. D. Rezende<sup>2</sup>, A. Schmidek<sup>2</sup>, J. M. B. Benatti<sup>3</sup>, M. H. Faria<sup>2</sup>, E. Oba<sup>1</sup>, and R. F. Cooke<sup>4</sup>, <sup>1</sup>*Universidade Estadual Paulista - FMVZ, Botucatu, SP, Brazil*, <sup>2</sup>*APTA, Colina, SP, Brazil*, <sup>3</sup>*Universidade Estadual Paulista - FCAV, Jaboticabal, SP, Brazil*, <sup>4</sup>*Oregon State University, EOARC, Burns.*

The objective of this experiment was to evaluate the effect of temperament on plasma hormones, performance, and carcass traits of Nelore (*Bos indicus*) feedlot steers. Forty-four steers were evaluated for BW and temperament at feedlot entry (d 0). Temperament was assessed by chute score and exit velocity. Further, individual exit score was calculated by dividing exit velocity results into quintiles and assigning steers with a score from 1 to 5 (exit score: 1 = slowest steers; 5 = fastest steers). Temperament scores were calculated by averaging chute score and exit score. Steers were also classified for temperament type according to temperament score [ $\leq 3$  = adequate temperament (ADQ) or  $> 3$  = aggressive temperament (AGR)]. Shrunken BW was recorded on d 0 and 109, whereas blood samples were collected on d 0, 67, and 109 for analysis of plasma cortisol and insulin. Total DMI was recorded daily (d 0 to 109). Steers were slaughtered on d 109, and carcasses were evaluated for backfat thickness, LM area, carcass pH, and incidence of hematomas. Samples from the LM were collected and analyzed for Warner-Bratzler shear force. Plasma cortisol was greater ( $P = 0.04$ ) whereas plasma insulin tended to be reduced ( $P = 0.06$ ) in AGR vs. ADQ steers (19.6 vs. 16.7 ng/mL of cortisol, and 12.7 vs. 19.4 IU/mL of insulin). Feedlot BW gain was reduced ( $P = 0.02$ ) in AGR vs. ADQ steers (1.05 vs. 1.30 kg/d). Total DMI tended to be reduced ( $P = 0.14$ ) whereas G:F was reduced ( $P = 0.03$ ) in AGR vs. ADQ steers (8.8 vs. 9.4 kg/d of DMI, and 119 vs. 138 g/kg of G:F). Carcasses from AGR steers had greater ( $P = 0.05$ ) incidence of hematomas compared with ADQ carcasses (1.3 vs. 0.6 hematomas/carcass). No differences between ADQ and AGR steers were detected for the remaining carcass traits. In conclusion, aggressive steers had greater plasma cortisol during

handling, decreased feedlot performance, and impaired carcass quality compared with cohorts with adequate temperament.

**Key Words:** Nelore steers, feedlot performance, temperament

**T238 Skin temperature differentials in relation to residual feed intake in beef cattle using infrared thermography.** L. S. Martello\*<sup>1</sup>, P. R. Leme<sup>1</sup>, S. da Luz e Silva<sup>1</sup>, R. da Costa Gomes<sup>2</sup>, C. A. Zotti<sup>1</sup>, C. L. Oliveira<sup>1</sup>, and T. F. Canata<sup>1</sup>, <sup>1</sup>*Faculdade de Zootecnia e Engenharia de Alimentos, Universidade de São Paulo, Pirassununga, SP, Brazil,* <sup>2</sup>*Faculdade de Zootecnia, Universidade Estadual de Londrina, Londrina, PR, Brazil.*

Infrared thermography (IRT) has been studied as an alternative for indirect measuring of the residual feed intake (RFI) because of its association with body heat dissipation and consequently with skin temperature. Moreover, different areas of the body have distinct relationships with heat dissipation and should be considered for analyses. Therefore the aim of this study was to evaluate the skin temperature measured by IRT on different body areas, in low and high RFI cattle under feedlot conditions. Residual feed intake of Nelore steers (n = 40) and bulls (n = 40) fed high concentrate diets (85% of concentrate) was determined after 70d feeding. Nine calves classified as high and 9 as low RFI

were then allotted to individual pens with free access to shadow and sunlight and had the IRT determined for 10 consecutive days. The IRT of 8 body regions were measured at 7h, 12h and 16h with the infrared camera Fluke® TI 20. The evaluated regions were 2 spots on frontal head (FH1 and FH2), eye, cheek, flank, ribs, rump and front feet. The rectal temperature (RT) was also measured. The effect of efficiency group on IRT was evaluated by ANOVA using SAS software. The mean air temperature (AT) during the trial was 24.4°C ranging from 14.4°C to 30.7°C indicating a stressful environmental for cattle during hottest hours. The IRT temperatures showed a linear association ( $P < 0.01$ ) with AT whereas RT showed a quadratic effect ( $P < 0.05$ ) on AT. The IRT temperatures measured at eye, cheek, flank, ribs, rump and front feet were not affected by RFI group. However, IRT on FH1 and FH2 for high RFI cattle (31.4°C and 30.3°C, respectively) were lower ( $P < 0.01$ ) than for low RFI cattle (31.8°C and 30.7°C, respectively). Conversely, lower RT was observed for low RFI (38.3°C) than for high RFI group (38.4°C;  $P < 0.01$ ). The higher skin temperature, measured by IRT, for calves of low RFI group may be related with an improved efficiency of thermoregulatory mechanisms, because the RT remained lower in the Low RFI group. The IRT of frontal head (FH1 and FH2) is a promising body location for studies related to RFI in beef cattle

**Key Words:** infrared image, skin temperature, cattle