

# Production, Management and the Environment: Management and Methods

**W383 Effects of fenceline contact at weaning and length of preconditioning period on preconditioning performance and morbidity during the feedlot receiving period.** J. E. Anderson\*, K. W. Harborth, M. D. Garcia, R. S. Walker, C. C. Williams, and T. G. Page, *Louisiana State University AgCenter, Baton Rouge.*

Fenceline contact at weaning has shown to be a management practice that can reduce the stress during the time following maternal separation. A 45 d preconditioning period is required by many value added programs. Combining these 2 management practices could reduce the length of time calves need to be held in a preconditioning program. Thus a study was conducted over a 2 year period to evaluate if fenceline weaning systems will allow for a 21-d preconditioning (PRECON) period rather than the preferred 45-d PRECON period. Three-hundred cross-bred steer calves from 2 locations (Central Research Station, Baton Rouge, LA and Hill Farm Research Station, Homer, LA) were used over a 2 year period. Both locations were managed independently following the same protocol. Each year, calves were randomly stratified by BW into 4 treatments at each location. Treatments were 1) fence line separation from dam for 7 d period followed by a preconditioning period of 21 d (FL21), 2) fence line separation from dam for 7 d period followed by a preconditioning period of 42 d (FL42), 3) no separation from dam for 7 d period followed by total dam separation and preconditioning of 21 d (S21), 4) no separation from dam for 7 d period followed by total dam separation and preconditioning of 42 d (S42). Calf was the experimental unit. After the initial 7 d weaning period, all calves were placed on pasture for the assigned PRECON treatment. Calves were fed an 18% CP commercial preconditioning ration at 1% of BW during the entire PRECON treatment period. There were no significant differences ( $P > 0.05$ ) between BW at weaning. As expected, a significant difference ( $P = 0.03$ ) was found in shipping weights based on preconditioning time length (21-d PRECON = 266.83kg, 42-d PRECON = 280.43kg). Steers were transported to and managed by a commercial feedlot in Guymon, OK, until harvest. The current results from this study showed no effect of pre- and post-weaning treatment on weaning performance through 60 d in the feedlot.

**Key Words:** weaning, preconditioning, beef cattle

**W384 The effect of breed group and production system on performance of steer in the Colombian Caribbean Coast.** R. Patiño<sup>1</sup>, L. Salazar<sup>1</sup>, C. Villalba<sup>1</sup>, K. González<sup>1</sup>, F. Porras<sup>1</sup>, E. van Cleef<sup>2</sup>, and O. Vergara<sup>3</sup>, <sup>1</sup>University of Sucre, Sincelejo, Sucre, Colombia, <sup>2</sup>Kansas State University, Manhattan, <sup>3</sup>University of Cordoba, Montèria, Colombia.

The objective of this research was to evaluate the effect of breed group and production system (grazing or feedlot) on performance traits of growing steers in the Colombian Caribbean Coast. Steers ( $n = 90$ , BW =  $260 \pm 10$  kg) of 3 breed groups [Crossbred (CB), Colombian Zebu (CZ) and 1/2 Angus  $\times$  1/2 Brahman (AB)] were randomly distributed to one of the treatments in a  $3 \times 2$  factorial design. Thirty animals from each group were divided into 2 groups of 15 animals, which one was fed in feedlot (FLOT) and the other was pasture-fed (PAST), for a total of 6 treatments. Weight gain, heart girth and body condition were evaluated for 5 mo. Feedlot animals received a total mixed ration consisted of corn silage (42%), grass hay (40%), cottonseed (10%), corn syrup (3%) and cassava flour (5%). Grazing animals rotated in a module of 36 paddocks with *Dichanthium aristatum*, predominantly, with 2-d of

occupation, to provide 2200 kg/ha of DM, and free access to water and mineral supplement. The data were analyzed using the GLM procedure of SAS. Weight gain was higher ( $P < 0.05$ ) in feedlot steers (884.1 g/d), compared with grazing animals (819.4 g/d), and there was variation ( $P < 0.05$ ) between groups, with values of 910.2, 846.4, and 799.6 g/day for CB, AB and CZ, respectively. Furthermore, was observed interaction ( $P < 0.05$ ) among management factor and breed group, mainly due to the lower performance of CZ animals. It was also observed an increase ( $P < 0.05$ ) in girth and body condition, which were higher for crossbred steers from the dual-purpose system in the region. Weight gains of the 6 groups were: 980.4 (CB-FLOT), 871.1 (AB-FLOT), 840 (CB-PAST), 820 (AB-PAST), 800.9 (CZ-FLOT), and 798.2 (CZ-PAST) g/day. The results of this study show that animal performance, in terms of weight gain and body size, is a function of breed group, and that performance under grazing or feedlot systems depends on this group, highlighting the animals Zebu for low performance in both production systems.

**Key Words:** Colombia, livestock, performance

**W385 Effects of implant management during the stocker phase on grazing performance, subsequent feedlot performance, and carcass characteristics of beef steers.** J. D. Rivera\*<sup>1</sup>, H. B. Jones<sup>2</sup>, M. L. Galyean<sup>3</sup>, and G. K. Blue<sup>4</sup>, <sup>1</sup>South MS Branch Experiment Station, Mississippi Agriculture and Forestry Experiment Station, Poplarville, <sup>2</sup>Coastal Research and Extension Center, Biloxi, MS, <sup>3</sup>Department of Animal and Food Sci., Texas Tech University, Lubbock, <sup>4</sup>Elanco, Lawrenceburg, TN.

Crossbred beef steers ( $n = 36$ ; BW = 254 kg) were used to evaluate the effects of no implant, 36 mg zeranol given at d 0 and again at d 56, or 25.7 mg of estradiol given at d 0 on grazing performance, subsequent finishing performance, and carcass characteristics. Cattle grazed twelve 1.2-ha annual ryegrass pastures for 99 d, after which they were maintained on common bermudagrass pastures for 12 d until shipment to the feedlot in New Deal, TX. The statistical model included the fixed effect of treatment and random effect of block, with pasture as the experimental unit. During the grazing period, body weight was not affected ( $P > 0.10$ ) by treatment at d 0 or 28; however implant increased ( $P < 0.08$ ) BW and ADG at d 56, 99, and 111. On d 84, cattle receiving estradiol had greater BW and ADG than cattle that received zeranol ( $P < 0.08$ ) and cattle receiving zeranol had greater BW and ADG than cattle not receiving an implant ( $P < 0.04$ ). On arrival at the feedlot and again on d 84, all steers were implanted with 80 mg of trenbolone acetate and 16 mg of estradiol. Due to space limitations, pasture groups were combined, resulting in a total of 6 pens for feedlot data analyses. Pasture implant type did not affect ( $P > 0.10$ ) BW or ADG during the finishing period. Grazing implant affected ( $P < 0.01$ ) dressing percent, with cattle that received estradiol at grazing having a lesser dressing percent than control or zeranol-implanted cattle. Carcass weight, longissimus muscle area, and yield grade were not affected ( $P > 0.10$ ) by implant type. A difference was detected ( $P < 0.09$ ) among grazing treatments for 12th rib fat, with cattle receiving estradiol at grazing having the least amount of 12th rib fat, followed by control cattle, with cattle that received zeranol at grazing having the greatest 12th rib fat. Grazing implant decreased ( $P < 0.06$ ) marbling score. Results suggest that implanting during the grazing period improved pasture performance, had no effect on feedlot performance, and had limited carcass effects.

**Key Words:** beef cattle, grazing, growth-promoting implant

**W386 Fatty acid profiles, meat quality, and sensory attributes of organic versus conventional dairy-beef.** E. A. Bjorklund\* and B. J. Heins, *University of Minnesota, West Central Research and Outreach Center, Morris.*

Holstein and crossbred dairy steers (n = 49) were evaluated for fatty acid profiles, meat quality, and sensory attributes of organic dairy-beef compared with conventional dairy-beef. Calves were randomly assigned to 1 of 3 replicated groups: conventional (CONV, n = 16), organic (ORG, n = 16), and grass-fed organic (GRASS, n = 17) and were born at the University of Minnesota West Central Research and Outreach Center, Morris from March to May 2011. The CONV steers were fed a diet that contained 80% concentrate and 20% roughage, and ORG steers were fed a diet of organic corn, organic corn silage, and organic protein supplement. Furthermore, ORG steers consumed at least 30% of diet dry matter in pasture during the grazing season. The GRASS steers consumed 100% forage from pasture during the grazing season and hay or hay silage during the non-grazing season. Independent variables for analysis of fatty acid profiles and meat quality were fixed effects of breed and treatment group. For sensory analysis, independent variables were fixed effects of treatment group, replicate, and the interaction of treatment group and replicate, and consumer and the interaction of consumer and treatment group were included as random effects. The GRASS steers (22.9%, 1.3%) were significantly ( $P < 0.05$ ) lower for monounsaturated and polyunsaturated fat than the ORG (42.9%, 2.4%) and CONV (39.4%, 3.1%) steers, respectively. Furthermore, the GRASS steers were higher ( $P < 0.05$ ) for n-3 fat and lower ( $P < 0.05$ ) for n-6 fat than the ORG and CONV steers. For sensory attributes, there were no significant differences for ORG (71.3) and CONV (69.2) steers for overall liking; however, the GRASS (56.3) steers had the lowest ( $P < 0.05$ ) overall liking among beef consumers. The ORG (73.3) steers had higher ( $P < 0.05$ ) flavor liking than the GRASS (56.8) and CONV (69.2) steers. Furthermore, the GRASS (6.3) steers had the highest ( $P < 0.05$ ) scores for off-flavor compared with the ORG (3.9) and CONV (4.1) steers. These data indicate that fatty acid composition can be altered by inclusion of grass and more forage in the diet.

**Key Words:** organic, grass fed, n-3 fat

**W387 Growth measurements, carcass characteristics, and profitability of organic versus conventional dairy-beef steers.** E. A. Bjorklund\* and B. J. Heins, *University of Minnesota, West Central Research and Outreach Center, Morris.*

The objective of this study was to compare the growth, carcass characteristics, and profitability of organic dairy steers and conventional dairy steers. Holstein and crossbred dairy bull calves (n = 49) were randomly assigned to one of 3 replicated groups at birth; conventional (CONV, n = 16), organic (pasture and concentrate, ORG, n = 16), and organic-grass only (100% pasture, GRASS, n = 17). Calves were born at the University of Minnesota West Central Research and Outreach Center, Morris from March to May 2011. The CONV steers were fed a diet of 80% concentrate and 20%. The ORG steers were fed a diet of organic corn, organic corn silage, and at least 30% of their diet consisted of organic pasture during the grazing season. The GRASS steers grazed organic pasture during the grazing season and were fed organic hay or hay silage during the non-grazing season. Feed intakes were recorded daily with herd management software. A profit function was defined to include revenues and expenses for beef value, feed intake, pasture intake, and yardage. For analysis of body and carcass measurements, independent variables were fixed effects of steer group and breed group. For analysis of profit per steer, independent variables were fixed effects of steer group. The GRASS (358.6 kg) steers had lower ( $P < 0.05$ ) gain from

birth to slaughter than ORG (429.6 kg) and CONV (534.5 kg) steers. Furthermore, the GRASS (0.61 kg/d) steers had lower ( $P < 0.05$ ) average daily gain compared with ORG (0.81 kg/d) and CONV (1.1 kg/d) steers. Both organic steer groups had smaller ( $P < 0.05$ ) ribeye area (49.5 cm<sup>2</sup> for GRASS, 65.8 cm<sup>2</sup> for ORG, respectively) compared with CONV (75.4 cm<sup>2</sup>) steers. For profitability, GRASS steers had 25% greater ( $P < 0.05$ ) profit per steer (+\$151), than CONV steers. Conversely, ORG steers had 169% less ( $P < 0.05$ ) profit per steer (-\$1,086) than CONV steers. The higher cost for production of the ORG steers is because of the extreme high value of organic corn. The results suggest there may be a potential market for the male offspring of organic dairy cattle in the Midwest.

**Key Words:** organic, pasture, profitability

**W388 Effect of seasonality on subclinical mastitis and milk composition of a 3/4 Holstein × Zebu herd of Minas Gerais State, Brazil.** C. V. G. Ladeira<sup>1,4</sup>, S. V. Teixeira<sup>1</sup>, N. Silva<sup>2</sup>, G. M. Costa<sup>3</sup>, D. S. Rodrigues<sup>1</sup>, L. G. A. Ladeira<sup>1</sup>, P. Oliveira<sup>1</sup>, T. C. Gouveia<sup>1</sup>, R. Rodrigues<sup>2</sup>, L. M. Fonseca<sup>2</sup>, M. O. Leite<sup>2</sup>, and M. M. O. P. Cerqueira<sup>2</sup>, <sup>1</sup>Empresa de Pesquisa Agropecuária de Minas Gerais, EPAMIG, Belo Horizonte, Minas Gerais, Brazil, <sup>2</sup>Escola de Veterinária, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brazil, <sup>3</sup>Departamento de Medicina Veterinária, Universidade Federal de Lavras, Lavras, Minas Gerais, Brazil, <sup>4</sup>FAPEMIG CVZ APQ03680/10, Belo Horizonte, Minas Gerais, Brazil.

The aim of this study was to evaluate the occurrence of subclinical mastitis in 3/4 Holstein × Zebu cows and the effect of season on somatic cell counts, mastitis pathogens, milk production and composition. The study was conducted at the Santa Rita Experimental Farm belonging to EPAMIG, Brazil. A total of 727 composite milk samples were collected from August, 2011 to December, 2012. Effect of season was considered. The somatic cell count (SCC) and its correlation with milk production, fat, lactose, protein, nonfat and total solids content, and mastitis pathogens were determined. Statistical analyzes were performed using SAS/STAT. Average values for rainy and dry seasons, respectively, were: SCC (5.9 log cells/mL; 5.6 log cells/mL), fat (4.00 g/100 g; 3.73 g/100 g), protein (3.36 g/100 g; 3.41 g/100 g), lactose (4.36 g/100 g; 4.26 g/100 g), total solids (12.64 g/100 g; 12.41 g/100 g), nonfat solids (8.63 g/100 g; 8.68 g/100 g) and milk production (12.47 kg/d; 10.46 kg/d). Higher SCC ( $P \leq 0.0001$ ), fat ( $P = 0.001$ ), lactose ( $P = 0.007$ ), total solids ( $P = 0.05$ ) and milk production ( $P \leq 0.001$ ) were observed during the rainy season (November to February). Seasonal differences did not occur for protein ( $P = 0.34$ ) and nonfat solids ( $P = 0.42$ ). The log SCC presented a positive correlation with parturition order ( $r = 0.30$  and  $P < 0.0001$ ), protein ( $r = 0.14$  and  $P = 0.0001$ ), fat ( $r = 0.11$  and  $P = 0.004$ ) and negative with lactose ( $r = -0.32$  and  $P < 0.0001$ ), milk production ( $r = -0.08$  and  $P = 0.03$ ) and nonfat solids ( $r = 0.08$  and  $P = 0.02$ ). The mastitis pathogens isolated did not affect milk production, fat, protein, nonfat solids, total solids and lactose content ( $P > 0.05$ ). *Staphylococcus aureus* was the main pathogen and it was found in 37.1% of the samples. Other pathogens isolated included *Streptococcus uberis* (14.4%), *E. coli* (3.0%), *Corynebacterium* sp. (3.8%), and *Bacillus* sp. (2.3%). It can be concluded that SCC was greater during the rainy season and affected milk production and almost all milk components. The presence of mastitis pathogens did not result in changes in milk composition.

**Key Words:** seasonality, milk, quality

**W389 Identification of phenotypic predictors of milk yield losses in response to once-daily milking: Preliminary results.**

J. Flament<sup>\*1</sup>, S. Pochet<sup>2</sup>, and H. Larroque<sup>3</sup>, <sup>1</sup>*Agrocampus Ouest, UMR1348 PEGASE, Rennes, France*, <sup>2</sup>*INRA, UR342 URTAL, Poligny, France*, <sup>3</sup>*INRA, SAGA, Toulouse, France*.

Extended milking intervals can reduce milk yield but this response is highly variable among cows. Identifying cows with the low milk yield loss associated with milking interval is difficult, restricting the development of milking practices such as once-daily milking. A trial was carried out to identify phenotypic predictors linked to a physical regulation of milk yield due to milk accumulation in the udder. Thirty-two primi- and multiparous Holstein cows producing  $34.1 \pm 5.4$  kg/d of milk at  $184 \pm 29$  d in milk were milked twice a day at 0700 and 1600 h during the 7-d control period (C) and then morning milking was omitted one day (MO, milking omission). Indeed milk loss was shown to occur very rapidly, from the 1st day of implementation. Milk yield and flow were recorded at each milking. Milk fat, protein, lactose, and cell contents were analyzed at each milking for 3 consecutive days of the control period, and on the MO day. Lactose was analyzed in tail blood samples collected 1 h before milking 2 d before MO and on MO day; distances between the 4 teats tips were also measured 1h before milking. Data were analyzed to determine Pearson correlations using SAS. Milk yield decreased by 6.8 kg/d (20%) in response to MO ( $P = 0.0001$ ). The absolute and relative milk losses showed high variability between cows ( $-0.1$  to  $13.4$  kg/d and  $-0.5$  to  $42\%$ , resp.). Milk loss (absolute or relative) was not correlated to C milk yield. Absolute milk loss was negatively but poorly correlated with C milk fat and protein content ( $r = -0.34$  and  $-0.40$ ;  $P = 0.05$ ) and positively but poorly also with C milk lactose content ( $r = 0.33$ ;  $P = 0.06$ ). Milk loss was not correlated with C plasma lactose levels and the C total distance between tips. Absolute milk loss was positively correlated to C milk average flow ( $r = 0.59$  and  $0.46$ , resp.;  $P < 0.01$ ) and negatively to C milking time ( $r = -0.58$ ;  $P < 0.001$ ). In conclusion, milk flow could be a promising key phenotypic predictor of individual milk yield losses in response to once-daily milking and in relation to physical regulation of milk secretion.

**Key Words:** once-daily milking, milk yield loss, predictor

**W390 The effect of body condition score change 15 days prior to calving on lactation curve and production parameters in grazing dairy cows in Ireland.** M. R. Sheehy<sup>\*1,2</sup>, F. J. Mulligan<sup>1</sup>, M. M. Schutz<sup>3</sup>, M. A. Crowe<sup>1</sup>, S. P. M. Aungier<sup>1</sup>, and A. G. Fahey<sup>4</sup>, <sup>1</sup>*School of Veterinary Medicine, University College Dublin, Dublin, Ireland*, <sup>2</sup>*Devenish Nutrition Ltd., Belfast, United Kingdom*, <sup>3</sup>*Dept. of Animal Sciences, Purdue University, West Lafayette, IN*, <sup>4</sup>*School of Agriculture and Food Science, University College Dublin, Dublin, Ireland*.

Body condition score (BCS) is an indirect measure of energy balance. Energy balance before calving may affect production and health in the following lactation. The objective of this study was to determine if loss of BCS 15 d before calving had an effect on lactation curve characteristics and production. Milk production data were collected at 15 d intervals from calving (d 0) to d 315 of lactation from 93 Holstein-Friesian cows. Body condition scores were assessed on d -15 to d 0 relative to calving (1 = emaciated, 5 = obese). Cows were divided into 2 groups; those that did not lose BCS between d -15 and d 0 (MAINT,  $n = 50$ ) and those that lost BCS from d -15 to d 0 (LOSS,  $n = 43$ ). The Woods incomplete gamma function was used to fit individual cow lactation curves using PROC NLIN of SAS. The Woods' function estimated initial daily yield (a, kg/d), rate of increase to peak yield (b, kg/d) and rate of decrease from peak yield (c, kg/d), persistency, time to peak yield (Tm), and peak milk yield (Ym, kg/d). 305-d milk (kg), fat (kg), protein (kg), protein %, fat %, and SCC were recorded for each cow. The effect of

BCS group (MAINT and LOSS), parity (primi- and multiparous), and month of calving (1 to 4) and interactions were analyzed using PROC MIXED of SAS. MAINT cows had higher initial daily yield compared with LOSS ( $P < 0.05$ ). Primiparous MAINT cows had a tendency to have a lower C than LOSS cows ( $P < 0.10$ ) and higher Tm ( $P < 0.10$ ). Primiparous MAINT had a tendency for a greater persistency for fat than primiparous LOSS ( $P < 0.10$ ). Multiparous MAINT had a greater Tm for fat than multiparous LOSS ( $P < 0.05$ ). Somatic cell count was lower in multiparous MAINT than multiparous LOSS ( $P < 0.05$ ). In conclusion, MAINT cows had a higher initial yield and delayed Tm and reduced SCC. This may suggest that cows that maintain BCS 15 d before calving undergo less stress during lactation.

**Key Words:** body condition score, lactation, somatic cell count

**W391 Comparison of different types of roofings in individual houses for calves through thermal comfort indexes.** R. S. Marçola, P. A. Bustos Mac-Lean<sup>\*</sup>, G. T. Santos, and O. R. Barbosa, *State University of Maringa, Maringa, Parana, Brazil*.

Countries located in the tropics such as Brazil have higher average temperatures throughout the year, thus resulting in thermal stress for animals. Shelters are commonly used to enhance the welfare of suckling calves and protect them against weather odds, which may increase production. This study aimed to evaluate different roofing materials for housing calves in Maringa - Paraná, using black globe temperature and humidity index (BGHI) and radiant heat load (RHL), calculated based on temperature of air, black globe and dew point, wind speed and relative humidity. Sixteen individual shelters were installed and covered by one of 4 types of tiles: ecological tiles, galvanized iron, sheet material Tetra Pak, fiber cement (composite material made of sand, cement and cellulose fibers) tile painted white outside and black inside. There were 4 shelters allotted randomly to each material. Data recordings were made at 8, 10, 14 and 16 h, always in the presence of sunlight, and the results were submitted to ANOVA using the GLM procedure of SAS (2007). Mean separation was conducted using the Tukey test and significance was declared at  $P \leq 0.05$ . Regardless of the season, values of weather measurements were always higher at 14 and 16 h than at 8 and 10 h, and parameters measured during summer were always the highest. The lowest values of BGHI and RHL were found for the in fiber cement tiles during the hottest hours of the day (BGHI:  $79.5$  and  $79.2 \pm 3.5$ ; RHL:  $500.4$  and  $504.4 \pm 36.0$ ), but there were no differences during day time for the other materials. These data suggest that recyclable materials such as sheet material Tetra Pak can be used to build shelter roofs, which may contribute to a better environment.

**Key Words:** individual shelter, thermal comfort index, roof type

**W392 Effects of parity and pregnancy status on body weight changes of dairy cows in early lactation.** M. L. S. Canha<sup>1</sup>, S. L. Viechnieski<sup>2</sup>, and R. Almeida<sup>\*1</sup>, <sup>1</sup>*Universidade Federal do Paraná, Curitiba, PR, Brazil*, <sup>2</sup>*StarMilk Farm, Céu Azul, PR, Brazil*.

The objectives of this study were to describe parity and pregnancy status differences on daily body weight (BW) changes during the first 100 d of lactation. Data included 26,344 daily BW measurements from 372 Holstein cows that calved from June 2, 2011, to June 1, 2012, in southern Brazil. Cows were automatically weighed on their way back from the milking parlor 3 times daily and were assigned, according to parity, to 3 groups: 152 first-parity (P1), 100 second-parity (P2), and 120 third parity and greater (P3+). For generating variables representing BW changes in early lactation, individual measurements were first

smoothed using cubic splines (TPSPLINE procedure of SAS). This approach used days in milk (DIM) as a single smoothing variable. Parity effects on BW characteristics were estimated using GLM procedure of SAS. Milk production was assessed by the cumulative yield until 100 DIM and reproductive performance by pregnancy status at 180 DIM. Body weight at calving differed ( $P < 0.01$ ) across parities; 570.5, 653.5, and 699.9 kg for P1, P2 and P3+, respectively. Liveweight at nadir also differed ( $P < 0.01$ ) across parities; 521.5, 608.8, and 647.3 kg for P1, P2 and P3+, respectively. Mean days from calving to nadir and mean loss of BW from calving to nadir BW did not differ ( $P > 0.05$ ) across parity; 35.7, 32.9, and 37.8 d, and 48.9, 44.7, and 52.6 kg, respectively for P1, P2 and P3+ cows. There was no difference ( $P > 0.05$ ) on milk yield between cows with good and poor reproductive performance. Cows with desirable reproduction calved lighter ( $P < 0.05$ ) than cows with poor reproductive performance; 632.8 vs. 649.8 kg. Further, cows with shorter days open lost less ( $P < 0.01$ ) weight than cows with undesirable reproductive performance; 42.8 vs. 54.7 kg and -6.5 and 8.3%, respectively. These results support the statement that improvements in fertility of dairy cows should be achieved minimizing BW loss early in lactation.

**Key Words:** automatic walkover weighing, daily liveweight

**W393 Ovarian activity and oocyte quality associated to serum and follicular fluid biochemical profile of crossbreed dairy cows during postpartum in summer and winter.** B. G. Alves<sup>2</sup>, K. A. Alves<sup>2</sup>, R. M. Santos\*<sup>1</sup>, M. C. Martins<sup>1</sup>, L. S. Braga<sup>1</sup>, T. H. Silva<sup>1</sup>, B. G. Alves<sup>1</sup>, A. C. Lucio<sup>1</sup>, T. V. Silva<sup>1</sup>, M. E. Beletti<sup>1</sup>, J. O. Jacomini<sup>1</sup>, and M. L. Gambarini<sup>2</sup>, <sup>1</sup>Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brazil, <sup>2</sup>Universidade Federal de Goiás, Goiânia, Goiás, Brasil.

This work was delineated to evaluate the influence of heat stress (HS) and negative energy balance (NEB) on serum metabolic and dominant follicular fluid profile, follicular development and oocyte quality of crossbred dairy cows. The oocytes, blood and follicular fluid samples (follicles  $\geq 9$  mm) were obtained on 30, 45, 60, 75 and 90 d of postpartum in summer ( $n = 30$ ) and winter ( $n = 30$ ). In the moment of transvaginal follicular aspiration, there were recorded data from follicles number, quality and amount of oocytes, rectal temperatures (RT) and body condition scores (BCS). The ambient air temperature (AT), relative humidity (RH) was collected in each season to calculate the temperature humidity index (THI). The glucose, total cholesterol (TC), triglycerides (TG), urea, sodium (Na), potassium (K) and calcium (Ca) concentrations were determined on serum and follicular fluid (FF) samples. The RT, RH and THI were superior ( $P < 0.01$ ) on summer as well as BCS loss. The TC, TG, urea, K and Ca concentrations on FF were higher in summer ( $P < 0.05$ ). The serum concentrations of glucose, urea, Na and K were superior in winter ( $P < 0.05$ ). The total of aspirated follicles was higher ( $P < 0.01$ ) in winter and the mean of viable oocytes did not differ among seasons. Degenerate oocytes showed positive association ( $P < 0.05$ ) with THI ( $r = 0.14$ ) and AT ( $r = 0.13$ ), as well as negative correlation with glucose ( $r = -0.12$ ) and K ( $r = -0.11$ ) serum concentrations. The heat stress and NEB induce metabolic changes which compromise the folliculogenesis, follicular dominance and follicular environment resulting in development of oocytes morphologically impaired. Supported by CAPES/PROPP-UFU.

**Key Words:** oocyte quality, heat stress, dairy cattle

**W394 Interference of the production system on milk quality.** A. L. Silva, M. I. Marcondes, D. C. Jácome, M. B. Boto, I. M. Batalha,

T. R. Pereira, and J. P. P. Rodrigues\*, Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil.

Criteria for defining the quality of raw milk have changed to meet official regulation demands of industry and consumers in an effort to improve food safety and industrial yield. Our objective was to evaluate raw milk quality in different production systems and its variation throughout the year. The data used in this study were collected from 943 dairy farms in South, Midwest and Central Minas regions of the state of Minas Gerais and in Vale do Paraíba in the state of São Paulo, Brazil. Data were provided by the company Danone with a total of 18,206 samples from the period of January 2009 to September 2011. Data were sorted between confinement, semi-confinement and extensive production systems. The quality factors evaluated were somatic cell count (SCC), total bacterial count (TBC) and protein and fat contents. Data were analyzed in repeated measures over time using the MIXED procedure of SAS (2008). There was no effect of production system on milk protein, fat and SCC. Total bacterial count, however, was affected by production system, and it was related to the type of structure used for feeding. The results were possibly a consequence of the program of payment for quality implemented by the dairy sector since 2002. Seasonal variations were found for milk SCC, TBC, protein and fat: the highest protein values were identified from March to June; the highest fat contents were found from May to August, and TBC and SCC from December to March. In conclusion, the production system did not have an effect on milk fat, protein and SCC; however, confinement systems had a better TBC. We also conclude that both month and year affect milk TBC, SCC, protein and fat with the best milk quality found during the coldest periods of the year. Supported by CNPq, CAPES, FAPEMIG, INCT-CA.

**Key Words:** fat, protein, SCC

**W395 Methane emission from dairy calves, heifers and dry cows.** D. P. Bu<sup>1</sup>, X. L. Wang<sup>2</sup>, L. H. Baumgard<sup>1</sup>, J. Q. Wang\*<sup>1</sup>, and L. Y. Zhou<sup>1</sup>, <sup>1</sup>State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China, <sup>2</sup>Department of Animal Science, Iowa State University, Ames.

Study objectives were to compare ruminal methane production in calves ( $n = 4$ , BW =  $130 \pm 3$  kg), heifers ( $n = 4$ , BW =  $400 \pm 20$  kg), and dry cows ( $n = 4$ , BW =  $550 \pm 50$  kg). Animals were housed in 3 environmentally controlled chambers (size,  $4 \times 3 \times 2.5$  m; one animal/chamber) with indirect calorimetry capabilities for 9 d. Calves and heifers were fed the same TMR diet consisting primarily of corn silage 26.8%, Chinese wildrye 3.7%, alfalfa hay 28.5% and concentrate 41% and the dry cows were fed a TMR diet consisting primarily of corn silage 30.1%, Chinese wildrye 23.3%, alfalfa hay 17.5% and concentrate 29.1%. The temperature of each environmental chamber was maintained at  $25 \pm 1^\circ\text{C}$ , and humidity was  $40 \pm 2\%$  (THI = 70.7). Feed offered andorts were recorded and sampled once daily. Feed samples were analyzed for EE, CP and ash and GE was calculated.  $\text{O}_2$  consumption,  $\text{CO}_2$  and  $\text{CH}_4$  production within each chamber was automatically recorded every 30 s by Oxyman instrument (Columbus Instruments, US). Gas consumption and production data around feeding time was excluded due to chamber imbalance. Data was analyzed by SAS (9.0) using MIXED model. Daily  $\text{CH}_4$  production was  $130.64^a$ ,  $261.65^b$ , and  $340.52^c$  L/d for calves, heifers and dry cows, respectively. However, daily  $\text{CH}_4$  production per unit of dry matter intake and total energy intake were  $27.02^c$ ,  $41.80^a$ , and  $30.38^b$ , and  $6.14^c$ ,  $9.40^a$ ,  $6.97^b$ , respectively. Overall, heifers produced more methane per unit of dry matter intake compared with dry cows and calves.

**Key Words:** cattle, methane emission

**W396 Ruminant methane emission during heat stress.** D. P. Bu<sup>1</sup>, X. L. Wang<sup>1</sup>, L. H. Baumgard<sup>2</sup>, J. Q. Wang<sup>\*1</sup>, and L. Y. Zhou<sup>1</sup>, <sup>1</sup>*State Key Laboratory of Animal Nutrition, Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China*, <sup>2</sup>*Department of Animal Science, Iowa State University, Ames.*

The study objective was to evaluate the effect of heat stress (HS) on methane production. Eight female dairy calves ( $130 \pm 3$  kg of BW) were used in this trial and fed a TMR designed for lactating cows. Calves were acclimated to environmentally controlled chambers for 7 d. After acclimation, the experiment was conducted for 20 d and was separated into 2 periods (P). The first 10 d was classified as P1 and the second 10 d as P2. During P1, all calves were allowed to eat ad libitum while being maintained in thermal neutral (TN) conditions (20°C). During P2, 4 calves remained in TN conditions (exactly the same as P1) while 4 calves were exposed to cyclical heat-stress (HS) conditions. Between 2100 to 0900 h, the temperature was maintained at 33°C, and between 1000 to 2200 h, the temperature was maintained at 37°C. Reductions in feed intake by HS calves during P2 was determined daily as a percentage of their mean daily ad libitum intake in P1. The TN control calves were pair-fed (PFTN) to the HS calves during P2 to eliminate the dissimilar effect of nutrient intake. Daily dry matter intake for all calves was recorded throughout the experimental. Body temperature indices (respiration rate and rectal temperatures) were obtained 4 times daily (0600, 1000, 1400 and 1800 h). Methane, oxygen and carbon dioxide production was obtained (every 30 s) from the auto recording system during both periods. Compared with PFTN, HS increased ( $P < 0.01$ ) rectal temperature and respiratory rate and tended ( $P = 0.09$ ) to decrease (17.6%) CH<sub>4</sub> emissions. The daily average RQ (CO<sub>2</sub>/O<sub>2</sub>: 0.91) did not differ ( $P > 0.05$ ) between HS and PFTN calves. In conclusion, HS reduced methane production and our data suggests that HS alters rumen fermentation patterns.

**Key Words:** heat stress, methane emission

**W397 Effect of feed delivery frequency on the behavior and productivity of lactating dairy cows.** K. D. Hart<sup>\*1</sup>, B. W. McBride<sup>2</sup>, T. F. Duffield<sup>3</sup>, and T. J. DeVries<sup>1</sup>, <sup>1</sup>*Dept. of Animal and Poultry Science, University of Guelph, Kemptville Campus, Kemptville, ON, Canada*, <sup>2</sup>*Dept. of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada*, <sup>3</sup>*Dept. of Population Medicine, University of Guelph, Guelph, ON, Canada.*

The objective of this study was to determine the effect of feed delivery frequency on the behavior and productivity of lactating dairy cows. Twelve free-stall housed, lactating Holstein dairy cows, milked 3×/d, were exposed to each of 3 treatments (over 21-d periods) in a replicated Latin square design. Treatments were feed delivery frequency of (1) 1×/d (at 1400 h), (2) 2×/d (at 1400 and 2200 h), and (3) 3×/d (at 1400, 2200, and 0600 h). Milk production, feeding, lying, and rumination behavior were electronically monitored for each animal for the last 7 d of each treatment period. Milk samples were collected for the last 3 d of each period for milk component analysis. Data were analyzed in a general linear mixed model. Dry matter intake varied with feed delivery frequency ( $P_{\text{quadratic}} = 0.03$ ; SE = 0.87), with greatest DMI observed in cows fed 3×/d (27.8 kg/d) compared with when fed 2×/d (27.0 kg/d) or 1×/d (27.4 kg/d). There was no effect of treatment on milk yield (41.3 kg/d), which translated into greater production efficiency ( $P_{\text{quadratic}} = 0.04$ ; SE = 0.08) for cows fed 2×/d (1.57 kg milk/kg DMI) compared with 1×/d (1.55 kg milk/kg DMI) and 3×/d (1.53 kg milk/kg DMI). Milk protein % increased with greater frequency of feed delivery (3.15 vs. 3.16 vs. 3.21%; SE = 0.01;  $P_{\text{linear}} = 0.02$ ), with multiparous (MP) cows showing the greatest increase with 3×/d feed delivery frequency

(3.30%;  $P = 0.01$ ). Cows that did not receive fresh feed at milking had lower DMI during the first hour after milking than those that received fresh feed at all milkings. Meal frequency (9.5 meals/d), size (3.0 kg/meal) and duration (25.2 min/meal) did not vary by treatment. Although lying time (9.3 h/d) did not vary by treatment, PP cows spent more time lying (10.3 vs. 8.3 h/d; SE = 71.0;  $P = 0.02$ ) than MP cows. There was a tendency ( $P_{\text{quadratic}} = 0.06$ ; SE = 41.3) for cows to spend more time standing following the first milking when fed 2×/d (144.8 min) compared with 1×/d (118.8 min) and 3×/d (110.8 min). In summary, feed delivery frequency had little effect on the behavior and productivity of dairy cows milked 3×/d, with the exception of DMI and milk protein % being greatest with 3×/d feed delivery.

**Key Words:** feeding frequency, behavior, parity

**W398 Associations between herd-level feeding and housing management practices, feed sorting, and productivity of freestall-housed dairy cows.** A. D. Sova<sup>1</sup>, B. W. McBride<sup>2</sup>, S. L. LeBlanc<sup>3</sup>, and T. J. DeVries<sup>\*1</sup>, <sup>1</sup>*Dept. of Animal and Poultry Science, University of Guelph, Kemptville Campus, Kemptville, ON, Canada*, <sup>2</sup>*Dept. of Animal and Poultry Science, University of Guelph, Guelph, ON, Canada*, <sup>3</sup>*Dept. of Population Medicine, University of Guelph, Guelph, ON, Canada.*

The objective was to examine associations between herd-level feeding and housing management factors, feed sorting, and milk production. Twenty-two freestall herds with average lactating herd size of  $162 \pm 121$  cows, feeding TMR, were studied for 7 consecutive days in both summer and winter. In cases of multiple feeding groups, the highest producing group of cows with an even distribution of DIM and parity was studied. The average group size studied was  $83 \pm 31$  cows, consisted of cows  $187 \pm 47$  DIM, with a parity of  $2.3 \pm 0.6$ , consuming  $24.3 \pm 2.6$  kg DM, with group-average yield of  $34.3 \pm 6$  kg of milk/d,  $3.7 \pm 0.3\%$  milk fat,  $3.2 \pm 0.18\%$  milk protein, and  $225,000 \pm 129,000$  cells/mL SCC. Milk production parameters, including yield, fat, and protein, were recorded through DHI milk testing. A survey of feeding management practices and barn characteristics was administered on each farm. The amount of feed offered and refused was recorded and sampled daily to assess DMI and particle size distribution. Data were summarized across each 7-d period for each farm and analyzed in multivariable mixed-effect regression models. Increased frequency of feed delivery (2× vs. 1×/d) was associated with an increase of 1.4 kg/d DMI ( $P = 0.008$ ), 2.0 kg/d milk yield ( $P = 0.047$ ), and a tendency for 1 point less sorting against long ration particles ( $P = 0.1$ ). Increased 4% FCM was associated with reduced long particle sorting, with every 2% group-level reduction in sorting being associated with an increase of 0.9 kg/d of 4% FCM ( $P = 0.036$ ). Increased feed bunk space was associated with greater group-average milk fat % ( $P = 0.006$ ) and lower SCC ( $P = 0.001$ ), with every 10cm/cow more space associated with an increase of 0.06% milk fat and a 13% reduction in SCC. Overall, our results indicate that factors that improve access to the feed bunk, such as feeding frequency and bunk space, improve group-level DMI, consistency in nutrient intake, and milk production.

**Key Words:** sorting, production, feeding management

**W399 Associations between daily variability in ration characteristics and measures of productivity in freestall-housed cows.** A. D. Sova<sup>1</sup>, B. W. McBride<sup>2</sup>, S. L. LeBlanc<sup>3</sup>, and T. J. DeVries<sup>\*1</sup>, <sup>1</sup>*Dept. of Animal and Poultry Science, University of Guelph, Kemptville Campus, Kemptville, ON, Canada*, <sup>2</sup>*Dept. of Animal and Poultry*

Science, University of Guelph, Guelph, ON, Canada, <sup>3</sup>Dept. of Population Medicine, University of Guelph, Guelph, ON, Canada.

The ration supplied day-to-day by the dairy producer may not reflect the TMR formulated, potentially affecting production. The objectives of this study were to determine (1) how TMR fed differs or agrees with TMR formulation, (2) the daily variability in nutrient and physical characteristics of TMR fed on commercial farms, and (3) associations between daily variability in TMR characteristics and group-average productivity measures (milk yield, milk components, DMI, efficiency and feed sorting). Samples of fresh and refused TMR were collected for 7 d in both summer and winter on 22 commercial freestall farms to assess particle size (% long, medium, short and fine using a Penn State Particle Separator), DM, and chemical content. Milk production, including yield, fat, and protein, were recorded through DHI. Multivariable mixed-effect regression models were used to analyze associations between herd-level productivity and coefficients of variation (CV) in TMR characteristics over 7 d. The average TMR delivered exceeded TMR formulation for NeL (+0.05mc/kg), NFC (+1.2%), ADF (+0.7%), Ca (+0.08%), P (+0.02%), Mg (+0.02%) and K (+0.04%) and underfed CP (-0.4%), NDF (-0.6%) and Na (-0.1%). Greater than 5% CV over the 7 d of the fed ration was observed for refusal rate (CV = 74%), % long particles (CV = 16%), % medium particles (CV = 7.7%), % short particles (CV = 6.1%), % fine particles (CV = 13%), Ca (CV = 7.7%), Mg (CV = 5.2%), and Na (CV = 10%). Every 0.5% increase in NeL variability (NeL =  $1.7 \pm 0.03$  mc/kg) was associated with 3.2 kg/d lower milk yield ( $P < 0.001$ ; milk yield =  $34.3 \pm 5.9$  kg/d), 1.0 kg/d lower DMI ( $P = 0.005$ ; DMI =  $24.3 \pm 2.1$  kg/d), and 4.3% lower efficiency of production ( $P = 0.03$ ; efficiency =  $1.41 \pm 0.16$  kg/kg). Every 5% increase in variability in % long particles (% long =  $19.8 \pm 6.5$ ) in the TMR was associated with 1.2 kg/d lower milk yield ( $P = 0.02$ ), 2.6% decrease in efficiency of milk production ( $P = 0.02$ ), and 18.5% increase ( $P < 0.001$ ) in group-average SCC (SCC =  $225,000 \pm 129,000$  cells/mL). These results demonstrate the importance of ensuring TMR consistency to maximize DMI, production, and efficiency.

**Key Words:** total mixed ration, variability, milk yield

**W400 Effect of vaccination against foot-and-mouth disease on growth performance of Korean native goat (*Capra hircus coreanae*).** N. Jo<sup>1</sup>, J. Jung\*<sup>1</sup>, J. Lee<sup>1</sup>, S. Jeong<sup>1</sup>, J. Jeong<sup>1</sup>, L. Sun<sup>1</sup>, H. Sung<sup>2</sup>, K. Son<sup>1</sup>, and S. Seo<sup>1</sup>, <sup>1</sup>Division of Animal Biosystem Sciences, Chungnam National University, Daejeon, Republic of Korea, <sup>2</sup>Adbiotech, Seoul, Republic of Korea.

The objectives of this study were (1) to evaluate the effect of vaccination against foot-and-mouth disease (FMD) on growth performance, nutrient digestibility, hematological response and goat behavior, and (2) to investigate a possible strategy for reducing its adverse effect. A total of 12 Korean native goats ( $19.8 \pm 2.9$  kg) were divided into 3 groups and randomly allocated to one of the following treatments: 1) control, 2) co-injection of a commercial vaccine stress reliever (VSR; Anti VS-2, Samyang Anipharm, Korea) and 3) supplementation of 1% gamma-amino butyric acid (GABA, Adbiotech, Korea). The goats were individually housed in a metabolic cage and fed ad libitum with a diet consisting of 60% bermudagrass and 40% commercial concentrate mix. A replicated  $3 \times 3$  Latin square design was used, and each period lasted 4 weeks. The vaccination against FMD was carried out at 2 weeks after the start of each period. Intake, growth performance, nutrient digestibility, hematological response and behavior of the goats were measured before and after vaccination. Although no significant reduction in DMI was observed after the vaccination ( $P > 0.05$ ), the vaccination decreased ADG of the animals ( $P < 0.01$ ). A significant interaction between treat-

ment and vaccination was also observed ( $P < 0.05$ ). Compared with the other treatments, VSR reduced the adverse effect of vaccination for ADG. After vaccination, nutrient digestibility was significantly decreased ( $P < 0.01$ ). The vaccination shortened standing time and extended lying time of the goats. The vaccination also increased the time spent drinking water of the goat ( $P < 0.05$ ). After vaccination, the total number of leukocytes was increased while that of erythrocyte and thrombocyte was decreased ( $P < 0.01$ ). No interaction between treatment and vaccination was observed in nutrient digestibility, goat behavior, and blood cell counts. We concluded that vaccination stress decreased ADG of the goats without depression of diet intake. A reduction in growth performance was primarily due to a decrease in nutrient digestibility. VSR attenuated the adverse effect of vaccination.

**Key Words:** Korean native goat, vaccination, digestibility

**W401 Metabolism of broiler chickens as a function of the rearing period and environmental conditions.** S. T. Nascimento\*, A. S. C. Maia, M. D. Carvalho, and L. G. Leite, São Paulo State University (UNESP), Jaboticabal, São Paulo, Brazil.

The aim of this trial was to settle the metabolism and respiration flow of broiler chickens during the rearing period through indirect calorimetry. Six Cobb broilers allocated in a  $6 \times 6$  Latin square were evaluated for a period of 2 h each during 6 weeks (one evaluation per week). Animals were raised in a climatic chamber, with an average temperature of 23.8°C and 55% of relative humidity. A respiratory mask was developed to measure the tidal volume of broilers coupled to a Spirometer, connected to a flow head with 1 L of capacity, being possible the measurement of respiratory rate and of respiration flow, characterized by the volume of air expired per second. The percentages of oxygen in the inspired air and of carbon dioxide in the expired air from birds were measured, by a connection of the mask to a gas analyzer. The temperature of expired air from birds was measured by a temperature sensor inserted inside the mask. Metabolism (M, W/m<sup>2</sup>) of broilers per unit of surface area was obtained through eq.:  $M = RF \cdot \{(\Delta O_2 \cdot QO_2 \cdot 0.7633) + (\Delta CO_2 \cdot QCO_2 \cdot 0.2358)\} \cdot A^{-1}$ , where RF is the respiration flow, L/s;  $\Delta O_2$  is the proportion of oxygen in inspired air, %;  $QO_2$  is the caloric coefficient of oxygen, kJ/L;  $\Delta CO_2$  is the proportion of carbon dioxide in expired air, %;  $Q CO_2$  is the caloric coefficient of carbon dioxide, kJ/L; A is the surface area of broilers, m<sup>2</sup>.  $QO_2$  and  $QCO_2$  are determined in accordance to respiratory coefficient of birds. Data were tested by analysis of variance and multiple comparison of means by Tukey's test ( $P < 0.05$ ). The statistical model included the effects of schedule of the day, age of broilers, live weight and week of the rearing period. Respiratory flow of broilers was increasing through the rearing period ( $P < 0.05$ ), with an initial respiratory flow of 0.006 L/s in the first week and increasing up to 0.018 L/s in the sixth week of life and it was not influenced by the schedule of the day ( $P = 0.2469$ ). The same was observed for metabolism, which also varied in relation to the body weight and with the age of broilers ( $P < 0.05$ ), air temperature and respiration flow ( $P < 0.05$ ), but not with the schedule of the day ( $P = 0.0958$ ).

**Key Words:** calorimetry, heat flow, poultry

**W402 Methane emission associated to meteorological variables in lambs.** A. S. C. Maia\*, S. T. Nascimento, R. B. Silva, C. C. M. Costa, and M. D. Carvalho, São Paulo State University (UNESP), Jaboticabal, São Paulo, Brazil.

The aim of this trial was to study the influence of environment in methane emissions of lambs in tropical environment. Corriedale lambs (n = 10; 5

males and 5 females) were allocated in a 10 × 10 Latin square (10 animals in 10 different schedules), and each animal was evaluated through one hour per day. The animals were housed during the experimental period, receiving no direct solar radiation. The measurements were done from 8:00 to 18:00. Air and black globe temperatures and air humidity were continuously monitored. Solar radiation was observed through a pyranometer. Heat metabolic production ( $M$ ,  $W\ m^{-2}$ ) was measured through indirect calorimetry. These systems were connected to a facial mask adapted for lambs. The enteric emission of  $CH_4$  ( $E_{CH_4}$ ,  $L\ h^{-1}$ ) was monitored by a methane analyzer. Data was submitted to ANOVA (least square method), and the adjusted means were compared by Tukey's test ( $P < 0.05$ ). Statistical analysis considered the effects of sex, animal, day of measurement, schedules of evaluation and its interaction. Respiratory rate and body temperature were higher at 13:00 ( $P < 0.05$ ), respectively of 170  $resp.\ min^{-1}$  and 40.05°C, which was the schedule of the day with the higher value of solar radiation (800  $W\ m^{-2}$ ) and air (32°C) and black globe temperatures (35°C). Methane emission in lambs occurs as peaks through the day, and the peaks are more frequent in the first hours of evaluation (morning period,  $P < 0.05$ ), with an average of 8.54  $L\ h^{-1}$ , and a reduction in the emission was observed from 11:00 to 15:00 and an increase is observed with a higher intensity after 17:00 ( $P < 0.05$ ), and an average mean of 2.61  $L\ h^{-1}$  of methane was observed. The higher values of metabolism were observed between 8:00 and 10:00 ( $P < 0.05$ ). The emission was not continuous through the day, occurring in peaks which are more frequent with the consumption of  $O_2$  and release of  $CO_2$  in each respiration. However, with high air and mean radiant temperatures respiration rate is higher, followed by an increase in tidal volume. This greater volume increased heat loss by respiratory evaporation and a smaller number of methane peaks emission.

**Key Words:** environment, greenhouse gas, sheep

**W403 Influence of trenbolone-estradiol implant level on feedlot performance of hair-sheep.** R. Barajas\*<sup>1</sup>, B. Ortiz<sup>1</sup>, and J. J. Alvarez<sup>2</sup>, <sup>1</sup>Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, <sup>2</sup>Productores de Ovinos de Guanajuato, S.P.R. de R.L., Silao, Guanajuato, Mexico.

Seven hundred twenty hair sheep (480 ram lambs and 240 ewe lambs) weighing 20.96 ± 0.92 kg, were utilized to evaluate the influence of trenbolone acetate and estradiol ear-implant level on feedlot-performance of hair lambs. Sheep were weighed, grouped by initial weight and sex in 6 blocks of 120 animals, and were placed in 24 elevated pens (4 × 5 m) fitted with plastic-slot floor (30 sheep by pen). Each block was integrated by 4 pens, and the pen constituted the experimental unit. In a complete randomized block design experiment, within a block, pens were randomly assigned to receive one of 4 treatments: (1) No ear implant (CTRL); (2) Ear-implanted with 20 mg of trenbolone and 4 mg of estradiol (T20); (3) implanted with 40 mg of trenbolone and 8 mg of estradiol (T40); and (4) implanted with 60 mg of trenbolone and 12 mg of estradiol (T60). Trenbolone /estradiol levels were obtained with the application of 1, 2 or 3 pellets, from the 6 pellets contained in a regular implant-cartridge of Component TES (Elanco). Sheep were weighed d 1 and 60. Results were analyzed by ANOVA for a randomized complete block design, implanted vs. no implanted sheep were compared using orthogonal contrasts, and the quadratic trend was tested by polynomial contrasts. At the end of the experiment, implanted sheep were 4.3% heavier (34.44 vs. 33.00 kg), and gain 11.5% faster (222 vs. 199 g/d) than CTRL ( $P = 0.02$ ). DMI was not influenced by treatments ( $P = 0.73$ ). Gain:feed ratio was improved 9.4% ( $P < 0.01$ ) in implanted sheep compared with CTRL (212 vs. 195 g/kg). A quadratic response to trenbolone-estradiol implant level on gain:feed ratio was observed ( $P = 0.04$ ), with mean values of 195, 214, 213, and 210 g of gain/kg of DMI

for CTRL, T20, T40, and T60 treatments, respectively. It is concluded that trenbolone-estradiol implants improves feedlot-performance of sheep, and that a dose of 20 mg of trenbolone combined with 4 mg of estradiol is enough to produce the maxima feedlot response in hair-sheep

**Key Words:** feedlot performance, hair sheep, trenbolone

**W404 Effects of nursery floor space allowance on body weight and organ characteristics in replacement gilts.** S. R. Callahan\*<sup>1</sup>, M. J. Estienne<sup>1</sup>, and A. E. DeDecker<sup>2</sup>, <sup>1</sup>Virginia Tech, Blacksburg, <sup>2</sup>Murphy-Brown LLC, Rose Hill, NC.

Current research at Virginia Tech focuses on effects of nursery floor space allowance on growth, physiology, and immunology of replacement gilts, with the overall goal of determining if lifetime reproductive performance and sow longevity are affected by conditions to which gilts are exposed early in life. A previous report (Callahan et al., 2013) described a study in which gilts ( $n = 2,537$ ;  $BW = 5.6 \pm 0.6$  kg) were classified by size at weaning and placed in nursery pens of 14, 11 or 8 pigs, resulting in floor spaces of 0.15, 0.19, or 0.27  $m^2/pig$ , respectively; ADG was affected by treatment ( $P < 0.01$ ) and was greatest for gilts allowed 0.27  $m^2$  floor space each and least for gilts allowed 0.15  $m^2$ . Described here are BW and organ characteristics for a subset of 30 gilts from that experiment. There were 3 to 4 pigs for each combination of size (large, medium, or small) and floor space allowance and data were obtained after 6 wk in the nursery. At harvest, there was a linear effect of floor space ( $P < 0.05$ ) for BW (33.7, 31.8, and 30.4 kg [ $SE = 1.1$  kg] for gilts allowed 0.27, 0.19, or 0.15  $m^2/pig$ , respectively). There was an interaction of size and floor space ( $P < 0.01$ ) for liver weight; Liver weights decreased for large pigs as space allowance was decreased (1330.1, 1093.6, and 1016.7 g [ $SE = 59.8$  g] for gilts allowed 0.27, 0.19, or 0.15  $m^2/pig$ , respectively). There was a linear effect of floor space ( $P < 0.01$ ) for spleen weight, and weights were 79.8, 68.9, and 64.7 g ( $SE = 4.0$  kg) for gilts allowed 0.27, 0.19, or 0.15  $m^2/pig$ , respectively. Kidney and heart weights were not affected by floor space or the interaction of size and floor space ( $P > 0.1$ ). For reproductive organs, weights of the uterus and ovaries, and length and area of the vulva were not affected by floor space, or the interaction of size and floor space ( $P > 0.1$ ), however, the width of the vulva tended ( $P < 0.07$ ) to decrease linearly with decreasing floor space. Further study will determine if these effects influence future reproduction and sow longevity.

**Key Words:** nursery, floor space, pig

**W405 Effect of oxytocin addition to reduced seminal doses using intra uterine AI technique on reproductive performance of sows serviced during summer and autumn in northwest Mexico.** J. M. Romo\*<sup>1,2</sup>, J. A. Romo<sup>1</sup>, H. R. Guemez<sup>1,2</sup>, and R. Barajas<sup>1</sup>, <sup>1</sup>Facultad de Medicina Veterinaria y Zootecnia, Universidad Autonoma de Sinaloa, Culiacan, Sinaloa, Mexico, <sup>2</sup>Granja Porcina La Huerta, Culiacan, Sinaloa, Mexico.

Two hundred and 203 multi parturient sows were utilized to evaluate the effect of oxytocin addition to reduced seminal doses using intra uterine AI technique on reproductive performance of sows serviced during summer and autumn in the North-West of Mexico. Sows were blocked by parity (3–5) and assigned randomly to be serviced twice with the semen from same boar(s) in one of 2 treatments: (1) Served with a reduced semen dosage equivalent to  $1.5 \times 10^9$  viable spermatozoa cell diluted in 40 mL of semen dose (CTRL,  $n = 111$ ); or (2) Control plus addition of 4 IU oxytocin to semen at service time (OX,  $n = 112$ ). Sows were serviced from June to October 2012, using an intrauterine semen delivery device. The total number born (including mummified fetuses) and total number born alive were counted

at farrowing. As parity have not effect ( $P > 0.10$ ) was removed from the model, and results were compared by ANOVA for a completely randomized design, farrowing date was compared using  $\chi^2$  analyses. Treatments had no effect ( $P > 0.05$ ) on litter size (11.0 vs. 10.8) or number born alive piglets (9.8 vs. 9.6). OX increased ( $P = 0.03$ ) 9.6% the farrowing rate, with mean values of 84.68 vs. 93.75% for CTRL and OX, respectively. Results suggest that the addition of 4 IU oxytocin to semen at service time using reduced semen dosage ( $1.5 \times 10^9$  viable spermatozoa cell), improves farrowing rate of multi parturient sows serviced during summer and autumn in the North-West of Mexico, without effect on other reproductive performance variables.

**Key Words:** artificial insemination, oxytocin, sow

**W406 Effect of different gestation housing types on reproductive performance of sows.** M. Song<sup>1</sup>, S. K. Baidoo<sup>2</sup>, J. Kim<sup>\*1</sup>, H. C. Park<sup>1</sup>, and S. W. Seo<sup>1</sup>, <sup>1</sup>Chungnam National University, Daejeon, South Korea, <sup>2</sup>Southern Research and Outreach Center, University of Minnesota, Waseca.

A study was conducted to evaluate effect of housing type on sow performance. A total of 60 sows with mixed parity ( $218 \pm 24$  kg BW) were used. During gestation, 28 sows were housed in-group house with electronic sow feeder (space allowance = 1.26 m<sup>2</sup>/sow) and 32 sows were housed in individual stalls (space allowance = 1.8 m<sup>2</sup>/sow). Sows from both housing types were moved to farrowing crates on d 109 of gestation and stayed until weaning (18 d post-farrowing). Typical corn-soybean meal diets that met or exceeded nutrient requirements of sows during gestation and lactation were provided to sows. Measurements were reproductive responses of sows after farrowing as well as sow and litter performance during lactation. Sows had similar number of total piglet born regardless of housing type during gestation, but sows in group housing during gestation had more mummies (0.321 vs. 0.064;  $P < 0.05$ ) and stillbirths (0.893 vs. 0.469;  $P = 0.073$ ) than sows in individual stalls during gestation, resulting in difference in the percentage of piglet born alive (90.4 vs. 95.5%;  $P < 0.05$ ). On the other hand, sow and litter performance during lactation was not different between housing types during gestation. In conclusion, group housing for sows during gestation decreased the percentage of piglet born alive by increasing the number of mummies and stillbirths compared with sows housed in individual stalls during gestation.

**Table 1.** Reproductive performance of sows in different housing (group or individual) types during gestation

Item	Group	Individual	SEM	P-value
Sows, no.	28	32		
Total piglet/litter, no.	11.86	11.94	0.59	0.921
Mummies/litter, no.	0.32	0.06	0.08	<0.05
Stillbirth/litter, no.	0.89	0.47	0.15	0.073
Piglet born alive/litter, no.	10.64	11.38	0.54	0.325
Piglet born alive/litter, %	90.42	95.54	1.52	<0.05

**Key Words:** housing type, reproductive performance, sow

**W407 Rectal temperature and infrared thermography of the eye in Nellore beef cattle.** A. M. Mobiglia, F. R. Camilo, T. S. Almeida, M. D. Freitas Neto, V. R.M. Couto\*, J. C. Pimenta, B. J. M. Lemos, and J. J. R. Fernandes, Universidade Federal de Goias, Goiania, Goias, Brazil.

The use of infrared thermography to non-invasively measure animal temperature could minimize the stress caused by aversive procedures used routinely on feedlot. The objective of this study was to correlate

the rectal temperature and infrared thermography of the eye in Nellore beef cattle. Therefore, 120 Nellore bulls ( $393.04 \pm 47.30$  kg of BW), with average of 20 mo of age, were placed in individual pens. The infrared thermography of the eye was performed using an infrared portable camera (FLIR I7 of Flir Systems Inc.) calibrated with an emissivity value ( $\epsilon$ ) of 0.95 and spectrum between 7.5 and 13  $\mu$ m. All infrared thermography of the eye was taken approximately 0.5m from the location studied. The infrared thermography of the eye was interpreted using Flir Tools Software (Program version 2.0), on option "iron," and temperature ranging from 0°C to 50°C, with thermal sensibility of  $\pm 1^\circ$ C. In all photographs, a specific shape (circle) was considered to keep a constant sub-area (eye surface), and the average ( $^\circ$ C) was computed. The rectal temperature was measured with a digital thermometer, simultaneously with the infrared thermography of the eye. The data of infrared thermography of the eye and rectal temperature were analyzed by Pearson correlation using statistical software R (R Development Core Team, 2010). The data regarding infrared thermography of the eye and rectal temperature were  $35.63 \pm 1.60^\circ$ C and  $38.39 \pm 0.61^\circ$ C, respectively. The infrared thermography of the eye ranged between  $39.30^\circ$ C and  $31.50^\circ$ C, whereas, the rectal temperature ranged between  $40.30^\circ$ C and  $37.20^\circ$ C (maximum and minimum). There was significant correlation ( $P < 0.05$ ) between infrared thermography of eye and rectal temperature (0.53). Therefore, the infrared thermography of the eye could estimate the body temperature of Nellore beef cattle.

**Key Words:** beef cattle, infrared thermography, physiology parameter

**W408 Evaluation of a 3-dimensional camera system to measure feed intake.** A. N. Shelley<sup>1</sup>, D. N. Lau<sup>1</sup>, A. E. Sterrett<sup>\*2</sup>, and J. M. Bewley<sup>2</sup>, <sup>1</sup>University of Kentucky, Department of Electrical and Computer Engineering, Lexington, <sup>2</sup>University of Kentucky, Department of Animal and Food Sciences, Lexington.

Individual dairy cow feed intake measurements are difficult to obtain. Three-dimensional (3D) imaging using cameras over the feed bunk could be connected to individual animal identification tags to provide automated daily feed intake. The objective of this study was to evaluate the potential utility of a 3-D camera system to measure feed intake. Daily feed weights were obtained from an analog scale and a novel 3D scanning system from January 7 to 26, 2013, at the University of Kentucky Coldstream Dairy. Individual feed bins filled with a lactating cow TMR were provided for each tie-stall housed lactating cow. Data from 272 feed bins were collected from the same 7 cows over the study period. Scale weights (SW) were recorded for each bin of fresh feed each day and for orts the day after. Image weights (IW) were obtained from a 3D image of the bin, using a 3D scanning system with structured light illumination. A computer, connected to a projector enclosed in black plastic to prevent ambient light entrance, created white and black striped frequency patterns on the surface of the feed. Based upon the shifts and distortions in the light and dark boundaries of the frequency patterns on the surface of the feed, QT software GmbH (Berlin, Germany) created a 3D textural surface image of the feed. The collected data points were then triangulated and averaged using MATLAB (The MathWorks Inc., Natick, MA) to create an output image value which was then placed in a linearly correlated equation to create an IW value in Excel 2010 (Microsoft, Redmond, WA). All IW and SW were recorded in Excel 2010. The CORR procedure of SAS 9.3 (SAS Institute, Inc., Cary, NC) was used to calculate the Spearman rank correlation between the SW and IW. Image weights were highly correlated with SW with  $R = 0.97$  ( $P < 0.01$ ;  $n = 272$ ). Mean ( $\pm$ SD) weights were  $16.73 \pm 9.53$  and  $17.03 \pm 9.10$  kg for the IW and SW, respectively. Development of this imag-

ing technique represents a breakthrough toward using image analysis to measure feed intake.

**Key Words:** image analysis, feed intake, 3D imaging

**W409 Factors affecting rectal and vaginal temperature in Holstein × Zebu crossbred cows in northeastern Brazil.** A. N. Costa<sup>2</sup>, A. A. Araujo<sup>2</sup>, J. V. Feitosa<sup>2</sup>, P. A. Montezuma Jr.<sup>2</sup>, and K. N. Galvão\*<sup>1</sup>, <sup>1</sup>University of Florida, Gainesville, <sup>2</sup>Universidade Federal do Ceará, Fortaleza, CE, Brazil.

Objectives were to evaluate factors affecting rectal (RT) and vaginal temperature (VT) in the Northeastern region of Brazil. Measurements (n = 2016) of RT and VT were taken at the time of AI from 798 3/4 Holstein × 1/4 Gir and 197 1/2 Holstein × 1/2 Zebu (Gir/Gyr) cows from one dairy from March to December 2011. Apart from information on breed composition, season (dry = Jul-Dec or rainy = Mar-Jun) and the time of day temperatures were measured (morning = 6:00–12:00 h; afternoon = 12:00–18:00 h; night = 18:00–6:00 h) were collected. Data were analyzed using the MIXED procedure of SAS. Cow was included as a random variable. Results are presented as means ± SE. There was high correlation between RT and VT (VT = 1.46 + 0.969 × RT; R-Sq = 92%; P < 0.001); however, VT was higher than RT (38.8 ± 0.01 vs. 38.5 ± 0.01°C; P < 0.001). Breed composition, season, and time of day affected (P < 0.001) RT. Cows with 3/4 Holstein had higher RT than 1/2 Holstein cows (38.6 ± 0.01 vs. 38.4 ± 0.03°C; P < 0.001). RT was higher (P < 0.001) in the afternoon (38.8 ± 0.01°C) than in the morning (38.3 ± 0.03°C) or night (38.3 ± 0.01°C), but only tended (P = 0.1) to be higher in the morning than at night. RT was higher in the rainy season than in the dry season (38.5 ± 0.02 vs. 38.4 ± 0.02°C; P < 0.0001). Breed composition and time of day affected (P < 0.001) VT. Similar to RT, cows with 3/4 Holstein had higher VT than 1/2 Holstein cows (38.8 ± 0.01 vs. 38.6 ± 0.03°C; P < 0.001), and VT was higher (P < 0.001) in the afternoon (39.0 ± 0.01°C) than in the morning (38.6 ± 0.03°C) or night (38.5 ± 0.02°C), but only tended (P = 0.07) to be higher in the morning than at night. In conclusion, 3/4 Holstein crossbred cows are less capable of thermoregulating than 1/2 Holstein cows.

**Key Words:** thermoregulation, crossbred, dairy cow

**W410 Effects of seasonality on rectal temperature and conception rate in crossbred dairy cows.** F. R. Souza<sup>1</sup>, T. H. Silva<sup>1</sup>, B. G. Alves<sup>1</sup>, J. O. Jacomini<sup>1</sup>, L. Z. Oliveira<sup>2</sup>, and R. M. Santos\*<sup>1</sup>, <sup>1</sup>Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brazil, <sup>2</sup>UNIRP - Centro Universitário de Rio Preto, São José do Rio Preto, São Paulo, Brazil.

Heat stress reduces reproductive efficiency in dairy cows due to negative effects on heat detection, oocytes and embryo development. Holstein/Gir crossbred dairy cows are better adapted to hot environments, and thus have less negative effects of heat stress on reproductive performance. The objective of this study was to evaluate effects of seasonality on rectal temperature (RT) and conception rate (CR) in crossbred dairy cows. We analyzed 1219 inseminations of dairy cows from a commercial farm with 480 crossbred Holstein/Gir lactating cows located in the hot climate of Minas Gerais State, Brazil. Cows were maintained on pasture during the rainy season and in loose housing in the dry season and produced 18.75 kg of milk/day. The herd was routinely subjected to a fixed-time AI protocol (TAI) and early pregnancy diagnosis by ultrasound. The rectal temperature was measured at AI by a digital thermometer. The effects of season (autumn/winter vs. spring/summer) and timing of AI (morning vs. afternoon) on RT

were analyzed by ANOVA using the SAS program. The effects of season, time of AI and adjusted RT (RT below vs. above average) on CR were analyzed by logistic regression using the SAS program. The average RT was 39.4°C. The RT and CR were affected (P < 0.01) by season, i.e., in the hot season crossbred dairy cows had higher RT (39.4 ± 0.56 vs. 39.3 ± 0.59°C) and lower CR (25.5 vs. 31.8%). Cows with RT > 39.4°C had lower (P = 0.001) conception rate (25.8 vs. 32.5%) than cows with RT < 39.4°C. The time of AI affected (P < 0.01) RT and CR; cows inseminated in morning had lower RT (38.9 ± 0.49 vs. 39.6 ± 0.50°C) and higher CR (32.9 vs. 26.1%) than cows inseminated in afternoon. In conclusion, crossbred dairy cows also had higher rectal temperature and lower conception rate during the hot season, and insemination should be performed in the morning in TAI programs. Supported by CAPES/CnPQ/PROPP-UFU.

**Key Words:** heat stress, reproduction efficiency, dairy cow

**W411 An evaluation of electrical conductivity as a practical tool in mastitis detection.** C. Meisar, J. Thayer, and K. Koudele\*, Andrews University, Berrien Springs, MI.

The electrical conductivity (EC) of cow milk usually increases before or during a bout of clinical mastitis (CM). Technology to detect the changes in EC has been incorporated into commercial milking equipment to facilitate the early detection of mastitis during the milking process. The objective of this study was to determine if this technology was of practical use to the employees of the 750-head dairy farm at Andrews University. EC data was collected from cows with at least one episode of CM during d 3–305 of their lactation (n = 89). To establish a physiological baseline for each cow, a 10-d rolling EC average of each cow was determined. Any increase in EC > 20% (percentage recommended by the Afimilk system) above the baseline was marked as a “spike.” If a spike was followed within 10 d by an episode of CM then it was a “true alarm.” If not, then it was a “false alarm.” A “false negative” was CM occurring without a preceding spike. A “true negative” was anytime a cow did not have a spike or CM. Bayes’ theorem was applied to the probability of spikes and incidence of CM: P(M|S) = P(S|M)P(M) / P(S|M)P(M) + P(S|NM)P(NM) where P(M|S) is the probability of CM given that there was a spike, P(S|M) is the probability of a spike given that there was CM (true alarms), P(S|NM) is the probability of a spike but no CM (false alarms), P(M) is the probability of a cow having CM as determined by averaging the daily percentage of cows in the herd with CM, and P(NM) is the probability of a cow not having mastitis [1 - P(M)]. A spike correctly predicted CM in 29.615% of cases but was a false alarm for 70.385%. Episodes of CM were correctly predicted by spikes 52.294% of the time while 47.706% of the episodes were unpredicted. Therefore, P(M|S) = 0.1059%. Lowering the sensitivity to changes in EC from 20% to 15% resulted in a 60% increase in true alarms but also a 75% increase in false alarms. It is therefore concluded that the EC change detection technology was not a good enough predictor of CM to be used by the milking parlor employees to catch CM in its early stages.

**Key Words:** electrical conductivity, mastitis, Bayes’ theorem

**W412 Use of infrared thermography in determining the surface temperature of quail eggshell during incubation.** T. C. Santos, P. A. Bustos MacLean\*, A. E. Murakami, J. F. Mello, and C. Souza, State University of Maringa, Maringa, Parana, Brazil.

This study aimed to evaluate the behavior of the eggshell temperature surface of the of European quail (24 weeks) along the incubation by

infrared thermography. The eggshell temperature was assessed in fertile (n = 60) and infertile (n = 25,  $13.26 \pm 0.11$ g) eggs. Fertile eggs were sorted by weight into 3 groups: small ( $12.68 \pm 0.14$ g), medium ( $13.49 \pm 0.14$ g) and large ( $14.31 \pm 0.16$ g). The eggs were incubated in an automatic incubator with fixed relative humidity (60%) and temperature ( $37.6^\circ\text{C}$ ). The temperature of the eggshell was recorded every 24 h for 15 consecutive days with a thermographic camera Fluke Model Ti110. The images were taken 20cm from the lateral surface of the eggs and they were analyzed by the program SmartView 3.2. The temperature was measured at the midpoint of the outer surface of the eggshell. The eggshell temperature of infertile eggs had a quadratic behavior ( $y = 35.075 + 0.0128\text{day} - 0.00003\text{day}^2$ ,  $R^2 = 0.39$ ). This was probably due to weight loss by dehydration of infertile eggs that lost temperature by

evaporation for the incubator environment. These eggs had an average temperature of  $36.11 \pm 0.79^\circ\text{C}$ . In fertile eggs, the temperature of the eggshell differed among weight classes, with increasing linear behavior for small eggs ( $y = 36.567 + 0.00132\text{day}$ ,  $R^2 = 0.39$ ) and medium ( $y = 36.576 + 0.0018\text{day}$ ,  $R^2 = 0.32$ ) and quadratic ( $y = 35.679 + 0.0093\text{day} - 0.000015\text{day}^2$ ,  $R^2 = 0.39$ ) for large eggs. The eggshell's temperature remained below air temperature and, in the last days of incubation there was metabolic caloric heat elevation, which caused a higher eggshell temperature. It is concluded that the temperature of the eggshell in European quails can be measured by infrared thermography and this methodology useful in incubation researches.

**Key Words:** European quail, infrared thermography, incubation