

**1469 Selenium status of beef calves from dams receiving different forms of selenium supplementation.** G. Valle<sup>1</sup>, L. R. McDowell<sup>1</sup>, P. A. Davis\*<sup>1</sup>, D. L. Prichard<sup>2</sup>, P. J. Chenoweth<sup>3</sup>, D. L. Wright<sup>2</sup>, F. G. Martin<sup>4</sup>, W. E. Kunkle<sup>1</sup>, and N. S. Wilkinson<sup>1</sup>, <sup>1</sup>University of Florida, Department of Animal Sciences, Gainesville, <sup>2</sup>UF-IFAS North Florida Research and Education Center, <sup>3</sup>College of Veterinary Medicine, University of Florida, Gainesville, <sup>4</sup>University of Florida, Department of Statistics, Gainesville.

Seventy-five Angus cows (150-240 d gestation) were randomly assigned to five groups and received either no selenium (Se) supplementation (control), 5 ml sodium selenite via subcutaneous injection (Mu-Se, Burns Biotech Labs, Inc. Oakland, CA) every six mo, 9 ml barium selenate via subcutaneous injection (Deposel, Grampian Pharmaceuticals Ltd, Lancashire, UK), and two groups received selenized yeast (Se-Plex, Alltech Biotech, Nicholasville, KY) via ad libitum salt-based mineral mixtures (30 ppm Se) for two yr. Calf plasma Se levels were determined at birth, 60, 120 and 180 d postpartum each yr. During yr 1, calf plasma Se concentrations at birth were at critical concentrations (0.03 mg/L) for the control, Mu-Se, and Deposel treatments. The two free-choice mineral treatments had an average Se concentration of 0.06 mg/L, which is borderline to adequate (0.07 mg/L). At 60, 120 and 180 d, the control, Mu-Se and Deposel treatments were below critical Se concentrations, whereas the averages for the free-choice mineral mixtures were at or above adequacy. During yr 2, control calves were below critical concentrations at all times, while Mu-Se and Deposel treatments were at a critical level at birth and 60 d postpartum and below the critical level thereafter. Calves from the two free-choice mineral treatments were higher in plasma Se ( $P < 0.05$ ) than calves from all other treatments with average concentrations being borderline (0.055 mg/L) at birth and near adequate (0.065 mg/L) for the remainder of the experiment. In general, the control and the two injectable inorganic treatments resulted in calf plasma Se concentrations declining with time and at no time being adequate. Calves on the two free-choice mineral mixture treatments with organic Se had adequate plasma Se during the majority of the study. Neither injectable inorganic Se source was effective for increasing and maintaining calf plasma Se concentrations during this experiment. Calves nursing dams on inorganic Se treatments had plasma Se concentrations that tended to decrease with time. Organic Se treatments were effective in attaining and maintaining near adequate plasma Se concentrations throughout the experiment.

**Key Words:** Beef calves, Selenium, Supplementation methods

**1470 Estimating bone mineral content in dairy cows.** B.E. Keene\*, A.M. Rutledge, S.M. Nickols-Richardson, C. Holtaway, J.M. McKinney, and K.F. Knowlton, Virginia Polytechnic Institute and State University, Blacksburg.

The objectives were to evaluate non-invasive measures of bone mineral content (BMC) and bone mineral density (BMD) in dairy cows, and to evaluate effects of parity and stage of lactation on BMC and BMD using dual energy X-ray absorptiometry (DXA). DXA is an imaging technique used to assess bone strength and to predict osteoporosis fractures in humans. The tail (caudal vertebrae) and right front leg (metacarpal) were excised from 107 Holstein cull cows following slaughter. Parity and days in milk (DIM) of donor animals were obtained for 43 sets of samples. Samples were grouped by parity (1, 2, 3, 4+) and stage of lactation (0-89 DIM; 90-150; 151-250; 251+). BMC and BMD of the fused 3rd and 4th bones of the metacarpal, and of caudal vertebrae 14 and 15 were measured by DXA. In the metacarpal, increasing parity increased BMC linearly, but stage of lactation had no effect. Stage of lactation affected BMC of caudal vertebra 15, with the highest values observed in samples from cows in late lactation (151-250 DIM). Imaging techniques offer opportunity to evaluate factors affecting bone mineral metabolism of dairy cows.

**1472 Effect of greenhouse housing on performance of neonatal dairy calves housed in hutches.** D.R. McKnight\*<sup>1</sup>, P.H. Sharpe, and R.S. Rana, <sup>1</sup>Kemptville College, University of Guelph.

Eight studies with a total of 198 calves were conducted during 2 consecutive years and 4 seasons to evaluate the effects of providing supplemental greenhouse shelter to neonatal dairy calves housed in polyethylene

	Parity				SEM	P <		
	1	2	3	4		Parity	Lin	Quad
Metacarpal								
BMC <sub>UPPER</sub> <sup>1</sup>	9.47	13.06	10.70	14.58	1.77	0.07	0.07	0.92
BMC <sub>MID</sub> <sup>2</sup>	33.41	44.04	37.83	45.49	4.07	0.06	0.07	0.67
BMC <sub>TOTAL</sub> <sup>3</sup>	43.65	60.05	49.59	61.24	5.75	0.04	0.04	0.63
BMD <sub>UPPER</sub> <sup>4</sup>	1.52	1.90	1.65	1.98	0.17	0.10	0.11	0.85
	Stage of lactation <sup>5</sup>				SEM	P <		
	1	2	3	4		Stage	Lin	Quad
Caudal vertebrae								
BMC <sub>V14</sub> <sup>6</sup>	1.44	1.42	2.18	1.37	0.27	0.09	0.58	0.15
BMC <sub>V15</sub> <sup>7</sup>	0.91	0.87	1.65	0.92	0.24	0.05	0.34	0.15
BMC <sub>VTOTAL</sub> <sup>8</sup>	4.96	4.78	7.47	4.84	0.94	0.10	0.49	0.20
BMD <sub>V15</sub> <sup>9</sup>	0.45	0.44	0.51	0.45	0.02	0.10	0.43	0.25

<sup>1</sup>BMC<sub>UPPER</sub> = BMC of upper metacarpal, g; <sup>2</sup>BMC<sub>MID</sub> = BMC of mid-section of metacarpal, g; <sup>3</sup>BMC<sub>TOTAL</sub> = Total BMC of mid- and upper metacarpal, g; <sup>4</sup>BMD<sub>UPPER</sub> = BMD of upper metacarpal, g/cm<sup>2</sup>; <sup>5</sup>Stage of lactation defined by DIM. Stage 1 = 0-89; Stage 2 = 90-150; Stage 3 = 151-250; Stage 4 >250; <sup>6</sup>BMC<sub>V14</sub> = BMC of caudal vertebra 14, g; <sup>7</sup>BMC<sub>V15</sub> = BMC of caudal vertebra 15, g; <sup>8</sup>BMC<sub>VTOTAL</sub> = Total BMC of caudal vertebrae 14 and 15, g; <sup>9</sup>BMD<sub>V15</sub> = BMD of caudal vertebra 15, g/cm<sup>2</sup>

**Key Words:** Bone mineral content, Bone mineral density, DXA

**1471 Organic chromium and selenium effects on immunoglobulins concentration, and carcass composition of finishing lambs.** I. Dominguez-Vara<sup>1</sup>, S. Gonzalez\*<sup>2</sup>, R. Barcena<sup>2</sup>, M. Cobos<sup>2</sup>, and G. Mendoza<sup>2</sup>, <sup>1</sup>Universidad Autónoma del Estado de México, <sup>2</sup>Colegio de Postgraduados.

Fifty four lambs (27.0 kg BW) were fed 95 d and assigned to a completely randomized experiment (2x3 factorial arrangement) using organic Se (0, 0.3 ppm, as Sel-Plex-50) or Cr (0, 0.250, 0.350 ppm, as Biochromium). Sel-Plex-50 (0.0, 3.0 g/lamb/d) and (Biochromium, 0.0, 2.5, 3.5 g/lamb/d) were offered with the morning feeding. Basal diet (%DM) had shorgum 65.0, corn stover 13.0 and DPW 12.0, as main ingredients. Jugular blood samples were taken at the beginning and weeks two, seven and eleven. Plasma metabolites, tryglicerides, cholesterol, glucose and urea-N were analyzed using enzymatic methods, and serum immunoglobulins IgG by ELISA. At the beginning of the experiment four lambs were slaughtered and 30 at the end, to measure carcass composition by specific gravity. Three days before slaughter, backfat depth was measured in vivo on 6th and 10th ribs by ultrasound and in situ with a metallic rule. Means were analyzed by orthogonal contrasts (C): C-1, 0 Se vs 0.3 ppm Se; C-2, 0 Cr 0 Se vs 0.250+0.350 ppm Cr+0 Se; C-3, 0 Cr+0.3 ppm Se vs 0.250+0.350 ppm Cr+0.3 ppm Se; C-4, 0.250 ppm Cr+0 Se vs 0.350 ppm Cr+0.3 ppm Se; C-5, 0.250 ppm Cr+0.3 ppm Se vs 0.350 ppm Cr+0.3 ppm Se. Among weeks there were differences for tryglicerides and cholesterol at 0 h ( $P < 0.0008$  and  $P < 0.0001$ ) and 3 h ( $P < 0.04$  and  $P < 0.0002$ ); for glucose and urea-N concentration at 0 h ( $P < 0.074$  and  $P < 0.021$ ); and for IgG ( $P < 0.0001$ ). Carcass in situ measurements at the 10th rib and in vivo at the 6th rib were significant for C-2 ( $P < 0.01$ ,  $P < 0.07$ ). Body fat was reduced by Cr (C-2,  $P < 0.01$ ; C-4,  $P < 0.02$ ) and total carcass energy was higher for lambs without Cr or Se. Weight of heart, lung, liver and spleen was increased ( $P < 0.04$ ; C-3) by Cr and Se. Addition of organic Cr improved carcass composition of finishing lambs; however, tryglicerides, cholesterol, glucose and urea-N, and immunoglobulins IgG levels were not affected by treatments.

**Key Words:** Organic chromium and selenium, Immunoglobulins and carcass composition, Finishing lambs

## Animal Behavior and Well-Being

**1472 Effect of greenhouse housing on performance of neonatal dairy calves housed in hutches.** D.R. McKnight\*<sup>1</sup>, P.H. Sharpe, and R.S. Rana, <sup>1</sup>Kemptville College, University of Guelph.

Eight studies with a total of 198 calves were conducted during 2 consecutive years and 4 seasons to evaluate the effects of providing supplemental greenhouse shelter to neonatal dairy calves housed in polyethylene

hutches. Purchased Holstein bull calves from 3 to 7 days of age weighing 40 to 45 kg. were randomized by weight to 12 hutches in an open control area or 12 hutches under a greenhouse shelter. The greenhouse shelter had an open ridge vent, removable side curtains and end walls, and a translucent grey cover rated to prevent 60% of sunlight penetration. Side curtains and end walls were removed during summer and fall trials. The

south end wall was always left open. Each seasonal replicate ran for 56 d. Calves were fed 2 L of whole milk twice daily, except during winter trials when it increased to 2.5 L. Weaning occurred after 4 wk on trial when a calf had consumed 750 g calf starter for 3 consecutive d. Water and calf starter were provided ad libitum. Milk, water, calf starter, fecal scores, respiration rates and health treatments were recorded daily. Environmental temperatures and humidity were recorded daily inside and outside selected hutches using maximum-minimum digital recorders. Data were analyzed as a factorial design using SAS procedures. No interaction ( $P>0.05$ ) was detected between housing and season. Greenhouse shelter had no significant ( $P>0.05$ ) effect on performance of neonatal calves. Maximum and minimum temperatures were moderated ( $P<0.05$ ) by greenhouse housing. It is suggested that summer shade of hutches is still desirable from a humane aspect. Evaluation of less costly, more easily sanitized shade options are recommended. There were significant ( $P<0.05$ ) seasonal differences. Calves grew significantly ( $P<0.05$ ) faster in winter and fall than spring and summer trials (.61, .69, .74, .58 kg/d for summer, fall, winter, spring resp.). Alternatives to hutch housing is recommended for newborn calves when environmental temperatures drop below  $-25^{\circ}\text{C}$  for any prolonged period. In conclusion, greenhouse shelter for neonatal calves housed in hutches did not effect performance or health.

**Key Words:** Greenhouse, Hutch, Neonatal dairy calves

**1473 Rearing calves outdoors compared with indoor housing on calf health, immunity, behaviour and performance.** B Earley\*<sup>1</sup>, <sup>1</sup>Teagasc, Grange Research Centre, Dunsany, Co. Meath, Ireland.

The objective of this study was to compare the effects of rearing calves outdoors with and without calf jackets with calves reared indoors on calf health, immunity, behaviour and performance. Ninety male Holstein calves ( $55 \pm 2.0$  kg) were randomly assigned to each of 3 treatments ( $n=30$  per treatment): 1). Outdoor with Jacket (J); 2). Outdoor No Jacket (NJ); or 3). Indoors (I) housed on straw. Calves received an individual allowance of 25 kg of milk replacer during the first 42 d with ad libitum access to a concentrate ration from d 1 to 63. No significant difference among treatments was found in liveweight gain from d 1 to 63 of the study (Jackets; 0.79; No Jackets; 0.80; I; 0.80 mean kg/d). Thirteen percent of the J calves and 13% of the NJ calves required 4 or more antibiotic treatments for respiratory disease while corresponding treatments for the Indoor calves was 60%. The incidences of diarrhoea was significantly higher ( $P < 0.05$ ) in the outdoor treatments, irrespective of calf jackets. Concanavalin-A (Con-A) and Keyhole limpet haemocyanin (KLH) induced interferon- $\gamma$  were significantly reduced ( $P < 0.05$ ) in calves treated for respiratory disease. Calves reared outdoors spent significantly ( $P < 0.05$ ) longer periods standing than calves reared indoors. There was no significant difference in Ig serum levels or white cell counts among treatments on days 1, 7, 14, 21, 28, 42, 49, 56 and 63. It is concluded that rearing calves outdoors using calf jackets had no beneficial effect on calf performance. The incidence of respiratory disease was higher in calves reared indoors compared with calves reared outdoors with and without jackets and cell mediated immune function was lower in calves treated with antibiotics for respiratory disease.

**Key Words:** Immunity, Respiratory disease, Behaviour

**1474 Preference of dairy cows for four commercial free stall mattresses.** J. K. Bernard\*, B. G. Mullinix, J. W. West, and H. Cross, *University of Georgia, Tifton, GA/USA.*

Four commercially available free stall mattresses were used in a 5-mo study to compare cow usage. The mattresses were 1) Pasture Mat, Promat Ltd; 2) Comfy Mat, Sikkema's Equipment; 3) Alanta water bed, Georgia Duck and Cordage; and 4) System 2000, Don Themm Enterprises, Inc. Mattresses were installed in blocks of four in a section of 32 stalls on the north side of a 4-row open sided barn and populated at 75% capacity with Holstein cows. Free stalls were 1.2 m wide and 2.3 m long. Neck rails were set at 1.6 m from the back of the curb and 1.1 m above the free stall floor. Observations were made once daily Monday through Friday of each week from February 14 through June 29, 2001 approximately 2 to 4 h after the AM feeding. The position of cows was recorded as laying, standing or partially in free stalls. Data were analyzed using PROC MIXED procedures of SAS for differences due to mattress and usage (laying, standing, or partially in the stall). The proportion of cows using stalls fitted with the Comfy Mat was highest ( $P < 0.001$ )

and least for the Alanta water bed. The proportion of cows using stalls fitted with Pasture Mat and System 2000 were similar. The proportion of cows laying in stalls (54.1, 30.0, 41.5, and 3.8%), partially standing in the stall (18.2, 16.7, 14.7, and 4.5%) or standing in a stall (6.7, 6.6, 6.4, and 3.5% for Comfy Mat, Pasture Mat, System 2000, and Alanta water bed, respectively) differed ( $P < 0.01$ ) among mattresses. Results of this study indicate that cows differ in their preference to mattress type when allowed a choice.

**Key Words:** Free stall bedding, Mattresses, Cow preference

**1475 Effect of recycling sand and sand retaining devices on bacterial counts in free stalls.** J. K. Bernard\*<sup>1</sup>, D. R. Bray<sup>2</sup>, J. W. West<sup>1</sup>, and D. S. Trammell<sup>1</sup>, <sup>1</sup>University of Georgia, Tifton, GA/USA, <sup>2</sup>University of Florida, Gainesville, FL/USA.

A year long trial was conducted to determine the effect of sand source and sand retaining devices on bacterial concentrations in free stalls. Two sections of free stalls were bedded with either fresh sand from a pit or recycled sand. The recycled sand was collected from a settling basin and stacked outside until reused for bedding. Within each section of stalls, groups of four stalls were fitted with either Pack Mat, Sand Trap, or Sand Mizer plus one control group. Samples of sand were randomly collected from stall surfaces before rebedding each week. Samples of sand used for bedding were collected and amount of sand required to maintain each group of stalls recorded. Weekly samples were analyzed for DM and ash and one set of samples per month were submitted to All Florida Veterinary Laboratory, Inc. (Archer, FL) for analysis of bacterial concentrations. The amount of sand required to maintain free stalls in our study ranged from 12.7 to 18.8 kg/d. The DM of sand used for bedding was similar for fresh (96.7%) and recycled (96.5%) sand, but the OM content was higher ( $P < 0.001$ ) for recycled sand (1.1% of DM) compared with fresh sand (0.6% of DM). There was no difference in DM and OM concentrations among sand retaining devices, but DM ( $P < 0.03$ ) and OM ( $P < 0.01$ ) concentrations in fresh sand collected from free stall surfaces (97.8% and 1.2% of DM) was lower than recycled sand (98.2% and 2.1% of DM). Concentrations of *Bacillus* gram negative, coliform and *Coryne* sp. were higher ( $P < 0.05$ ) in recycled sand used for bedding compared with fresh sand. No differences were observed in bacterial concentrations among sand retaining devices except for *Streptococcus dysgalactiae* which was highest ( $P < 0.01$ ) for stalls fitted with Pack Mat and Sandmizer and lowest for Stand Trap. Concentrations of *Bacillus cereus*, *Bacillus subtilis*, and *Bacillus* gram negative were higher ( $P < 0.05$ ) and *Streptococcus dysgalactiae* in the stalls were lower ( $P < 0.05$ ) for recycled sand compared with fresh sand. Concentrations of coliform were similar for both fresh and recycled sand and sand retaining devices. Results indicate that recycled sand has higher concentrations of certain bacteria.

**Key Words:** Free stall bedding, Sand, Bacteria concentrations

**1476 Circadian activity profiles of loose housed dairy cows.** B.L. Nielsen\*<sup>1,2</sup> and P. Lovendahl<sup>2</sup>, <sup>1</sup>Scottish Agricultural College (SAC), <sup>2</sup>Danish Institute of Agricultural Sciences (DIAS).

In the present study activity levels of loose housed dairy cows were measured in relation to genotype, feeding level and stage of lactation using electronic pedometers. Sixteen cows of either high or low genetic merit were fed one of two total mixed rations (TMRs) with two levels of concentrate inclusion (High: 450 g concentrate DM/kg total DM, 376 g DM/kg fresh, 12.4 MJ ME/kg DM; and Low: 200 g concentrate DM/kg total DM; 314 g DM/kg fresh; 12.2 MJ ME/kg DM) in a two by two factorial experimental design. Electronic pedometers were fitted during six periods of 7 d across the duration of lactation (periods 1 through 6: median 74, 122, 164, 220, 248, and 304 d from calving). During the last period the cows were on pasture. The pedometers logged activity (an estimate of leg movements) in 2-h counts. The circadian activity patterns of the housed cows was similar across lactation with two activity peaks immediately following the morning and afternoon milkings. Cows were significantly more active when on pasture (mean log activity/hour in periods 1-5 vs. 6 (SD): 3.25 (0.07) vs. 4.05 (0.06);  $P<0.001$ ). When housed (periods 1 through 5) the selection line cows in the HC feeding group were more active during the afternoon than the other cows (mean log activity/h from 1200 through 1800 h for HC-sel vs. the others (SD): 3.12 (0.2) vs. 2.55 (0.3);  $P<0.05$ ). These cows also had the highest dry matter intake (HC-sel vs. the others (SD): 19.9 (0.7) vs. 16.2 (1.5) kg/d;  $P<0.01$ ) and highest milk yield (HC-sel vs. the others (SD): 29.8

(2.6) vs. 24.4 (3.3) kg/d;  $P < 0.05$ ). The increased activity of the highest yielding group of cows may reflect increased restlessness in these animals. We conclude that pedometer measured activity of dairy cows is useful in describing changes in the circadian activity profiles related to feed intake or selection for milk yield.

**Key Words:** Circadian Activity, Dairy Cows, Production Level

**1477 Behavioral comparisons of cloned and non-cloned pigs during maintenance, dominance and intelligence testing, and in the peripartum period.** F.C. Gwazdauskas<sup>1</sup>, A.H. Walters<sup>1</sup>, M.L. McGilliard<sup>1</sup>, S.F. Ball<sup>2</sup>, S.S. Flesher<sup>1</sup>, W.F. Nicholson<sup>1</sup>, K.S. Rosoff<sup>1</sup>, L.L. Keyes<sup>1</sup>, M.R. Wheeler<sup>1</sup>, and D.L. Ayares<sup>2</sup>, <sup>1</sup>Virginia Tech, Blacksburg, VA, <sup>2</sup>PPL Therapeutics, Blacksburg, VA.

Genetic manipulation and use of assisted reproductive technologies, including somatic cell nuclear transfer (cloning), have engendered concern of the general public for the welfare of the animals produced with these laboratory procedures. The goal of this study was to evaluate whether there were differences in innate behaviors of cloned and non-cloned pigs. The specific objectives of this project were: 1) to evaluate maintenance behaviors; 2) to determine the establishment of dominance; 3) to assess intelligence; and 4) to evaluate farrowing and mothering abilities of cloned and non-cloned gilts. The cloned pigs were derived from cultured adult somatic cells (granulosa) using nuclear transfer procedures. Maintenance behaviors were recorded at 15-min intervals over a 12-h period. There were no significant differences in the frequencies of lying, standing, feeding, and rooting behaviors between groups (clone vs. non-clone). The analysis of aggressive encounters revealed a significant group by time interaction ( $P < 0.05$ ), with cloned gilts more active in late morning. Short term paired feeding tests used to establish social order and dominance found no significant effects of group on attempts to chase away, fleeing activity, or attempts to eat. However, there was a significant difference ( $P < 0.01$ ) in the amount of time spent eating by each gilt during the dominance testing. Intelligence evaluated using a problem-solving maze with a feed reward found no difference between the groups going through the maze. The ease of farrowing, mothering ability score, and the suckling order were assessed and recorded. Average piglet birth weight was affected ( $P < 0.05$ ) by the number of piglets born, but not by the other independent variables. Farrowing score was not different across groups. Mothering scores were not affected by group, dominance or intelligence scores. In general, the behavior of cloned gilts was not different from that of non-cloned gilts.

**Key Words:** Cloned pig behavior, Dominance, Intelligence

**1478 Cross-sucking before and after weaning by calves fed with a computerized milk feeding system.** A. M. de Passille\* and J. Rushen, *Agriculture and Agri-Food Canada, Lennoxville, QC, Canada.*

There is interest in group rearing of young calves because of reduced labor requirements and animal welfare concerns. However, dairy producers are concerned about the incidence of cross-sucking, which some believe will lead to milk stealing or udder malformation. We examined the behavior of 11 groups of younger calves (4-d to 25-d of age) and 10 groups of older calves (25-d to 50-d of age) fed with a computerized milk replacer feeding system on a commercial farm. The milk feeder had been fitted with a special door to allow each calf to suck without interference from other calves. Calves were allowed a maximum of 4L/d in four portions. Milk was diluted two-fold and milk flow regulated to increase sucking time. Group size ranged from 3 to 16 (median = 8). Calves were videotaped for 2, 24-h periods each wk in each of the two group pens. Calves visited the milk feeder on average 17 times a d. Each video was scanned to search for all cross-sucking events. We calculated the rate of cross-sucking as the number of cross-sucking events/calf-day. We observed a total of 238 cross-sucking events over 2145 calf days. Rates of cross-sucking were 0.08 and 0.09 cross-sucking events/calf-day for the young calves and older calves respectively ( $P > 0.10$ ). Cross-sucking events did not last very long. For the younger calves, a cross-sucking lasted on average 90 s with a range from 21 s to 193 s. For the older calves, the average cross-sucking lasted 77 s (range 19 s to 391 s). We also observed the group reared calves ( $n = 134$ ) after weaning when they were mixed with calves that had been reared individually and bucket fed during the milk feeding period ( $n = 176$ ). Cross-sucking rates were

0.12-events/calf-day for the group-reared calves and 0.15 events/calf-day for individually reared calves ( $P > 0.10$ ). Overall, cross-sucking rates were extremely low. The computerized milk feeder did not cause cross-sucking behaviour to develop during the milk feeding period nor did it lead to an increase in cross-sucking following weaning. However, it is important that the feeder be operated in a way as to allow adequate sucking time for the calves.

**Key Words:** Cross-sucking, Calf feeding, Group housing

**1479 Behavior and meat quality of veal calves provided with drinking water for welfare purpose.** G. Cozzi\*<sup>1</sup>, F. Gottardo<sup>1</sup>, S. Mattiello<sup>2</sup>, E. Canali<sup>2</sup>, S. Segato<sup>1</sup>, and I. Andrighetto<sup>1</sup>, <sup>1</sup>Dipartimento di Scienze Zootecniche, University of Padova, Italy, <sup>2</sup>Istituto di Zootecnica, University of Milan, Italy.

Growth performance, behavior, forestomach development, abomasal lesions and meat quality of veal calves fed a milk replacer diet (No Water) were compared to those obtained from calves fed the same diet and provided with increasing amounts of drinking water (Water) during the fattening period. Two groups of 69 Polish Friesian calves, balanced according to initial BW, were assigned to the two water treatments in a 3 x 2 x 2 factorial arrangement which considered the provision of solid feed and the adoption of two housing systems. Drinking water was offered to the calves starting from the wk 2 of the study and its amount was progressively increased from 3 to 8 L/d per calf. Calves were not dehydrated, as shown by hematocrit, Na, and K concentration, however when drinking water was available they drank it. Therefore, the water provided by the milk replacer (from 6 to 16 L/d per calf) was not sufficient to fully satisfy the needs of the animals. Drinking water did not affect the calves' growth performance but it reduced their abnormal oral behavior throughout the fattening period (9.6 vs 11.6%,  $P < 0.05$ ). Based on these results, it seems that drinking water did not cover a shortage in calves water requirement but it played a role of an environmental enrichment. Health status was similar between treatments (No Water: 1.76%, Water: 1.44%), although water provision reduced the episodes of feed refusal (0.19 vs 0.89%,  $P < 0.05$ ). Chronic stress measurement by cortisol levels showed that the provision of water should be advisable (12.8 vs 22.1 ng/mL,  $P < 0.01$ ). Feces consistency and animal cleanliness were not affected by drinking water. At slaughter, forestomach development was similar between treatments (No Water: 2548 g, Water: 2500 g) and drinking water did not affect the number of calves showing rumen hairballs and abomasal lesions. No differences in color and other meat quality traits were observed between Water and No Water calves. Despite the lack of direct effects on productive traits, when water was available, the calves drank it and an improvement on some welfare indicators were noticed.

**Key Words:** veal-calves, drinking water, animal welfare

**1480 Head coloration is related to Holstein cow temperament.** S. Rose\*, T. Grandin, and W.R. Wailes, *Colorado State University, Fort Collins, Colorado, U.S.A.*

Studies with mice indicate that animals with a yellow coat color are more prone to stress when subjected to the same stress as animals with a wild-type coat color. Mice with a yellow coat color experienced greater weight loss, higher levels of corticosterone, and an increase in norepinephrine turnover when restrained in a tube for thirty minutes. In this study, temperament and the amount of dark pigmentation on the head was evaluated in Holstein cows ( $n = 219$ ). All animals were restrained in a fenceline headlock system for scoring. While standing about one meter from the stanchion, the experimenter stood sideways towards the front of the cow. The experimenter leaned towards the animal's head while maintaining position, then observed and recorded the temperament score. The criteria was 1) Extends head forward ( $f = 20$ ), 2) No reaction ( $f = 16$ ), 3) Pulled away, did not pull against headlock ( $f = 107$ ), and 4) Pulled against headlock when a person moved towards the animal ( $f = 76$ ). After animals were scored for temperament, pigmentation scores were given based on the amount of black and white hair covering their head. Pigmentation scores were 1) >95% black ( $f = 11$ ), 2) >50-95% black ( $f = 134$ ), 3) 50:50 black:white ( $f = 34$ ), 4) >50-95% white ( $f = 35$ ), and 5) >95% white ( $f = 5$ ). SEM temperament scores relating to head color scores were 1) >95% black ( $2.64 \pm 0.08$ ), 2) >50-95% black ( $3.04 \pm 0.06$ ), 3) 50:50 black:white ( $3.06 \pm 0.06$ ), 4) >50-95% white ( $3.34 \pm 0.06$ ), and 5) >95% white ( $3.80 \pm 0.03$ ). Cows with more white head color were more likely to pull back against the

stanchion than cows with more black head color (Pearson correlation,  $r^2 = 0.03$ ,  $P < 0.01$ ). Visual assessment of color may help predict a Holstein dairy cow's temperament in order to identify those animals that have a tendency to be more flighty and may require gentler handling.

**Key Words:** Behavior, Pigment, Dairy

**1481 Effect of the presence of a foraging substrate on the welfare of nutritionally satiated sows.** J.A. de Leeuw<sup>\*1,2</sup>, E.D. Ekkel<sup>2</sup>, A.W. Jongbloed<sup>1</sup>, and M.W.A. Verstegen<sup>2</sup>, <sup>1</sup>ID TNO Animal Nutrition, Lelystad, The Netherlands, <sup>2</sup>Wageningen Institute of Animal Sciences, Wageningen, The Netherlands.

the aim of this study was to test whether, in addition to nutritional satiety, the presence of a foraging substrate can improve the welfare of sows. Therefore, 48 nulliparous sows were used in this experiment, divided over three batches and two rooms. Sows were individually housed in 3 m<sup>2</sup> pens with 1.8 m<sup>2</sup> solid floor. Lights were on from 0600 to 1800h. Sows had either wood-shavings on the floor as foraging substrate (S), or no substrate (NS). They had unrestricted access to feed from a feed-hopper. After 7 wk adaptation to the environment and substrate behavior was scored once per week during 5 wk in the periods 0700 to 0900h (P1), 1000 to 1200h (P2), and 1300 to 1500h (P3). The scan-sampling method was used with 4-min intervals. Data of 5 wk were pooled per animal. Saliva samples were taken in wk 11, every 2 h for 24 h for determination of cortisol levels. In weeks 2, 7, and 12, spontaneously voided morning-urine was sampled and measured for (nor)adrenaline levels. Ratio's with creatinine levels were calculated to correct for dilution of urine. Hormones were only analyzed for eight sows per treatment (only batches 1 and 2). Most effects on behavior were found in P1. S-sows stood more ( $P < 0.01$ ) and showed more (visible) oral behavior ( $P = 0.001$ ), which was mainly more (sham chewing (including chewing on substrate;  $P < 0.05$ ) and floor manipulation (including substrate manipulation;  $P < 0.001$ ). Only the latter effect was also significant in P2 and P3 ( $P = 0.001$ ). NS-sows had higher cortisol levels during the whole 24 h period. At most times differences were significant ( $P < 0.05$ ). Only in week 2 NS-sows had higher adrenaline levels ( $P < 0.05$ ), whereas noradrenaline levels were higher in weeks 2, 7 ( $P = 0.005$ ), and 12 ( $P < 0.05$ ). Both behavior and physiology imply that nutritionally satiated sows appreciate the presence of a foraging substrate. Therefore, their welfare might be improved.

**Key Words:** Sows, Foraging Behavior, Welfare

**1482 Importance of the activity sort level when using pedometry to detect estrus.** O. A. Peralta\*, R. L. Nebel, and R. E. Pearson, *Virginia Polytechnic Institute and State University, Blacksburg, VA/USA.*

A review of the literature reveals that pedometer measurements identify 70 to 80% of the cows in estrus; activity increases approximately 4 h prior to the onset of standing estrus, and the predicted optimal time of AI to be between 6 and 17 h after increased activity. The objective of this study was to determine how activity alarm setting affected pregnancy rate. Four commercial dairy herds (A, B, C, D) recorded activity measurements obtained during the four milking sessions prior to AI. For the milking prior to AI, the increase in activity, relative to a baseline activity determined by the pedometry system, was similar across herds ( $P \geq 0.05$ ), 2.9 for A ( $n = 167$ ), 3.6 for B ( $n = 84$ ), 3.3 for C ( $n = 166$ ), and 3.8 for D ( $n = 308$ ). However, the activity for the second milking prior to AI was related to the timing of AI ( $P \leq 0.05$ ). Herds A and D performed AI once daily and had activity increases of 3.3 and 2.5 above baseline, whereas herds B and C that inseminated cows after each milking had activity increases of 1.3 and 1.5 above baseline. Retrospectively, five activity levels (2 $\times$ , 2.5 $\times$ , 3 $\times$ , 3.5 $\times$ , and 4 $\times$  baseline) were applied to determine the number of cows and pregnancy rate for cows in each activity level. Overall pregnancy rates ranged from 33.1% for herd C to 41.6% for herd D. Pregnancy rates increased from 38.4% when activity increase was twice baseline to 41.9% when the activity was 4 $\times$ , the baseline. Requiring that a cow exhibit a four fold increase in activity decreased the number that would have been inseminated by 58% when compared to cows that qualified at twice the baseline activity. More importantly the number of pregnant cows decreased from 212 when using a two fold increase in activity to 98 when a four fold increase was required for insemination. The software interface of commercially available pedometer systems has improved significantly in the last few years

and thus enhances pedometry as a viable alternative for the detection of estrus.

**Key Words:** Dairy cows, Pedometry, Detection of estrus

**1483 Reproductive performance of guinea pigs subjected to 10, 12, and 14 hour continuous and intermittent photoperiods.** N.P. Johnston<sup>\*1</sup> and M.E. Uzcategui<sup>2</sup>, <sup>1</sup>Brigham Young University, <sup>2</sup>University of San Francisco-Quito, Ecuador.

The effect of 10-, 12, and 14 h continuous and intermittent photoperiods was observed for 10 months on the reproductive performance and growth of guinea pigs. Sixty, two-month old virgin female guinea pigs were equally divided into 6 identical, environmentally controlled rooms under the following photoperiods: 14L:10D, 12L:12D, 10L:14D, 1L:5.5D:1L:5.5D:1L:10D, 1L:4.5D:1L:4.5D:1L:12D, and 1L:3.5D:1L:3.5D:1L:14D. These photoperiods simulated continuous and intermittent subjective days of 14, 12 and 10h respectively. There were no differences between continuous and intermittent lighting for number of litters for 10 months (3.0 v.2.7), litter size at birth (4.18 v. 3.50 kits) and at weaning (2.85 v. 2.84 kits) and parturition interval (71.2 v. 72.8 d between litters). Prewaning mortality was higher ( $P < .05$ ) under continuous lighting. Sows appeared less active under intermittent light which may have contributed to lower early mortality. Continuous and intermittent light had similar effects for postnatal kit daily gain (3.7 v. 3.8 g), feed consumption (83.5 v. 79.2g) and feed to gain. It was concluded that guinea pigs were not photosensitive and daily photoperiods as short as 10 hours would support normal reproductive performance and kit growth.

**Key Words:** guinea pig, photoperiod, reproduction

**1484 Feed consumption pattern of young pigs.** S. Salgado<sup>2</sup>, H. Herrera<sup>\*1</sup>, and A.G. Borbolla<sup>1</sup>, <sup>1</sup>Universidad Nacional Autonoma de Mexico, <sup>2</sup>Universidad Autonoma Metropolitana.

Feed intake immediately after weaning is a critical factor that strongly influences future production under intensive production systems. Information on consumption patterns can be used as a way to optimize the labor force and/or the feeding management. The objective of this study was therefore, to evaluate the feed intake pattern of young pigs. One hundred and fifty pigs weaned at 19 d of age were transported to a specialized facility located at 5 km from the sow unit. Pigs were randomly allocated to ten pens of 15 animals each. Distribution of the pigs into pens was following the rules of a randomized complete block design with weight as the blocking factor. Average weaning weight was 5.8 0.8 kg. Feed was provided ad libitum during day and night but changed every eight hours following the next schedule: 8 to 16, 16 to 24, 24 to 8 h, for the whole experimental period (28 d). Self-feeders of 25 Kg of capacity and four holes were used. After each period of 8 h, the remaining feed was weighed and subtracted from the amount previously added. Dry non-consumed feed recollected from each period was cleaned and reintroduced into the next period (to avoid the freshness factor). Data were analyzed using the GLM procedures of SAS using pens as the experimental unit. Feed intake during the first wk, between 8 to 16 h (8 h) period, was 45 and 26% greater ( $P < 0.0001$ ) than the consumption registered at 16 to 24 hrs (16 h) and 24 to 8 h (24 h) periods (39.9 vs. 21.9 and 29.5 g, respectively). Second week consumption at 8 h period was similarly superior ( $P < 0.0001$ ), than registered at 16 h and 24 h periods (135 vs. 110 and 105 g, respectively). Similar consumption pattern was observed during the third experimental week were 8 h and 16 h periods were greater ( $P < 0.0001$ ) in feed intake when compare to the 24 h periods (228 and 222 vs. 196 g). Contrarily, during the four wk, feed intake during the 16 h period was slightly larger than at 8 h period (276.6 vs. 267.8 g, respectively), however, both periods were considerably better than the 24 h period (222.9 g). The present study suggest that feed intake in young pigs is larger between 0800 to 1600 h; therefore, strategies to stimulate this trait and the labor involved would be more successful around this time.

**Key Words:** Young Pigs, Feeding Management

**1485 Defining feeding bouts for lactating dairy cows housed in a free stall barn.** M.A.G. von Keyserlingk<sup>1</sup>, L.G. Baird<sup>1</sup>, D.M. Weary<sup>1</sup>, and K.A. Beauchemin<sup>2</sup>, <sup>1</sup>The University of British Columbia, Vancouver, Canada, <sup>2</sup>Agriculture and Agri-Food Canada, Lethbridge Research Centre, Canada.

Feeding behavior has a significant impact on dairy cow productivity and health. Animals typically divide feeding time into a series of bouts or 'meals'. Any work involving feeding behavior must be based on the clear understanding of how these meals are defined. One way of doing this is to measure the interval between feeding events. Some of these intervals are very short, typical of breaks within a meal, and others are much longer, characteristic of separate meals. By plotting the frequency distribution of these intervals (typically log transformed), discontinuities in the distribution can be readily assessed and used to objectively define intervals between meals. The objective of this study was to apply this method of feeding bout analysis to lactating dairy cows housed under normal free stall conditions, with unrestricted access to the feed bunk. Twenty-two cows were monitored continuously for 10 d. Cows wore transponders that allowed us to automatically monitor bunk attendance at 6 s intervals. The intervals between records were log-transformed and the resulting frequencies of each interval length were plotted. These frequency distributions were bi-modal, with the first peak showing intervals within meals and the second showing intervals between meals. The meal interval was defined as the low point in the trough separating these distributions. Based on this definition, intervals greater than  $1660 \pm 373$  s (mean  $\pm$  S.D.) or  $27.7 \pm 6.22$  min away from the feed bunk were characterized as a new meal. According to this criteria, cows consumed  $7.40 \pm 0.94$  meals per day. Objective definitions of meal durations may lead to improved consistency in the published literature, and provide more sensitive measures of responses to treatments that affect feeding behavior.

**Key Words:** feeding bout criterion, feeding frequency, feeding behaviour

**1486 Neuroma formation following tail docking of dairy calves.** C. A. Lunam<sup>1</sup>, A. M. de Passille<sup>2</sup>, and J. Rushen\*, <sup>1</sup>Flinders University, Adelaide, SA, Australia, <sup>2</sup>Agriculture and Agri-Food Canada, Lennoxville, QC, Canada.

Tail docking is common in the dairy industry but there is concern about the effect on the welfare of the cattle. The procedure appears to cause little acute pain but less is known about chronic pain that may result. In other species, tail docking results in the formation of neuromata, which have been associated with altered sensitivity and spontaneous neural discharges resulting in chronic pain. We examined tail stumps of tail-docked calves to determine if neuromata develop after docking. At 5 months of age, we removed the tails from slaughtered male calves that had been docked at 11d of age (range 7 to 17d) either with a hot docking iron (n=5), or with a rubber ring (n=5) and the entire tails of undocked male calves (n=6). All tails were fixed in buffered formalin, and frozen sections stained by silver impregnation for histopathology. Neuromata were identified by large tangled masses of nerve fibres within the dermis. Less extensive neuromata were also observed close to the skeletal muscle bundles. Neuromata were found in the most distal 2 cm segment of all tail stumps of docked calves but neuromata were not present in the intact non-docked tails ( $P < .05$ ). No differences were observed between the two methods of docking ( $P > .10$ ). In contrast to the disarray of the nerves observed in the neuromata of docked tails, all peripheral nerves observed in intact tails were organized in nerve bundles surrounded by intact perineurium. Each nerve bundle consisted of several fascicles, consisting of many myelinated axons. Peripheral nerves were aligned parallel to one another throughout the length of the intact tails, suggesting that removal of the tail at any region along its length could lead to neuromata that persist for several months after docking. The presence of neuromata 5 months after docking suggests that this practice may lead to chronic pain or altered sensitivity of the nerves in the tails, raising concern about the well-being of docked cattle.

**Key Words:** Tail docking, Pain, Neuroma

**1487 Comparison of analgesia methods for removing velvet antler in elk.** N.J. Cook<sup>\*1</sup>, J.R. Webster<sup>2</sup>, J. Church<sup>3</sup>, L.R. Matthews<sup>2</sup>, T. Church<sup>4</sup>, and A.L. Schaefer<sup>1</sup>, <sup>1</sup>Agriculture and Agri-Food Canada, Lacombe, AB, <sup>2</sup>AgResearch, Hamilton, New Zealand, <sup>3</sup>Agriculture Food and Rural Development, Red Deer, AB, <sup>4</sup>Canadian Rocky Mountain Ranch, Calgary, AB.

The present study compared three methods of providing analgesia to elk during velvet antler removal. The animals were gathered into a conventional holding facility, restrained and had one of three analgesic treatments applied prior to antler removal. The lidocaine treatment (L, n=8) consisted of a ring block procedure using 1.25 ml of buffered, neat lidocaine per cm pedicle circumference followed by a 4 min wait pre-antler removal. The compression treatment (C, n=32) consisted of applying a latex band around the base of a pedicle at high tension followed by a 4 min wait (AgResearch devise). For animals in an electrical analgesia treatment (EA, n=10) a direct pedicle placement of a trans-cutaneous nerve stimulation (TENS) device was applied and a 9 v alternating current applied for 45 s as per standard industry practice. Analgesia efficacy was assessed by measuring behavioural responses to saw cuts to the antler after the respective times. Also, infrared temperatures of the orbital region and beta endorphin from venous samples collected prior to, during and after antler removal were measured. Behavioural responses were ranked on a scale from 0 (no response) to 4 (struggle) and scores of 2 or above indicated aversiveness. Animals in EA displayed higher scores ( $P < 0.01$ ) than L or C. Maximum infrared temperatures recorded after antler removal were higher in EA ( $41.24^\circ$  C) than either L ( $40.22^\circ$ ) or C ( $39.73^\circ$ ). With respect to beta endorphin, highest levels were found once again in EA (210.3 pg per mL) compared to either L (192.2) or C (196.7). Taken together, these data consistently suggest that EA, as used, was less effective at providing analgesia for velvet removal than either lidocaine or compression.

**Key Words:** Elk, Antler, Analgesia

**1488 Influence of tail docking and tooth resection on behaviour and performance of piglets.** M.C. Meunier-Salaun<sup>\*1</sup>, G. Bataille<sup>2</sup>, Y. Rugraff<sup>2</sup>, and A. Prunier<sup>1</sup>, <sup>1</sup>INRA-UMRVP Saint-Gilles/ France, <sup>2</sup>ITP Le Rheu / France.

Tail docking and tooth resection and performed in pig herds in order to reduce the consequences of biting are criticized since their efficiency is controversial and they are supposed to be painful. Two experiments were carried out on their short term consequences on behaviour and growth performance. The first one was performed on 160 piglets allotted to 5 treatments applied the day after birth: tail docking, tail docking and a cold analgesic spray, control handling, control handling and spray, no handling. Tail was docked with an iron docking (cautery). During treatment, tail docking caused more movements (legs and/or body, + 13%) and howls ( $P < 0.05$ ). During the following 20 s, docked piglets demonstrated more tail jamming and wagging (+ 60%;  $P < 0.05$ ). Both types of docking consequences were attenuated with the use of the cold spray. During the following 12 h, treatment had no effect on the resting time and activity at the sow udder. Growth rate during the first wk of life and the occurrence of injuries at the tail were also not affected ( $P > 0.1$ ). The second experiment was realized on 128 piglets allotted to 4 treatments applied the day after birth: tooth resection with a grinding or with cutting pliers, simulated grinding, no handling. The percentage of piglets with leg movements was higher during grinding of teeth (94% vs 75%,  $P < 0.05$ ). Piglets submitted to tooth resection (grinding and clipping) demonstrated more chewing behaviours over the 20-s period following treatment (65% vs 38%,  $P < 0.05$ ). During the following 12 h, time spent by the piglets resting or being active at the sow udder was similar in the 4 groups. At 7 d of age, lip lesions were more numerous for the resected piglets (48% vs 18%,  $P < 0.05$ ) and clipped piglets were lighter than control ones (- 300 g,  $P < 0.05$ ). In conclusion, tail docking and tooth resection causes probably pain of moderate amplitude in short term. However, tooth clipping with pliers had a detrimental influence on piglet skin integrity and the growth rate during the first week of life

**Key Words:** Piglets, Tail docking, Tooth resection

**1489 Behavior of primi- and multiparous lactating dairy cattle in commingled groups.** W.C. Matzke\* and R.J. Grant, *University of Nebraska*.

The objective of this study was to collect baseline behavioral data on primiparous and multiparous lactating dairy cattle in commingled groups housed in a free stall facility. Cows were observed in two operations; two 24-h observations were performed on a commingled group (every 20 min). Dairy A had a 6-row free stall design (3 rows per group); Dairy B had a 4-row free stall design (2 rows per group). Dairy A, observation A1 was a 48-h behavioral observation during hot weather (45% primiparous). Observation A2 was a 48-h behavioral observation during thermoneutral weather (50% primiparous). Dairy B, observation B1 was a 72-h behavioral observation during hot weather (28% primiparous). Observation B2 was a 48-h observation during thermoneutral weather (31% primiparous). Data were recorded for 7 categories of behavior and location within the pen. Dairy A results showed that 1) more heifers than cows were standing at the manger ( $P < 0.05$ ), 2) more heifers than cows were observed to be eating ( $P < 0.05$ ), 3) there was no difference in numbers resting, 4) there was no difference in numbers resting and ruminating, 5) heifers spent more time in crossovers and alleys than did cows ( $P < 0.10$ ), and 6) there was no difference in the number of heifers and cows drinking water. Cows locked in headlocks consumed feed for approximately 1 h, and during the next h, 30-40% gradually began to ruminate. Dairy B results showed that 1) more heifers than cows were standing at the manger ( $P < 0.07$ ), 2) there was no difference in the number of heifers and cows eating, 3) cows spent more time resting in Observation B1 than did heifers ( $P < 0.05$ ) but there was no difference in observation B2, 4) there was no difference in numbers resting and ruminating, 5) there was no difference in numbers in crossovers and alleys, and 6) there was no difference in numbers drinking water. Reducing pen size to match parlor capacity increased resting time from 36 to 49%. There are behavioral differences between cows and heifers in commingled groups, but analysis within a day will be necessary to effectively describe them.

**Key Words:** Dairy cattle behavior, Primiparous, Multiparous

**1490 Effect of sprinkling cattle on behavior and incidence of zoonotic pathogens.** J.L. Morrow\*<sup>1</sup>, T. Callaway<sup>2</sup>, F.M. Mitloehner<sup>3</sup>, M.L. Galyean<sup>4</sup>, J.W. Dailey<sup>1</sup>, T. Edrington<sup>2</sup>, R. Anderson<sup>2</sup>, and D. Nisbet<sup>2</sup>, <sup>1</sup>USDA-ARS Livestock Issues Research Unit, Lubbock TX, <sup>2</sup>USDA-ARS Food and Feed Safety Research Unit, College Station TX, <sup>3</sup>Dept. Animal Science, University of California, Davis CA, <sup>4</sup>Dept. Animal Science, Texas Tech University, Lubbock, TX.

Eight pens of finishing cattle were used to determine whether cooling cattle with sprinklers altered their behavior or the presence of *Salmonella* and *E. coli* in their feces or on their hides. Heat stress is a common challenge for fed cattle in the Texas panhandle during summer. The study was conducted between June and September when average ambient temperatures for Lubbock, TX are between 12 and 35 C. Typical methods of cooling cattle include provision of shade and/or water. The effect of cooling cattle with water has not been studied with respect to the incidence of zoonotic pathogens. Four pens of heifers ( $n = 41$ ) were cooled using sprinklers and four pens ( $n = 43$ ) served as controls. Sprinkling was initiated when cattle were on full feed (July). Cattle were weighed every 56 d, and blood samples, fecal samples, and hide swipes were collected. Respiration rates were collected weekly. Cattle behavior was observed using a 10-min scan sampling technique for a 24-h period during one warm period. Behavior and production data were analyzed as a completely randomized design. Body weights and ADG did not differ between treatments ( $P > 0.1$ ). Respiration rates tended ( $P = 0.053$ ) to differ between treatments across the study. Several behaviors had significant time of day x treatment interactions, including drinking, lying and standing ( $P < 0.05$ ). Chi square analysis of pathogen data (number of positive animals per treatment) did not identify differences between treatments for *Salmonella* and *E. coli* 0157:H7 in feces or on hides. The most prevalent serovars of *Salmonella* were Muenster, Kentucky and Melagridis. Sprinkling cattle to cool them during heat stress had no effect on performance measures or on presence of *Salmonella* or *E. coli* 0157: H7. Changes in behavior and respiration rates were indicative of heat stress but the level of stress experienced by these cattle was not associated with increased prevalence of zoonotic pathogens.

**Key Words:** cattle, stress, pathogens

**1491 Evaluation of compression analgesia for velvet removal in red deer.** L.R. Matthews, K.J. Bremner, A.J.T. Pearse, C.J. Morrow, and J.R. Webster\*, *AgResearch, Hamilton, New Zealand*.

A series of experiments evaluated a new analgesia method for velvet removal from restrained deer, which uses compression (C) to produce a rapid nerve block. C consisted of a latex band, tightened around the pedicle to a consistent pressure, using a custom-made tool. Initially, the time for analgesia to develop after band application, was tested by measuring behavioural responses to electrical stimulation of the antler every 30s, beginning after 90s. Responses were scored on a scale from 0 (none) to 4 (struggle) and scores of 2+ grouped as aversive. The time until a score of 0 was reached was recorded for 27 stags. All were analgesic by 4 minutes, which was thereafter used as the time from application until cutting. In further experiments, C was compared to analgesia with lidocaine (L). L consisted of 2% lidocaine hydrochloride, applied at a dose of  $>1\text{mL/cm}$  pedicle circumference in a ring around the pedicle, also followed by a 4 min wait until cutting. Behavioural responses to application of C (29 antlers) or L (28 antlers) did not differ ( $P > 0.05$ ), with around 10% showing an aversive response. Analgesia was tested at cutting time from behavioural responses to light saw cuts to the base of the antler, termed a nick test, which was followed by cutting if there was no aversive response. There were no differences ( $P > 0.05$ ) between C (67 antlers) and L (54 antlers) in responses to nick tests (no aversive responses) or cutting (1% and 2% aversive, respectively). A further experiment ( $n=16$  per group) assessed stress and immune responses following velvet removal by measuring faecal glucocorticoid metabolites (FC) and haematological values (HV) from samples taken prior to and up to 7 day after cutting. Two additional treatments were included, restraint only (R) and L followed by C (LC). FC increased by around 40% following velvet removal but did not differ ( $P > 0.05$ ) between treatments. There was no evidence of immune suppression in HV in any treatment. In summary, these experiments suggest that C can be used to successfully provide analgesia for velvet removal in red deer.

**Key Words:** Deer, Antler, Analgesia

**1492 The effect of transport and preconditioning on radiated temperature in calves.** A.L. Schaefer\*<sup>1</sup>, N.J. Cook<sup>1</sup>, J.S. Church<sup>2</sup>, K.S. Schwartzkopf-Genswein<sup>3</sup>, M.E. Booth<sup>4</sup>, G.J. Mears<sup>4</sup>, and T.A. McAllister, <sup>1</sup>Agriculture and Agri-Food Canada, Lacombe, AB, <sup>2</sup>Agriculture Food and Rural Development, Red Deer, AB, <sup>3</sup>Agriculture Food and Rural Development, Lethbridge, AB, <sup>4</sup>Agriculture and Agri-Food Canada, Lethbridge, AB.

Transport and handling conditions to which calves are exposed during marketing are known stressors and can predispose the animals to energy loss, poor growth and disease. The purpose of the present study was to measure the impact of these conditions on thermal characteristics and to examine whether a pre-conditioning program enabled the calves to better tolerate the transport stressors. Eighty eight healthy, pasture raised Charolais and Angus steer calves, weighing between 180 and 225 kg were used in the study. All male calves had been castrated within two weeks of birth. Animals allocated to the pre-conditioning program (PC,  $n=44$ ) were weaned 14 days pre-transport and were vaccinated and treated for parasites 30 days pre-transport. Non- preconditioned calves (NPC,  $n=44$ ) received no treatments and were weaned the day of transport. All calves were transported on commercial carriers for 964 km (15h) followed by unloading and a 1 h rest before reassessment. Infrared thermal scans (IRT) of the orbital region were collected with an Inframetrics 740 camera pre-loading and again approximately 1 h following off loading. Orbital IRT values are measures of an animals energy sufficiency and ACTH driven events. The average pre-transport IRT orbital max value for all calves was 39.70 (1.15 SD) which dropped significantly ( $P < 0.01$ ) to 38.75 (0.65) post transport. This reduction was apparent in both NPC calves (38.87 (0.86) pre vs 38.63 (0.66) post;  $P=0.15$ ) and in the PC calves (40.56 (0.69) pre vs 38.88 (0.62) post;  $P < 0.01$ ). The difference in IRT change was greatest in the PC animals seemingly due to the higher initial temperature in PC (40.56) compared to NPC calves (38.87;  $P < 0.01$ ). The higher initial orbital max IRT measurements in the PC animals was likely due to a stress response to recapture and rehandling pre-transport.

**Key Words:** preconditioning, calves, infrared

**1493 Sole lesions in dairy cattle.** E. Bell and D. Weary\*,  
*University of British Columbia, Vancouver, BC, Canada.*

One of the principal causes of lameness in cattle is sole lesions on the hoof. Our aim was to describe the prevalence of sole lesions in dairy cattle from the Fraser Valley of British Columbia, and determine farm management and environmental factors that are most associated with sole lesions in this area. We recorded the number, severity and location of lesions in the claws of 624 Holstein cows from 20 herds during hoof trimming. Lesions were found in cows from all herds. The mean (SD) herd prevalence of cows with at least one lesion was 85.7 (13.8)%. The mean (SD) herd prevalence of cows with at least one severe lesion (severe haemorrhage or ulcer) was 34.9 (15.1)%. Within the cow, we found differences in the number of lesions observed on different claws, with the hind lateral claws containing the most lesions ( $P < 0.0001$ ). Overall, the hind lateral claws contained 54.9% of the lesions followed by the front medial (17.7%), the hind medial (16.4%) and the front lateral (10.9%). We found a very similar pattern when considering only the most severe lesions. Focusing on the distribution of lesions within the claws, zones differed in the total number of lesions. Of the 2116 lesions observed, 47.1% were located in Zone 4, 26.8% in Zone 3, 14.2% in Zone 5, 7.9% in Zone 2, and 4.0% in Zone 1. Once again, we found a very similar pattern of results for the most severe lesions. Primiparous cows were at greater risk for sole lesions at the beginning of their lactation ( $P < 0.001$ ) while multiparous cows were more likely to have visible lesions in mid- to late-lactation ( $P < 0.01$ ). Overall, cows with higher body condition scores were less likely to have sole lesions than those with lower scores ( $P < 0.001$ ). Cows were more likely to have lesions on farms with high steps ( $P < 0.01$ ), computer grain feeders ( $P < 0.01$ ), automatic alley scrapers ( $P < 0.01$ ), and flooring imperfections ( $P < 0.05$ ). In conclusion, sole lesions affect the majority of dairy cows in the Fraser Valley. The risk of lesions is related to stage of lactation, individual cow factors, and farm characteristics.

**Key Words:** Dairy cattle, Lesion, Lameness

**1494 Preferences of pigs for floor types according to ambient temperature.** E. Ducreux<sup>1</sup>, V. Courboulay<sup>2</sup>, and M.C. Meunier-Salaun\*<sup>1</sup>, <sup>1</sup>I.N.R.A. Joint Research Unit for Calf and Pig production Saint-Gilles/ France, <sup>2</sup>I.T.P. Pig Technical Institute, Le Rheu /France.

The environmental enrichment of housing through flooring is a way to improve the well-being of pigs. The objective of the study was to determine the preference of groups of six growing pigs (70 kg) for three types of floor (Deep-Litter: L, concrete: C and slatted: S) offered as free choice within the same pen. In each flooring type the space allowance was similar (0.78 m<sup>2</sup>/pig) and a feeder was supplied. Sixteen groups were penned in two experimental rooms where the ambient temperature was at a low level (18°C, n = 8 groups) or at a high level (27°C; n = 8 groups). Each group was videotaped during a 24-h period and the behavioral activities were recorded by 10-min scan sampling. The data analysis was focused on the nature, the localisation and the context of the behavioural activities. Major activities within a 24-h period were resting (70% of total time,  $P < 0.05$ ) and investigation (20%,  $P < 0.05$ ) whatever the ambient temperature. The pigs preferred the litter flooring during time spent investigating ( $P < 0.05$ ) at both temperature levels (62% of total time of investigation). Pigs exposed at 18°C spent more time lying on litter (71% of resting time vs 12% at 27°C,  $P < 0.05$ ) whereas they lied down on concrete or slatted floor when exposed at 27°C (44% vs 15% at 18°C,  $P < 0.05$ ). Pigs adopted, more frequently, a ventral posture and contact with congeners at low temperature level compared to pigs lying down on their sides without physical contact when exposed to warm conditions (66% of resting time vs 34% in "recumbent",  $P < 0.05$ ; 55% vs 44% in "ventral",  $P < 0.05$ ). Pigs used separate areas for resting and dunging activities ( $P < 0.05$ ). These results illustrate that temperature may influence the floor preference of pigs. They point out various preference degrees related to the behavioral activity such as strong use of litter for investigation. Recommendations for housing conditions should therefore consider behavioural needs and thermal context related to season and geographic location.

**Key Words:** Pig, Floor type, Temperature

## Animal Health Mastitis

**1495 The effects of pre-milking procedures on hygienic quality of milk.** R. Skrzypek\* and J. Wojtowski, *Agricultural University, Poznan, Poland.*

The study was carried out over 1999-2000 in 120 dairy herds. The average number of cows in the herd was 47, and ranged from 4 to 244. In the period of observations, the following pre-milking procedures were recorded: fore-stripping (Yes, with tester vs. Yes, without tester), practicing fore-stripping as the first routine before milking (Yes vs. No), and method of udder and teat cleaning before milking (method 1 - wet paper towel with a disinfectant; method 2 - washing with water containing a disinfectant, drying with a cotton towel; method 3 - dry paper towel; method 4 - washing with clean water, drying with a cotton towel). For the statistical analysis, data on somatic cells count (SCC) and total microorganisms count (TMC) were also used. Both variables were determined in bulk tank milk fortnightly. Before calculations, the raw data on SCC and TMC were transformed with the natural logarithm. The method of fore-stripping affected the SCC only: a lower SCC was found in herds practicing fore-stripping with a tester (12.27 vs. 12.45;  $P \leq 0.01$ ), and in herds in which fore-stripping was not the first routine before milking (12.28 vs. 12.44;  $P \leq 0.01$ ). Out of the methods of udder and teat cleaning before milking, method 2 was most effective in decreasing the SCC (12.25 vs. 12.35-12.44 for other methods;  $P \leq 0.01$ ), whereas method 3 was most effective in decreasing the TMC (10.93 vs. 11.27-11.34 for other methods;  $P \leq 0.01$ ).

**Key Words:** Pre-milking procedures, Milk, Hygienic quality

**1496 Impact of lactoferrin or lactoferricin with or without penicillin G on the morphology and ultrastructure of *Staphylococcus aureus*.** M.S. Diarra\*<sup>1</sup>, P. Lacasse<sup>1</sup>, G. Grondin<sup>2</sup>, C. Paradis-Bleau<sup>1</sup>, and D. Petitclerc<sup>1</sup>, <sup>1</sup>AAFC-Dairy and Swine Research and Development Centre, Lennoxville, Quebec, Canada, <sup>2</sup>Sherbrooke University, Sherbrooke, Quebec, Canada.

In a previous study, we found a synergism between lactoferrin or lactoferricin and penicillin G against *S. aureus* (Diarra et al., J. Dairy Sci., in press). To investigate the mechanism of action of lactoferrin or lactoferricin with or without penicillin G, transmission electron microscopy was performed on thin sections of two penicillin-resistant *S. aureus* strains: a clinical bovine mastitis *S. aureus* strain SHY97-4320 and a reference strain PC-1. Lactoferrin affected the ultrastructure of both *S. aureus* strains and groups of multiple cells were observed after lactoferrin treatment with or without penicillin G. These results suggest that lactoferrin can affect staphylococcal cell separation. After treatment with lactoferrin, cells from *S. aureus* SHY97-4320 were less covered ( $P < 0.05$ ) with WGA-gold thus suggesting that lactoferrin affected binding to N-acetyl- $\beta$ -D-glucosamine and/or the synthesis of peptidoglycan. Lactoferricin with or without penicillin G induced the lysis of many bacteria. Lactoferricin also induced formation of merosomal structures. Our data indicate that lactoferrin can affect *S. aureus* cell separation thus preventing dissemination of daughter cells from spreading infection and increasing susceptibility to phagocytes. Furthermore, lactoferrin can induce a weakening of the cell wall that could enhance *S. aureus* killing by penicillin G.

**Key Words:** lactoferrin, *Staphylococcus aureus*, morphology