Graduate Student Competition: ADSA Production Division Poster Competition, MS Division

M102   Meta-analysis: Impact of corn silage harvest practices on intake, digestion, and milk production by dairy cows. L. F. Ferraretto* and R. D. Shaver, *University of Wisconsin-Madison, Madison.*

A meta-analysis was performed to determine effects of DM content, kernel processing (PROC), and theoretical length of cut (LOC) of whole-plant corn silage (WPCS) on intake, digestion, and lactation performance by dairy cows using a data set composed of 106 treatment means from 24 peer-reviewed journal articles published from 2000 to 2011. Categories for DM content at silo removal and PROC and LOC at harvest were: ≤28% (VLDM), >28% to 32% (LDM), >32% to 36% (MDM), >36% to 40% (HDM), and >40% (VHDM) DM; 1 to 3 or 4 to 8 mm roll clearance or unprocessed; 0.48 to 0.64, 0.93 to 1.11, 1.27 to 1.59, 1.90 to 1.95, 2.54 to 2.86, and ≥3.20 cm LOC. Data were analyzed using Proc Mixed in SAS with WPCS treatments as fixed effects and trial as a random effect. Milk yield was decreased ($P = 0.01$) by 2 kg/d per cow for VHDM. Fat-corrected milk yield decreased ($P = 0.01$) as DM content increased. Total-tract digestibility of dietary starch (TTSD) was reduced ($P = 0.03$) for VHDM compared with HDM and LDM. Processing (1 to 3 mm) increased ($P = 0.001$) TTSD compared with 4 to 8 mm PROC and unprocessed WPCS. Milk yield tended ($P = 0.10$) to be 1.8 kg/cow/d greater, on average, for PROC (1 to 3 mm) and unprocessed WPCS than 4 to 8 mm PROC. An observed interaction ($P = 0.01$) between DM content and kernel processing for TTSD revealed that the mechanical processing of WPCS increased ($P = 0.01$) TTSD for diets containing 32% to 40% DM WPCS but not ($P > 0.10$) VHDM. The LOC of WPCS had minimal effect on any of the parameters evaluated. However, an observed interaction ($P = 0.01$) between LOC and kernel processing for TTSD revealed that kernel processing increased diet TTSD when LOC was 0.93 to 2.86 cm ($P = 0.01$), but not ($P = 0.01$) when ≥3.20 cm LOC. Starch digestibility and lactation performance were reduced for dairy cows fed diets containing WPCS with > 40% DM or WPCS with insufficient kernel processing. Furthermore, kernel processing WPCS to improve starch digestibility is effective across a wide range of DM contents and LOC, but does not overcome adverse effects of very high DM content on TTSD and was ineffective at a very long LOC.

Key Words: corn silage, dairy cow, meta-analysis

M103   Response to different concentrations and sources of dietary protein on blood urea nitrogen concentrations and plasma amino acid utilization for milk production. I. P. Acharya,* D. J. Schingoethe, K. F. Kalscheur, and D. P. Casper, *South Dakota State University, Brookings.*

A trial was conducted to determine the response of feeding 2 different crude protein (CP) concentrations (15% and 17%) and sources [canola meal (CM) and high-protein dried distillers grain (DG)] on blood urea nitrogen (BUN) concentration and plasma amino acid (AA) utilization. Sixteen lactating Holstein cows were used in multiple 4 × 4 Latin squares having a 2 × 2 factorial arrangement of treatments. Each period was 4 wk and blood samples were collected once during wk 4 of each period from tail artery (TA) and mammary vein (MV) 3 h after feeding. Diets were formulated with 15% CP with CM (15CM), 15% CP with DG (15DG), 17% CP with CM (17CM) and 17% CP with DG (17DG). All diets contained 55% forage (50% alfalfa hay and 50% corn silage) and 45% concentrate and approximately 4.1% ether extract. Average DMI (25.2 kg/d) and milk yield (34.2 kg/d) were similar between diets. Concentration of BUN (mg/dL) from TA was higher ($P < 0.01$) for cows fed 17% CP diets than the 15% CP diets (18.1 vs. 14.3), but similar between CM and DG. Concentration of BUN from MV and artery-vein difference (AVD) were different ($P < 0.01$) between CP concentrations but similar between CP sources. Total essential amino acid (EAA) concentrations (μmol/dL) in TA plasma were higher ($P < 0.01$) for cows fed 17% CP diets compared with 15% CP diets (106.1 vs. 91.1), but similar for CM and DG. Branched chain amino acid (BCAA) concentrations (μmol/dL) in TA plasma were higher ($P < 0.01$) for cows fed 17% CP diets compared with 15% CP diets (62.9 vs. 52.0), but similar for CM and DG. Total plasma MV EAA concentrations were higher ($P < 0.01$) for 17% CP diets, but similar between sources. Total EAA AVD (μmol/dL) were higher ($P < 0.05$) for 17% CP diets than for 15% CP diets (33.6 vs. 27.8), but similar between sources. Mammary gland extraction efficiency of EAA indicated that Met was first limiting AA for CM-based diets followed by Lys, Arg, and Phe, while Lys was first limiting for DG-based diets followed by Met, Arg, Glu, and Phe. The order of limiting AA for milk production is altered by protein sources.

Key Words: crude protein, blood urea nitrogen, plasma amino acid

M104   Effects of adjustable and stationary fans with misters on core body temperature and resting behavior of lactating dairy cows in a semi-arid climate. S. D. Anderson*[1], B. J. Bradford[2], J. P. Harner[2], C. B. Tucker[3], J. D. Allen[1], L. W. Hall[1], S. Rungruang[1], E. Rajapaksha[3], R. J. Collier[1], and J. F. Smith[1], [1]*The University of Arizona, Tucson,* [2]*Kansas State University, Manhattan,* [3]*University of California, Davis.*

Cows readily seek shade to reduce solar heat load during high ambient heat. When shade structures are orientated north-south, stationary cooling systems are unable to follow shade as sun angle shifts during the day. The FlipFan Dairy Cooling System (FLFN) employs fans and misters to follow shade by rotating on a horizontal axis and compensates for wind speed. Multiparous, lactating Holstein cows (n = 144) on a commercial dairy in Arizona were cooled by either a system comprised of stationary fans and misters (CTRL) or the adjustable FLFN operated for 16.5 h/d (0830 to 0100 h). Core body temperature (CBT) of 64 cows (4 pens/treatment; 8 cows/pen; 7 d) and resting behavior of 144 cows (4 pens/treatment; 18 cows/pen; 5 d) was collected by intravaginal and leg data loggers, respectively. Cows were allotted to pens based on milk production and DIM. Pen was the experimental unit. Mean temperature-humidity index (THI) during the study was 80.2 (33.0°C and 40.3% relative humidity) and ranged from 76.3 to 84.4. Mean 24-h CBT was lower for cows cooled by FLFN than CTRL (38.9 vs. 39.1 ± 0.04°C; $P < 0.01$). A treatment × time interaction was observed in which CBT of FLFN was 0.4°C lower than CTRL ($P < 0.001$) from 0600 to 0800 h and 1500 to 1600 h. Cows cooled by FLFN spent more time lying down compared with CTRL (9.5 vs. 8.6 ± 0.13 h/d; $P < 0.001$). Cows in the FLFN treatment had more frequent lying bouts than CTRL (12.8 vs. 10.7 ± 0.10; $P < 0.001$). Lower CBT and decreased standing time are consistent with other studies in which ambient heat load was reduced. In a second experiment, isothermal maps representing the shaded area of pens at different times of day were analyzed for differences in THI provided by each cooling treatment. The FLFN provided a lower THI in the morning and evening (5.9 and 1.7%, respectively; $P < 0.001$) and

tended to be lower (0.8%) in the afternoon ($P < 0.10$) compared with CTRL. Results suggest that FLFN is more effective than stationary fan systems at decreasing CBT, increasing lying time and bouts, and providing a more desirable microenvironment for cows throughout the day. The FLFN may yield similar results in different housing systems.

Key Words: adjustable fan, body temperature, resting behavior

M105   Evaluation of fc receptor gene variants in cow genomic dna. J. Williams* and M. Worku, *North Carolina Agricultural and Technical State University, Greensboro, North Carolina.*

Genetic differences exist among cows in susceptibility to mastitis. Receptors for the Fc portion of immunoglobulin molecules (FcR) provide an important link between circulating antibody and cellular functions. Cattle possess the 3 classes of immunoglobulin G (IgG) FcR (FcγRI, -II, and -III). Further, activating (CD32a) and inhibitory (CD32b) isoforms of IgG Fcγ receptor (FcγR) II (CD32) have also been identified. Genetic variations in FcR have been identified as risk factors for chronic inflammatory conditions in man. Genetic differences in FcR may affect response to pathogens in cattle. The objective of this study was to detect FcR I, FcR II and their sub isoforms in cows. Blood was collected from 10 lactating cows (8 were 100% Holstein Friesian and 2 Holstein × Jersey). The somatic cell counts (SCC) were recorded. Genomic DNA was isolated from blood stored on FTA cards. Specific primers for FcRI (CD64), FcRII (CD32) and FcRII sub-isoforms were used to amplify Fc receptor genes. A primer for GAPDH was used as a loading control. Amplified products were separated on a 1% agarose gel and observed following staining with ethidium bromide. Genes encoding FcRI and FcRIIc were detected in all cows. The activating (FcRIIa) and inhibitory (FcRIIb) respectively were detected only in Holstein × Jersey crossbred cows regardless of SCC. Further studies are needed to evaluate the effect of FcR gene polymorphism on the cellular response in cattle.

Key Words: fc receptor, crossbreed, genetic variation

M106   Quantitative calcium determination from an ashed feed sample. D. J. LaMay,* J. L. Squire, K. D. Baldock, and D. L. Smith, *Eastern New Mexico University, Portales.*

Advances in technology have continued to improve the speed and quality of feed analyses. This protocol is a quantitative spectrophotometric method of determining calcium in an ashed feed sample. Hydrochloric acid (HCl) aids in the release of calcium bound to other molecules; while O-Cresolphthalein Complexone binds calcium ions in an alkaline medium, and 8-Hyrdroxy-quinoline binds magnesium ions to eliminate their interference. To maintain an alkaline pH, 2-amino, 2-methyl, 1-propranol (AMP) is used as a buffer. From a stock solution of calcium carbonate, dilutions (0.078, 1.56, 3.13, 6.25, 12.5, 25, and 50 mg/dL) are produced. One gram of ashed feed sample is transferred to a 50 mL conical tube. The crucible is rinsed with 10 mL of 0.1N HCl. Add 0.7 mL of 37% HCl to the tube and vortex for 5 s. Pour the solution into an acid rinsed beaker. Rinse the tube with 10 mL of distilled water into the beaker, then add 479.3 mL of distilled water. Vortex each standard for 5 s, and pipette 50 μL of each standard into 4 wells of a 96-well microplate. The 6.25 and 12.5 mg/dL standards are used as controls. Vortex each control and pipette 50 μL of each. Mix the ash solution and pipette 50 μL of the solution. All the standards, controls, and samples are run in quadruplicate. Pipette 180 μL of color reagent and AMP buffer into all wells. Incubate the plate at room temperature for 10 min on a shaker plate at 318 rpm. The test is analyzed at 630 nm with a background subtraction of 490 nm. The curve fit of the standard dilution is linear

and the test samples are compared with these values. Results obtained from Cumberland Valley Analytical Services (CVA) were compared with results obtained from our laboratory (OL), replicated 6 times. Results for Feed Sample A were 0.27 versus 0.28% on a dry matter (DM) basis for CVA versus OL, respectively. Results for Feed Sample B were 3.92 versus 3.94% on a DM basis for CVA versus OL, respectively. Results for Feed Sample C were 0.79 versus 0.76% on a DM basis for CVA versus OL, respectively. These results present validation the quantitative spectrophotometric protocol is an effective and inexpensive method of calcium determination.

Key Words: calcium, ashed feed, spectrophotometric

M107   Cow comfort in dry lots: Lameness, leg injuries and lying times on dairy farms in Texas and New Mexico. A. K. Barrientos*[1], D. M. Weary[1], E. Galo[2], and M. A. G. von Keyserlingk[1], *[1]Animal Welfare Program, University of British Columbia, Vancouver, British Columbia, Canada, [2]Novus International Inc., St. Louis, MO.*

The aim of the study was to describe the variation in lameness, leg injuries and lying behavior on dry lot dairies in Texas and New Mexico. Data were collected by the same 2 trained individuals from 35 predominantly Holstein herds. Herd size had on average (±SD) 3056 ± 1047 milking cows. One group of high production multiparous cows was monitored on each farm, with pen size averaging (±SD) 286 ± 177 cows. Cows were gait scored using a 5-point Numerical Rating System where 1 and 2 are considered non-lame, ≥ 3 clinically lame, and ≥ 4 severely lame. Prevalence of knee injuries was recorded based on swollen carpal joints (yes/no). Focal cows (n = 40), randomly selected from the assessment group, were evaluated for hock injuries on a scale of 1 to 5 (1 = healthy and 5 = evident swelling and severe lesion). Electronic data loggers recorded lying behavior of the focal cows at 1-min intervals for 3 d. The analysis was descriptive and all results are presented as means ± SD. Prevalence of clinical lameness averaged 31.7 ± 7.7%; severe lameness averaged 2.0 ± 1.6%. Prevalence of swollen knees averaged 16.8 ± 10.2%. The overall prevalence of hock injuries (≥2) was 18.2 ± 11.0%; the prevalence of moderate-to-severe hock injuries (3, 4, and 5) was 4.7 ± 3.7%, with almost no presence of severe injuries (4 and 5). Lying times were similar across farms, averaging 10.2 ± 0.8h/d, but cows within farms varied from 1.9 to 17.9 h/d. To our knowledge this study is the first to describe the variation in lameness, injuries and lying times in dairy cattle housed in dry lot dairies.

Key Words: dry lot, lameness, leg injuries

M108   The effect of temperature on performance of Keto-Test strips. J. Shire*[1], J. L. Gordon[2], and E. L. Karcher[1], *[1]Department of Animal Science, Michigan State University, East Lansing, [2]Department of Population Medicine, University of Guelph, Guelph, Ontario, Canada.*

Ketosis is estimated to affect 15% of early lactation dairy cows. The Keto-Test (Elanco Animal Health, Greenfield, IN) offers producers an easy test to determine the concentration of β-hydroxybutyrate (BHBA) in milk and track herd incidence of ketosis. The objective of this study was to determine the effect of altering temperature at time of test on the reliability of the Keto-Test. A total of 116 Holstein cows, ranging from 5 to 17 DIM, were selected from a commercial Holstein dairy herd in Michigan. A milk sample was collected from one quarter of each cow during the AM milking. Each sample was tested under 4 temperature treatment conditions, A: Keto-Test strips and milk at room temperature (RT, 24.0°C ± 0.1; control, manufacturer's recommendations); B: cold

strips (10.8°C ± 0.9) and milk at RT; C: cold strips and fresh milk; D: strips at RT and fresh milk. Blood samples were collected immediately following milk collection and analyzed for BHBA concentration using a Precision Xtra meter (Abbott Laboratories, Abbott Park, IL). Cows with BHBA of ≥ 1400 μmol/L were considered positive for subclinical ketosis. Accuracy of the Keto-Test strips under the 4 conditions was determined by the kappa coefficient of agreement, using the result of treatment A as the control. Additionally, sensitivity and specificity were calculated using the blood BHBA concentrations and results of the treatment A. Using the Keto-Test 60.2% of cows tested negative for milk BHBA, 24.6% tested weak positive, 14.4% tested positive, and 0.8% tested highly positive. The weighted kappa coefficient of agreement between the control test (A) and tests B, C, D and 95% lower and upper confidence intervals were: test B = 0.71 (0.62, 0.80), test C = 0.69 (0.60, 0.78), and test D = 0.63 (0.54, 0.73). These results indicate good agreement between the outcome of the treatment A and tests B, C, and D. The sensitivities/specificities for A, B, C, and D are as follows: 0.70/0.81, 0.68/0.77, 0.60/0.88, and 0.58/0.87 indicating that the test in all temperature conditions had a strong ability to detect the presence of BHBA in milk. In conclusion, the reliability of the Keto-Test strips was not dependent on the temperature of the milk or the strips.

Key Words: BHBA, ketosis, Keto-Test

M109   Effects of prepartum grouping strategy on immune parameters of peripartum dairy cows. P. R. B. Silva*[1,2], J. G. N. Moraes[1,2], L. G. D. Mendonça[1], A. A. Scanavez[1], G. Nakagawa[1], M. I. Endres[2], M. A. Ballou[3], and R. C. Chebel[1], *[1]Department of Veterinary Population Medicine, University of Minnesota, St. Paul, [2]Department of Animal Science, University of Minnesota, St. Paul, [3]Department of Animal and Food Sciences, Texas Tech University, Lubbock.*

Objectives were to evaluate the effect of an "all-in-all-out" (AIAO) prepartum grouping strategy on immune parameters of Jersey cows. Cows (254 ± 7 d of gestation) were paired by gestation length and assigned randomly to an AIAO or control (CON) treatment. In the AIAO treatment groups of 44 cows were moved into a pen where they remained for 5 wk, whereas in the CON treatment approximately 10 cows were moved into a pen weekly to maintain stocking density (44 cows for 48 headlocks). Pens were identical in size and design and each of the pens received each treatment a total of 3 times, totaling 6 replicates and 259 and 308 cows enrolled in the AIAO and control treatments, respectively. Blood was sampled weekly from d-14 to d 14 from a subgroup of cows (n = 34/treatment) to determine neutrophil phagocytosis (PHAGO), oxidative burst (OXID), and expression of CD18 and L-selectin and for hematology. Data were analyzed by MIXED procedure with the fixed effect of treatment (AIAO vs control) and random effects of pen by replicate and cow by pen by replicate. Among the subgroup of cows evaluated for immune parameters no differences between treatments were observed in percentage of male calves ($P = 0.81$) and twins ($P = 0.57$) or incidence of retained fetal membranes ($P = 0.71$) and metritis ($P = 0.43$). Percentage of neutrophil positive for OXID ($P = 0.91$) and intensity of OXID ($P = 0.94$) were not different between treatments. Similarly, no differences were observed between treatment regarding percentage of neutrophil positive for PHAGO ($P = 0.98$) and intensity of PHAGO ($P = 0.91$). In addition, percentages of neutrophil expressing CD18 ($P = 0.17$) or L-Selectin ($P = 0.83$) were not different between treatments. Number of leukocytes ($P = 0.64$), neutrophils ($P = 0.33$), and lymphocytes ($P = 0.80$) were not affected by treatment. Cows submitted to an AIAO prepartum grouping strategy had similar innate

immunity and hematological parameters compared with cows submitted to a conventional prepartum grouping strategy.

Key Words: prepartum dairy cow, grouping strategy, immune parameters

M110   Detection of clinical and subclinical mastitis using reticulorumen temperatures. A. E. Sterrett,* K. N. Brock, B. I. Kiser, J. D. Clark, D. L. Ray, and J. M. Bewley, *University of Kentucky.*

The objective of this study, conducted at the University of Kentucky Coldstream Dairy from September 15, 2011, to February 1, 2012, was to examine the relationship between changes in reticulorumen temperature (RT) and subclinical and clinical mastitis. The DVM Systems, LLC (Boulder, CO) bolus system monitors RT using a passive RFID transponder (Phase IV Engineering, Inc., Boulder, CO) equipped with a temperature sensor queried twice daily by a panel reader placed in parlor entrances. A composite milk sample was obtained from each cow in the herd every 14 d for SCC analysis (Fossomatic FC somatic cell counter, Foss, Hillerød, Denmark). Subclinical mastitis events were established by SCC >200,000 cells/mL. Milkers recorded clinical mastitis events. Data were analyzed using SAS (Cary, NC). Reticulorumen temperatures <38.9°C were interpreted as erroneous reads, likely from water intake before entering the parlor, and were eliminated from the data set. Reticulorumen temperatures were adjusted for the change in herd RT at each milking to account for the effect of changing ambient conditions and diurnal variation. A 30-d rolling mean baseline RT was calculated along with the number of SD from which each respective RT varied from this baseline. The maximum RT and number of SD among all RT within the previous 10 d were used as a baseline to assess whether a RT alert was observed for mastitis and high SCC events. Using alert levels of >2 SD and >3 SD within 10 d of a mastitis event, alerts occurred for 47% (n = 7) and 33% (n = 5) of clinical mastitis events, respectively (n = 15). Using alert levels of >2 SD and >3 SD within 10 d of a high SCC event, alerts occurred for 23% (n = 10) and 5% (n = 2), respectively. Across all RT (n = 23,298), 11% (n = 2491) were >40°C. Using alert levels of RT >40°C, alerts occurred for 80% (n = 12) and 50% (n = 22) of clinical mastitis and high SCC events, respectively. Reticulorumen temperature may be an indication of subclinical and clinical mastitis, but natural variation may limit the utility of a RT monitoring system.

Key Words: mastitis, reticulorumen, temperature

M404   Effect of precision processing barley grain on dry matter intake, milk production, rumen pH and nutrient digestibility in lactating dairy cows. N. Schlau*[1], L. Duineveld[1], W. Z. Yang[2], T. A. McAllister[2], and M. Oba[1], *[1]University of Alberta, Edmonton, AB Canada, [2]Agriculture and Agri-Food Canada Research Centre, Lethbridge, AB Canada.*

The objective of this study was to evaluate the effects of precision processing (processing based on kernel size and volume weight) barley grain on rumen fermentation and productivity of lactating dairy cows. Twenty multiparous lactating Holstein cows including 8 ruminally cannulated cows were used in a replicated 4 × 4 Latin square design with 21-d periods. Cows were fed diets containing light barley grain (52.8 kg/hL) processed using a narrow roller setting (LIGHT, processing index (PI) = 80.2); heavy barley grain (68.6 kg/hL) processed using a wide roller setting (HEAVY, PI = 76.4); light and heavy barley grain precision processed and mixed equal proportions (PP, PI = 76.3); or light and heavy barley grain mixed equal parts then processed at a single narrow roller setting (industry standard; CON, PI = 82.9). All diets consisted of 40%

barley grain, 40% barley silage, and 20% of a supplement premix. There were no treatment effects between LIGHT and HEAVY or PP and CON on DMI (24.0 vs. 23.9 kg/d and 24.7 vs. 23.5 kg/d, respectively), rumen pH (6.13 vs. 6.25 and 6.20 vs. 6.07, respectively), rumen metabolites or sorting index. Digestibility of DM, OM, CP, starch, and NDF were unaffected by treatment. Milk yield was not different between LIGHT and HEAVY or PP and CON (28.8 vs. 28.3 kg/d and 28.6 vs. 28.9 kg/d, respectively); nor was milk fat, protein, and lactose. MUN was higher for cows fed the PP diet compared with those fed the CON diet (11.0 vs. 10.4 mg/dL; $P = 0.02$) and for cows fed the LIGHT diet compared with those fed the HEAVY diet (11.6 vs. 10.7 mg/dL; $P = 0.05$), which can be attributed to the differences in starch availability in the rumen and amount of N captured by rumen microbes for protein synthesis. These results suggest that precision processing barley grain may not drastically affect rumen fermentation or productivity in dairy cows. Previous research on beef steers showed that precision processing barley grain improves nutrient digestibility without affecting rumen pH. Different responses between dairy and beef cattle might be explained by the difference in the level of barley grain in the diet.

Key Words: rumen acidosis, precision process, barley grain

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