

ash, and starch. Data was analyzed as a complete random design, with cow as experimental unit, day as repeated measure, and each cow's P1 fecal concentration as a covariate. During P2, HS cows had a 1.8°C increase in Tre and a 3-fold increase in RR compared with PFTN cows ($P < 0.01$). Heat stress reduced ($P < 0.01$) DMI by 20% and by design PFTN cows had similar intake reductions. Milk yield was decreased 12% during HS and 8% in PFTN cows. Fecal dry matter tended ($P < 0.10$) to be higher in PFTN cows (16.6%) compared with P1 (15.8%) and HS (15.8%) cows. Fecal fiber components, NDF and ADF, were lower ($P < 0.01$) in PFTN cows (44.5 and 29.0%, respectively) compared with P1 (48.5 and 33.9%) and HS (47.1 and 32.6%) cows. Fecal starch was lower ($P < 0.05$) in HS cows (1.90%) compared with P1 (2.4%) and PFTN (2.8%) cows. There was no difference ($P > 0.10$) in fecal ash and CP. A period by day effect was seen in NDF, ADF, and starch ($P < 0.05$). Results indicate heat stress reduces fecal starch concentration, and lowered DMI reduces fecal NDF and ADF concentrations.

Key Words: dairy cow, fecal composition, heat stress

W102 Long-term performance of growing dairy heifers fed increased dietary fat from dried distillers grains. J. L. Anderson*, K. F. Kalscheur, A. D. Garcia, and D. J. Schingoethe, *South Dakota State University, Brookings.*

The objective of this study was to determine if feeding increased dietary fat from dried distillers grains with solubles (DDGS) to pre-pubertal dairy heifers influenced long-term performance. During the pre-pubertal growth phase, 33 Holstein heifers (133 ± 18 d old) were used in a 24-wk randomized complete block design with 3 treatment diets. Diets were (1) control (C) that contained 15.9% (DM basis) ground corn and 17.9% soybean products, (2) low-fat (LFDG) that contained 21.9% reduced-fat DDGS and 11.9% ground corn, and (3) high-fat (HFDG) that contained 33.8% traditional DDGS. All diets contained 39.8% grass hay, 24.8% corn silage, and 1.5% vitamins and minerals. Although diets were isonitrogenous and isocaloric, HFDG was formulated to contain 4.8% fat versus 2.8% in C and LFDG. Previous results demonstrated that growth performance was maintained, despite differences in metabolic profiles. Also, previous results indicated that heifer fed HFDG were pubertal earlier. Post-trial production data (farm and DHIA records) for each heifer was collected during the first 4 mo of lactation. Body weights, body condition scores, and frame measurements were taken 3 wk prepartum and at calving. Treatment did not affect ($P > 0.05$) age at conception or age at calving. At calving, wither height was shorter ($P = 0.03$) for heifers fed HFDG compared with other diets. For heifers fed LFDG milk production was greater (33.04, 36.40, 34.7 kg for C, LFDG, and HFDG, respectively; SEM = 1.35; $P = 0.03$) and milk protein yields tended to be greater (0.98, 1.08, and 1.03 kg; SEM = 0.043; $P = 0.06$) compared with heifers fed C. Heifers fed HFDG had similar milk production compared with C. Milk fat and energy-corrected milk yield were similar among treatments. Feeding increased dietary fat from DDGS during the pre-pubertal growth phase maintained milk production despite previous findings indicating differences in puberty. Based on these findings, producers can feed dietary fat from DDGS as a replacement for starch from corn as an energy source for pre-pubertal heifers without detriment to long-term performance.

Key Words: dairy heifer, distillers grain, long-term performance

W103 Validation and recovery rates of an indirect calorimetry headbox system used to measure heat production of cattle. A. J. Foth*¹, T. Brown-Brandl², H. C. Freety², M. D. Hayes², and P.

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A headbox system was constructed at the University of Nebraska-Lincoln to determine heat production from dairy cattle using indirect calorimetry. The system was designed for use in a tie-stall barn to allow the animal to be comfortable and was mounted on wheels to transport between animals between sampling days. The frame was constructed out of aluminum angle iron with sides of plexiglass for other animals to remain within sight. The system continuously sampled gas produced in the headbox and directed it into foil bags, allowing for analysis of O₂, CO₂ and methane concentrations. To validate the data collected by 3 constructed units, alcohol burning lamps containing 100% ethyl alcohol were placed inside, ignited and burned for 2 h. The rate of gas flowing out of the system was recorded and samples of gas entering and exiting each of the sealed headboxes was collected into 44 L sample bags and later analyzed. The difference between gas concentrations from incoming and outgoing air, corrected to standard temperature and pressure, was calculated and the amount of O₂ consumed and CO₂ produced during the sampling time was compared with the theoretical amount of each of these gases calculated based upon the amount of alcohol burned, giving the recovery rate of each gas. Two runs were carried out on 2 separate occasions for each unit and the results can be found in Table 1. Recovery rates for O₂ and CO₂ averaged 101.3 ± 2.72% and 100.5 ± 3.59% suggesting that these units may be used to adequately estimate gas exchange and for indirect calorimetry to indirectly determine heat production.

Table 1. Means and standard deviations of 2 lamp runs on headboxes 1, 2, and 3

	Headbox 1		Headbox 2		Headbox 3	
	Mean	SD	Mean	SD	Mean	SD
Average gas flow (m ³ /min)	0.94	0.01	0.97	0.01	1.03	0.03
O ₂ consumed (L)	175.4	21.1	144.9	12.4	134.0	1.77
CO ₂ produced (L)	116.3	11.74	95.5	4.60	89.6	4.10
Average temperature (°C)	32.5	3.95	29.8	3.43	29.0	1.90
Average dew point (°C)	16.6	4.04	13.1	3.31	13.1	1.87
O ₂ recovery rate (%)	101.19	2.17	104.12	0.57	98.71	1.65
CO ₂ recovery rate (%)	100.80	0.19	103.11	3.32	97.64	4.81

Key Words: indirect calorimetry, headbox, lamp run

W104 Energy requirement of Holstein calves. J. C. M. Lima¹, J. P. P. Rodrigues¹, M. I. Marcondes*¹, F. S. Machado², A. S. Treece¹, M. M. D. Castro¹, J. L. C. Dias¹, and T. Araújo¹, ¹Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil, ²Embrapa Gado de Leite, Juiz de Fora, Minas Gerais, Brazil.

This study aimed to evaluate energy requirements in dairy calves. Forty-two male Holstein calves, at 3 d of age and with an average live weight of 35.56 ± 5.86 kg, were used. Ten animals were slaughtered to compose the reference group, and the remaining animals were distributed into a completely randomized design. The treatments consisted of different amounts of milk, which were: 2, 4, 6 and 8 L milk/head/d, fed twice a day, in 8 replications. The animals were fed milk until they reached 58 d. Four animals per treatment were slaughtered at 59 d, while others started to receive Coast cross hay plus starter, and they were subsequently slaughtered at 87 d. After slaughter, 2 samples were obtained for each animal, called carcass and non-carcass. The retained energy was estimated by determining energy concentration in carcass

and non-carcass samples, and diminishing by the initial body energy concentration. The HP of each animal was estimated as: $HP = \beta_0 \times e^{(\beta_1 \times MEI)}$, where MEI is metabolizable energy intake. Digestible energy intake (DEI) was obtained by controlling protein, fat and carbohydrates daily intake, which were multiplied by 5.6, 9.4, and 4.2 Mcal/kg, respectively, and by their respective digestibilities. MEI of each animal was obtained by the equation: $MEI = DEI \times (0.96 \times DMI + 0.88 \times (1 - DMI))$, where DMI is the proportion of milk intake in dry matter intake. Net (NEm) and metabolizable (MEm) energy requirements for maintenance were obtained as a function of heat production (HP) and metabolizable energy intake (MEI), while net energy requirements for gain (NEg) were obtained as a function of empty body weight (EBW) and empty body gain (EBG). The NEm and MEm were respectively 85.2 and 143.4 kcal/EBW^{0.75}/d. The efficiency of utilization of metabolizable energy for maintenance (k_m) was 59.41%. The equation obtained for NEg and efficiency of utilization of metabolizable energy for gain (k_g) were, respectively, $NEg \text{ (Mcal/d)} = 0.0931 \times EBW^{0.75} \times EBG^{1.454}$, and 38.07%. The efficiencies of energy deposition as protein and fat were 67.69% and 60.73%, respectively. The equations suggest that net and metabolizable energy requirements for maintenance of Holstein calves exceed those commonly use in the dairy industry.

Key Words: calf, gain, maintenance

W105 Brown marmorated stink bug odor compounds do not transfer into milk in lactating dairy cattle by feeding bug-contaminated corn silage. R. L. Baldwin VI^{1*}, A. Zhang², S. W. Fultz³, S. Abubeker², C. Harris², E. E. Connor¹, and D. L. Van Hekken⁴, ¹USDA, ARS, BFG, Beltsville MD, ²USDA, ARS, IIBBL, Beltsville MD, ³University of Maryland Extension, Frederick, ⁴USDA, ARS, EERC, Wymdmoor, PA.

Brown marmorated stink bug (BMSB), *Halyomorpha halys*, is an emerging invasive species of grave concern to agriculture as a polyphagous plant pest with potential negative effects on the dairy industry. We sought to determine the risk of including BMSB contaminated silage in lactating dairy cow rations. First, 6 dairies, either highly infested ($n = 3$; 30 to 100 bugs per stalk) or not infested ($n = 3$) were sampled to assess prevalence of bug secretion compounds tridecane and E-2-decenal (odor component) in silage and milk. Second, using wild BMSB, a mini-silo dose response experiment (adding 100, 50, 25, 10, and 1 fresh crushed bugs/0.5 kg chopped corn) was conducted to assess the effect of ensiling on BMSB odor compounds. Finally, synthetic BMSB secretion compounds (10 g tridecane and 5 g E-2-decenal) were ruminally infused 2 times daily over 3 d and samples of milk, urine, and rumen fluid were collected to evaluate disposition. Samples were analyzed by solid phase microextraction (SPME) and gas chromatography-mass spectrometry (GC-MS). Milk production and feed composition were unaffected ($P > 0.05$) when BMSB contaminated silage was fed. Moreover, no E-2-decenal was detected in silage nor milk (detection threshold = 0.00125 ppm). Dose response of tridecane in mini-silo samples exhibited a linear relationship ($R^2 = 0.78$) with BMSB added; however, E-2-decenal was completely decomposed and undetectable in spiked mini-silos after ensiling. Both synthetic secretion compounds infused into rumen were

undetectable in all milk and urine samples. Content of E-2-decenal was also not detectable in rumen fluid; however, tridecane was detected at 15 min post-infusion but not present thereafter. Feed intake was unaffected by infusion treatment and BMSB secretion compounds were not observed in milk. Compounds from the metathoracic gland of BMSB are not able to contaminate milk due to either the ensiling process or metabolism within the rumen. Concern over BMSB odor compounds contaminating the fluid milk supply even on highly infested farms is not warranted.

Key Words: brown marmorated stink bug, milk taint, lactating dairy cow

W106 Effects of restricted versus conventional dietary adaptation over periods of 9 and 14 days on total-tract digestibility of dry matter and starch of feedlot Nellore cattle. A. L. N. Rigueiro², D. H. M. Watanabe², M. C. S. Pereira², J. Silva², T. V. B. Carrara¹, M. C. S. Franzoi¹, R. S. Barducci¹, M. D. B. Arrigoni¹, F. Perna Junior⁴, M. Caetano³, D. P. D. Lanna³, and D. D. Millen^{*2}, ¹São Paulo State University (UNESP), Botucatu, São Paulo, Brazil, ²São Paulo State University (UNESP), Dracena, São Paulo, Brazil, ³University of São Paulo (USP), Piracicaba, São Paulo, Brazil, ⁴University of São Paulo (USP), Pirassununga, São Paulo, Brazil.

This study was designed to determine effects of restricting DMI of the final finishing diet (REST) as a means of dietary adaptation compared with diets increasing in concentrate (STEP) over periods of 9-d and 14-d on total-tract digestibility of DM and starch of feedlot Nellore cattle. The experiment was designed as a completely randomized block with 2×2 factorial arrangement, replicated 6 times (5 bullocks/pen), in which one hundred twenty 22-mo-old yearling Nellore bulls (361.3 ± 30.2 kg) were fed in 24 pens for 84 d according to the treatments: STEP for 9-d and 14-d, REST for 9-d and 14-d. Measures over time were taken on d 5, 10, 15, and 20 of experimental period. The STEP program consisted of ad libitum feeding of 3 adaptation diets over periods of 9-d or 14-d with concentrate level increasing from 55% to 85% of diet DM. The REST program consisted of restricted intake of the final diet (85% concentrate containing 55% of high moisture corn) with programmed increases in feed offered until yearling bulls reached ad libitum access over periods of 9-d and 14-d. Fecal samples were collected just before morning (0800 h) and afternoon (1500 h) meals, and a composite sample per pen in each day was made. It was observed ($P < 0.05$) an interaction between protocols, length of protocols and days for DM and starch digestibility. Yearling bulls adapted for 14-d had greater DM digestibility on the first day of the finishing period (15-d: STEP in 14-d = 79.05%, REST in 14-d = 78.05%) than those adapted for 9-d (10-d: STEP in 9-d = 68.04%, REST in 9-d = 69.39%); however, no differences ($P > 0.10$) between treatments were observed on d 15. Moreover, yearling bulls in REST for 14-d and STEP during 9-d did not present differences ($P > 0.10$) in starch digestibility over days of collection. However, yearling bulls adapted in REST for 9-d and STEP during 14-d ($P < 0.05$) only proved to be able to digest starch like those in REST for 14-d and STEP for 9-d on d 15. Thus, according to present data, yearling Nellore bulls should be adapted in 14 d, regardless of the protocol.

Key Words: adaptation, digestibility, Nellore