Production, Management, and the Environment 2: Posters

2421 Associations of the Fresh Cow Index with performance later in lactation. A. De Vries*[1] and R. H. Fourdraine[2], [1]*University of Florida, Gainesville, FL,* [2]*Dairy Records Management Systems, North Carolina State University, Raleigh, NC.*

The Fresh Cow Index (FCI) is the ratio of actual energy-corrected first test-day (TD) milk yield (ECM) and predicted ECM × 100. An FCI significantly less than 100 may indicate that the cow had a poor transition into lactation. The objective of this study was to associate the FCI with milk production and herd removal (culling) later in lactation. For FCI model building, data collected between 2020 and 2024 were provided by Dairy Records Management Systems and included 989,296 first parity records from 1,938 herds and 2,049,356 older parity records from 3,094 herds. Linear mixed models were developed to predict ECM at first TD (5 to 40 DIM) for first-parity and older parity cows. The models included variables related to year, calving age, genetic traits, dam performance, season, region, milking frequency, breed, abortion, calving ease, gestation length, and DIM at first TD. The older parity model also included variables related to previous parity dry period length and days open. Herd was included as a random effect. The coefficients from the regression models were then used to predict ECM at first TD. To determine the associations of low versus high FCI with nonvoluntary removal rates and milk production, data from 409,384 first and 1,252,150 older parities were grouped by 10 FCI increments from FCI <70 to FCI ≥130. Removal rates for first-parity cows decreased from 26.7% for cows with FCI <70% to 23.2% for cows with FCI ≥130, whereas peak milk yield increased from 31 kg to 43 kg. Similarly, 305-d ECM increased from 9,297 to 12,293 kg for FCI <70 to FCI ≥130. For older cows, removal rates decreased from 37.7% to 33.1%, peak milk yield increased from 41 kg to 59 kg, and 305-d ECM increased from 10,596 kg to 14,528 kg, respectively. Across parities, cows with FCI <100 were less likely to start a subsequent lactation. Cows with FCI < 80 were predominantly removed for production reasons and cows with FCI >80, if removed, were increasingly removed for reproduction reasons. In conclusion, monitoring FCI grouped by calving cohort will provide the dairy producer with a tool to evaluate transition cow management.

Key Words: transition, monitor, management

2422 Lactating dairy cow behavior under commercial application of "smart" versus a conventional cooling system. I. M. Toledo*, H. Olmo, and G. E. Dahl, *University of Florida, Gainesville, FL.*

Active cooling systems are widely used to reduce the negative effects of heat stress and optimize dairy cow performance during all phases of the lactation cycle. Shade, ventilation and soaker systems are extensively used in dairy farms as cooling strategies. The objective of this study is to evaluate the behavior of lactating dairy cows under an automated "smart" system (AgPro, Paris, TX) for control of soaker output relative to a conventional approach that relies on set timing after reaching a specified temperature threshold. We hypothesize that the smart system will reduce water usage compared with the conventional system while not affecting the behavior of lactating dairy cows. Automated monitoring devices (Nedap, Groenlo, the Netherlands) were used to assess behavioral activity of lactating cows under an automated smart system (SS; n = 12) or conventional cooling systems (CON; n = 12). Cows received a leg tag to measure daily lying time, number of steps, and standing bouts, and a neck tag to measure eating and rumination time. Behavioral activities were recorded for 17 d, during which the average temperature-humidity index was 75. All cows were housed in a sand-bedded freestall barn equipped with a cooling system of shade, fans and soakers. Soaker systems water usage (WU; L/d) per pen were recorded daily. As expected, no differences in behavioral activities were observed between the groups. Eating (232.6 vs. 241.0 ± 21 min/d; $P = 0.78$), rumination (241.3 vs. 250.1 ± 8.2 min/d; $P = 0.41$), lying (738.9 vs. 714.0 ± 34 min/d; $P = 0.61$) and standing (701.0 vs. 726.0 ± 34 min/d; $P = 0.61$) did not differ between SS and CON. Steps (5,133 vs. 4,718 ± 185 steps/d; $P = 0.13$), stand bouts (11 vs. 13 ± 0.8 stands/d; $P = 0.30$) and inactivity (580.1 vs. 545.7 ± 26 min/d; $P = 0.37$) were also similar between SS and CON. Water usage was significantly higher in the CON pen compared with SS (34.2 vs. 19.6 ± 1.8, L/day × 1,000; $P < 0.001$). These results suggest that the automated smart system is as effective as a conventional soaker system to actively cool cows and does not affect behavior while using significantly less water.

Key Words: water use, active cooling, smart system

2423 Evaluating the RuFaS model: Insights into NH_3 emission simulations via data assimilation. H. Hu*[1], H. Xu[2], Y. Luo[2], and K. F. Reed[3], [1]*Department of Animal Science, Cornell University, Ithaca, NY,* [2]*School of Integrative Plant Science, Cornell University, Ithaca, NY,* [3]*USDA-Dairy Forage Research Center, Madison, WI.*

Ammonia (NH_3) poses significant risks to the environment and human health, serves as a precursor to nitrous oxide, and represents a source of nutrient loss and inefficiency. Quantification of NH_3 emissions on farms is challenging because manure management practices and environmental conditions can vary widely. Process-based modeling offers a more robust approach than empirical methods for addressing this complexity. The Ruminant Farm Systems (RuFaS) model combines process-based models across the farm system to estimate whole-farm NH_3 emissions. In particular, an established NH_3 volatilization equation is used to assess emissions from the barn floor. This study develops a data assimilation algorithm to estimate farm-specific parameters for NH_3 emissions. To enhance computational efficiency, we isolated the NH_3 emissions method from the RuFaS model and conducted a first-order sensitivity analysis to identify key parameters for estimation. Among the parameters analyzed (manure pH, housing-specific constant, barn area, and manure density), manure pH had the highest sensitivity index (0.661), indicating its strong influence on NH_3 emissions. Using this insight, we developed a Metropolis–Hastings algorithm to estimate manure pH and evaluated the method with simulated housing NH_3 emissions data. The proposed data assimilation method consistently converged to the target pH value of 7.7, regardless of the initial values (6.5, 7.7, or 8.5), with an average acceptance rate of 21.5%. These results demonstrate the algorithm's potential for accurately estimating farm-specific parameters. Future work will focus on extending the algorithm to estimate multiple parameters simultaneously and validating it with on-farm NH_3 measurements. This work presents an opportunity to advance the development of regional NH_3 emission inventories tailored to specific manure management practices.

Key Words: manure ammonia, data assimilation, Ruminant Farm Systems (RuFaS)

2424 Effect of whole lactation chromium propionate supplementation in automated milking systems on body weight, body condition score, production, and reproduction. T. A. Westhoff[1],