Cow longevity and culling on China dairy farms from 2013 to 2015. S. Liu*, J. Ma, and Z. Cao, China Agricultural University, Beijing, China.

Few data are available on the descriptive characteristics of cow longevity and culling within a national population in China. The objective of this study was to describe cow longevity and the reasons associated with culling on dairy farms with more than 100 cows across China. In 2016, a nationwide survey was conducted, and 100 dairy farms in 12 provinces were involved. Culling records and the related data were obtained from management software and report system. Data were analyzed using SAS (version 9.0, SAS Institute Inc., Cary, NC, USA). Culling refers to the exit of cows from farms, as a result of death but regardless of reason, and cow-culling rate was calculated as the number of mature cow exits each year divided by the mean of mature cows stocked in the same year. The results showed that from 2013 to 2015, average culling rate were 24.7%, 22.9% and 30.4%, and average lactation age were 2.5, 2.7 and 2.9, respectively. 72% of culls were from the first 3 lactations, and the highest proportion of culls occurred in second lactation, accounting for 26.2%. Days in milk had effect on culling rate (P < 0.01), and most culling occurred before 60 d in milk, accounting for 27%. The causes of culling were also different (P < 0.05) with reproduction related reasons accounting for 20.9%, followed by digestive related reasons (20.7%), udder related reasons (13.7%), hoof related reasons (8.5%) and unknown reasons (8.4%). Voluntary culling accounted for 11.4%. In addition, the lactation age was affected by causes of culling (P < 0.01). Cows with reproductive diseases and respiratory diseases usually were culled in first 3 lactations, while cows with digestive system disorders, metabolic diseases, hoof diseases and udder diseases were often culled in higher lactation age (4–6 lactation). Culling rate was also related to farm scale (P < 0.01). Dairy farms with 100 to 500 cows had the highest culling rate (32.9%), followed by dairy farms with 500 to 1000 cows (30.7%), dairy farms with 1000 to 2000 cows (27.5%), and dairy farms with more than 2000 cows had the lowest culling rate compared with other sale farms (23.4%, P < 0.05). This study provides an overview on dairy cow longevity and culling in China.

Key Words: mature cow, cow longevity, culling rate


Milk fatty acids (FA) originate from synthesis in the mammary gland (de novo), feed intake or body fat mobilization (preformed) or both origins (mixed). Rapid analysis of milk FA profiles through mid-infrared (MIR) spectroscopy could provide a valuable tool for feeding and management. Bulk tank samples from 3,395 dairy herds using milk recording in Quebec (CAN) are routinely tested by MIR. Samples (n = 573,000) between April 2019 and Feb 2020 were used to evaluate the use of FA as a monitoring tool. On a milk basis, each 0.1-unit increase in de novo FA was associated with an increase in fat by 0.201 units (R^2 0.67) and true protein by 0.117 units (R^2 0.65) whereas each 0.1-unit increase in preformed FA increased milk fat by 0.099 units (R^2 0.23) but had no association with true protein (R^2 0.01). Seasonal cycles showed decreased de novo and increased preformed FA during the summer months (FA basis). JE herds had a lesser drop in de novo FA than HDN herds (~0.7 vs ~1.3 g/100 g FA, respectively, for August vs April). Across seasons, JE herds had higher de novo (+1.5 g/100 g FA) but lower preformed FA (~2.9 g/100 g FA) and an overall greater milk fat content (+0.8%–units) as compared with HO herds. A snapshot analysis was conducted with herd averages for April 2019 for 2035 HO herds having high de novo (>median; HDN; mean ± SD of 27.9 ± 0.73 g/100 g FA) and low de novo (<median; LDN; 25.9 ± 1.14 g/100 g FA) levels. A mixed model approach was used in R with Gaussian distribution for continuous variables, and with binomial distribution and log-link function for variables with binary outcome, consid-
ering herd as a random effect. No differences existed in herd size, days in milk, and conventional vs organic, but HDN herds had higher odds (2.0; P ≤ 0.01) of having a positive Transition Cow Index and lower odds (0.80; P = 0.02) of having a somatic cell count of 200 or more on test day. HDN herds had a 0.89 kg greater (P ≤ 0.01) milk yield per cow on test day. A graphical and interactive tool was developed to visualize milk FA profiles with respective benchmarks and farm-specific historical data, was tested on farm and deployed in production via an IBM Cognos platform.

Key Words: fatty acid, Fourier-transform infrared, decision-support

Impacts of BiOWiSH application on greenhouse gases and air quality from liquid dairy manure. C. B. Peterson*, Y. Zhao, Y. Pan, and F. M. Mitloehner, University of California, Davis, Davis, CA.

With increasing focus on the environmental impacts of greenhouse gases (GHG) from livestock, decreasing the impacts of dairy production is of utmost importance. Dairy cattle waste can be a source of GHG emissions and criteria pollutants as well as a possible groundwater contaminant. Several manure additives have been studied as an approach to mitigate environmental impacts of liquid dairy manure (lagoon water). However, these additives have shown mixed efficacy. The present research aimed to test the commercial additive “BiOWiSH” on alterations of carbon dioxide, methane (CH4), and nitrous oxide as well as ammonia. Lagoon water was collected from a commercial dairy in Solano County, CA and contained 0.34% solids, 99.7% moisture, and 0.026% total nitrogen with a pH of 7.68. Lagoon water was randomly allocated into treatment barrels (190 L each) with 6 replicates per treatment for the 3 treatments (n = 6; control, BiOWiSH Manure, and BiOWiSH Odor). Treatments were rehydrated according to product specifications (stock solution: 1 kg of treatment per 1,000 mL of DH2O) and aliquots of 14 mL stock solution were applied every 9 d for 27 d (shock dose) followed by aliquots of 7 mL of stock solution applied every 9 d over an additional 27 d (maintenance dose), to the respective treatment barrels. Gaseous emissions were collected using flux chambers covering each barrel at designated intervals and measured in real time over a 54-d period. Chambers were connected to a mobile air quality emissions laboratory equipped with gaseous analyzers. The effects of treatments were compared against control. Results showed that BiOWiSH Manure versus the control increased emissions of CH4 by 35.9%. BiOWiSH odor versus control also increased emissions of CH4 by 85.1%. This additive may be applied as an alternate manure management strategy to increase CH4 from covered dairy waste systems where CH4 may then be trapped for subsequent use as a biogas. Further studies are needed to investigate the large scale repeatability of using this product as well as the mechanism of the BiOWiSH lagoon additives.

Key Words: sustainability, dairy cattle, lagoon additive


The GreenFeed (GF) gas flux (mass flowrate) measurement system is a non-invasive means of measuring enteric methane (CH4) from ruminant animals. GF has been used for several purposes, including evaluating the effectiveness of feed additives [KM1] in reducing enteric CH4 emissions. This study evaluated GF parameters using the United States Pharmacopeia < 1033 > §2.4 guidelines (USP) for instrument methodologies. Per USP guidelines, concentration measurements were evaluated using 5 certified CH4 concentration mixtures (103.7–2104 ppm) in 3 replicates passed through the GF system. In addition, CH4 flux measurements were evaluated by releasing gravimetrically measured ‘pulses’ of CH4 at 5 different fluxes (70.7–509.7 g/d), with at least 3 replicates
each, at a range of temperatures (4–29°C) and pressures (912–927 mbar) into the GF intake manifold. The tests were repeated with 2 unique GF machines to measure between unit variability. The USP requires repeatability and precision analysis using ‘Intermediate Precision’ (IP) reported as %Geometric Coefficient of Variation, using mixed linear models (MLM). Significance of random effects was determined by ratio tests between a model with a given random effect and a model without. Singular (zero) variance estimates were removed. The MLM were computed using the ‘lmer’ function of the ‘lme4’ library for the R platform, while ratio tests used the ‘anova’ function. CH$_4$ flux estimates had an IP of 6%, while concentration estimates had an IP of 2%. The GF measurements were found to be highly correlated to certified concentration standards and gravimetric fluxes (0.9993, 0.9972). The GF system estimated CH$_4$ were found to be highly correlated to certified concentration standards and with gravimetric measurements or certified concentration standards. The IP of 2% for the concentration estimates was equivalent to the IP of 6% for the flux estimates. The GF system was found to produce repeatable and accurate emissions measurements compared with gravimetric measurements or certified concentration standards.

**Key Words:** methane, measurement, emissions

### 86 An environmental assessment of dairy farms in the eastern United States

C. A. Rotz$^1$, R. Stout$^*$, M. Holly$^2$, and P. Kleinman$^1$, 1USDA-ARS, University Park, PA, 2University of Wisconsin-Green Bay, Green Bay, WI.

There is need for a comprehensive assessment of the environmental impacts of dairy farms at regional and national scales to better track improvements made by the industry. A methodology using process-level simulation and cradle to farm-gate life cycle assessment has been applied to the eastern United States with plans for completing all regions of the country. Representative dairy farms of various sizes and management practices are simulated with the Integrated Farm System Model using the soil characteristics and climate where farms are located. Farm-gate footprints are determined by totaling values among farms and locations within the region considering the amounts of milk produced by each. Northeastern dairy farms were determined to emit 12,455 ± 1,100 Gg CO$_2$e of greenhouse gas with an intensity of 0.99 ± 0.09 kg CO$_2$e per kg of fat and protein corrected milk (FPCM) produced. Fossil energy consumption was 33,542 ± 5,300 TJ or 2.68 ± 0.42 MJ per kg FPCM. Blue (non-precipitation) water consumption was 193 ± 42 Tg with an intensity of 15.4 ± 3.4 kg per kg FPCM. A total of all forms of reactive N loss was 108 ± 13 Gg with an intensity of 8.6 ± 1.0 g per kg FPCM. These metrics were equivalent to 1.5% of the greenhouse gas emissions, 0.32% of fossil energy use and 0.87% of fresh water consumption reported by governmental agencies for recent years covering all states in the region. Thus, greenhouse gas emissions, fossil energy use and blue water use associated with dairy farm production in this region are relatively small compared with total estimates. Simulated emissions of volatile organic compounds were also within 2% of governmental estimates for the region. The greatest environmental concern appears to be that of ammonia emission, where dairy farms accounted for 65% of governmental estimates for the region. Environmental footprints were found to vary widely among farms as influenced primarily by soil characteristics and climate and secondarily by farm management. Therefore, prescriptive mitigation strategies for individual farms is more effective than uniform enforcement of specific strategies.

**Key Words:** life cycle assessment, greenhouse gas, nitrogen loss

### 87 National consumer survey of dairy food preferences and purchase interest

M. Camire$^*$, R. Bernier$^2$, R. Labbe$^2$, D. Bouchard$^2$, G. Shaler$^3$, and L. Yeitz$^3$, 1University of Maine, Orono, ME, 2Atlantic Corporation, Waterville, ME, 3University of Southern Maine, Portland, ME.

The United States’ dairy industry faces increasing competition from plant-based dairy mimetics, fluctuating export markets, and animal welfare criticism. Small and medium-sized dairy farms are vanishing. Improved understanding of American consumers’ attitudes and desires could enable small dairy processors to expand markets and sustain smaller farms through niche product marketing. We conducted an Internet survey in the summer of 2019. At least 400 adults aged 18 years or older were recruited from each US state by Dynata (n = 20,040). National, regional, and state results were tabulated. Data were analyzed by chi-squared and ANOVA, with a significance level of $P = 0.05$. Nearly 97% of the respondents consume dairy foods. Fewer than 50% of respondents were aware of local dairy farms, processing, or local products sold in retail stores. Residents of the New England, East North Central, and Mid-Atlantic regions were more knowledgeable of local dairy businesses and products. The respondents who consume dairy foods were aware of the farm locations only 25% of the time spent shopping; the consumers knew where the products were processed 24% of the time, and they read the product labels only 31% of the time to find that information. When asked how label claims would influence their willingness to pay (WTP) for conventional dairy products from larger, regional, and national processors, survey participants said they would pay less for raw products, and more for local products. Cows’ milk was preferred by 92%, and 72% preferred cheese made from cows’ milk. Vermonters and people aged 55 or older rated the visual, taste, and nutritional quality of milk, cream, butter, yogurt, cheese, and frozen desserts higher than the national mean scores on a 7-point scale. The most-preferred package size (61% of respondents) for milk was one gallon, but only 49% of Mid-Atlantic residents chose that option. One-third of respondents chose clear plastic containers as best for milk. The data from this survey guided the development of an online visualization tool for farmers and processors to better understand dairy food preferences among consumers in their marketing area.

**Key Words:** consumers, local, purchasing