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1259 Review and revision of the St-Pierre dairy cow model to estimate losses from heat stress. M. Malekkhahi[1], I. Flamenbaum[2], and A. De Vries*[1], *[1]University of Florida, Gainesville, FL, [2]Cowcooling Flamenbaum and Seddon, Jales, SP, Brazil.*

In 2003, St-Pierre et al. (STP) published equations that estimated the economic losses from heat stress in major livestock industries in the USA, including dairy cattle. Our objective was to review and revise the dairy cow equations in STP that predict how milk yield, dry matter intake, days open, reproductive culling, and death risk are affected by heat stress as measured by functions of the temperature-humidity index (THI) such as THI-load and THI-maximum. First, the published equations for changes in days open and reproductive culling clearly contain errors. We used the published results in STP to derive new equations to replace the erroneous equations. We found that a second-degree polynomial fitted the association between the increase in reproductive culling and THI-load well. A simple linear equation fitted the association between days open loss and THI-load. However, we found the relationship between THI-load and days open in STP to be overestimated by a factor of 2. Second, we fitted new equations for milk loss and dry matter intake loss based on more recent literature (30 studies published between 1990 and 2023). The new equations predict lower milk losses and lower dry matter intake losses at higher THI-maximum than the equations in STP. This suggests that losses at higher THI may be overestimated in STP. Third, we developed equations for reductions in milk fat and milk protein as functions of THI. Based on a literature review, we assumed that under a high heat stress load such as during summer conditions in the Florida, both fat and protein percentages would decrease by 0.20%-points. Fourth, we did not find sufficient evidence to update of the equations for reproductive culling and death risk as published in STP. Collectively, we concluded that several equations in STP overestimated losses due to heat stress as measured by THI. However, current THI-thresholds at which heat stress losses start are lower than assumed in STP and average THI have increased in the last 2 decades. Further analyses will estimate the profitability of mechanical cooling with the revised equations.

Key Words: climate, heat stress, cooling

1260 Milk spectra analysis as a tool for predicting heat stress in dairy cows. M. Bahadi[1], A. Ruiz-Gonzalez[2], L. Fadul-Pacheco[1], and D. E. Rico*[3], *[1]Lactanet, Dairy Center of Expertise, Sainte-Anne-de-Bellevue, QC, Canada, [2]Université Laval, Québec, QC, Canada, [3]CRSAD, Deschambault, QC, Canada.*

Fourier-transform infrared (FTIR) spectroscopy of milk samples presents a promising approach for identifying heat stress risk in dairy cows. Milk spectra from 4 independent heat stress induction experiments were used to identify spectral features with predictive potential. Each experiment followed a Latin square design, providing 12 observations per treatment and sampling time. Treatments were designed to isolate the effects of heat stress at a consistent feed intake level: (1) heat stress (HS; cyclical THI variation between 72 and 82) and (2) pair feeding under thermoneutrality (PF; THI = 64). Milk samples were collected at baseline (d 0) and at subsequent time points (d 3, 7, 10, and 14 of each period). Spectral regions 3,061–2,803 cm^{-1}, 1,797–1,681 cm^{-1}, and 1,612–925 cm^{-1} were analyzed. Principal component (PC) analysis combined with mixed modeling identified significant treatment effects ($P < 0.001$) in PC2, PC4, and PC5. Key spectral features in loading spectra of these PCs correspond to protein, unsaturated fatty acids, and energy-related metabolites, such as b-hydroxybutyrate, acetone, and citrate. These findings suggest that these metabolites may serve as discriminative indicators of heat stress. To further differentiate HS cows from baseline, a partial least squares discriminant analysis (PLS-DA) model was developed, excluding spectra from d 2 and 3 and all PF treatment spectra. The model achieved a misclassification rate of 7%, with a Matthew's correlation coefficient of 0.852, sensitivity of 0.95, and specificity of 0.93. Spectral features contributing to group differentiation included fat and urea, in addition to previously identified metabolites. Although heat stress-induced changes in milk spectra effectively distinguished treatment groups, the metabolic impact of feed restriction in PF cows must be considered, as ad libitum-fed animals may provide a more appropriate reference. These findings suggest that milk spectral analysis may serve as a valuable tool for detecting metabolic stress due to hyperthermia in dairy cows.

Key Words: milk spectroscopy, heat stress, metabolic biomarker

1261 Commercial application of "smart" technologies to reduce water usage when cooling dairy cows. H. Olmo*, M. A. T. de Bari, D. Onan-Martinez, J. Magalhaes, M. Siregar, J. Lance, I. M. Toledo, and G. E. Dahl, *University of Florida, Gainesville, FL.*

Optimal performance of dairy cows during all phases of the lactation cycle, is crucial to mitigate the effects of heat and humidity, as these factors can negatively impact animal health and productivity. To alleviate the negative effects of heat stress, shade, ventilation and active cooling systems are widely used strategies. The objective of this study is to evaluate the effectiveness of an automated "smart" system (AgPro, Paris, TX) for control of soaker output, compared with a conventional approach that relies on set timing after reaching a specified temperature threshold. We hypothesize that the "smart" system will reduce water use but be as effective as the conventional system in maintaining body temperature and respiration rate and not impact milk yield. Under commercial settings, we evaluated the water usage (soakers and water intake of cows) in 4 pens of lactating cows (n = ~460 cows/pen); 2 pens with smart soakers (LSS) and 2 pens with the conventional system (LC), and 4 pens of dry cows (n = ~170 cows/pen); 2 pens with smart soakers (DSS) and 2 pens with the conventional system (DC). Respiration rate (RR; bpm), rectal temperature (RT; °C), and skin temperature (ST; °C) were measured thrice weekly in a random group of 30 cows in each pen. Milk production (MP; kg/d), dry matter intake (DMI; kg/d), water intake (WI; L/d), and soaker system water usage (WU; L/d) per pen were recorded daily. Preliminary results indicate no differences in both lactating and dry cows for RT, RR, ST, and MP. A lower WI (3.9 vs. 3.6 ± 0.2 L/pen/d × 1,000; $P = 0.05$) and higher DMI (12.8 vs. 13.6 ± 0.3 kg/cow/d; $P = 0.009$) was observed in the DSS pens. Water usage was significantly higher in both LC and DC compared with LSS and DSS (43.3 vs. 25.5 ± 0.8, 22.1 vs. 12.4 ± 0.8 L/d × 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 while using about half the amount of water.

Key Words: dairy cattle, cooling system, water use

1262 Real-time milk yield prediction and health monitoring system for dairy cows. M. J. Gote*[1], D. Meuwissen[1], L. D'Anvers[1],