

## Variation of enteric methane intensity predicted from bulk tank milk in commercial dairy herds

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Enteric methane emissions account for approximately half the greenhouse gas emissions in Canadian milk's carbon footprint, highlighting the need to identify their main drivers to support effective mitigation strategies. This study aimed at describing the variation in enteric methane emissions on large scale on commercial dairy farms and identifying farm practices influencing herd-level emissions.

Herds were ranked on methane intensity (g CH<sub>4</sub> per kg of FPCM) predicted from bulk tank milk spectra collected throughout 2025 from 2,296 Quebec dairy herds. Details on the prediction model are presented in an accompanying abstract. Average methane intensity across individual bulk tanks was 14.9 g/kg FPCM (SD 1.40). Herd key performance indicators were extracted as herd averages from Lactanet (Canadian Network for Dairy Excellence) database. Feed records were collected for 402 herds. Datasets were aggregated with the respective yearly methane average. Univariate analyses were used to assess differences in herd performance across three levels of methane emissions, low (<14.0 g), intermediate (14.0-15.8 g) and high emitters (>15.8 g/kg FPCM).

Across the population, methane intensity differed among seasons (14.3 g in summer vs 15.4 g in winter), predominant breed (14.6 g for Jersey, 14.9 g for Holstein, 16.8 g for Ayrshire herds) and herd size (14.6 g for herds of 120 cows and more vs 15.1 g for herds with 60 cows or less). Herd performance was generally more favorable for low as compared to high emitters with, relative to high emitters, improved reproduction performance ( $P < 0.001$ ; 118 vs 129 days open), transition management ( $P < 0.001$ ; 206 vs -186 points on the transition management index), and health ( $P < 0.001$ ; 154 vs 207 cells/ $\mu$ L and 1.2 vs 3.8% cows with BHB > 0.20 mmol/L). Low emitters tended ( $P < 0.05$ ) to feed higher corn silage proportions (+9.7%) and had a higher ratio milk to concentrates (+0.3) than high emitters. Overall, low emitters had a 5 Can\$ greater income over feed costs than high emitters. These results suggest that appropriate changes in herd management and best management practices recommendations can be effective in mitigating enteric methane emissions on farm.