Session 4.1: Climate Change Mitigation Strategies.

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Implementation of Genomic Evaluation for Methane Efficiency in Holsteins

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Methane (CH4) is a potent greenhouse gas (GHG) that warms the atmosphere at a rate 25 to 27 times more than that of carbon dioxide. The average first parity Holstein cow produces nearly 500 g of CH4 per day or 180 kg per year, mainly due to enteric fermentation. A 30% difference above or below average can also be seen between cows, meaning two cows in the same herd can differ in their CH4 emissions by up to 110 kg per year. Methane emissions can also represent a loss of 4% to 7% gross energy intake for the animal. The emission differences between animals and loss in energy intake highlights the opportunity to decrease methane emissions by using genetic selection. Together with other major international dairy organizations, Dairy Farmers of Canada has pledged to reach net-zero greenhouse gas emissions from farm-level dairy production by 2050. Consequently, Canada has been building its capacity to measure and/or predict enteric methane (CH4) emissions for both herd monitoring and genetic tools.

Previous research using artificial neural networks methods and models has determined that a cow’s milk MIR spectral data can be used as a good predictor of its CH4 emissions. Lactanet was able to replicate this research through several data processing steps and develop CH4 predictions using milk spectral data and CH4 data collected from research herds in Canada. The resulting data are the input for a newly developed genomic evaluation for Methane Efficiency, which includes records on over 500,000 cows (over 60,000 genotyped) in milk recorded herds across Canada. Lactanet’s genomic evaluation for Methane Efficiency was developed using a 4-trait single-step genomic evaluation for predicted methane production for the Holstein breed, including milk, fat and protein yields as energy sinks. Methane Efficiency is defined as genetic Residual Methane Production in 120-185 DIM of the first lactation, independent of milk, fat and protein via a linear regression approach. Methane Efficiency is a functional trait expressed as a Relative Breeding Value (RBV) averaging 100 and ranging from 85 to 115. For every 5-point increase in a sire’s RBV for Methane Efficiency, daughters are expected to produce approximately 3 kilograms less CH4 per year. This equates to a 1.5% reduction in CH4 emissions per cow per year and a herd can achieve a 20% to 30% reduction by 2050 through genetic selection. The average reliability of Methane Efficiency for genotyped young bulls and heifers is over 70%. Methane Efficiency does not have a significant undesirable correlation with any other trait, including LPI and Pro$ as well as the production traits. This is expected since Methane Efficiency is designed to be genetically independent of milk, fat and protein yields. Methane Efficiency is an important selection tool, allowing dairy producers to achieve significant reduction in methane emissions from their herd without negatively affecting production.