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Using a laser methane detector to assess enteric methane emissions from Indian indigenous dairy breeds

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Abstract

Enteric methane generated in gastrointestinal tracts of ruminants represents one of the major sources of greenhouse gas (GHG) emissions from livestock. In India, dairying is an important activity contributing about 27 % of the agricultural gross domestic product (GDP). This contribution is from different breeds including indigenous ones. Although indigenous breeds contribute substantially to the dairy products in India, studies on methane emissions from indigenous dairy breeds are sparse. A study was conducted to determine breed differences in enteric methane concentrations in three Indian indigenous breeds. The experiment took place on one dairy farm in Coimbatore district, Tamil Nadu, India. A total of 20 dairy cattle from Thapakar, Gir, and Kankrej breeds were selected using randomised block design and grouped into four stages of lactations. All animals were on a similar diet with body weights between 210 – 471 ± 90.01 kgs. Methane was measured directly from each animal, at a 1-metre distance, using a Laser Methane Detector (LMD). The LMD employs infrared absorption spectroscopy for precise, rapid and remote detection of methane gas by emitting a laser beam, which is then analysed for methane absorption. To ensure repeatability, measurements were taken twice daily after feeding for 6 minutes per animal over six consecutive days. Data analysis was performed using a Linear Mixed Effects (LME) with methane as the dependent variable, breed, animal weight and age as independent variables, and individual animal as the random variable. Results showed a significant effect ($p < 0.05$) of animal weight on methane, indicating biological variation at individual animal level, probably attributed to genetic or physiological reasons. There was no significant difference in methane across breeds although there were differences in the estimated marginal means (EMM) of methane concentrations with Gir showing the highest (203.08 ± 32.70 ppm-m) and Kankrej the lowest (130.96 ± 23.9 ppm-m). In conclusion, among indigenous breeds of India, individual animal parameters rather than breed differences are likely to have an influence on enteric methane concentrations. Mitigation strategies would focus on individual animal level rather than breed level.

Keywords: Dairy productivity, enteric methane mitigation, greenhouse gas emissions, indigenous cattle breeds, laser methane detector

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