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► To cite this version:

Mohammed Benaouda, Cécile Martin, Xinran Li, Ermias Kebreab, Alexander N. Hristov, et al.. Evaluation of mathematical models to predict methane emissions from ruminants under different dietary mitigation strategies. 7. Greenhouse Gas and Animal Agriculture Conference, Aug 2019, Foz de Iguazu, Brazil. 2019. <hal-02159601>

HAL Id: hal-02159601

<https://hal.science/hal-02159601v1>

Submitted on 2 Jun 2020

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HAL Authorization

1. Title

Evaluation of mathematical models to predict methane emissions from ruminants under different dietary mitigation strategies ⁽¹⁾

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⁽¹⁾ This study is part of the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI)'s "GLOBAL NETWORK" project and the "Feeding and

Nutrition Network” (<http://animalscience.psu.edu/fnn>) of the Livestock Research Group within the Global Research Alliance for Agricultural Greenhouse Gases (www.globalresearchalliance.org).

3. Abstract

This study evaluated the ability of published models to predict enteric methane (CH₄) emissions from dairy cattle, beef cattle, sheep and dairy goat, using a large database (3183 individual animal data). Models for each animal subcategory and CH₄ dietary mitigating strategies of lipid or starch supplementation and of diet quality (described by organic matter digestibility and neutral-detergent fiber digestibility) were assessed. Models were ranked according to root mean square prediction error (RMSPE; % of observed mean) to standard deviation of observed values ratio (RSR) and RMSPE, using all data within each animal subcategory. For dairy cattle, CH₄ emissions (g/day) were predicted with the smallest RSR using the model based on feeding level [dry matter intake (DMI)/body weight (BW)], digestibility of feed gross energy (dGE) and dietary ether extract (EE) content (RSR=0.66, RMSPE=15.6%). For beef cattle, the smallest RSR was obtained using GE intake, BW, forage and EE content (RSR=0.83, RMSPE=27.2%). For sheep and goat, there were limited published models; the smallest RSR was observed for a sheep model based on digestible energy intake (RSR = 0.61, RMSPE = 19.2%). IPCC Tier 2 models (1997; 2006) had low predictive ability for variation in dietary EE content, neutral detergent fiber content and organic matter digestibility (RMSPE 14.3-30.5% and 23.0-40.5% for dairy and beef cattle, respectively). No model predicted CH₄ emissions accurately under all dietary mitigation strategies. Some models gave satisfactory predictions and for improved prediction, models should include feed intake, digestibility and information on dietary chemical composition.

4. Index terms:

Prediction equation, enteric methane, livestock, nutritional practices.