Prediction of enteric methane emissions from cattle

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Abstract
Agriculture has a key role in food production worldwide and it is a major component of the gross domestic product of several countries. Livestock production is essential for the generation of high quality protein foods and the delivery of foods in regions where animal products are the main food source. Environmental impacts of livestock production have been examined for decades, but recently emission of methane from enteric fermentation has been targeted as a substantial greenhouse gas source. The quantification of methane emissions from livestock on a global scale relies on prediction models because measurements require specialized equipment and may be expensive. The predictive ability of current methane emission models remains poor. Moreover, the availability of information on livestock production systems has increased substantially over the years enabling the development of more detailed methane prediction models. In this study, we have developed and evaluated prediction models based on a large database of enteric methane emissions from North American dairy and beef cattle. Most probable models of various complexity levels were identified using a Bayesian model selection procedure and were fitted under a hierarchical setting. Energy intake, dietary fiber and lipid proportions, animal body weight and milk fat proportion were identified as key explanatory variables for predicting emissions. Models here developed substantially outperformed models currently used in national greenhouse gas inventories. Additionally, estimates of repeatability of methane emissions were lower than the ones from the literature and multicollinearity diagnostics suggested that prediction models are stable. In this context, we propose various enteric methane prediction models which require different levels of information availability and can be readily implemented in national greenhouse gas inventories of different complexity levels. The utilization of such models may reduce errors associated with prediction of methane and allow a better examination and representation of policies regulating emissions from cattle.


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