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Current state of enteric methane emissions and mitigation strategies from grazing systems in the tropics

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Abstract

Efficient livestock production systems that optimally supply livestock products with minimum enteric methane emissions (eCH_4) need to be adopted to lessen the contribution of this sector to climate change. However, cattle grazing in the tropics still report low productivity and high emission intensities compared to those in the temperate regions. This observation has been attributed to the low nutritive quality of tropical pastures and the high seasonal fluctuations of pasture availability. In this study, a meta-analysis of the tropical grazing systems was conducted to understand the trend of eCH_4 over a 15-year period (2008–2022) and the efficacy of eCH_4 mitigation strategies employed for cattle grazing systems in the tropics. A linear mixed model was employed to analyse data from 160 observations obtained from 29 studies, across 12 countries within the tropics. Fixed terms for the model included climatic zones, management systems, animal parameters and pasture diets. On average, eCH_4 were 130 g per day per cattle which formed the baseline of this study. We observed a decreasing trend in eCH_4 from 2012 to 2018 and a sharp rise between 2019 and 2020. There was a significant contribution of climatic zones to emissions ($p < 0.001$) with oceanic climates within tropics contributing highest emissions. Besides, the pasture diets significantly affected on emissions ($p < 0.05$) with mixed grass-legume pastures producing 17.6 % less emissions than the baseline. Intensively managed grazing systems had the highest dry matter intake and eCH_4 emissions. Adult female cattle had the highest eCH_4 (223.18g per day per cattle) across the animal types. On mitigation strategies, we found that eCH_4 reduced over the years with the adoption of improved pasture diets and management methods. This indicate that improving feeding and management strategies was effective in methane mitigation. The variation of emissions across the management systems and pasture diets were highly dependent on the average temperature and precipitation of a region. As the type of climate had a high influence on eCH_4, it was concluded that feeding and management strategies would be more effective when adopted based on the specific climatic parameters of a region.

Keywords: Adaptation, cattle productivity, greenhouse gas emissions

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