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Enteric methane emissions of peri-urban dairy farms during the wet season in southern Benin

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Abstract

Enteric methane (eCH₄) emitted by ruminant livestock, especially lactating cows, is a major environmental pollutant worldwide. Six pasture-based dairy farm types (FT) were identified in the peri-urban areas of South Benin and characterised as follows: Small-Herds-Zebu cattle (FT1); Small-Herds-Taurine cattle (FT2); Medium-Herds-Zebu cattle (FT3); Medium-Herds-Taurine cattle (FT4); Large-Mixed-Herds-Taurine-Zebu cattle (FT5); and Medium-Mixed-Herds-Taurine-Zebu cattle (FT6). Up to present, there has been no assessment of their eCH₄ emissions. This study was conducted at the peak of the vegetation period, between mid-September and October 2021, to estimate the eCH₄ emissions from different animal categories (bull, cow, steer and heifer) across the different FTs, with one herd selected per FT. In each herd, one animal per animal category was selected and its bodyweight was predicted from its linear body measurements. Subsequently, its grazing behaviour was monitored for three consecutive days. Direct observation of grazing duration, bite counts and hand-plucked bite mass estimation were used to estimate daily feed intake on pasture. The nutrient content and digestibility of the collected feed samples were predicted using near-infrared spectroscopy. Feed dry matter intake (DMI) was estimated as a function of the animal's grazing behaviour and metabolic bodyweight (kg^{0.75}). The eCH₄ emission factors (EF) and annual emissions for each animal category were estimated using the IPCC Tier 2 method and compared across FTs. All statistical analyses were performed with R software. EF (kg CH₄/head/year) varied ($p < 0.05$) between FTs for all animal categories, except for lactating cows. It ranged from 8.8 to 9.3 in steers, 9.3 to 10.0 in bulls, 9.0 to 9.3 in heifers, and 9.3 to 9.7 in lactating cows ($p < 0.05$). The lowest EF (10.3) was recorded in bulls followed by steers (15.3) in FT2. The highest eCH₄-emitting lactating cows (399) and heifers (173) were found in FT5, whereas the lowest-emitting lactating cows (72) and heifers (35) were observed in FT1 and FT2, respectively. These preliminary findings suggest that a shift towards small herds of locally adapted taurine cows selected for increased milk production will likely contribute to the reduction of eCH₄ emissions in peri-urban dairy farms of South Benin.

Keywords: Emission factors, feed ingestion, greenhouse gas emissions, pasture-based livestock systems, peri-urban cattle farming