CH_4 emission from enteric fermentation and manure management of domestic goats in Nepal

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Introduction

Goat farming plays a crucial role in Nepal's agricultural sector, but it produces carbon emissions that threatens the environment. Knowledge about feed characteristics and manure management practices is important to understand livestock's contribution to carbon emissions. Goat feeding practices, feed type and rearing pattern determines manure management practices and ultimately manure-related emissions.

Research question

- This study estimates methane (CH_4) emissions from enteric fermentation and manure management of domestic goats

Methodology

Data on goat body length, girth length, feed characteristics, and manure management practices were collected through direct field measurements and farmer surveys in two municipalities: Bheriganga in Surkhet district and Dullu in Dailekh district. Data were collected using Kobo – Toolbox for a questionnaire survey and direct observation of manure management practices by farmers. The country-specific emission factors for both CH4 enteric fermentation and manure management was computed using the Tier 2 approach of the IPCC 2019 refinement GHG inventory guidelines.

The study included a total of 529 goat farmers – 321 from Dullu and 208 from Bheriganga, who reared 3001 and 1883 goats respectively.

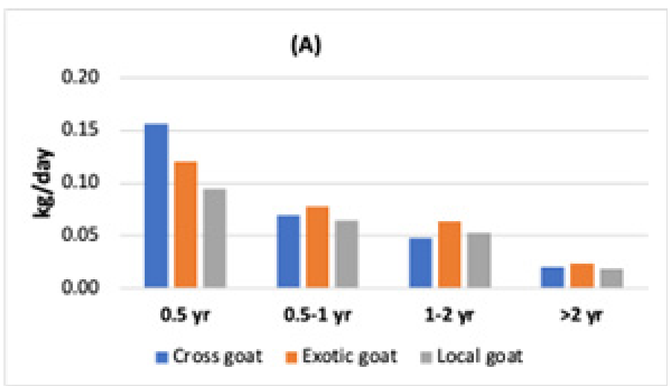
Key findings

Goat breed varies from indigenous, to exotic and even cross breeds.
The goat rearing system comprised intensive (64.11%), semi-intensive (35.08%), extensive and free ranges (0.81%).

The feeding systems included both confined (75.2%) and grazing (24.8%). The feed characterization resulted in both roughage and concentrated food.

Country-specific emission factor for enteric fermentation ranged from 2.3 kg CH_4 head^{-1} yr^{-1} (for <0.5 yrs age group) to 8.1 kg CH4 head^{-1} yr^{-1} (for >2 years' age group), and for manure management, it ranged from 0.03 kg CH4 head^{-1} yr^{-1} (for <0.5 years' age group) to 0.32 kg CH4 head^{-1} yr^{-1} (for >2 yrs age group). Total estimated CH4 emissions from goat farming in Nepal is 75.3 Gg yr,$^{-1}$ which includes 73.5 Gg yr^{-1} from enteric fermentation and 1.8 Gg yr^{-1} from manure management.

Figure 1 Growth rate of goats in Bheriganga (A) and Dullu (B) municipalities by age group



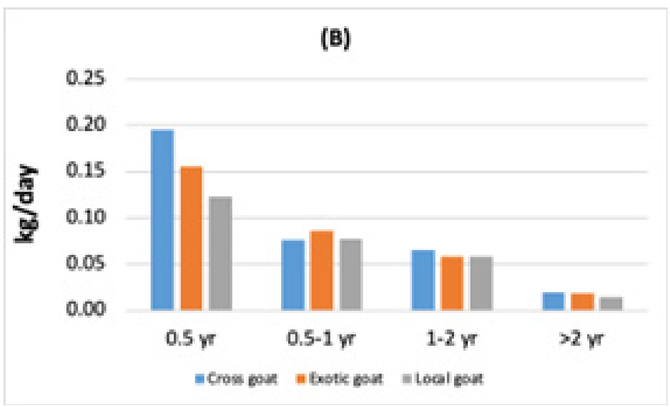


Table 1 Emission factor for goats in Dullu Municipality

Category	Sub-category (Age)	Gross Energy (GE)	Emission factor (EF)
Cross	0.5 yr	6.8	2.5
	0.5-1 yr	14.1	5.1
	1-2 yr	18.7	6.7
	>2 yr	22.7	8.2
Exotic	0.5 yr	6.4	2.3
	0.5-1 yr	16.4	5.9
	1-2 yr	19.9	7.2
	>2 yr	24.4	8.8
Local	0.5 yr	5.6	2.0
	0.5-1 yr	13.8	5.0
	1-2 yr	16.8	6.0
	>2 yr	20.8	7.5

Table 2 Emission factor for goats in Bheriganga Municipality

Category	Sub-category (Age)	Gross Energy (GE)	Emission factor (EF)
Cross	0.5 yr	6.8	2.5
	0.5-1 yr	14.1	5.1
	1-2 yr	18.7	6.7
	>2 yr	22.7	8.2
Exotic	0.5 yr	6.4	2.3
	0.5-1 yr	16.4	5.9
	1-2 yr	19.9	7.2
	>2 yr	24.4	8.8
Local	0.5 yr	5.6	2.0
	0.5-1 yr	13.8	5.0
	1-2 yr	16.8	6.0
	>2 yr	20.8	7.5

Conclusion

This study concludes that feed characteristics, the amount of manure produced, and manure management practices affect CH4 emissions. Given the need to expand goat farming for meat, milk, and wool in the country, it is necessary to introduce green farming methods and technologies.