Tropentag, September 17-19, 2018, Ghent

"Global food security and food safety:
The role of universities"

Estimation of Enteric Methane Emission Factors and Intensities in Smallholder Cattle Systems in Western Kenya

Alice Onyango[1], Uta Dickhoefer[1], Klaus Butterbach-Bahl[2], John Goopy[2]

[1] *University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Germany*
[2] *International Livestock Research Institute (ILRI), Kenya*

Abstract

Data on methane (CH_4) emissions from cattle in sub-Saharan African (SSA) are scarce, outdated, and commonly derived from the Tier 1 methodology, and thus not specific to prevailing systems. Tier 2 methodology, based on area-specific feed and cattle characterisation, would improve accuracy and lower uncertainties on CH_4 emissions estimates for cattle systems in SSA. Hence, the objectives were i) to estimate enteric CH_4 emission factors (EF) and emission intensities (EI) for meat and milk production using IPCC Tier 2 methodology, and ii) to evaluate uncertainties related to Tier 2 EF estimates in cattle systems of western Kenya. Cattle herd feeding and productivity were characterised in twenty villages of three geographic zones in western Kenya over four seasons of one year (n=388 cows). Cattle were disaggregated by age and production stages. Seasonal ingredient composition of cattle diets was established from the available feed biomass. Feed samples were collected and their apparent total tract organic matter digestibility estimated from analysed proximate nutrient concentrations and *in vitro* gas production. Animal performance was evaluated using liveweight (LW) measurements, body scoring, milk yield, and number of hours worked. The animals' net energy requirements, gross energy intakes, and EF were calculated following IPCC Tier 2. Uncertainty analysis was performed using coefficients of variation method and individual uncertainties combined to give overall uncertainty using IPCC propagation of errors method. By dividing EF by annual milk or meat production of individual animals, EI were calculated (in carbon dioxide equivalents; CO_2eq.). Tier 2 EF were 20–29 kg CH_4 for young, 34–63 kg CH_4 for adult females, and 40–50 kg CH_4 head^{-1} year^{-1} for adult males. The EI ranged from 56 to 100 kg CO_2eq. kg^{-1} meat and from 4 to 32 kg CO_2eq. kg^{-1} milk. Milk yield, LW, and diet digestibility contributed most to overall uncertainty in EF estimates (i.e., 52 %, 20 %, and 13 % of cumulative uncertainty, respectively). Smallholder cattle likely emit more CH_4 than Tier 1 estimates of their emissions. The EI reveal great potential for mitigation of emissions by increasing cattle productivity. Accurate milk records, LW, and diet digestibility would reduce uncertainty in EF estimates.

Keywords: Cattle systems, emission factors, emission intensity, uncertainty

Contact Address: Uta Dickhoefer, University of Hohenheim, Animal Nutrition and Rangeland Management in the Tropics and Subtropics, Fruwirthstr. 31, 70599 Stuttgart, Germany, e-mail: aninutrop@uni-hohenheim.de