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Effects of Nutrients Supply on Milk Yield, Composition and Enteric Methane Gas Emissions from Smallholder Dairy Farms in Rwanda

Authors : Jean De Dieu Ayabagabo, Paul A.Onjoro, Karubiu P. Migwi, Marie C. Dusingize

Abstract : This study investigated the effects of feed on milk yield and quality through feed monitoring and quality assessment, and the consequent enteric methane gas emissions from smallholder dairy farms in drier areas of Rwanda, using the Tier II approach for four seasons in three zones, namely; Mayaga and peripheral Bugesera (MPB), Eastern Savanna and Central Bugesera (ESCB), and Eastern plateau (EP). The study was carried out using 186 dairy cows with a mean live weight of 292 Kg in three communal cowsheds. The milk quality analysis was carried out on 418 samples. Methane emission was estimated using prediction equations. Data collected were subjected to ANOVA. The dry matter intake was lower ($p<0.05$) in the long dry season (7.24 Kg), with the ESCB zone having the highest value of 9.10 Kg, explained by the practice of crop-livestock integration agriculture in that zone. The Dry matter digestibility varied between seasons and zones, ranging from 52.5 to 56.4% for seasons and from 51.9 to 57.5% for zones. The daily protein supply was higher ($p<0.05$) in the long rain season with 969 g. The mean daily milk production of lactating cows was 5.6 L with a lower value ($p<0.05$) during the long dry season (4.76 L), and the MPB zone having the lowest value of 4.65 L. The yearly milk production per cow was 1179 L. The milk fat varied from 3.79 to 5.49% with a seasonal and zone variation. No variation was observed with milk protein. The seasonal daily methane emission varied from 150 g for the long dry season to 174 g for the long rain season ($p<0.05$). The rain season had the highest methane emission as it is associated with high forage intake. The mean emission factor was 59.4 Kg of methane/year. The present EFs were higher than the default IPPC value of 41 Kg from developing countries in African, the Middle East, and other tropical regions livestock EFs using Tier I approach due to the higher live weight in the current study. The methane emission per unit of milk production was lower in the EP zone (46.8 g/L) due to the feed efficiency observed in that zone. Farmers should use high-quality feeds to increase the milk yield and reduce the methane gas produced per unit of milk. For an accurate assessment of the methane produced from dairy farms, there is a need for the use of the Life Cycle Assessment approach that considers all the sources of emissions.

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