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Effect of Manure Quantity and Quality on Ghg Fluxes from Tropical Pastures in Kenya

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Abstract

Dung patches on grazed rangeland are a major source of anthropogenic GHGs emissions from agricultural systems. Dung is rich in available carbon and nitrogen, thus, supporting microbial processes such as methanogenesis, nitrification and denitrification. These processes are driving greenhouse gas emissions from dung. However, the amount and quality of dung patches depends on nutritional status and feed intake of the livestock. Factors, which so far have not been considered in most studies focusing on GHG emissions from dung. Moreover, our study focus on Kenya, a country in Sub-Saharan Africa (SSA), for which little to nothing is known about regarding manure induced GHG emissions. Using an automated chamber system, we investigated the effect of manure quality and quantity on dung patches' GHG emissions in the dry and wet season. Experiments were done on the campus of the International Livestock Research Institute, Nairobi, Kenya.

While significant CH₄ fluxes were observed immediately following dung application to rangelands, no major stimulation of N₂O and CO₂ fluxes were observed. However, total net GHGs cumulative emissions from 1 kg manure were twice as high as those from 0.5 kg manure during two consecutive dry seasons.

With regard to manure quality experiment, CH₄ emissions from farm manure dung patches were approx. one magnitude higher as from dung patches of cattle fed at 40% maintenance. However, no significant manure quality effects were found on both net cumulative CO₂ and N₂O emissions in four observation periods. Specifically for dung patches N₂O emissions showed large variations in total cumulative emissions over a four week period, which could partly be explained by variations in environmental conditions (dry/ wet season), but partly were stochastic. This suggests that more research with more replicates and treatments in different seasons is required to calculate robust emission factors for N₂O emissions from dung patches from rangelands in SSA.

Keywords: Dung patches, GHGs emissions, manure quantity and quality, Sub-Saharan Africa

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