Simulating impacts of alternative manure management on greenhouse gas emissions from a typical beef cattle feedlot in Brazil

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Abstract: There is a lack of assessments evaluating the factors affecting greenhouse gas emissions (GHG) during the entire manure management (from excretion to field application) in beef cattle feedlots in Brazil, what may delay decisions for mitigation options. Evaluating the net exchange of GHG emissions in conjunction with process-based models may give a comprehensive insight on the impact of alternatives scenarios in those emissions. The observed flux data (methane -CH_4- and nitrous oxide –N_2O) in conjunction with the local climate, soil and management information were utilized to test a process- based model, Manure-DNDC, for its applicability evaluating a typical manure management in beef cattle feedlots in Brazil. That management basically consists in removing manure from bare soil housing floor every 90 days to storage as a solid in heaps until time for field application at a rate of around 300 kg N ha^{-1}. The tested Manure-DNDC was then used for predicting impacts of management alternatives on CH_4 and N_2O emissions from the target field. Principal results from the simulations indicated that (1) CH_4 and N_2O emissions were significantly affected by temperature, rainfall and soil properties throughout the manure management system; (2) Concreting the housing floor decrease N_2O, but substantially increase CH_4 emissions; (3) Initial SOC, conventional tillage (soil plowing) and higher quantities of manure N are factors that stimulate N_2O emissions during the field application. In terms of net global warming potential the modeled results suggested that increasing the frequency of manure removal from housing to storage in heaps followed the soil application of recommended N rates (120 kg N ha^{-1}) in conjunction with no-tillage system would more efficiently mitigate GHG emissions from the tested manure management system. Although only few experiments have been simulated using Manure-DNDC so far, this model appears promising to delivery feasible alternatives for mitigating GHG emission from animal manure management as well as improve national inventories.

Keywords: Beef production, animal waste, methane, nitrous oxide, GHG mitigation options