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Carbon footprint related to cattle production in Brazil, management practices and new alternatives.

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Brazil has the World largest commercial beef cattle herd, over 209.5 million heads in 2010 and is the leading exports of cattle meat. It has been argued that this activity has an important impact on GHG emissions, but a variety of options exists for greenhouse gases (GHG) mitigation in agriculture. Among those, the most prominent options are associated to the improvement of crops and grazing land management. Our study is focused on the GHG balance related to the improvement of brachiaria spp. pasture, leading to increases in the animal stocking rate and meat production per area and time. This study is based on the IPCC (2006) methodology and others Brazil specific data and results presented by scientific literature to estimate GHG balance (emissions sources and sinks) for three scenarios proposed for brachiaria pasture: 1) degraded pasture, 2) managed pasture and 3) crop-livestock-forest integration system (CLFIS). The approach takes into account the amounts of supplies per hectare used for each of the simulated scenario projected over a 20 years period. The GHG estimates are presented in kg CO_2eq per kg of liveweight, considering the following emission sources and sinks within farm-gate: i) CH4 from enteric fermentation, ii) CH4 from manure deposited on pasture, iii) N2O emissions from urine and dung deposited by cattle on pasture, iv) N2O emissions from N synthetic fertilizer, v) N2O emissions from crop residues as of N-fixing crops and pasture renewal returned to soils, vi) CO_2 from potassium use, vii) CO_2 from phosphorus use, viii) CO_2 from insecticides use, ix) CO_2 from herbicides use, x) CO_2 emissions due to lime application, xi) emissions due to diesel combustion, xii) eucalyptus biomass sequestration and xiii) soil carbon sequestration. We considered initial body weight of 200 kg for each heifer and a final slaughter weight of 450 kg head-1 for all scenarios; for degraded pasture a stocking rate of 0,5 head ha-1 year-1 and liveweight gain of 83 kg head-1year-1 or a gain of 41.5 kg of liveweight ha-1 year-1 and three years to reach slaughter weight. In contrast, for managed pasture and for CLFIS scenarios, two years to reach slaughter time and liveweight gain of 125 kg head-1 year-1 with 4 heads ha-1 year-1, resulting in a gain of 500 kg of liveweight ha-1 year-1. Our results indicate a GHG emission of 17.7 kg CO_2eq kg-1 of liveweight to the scenario degraded pasture (1), 11.4 kg CO_2eq kg-1 to the scenario managed pasture (2) and a positive balance of 4.9 kg CO_2eq kg-1 in the scenario CLFIS (3), which is mainly related to the eucalyptus biomass and soil C sequestrations. Our simulation indicates a great potential not only to reduce GHG emissions associated to cattle production on managed pasture in Brazil, but also a C sequestration in CLFIS, which would be an additional strategy to mitigate the climate change.