ESTIMATES OF ENTERIC METHANE EMISSION BY STEERS BOVINE CONSIDERING IPCC PROTOCOL IN STATE OF PARA

W. Souza Filho[1], L.G. Martorano[2], L. G. Barioni[3], P. C. Fernandes[2], A. Berndt[4], P.P.A. Oliveira[4]

[1]AnimalChange scholarship-Embrapa Eastern Amazon, Belem, PA, Brazil, [2]Embrapa Eastern Amazon, Belem, PA, Brazil; [3]Embrapa Informatic Agropecuary, Campinas, SP, Brazil; [4]Embrapa Southeast Livestock, Sao Carlos, SP, Brazil.

1. Introduction

The Brazilian government has announced, at COP 15, the country will target a reduction of its greenhouse gas emissions of between 36.1 and 38.9% from projected levels by 2020. The mitigation actions will be carried out on a voluntary basis. The policy makers assumed that the majority of Brazil's emission cuts will come from slowing deforestation (20.9% coming from the reduction in the Amazon) and reduction from agricultural emissions. Methane is produced during the fermentation of carbohydrates, which is, in the Brazilian case, mostly related mainly with grass forage fiber and its magnitude is driven by a number of factors, including the animal traits (e.g. age, bodyweight, and genetics), feed quality and environmental parameters (e.g. temperature). Therefore, mitigation options would have to address those drivers. IPCC (2007) reviewed the mitigation potentials linked mostly with animal and feed factors and reported that they could be categorized more precisely into improved feeding practices, use of specific agents or dietary additives, and longer term management changes and animal breeding. The Brazilian government is taking measures to minimize deforestation through various environmental policies and stricter enforcement. However, they also have an ambitious goal of becoming the global biofuel leader. To meet global energy demands without compromising environmental standards and preservation, the Brazilian government approved the expansion of palm oil plantations on previously deforested lands. According to the National Energy Plan (BRASIL, 2007), Brazil will need to expand the area planted with oilseeds to meet its domestic demand for biodiesel production. At the same time, livestock intensification in currently underutilized pastureland could allow the expansion of grains and oil seeds. Methane emission by ruminants represents an energy loss of 4 to 12% of gross energy intake. Diet intake and digestibility are factors that influence CH_4 production. However, there is a lack of data of emissions of Zebu cattle on grazing conditions under tropical climate, and the IPCC's estimates are mostly based on *Bos taurus* and temperate grass evaluations. Thus, the purpose of this work was to estimate the enteric methane emissions by beef cattle bovine on pasture in State of Para field conditions and predict some scenarios for GHG mitigation by using the adoption of production systems with conservation practices.

2. Materials and Methods

The dynamic of cattle ranching and deforestation in the State of Para was analyzed using data of herd numbers from Brazilian Institute for Geography Statistics (IBGE) for the most important cities in cattle ranching in State of Para and accumulated deforestation data available from INPE-PRODES in the years from 2004 to 2010. This study has also used average data regarding productivity in the State of Para to estimate enteric methane emission. The inputs to the models considered the local cattle production characteristics. Validation of those estimates will be carried out in further studies using the methodology consolidate in

network PECUS (PRIMAVESI *et al* , 2004). We have estimated enteric fermentation by applying IPCC (2007) national greenhouse gas inventories guidelines Tier 2 model, considering the follows specifications: average daily feed intake (in terms of GE content, MJ/d) and CH4 conversion rates (Ym) are used to estimate CH4 emissions in the tier 2 method. For calculation of enteric methane emissions was considered the production system as extensive grazing, CH4 conversion rate (Ym) as 6 %, intake of gross energy as 130,4 MJ/day, CH4 energy value (MJ/kg) being 55,65.

3. Result and Discussion

To estimate the influence of cattle ranching in methane emission we adjust some points in Tier 2 (IPCC, 2007). In the Table 1 we present the values of estimate the emission factor, the feed intake is multiplied by the methane conversion rate considering effective bovine from 2010.

Table 1. Methane emission by steers

Climate Region	Production System	Sub-Category	CH_4 Conv. Rate (Ym)	CH_4 Energy Value (MJ/kg)	EF (kg CH_4/ head/yr)	Population[1] (thousand heads)	CH_4 Emission (Gg/yr)
Tropical	Extensive Grazing	Steers	0.06	55.65	51.32	15.000	769.74

[1] Estimative considering steers category in 2012.

The Figure 1 illustrates the estimate of enteric methane emissions in State of Para till 2009 and it inferred that between 2004 and 2006 increase the enteric emissions forced by the highest number of animals.

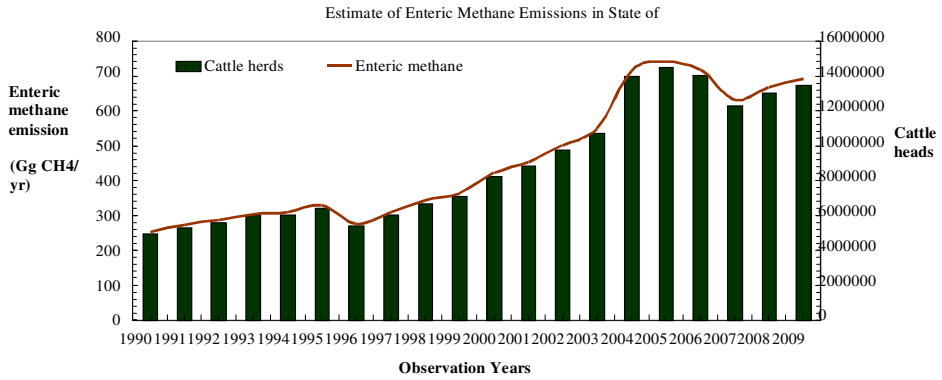

Figure 1. Estimates of enteric methane emissions in State of Para.

According to Martorano *et al.* (2012), after 1994 the number of bovines in the Para State herd has increased from 315 thousand to around 1,7 millions heads, particularly along the Trans-Amazonian road and Belem-Brasilia road into south of Para State. Therefore, it is important to evaluate the rapid increase of cattle herd associated with local economics growth and agribusiness of Para. These authors highlighted that if has an increase of the efficiency in capacity of support of pastures to 3 head ha^{-1}, different of the actual average of 0.9 head ha^{-1} and adopted iLPF system and considering 12 mouths of slaughter age reduction in 10 years in 5% of total area (10.8 millions ha). Assuming, the same baseline of emission (56 kg CH_4

head^{-1} yr^{-1}) and a reduction of 30% of emissions in Integrated Crop Livestock Forest systems, we estimate in this study, using the effective of bovine from 2009, that is possible reduce the enteric emissions in 34.6 Gg CH4/year in the Para State. It is important to highlight that the cities with highest forest loss and related forest disturbances, such as fire and logging, use or abandonment after forest clearing are the areas with the highest level of cattle ranching. In the last ten years, the city of São Felix do Xingu, situated in the southeast of Para State lost almost 21% (16.990 km²) of their forest. The rate of deforestation ranged between (0.4-1.6%) for year of total cover area of the city which represents a variation between (354-1400 km²). Deforestation average compared the effective bovine average between 2004 to 2010, in south and southeast of Para showed that 86% of rate of deforestation could be explained by increase of average effective bovine in the most important livestock cities in the state of Para. These preliminary results is the first step to understand and determinate the methane emissions using the sulfur hexafluoride (SF6) technique in Zebu cattle grazing *Brachiaria brizantha* in Integrated Crop Livestock Forest and extensive grazing to improve the National Inventory of GHG Emissions.

Conclusion

In areas already deforested in the Amazon it is necessary to adopt production systems with conservation practices, and bringing social, environmental and economic benefits to the region to reduce the emission GHG and decrease the "Meat Carbon Footprint", in the state of Para.

Acknowledgements

The authors would like to express their sincere gratitude to Embrapa Eastern Amazon, ANIMALCHANGE, iLPF, PECUS and ROBIN Projects for the scientific, financial and technological supporting developments in this research.

References

Brasil. Ministério de Minas e Energia. 2007. .Plano Nacional de Energia 2030. Ministério de Minas e Energia, Brasília, DF, Brazil. 12v.

Brasil. Governo Federal - Comitê Interministerial sobre Mudança do Clima. Plano Nacional sobre Mudança do Clima (PNMC). 2008. Governo Federal, Brasília, DF, Brazil. 132p. Available at: http://www.forumclima.org.br/arquivos/plano-nacional-mc.pdf [Accessed Jan. 11, 2009]

IPCC (Painel Intergovernamental sobre Mudança do Clima): Mudança do Clima 2007. A base das ciências físicas. Paris, 2007. Disponível em: http://www.natbrasil.org.br/Docs/ipcc_2007.pdf Acesso em: 15/06/10.

Martorano, L.G.; Bergamaschi, H.; Faria, R.T. de; Dalmago, G.A. Decision Strategies for Soil Water Estimations in Soybean Crops Subjected to No-Tillage and Conventional Systems, in Brazil. In: Manish Kumar (Org.). Problems, Perspectives and Challenges of Agricultural Water Management. Croácia: InTech, 2012. p.439-456.

Primavesi, O.; Trighetto, R.T.S.; Pededreira, M.S. *et al.* Metano entérico de bovinos leiteiros em condições tropicais brasileiras. Pesquisa Agropecuária Brasileira, v. 39, p. 277-283, 2004a.