A BASELINE PROJECTION OF METHANE EMISSIONS BY THE BRAZILIAN BEEF SECTOR: PRELIMINARY RESULTS

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INTRODUCTION

In the last 10 years, it is estimated that the Brazilian beef production has risen from about 5.8 to 9.0 million metric tons of carcass-equivalent ($MMTCE_1$ and exports increased from less than 0.3 to over 2.2 MMTCE. The continuous expansion of the Brazilian beef industry will face increasing restrictions of land availability and price, as the conversion of natural areas into pastures is going down rapidly and there is a projected expansion of sugarcane and other crops for biofuel production. Also greenhouse gases emissions maybe a problem, as enteric fermentation by bovines accounted for over 160 million metric tons of CO_2-equivalent ($MMTCO_2e$), i.e. around 11.6% of the anthropic sources of greenhouse gases in Brazil (Lima et al., 2002). In this context, a method to estimate Brazilian herd dynamics and a baseline projection of meat production, productivity and methane emissions is presented.

MATYERIAL & METHODS

In a discrete model the whole Brazilian herd was categorized into Cows, Calves (male and females up to 1 year old), Heifers1 (1 to 2 year old heifers), Heifers2 (2 to 3 year old heifers), Steers1 (1 to 2 year old steers), Steers2 (2 to 3 year old steers), Steers3 (3 to 4 year old steers) and Steers4 (steers older than 4 years). Population changes were calculated in annual time steps.

Changes in animal numbers in each category are defined by calving rates, mortality rates and slaughter coefficients. Initial numbers of animals in each category were based on the 1996 Brazilian agricultural census data (IBGE, 2007). Calving and mortality rates were adjusted using IBGE estimates for animal numbers and the slaughter between 1996 and 2006. In the projection, cow slaughter was fit to minimize the absolute deviation between beef supply and demand in the period of 2008 – 2030. Only the period from 2008 to 2025 were considered in the projections. External marked demand was assumed to increase 2% per year and internal market 1% per year in the period. The optimization problem is mathematically expressed as:

$$minimize \sum_{y=2008}^{2030} \left(D_y - S_y \right) \qquad (1)$$

where D_y is the total beef demand (domestic + exports) and S_y is the total supply in the y^{th} year, calculated in Equation 2.

$$S_y = \sum_j G_{yj} * CW_j \qquad (2)$$

where G_{yj} is the number of animals of the j^{th} category slaughtered in the y^{th} year; CW is the average carcass weight of the j^{th} category at slaughter. The current trend of improvement in production efficiency was considered by linearly change technical coefficients. Calving rates were increased from 55% to 68%; age at slaughter reduced from 36 to 28 month and calf mortality reduced from 7% to 4.5%. Methane emissions were calculated for each category based on the TIER 2 model, described in the IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 1996).

RESULTS & DISCUSSION

Results presented in Table 1 suggest that the increasing demand will be met with no significant change in cow numbers and a small increase in the total number of animals. Despite the increase in animal numbers, the reduction in emissions per unit of product will result in almost no variation in methane emissions despite over 25% increase expected in production.

CONCLUSIONS

The expected raise in beef production in Brazil in the next 18 years will probably not contribute to the increase in methane emissions. The expected improvement in animal productivity and feed quality will allow meeting future production demand without major variation in the national herd population and methane emission.

REFERENCES

IBGE - Instituto Brasileiro de Geografia e Estatística (2007) Sistema IBGE de Recuperação Automática – SIDRA. www.sidra.ibge.gov.br.

IPCC – Intergovernmental Panel on Climate Change (1996) Guidelines for national greenhouse gas inventories. J.T. Houghton et al. (Eds). Bracknell. UK: IPCC WGI Technical Support Unit.

Lima, M.A.; Pessoa, M.C.P.Y.; Ligo, M.A.V. (2002) Primeiro inventário brasileiro de emissões antrópicas de gases de efeito estufa: emissões de metano da pecuária. Brasília: Ministério da Ciência e Tecnologia. 2002. 78 p.

Table 1. Projected dynamics of bovine population, meat production and the methane emission in the Brazil in the period 2007-2025

Year	Cow number (million)	Animal number (million)	Slaughter (million)	Meat production (MMTCE)	Methane emission ($MMTCH_4$)	CH4/CWe
2007	64.3	208.0	43.0	8.83	9.56	1.08
2011	63.3	209.8	45.1	9.20	9.55	1.04
2015	63.0	214.0	48.0	9.73	9.65	0.99
2019	62.6	217.9	51.1	10.29	9.74	0.95
2023	62.1	221.4	54.1	10.81	9.80	0.91
2025	62.0	223.4	55.6	11.08	9.84	0.89
Variation	-3.6%	7.4%	29.3%	25.4%	2.9%	-18.0%