

# Livestock production systems balance and the emissions intensity of Greenhouse Gas Emissions on Brazilian Amazon

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## Introduction

Global warming resultant from rising in greenhouse gas emissions (GGE) to atmosphere on the last decades leads the mankind to enrich their knowledge about the relationship between the productive activities and GGE's (FAO, 2013). Nevertheless, the process of technology development and adoption to increase the environmental behavior of production systems should considered the economic and social sustainability of such production systems (SILVA *et al*, 2016).

The beef livestock production on Brazilian Amazon occur on extensive pasture mainly, as it is on the other country's Biomass (ALVIM *et al*, 2015). The North Region participates with 22% of national cattle herd on 2014 (IBGE, 2016). The research aiming to understand and explain the impacts of this activity on the environment, and search mitigation alternatives technologies will develop a more environmental friendly livestock production system. The identification of Technologies and production models which allows the GEE's reduction with good financial and social outputs.

This research objective is to compare the GEE 's emissions, production and economic indicators of four production systems of beef livestock on Brazilian Amazon, both single and in combination with others.

## Material and Methods

Four beef livestock production systems on Paragominas-PA region were analyzed, two traditional systems (cow-calf (Bz\_Td) and full cycle + finishing (BG\_Td)) and two proposed systems, with a higher technological level (cow-calf (Bz\_At) and full cycle + finishing (BG\_At)). The economic analyses was develop using the annual profit by the Family Income indicator (GUIDUCCI et al, 2012), and considered inputs and products prices for year 2014. The calculus of GEE 's production systems used the PECUS Emissions Model version v3.9.6, developed by Pecus Project Research's team. The Model estimates the annual carbon dioxide equivalent amount and the annual beef production for each production system. Aiming a higher comprehension of the alternatives, the production systems evaluation were done one by one and on pair combinations (one cow-calf plus one full cycle + finishing). The area amount on each combination were set by the equilibrium between the supply and demand of calves on each combination, and the results were normalized to one hectare for easier comparison. The interaction between systems could rise different and more accurate conclusions then the ones obtained by a single systems comparison.

## Results and Conclusions

The Figure 1 shows the production system singular performance. The Family Income, beef production, supply and demand of calves is bigger on higher technological production systems than on traditional ones. However, the emission intensity behavior is not as straight as the other indicators. The higher technological cow-calf system 's emission intensity is 25% higher than from the traditional one, while the higher technological full cycle + finishing system reduces the emission inten-

sity by 46% compared with the traditional one. The production system individual analyses, when applied to the systems considered, leads to a conclusion that the traditional cow-calf system is better than the technological one, and the opposite occurs with the full cycle + finishing systems on environmental terms. The system BG\_At is the best of all four in terms of production and emission intensity, and the second on terms of Family Income.

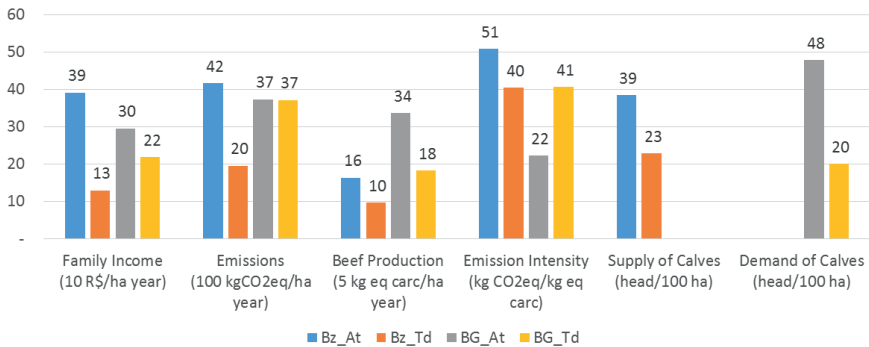


Figure 1 – Family Income, GEE emission per area, beef production, emissions intensity, supply of calves and demand of calves for the production systems individually.

Source: Research data

However, the full cycle + finishing production systems couldn't exist without the cow-calf production systems, and vice versa. Therefore, the individual analyses could not be the best approach to analyze the systems efficiency. Besides, the combination of areas on each pair of systems is not the same, once the supply and demand capacity of calves on each system differs. In addition, the cow-calf systems main objective is the supply of calves, and compare then by the emission intensity considering beef production could not be the best strategy.

Figure 2 shows the systems combinations indicators performance. The pair's area were set by the supply and demand of calves balance, and then normalized to one hectare. The higher technological pair (Bz\_At-BG\_At) results on best indicators for Family Income and produc-

tivity. The intensification allows an increase on heard, thus increasing the emission by area. However, the emission intensity is the second best, being 19% less of the traditional combination adopted.

The alternative systems combination adoption (Bz\_At-BG\_At) allows a 96% increase on Family Income, 69% increase on beef production, 37% increase on GEE ´s emission by area, and a decrease of 19% on emission intensity when compared with the traditional combination (Bz\_Td-BG\_Td). However, this production strategy not reach the same emission intensity obtained by the combination of traditional cow-calf system with technological full cycle + finishing production system (Bz\_Td-BG\_At).

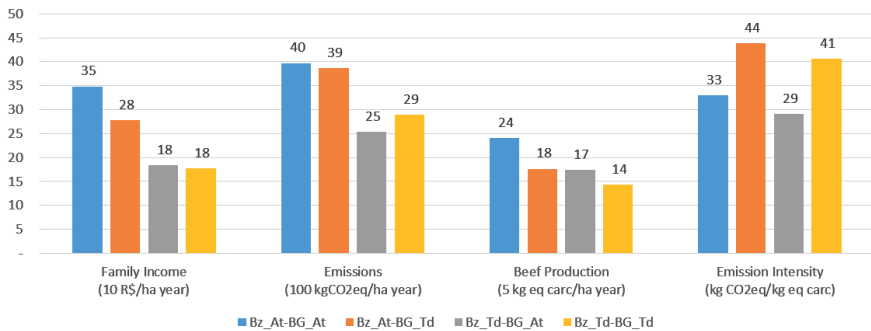


Figure 2 – Family Income, GEE emission per area, beef production and emissions intensity for the production systems combinations.

Source: Research data

Those results suggests a great opportunity to technological cow-calf system development with a stronger environmental strategy, possible allowing the same Family Income and production levels, but with an overall average emission intensity below 29 kg CO<sub>2</sub>eq/Kg beef cattle.

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