

Plan Overview

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Title: IMPACT OF SUSTAINABLE INTENSIFICATION OF BEEF PRODUCTION IN TROPICAL AREAS ON CLIMATE CHANGE MITIGATION

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Project abstract:

Focused on the awareness of climate change, food shortage risks and the concept of sustainable intensification, the main purpose of this project is to measure the environmental and productive impact of process of cattle ranching intensification and to develop a comprehensive set of indicators for ecologically sustainable intensification of beef cattle. We also aimed to measure emissions factors (EFs) for methane (CH₄), nitrous oxide (N₂O) and ammonia (NH₃) to improve greenhouse gases (GHG) inventories e balance. There are two EFs for N₂O, one for fertilizer (EF1) and other for animal excreta (EF3PRP) that are used to being quantified separately. However, in the pastoral system, fertilizer is applied on the excreta therefore; we will measure for the first time these two EFs simultaneously in tropical conditions. The experimental area will consist of 24 ha of *Brachiaria brizantha* Hochst ex A. Rich Stapf cv. Marandu pasture divided into 12 paddocks of approximately 2 ha each. The Marandu grass pasture was implemented in 2005/2006, with no interference (fertilizations) for at least five years. The experiment will be repeated for two consecutive years. Within each year, the experiment will be divided in two stages: rearing phase (rainy season, from November to March; rainy-dry transition, from April to June), and finishing phase on pasture or in feedlot (dry season, from July to September). The treatments will consist of three cattle ranching intensification (low, intermediate and high) in a completely randomized design with four replicates (paddocks), characterized by stocking rates of approximately 1.5, 3.5 and 5.5 animal unit (AU)/ha; respectively. Pasture evaluation will include herbage mass and forage quality determination. Animal response variables include intake and nutrient digestibility, enteric CH₄, N balance, performance, carcass yield, and protein and energy deposition. Environmental impacts to be assessed include N loss through volatilization of NH₃ and N₂O; CO₂ and CH₄ from excreta and N fertilization; and CH₄ enteric. Finally, GHG balance and carbon footprint will be estimated through the calculation of the emissions of GHG from animals and fertilizer and the emission of fossil CO₂ by other activities. Impacto da intensificação sustentável da produção de bovinos de corte em áreas tropicais na mitigação das mudanças climáticas Tendo ciência das mudanças climáticas, dos riscos de escassez de alimentos e do conceito de intensificação sustentável, o objetivo principal deste projeto é medir o impacto ambiental e produtivo do processo de intensificação da pecuária e desenvolver um conjunto abrangente de indicadores de intensificação ecologicamente sustentável de bovinos de corte. Também

objetivamos medir os fatores de emissão (EFs) para o metano (CH₄), o óxido nitroso (N₂O) e o amônia (NH₃) para melhorar os inventários e estoques dos gases de efeito estufa (GEE). Existem dois EFs para N₂O: um para fertilizante (EF1) e outro para excreta de animais (EF3PRP), os quais são quantificados separadamente. No entanto, no sistema pastoral, o fertilizante é aplicado sobre a excreta, de forma que pela primeira vez esses dois EFs serão medidos simultaneamente em condições tropicais. A área experimental consistirá em 24 ha de pastos de *Brachiaria brizantha* Hochst ex A. Rich Stapf cv. Marandu divididos em 12 piquetes de aproximadamente 2 ha cada. O pasto de Marandu foi implementado em 2005/2006 e está sem interferência (fertilizações) por pelo menos cinco anos. O experimento será repetido por dois anos consecutivos. Dentro de cada ano, o experimento será dividido em duas etapas: recria (estação chuvosa, de novembro a março, transição chuva-seca, de abril a junho) e terminação em pastagem ou em confinamento (estação seca, de julho a setembro). Os tratamentos consistirão em três níveis de intensificação (baixo, intermediário e alto) em delineamento inteiramente casualizado com quatro repetições (piquetes), caracterizados por taxas de lotação de aproximadamente 1,5, 3,5 e 5,5 unidades animal (UA)/ ha; respectivamente. A avaliação do pasto incluirá a determinação da massa de forragem e da qualidade da forragem. As variáveis de resposta animal incluem ingestão e digestibilidade dos nutrientes, CH₄ entérico, balanço de N, desempenho, rendimento de carcaça e deposição de proteína e energia. Os impactos ambientais a serem avaliados incluem a perda de N por meio da volatilização de NH₃, N₂O, CO₂ e CH₄ de excreta e fertilização de N e do CH₄ entérico. Finalmente, o balanço de GEE e a pegada de carbono serão estimados através do cálculo das emissões de GEE de animais e fertilizantes e a emissão de CO₂ fóssil por outras atividades.

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The experimental data will be collected from field measurements and laboratory analysis. Field measurements will gather data from animal, pasture, soil and static chambers, whose type will be as follow:

Data from animal: weight, enteric methane emission, intake of feed, feces, urine, in vivo ultrasound images in the 12-13th ribs, carcass weight.

Data from pasture: stocking, sward height, herbage mass, morphological composition (leaf, stem and dead material proportion).

Data from soil: Soil density, nitrate, nitrite, gravimetric water content, percent water filled pore space, ammonium-N, organic matter, P, Ca, Mg, K, cation exchange capacity, pH, H+Al, base saturation.

Data from static chambers: air samples to be analyzed for CH₄, N₂O and CO₂ using gas chromatography. In addition, semi-open chamber will be used to collect data of NH₃ volatilization.

Laboratory analysis will generate data from chemical analysis of forage, diet ingredients, feces, urine and carcass.

Daily maximum, mean, and minimum temperatures and daily rainfall precipitation will be obtained at a meteorological station located 1.5 km from the experimental site.

Firstly, data will be collected in the field or laboratory in notebooks, and then, immediately, typed in excel spreadsheets and stored in cloud server (Google Drive).

A file or spreadsheet with methodological procedures (in field and laboratory), including definition of variables, units of measurement and assumptions, will accompany the data.

The animals involved in the experiment were cared for according to the rules of the São Paulo State University Animal Ethics and Use Committee. The committee reviewed and approved the experiment and all procedures conducted in the study (protocol approval number 7979/18).

The data will be available in the Unesp open access repository, after publication of reports at events (congresses, symposia) and scientific journals. The metadata of the research will be public, however the data can only be shared and used by citing the authors.

The data will be stored at Google Drive cloud.

All members of the research group involved in this project will have access to the files as readers, but only the responsible researcher and coordinator will be able to edit them. .

All data will be considered as long-term data.

Data will be preserved and stored in the Google Drive cloud as further as possible, or at least for 10 years. Other data will be available in the institutional repository of Unesp, according to publisher's policy. The data will be preserved according to the repository policy.

The not-published data will be partially and/or fully disclosed in scientific events. The results will be prepared as original research articles for submission in periodicals in the area. Data will be available in the institutional repository of Unesp, according to publisher's policy.

Question not answered.

The project coordinator will be responsible for data management.

Question not answered.
