Grazing intensity as a strategy to mitigate methane in native grassland

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Introduction

Ruminants, thank to symbiotic microorganisms, are particularly efficient in transforming vegetal fiber to protein destined to human feeding. In extensive grazing systems where external inputs are absent, grazing intensity (stoking rate/forage biomass) is the main management factor that influence livestock production efficiency. Moderate grazing intensities are generally recognized to optimize livestock productivity while limiting CH_4 emissions (Gerber et al., 2011; Hristov et al., 2013). Native grazing ecosystems are widespread over all continents. They have great economical value through livestock production, particularly in the developing countries of South America (e.g. Argentine, Uruguay, Brazil) that are highly dependent upon this activity (FAO, 2010). When well managed, native grazing ecosystems have the potential to add large amounts of carbon into the soil (>500 kg CO_2 eq yr^{-1} ha^{-1}, Henderson et al. 2016). However, technical information for grazing management in South American native grassland are sparsely. Such information are particularly important to improve productivity, enabling economic development while preserving natural environments. The aim of this work is to discuss the pattern of animal productivity and methane emissions under different grazing intensities in a beef production system in South Brazilian's native grassland.

Material and Methods

The experiment was conducted at the Agronomical Experimental Station of the Federal University of the Rio Grande do Sul, Southern Brazil. This long-term experiment, kept since 1986, involves continuous stocking of heifers on native grassland under different forage allowances (FA, the inverse of grazing intensity). Stoking rate was adjusted monthly to maintain different levels of forage allowances (1, 2, 2-3, 3 and 4 kg of DM.ha^{-1} per kg LW.ha^{-1}) in different paddocks. The forage allowance 2-3 kg DM/kg LW was adjusted with 2 kg DM/kg LW during spring and 3 kg DM/kg LW during the rest of the year. The experimental design was a randomized complete block with two repetitions of each FA. We estimated CH_4 emission from six cows per treatment (2.5 years old in average) using the SF_6 marker technique. Methane emissions were collected over periods of 5 days for the summer, autumn, winter and spring of 2012 to represent emissions over all year round.

Results and Conclusions

The forage allowance of 4 kg DM/kg LW represent a very low grazing intensity with few animals per ha and was choose as a reference level here. From this reference level, increasing grazing intensity (or lowering forage allowance) result in direct increase of stoking rate and consequently a quasi-linear increase in CH_4 emissions per ha. The increase in grazing intensity also resulted in a relatively constant decrease in NAPP. On the other hand, moderate grazing intensities (i.e. FA 2-3) optimizes both animal daily gain and animal productivity per ha. Passing this moderate level of grazing intensity, all productive variables decreased while CH_4 emissions continue to increase. Here, moderate grazing intensities represent a simple management technic to mitigate CH_4 emissions while optimizing animal productivity and so being economical viability, with durable effects in time and space.

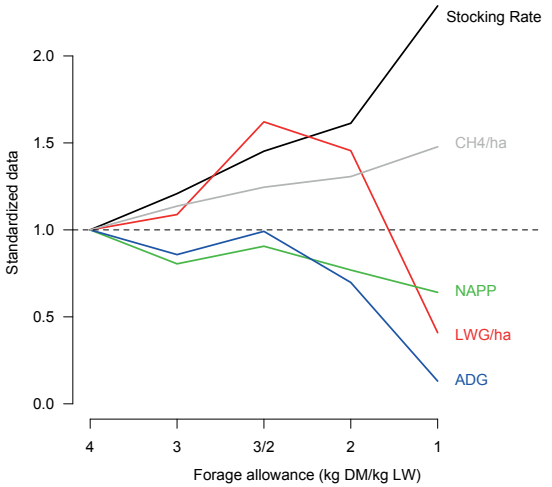

Figure 1: The relative effects of forage allowance on Stocking Rate, Methane Emission (CH_4/ha), Net Aboveground Primary Production (NAPP), Live Weight gain (LWG/ha) and Average Daily Gain (ADG) in a native pasture freely grazed by heifers.

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