PRELIMINARY RESULTS ON METHANE EMISSION BY NELORE CATTLE IN BRAZIL GRAZING *Brachiaria brizantha* cv. Marandu.

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ABSTRACT
Methane emissions by Nelore cattle grazing *Brachiaria brizantha* were monitored during winter (August) and spring (December) seasons. Sixteen Nelore steers with live weight (LW) varying from 206 to 525 kg, 196 to 538kg during winter and spring, respectively. Methane emissions were measured with the sulfur hexafluoride (SF_6) technique. Mean methane emissions were 102.3 and 136.5 g/animal/day and 0.343 and 0.420 g/kg LW/day in winter and spring, respectively. The mean emissions showed 39.7 and 35.3 g/kgDDMI for winter and spring seasons, respectively. For both seasons a high associative effect was observed of CH_4 emissions and live weight (r=0.78 and r= 0.97, respectively) and DDMI (r= 0.73 and r=0.96, respectively). Relative methane emissions (g/kgLW) were inversely correlated with LW (r=-0.75 and -0.87 for winter and wet seasons, respectively). Variations in observed methane production among seasons were related to forage quality that affects digestibility and consumption.

KEYWORDS
Methane, Brachiaria brizantha, Nellore.

INTRODUCTION

Methane (CH_4) is considered a greenhouse gas, and is the second in global importance. CH_4 is naturally produced during rumen digestive fermentation process of structural carbohydrates contained in forage based diets. The total CH_4 emission by cattle in the world is estimated to be 58 millions/year, or 73% of all livestock species (US Environmental Protection Agency, 1994). At least half of world cattle population occurs in tropical regions, mainly based on grazing systems. Brazil has the world largest commercial beef cattle population (130 millions), mostly zebu breeds, with 98% of animals on pastures, mainly cultivated with *Brachiaria spp.*

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 zebu cattle on grazing conditions under tropical climate, and the IPCC's estimates are based on *Bos taurus* and temperate grass evaluations. Thus, the purpose of this work was to evaluate the methane emissions by Nellore cattle grazing *B. brizantha* in different seasons of the year to corroborate to the IPCC´s agriculture greenhouse gases inventory.

MATERIAL AND METHODS

Methane emissions by Nelore cattle grazing *B. brizantha* cv. Marandu were monitored during winter (August) and spring (December) seasons at the Instituto de Zootecnia in Nova Odessa-SP, Brazil. The evaluation was carried out in an area of 48 ha, divided in paddocks of 1 ha each. There were 16 experimental units, formed by 3 paddocks where the animals rotated. Sixteen Nellore steers with live weight (LW) varying from 206 to 525 and 196 to 538 kg were used during winter and spring seasons, respectively. These animals were distributed to each experimental unit with 10 other animals of the normal herd.

Methane emissions were measured using the sulfur hexafluoride (SF_6) technique (Johnson & Johnson, 1995) adapted by Primavesi et al. (2002). Such technique consisted in the infusion of a capsule with a known SF_6 release rate inside the rumen, and methane and SF_6 gases were collected in a canister with vacuum, provided with a system of valves and capillaries, connected to a halter. -The measurements were made during 5 consecutive days, and the canisters were changed every 24 hours. The concentration of gases in the canister was measured with a gas chromatograph equipped with FID and ECD detectors, two megabore columns (0.53µm, 30m) Plot HP-Al/M (for CH_4) e HP-MolSiv (for SF_6), two 0.5cc stainless steel loops and two six-port valves.

Forage mass allowances of each paddock were measured the first day of measurements. Forage samples were dried to determine their water content, chemical composition (CP. NDF, ADF, lignin, EE and ash) and in vitro dry matter digestibility (IVDMD). The forage dry matter intake (DMI) was estimated by Cornell Net Carbohydrate and Protein System (5.0) for each animal. It was considered that IVDMD were equal to TDN, then 1 kg of digestible DMI were considered to be equal 4.44 Mcal of digestible energy (DE) (NRC, 1996). The energy loss was estimated by dividing CH_4 energy-equivalent by estimated digestible energy intake.

The co-relations were determinate with Proc Corr. The statistical program used was Statistical Analysis Systems (SAS, 1998).

RESULT AND DISCUSSION

Winter forage had the lowest CP and digestibility, and the highest NDF, ADF and lignin content (table 1) than spring forage. The mean CH_4 emissions were higher in- spring than winter (136,.5, and 102,.3 g/day), as the CH_4/LW (0,.420, 0,.343). The chemical variation of forages was the first cause of methane emission differences among seasons, which affected digestibility and consequently feed intake. Differences on methane emission related to forage quality are well described by Kurihara et al (1999) working with Brahman heifers receiving tropical forages. Animals eating low quality forage (Angleton grass) had lower intake (3.58 kg DM/day) and methane emissions (113 g/day), but when the animals had access to a better quality forage (Rhodes grass), the intake was higher (7.07 kgDM/day) and consequently the CH_4 emission (235 g/day) too.

The CH_4/DDMI in spring (35.3 g/kg) showed a slightly tendency of lower values compared to winter (39.7 g/kg). The lower fiber contents (NDF and ADF) during spring, were the main causes of lower CH_4/DDMI, as reported by

Kurihara et al (1999). The methane conversion rate (MCR) or the digestible energy losses as methane in spring (10,6%) were lower than in winter (11,9%). Those values are higher than 5.5-6,5% proposed by USEPA (1994) for use in greenhouse gas inventories of cattle fed on temperate forage diets. Kurihara et al (1999) did bring values in the same range as of this work for low quality grass (10,4 %) and high quality grass (11,4 %)

CH_4 daily emissions did have a high associative effect ($P<0,05$) with LW for all evaluations (r = 0,97, 0,78, for spring and winter, respectively; Figure 1), as a consequence of the increased DDMI intake ($P<0,05$) (r= 0,96, 0,73 for spring and winter, respectively; Figure 2). Although, CH_4/LW were inversely correlated ($P<0,05$) with LW (r= -0,87, -0,75 for spring and winter, respectively; Figure 3). This is probably because of that growing animals have a relative higher intake (%LW) than animals on maintenance. Figure 4 shows the positive correlation (r= 0,84, 0,63 for spring and winter, respectively; $P<0,05$) of CH_4 emissions with relative DM intake (%LW).

CONCLUSIONS

These preliminary results indicate differences of methane emissions because of forage quality and a high associative effect of methane production with live weight due to digestible dry matter intake. Using these preliminary data it could be estimated that the mean methane emission is 51,79 kg/head/year, and that the total beef cattle annual production is 4.915,51 Gg.

Evaluating the differences of methane emissions between the season (wet and dry), we may consider that during the dry season animals in the Brazilian production systems usually have weight loss, and it is the main cause of the high average age to reach the slaughter weight, 4 years. With just a decrease of the average slaughter age of steers, the Brazilian beef cattle production system may decrease total methane emissions by 10%.

This was the first step to understand and determinate the methane emissions of Zebu cattle grazing *B. brizantha,* which are very representative of Brazilian cattle and grasslands, and it may be helpful to improve the IPCC (Intergovernmental Panel on Climate Change) database. The next step we will focus the study on techniques to mitigate the emission by individuals, and by the whole production system.

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Table 1: Forage mass, In vitro dry matter digestibility and chemical composition of *B. brizantha grass in different seasons of the year.*

	Winter	Spring
DM (%)[1]	61.86	25.98
IVDMD (%DM)[2]	41.37	60.38
CP (%DM)[3]	3.33	7.72
NDF(%DM)[4]	82.1	71.43
ADF(%DM)[5]	51.38	41.23
Lignin(%DM)	7.79	4.35
EE(%DM)[6]	0.64	1.64
Ash(%DM)	6.21	8.13

[1]dry matter; [2]in vitro dry matter digestibilty; [3]crude protein; [4]neutral detergent fiber; [5]acid detergent fiber; [6]ether extract.

Table 2: Mean live weight and methane emissions by Nelore cattle in winter, spring and summer.

	Winter	Spring
LW (kg)[1]	317,6	332,7
DDMI (kg/day)[2]	2,69	3,85
CH4 (g/day)	102,3	136,5
CH4/LW[3] **(g/kg)**	0.343	0.420
CH4/DDMI[4] **(g/kg)**	39.7	35.3
CH4 Energy Loss (%)[5]	11.90	10.6

[1]Live weight; [2]Digestible dry matter intake; [3]methane emission per kg of LW; [4]methane emission per kg of digestible dry matter intake; [5]digestible energy loss as methane

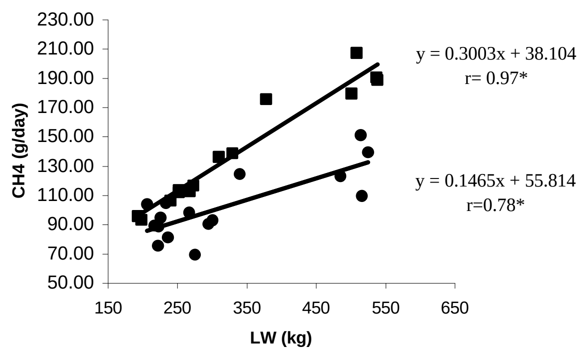

Figure 1: Correlation and linear regression fit of daily CH_4 (g/day) emissions and live weight during winter (?) spring (¦). *(P<0,05)

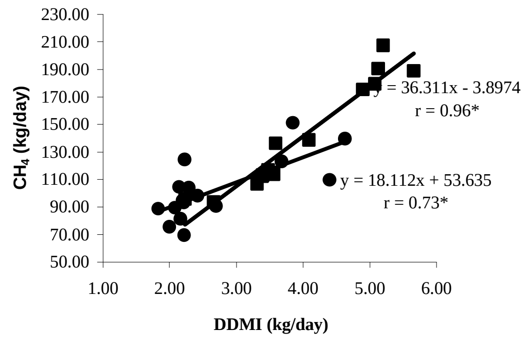

Figure 2: Correlation and linear regression fit of daily CH_4 (g/day) and digestible dry matter intake during winter (?) spring (¦). *(P<0,05)

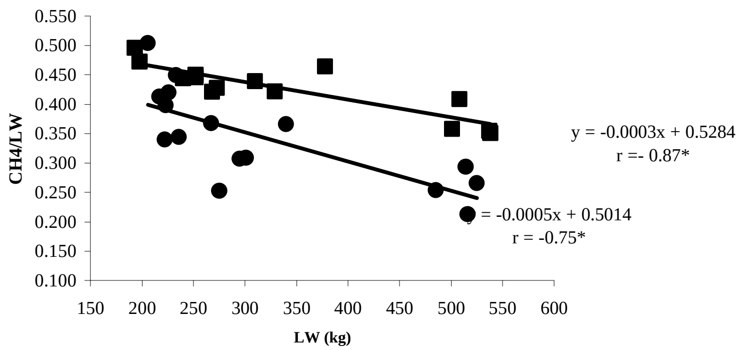

Figure 3: Correlation and linear regression fit of daily CH_4/LW(g/kg) emissions (g/day) and live weight during winter (?) spring (¦). *(P<0,05).

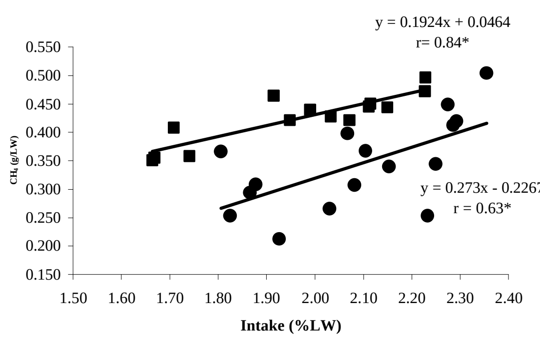

Figure 4: Correlation and linear regression fit of daily CH_4/LW(g/kg) emissions (g/day) and relative dry matter intake (%LW) during winter (?) spring (¦). *(P<0,05).