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The effect of lipid sources on the methane emission of beef cattle at pasture using the SF6 tracer technique

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Introduction Methane is known to be a potent greenhouse gas and its release to the atmosphere contributes to global warming. The losses of dietary energy average about 5-12% in methane (Van Soest, 1991) and it contributes to 68 % of the Brazilian emission of this gas. The methane production in the rumen is intrinsic to the rumen fermentation, acting as a hydrogen (H_2) drain, so the reduction on methane emission requires an alternative route for the H_2, avoiding its accumulation. Lipid sources can reduce methanogens and protozoa through a toxic effect and also act as an H_2 drain due to the biohydrogenation process.

Materials and methods Twenty Nellore steers (initial average body weight of 440kg) were assigned to five treatments of a completely randomized design. The animals were divided in to 10 paddocks (2 paddocks per treatment) of Brachiaria brizantha cv. Xaraés. Linseed oil, palm oil, soy bean grain and by-pass fat (Lactoplus®) were added to a supplement offered to the animals once a day (an amount of 1,0% of the body weight). The control treatment was composed of an energy-protein supplement with no additional fat. All the concentrate containing 20% CP and 10% EE (except the control supplement, which contained 3% EE). The animals were weighed every 28 days and slaughtered at 495.6 kg. The methane emissions were evaluated using the SF6 tracer gas technique (Johnson et al., 1994; Westberg et al., 1998, adapted by Primavesi et al. 2004). Permeation tubes with known release rates for SF6 were placed in the rumen, 72 hours prior to the start of gas sampling. Each tube was charged with 500-600 mg of SF6 and incubated at 39°C for calibration. Release rates of SF6 were determined by measuring the weight loss of tubes for 6 wk to establish a steady pre-determined rate. Release rates of the permeation tubes used in this study ranged from 930 to 1600 ng min–1. Gases exhaled from the nose and mouth were drawn into pre-evacuated collection tubes, through a capillary tubing. The collection system was designed to deliver half its volume during a 24-hr collection, ensuring a uniform collection rate. Five consecutive 24-hr gas samples were collected from each animal. The fixed effect was the treatment. The paddocks were used as the experimental unit. The methane emission and average daily gain were analysed using the tukey test, with a 5% probability.

Results There was no effect ($P>0.05$) of lipid sources on the average daily gain (ADG) of beef steers at pasture fed with 1% body weight supplement. The methane emissions were expressed in kilograms of methane emitted per year (kg $CH_4.yr^{-1}$), gram of methane emitted per day (g $CH_4.day^{-1}$), milligram of methane emitted per day per kilogram of body weight (mg $CH_4.day.BW^{-1}$), gram of methane emitted per day per kilogram of metabolic body weight (g $CH_4.day.MBW^{-1}$) and kilograms of methane emitted per kilogram of carcass produced (kg $CH_4.kg\ CAR^{-1}$). The methane emission was also not different ($P>0.05$) among the treatments in any unit expressed .

Table 1 Average daily gain and methane emission of animals receiving lipid sources on supplement

Variables	Treatments					CV (%)
	Control	Palm oil	Linseed oil	By pass fat	Soy bean	
ADG	0.564	0.567	0.661	0.556	0.561	12.123
kg $CH_4.yr^{-1}$	41.515	41.115	25.615	37.190	30.100	19.443
g $CH_4.day^{-1}$	113.735	112.645	70.180	101.880	82.470	19.446
mg $CH_4.day.BW^{-1}$	238.651	228.516	147.044	208.547	180.847	11.770
g $CH_4.day.MBW^{-1}$	1.115	1.077	0.687	0.980	0.836	13.627
kg $CH_4.kg\ CAR^{-1}$	0.236	0.245	0.144	0.227	0.180	22.604

Means within each variable followed by different letters differ by tukey test ($P < 0.05$), n=2.
ADG = average daily gain; BW= body weight; MBW = metabolic body weight; CAR= carcass

Conclusions Lipid sources such as palm oil, linseed oil, soy bean and by pass fat were not effective in mitigating methane emissions in Nellore steers, when included in a supplement with 10% EE, offered at a quantity of 1.0% BW to animals at tropical pasture.

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