Nitrous oxide emissions from different dairy cattle production systems with tropical pastures during the Brazilian spring

P P A Oliveira[1], T C Alves[1], A F Pedroso[1], R Marques[1,2], L F Passeri[1,2], J R M Pezzopane[1], A Berndt[1]
[1]Embrapa, São Carlos,SP, Brazil, [2]CNPq, Brasília, DF, Brazil *Email:patricia.anchao-oliveira@embrapa.br*

Introduction The Brazilian production of milk is based on tropical pastures production systems. The direct recovery and adoption of intensive management of pastures have shown potential for mitigation of greenhouse gases (GHG) due to high biomass production of tropical grasses, which have high efficiency of N-fertilizer use, and consequent accumulation of soil organic matter. The aim of this study was to evaluate the impact of pasture management on the nitrous oxide emission. N2O emissions were measured in situ during 20 days, after grazing and fertilization. Daily rate and cumulative N2O emission during 28 days were compared between treatments. These results will be used by PECUS Research Network, a multi-institutional project conceived by EMBRAPA with the objective to obtain consistent data, using internationally accepted research protocols, in order to subsidize governmental policies and to contribute to the development of mitigation alternatives for GHG emissions.

Material and Methods The study was conducted at the experimental station of the Brazilian Agricultural Research Corporation (EMBRAPA), located in São Carlos, São Paulo state, in the southeast of Brazil. The experimental design was randomized blocks (n=2 areas per treatment) with repetitions (n=3 chambers per block). Three treatments were evaluated: two production systems - intensive irrigated pasture of *Panicum maximum* cv. Tanzânia overseeded with oat and ryegrass with high stocking rate (intensive), and degraded pasture composed of a mixture of pastures of *Cynodon nlemfuensis* and *Brachiaria decumbens,* (degraded) - and the native forest (Atlantic forest) near the experimental area (reference), representing the original atmospheric conditions of this site. The intensive system had 28 paddocks rotationally grazed with 1 day of occupation and 27 days of rest periods. The degraded system was managed under continuous stocking. The intensive system was established in 1992, receiving annual fertilizations and liming; the lowest dose of N-fertilizer used was 500 kg of N/ha per year. Three static chambers were allocated randomly in each block - after grazing and fertilization with 33 kg N/ha (20.05.20 + 6%S) in the pastures and simultaneously in the forest. Gases samples were collected during 20 days and N_2O emission accumulations calculated for 27 days. N_2O concentration was determined by gas chromatography. Climate conditions and soil characteristics were also evaluated. Data were analyzed using ANOVA and Tukey test for comparison of means (Silva and Azevedo, 2009).

Results Accumulated N_2O emissions (27 days) were different ($P < 0.01$) among treatments. The extensive system with degraded grassland and forest showed similar nitrous oxide emissions whereas the intensive system showed higher emission (Table 1) although representing only 0.01% of the N applied at the grazing cycle (33 kg/ha). In the intensive system there were two peaks of N_2O emission, after precipitation of 9.6 and 20.4 mm respectively (Figure 1, A).

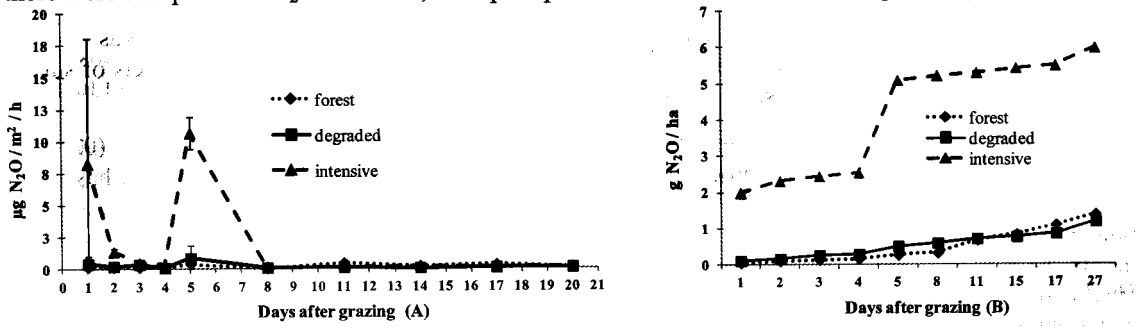

Figure 1 (A) Daily rate of nitrous oxide emission, (B) Accumulated nitrous oxide emissions.
Vertical bars in each evaluation of N_2O emission represent the standard deviation. Intensive = Intensive irrigated pasture with high stocking rate; degraded = Extensive system with degraded pasture; forest = Atlantic Forest.

Table 1 Nitrous oxide emission accumulated during 27 days (13/10/2012 a 08/11/2012).

treatment	forest	degraded	intensive
g N_2O/ha	1.375 b	1.180 b	5.973 a

Means followed by the same letter did not differ by Tukey test at 5% significance level. CV % = 35.95 (transformed data $\sqrt{x}$)

Conclusions The nitrous oxide emissions from intensive system, although greater compared with forest and extensive system, represented only 0.01% of the 33 kg N/ha applied in grazing cycle.

Acknowledgements The authors gratefully acknowledge funding from CNPq and EMBRAPA.

Reference

Silva, F. de A. S. E. and Azevedo, C. A. V. de. In: World Congress on Computers in Agriculture, 7, Reno-NV-USA: American Society of Agricultural and Biological Engineers, 2009.