Soil direct N_2O emissions due to bovine excreta deposition in native grassland at Southern Brazil: effect of different year's seasons

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Introduction

- Livestock has great impact on global nitrous oxide (N_2O) emissions for providing sources of N by grazing animal's excreta.
- In Brazil, due to the large areas occupied by extensive grazing systems, excreta deposition contributes to 57% of total N_2O emitted in agricultural soils.
- In contrast, information on emission factors (EF) of N_2O are scarce.

Objectives

- Determine EF of N_2O for bovine excreta (urine and dung) in native grassland of Southern Brazil.
- Evaluate if the generated values are comparable to IPCC EF (2%).

Materials and Methods

- Field study conducted in Federal University of Rio Grande do Sul experimental station (Eldorado do Sul, RS, Brazil)
- Soil: sandy clay loam Acrisol (FAO) or Paleudult (US soil taxonomy)
- Randomized complete block design; 3 replications
- Proportional of one bovine event for each excreta type applied in the beginning of each season of 2016 year; excreta-N rates at Table 1
- Greenhouse gases sampling by static chamber method and analyzed by gas chromatography
- Data were analyzed in PROC MIXED in SAS; means separated using Tukey test ($p<0.05$)

Results and Discussion

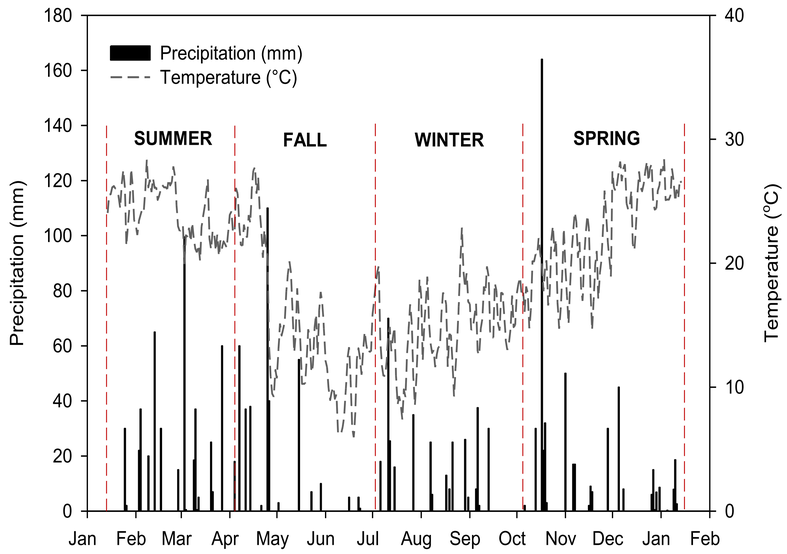


Figure 2. Daily rainfall precipitation and the mean daily temperature for all year's seasons.

- Cumulative N_2O emissions were affected by year's seasons and type of excreta.
- Higher N_2O emissions were observed in seasons with higher average air temperatures (Figure 2).
- Higher N_2O cumulative emission was observed in Spring season for urine treatment (5.85 kg N_2O-N ha^{-1}) (Figure 3-A).
- N_2O emissions due to dung deposition were low in all year's seasons (Figure 3-A).
- The EF for bovine dung varied from 0.008 and 0.029% between year's seasons and from 0.34 and 2.2% for urine (Figure 3-B).
- Across all seasons, the mean EF-N_2O for urine was 98% higher than dung EF (Figure 3-B).

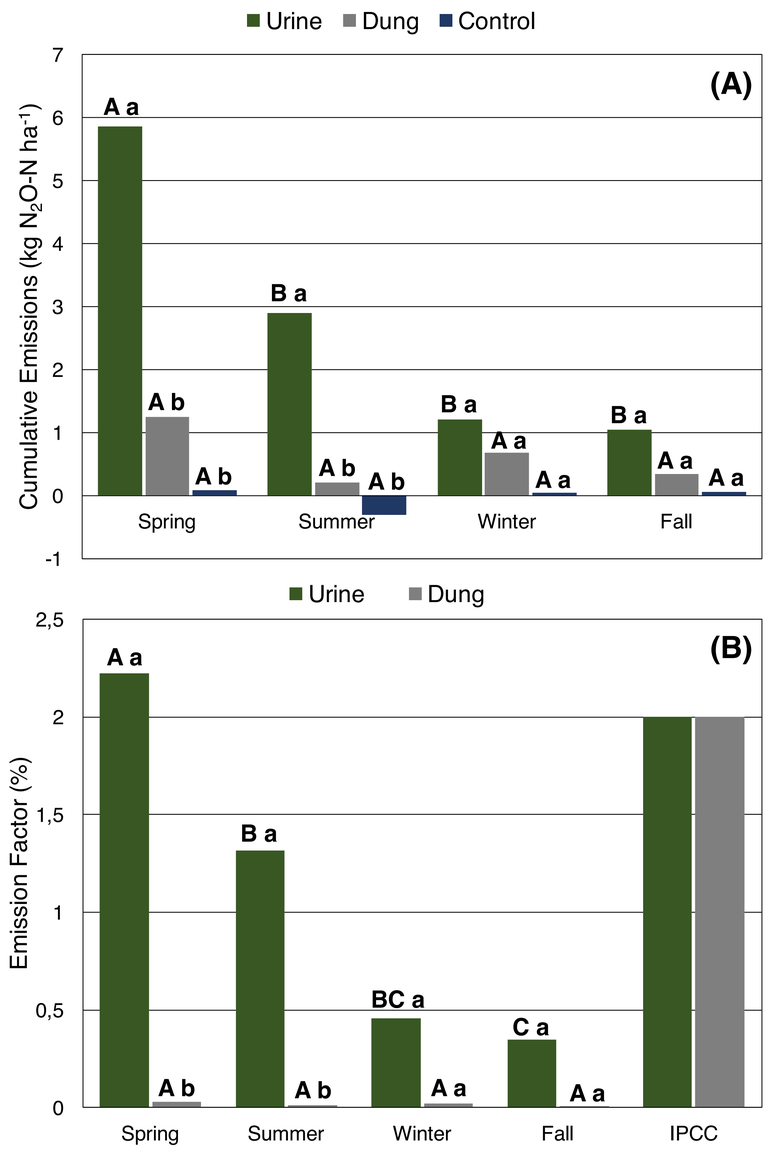


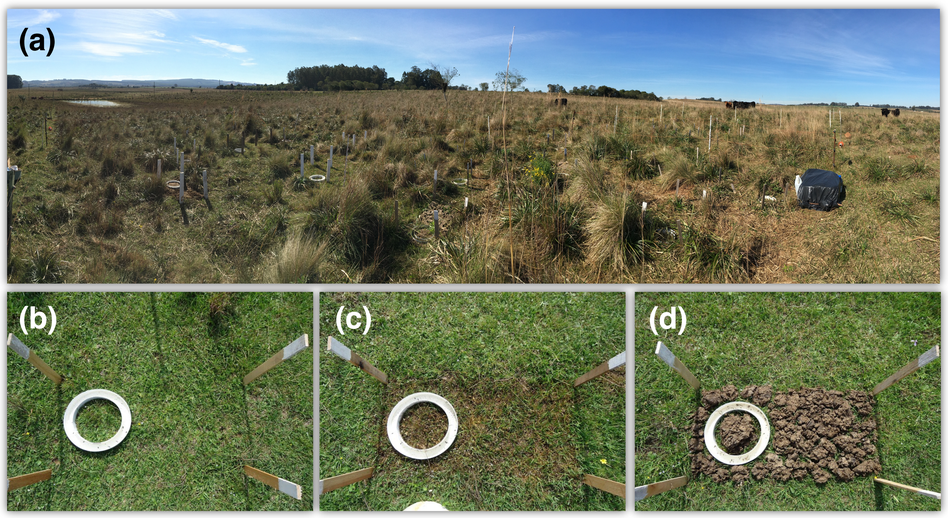
Figure 3. **(A)** Cumulative N_2O emissions and **(B)** N_2O emission factor for 2016 seasons due to soil bovine excreta applications. Lowercase letters compare treatments within each season. Uppercase letters compare treatments between seasons, according to the test and Tukey ($p<0.05$).

Soil-applied excreta treatments

Table 1. Bovine excreta-N rates (kg N ha^{-1}) applied in all 2016 seasons (summer, fall, winter and spring).

Seasons	Urine	Dung
	--rate (kg N ha^{-1})--	
Summer	243	662
Fall	282	628
Winter	254	527
Spring	260	730
Mean	260	637

Figure 1. **(a)** Native grassland experimental site; **(b)** control treatment (without N application); **(c)** urine treatment; **(d)** dung treatment.



Conclusions

- The dissimilarity of the N_2O emission factor for urine and dung found in this study, indicates the need for distinct EF to be considered for each type of excreta.
- In addition, our results showed that for subtropical region of Brazil the EF's values vary among year's seasons due to the influence of climate variables (temperature and rainfall).
- Across all seasons, the mean EF-N_2O is lower than indexes recommended by the IPCC.

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CAPES

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