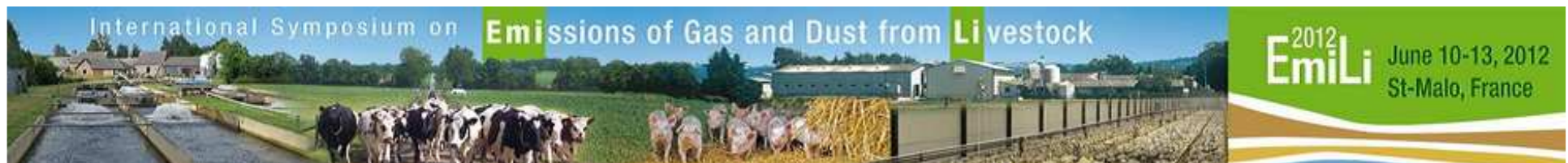


N₂O emissions from soil amended with cattle slurry under Mediterranean conditions

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N₂O EMISSIONS FROM SOIL AMENDED WITH CATTLE SLURRY UNDER MEDITERRANEAN CONDITIONS

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ABSTRACT

N₂O emissions are affected by several factors, including type of fertilizer, edafo-climatic conditions and mitigation measures applied. However, one single N₂O emission factor of 1.25% of total N applied is usually used. For two years a field experiment was carried out in central Portugal, to evaluate the effect over soil N₂O emissions originated from the application of cattle slurry (CS) to a double-cropping system producing maize and oats. The use of a nitrification inhibitor (DCD) was evaluated as emission mitigation measure. A mineral fertilizer treatment (MIN) and a Control were included and the DCD effects were tested together with MIN (MIN+DCD) and CS (CS+DCD). Total N input was equal for all fertilizing treatments (oat 80 kg N ha⁻¹; maize 170 kg N ha⁻¹). N₂O fluxes were measured on 165 sampling dates, using a photo-acoustic spectroscopic infrared gas analyzer. The polypropylene chambers used (2 per plot) were kept at fixed locations throughout all each cultural period. Gas samples were taken when chambers were closed (t₀) and 1h later (t₁), and fluxes were calculated based on changes in headspace concentrations between t₁ and t₀. The calculated hourly emissions were integrated over time to estimate the total daily emission and the emission over the measurement period during each season. The emission factor based on N application (EF) was calculated using $EF(\%) = 100 \times ((N_{2O_{fert}} - N_{2O_{Control}}) / N_{app})$, where N_{2O_{fert}} represent the cumulative N₂O flux (kg N ha⁻¹) in the fertilized plot, N_{2O_{Control}} the cumulative flux in the zero-N treatment, and N_{app} the amount of applied N (kg N ha⁻¹). Independently of the cultural period considered, the most important fluxes were observed 8-10 days after fertilizers incorporation and during the following 20-40 days. The highest value (297 g N-N₂O ha⁻¹ day⁻¹) was measured in MIN, during first autumn-winter crop. Annual N-N₂O losses were higher in the first year, with a wettest autumn and a warmer summer than usual. The higher values were measured with the use of mineral fertilizers (4.65 and 4.21 kg N ha⁻¹ in MIN+DCD and MIN, respectively), which were 60-70% higher than those measured with slurry application or without fertilization (1.85, 1.55 and 1.33 kg N ha⁻¹ in CS+DCD, CS and Control, respectively). Mean annual EF values measured were 0.76, 0.63, 0.12 and 0.07%, in MIN+DCD, MIN, CS and CS+DCD, respectively. The DCD use, namely with mineral fertilizer, didn't produce an evident effect on total N₂O losses.

Keywords: Greenhouse gas emissions, soil fertilization, nitrogen, nitrification inhibitor.