

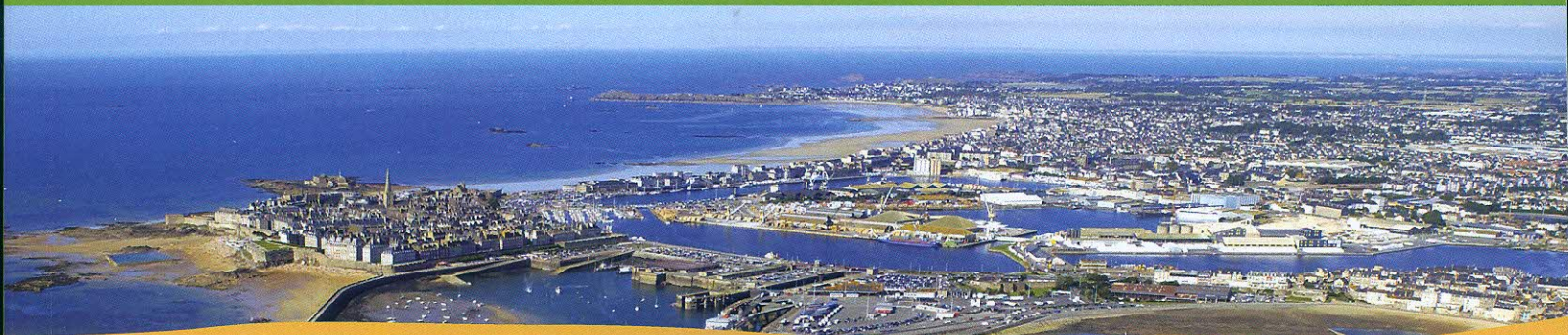
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SOIL APPLICATION OF ACIDIFIED SLURRY AS ALTERNATIVE TO RAW CATTLE-SLURRY INJECTION TO MINIMISE GASEOUS EMISSIONS IN MEDITERRANEAN CONDITIONS

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ABSTRACT

Slurry injection is the recommended method to minimise NH₃ emissions but its impact on other gases as N₂O is not clear and such technique is not always applicable, namely in stony soils or small plots. Slurry acidification is efficient to minimise NH₃ emissions along the slurry management chain but application of acidified slurry is still limited to Denmark and other countries from North Europe (1). Information about the impact of acidified slurry application to soil on gaseous emissions (NH₃ and GHG) in Mediterranean conditions are still scarce or inexistent. Our main hypothesis is that band application of acidified slurry is almost as efficient as slurry injection to minimise gaseous emissions at field scale. Hence, the objective of the present study was to compare NH₃ and GHG emissions from two different soils following band application of acidified cattle-slurry (AS) or raw cattle-slurry injection (SI) in Mediterranean conditions. Band application of raw cattle-slurry followed by incorporation (SS) was also considered as the traditional method and the impact of acidified slurry incorporation in soil following band application was also tested (ASS). For this, a double cropping system (maize followed by oat) was run over three years (September-2012 to July-2015) in 1 m ×1 m plots from a sandy (S) and a sandy loam (SL) soil. Experimental conditions used here were similar to those described in (2). The results obtained showed that NH₃ emissions from SS treatment varied between 26 and 64% and 0.1 and 34% of total NH₄⁺ applied in S and SL soils, respectively. However, NH₃ emissions from AS and ASS treatments were always lower than 2.7% of total NH₄⁺ applied in both soils during the three years experiment. Similarly, NH₃ emissions from SI remained lower than 1% of total NH₄⁺ applied. Significant differences were observed between treatments and soils in terms of cumulated amounts of N₂O, CO₂ and CH₄ emitted over the three years. Furthermore, the dynamics of GHG emissions were also different when comparing SI and AS or ASS treatments: SI led to higher and earlier peaks of N₂O relative to AS or ASS. During maize cycle, the highest (P<0.05) N₂O emissions were measured in SI but, during oat cycle, N₂O emission rates observed in SS, AS and ASS were in some cases higher than in SI. It can be concluded that slurry acidification has no negative impact on N₂O emissions since similar values were observed in SS, AS and ASS. Relative to C emissions, AS and ASS treatments led always to emissions rates similar or lower than those observed in SI. Thus, band application of acidified slurry is a good alternative to slurry injection to minimise N and C gaseous emissions at field scale in Mediterranean conditions.

Keywords: GHG, N₂O, CH₄, NH₃, CO₂, cattle-slurry, mitigation strategy, acidification, injection

References:

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IMPACT OF PIG-SLURRY TREATMENT AND APPLICATION TECHNIQUES ON AMMONIA AND GREENHOUSE GAS EMISSIONS IN A MEDITERRANEAN FORAGE SYSTEM

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ABSTRACT

Slurry injection is a well-known solution to reduce NH₃ emissions during and after soil application. However, its impact on other greenhouse gas (GHG) emissions is not clear and slurry treatment might also be efficient to minimise gaseous emissions at field scale. We hypothesized that, in a double-cropping forage system, slurry treatment combined with surface banding application may be as much or more efficient than raw slurry injection to decrease gaseous emissions. Thus, the aim of the present study was to assess the impact of pig-slurry treatment and/or application methods on NH₃ and GHG emissions. The experiment was carried out from June-2013 to May-2015 in field plots (5.6 m × 8.0 m) located at Castelo Branco - Portugal (latitude: 39.826901°, longitude: -7.460200°). The field experiment was a randomized block design with three replications and seven treatments. The following treatments were considered: unfertilised plot (Control), injection at 80 mm depth of raw pig-slurry (Inj-S), traditional broadcast application of raw pig-slurry immediately followed by soil incorporation (20 mm depth) (Broad-S), band application of raw pig-slurry (Band-S), band application of acidified (pH=5.5) raw pig-slurry (Band-AS), band application of mechanical separated liquid fraction of raw pig-slurry by screw-press (Band-LF), and application of mineral fertiliser (Mineral). A double-cropping forage system producing maize (June to September) and oat (October to May), was established and both crops were grown according to commercial practice. The rates of pig-slurries applied were equivalent to 170 kg N ha⁻¹ in June (maize silage) and 80 kg N ha⁻¹ in October (oat silage). The NH₃ fluxes were measured by the dynamic chamber technique using acid traps during the first 72 h after soil amendment of the treatments, while the N₂O, CO₂ and CH₄ fluxes were measured during the whole experiment by the closed chamber technique with gas concentration determination by gas chromatography. The results obtained showed that the average annual cumulative NH₃ emissions in treatments Inj-S, Mineral and Band-AS were <1.4% of NH₄⁺ applied whereas in treatments Band-S and Band-LF were about 11% of NH₄⁺ applied. The cumulative annual NH₃ emissions did not differ significantly between treatments Band-AS and Band-LF. The average cumulative annual N₂O emissions were <0.17% of total N applied in treatments Mineral and Band-LF, 0.28% of total N applied in treatments Inj-S, Broad-S and Band-S, and 0.37% in treatment Band-AS. The average cumulative annual GHG emissions in treatments Band-LF and Mineral were <400 kg ha⁻¹ while in all other treatments were >650 kg ha⁻¹. Hence, it can be concluded that slurry acidification and injection reduced NH₃ emissions to Control levels whereas the separated LF reduced GHG emissions relative to raw slurry. Slurry acidification did not increase GHG emissions when compared with injection. Thus, band application of acidified slurry is a good alternative to slurry injection.

Keywords: band application, maize, oat, slurry acidification, slurry injection, solid-liquid separation

CHARACTERISATION OF GASEOUS EMISSIONS FROM TUNNEL VENTILATED BROILER BUILDINGS DURING WINTER SEASON IN PORTUGAL

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ABSTRACT

Broiler husbandry is a significant source of ammonia (NH₃), nitrous oxide (N₂O), carbon dioxide (CO₂) and methane (CH₄) emissions but scarce studies have been made under Mediterranean conditions. The aim of our study was to evaluate the NH₃, N₂O, CO₂ and CH₄ emissions on commercial broiler buildings under Mediterranean winter conditions. Three tunnel ventilated broiler buildings, with similar equipments (climate system by Fancom; feeding and drinking systems by Roxell) and production practices, were selected in a commercial broiler farm Quinta de Antelas (latitude: 40.710500°, longitude: -8.244194°) located in central Portugal (Oliveira de Frades, Viseu). The experiment started with 21000 broilers per house on 18-December 2015 and finished on 29-January 2016, with a fattening cycle of 42 days. The outdoor and indoor environmental conditions, gas concentrations and ventilation rates of each broiler building were measured intermittently during the fattening cycle. Tedlar bags were used to collect air samples from the inlet, middle and outlet of each broiler building and then analysis with a photoacoustic field gas-monitor (INNOVA 1412). Results showed that the maximum concentrations of NH₃, N₂O, CO₂ and CH₄ did not exceed the threshold values recommended to maintain indoor air quality on broiler buildings. The average emission rates from broiler buildings under winter conditions were 5.5±2.3, 1.7±0.1, 4007±1337 and 9.4±2.7 mg h⁻¹ bird⁻¹ for NH₃, N₂O, CO₂ and CH₄, respectively.

Keywords: CH₄, CO₂, Emission rates, Mediterranean Portugal, NH₃, N₂O, Poultry husbandry, Winter season



SESSION 1 • **Mitigation Strategies**

SESSION 2 • **Modelling**

SESSION 3 • **Inventories & Environmental Assessment**

SESSION 4 • **Measurement Methods**

SESSION 5 • **Emission Factors and Air Quality**

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