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(LIFE20 CCM/ES/001751)

Ammonia volatilisation from an uncovered pig slurry storage lagoon

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INTRODUCTION

The whole manure management chain is an important ammonia (NH_3) hotspot. Animals' housing with the usual pit storage (all in/all out system), external uncovered lagoons, and traditional practices in land application of slurry as organic fertiliser are the three stages in which the LIFE CLINMED-FARM project (LIFE20 CCM/ES/001751) proposes to demonstrate greenhouse gas and ammonia mitigation techniques (more information in poster n. 131 'Sustainable and efficient slurry management models for approaching climate-neutral farms').

Uncovered lagoons have great emission potential because of their large surface area to volume ratio (Webb et al., 2005) and the long-term storage of pig slurry with a large fraction of its nitrogen in the form of ammonium. This form is rapidly emitted into the atmosphere in the form of ammonia (UNEP, 2013). Large air/liquid contact surface, as well as the hot and windy conditions in the Ebro Valley (Spain), are key drivers of ammonia emission risk.

The study aims to evaluate time-lapse differences while measuring the ammonia emission from a traditional pig slurry storage lagoon (uncovered) with simple passive samplers. It sets the reference scenario of emissions under Mediterranean conditions from which the mitigation potential of the technical solutions proposed in the project will be evaluated (www.lifeclinmed.eu).

METHODOLOGY

NH_3 air concentrations were monitored with ALPHA® passive samplers (Adapted Low-cost Passive High Absorption, CEH-UK) and net NH_3 fluxes were estimated with the Backward Lagrangian stochastic inverse dispersion model (bLS IDM). The NH_3 air concentration was calculated from the theoretical air uptake rate by diffusion depending on the exposure time and the analysis of the ammonium (NH_4^+) concentration in the aqueous extracts from the ALPHA® sampler filters. This concentration was determined by colourimetry following the salicylate method with nitroprusside (Searle, 1984) in a segmented flow analyser (AutoAnalyser3, Bran+Luebbe, Norderstedt, Germany). The atmospheric dispersion modelling software WindTrax (www.thunderbeachscientific.com) was used to obtain such estimations of the NH_3 flux.

RESULTS AND DISCUSSION

The following results were obtained in the monitoring of a sow pig farm of 1,015 heads in Almuniente (Huesca, ES) with a traditional slurry uncovered storage lagoon with a surface of 2,106 m^2.

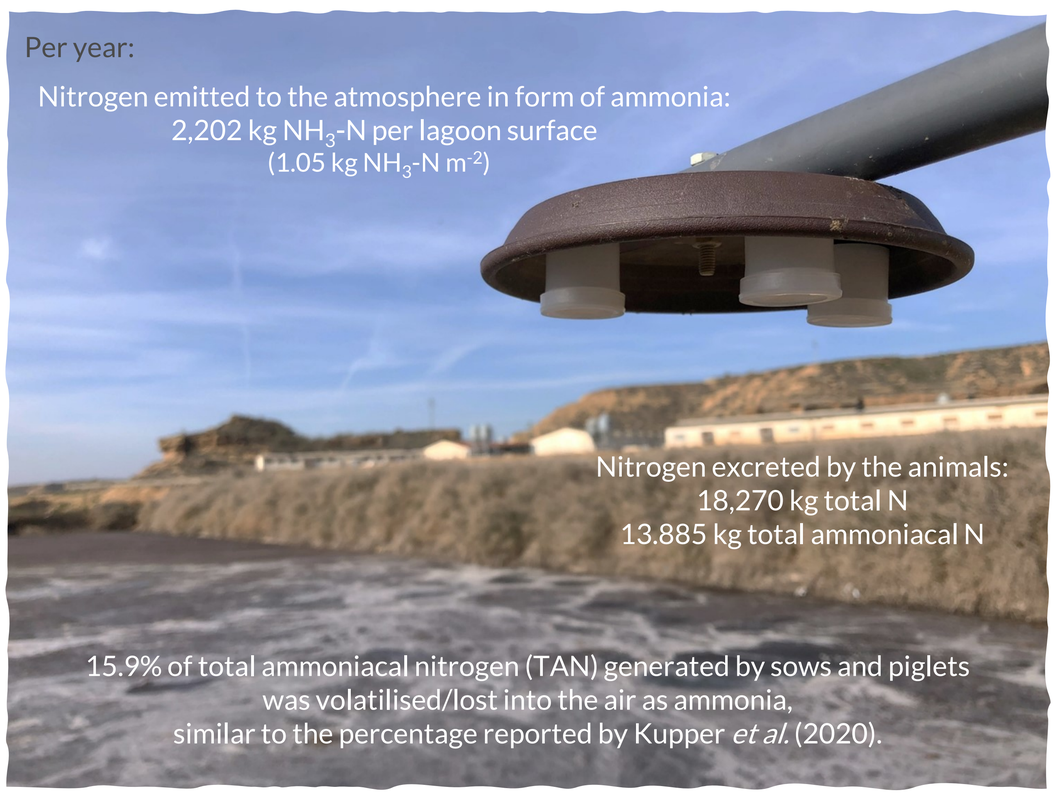

Figure 1. Detail of ALPHA® samplers located in the surroundings of the uncovered pig slurry lagoon.

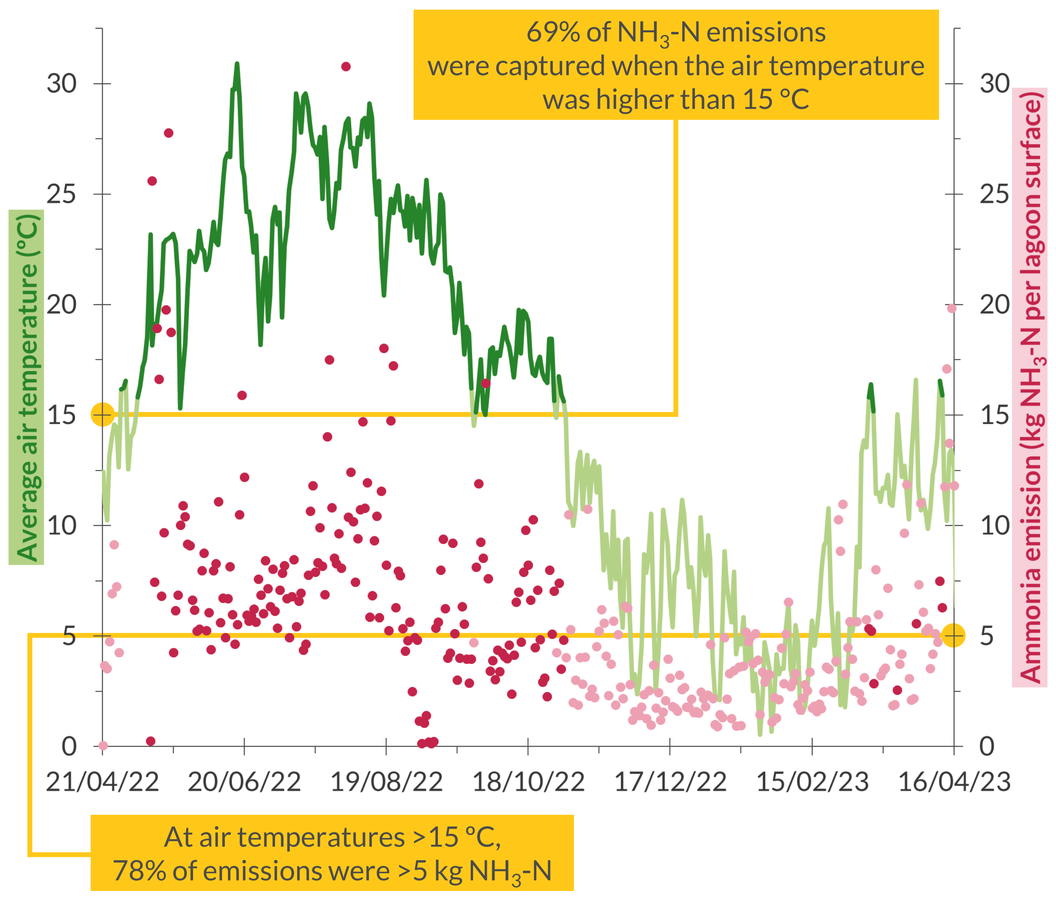

Figure 2. Average air temperature (°C) and ammonia emission rate (kg NH_3-N per lagoon surface) for the monitoring season.

CONCLUSION

The studied scenario, an uncovered pig slurry storage lagoon, was a hotspot of ammonia emissions that contributed to 15.9% of TAN lost to the atmosphere.

The temperature was identified as a key driving factor for ammonia volatilisation and its direct effect was evidenced. Considering the future context of global warming, ammonia emissions could have great significance in hot and mild climate regions where the average ambient temperature will reach more and more frequently values above 15 °C during large periods.

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