EGU22-7188
https://doi.org/10.5194/egusphere-egu22-7188
EGU General Assembly 2022

Soil texture and pH effects on NH3 emissions from pig slurry and anaerobic digestate with and without incorporation

Andreas Pacholski[1,2], Felix Engel[2], and Achim Seidel[3,2]
[1]Thuenen Institute, Thuenen Institute for Climate Smart Agriculture, Germany (andreas.pacholski@thuenen.de)
[2]Institute of Institute of Crop Science and Plant Breeding, Chair of Agronomy and Crop Science, Christian-Albrechts-University Kiel, Germany
[3]Landwirtschaftskammer Federal State of Schleswig Holstein, Rendsburg, Germany

Ammonia (NH_3) emission is one of the dominant pathways of N loss from liquid manure fertilization with negative effects on environment and human health. It is still an unanswered question, how soil (e.g. pH, Corg, texture) and slurry factors (e.g. pH, Dm) interact in NH_3 emission processes and which of the two systems eventually dominates the other. A systematic incubation study was set up using soils with different soil textures, in which different soil pH levels were established by in two long-term fertilisation trials (Jyndevad, Denmark; Bad Lauchstädt, Germany). Two contrasting slurry types combined with two application techniques (surface banding, incorporation) were tested. Guiding hypotheses were that emissions from surface applied slurry are mainly governed by slurry characteristics while soil effects become dominant after slurry incorporation.

Dynamic chamber incubations (400 g dry soil, 60% WHC, 15 °C, exchange rate 10 head space Vol/min) were set up to determine NH_3 emissions after surface or incorporated application of pig slurry (PS, pH 6.6, DM 13.2%) and anaerobic digestate (AD, pH 8.1, DM 6.6%). Ammonia emissions were measured by photoacoustic gas monitor for a maximum of four days after fertilization. Soils investigated were a sandy soil with low clay content from Jyndevad in Denmark and a loamy loess-chernozem with high clay content from Bad Lauchstaedt in Saxony-Anhalt, Germany. From each location several soils (4 x Jyndevad and 7 x Bad Lauchstaedt) were collected from different experimental plots. The measured soil-pH-values of Jyndevad soils ranged between pH ($CaCl_2$) 3.62 – 6.17 and those from Bad Lauchstaedt between 5.29 – 7.22. Soil incorporation was done manually in the upper 2-3 cm soil layer immediately after slurry application. Data were analysed by ANOVA and multiple contrast tests or multiple mean comparisons.

A general relationship between soil-pH and NH_3 volatilization was not observed, although statistically significant differences occurred between different soils. Ammonia emissions for Bad Lauchstaedt were in the order 'surface AD' (44 % N applied) > 'surface PS' (12 %) > 'incorporated PS' (11 %) > 'incorporated AD' (7 %). Ammonia emissions for the location Jyndevad followed the same order though on a higher level, the emissions from incorporated AD tended to rise with increasing soil-pH-value and by contrast NH_3 emissions for incorporated PS at Jyndevad tended to decline with increasing soil-pH. For PS the effect of incorporation on emissions was only marginal while

being very pronounced in AD. This was probably due to comparatively shallow incorporation in this pot trial and very high DM content of PS. Sand content was positively correlated with emissions, while clay and humus content showed negative relationships.

Lower NH_3 emissions occurred from PS compared to AD. Emissions were reduced due to factors 'incorporation' as well 'clay and humus content'. Soil pH values had only effects on ammonia emissions from incorporated slurries. The results confirm the hypotheses that soil pH governs emissions from incorporated slurries while soil texture had a much more pronounced effect for both slurry application systems. Interactions with N_2O emissions will be discussed.