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4. Assessment of Ammonia Emission from grazing dairy

Huijsmans, J [a*], Mosquera, J[a] ,Bannink [b], A., & Sebek, L[b]

Wageningen Plant Research, The Netherlands [a]; Wageningen Livestock Research, The Netherlands [b]; *Corresponding author, email: jan.huijsmans@wur.nl

Introduction

Assessment of ammonia (NH_3) losses from field-applied manure gets an ongoing attention within political and scientific discussions when data are used in inventories for reporting national emissions. Ammonia losses from grazing dairy are assumed to be of little importance due to relatively low emissions. The underpinning of the emission from grazing dairy in The Netherlands is based on a restricted number of measurements in the late 1980's. In that period nitrogen fertilization was high compared to nowadays restricted application rates. Therefore nitrogen content of feeding (grass) was high resulting in high nitrogen contents of the urine. Only a few data of measurements at low application rates are available. These data are currently used to assess emissions from grazing at a national scale. Feeding concentrations and grazing strategies may affect ammonia emissions from grazing. The aim of the underlying study is to underpin ammonia losses from grazing dairy considering different feeding and grazing strategies. The focus is on the ammonia emission from urine patches as the main source of ammonia volatilisation.

Methodology

A desk study was performed to provide information on both the nitrogen (N) content of urine during grazing, and the application rate (volume) of a cow urination. Different scenarios were evaluated, based on data on milk production, feed intake and composition, and restricted or unlimited grazing. Data were gathered from national inventory assessments and from real farm data. Assessment of the urine volume per day was based on Bannink et al. (1999), and for the nitrogen content in cow urine on Bannink et al. (2011 and 2018). This information was used to set up experiments to measure ammonia losses from urine (artificial prepared and collected cow urine), varying the nitrogen content of the urine and the volume per urination. Measurements were performed using open flux chambers, allowing intercomparison of eight different objects in fourfold within an experiment. Experiments were repeated during the year (variable measurement conditions). Within each experiment shallow injection of dairy manure was used as reference. The experiments resulted in an estimated quotient of the NH_3 emission (emission reduction factor) of an object with respect to the standard reference. The emission factor (EF) can then be estimated by multiplying the EF of the standard method by this quotient.

Results and discussion

According to the desk study, the expected variation in nitrogen concentration in cow urine is between 5.7-6.9 g N/litter, with a constant urination volume of circa 3 l/urination. On average 85% of the nitrogen content could volatilise. For restricted grazing five urinations per day during grazing are expected, and about twelve for unlimited grazing.

Measurement results showed that ammonia emission from urine (% of N total) hardly differed between different urine concentrations and between different urination volumes. No differences were found between artificial prepared urines and urines gathered at a farm (under the tail). The measured emissions from urine patches were comparable or slightly lower than the emission from shallow injection of dairy manure (% of total ammoniacal nitrogen).

Conclusion

The results show that ammonia losses from grazing are at this stage underestimated in national inventories and in emission assessing tools at farm scale by the Annual Nutrient Cycling Assessment (ANCO or Kringloopwijzer) tool.

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