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MEASURING CONCEPT FOR DETERMINING AMMONIA EMISSIONS FROM NATURALLY VENTILATED DAIRY HOUSING WITH AN OUTDOOR EXERCISE AREA

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ABSTRACT There is a pressing need for up-to-date data on NH_3 emissions from naturally ventilated dairy farming, from both an agricultural and an environmental policy point of view. However, existing data are very limited because they mostly rely on individual farms and/or do not cover seasonal variations sufficiently. The aim of this study is to determine NH_3 emissions for the most common future dairying situation in Switzerland and to derive an emission factor as a contribution to emission inventories.

A novel tracer ratio method with two tracer gases (SF_6, SF_5CF_3) was employed to determine the emissions. The diluted tracer gases were continuously dosed to the NH_3 emitting surfaces. An air collection system facilitated representative sampling in the spacious housings. A recently developed GC-ECD method was used to simultaneous quantify SF_6 and SF_5CF_3 with a detection limit below 1 ppt, while NH_3 was measured using a photoacoustic trace gas analyzer. A set of relevant accompanying parameters such as climate data, N-level related parameters and other descriptive farm data (outdoor climate, climate in housing and outdoor exercise area, use of the different areas by the animals, aisle/exercise-area soiling, and nitrogen input, output and utilisation) were used to characterise each measuring situation.

Measurements were taken over twelve measurement periods on six farms with loose housing cubicle systems with solid floor surfaces and an outdoor exercise area. Measurements in two out of three seasons on each farm covered the variation in climate over the course of the year. Statements relating to various climatic situations are made possible beyond the individual farm level with a so-called “multi-site sampling approach”.

With this systematic measuring approach it was possible to illustrate and quantify seasonal effects and variations between individual farms. The tank milk urea level - as a reliable indicator of N utilisation and the N level for the whole herd - between 13 and 31 mg/dl appeared to be useful to understand fluctuations within and in between farms. NH_3

emissions were highly reproducible for consecutive days with similar meteorological conditions. Furthermore, the dataset showed a consistent picture for temperature dependence and seasonal variations.

Keywords: ammonia emission, measuring concept, tracer ratio method, dairy cattle, natural ventilation