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Ammonia emissions from cattle slurry and digestates

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The recycling of organic waste in biogas plants is proposed as a measure to close nutrient cycles and possibly reduce nitrogen losses such as nitrous oxide emissions and nitrate leaching. Ammonia volatilization after fertilizer spreading is yet another nitrogen loss pathway which is often understudied and not yet fully understood but the knowledge is needed in order to optimize fertilizer management. We therefore aimed to quantify the volatilization of ammonia after the trail-hose application of digestates compared to cattle slurry. We hypothesize that digestates have larger and longer lasting nitrogen losses via ammonia volatilization due to higher NH_4^+ contents and pH values compared to fresh manure. In this project, digested and un-digested organic fertilizers were applied twice per year in a 2.5-years field experiment with three consecutive arable crops (maize, winter wheat and winter barley) under organic farming. We used Automated Low Cost Impinger Systems to measure ammonia emissions after fertilizer application. The emissions were then modeled using the backwards Langrangian stochastic dispersal model with respect to wind conditions. A preliminary presentation of the data indicates that ammonia emissions from the cattle slurry, slurry-based digestate, and industrial digestate are alternately higher or lower. In 2018, emissions from cattle slurry tended to be lower than those from slurry-based digestate and industrial digestate, while in 2019 and 2020 all three liquid organic fertilizers had similar emissions. In the measurement period after the second fertilizer application in 2018, which took place at the end of May, conspicuously high emissions were measured. This can be explained by the high temperatures during this period. Adaptive strategies in fertilizer management should thus consider reduced inputs of organic fertilizers during warm periods.