STRATEGIES TO REDUCE AMMONIA VOLATILIZATION FROM N MINERAL FERTILIZERS IN THE PO RIVER BASIN, NORTHERN ITALY

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STRATEGIES TO REDUCE AMMONIA VOLATILIZATION FROM N MINERAL FERTILIZERS IN THE PO RIVER BASIN, NORTHERN ITALY

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Would you like to receive more information about applying for a grant once this becomes available?: Yes
Content: Ammonia (NH_3) losses from nitrogen mineral fertilizers is a debated issue in Europe due to their contribution to fine particulate matter formation ($PM_{2.5}$ and PM_{10} fractions). In particular, up to 70% NH_3 can be lost from urea-based fertilizers under broadcast application. A number of Best Available Techniques (BATs) for preventing and reducing emissions have been recommended although uncertainties in their effectiveness at the site-specific level still occur. The Life PREPAIR project aims to study reduction methods for NH_3 emissions from urban to agricultural sources in the Po river basin, northern Italy, one of the most air-polluted areas in Europe. Within the PREPAIR framework, the present study aims to identify site-specific based BATs which meet the criteria for the UNECE benchmark for mineral fertilizers, namely a NH_3 emission reduction of at least 30% compared to urea surface broadcast.

The study was conducted across the Veneto region, northeastern Italy. Firstly, a potential risk map of NH_3 volatilization was created by overlapping soil properties (e.g. pH, CEC) and climatic conditions which are well-known to affect NH_3 losses. In high risk hot spots, N losses (e.g. NH_3 and N_2O volatilization, N leaching, etc..) were estimated using a modified version of DNDC v. CAN (Dutta et al., 2016). Inputs for DNDC v. CAN were collected via a questionnaire conducted among farmers to identify business-as-usual practices for different crops. Alternative BATs, such as NH_4NO_3 (AN), organic fertilizers (e.g. beef digestate, liquid manure) and different incorporation methods (injection, deep incorporation), were compared to urea broadcast application for maize (*Zea mais* L.) and winter wheat (*Triticum aestivum* L.) production.

The most promising BATs were further tested in a field experiment on bare soil using a wind tunnel combined with a FTIR gas analyzer (Gasmet DX4015) for continuous gas measurements. Wind speed, soil water content, and both air and soil temperature were also continuously monitored and used to improve prediction of NH_3 volatilization dynamics.

Modeling results showed that AN closed-slot injection and deep incorporation of organic fertilizers significantly reduced ammonia loss both for maize (-75% and -96% respectively) and winter wheat (-87% and -98%). Nevertheless, some increase in nitrate leaching was observed, mostly in case of winter wheat (+24% for injection of AN and +89% for organic fertilizers). Field results on bare soil confirmed the effectiveness of closed-slot injection, being able to bring a reduction up to 68% compared to NH_3 emissions after surface broadcast. Contrasting results were observed with urea incorporation or mixing only, that showed enhanced NH_3 emissions (+50%).

Our study showed that NH_3 loss can be highly reduced, and that N injection practices are among the most effective solutions in Veneto region. Furthermore, a site-specific approach is highly recommended to reduce N losses in air and water, which are strongly related to soil and climatic properties and their interactions with agricultural management.

Disclosure of Interest: None Declared

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