

Ammonium volatilization from urea and its inhibition by urease inhibitor Limus®: Methods for sensual perception as tools to foster environmental awareness

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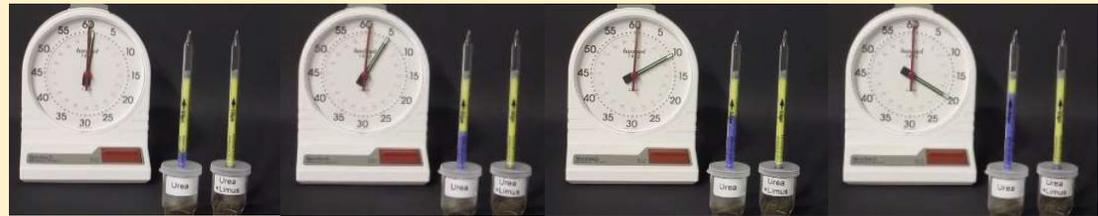


Invisible contribution – visible success: The addition of urease inhibitors (UI) as Limus® may reduce NH₃ emissions from soil applied urea massively, thereby increasing the nitrogen use efficiency of urea-based fertilization and minimize unwanted environmental side-effects. However, tools are much in demand to make NH₃ emissions and its prevention by UI tangible in short term according to a “seeing, smelling, tasting” approach to foster both economic and environmental awareness. “What you see is all there is” is a well-known slogan in behavioral economics.

1. Sniffing test: Makes use of the fact that the odor threshold for ammonia is low and NH₃ emissions can be detected simply by encasing soil samples in a closed container, adding urea fertilizer with or without UI. Sniff 2 – 3 d after fertilization and get the difference.

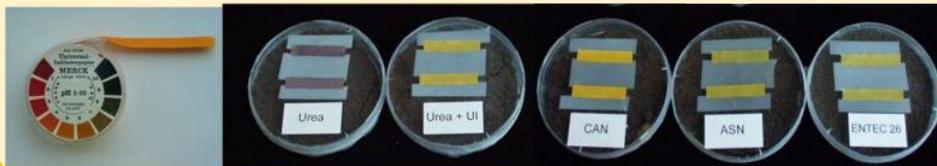


4. Ammonia sensitive Dräger tubes change color due to NH₃ in the air.



2. The pH indicator paper only with straight urea indicates an alkalization due to the hydrolysis of urea in soil:

$$\text{Urea} + \text{H}_2\text{O} \rightarrow 2 \text{NH}_3 \rightarrow \text{with moist filter paper} \Rightarrow \text{NH}_4\text{OH}.$$



5. Acidified foam placed in pipes serve as a NH₃ scrubber, that can be “harvested” after some days and NH₄⁺ extracted in the lab for quantification of NH₃ emissions. Applicable for small field trials with many treatments.



3. Germination test: Fast germinating seeds in a sealed container will show symptoms of NH₃ intoxication 3 days after seeding unless urea is treated with a UI.



6. Pot experiment: After fertilizing urea or urea plus Limus on bare soil without irrigation after 7 days maize was seeded and watered from top until harvest.

