

Potential for non-urea urine nitrogen compounds to mitigate ruminant urine-derived nitrous oxide emissions

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Previous studies have hypothesized that non-urea urine nitrogen (N) compounds (NUNCs) in ruminant urine could play a role in reducing nitrous oxide (N₂O) emissions from urine patches, either by reducing N-substrate availability for N₂O emitting processes, primarily nitrification, or inhibiting the nitrifying soil bacteria that control this process. Urea-N is readily transformed into inorganic-N substrates that are precursors to N₂O, but it is unknown whether NUNC-N is as freely available for use by soil microbes. We hypothesized that increased NUNC concentrations in cattle urine would not reduce urine patch N₂O emissions because NUNC-N would be easily degraded and used by soil microbes. To examine these effects, we applied a water control, synthetic urine control, and 5 synthetic urine treatments with elevated NUNC concentrations to perennial ryegrass (*Lolium perenne*) and white clover (*Trifolium repens*) pasture. The NUNCs examined were allantoin, creatinine, creatine, uric acid, and hypoxanthine. Daily N₂O fluxes were determined for 35 d along with inorganic-N, surface pH, soil oxygen, temperature, and water content. Pasture cuts were taken on Day 16 and 35. Cumulative N₂O emissions increased in the urine treatments, but none of the NUNC treatments significantly varied from the urine control. There were no significant differences between treatments in inorganic-N concentrations, pH, or dry matter pasture yields. NUNC treatments had slightly, but not significantly, higher N₂O emissions in Days 15-35 compared to the urine control. Therefore, increasing the NUNC concentration did not reduce inorganic-N availability and this was reflected in no change to cumulative N₂O emissions.