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Mitigation of soil nitrous oxide emissions during maize production with basalt amendments

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The concentration of nitrous oxide (N_2O), a potent and long-lived greenhouse gas that accounts for roughly 6% of global anthropogenic greenhouse gas emissions, has risen from its preindustrial concentration of 270 ppb to the current level of 332 ppb. The majority of anthropogenic N_2O emissions (52-80%) come from agricultural settings due to increasing rates of reactive nitrogen fertilizer application. Basalt applications are gaining traction as a carbon sequestering alternative to liming, and they have been predicted by numerical models to significantly decrease N_2O emissions. In this contribution, with continuous measurements of N_2O fluxes from large-scale greenhouse maize mesocosms, we provide empirical constraints on N_2O emission during enhanced basalt weathering. We found basalt addition led to a significant decrease in cumulative N_2O emissions—between 29 and 32%. Using a machine learning framework, we found that basalt application rate, soil pH, Sikora buffer pH, and surface soil moisture were the strongest levers on N_2O emissions depending on the system settings.