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Agricultural N_2O emission is influenced by N-fertilization form rather than landscape position

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Agricultural soils are an important source of nitrous oxide (N_2O) emission and are mainly affected by the application of N fertilization. In addition to the effect of fertilizer form (mineral/organic), N_2O production and consumption processes in agricultural systems are influenced by the soil characteristics. However, knowledge of this is still very limited for erosion-affected arable soils. Therefore, the aim of our investigations was to find the impact of soil erosion state associated with the landscape position and N fertilization form have on N_2O emission. This information is needed to evaluate the effects/benefits of new agricultural practices in future mitigation strategies aiming towards lower N_2O emissions.

We present 3 years of N_2O flux measurements in a two-factorial experiment by using a non-flow-through non-steady-state (NFT-NSS) manual chambers. Three sites were established on the summit position having similar soil type (Albic Luvisols; non-eroded soil) and were treated with organic fertilizer (100% organic biogas fermented residues (BFR)), mineral fertilizer (100% mineral calcium ammonium nitrate (CAN)), and a mixture of both fertilizers (50% CAN + 50% BFR). Two additional sites were established on the extremely eroded soil (Calcaric Regosols; on a steep slope with very dense parent material) and at a colluvial site in a depression (Endogleyic Colluvic Regosols) and treated with 100% CAN. The crop rotation was identical for all sites during the study period which includes: Maize (Zea mays L.) – Maize (Zea mays L.) – Winter rye (Secale cereale L.) – Sorghum (Sorghum bicolor) – Triticale (Triticosecale).

Our results show that the N_2O emission exhibited temporal and spatial variability and is mainly influenced by fertilization form and soil type. Among the three fertilization treatments within the same soil type (non-eroded soil), the site with the application of organic fertilization shows the highest cumulated N_2O emission which is accumulated to 13.5 kg N_2O-N ha^{-1} compared to the site with mixed fertilization (11.4 kg N_2O-N ha^{-1}) and mineral fertilization (4.5 kg N_2O-N ha^{-1}). Among the three distinct soil types with an identical application of mineral fertilizer, the cumulated N_2O emission is higher at the depression (7.3 kg N_2O-N ha^{-1}) compared to the non-eroded (4.5 kg

N_2O-N ha^{-1}) and extremely eroded soil (1.6 kg N_2O-N ha^{-1}). In general, our results suggest a stronger influence of N fertilization form than erosion affected soil on N_2O emission.

Keywords: NFT-NSS manual chamber; soil erosion; N fertilization form, nitrous oxide, soil type