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Liming halved N₂O emissions following ploughing of grass-clover mixtures in an acidic soil

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Abstract

Introduction

Leguminous in ley mixtures and green cover crops in rotation with cash crops are means to increase nitrogen use efficiency and/or reduce N losses. However, their benefits can be offset by increased N₂O emissions following termination by tillage. Liming of low pH soils can reduce N₂O from denitrification¹⁾, but the effect on total N₂O emissions from incorporation of nitrogen rich green residues¹⁾ is uncertain, as it can also enhance mineralization and nitrification.

Methods

We measured field N₂O emissions following ploughing of several ley mixtures. Treatments were repeated in control (pH_{aq} ~5.5) and limed (pH_{aq} ~6.0) plots which were wholly randomized in a silty clay loam at Ås, Norway. Liming took place shortly before establishing the leys, 4 years before ploughing.

Results

N₂O emissions increased with increasing ley yields in the previous years, which indicates a linear relationship with residue amounts. However, at any level of previous biomass yield, N₂O emissions in limed treatments were only half of those in low pH treatments. In this experiment the biomass yield dependent on species composition and N fertilization, not on soil pH, and was higher in red clover-grass than in grass only or white clover-grass mixtures. Liming significantly raised the total mineral N content in the soil, but the increase was small (typically around 3 mg N kg⁻¹).

Conclusion

Maintaining a sub-neutral pH can effectively mitigate N₂O emissions following incorporation of nitrogen rich green residue. Whether this applies also in the case of large incorporation of fresh herbage deserves further studies.

References

Bleken, M. A., Rittl, T. F., 2022. Soil pH-increase strongly mitigated N₂O emissions following ploughing of grass and clover swards in autumn: A winter field study. *Science of The Total Environment* 828: 154059. <https://doi.org/10.1016/j.scitotenv.2022.154059>.