Climate effects of recycled fertilizers and biochar: emissions of nitrous oxide, methane and ammonia in a field experiment

Background
Nitrogen (N) fertilizers are essential for crop production. Farmyard manure and slurry traditionally constitute about half of the total N inputs into crop production in Switzerland [1]. Recycled fertilizers such as biogas slurry, liquid digestates and compost enable simultaneous energy production and closing of nutrient cycles (fig.1). There is evidence that recycled fertilizers can help to increase N use efficiencies and to improve N supply in organic farming [2]. Biochar amendment has shown a potential to mitigate soil greenhouse gas (GHG) emissions, in particular nitrous oxide (N₂O) emissions [3]. Here, we combine one of the liquid recycled fertilizer treatments with biochar. In a 2.5-years on-farm experiment, we quantify GHG emissions and further gaseous N-losses via ammonia (NH₃) emissions.

Fertilizer recycling

Project aims
Evaluate the effects of recycled fertilizers on
- GHG emissions
- gaseous N-losses
- Soil quality
- Soil microbial community

Treatments
Liquid organic fertilizers (140 kg N/ha/year)
- Biogas slurry anaerobic, from an agricultural biogas plant
- Biogas slurry amended with pyrolyzed (500–600 °C) tree and shrub cuttings
- Liquid digestate aerobic, from a commercial biogas plant
- Cow slurry

Controls
- Unfertilized (O-control)
- Mineral fertilizer (positive control)

Methods
GHGs: N₂O, CH₄ and CO₂
- Measured with closed static chambers [4]
- Weekly and event-based measurement
- Two chambers per plot/treatment, four replicates (n=48)
- Analysis via gas chromatography

Further gaseous N-losses: NH₃
- Captured via acid traps in a micrometeorological setup
- Complemented by wind dispersal modelling [5]

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References

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