Nitrous oxide mitigation potential of nitrification inhibitors from soil amended with mineral and organic fertilizers

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Experimental setup

- Effect of three nitrification inhibitors:
  - DMPP
  - N-lock
  - Piadin
- Mineral (granular and liquid) and organic (pig slurry) fertilizers

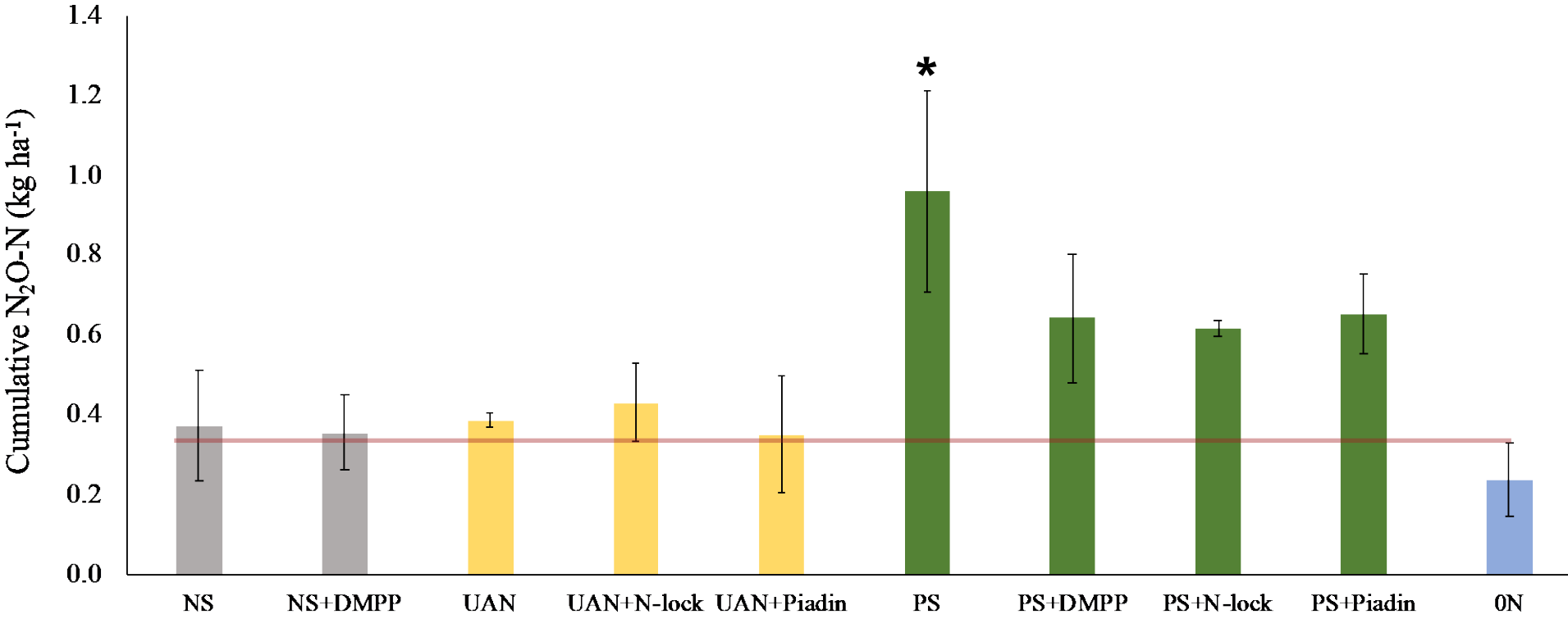
NS (26:13)	> 124 kg ha^{-1}
UAN (31.7 % N)	> 124 kg ha^{-1}
Pig slurry (0.488 % N)	> 165 kg ha^{-1}

1	Zero Fertilizer	0 N
2	NS granular fert.	NS
3	NS granular fert. w DMPP	NS+DMPP
4	UAN liquid fert.	UAN
5	UAN liquid fert. w N-lock	UAN+N-lock
6	UAN liquid fert. w Piadin	UAN+Piadin
7	pig slurry	PS
8	pig slurry w DMPP	PS+DMPP
9	pig slurry w N-lock	PS+N-lock
10	pig slurry w Piadin	PS+Piadin

Block-1 **Block-2** **Block-3**

Plot = 3*3 m^2

Cumulative N_2O emissions and emission factor (EF)



EF % (±SE)	0.11 (±0.11)	0.10 (±0.07)	0.12 (±0.01)	0.16 (±0.08)	0.09 (±0.12)	0.44 (±0.15)	0.25 (±0.10)	0.23 (±0.01)	0.25 (±0.06)
Reduc-tion (%)		- 14		30	- 23		- 44	- 47	- 42

For further discussion see you at poster exhibition

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Background

Nitrogen (N) fertilization is essential to obtain sufficient crop yields. However, not all the N is taken up by the plant and the rest is lost to the environment in the form of nitrate (NO_3^-) leaching, ammonia volatilization, emission of elemental nitrogen or nitrous oxide (N_2O). Nitrous oxide is an important greenhouse gas (GHG) emitted from agricultural sources and constitute approximately 90 % of the total anthropogenic N_2O emissions. Different mitigation strategies have been developed to reduce the emissions of N_2O, e.g., better fertilizer management, water management (irrigation and drainage), catch crops and nitrification inhibitors (NIs) etc. NIs are compounds that are able to impede the nitrification process and, in that way, potentially reduce the N leaching and N_2O losses from agricultural soils and increase the N availability for crops.

Objectives

The specific objectives of the study conducted at University of Copenhagen are as follows:

- To determine the N_2O mitigation potential of nitrification inhibitors from organic and mineral fertilized soils.
- To examine the effect of nitrification inhibitors on crop yields and N uptake.

Material and Methods

Experimental setup and Treatments

Sr. #	Treatments	Code
1	Zero Fertilizer	Zero
2	NS granular fertilizer	NS
3	NS granular fertilizer with DMPP	NS+DMPP
4	UAN liquid fertilizer	UAN
5	UAN liquid fertilizer with N-lock	UAN+N-lock
6	UAN liquid fertilizer with Piadin	UAN+Piadin
7	pig slurry	PS
8	pig slurry with DMPP	PS+DMPP
9	pig slurry with N-lock	PS+N-lock
10	pig slurry with Piadin	PS+Piadin

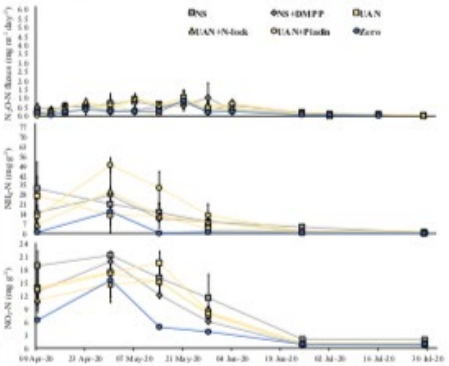
6 soil cores (20 cm) per plot Collected biweekly during the crop growth season

TMS-4 dataloggers – to log soil & air Temp. and soil moisture

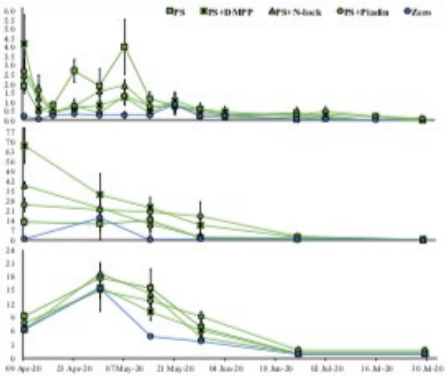
Gas sampling in field: Chambers placed on preinstalled metal frames during. Intensive sampling with 1-3 days interval in first two weeks after fertilization, weekly until eight weeks of fertilization, biweekly afterwards until crop harvest.

Results

N2O fluxes and soil mineral N from soil amended with mineral N



N2O fluxes and soil mineral N from soil amended with organic N



Treatments	Cumulative N_2O-N (kg ha^{-1})	EF (%)	Grain Yield (tons ha^{-1})	N uptake (kg N ha^{-1})
Zero	0.24 (±0.09)	-	5.09 (±2.26)	63.9 (±29.2)
NS	0.37 (±0.14)	0.11 (±0.11)	6.95 (±1.23)	94.6 (±16.9)
NS+DMPP	0.36 (±0.09)	0.10 (±0.07)	7.14 (±0.22)	97.0 (±5.0)
UAN	0.39 (±0.02)	0.12 (±0.01)	6.67 (±1.07)	92.8 (±20.0)
UAN+N-lock	0.43 (±0.10)	0.16 (±0.08)	6.37 (±0.65)	87.0 (±11.0)
UAN+Piadin	0.35 (±0.15)	0.09 (±0.12)	7.74 (±0.44)	110.0 (±7.9)
PS	0.96 (±0.25)*	0.44 (±0.15)	7.91 (±0.37)	108.7 (±6.4)
PS+DMPP	0.64 (±0.16)	0.25 (±0.10)	6.75 (±0.12)	90.7 (±3.5)
PS+N-lock	0.62 (±0.02)	0.23 (±0.01)	7.14 (±0.44)	100.4 (±6.1)
PS+Piadin	0.65 (±0.10)	0.25 (±0.06)	7.50 (±0.29)	101.0 (±4.7)

Conclusions

Application of NIs with organic fertilizers is a promising N_2O mitigation strategy, but less effect of NIs on N_2O mitigation with mineral fertilizers. Crop yields and N uptake by the crop were not affected by NIs

Acknowledgement

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