DMPP performance on annual N_2O emission

with Cattle Slurry vs. Ammonium Sulphate Nitrate
- a multisite comparison -

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Background & Hypothesis

- Nitrification Inhibitors (NI) represent a potential reduction measure of Nitrous Oxide (N_2O) emission
- Germany approx. 80% of N_2O emission are originated from agriculture
- Nitrification and Denitrification N_2O is reduced by NI inhibited transformation of fertilizer ammonium to nitrate (Fig. 1)
- Uncertainty about effect of NI on annual emissions, almost only data from vegetation period published
- Other processes outside vegetation period (e.g. residue mineralisation, soil cultivation) may interfere with and superimpose NI reduction effects occurring within the vegetation period.

<u>Hypothesis</u>

DMPP does not reduce annual N_2O emission compared to non-inhibited fertilizer.

DMPP effect does not differentiate between fertilizer types.

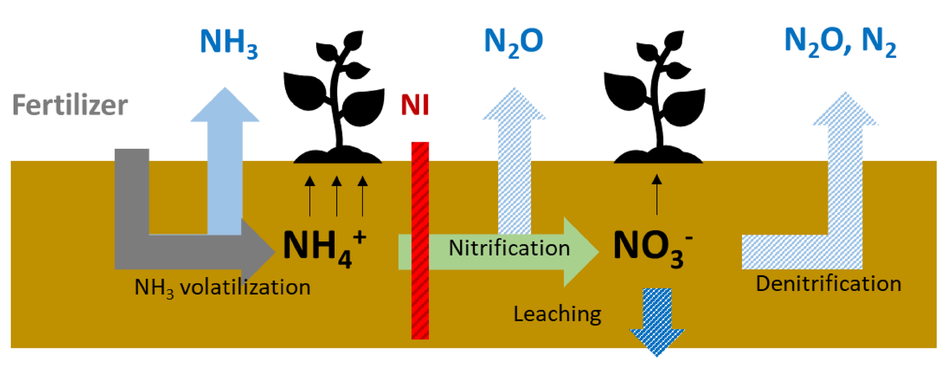

Fig. 1: Mineral N transformations in soil influencing N_2O formation and postulated effects of Nitrification Inhibitors (NI).

Material & Methods

<u>NitriKlim Project</u>

- Coordinated field trials over Germany (small plots in semi CRBD)
- 4 sites and 2 years each for evaluation (Tab. 1; Fig. 2A, red frames)
- Fertilizer: Cattle Slurry and Ammonium Sulphate Nitrate (ASN)
- Nitrification Inhibitor: DMPP (3,4-Dimethylpyrazolphosphat)
- Annual N_2O fluxes: non-steady state chamber method (Fig. 2B) (weekly sampling, biweekly after fertilization, additional to special events)

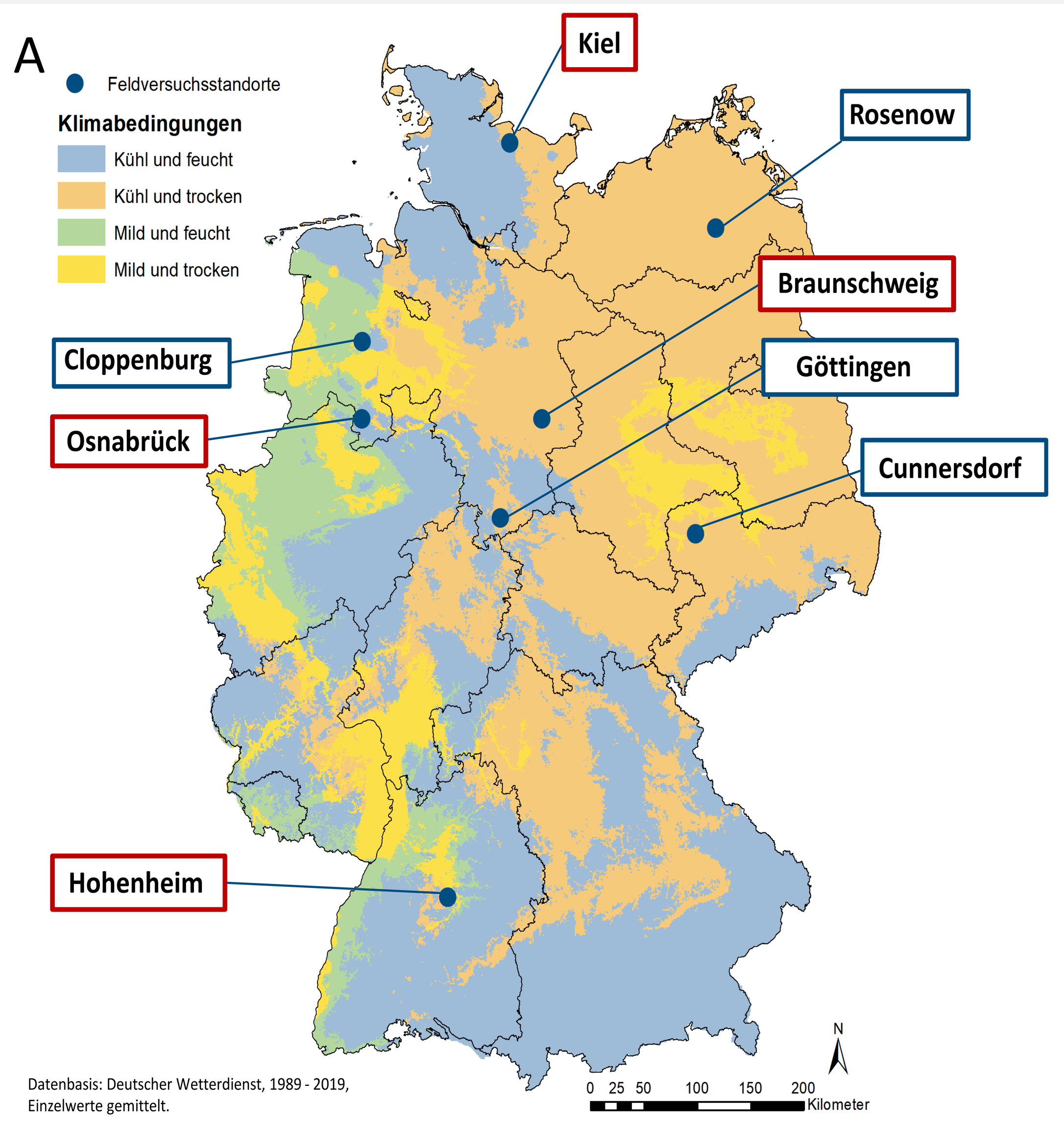

Fig. 2A: Experimental sites over Germany in joint NitriKlim project, red frame = selected sites for calculations on this poster; ***2B:*** non-steady state chamber at location in Braunschweig

Tab. 1: Soil conditions of experimental sites over Germany (Fig. 2A, red frames)

	Kiel		*Braunschweig*		*Osnabrück*		*Hohenheim*	
Year	*2023*	*2024*	2023	2024	2023	2024	2023	2024
pH (CaCl)	6.2	6.2	6.7	6.8	5.9	5.3	6.9	6.9
Sand (%)	61.1	66.9	8.2	5.6	69.5	92.2	2.5	2.8
Silt (%)	26.3	21.8	80.5	80.4	20.6	3.3	73.8	72.1
Clay(%)	12.6	11.3	10.8	14.0	9.9	4.5	23.7	25.0

Results & Discussion

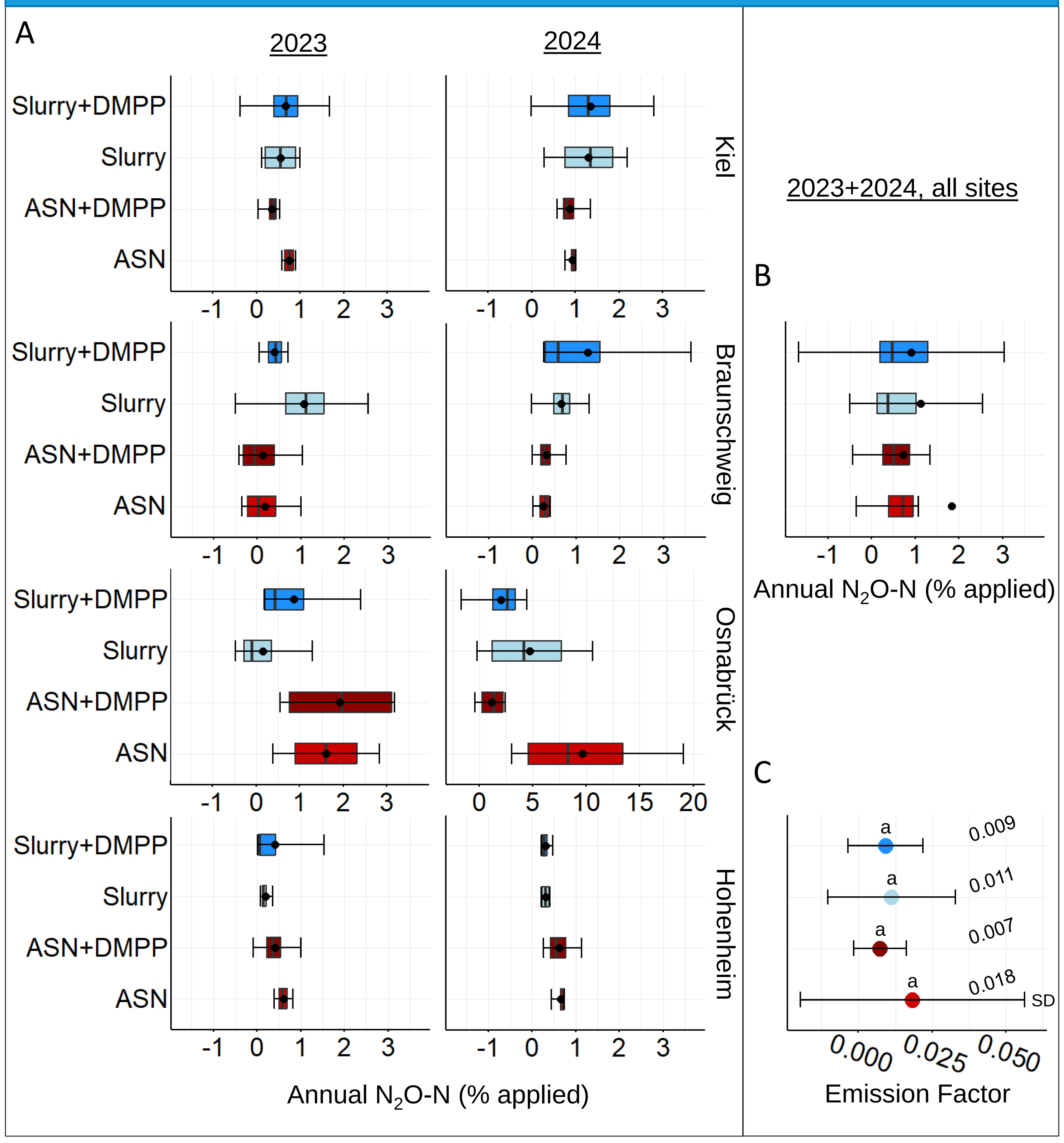

Fig. 3A: Cumulative annual N_2O-N emission subtracted by unfertilized control in % of applied fertilizer nitrogen, seperate for each site and both field years. ***3B:*** cumulative annual N_2O-N emission subtracted by unfertilized control in % of applied fertilizer nitrogen for all sites and years; boxplot: line: median, point: mean, box: 25% - 75% percentile, whisker: ±1.5×interquartile range ***3C:*** mean emission factors with standard deviation for all sites and years, calculated by IPCC standard.

Tab. 2: 3-way ANOVA of emission factors. (data log-transformed due to test requirements)

	Treatment (T)	Site (S)	Year (Y)	T×S	T×Y	S×Y	T×S×Y
P	0.374	0.499	0.425	0.227	0.491	0.984	0.319

- Variation of N_2O emission high between fertilizer typ, years and sites (Fig. 3A)
- Inhibited vs. non-inhibited slurry treatments show no consistent patterns compared to ASN treatments (Fig. 3A)
- Mean annual N_2O emission in similar range between treatments (Fig. 3B)
- Trend of lower emission factors with DMPP use, but not significant (Fig. 3C)

Conclusion & Outlook

- Trend of lower emission factors when using DMPP with Slurry and ASN
- No signigicant N_2O emission reduction, due to high variabilities in all factors
- ➢ Hypothesis of no reduced N_2O emission with DMPP use can be confirmed
- ➢ Hypothesis of no DMPP effect dependent of fertilizer type can be confirmed

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more information to **NitriKlim** project

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