

Location specific evaluation and crediting of nitrification inhibitors as a climate change mitigation tool in crop production - The NitriKlim project

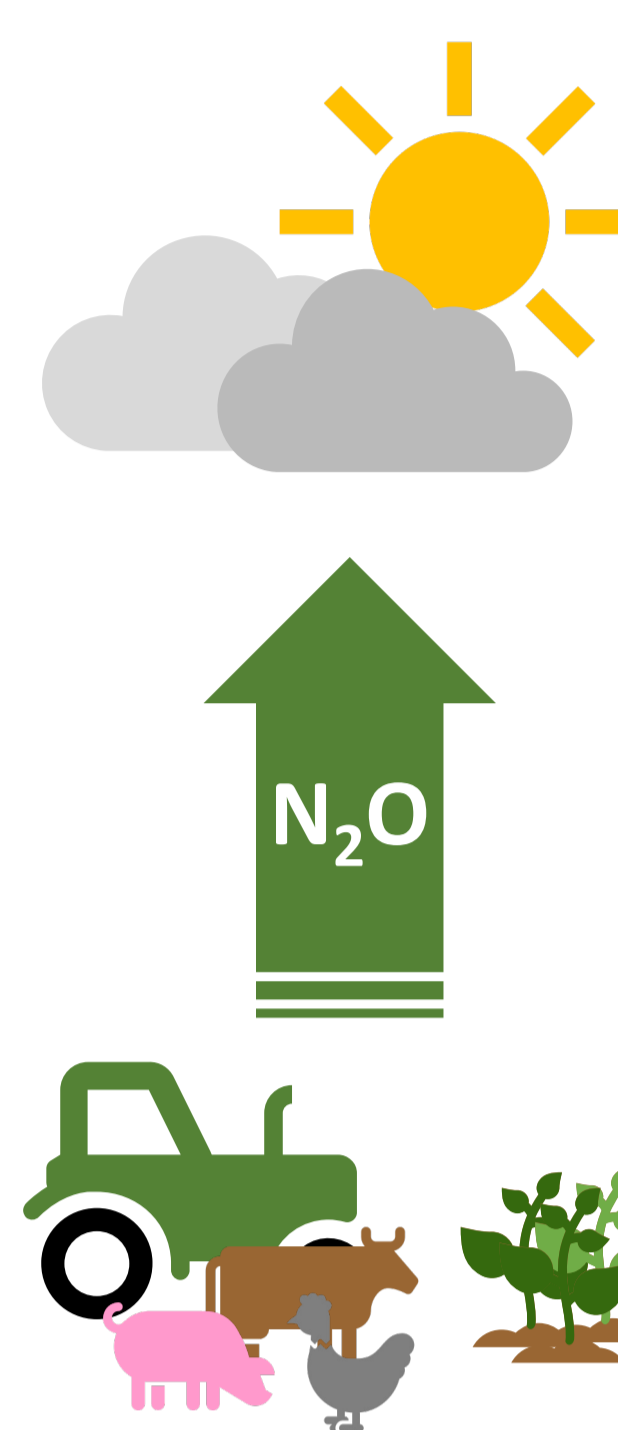
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Background

The use of nitrification inhibitors presents a robust and scalable greenhouse gas reduction measure for crop production. However, scientifically robust and site-differentiated results to prove inhibitors as an efficient, practical and environmentally sound measure to reduce fertilization-induced N₂O emissions under Central European conditions are lacking for a sound assessment on several points:

- i) the assessment of the effect on annual N₂O emission and nitrate leaching
- ii) the long-term ecological and environmental effects of regular application of the inhibitors
- iii) the combined and site-differentiated overall assessment as a climate protection measure, taking into account climate protection effects, ecological risks, as well as economic and plant cultivation effects.

Problems & Research questions



Agriculture is the largest source of N₂O, a potent greenhouse gas



Improvement opportunities to mitigate emissions

- Stabilization of N-fertilizers with nitrification inhibitors
- Fertilization according to demand
- Reduction of excess nitrogen



Necessary research

Investigating the effect of nitrification inhibitors on

- Soil nitrogen dynamics
- Direct N₂O emissions
- Nitrogen use efficiency
- Soil microbiome

Material & Methods

Variant	Treatment	Nr. of fertilizer applications
1.	unfertilized control	0
2.	Ammoniumsulfatenitrate (ASS)	3 (% 35, 35, 30)
3.	ASS	2 (% 50, 50)
4.	ASS+ DMPP* (Entec)	2 (% 50, 50)
5.	ASS+ DCD* (Ensin)	2 (% 50, 50)
6.	Urea	3 (% 35, 35, 30)
7.	Urea + 2-NPT+ (Piagran Pro)	3 (% 35, 35, 30)
8.	Urea + MPA* + 2-NPT+ (ALZON Neo-N)	2 (% 50, 50)
9.	Urea + 2-NPT+ (Piagran Pro)	2 (% 50, 50)
10.	Urea ammonium nitrate (UAN) (Piasan 28)	3 (% 35, 35, 30)
11.	UAN + MPA*	2 (% 50, 50)
12.	Calcium ammonium nitrate (KAS)	3 (% 35, 35, 30)

- * Nitrification inhibitor: DCD, DMPP, MPA
- + Urease Inhibitor: 2-NPT

Experimental site: Cunnersdorf, Saxony, at Stickstoffwerke Piesteritz
Experimental set up:

1. „Experiment on climate protection effect“

Investigation of the N-fertilizers (see table on the left) with and without nitrification inhibitors in winter wheat (three years, four replicates)

2. „Static Experiment“

Investigation of the N-fertilizers with and without inhibitors in the crop rotation silage corn, winter wheat, winter barley (three years, four replicates)

Measurements:

- N₂O emissions by closed chamber method (Mosier & Hutchinson, 1981), weekly
- regular recording of weather data
- Harvest parameters: grain yield, N removal, crude protein content, TGW



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Objective

The aim of the interdisciplinary joint project NitriKlim is the site-differentiated evaluation of the use of nitrification inhibitors in nitrogen fertilization as a climate protection measure.

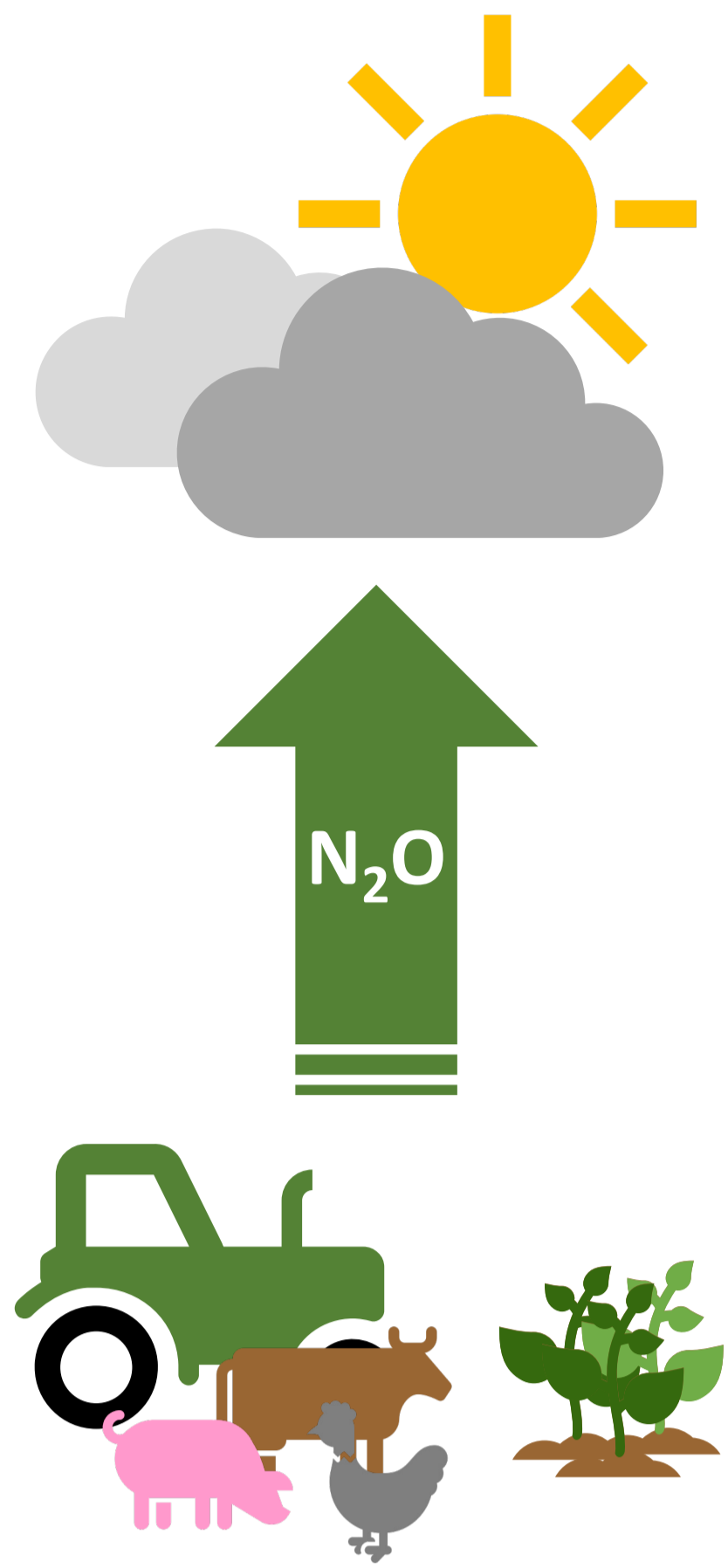
1. Location-differentiated recording, modeling and evaluation of opportunities and risks of the use of nitrification inhibitors in crop production and its climate protection effects under cultivation conditions in Germany.
2. Site-specific collection, modeling and evaluation of the ecological risks and long-term effects of the use of nitrification inhibitors in crop production.
3. Site-specific economic evaluation of the use of nitrification inhibitors as a climate protection measure in crop production.
4. Mapping of possible climate protection effects of the use of nitrification inhibitors in crop production in the greenhouse gas inventory of the Federal Republic of Germany
5. Knowledge transfer to agricultural extension and practice

General informations

- Project period: 2022-2026, Funding number: 2822ABS023
- Project partner: Thünen Institut, Julius-Kühn-Institut, SKW Piesteritz, University Hohenheim, Georg-August-University Göttingen, Hochschule Osnabrück, University Kassel, Christian-Albrechts-University Kiel
- Funding institution: Federal Ministry of Food and Agriculture

Literature

Mosier, A. R., and G. L. Hutchinson. *Nitrous oxide emissions from cropped fields*. Vol. 10. No. 2. American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America, 1981



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