

Minutes from 5th amoA project meeting

5-6 of February, Hotel Nyborg Strand, Østergade 2, 5800 Nyborg, Denmark

Participants

Anders Priemé (AP), Åsa Helena Frostegård (ÅHF), Carsten Suhr Jacobsen (CSJ), Cecilie Skov Nielsen (CSN), Christian Albers (CA), Claus Kjølner (CK), Erkin Gozdereliler (EG), Lea Ellegaard-Jensen (LEJ), Lisa Hald (LH), Linyan Zhu (LZ), Louise Feld (LF), Lucas Horstmann (LH), Nanna Karkov Ytting (NKY), Nanna Schrøder Baggesen (NSB), Pedro Carvalho (PC), Peter Svendsen (PS), Rose Kristoffersen (RK), Signe Rasmussen (SR), Søren Petersen (SP), Thorkild Frandsen (TF), Trine Henriksen (TH), Ulla Elisabeth Bollmann (UEB)

Excuse: Anne Winding (AW)

Minutes

ARLA Project Perspective & Insights (TF)

TF introduced FarmAhead (innovation, technology and incentives). FarmAhead is Arla's sustainability program. Mainly Arla's incentives model was discussed and how potentially nitrification inhibitors could be a part of FarmAhead Incentives.

TF clarified that the incentives can be quite detailed, so that incentives for nitrification inhibitors can be tailored for sandy soils or for specific crop types.

Work Package Updates

WP1: Sorption and Degradation of NIs (UB, GEUS)

UB reported on WP1. For DMPP/Vizura, DMP strongly sorbs to the A-horizon at low concentrations, with no sorption to the subsoil and some concentration dependence. DMP shows fast degradation in batch incubations with manure (DT50 10–15 d), with no effect of formulation, and a residual content of 10–15%. 3-MPA is formed in active incubations but not in sterile ones. Some unknown transformation products are formed, and no 3-MP formation is observed.

For Nitrapyrin/Instinct, Nitrapyrin strongly sorbs to the A-horizon at low concentrations, with no sorption to the subsoil. There is a strong effect of formulation, and some effect of manure. Nitrapyrin shows fast degradation in batch incubations with manure (DT50 60–80 d), with high persistency with the formulation. DCMP is formed up to 10%, and 6-CPA is formed but also degraded. Some unknown, but probably relevant, transformation products are formed.

WP2: Leaching of NIs (CAL, GEUS)

Main conclusions on leaching reported by CAL for the 2024 data. A fraction of DMP is quite persistent in topsoil, but leaches marginally in sandy soil without preferential flow. The degr. prod. 3-MPA is more prone to leaching, but concentrations in leachate are low.

Nitrapyrin seems more persistent than anticipated, especially as Instinct, however leaching in sandy soil seems marginal/non-existing. The degr. prod. 6-CPA is more prone to leaching, but concentrations in leachate are relatively low when applied as Instinct.

WP3: Results of the Field Studies (NSB, SEGES)

NSB reported on WP3. The effect of NI is variable, and in approximately 50% of the trials we observe a significantly lower N₂O emission when using NI compared to without NI. Ignoring the spread in the data, there is overall a reduction in emissions of about 40% across all three trials and the two different NIs that were tested. The 40% reduction aligns perfectly with other trials and meta-analyses on the effect of NI.

WP4: Results of Nitrogen Cycling Genes (AP, KU)

AP reported on WP4. Quantification of bacterial and archaeal amoA transcripts revealed a strong dominance of archaeal transcripts. This is surprising since ammonia-oxidizing bacteria usually dominate over archaeal ammonia oxidizers in arable soils receiving nitrogen fertilizers. At the field near Agerbæk (Varde 3 field), the 2024-samples showed a strong increase in archaeal amoA transcripts at Day 2 following fertilization but low transcript numbers in plots receiving Vizura or Instinct indicating an inhibitory effect of both nitrification inhibitors on nitrification during the post-fertilization period.

WP5: Results of Non-Target Effects of NIs (LH, AU)

LH reported on WP4. rRNA and mRNA profiles show that archaea are the main ammonia oxidisers in the two fields.

Functional diversity is only impacted by Instinct in Varde 1 resulting in a slight increase at day 2 & 32, while Varde 3 only shows effects of manure.

Differential gene expression shows subtle up & down regulation at all timepoints, while effects are 1 order of magnitude larger for Varde 3 compared to Varde 1.

CJS asked if it's possible to closer investigate fungi and see if there might be more changes in biodiversity. LH confirmed it's possible and agreed to closer investigate if certain fungal taxa respond to the NI treatment.

Discussion of Impact Evaluation Framework of NIs

Based on results from WP2 it seems it should be possible to write papers and protocols regarding sandy soil, because the experiment was designed as a worst-case scenario. It was argued that it's important to take into consideration persistence of compounds in the soil. Results shows the formulation really matters for persistence and it might accumulate in the soil over the years as it is applied and then might break down and leach into the groundwater. However, this aspect was not within the scope of the deliverables defined for this study but might be part of a recommendation.

Regarding ecosystems it seems that the results from WP5 are very promising. The correct group of organisms are being hit and not much else, but we have to look further into.

Regarding biodiversity it was more less agreed that there wasn't too much to worry about. So, it seems feasible to write a protocol. But as it was discussed earlier during WP5 results it was agreed to closer investigate certain fungal respond.

Bioengineering soil (ÅHF, NMBU)

ÅHF made a short presentation of a different approach to mitigation through soil augmentation. ÅHF concluded that next step could be testing the combination of NI and soil augmentation.

Draft for Wrap up meeting June 24 2026

Risk assesment of synthetic nitrification inhibitors and implications for evaluation of soil health and water quality

- 09.30 - 10.00 Kaffe velkomst
- 10.00 - 10.15 Indflyvning: AU (Carsten).
- 10.15 - 11.00 Talk about nitrogen: Jan Willem Erisman + Anders Prieme
- 11.00 - 12.00 Up to debate: Blok med mfl. Hovedresultater - leaching - Impact evaluation framework
- 12.00 - 13.00 Lunch
- 13.00 - 14.00 Soil health
- Claire Chenu, fra INRAE (har blik for EU regulation)¹
 - Prof. Bridget Anne Emmett
- 14.00 - 15.00 Our project and toxicology
- Nina Cedergren risikovurdering
 - Lucas results Eco tox soil
- 15.00 - 15.30 Kaffe
- 15.30 - 17.00 paneldebat
- 5-6 deltagere, 5 min oplæg fra hver og så diskussion og spørgsmål
 - Concito
 - Danmarks naturfredningsforening (Thyge Nygaard)
 - Dansk erhverv
 - Landbrug og fødevarer
- 18.00 - 21.00 Middag

1: EU vedtog i november 2025 en ny ”[Soil monitoring law](#)”.

Claire Chenu har været Programme Coordinator for forskningsprogrammet [EJP Soil](#), som er gået forud for lovgivningen, og hun [udtaler sig](#) om Soil Monitoring Law på EU-kommisionens hjemmeside.

Derfor foreslog SOP Claire Chenu, hun kan måske holde et oplæg om kravene til jordsundhed.

Project Coordination Meeting – Nitrogen Inhibitors & Microbiology Studies (EG, AU)

1. Chemistry Sampling (2024)

- 2024 chemistry samples will be extracted by (GEUS).
 - Sampling design: 4 time points, 2 fields, Approximately 96 samples
- Extracts will be analyzed by (AU) – Erkin – using GC-Orbitrap.

2. Molecular Analyses

- Anders will perform digital PCR on samples previously tested by qPCR.
 - Expected completion: End of June.
- Decision on molecular biology experiments related to cut columns from the leaching experiment will be made at a later stage.

3. Data Meetings

- A TEAMS meeting will be arranged by Erkin (AU) to discuss data publication status and ensure all aspects are covered.

4. Nitrous Oxide & Field Trial Data

- Nitrous oxide data (including selected additional field trials) will be published/submitted by SEGES (Cecille).
 - Timeline: Within 6 months.

5. Microbiology Data & Publications

- 2025 microbiology results will be developed into an “understanding paper.”
- 2024 and 2025 microbiology datasets will be separated into two papers.
 - Both papers will be written by (AU).
- SEGES will not include CO₂ and methane data in their publication, allowing these datasets to be used in the AU microbiology paper.

6. Environmental Fate of DMPP

- Christian (GEUS) has prepared a draft manuscript on environmental fate of DMPP (degradation, leaching, and related aspects).
- Planned submission: Spring 2026.

7. Nitrapyrin Data

- Nitrapyrin data collection is ongoing.
 - Expected completion: End of February (AU).
- Manuscript will be written collaboratively by GEUS and AU (Erkin, Linyan, Pedro).
- Planned submission: Autumn 2026.

8. Policy/Opinion Paper

- A policy/opinion paper covering various aspects of nitrogen inhibitors (NIs) is under consideration.
- Decision postponed to a later stage.