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INTERNATIONAL FERTILIZER ASSOCIATION

Adoption of nitrogen stabilizers to transition to low-carbon agriculture

Methodology webinar
10th April, 2025

Speakers

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Engineer
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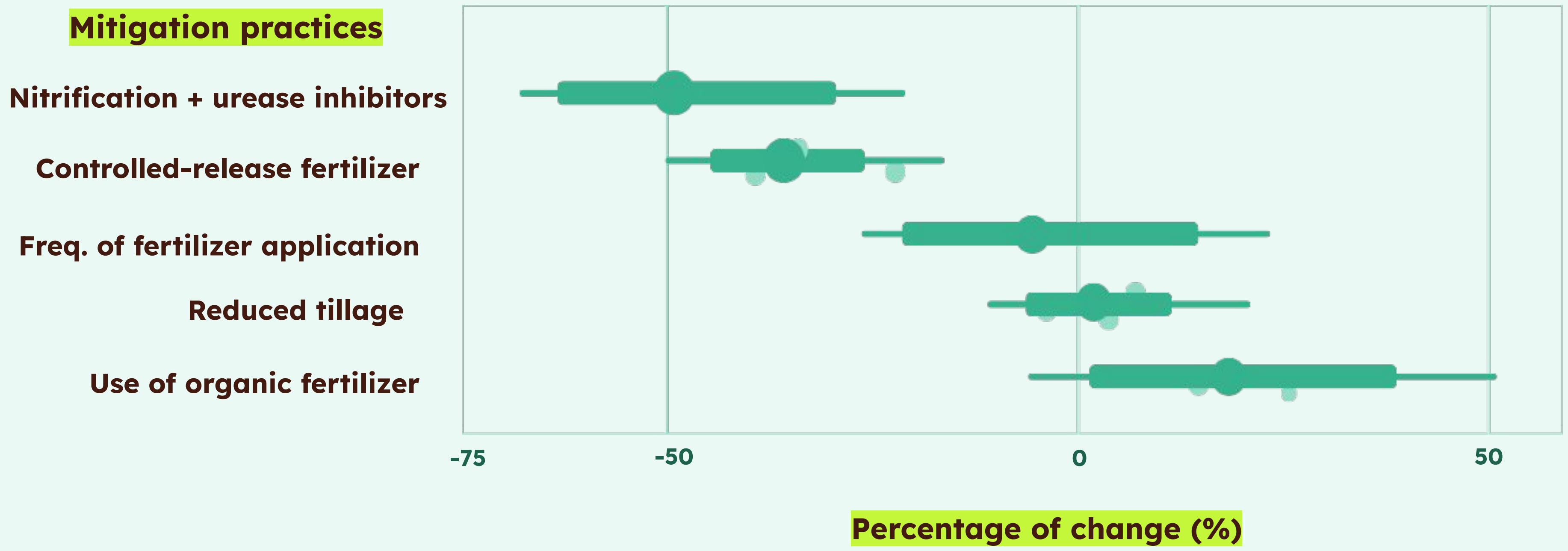
Why nitrogen stabilizers?

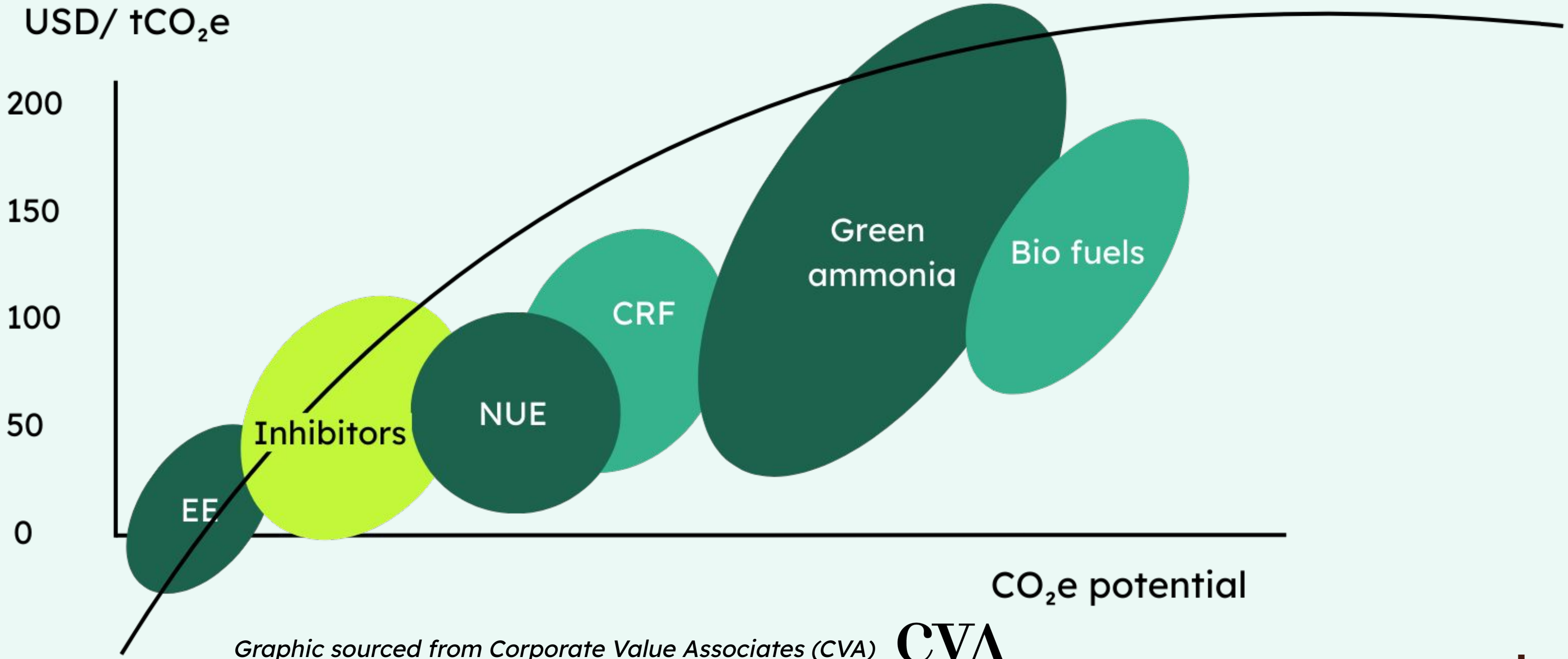
They make an impact



Grados, D., Butterbach-Bahl, K., Chen, J., van Groenigen, K. J., Olesen, J. E., van Groenigen, J. W., & Abalos, D. (2022). Synthesizing the evidence of nitrous oxide mitigation practices in agroecosystems. Environmental Research Letters, 17(11), 113003. https://doi.org/10.1088/1748-9326/ac9b50

They are affordable

premium of $40-100/t product



Graphic sourced from Corporate Value Associates (CVA)

They are studied

	Yield increase	NH_3 decrease	N_2O decrease	NO_3^- leaching decrease	Meta-analyses
UI	2-10% (n=5)	25-100% (n=5)	**0-38% (n=3)**	39% (n=1)	Thapa et al., 2016; Linquist et al., 2013; Abalos et al., 2014; Saggar et al., 2013; Snyder et al., 2009; Pan et al., 2016, Dimkpa et al., 2020; Li et al., 2018; Silva et al., 2017
NI	2-14%* (n=8)	-3 to -65% (n=4)	**8-100% (n=7)**	17-48% (n=3)	Quemada et al., 2013; Thapa et al., 2016; Linquist et al., 2013; Abalos et al., 2014; Qiao et al., 2015; Snyder et al., 2009, Lam et al., 2017; Pan et al., 2016, Dimkpa et al., 2020; Li et al., 2018; Burzaco et al., 2014; Rose et al., 2020; Han et al., 2017
UI + NI	0-9% (n=6)	13-87% (n=2)	**0-39% (n=3)**	29% (n=1)	Thapa et al., 2016; Linquist et al., 2013; Abalos et al., 2014; Snyder et al., 2009; Dimkpa et al., 2020; Li et al., 2018
CR	5-7% (n=2)	39-68% (n=2)	**24-55% (n=2)**	27% (n=1)	Linquist et al., 2013; Pan et al., 2016; Zhang et al., 2019; Han et al., 2017

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They are available

Mitigation practice	Commercial availability	Ease of adoption
Nitrogen stabilizers (Urease & Nitrification Inhibitors)	✅ **Widely available**	✅ **High – can be applied with standard fertilizer**
Controlled-release fertilizers (CRFs)	✅ Available, growing market	⚠️ Medium – requires switching products
Fertilizer application frequency (Split/Timed)	✅ Technique, not a product	⚠️ Medium – requires planning and labor
Use of organic fertilizers	⚠️ Limited in volume	❌ Low – bulky, harder to apply at scale

For farmers:

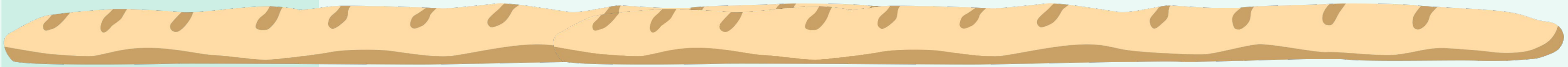
No major practice change needed

Reducing emissions of fertilizer use

Incentivize the use of enhanced efficiency fertilizers

40-50% of a baguette's GHG emissions stems from fertilizers

Industrial baguette production CO2e emissions in France (g/kg of finished good)



Food value chain	Inputs	Farming	Logistics & storage	Mill	Food processing	Baking	Packaging	Outbound freight	Retail	Consumer
CO_2e emissions Share of CO_2e	11% (~10)	47% (~35)	3%	3%	11%	8%	13%	3%	1%	100%
Emissions sources	Production of fertilizers and plant protection products releases CO_2 and N_20	Fuel used in trucks and farming equipment releases CO_2 **Nitrogen fertilization releases N_20**	Mileage to the mill (truck fuel) Insecticides/ fungicides used to preserve wheat	Energy used by seeds cleaner and grader and electric mills to grind seeds into flour	Energy to knead dough and use of additives coming from Asian countries	Energy of ovens, using gas or electricity	Plastic used in packaging	Mileage to the retail store (truck fuel)	Energy in department (light, etc.,)	

Related to fertilizers

40-50% of emission from n-fertilizer

Share of GHG emission from n-fertilizers

1 For a 250g baguette
Source: Agribalyse (ADEME), TerraEco

Information from Corporate Value Associates (CVA)

CVA Corporate Value Associates

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Stabilizers can work magic here

Production emissions	Transport	In field emissions		
98% Green fertilizers	**10%**	**30%** Stabilizers	**30%** Controlled Release Fertilizers (CRF)	**5-50%** Nitrogen Use Efficiency (NUE)
30%	10%	60%		

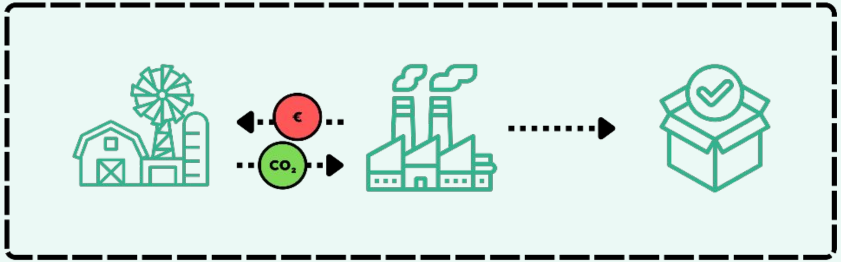
Scope 3 emission reduction for food companies *and* fertilizer producers

More adoption of nitrogen stabilizers by creating an incentive mechanism to share cost along the supply chain.

For example: in SE Asia there is an adoption rate of stabilized urea of <1%*. It can be greatly improved elsewhere as well.

** Information from Corporate Value Associates (CVA)*

Insetting: The bigger and better cousin of offsetting



Insetting

Within a company's supply chain

→ Companies can support or start GHG projects in their supply chain and reduce their Scope 3 emissions.

Offsetting

Outside the company's supply chain: compensate and neutralize residual emissions

Ingredients to make this happen

A. A science-backed methodology to support proper quantification and verification of the impact

B. Database with emission factors
C. Strict governance
D. Reporting and Claiming Guidelines

We are looking for feedback on the methodology

So, the main goal is:

1. To get feedback from you.
2. Use the feedback to improve methodology.
3. Make this transparent in a feedback and response document.
4. Formally publish the methodology.

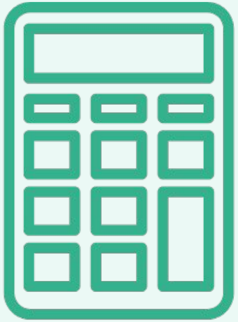
And…. get you interested in starting to use the methodology

GHG Methodology

Adoption of nitrogen stabilizers to transition to low-carbon agriculture

What is a GHG methodology?

Applicability and eligibility criteria



Quantification of emission reduction

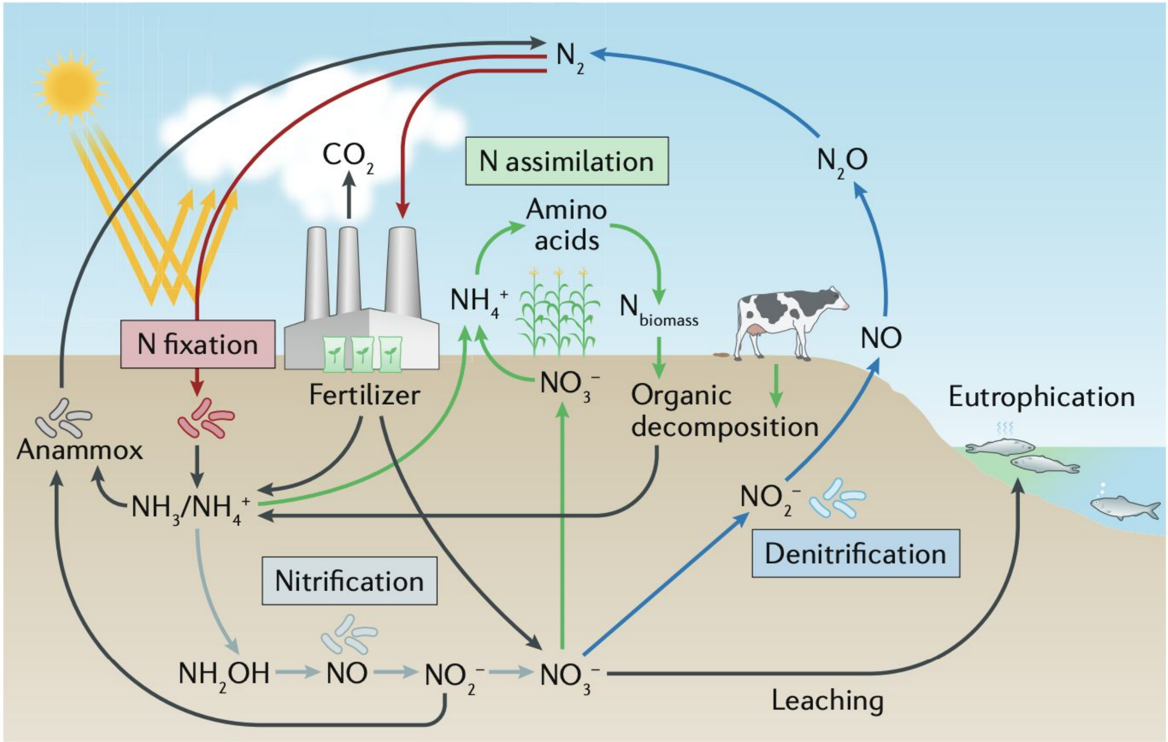
Guidelines for monitoring, reporting and verification (*MRV*)

Fertilizers 101

- Nitrogen is an essential nutrient for plant growth
- Farmers add large amounts of nitrogen-containing fertilizers
- Typically, only 30–50% is taken up by plants (Lehnert et al., 2018)

Lehnert, N., Dong, H.T., Harland, J.B. et al. Reversing nitrogen fixation. Nat Rev Chem 2, 278–289 (2018).
https://doi.org/10.1038/s41570-018-0041-7

Nitrogen cycle and fertilizers



Lehnert, N., Dong, H.T., Harland, J.B. et al. Reversing nitrogen fixation. Nature Reviews Chemistry 2, 278–289 (2018). https://doi.org/10.1038/s41570-018-0041-7

Nitrogen fertilizers are a powerful yet double-edged tool.

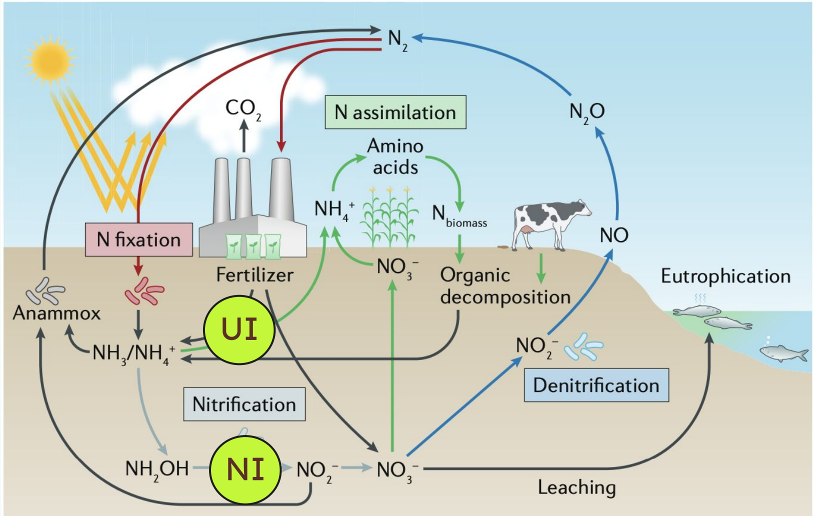
Enter: **Nitrogen stabilizers**

What are nitrogen stabilizers?

Nitrogen stabilizers are additives designed to improve the efficiency of nitrogen fertilizers in agricultural systems.

They slow down key soil processes that lead to nitrogen loss.

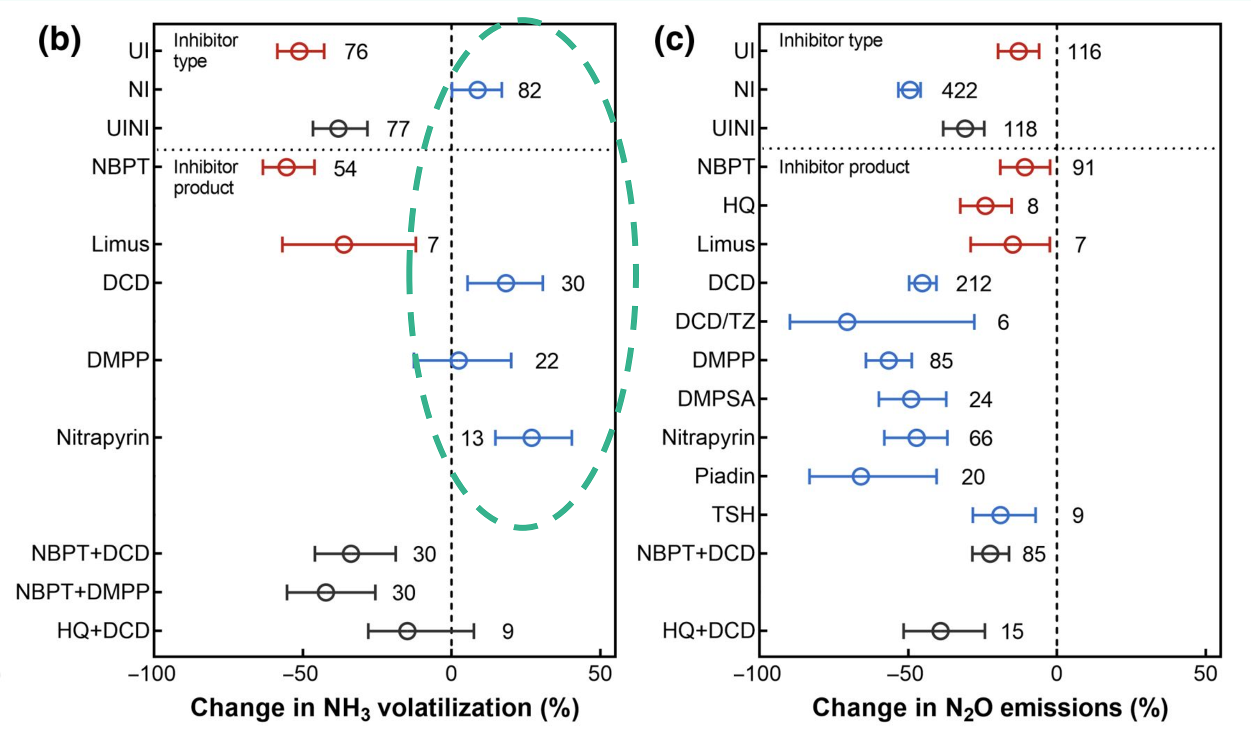
- **Urease inhibitors (UI)**
- **Nitrification inhibitors (NI)**
- **Double inhibitors (DI)**



Lehnert, N., Dong, H.T., Harland, J.B. et al. Reversing nitrogen fixation. Nature Reviews Chemistry 2, 278–289 (2018). https://doi.org/10.1038/s41570-018-0041-7

Source: Sha, Z., Ma, X., Wang, J., Lv, T., Li, Q., Misselbrook, T., & Liu, X. (2020). Effect of N stabilizers on fertilizer-N fate in the soil-crop system: A meta-analysis. Agriculture, Ecosystems & Environment, 290, 106763.

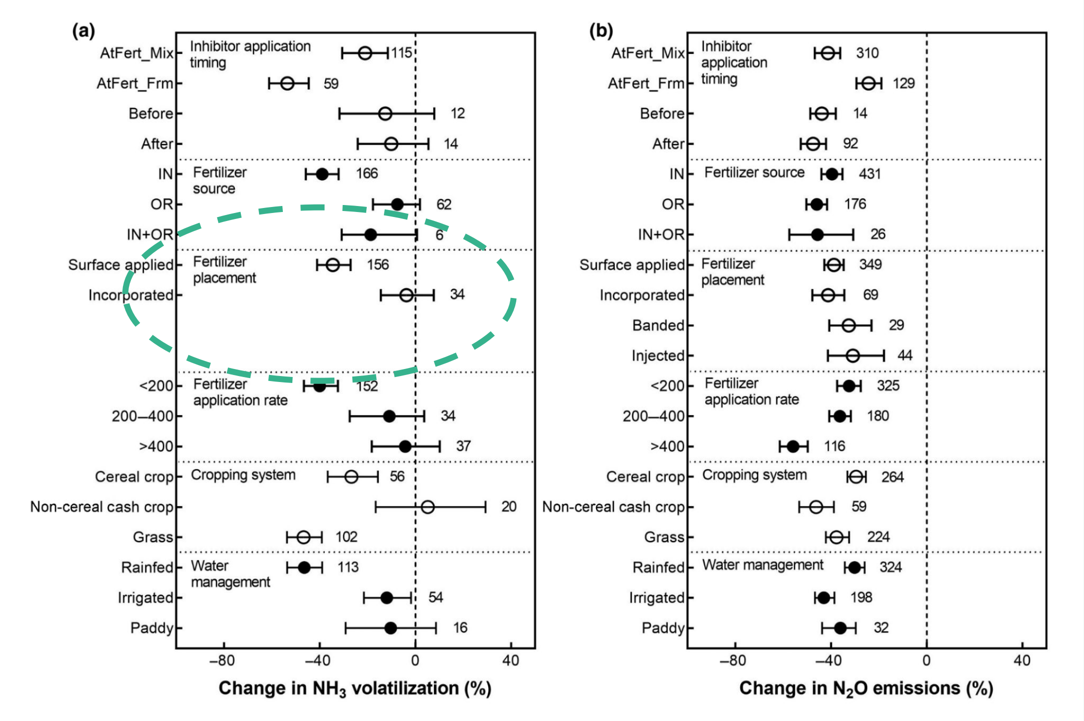
Are there any challenges?



NH_3 volatilization can **increase** (in some cases)

Fan, D., et. al. (2022). Global evaluation of inhibitor impacts on ammonia and nitrous oxide emissions from agricultural soils: A meta-analysis. Global Change Biology, 28, 5121–5141. *https://doi.org/10.1111/gcb.16294*

Are there any challenges?



We need to be **careful** when, where and how we place the stabilizers

Fan, D., et. al. (2022). Global evaluation of inhibitor impacts on ammonia and nitrous oxide emissions from agricultural soils: A meta-analysis. Global Change Biology, 28, 5121–5141. https://doi.org/10.1111/gcb.16294

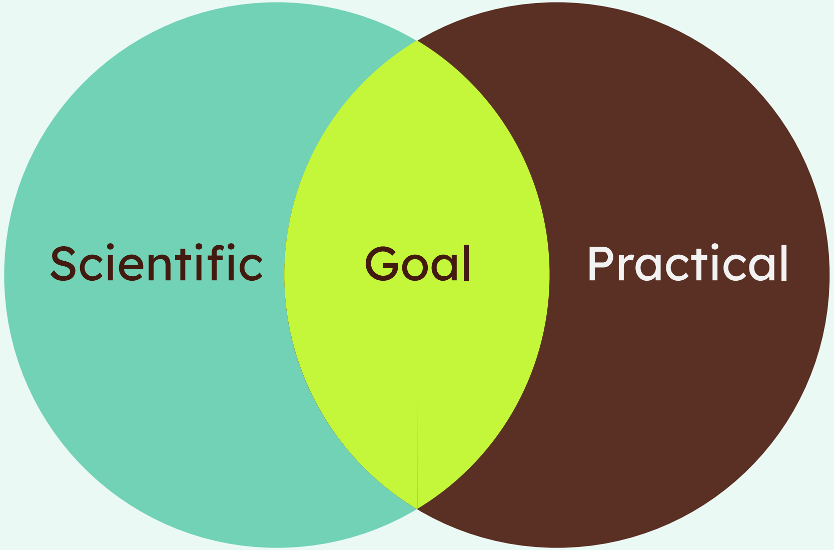
Why does this GHG methodology matter?

1. Drives adoption of nitrogen stabilizers

2. Enables credible Scope 3 emission reductions across agri-food supply chains

3. Ensures permanent and additional climate impact

Development process



Which means that we have made certain design choices for which

We need your input

Applicability choice No 1

Applicability is based on the availability of scientific evidence

Applicability choice No 2

Baseline must start from good farming practices

Applicability choice No 3

Nitrogen application rate reduction is out of scope

Call to action by the scientific community (e.g., Fan et al.)

Fan, D., et. al. (2022). Global evaluation of inhibitor impacts on ammonia and nitrous oxide emissions from agricultural soils: A meta-analysis. Global Change Biology, 28, 5121–5141. https://doi.org/10.1111/gcb.16294

GHG sources

Only direct and indirect N_2O emissions are accounted

Transparency required for other emissions, *if applicable*

Spatial boundaries

Land management unit

Access to farm level data

Higher **traceability**

Lower uncertainty

Additional practices allowed

Sourcing region

No access to farm level data

More **scalable**

Higher uncertainty deduction

Interim approach

Aligned with *SBTi* and *GHG Protocol's* directions

Baseline

Counterfactual approach

rather than historical

Quantification (1)

Production emissions

PCF / LCA

Direct and indirect N_2O emissions

Direct measurements

Scientific literature

IFA EF Database

Quantification (2)

Tier 1 emission factors are only allowed for indirect emissions *

* ammonia volatilization, nitrate leaching

Monitoring, reporting & verification

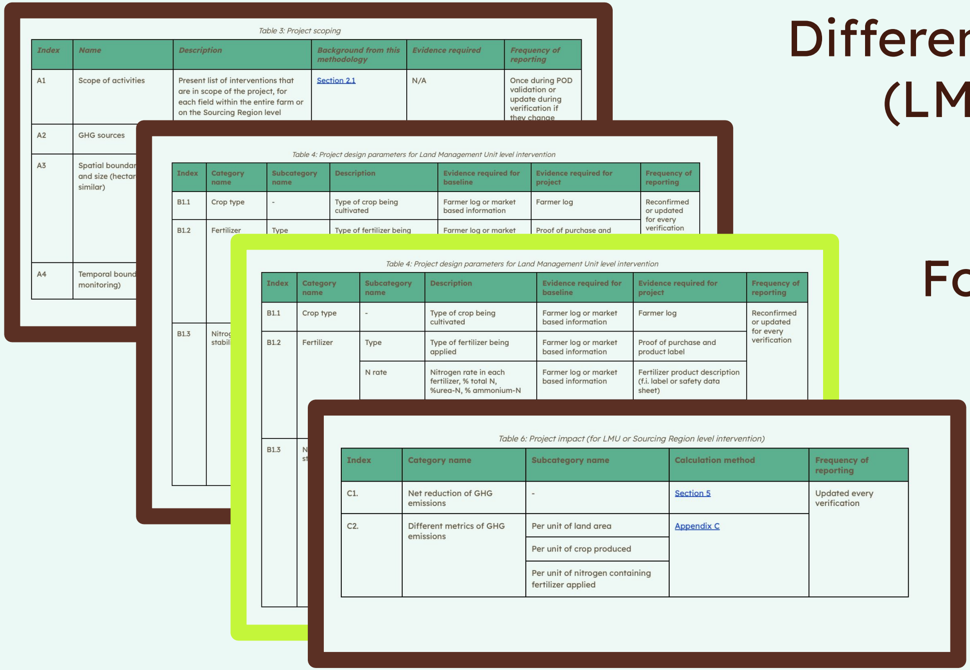


Table 3: Project scoping

Index	Name	Description	Background from this methodology	Evidence required	Frequency of reporting
A1	Scope of activities	Present list of interventions that are in scope of the project, for each field within the entire farm or on the Sourcing Region level	Section 2.1	N/A	Once during POD validation or update during verification if they change
A2	GHG sources				
A3	Spatial boundar… and size (hectar… similar)				
A4	Temporal bound… monitoring)				

Table 4: Project design parameters for Land Management Unit level intervention

Index	Category name	Subcategory name	Description	Evidence required for baseline	Evidence required for project	Frequency of reporting
B1.1	Crop type	-	Type of crop being cultivated	Farmer log or market based information	Farmer log	Reconfirmed or updated for every verification
B1.2	Fertilizer	Type	Type of fertilizer being applied	Farmer log or market based information	Proof of purchase and product label	
		N rate	Nitrogen rate in each fertilizer, % total N, %urea-N, % ammonium-N	Farmer log or market based information	Fertilizer product description (f.i. label or safety data sheet)	
B1.3	Nitrog… stabili…					

Table 6: Project impact (for LMU or Sourcing Region level intervention)

Index	Category name	Subcategory name	Calculation method	Frequency of reporting
C1.	Net reduction of GHG emissions	-	Section 5	Updated every verification
C2.	Different metrics of GHG emissions	Per unit of land area	Appendix C	
		Per unit of crop produced		
		Per unit of nitrogen containing fertilizer applied		

Different requirements (LMU vs Sourcing Region)

Focus on science-based evidence

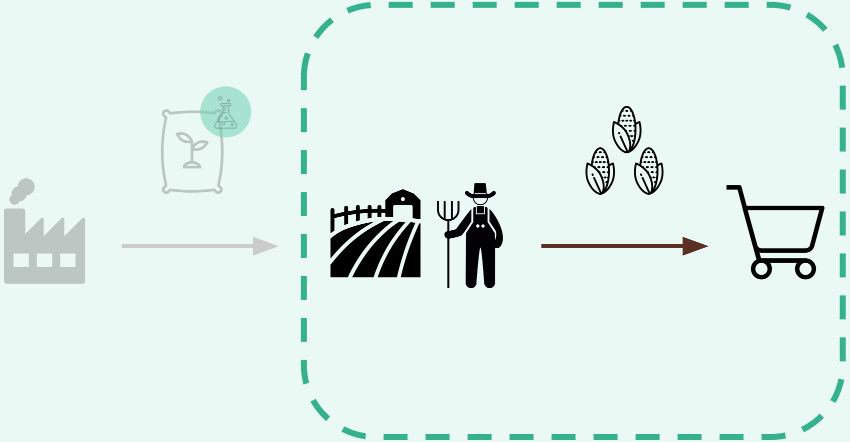
Allows multiple interventions

And finally, an example.

Two use cases of the methodology to support the adoption of stabilized fertilizers

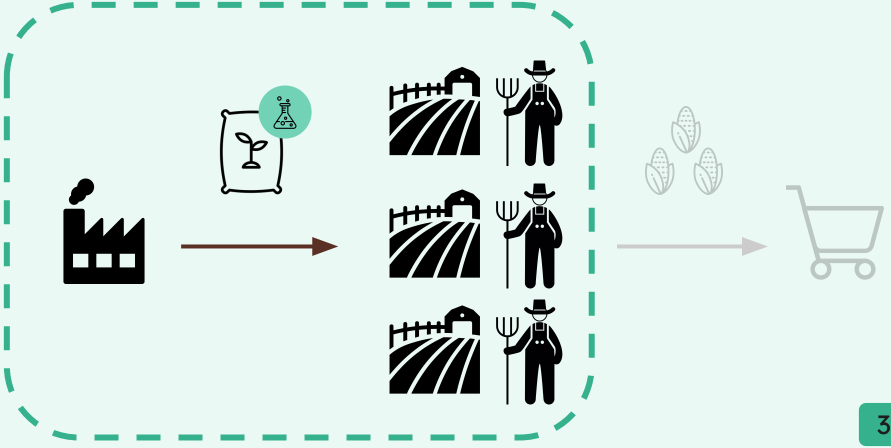
Land management unit:

Farmers adopting stabilized fertilizers to produce low-carbon crops



Sourcing region use case:

Supplying stabilized fertilizers to a predefined "demand shed " of farmers



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Get in touch

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Methodology information

Methodology: Adoption of nitrogen stabilizers to transition to low-carbon agriculture

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