# NUTRI-CHECK NET

# FINAL CONFERENCE
## Steps to Optimise Crop Nutrition

**NH BRUSSELS EU BERLAYMONT HOTEL**

HYBRID EVENT
**18th November 2025**

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# AGENDA

NUTRI-CHECK NET
OPTIMISING CROP NUTRITION

08.30 Welcome and coffee

**09:00 Introduction to NUTRI-CHECK NET |** Sarah Kendall, ADAS (Online)

**09:10 Conference opening address |** Miguel Quemada, UPMadrid

**09:40 Session 1 | Challenges in Nutrient Management in Europe |** Chair: Thomas Wilkinson, ADAS

10:40 Coffee break

**11:00 Session 2 | Tools For a Better Nutrient Management |** Chair: David Wall, TEAGASC

12:30 Networking Lunch | HE Projects Posters Session

**13:45 Session 3 | Co-creation and Best Practices To Support Adoption |** Chair: Milan Franssen, DELPHY

15:15 Coffee break

**15:35 Session 4 | Horizon Europe shaping Crop Nutrient Management |** Chair: Alexandros Fournarakos, AUA

16:50 Leg stretch break

**17:00 Panel Discussion | Bridging sectors for a Better Future |** Chair: Francesca Degan, ARVALIS

**17:30 Conference close |** Sypros Fountas, AUA

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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

## 09:00 - 09:10 | INTRODUCTION TO NUTRI-CHECK NET


**SARAH KENDALL,** ADAS

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**SARAH KENDALL**
ADAS

**Crop Physiologist and Associate Managing Director of ADAS' Sustainable Agricultural Systems business, based in the UK.**

**Scientific Coordinator of the NUTRI-CHECK NET project.**

**Research focused on optimising crop nutrition and supporting farmers to make the best nutrition decisions to increase productivity sustainably.**

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From January 2023 to December 2025
“To maximise site-specific precision in managing the nutrition of European arable crops”


SEGES INNOVATION

Teagasc
Agriculture and Food Development Authority

ADAS

ARVALIS
Institut du végétal

consulai

Lithuanian Agricultural Advisory Service

LAMMC
Lithuanian Research Centre for Agriculture and Forestry

CDR

Delphy

Agricultural University of Athens

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# 2030 Targets for sustainable food production in EU

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Reduce by 50% the overall use and risk of **chemical pesticides** and reduce use by 50% of more hazardous **pesticides**

Reduce **nutrient losses** by at least 50% while ensuring no deterioration in soil fertility; this will reduce use of **fertilisers** by at least 20 %

Reduce sales of **antimicrobials** for farmed animals by 50%

Achieve at least 25% of the EU's agricultural land under **organic farming** and a significant increase in **organic aquaculture**

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# The 4Rs – is it enough?

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Right Source
Match fertiliser type to crop needs

Right Rate
Match the amount of fertiliser to crop needs

Right Time
Make nutrients available when the crop needs them

Right Place
Keep nutrients where crops can use them

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# A change in Approach

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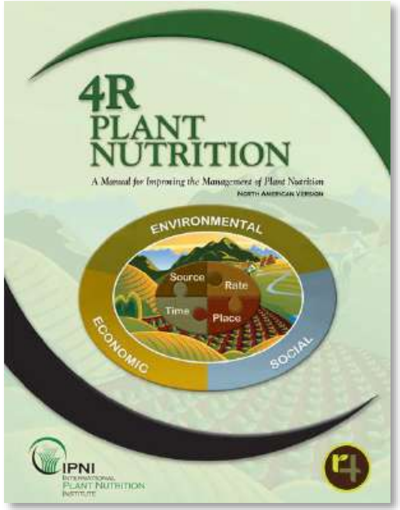
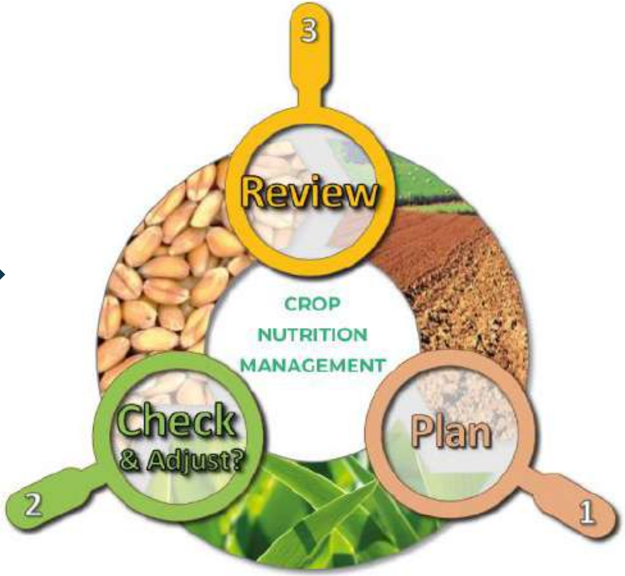
From assuming that predictions are always 'right' e.g. the 4Rs

To a dynamic management approach which utilises monitoring & measurements





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# NUTRI-CHECK NET in numbers

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- 9 National Expert Groups
- 26 Farmer Crop Nutrition Clubs
- 122 Needs & Barriers identified
- 173 Tools & Services Inventoried
- 135 farmers evaluating tools
- 1 New management framework
- 21 Best Practices
- 102 Practice Abstracts
- 89 Field Demonstrations

# Thank You!

**Sarah Kendall**

*Sarah.Kendall@adas.co.uk*

https://nutri-checknet.eu/

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## 09:10 - 09:40 | CONFERENCE OPENING ADDRESS

**MIGUEL QUEMADA,** UPMADRID

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**MIGUEL QUEMADA**
UPMADRID

**PhD in Agronomy and Professor at the Universidad Politécnica de Madrid (UPM) and a Senior Scientist at the Research Centre for the Management of agricultural and Environmental Risks (CEIGRAM).**

**Area of expertise is nitrogen and water management in agricultural systems, seeking to increase economic and environmental sustainability.**

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# Fertilizer dependency complements NUE to improve sustainable management in agrosystems

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ceigram
Centro de Estudios e Investigación para la Gestión de Riesgos Agrarios y Medioambientales

POLITÉCNICA

AgSystems

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# Outline

- Introduction
- Application to field experiment
- Application to farm scale
- Application to country and global scale
- Conclusions

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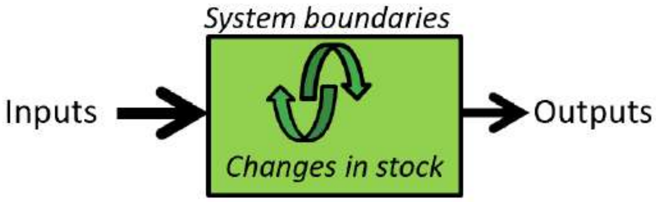
# Introduction

$$NUE = N_{output} / N_{input}$$

*Lassaletta et al. 2014*
*EUNEP 2015*
*Zhang et al. 2015*

- Resource use efficiency
- Potential environmental impacts
- Productivity level




EU Nitrogen Expert Panel (2015)

**NUE** = Output / Input

**N surplus** = Input – output

**N output** = N yield

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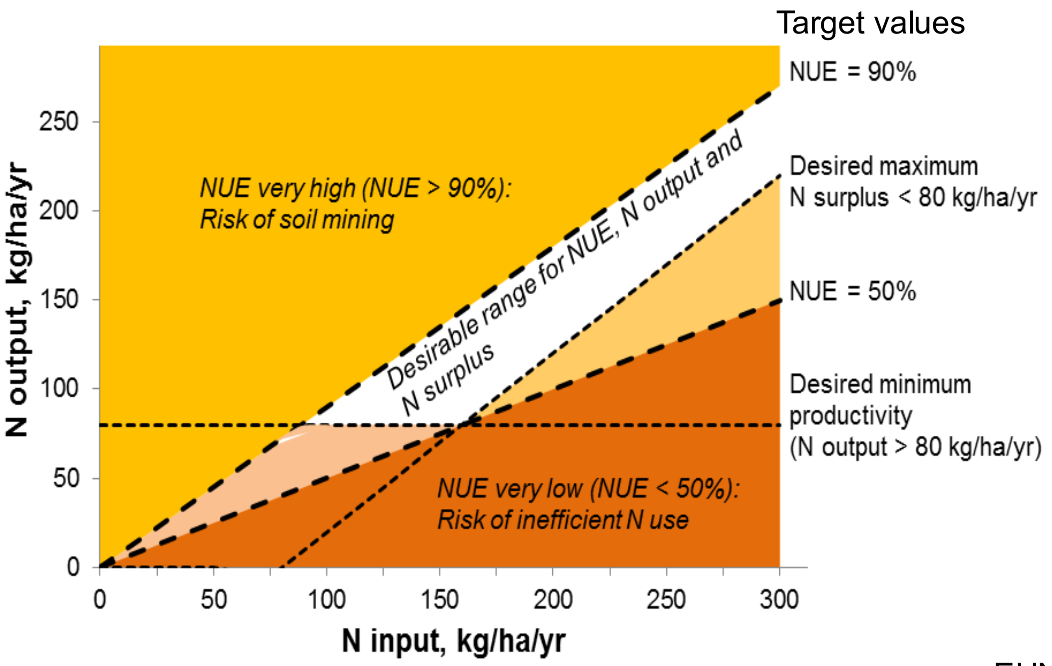
# Introduction

$$NUE = N_{output} / N_{input}$$

*Lassaletta et al. 2014*
*EUNEP 2015*
*Zhang et al. 2015*




EUNEP 2015

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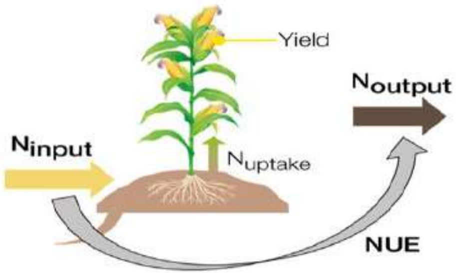
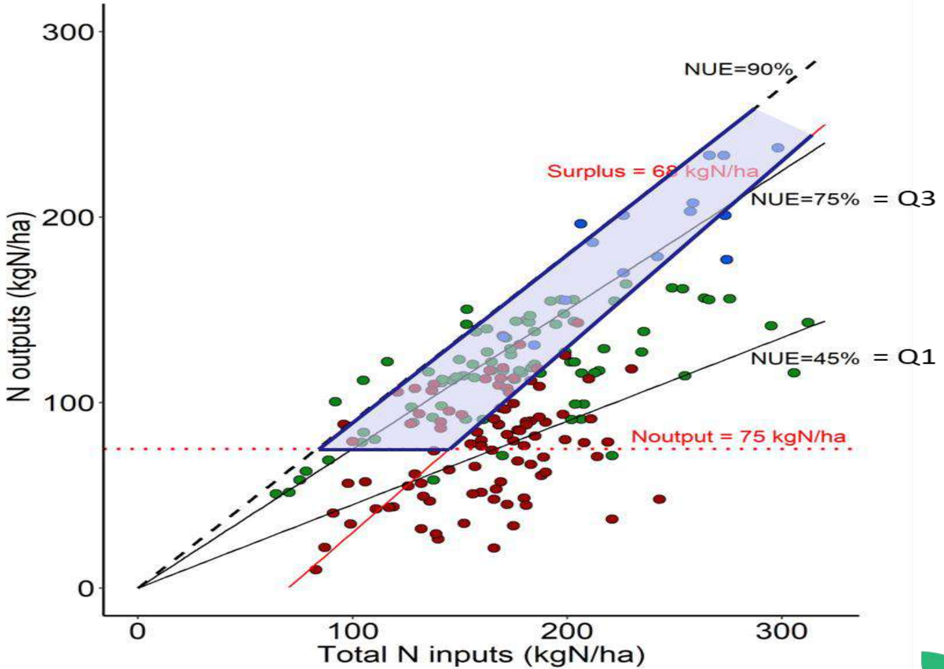
# Introduction




$$NUE = N_{output} / N_{input}$$

*Lassaletta et al. 2014*
*EUNEP 2015*
*Zhang et al. 2015*




Quemada et al. 2020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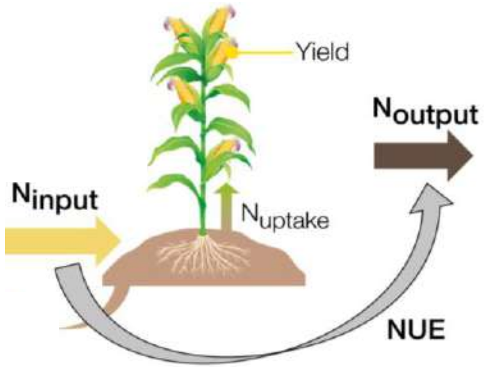
# Introduction



$$\text{NUE} = \text{N}_{\text{output}} \,/\, \text{N}_{\text{input}}$$

$$\text{NUE} = \text{YE}_{\text{N}} \times \overbrace{\text{UtE}_{\text{N}} \times \text{RE}_{\text{N}}}^{\text{AE}_{\text{N}}}$$

$$\text{NUE} = \frac{\text{N}_{\text{ouput}}}{\cancel{\text{Yield}}} \times \frac{\cancel{\text{Yield}}}{\cancel{\text{N}_{\text{uptake}}}} \times \frac{\cancel{\text{N}_{\text{uptake}}}}{\cancel{\text{N}_{\text{fertilizer}}}} \times \frac{\cancel{\text{N}_{\text{fertilizer}}}}{\text{N}_{\text{input}}}$$

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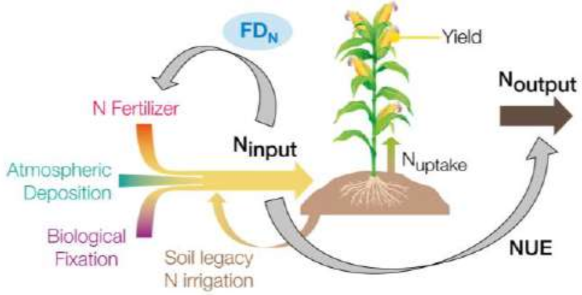
# Introduction

*Lassaletta et al. 2014*
*EUNEP 2015*
*Zhang et al. 2015*

$$NUE = N_{output} \,/\, N_{input}$$

$$NUE = YE_N \times \overbrace{UtE_N \times RE_N}^{AE_N} \times FD_N$$

$$NUE = \frac{N_{ouput}}{Yield} \times \frac{Yield}{N_{uptake}} \times \frac{N_{uptake}}{N_{fertilizer}} \times \frac{N_{fertilizer}}{N_{input}}$$





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# Introduction

*Lassaletta et al. 2014*
*EUNEP 2015*
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$$NUE = N_{output} / N_{input}$$

$$NUE = YE_N \times \overbrace{UtE_N \times RE_N}^{AE_N} \times FD_N$$

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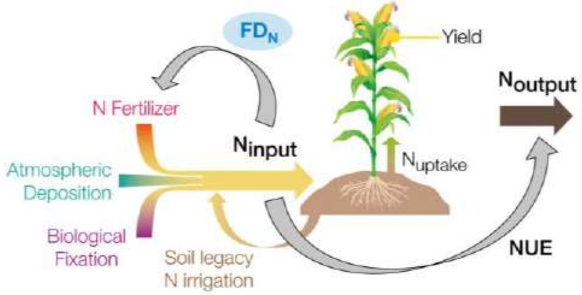


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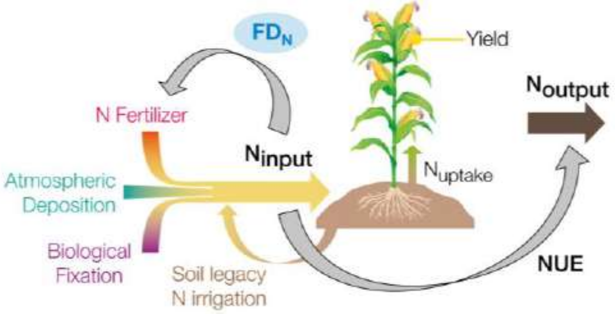
# Introduction

$$FD_N = \frac{\sum N_{\text{applied with fertilizers}}}{\sum N_{\text{inputs}}} \cdot 100$$

**$FD_N$** is an indicator of the relevance of the N provided by internal sources:

| | |
|---|---|
| System supplies a lot of N (fertile soils, biological $N_2$ fixation,…) | Low $FD_N$ |
| System supplies little N (low fertile soils, hydroponics,…) | High $FD_N$ |

**$FD_N$** may decrease with management practices that enhance N availability and by circular economy principles applied to agriculture

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# Introduction

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## Objective

- To test the fertilizer dependency concept at the cropping system scale, and at different spatial scales as an indicator to promote sustainable production systems

Spatial scales: field experiment
farm
country and global

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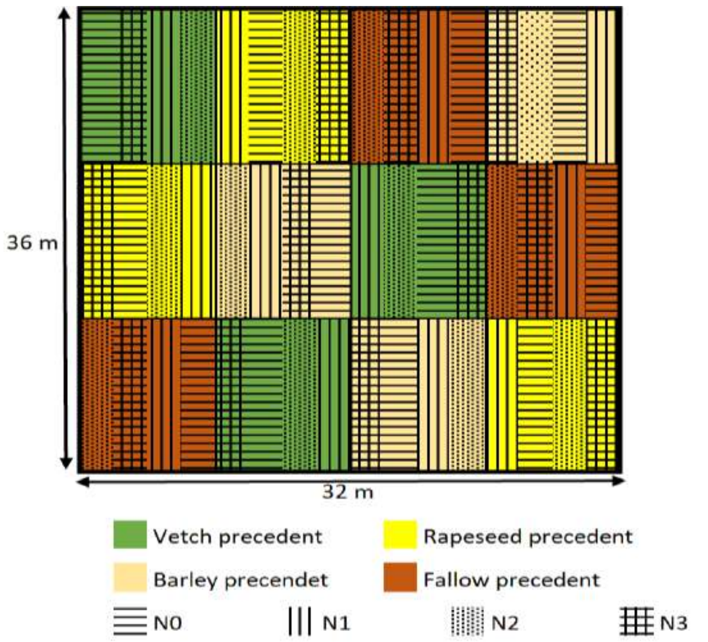
# Application to field experiments




0 kg N/ha | 70 kg N/ha | 140 kg N/ha | 200 kg N/ha

Location: Central Spain

Main crop: Bread wheat (November to July)

Factors: Precedent

N fertilizer rate (ANS 26%)

Harvest: Yield

Grain and biomass N concentration

$N_{output}$

**N inputs**

N applied with fertilisers

N in the aboveground biomass of N0 = N atmospheric deposition + N supplied from biological fixation + N in irrigation water + soil N supplied

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# Application to field experiments

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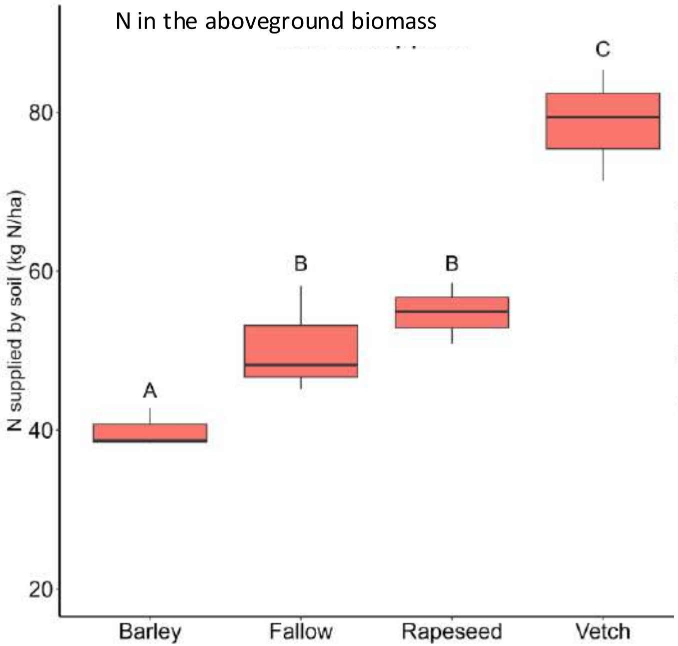
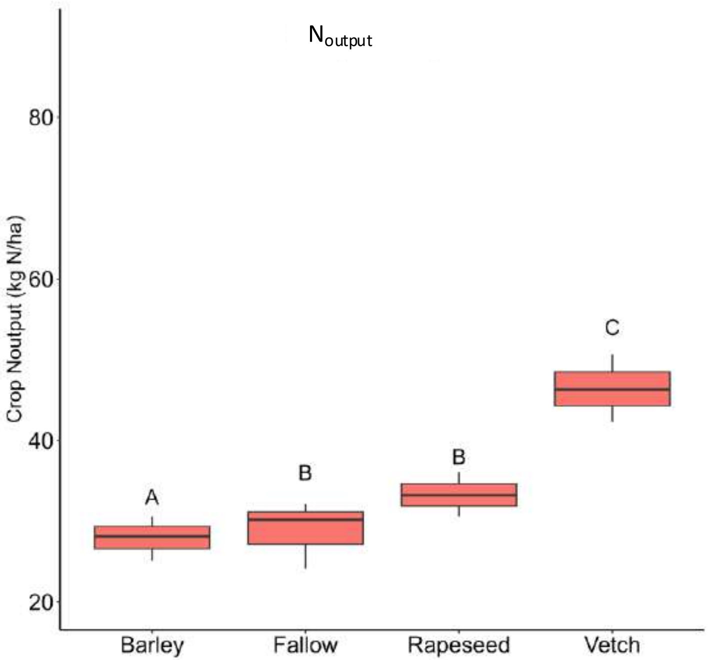
Control treatment (N0)





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# Application to field experiments

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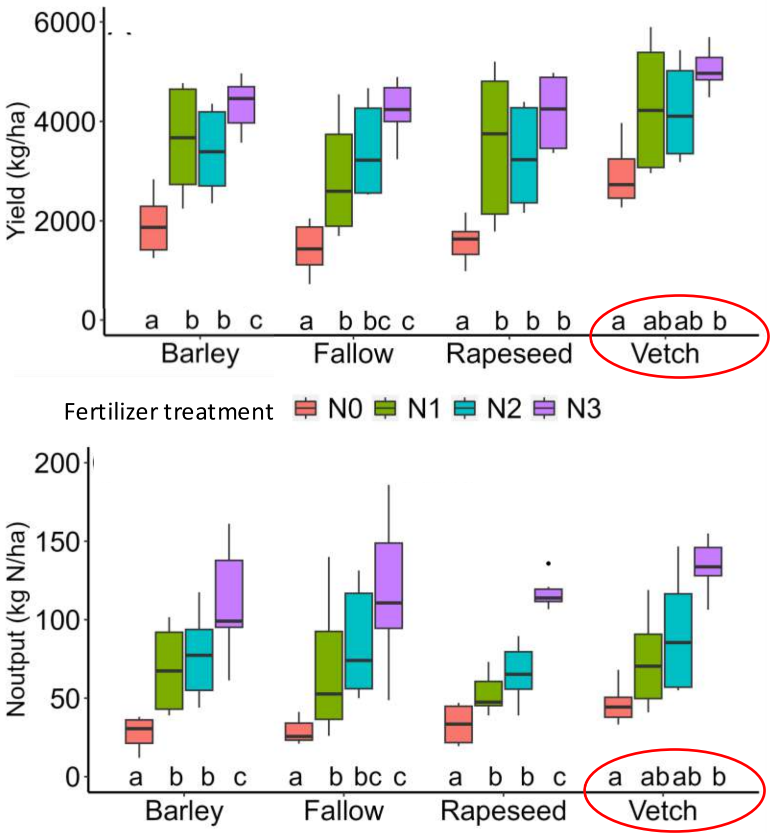


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# Application to field experiments

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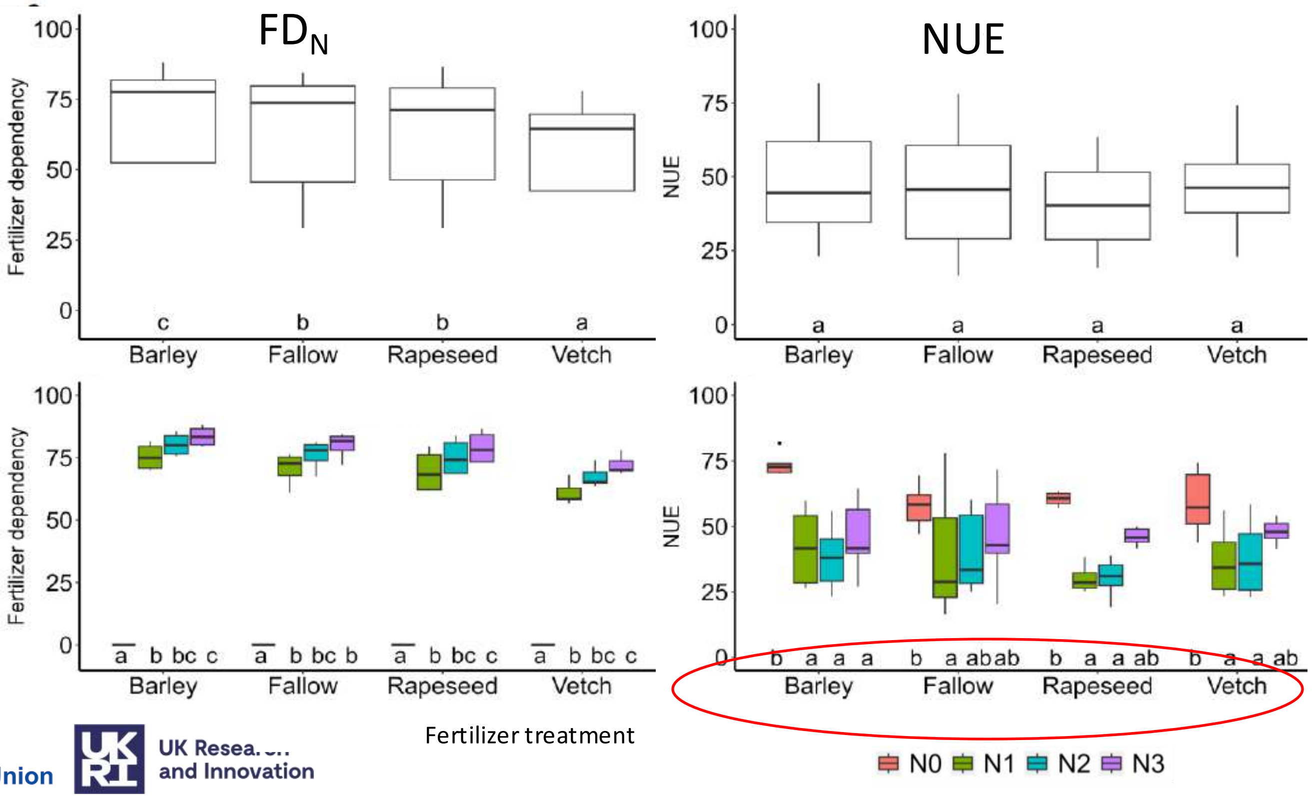
In all N0 treatments

fertilizer depedency

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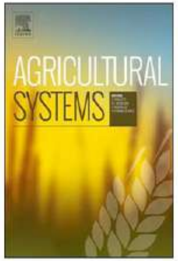
# Application to farm scale

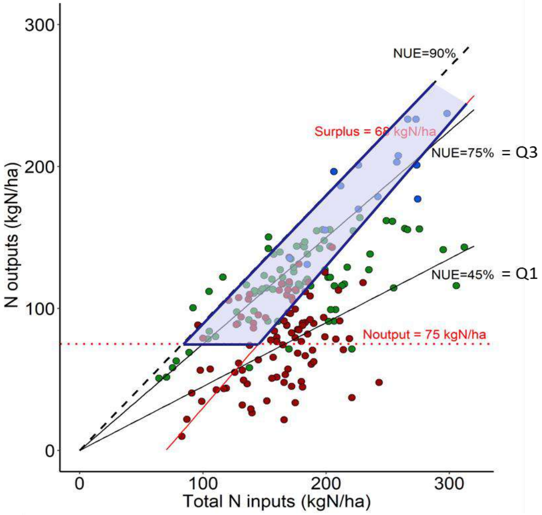
Agricultural Systems 177 (2020) 102689

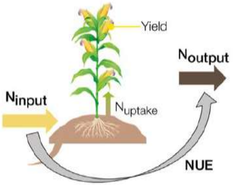
## Exploring nitrogen indicators of farm performance among farm types across several European case studies

M. Quemada[a,*], L. Lassaletta[a], L.S. Jensen[f], O. Godinot[e], F. Brentrup[b], C. Buckley[c], S. Foray[d], S.K. Hvid[g], J. Oenema[h], K.G. Richards[c], O. Oenema[h]




| Nitrogen input (kg N/ha) | | Nitrogen output (kg N/ha) | |
|---|---|---|---|
| I1 | Mineral fertilizers | O1 | Crop products |
| I2 | Feed and fodder (net) | O2 | Animal products (milk, egg, wool) |
| I3 | Biological nitrogen fixation | O3 | Animals (net) |
| I4 | Atmospheric N deposition | O4 | Orchard trees (net) |
| I5 | Compost and sewage sludge | | |
| I6 | Seed and planting material | | |
| I7 | Bedding material (straw, saw dust) | | |
| I8 | Animal manure (net) | | |
| I9 | Irrigation water | | |

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# Application to farm scale

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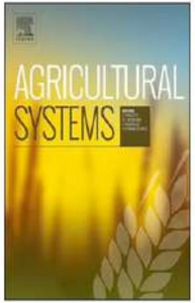
Agricultural Systems 177 (2020) 102689

## Exploring nitrogen indicators of farm performance among farm types across several European case studies

M. Quemada[a,*], L. Lassaletta[a], L.S. Jensen[f], O. Godinot[e], F. Brentrup[b], C. Buckley[c], S. Foray[d], S.K. Hvid[g], J. Oenema[h], K.G. Richards[c], O. Oenema[h]




**Subset**

Arable farms
3-year crop rotation → 45 farms (29 from Spain + 16 from Germany)

German farms: Rainfed & Applied organic manure plus mineral fertilizers
Spanish farms: Irrigated & Applied only mineral fertilizers

Main crops: Winter cereals (46%), maize (19%), rape (14%) and root crops (12%)

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# Application to farm scale

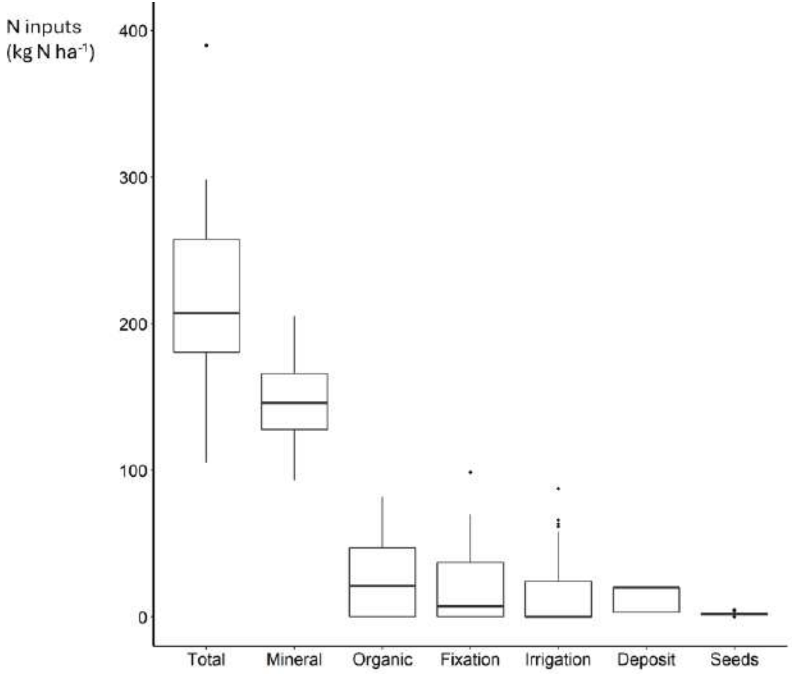
## N inputs

$N_{fertilizer}$

- N applied with mineral fertilizers
- N applied with organic fertilizers
- N applied in bedding material

Other N inputs

- N atmospheric deposition
- N supplied from biological fixation
- N in irrigation water
- N imported in seeds

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# Application to farm scale

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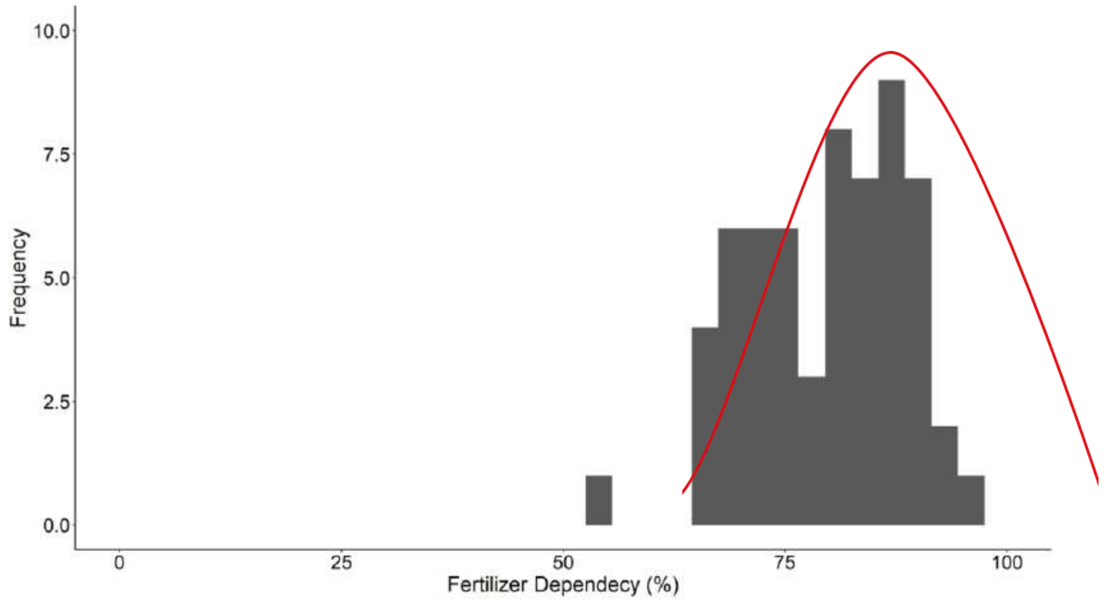
**$FD_N$** range from 47 to 95% and follows a normal distribution

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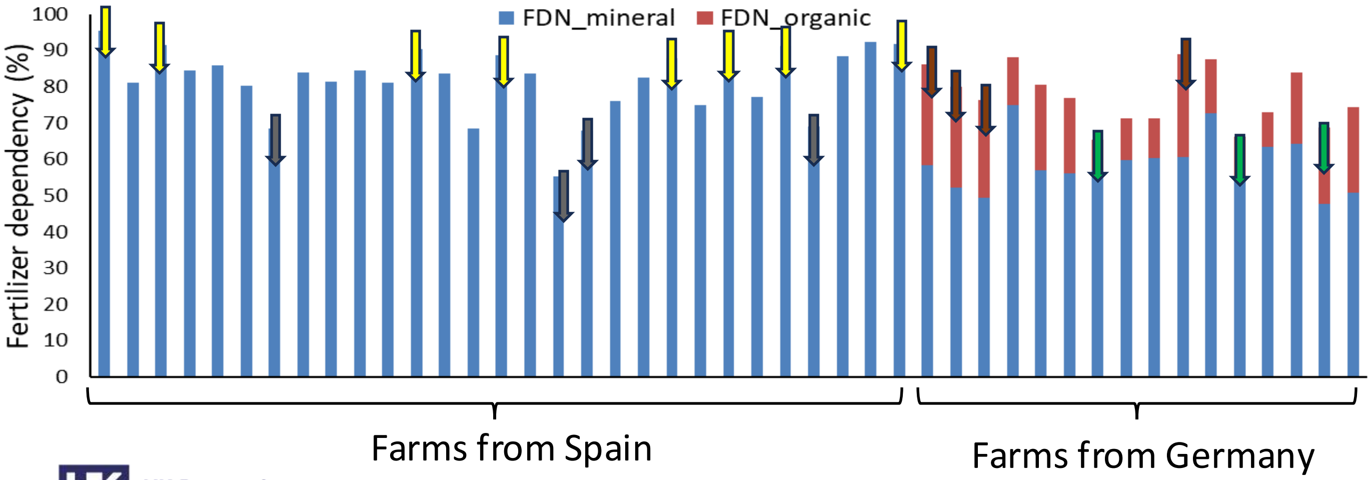
# Application to farm scale

$$FD_{N\_mineral} = \left[{}^{N\ applied\ with\ mineral\ fertilizers}/{}^{N}{}_{inputs}\right] \cdot 100$$

$$FD_{N\_organic} = \left[{}^{N\ applied\ with\ organic\ fertilizers}/{}^{N}{}_{inputs}\right] \cdot 100$$



# Application to farm scale

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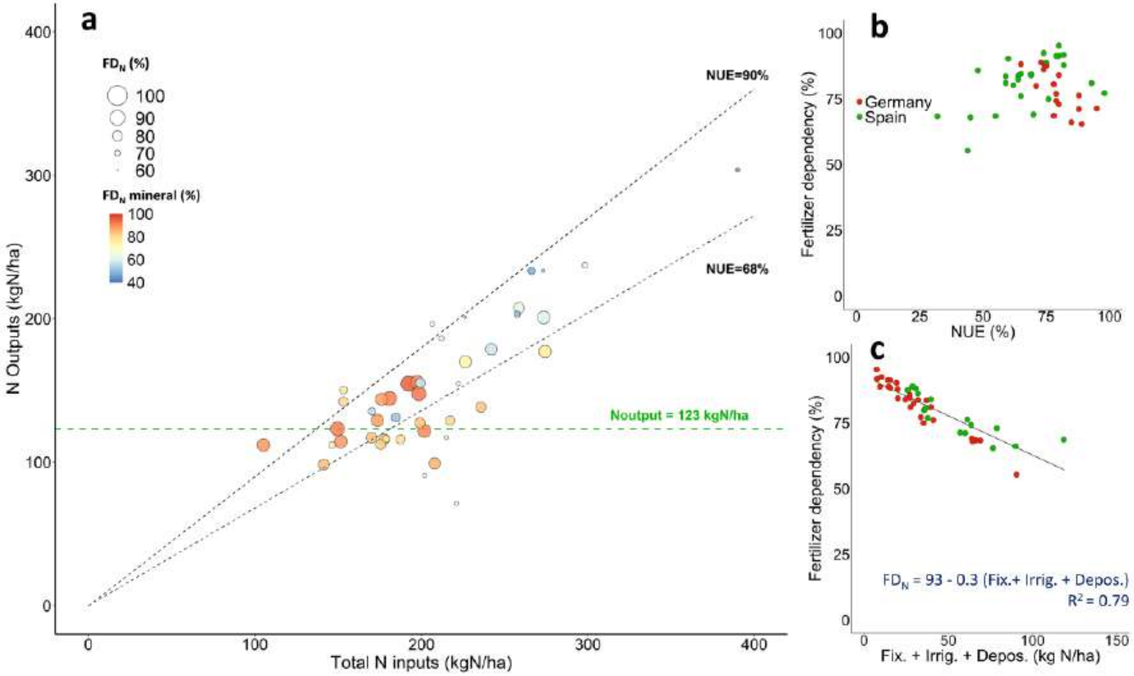



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# Application to country & global scale

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IOP Publishing Environmental Research Letters
Environ. Res. Lett. 9 (2014) 105011 (9pp) doi:10.1088/1748-9326/9/10/105011

## 50 year trends in nitrogen use efficiency of world cropping systems: the relationship between yield and nitrogen input to cropland

Luis Lassaletta, Gilles Billen, Bruna Grizzentti, Juliette Anglade and Josette Gardnier

### Dataset

Crop N budgets for 203 countries for the 1961-2013 period

### N inputs

- mineral fertilizer application
- manure application
- symbiotic biological fixation
- N atmospheric deposition of oxidized N forms.

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# Application to country & global scale

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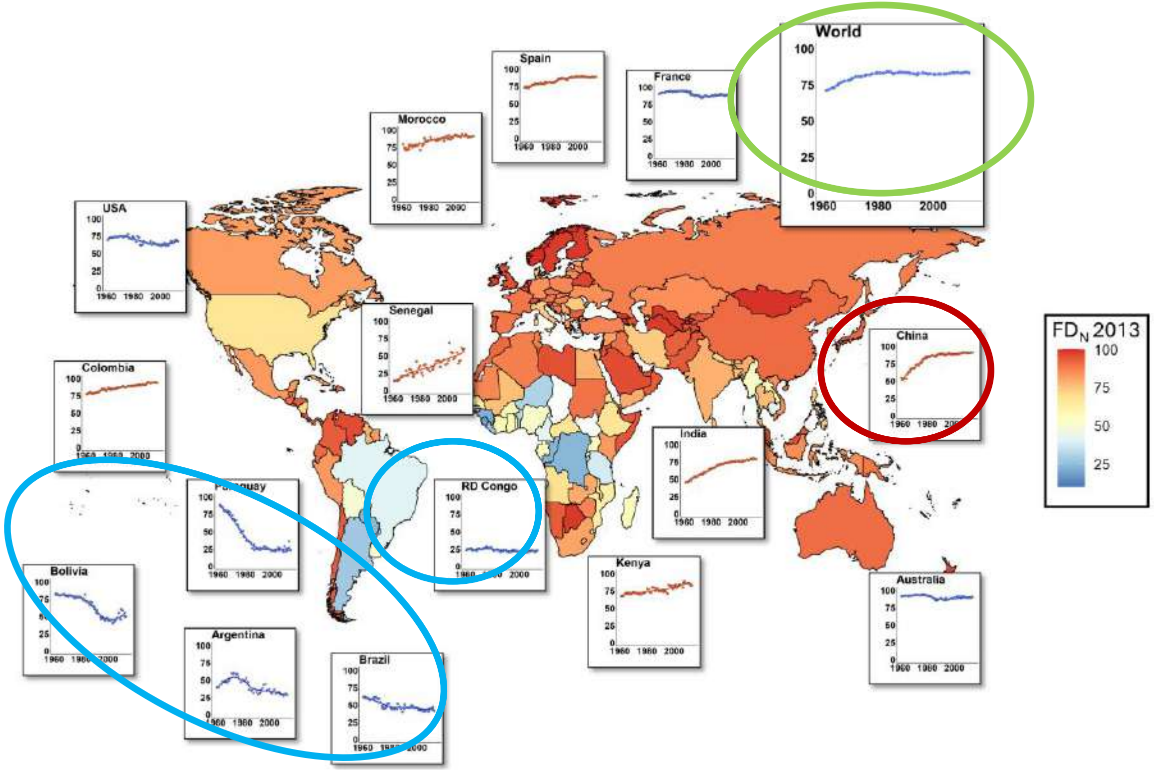



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# Application to country & global scale

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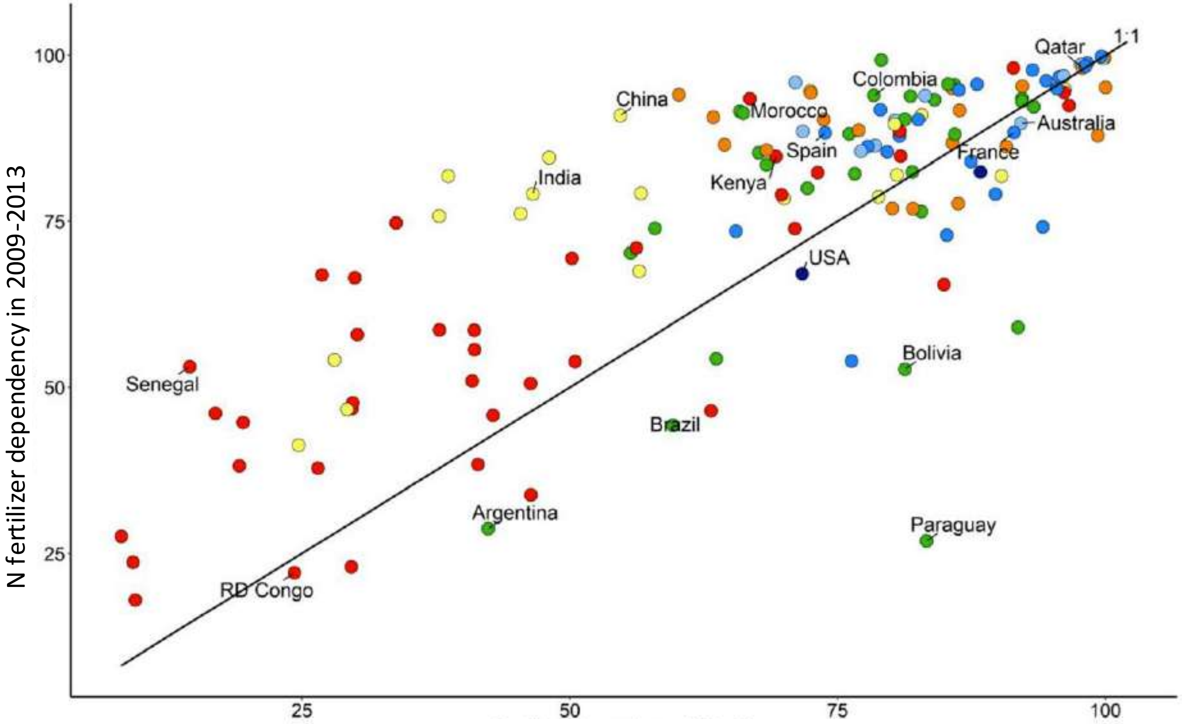


MENA: Middle East/North Africa
SSA: Sub-Saharan
LATAM: Latin America

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# Application to country & global scale

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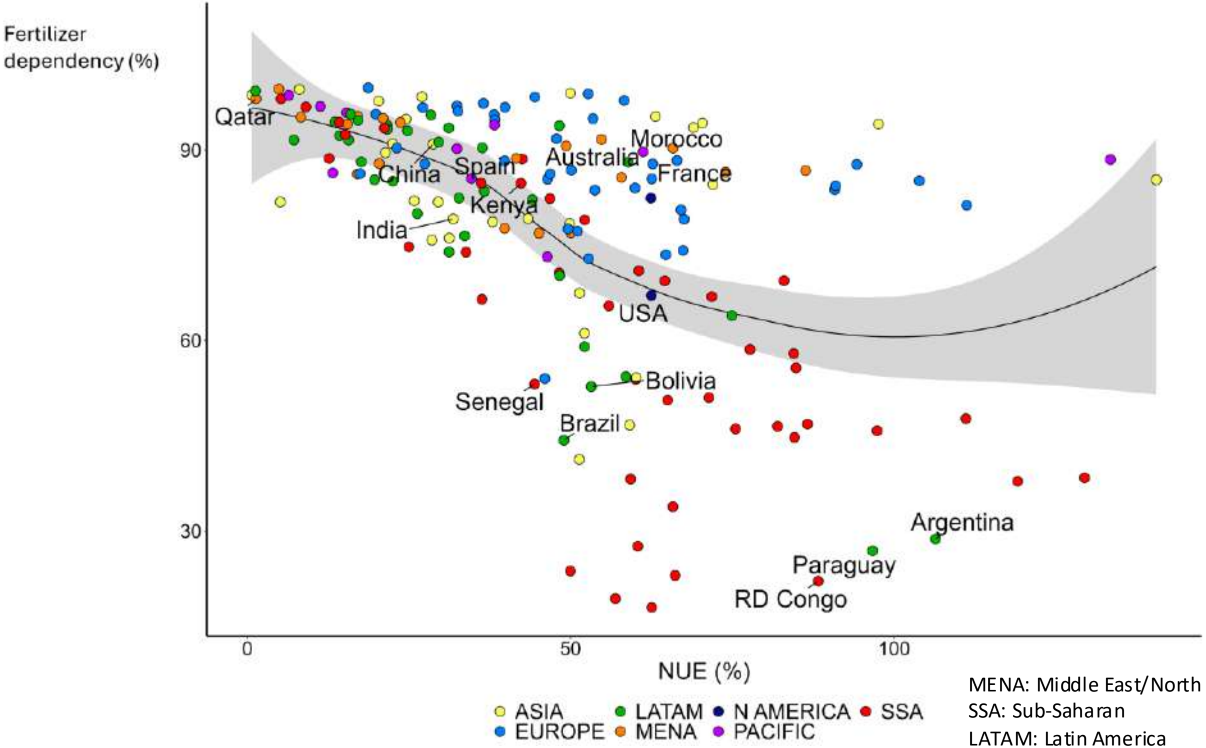
Relationship between NUE and N fertilizer dependency




MENA: Middle East/North Africa
SSA: Sub-Saharan
LATAM: Latin America

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# Conclusions

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- Nitrogen fertilizer dependency ($FD_N$) complements NUE, N surplus and N output and should be reported as the fourth agro-environmental indicator
- $FD_N$ provides relevant information on whether N fertilizer application is reduced by increasing inputs through symbiotic fixation or recirculation of already available N sources (N reuse of organic products, water or soil)
- Application at a regional scale reveals countries in which fertilizer dependency decreases, mainly because of increasing biological N fixation, and others that experienced increases in the last decades
- The global N fertilizer dependency ≈ 83%

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# Conclusions

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- If the goal is promoting N inputs other than external fertilizers in cropping systems, $FD_N$ has great potential, allowing farmers and policy makers to monitor achievements and to evaluate the ability of food production to confront international instability or shocks

- Research needs:
  - to test the applicability of $FD_N$ to crop-livestock farms
  - to test the applicability of $FD_N$ to the agro-food system
  - to assess the N inputs at different spatial and temporal scales

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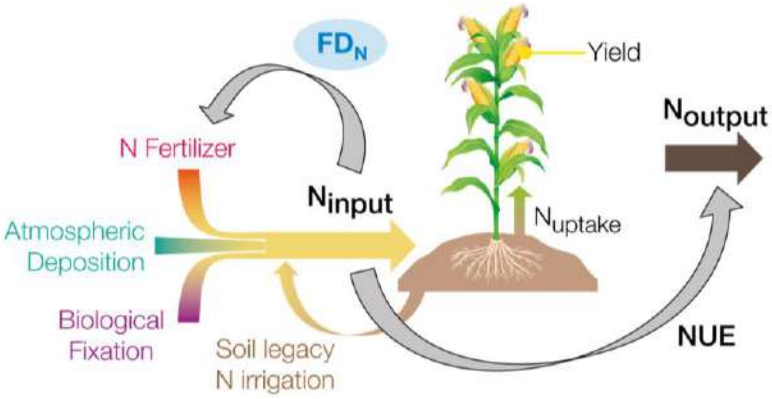
$$\mathrm{NUE} = \mathrm{YE_N} \times \overbrace{\mathrm{UtE_N} \times \mathrm{RE_N}}^{\mathrm{AE_N}} \times \mathrm{FD_N} = \mathrm{N_{output}} / \mathrm{N_{input}}$$

$$\mathrm{NUE} = \frac{\mathrm{N_{ouput}}}{\mathrm{Yield}} \times \frac{\mathrm{Yield}}{\mathrm{N_{uptake}}} \times \frac{\mathrm{N_{uptake}}}{\mathrm{N_{fertilizer}}} \times \frac{\mathrm{N_{fertilizer}}}{\mathrm{N_{input}}}$$




Reference: *Quemada & Lassaletta. 2025*. Agronomy for Sustainable Development. Fertilizer dependency: a new indicator for assessing the sustainability of agrosystems beyond nitrogen use efficiency. 44, 44-58

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# Thank You!

Miguel Quemada

miguel.quemada@upm.es

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 09:40 - 10:40 | SESSION 1: CHALLENGES IN NUTRIENT MANAGEMENT IN EUROPE

**THOMAS WILKINSON**
ADAS

**DAVID WALL**
TEAGASC

**DIRK-JAN BEULING**
BOERENBEDRIJF BEULING B.V.

**JÉRÔME CHARPENTIER**
SEVÉPI

**BERNADETTE BENNETT**
EUFRAS

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**THOMAS WILKINSON**
ADAS

**Senior Crop Research Consultant, Sustainable Agricultural Systems, RSK ADAS.**

**Focus is the incorporation of Ecosystem Service (ES) monitoring into good agricultural practice.**

**Lead of the Pilot Studies and ES Indicators WP in the legumES Horizon Europe project, technical lead of the Pulse Yield Enhancement Network and WP co-lead of the UK Nitrogen Climate Smart project.**

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 09:45 - 10:00 | CHALLENGES & OPPORTUNITIES IN CROP NUTRITION MANAGEMENT

**DAVID WALL**
TEAGASC

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**DAVID WALL**
TEAGASC

**Leader of NUTRI-CHECK NET WP3 "Evaluation of Crop Nutrition Decision Tools".**

**Head of TEAGASC, Crops, Environment and Land use Research Centre at Johnstown Castle, in Ireland and is responsible for updating the National Nutrient Advice for Grassland and Arable Crops in Ireland.**

**Research interests include building resilient soils for sustainable food production systems, identifying indicators of soil health, maximising the efficiency of organic manure inputs for arable cropping systems and developing soil specific nutrient advice for farms.**

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# NUTRI-CHECK NET

## *Challenges and opportunities in arable crop nutrition management*


**Dr. David Wall**

*Teagasc, Johnstown Castle, Wexford*


NUTRI-CHECK NET Final Conference

18th November 2025, Brussels, Belgium


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# Introduction

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**Aim of NUTRI-CHECK NET:** To improve the precision of crop nutrition by compiling nutrition decision tools, promoting farm-by-farm nutrient checking, and facilitating knowledge exchange.

- Practice adoption in agriculture is the process by which farmers decide to use new or improved technologies and management techniques,
- This can be influenced by factors like expected benefits (e.g., higher yields), available resources, and external conditions.
- The goal is to improve farm sustainability, resilience, and productivity while potentially reducing costs and improving market access.
- Various barriers can hinder the adoption of beneficial practices.

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# Methods of stakeholder engagement

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Interaction with 3 groups of stakeholders to determine challenges and opportunities in arable crop nutrition management.

Different stakeholder engagement methods were employed as follows;

1. **National Expert Group (NEG's)** – *Interviews*


2. **National Stakeholder actors** - *Surveys*

3. **Crop Nutrition Club Farmers** – *Evaluation workshops*

These methods enabled NUTRI-CHECK NET to cross validate the responses submitted by the different stakeholder actors who participated.

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# National Expert Groups (NEG's)

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**9 partner countries** have **NEG's**

**10-20 members** in each NEG representing the wider agricultural industry in each country.

122 NEG members were interviewed


NEG members from UK

## Aim of the NEG's

- Identify and promote the key drivers for increasing the precision of crop nutrition.
- Identify solutions and new ways of overcoming barriers to achieving optimum crop nutrient management.

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# Crop Nutrition Clubs (CNC's)

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**9 partner countries** with **2-3 CNC's in each,**

**200 CNC farmer members** throughout Europe.
Scale:40ha to over 1000ha of productive arable crops incl. cereals, maize, potatoes.

135 CNC farmers participated in workshops


CNC farmers from Wexford, Ireland

## Aim of the CNC's

- Evaluate on-farm decision tools & opportunities to improve the precision of crop nutrition management.
- Feedback & share experiences with other farmers and the wider agricultural industry.

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# Wider stakeholder survey responses captured

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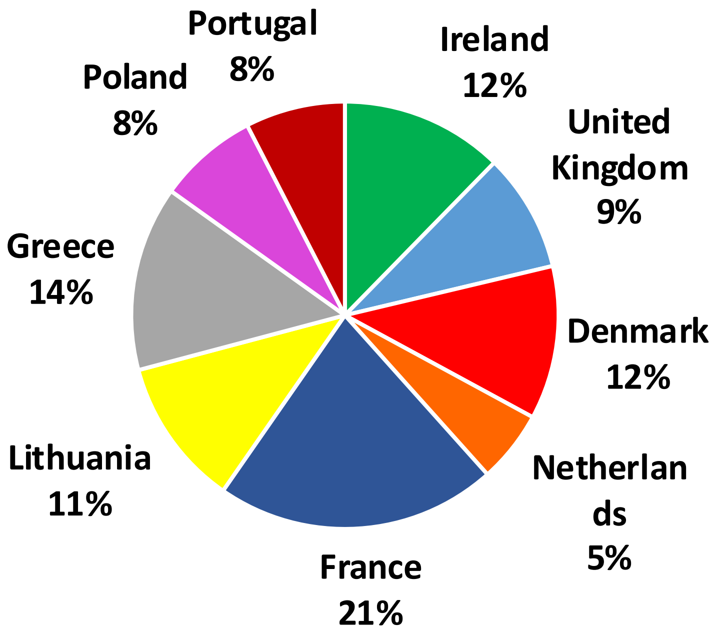
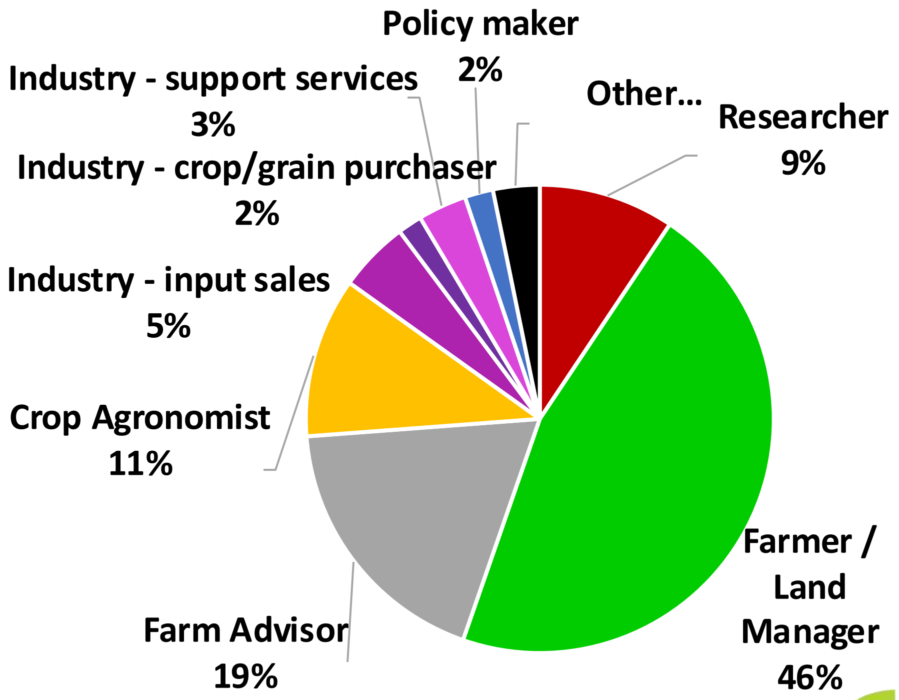
## Stakeholder responses *n=714*

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# What are the main drivers for improving crop nutrition on farms?

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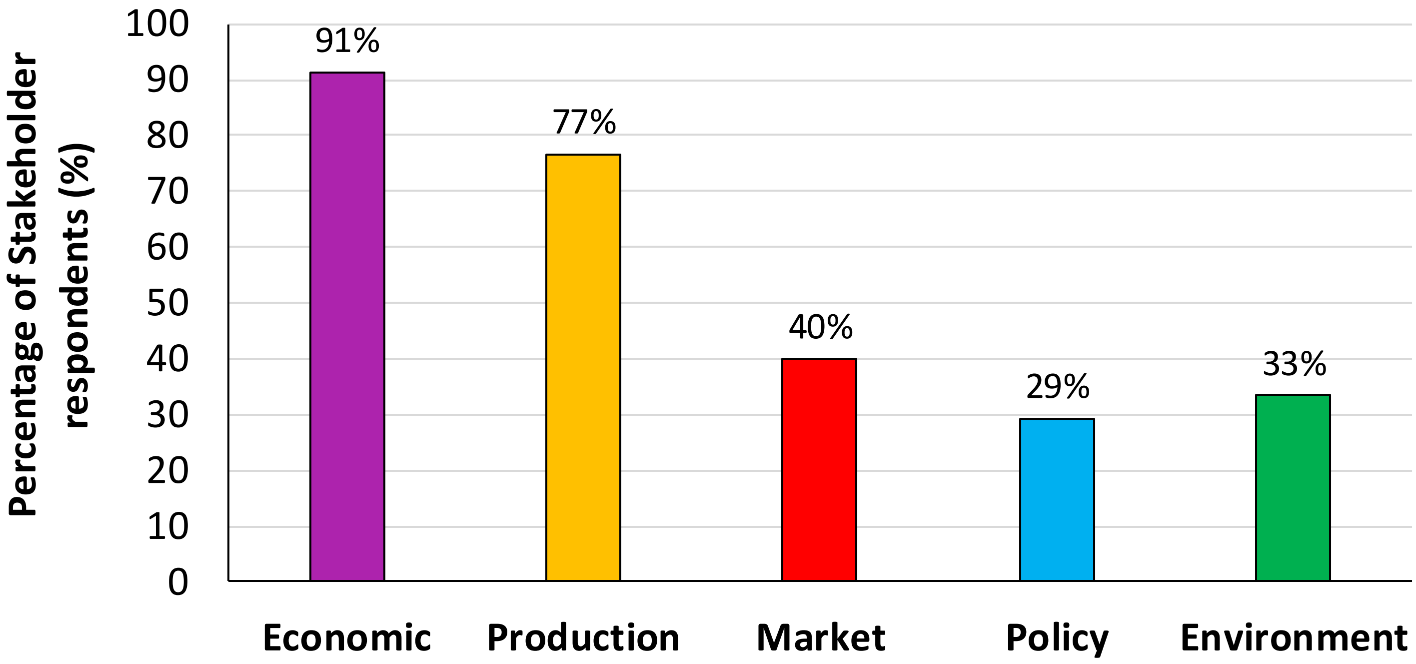


**Figure.** Main drivers for improving crop nutrition expressed by the stakeholders who responded to the wider stakeholder survey (n=714) across the 9 partner countries.


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# What are the primary motivations for improving crop nutrition?

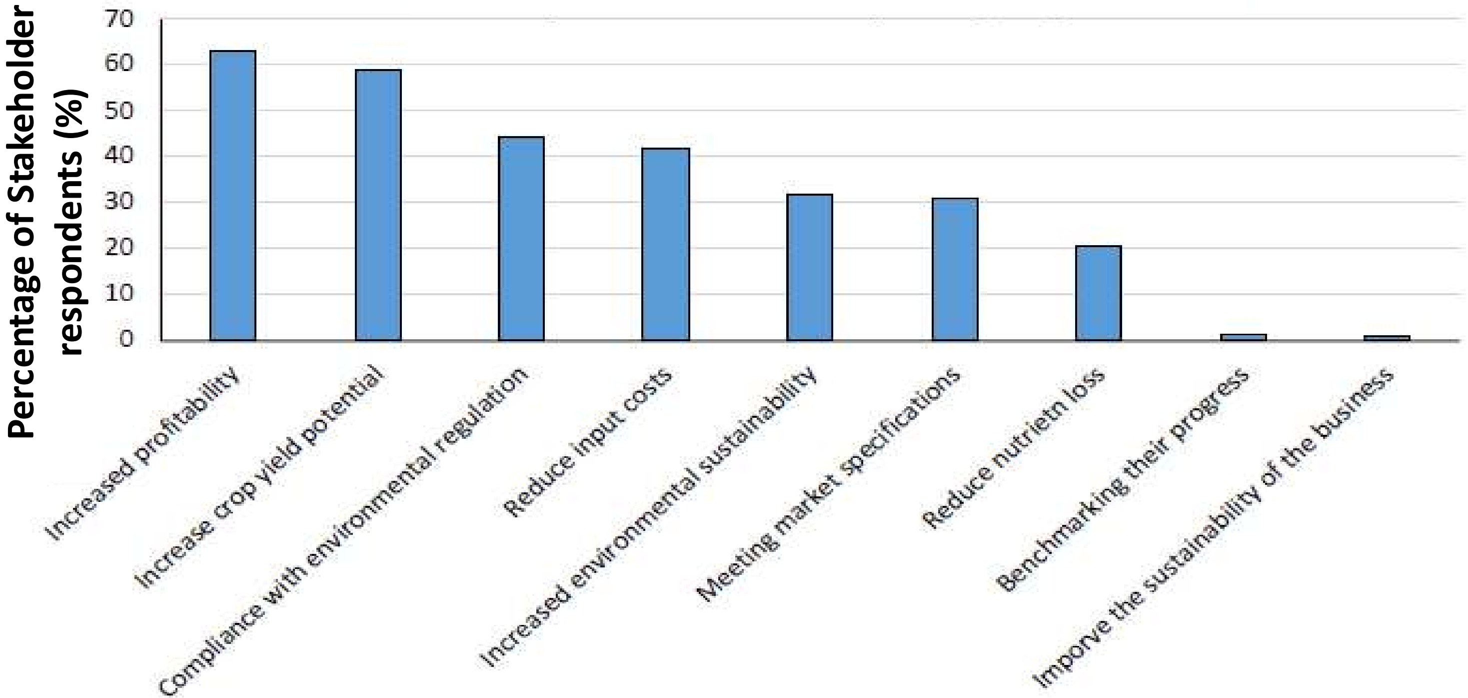


**Figure.** Perception of farmers primary motivations for engaging with crop nutrient management as expressed by the NEG stakeholder responses across the 9 partner countries.

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# How do farmers judge success?

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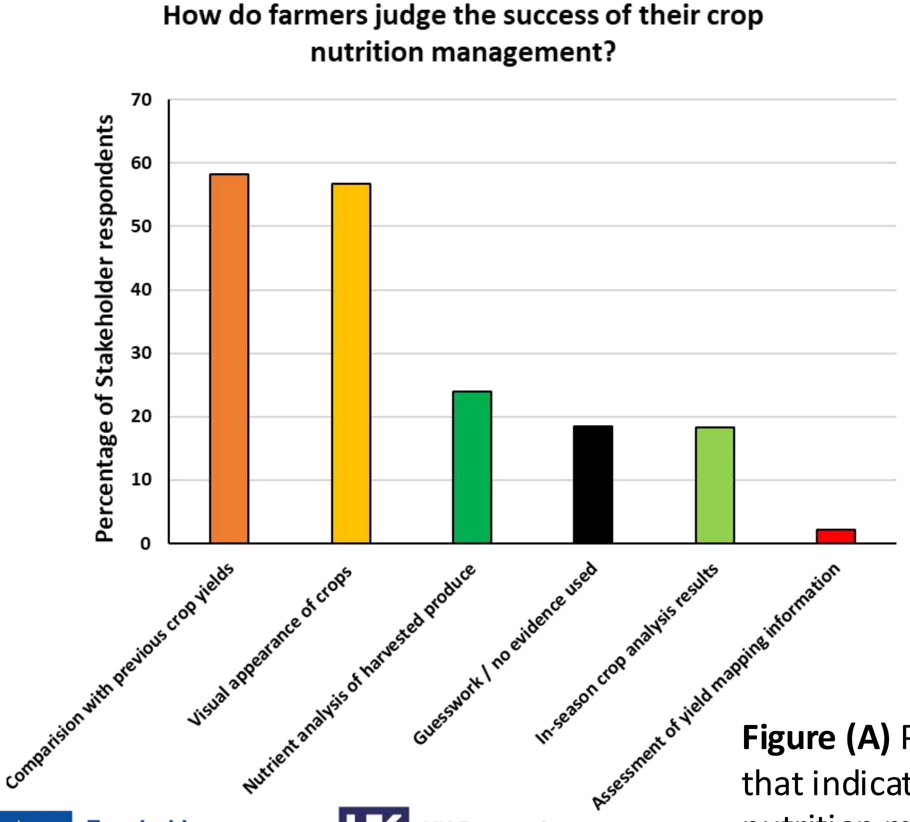


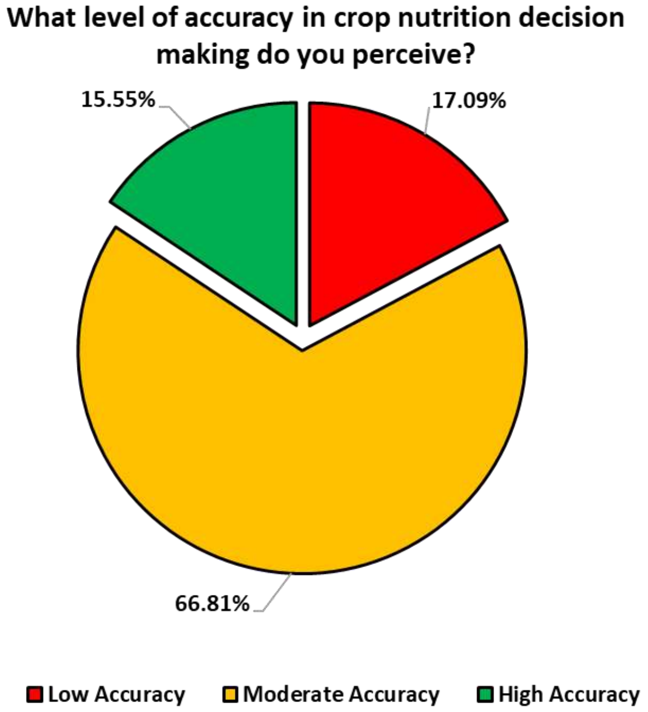


**Figure (A)** Percentage of the wider stakeholders surveyed (n=714) that indicated different methods for judging success of their crop nutrition management and **(B)** the level of accuracy they perceived in crop nutrition decision making.


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# Key data used for crop nutrition decisions?

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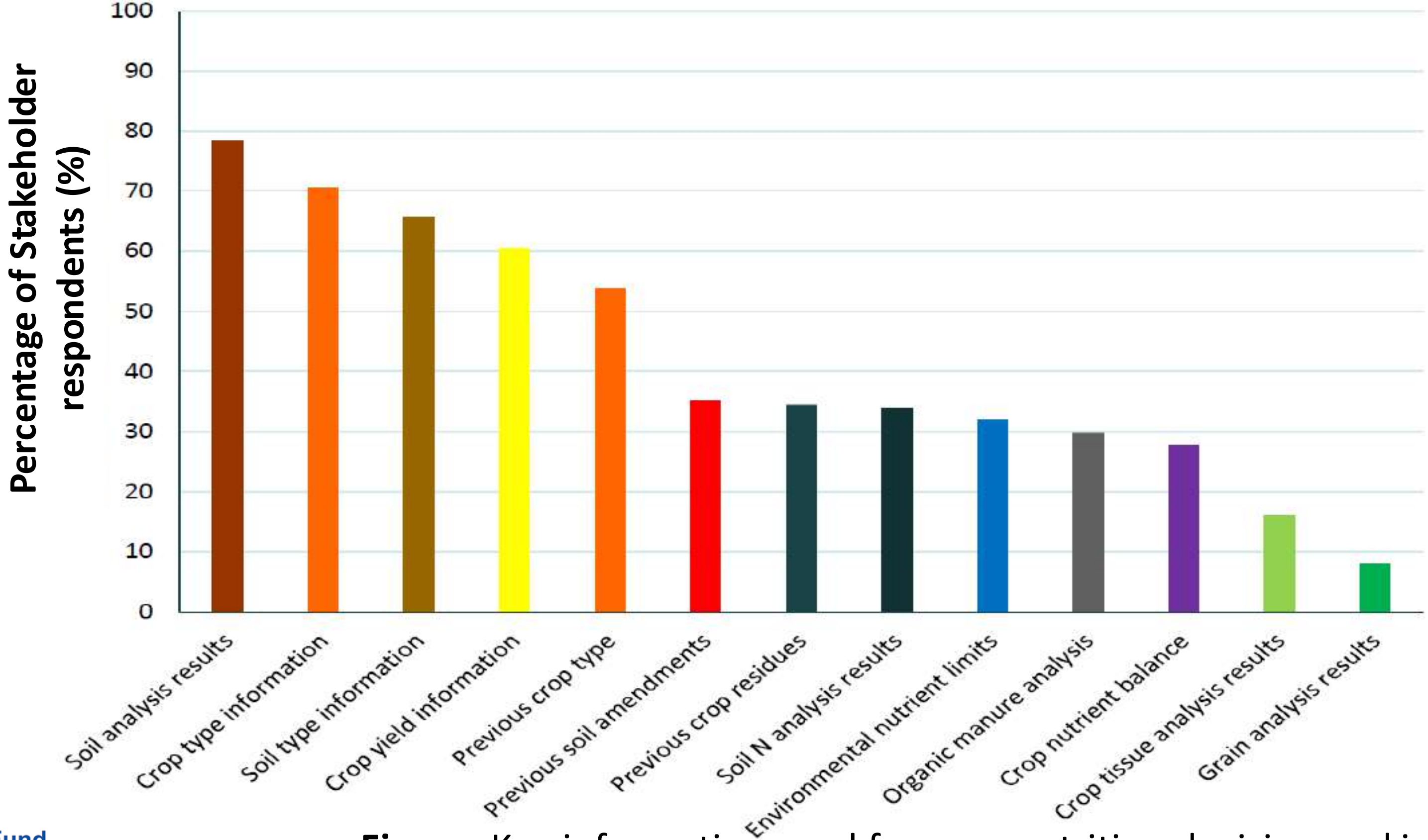


**Figure.** Key information used for crop nutrition decision making expressed by the stakeholders (n=714) across the 9 partner countries.

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# Barriers to adoption of crop nutrition tools?

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OPTIMISING CROP NUTRITION

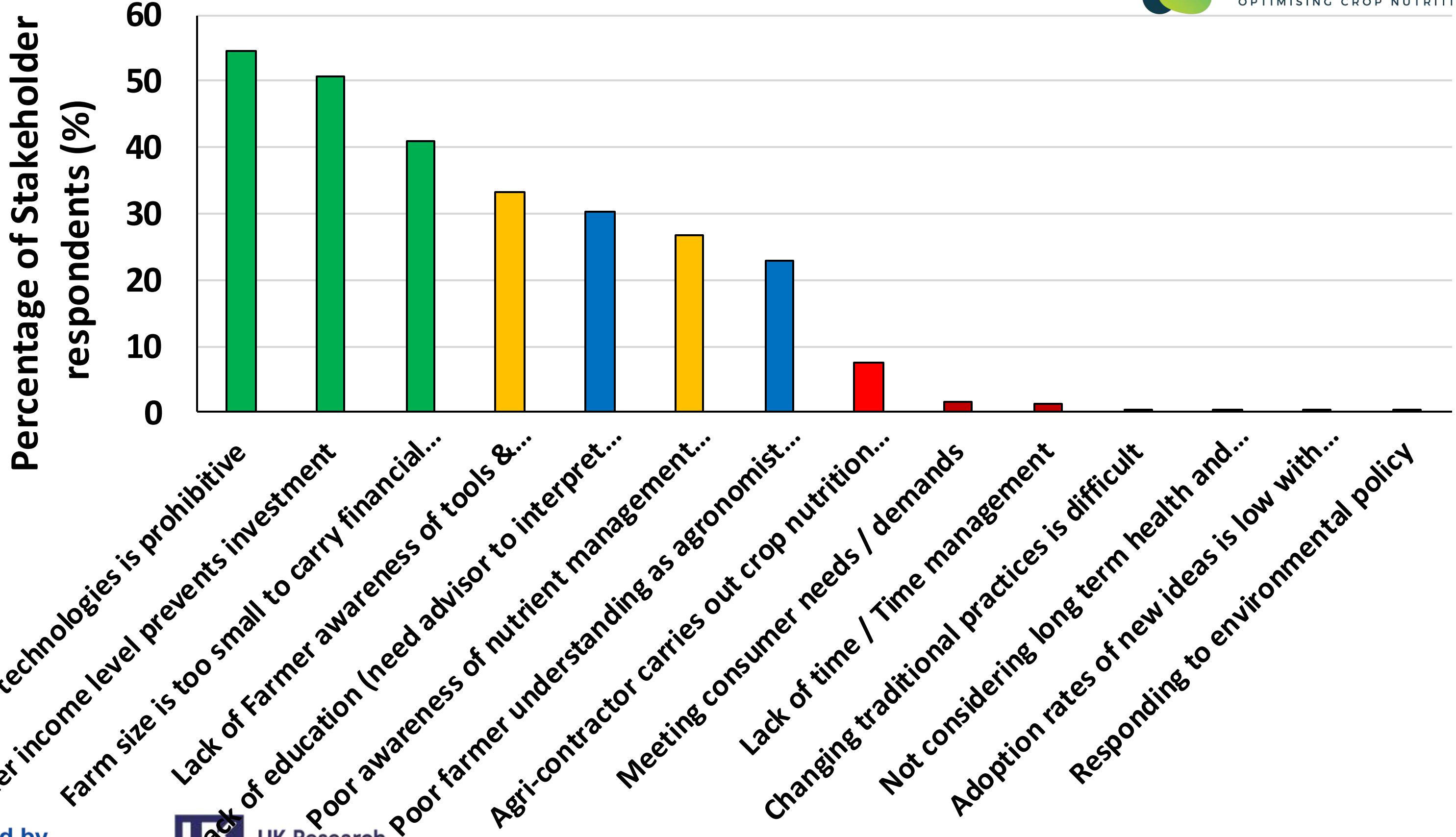


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**Figure.** Barriers to adoption of crop nutrition tools expressed by the stakeholders (n=714) across the 9 partner countries.

# Key needs of farmers to increase the precision of nutrient management and crop nutrition?

NUTRI-CHECK NET
OPTIMISING CROP NUTRITION

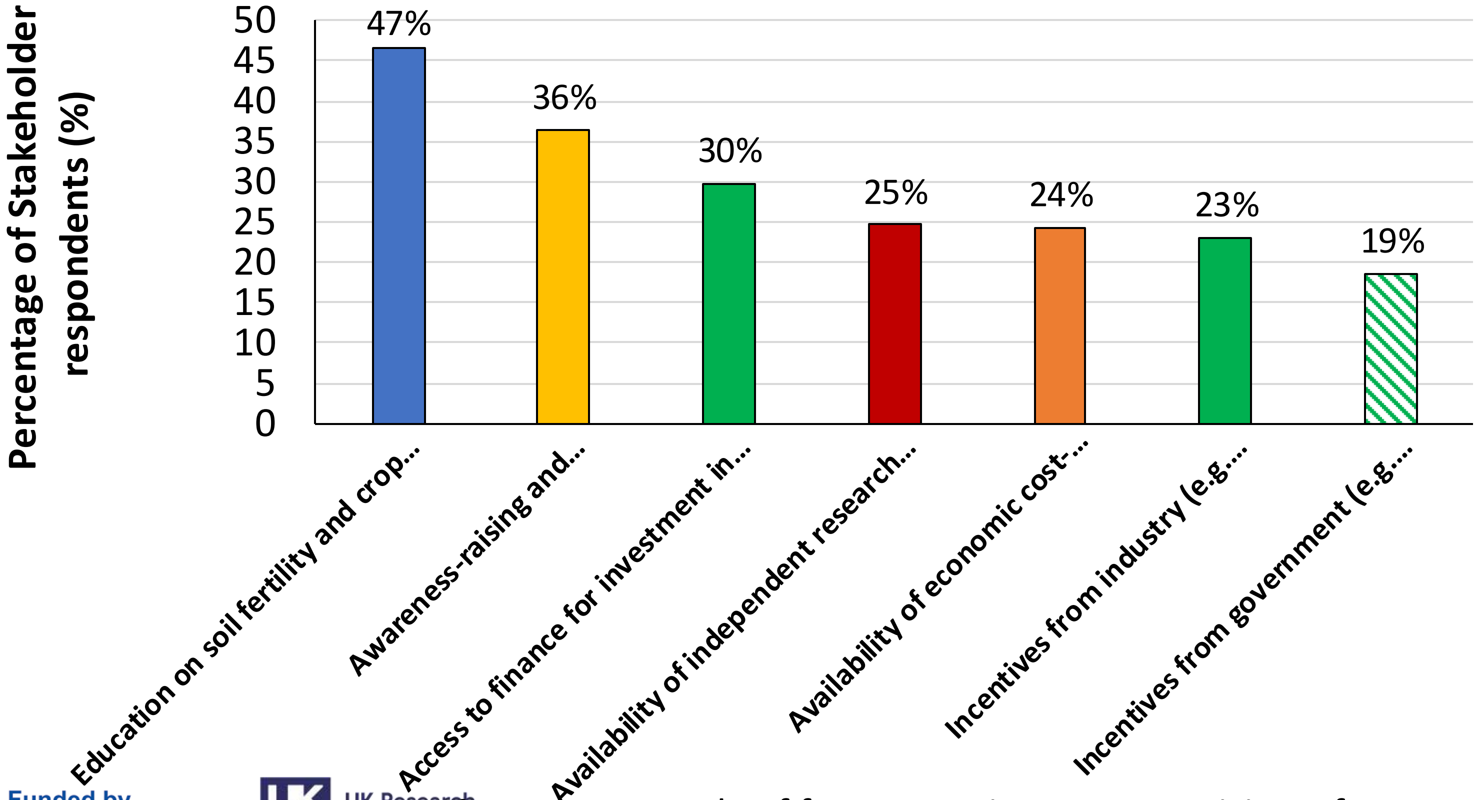


**Figure.** Key needs of farmers to increase precision of crop nutrition expressed by the stakeholders (n=714) across the 9 partner countries.

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# Key needs of farmers to increase the precision of nutrient management and crop nutrition?

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**Table.** Key needs of farmers to increase precision of crop nutrition expressed by the NEG stakeholders (n=122) across the 9 partner countries.

| Key needs of farmers to increase the precision of crop nutrition in each country | Denmark | France | Greece | Ireland | Lithuania | Netherlands | Poland | Portugal | United Kingdom |
|---|---|---|---|---|---|---|---|---|---|
| *Number of NEG Stakeholders that responded (n)* | *21* | *19* | *15* | *11* | *7* | *7* | *15* | *12* | *15* |
| | | | | % of stakeholder responses | | | | | |
| Education on soil fertility and crop nutrition | 57.1 | 84.2 | 73.3 | 63.6 | 42.9 | 14.3 | 47 | 33.3 | 40.0 |
| Improved IT skills | - | - | 6.7 | - | - | - | - | - | - |
| Availability of independent research results | 14.3 | 36.8 | - | 100 | 28.6 | - | 40.0 | 33.3 | 33.3 |
| Availability of economic cost-benefit information | 4.8 | 10.5 | - | - | - | - | 6.7 | - | 13.3 |
| Awareness-raising and demonstration of tools | 23.8 | 31.6 | 53.3 | 63.6 | 28.6 | 42.9 | 26.7 | 16.7 | 13.3 |
| Access to Farm Advisor / Agronomist | 9.5 | 31.6 | - | 72.7 | 28.6 | - | 33.3 | - | 20.0 |
| Independent crop nutrition advice | 4.8 | - | - | 18.2 | - | 14.3 | 13.3 | 25.0 | - |
| Incentives for government (meeting env. targets) | - | - | 6.7 | 27.3 | - | - | 13.3 | 16.7 | 6.7 |
| Incentives from industry (e.g. sustainability bonus ) | - | - | - | - | - | - | - | 16.7 | - |
| Access to finance for tools & technologies | 4.8 | - | 60.0 | - | 42.9 | - | 33.3 | 25.0 | - |

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# Key stakeholders who can support farmers?

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**Table.** Key stakeholders that can best support farmers to increase precision of crop nutrition expressed by the stakeholders (n=714) across the 9 partner countries.

| Key stakeholders who can best support farmers to meet their needs | Denmark | France | Greece | Ireland | Lithuania | Netherlands | Poland | Portugal | United Kingdom |
|---|---|---|---|---|---|---|---|---|---|
| *Number of Stakeholder that responded (n)* | *83* | *152* | *100* | *88* | *80* | *39* | *54* | *54* | *64* |
| | % of stakeholder responses | | | | | | | | |
| Professional farm advisors / agronomists | 78.3 | 80.3 | 63.0 | 33.0 | 78.8 | 79.5 | 75.9 | 70.4 | 28.1 |
| Agricultural University & Farmer training providers | 57.8 | 21.1 | 80.0 | 51.1 | 57.5 | - | 44.4 | 74.1 | 53.1 |
| Agricultural researchers & organisations | 45.8 | 42.1 | 27.0 | 29.5 | 43.8 | 84.6 | 27.8 | 51.9 | 28.1 |
| Policy makers | 24.1 | - | 31.0 | 13.6 | 30.0 | 17.9 | 13.0 | 11.1 | - |
| Industry - farm input sales | 27.7 | - | 17.0 | 4.5 | 27.5 | 5.1 | 35.2 | 13.0 | 3.1 |
| Industry - support services | 0.0 | - | 36.0 | 18.2 | 13.8 | 23.1 | 14.8 | 24.1 | 15.6 |
| Industry - crop purchasers (incl. grain/crop trade etc.) | 13.3 | - | 10.0 | - | - | 7.7 | 18.5 | - | - |
| National / local media | 7.2 | - | 9.0 | 0.0 | 7.5 | - | 13.0 | 7.4 | - |
| Agri-contractors | 10.8 | - | 9.0 | 10.2 | 15.0 | 23.1 | 20.4 | - | - |
| Consumers / General society | 7.23 | - | 18.00 | - | - | - | 9.26 | 1.85 | - |

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# Conclusions

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- Information currently used by farmers across the 9 countries involved in this assessment was broadly similar for calculating crop nutrient requirements.
- Perceived levels of accuracy and precision with respect to crop nutrient management decisions was moderate on average.
- High cost, low farmer income level, poor farmer awareness, poor education levels were main challenges to adopting tools on farms.
- High reliance on industry input sales & support services and agri-contractors who make key crop nutrition decisions on behalf of the farmer.
- Professional farm advisors/agronomists, agricultural training providers and research organization were identified as key stakeholders who can help farmers.
- This work helps build an understanding of why different approaches, tools & technologies have been adopted by farmers and also why others have not.

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# Thank You!

**Dr. David Wall**

***Teagasc, Johnstown Castle, Wexford, Ireland***

*David.wall@teagasc.ie*

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## 10:00 - 10:10 | INSIGHTS FROM THE FIELD: A DUTCH FARMER'S PERSPECTIVE

**DIRK-JAN BEULING**

BOERENBEDRIJF
BEULING B.V.

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**DIRK-JAN BEULING**
BOERENBEDRIJF
BEULING B.V.

**61-year-old Dutch Farmer with 2 children.**

**Owns an arable farm with 220 hectares of potatoes, sugar beets, cereals, onions and carrots. With sandy, drought-sensitive soil with a lot of historical weeds.**

**He believes that good fertilisation is the key to achieve a good yield.**

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# NUTRI-CHECK NET FINAL CONFERENCE

Dirk Jan Beuling
1e Exloërmond Netherlands

18 -11 -2025

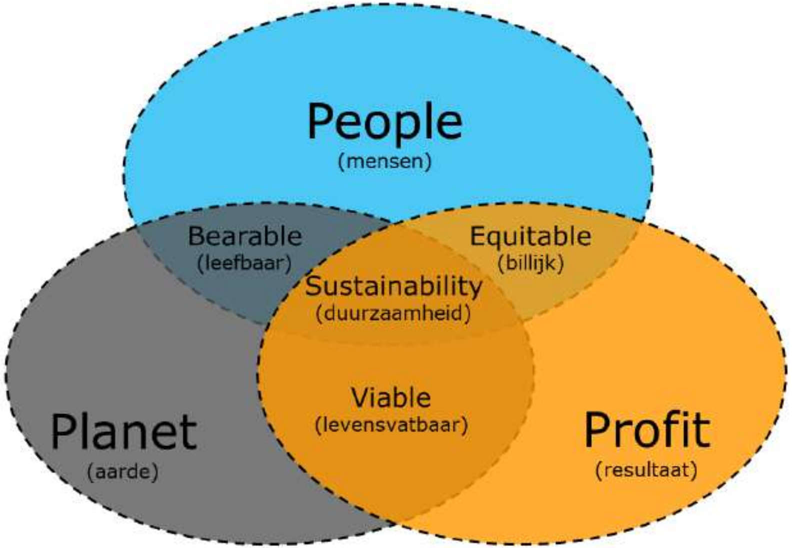
Boerenbedrijf BEULiNG

Delphy

# Change in policy makes change in fertilization

Social support

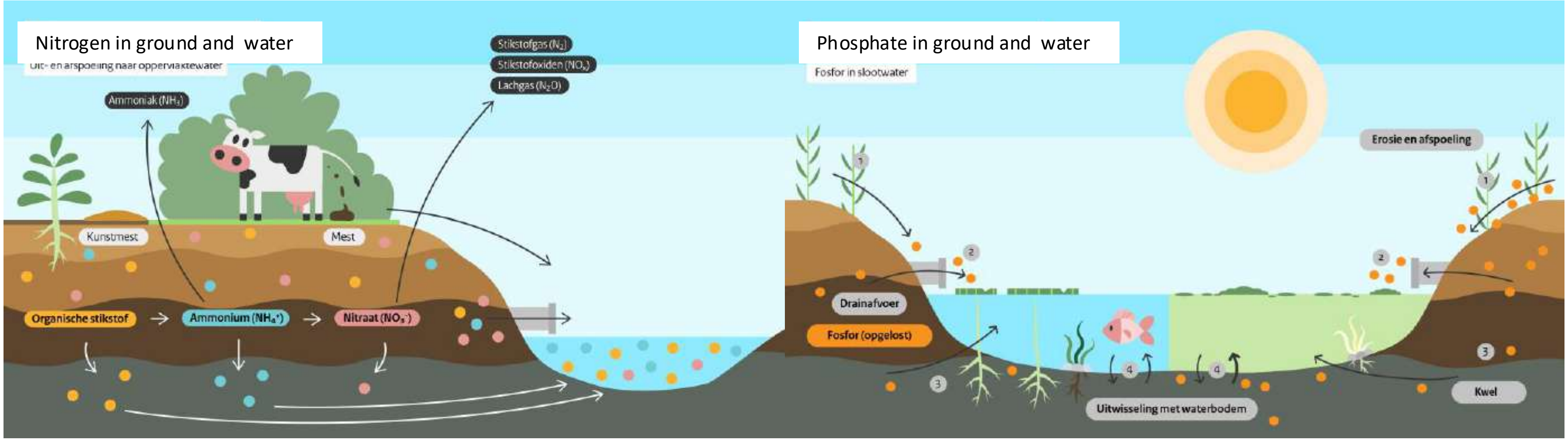
agricultural standards




Government interference

Less yield

# Why another nutrients policy




Holland is fertile delta with lots of surface water (didges, lakes, rivers and canals).

Delphy

# What does it mean

- Norm per crop and soil type (system of usage standards N&P)
- Manure laws with nitrogen discounts
- Introduction of attention areas (minus 20% of the agricultural fertilization standard)

# Typical Dutch

- A Lot of rules with exeptions (big brother is watching you)
- A lot of animals, a lot of manure, means revenue model for areable farmers.
- Fertilizers, relative expensive

## Standards 2026 (north sandy soil)

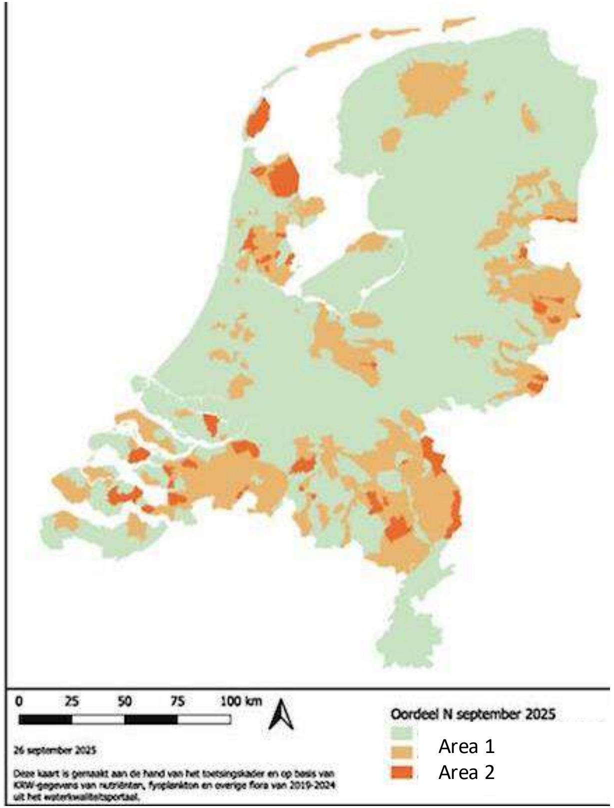
- Potatoes 230
- Sugarbeets 145
- Barley 85
- Silage maize 157

## Standards 2026 (south sandy soil)

- Potatoes 140
- Sugarbeets 83
- Barley 64
- Silage maize 90

- 10 % in attention area 1
- 20% in attention area 2

Attentions areas for nitrogen



# How do Dutch farmers fertilize

- Max 170 kg/ha nitrogen out of manure (when it is allowed on the crop)
- Complement with fertilizers
- More extensive farming is less manure (less money)

# Solutions

- Other crops like ……. (biobased, protein crops)
- Other varierties
- Other fertilisation strategies
- Extensive farming
- Precision farming
- Agricultural nature management payed by the government
- Goals is enough profit to explore the farm with high ground prices in the Netherlands (more than 120.000,- /ha)
- Optimize  fertilization with leaf and soil samples during the growing season, The Delphy QMS plant juice samples

# Conclusion

- Government wants goal control (measure is knowing)
- A challenge to keep your yield with less fertilization options
- Less space for organic manure

# Thank You!

**Dirk-Jan Beuling**

**tanjabeuling@boerenbedrijfbeuling.nl**

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## 10:10 - 10:20 | PRACTICAL EXPERIENCE FROM NORMANDY COOPERATIVE

**JÉRÔME CHARPENTIER**
SEVÉPI

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**JÉRÔME CHARPENTIER**
SEVÉPI

**46 years old farmer from Normandy (4th generation of farmers)**

**Farm with 210 hectares of wheat, barley, rapeseed, peas and flax, and 20 hectares of meadows (beef).**

**Master of Science in Agriculture at LaSalle Beauvais.**

**Board of the cooperative Sevépi since 2009 and president since 2018.**

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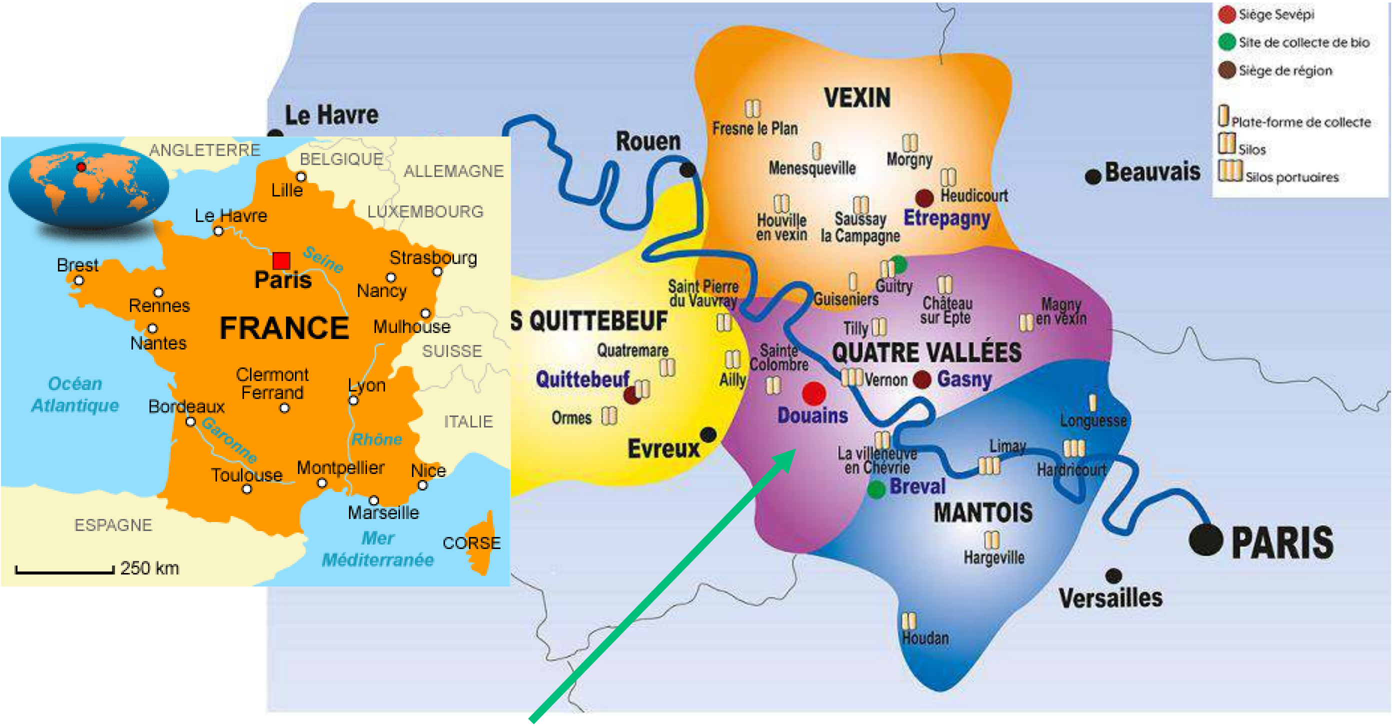
# My Farm and Sevépi




**220 Hectares**

- Wheat
- Barley
- Canola
- Flax,
- Dry Peas

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Sevépi Producteurs de qualité

# Decision Support Tools

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## Different Constraints

- Environnemental
- Economical
- Quality

mon beApi
Un seul et même environnement de conseil :

FARMSTAR expert
Vos parcelles vues du ciel

N-Tester®

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# Commercial Policy and Threats

- Price bonuses

    Linked to quality

- Solutions put forward

    Mini-conferences and stands

- Dedicated employees

    Internal expertise

- Losses of business

    Flour mill

- Cost of investment

Variable rate application, BeApi start report

- Commercial penalties

    Until 100€/T

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# Conclusion

- Acceptation by farmers
- Increasing demand for quality and environmental constraints
- Economic uncertainties and investment needs

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# Thank You!

**Jérôme Charpentier**

**charpentier27@gmail.com**

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## 10:20 - 10:30 | THE ROLE OF EUROPEAN ADVISORS

**BERNADETTE BENNETT**
EUFRAS & TEAGASC

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**BERNADETTE BENNETT**
EUFRAS & TEAGASC

**Agricultural advisor based in Laois, Ireland.**

**Bachelor's in Animal Science and Master's in Agricultural Extension and Innovation from University College Dublin.**

**Teagasc's Advisor since 2017, advising dairy, cattle and sheep farmers who farm grass-based agricultural systems.**

**Board member of EUFRAS since 2024.**

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# The Role of European Advisors: **An Irish Case Study**

Bernadette Bennett

18/11/2025

Teagasc
Agriculture and Food Development Authority

# My Role

## EUFRAS Board Member

- Dynamic European network of advisory organisations
- Fostering collaboration and advocacy for advisors
- Driving innovation in agricultural knowledge and practices
- Supporting sustainable rural development

EUFRAS
EUROPEAN FORUM FOR AGRICULTURAL AND RURAL ADVISORY SERVICES

## Agricultural Advisor

- Providing farmers with advice and support
- Improving farm performance, profitability, and sustainability

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Agriculture and Food Development Authority

# Challenges

Farmer attitude and mindset

Economics

Building knowledge

Agriculture and Food Development Authority

# Farmer Attitude and Mindset

- Prefer the known
- Family tradition
- Workload challenges
- Too much science

# Economics

- Policy and market uncertainty
- Costly equipment
- Cash flow challenges

# Building knowledge

- Discussion groups
- Monitor farms
- Events

- One to one consultations
- Neighbours, family and local networks

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Agriculture and Food Development Authority

# Key functions of an advisor in Nutrient Management decision making

- **Assessment:** Farmyard, nutrient, and land management review
- **Risk Identification:** Pinpointing sources and pathways of nutrient loss
- **Action Planning:** Co-development of improvement plans with timelines
- **Knowledge Transfer:** Dissemination of best practices and regulatory updates
- **Compliance Support:** Assistance with cross-compliance, derogation, and scheme participation
- **Monitoring & Follow-up:** Progress checks and adaptation of recommendations

# Thank You

# Questions?

bernadette.bennett@teagasc.ie

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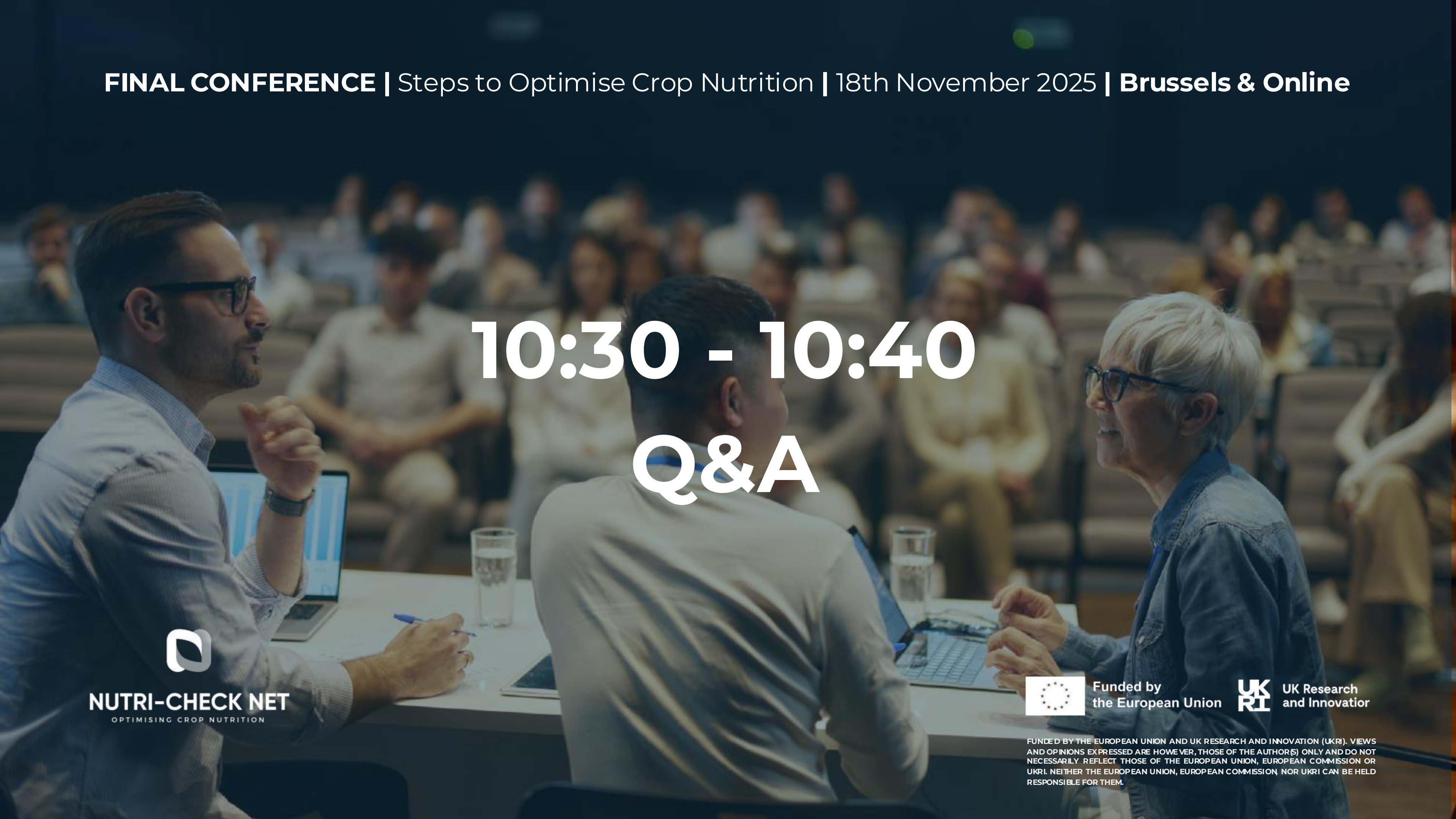

# 10:30 - 10:40

# Q&A

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# 10:40 - 11:00

# COFFEE BREAK

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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

## 11:00 - 12:30 | SESSION 2: TOOLS FOR A BETTER NUTRIENT MANAGEMENT

**DAVID WALL**
TEAGASC

**SARAH KENDALL**
ADAS

**MILAN FRANSSEN**
DELPHY

**MARK TUCKER**
YARA

**JULIE CHRISTENSEN**
SEGES

**KATE STORER**
ADAS

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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

**DAVID WALL**
TEAGASC

**Leader of NUTRI-CHECK NET WP3 "Evaluation of Crop Nutrition Decision Tools".**

**Head of TEAGASC, Crops, Environment and Land use Research Centre at Johnstown Castle, in Ireland and is responsible for updating the National Nutrient Advice for Grassland and Arable Crops in Ireland.**

**Research interests include building resilient soils for sustainable food production systems, identifying indicators of soil health, maximising the efficiency of organic manure inputs for arable cropping systems and developing soil specific nutrient advice for farms.**

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 11:05 - 11:20 | 3 STEP CHECKING APPROACH TO NUTRITION MANAGEMENT


**SARAH KENDALL**
ADAS

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**SARAH KENDALL**
ADAS

**Crop Physiologist and Associate Managing Director of ADAS' Sustainable Agricultural Systems business, based in the UK.**

**Scientific Coordinator of the NUTRI-CHECK NET project.**

**Research focused on optimising crop nutrition and supporting farmers to make the best nutrition decisions to increase productivity sustainably.**

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# The change of approach is …

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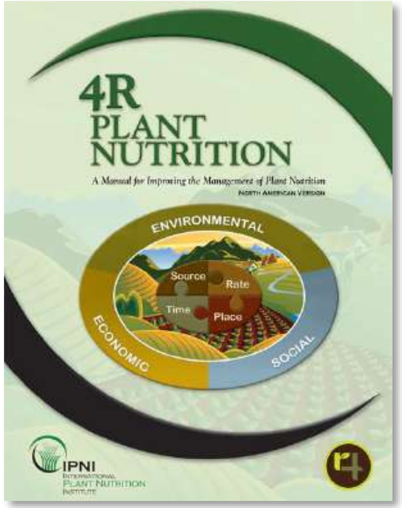
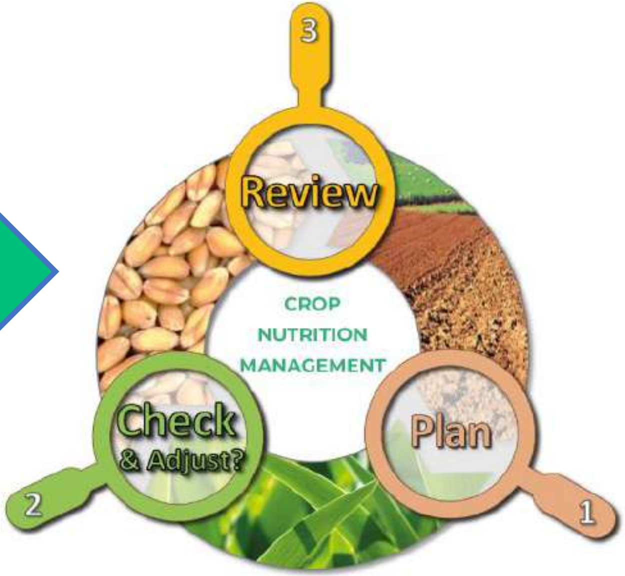
From assuming that predictions are always 'right' e.g. the 4Rs

To a dynamic management approach which utilises monitoring & measurements

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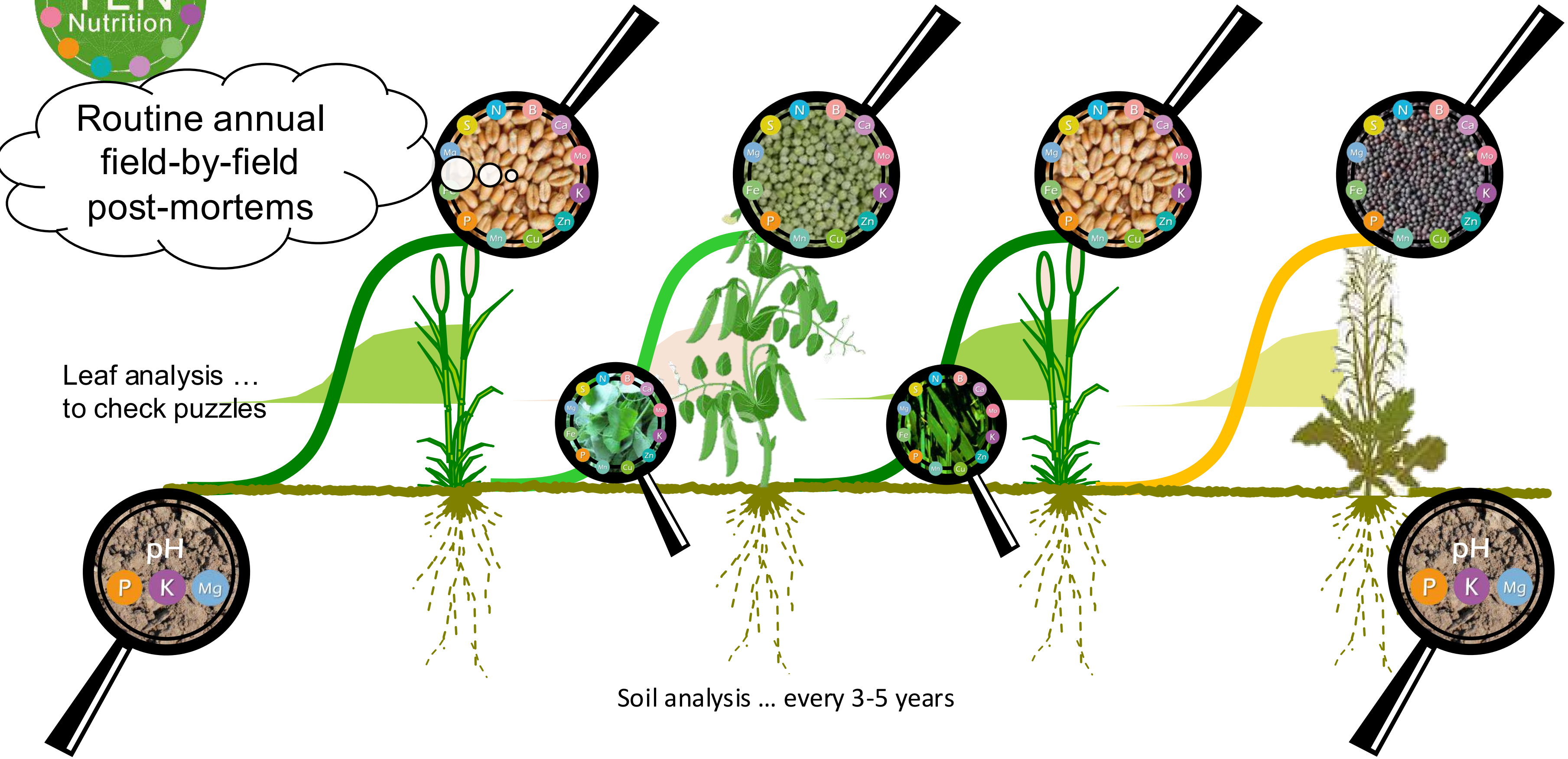
# … better monitoring to improve Crop Nutrition



# 3 Step Checking Approach

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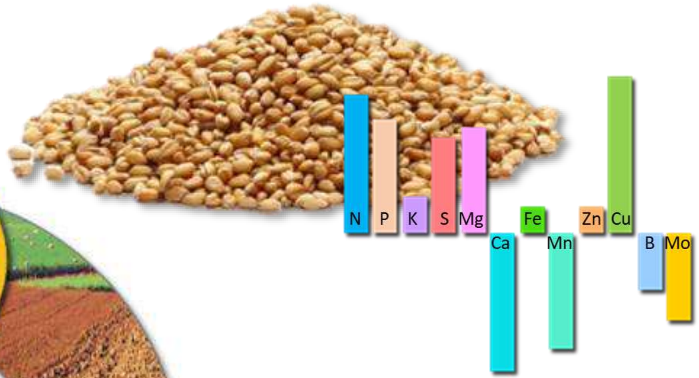


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# Why is planning important?

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- Agronomic and compliance requirements – match applications with crop demand
- Accurate purchasing
- Sustainability – Economic & Environmental value



- Use national recommendation systems and adapt to be farm specific.
- Make use of appropriate data (soil analysis, manure analysis, residues, offtakes & balances).
- Be dynamic – farms should be prepared to be flexible & deviate.

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# ‘Checks’ are useful at several stages

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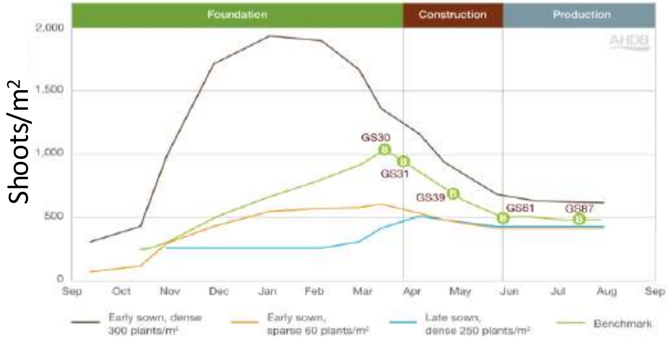


## ‘INSPECT’: Use the crop as an indicator

- Inspect all crops frequently in spring for nutritional issues
- Check growth stage, ground cover, plant count, shoot number, leaf colour, rooting.
- Do satellite images show any oddities?
- Are there deficiency symptoms?
- Account for seasonal effects which could affect crop demand.
- Select fields to target for further investigation if required
- Adapt the plan where required (i.e. adapting application rates and timings).

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# Adjustments for refinement

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- In some cases checks will reveal necessary adjustments.
- Consider if adjustments can be made within-season or if they should be considered for the future.
- Application rates, timings, products.
- If uncertain, farmers can test different treatments or approaches.
- Important to update records with adjustments and observations.

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# Review ‘Check List’

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- Gather data & compare actual with planned.
- Calculate nutrient offtakes and balances.
- Detect deficiencies, sufficiencies or those in excess.
- Complete an economic analysis
- Generate actions for next season to feed into next planning phase.

NUTRI-CHECK NET… Field Nutrient Account
OPTIMISING CROP NUTRITION

| | | | Macro-Nutrients | | | | | | | Micro-Nutrients | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *units* | N | P | K | Mg | S | Ca | *units* | Fe | Mn | Zn | Cu | B | Mo |
| 1 | **Demand budget** @ yield (t/ha) 6.5 | *kg/ha* | 135 | 20 | 90 | 15 | 15 | 15 | *g/ha* | 510 | 260 | 235 | 120 | 10 | 10 |
| 2 | **Soil Supply** | | | | | | | | | | | | | | |
| | Soil analysis (! Analysis) | *mg/l* | - | 23 | 307 | 200 | - | - | *mg/l* | - | - | - | - | - | - |
| | Soil Index | *index* | - | 2+ | 3 | 5 | | - | *index* | - | - | - | - | - | - |
| 3 | **Total Nutrients Applied** | *kg/ha* | 156 | 0 | 0 | 1 | 57 | 0 | *g/ha* | 0 | 3,000 | 0 | 0 | >0 | 0 |
| | In Organic Manures (totals*) | kg/ha | 0 | 0 | 0 | 0 | 0 | 0 | g/ha | 0 | 0 | 0 | 0 | 0 | 0 |
| | In Fertilisers & Sprays | kg/ha | 156 | 0 | 0 | 1 | 57 | - | [illegible] | - | 3,000 | - | - | Yes | - |
| 4 | **Crop Capture** with yield (t/ha) of 7.5 | *kg/ha* | 189 | 50 | 121 | 19 | 39 | 13 | *g/ha* | 463 | 241 | 353 | 148 | 8 | 15 |
| 5 | Demand difference (! Analysis) | kg/ha | +54 | +30 | +31 | +4 | +24 | -2 | g/ha | -48 | -19 | +118 | +28 | -2 | +5 |
| | Leaf analysis | %DM | 3.63 | 0.38 | 2.12 | 0.14 | 0.37 | 0.76 | ppm | 116 | 67 | 21 | 6 | 8.6 | 1.5 |
| | Grain analysis (! Analysis) | %DM | 2.30 | 0.30 | 0.51 | 0.11 | 0.13 | 0.03 | ppm | 32 | 21 | 39 | 5 | 0.9 | 0.8 |
| | Harvest offtakes | kg/ha | 168 | 20 | 66 | 9 | 12 | 8 | g/ha | 335 | 187 | 302 | 91 | 7 | 10 |
| 6 | **Soil Balance** | *kg/ha* | -12 | -20 | -66 | -9 | 45 | -8 | *g/ha* | -335 | 2,813 | -302 | -91 | N/A | -10 |
| | All values are for elements. For Oxides (e.g. $P_2O_5$) multiply by: | | 1.0 | 2.3 | 1.2 | 1.7 | 2.5 | 1.0 | | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

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# Summary

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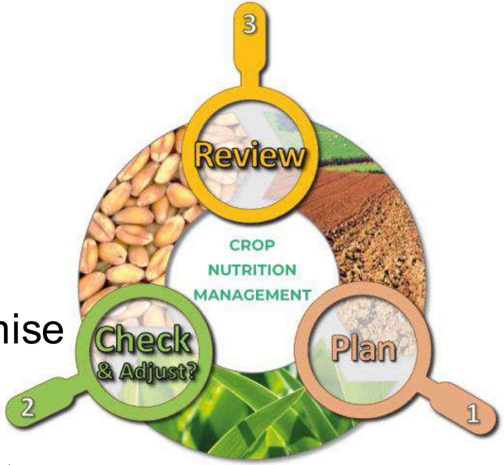
- 3 step checking involves: i) Planning; ii) Check & Adjust; iii) Review.
- A circular framework – both within season but importantly between crops, rotations and seasons.
- More to nutrient management than planning.
- Soil analysis is an important foundation but is not sufficient to optimise nutrition decisions on its own.
- Recommendation systems need to better incorporate the Review step and farmers need appropriate tools to support implementation.
- This framework helps to position tools appropriately for use.

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# Thank You!

*Sarah.Kendall@adas.co.uk*

https://nutri-checknet.eu/

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OPTIMISING CROP NUTRITION

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## 11:20 - 11:35 | TOOLS TO SUPPORT CROP NUTRITION DECISION MAKING


**MILAN FRANSSEN**

DELPHY

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**MILAN FRANSSEN**

DELPHY

**Soil Scientist, Agricultural Economist, Leader of the Projects & Innovations Team at DELPHY, The Netherlands.**

**Leader of the NUTRI-CHECK NET's WP 2 "Inventory of crop nutrition decision-making tools".**

**Manages national and European projects with collaborations between farmers, agronomists, researchers, supply chain partners, and public entities.**

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# Farm nutrient decision support adoption

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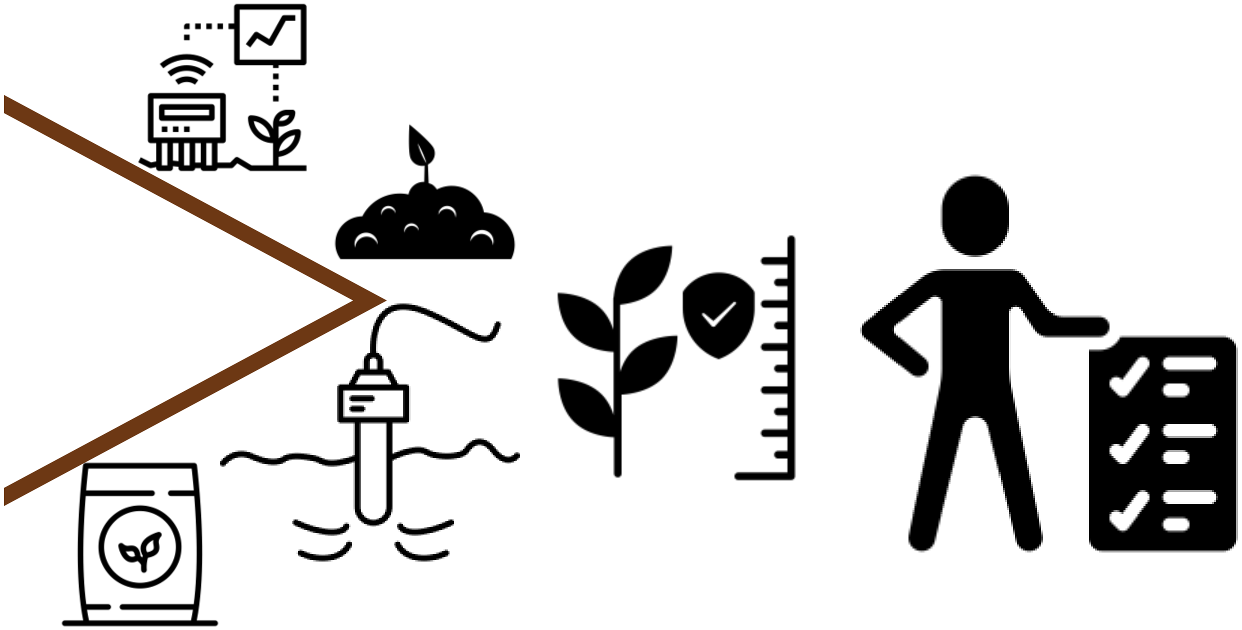
| Effective practices ('tools') for use on-farm | UK | EL | LT | PL | NL | PT | DK | FR | IE |
|---|---|---|---|---|---|---|---|---|---|
| Professional advice for N, P or K decisions | S | S | S | F | S | F | S | S | S |
| Look-up tables for N, P or K decisions | S | S | N | S | S | R | S | S | S |
| Balance calculations for N, P or K | S | F | F | R | S | R | S | S | S |
| Nutrient budgeting at a farm scale | R | R | F | R | S | R | S | R | R |
| Nutrient budgeting at a field scale | N | N | S | R | F | R | S | S | N |
| Routine analysis of topsoil for pH, P, K & Mg | S | S | F | F | S | F | S | S | S |
| Routine analysis of top- & subsoil for SMN | R | N | F | N | F | R | R | S | N |
| Analysis of topsoil for any micro-nutrients | R | F | R | N | F | R | F | R | R |
| Mapping of soil type / texture e.g. using EMI | F | F | S | N | R | R | R | R | R |
| Mapping of P, K & Mg | F | F | F | N | R | R | S | R | S |
| Variable N applications | R | F | R | R | R | R | R | F | R |
| Variable P & K applications | F | F | R | R | R | R | R | F | R |
| Analysis of topsoil 'health' characteristics | R | R | N | N | R | R | R | F | R |
| Use of animal manures | S | F | R | S | S | F | S | S | S |
| Routine analysis of animal manures for N, P & K | R | N | N | R | S | R | F | F | R |
| Canopy reflectance / NDVI monitoring | R | N | N | N | R | N | F | R | R |
| Canopy colour measurement | R | N | N | N | R | N | F | F | R |
| Analysis of foliage for major nutrients (N,P,K,S) | F | R | R | N | R | R | N | F | F |
| Analysis of foliage for micro-nutrients | F | R | R | N | R | R | N | R | F |
| Micro-nutrient sprays | S | S | S | S | F | F | S | F | S |
| Crop yields recorded annually by farm | S | S | S | R | S | S | S | S | S |
| Crop yields recorded annually by field | F | R | S | R | F | F | F | F | F |
| Crop yields recorded annually by GPS-map | F | R | R | R | R | R | F | R | R |
| Grain analysis for protein by farm | S | N | R | S | S | R | S | S | S |
| Grain analysis for protein by field | R | N | R | R | F | N | R | F | R |
| Grain analysis for non-N nutrients | N | N | N | N | N | N | N | R | N |
| Brix tests of foliage (for sugar content) | N | F | N | N | N | N | N | N | N |
| Own comparisons / trials of fertilisers or sprays | R | F | R | N | F | N | R | R | R |
| Membership of marketing cooperative | N | R | N | R | F | F | R | F | N |
| Membership of farming discussion groups | F | F | R | N | F | F | S | F | F |
| Membership of data-sharing groups | R | N | N | N | R | R | R | R | R |
| Regular engagement with social media | F | F | R | R | R | F | F | S | F |



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# Objetive 2 | Create an inventory of crop nutritional decision tools to summarise knowledge & best practices

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- Develop a framework for knowledge capture & categorisation to ensure robust methods are used throughout.
- Summarise current nutritional recommendation systems across Europe.
- Create an inventory of nutritional decision tools building on research findings, commercial services and products.

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# WP2 Inventory of crop nutrition decision-making tools

- (National) Recommendation Systems
- Research, Projects and novel systems
- **Commercial Tools & Services**

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# Examples types of tools/ services

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- Soil sampling and analysis
- VRA support
- Crop growth model
- Leaf tissue analysis
- Fertilisation planning software
- Tractor mounted sensors
- Soil sensors
- Grain analysis

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Rapport

BodemCheck

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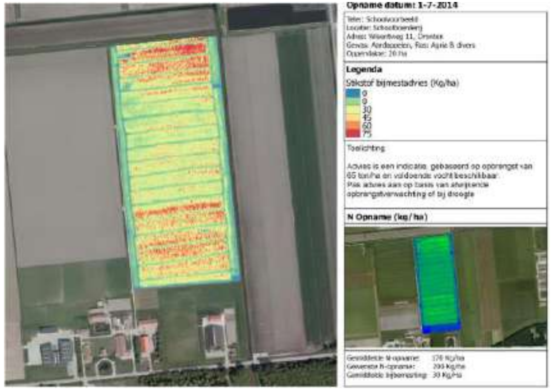
2 x N-grondstalen

**Wat zit er in uw bodem:**

| Resultaat | Resultaat | Eenheid | Streeftraject |
|---|---|---|---|
| Nitraat-N | 16 | kg $NO_3$-N/ha | |
| Ammonium-N | < 3 | kg $NH_4$-N/ha | |
| Stikstof | 16 | kg N/ha | 60 - 100 |
| Zwavel | < 5 | kg/ha | 60 - 100 |
| Fosfor | 0,6 | kg/ha | 2,0 - 5,0 |
| Kalium | 56 | kg/ha | 178 - 261 |
| Calcium | 98 | kg/ha | 249 - 581 |
| Magnesium | 136 | kg/ha | 150 - 240 |
| Silicium | 23 | kg/ha | 7,5 - 10 |
| IJzer | < 6 | g/ha | 250 - 500 |
| Zink | 51 | g/ha | 250 - 1000 |
| Mangaan | 144 | g/ha | 500 - 750 |
| Borium | 414 | g/ha | 175 - 250 |
| Geleidingsvermogen | 0,14 | mS/cm 25°C | |



Alle bovenstaande resultaten zijn in elementvorm (N, P, K, etc) weergegeven.

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# Inventory of Tools & Services: A quick recap

- 280+ Tools & Services assessed
- Relevant for the NCN platform?
- Relevant for Cost-benefit assessment?


*D2.1 describes the full method of inventory

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# Tool names

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# Tools & Services found relevant

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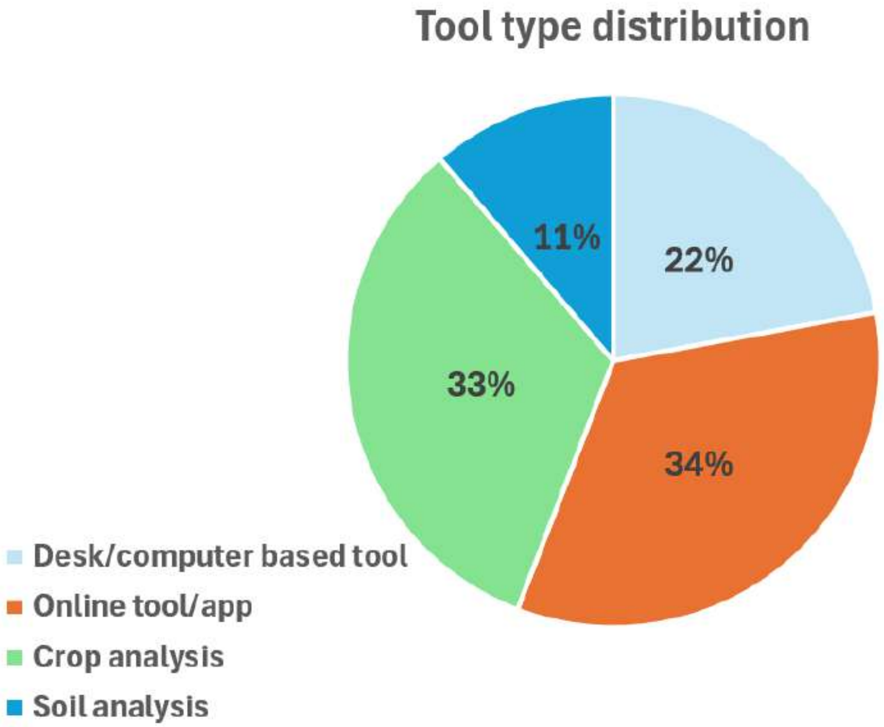
Total of:

**233 tools & services captured**





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# Language support

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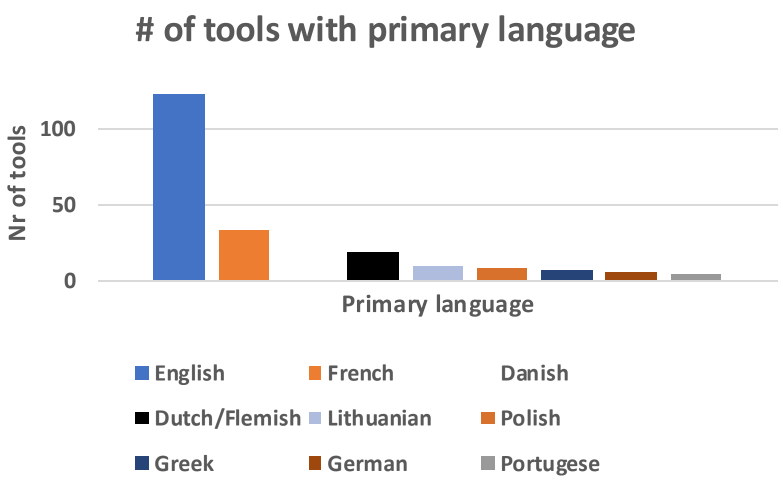


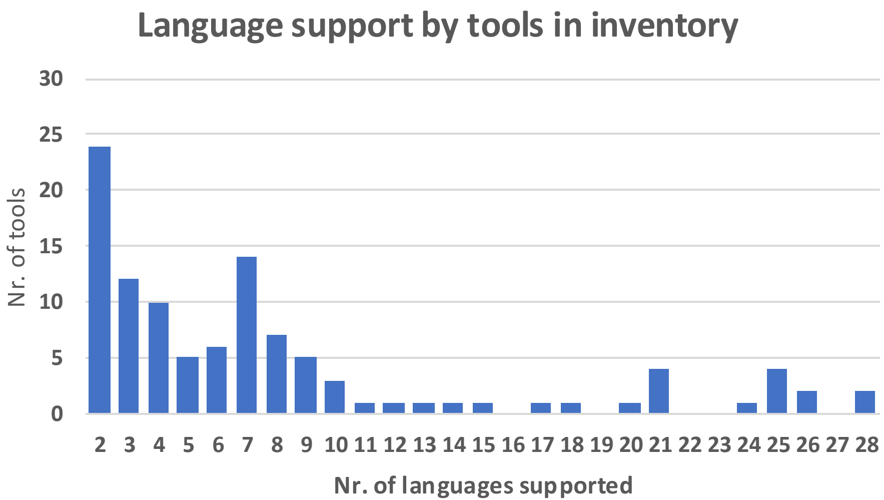



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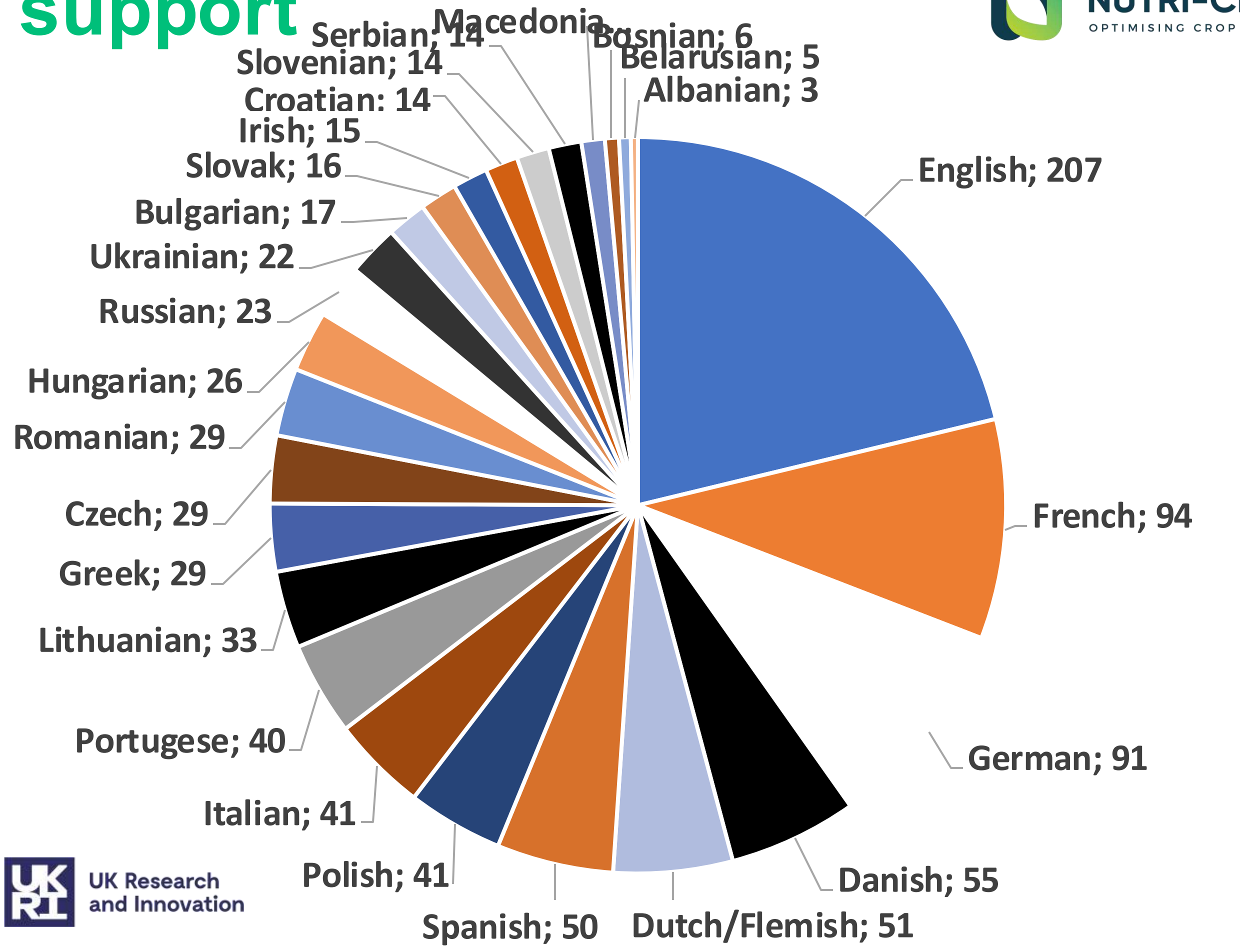


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# Manufacturers

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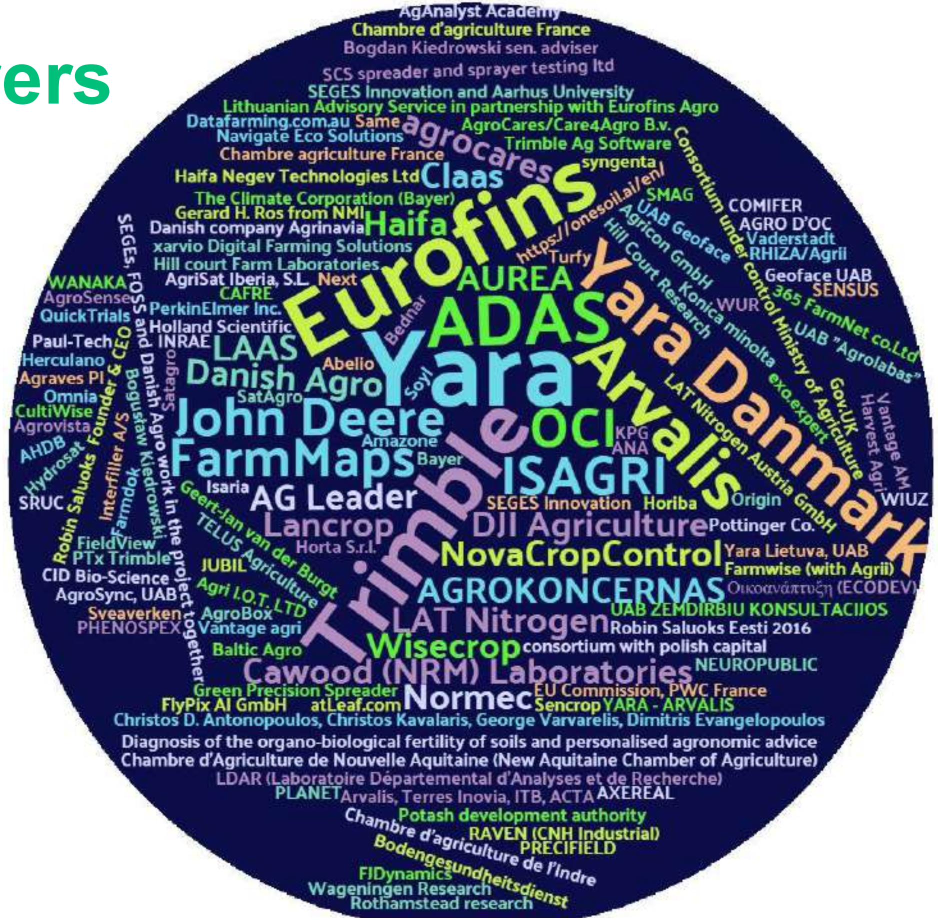


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# Soil analyses

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**27 soil analysis offerings**

- 18/27 include lab analysis

<u>Of which</u>

14x Nitrogen

17x Phosphorus

16x Potassium

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Eurofins Agro Testing Wageningen, Kortingsregeling 490
Postbus 170, 6700 AD WAGENINGEN

2 x N-grondstalen

**Resultaat**

| Wat zit er in uw bodem: | Resultaat | Eenheid | Streeftraject | laag | vrij laag | goed | vrij hoog | hoog |
|---|---|---|---|---|---|---|---|---|
| Nitraat-N | 16 | kg $NO_3$-N/ha | | | | | | |
| Ammonium-N | < 3 | kg $NH_4$-N/ha | | | | | | |
| Stikstof | 16 | kg N/ha | 60 - 100 | | | | | |
| Zwavel | < 5 | kg/ha | 60 - 100 | | | | | |
| Fosfor | 0,6 | kg/ha | 2,0 - 5,0 | | | | | |
| Kalium | 56 | kg/ha | 178 - 261 | | | | | |
| Calcium | 98 | kg/ha | 249 - 581 | | | | | |
| Magnesium | 136 | kg/ha | 150 - 240 | | | | | |
| Silicium | 23 | kg/ha | 7,5 - 10 | | | | | |
| IJzer | < 6 | g/ha | 250 - 500 | | | | | |
| Zink | 51 | g/ha | 250 - 1000 | | | | | |
| Mangaan | 144 | g/ha | 500 - 750 | | | | | |
| Borium | 414 | g/ha | 175 - 250 | | | | | |
| Geleidingsvermogen | 0,14 | mS/cm 25°C | | | | | | |

Alle bovenstaande resultaten zijn in elementvorm (N, P, K, etc) weergegeven.

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# Crop analyses

NUTRI-CHECK NET
OPTIMISING CROP NUTRITION

| Crop sensor measurement/assessment | |
|---|---|
| SPAD | 8 |
| NDVI | 28 |
| Leaf nutrient content | 18 |
| RBG imagery | 15 |
| Grain nutrient content | 3 |
| Green Area Index (GAI) | 18 |
| % Canopy cover | 7 |
| Yield map | 5 |
| Cumulative | 102 |

| Type of crop analysis | |
|---|---|
| Leaf analysis | 24 |
| Grain analysis | 8 |
| Protein analysis silage maize at harvest | 1 |
| Sap analysis | 2 |
| Leaf stem analysis | 1 |
| Root analysis | 1 |
| Cumulative | 37 |

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# Overall scope and volume

NUTRI-CHECK NET
OPTIMISING CROP NUTRITION

- Near 10.000 datapoints characterising Tools & Services

## Team effort

by Project Partners & Stakeholders

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# Thank You!

*Milan Franssen*

m.franssen@delphy.nl

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 11:35 - 11:50 | TOOLS AND SUPPORT FOR GOOD FERTILISER DECISIONS: A MANUFACTURERS PERSPECTIVE

**MARK Tucker**
YARA

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**MARK Tucker**
YARA

**Degree in Agricultural Botany from the University of Reading (1989).**

**10 years as a commercial agronomist, and an independent agronomist with Aubourn Farming, Norfolk, for two years.**

**Joined Yara UK Ltd (2002) as Company Agronomist**

**Since December 2023, serves as Partnership & Value Chain Manager, Yara Europe, focusing on bringing lower-carbon fertilisers into local markets.**

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Knowledge grows

# Tools For Better Nutrient Management

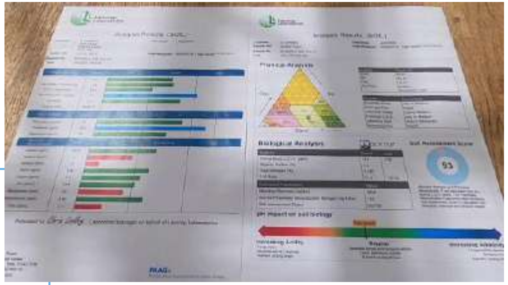
**Tools and support for good fertiliser decisions:**
**“a manufacturers perspective”**

| Mark Tucker, YARA EU|
Value Chain Partnership Manager

## The Reason Why?

- **Why *<u>should or do</u>* manufactures get involved in Tools and Support for good fertiliser decisions?**

- **What do we mean by Tools and Support?**
  - **Hardware** e.g. Yara N Tester, Yara N Sensor, Soil/Leaf/Grain Analysis
  - **Satellite** data
  - **Calculators** – e.g. Nutrient Management Plans, Carbon Footprint Calculators
  - **Knowledge Exchange** / Problem Solving




# Why do?

- **…a sound business case to add to the bottom line**
  - Products/knowledge **to sell**
  - Products/knowledge to support **a 'premium' position – 'freemium'.**
  - Products that help support and **protect a long-term position for the industry.**
- **…………………**and increasingly towards **'triple bottom line accounting'**

# Why Should?

- **Nutrient stewardship** will be critical to ensure that there is sustainable use of fertilizer that encompasses all elements – **economic, environmental and social.**

- **All the 4 R's** become **even more relevant** for **optimising** product performance.

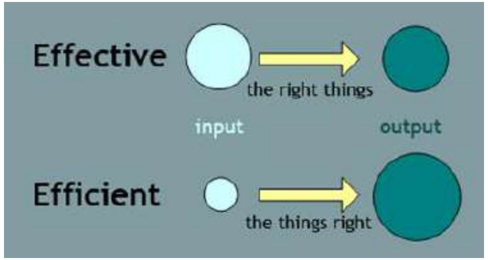
…"Better Fertilizers, Used in a Better Way"

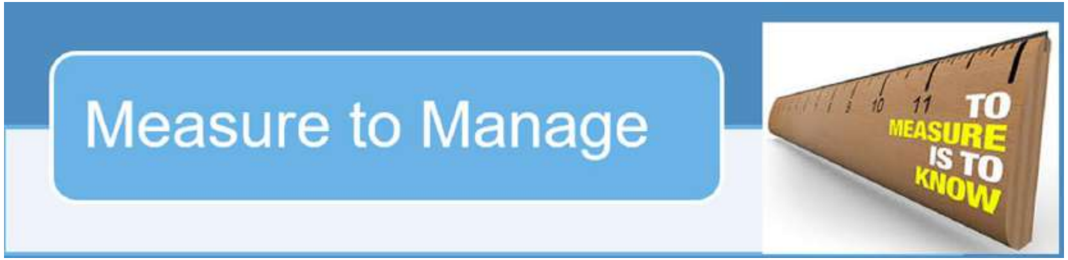
# Some of the challenges that continue to be a barrier towards adoption…especially Digital Tools / VRA

- **Ease** of use **/ TIME** is at a premium
- **Compatibility | integration | Duplication | Connectivity**
- **All stakeholders to be engaged**
  - *Farmer>>Agronomist>>Distrib/CoOp>>Manufacturer*
- **Academic** institutional support **to build TRUST**
  - *Reliability/integrity/consistency/competence/sincerity*

# Looking ahead….

- **#1** must be improved agricultural and environmental productivity = **EFFICIENCY**
- **#2** we must move away from ***'Risky Management'*** to ***'Risk Management'***
- **#3** with **SUSTAINABILITY** becoming central to every decision then 'data', 'data sharing' and 'data integration' must be at the heart of it all


*MUST TURN MEASUREMENT INTO ACTIONS*

# Thank You

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## 11:50 - 12:05 | REGULATING NITROGEN APPLICATION IN SEASON USING SATELLITE BASED MODEL

**JULIE CHRISTENSEN**

SEGES

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**JULIE CHRISTENSEN**
SEGES

**Senior Specialist at SEGES Innovation in the Department of Crop Nutrition with a PhD in Soil Science from Aarhus University.**

**Work focuses on nitrogen management, including nitrogen requirements and leaching. She serves as Chair of the Danish working group on national nutrient norms.**

**She has extensive experience in applied research within plant nutrition and sustainable crop production.**

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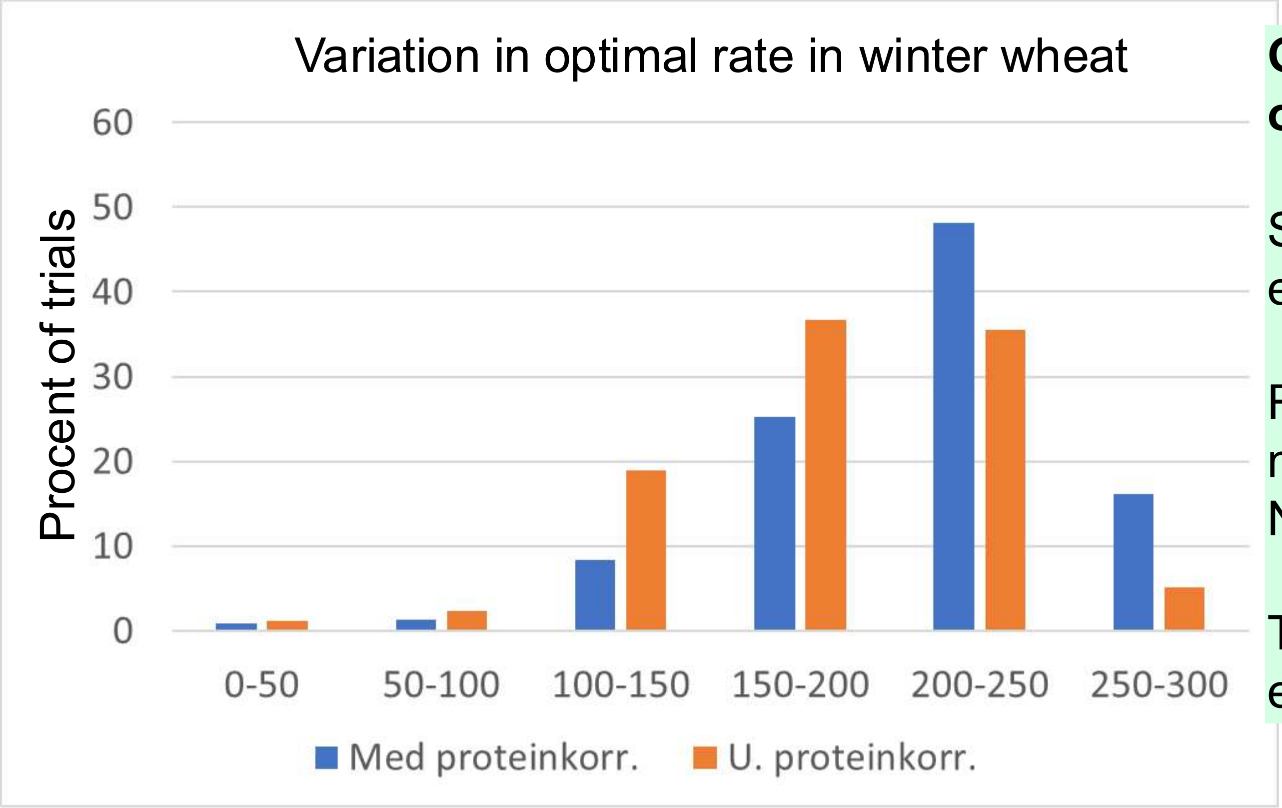
# Regulating nitrogen application in season using satellitebased model

Julie Therese Christensen

**18. November**

# Challenge! – how to hit the right N-demand on field level?




**Great variation in optimum**

Standard or model explain only a small part

Relative little profit by more accurate setting of N-Demand

Tools must be cheap and easy to use!

Based on 241 with proteincorrection and 251 without correction 2012-2021

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## The vision

- No extra demand to the farmer for input of data or changed fertilization
- The total amount of N is corrected in 3. application medio May
- The correction is based on satellitte images and expected yield
- The result is an INPUT to the final decission of N-demand.

## Planned fertilization:

| | **Amount of N:** |
|---|---|
| Primo March | 40-60 kg N |
| Medio April | Rest - 40-60 kg N |
| Medio May (st. 37) | After satellit |

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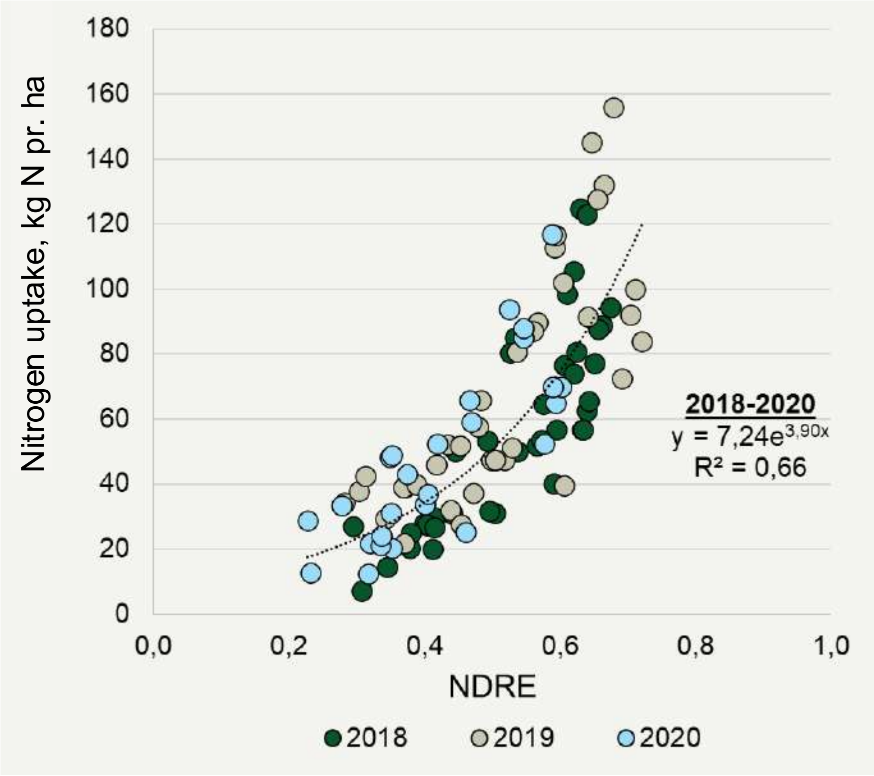
# NDRE measured from satelite vs. nitrogen uptake

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*Oversigt over Landsforsøgnene 2020, s. 195*

# Data in model

- The model is based on 61 field trials with increasing N rate to winter wheat
- Years: 2019-2021
- Nitrogen levels: 0-300 in 50 kg N intervals
- Drone measurements 3-6 times in all trials

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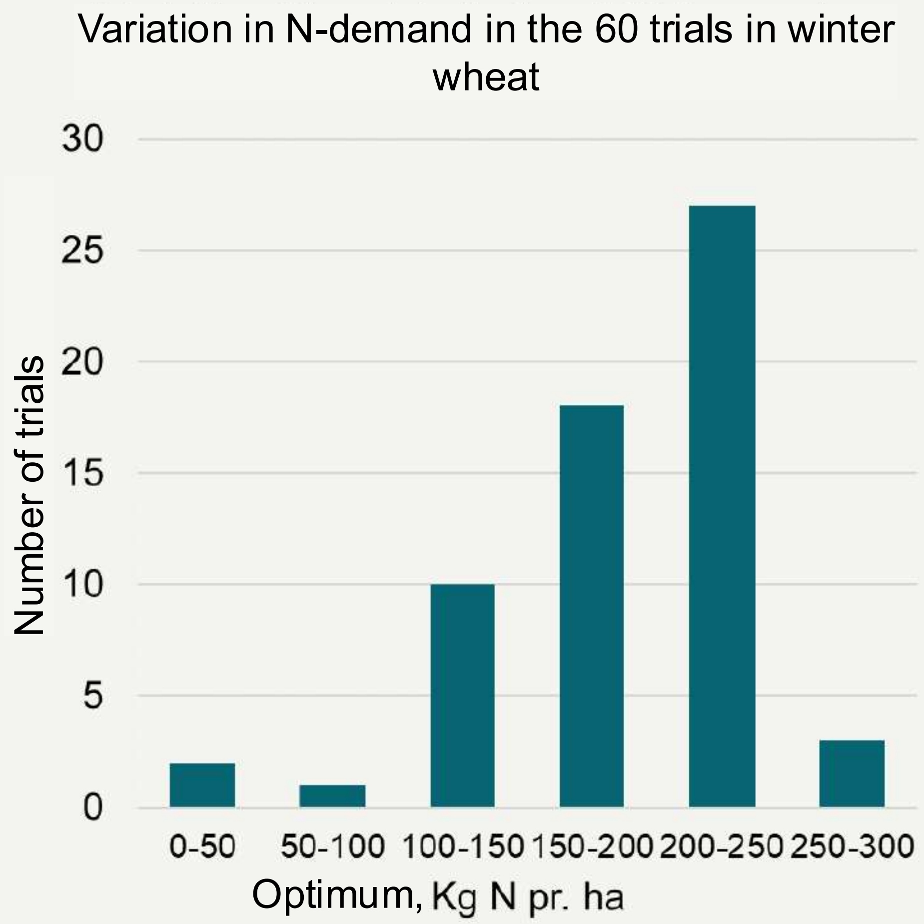
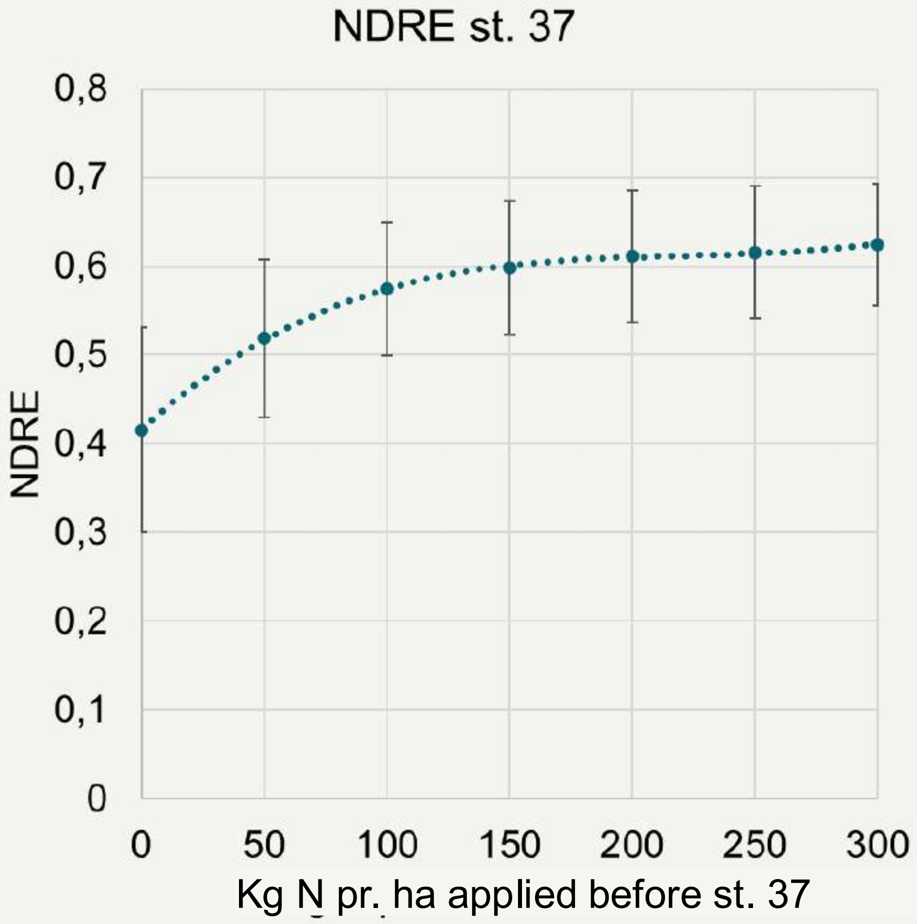
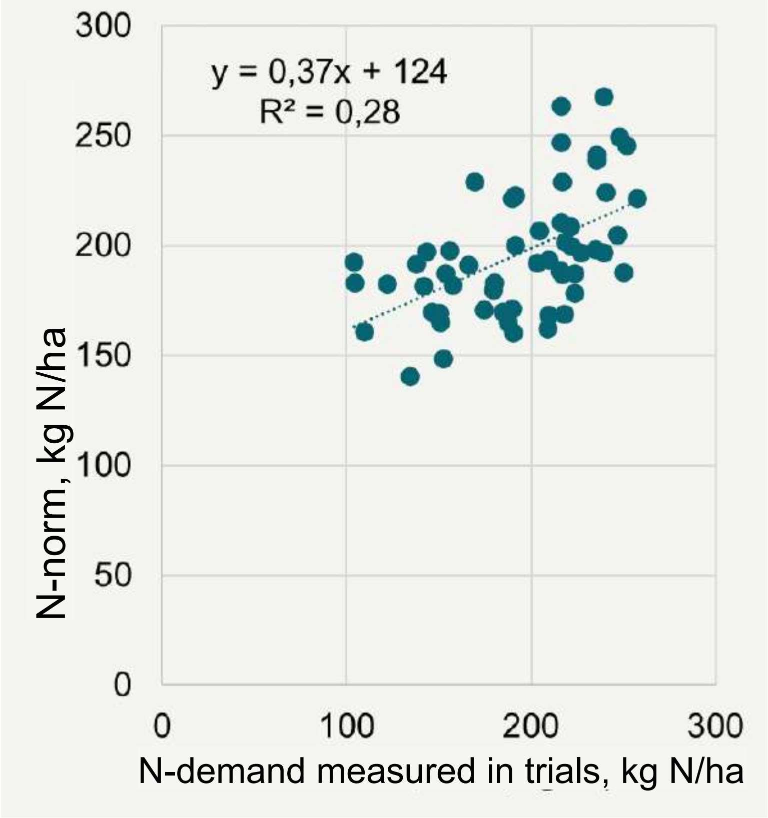


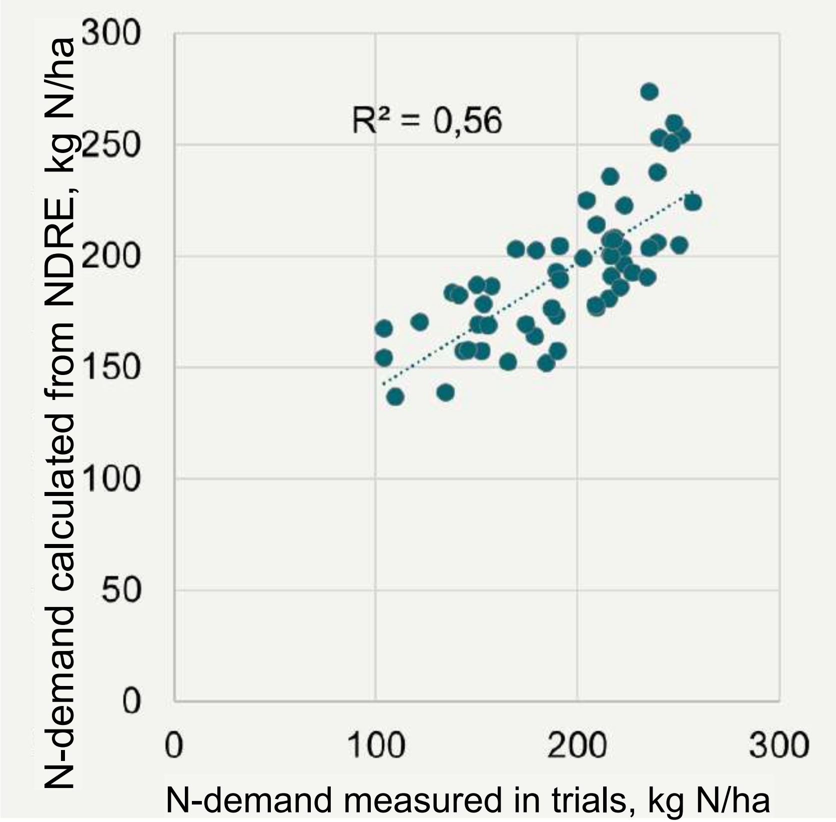
Variation in N-demand in the 60 trials in winter wheat
30
25
20
15
10
5
0
Number of trials
0-50
50-100
100-150
150-200
200-250
250-300
Optimum, Kg N pr. ha

NDRE st. 37
0,8
0,7
0,6
0,5
0,4
0,3
0,2
0,1
0
NDRE
0
50
100
150
200
250
300
Kg N pr. ha applied before st. 37

# Can we do it better than the N-norms?



# Tool implemented in CropManager

Calculation of N-demand

**Kvælstofbehov** for vinterhvede (Mark 9-0)

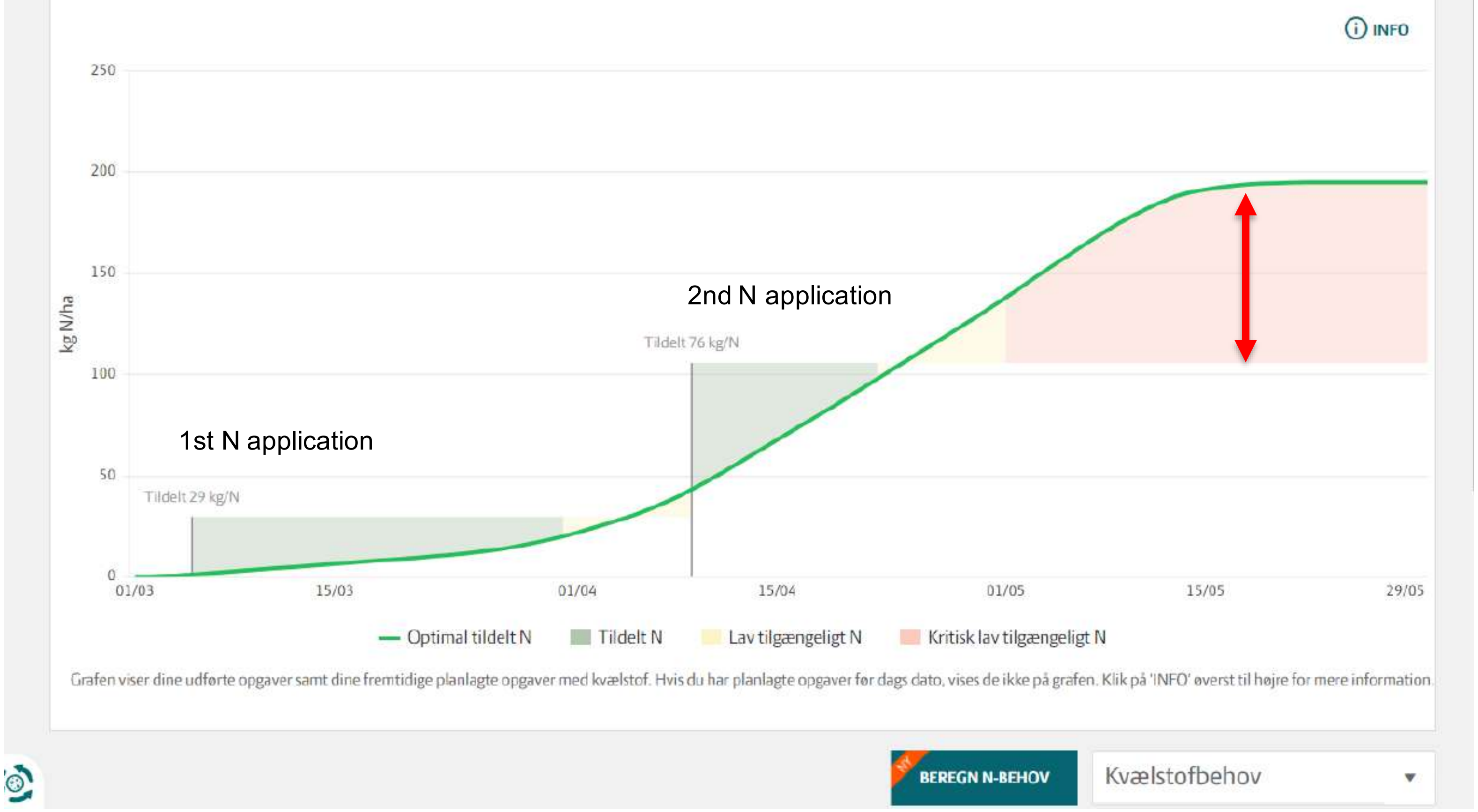
BEREGN N-BEHOV

Kvælstofbehov

Field Crop N-applied N- planned N-demand

| Marker | Afgrøde | N-Tildelt | N-Planlagt | N-behov | N-Balance | N-0-Skæring | Næste behandling | Status | Dato | Produkt | Mængde | Mængde i |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-1 | Vinterhvede | 68 kg N/ha | 99 kg N/ha | 140 kg N/ha | | | 04-03-2025 (0 kg N/ha) | | | | | |
| 1-2 | Vinterhvede | 60 kg N/ha | 91 kg N/ha | 151 kg N/ha | | | 08-03-2025 (0 kg N/ha) | | | | | |
| 1-3 | Vinterhvede | 68 kg N/ha | 99 kg N/ha | 151 kg N/ha | | | 04-03-2025 (0 kg N/ha) | | | | | |
| 4-1 | Vinterhvede | 30 kg N/ha | 61 kg N/ha | 174 kg N/ha | | | 06-04-2025 (0 kg N/ha) | | | | | |
| 4-2 | Vinterhvede | 30 kg N/ha | 61 kg N/ha | 184 kg N/ha | | | 06-04-2025 (0 kg N/ha) | | | | | |
| **9-0** | **Vinterhvede** | **94 kg N/ha** | **125 kg N/ha** | **142 kg N/ha** | | **29-04-2025** | **06-05-2025 (27 kg N/ha)** | | | | | |
| 9-1 | Vinterhvede | 95 kg N/ha | 126 kg N/ha | 104 kg N/ha | | | 06-05-2025 (27 kg N/ha) | | | | | |
| 9-2 | Vinterhvede | 97 kg N/ha | 128 kg N/ha | 135 kg N/ha | | 02-05-2025 | 06-05-2025 (27 kg N/ha) | | | | | |
| 9-3 | Vinterhvede | 94 kg N/ha | 125 kg N/ha | 131 kg N/ha | | 01-05-2025 | 06-05-2025 (27 kg N/ha) | | | | | |
| 9-4 | Vinterhvede | 97 kg N/ha | 128 kg N/ha | 132 kg N/ha | | 02-05-2025 | 06-05-2025 (27 kg N/ha) | | | | | |

# N-demand for winter wheat – field 5

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# Current prises can be entered for more precise N-demand

## Satellitberegnet N-behov før 3. tildeling

INFO

Vinterhvede

Kvælstofpris Kr.pr.kg N

Afgrødepris Kr.pr.hkg

Proteinpris Kr. pr. pct. prot.

GENBEREGN

Vil du overskrive 'N-restbehov ud fra gødningsplan' med 'N-restbehov ud fra satellitberegning' på alle marker?

OVERSKRIV N-RESTBEHOV UD FRA GØDNINGSPLAN

| Marker | Forventet udbytte | N-restbehov ud fra satellitberegning | | N-restbehov ud fra gødningsplan |
|---|---|---|---|---|
| 1-1 | 94 | - | ! | 82 |
| 1-2 | 94 | - | ! | 91 |
| 1-3 | 94 | - | ! | 84 |
| 4-1 | 85 | - | ! | 144 |
| 4-2 | 90 | - | ! | 154 |
| 9-0 | 94 | - | ! | 58 |
| 9-1 | 74 | - | ! | 19 |
| 9-2 | 94 | - | ! | 48 |
| 9-3 | 53 | - | ! | 47 |
| 9-4 | 53 | - | ! | 45 |
| 9-5 | 53 | - | ! | 50 |
| 10-2 | 53 | - | ! | 39 |
| 13-0 | 53 | - | ! | 46 |
| 13-1 | 53 | - | ! | 101 |

GEM AFBRYD

# Conclusions and outlook

- Determination of nitrogen requirement can be improved based on drone/satellite data
- The model is not perfect - still some uncertainty
- Model requires no input data from the farmer – except adjusted expected yield
- The model was integrated into CropManager for use in 2022
- Important that the farmer consider the fertilization strategy from the beginning

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# Thank You!


***Julie Therese Christensen***

jtcn@seges.dk



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## 12:05 - 12:20 | GRAIN NUTRIENT ANALYSIS - A KEY TOOL FOR REVIEWING

**KATE**
**STORER**
ADAS

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**KATE STORER**

ADAS

**Principal Research Scientist in the Crop Physiology team at ADAS.**

**Her research aims to improve crop performance sustainably, primarily by optimising nutrient management through several projects on crop nutrition and biostimulants.**

**She co-leads the ADAS High Mowthorpe Farming Association, a network for local farmers and agronomists to discuss the latest applied research, and as part of the NUTRI-CHECK NET project helped to create the inventory of nutrient management tools and services available in the NUTRI-CHECK NET.**

NUTRI-CHECK NET

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# Grain analysis – a key tool for reviewing

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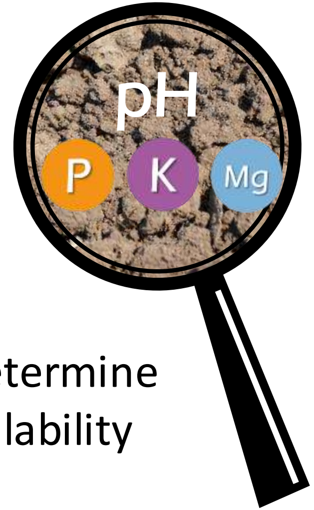
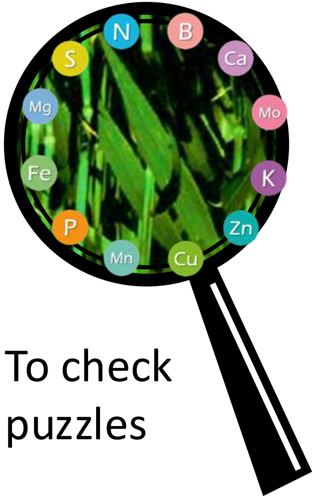
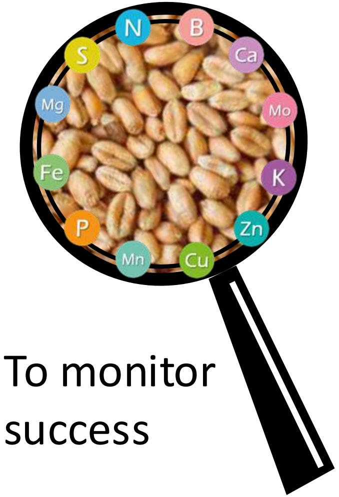
| Plan | Check & Adjust | Review |
|---|---|---|
| **Soil analysis...** | **Leaf analysis ...** | **Grain analysis...** |




To determine availability




To check puzzles




To monitor success

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# The value of GRAIN ANALYSIS lies in …

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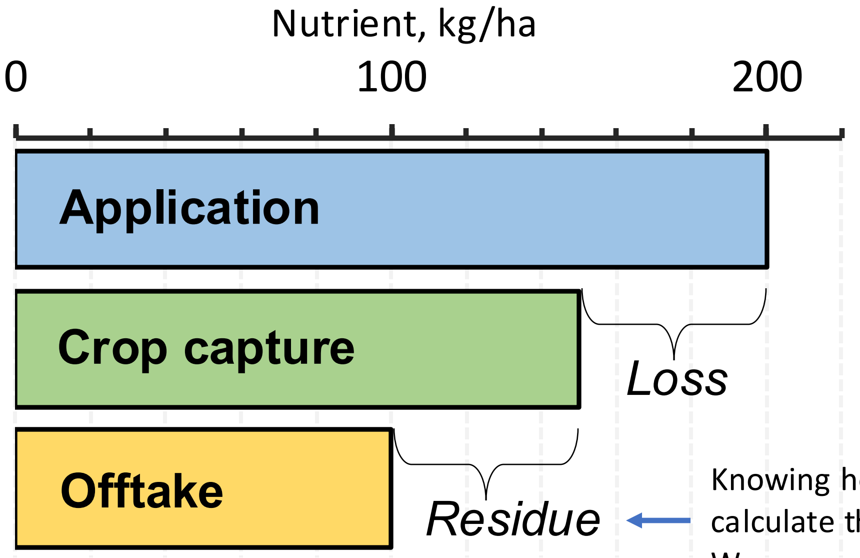
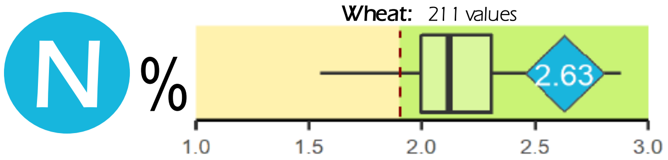
## 1. Balances & Maintenance




Knowing how much nutrient the grain has taken off allows you to calculate the **residue**.
We can use this to adjust inputs to maintain target indices

## 2. Diagnosing deficiencies & excesses




By benchmarking against other crops…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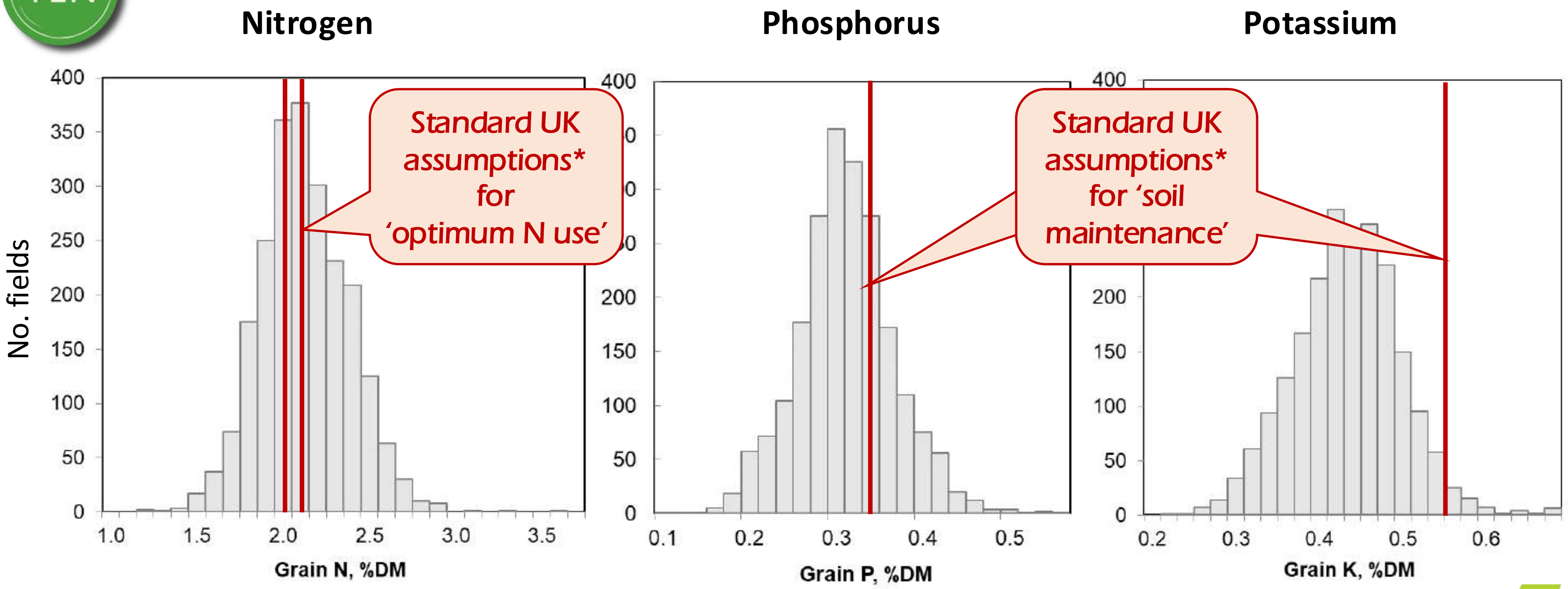
# Grain nutrient concentrations vary

~1,700 YEN Wheat crops, 2013-2021

… show standard assumptions are high – we have been overestimating offtakes for P and K…

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* from: RB209 (AHDB, 2022) & www.pda.org.uk/pda_leaflets/nutrients-in-crop-material

# Frequencies of Deficiencies in YEN *Wheat* *2013 – 2021*

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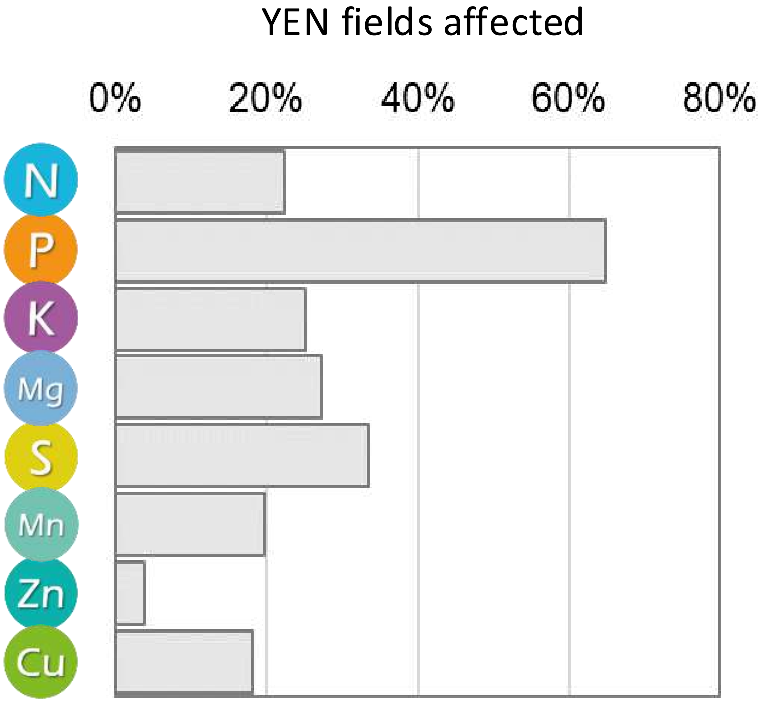
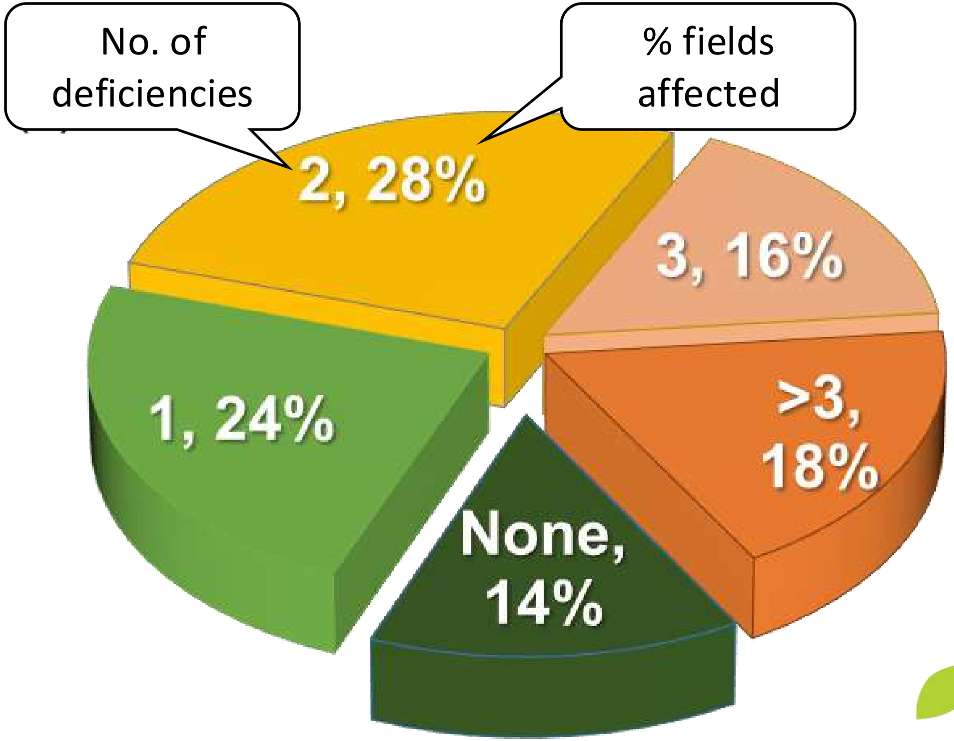
OPTIMISING CROP NUTRITION

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# Examples of grain analysis

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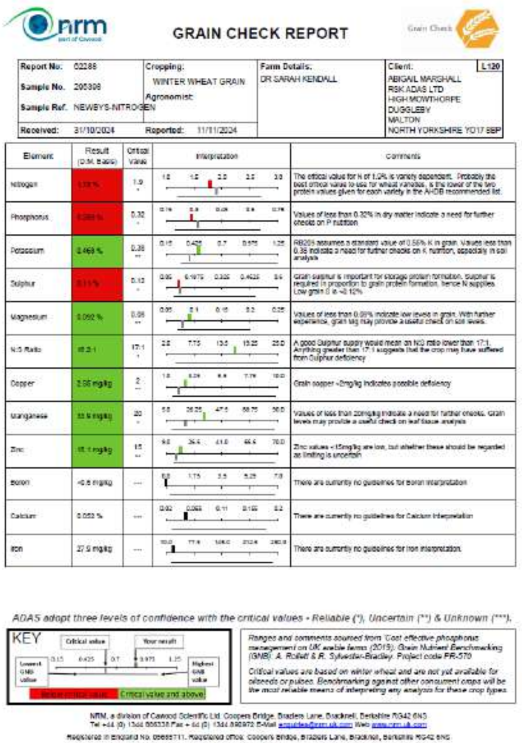

## GRAIN CHECK REPORT

nrm part of Cawood — Grain Check

| Report No: 02288 | Cropping: WINTER WHEAT GRAIN | Farm Details: DR SARAH KENDALL | Client: L120 |
|---|---|---|---|
| Sample No. 205308 | Agronomist: | | ABIGAIL MARSHALL<br>RSK ADAS LTD<br>HIGH MOWTHORPE<br>DUGGLEBY<br>MALTON<br>NORTH YORKSHIRE YO17 8BP |
| Sample Ref. NEWBYS-NITROGEN | | | |
| Received: 31/10/2024 | Reported: 11/11/2024 | | |

| Element | Result (D.M. Basis) | Critical Value | Interpretation | Comments |
|---|---|---|---|---|
| Nitrogen | [illegible] % | 1.9 * | 1.0 1.5 2.0 2.5 3.0 | The critical value for N of 1.9% is variety dependent. Probably the best critical value to use for wheat varieties, is the lower of the two protein values given for each variety in the AHDB recommended list. |
| Phosphorus | [illegible] % | 0.32 * | | Values of less than 0.32% in dry matter indicate a need for further checks on P nutrition. |
| Potassium | 0.469 % | 0.38 ** | 0.15 0.425 0.7 0.975 1.25 | RB209 assumes a standard value of 0.55% K in grain. Values less than 0.38 indicate a need for further checks on K nutrition, especially in soil analysis. |
| Sulphur | 0.11 % | 0.12 * | 0.05 0.1875 0.325 0.4625 0.6 | Grain sulphur is important for storage protein formation. Sulphur is required in proportion to grain protein formation, hence N supplies. Low grain S is <0.12%. |
| Magnesium | 0.092 % | 0.08 ** | 0.05 0.1 0.15 0.2 0.25 | Values of less than 0.08% indicate low levels in grain. With further experience, grain Mg may provide a useful check on soil levels. |
| N:S Ratio | [illegible]:1 | 17:1 * | 2.0 7.75 13.5 19.25 25.0 | A good Sulphur supply would mean an N:S ratio lower than 17:1. Anything greater than 17:1 suggests that the crop may have suffered from Sulphur deficiency. |
| Copper | 2.56 mg/kg | 2 *** | 1.0 | Grain copper <2mg/kg indicates possible deficiency. |
| Manganese | 33.9 mg/kg | 20 * | 5.0 26.25 47.5 68.75 90.0 | Values of less than 20mg/kg indicate a need for further checks. Grain levels may provide a useful check on leaf tissue analysis. |
| Zinc | 18.1 mg/kg | 15 ** | 9.0 26.6 41.0 66.6 70.0 | Zinc values <15mg/kg are low, but whether these should be regarded as limiting is uncertain. |
| Boron | <0.8 mg/kg | --- | 0.0 1.75 3.5 5.25 7.0 | There are currently no guidelines for Boron interpretation. |
| Calcium | 0.052 % | --- | 0.02 0.065 0.11 0.155 0.2 | There are currently no guidelines for Calcium interpretation. |
| Iron | 27.9 mg/kg | --- | 10.0 | There are currently no guidelines for Iron interpretation. |

*ADAS adopt three levels of confidence with the critical values - Reliable (*), Uncertain (**) & Unknown (***).*

KEY: Critical value; Your result; Lowest GNB value; Highest GNB value; 0.15 0.425 0.7 0.975 1.25; Below critical value; Critical value and above

*Ranges and comments sourced from 'Cost effective phosphorus management on UK arable farms (2015); Grain Nutrient Benchmarking (GNB)' A. Rollett & R. Sylvester-Bradley. Project code PR-570*

*Critical values are based on winter wheat and are not yet available for oilseeds or pulses. Benchmarking against other concurrent crops will be the most reliable means of interpreting any analysis for these crop types.*

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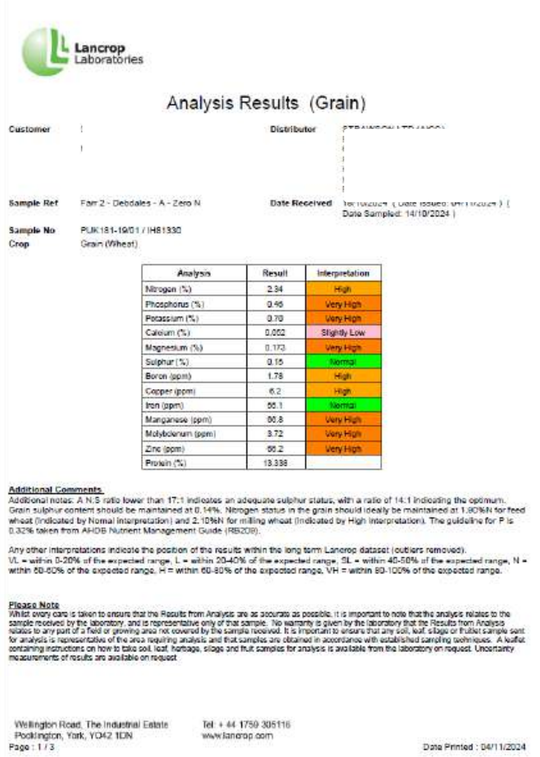

Lancrop Laboratories

## Analysis Results (Grain)

**Customer**

**Distributor**

**Sample Ref** Farm 2 - Debdales - A - Zero N

**Date Received** ( Date Sampled: 14/10/2024 )

**Sample No** PUK181-19/01 / IH81330

**Crop** Grain (Wheat)

| Analysis | Result | Interpretation |
|---|---|---|
| Nitrogen (%) | 2.34 | High |
| Phosphorus (%) | 0.46 | Very High |
| Potassium (%) | 0.70 | Very High |
| Calcium (%) | 0.052 | Slightly Low |
| Magnesium (%) | 0.173 | Very High |
| Sulphur (%) | 0.15 | Normal |
| Boron (ppm) | 1.78 | High |
| Copper (ppm) | 6.2 | High |
| Iron (ppm) | 56.1 | Normal |
| Manganese (ppm) | 56.8 | Very High |
| Molybdenum (ppm) | 3.72 | Very High |
| Zinc (ppm) | 56.2 | Very High |
| Protein (%) | 13.338 | |

**Additional Comments**

Additional notes: A N:S ratio lower than 17:1 indicates an adequate sulphur status, with a ratio of 14:1 indicating the optimum. Grain sulphur content should be maintained at 0.14%. Nitrogen status in the grain should ideally be maintained at 1.90%N for feed wheat (indicated by Nomal interpretation) and 2.10%N for milling wheat (indicated by High interpretation). The guideline for P is 0.32% taken from AHDB Nutrient Management Guide (RB209).

Any other interpretations indicate the position of the results within the long term Lancrop dataset (outliers removed).
VL = within 0-20% of the expected range, L = within 20-40% of the expected range, SL = within 40-50% of the expected range, N = within 50-60% of the expected range, H = within 60-80% of the expected range, VH = within 80-100% of the expected range.

**Please Note**

Whilst every care is taken to ensure that the Results from Analysis are as accurate as possible, it is important to note that the analysis relates to the sample received by the laboratory, and is representative only of that sample. No warranty is given by the laboratory that the Results from Analysis relates to any part of a field or growing area not covered by the sample received. It is important to ensure that any soil, leaf, silage or fruitlet sample sent for analysis is representative of the area requiring analysis and that samples are obtained in accordance with established sampling techniques. A leaflet containing instructions on how to take soil, leaf, herbage, silage and fruit samples for analysis is available from the laboratory on request. Uncertainty measurements of results are available on request.

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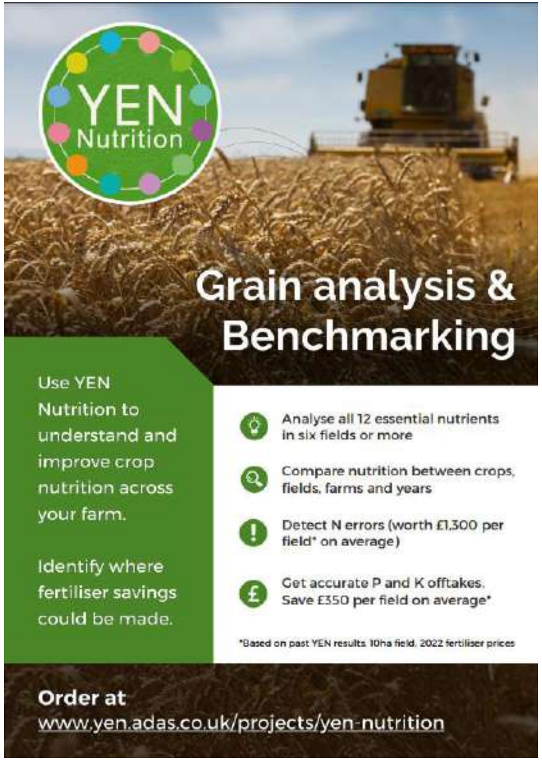
Date Printed : 04/11/2024

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# Example benchmarking diagram:

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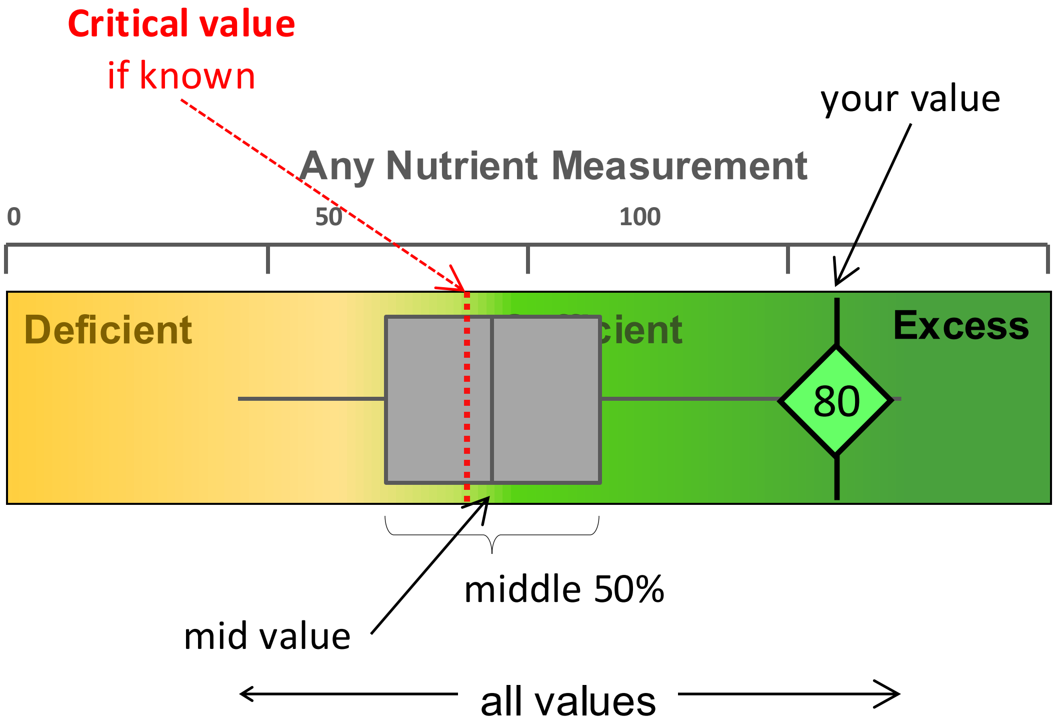



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# Example Grain Nutrient Benchmarking report

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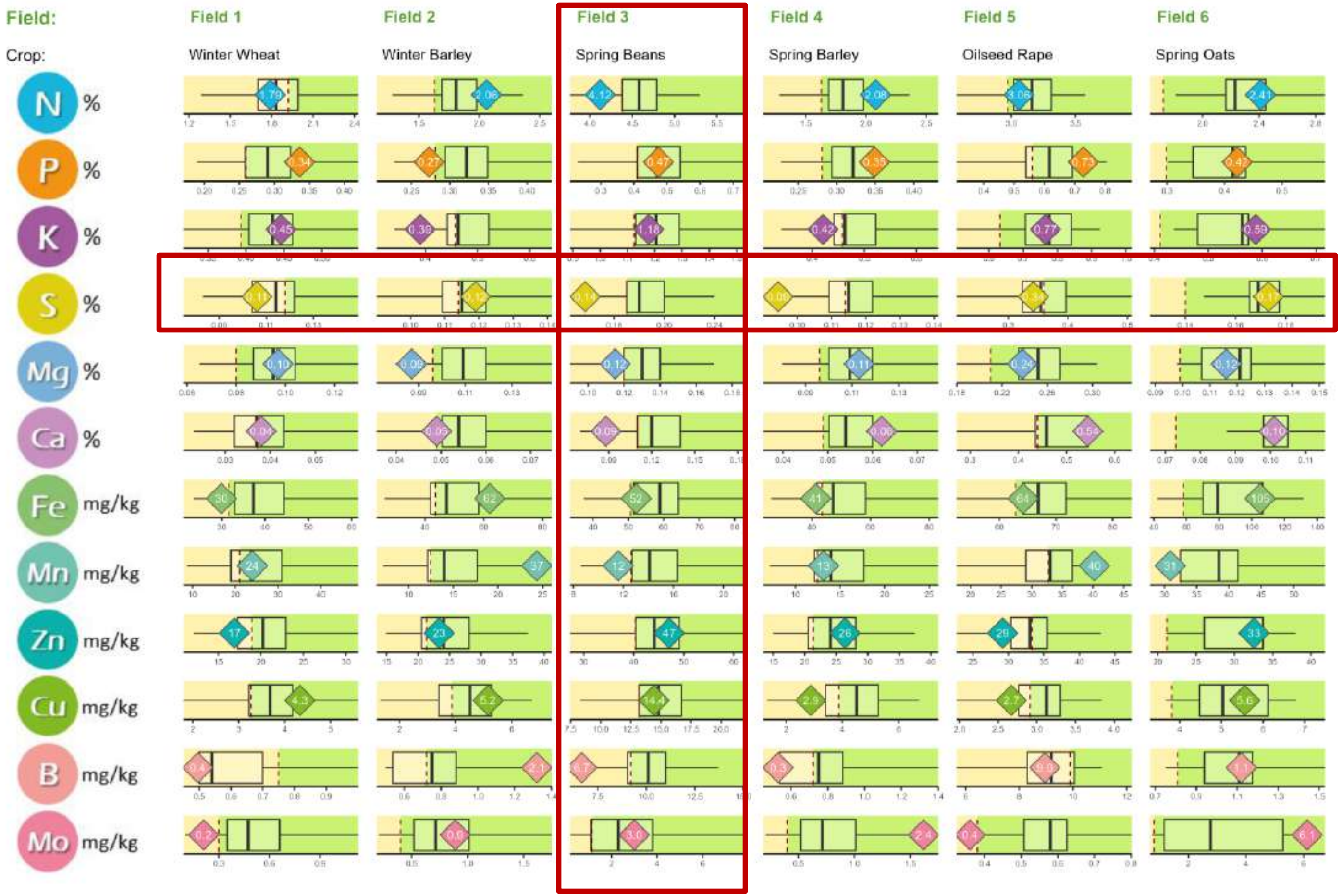


YEN Nutrition

# Practical advice

| Observation | Action |
| --- | --- |
| Check yields | Any unexpectedly low or high yields? Any quality factors deviating from the expected? |
| Low S across fields | Check for next season, application might be suitable to maintain optimum yield |
| Sufficient P in most fields | Maintain good P levels |
| Field 3 looks low on several nutrients | Check if there are any soil issues; compaction? Drainage issues/waterlogging? Crop disease? |
| Compare with previous years | Compare to see if good nutrient status has been maintained and bad status has been improved |

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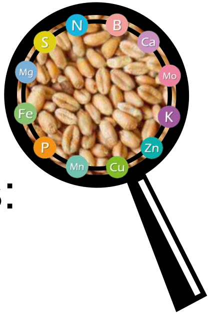
# Summary

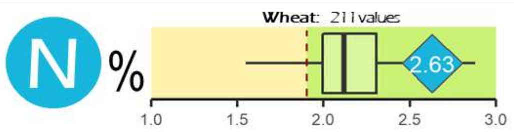



## Grain analysis Reviews progress:

- Completes the season of nutrient management monitoring
- Did it work? What to do differently next year?
- We know:
  - Standard nutrient offtake values (kg/tonne) can be exaggerated (e.g. P & K)
  - Big variation in crop nutrient concentrations … as big as Yield Variation!
  - Most crops have nutrition issues … and variation is often farm-related

## Benchmarking can help:

- To understand How & Why Crop Nutrition varies
- By Sharing and Analysing data field-by-field
  - To provide context and aid interpretation
- This should develop more certain understanding farm-by-farm & / or set new standards.

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# Thank You!

*Kate.Storer@adas.co.uk*

https://nutri-checknet.eu/

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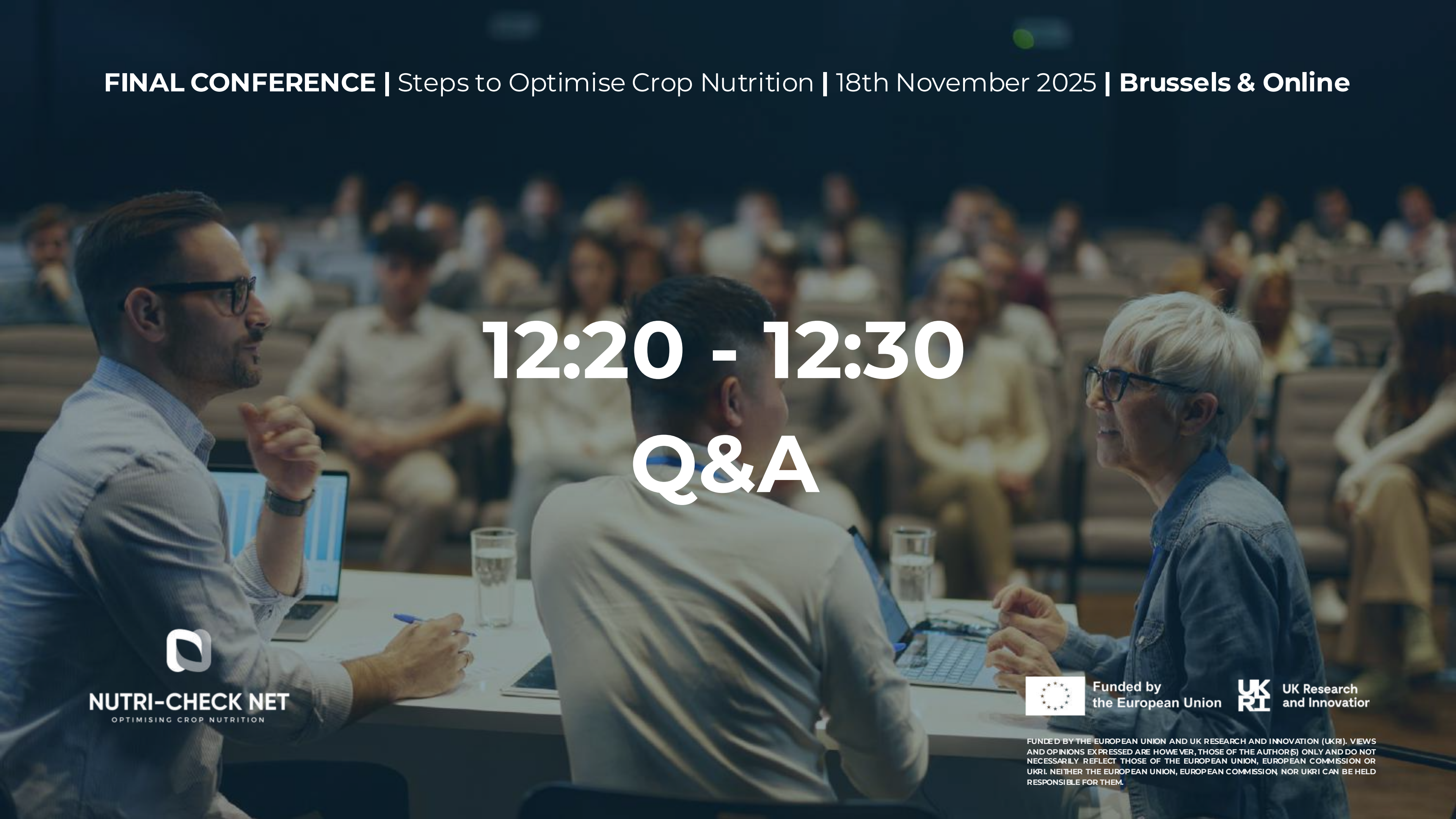

# 12:20 - 12:30
# Q&A

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FINAL CONFERENCE | Steps to Optimise Crop Nutrition | 18th November 2025 | Brussels & Online
12:30 - 13:45
NETWORKING LUNCH
POSTERS SESSION
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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

## 13:45 - 15:15 | SESSION 3: CO-CREATION AND BEST PRACTICES TO SUPPORT ADOPTION

**MILAN FRANSSEN**
DELPHY

**FRANCESCA DEGAN**
ARVALIS

**JULIE CHRISTENSEN**
SEGES

**ALEXANDROS FOURNARAKOS**
AUA

**NIKOS GEORGANTZIS**
BURGANDY SCHOOL OF BUSINESS

**LUDWING HERMANN**
PROMAN

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

**MILAN FRANSSEN**

DELPHY

**Soil Scientist, Agricultural Economist, Leader of the Projects & Innovations Team at DELPHY, The Netherlands.**

**Leader of the NUTRI-CHECK NET's WP 2 "Inventory of crop nutrition decision-making tools".**

**Manages national and European projects with collaborations between farmers, agronomists, researchers, supply chain partners, and public entities.**

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 15:50 - 14:05 | COST-BENEFIT ANALYSIS TO SUPPORT CROP NUTRITION

**FRANCESCA DEGAN**

ARVALIS

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**FRANCESCA DEGAN**
ARVALIS

**Research & Development Engineer at the forefront of agronomy, pedology, and nutrient management in ARVALIS.**

**Leads strategic initiatives focused on integrating crop models and sensor technologies to optimise precision nutrient management in agriculture.**

**Actively engaged in EU-funded projects and digital agriculture platforms.**

**In the NUTRI-CHECK NET project actively worked in WP2 and WP5.**

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NUTRI-CHECK NET

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# Cost-Benefit Analysis of Crop Nutrition Decision and Precision Tools on arable farms in Europe

*Authors: Francesca Degan (Arvalis), David Wall (Teagasc), Sarah Kendall (ADAS)*

*Contributors: Laurie Abel (ADAS), Despina Berdeni (ADAS), Roger Sylvester-Bradley (ADAS), Elodie Gagliardi (Arvalis), Lucas Kerdal (Arvalis), Mathieu Marguerie (Arvalis), Alexandros Fournarakos (AUA), Eirini Chlouveraki (AUA), Efstathios Stathopoulos (AUA), Marek Krysztofrski (CDR), Leszek Żukowski (CDR), Beatriz Cardoso (CONSULAI), Laura Matos (CONSULAI), Angelique Walsweer (Delphy), Milan Franssen (Delphy), Remon te Velde (Delphy), Niek Vedelaar (Delphy), Wendy Schalke (Delphy), Virmantas Povilaitis (LAMMC), Rimas Magyla (LZŪKT), Lina Žukauskienė (LZŪKT), Romutė Mikučionienė (LZŪKT), Maja Runge Christensen (SEGES), Julie Therese Christensen (SEGES), Randi Wiborg Hansen (SEGES), Rose Elsgaard Kelada (SEGES), Cathal Redmond (Teagasc)*

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# What is Cost-Benefit Analysis?

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- **Cost-benefit analysis (CBA)** is a structured approach used **to evaluate the advantages (benefits) and disadvantages (costs) associated with using a specific tool** that helps to inform decision making.
- In agriculture, CBA involves quantifying the costs and benefits associated with different farming activities and investments (European Commission, 2014).
- This process helps to make decisions that align with long-term agricultural goals, such as maximizing economic returns, enhancing sustainability, and reducing environmental impact.

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# Scope and Perspective of this CBA

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**What was evaluated & analyzed in this CBA?**

- A range of Crop Nutrition Decision and Precision Tools
- Enabled comparisons between different tools with a similar aim or offering a solution to a common problem.

**Whose perspective was captured?**

Analyzed the costs and benefits associated with these tools as perceived by a group of arable farmers (at National level and across different European climatic zones).

*Reference Methodology used: European Commission (EC), 2014. Guide to Cost-Benefit Analysis of Investment Projects.*

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# Key concepts of this CBA

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**Costs associated with using a crop nutrition decision & precision tool**

- **Direct Costs:** Equipment, fertilizers, labor & time, technology investments etc.
- **Indirect Costs:** Maintenance, insurance, potential downtime etc.

**Benefits associated with using a crop nutrition decision & precision tool**

- **Direct Benefits:** Increased crop yields and revenue, reduced production expenses, reduced time, labour etc.
- **Indirect Benefits:** improved sustainability, better soil health meeting environmental targets etc.

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# Data Collection

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- **Structured questionnaire** used to collect the information - **295 user evaluations** (farmers and advisors) **across 83 unique tools** that were evaluated, total number of distinct users was 174.
  - ➢ **9 countries involved and 26 Crop Nutrition Clubs (CNC's)**
- **Capital costs** to access the tool/technology: *9 questions.*
- **Operational costs** of tool/technology - compared to current standard management: *8 questions*.
- **Cost savings / additional revenue** generated when using the tool - compared to current standard management: *6 questions*.
- **Operational savings** when using the tool - compared to current standard management: *5 questions*.
- **Provenance, Information capture, Decision making and Confidence** in the tool/technology: *9 questions*.

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# Key Financial Indicators used

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- **Net Present Value (NPV)**: Measures the total value generated over time (5 yr time frame), adjusted for the change in value of money over time.
- **Benefit-Cost Ratio (BCR)**: Compares the present value of benefits to the present value of costs.
- **Return on investment (ROI):** Net gain from an investment as a percentage of its initial cost.
- **Payback Period (PBP):** Time needed to recover the initial investment.

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# Key Qualitative indicators used

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- **User-friendliness** (technical knowledge, skill required, accessibility, ease of uptake, data use, etc.),
- **Trustworthiness** (credibility and accuracy, confidence and precision, support for decision making etc.)

| category | label |
|---|---|
| **Trustworthiness** | Provenance – evidence that the tool works? |
| **Trustworthiness** | Meaningfulness of the decisions made |
| **Trustworthiness** | Tool accuracy – does it do what it claims? |
| **Trustworthiness** | User-confidence in repeatability |
| **User-Friendliness** | What was the user Technical Knowledge requirement? |
| **User-Friendliness** | Describe the change in time required |
| **User-Friendliness** | What is the user Support required to use the tool? |
| **User-Friendliness** | Improvement in farm Data collection? |
| **User-Friendliness** | Improvement in Data utilization? |
| **User-Friendliness** | Change in support service requirements |
| **User-Friendliness** | Skill required to use the tool |
| **User-Friendliness** | Effort required to use the tool |

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# Results

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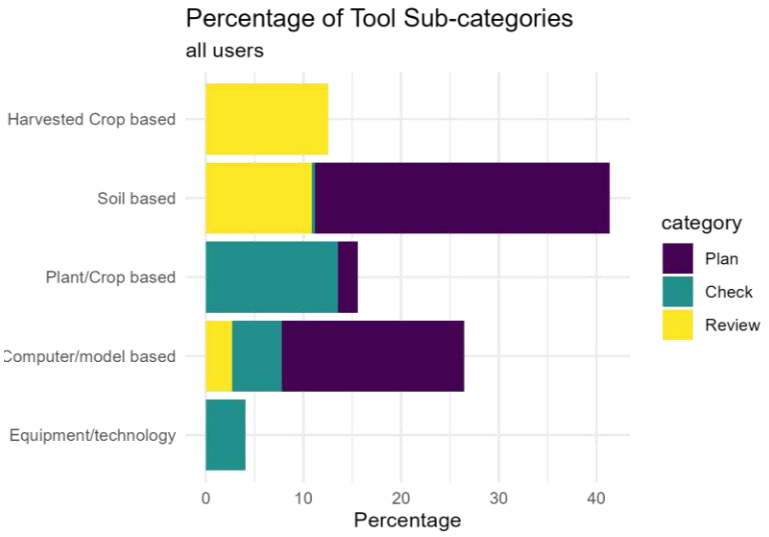
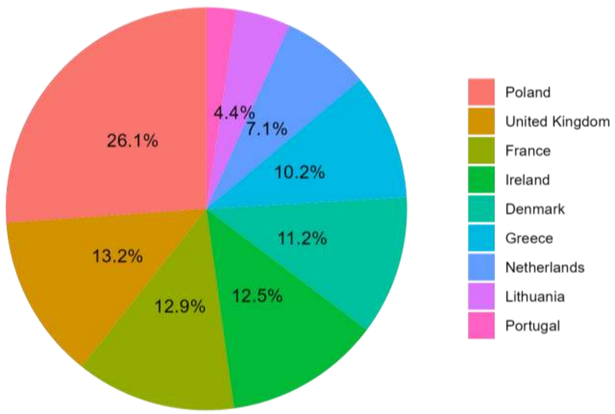
5 Sub-categories of Tools




Percentage of unique tool x user that were evaluated per country




n = 295
Data below 3% not shown

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# Results

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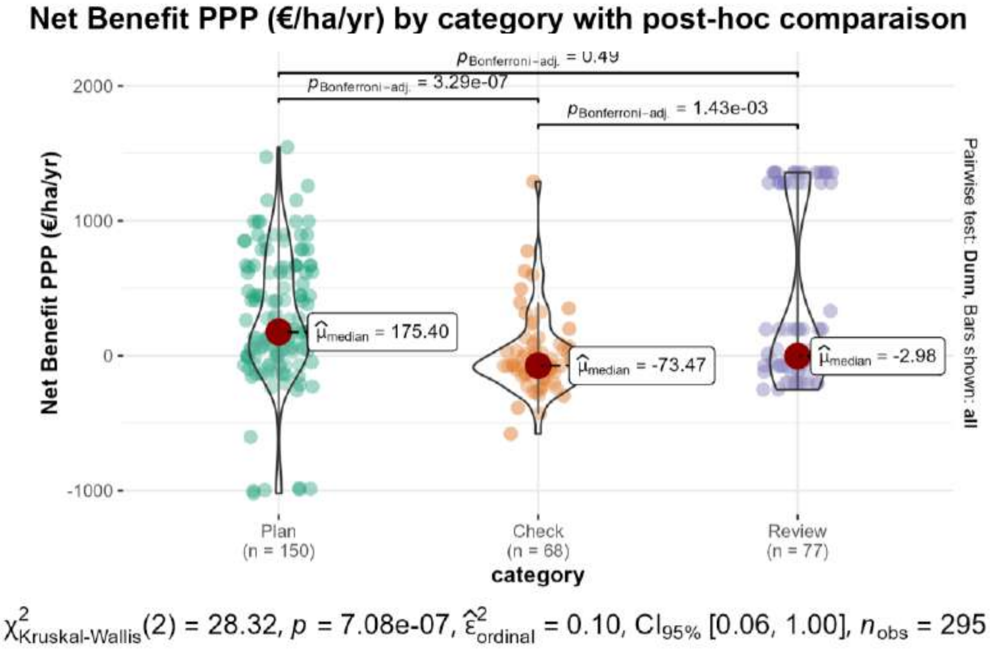
- **Robust difference across categories** (★★★).
- **Variance matters:**
    - Effect size = category explains ~10% of NPV variability.
    - 95% CI effect is real but magnitude uncertain due to variability.
    - *Plan* tools show **wide variability** (–1000 to +1500 €/ha/yr) but cluster strongly positive.
    - *Check* and *Review* have **narrower ranges**, medians negative.
- **Median NPVs:**
    - **Plan:** +175 €/ha/yr (★★★)
    - **Check:** –73 €/ha/yr
    - **Review:** –2 €/ha/yr
- Post-hoc comparisons:
    - Plan vs Check: ★★★
    - Plan vs Review: ★★
    - Check vs Review: n.s.
- **Implication:**
    - Prioritize **planning tools** for highest economic value;
    - Check & Review need cost reduction or added benefits.





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# Results

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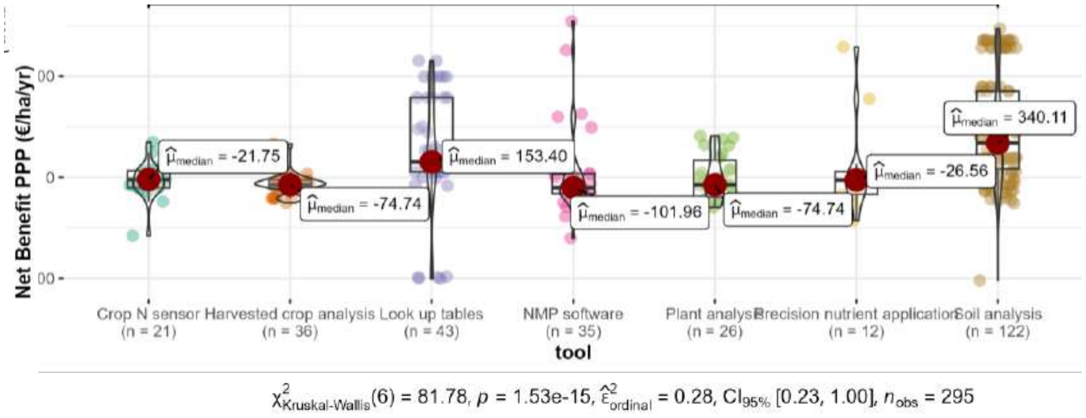
- **Significant difference across tools** (★★★), **moderate to large effect** (28% variance explained).
- **Confidence interval:**
95% CI [0.19, 1.00] → effect is at least moderate, robust difference confirmed.
- **Top performers:**
    - **Soil analysis:** +340 €/ha/yr (highest median).
    - **Look-up tables:** consistently strong positive returns.
- **Low performers:**
    - NMP software, Plant analysis, Harvested crop analysis → **negative medians**.
- **Key insight:**
Tool choice matters → **Plan-phase tools dominate economic performance**, while Check & Review tools show limited short-term NPV

**Net Benefit PPP (€/ha/yr) by tool with post-hoc comparaison**

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# Results – Quantitative analysis

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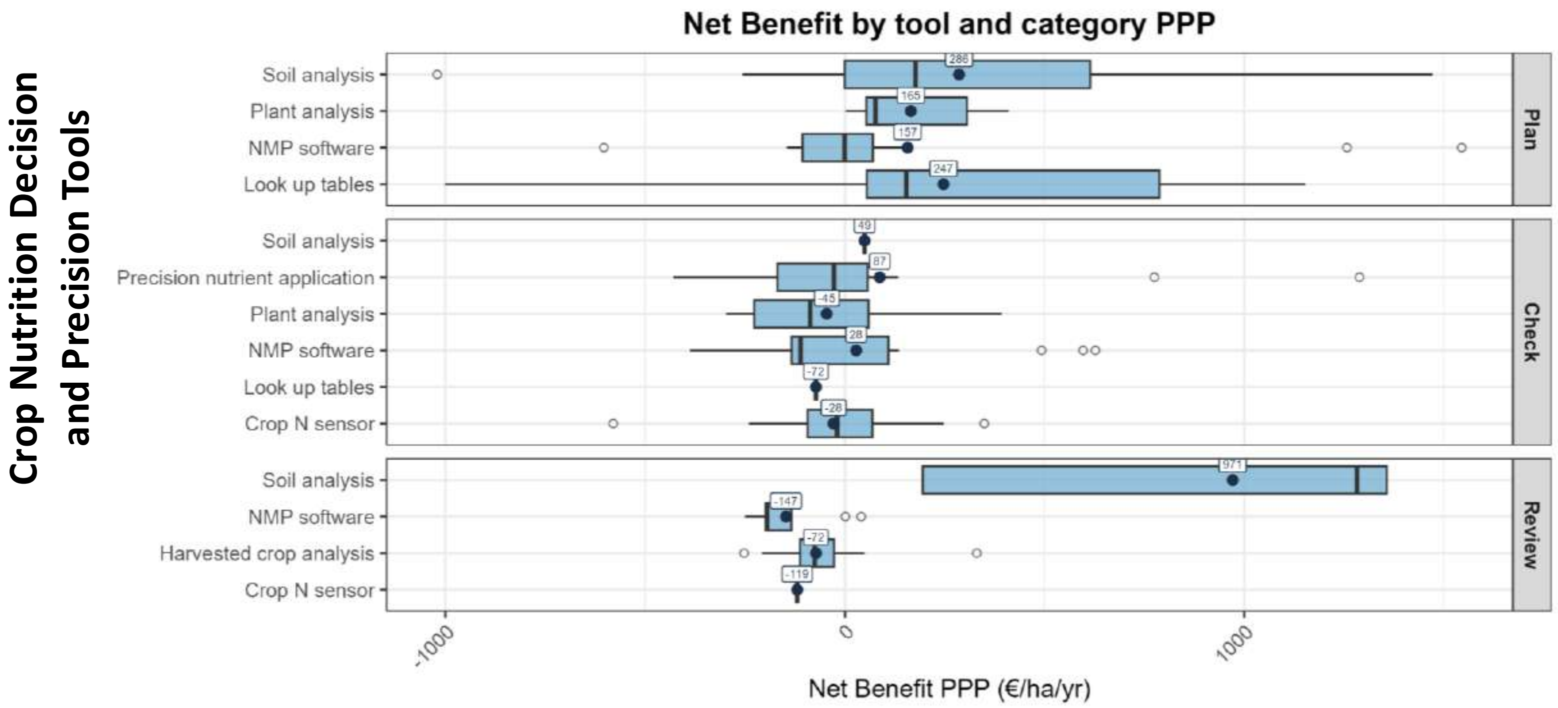


**Figure.** Net Benefit by tool and according to the 3-step crop nutrient management category


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# Results – Quantitative analysis

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**Net Benefit PPP by Tool Category x 3-step approach**

**Plan tools** deliver the most consistent positive returns:

- Soil analysis (~286 €/ha/yr) and Look-up tables (~247 €/ha/yr) lead.
- Plant analysis (~165 €/ha/yr) and NMP software (~157 €/ha/yr) also strong.

**Check tools** show mixed outcomes:

- Precision nutrient application highest (~87 €/ha/yr) but highly variable.
- Some tools negative (Plant analysis –45 €/ha/yr; Look-up tables –72 €/ha/yr).

**Review tools** generally negative:

- Harvested crop analysis (–75 €/ha/yr), Crop N sensor (~–119 €/ha/yr).
- Exception: Soil analysis (~971 €/ha/yr) with extreme variability → context-dependent.

- **Key insight:**
  - Planning tools = most reliable economic benefit.
  - Check & Review tools = variable or negative ROI → need innovation and integration.
  - High variability highlights importance of **farm-specific conditions**.

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# Results – Qualitative analysis

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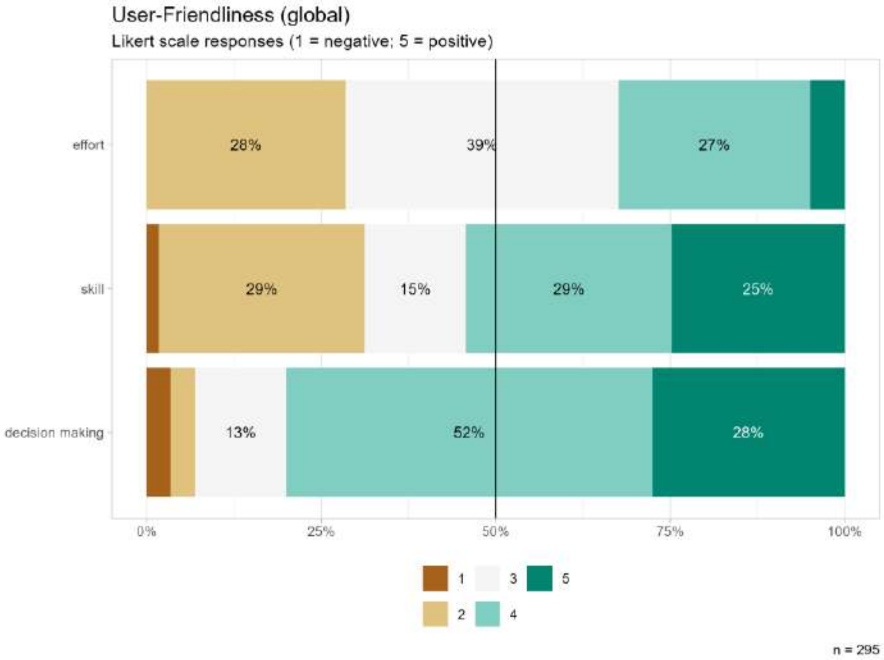


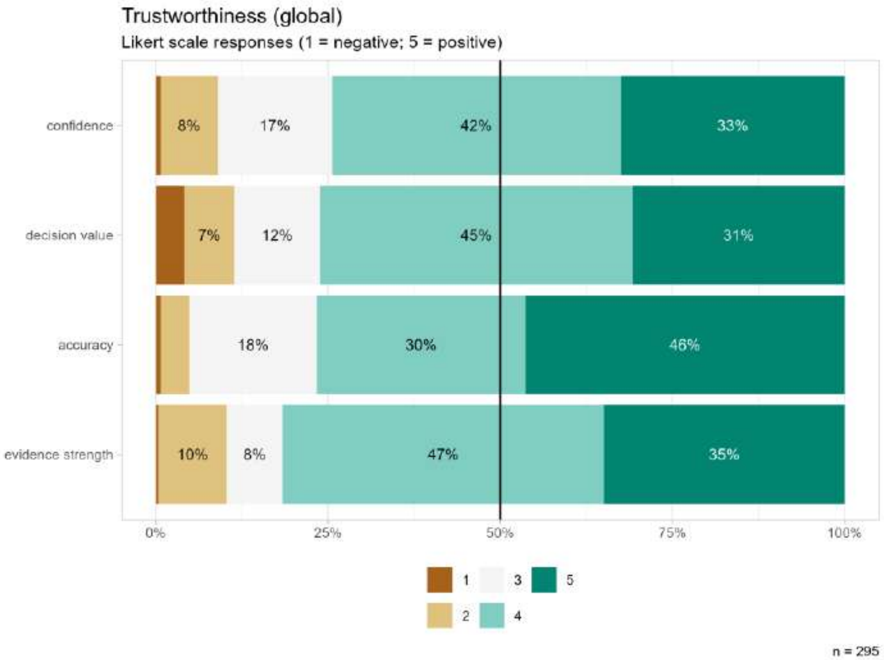



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# Results – Qualitative analysis

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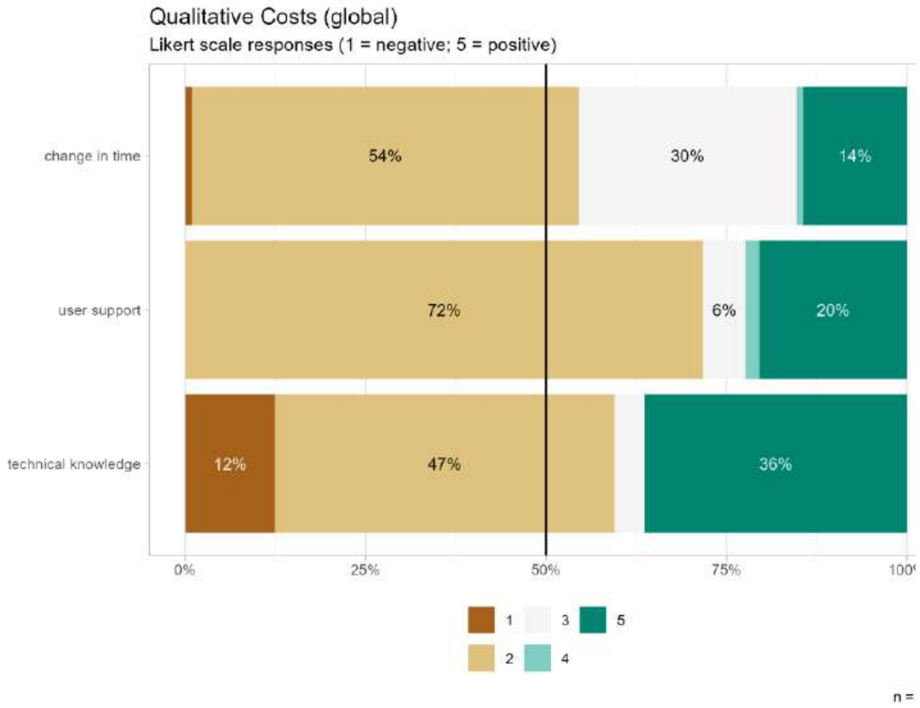


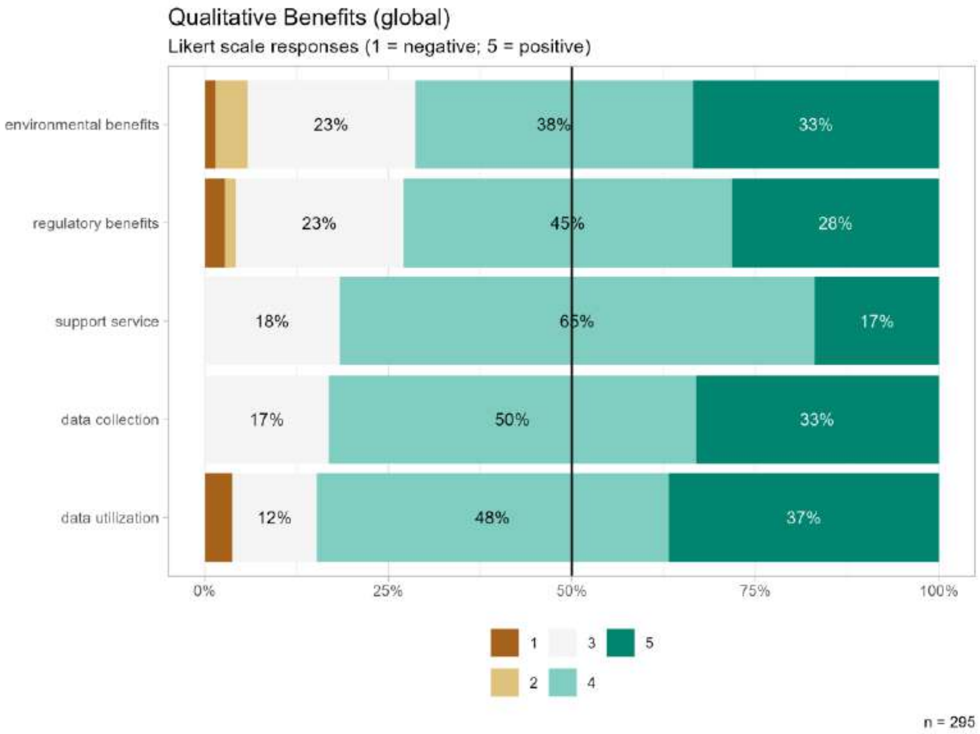


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# Overall Findings

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- "**Soil analysis**" shows the highest overall scores
- "**NMP software**" and "**Plant analysis**" also perform relatively well, especially in Trust and Benefit Quality
- "**Look-up tables**" and "**Precision nutrient application**" occupy an intermediate position
- "**Crop N sensor**" and "**Harvested crop analysis**" display generally lower scores


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# Key Findings

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- Highest economic value lies in the initial “Plan” phase
- Basic strategic tools like “Look up tables” and foundational practices like “Soil analysis” appear to be the most financially rewarding, but without costs of follow-up actions or remediation practices
- High Variability across tool types & countries (investment cost, yield response, nutrient management practices and tool maturity)
- Different incorporation of the costs of follow-up actions or remediation practices
- Potential long-term benefits when tools are used to help decision making on farms:
  - ↑ Nutrient Use Efficiency
  - ↑ Yield potential
  - ↓ Operational costs

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# Observations and conclusions

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- Technology adoption can lead to significant operational and environmental improvements.
- CBA shows that long-term benefits outweigh initial costs for most tools.
- Both quantitative and qualitative factors need to be considered when tools are being developed and when making decisions to invest in tools and technologies
- Planning tools and soil-based tools consistently showed the greatest benefits and were trusted by farmers
- More confidence & trust in the recommendations generated from plant-based tools and crop sensors (Check & Adjust tools) is required by farmers.
- Tools that enable the review of nutrient management actions e.g. grain analysis post harvest, nutrient balance etc. were perceived as beneficial, but require longer time to see benefits
- Most tools require further support for farmers to help with interpretation, trustworthiness and during decision making on resulting actions/practices.

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# Thank You!

*Francesca Degan*

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 14:05 - 14:20 | CO-CREATION OF BEST PRACTICES FOR OPTIMAL NUTRIENT MANAGEMENT ACROSS EUROPE

**JULIE CHRISTENSEN**

SEGES

NUTRI-CHECK NET

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**JULIE CHRISTENSEN**

SEGES

**Senior Specialist at SEGES Innovation in the Department of Crop Nutrition with a PhD in Soil Science from Aarhus University.**

**Work focuses on nitrogen management, including nitrogen requirements and leaching. She serves as Chair of the Danish working group on national nutrient norms.**

**She has extensive experience in applied research within plant nutrition and sustainable crop production.**

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# Co-creation of best practices for optimal nutrient management across Europe

Julie Therese Christensen, PhD

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# Identifying best practices

Aim: to improve precision in crop nutrient management

Focus on: improving NPK fertilization in maize, wheat and potatoes

How: co-creating best practices through a step wise approach with inputs from farmers and expert groups nationally and cross country

Strength: local network, multiple stakeholders, interdisciplinarity and on-the-ground experience – ensuring practical relevance

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# Steps in the co-creation

1. Collection of initial suggestions
2. Co-creation: partner workshop
3. National validation: all national expert groups
4. Online workshop: all countries
5. Final partner approval

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# Step 1: Collection of initial suggestions

300+ submissions narrowed down to 168

- Each of the 10 partner countries submitted at least 7 BP for each of the 3 steps
- Resulted in 334 total entries
- Narrowed down to 168 (several similar ones)


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# Step 2: Co-creation – partner workshop

300+ submissions narrowed down to 168 → Workshop held in Aarhus to prioritize BP

- Physical meeting at SEGES, Denmark with 16 participants across 9-10 partner organizations
- Aim of the event: define criteria and co-develop BPs
- How: grading relevance and applicability
- Outcome: best practices were shortlisted

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# Criterias for best practices

| | | | | | | |
|---|---|---|---|---|---|---|
| Specific tool | ○ | ○ | ○ | ● | ○ | General Practice |
| National | ○ | ○ | ○ | ● | ○ | European |
| Crop Specific | ○ | ○ | ● | ○ | ○ | Broad Application |
| Nutrient Specific | ○ | ○ | ● | ○ | ○ | Broad Application |
| Common Practice | ○ | ○ | ● | ○ | ○ | Innovative Practice |

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# Group work: joint scoring of the unique proposals

- Each group worked on one of the three steps
    - Plan, Check & adjust and Review
- All proposals were scored according to relevance and importance
- Shared in one online file
- Reviewed by the other groups and validation in plenary discussions
- At the end: 21 best practices were chosen

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# Step 3: National validation

300+ submissions narrowed down to 168 → Workshop held in Aarhus to prioritize BP → 21 BP presented to the NEG

- Each country held a meeting with their National Expert Groups (NEG)
- Participants included academics, advisors, companies
  - In total 171 representatives across nine NEG-meetings
- Aim: discus relevance at national level + get feedback from practitioners
- Outcome: country-specific inputs

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# Step 3: National validation – review and scoring

| ID | Best Practice | Score | Step |
|---|---|---|---|
| K | Use weather forecasts to optimize fertilizer application throughout the season. | | |

**Group** BPs in either **Plan, Check&Adjust** or **Review**


**Score** relevance of BPs **1-10**

| Score | Meaning |
|---|---|
| 10 | Critical |
| 9 | Highly Important |
| 8 | Important |
| 7 | Moderately Important |
| 6 | Somewhat Relevant |
| 5 or less | Low Relevance |

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# Working actively in the National Expert Groups

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# Step 4: Online workshop – all countries

1. 300+ submissions narrowed down to 168
2. Workshop held in Aarhus to prioritize BP
3. 21 BP presented to the NEG
4. Online workshop to validate NEGs inputs

- Online validation workshop: 16 September 2025 with representatives from all nine partner countries' NEGs
- Aim: validation of the Best Practices ensuring alignment cross countries and NEGs
- All stakeholder categories were represented in each breakout group (Plan, Check & Adjust and Review)
- All countries actively contributed through prior national workshops
- Input from all nine NEGs was incorporated in the final outcome

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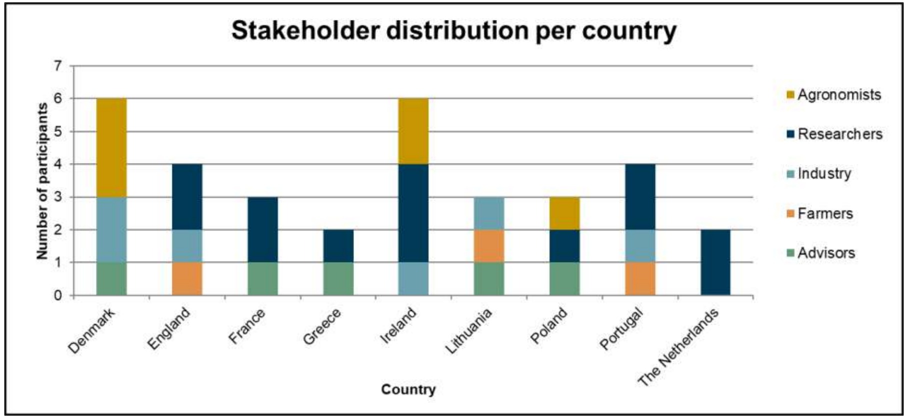
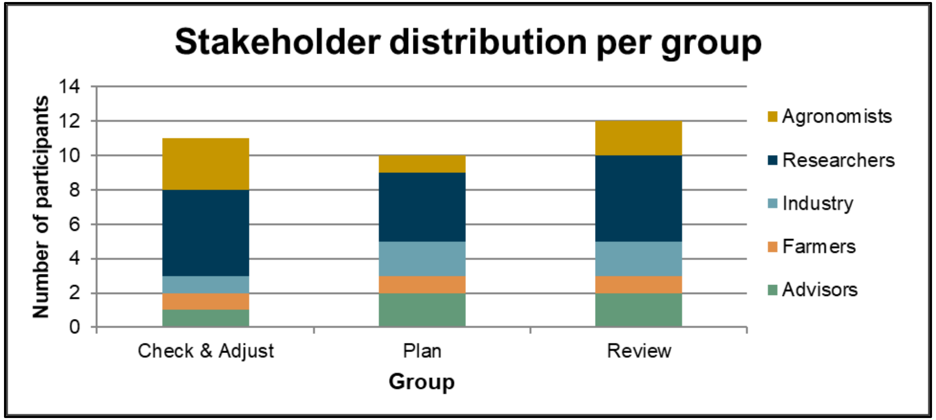
# Step 4: Online workshop – all countries





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# Step 5: final partner approval and 1-pagers

1. 300+ submissions narrowed down to 168
2. Workshop held in Aarhus to prioritize BP
3. 21 BP presented to the NEG
4. Online workshop to validate NEGs inputs
5. Final partner approval – 1 pagers

- **Consolidation**:
  - Final review of shortlist of 21 Best Practices
  - Integrating refinements from the online validation workshop
- **Agreement**
  - Securing partner consensus on the definitive set of practices
- **Next Steps**
  - Outline how the Best Practices would be documented and disseminated

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# Final Best Practices

| Plan |
| --- |
| Perform soil analysis at consistent points in time |
| Understand fertiliser types: match the right type to crop needs across the season |
| Estimate crop nutrient demand |
| Account for nutrient composition of organic materials |
| Account for residual nutrient supply from manure, previous crops and green manures |
| Assess nutrient composition of irrigation water supplies |
| Create a nutrient management plan |
| Calibrate fertiliser and manure spreaders |
| Align fertilization plans with national nitrogen quotas and environmental protection rules |

# Final Best Practices

| Check & Adjust | Review |
|---|---|
| Make use of in-season plant observations and adjust fertilization rates accordingly | Analyse crops nutrient contents |
| Perform in-season observations to review soil conditions and predict nutrient uptake | Record and review yield variability |
| Make use of weather forecasts to optimize in-season applications | Calculate nutrient balances and nutrient use efficiencies |
| Apply manures, fertilisers, sprays and liming materials precisely and on time | Compare results against benchmarks at scales |
| Split nutrient applications where relevant | Endorse collaboration as means of knowledge sharing |
| Review potentially limiting factors before deciding to apply more fertilizer | |
| Record data of fertilizer applications and crop responses, as they occur | |

# Example of 1-pager

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BEST PRACTICE NO.10

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## Use in-season plant observations to adjust fertilisation rates

### WHY

Crop nutrient needs can vary throughout the growing season due to factors such as weather conditions, pest or disease pressures, and unexpected soil variability. By monitoring crop growth, colour, and overall health during the season, farmers can adjust fertiliser applications to match the crop's actual requirements rather than relying solely on pre-season estimates. By responding to visible signs of deficiencies or excesses, or using sensor-based measurements of crop greenness, farmers can better match fertilization to plant needs. This approach helps optimise yield and quality, reduces unnecessary fertiliser use and input costs, and minimises environmental impacts such as nutrient leaching or runoff.

### HOW

In-season adjustment of fertilisation can be achieved through regular monitoring of crop growth and nutrient status. Farmers can walk fields to visually assess crop colour, vigour, and uniformity, looking for signs of nutrient deficiencies or excesses. Tools such as chlorophyll meters, leaf tissue analysis, sap analysis and handheld or drone-mounted sensors can provide quantitative data on nutrient status and overall plant health. Remote sensing and satellite imagery can also help detect variability within and between fields. By combining these observations with information on soil fertility, previous fertiliser applications, and weather conditions, farmers can make informed decisions on the type, rate, and timing of future fertiliser applications. This data can then be used to adjust splitting rates, ideally applying nutrients just before the crop's peak uptake period to maximise efficiency and minimise losses.

### VALUE/OUTCOME

By applying nutrients according to actual crop needs, farmers can optimise growth, yield, and quality while avoiding over- or under-fertilisation. This approach increases fertiliser efficiency, reduces input costs, and minimises environmental impacts such as nutrient leaching, runoff, and greenhouse gas emissions. It also supports precision management by enabling field-specific interventions and allows for early detection of nutrient deficiencies or imbalances, reducing the risk of yield loss. Overall, in-season observation and adjustment of fertilisation help ensure productive, cost-effective, and environmentally responsible nutrient management.

### SUPPORTING TOOLS AND TECHNOLOGIES

BEST PRACTICE NO.10

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### Related Practice Abstract

Direct Plant Observation and Analysis
1.5 – Leaf Analysis to diagnose crop nutrient status
6.5 – Why to use leaf content analysis in starch potatoes
10.9, Plant Counts In-Season Adjustment Frameworks
1.7 – 3 Step Checking – Check and Adjust
7.6 – Smart Agrometer – for adjusting nutrient needs during the growing season
Sensor-Based and Remote Monitoring
2.9, Piloting potato splitting applications of nitrogen fertilization in potato crop
3.2 – Crop sensing technology method to optimize fertilization in wheat
3.3 – Crop sensing technology method to optimize fertilization in potatoes
3.4 – Satellite Crop Monitoring for Maize
7.2 – Nitrogen use efficiency during fertilization based on N sensors
7.7 – Fertilization with N fertilizer based on satellite images

### Related Factsheet

11, Advanced Nutrient Analytical Techniques
12, Crop sensing technology method to optimize fertilization in potatoes
15, Check & Adjust Phase: In-Season Nitrogen Management with crop models and in situ diagnosis for cereals and potato crop

### About this Best Practice

**Authors: Nadja Fuglkjær, Ferdinando Binacchi**

**NUTRI-CHECK NET** is a Horizon Europe multi-actor project establishing a self-sustaining, multi-actor, Thematic Network called "NUTRI-CHECK NET" that builds farm-level adoption of best field-specific nutrient management practices across Europe. In nine countries, farmers' Crop Nutrition Clubs will identify and share the nature of their uncertainties about crop nutrition, their challenges and barriers to change. Decision systems and nutrition tools (including commercial products, services, and recent research outputs) will be assembled by national experts across Europe, including leading farmers, into a common online NUTRI-CHECK NET platform.
Check the project website: https://nutri-checknet.eu

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# Lessons learned and way forward

- The high degree of involvement and collaboration across farmers, advisors, companies and scientists creates robust and practical relevant best practices

- The interactive process have ensured relevance and engagement
  - The approach can be used in future work to improve nutrient management

- We now have 21 Best Practices:
  - Integration into the NUTRI-CHECK NET platform
  - Targeted communication materials

- Shared commitment of all partners to ensure dissemination of the Best Practices as a common European reference for improving nutrient management

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# Thank You!


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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 14:20 - 14:35 | THE NUTRI-CHECK NET PLATFORM

**ALEXANDROS FOURNARAKOS**

AUA

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**ALEXANDROS FOURNARAKOS**
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**Researcher at AUA's Smart Farming Technology Group.**

**Leads projects related to digital agriculture and the uptake of digital tools in the agricultural sector.**

**His work focuses on exploring the needs of actors in the agrifood sector and tailoring digital technologies to their day-to-day practices.**

**Leader of WP 4 - NUTRI-CHECK NET's Platform and Project Coordinator.**

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# THE NUTRI-CHECK NET PLATFORM

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[Platform | NUTRI-CHECK NET]

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 14:35 - 14:50 | USING GREEN NUDGES TO PROMOTE SUSTAINABLE PRACTICES

**NIKOS GEORGANTZIS**
BURGANDY SCHOOL OF BUSINESS

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BURGANDY SCHOOL OF BUSINESS

**Professor of Experimental Economics and Director of the Wine and Spirits Business Lab at the School of Wine and Spirits Business (Burgundy School of Business) in Dijon, France.**

**Studied Economics at the University of Piraeus and he has an MPhil from the University of Wales (UC Swansea) and an MA and PhD from the European University Institute (Florence, Italy).**

**ForestAgriGreenNudge project coordinator.**

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# Using Green Nudges to promote sustainable practices

**Nikos Georgantzis**
***Burgundy School of Business***

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ForestAgri GreenNudge

# ForestAgriGreenNudge

***GREEN NUDGEs for sustainable FORESTry and AGRIcultural practices post 2027***

https://greennudge.eu/

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# Farmers, foresters, all! decision “mistakes”

1. **Wrong/insufficient information**
2. **Decision making biases**
3. **Social dilemma type of situations**
4. **Other (?)**

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# Social science and behavioral interventions. A popular alternative/complement to:

## Legislation

- **Imposing by law:** **Unpopular; political and administrative costs**

## Financial incentives

- **Encouraging (subsidy, bonus):** **Costly; monitoring; moral hazard**
- **Discouraging (taxes, fines):** **Unpopular; administrative costs**

**But, in any case, nudging may coexist with all the types of intervention through regulation and economic (dis) incentives.**

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# A nudge is:

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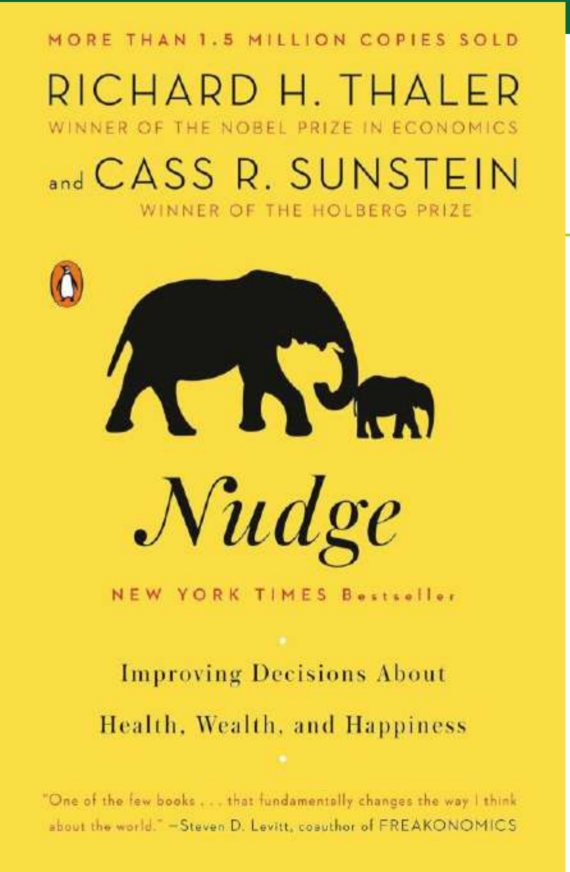


Thaler and Susntein (2008), *Nudge: Improving Decisions About Health, Wealth, and Happiness.*

# The origins of the term

*Nudge (the book)* is about how we make choices and how we can make better ones.

The authors show that no choice is ever presented to us in a neutral way, and that we are all susceptible to biases that can lead us to make bad decisions.

But by knowing how people think, we can use sensible "choice architecture" to nudge people toward the best decisions.

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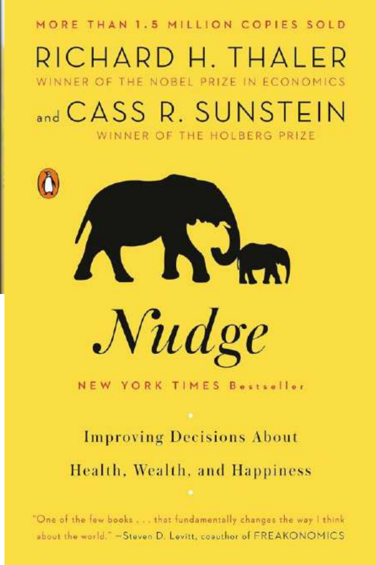
# "Nudge" ("prime"), "una spinta leve", "un empujoncito ligero", "παρότρυνση", "coup de pouce", ...other?

We are all susceptible to biases that can lead us to make bad decisions.





*Nudge (the book)* is about how we can make better decisions.

We can use sensible "choice architecture" to nudge people toward the best decisions.

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# How/why do nudges work?

They may activate:

1. **System 1:** Concerning nudging aiming at automatic reactions to external stimuli, usually unconscious and decision-time/context dependent, thus not participatory or co-created. Necessarily manipulative?
2. **System 2:** Leads to reflection and conscious awareness on own possible biases, the importance of the action for you, the world, society, your own family, appealing to one's own values and inbuilt "goodness".

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# Adressing,  using, mitigating decision “mistakes”

1. **Wrong/insufficient information**

   **How?** Informational nudges (always reliable, correct information)

2. **Decision making biases**

   **Attention!** Some nudges may USE the bias (**Anchoring** on default options reduce the cost/complexity of a decision) while others may aim at mitigating the bias (**Ambiguity aversion** is reduced with knowledge of risk/probability of a negative or a positive event)

3. **Social dilemma type of situations**

   Activating the **“other-regarding component”** in a person’s preferences (reducing selfish and encouraging pro-social/pro-environmental considerations).

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# In general, a nudge

## Could:

- Be informative
- Appeal to cultural, social and personal values of the decision maker
- Use aesthetic and visual tools to prime nudgees (example: “Green”)
- Help nudgees reflect in the right direction

## Should not:

- Be manipulative
- “Infantilise” (gamification?) the decisionmaker
- Instruct or order nudgees
- Create shame or regret
- Mislead
- Confuse, offering useless information

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# However, several factors **hinder the success of nudges EVEN when System 2 is activated**:

For example:

1. Information may lead to the contrary outcome ("*Now that I know what this means I do not want to do it*")
2. Information avoidance ("*I do not want to know*" or "*I do not want to be convinced to change*")
3. First order (me) and second order (others) beliefs on Nudge (in)efficiency ("*This will not work for me*", "*This will not work for the others*")
4. Regret aversion ("*I do not want to be shown [or admit] that I have been making a mistake*", "*Why change? I prefer myself the way I am*")

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# In our project, a Green Nudge is:

***An intervention in farmers' and/or foresters' decision-making "choice architecture" (**framing of a problem, information available, presentation, *etc.*) **which favours in a systematic and predictable way the adoption of sustainable practices, without modifying the economic incentives, nor reducing the decision-makers' choice set, thus preserving their freedom of choice.***

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| Objectives | Outcomes and lasting impacts |
|---|---|
| **Objective 1**:<br>**Identify Green Nudges**<br>**…even when initiatives were not aware!** | **IMPACT 1:** Multi-actor stakeholders are aware of Green Nudges and have access to information about Best Practice of their application.<br>**Outcome 1**: Green Nudges contribute to practitioners' transition to sustainable practices |
| **Objective 2**:<br>**Test innovative Green Nudges and improving practitioner's self-regulatory capacity** | **IMPACT 2:** Increased research into development of novel nudges and implementation, and integration into the evaluation grid. Nudgees self-regulate behaviour in response to Green Nudges.<br>**Outcome 2**: Innovations along value chains nudge practitioners towards sustainable practices, and new Green Nudge polices are designed |
| **Objective 3**:<br>**Scale up access to and uptake of Green Nudges** | **IMPACT 3:** Green Nudges are selected and embedded into policy development and implementation at European and national scales.<br>**Outcome 3**:<br>Nudging solutions provided to policy makers, and Green Nudges are used in relevant policies |

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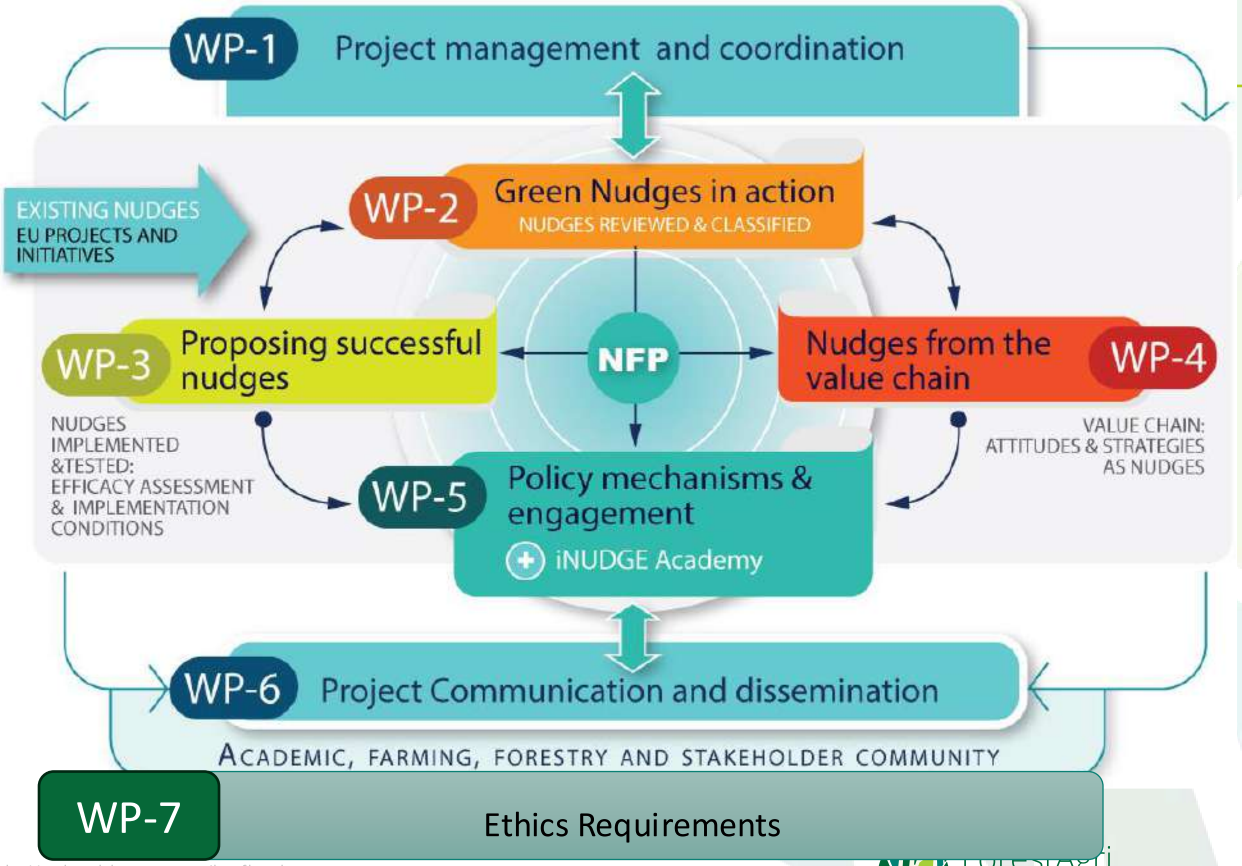
# Work Package structure

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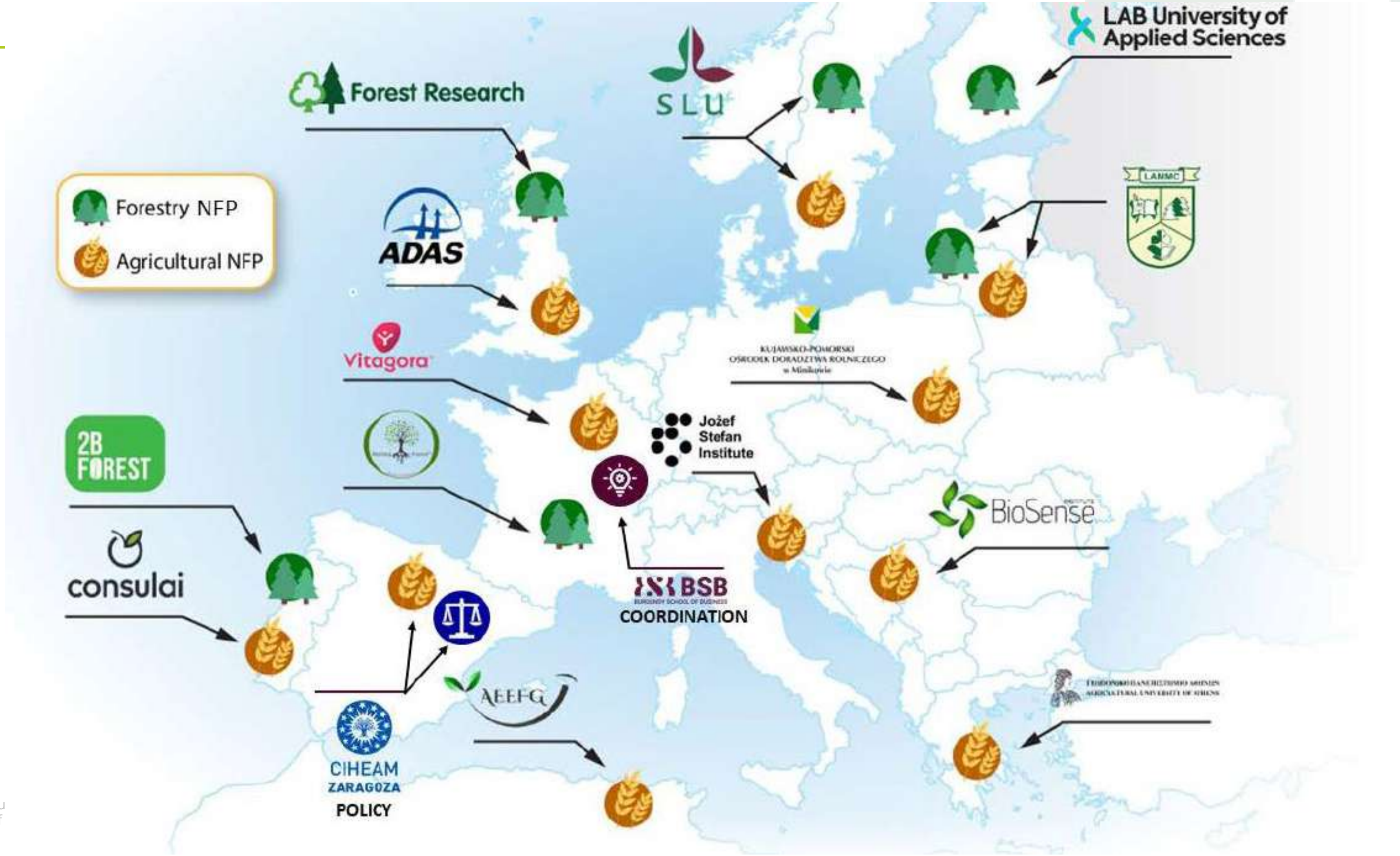
# Partner roles and geographical scope

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# Relevance/assessment factors in our project

We have committed to several standard principles:

**Efficacy** Nudges must work, bringing the desired change

**Efficiency** Nudges must not be too costly for any of the parties involved in comparison to the outcome obtained

And our project-specific novelty:

**Co-Par** Co-creation-Participation by the target population

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# A practical classification of decision-makers' motivation to Co-Par in nudging towards change

1. **I do not want to change, because I am fine as I am**
    1. Information avoidance, blocking nudges, negative attitude
    2. Ok, maybe I listen to the nudge, but I have a commitment (past investments, large farm, contracts) that makes it impossible to change (now)
2. **I (may) want to change, …**
    1. …but I want to make sure it is good for me
    2. …even if I end up sacrificing part of my profits
        1. …provided that more people do the same
        2. …unconditionally (after all we may gain in image and give a good example to the others)
3. **I may decide that I want to change, after I expose myself to the nudge**

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# First Green Nudge conference: 21/05/2025 next is being planned for May 2026, Brussels

## …Welcome!

OUR SITE:

- https://greennudge.eu/

OUR VIDEO:

- https://youtu.be/U7mUSIK4obg?si=D3hJbeF2Z9uxYp_j

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# Thank you!

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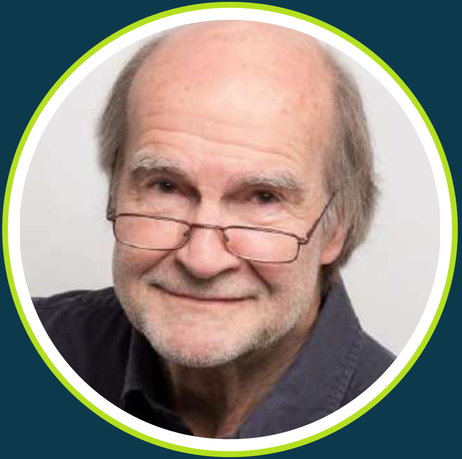
**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 14:50 - 15:05 |THE ROLE OF POLICY IN SCALING BEST PRACTICES



**LUDWING HERMANN**
PROMAN

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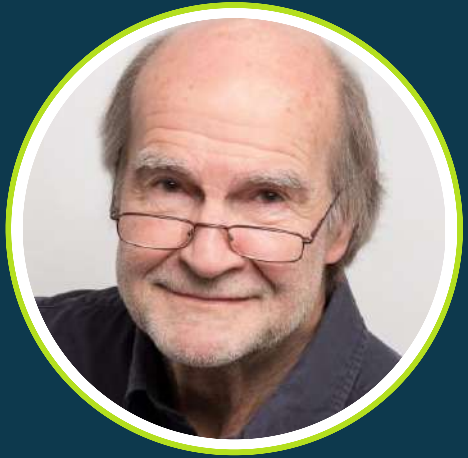
**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**



**LUDWING HERMANN**
PROMAN

**Co-founder and former CEO of ASH DEC Umwelt AGworking with over 35 years' experience as a technology, sustainability and innovation manager.**

**He currently works as a senior researcher and advisor at Proman Management GmbH in Vienna and serves as secretary and board member of the European Sustainable Phosphorus Platform (ESPP) in Brussels.**

**He sits on the Steering Committee of the IWA Resource Recovery Cluster in London and is a member of expert groups focusing on climate, soil and water protection, and the extraction and management of critical raw materials and NORM residues, representing the European Commission, the IAEA, the UNECE and the UN Environment Programme.**

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# NutriBudget - Optimisation of Nutrient Budget in Agriculture

## The role of policy in scaling best practices

Ludwig Hermann, Julia Tanzer, Gabriele Sacchettini (RISE)

Proman Management GmbH

# PROJECT OVERVIEW

NutriBudget

**NUTRIBUDGET** – www.nutribudget.eu

*The Horizon Europe NutriBudget project is developing NutriPlatform, an innovative decision-support tool (DST) for integrated nutrient management. The platform will help identify agronomic and policy measures to implement and assess their impact at both farm (for farmers) and regional to European levels (for policymakers).*

Related to the policy and market uptake for nutrient recycling

**Main objectives:** To develop policy recommendations on the legal and economic aspects of nutrient management

**To be disseminated through:**
- Speakers at conferences
- Workshop in Brussels
- MEP bilateral briefing
- Policy brief
- Specific briefing at the MS/EU level

# POLICIES AND PATHWAY TO MARKET

Project results:

- Legal assessment
- Transformation roadmaps
- Environmental and agronomic assessment
- Experiences from pilot site experiments incl. real costs for farmers
- Feedback from co-creation workshops

Focus on

- CAP
- Environmental regulations / directives
- Carbon farming, EU ETS

Disseminated through

- Conferences
- Workshops
- Bilateral briefings

Aim

- Remove regulatory and financial barriers
- Reward farmers for ecosystem services and transition to efficient nutrient management
- Advocate for policymaking that is based on clear, evidence-based arguments

# SUCCESSFUL ASPECTS AND BOTTLENECKS IDENTIFIED

**Successful Aspects**

- Research-driven approach: Science-based results.
- Co-creation focus: Collaborative and inclusive.
- Strong consortium: Diverse stakeholder representation and extensive networking potential.
- Well-timed alignment in EU policy

**Bottlenecks Identified**

- Time constraints: Balancing research outcomes with timely policy recommendations.
- Policy constraints – lack of a clear industrial EU policy
- Budget limitations: Insufficient resources to fully realize objectives.
- Cooperation with other EU projects and initiatives.
- Stakeholder engagement: Ensuring effective and meaningful participation.

# European Green Deal [1]

- *Farm-to-Fork Strategy* [2]
- *Biodiversity Strategy* [3]
- *Chemicals Strategy* [4]
- *Zero Pollution Action Plan* [5]
- *Circular Economy Action Plan* [6]

The Green Deal states that "*legislation to stimulate the market for secondary raw materials with mandatory recycled content*" is possible.

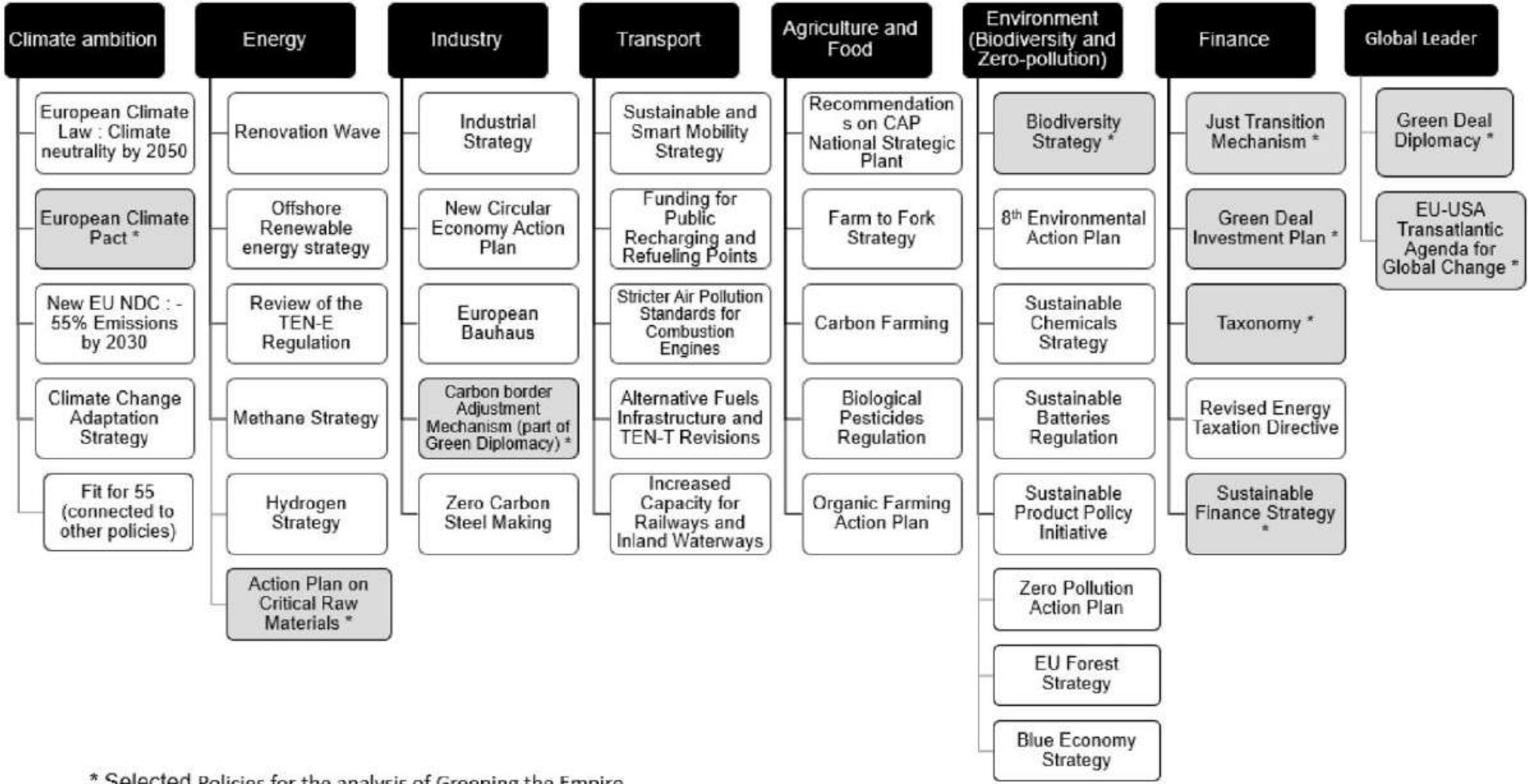

1 = COM(2019)640 https://ec.europa.eu/info/files/communication-european-green-deal_en
2 = COM(2020)381, 20th May 2020 https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1590404602495&uri=CELEX%3A52020DC0381
3 = COM(2020) 380 final, 20th May 2020 https://ec.europa.eu/environment/nature/biodiversity/strategy/index_en.htm
4 = COM(2020)667, 14/10/2020 https://ec.europa.eu/environment/pdf/chemicals/2020/10/Strategy.pdf
5 = https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12588-EU-Action-Plan-Towards-a-Zero-Pollution-Ambition-for-air-water-and-soil/public-consultation
6 =11/3/2020 https://ec.europa.eu/environment/circular-economy/

# Farm-to-Fork Strategy Com(2020) 381 final, 20.05.2020

## Direct Impact on Nutrients – Fertiliser Use

- Mitigate soil, air and water pollution by increasing nutrient use efficiency (NUE)
  - By reducing nutrient losses by 50% by 2030, leading to using 20% less by 2030
  - By developing an integrated nutrient management plan (COM & Member States)
  - By having 25% of EU agricultural land under organic farming by 2030
- Bio-based fertilisers for organic farming under evaluation
- New green business models (e.g. carbon farming)
- Circular, bio-based economy focusing on nutrient recovery & recycling

# European Green Deal – Set of Derived Policies (Vela Almeida et al., 2023)




* Selected Policies for the analysis of Greening the Empire

# Circular Economy Action Plan

## 2014 EU Consultative Communication on Sustainable Use of Phosphorus

Proposals include increasing knowledge and research, P-recycling, risk of soil contamination by mineral or recycled fertilisers
[www.phosphorusplatform.eu/scope107](www.phosphorusplatform.eu/scope107)

**Joint statement on the EU Fertilising Products Regulation**

*20th November 2017*

Our organisations jointly underline the importance of addressing a number of **important outstanding issues in the proposed EU Fertilising Products Regulation**, including those indicated below. Not all of our organisations are directly concerned by all of the points listed, but we consider that they require attention to achieve a final regulatory text which is workable in implementation, which will facilitate innovation and development of the nutrient circular economy and nutrient stewardship, whilst ensuring the protection of farmers, consumers and the environment.

The signatories call the co-legislators to **conclude this important dossier rapidly**, because implementation is strongly awaited by industry and stakeholders to develop the Circular Economy, whilst **ensuring dialogue** with industry and operators to **ensure that the final text is functional**.

## 2015: EU Circular Economy Package
## 2020: EU Circular Economy Action Plan

11/3/2020 [https://ec.europa.eu/environment/circular-economy/](https://ec.europa.eu/environment/circular-economy/)

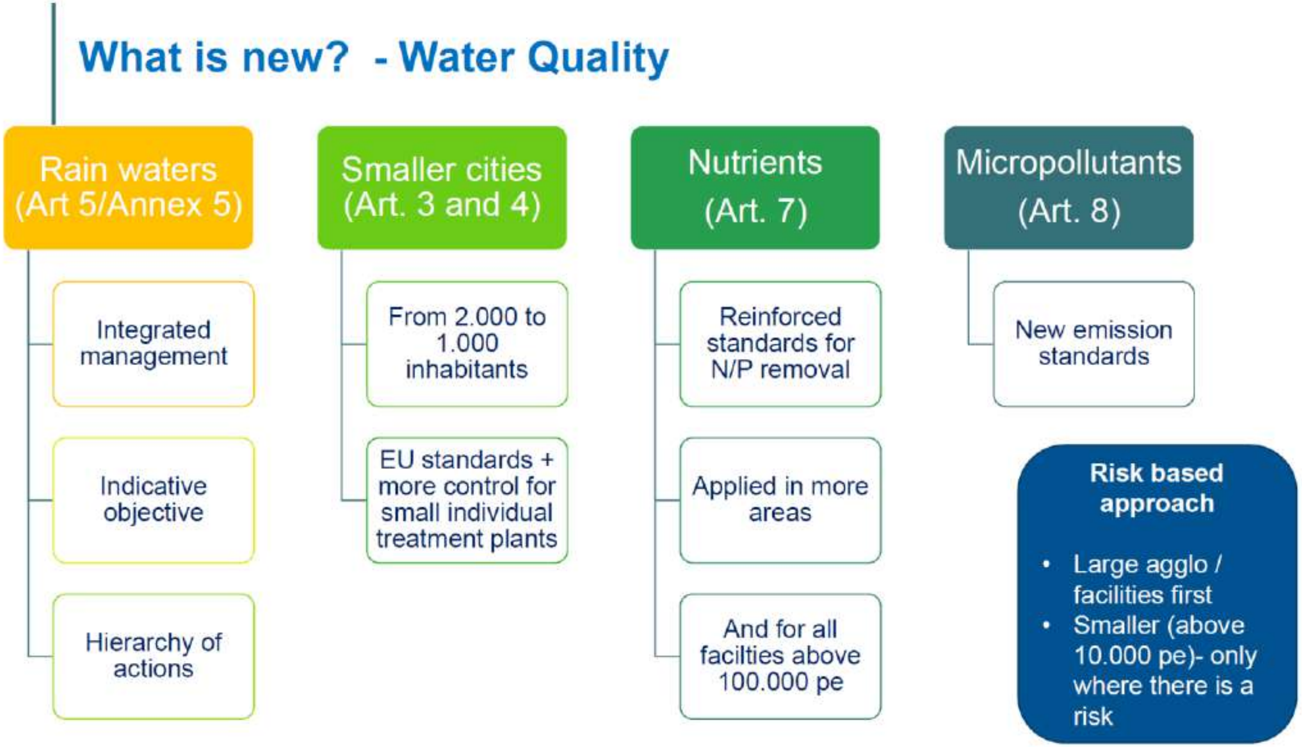

1 August 2025 - Directorate-General for Environment

## Commission launches consultation and call for evidence for upcoming Circular Economy Act

The feedback period was open until 6 November 2025.

# EU Urban Wastewater Treatment Directive (EU) 2024/3019

(Enacted 1st January 2025)




More stringent discharge limits for phosphorus and nitrogen (Annex I)

- 0.5 mg $P_{tot}$/l or 90% P removal (*was 1-2 mg/l or 80%*) for WWTPS >10 000 PE
- 6 mg N/l or 85% N removal (*was 10-15 mg/l or 70-80%*) for WWTPS >10 000 PE
- in eutrophication sensitive areas and for WWTPS >100 000 in on-sensitive areas.

# European states with P-recycling obligation

## *Switzerland*

2016 VVEA (waste ordinance, Art 15, and new waste act 2024 makes
**phosphorus recycling become obligatory by 2033**
from sewage sludge incineration ash* and meat and bone meal ash
* Switzerland banned land use of sewage biosolids in 2006

## *Germany*

AbfKlärV 2017 (sewage sludge regulation):
**phosphorus recycling from sewage becomes obligatory**
- by 2029 / 2032 years for all WWTPs > 100 000 P.E. / > 50 000 P.E. if sewage sludge P > 2% of dry matter

## *Austria*

2024 AVV Abfallverbrennungsverordnung 2024
**phosphorus recycling becomes obligatory by 2033**
for WWTP >20 000 P.E. from sewage sludge (>60% recovery) or sludge ash (>80% recovery)
Under consideration in other countries (e.g., Denmark) and EU (UWWTD 2024/3019)

***https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12328-Evaluation-of-the-Sewage-Sludge-Directive-86-278-EEC-/public-consultation***

# Fertilising Products Regulation (EU) 2019/1009 enforced 16th July 2022

- Flagship of the European Commission's first circular economy package
- Covers all "fertiliser products": fertilisers (mineral, organic/mineral and organic), plant materials, by-products of the food industry, composts, digestates, soil conditioners, growing media, bio-stimulants, lime materials, etc.
- First EU product legislation that defines end-of-waste status across the EU
- Opens a harmonised EU market for recycled fertilisers and recycling technologies
- FPR compliance not mandatory - national fertilisers can still be defined and sold - both CE marked fertilisers and national fertilisers will be available on future markets
- Since entry into force, 5 additional component substances (CMC 11, 12, 13, 14, 15) have been included, including precipitated phosphate salts (e.g. struvite), ash derivatives (e.g. RevoCaP), biochar (not yet from sewage sludge), phosphorgypsum, ammonium salts, etc.
- Many other component substances are currently being tested for inclusion as CMCs

https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02019R1009-20240703

# Successful Agri-Environmental Programme "ÖPUL (1)

Breakdown for Austria's **ÖPUL (Agri-environmental Programme) as part of the 2023–2027 CAP Strategic Plan**:

**Funding Structure for ÖPUL**

- **Overall Budget**
  ÖPUL (excluding eco-schemes) receives approximately **€574 million annually** (average 2023–2027), which *includes* about **€100 million per year for eco-schemes**. (BMLUK)
- EU CAP Share = 58% of the total Austrian ÖPUL Budget
- **Eco-schemes**
  These measures (Article 31) are financed **100 % by EU funds**. (BMLUK)
- **All other ÖPUL measures (excluding eco-schemes)**
  These are financed approximately:
  - **50 % by EU funds** (via CAP; EAGF and/or EAFRD)
  - **50 % by Austrian national funds**, split between:
    - Federal government – 60 %
    - Provincial (Länder) authorities – 40 % (BMLUK)

**Farmers prefer to be funded for measures rather than outcomes.**

# Successful Agri-Environmental Programme "ÖPUL (2)

**Non-eco measures in ÖPUL 2023–2027** – i.e. those agri-environmental and animal welfare measures that are **not considered fully EU-funded eco-schemes**, but are implemented in the form of agri-environmental measures (EAFRD, Art. 70 Regulation (EU) 2021/2115) and are co-financed **50% by the EU and 50% by Austria (federal government & federal states)**:

| Measure / Supplement | 2023 (€/ha) | 2024 (€/ha) | 2025 (€/ha) |
|---|---|---|---|
| Regenerative agriculture – basic premium | 70.00 | 75.60 | 85.00 |
| Organic farming – basic premium | 205.00 | 221.40 | 235.00 |
| Arable biodiversity areas (supplement) | 70.00 | 75.60 | 140.00 |
| Sunflowers (supplement) | 50.00 | 86.40 | 86.40 |
| Multi-purpose hedge (supplement) | 800.00 | 1 000.00 | 1 000.00 |
| Grassland biodiversity (supplement) | 50.00 | 54.00 | 100.00 |
| Education/advice (supplement) – Groundwater protection arable land | 30.00 | 60.00 | 60.00 |
| Species-rich grassland with slope (supplement) | 150.00 | 262.00 | 262.00 |
| Non-productive arable land | – | – | 350.00–450.00 €/ha |
| Agroforestry strips | – | – | 600.00–800.00 €/ha |

# Carbon Farming Business Models – DOWNFORCE Technologies

## Client: Grain trader in the UK

**Structure**: Customers / offtakers of the grain provide money into a “natural capital marketplace” fund.

**Farmer revenue**: Per/ha payment to participating farmers to change to more regenerative practices.

**MRV**: Downforce monitors the fields covered by the programme for annual soil carbon performance.

**Objective:** Incentivise large-scale regenerative transition to enhance soil health and carbon co-benefits.

## Client: Specialty barley producer in AUS

**Structure**: Maltster offtaker pays a premium for the barley from that producer due to certified SOC outcomes.

**Farmer revenue**: Per/kg premium due to the farm’s verified net zero GHG inventory.

**MRV**: Downforce monitors the whole farm for annual soil carbon performance and works with the farm togather emissions data for net GHG accounting.

**Objective**: Reward net emissions reduction outcomes from farm-level production which flow through the value chain.

# Useful sources for information

| Questions | Source of information |
| --- | --- |
| Regarding the Fertilising Products Regulation (EU) 2019/1009 | FAQs related to Regulation (EU) 2019/1009 on fertilising products (the 'Fertilising Products Regulation') |
| Regarding labelling of fertilising products | Guidance document labelling of EU fertilising products |
| Regarding the conformity assessment (CE mark) | NANDO Database: https://CE.europa.eu/growth/tools-databases/nando/index.cfm?fuseaction=na.main |
| Regarding market and prices | https://www.agrarheute.com/markt/duengemittel/duengerpreise-stickstoffduenger-billiger-bauern-koennen-sparen-619561 |


And through **ESPP www.phosphorusplatform.eu**

# Related events and workshops


**Forum For the Futur of Agriculture 2026**

Since 2009, the premier meeting place in Brussels to debate sustainable agriculture and environmental challenges, attracting diverse stakeholders, from international institutions to farmers, NGOs, and businesses (https://forumforag.com/).

NutriBudget

European Sustainable Phosphorus Platform

ESNI

Forum for the Future of Agriculture®

# Conclusions

- Transition is largely policy driven
- CAP and national measure-oriented support schemes are largely successful
- Revenues for carbon sequestration is an artificial market created by politics
- However
  - Carbon farming is not yet pursued by farmers
    - due to soil sampling efforts and costs
    - revenue uncertainty
    - complexity
  - However, efforts and big data may change farmers' attitude
- Other artificial market, e.g. "BIODIVERSITY" may be needed

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# Thank you!

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https://www.proman.pro

https://www.nutribudget.eu/

NutriBudget

# 15:05 - 15:15

# Q&A

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

# 15:15 - 15:35

# COFFEE BREAK

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 15:35 - 16:40 | SESSION 4: HORIZON EUROPE SHAPING CROP NUTRIENT MANAGEMENT

**ALEXANDROS FOURNARAKOS**
AUA

**SARA JOHANSSON**
EEB

**CHARLOTTE LYBAERT**
SOIL SERVICE OF BELGIUM

**ANNA BAGÓ**
UNIVERSITAT CATALUNYA

**NICOLAS PLUMERÉ**
TUM

**ANNE SCHNEIDER**
TERRES INOVIA

**GEORGIOS CHARVALIS**
NEUROPUBLIC

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FINAL CONFERENCE | Steps to Optimise Crop Nutrition | 18th November 2025 | Brussels & Online

## 15:35 | HORIZON EUROPE SHAPING CROP NUTRIENT MANAGEMENT - INTRODUCTION

**ALEXANDROS FOURNARAKOS**
AUA

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**ALEXANDROS FOURNARAKOS**
AUA

**Researcher at AUA's Smart Farming Technology Group.**

**Leads projects related to digital agriculture and the uptake of digital tools in the agricultural sector.**

**His work focuses on exploring the needs of actors in the agrifood sector and tailoring digital technologies to their day-to-day practices.**

**Leader of WP 4 - NUTRI-CHECK NET's Platform and Project Coordinator.**

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# Horizon Europe


- EU's flagship funding programme.
- Running from 2021 – 2027, with a budget of 93.5 billion.
- Aims to fund collaborative projects in a multitude of sectors, to support the **UN's Sustainable Business Goals**.
- Is split in **six clusters:** Cluster 6 (Food, Bioeconomy, Natural Resources, Agriculture, environment).

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# How will Cluster 6 make a difference?

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- Climate neutrality
- Biodiversity  restoration
- Sustainable and circular management and use of natural resources
- Food and nutrition security
- Rural, coastal and urban areas are developed in a sustainable, balanced and inclusive manner
- Innovative governance models enabling sustainability and resilience

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# Cluster 6: Destinations

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- Biodiversity and Ecosystem Services
- Fair, Healthy and Environment-Friendly Food Systems from Primary Production to Consumption
- Circular and Bioeconomy Sectors
- Clean Environment and Zero Pollution
- Land, Oceans and Water for Climate Action
- Resilient, Inclusive, Healthy and Green Rural, Coastal and Urban Communities
- Innovative Governance, Environmental Observations and Digital Solutions in Support of the Green Deal

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# Thank You!

***Alexandros Fournarakos***

a.fournarakos@aua.gr

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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

## 15:40 - 15:50 | INNOVATIVE GOVERNANCE MODELS TO BOOST NUTRIENT RECYCLING

**SARA JOHANSSON**

EEB

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NENUPHAR

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

**SARA JOHANSSON**

EEB

**Senior Policy Officer for Water at the European Environmental Bureau (EEB).**

**The EEB is a network of environmental civil society organisations with over 190 member organisations in 41 countries.**

**At the EEB, Sara's work focuses on water protection, including implementation of the Water Framework Directive and the Nitrates Directive as well as the roll-out of the Water Resilience Strategy.**

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OPTIMISING CROP NUTRITION

NENU PHAR

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Nutrients recycling and pollution handling

# Nutri-check Final event
# 18 November 2025


## Sara Johansson
European Environmental Bureau

Sara.Johansson@eeb.org


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# Introduction to NENUPHAR project

New governance solutions and value chains addressing the recovery of **nitrogen (N) and phosphorus (P)** from three key waste streams with a high nutrient load and widely present in the EU: manure, sewage sludge, and dairy wastewater.

Four main innovations will be addressed:

- Methodology to estimate N/P emissions from fertilizer application.
- **New governance models.**
- Innovative economic and financial incentives for public and private entities.
- A set of technologies to treat manure, sludge, and dairy wastewater and recover nutrients.



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# Introduction to NENUPHAR project

November 2023

April 2027




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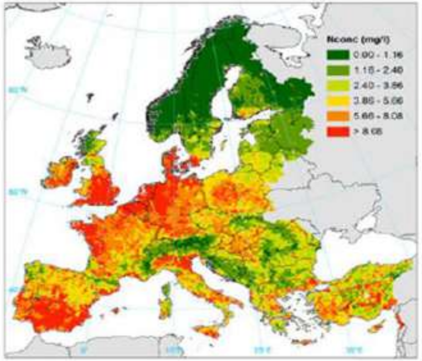
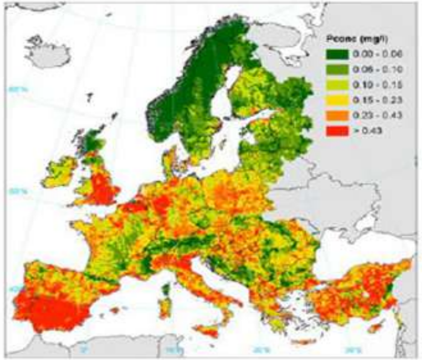
# Introduction to NENUPHAR project

Wastes

- animal manures  1,400 million tons per year in EU
- sewage waste (sludges)  9 millions tons (dry matter) per year in EU
- food chain waste (dairy wastewaters)  926 million $m^3$ per year in EU

2-5 Mt of N
0.6 Mt of P




Grizzetti, B., Pistocchi, A., Liquete, C. *et al.* (2017) Human pressures and ecological status of European rivers. *Sci Rep* 7, 205.

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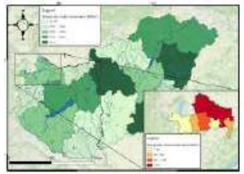
# Introduction to NENUPHAR project

**Main demosites**

- animal manures → **SPAIN**
  - River basin → Ebro
  - Drainage sea → Mediterranean Sea
  - Tech → Ammonia stripping

- sewage waste (sludges) → **LATVIA LITHUANIA**
  - River basin → Lielupe
  - Drainage sea → Baltic Sea
  - Tech → Composting


- food chain waste (dairy wastewaters) → **HUNGARY SLOVAKIA**
  - River basin → Danube
  - Drainage sea → Black Sea
  - Tech → 1. Membrane with pre-oxidation
    2. Nature-based solution



**Followers**

**DENMARK** →
Drainage sea → Baltic Sea
Waste → Sludge, manure and wastewater

**CYPRUS** →
Drainage sea → Mediterranean Sea
Waste → Sludge and wastewater



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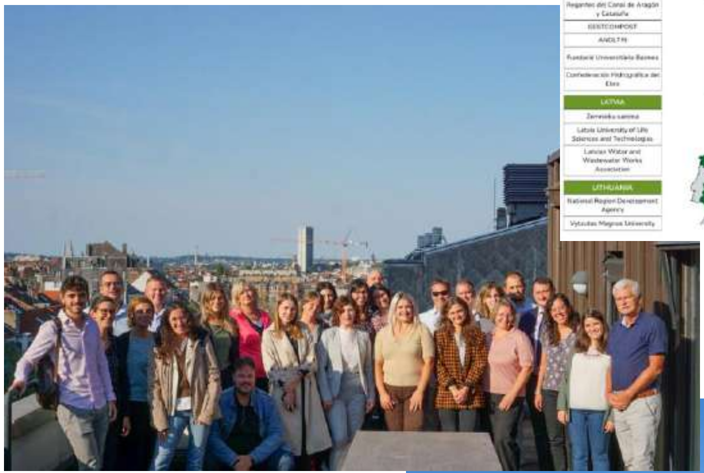
# What is the NENUPHAR project (1)

- Focus:
  - Nutrient pollution and recycling
  - Circular economy
  - Protect aquatic ecosystems
  - Support farmers

- Objectives:
  - Establish advanced technical solutions
  - Develop scalable governance models

- Regions: **10 European** countries across Mediterranean, Central/Eastern Europe and Baltics




# What is the NENUPHAR project (2)


The purpose of this project, which brings together 21 separate expert entities across 10 EU countries, is to **address the currently unsustainable levels of nutrient pollution** across Europe.

Today, **nutrient pollution is at the root of major challenges to nature** (particularly aquatic ecosystems), **drinking water, people's health, and the future sustainability of farming** and fishing - the the millions of livelihoods that these sectors represent.

Embracing all relevant stakeholders, NENUPHAR is undertaking **demonstration and replication cases across three European regions** (and seven countries) involving novel **technical solutions** to improve the **management and recycling of nutrients** in the European food chain. In addition, it is developing comprehensive **governance models** that will support the **upscaling of technical solutions at the wider European level**.



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# Introduction to NENUPHAR project

**Website**
Join our Community of Interest
& register to our newsletter

**Social media**

- LinkedIn
- BlueSky
- Youtube



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# Water Framework Directive

**Objective**

- Good status of Europe's waters by 2015, or 2027 at the latest

**Current status**

Member States are far from delivering on their legal obligations to bring Europe's waters to good status, undermining Europe's water resilience.

- Less than 40% of surface water bodies in good or high ecological status
- 32% of groundwater bodies are under pressure from agricultural pollution

**Agriculture is the most significant pressure impacting both surface and groundwaters**

- Pollution from intensive use of nutrients and pesticides
- Water use: agriculture is the highest net water consumer in Europe

**Source**: EEA, Europe's state of water 2024



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# Closing the implementation gap

- November 2025: the Commission launches **Structured Dialogues** with Member States
  - Aim to identify implementation hurdles and achieve a political commitment to overcome them

- Member States need to finalise the **next (4th) River Basin Management Plans** by the end of 2027
  - After 2027 Member States will have limited scope to justify failures to achieve good status

**6-year management cycles**

| Management cycle/ Update | Period | Deadline for publication |
|---|---|---|
| 1st cycle | 2010-2015 | 22 December 2009 |
| 2nd cycle/ 1st update | 2016-2021 | 22 December 2015 |
| 3rd cycle/ 2nd update | 2022-2027 | 22 December 2021 |
| 4th cycle/ 3rd update | 2028-2033 | 22 December 2027 |
| 5th cycle/ 4th update | 2034-2039 | 22 December 2033 |
| ... | ... | ... |

**Source**: ClientEarth (2023), Key deadlines under the Water Framework Directive



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# Nitrates Directive

**Ongoing evaluation**

- Assessing effectiveness, efficiency, coherence, relevance, and EU added value
- Conclusion expected in the beginning of 2026

**Manure limit** (170 kg N/ha, year)

- Derogations coming to an end: DK won't renew, NL and IE likely to re-apply
- Spring 2024: EC draft act **allowing the application of processed manure (RENURE)** above the current manure limit, currently under scrutiny by EP and Council
- Questionable procedure: no impact assessment, no public consultation while amending an essential element of the Directive

**Room for better implementation and enforcement**

- >30% of rivers, lakes and coastal waters reported as eutrophic
- Several Member States failed to present data on key indicators, e.g. livestock numbers, manure and mineral fertiliser use in their 2016-2019 implementation reports (ECA, 2023)
- The Commission has only launched three infringement case in the last 10 years



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# Water Resilience Strategy

- **WRS flagship actions with relevance for nitrate pollution**

- **Structured Dialogues** with Member States
  - With aim to identify WFD implementation hurdles and achieve a political commitment to overcome them
- Launch of an **Assistance Toolbox** for Member States to support actions to reduce nutrient pollution
  - E.g. enhanced modelling, interactive maps and exchanges of best practices
- Maximise the use of **CAP Strategic Plans** for water resilience
  - Knowledge sharing and innovative solutions promoted by the **EU CAP network, the European Innovation Partnership** (EIP-AGRI)
  - Improved and independent **farm advisory services**
  - In the next programming period, continue to **incentivise farmers** to improve the environmental and climate performance of their holdings, including towards better water management.

**WRS main objectives**

- Restoring and protecting the water cycle
- Building a water-smart economy together in a way that supports EU competitiveness, is attractive to investors and supports a thriving EU water industry
- Securing clean and affordable water and sanitation for all



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# Thank you for your attention

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Ben Snelson benedict.Snelson@eeb.org

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 15:50 - 16:00 | CONNECT ADVISORS FOR ACCELERATING KNOWLEDGE ON INTEGRATED FERTILIZATION MANAGEMENT

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**CHARLOTTE LYBAERT**

SOIL SERVICE OF BELGIUM

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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

## CHARLOTTE LYBAERT

SOIL SERVICE OF BELGIUM

**Researcher at the Social Sciences Unit of the Flanders Research Institute for Agriculture, Fisheries and Food (ILVO).**

**Her work explores how agricultural advisors can act as key facilitators of sustainable transitions within European farming systems.**

**She studies knowledge exchange, advisory networks, and innovation processes from a social science perspective. Within the STRATUS project, ILVO is responsible for developing and implementing the training programme for advisors.**

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# NUTRI-CHECK NET Final Conference

## Steps to Optimise Crop Nutrition

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# Content :



NUTRI-CHECK NET
OPTIMISING CROP NUTRITION

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# What is STRATUS?

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Duration: February 2024 – January 2029
Grant: 3 998 770,31 €

INTIA CDR ZLTO iniciativas innovadoras VEGEPOLYS VALLEY AC3A EUFRAS SEASN ILVO WAGENINGEN Hushållningssällskapet GHENT UNIVERSITY

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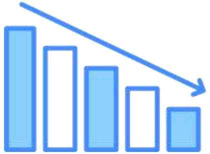
HORIZON EUROPE

# Main objective

**To connect advisors across Europe**

On optimal fertilizer use



Reducing nutrient losses to the environment

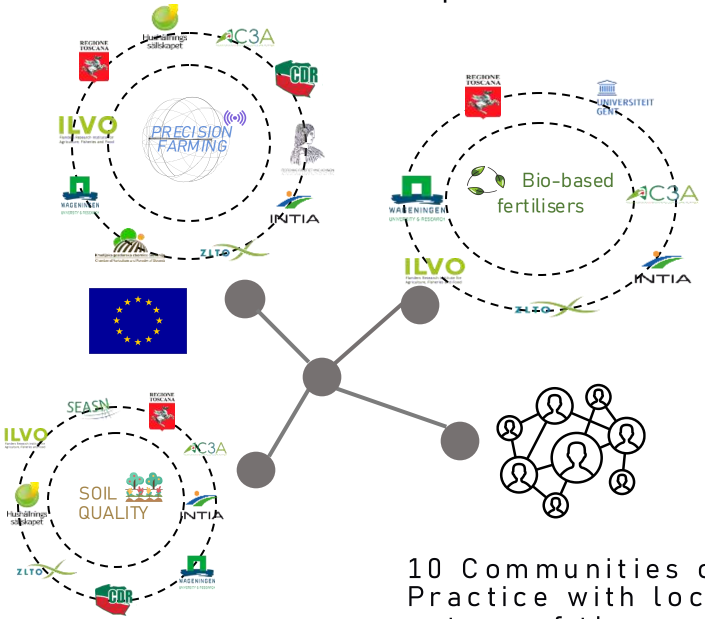
While maintaining soil fertility

# Work done so far (Feb 24' - now)

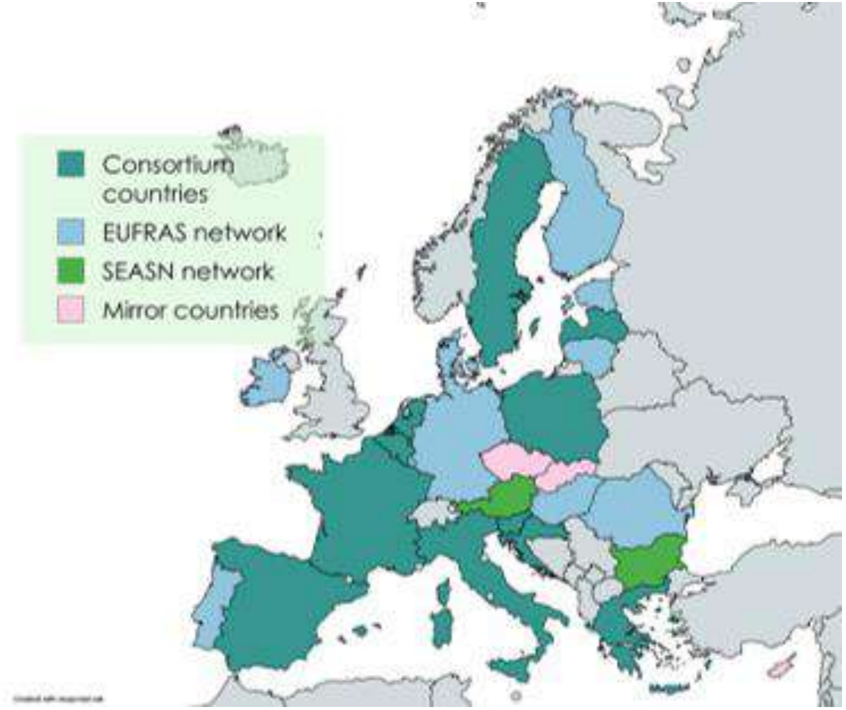


## EU-Wide network

3 Fertilization and Innovation Networks with advisors and experts:




10 Communities of Practice with local actors of the sector



# Work done so far (Feb 24' – now)

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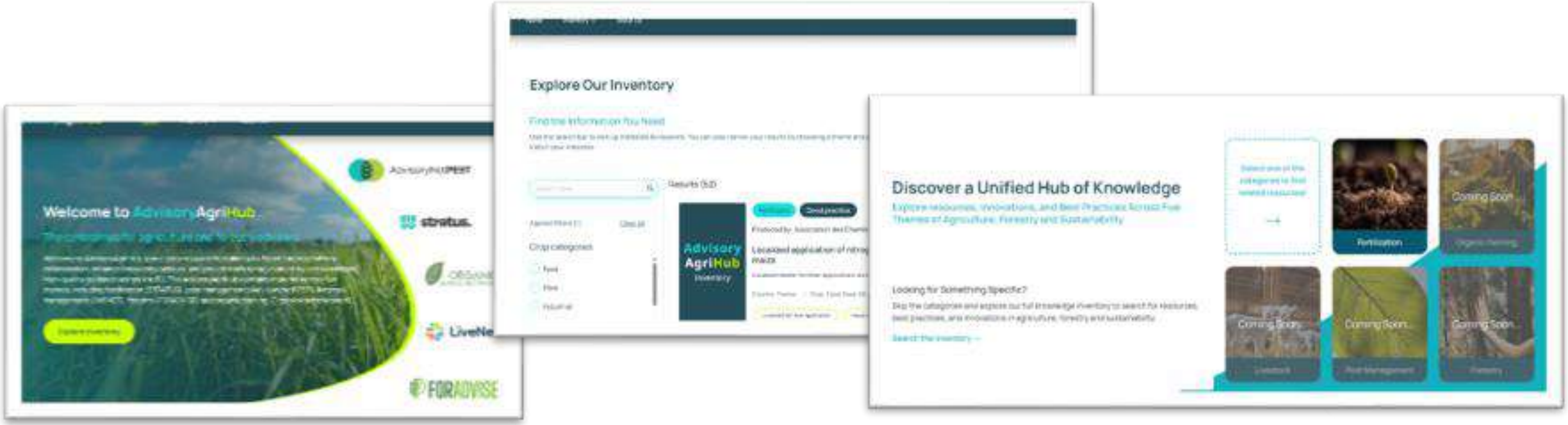
## EU-Digital platform

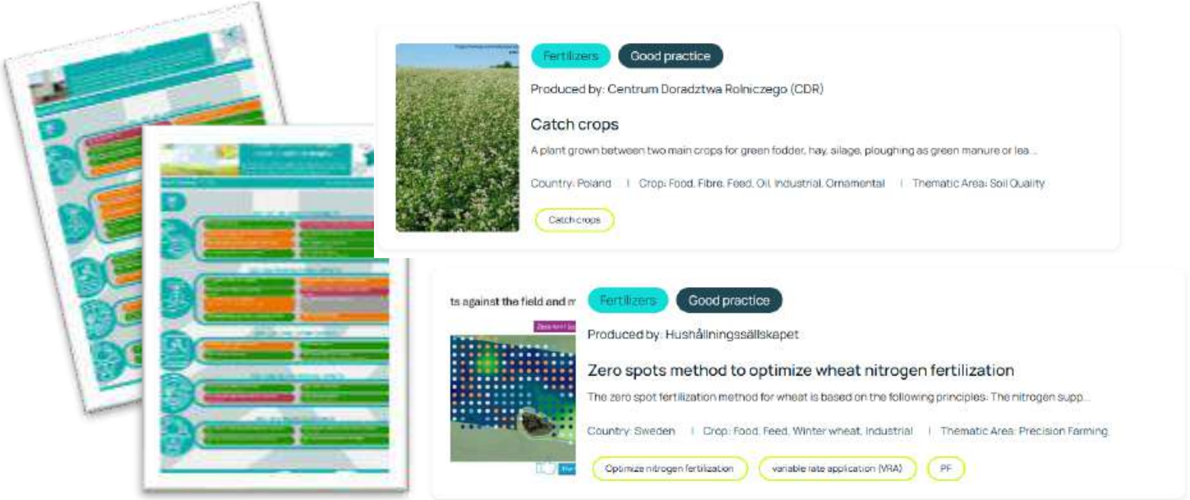
https://www.advisoryagrihub.eu/

| stratus. | ORGANIC ADVICE NETWORK | LiveNet | AdvisoryNetPEST | FORADVISE |
|---|---|---|---|---|
| Fertilizers | Organic Farming | Livestock | Pesticides | Forestry |



# Work done so far (Feb 24' – now)

Collection of 52 Good Practices
and Research Innovations*

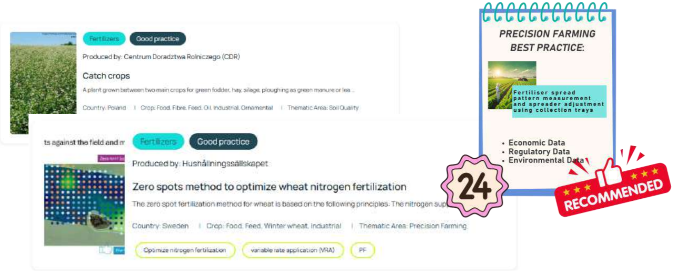



Selection 24 Best
Practices


*Translated to 11 languages (Partners languages +English)
Available in: https://www.advisoryagrihub.eu/

# Work to be done

### Collection of 104 Good Practices and Research Innovations + 48 Best Practices




### 20 Cross-visits for advisors from 27 MS for peer-to-peer learning about optimal fertilizer use

### Train advisors who will train more advisors

- Soft-skills 2024
- Advisory skills (organising a demo event) 2025
- Technical 2026

### Policy briefs

That will help policy makers to understand:

- ✓ Needs of farmers
- ✓ Needs of advisors
- ✓ Needs of researchers
- ✓ Needs of industry stakeholders

# STRATUS and HE cluster 6 destination

## Cluster 6

**Supporting EU Green Deal, Farm to Fork (F2F), and Biodiversity Strategies**

- **Promotion of Integrated Fertilisation Management (IFM)** to reduce nutrient losses while maintaining soil fertility.
- **The network bottoms-up identification and validation** of Good Practices (GPs) and Research Innovations (RIs) across all 27 Member States.

**Substitution of Mineral Fertilisers with Bio-Based Alternatives**

- STRATUS has a dedicated **Bio-Based Fertilisers (BBF) sub-network** and will collect **14 GPs/RIs** on BBF.

**Modernising the Agricultural Sector through Innovation and Digitalisation**

- AdvisoryAgriHub **digital platform** + collection of 20 GPs/RIs regarding **Precision Farming**.

# STRATUS and HE cluster 6 destination

## Cluster 6

HORIZON EUROPE

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**Engaging Policymakers and Addressing Institutional Barriers**

- Involves regional and national policymakers through its Communities of Practice (CoPs) and workshops.

- Identifies **regulatory bottlenecks and institutional challenges** to fertiliser reduction, contributing to evidence-based policy design.

**Providing Tools and Services for Nutrient Loss Reduction**

- Delivers **trainings** for advisors, **demos, cross-visits**, and **materials** for the adoption of optimal feriliser use.

Accelerating Innovation Uptake and Knowledge Co-Creation

- Applies a **Multi-Actor Approach.** Integrating researchers, advisors, farmers, policy makers and industry for **co-creation** and ensuring relevance and replicability across diverse EU contexts.

# The importance of the STRATUS network towards shaping fertilization management

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## 1. FINs


**Mirror countries**

EUFRAS

EUROPEAN FORUM FOR AGRICULTURAL AND RURAL ADVISORY SERVICES

SEASN

Experts from 27 MS that:

1. Exchange Knowledge: Collect 104 Good Practices and Research Innovations
2. Identify 48 Best Practices for Optimal fertilizer use
3. Train advisors on optimal fertilizer use and advisory skills
4. Attend to Cross-visits where Best Practices are showcased

## 2. Communities of Practice (CoPs)


AKIS stakeholders:

1. Bottom up needs
2. Oragnise Cross Visits and showcase Best Practicies for optimal fertiliser use as demos.
3. Celebrate demos of practices suitable for the local context

# thanks.

for your attention

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AGRICULTURAL UNIVERSITY OF ATHENS

Kmetijsko gozdarska zbornica Slovenije

iniciativas innovadoras

ZLTO

VEGEPOLYS VALLEY

AC3A

EUFRAS
EUROPEAN FORUM FOR AGRICULTURAL AND RURAL ADVISORY SERVICES

SEASN South Eastern Europe Advisory Service Network

REGIONE TOSCANA

ILVO
Flanders research institute for agriculture, fisheries and food

WAGENINGEN UNIVERSITY & RESEARCH

Hushållnings sällskapet

GHENT UNIVERSITY

www.stratusproject.eu

**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 16:00 - 16:10 | INTEGRATING KNOWLEDGE AND PRACTICE

NUTRI•KNOW

**ANNA BAGÓ**
UNIVERSITAT CATALUNYA

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**ANNA BAGÓ**
UNIVERSITAT CATALUNYA

**Coordinator of the Science4Practice line within the Governance for Sustainability Team at the BETA Technological Centre (UVic-UCC) and NUTRI-KNOW project coordinator.**

**Her work focuses on bridging the gap between science and practice, fostering knowledge adoption, and empowering rural and regional actors to drive sustainable and resilient transformations.**

**She specialises in methodologies for knowledge translation, co-creation and stakeholder engagement, and leads initiatives that connect**

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# NUTRI-KNOW: Strengthening Nutrient Management Knowledge Flows Within European Food Systems

Connecting research, practice and policy across Europe to transform management for sustainable food systems.

# Introduction

NUTRI-KNOW is a Horizon Europe project (2023–2025) (2023–2025) that strengthens nutrient management management across Europe by collecting, translating translating and sharing knowledge from EIP-AGRI AGRI Operational Groups.

The project supports fair, healthy and friendly food systems through better nutrient enhanced collaboration and practical

By bridging the gap between research and NUTRI-KNOW ensures that cutting-edge reaches those who need it most—farmers, and policymakers working at the frontline of sustainable agriculture.

12

Operational Groups

Across five countries

11

Project Partners

Multi-actor collaboration

36

Months Duration

2023–2025

NUTRI•KNOW NUTRI-CHECK NET OPTIMISING CROP NUTRITION

# Why NUTRI-KNOW Matters

Nutrient management represents one of the most pressing challenges for sustainable food Europe. Farmers navigate increasingly complex regulations, address nutrient surpluses and soil whilst facing significant knowledge gaps between scientific research, policy requirements and level application.

### Researchers

Generating evidence-based solutions

### Advisers

Translating knowledge to practice

### Farmers

Implementing sustainable practices

### Policy Makers

Creating enabling frameworks

NUTRI-KNOW bridges these critical gaps through multi-actor collaboration, ensuring knowledge flows flows seamlessly across the entire food system value chain.

NUTRI•KNOW NUTRI-CHECK NET OPTIMISING CROP NUTRITION

# Project Scope and Objectives

### Collect & Analyse

Gather and evaluate outcomes from 12 EIP-AGRI Operational Groups across diverse European contexts, innovation and best practice.

### Translate Results

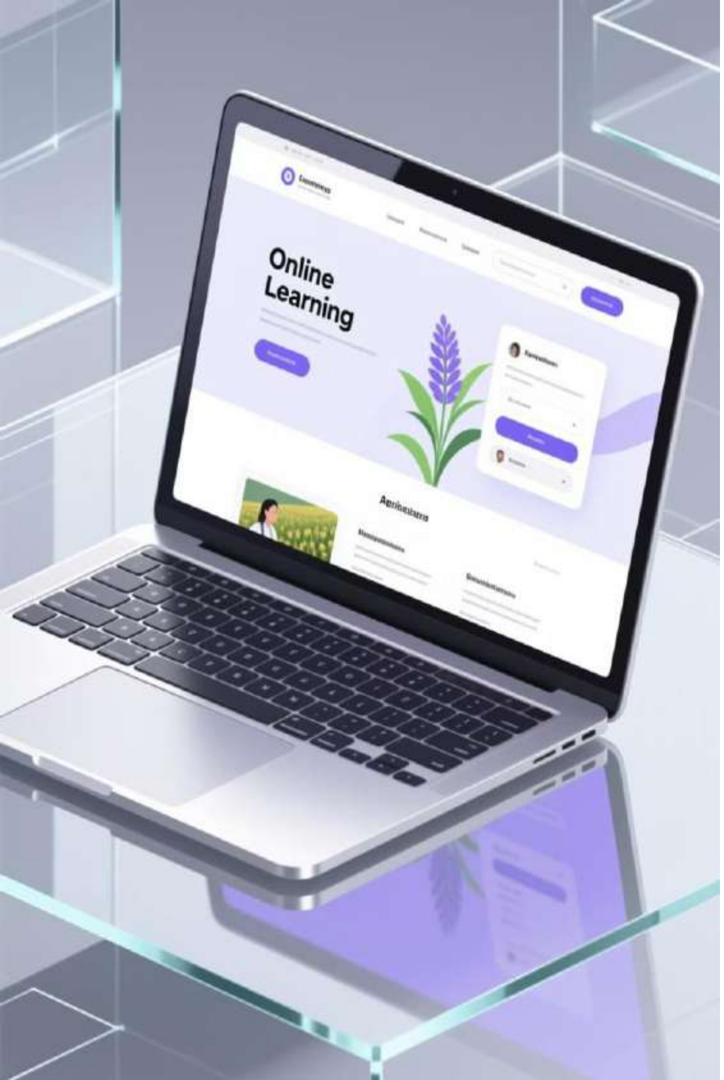
Transform complex research findings into accessible, farmer-friendly materials that practitioners can immediately immediately apply in the field.

### Share Knowledge

Establish an open Community of Practice on nutrient management, facilitating peer-to-peer learning exchange.

### Amplify Impact

Develop a Results Amplification Methodology (RAM) to upscale successful outcomes and replicate innovations across innovations across Europe.




# From Data to Practice: Key Outputs

NUTRI-KNOW has developed an extensive suite of practical resources designed to make nutrient management accessible, actionable and adaptable across diverse farming contexts.

1

## Meta-Databases

Two comprehensive databases documenting nutrient management practices and policy contexts across across participating countries, providing evidence-based insights for decision-making.

2

## Practitioner Materials

6 detailed booklets, > 30 practice abstracts and > 50 multilingual flyers, infographics, videos... guidance directly to farmers and advisers.

3

## Online Learning

Massive Open Online Course (MOOC) launched in 2025, offering flexible, self-paced learning on nutrient nutrient management principles and techniques.

4

## Community Platform

Active Community of Practice (CoP) featuring multilingual Q&A forums, peer exchange time knowledge sharing.

Access resources at nutri-know.eu and join the community at cop.nutri-know.eu

NUTRI•KNOW NUTRI-CHECK NET OPTIMISING CROP NUTRITION

# Empowering Farmers and Practitioners

Through **targeted capacity-building initiatives**, NUTRI-KNOW has reached hundreds of farmers hundreds of farmers and agricultural advisors across Europe, ensuring knowledge is not only not only shared but effectively embedded in daily practice.

24

**In-Service Trainings**

Short, focused sessions adapted to local needs

5

**Train-the-Trainer Courses**

Building advisory capacity for long-term impact

4

**Study Visits**

Cross-border learning and innovation exchange

These activities ensure that knowledge is adapted to regional contexts, accessible in local languages and directly applicable in the field, creating lasting change in farming practices.

# Building Bridges Through Collaboration

NUTRI-KNOW actively **collaborates with key Horizon Europe initiatives and European networks**, amplifying impact through knowledge exchange.

### BBioNets & Novafert

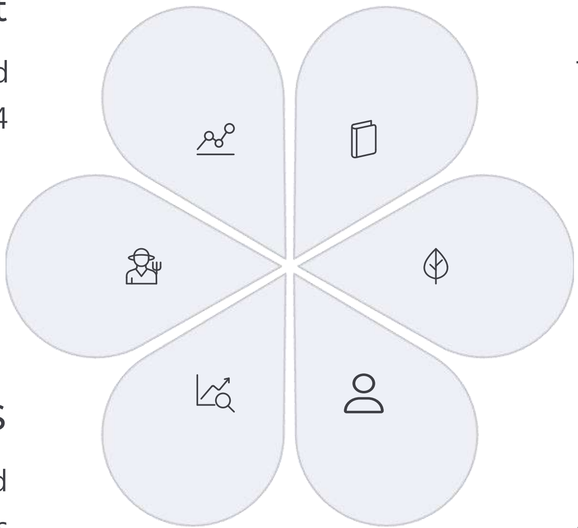
Joint workshop on bio-based fertilisers and nutrient value chains, Ireland 2024

### EU-CAP Network

Supporting Common Agricultural Policy implementation and innovation

### SCAR-AKIS

Strengthening Agricultural Knowledge and Innovation Systems



### EU-FarmBook

Top contributor with 68 knowledge objects uploaded to the platform

### Biorefine Cluster

Advancing circular bioeconomy solutions for solutions for nutrient recovery

### ESPP

European Sustainable Phosphorus Platform collaboration on nutrient stewardship

These partnerships foster synergies, enhance visibility and ensure policy impact at European level.

NUTRI•KNOW NUTRI-CHECK NET OPTIMISING CROP NUTRITION

# The Results Amplification Methodology (RAM)

RAM provides a systematic, validated process to broaden project results effectively across regions and contexts. This guides how to collect, align, translate, exchange and adapt knowledge for successful replication.

1. **Collection**
   Gather outcomes from operational groups
2. **Homogenisation**
   Standardise data formats and structures
3. **Alignment**
   Match with policy and research priorities
4. **Translation**
   Create accessible practitioner materials
5. **Exchange**
   Facilitate peer-to-peer knowledge sharing
6. **Adaptation**
   Tailor solutions to local contexts
7. **Amplification**
   Scale successful innovations across Europe

The methodology has been rigorously validated by farmers, policymakers and researchers, ensuring its practical relevance and scient

NUTRI•KNOW NUTRI-CHECK NET OPTIMISING CROP NUTRITION

# Policy Relevance and Long-Term Impact

NUTRI-KNOW directly supports critical EU policy objectives by strengthening the strengthening the evidence base for sustainable nutrient management and creating and creating practical pathways for policy implementation.

### Nutrient Circularity

Promoting closed-loop systems and sustainable fertiliser use, reducing environmental impact whilst maintaining productivity.

### AKIS Empowerment

Strengthening Agricultural Agricultural Knowledge and and Innovation Systems by by empowering actors to to co-create context-appropriate solutions.

### Policy Recommendations

Delivering evidence-guidance through 2 comprehensive policy briefs addressing frameworks and mechanisms.

**Final Policy Conference** Brussels, April 2026 (ESNI) Ensuring project outcomes inform EU-level policy development and implementation strategies.

NUTRI•KNOW NUTRI-CHECK NET OPTIMISING CROP NUTRITION

# Contribution to the Cluster 6 Destination

NUTRI-KNOW advances the Horizon Europe goal of "Fair, healthy and environmentally friendly food systems" through integrated action across three interconnected dimensions.
interconnected dimensions.

## Fair Systems

Ensuring equitable access to knowledge and all farming scales and contexts

- Multi-actor collaboration
- Inclusive knowledge exchange
- Supporting farmer-led innovation

## Healthy Systems

Promoting practices that enhance soil health, crop and human nutrition

- Optimised nutrient use efficiency
- Healthier soils and crops
- Stronger rural communities

## Environmentally Friendly

Accelerating climate-resilient, resource-efficient across Europe

- Reduced environmental footprint
- Climate adaptation strategies
- Circular nutrient management

By connecting science, policy and practice, NUTRI-KNOW accelerates knowledge flows that transform European agriculture for the benefit of farmers, environment.

# Thank you!

Anna Bagó

anna.bago@uvic.cat

**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 16:10 - 16:20 | DATA AND SENSORS TO OPTIMISE CROP NUTRITION

LiveSen MAP

**NICOLAS**
**PLUMER**
**É**
TUM

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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

**NICOLAS**
**PLUMER**
**É**
TUM

**PhD in inorganic chemistry from the University of Tübingen (Germany) and subsequently completed a postdoctoral fellowship at the company NECi (USA) on nitrate sensing applications using redox-active enzymes and electrochemistry.**

**He began his independent research career at the Ruhr-University Bochum (Germany) in 2010 and, since 2020, has been a tenured professor at the Technical University of Munich (Germany) where his team focuses on developing bioelectrocatalytic systems for point-of-use sensing in agriculture.**

**Sensor Developer in the LiveSenMAP project.**

NUTRI-CHECK NET
OPTIMISING CROP NUTRITION

LiveSen MAP

Funded by the European Union

UK Research and Innovation

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European Innovation Council

Technical University of Munich

LiveSen MAP

# Real-time Nutrient Sensing for Mapping Fertilizer Needs

EIC transition
(2023-2026)


Nicolas Plumeré

Campus Straubing for
Biotechnology and Sustainability
Technical University of Munich


Nutri-Check Final Conference

18th of November 2025
Brussels

**Echem lab** **Synthesis lab** **Protein lab**

TUMC

European Innovation Council

# LiveSen MAP

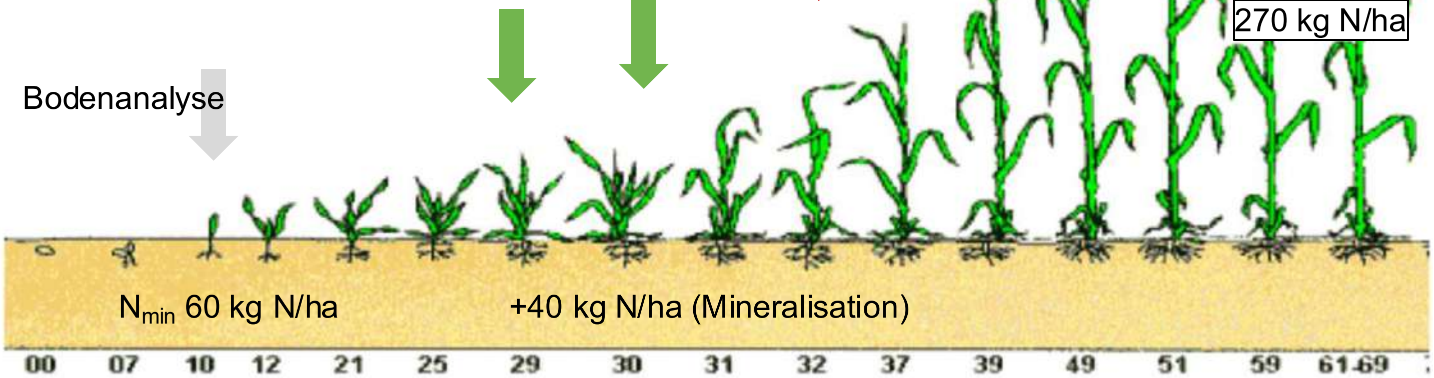
Technical University of Munich

**1** Our app suggests measurement points via remote sensing.

**2** The farmer measures the plants' nitrate content on-spot.

**3** NDVIs are recalibrated and the farmer receives a fertilizer application map.

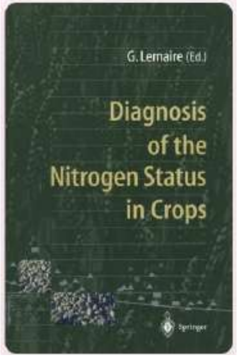





CHAPTER 10

## Diagnosis Using Stem Base Extract: JUBIL Method

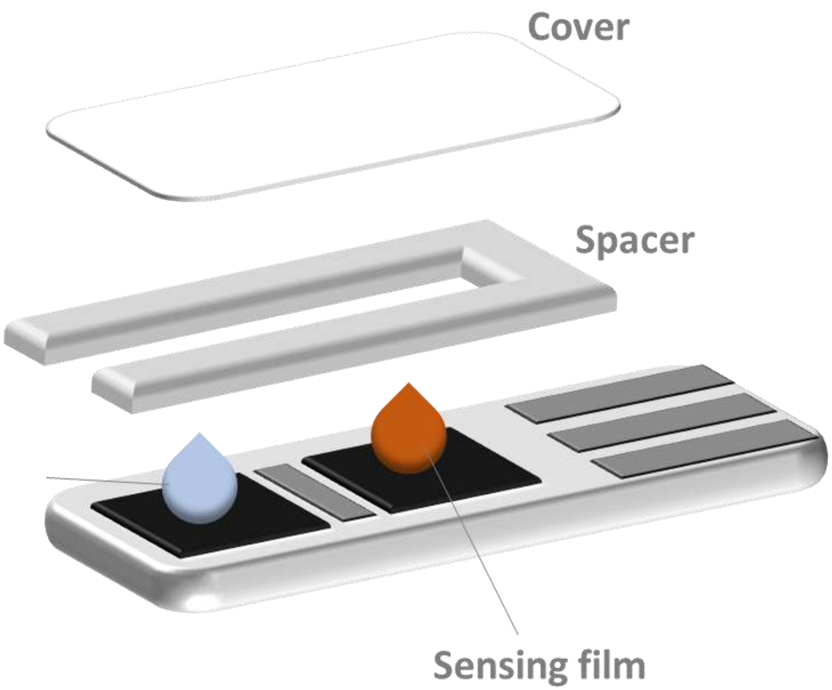
E. Justes[1], J.M. Meynard[2], B. Mary,[3] and D. Plénet[4]



# Electrochemical biosensing

Zhang, Saadeldin, Buesen, Elfaitory, Burger, Friebe, Honacker, Vöpel Oughli, Plumeré
*Science Advances*, **2025** 11 (37), eadw6133.






NutriSen

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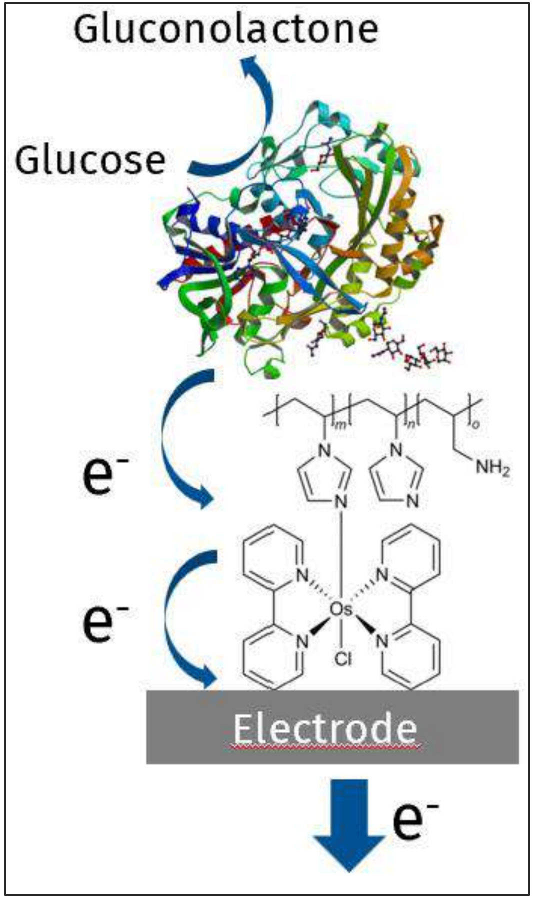
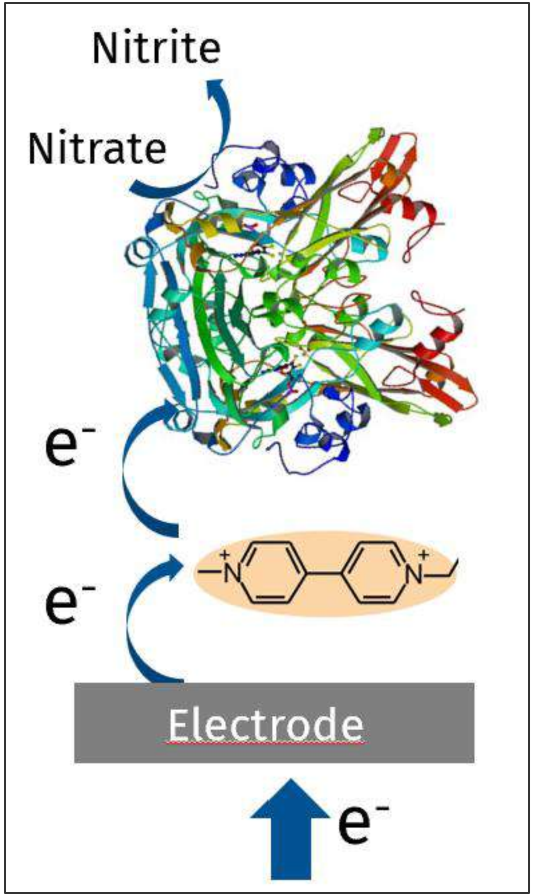



NutriSen

# Electrochemical biosensing



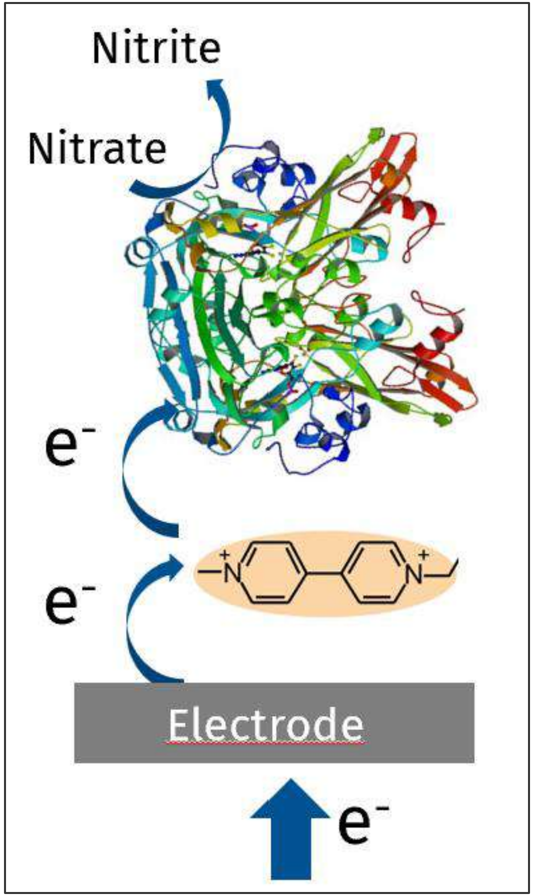



NutriSen

# Electrochemical biosensing


10 billions / year

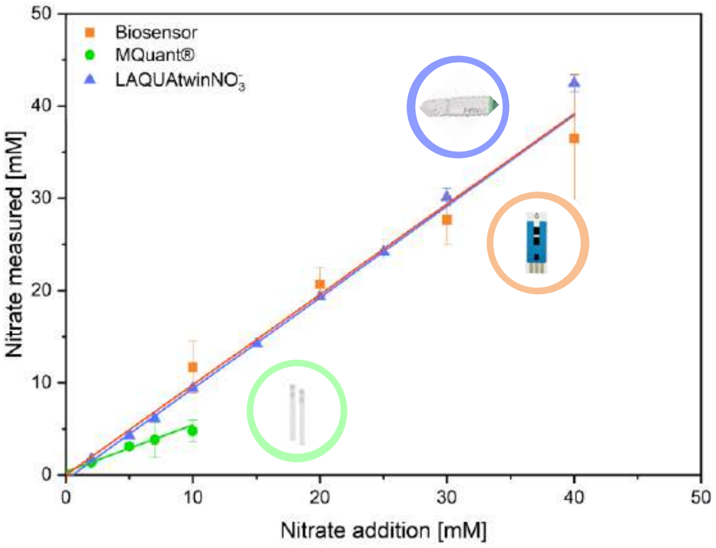

10 thousands / year




NutriSen

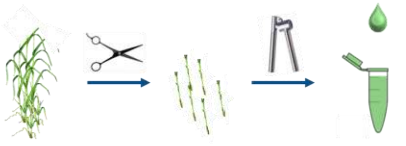
# Lab trials 2023

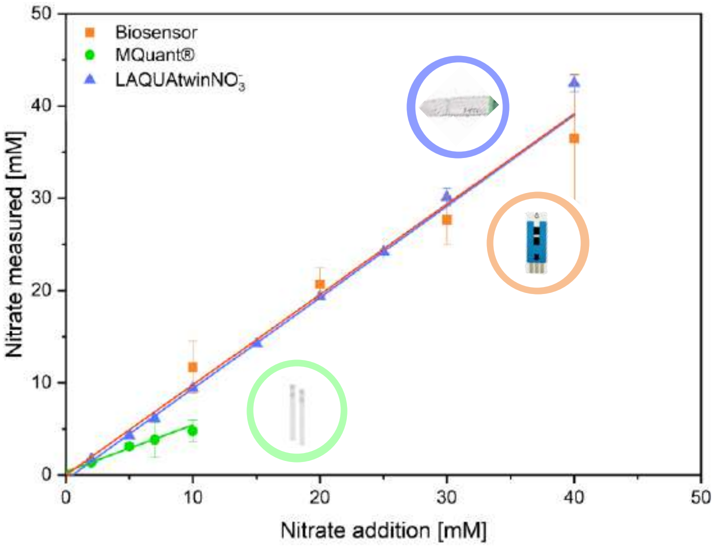
## Nitrate in water

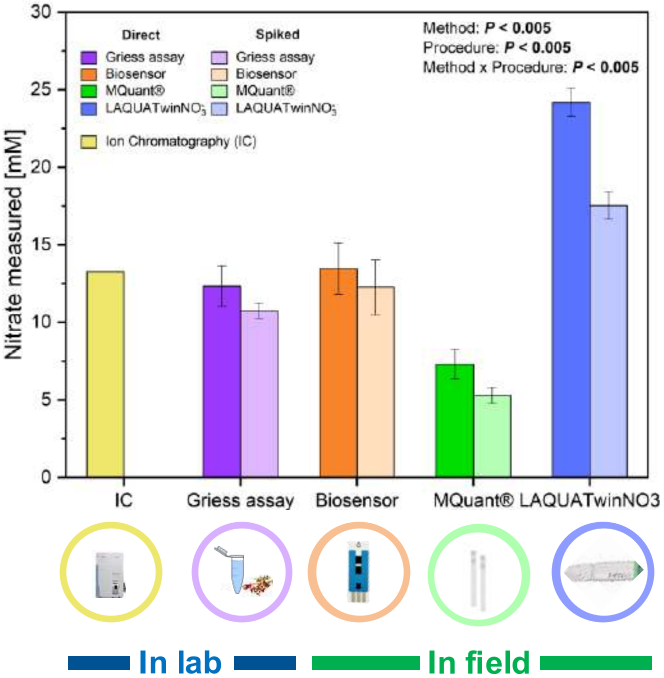


# Lab trials 2023

## Stem base extract (SBE)

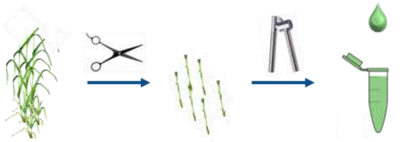


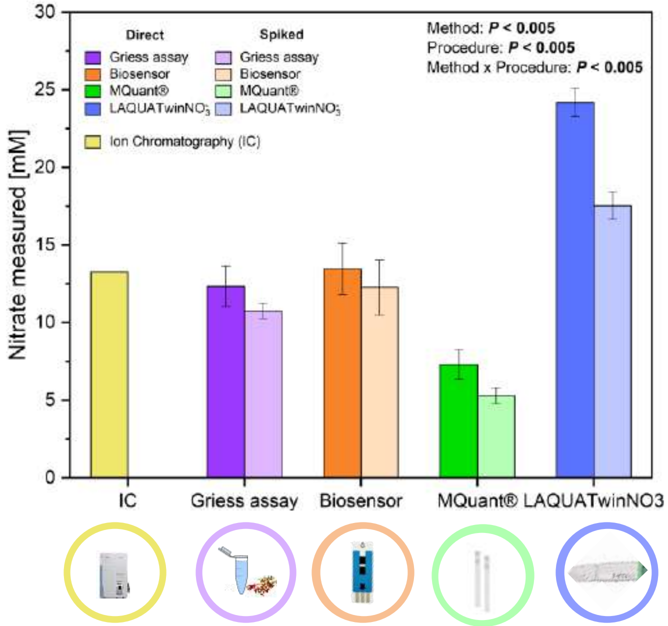
# Lab trials 2023

## stem base extract SBE



SBE

- The **biosensor** provides **calibration- and dilution-free** measuring tool
- The biosensor matched **lab-grade accuracy**
- Commercial devices showed bias (over/under-estimation)
- Causes: **sample interferences calibration or dilution needs** due to limited detection range




In lab

In field

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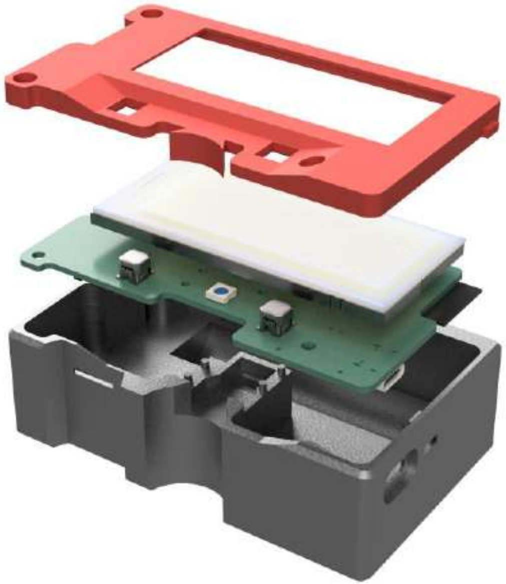
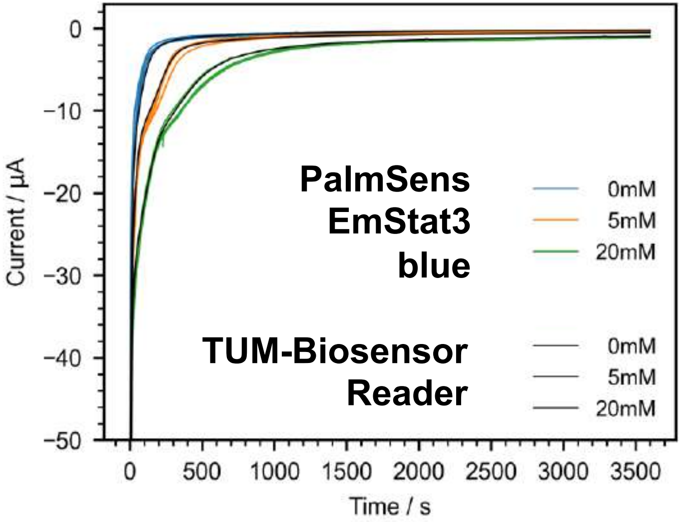
# The Biosensor Reader




- Automatic measurement
- Battery-operated
- On-screen user interface
- Micro SD card interface for data collection

# The Biosensor Reader




TUM- biosensor reader outperforms expensive research devices



220 produced

European Innovation Council

Technical University of Munich

# Field trials 2024

## Validation by the technicians

**60**

**Fields**

**3000**

**Measurements**

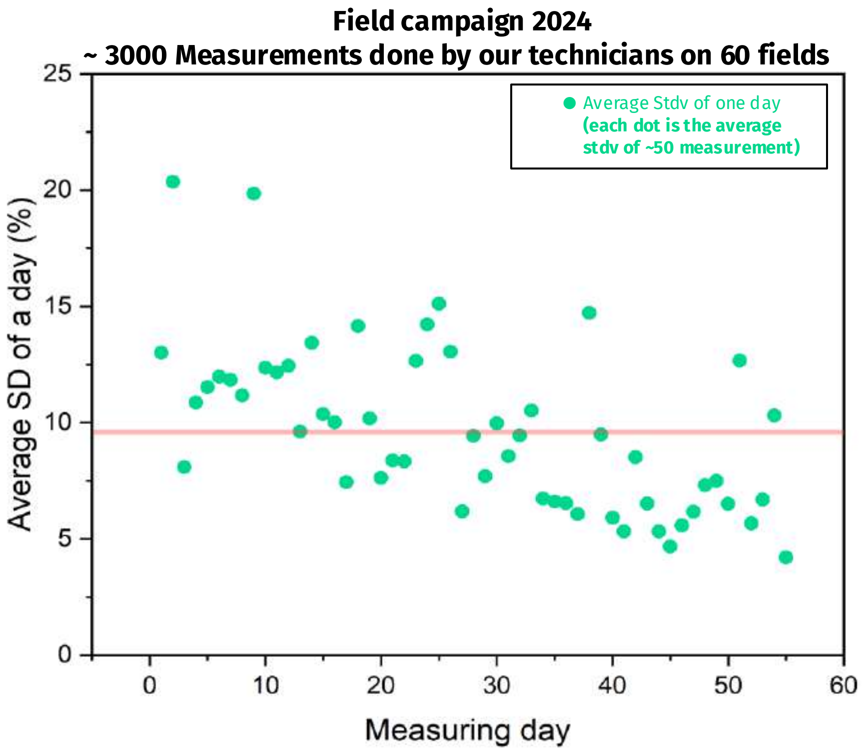
# Field trials 2024

## Validation by the farmers

**Average standard deviation:**
Unter 10 %.

**Enhancements:**

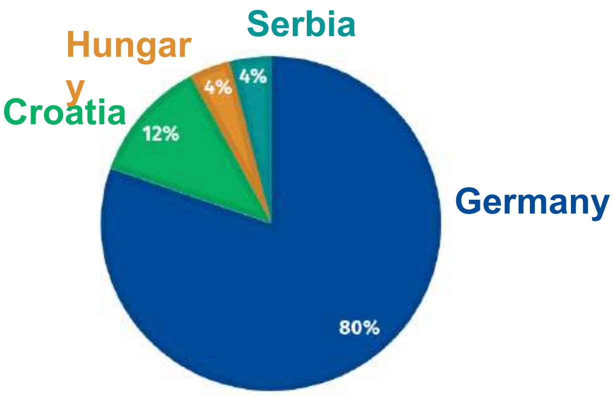
- Sensors and sampling procedures were optimized over the course of the season.
- In the final weeks of the campaign, the standard deviation was down to 5%.



# Field trials 2025

Validation by the technicians
Validation by the Farmers

**178** Fields
**4** Countries

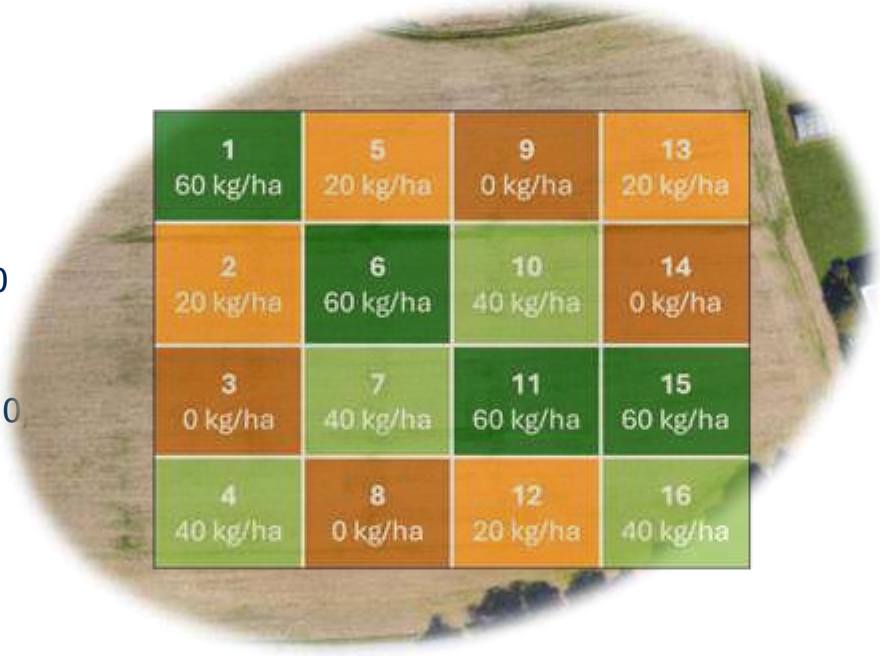



# Field trials 2025

## Validation by the technicians

### Experimental conditions

- **Location:** Measurements in TUM plots in Freising (30x30 m each).
- **Fertilization** in 3 additions; 0, 20, 40 or 60 kg of nitrogen fertiliser were applied per addition.
- **Wheat variety:** Apostel



# Field trials 2025

## Validation by the technicians

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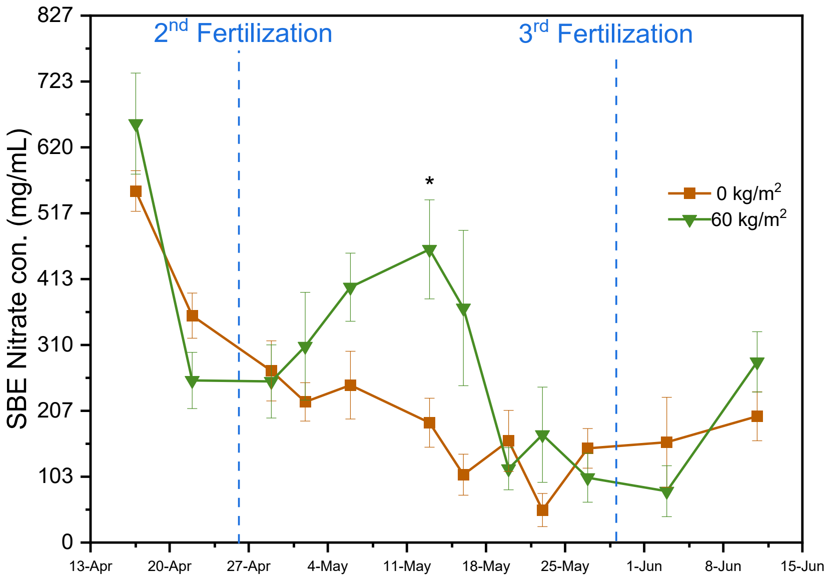
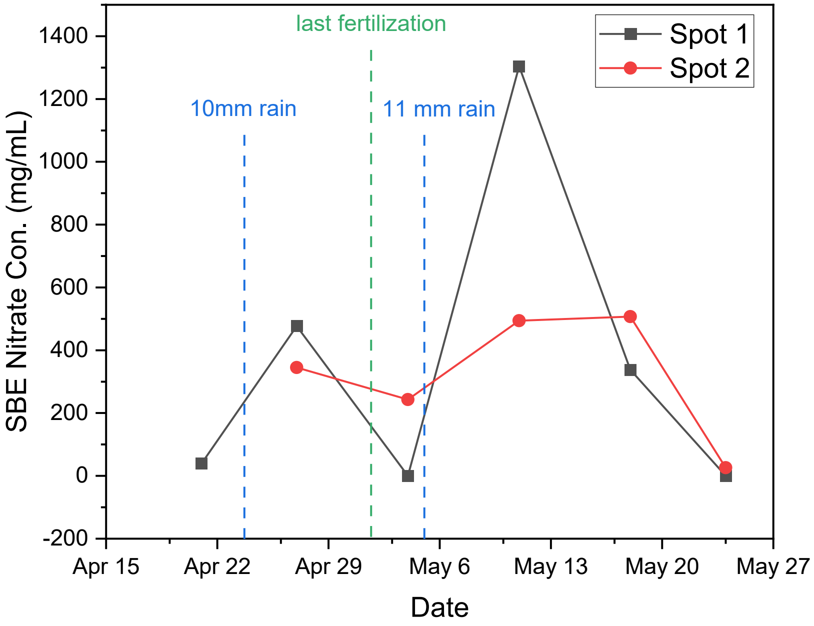


# Field trials 2025

## Validation by farmers

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# Field trials 2026

## Validation by Jubil farmers

1 Our app suggests measurement points via remote sensing.

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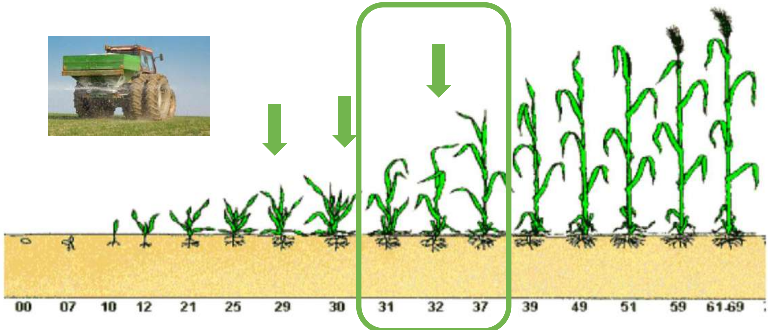

# Thank you for your attention

Current Group
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Yoshua Moore
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Dr Christophe Léger
Dr Vincent Fourmond

HYPHE-C1
Prof Marc Robert (Sorbonne)
Prof David Tilley /Zurich)
Prof Fabrice Odobel (Nantes)

**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 16:20 - 16:30 | INNOVATING NUTRIENT MANAGEMENT THROUGH LEGUME INTEGRATION

**ANNE SCHNEIDER**
TERRES INOVIA

legumES

NUTRI-CHECK NET
OPTIMISING CROP NUTRITION

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**ANNE SCHNEIDER**
TERRES INOVIA

**Agronomist at Terres Inovia and WP project co-coordinator of the LegumES WP project.**

**Agricultural engineer (INA-Paris-Grignon) and D.E.A. (UT Compiègne).**

**After 16 years of establishing R&D partnerships in Europe and internationally, Anne worked for the inter-professional organisation for protein-rich plants (UNIP) before joining Terres Inovia in 2014 in the Agronomy, Environment and Economics Department.**

NUTRI-CHECK NET
OPTIMISING CROP NUTRITION

legumES

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Anne SCHNEIDER
Terres Inovia

# How to increase the contribution of legumes to crop nutrition in the agricultural systems ?

NUTRI-CHECK NET Final Conference, 18 November 2025

legumES
www.legumesproject.eu

## *Valorising and balancing the ecosystem service benefits offered by legumes, and legume-based cropped systems*

***(2024-2027)** supported by HORIZON-CL6-2023-BIODIV-01*

Funded by the European Union

**Legume cultivation can contribute to reduce dependence on synthetic fertilizers and, at the same time, improve soil health, lower GHG emissions and maintain biodiversity.**

Consortium at the kick off meeting, Porto (PT), February 2024

## 6 objectives and WPs

1. **Engage and build capacity in legume production** amongst farmers, advisers, students, and other stakeholders
2. **Develop a suite of practical methodologies and tools** to quantify ecosystem services and indicators in environmental and economic terms, and across scales
3. **Assess the environmental benefits of legumes at cropping system and value chains scales** and integrate them into policy solutions
4. **Demonstrate the economic potential of legume crops** across field, farm, regional, EU and global scales
5. **Enable policies, legislation, and regulatory procedures to facilitate** the delivery of enhanced and better-balanced ESs from more biodiverse legume-based systems
6. **Assess and improve the ES** at different levels (local, regional, and national/European)

## 22 partners from 12 countries

legumES
www.legumesproject.eu

# 28 pilot studies *over a wide range of soil-climatic conditions of the EU*

## WP2 activities

**= assessment of ES data from the Pilot Studies** which:

- have designed studies to adress **locally relevant legume based solutions/barriers** to uptake which are indipendently aligned to the project objectives,
- share **core design elements** for some of them, or are clustered together **to investigate trade-offs in different legume utilising systems**.

*Gorse shelter belts & Flowering margins*
*Intercrop-management*
*Legumes as livestock feed*

**With forecasted outputs :**

- Data for use in other WPs and for inclusion in open access **legumES database**
- **Agronomy Guide** on practical management and performance of legumes
- **Practitioner methodologies** for measuring legume ESI

Figure 1.2: Geographical distribution of legumES partners and Pilot Studies (colored stadiums), their legumes types) and the ESs being considered for investigation.

# Three types of usage of legumes in farm systems

**Legumes**
**= a botanical family** with a unique particularity: the **symbiotic nitrogen fixation**


Natural symbiosis with bacteria in the nodules

Forage and grass

Grains

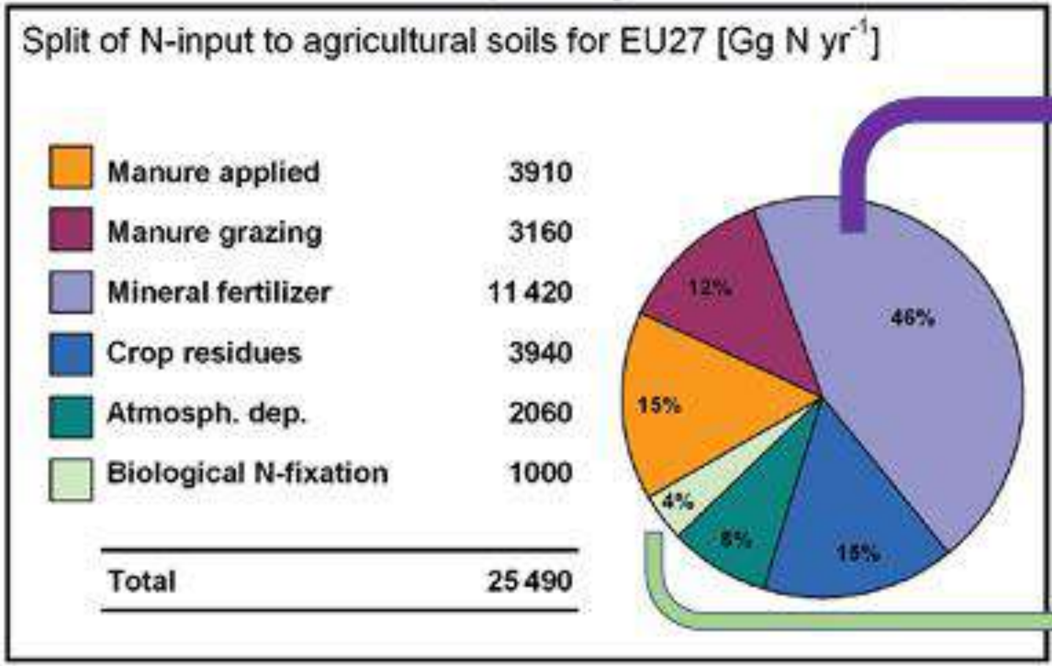
Non harvested

| Forage and grass | Grains | Non harvested |
|---|---|---|
| Plants sown in **mono-specific crop or in association of crops…** | | **Non-harvested plants,** sown alone or in mixture, in intercropping period or as companion plant of a rent crop |
| …then **mowed or pastured** (or natural area) | …whose **grains are harvested** | |
| Alfalfa, clover, vetch, sainfoin, lotus, peas | Peas, field beans, soya beans, lupins, lentils, chickpeas, beans | Faba beans, vetch, lentils, clover, peas, lupins, gesses |
| **Whole areal biomass, pastured or +/- transformed after mowing** | **Grains or ingredients issued from grains** | **Services of the non harvested plants** |

| | | | |
|---|---|---|---|
| **CURRENT PLACE in the EU** | **MAJOR In pastures** | **MINOR in arable crops** | **Increasing** |

# « Symbiotic » nitrogen ?
## … a possible N entry which is not used in Europe and in France

*« European Nitrogen Assessment » Sutton et al., 2011.*




**Synthetic mineral fertilisers > 45%**

Exponential rise since their creation in 1960

**Symbiotic fixation < 5%**
*(1mtN)*

*Against ~ **25%** at the world scale*
*(~**50**Mt N fixed in cropping systems)*

# How to benefit from benefits of legumes – Nitrogen related issues

*Data : Case of spring pea as monospecific crop*

**Exported grains (54 %)**
*Grains rich in proteins*

**2/ Increase protein production**

**Organic nitrogen left in the field (46 %)**
*Crop residues with high N content*
*Above ground: in small quantities,*
*Below ground: to be better characterised*

**3/ Avoid losses outside the production system**
($N_2O$, $NH_3$, $NO_3^-$, etc.)
*Leaching to be minimised*

**4/Increase the pre-crop effects on the following crops**
(easier access to nutrients, efficient absorption by roots at the same available dose)

**5/ Contribute to soil fertility**
(chemical, physical compositions, organic matter and biological activities)

$NO_3^-$

$N_2$

**1/ Capture more nitrogen from the air $N_2$** (biological fixation)

**Climate mitigation**
**Less environmental impacts**

**Higher N autonomy of the cropping systems**
*Less exogen N supply*

**Productivity**
**Robustness**

# A precrop effect for the crop which follows legumes
# **... which is under-used** in France and EU

Low legume crop area & «**wheat after wheat »** still a significant percentage of wheat surfaces **= still 10 to 18%** in some major wheat producing areas in France for example


Wheat after pea | Oil Seed Rape after pea | Maize after soya | Wheat after soya

## 1. Increase in yield of the following crop

| Wheat after pea | Oil Seed Rape after pea | Maize after soya | Wheat after soya |
|---|---|---|---|
| **Average = 0,6 or 1,2 t/ha** compared with wheat-wheat *(pluriannual statistics from 36000 wheat fields in* ***7 homogeneous French regional areas*** *PRA over 9-18 years, Ballot 2009)* | **+0,5 à 3 quintal/ha** compared with barley-OSR *(trials on 3 campaign)* | **+0 à 8 quintal/ha** compared with maize-maize | **+10%** / cereal-wheat |

*(France references, Schneider et Huyghe 2015)*

## 2. Nitrogen fertilisation rates:

**Making decision tools** include often forfaits for the precrop effects; importance of the choice of the forecasted yield

...... **NOT always adapted to the succession of crops in farmers' practices !**

► **The legume pre-crop effects could be better used to get higher wheat yield WITH lower N application**

→ ***High variability of legume precrop effects***

***= to be refined according to the situation for a higher consideration by farmers***

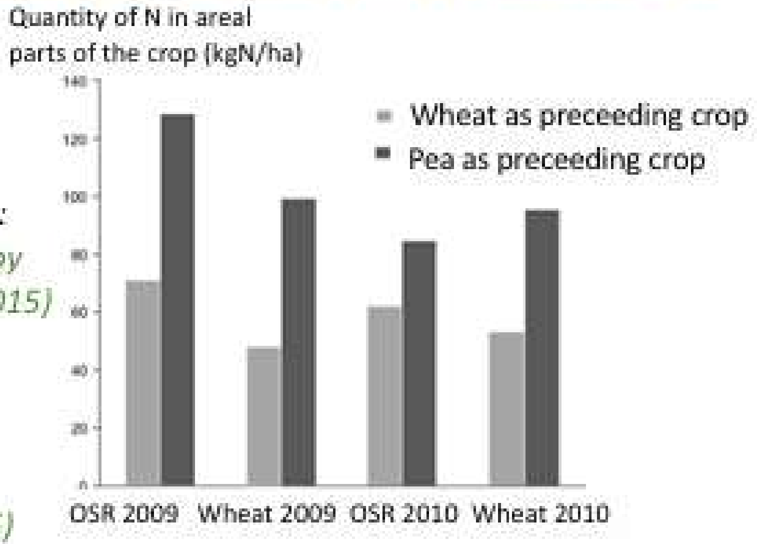
*(depending on soil and climate conditions, system design, intercropping management, legume crop management and success)*

# Grain legumes: N provision to the following crops

✓ In France, **previous experiments** highlihted that the provision of nitrogen from pea crop to the following crop could be from **25 to 80kgN/ha in non fertilised crop :**

▶ *Measurements in 2009 and 2010 in France :*

*(Jeuffroy et al.2015)*




In addition the break crop effects (less biotic stress pressure) enable to get a **higher efficiency of** the following crop to uptake nitrogen present in the soil.

✓ **Meta-analysis** on experimental data *(PhD Thesis C Cernay 2015)*

The results show that the yields of cereals grown after grain legumes are,

**on average, +29% significantly higher than the yields of cereals** grown after cereals.

This positive effect is **significant for 13 of the 16 grain legume species**.

Literrature references and French data identify
a **potentiel precrop effects** of **40kgN/ha** on oil seed rape or wheat

# **Wheat yields** according to the preceeding crop

► Between 2016 and 2019 : Measurements in France
**at 0N or suboptimal N doses**

ALTER'N

***Analytical trials of Terres Inovia*** *on 2 sites and 2 climatic series :*

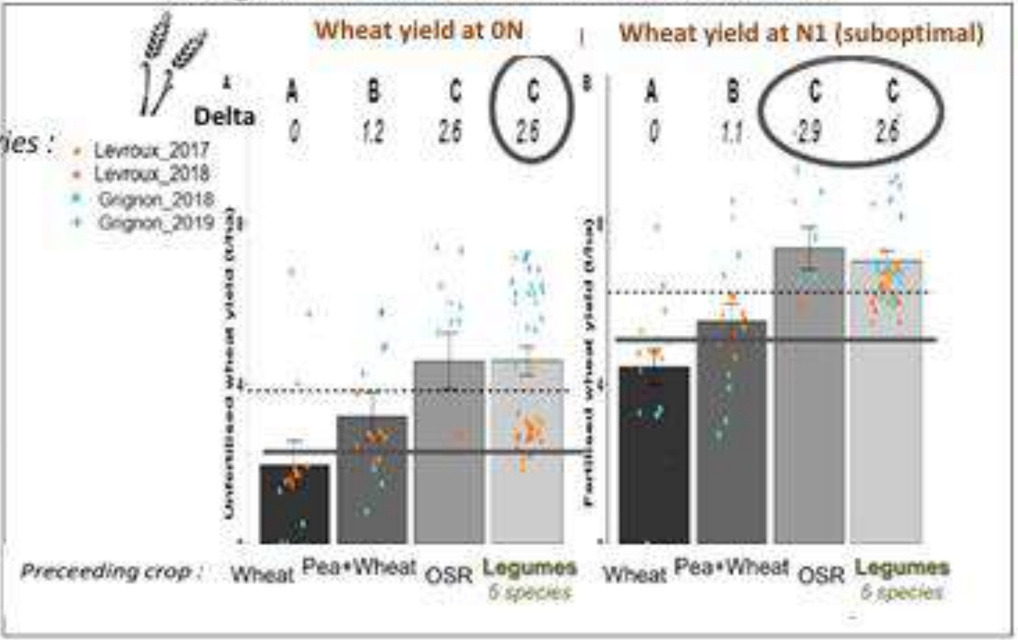
**Wheat yield is <u>significally higher</u> with grain legume as pre crop compared with wheat:**

**+2.6t/ha** in average WITHOUT fertilisation

**+2.6t/ha** with sub-optimal fertilisation *(lower than* ex ante *calculated optimal dose based on soil N content)*

**Trends also confirmed with results from INRAE in 2 other situations in Dijon : +1.8 à +1.7 t/ha**
(10 GL, 1 bloc, 2 years) *Guinet PhD thesis 2019*

Average ALL SITUATIONS – Data from Terres Inovia




► Between 2024 and 2028 : **N responses of wheat according to previous crop**

= **Multi-site experiments with several levels of N doses in 6 different contexts** (WP2 of LegumES)

*To target better operational advice to farmers*

legumES

# Legumes and nutrient management of cropping systems

- **Symbiotic nitrogen fixation is a <u>key ecological function</u> for an N entry** in the system (not used in the EU context)
- **Nutrient provision is <u>modulated when legume plants</u> are grown in the field**, either as harvested crops or cover crops : *the presence of legume in the rotation influences both N fluxes and crop root efficiency to use available N stocks*
- **Pre-crop effects are observed on the following crops are <u>very different from one farm situation to another</u>** : *need to identify the major variation factors to provide action for farmers to mobilise better the legume services :*

**Need to target site by site nutrient strategy decision making for farmers** :

- Tools (such as **MERCI**) available for cover crops between two catch crops
- To **be developed** for harvested annual crops : strategic tool (to transfer knowledge that the farmer can then adapt to his/her own context, site-to-site adapted advice and potential tool.

***To adapt further N applications in legumes-based cropping systems is crucial***
*to benefit more from services of these N-fixing crops :*
*(i) close the N cycle*
*(ii) reduce significantly the impact of agricultural production of the environment*

# **Thanks for your** attention

*a.schneider@terresinovia.fr*


***Thanks to my colleagues***

*from Terres Inovia*

*from French R&D partners*

*From EU partners*

Schneider et Huyghe 2015

French collective book 2015, 473 pages, Eds QUAE

Terres Inovia

**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

## 16:30 - 16:40 | QUANTIFYING DIGITAL IMPACT: THE QUANTIFARM TOOLKIT

QuantiFarm

**GEORGIOS CHARVALIS**

NEUROPUBLIC

NUTRI-CHECK NET

OPTIMISING CROP NUTRITION

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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

**GEORGIOS CHARVALIS**
NEUROPUBLIC

**MSc in Geo-information Science and Earth Observation for Environmental Modelling and Management, with expertise in GIS, earth observation, and spatiotemporal data analysis.**

**Four years of experience in technical management across multiple national and European-funded projects in the environmental and agricultural sectors.**

**Currently developing data-driven approaches to achieve a more evidence-based and sustainable agricultural productivity growth in EU in NEROPUBLIC.**

**QuantiFarm project WP leader.**

NUTRI-CHECK NET
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QuantiFarm

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# NUTRI-CHECK NET FINAL CONFERENCE

18/11/2025

## Quantifying digital impact:
## The QuantiFarmToolkit

quantifarm.eu

# PROJECT DETAILS


- **Acronym:** QuantiFarm
- **Title:** Assessing the impact of digital technology solutions in agriculture in real-life conditions
- **Total budget:** 7,723,539 EUR €
- **Total funding:** 7,397,382.50 €
- **Duration:** 01 July 2022 – 31 March 2026 (45 months)
- **Consortium:** 32 partners from 20 countries
- **Coordinator**: GAIA EPICHEIREIN (Greece)

# THE CHALLENGE

- The last decade has seen an explosion of interest and investment in the use of digital technologies in agriculture and food production (DATSs).
- Many promised/predicted benefits of DATSs
- Slow and limited actual uptake and use by farmers in the EU

**Lack of knowledge about DATSs**

**Insufficient clear and hard data on the monetary costs and benefits of DATSs**

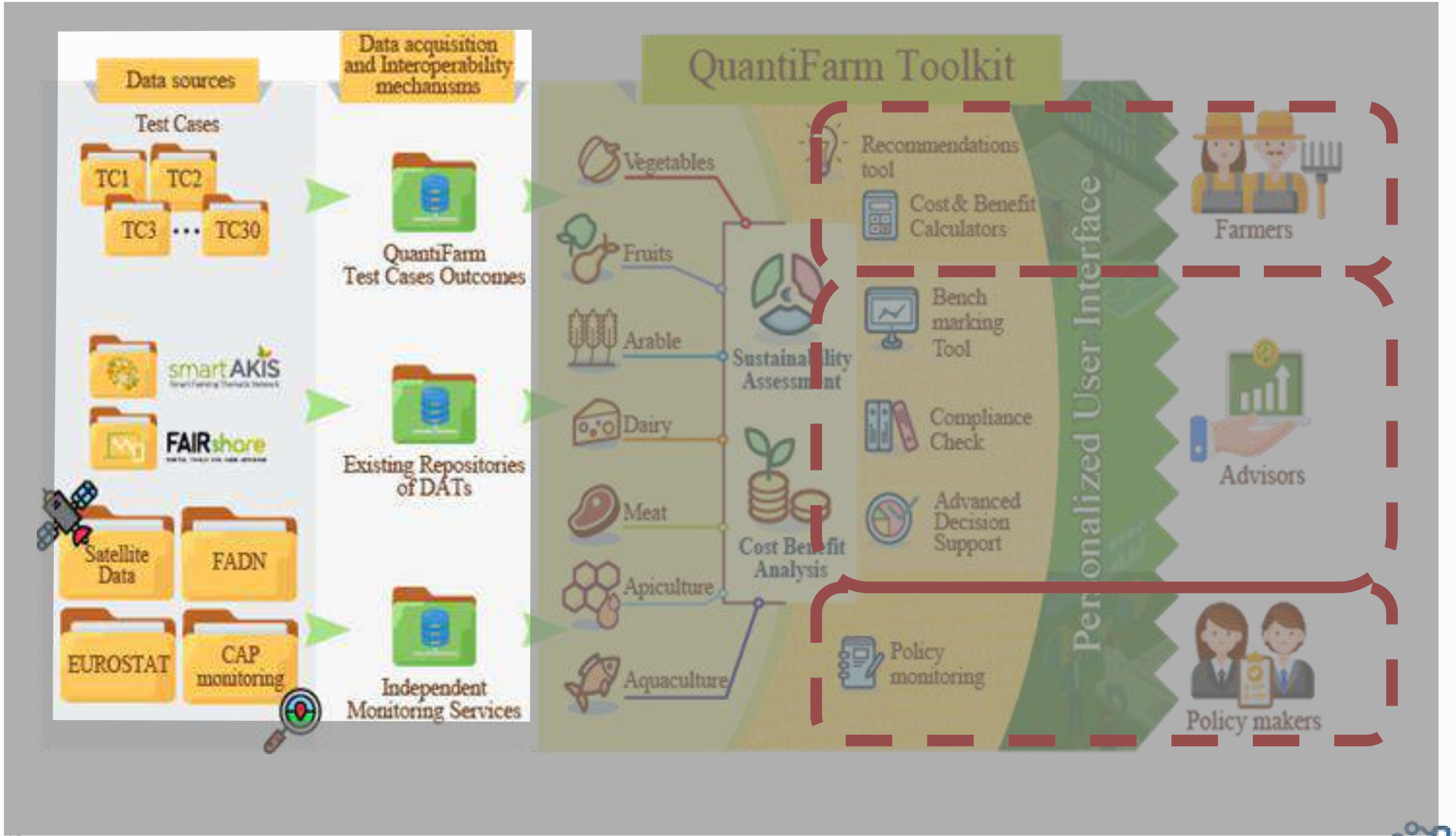
**DATSs impact on environmental and social sustainability**

**Impediments such as farmers’ cultural and behavioural attitudes**

# MISSION AND UNIQUE CHARACTERISTICS

- Our **mission** to support the further deployment of DATSs as key enablers for enhancing the sustainability (economic, environmental and social) performance and competitiveness of the agricultural sector
- Why is QuantiFarm **unique**?
  - Focus on commercial farms: Allows testing in real conditions
  - Systematic cross-European coverage of DATs: Evaluating the performance of DATSs in 30 test cases across 10 Biogeographical Regions and 20 countries.
  - Tools BY farmers & advisors FOR farmers & advisors: Coordinated by GAIA and a total of 12 partners representing farmers & advisors, including Copa Cogeca & EUFRAS.

# QUANTIFARM TOOLKIT: ARCHITECTURE



# QUANTIFARM TOOLKIT

- DATSs assessment results
- Cost-Benefit Calculator
- Recommendations tool
- Benchmarking tool
- Advanced decision-support tool
- Policy Monitoring tool

https://quantifarmtoolkit.eu/index.html


- A web based user-friendly dashboard to raise awareness and facilitate evidence-based decision making regarding DATSs
- 4 Decision Support Tools for Farmers & Farm Advisors
- 1 Monitoring Tool for Policy Makers
- >500 DATSs included
- Customized assessments and personalized advisory services regarding DATSs

QuantiFarm Toolkit

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Login


# Your gateway to the digital era of farming

Get evidence-based, personalized recommendations and trustworthy assessments of Digital Agriculture Technology Solutions (DATS).

## Start using the Toolkit!

Select your starting point from the main tools provided below

### Recommendations Tool

Get a Recommendation for a Digital Agricultural Technology Solution that fits your farm type, crop type, and needs. **Browse through more than 500 solutions.**

for Farmer

for Advisor

### Cost & Benefit Calculators

Perform a Cost-Benefit Analysis on selected Digital Agricultural Technology Solution. **When and how will your investment pay you back?**

for Farmer

for Advisor

### Policy Monitoring Tool

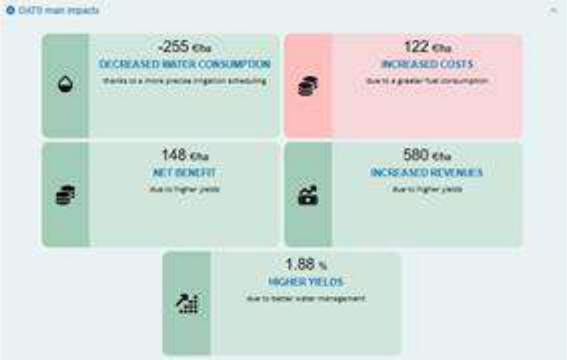
What is the **large-scale impact** of Digital Agricultural Technology Solutions when applied on regional level?

for Policy Maker

# DATSs ASSESSMENT RESULTS

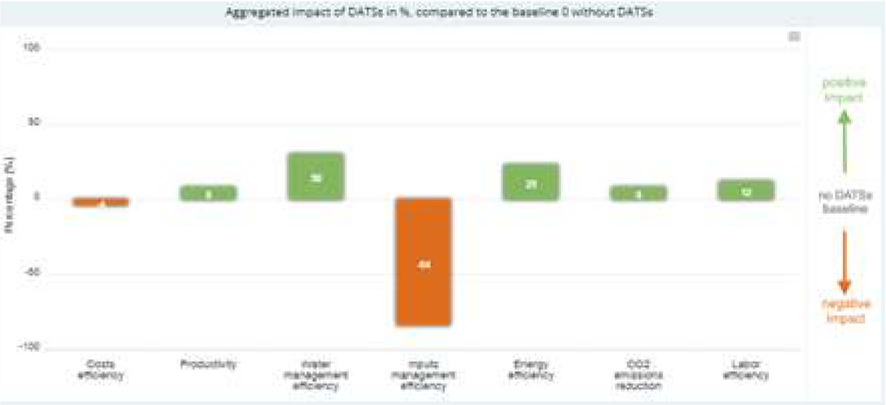
**TEST CASE 1**

- Agricultural Sector: **Arable**
- Crop / Livestock: **Potatoes**
- Country: **Greece**
- Digital Solutions: **gaiasense**




**Cost and revenues impacts**

| | | | |
|---|---|---|---|
| DATSs COSTS | 450 | €/ha | Initial investment for the DATSs |
| | 310 | €/ha | Cost of DATSs (maintenance + annual fees) |
| COSTS | -15 | €/ha | Cost of pesticides: Despite an overall increase in the average quantity of pesticides used, there is a reduction in costs due to the different products applied in the two scenarios, with and without the DATSs |
| | 1.5 | €/ha | Cost of labour for pesticides application: The slight increase in the cost associated with pesticide distribution is linked to the higher number of interventions in farms with DATSs |
| | -30 | €/ha | Cost of labour for irrigation: Irrigation practices are made more efficient in terms of duration and frequency, reducing the workload |
| | -38 | €/ha | Cost of electricity: Electricity is used for irrigation, which has been made more efficient by the DATSs |
| | 616 | €/ha | Cost of fertilizers: An increase in fertilizer costs is observed, probably because the DATS system recommended increasing nutrient application based on the crop's specific needs. However, in 3 out of 4 cases, there was a reduction in fertilizer use, which was not offset by the disproportionately higher increase in the fourth case |
| | -255 | €/ha | Cost of water: The data collected by the DATS system, including temperature, humidity, precipitation, and soil moisture, supports precise irrigation scheduling, resulting in significant water savings |
| | -158 | €/ha | Cost of fuel: A significant portion of the fuel is used for agronomic practices that have been made more efficient by the DATS system, resulting in lower fuel costs |
| OUTPUT | 580 | €/ha | Revenues: The revenue increase is generated by the higher yields achieved with DATSs |
| CBA | 148 | €/ha | Net Benefit: Despite the increase in costs, mainly related to the fertilizers applied, the balance is positive due to a revenue increase resulting from higher yields |



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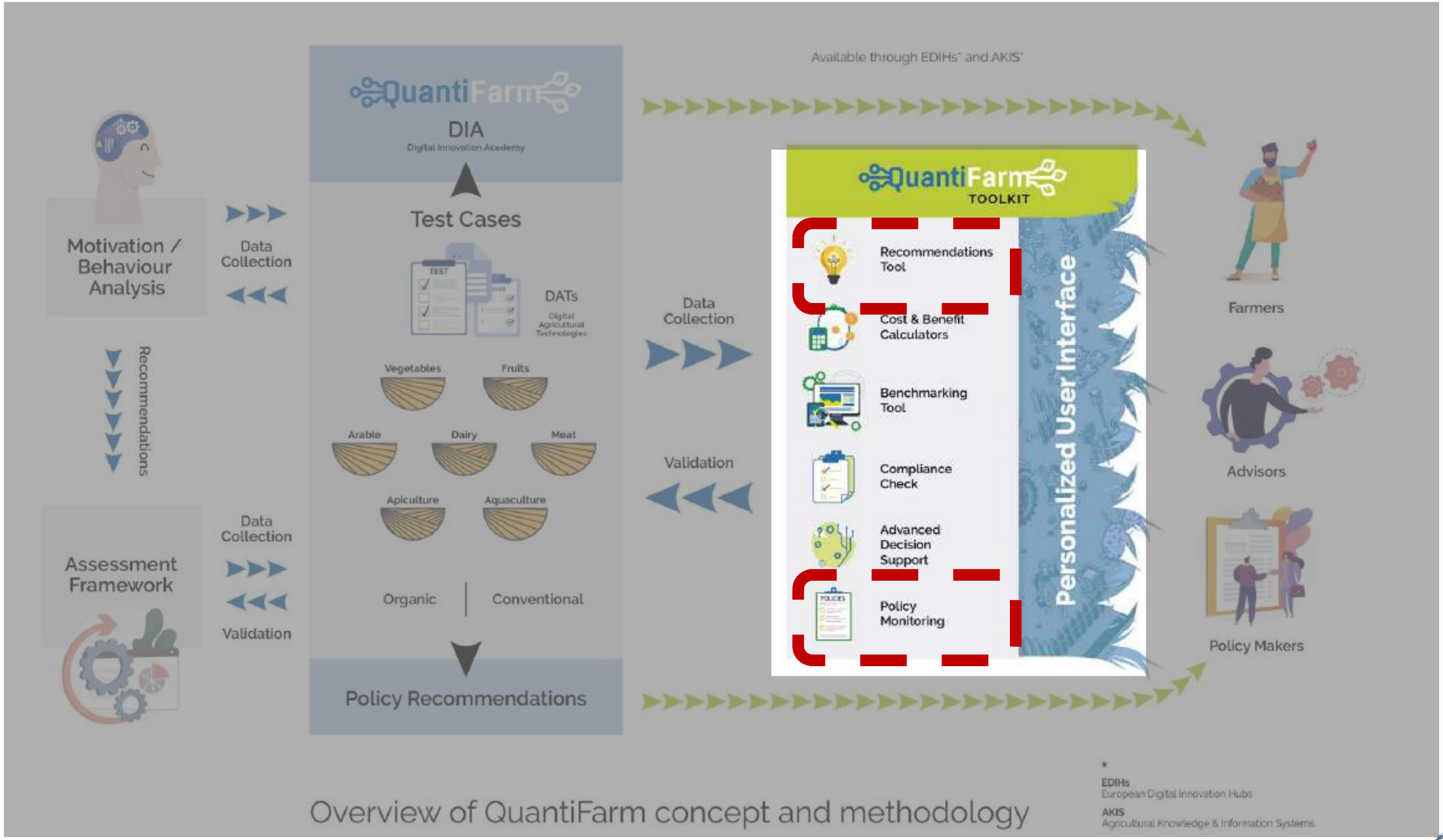
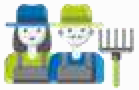
# QUANTIFARM TOOLKIT: ARCHITECTURE



# QUANTIFARM TOOLKIT: RECOMMENDATION TOOL

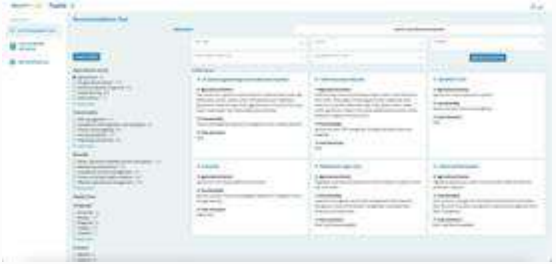
✓ An interactive tool that provides recommendations of suitable DATSs, given various criteria:



Farmers

Advisors

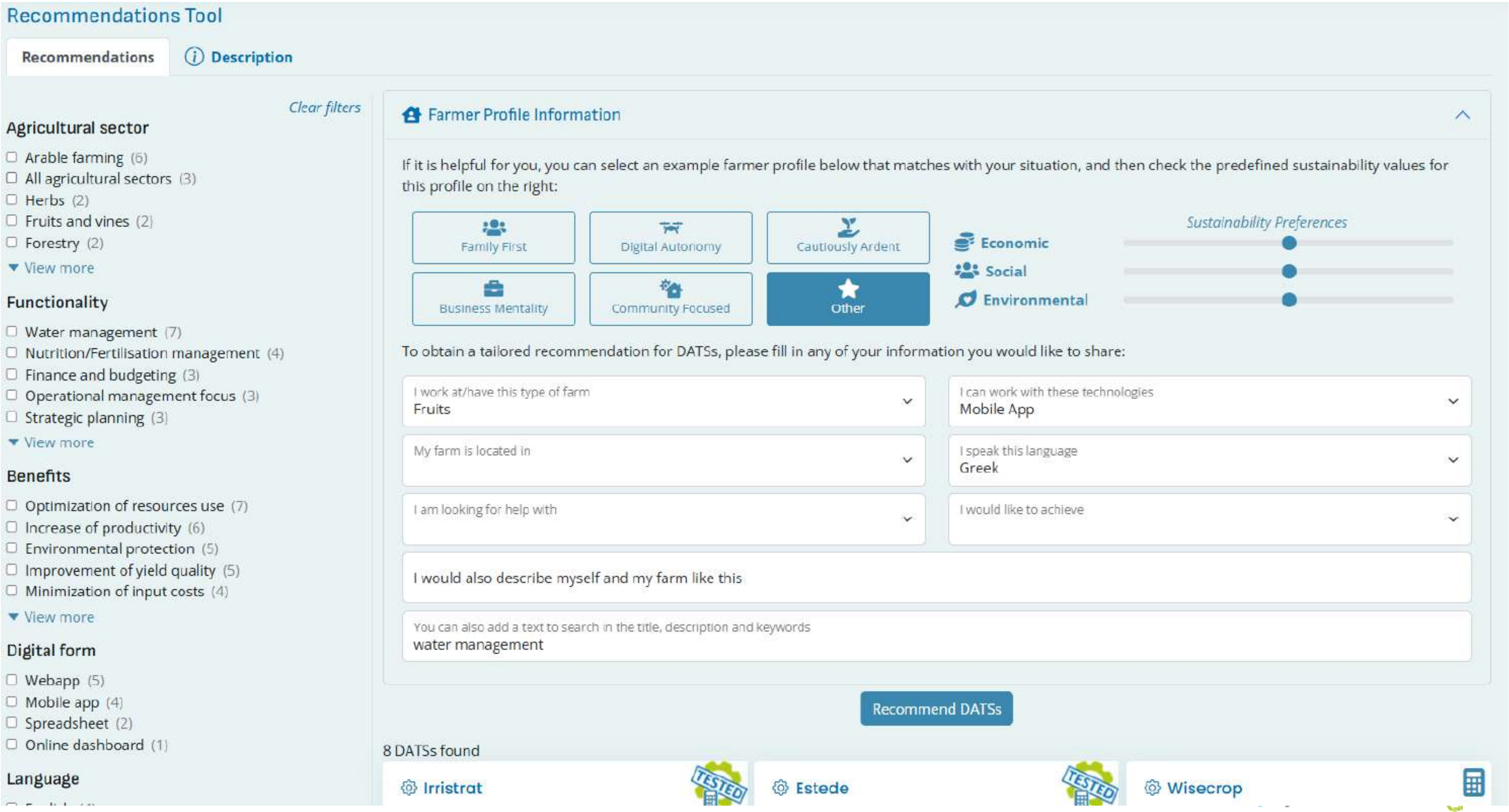
1. DATS search filter values:
   - (Agricultural Sector) the sector the DATS is targeting
   - (Functionality) the relevant functionality of the DATS
   - (Benefits) the benefits that can be reached by using the DAT
   - (Digital Form) the digital form of the DATS
   - (Language and Country) the supported language and targeted country of the DATS
   - (Cost Structure) the cost structure of the DATS



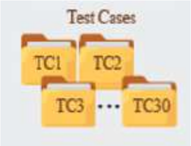
2. Farm characteristics values (Recommend) - The possible farm characteristics to recommend the DATSs/ Criteria: Farm Type , Country, Language

✓ Recommendations based on additional criteria and on a similarity evaluation algorithm based on **QuantiFarm's Test Case assessment results. To support generalised recommendations based on context similarity.**

✓ Farmers behavioural aspects will also be part of the recommendation algorithm.

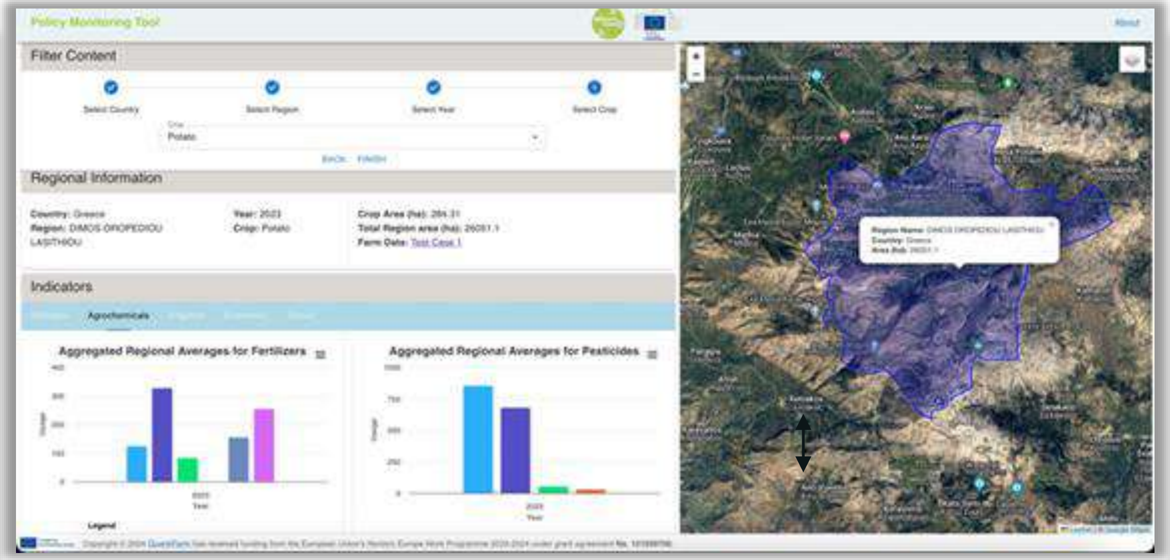

Recommendations Tool
Recommendations
Description
Clear filters
Agricultural sector
Arable farming (6)
All agricultural sectors (3)
Herbs (2)
Fruits and vines (2)
Forestry (2)
View more
Functionality
Water management (7)
Nutrition/Fertilisation management (4)
Finance and budgeting (3)
Operational management focus (3)
Strategic planning (3)
View more
Benefits
Optimization of resources use (7)
Increase of productivity (6)
Environmental protection (5)
Improvement of yield quality (5)
Minimization of input costs (4)
View more
Digital form
Webapp (5)
Mobile app (4)
Spreadsheet (2)
Online dashboard (1)
Language
Farmer Profile Information
If it is helpful for you, you can select an example farmer profile below that matches with your situation, and then check the predefined sustainability values for this profile on the right:
Family First
Digital Autonomy
Cautiously Ardent
Business Mentality
Community Focused
Other
Sustainability Preferences
Economic
Social
Environmental
To obtain a tailored recommendation for DATSs, please fill in any of your information you would like to share:
I work at/have this type of farm
Fruits
I can work with these technologies
Mobile App
My farm is located in
I speak this language
Greek
I am looking for help with
I would like to achieve
I would also describe myself and my farm like this
You can also add a text to search in the title, description and keywords
water management
Recommend DATSs
8 DATSs found
Irristrat
TESTED
Estede
TESTED
Wisecrop

# QUANTIFARM TOOLKIT: POLICY MONITORING TOOL




**Regional TC indicators**

- ✓ Irrigation
- ✓ Fertilizers
- ✓ Pesticides
- ✓ Harvests
- ✓ Costs
- ✓ Labor





**External data sources**

- ✓ EU LAU regions
- ✓ GISCO
- ✓ Natura 2000
- ✓ Land use data
- ✓ FAO/FADN
- ✓ Regional crop type classification

**Offers extrapolated regional metrics to the whole region based on the crop area of the classification product.**

Regional metrics can be used for :

- ✓ **Generalized indicators tracking**
- ✓ **DATS vs. Non-DATS performance**
- ✓ **Regional benchmarking**

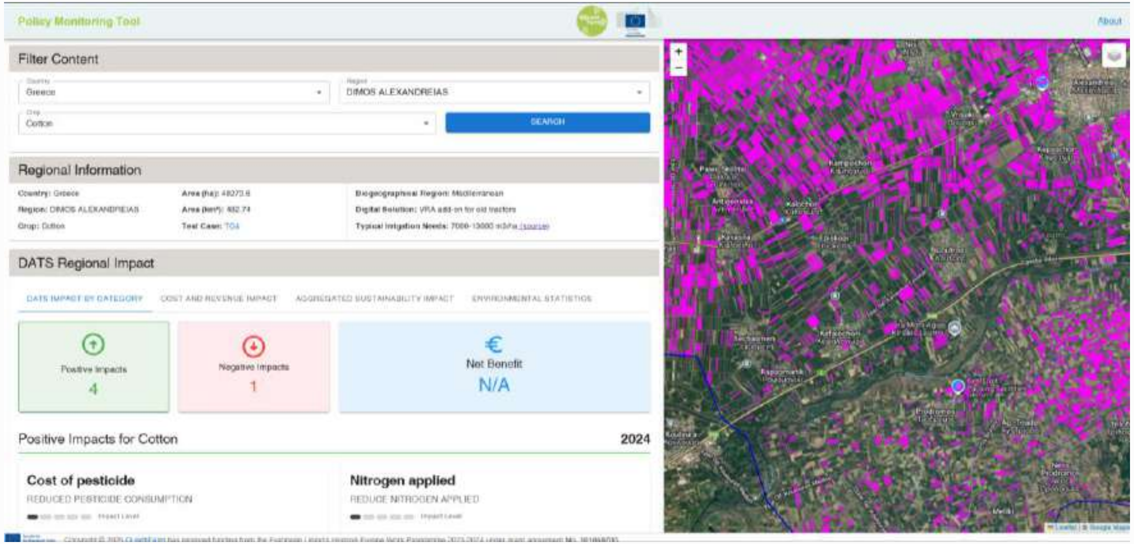
**Target audience:**


quantifarm.eu

QuantiFarm

# QUANTIFARM TOOLKIT: POLICY MONITORING TOOL KPIs

- ✅ 13 TCs integrated (9 TCs initially targeted)
- 8 countries
- 45+ regions
- 110+ parcels
- 2500+ hectares
- 13+ crop types
- 5 biogeographical regions



# NAVIGATE THROUGH THE TOOLKIT'S ONLINE ENVIRONMENT

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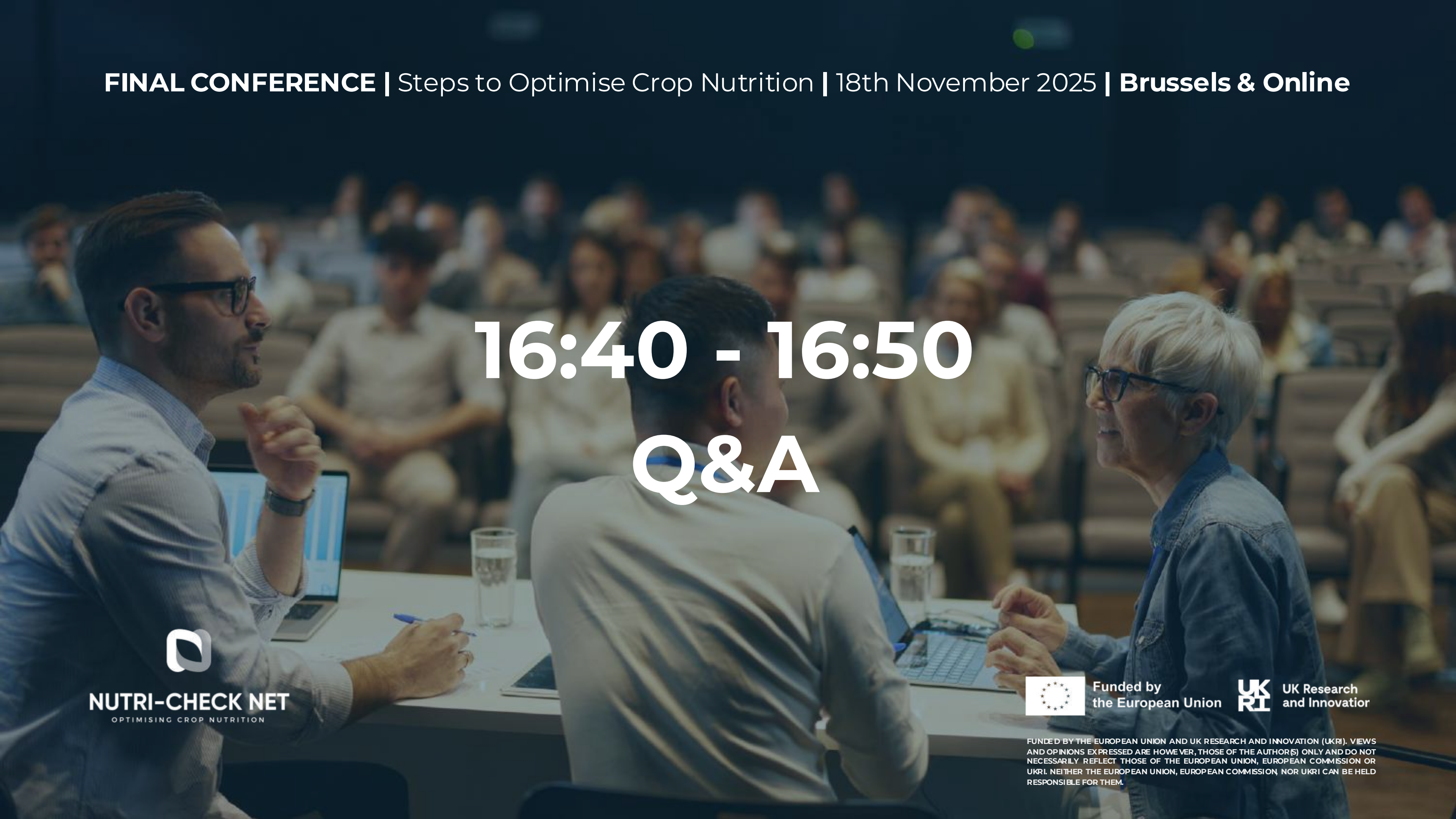
for Policy Maker

Funded by the European Union

# Thank you for your attention

g_charvalis@neuropublic.gr



FINAL CONFERENCE | Steps to Optimise Crop Nutrition | 18th November 2025 | Brussels & Online
16:40 - 16:50
Q&A
NUTRI-CHECK NET
OPTIMISING CROP NUTRITION
Funded by the European Union
UK Research and Innovation
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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

# 16:50 - 17:00

# LEG STRETCH BREAK

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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

## 17:00 - 17:30 | PANEL DISCUSSION: BRIDGING SECTORS FOR A BETTER FUTURE

**FRANCESCA DEGAN**
ARVALIS

**MIGUEL QUEMADA**
**UPMADRID**

**DIRK JAN BEULING**
BOERENBEDRIJF BEULING B.V.

**MARK TUCKER**
YARA

**LUDWING HERMANN**
PROMAN

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**FINAL CONFERENCE |** Steps to Optimise Crop Nutrition **|** 18th November 2025 **| Brussels & Online**

## 17:30 - 17:45 | CONFERENCE CLOSE

**SPYROS FOUNTAS,** AUA

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**FINAL CONFERENCE** | Steps to Optimise Crop Nutrition | 18th November 2025 | **Brussels & Online**

**SPYROS FOUNTAS**

AUA

**Professor and Dean in the School of Environment and Agricultural Engineering at the Agricultural University of Athens.**

**BSc in Agricultural Sciences from Greece in 1993, MSc in Management Information Systems from Cranfield University, UK, in 1998, and PhD from Copenhagen University, Denmark, in Systems Analysis on Precision Agriculture in 2004.**

**He has been Editor-in-Chief of the Elsevier journal Smart Agricultural Technology (2021-today)**

**He has coordinated 7 H2020 and Horizon Europe projects, while he has participated in several other European, national and industry-based projects. He has more than 250 papers, including book chapters, journal papers and conference papers and 11,800 citations (Google Scholar, October 2025).**

**NUTRI-CHECK NET's project coordinator.**

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