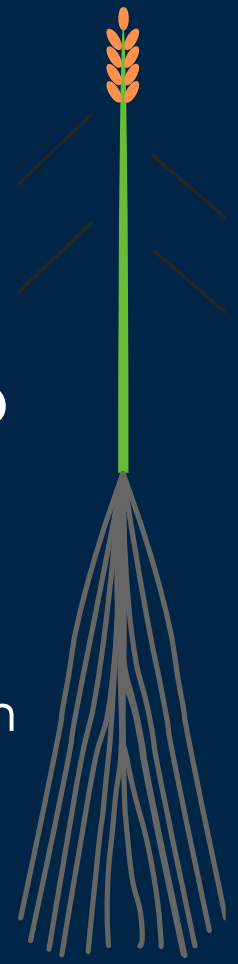
The New Crop Portfolio in the Nordic Region

Perennial Grain Crops
Why should Denmark grow them?



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Department of Agroecology
Aarhus University

What are perennial grain crops?

Perennial cereals

Grown in ~2000 ha in the U.S

The three challenges for faster adoption

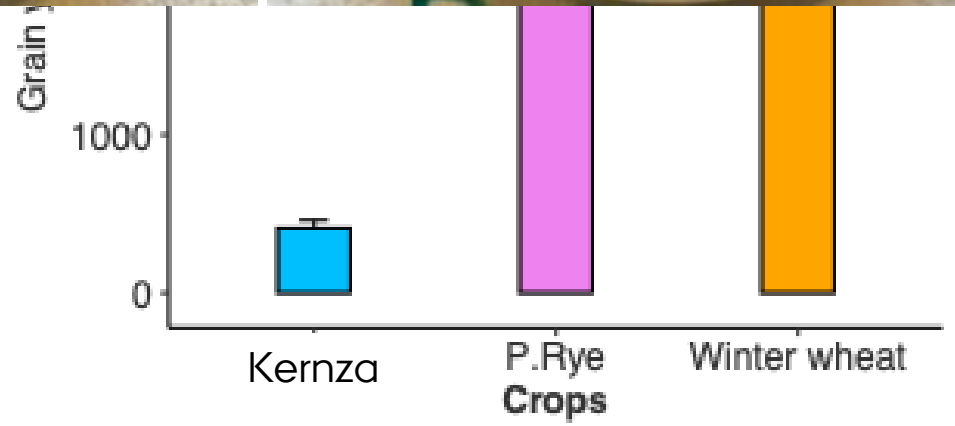
Under Danish context

Low grain yield potential relative to annuals

Insufficient **quantitative evidence** for ecosystem service potential

Lack of **product value and market pathways** to ensure industry adoption.

Yield – Wild type vs Hybrid vs Modern variety



Perennial System Trial in Foulum (2024)

Yield - Strategy 1: Domestication gene

Wild type

Anna Westebergh, SLU

Michael Palmgreen, KU

Christian Benjamin Andersen
Søren Knudsen
Carlsberg Research Lab

Ø[illegible]berg *et al*. (2017)
Trends in Plant Science

Hybrid type

[illegible]aus Krogh Madsen, AU

Virginia Anne Nichols, AU

Yield – Strategy 2: Early traits for easier breeding

Video: Yuma Ikeda

Lego-inspired phenotyping platform

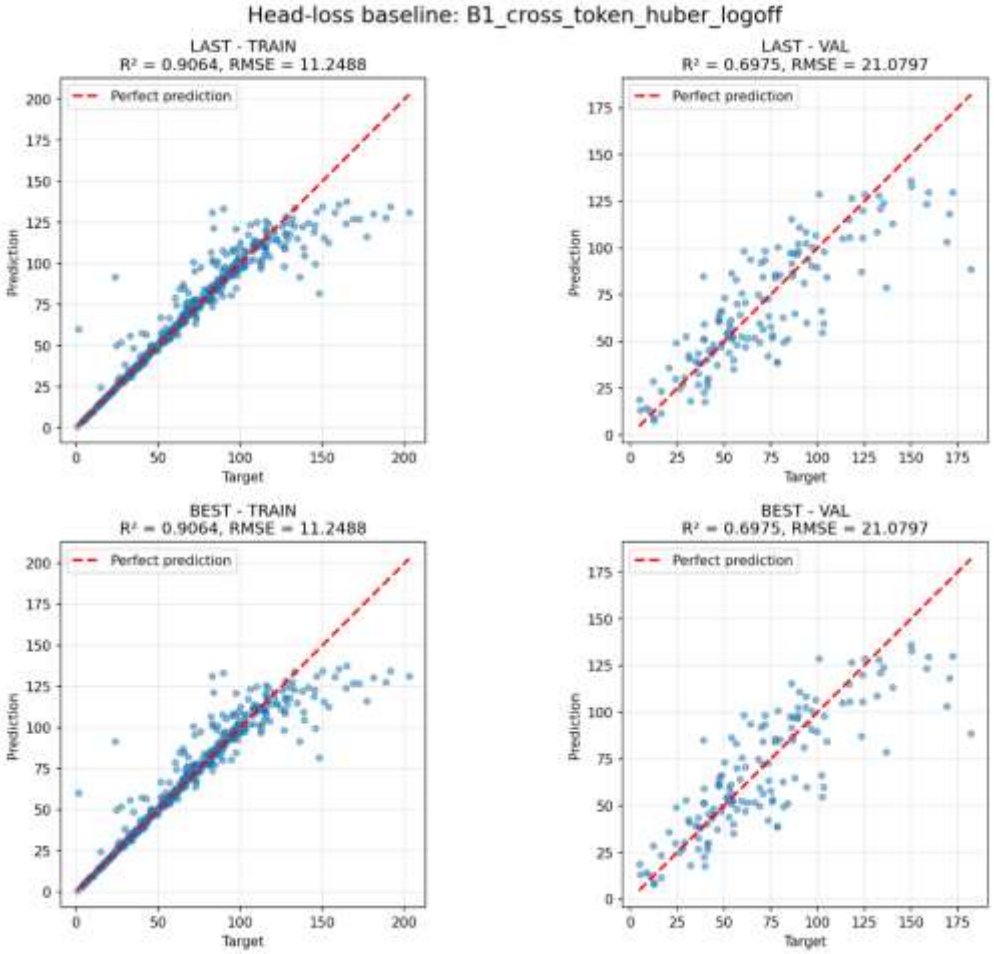
Predicting

- Photosynthesis
- Leaf area
- Plant vigour
- **Grain yield**

[3D plants]

Yield – Strategy 2: Data-driven approach

Perennial Grain Nursery at FG
During the 1st harvest



Yield – Strategy 3: Management “Dual-purpose cropping”

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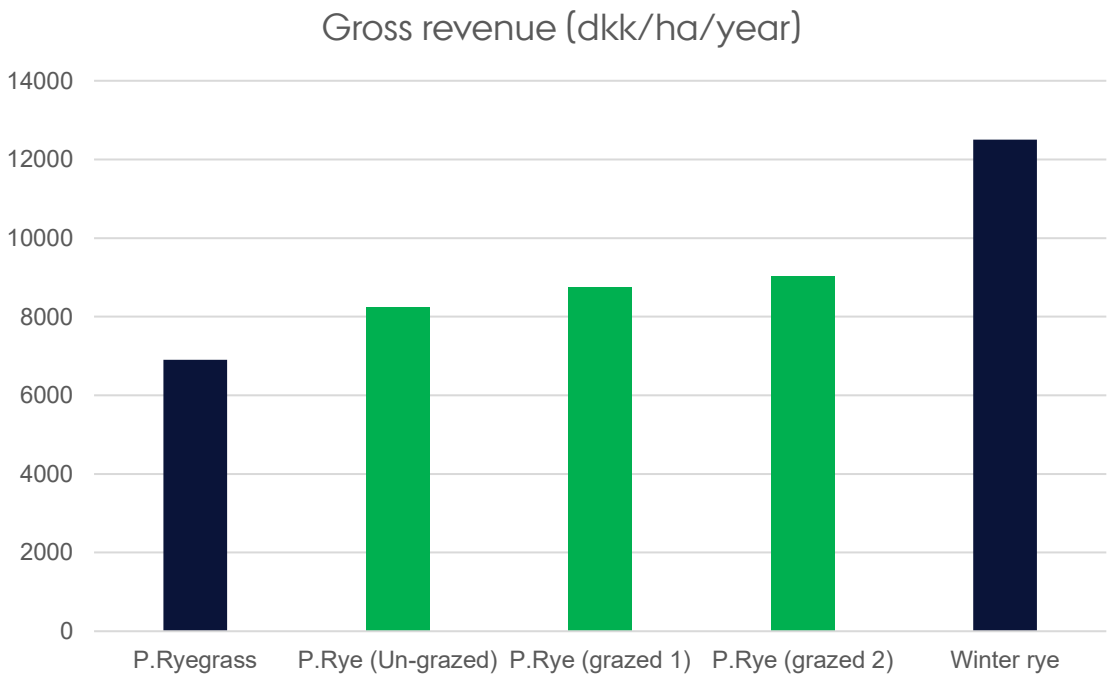
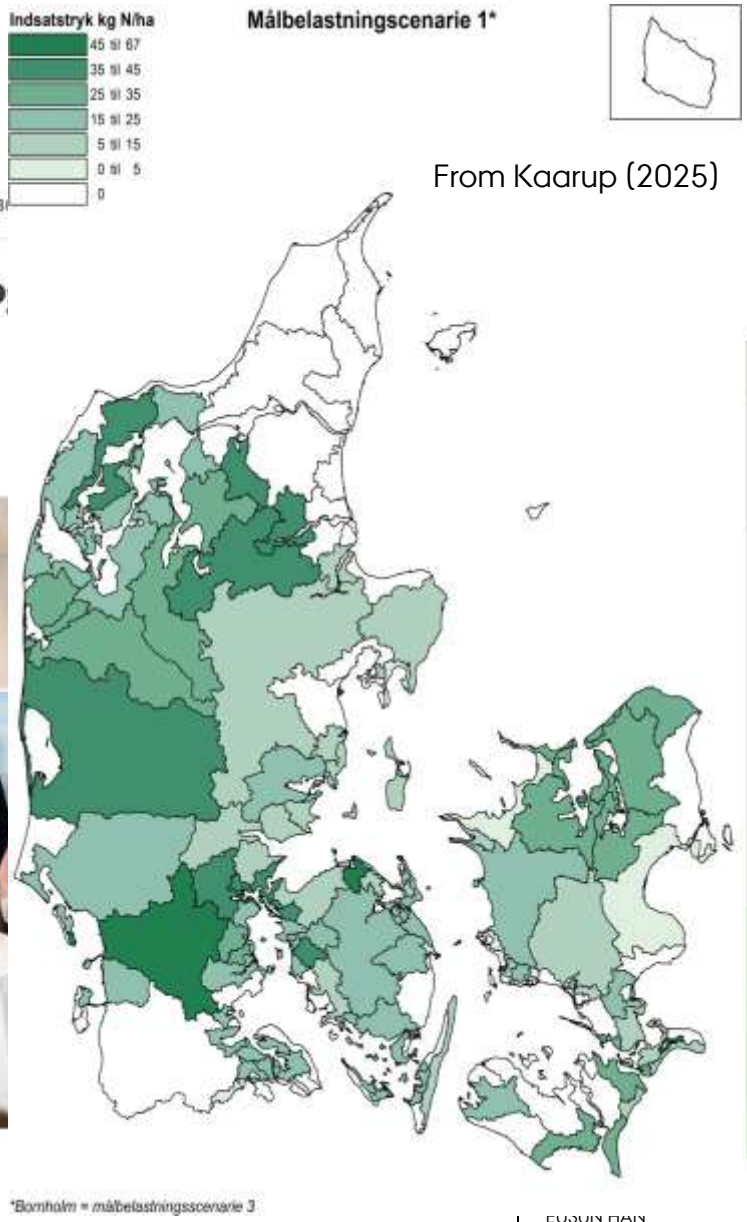
Grain + Green forage

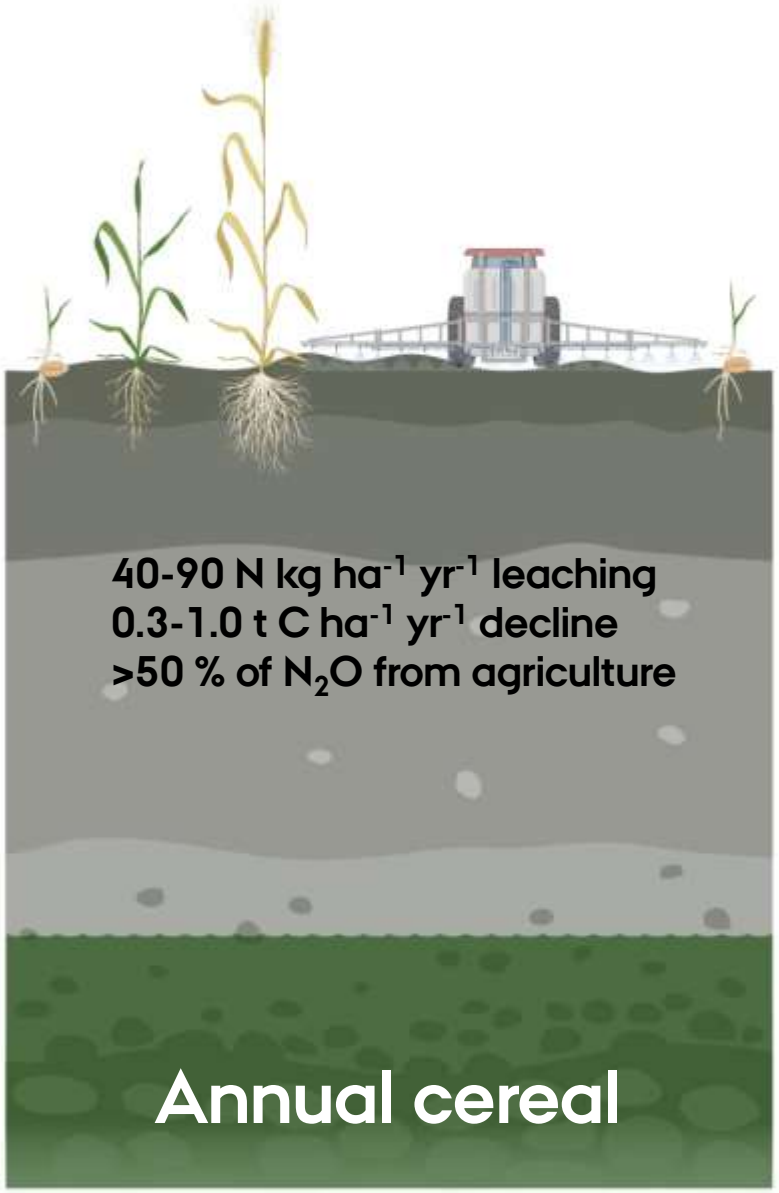


A preliminery results from Denmark
Data: Alexa Peterson

Ecosystem service - Danish context



From Kaarup (2025)



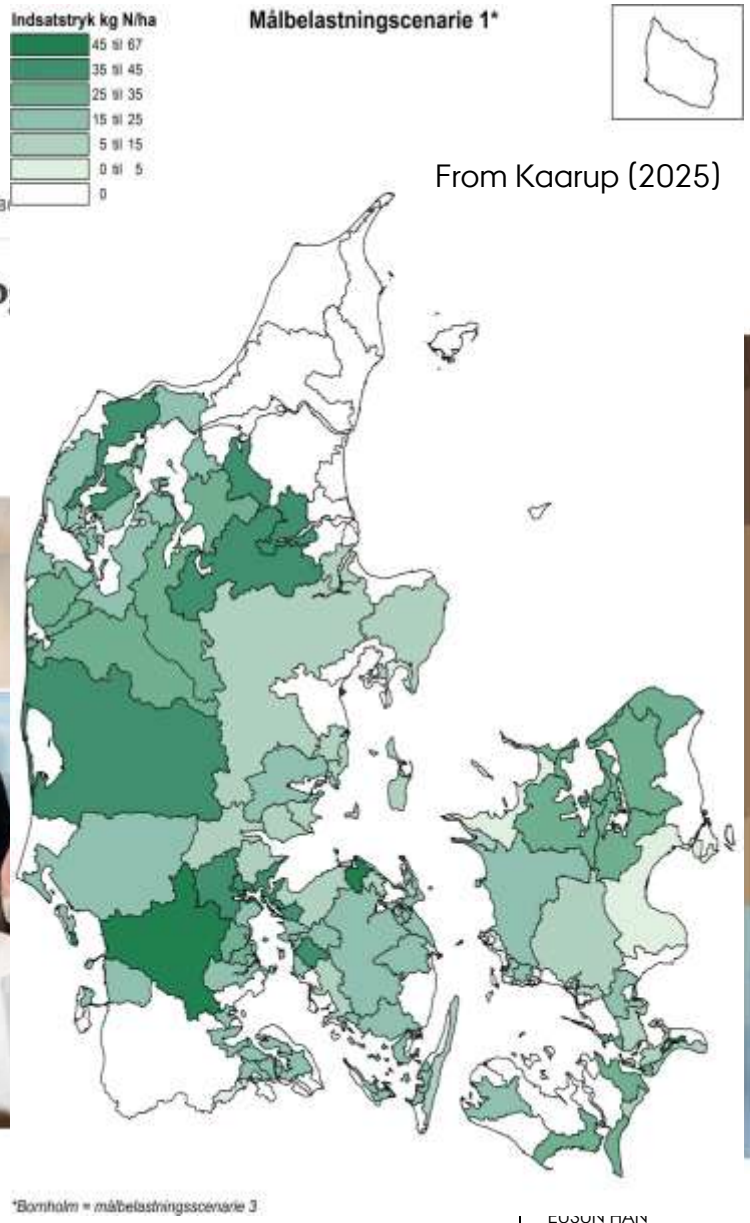
Incentives for perennial grain growers?

DANISH NEWS PRACTICAL HELP LEARN AB

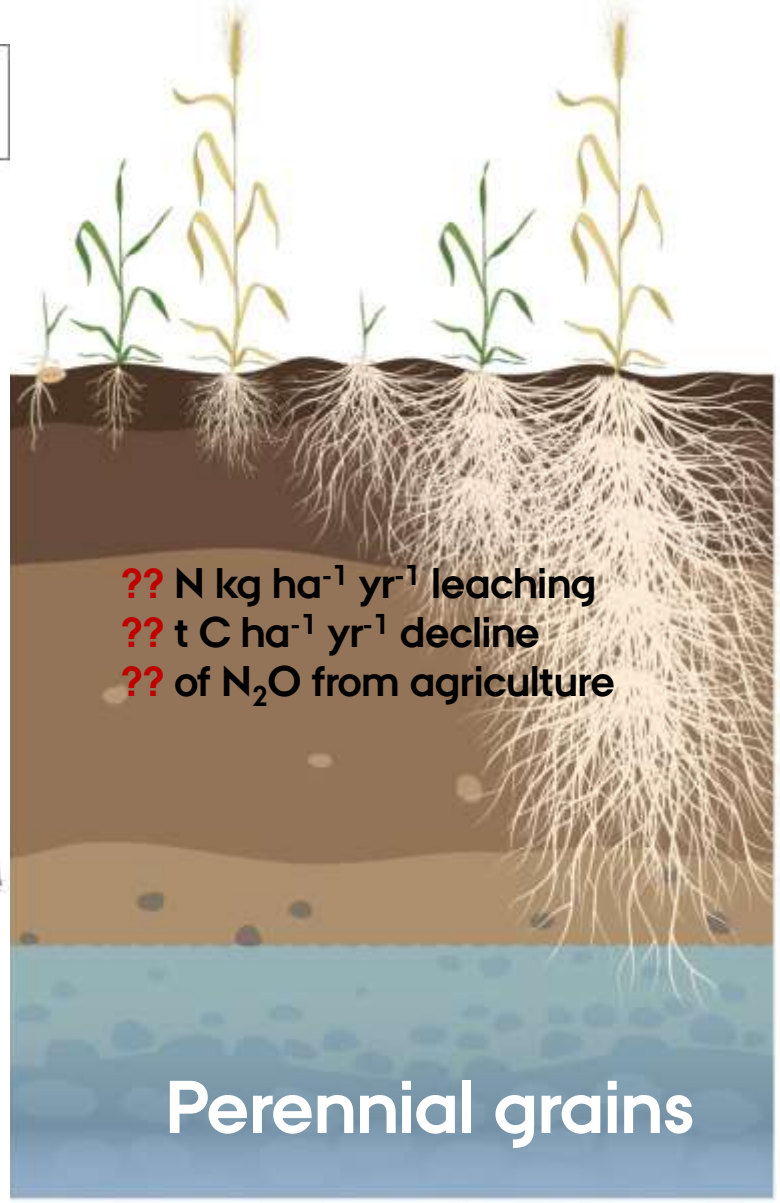
Environment

Denmark targets farm nitro boost water quality

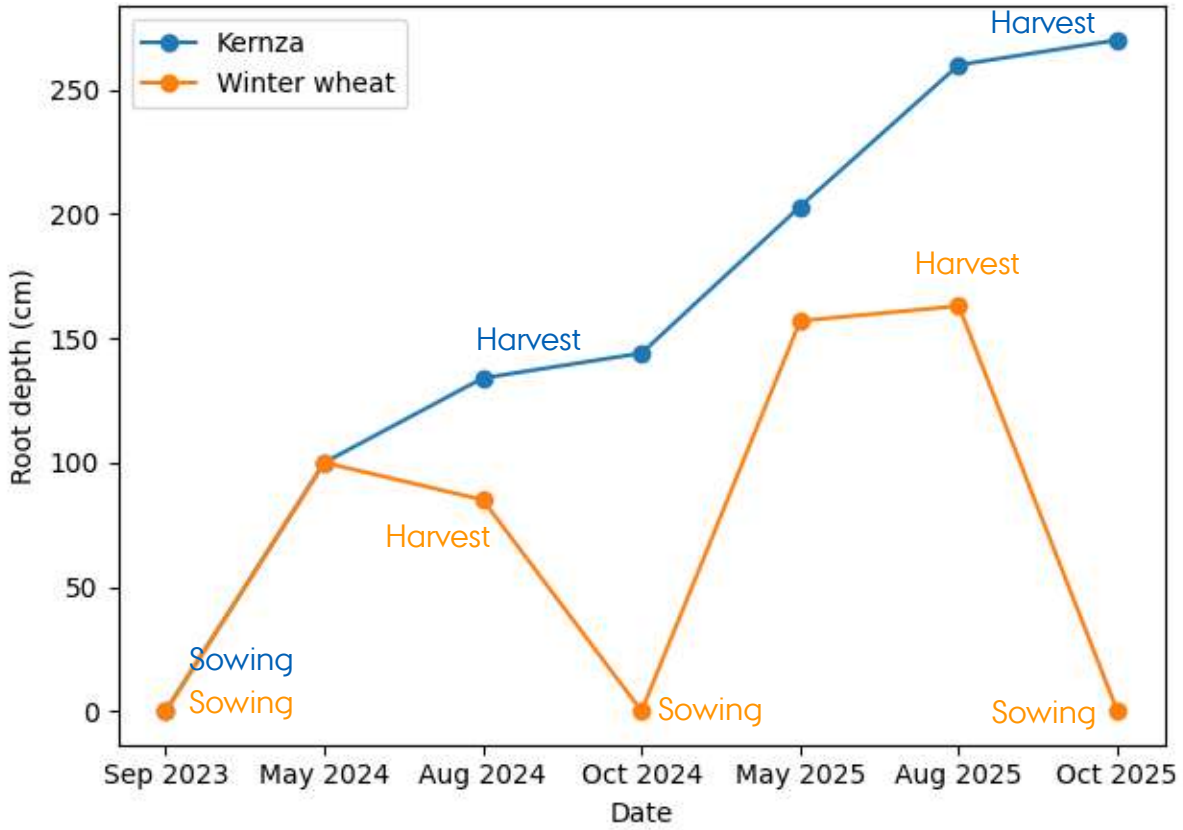
AFP - news@thelocal.dk
Published: 4 Dec, 2025 CET. Updated: Thu 4 Dec 2025 10:02 CET



From Kaarup (2025)

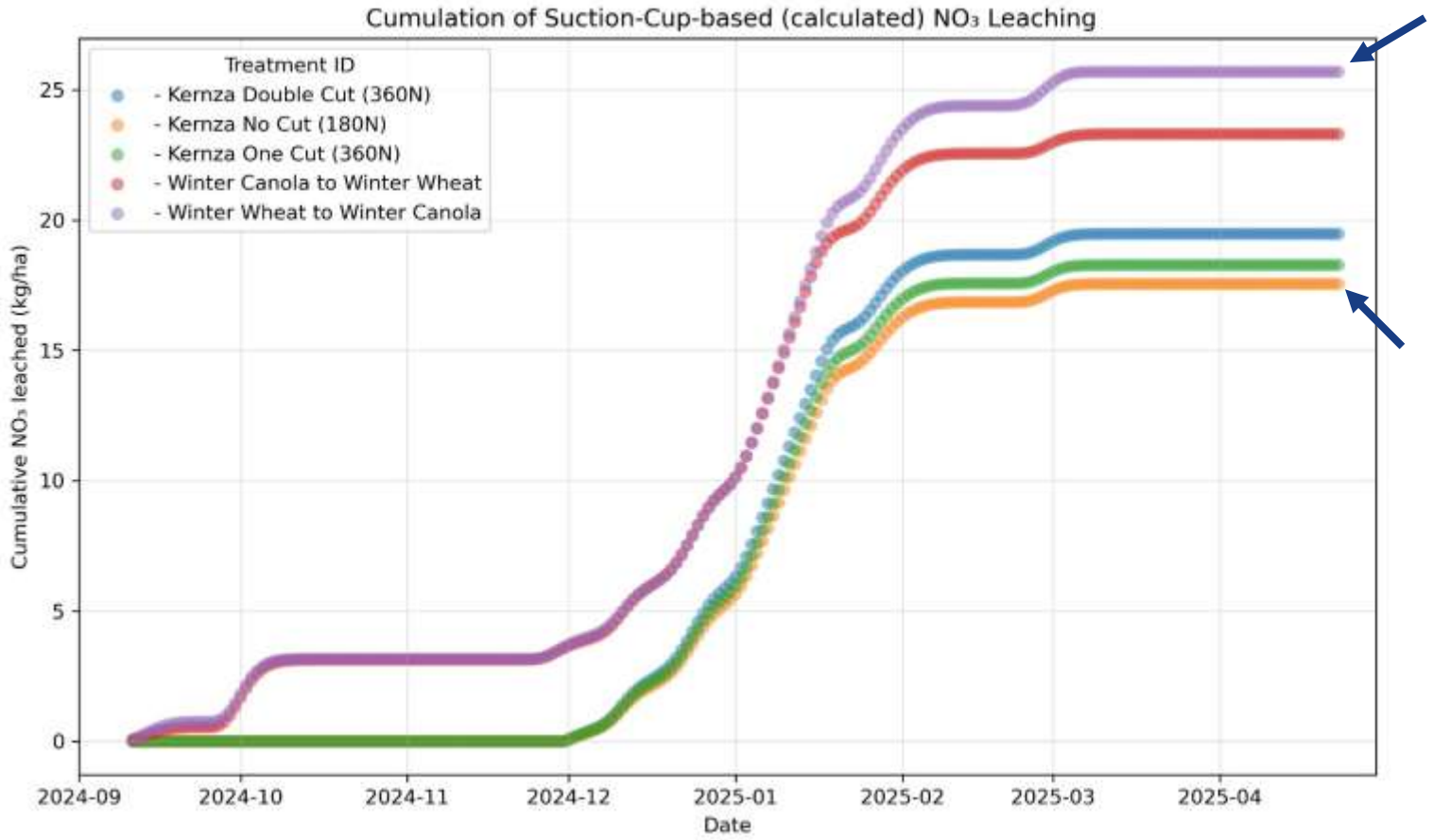


Roots – the core of ecosystem service



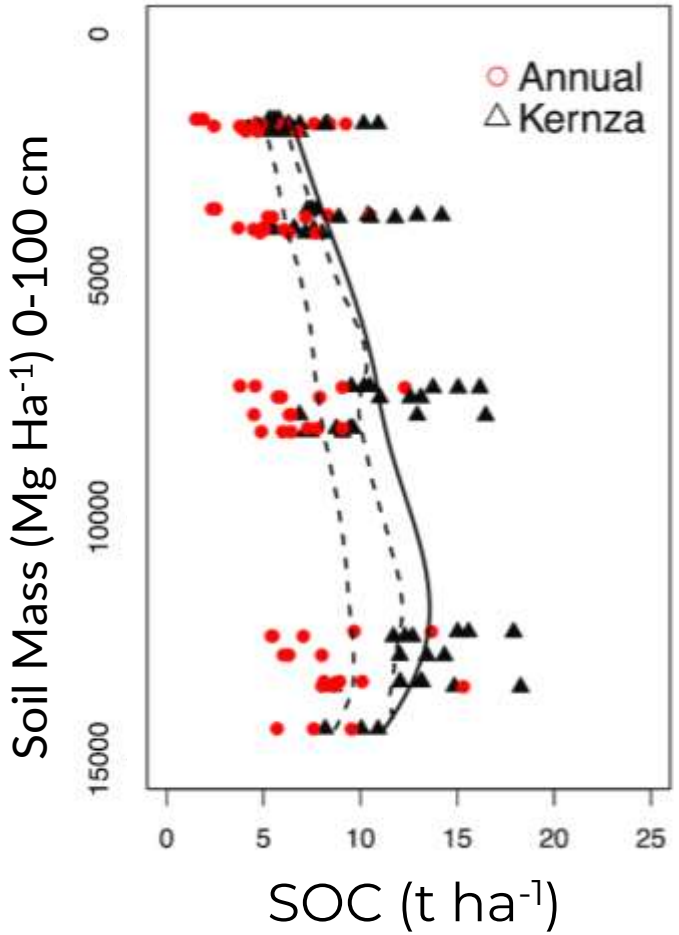
Perennial System Trial, Foulum

N leaching – measured at 2 m – preliminary data



Perennial System Trial, Foulum

“Kernza can increase 0.5 t C/ha/year"



van der pol et al. (2022)

Product, market, industry – North America

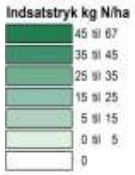
Sold for 50 – 100 dkk per kg

Slow adoption

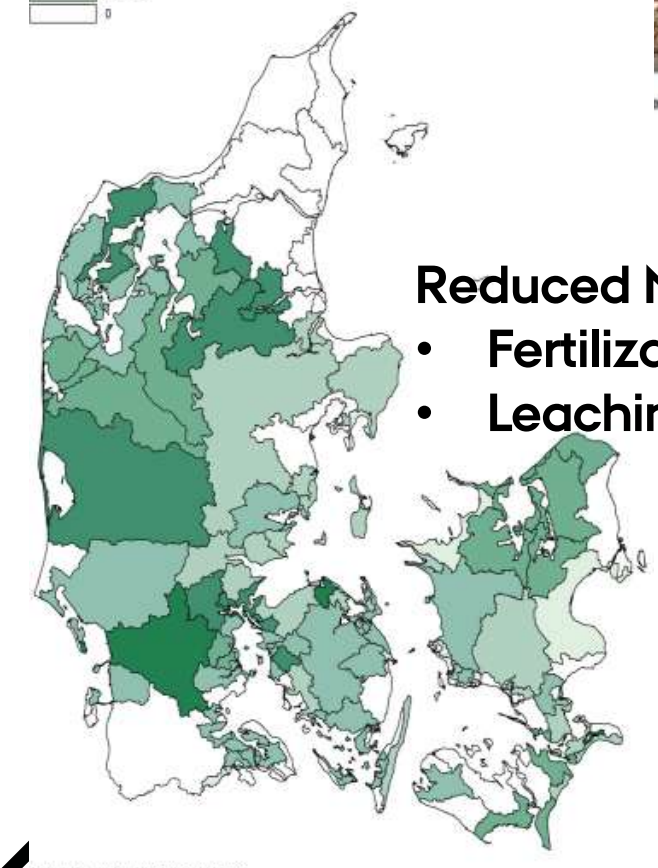
Grown in ~2000 ha

Why?

Ideal scenario for Denmark –As a MULTI-purpose crop



Målbelastningscenarie 1*



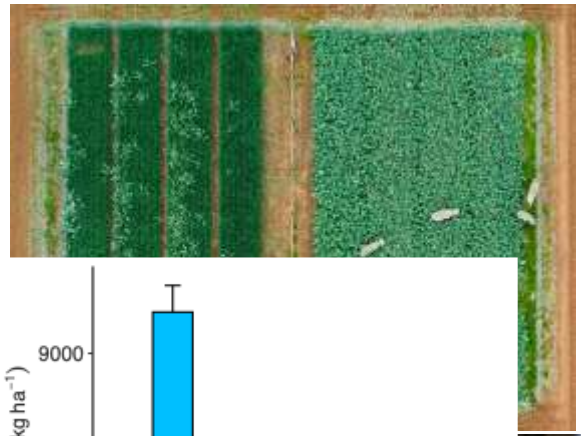
Reduced N

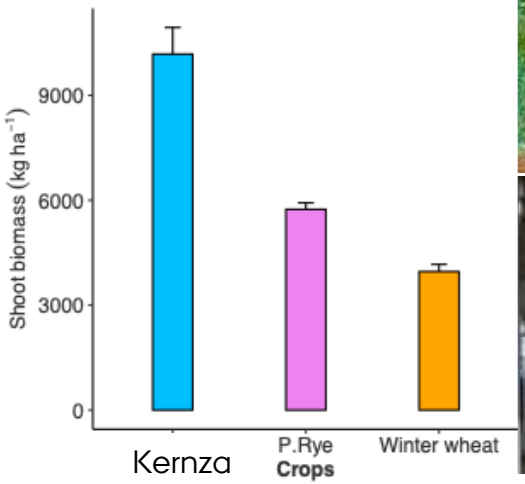
- Fertilization ~half
- Leaching~10-20 kg/ha/year

Food

Feed

Straw



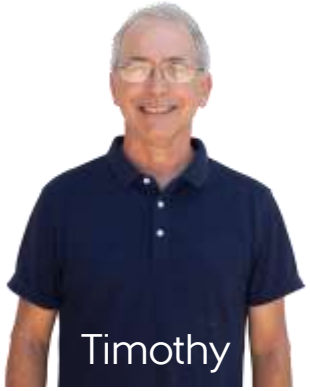
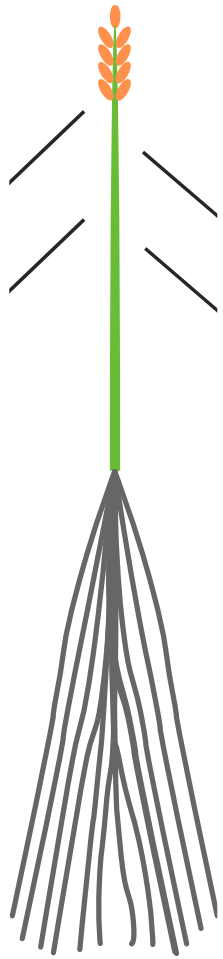


C sequestration ~0.5 t/ha/year

*Bornholm = målbelastningscenarie 3

From Kaarup (2025)

Network: European hub for perennial agriculture

Thank you

Steering Committee