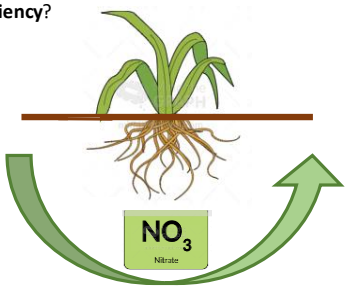
Nitrogen fate in cereal cropping systems is affected by cover crops, N fertilization and tillage intensities - a case farm study

Tomke S. Wacker (tsw@plen.ku.dk) and Kristian Thorup-Kristensen

Univeristy of Copenhagen, Faculty of Science, Department of Plant and Environmental Sciences, Denmark

Objective

How do **different agronomic practices** affect below ground N flows, and can that be utilized to **increase N use efficiency**?



Increase N use efficiency in cereal production

Case farm study

Crop rotation

A **three-year** field experiment was conducted on three different **case farms**, which applied varying **tillage systems**:

- Mouldboard plough (P)
- Harrow (RED)
- No-till (CA)

On one field of each case farm, a **cover crop plot experiment** was established, with:

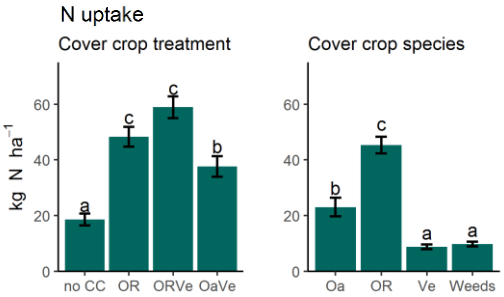
- Oilseed Radish (OR)
- OR & Vetch (ORVe)
- Oats & Vetch (OaVe)
- Weeds (control)

In addition, two **levels of N fertilization** were applied after the recommended dose:

- full dose
- half dose.

Cover crop treatment and species

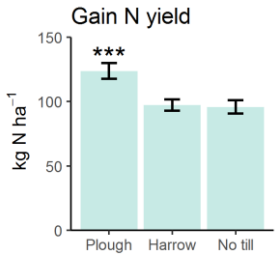
Cover crop treatments and species differed significantly ($p<0.001$) in their N uptake, with **OR > Oa** and **OR = ORVe**. Weeds also showed relevant N uptake capacity.



Cover crop N uptake by species and treatment

Tillage system effect

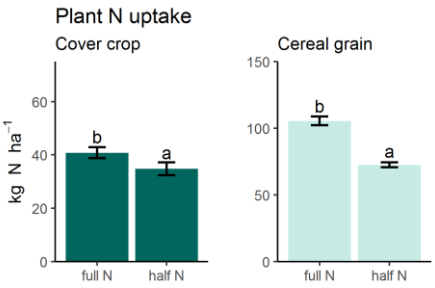
Grain N yield was on average 23 kg ha^{-1} **higher** in the **Ploughed system**, than in the Harrowed and No-till system:



Tillage system effect on grain N yield as average over three years

N fertilization effect

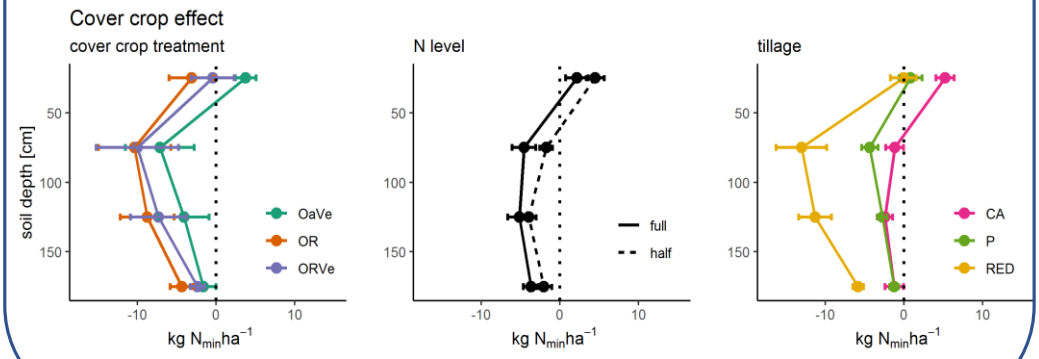
N uptake in cover crop biomass and cereal grain was significantly ($p<0.001$) **higher under full N fertilization**. The effect was more pronounced in the cereal grain.



N fertilization effect on plant N uptake

Cover crop effect on soil mineral N

Cover crop effect is the depletion effect of **soil mineral N** by cover crops, measured in **late autumn to 2m depth**. All **cover crop** treatments **decreased** soil mineral N in the deeper soil layers. Differences in cover crop treatment **N uptake correlated to the cover crop effect**. With higher **N fertilization level** the cover crop **effect was increased**. While the RED tillage field showed high response of cover crops on soil mineral N (likely due to soil texture), **differences between CA and P were small**, and mainly located in the topsoil.



Cover crop effect on soil mineral N in autumn affected by cover crop treatment, N level and tillage. Cover crop effect is calculated as the difference to the control treatment

Conclusions

All **Agronomic practices** influenced spatio-temporal dynamics of **soil mineral N up to 2m** depth.

Cover crops
→ recycle N
→ Species vary in effect

N fertilization level
→ Level of available N
→ Crop growth

Tillage system
→ Crop development

8th World Congress on Conservation Agriculture

The future of farming
Profitable and Sustainable Farming with Conservation Agriculture

Online Congress Bern, Switzerland
June 21st-23th, 2021