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# Saving fertilizer N in Central European sugar beet cultivation through cover cropping?

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## Background & Objectives

- In Europe, cover crop cultivation prior to sugar beet is well **adopted?**
- However, it is not yet clear how much N from **cover crop** biomass differing in amount and composition can be accounted for the N supply of sugar beet and winter wheat as 1st and 2nd succeeding crop.
- **To clarify**, triennial field trials were performed, including the crop sequence cover crop (CC) – sugar beet (SB) – winter wheat (WW).

**This study focuses on the effect of cover crops on the N supply of subsequent non-fertilized sugar beet**

## Results & Discussion

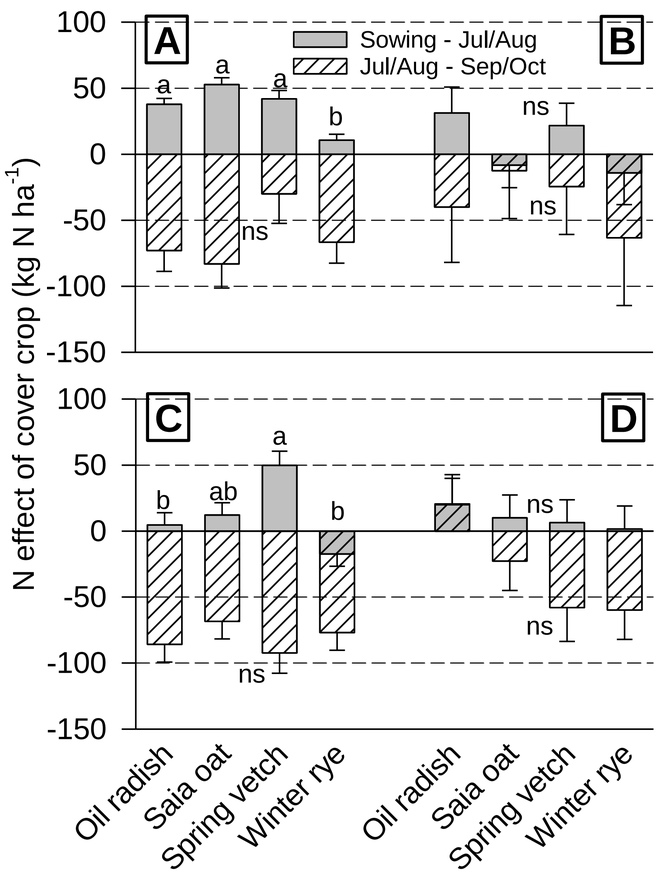



**Figure 1:**
**Cover crop N effect** to non–fertilized sugar beet in two periods of the season at Ihinger Hof 18/19 (A) and 19/20 (B), and Göttingen 18/19 (C) and 19/20 (D).

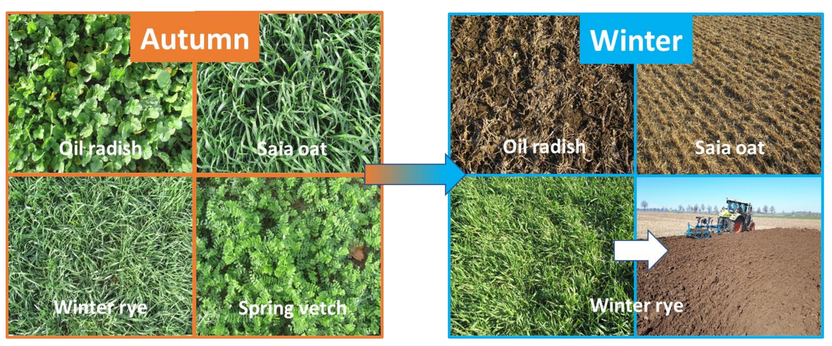
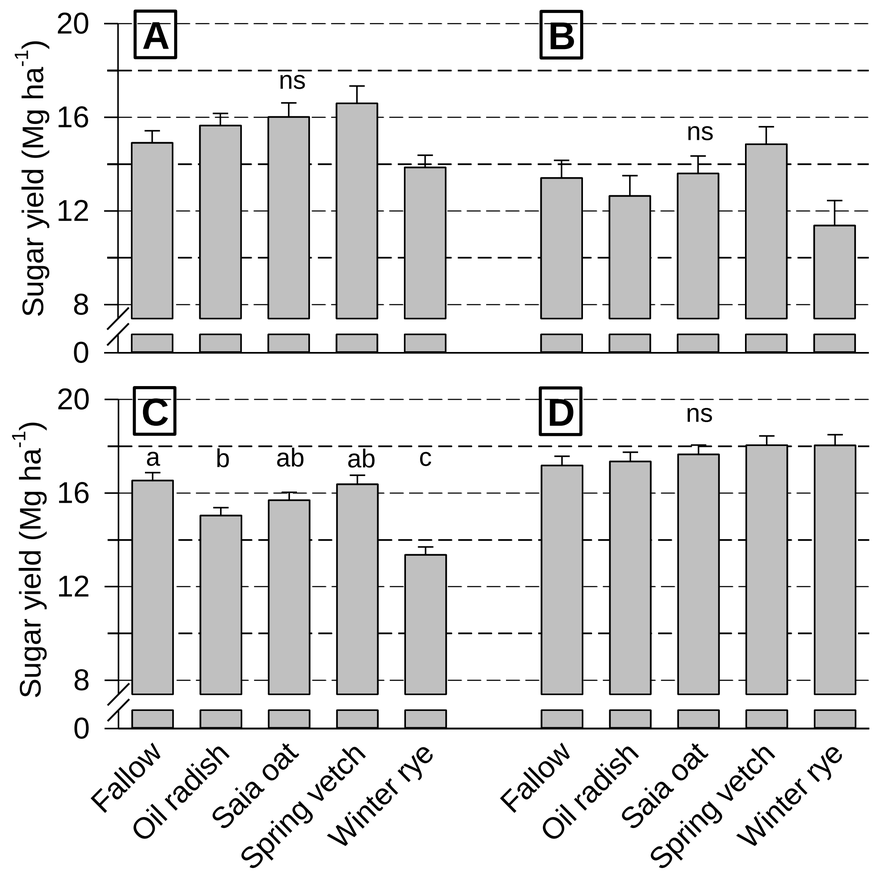



**Figure 2:**
Cover crop effect on **sugar yield** of non-fertilized sugar beet at Ihinger Hof 18/19 (A) and 19/20 (B), and Göttingen 18/19 (C) and 19/20 (D).




- **CC biomass C and N content** varied among sites/years and species from 365-1658 kg C $ha^{-1}$ and 41-172 kg N $ha^{-1}$ (not shown).
- **$N_{min}$ in March** was lowest after rye and radish, and highest after bare fallow in all trials, while after vetch and oat $N_{min}$ was either intermediate or as a high as after fallow (not shown).
- The CC **N effect** on non-fertilized SB was mostly **positive from Mar-Jul/Aug**, but substantially **negative from Jul/Aug-Sep/Oct** (Fig. 1).
- In the **first period**, the **N effect** was consistently **lowest after rye** and higher after the other CC, with variable effects of the different CC species in individual trials (Fig. 1).
- In the **second period**, the **N effect was negative** compared to fallow, indicating N immobilization caused by CC biomass (Fig. 1).
- **Sugar yield** was very high after vetch at all site/year combinations and lowest after rye in 3 out of 4 trials (Fig. 2).
- **Correlation analysis** revealed a clearly **negative relationship between CC biomass and $N_{min}$ in March** (not shown).
- **Increasing CC biomass decreased** both **N effect** and **sugar yield** (significant at one and two sites only, respectively; not shown).
- Consequently, whole season **N effect and sugar yield** were **correlated positively** (significant at Göttingen only, not shown).

## Conclusions and Outlook

- **Cover crops caused additional N mineralization in spring to midsummer, but substantial N immobilization in summer to autumn.**
- **Cover crop species effects on N release were inconsistent: only spring vetch, producing low biomass, increased sugar yield.**
- **Further data evaluation will reveal which cover crop types allow to reduce the N fertilizer dose for high yielding beet crops.**

## Field experiments, Measurements, Calculations

- Field trials were conducted at Ihinger Hof (South Germany) and Göttingen (Central Germany) on Luvisols in 2018/19 and 2019/20. Four CC species (oil radish, saia oat, spring vetch, winter rye) were grown in autumn/winter and compared with bare fallow.
- CC biomass was measured in late autumn and soil $N_{min}$ samples (0-90 cm) were taken in monthly intervals. SB biomass (leaves/tops, taproot) was sampled (i) in July/August and (ii) September/October, and N content was analyzed. Sugar yield was determined following standard procedures.
- The CC N effect on SB (non–fertilized) was calculated for distinct periods as: N uptake SB (CC) - N uptake SB (fallow), in kg N $ha^{-1}$.

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