# Interaction of pre-crop effects and nitrogen fertilization in sugar beet production

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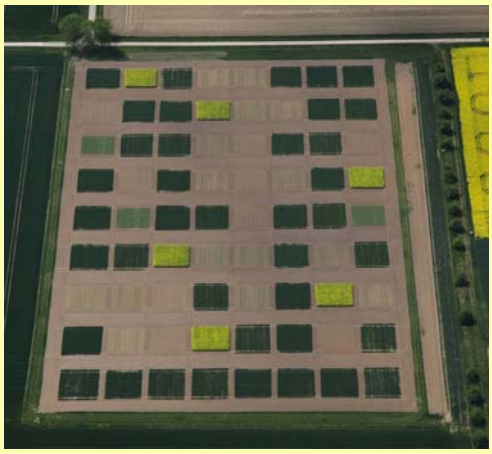
## Introduction

In sustainable agricultural production, food security needs to come together with a reduction of environmental impacts. As a key factor, mineral nitrogen (N)-fertilization requires a level of 'as little as possible - as much as necessary' in all crop production systems. For the cultivation of sugar beet, we aimed to investigate whether an adjustment of the recommended mineral N ($N_{min}$)-target value according to the respective pre-crop was an appropriate mean to optimize the N-fertilization.



## Materials and Methods

- Site: near Göttingen, Germany
  Stagnic Luvisol; 86% silt, 12% clay
  temperature: 8.9°C; precipitation: 620 mm (annual mean)
- Management: Table 1
- Pre-crops: winter wheat, silage maize, grain pea
- Three field replicates
- N-fertilization levels 2011: 0, 40, 80, 120 kg N $ha^{-1}$

**Table 1:** Production management of sugar beet after different pre-crops and the mineral N ($N_{min}$)-target value according to official recommendation.

| Pre-crop | Winter wheat | Silage maize | Grain pea |
|---|---|---|---|
| Catch crop | mustard (50 kg N $ha^{-1}$) | --- | mustard (50 kg N $ha^{-1}$) |
| Tillage | cultivator (18 cm), frost tillage (10 cm) | | |
| $N_{min}$-target value (kg N $ha^{-1}$) | 160-20 | 160 | 160-30 |

## Results

- Highest white sugar yields (WSY) after grain pea as pre-crop (Fig. 1)
- Strongest effects of N-levels after silage maize as pre-crop (Fig. 1, 2)
- N-levels higher than $N_{min}$-target value
  - did not significantly increase WSY (Fig. 1)
  - reached N-uptake of ≥ 200 kg N $ha^{-1}$ (Fig. 2)
  - reached unfavorable high contents of α-amino N compounds (≥ 8 mmol $kg^{-1}$; Fig. 2)
  - showed YARA N-Tester values of ≥ 570 (not shown)
- Reduced N-levels (40 kg $ha^{-1}$ lower than $N_{min}$-target value)
  - showed a non-significant decrease in WSY (Fig. 1)

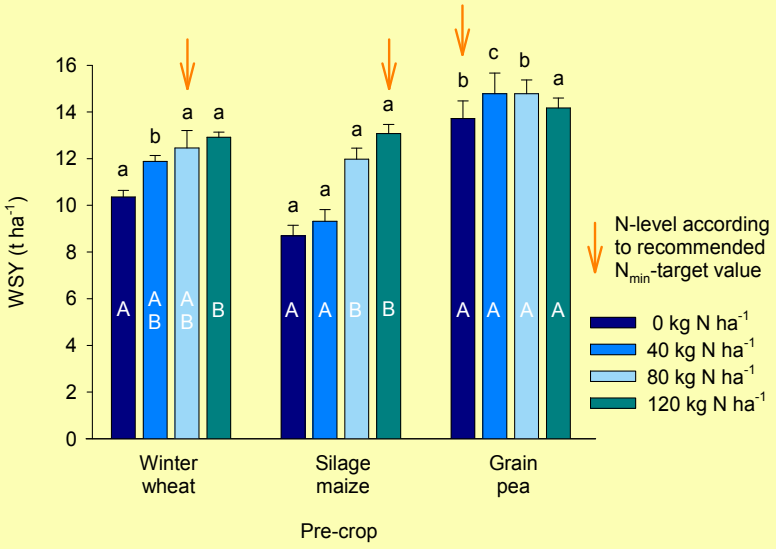



**Fig. 1:** White sugar yield (WSY) as affected by pre-crops and mineral N-fertilization levels. Means (n = 3) and standard deviations.
Lowercase letters indicate significant differences (p ≤ 0.05) between pre-crop treatments within one N-level and uppercase letters between N-levels within one pre-crop treatment.

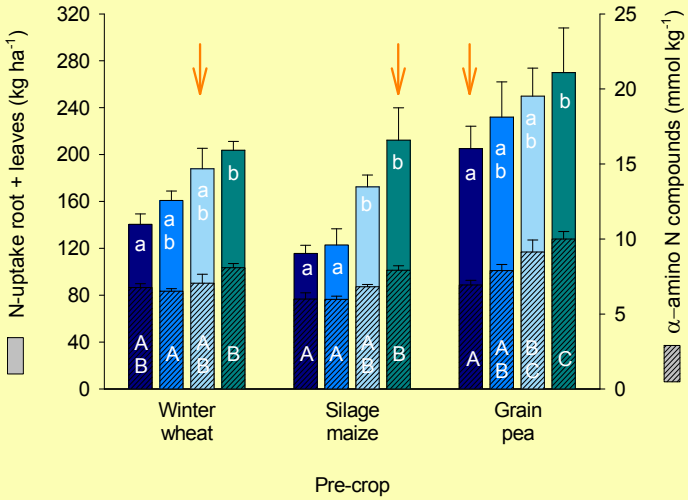



**Fig. 2:** Total N-uptake and contents of α-amino N compounds of sugar beet as affected by pre-crops and mineral N-fertilization levels. Means (n = 3) and standard deviations.
Significant differences (p ≤ 0.05) between N-levels within one pre-crop treatment are indicated by lowercase letters for N-uptake and by uppercase letters for α-amino N compounds.

## Conclusions

The demand of sugar beet for mineral N-fertilizer interacts with the respective pre-crop. Thus, an adjustment of the $N_{min}$-target value to pre-crop effects would contribute to a further optimization of sugar beet production. Moreover, it did not seem to be necessary to raise the $N_{min}$-target value for fertile sites.

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