

### Introduction

Environmental effects of agriculture are integrated increasingly into the EU's CAP. The German concept of an ordinance for sustainability of biofuels like bioethanol focuses also on cultivation intensity and environmental impacts. Hence a demand for information about the environmental situation in sugar beet cultivation exists. But reliable data about crop cultivation and resulting environmental impacts are rare and laborious to investigate. Therefore simple environmental indicators are suggested based on cultivation in practice.

### Database and Methods

- Indicators were assessed on the basis of a nationwide survey in the joint project "Environmental Effects of Sugar Beet Cultivation".
- 109 sugar beet growing farms in all growing areas are analyzed for ecological and economical aspects.
- All environmental indicators are derived from basic information about cultivation. The exemplary procedure is demonstrated for soil tillage and nitrogen fertilisation.
- Impacts on environment are estimated taking into account local conditions and environment's sensitivity.

### Results - Soil Tillage

#### Intensity:

- **Cumulative tillage depth** (= sum of tillage operations depths) varies due to different tillage frequencies and diverse tillage machineries (Fig. 1A).
- High **soil cover percentage** is estimated for fields with less frequent and less deep tillage, non ploughing and growing catch crops (Fig. 1B).

#### Impacts on environment:

- **Potential soil losses** due to water erosion were calculated with an adapted Universal Soil Loss Equation (Schwertmann et al. 1990). They account to 5 t ha<sup>-1</sup> a<sup>-1</sup> on most fields. This low value implies only minor threats for the soil's yield potential and for surface water (Fig. 1C).

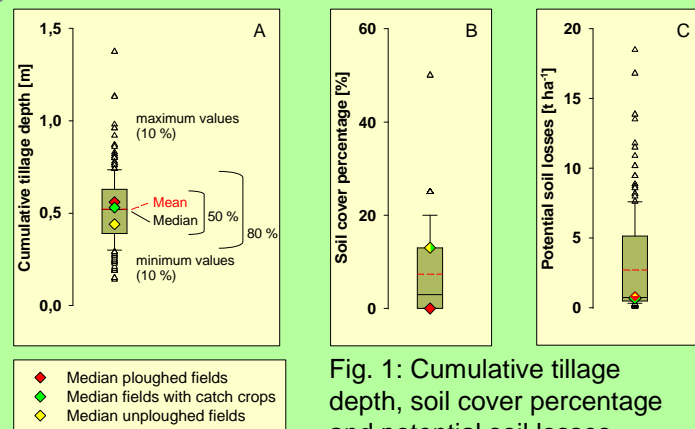


Fig. 1: Cumulative tillage depth, soil cover percentage and potential soil losses

### Results - Nitrogen Fertilisation

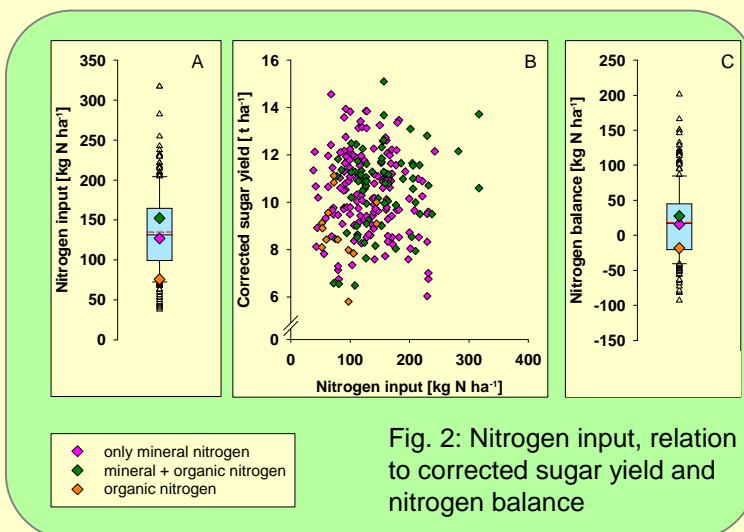


Fig. 2: Nitrogen input, relation to corrected sugar yield and nitrogen balance

#### Intensity:

- **N input** varies greatly and is comparatively high on some fields. The variation is partially explained with differently rated N contents of organic fertilizers (Fig. 2A).
- High **sugar yields** do not rely on high N input because there is no relation between N input and **corrected sugar yield** (Fig. 2B).

#### Impacts on environment:

- **N balances** vary from -40 to 80 kg ha<sup>-1</sup> on most fields. Larger surplus indicates risks for N losses in waterbodies and atmosphere (Fig. 2C).

### Conclusions

- Environmental indicators for sugar beet growing combine cultivation intensity with possible impacts on environment.
- They show possibilities for optimising and are useful for communication.
- The link with economical indices enables further sustainable development of producing sugar or bioenergy from beet.