Institute of Sugar Beet Research

Soil structure effects on the *Rhizoctonia* inoculum potential in the soil and the *Rhizoctonia* infestation of sugar beet

- EXPERIMENTAL CONCEPT-

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Introduction

The soil-borne pathogen *Rhizoctonia solani* (AG 2-2IIIB), causing the late root and crown rot in sugar beet, has become an increasing problem in sugar beet growing areas in Europe (Büttner *et al.,* 2002). Severe *Rhizoctonia* infestation is known to cause serious yield decline due to plant losses especially if maize is grown as pre-crop (Buhre *et al*., 2009). Physical and chemical soil characteristics are assumed to have a strong influence on (i) the *Rhizoctonia* inoculum potential and spread in the soil and (ii) the *Rhizoctonia* infestation of sugar beet. However, the interactions between soil structural properties and disease occurrence are not yet understood.

Experimental concept

A multi-factorial split-plot field experiment (pre-crop / inoculation as main plot, tillage, sugar beet type and harvest date as sub-plots) was conducted at the sites Göttingen (Lower Saxony) and Haardorf (Lower Bavaria).

- The soil was inoculated (Göttingen 150 kg ha^{-1}, Haardorf 50 kg ha^{-1}) with a barley inoculum and maize was grown as a susceptible pre-crop to create a high and uniform infestation potential in the soil
- The maize straw was left (grain maize) or removed (silage maize) from the field
- The soil structure of the topsoil (0-15 cm) was differentiated by a variation of soil tillage and additional soil compaction in autumn

We aim to describe pre-crop effects and soil structural effects on the *Rhizoctonia* inoculum potential in the soil and the *Rhizoctonia* infestation of different sugar beet types (tolerant and susceptible) by measuring the following parameters:

- Soil characteristics ➡ Bulk density, air and field capacity (pF 1,8), pneumatic conductivity, penetration resistance, C/N, $CaCO_3$, pH, plant available nutrients
- Soil conditions ➡ Soil temperature and moisture by continuous measurements with TDR probes
- Plant development and infestation ➡ Disease rating, plant yield and quality (Amino-N, K, Na), LAI
- *Rhizoctonia* inoculum potential ➡ Soil sampling for molecular analysis

Remaining crop residues

A. Grain maize plot **B.** Silage maize plot

Fig. 1: Remaining crop residues in the field on grain maize plots (A) and silage maize plots (B).

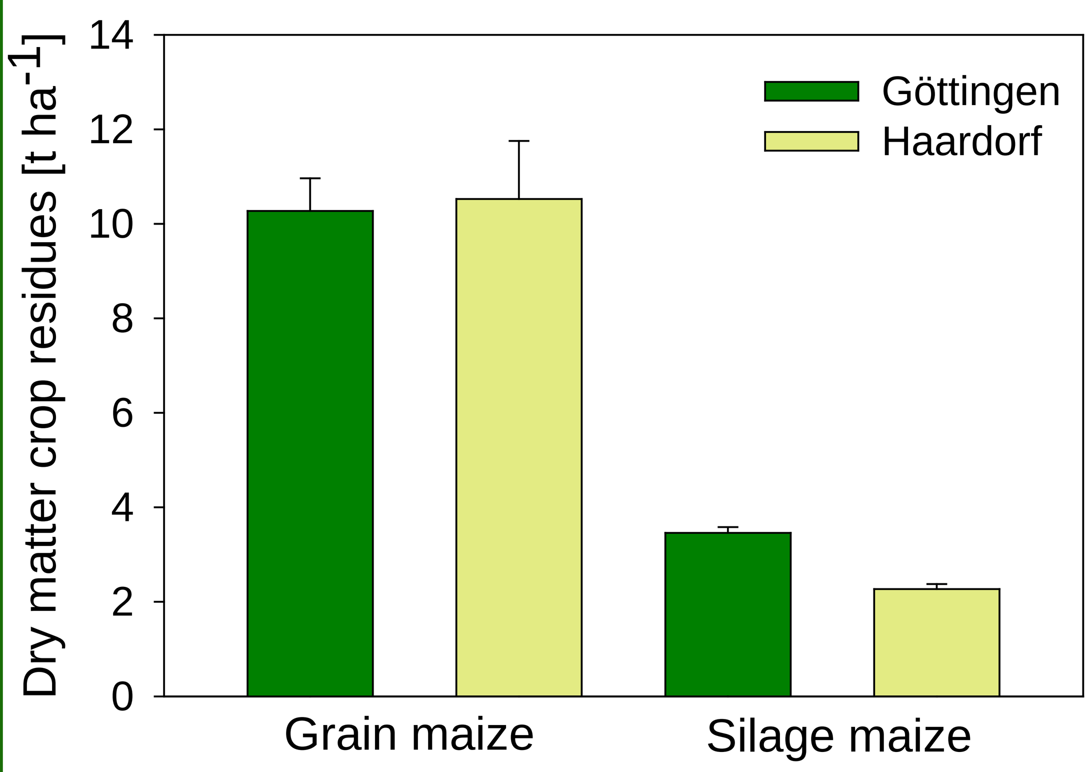


Fig. 2: Remaining grain and silage maize crop residues [t ha^{-1} DM] in the field.
Grain maize crop residues includes the whole plant except the grain, whereas silage maize crop residues include the stubbles only.

Summary

We successfully created:

- Plots with a different amount of remaining crop residues (Fig. 1, 2)
- Plots with a differentiated inoculum potential by artificial inoculation (Fig. 4)
- Different soil structures in the topsoil by a variation of soil tillage (Fig. 5)

for upcoming experiments.

Rhizoctonia on maize

A. Eye spots on stem basis **B.** Lodging

C. Reduced root system of infested plants

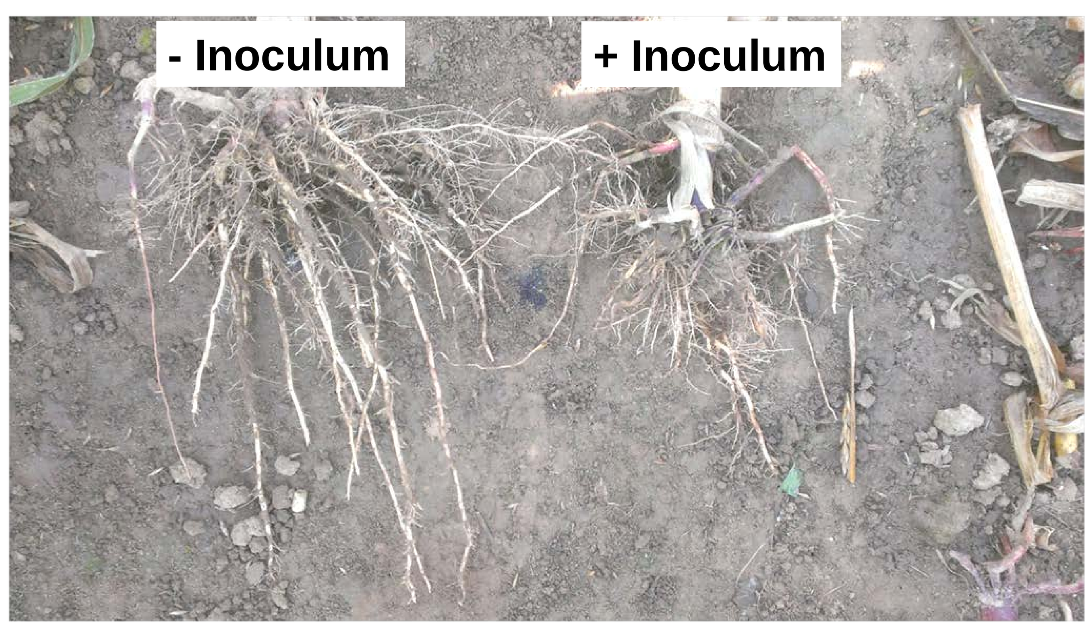


Fig. 3: Typical Rhizoctonia symptoms on maize.

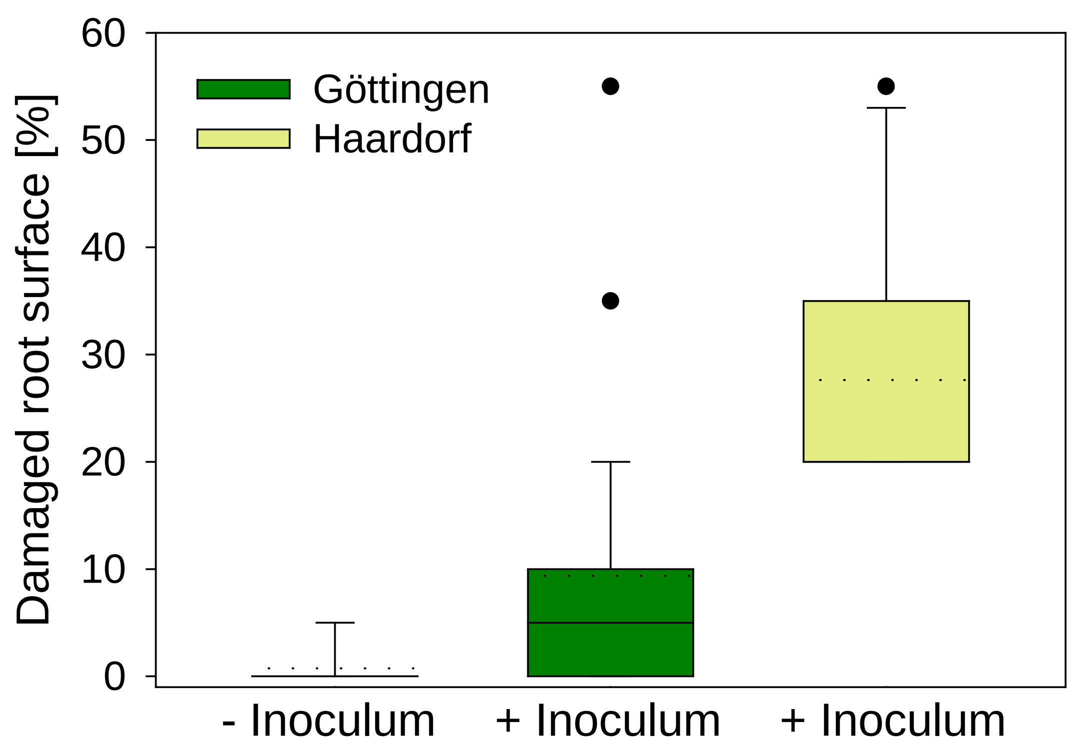
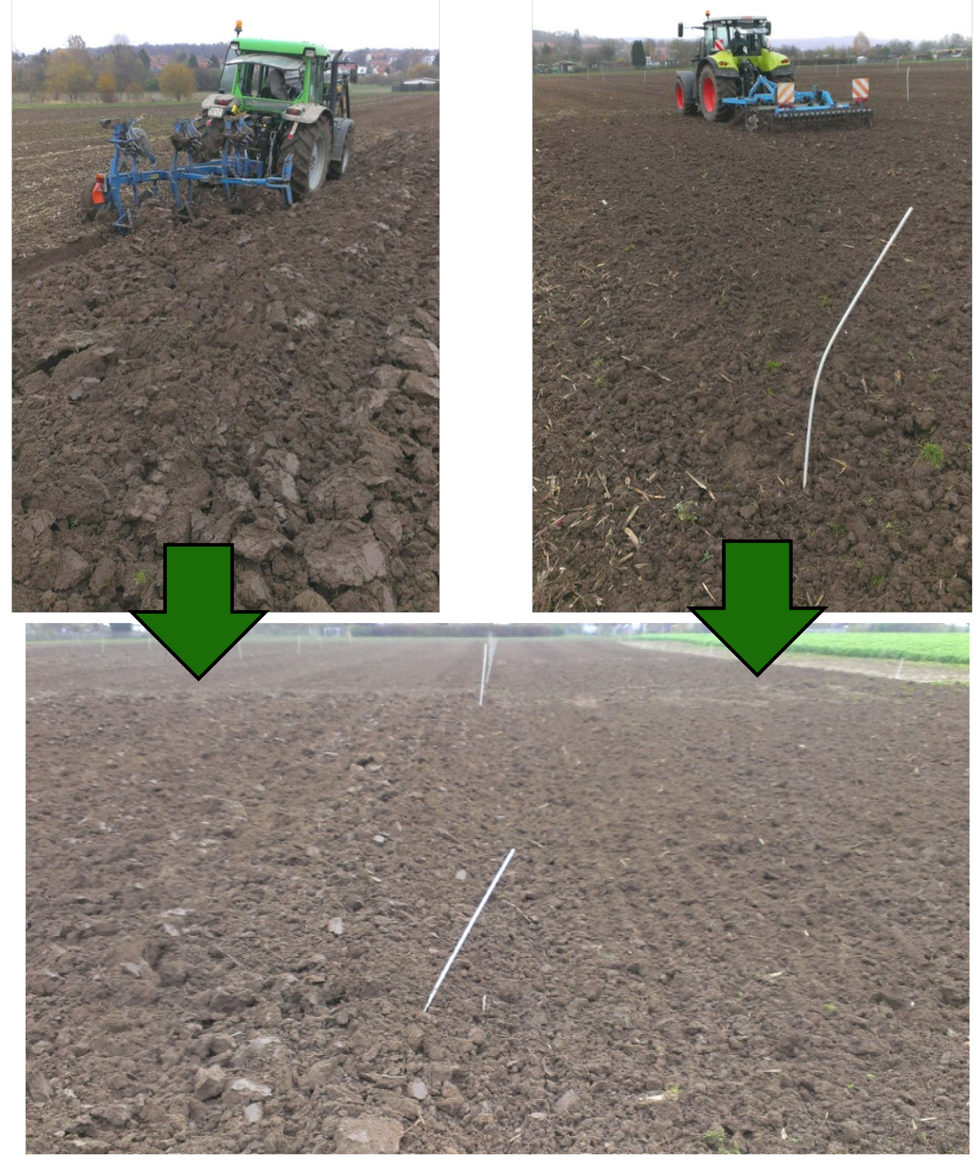


Fig. 4: Percentage of *Rhizoctonia* root damage on maize.
Non-inoculated plots showed no root damage whereas root damage was high in the inoculated plots.

Soil tillage

A. Plow (25 cm) **B.** Cultivator (10 cm)



C. Compacted soil + cultivator (5 cm)

Fig. 5: Differentiation of the structural properties of the topsoil by variation of the soil tillage and additional soil compaction.
The aggregates were more coarse in the plowed (A) compared to the cultivated plots (B). The compacted soil was only shallowly tilled (C).

References:
Büttner G, Führer-Ithurrart ME, Buddemeyer J (2002): Zuckerindustrie 127, 856-866.. Buhre C, Kluth C, Bürcky K, Märländer B, Varrelmann M (2009): Plant Disease 93:2, 155-161