

Creation of biopores by perennial fodder crops and their effects on the root length densities of annual crops

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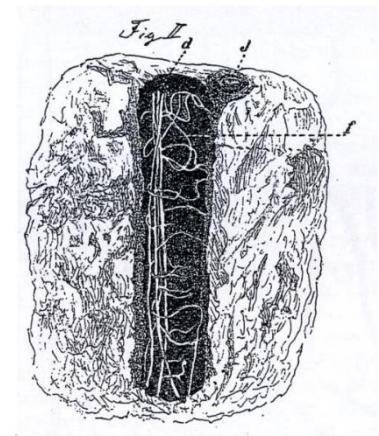
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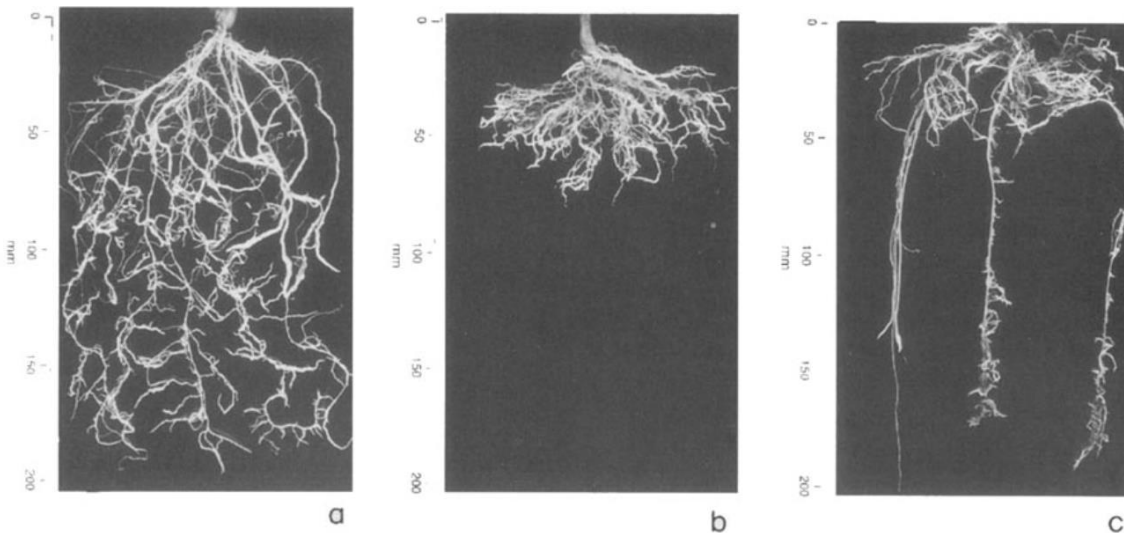
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Biopores are preferential pathways for root growth ...

... but roots may become trapped in the biopore and root-soil contact in the biopore may be poor.



Hensen, 1892



Barley roots growing in soil with

- a) a bulk density of 1.5 Mg m^{-3}
- b) a bulk density of 1.77 Mg m^{-3}
- c) a bulk density of 1.77 Mg m^{-3} containing 3.2 mm diameter biopores

Stirzaker et al., 1996

CeFiT – Factors

Haplic Luvisol - Bulk density up to approx. 1.6 g cm^{-3}

A: Fodder crop species

A1: Lucerne (*Medicago sativa*)

A2: Chicory (*Cichorium intybus*)

A3: Tall fescue (*Festuca arundinacea*)

B: Duration

B1: 1 year

B2: 2 years

B3: 3 years

C: Following crops

C1: mallow – w. barley – w. rey – oats

C2: s. wheat – w. oilseed rape – w. rey – oats

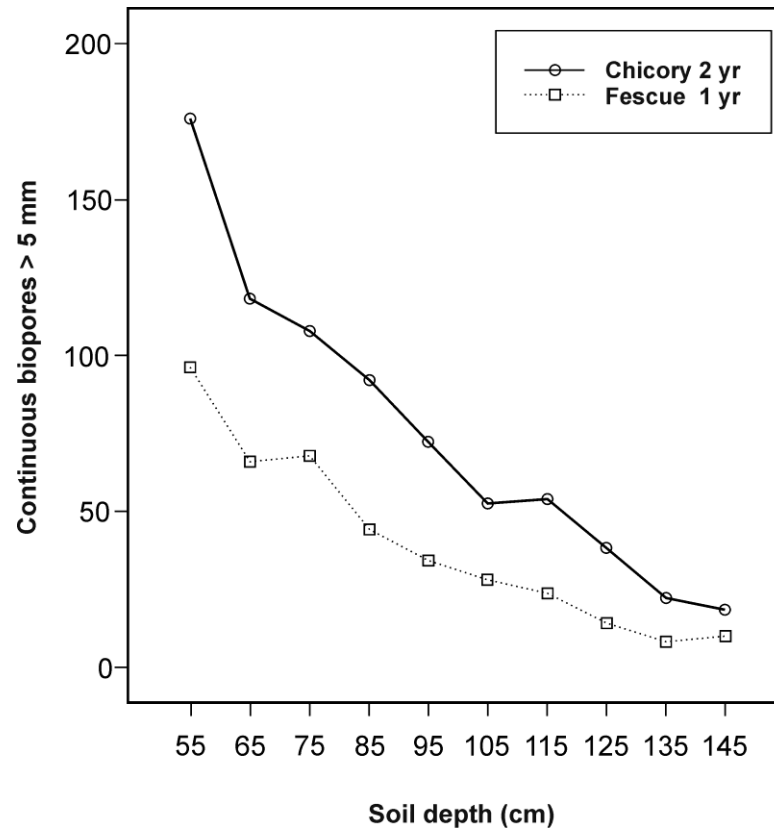
C3: s. wheat – w. barley – w. oilseed rape – oats



Continuous biopores as a function of soil depth after two years chicory and one year fescue preceding crops

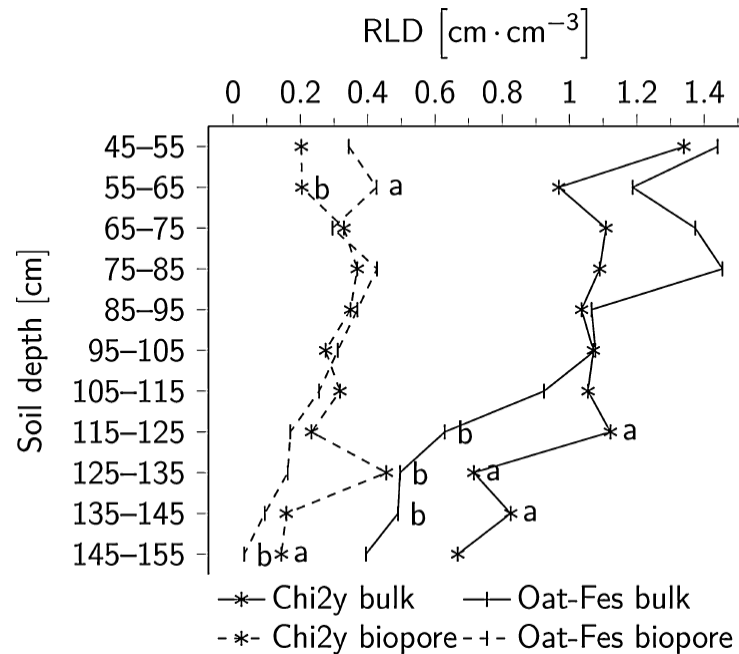


Chicory root
Depth: 50 cm



Root-length density of winter barley in the bulk soil and in biopores (diameter class >2 mm)

as a function of precrop (two years chicory, Chi2y [*] or oats-fescue, Oat-Fes []) and soil depth



Monolith method. Different letters indicate significant differences (Mann-Whitney-U-test, $\alpha = 0.05$).

Perkons et al., 2014

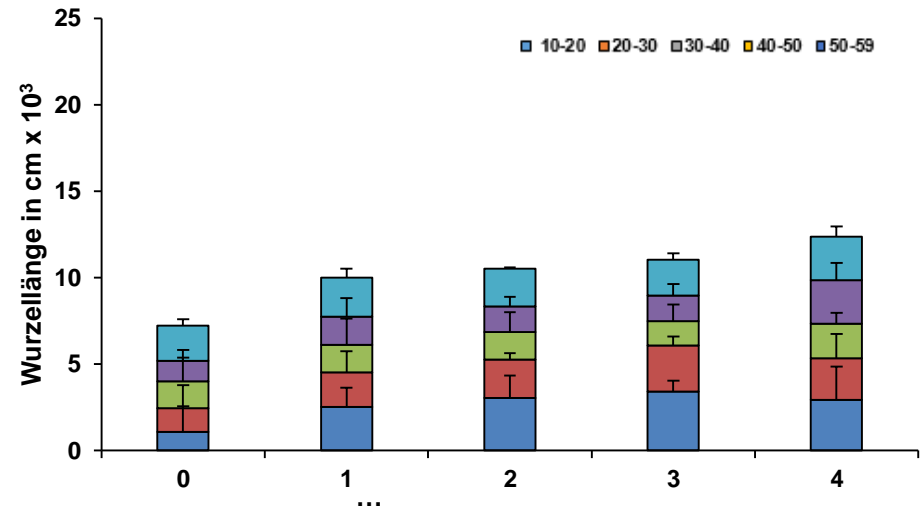
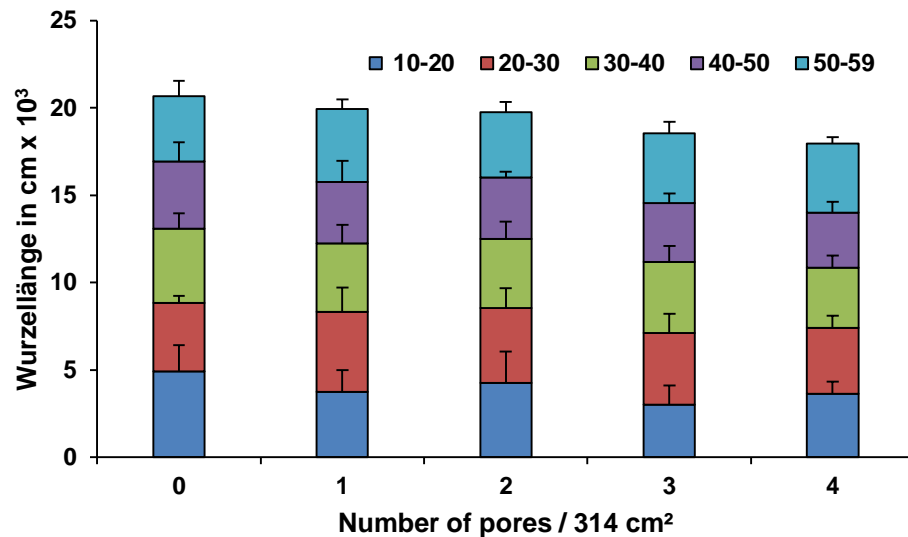
Root growth in biopores observed by *in situ*-endoscopy.

Ingrowing roots of mallow (left); root of mallow leaving the biopore entering the bulk soil (right).



Athmann et al. 2011

Root length-density of winter wheat (bulk soil + biopore) at 30% (left) and 10% (right) field capacity in a pot experiment with artificial pores Bulk density 1.6 g cm⁻³



(mean ± SE values)

Koch, 2019 (unpubl.)

Summary

Effects of biopores on the root length densities of annual crops depend on soil factors such as bulk density, moisture and nutrient distribution.