



## **Investigation of soil structure development and properties of macropore networks with X-ray computed tomography**

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X-ray computed tomography provides a non-destructive method to visualize and quantify three-dimensional pore networks. Geometrical and morphological parameters of the complex pore system such as connectivity, tortuosity, porosity and pore surface area would be very useful for modeling and simulating of transport and exchange processes. Thus, quantitative data on relevant soil structural features and their modification by soil management could be provided.

The scope of this study was to analyze and quantify the development of soil structure in the subsoil depending on three different precrop species (alfalfa, chicory and fescue), at three depths (45, 60 and 75 cm) and three cultivation periods (1, 2 and 3 yrs) on an experimental field trial (Germany) with a Haplic Luvisol as major soil type. Morphological (air-filled porosity, pore surface area) and geometrical (pore diameter, connectivity, continuity, tortuosity) parameters were gathered with X-ray CT and evaluated with image analysis. Furthermore, the results were linked with air-capacity data from laboratory measurements to validate the data and with tortuosity/connectivity data from diffusion-based measurements.

Air-filled porosity was highest for alfalfa (3 yrs, 75 cm). Tortuosity values ranged between 1.3 and 4.38, while alfalfa (3 yrs) showed the highest value, which may indicate structural development due to crack formation by enhanced root water uptake. An increase in accessible surfaces may improve water and nutrient supply for plants, whereas the high tortuosity values may also assume that oxygen supply is limited.