



Dye Tracer and MACRO Model to investigate Macropore Flow

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Dye tracer experiments provide qualitative pictures to illustrate the flow pathways in soil. However, to assess the hydrodynamic aspect of flow processes modelling is an efficient and necessary tool to quantify and compare flow types in soils. This study was conducted to assess the heterogeneity of flow pathways qualitatively by applying a dye tracer experiment and quantitatively by the dual-porosity model MACRO. Water exchange rate WER from macropores into the surrounding soil matrix is investigated to show the efficiency of macropores in conducting water. Two sites were compared with each other. Site 1 was used as grassland and site 2 as barley. The MACRO model successfully reproduced the patterns of the soil moisture measurements under non equilibrium conditions for both sites. The highest concentration values of the dye tracer most frequent at the topsoil of grassland and the lowest value of simulated WER show that more tortuous macropores were destroyed by compaction. Consequently, only the larger less tortuous and efficient ones remain. The surface density diagram shows a significant raise of dye coverage below 0.30 m. This is due to an increased network of macropores with decreasing diameters which leads to an enhanced penetration of tracer into the matrix. The only significant difference between topsoil pore volumes of the two sites concerns pores with a diameter larger than 50 μm . In fact, these pores are observed more frequently in the barley site than in the grassland site. The measured porosities confirm the loosening tillage effect of the topsoil as well.