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Quantifying temporal changes of soil structure affected by grass roots using X-ray computed tomography

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Abstract

Modern non-destructive tomography techniques such as X-ray Computed Tomography (CT) offer great opportunities to study the soil physical properties in detail. Quantification and visualisation of the soil porous architecture in 2-D and 3-D can provide important information for understanding soil processes and function as the soil physical environment affects many biological and chemical properties. This can be achieved from the macro to micro scale. For instance, the intra-aggregate pore space as part of soil structure is of great importance for microbial processes, the sequestration of organic carbon and water flow.

In this paper, we investigated the effects of apparent porosity, pore size and distribution on aggregate stability which relates to soil structural stability and in turn provides information on hydraulic processes. We also selected grass cultivars with improved root penetration through wax layers for assessing the temporal soil structure development. The grasses were grown in soil cores pre-packed with a poorly drained clay loam and scanned at frequent intervals. Undisturbed soil columns were also collected from field plots where the same grass cultivars were growing and scanned. Results demonstrated some grass cultivars had greater potential to reduce runoff by increasing water perco-

lation through soil structure development. It is expected modelling of water flow and solute transport will benefit significantly from 3-D pore space characterisation and quantification.