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Studies on soil structure and preferential flow in paddy fields

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Soil structure in Paddy rice fields is dynamically changing due to root growth, tillage induced stresses and flooding or draining induced swelling or shrinking. Reports of chemical leaching from such intensively cropped field sites indicate that soil structure dynamics possibly affects flow and leaching of dissolved chemicals despite of repeated 'puddling' and plough pan formation. The objective was to examine soil structure and identify preferential pathways. The experimental site is located in the subtropical SE-China in the province Jiangxi. In the ĆSunjian' watershed, a Paddy-rice field of 300 m^2 was selected that has been cultivated for about 20 years. Dye tracer experiments were carried out by applying 50 L of Brilliant Blue (5 kg m-3) in a single pulse such the micro-relief of the soil surface remained undisturbed. After excavation, vertical and horizontal soil profiles were photographed. Stained areas were counted and classified using the image processing toolbox of Matlab 6.5. Soft X-ray investigations were carried out on undisturbed soil columns of the cultivated horizon and the plough pan including the transition down to the subsoil. Dye tracer penetrated down below the plough pan. Numerous stained biopores and cracks were visible within the plough pan. The soil matrix structure was derived from areas of different bulk densities from soft X-ray images. Comparison with dye tracer images demonstrated that flow structures of dye leaching from cracks into the matrix corresponded with the soil matrix structure. The effect of the crack system decreases with depth while that of stained biopores increases. A lateral crack network at the plough pan seems to connect the preferential flow systems. The results suggest that preferential flow may occur in such Paddy fields even after swelling under flooding conditions.