



Exploration of the potentials of X-ray Computed Tomography to determine soil-surface seals in a non-inversion tillage system

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Several regions in the Belgian Loess Belt suffer from severe soil erosion problems due to the rolling topography, erodible soils and intensive agriculture. Although the rainfall amount in Belgium is equally distributed over the year, rainfall erosivity is much higher during the period May-October. Especially during the early stage of crop development (April – June), when the soils are nearly bare, high intensity rainstorms destroy the exposed aggregates leaving a sealed soil-surface behind. As soil-surface seals reduce the soil's porosity dramatically, soil infiltration rates drop causing considerable runoff and soil loss to occur. Conservation tillage is proposed as an alternative tillage technique to diminish erosion problems. In Belgium, conservation tillage is applied as shallow (15 cm) or deep (25 cm) non-inversion tillage. Past research proved that aggregate stability, as determined according to the 'dry and wet sieving' method of De Leenheer and De Boodt (1959), was higher for long term non-inversion tillage. Furthermore, deep non-inversion tillage had a higher infiltration rate, whereas shallow non-inversion tillage had a comparable infiltration rate as conventional tillage. Non-inversion tillage proved to reduce runoff with 40% up to 67% and soil erosion with 50% up to 85 % for shallow non-inversion tillage and deep non-inversion tillage respectively (results presented at COST 634 – Aveiro 2008 by J. Vermang et al.). As such, it can be expected that soil-surface seals would form to a lesser extent under non-inversion tillage resulting in a higher porosity at the soil's surface and eventually to a higher soil infiltration rate.

This hypothesis was tested using X-ray Computed Tomography (X-ray CT) on undisturbed soil samples taken from an experimental field in the loess belt in Flanders (Belgium). Four tillage practices were considered: conventional tillage, one shallow non-inversion tillage system and two deep non-inversion tillage systems. Non-inversion tillage is applied since 2003. X-ray CT showed distinct differences in pore size distribution and the cumulative porosity of the upper 0-10 mm of the soil between conventional and non-inversion tillage practices. It shows to be a promising technique to evaluate the effect of tillage practices on surface-seal formation.