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Using Tension Infiltrometry to Assess the Effect of Subsoil Compaction on Soil Hydraulic Properties

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Soil compaction is a major cause of soil degradation all over the world. The related changes in soil physical parameters are of growing importance in agricultural production. To understand fully the effects of different degrees of subsoil compaction on the growth and yield of arable plants requires knowledge of changes in both the soil hydraulic conductivity function, and in the soil water retention curve. In the present study measurements of the hydraulic properties were obtained on an arable field in the Canterbury Plains, South Island, New Zealand. The soil is classified as Templeton silt loam. The uppermost 15 cm of the soil were removed and replaced following five contrasting subsoil treatments. The subsoil was either cultivated (loosened), untreated, or compacted using a heavy roller with three different steps of compaction. Five randomised replications of each subsoil treatment were established. At each of the 25 plots, infiltration measurements were obtained at two depths: on the soil surface and within the compacted soil layer at 18 cm depth. Tension infiltrometry was used, as this method allows the precise and *in situ* determination of the hydraulic properties at near-saturated conditions. These conditions coincide with flow activation in the macro porosity of the soil. Thus, this method is also suitable to determine the amount and distribution of macro pores, as well as preferential flow paths in soils. Only a few studies have measured the near-saturated parts of the retention and conductivity curves of Templeton soils. The supply tensions were -15 cm, -10 cm, -4 cm, -1 cm, and 0 cm. Undisturbed soil samples were taken with steel cores before each measurement in the vicinity of each measurement site, enabling measurement of the initial and saturated water contents in the laboratory. Post-measurement samples were also taken directly below the infiltration disc to measure the final water content. The cumulative infiltration together with the initial and final water contents were used to inversely determine the parameters of a suitable soil water retention model using the Hydrus 2D/3D software package.

A statistical analysis will reveal any differences in the soil hydraulic properties that can be traced back to soil compaction. We expect that compaction of (sub-)soils leads to a significant decrease in macro porosity and hence a decrease of saturated hydraulic conductivity.