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Soil properties, root patterns and crop yields compared under different types of conservation tillage

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Many strategies exist to combat soil degradation through erosion and compaction on agricultural fields. One of these strategies is conservation agriculture (CA). Reduced or zero tillage techniques, together with crop residue management and crop rotation are the pillars of CA. The term reduced tillage covers a range of tillage practices but it never involves inverting the soil. In this way, soil disturbance is minimised and crop residues are left on the soil. Studies in many European countries have shown that CA can indeed be very effective in combating soil erosion. However, to practice sustainable soil management and as such ensure good soil functioning on the long term, one has to be aware of the effect of the used tillage method on different soil properties. Tillage techniques with negative effects on soil functioning are to be avoided. We present a study that investigates the effect of CA on different soil properties of agricultural loam soils in Belgium. We analyzed the effect of CA on water content, bulk density, penetration resistance, organic carbon and nitrate content of the soil. On the same experimental plots, the effect of CA on crop growth and root abundance was analyzed. Differences between conventional mouldboard ploughing and CA tended to be very small when the soil was tilled at the same depth as ploughing. Long time superficial reduced tillage increased soil penetration resistance in the upper soil layers. Deep reduced tillage was found to be able to break a plough pan. Importantly, nitrate content after harvest was found to be higher for ploughed soils, indicating that CA does not result in higher nitrate leakage.
We conclude that, on the Belgian loam soils, CA can be practiced whereby good soil functioning can be ensured. As crop yields were also similar, CA is an economically viable alternative that may contribute to soil protection. However the availability of local expertise and know-how are important to ensure good practice.