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Changes to infiltration and soil loss rates during the growing season under conventional and conservation tillage

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Rainfall simulation studies were conducted to determine how infiltration and soil erosion rates vary in field plots under conventional and conservation tillage practices during the growing season: i.) in April while the soil was under green cover; ii.) in May when the soil was a bare seed bed; iii.) in October when the soil was covered in stubble after harvest. At each time, five different rainfall intensities were applied to the plots and the infiltration rate calculated as function of rainfall intensity. The highest infiltration rates were observed on the plot under conservation tillage when it was under the cover crop. Comparing these infiltration rates with those at other times, important differences can be seen. When the soil was prepared as a seedbed, higher infiltration rates occurred when rainfall intensities were less than 80 mm/h. However, when the rainfall intensities were more than 80 mm/h, water infiltration rates were higher when the soil was covered in stubble. This means that natural pore forming processes can be more effective at improving soil drainage potential than temporary improvements created by soil tillage operations.

Different methods were used to assess the soil erosion potential. Independently of the method used to calculate soil erodibility, it is obvious that the soil is most vulnerable when prepared as a seedbed. In addition, the highest resistance against soil erosion was observed when the soil was covered with crops. A method of calculating the sediment transporting capacity of runoff found no significant difference between conservation and conventional tillage systems. This contrasts with the Universal Soil Loss Equation method, which indicated differences between the two tillage systems substantial at each time of observation. The lowest difference (less than two times) was when the soil was covered in stubble, which matches with literature data. Overall, conservation tillage resulted in much lower soil erodibility values for the same soil under extremely heavy precipitation events. Since these precipitation events trigger the majority of soil erosion losses in central Europe and their frequency is supposed to be increasing, practical research is need to investigate the consequences. We found that rainfall simulations were a highly applicable way to do this.

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