Conservation tillage reduced soil erosion significantly – results from a long-term monitoring study in Switzerland

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The positive effects of conservation tillage have mostly been demonstrated using small test plots and experiments. The present study aims at confirming such observations on farmers' fields at catchment scale. In a 20-year monitoring programme between 1997 and 2017, accurate mapping of erosion damage was carried out in the Frienisberg region (Switzerland). The investigation area included 203 arable fields with a total area of 263 ha, i.e. the mean field size was 1.3 ha. Most of the farms were mixed farms, i.e. they grew crops and kept livestock. During 115 field inspections, 4060 plot years were examined and 2165 mapped erosion systems were recorded.

The Swiss agriculture policy system is based on a complex system of direct payments (subsidies). In addition, there are various cantonal and state subsidy programmes for conservation tillage. In the communities of the Frienisberg region, the share of reduced tillage with mulch from the previous crop rose from 1% of arable land in 1997 to 53% by 2015, and the share of no-till from 1% to 32%, so that a total of 85% of arable land was 2015 cultivated with conservation tillage. This high level of Conservation Agriculture application can be explained by the particularly high sensitivity of farmers to the topic of soil protection in the region; motivation through financial incentives, rising awareness among farmers, innovative farm contractors, knowledge transfer and good extension service of cantonal agencies. The significant decrease of soil loss from an average of 0.74 t ha^{-1} yr^{-1} during the first ten years period to 0.20 t ha^{-1} yr^{-1} during the second ten years can directly be linked to the increased use of conservation tillage. The majority of soil erosion (88%) took place on plough tilled land (PT), 9% on non-ploughed land with less than 30% surface residue cover (RT), 1% on mulch-tilled land with more than 30% surface residue cover (MT), and 2% on non-tilled or strip-tilled land with >30% soil cover (NT). At 0.07 and 0.12 t ha^{-1} yr^{-1}, respectively, the mean soil loss in MT and NT fields was an order of magnitude lower than that under PT (1.24 t ha^{-1} yr^{-1}).

The field measurements show that soil erosion can be significantly decreased by changes in soil tillage practices. This finding also underpins that conservation tillage can be a successful production system in real-life agriculture in Switzerland. In this respect, the Frienisberg region should be considered a case example of successful erosion control.

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