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Interrill Erodibility of P and C on conventially and organically farmed Devon soils

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Soil erosion can have significant off-site effects on water quality and thus human and habitat health. Apart from sedimentation, the transfer of nutrients, both dissolved and particulate, is a major concern. The particulate transfer of nutrients from agricultural land can occur either by rill or interrill erosion. Rill erosion is non-selective and affects only a limited extent of agricultural land. Interrill processes such as crusting, splash and raindrop-impacted wash, on the other hand, act on all cropland and affect the quality of the water from all areas generating runoff. A significant amount of phosphorus (P) is contained in the surface soil layer transformed by interrill processes annually. In the EU, the P content of a crusted (2 mm) surface layer corresponds to 4 to 40 kg ha^{-1} of P on arable land (1.094 mil km2). Therefore, the role of interrill processes and erosion for regional nutrient cycling requires close attention.

Interrill erosion is a complex phenomenon, involving the detachment, transport and deposition of soil particles by raindrop impacted flow. Resistance to interrill erosion varies between soils depending on their physical, chemical and mineralogical properties. In addition, significant changes in soil resistance to interrill erosion occur during storms as a result of changes in surface roughness, cohesion and particle size. As a consequence, erosion on interrill areas is selective, moving the most easily detached small and/or light soil particles which are often enriched in clay, P and organic C. Commonly, the risk of erosion associated with organically farmed soils is lower than those farmed in a conventional way. This is attributed to greater aggregate stability and thus greater infiltration and lower erodibility. Erosion of nutrients on organically farmed soils is therefore considered to be reduced by the same order of magnitude than the amount of eroded soil compared to conventionally farmed soils. However, the selective nature of interrill erosion potentially counteracts this effect by the preferential removal of fine particles enriched in nutrients and soil organic matter.

In this study, an experiment comparing the erodibility of P and C on organically and conventially farmed soils from Devon is presented. The results show a disproportional increase of P in sediment from the organically farmed soil, reducing the perceived benefit of organic farming on nutrient erosion by 80%. The pronounced P enrichment in the organically farmed soil is attributed to the higher concentrations of C and P as well as lower densities of the small particle fraction. The results, while very preliminary, indicate that the impact of soil management on off-site effects of erosion such as water quality can only be fully assessed when we understand the relevant erosion processes. They also indicate that some less than expected positive effects of changing soil management to improve water quality might be caused by the preferential erosion of P-bearing soil particles.