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# Geomorphological characterization of conservation agriculture

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Soil water erosion is one of the major threats to soil resources throughout the world. Conventional agriculture has worsened the situation. Therefore, agriculture is facing multiple challenges: it has to produce more food to feed a growing population, and, on the other hand, safeguard natural resources adopting more sustainable production practices. In this perspective, more conservation-minded soil management practices should be taken to achieve an environmental sustainability of crop production. Indeed, conservation agriculture is considered to produce relevant environmental positive outcomes (e.g. reducing runoff and soil erosion, improving soil organic matter content and soil structure, and promoting biological activity). However, as mechanical weed control is limited or absent, in conservation agriculture, dependence on herbicides increases especially in the first years of transition from the conventional system. Consequently, also the risk of herbicide losses via runoff or adsorbed to eroded soil particles could be increased. To better analyse the complexity of soil water erosion and runoff processes in landscapes characterised by conservation agriculture, first, it is necessary to demonstrate if such different practices can significantly affect the surface morphology. Indeed, surface processes such erosion and runoff strongly depend on the shape of the surface.
The questions are: are the lands treated with conservation and conventional agriculture different from each other regarding surface morphology? If so, can these differences provide a better understanding of hydrogeomorphic processes as the basis for a better and sustainable land management?
To give an answer to these questions, we considered six study areas (three cultivated with no-tillage techniques, three with tillage techniques) in an experimental farm. High-resolution topography, derived from low-cost and fast photogrammetric techniques Structure-from-Motion (SfM), served as the basis to characterise the surface morphology. For each of derived Digital Elevation Model, seven morphometric indexes, such as slope, curvature, flow direction, contributing area, roughness, and connectivity was calculated. We showed then the variations of the morphology in the areas converted to the conservation agriculture, and, consequently, a possible modification of processes such as erosion and runoff. The results suggested that the agricultural surfaces interested by no-tillage practices are different from those tilled with conventional systems. The topography is rougher, with chaotic flow directions, and more concave areas, thus resulting in potential water storages, mitigating the intensity of soil erosion and runoff processes. On the other hand, the topography of traditional tillage area is more regular and smooth, with flow directions that tend to follow the same direction on the surface.
These results are a novelty in the Earth Science and Agronomy: we demonstrated and quantified, from the geomorphological point of view, the potential role of conservative agriculture in mitigating, not only land degradation phenomena, but also the distribution of pollutants, and rainfall-runoff processes.

References

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