



The impact of soil structure on runoff and nitrogen and phosphorous losses in the Argentinean Pampas

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The generalization of no-tillage (NT) in the silty soils of the Argentinean Humid Pampas has led to widespread soil densification and the frequent development of a platy structure layer near the soil surface (with thin and flat aggregates oriented parallel to the soil surface). No tillage was adopted in the region to reduce soil degradation by water erosion. However, previous findings have shown that platy structure has negative consequences on water infiltration and vertical transfer. The aim of this work was to evaluate surface runoff and N and P losses with different proportions of platy structure in A horizon of a Mollisol under NT. Fourteen natural-rainfall runoff plots (100 m²) with 3.5% slope situated in INTA Paraná (Entre Ríos province) were used to analyze the relationship between soil structural state, by cultural profile approach, and runoff. This 15-year NT trial on an Aquic Argiudoll with different crop sequences resulted in highly different proportions of platy structure in the A horizon (50 to 0%). After each runoff-producing rainstorm, runoff volume was measured in the collecting tank at each plot outlet, between July 2009 and June 2010, and P-PO₄ and N-NO₃ were determined by colorimetric methods. A total of twenty-nine runoff events were recorded and annual rainfall (1485 mm) was 50% above average. 85% of the plots exhibited a horizontal platy structure (<10 cm thick) developing either directly from the soil surface or from below A granular structure. Cumulative runoff increased as the proportion of platy structure increased (R²=0.61) and in agreement, N and P losses (R²=0.51 and R²=0.62, respectively). The platy structure altered the drainage pattern and increased the surface runoff and solute transport according to its proportion in the profile of A horizon. In consequence, the platy structure effect on water dynamics might be considered in solute transport models in silty soils of the Argentinean Humid Pampas. Understanding the effect of soil structure on nutrient transport with runoff will allow identifying strategies to reduce off-site transport and minimize undesirable effects to surrounding surface water resources.

Keywords: no tillage, platy structure, runoff, N and P losses