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Dissolved and particulate nutrient yields in terraced and non-terraced zero order catchments under no-tillage

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No-tillage is an extensively used soil conservation practice in crop fields. Yet, no-tillage is prone to runoff generation, which may lead to downstream concentrated forms of erosion, floods, solute transfer and eutrophication of water bodies. However, infiltration terraces on hillslopes can reduce runoff and erosion. We analyzed nutrient losses, in both dissolved and particulate forms, on terraced and non-terraced agricultural hillslopes under no-tillage in Southern Brazil. Precipitation, runoff, sediment yield and chemical elements' concentrations were monitored in paired catchments, including a 2.35 ha terraced catchment (TC) and a 2.43 non-terraced catchment (NTC), during rainfall events that occurred from 2017 to 2018. Runoff and suspended sediment samples were manually collected in H-flumes at the outlet of each hillslope, where automatic water level readings were recorded at 5-minute intervals by a limnigraph to estimate runoff discharge. P, K, Ca, Mg, Cu, Zn and N concentrations were analyzed in runoff-water samples and P, K, Ca e Mg in the suspended sediment samples to obtain dissolved and particulate concentrations, respectively, and total nutrient losses. Maximum N concentration in TC's runoff samples (8.70 mg L^{-1}) were higher than in the NTC (7.41 mg L^{-1}). Ca concentrations were higher in the NTC (average 3.9 mg L^{-1}). Low and similar Mg, Cu, Zn mean concentrations were observed in the catchments. Mean P concentrations were ~0.11 mg L^{-1} in both catchments but reached higher concentrations in the NTC. Mean (~3 mg L^{-1}) and maximum (8.74 mg L^{-1}) K concentrations were observed the TC. In sediment samples, Ca, Mg, P and K concentrations were higher in the NTC. To compare total dissolved nutrients losses, we chose 13 rainfall-runoff events and 10 events for particulate nutrient losses. Total rainfall for the 13 events was 1020 mm, leading to 110 and 222 mm of runoff in TC and NTC, respectively. Besides higher runoff volume, NTC shows higher losses of all analyzed nutrients in runoff. P losses were of 105 and 352 g ha^{-1} in TC and NTC, respectively, while K losses were of 2293 and 4604 g ha^{-1}, showing a similar trend. The average increase in Cu losses for NTC was 21 times higher than for TC. Total sediment yield in TC, for the 10 events, was 12 kg ha^{-1}, and 39 kg ha^{-1} in the NTC. Higher particulate nutrient loss was observed in the NTC outflow. An almost nine-fold increase in particulate P losses was observed in NTC, besides a four-fold increase in Ca, a seven-fold increase in Mg and two-fold K losses. Although higher nutrient concentrations in water were observed in the TC for some samples, overall losses and

concentrations were greater in the NTC. This indicates that nutrient flux from agricultural hillslopes is controlled by runoff and that terraces can decrease flow and material connectivity over hillslopes. As soil and water conservation practices are needed to ensure agriculture's sustainability and to avoid deleterious environmental impacts, measures for runoff mitigation, such as terraces, were shown to effectively control nutrient – and, potentially, other solutes – transfer to water bodies.