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Long-term application of liquid dairy manure in no-tillage: effects on water, soil, and phosphorus loss by runoff under natural rainfall

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Milk production generates a large amount of waste, which is disposed on agricultural fields, improving soil quality and crop yields. On the other hand, manure application without criteria can cause environmental problems. The objective of this study was to report the effects of long-term (10 years) application of liquid dairy manure (LDM) on runoff, soil and phosphorus losses in no-tillage under natural rainfall. The study was conducted at two research sites of the ABC Foundation, Paraná state, Brazil: 1) located in Ponta Grossa, started in November 2005 in a dystrophic red-yellow oxisol (sandy clay loam texture with 13% slope); 2) located in Castro, started in May 2006 in a dystrophic oxisol (clayey texture with 10% slope). Treatments consisted of four LDM (0, 60, 120, 180 m^3 ha^{-1} $year^{-1}$) displayed in a randomized complete block design with four replications. The manure was applied on soil surface in the winter and summer crops in 29.75 m^2 plot bounded by metal strip. The no-tillage had been practiced at the two research sites prior to the first application of LDM for more than 15 years, then, no-tillage practices continued to be applied along with annual applications of liquid dairy manure for the next 10 years in a crop rotation with black oat and wheat in the winter and soybean and maize in the summer. The surface runoff was sampled and analysed after each rainfall event for 10 years. Application of LDM reduced losses of water, soil and dissolved reactive phosphorus with lowest values, in general, at 120 m^3 ha^{-1} $year^{-1}$, in both oxisols (sandy clay loam and clayey soil textures). However, the weighted mean concentration of dissolved reactive phosphorus increased with LDM application. Overall, the losses of water, soil and phosphorus were low compared to intensive agricultural system, even in the treatment with no LDM application, indicating the efficiency of no-tillage on soil and water conservation. In practical terms, considering the potential risk of water pollution, it is recommended best management practices to avoid the surface runoff to reach the aquatic system providing agronomic benefits and minimizing environmental problems

Keywords: Conservation tillage; organic fertilization; water quality; eutrophication.

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