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Hydrological Variables and Dissolved Phosphorus in the Runoff from No-tilled Soil after Application of Swine Liquid

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Swine manure is used as a soil fertilizer in South Brazil. Commonly, it is applied continuously and in great amounts over surfaces with an important relief and without facilities that avoid water erosion. Thus, this manure is a potential risk of environmental pollution, mainly for the eutrophication of water bodies due to a runoff rich in nutrients. The aim of this work was to assess some soil hydrological parameters and to quantify the dissolved phosphorus losses in the runoff from no-tilled soils after the application of swine liquid manure. The experiment was carried out in the Highlands of Santa Catarina State, Brazil, in June 2009, over a Nitisol. On field plots, a 90-minute simulated rainfall test was performed with a rotating boom rainfall simulator and rainfall intensity of 70 mm h^{-1}. Prior to the rainfall simulation, sowing was performed using a disk planter either with or without tines. Spacing between lines was 0.5 m. Swine liquid manure was applied at rates of 0.0, 30 and 60 $m^3 ha^{-1}$ to the plots planted using tines; whereas it was applied at 15, 45 e 75 $m^3 ha^{-1}$ to the plots were no tines were used for planting. During rainfall simulation, readings of runoff rate were taken each five minutes; total water loss was calculated by integrating all the 5-minute readings. Runoff samples were collected at 10 minutes intervals, and they were filtered through a 0.45 μm filter to determine dissolved phosphorus. Hydrological variables were significantly affected by the use of tines, which favoured infiltration and reduced runoff as compared to the non-use of tines. Runoff started at 28 and 11 minutes, water losses were 252 and 467 m^3 ha^{-1}, maximum runoff rate were 29 and 42 mm h^{-1} and constant rates of infiltration were 41 and 28 mm h^{-1}, for treatments with and without tines, respectively. Dissolved phosphorus increased with the rate of swine liquid manure applied, with a trend to decrease from the beginning to the end of rainfall. The highest concentration was 0.19 mg L^{-1} and 0.85 mg L^{-1}, for treatments with and without tines, respectively. Dissolved phosphorus losses (g ha^{-1}) increased linearly with swine liquid manure (m^3 ha^{-1}). The angular coefficient of the equation, which relates the increase in phosphorus loss with the applied manure, was lower when using tines, indicating that their use may reduce eutrophication risks from areas where swine manure is used. Equations for phosphorus losses were y = 4.3 + 0.5x and y = 28.1 + 1.9x, for treatments with and without tines, respectively.