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Seasonal and land management impact on vineyard soil, runoff generation and associated pollutants in karstic environment (Mediterranean Croatia)

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Soil erosion in agricultural land is a global problem and recognized as one of the main drivers of sediment, nutrient losses and diffuse pollution. Vineyards intensively managed in Mediterranean karst environments with agrochemicals and tillage are an example. The objective of this work is to study the impacts of the season (spring, summer) and different land management practices (tilled, herbicide, grass-covered) on soil properties, erosion and nutrient losses in a vineyard located in Vrgorac (Croatia). Ten soil sampling points and rainfall simulations were carried out in two seasons in 3 different treatments (10x2x3). Rainfall simulation experiments were carried out with a pressurized rainfall simulator, simulating a rainfall at an intensity of 58 mm h⁻¹, for 30 min, over 0.785 m² plots. Undisturbed soil samples (0-10 cm) were sampled before rainfall simulations. The results showed that mean weight diameter had significantly greater values on the grass-covered treatment in spring) and summer compared to the tilled and herbicide (2.56 mm, 3.03 mm) treatment, while the tilled and herbicide treatment had significantly lower values of water-stable aggregates in spring and summer compared to the grass-covered treatment. Sediment losses were significantly lower on the grass-covered treatment in spring, while those losses were significantly higher on the tilled and herbicide treatment in the summer period. Those values were significantly higher on the herbicide treatment compared to the tilled and grass-covered treatment. Element losses had significantly higher values on the tilled and herbicide treatment. For instance, K losses were significantly higher on the tilled and herbicide treatment in spring and summer, while those losses were significantly lower on the grass-covered treatment (1090.09 g ha⁻¹, 4829.41 g ha⁻¹). Also, Fe losses were significantly higher on the tilled and herbicide treatment in spring, while that value was significantly lower on the grass treatment. In the summer period, significantly lower values were recorded on the tilled and grass-covered treatment. Significantly lower Cu losses in the spring period were recorded on the grass-covered treatment than the tilled and herbicide, while in the summer period, those values were significantly higher on the herbicide and grass-covered treatment than the tilled treatment. This research indicates that it is necessary to test the seasonal soil conditions and different land management to obtain sustainable and less sustainable practices in a sensitive karstic environment.

Keywords: rainfall simulation experiments, geochemistry, soil loss, conventional agriculture, temporal changes

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