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Runoff and soil loss under different land management practices in vineyards: grass cover treatments and traditional tillage. Results from simulated rainfall.

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Land degradation control is crucial in croplands located in semiarid lands, due to its low soil formation rate, above all in slope fields. This study is located in the South East of Madrid (Spain), in a vineyard at 800 masl under Mediterranean semiarid climatic conditions, with an average slope of 14%. We studied the impact of traditional tillage measuring runoff and soil loss in plots in two critical moments of the vineyard crop: summer with dry soil, and fall when tillage is done in order to facilitate the infiltration of winter rainfall´s water.

Three treatments were tested in nine erosion plots (4m x 0,5m): traditional tillage (“till”); Brachypodium distachyon (L.) (“bra”) allowing self-sowing; Secale cereale (“sec”), mown in early spring. Short (15 minutes) but intense (2,16 mm/min) simulated rainfalls were carried out at each plot:
The simulated rainfalls made in summer over the vineyard tilled in spring (“till”) produced little runoff (41 ml min-1; erosion rate of 0.24 g m-2) and it lasted 6 min from the start of the shower, it was due to the roughness and because the soil was near its wilting point. The low erosion rate is attributable to the sealing of soil after the rains occurred in spring. In treatments with plant cover runoff began earlier, at the 3rd minute. The average runoff was 516 and 730 ml min-1 and erosion rates were 3.04 g m-2 and 1.41 g m-2 in “bra” and “sec” respectively. There were significant differences ($F = 31.6$, $P < 0.001$) in runoff coefficient between the three treatments with the highest ratio shown in “sec”. The average runoff coefficients obtained were 16% in “sec”, 13% in “bra” and 1.4% in “till”.
Moreover two simulated rainfalls were carried out in autumn in order to test the effect of the autumnal traditional tillage. The plant cover treatments were efficient controlling the erosion (sediment yield were in “till”; “sec” and “bra” respectively 2.66, 0. 29, 0. 11 g m-2 in the first simulation, and 11.67, 0.66, 0.14 g m-2 in the second simulation). Before tillage the average runoff coefficient in “till” was 19% (six times higher than in plant cover treatments) probably because of its sealing and compaction due to the lack of plants. After tillage, in spite of the increase of roughness, and on the contrary to obtained in summer, the runoff increases. It is explained by the soil moisture: In the first simulated rainfall, the soil was 72% of its water holding capacity at 10 cm, and 44% at 35 cm soil depth. However, in the second simulated rainfall the surface was completely wet, and at 35 cm it reached the 85% of water holding capacity.

Comparing the runoff and erosion behavior in each treatment for both seasons, it is shown that in summer a shallow tillage increases the infiltration significantly. However in autumn, when the soil is wetter, the tillage increases runoff and erosion significantly. This has to be taken into account in order to change traditional uses in steep crops.

Keywords: erosion, runoff, simulated rainfall, vineyard, tillage, vegetable cover

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