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Soil and water conservation in a Mediterranean rainfed vineyard: effectiveness of common sainfoin cover crop

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Cover crops (CC) in vineyards and other woody crops (olive, almond and other fruit trees) provide an environmental-friendly alternative to conventional tillage (CT) for land management. Indeed, CC reduce soil, nutrients and organic matter losses and pesticide delivery in comparison with CT and no-tillage systems. Water infiltration improves in the inter-row area with CC compared to CT, and thus runoff coefficients decrease, though these changes depend on soil permeability and structure (macro, meso, and micropores, and the root system). In spite of these advantages, CT and bare soil after using herbicides still represent the most common techniques of soil management in the woody crops within the Mediterranean Basin.
In this study, we evaluated the effectiveness of a plantation of common sainfoin (Onobrychis viciifolia) in the inter-row areas of a rainfed vineyard as CC by means of (i) measuring the topsoil water content in the different vineyard compartments and in the surrounding land uses; and (ii) quantifying the runoff and sediment yields in two ephemeral gullies within the vineyard and using open sediment traps (ST). The commercial vineyard (Bodegas Fábregas, Certificate of Origin Somontano) was planted in 2008 with the variety Grenache (Vitis vinifera L. cv. Grenache) and is located near Barbastro town (Aragon, NE Spain). Field measurements were conducted during 2017 and a total of 15 runoff events were recorded and analysed. Soils are Luvic Calcisols, and climate is continental Mediterranean (annual rainfall of 420 mm / year; mean temperature of 14.1 °C, and ET0 of 1225 mm / year). The two ST have different upslope contributing areas (A: 3,286 and 6,214 m2), mean slope gradients (S: 17.0% and 9.2%), and areas with bare soil and very low surface cover (BS: 18.4% and 10.6%). The highest rates of runoff and sediment yield were recorded in September and October when the peaks of maximum rainfall intensity (I30max) were observed, and the percentage of surface cover by the CC was low. The different values of runoff and sediment yield observed in the two ST were explained by their different topographic and cover crop conditions, and these results supported the soil and water conservation role played by the CC.