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Soil management effects on infiltration and runoff at field scale in a hillslope vineyard

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The soil management which is adopted in the vineyard's inter-rows has a great influence on soil hydraulic properties, and, consequently, on runoff and soil erosion processes at field scale. The cultivation of soil in the vineyard's inter-rows with tillage, as well as the tractor traffic, is known to expose the soil to degradation and compaction, reducing water infiltration and holding capacity and favouring runoff. On the other side, the use of grass cover in the inter-row is one of the most common and effective soil management practices adopted in order to reduce runoff and soil erosion in vineyards.

The effects of inter-rows' soil management on soil hydrological properties was evaluated in two vineyard field-scale plots. The experiment was conducted from October, 2012 to November, 2014, in the Alto Monferrato vine-growing area (Piedmont, NW Italy). A total of 80 infiltration tests were carried out in two vineyards plots, which inter-rows were managed with conventional tillage and grass cover, respectively. Furthermore, a dataset of 29 rainfall-runoff events covering a wide range of topsoil characteristics was collected in the two plots, along with soil water content monitoring, measurements and sampling of runoff in order to determine the sediment yield. For 3 events 1-min rainfall intensity data has been obtained from an optical disdrometer installed near the plots. The datasets were analysed in order to identify correlations between rainfall characteristics, soil properties and field-scale response in terms of runoff and soil erosion, at event temporal scale.

The study shows that the soil tillage increased the hydraulic conductivity only for a short period after its execution. However, in summer, just a month after tillage execution, the topsoil was compacted and showed very low hydraulic conductivity, thus summer storms with 10-min intensities greater than 20 mm h^{-1} were able to cause hortonian runoff and high soil losses, up to 5.7 Mg ha^{-1} for a single event in the period of observation. In the tilled vineyard-plot the highest runoff rates were observed in late autumn and winter. In those seasons, despite the autumn tillage which increase the hydraulic conductivity for a longer period, very high saturation-excess runoff was observed, due to precipitation greater than 40 mm on wet soil.

Runoff rates observed in the tilled vineyard were usually greater than those measured in the field where grass cover was used. Hydraulic conductivity was higher in the grassed vineyard than in the tilled one in summer, and lower in late autumn and winter. Runoff was mainly due to saturation of the topsoil. High soil erosion was observed in the grassed vineyard in winter, up to 1.2 Mg ha^{-1} during a long-duration rainfall event, related to high runoff and large precipitation events. The grass cover generally reduced event runoff and sediment yield, but it was less effective in occasion of large precipitation events during the wet seasons than in other months.