



Effect of tractor passes on soil compaction and field-saturated hydraulic conductivity in tilled and grassed vineyards

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Tractor traffic in the vineyard necessarily occurs along fixed paths. It is particularly intense from late spring to harvest, and has a relevant effect on soil compaction, on soil hydraulic properties, and, consequently, on runoff at the field scale. The hydrological response of a vineyard is also influenced by the soil management that is adopted in the inter-rows. Inter-row management with tillage is known to favour runoff and soil erosion, especially in mechanized vineyards. On the other hand, the adoption of grass cover in the inter-row reduce these soil threats.

A study was conducted in order to evaluate the impact of the increasing number of tractor passes on soil compaction and on field-saturated hydraulic conductivity during the whole year. The study has been conducted in the Alto Monferrato hilly vine-growing area (Piedmont, NW Italy). Soil penetration resistance, soil bulk density and SFH infiltration tests were carried out in different positions (affected or not by the tractor passages) in two vineyard plots, which inter-rows were managed with tillage and grass cover, respectively. Furthermore, rainfall, runoff and soil water content have been monitored during the year.

The monitored period (from October 2016 to October 2017) was very dry, with only 639 mm of precipitation (75 % of the 17-years mean annual precipitation), with very low runoff in the two plots. As it was expected, the post-harvest tillage considerably increased the field-saturated hydraulic conductivity, with respect to the plot with permanent grass cover. The compaction effect was fast, since a significant increase (10%) of soil bulk density was measured in the topsoil, track position, already after the second tractor passage, that occurred in winter. Meanwhile, the mean order of magnitude of the field-saturated hydraulic conductivity fell down from more than 1000 mm h^{-1} to 1 mm h^{-1} . After the spring tillage, the highest soil bulk density was measured between 10 and 20 cm, where the formation of a compacted layer of soil after some tractor passage was evident, as it was revealed also by the high values recorded by penetration resistance measurements. In the grassed plot, the bulk density increased significantly in summer in the most surficial layer (0-10 cm of depth). The penetration resistance of the soil showed a significant increase during summer and, similarly to bulk density, was usually higher in the track position than in the no-track position in both treatments. Most values of the field-saturated hydraulic conductivity in the grassed plot were quite high, ranging between 50 and 250 mm h^{-1} , also during the very dry summer, because of the presence of cracks. The results of the study highlighted the very short period of effectiveness of tillage in enhancing water infiltration in trafficked vineyards, if compared with permanent grass cover, during very dry seasons.