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Effectiveness of soil water conservation measures under different rainfall characteristics in hilly vineyards of Piedmont (NW-Italy)

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Erosional processes are highly affected by the soil management practices and by climate variability, particularly changes in rainfall temporal pattern and intensity. Several studies highlighted that the use of grass cover (GC) in the inter-rows is one of the most common and effective soil and water conservation (SWC) practice available to reduce runoff and soil erosion in vineyards. Grass cover is supported at local level by Rural Development Programmes (RDPs) addressing EU Common Agriculture Policy soil and water conservation priorities. In Piedmont region (NW-Italy) GC has been adopted on 15.4 % of orchards and vineyards surfaces, following the implementation of 2007–2013 RDP. Contouring is an additional measure to limit the erosion phenomena. As typical in the Piedmont region, vineyards are arranged with rows along contour lines ("girapoggio") and up-and-down the slope ("rittochino").

Two experiments have been carried out in vineyards with similar soil management and inclination, but different vine rows orientation, to investigate the effectiveness of GC, compared to tillage (CT), and contouring as SWC practice. Runoff, soil losses and rainfall characteristics have been recorded in rainfed hillslope vineyards to determine the hydrological and erosive response in plots with different inter-rows soil management. Data have been collected in the two sites over the period 1992–1996 (contour line, 72 erosive events) and 2000–2014 (up-and-down, 86 events), respectively. Furthermore, the results of monitoring in the up-and-down vineyards in two recent years (2016-2018), characterized by extreme climate variability, 57% and 149% of the Mean Annual Precipitation (MAP) respectively, are compared with long-term results.

In contoured plots, "intense" events were responsible for the highest mean soil loss in tilled plot (0.7 Mg ha^{-1} per event), with very high erosion rates observed during a single storm (12.3 Mg ha^{-1}). In the up-and-down plots the highest erosion rates, 21.2 and 3.4 Mg ha^{-1}, were recorded during fall "long-lasting" events in the CT and GC plots, respectively. The GC proved to be effective in decreasing runoff and soil losses during most of the events reducing erosion, especially during summer storms when most of the "intense" events occurred in both experiments. The results show the fundamental role of contour-slope row orientation in reducing runoff and, particularly, soil losses (more than 80% in both treatments).

Rainfall, and consequent runoff and soil losses, recorded in the two last years (December 2016- November 2018) in the "rittochino" plots were very variable compared to MAP (828.3 mm): 2017 was the lesser rainy year since 2000 (474.6 mm), with runoff equal to 1% and 0.6% of rainfall, and only 4.6 and 0.7 kg ha^{-1} of soil lost, in CT and GC, respectively. Conversely, during the following year, precipitation was higher than usual (1232.8 mm), resulting in 11.3% and 2.6% of runoff, and 3.1 t $ha^{-1}$and 0.5 t $ha^{-1}$of soil was lost from the CT and GC plots respectively, mainly due to a summer storm and a "long-lasting event".