



Assessment of long-term erosion in a mountain vineyard, Aosta Valley (NW Italy)

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Tillage and chemical weeding are common soil management techniques adopted in mountain vineyards, with high slope gradient, to maintain bare soil. Both techniques exposes the soil to degradation, favoring runoff and soil losses, that may cause relevant on-site and off-site damage.

Steep mountain slopes makes optimum conditions for grape-growing. In the mountain region of Aosta Valley, NW Italy, the vineyards were, in the past, traditionally grown on terraces supported by dry stone walls. Since the 1960s the plantation of vines in the direction of the slope became more and more widespread, also on very steep slopes. Generally, no particular measure to channel and control surface water is adopted in this area due to the low rainfall (560 mm/year). Nevertheless in steep mountain slope rainfall events can cause important runoff erosion.

In order to evaluate the long-term effect of vineyard management techniques on soil erosion, a study was carried out on a mountain slope vineyard located near Aosta, at about 900 m above the sea level. The vineyard was planted at the end of 1960s and is managed by the Institut Agricole Régional. The rows are accommodated oriented along the slope, which is about 45%. The inter-rows' soil management of the vineyard included chemical weeding and, in first year after plantation, the adoption of irrigation (by fixed overhead sprinklers) and *hilling-up/taking-out* the soil around the vine plants, to protect them from cold weather.

The long-term soil erosion rate was determined adopting the technique of botanical benchmark (Casalí et al.,2009). The grafting callus was used as a marker to identify the paleo-surface at the time of planting. A detailed topographic survey was carried out to determine the present surface of the vineyard while the current position of the grafting callus was recorded for a number of plants. The original position of the callus was estimated by data obtained by farmers and by a survey on reference vineyards.

Two digital elevation models (DEMs) were generated: the first depicting, the present vineyard surface and the second representing the topography of the vineyard at time of vineyard plantation, based on the height of the grafting callus above the soil. The difference between the DEMs represents the local soil loss/gain over the vineyard surface from the plantation to today. According to this calculation the estimated total soil lost across 46 years was about 800 Mg, with average annual soil loss of $58.6 \text{ Mg ha}^{-1} \text{ year}^{-1}$.

The long-term erosion rate estimated by the study is consistent with values reported for vineyards by other studies considering shorter periods of time. The estimated erosion rate dramatically exceeds the upper limit of the tolerable soil erosion rates ($1.4 \text{ Mg ha}^{-1} \text{ year}^{-1}$) proposed for Europe by Verheijen et al. (2009). It is likely that the water and soil management practices adopted in the vineyard, besides the high slope gradient, have played a relevant role in determining the high erosion rate.