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Data acquisition system for soil degradation measurements in sloping vineyard

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The agricultural management techniques and mechanization adopted in sloping areas under temperate and sub-continental climate can affect the physical and hydrological characteristics of the soil with an increase of the soil erosion rates. Vineyards have been reported among the land uses most prone to erosion. Agricultural operations can be conducted to enhance the soil conservation, it is therefore important to know the site-specific characteristics and conditions of adopted practices.

A long-term monitoring to evaluate the influence of management systems in hilly vineyard on erosion and runoff and soil properties has been carried out in the north-western Italy since 2000. Three different inter-rows tillage systems were compared: conventional tillage (CT), reduced tillage (RT) and controlled grass cover (GC). To record the rainfall amount and duration, an agro-meteorological station was located near experimental plots. The three plots are hydraulically isolated, thus runoff and sediment have been collected at the bottom by a drain, connected with a tipping bucket device to measure the discharge of runoff. The system was implemented with electromagnetic counters that allow the automatic accounting with data capture by a control unit, powered by a photovoltaic panel and transmitted to a data collection center for remote viewing via web page. A portion of the runoff-sediment mixture was usually sampled and analyzed for soil and nutrients losses. In order to analyze with more detail the erosion process by means of predictive models, a micro-plot system was placed in the experimental site in 2012. Splash cups have been installed in each plot since 2011 to evaluate how the soil management affects the in-field splash erosion process. Rapid measurement of soil moisture content and temperature were performed starting from August 2011 to allow continuous monitoring of parameters that can provide an evaluation of space-time hydrological processes, determining the surface runoff response to a given precipitation events. Electromagnetic sensors were installed in the topsoil and measures were recorded in one-hour intervals by a data collection device. Some physical and hydrological properties were considered to provide information on the degree of soil compaction and its influence on soil status. The parameters analyzed are bulk density by core method and soil compaction by static and dynamic recording penetrometers. Since autumn 2011 the reduced tillage management was replaced with conventional tillage with a grass strip in the bottom of each inter-row (CTS). At the same time the grass cover of the GC plot was renewed after execution of tillage operation. Recurring measurements of the soil water content up to a depth of 60 cm and hydraulic conductivity tests with the Simplified Falling Head Technique (SFH) have been started in 2012, to observe the spatial and temporal variability of hydraulic behavior in the experimental plots.