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A conceptual water balance model to explore the impact of different soil management on water availability for vineyards under contrasting environments

Jose Alfonso Gomez (1), Gema Guzman (1), and Ignacio Lorite (2)

(1) Institute for Sustainable Agriculture. CSIC., Agronomy, Cordoba, Spain (joseagomez@ias.csic.es, g92gudim@uco.es), (2) IFAPA Alameda del Obispo. Consejería de Agricultura, Pesca y Desarrollo Rural. Junta de Andalucía. 14004 Córdoba, Spain

Vines are one of the most extended tree crops in Europe covering a wide range of environmental and management conditions. Soil management is a key element in maintaining vines in adequate agronomic conditions, as well as in determining not only yield but also grape quality. The soil management practices adopted in vineyards could favor accelerated erosion. Particularly, cultivation with rows running up-and-down the slope on sloping vineyards, maintenance of bare soil, compaction due to high traffic of machinery are some of the vineyard's management practices that expose soil to degradation, favoring runoff and soil erosion processes. In fact high erosion rates in vines have been recently reported by Gomez et al., (2011). The adoption of grass cover in vineyards as a soil management technique has a fundamental role in soil protection against erosion, but it can have a major impact on water balance and then in grape yield and quality. This effect, the possibility of competition for soil water with the vine, is in fact mentioned by vine growers as a limiting factor for use of cover crops in vineyards under semiarid conditions or during dry periods even in sub-humid climates.
To evaluate the interaction between the use of cover crops and soil management adjustments (eg. spatial extension in the vineyard and time for seeding and mowing) In order to achieve an optimum equilibrium between soil protection and grape production we developed a conceptual water balance model that reproduces the major processes in vineyards, WABYN. This model simulates the effect of different soil management alternatives, as for instance conventional tillage or cover crop, on soil water balance components. It has been implemented in a user friendly interface in order to allow its use by technicians and other stakeholders in the vine sector. It follows the methodology of a previous model specific for olive orchards (Abazi et al., 2012) using a model called WABOL. In spite of this simplified interface for the user, the model uses process-based methodologies to describe the key processes controlling water balance in rainfed or irrigated vines, such as runoff, deep percolation, cover crop growth, soil evaporation and vine and cover crop transpiration. This is possible using a complete model programmed in Fortran and executed from Excel as a DLL.

This communication presents a preliminary version of the model, as well as an evaluation of different scenarios of soil management impact on soil water balance in vines of different typologies under different soil and climate conditions.
Keywords: vines, cover crop, soil management, water balance

References

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