Geophysical Research Abstracts
Vol. 18, EGU2016-5625, 2016
EGU General Assembly 2016

Minidisk against ring infiltrometer measurements to assess the saturated hydraulic conductivity in Mediterranean vineyards (Vitis vinifera L.) under Tillage and No-Tillage managements

Maria Burguet (1), Simone Di Prima (1), Massimo Prosdocimi (2), Encarnación V. Taguas (3), and Artemi Cerdà (1)

(1) Soil Erosion and Degradation Research Group, Department of Geography, University of Valencia, Valencia, Spain (maria.burguet@uv.es), (2) Department of Land, Environment, Agriculture and Forestry, University of Padova, Agripolis, Viale dell'Università 16, 35020 Legnaro (PD), Italy. (massimo.prosdocimi@studenti.unipd.it), (3) University of Córdoba, Department of Rural Engineering, Campus Rabanales, Leonardo Da Vinci Building, 14071 Córdoba, Spain (evtaguas@uco.es)

Vineyard is one of the main crops in the Mediterranean region and it forms, along with wheat and olive, what it is known as the 'Mediterranean triad'. According to the Food and Agriculture Organization of the United Nations (FAO, 2010), the European Union has 4.5 million hectares of land occupied by vineyards. Out of all, the Mediterranean region has the largest total area of vineyards. France, Italy and Spain together are responsible for 48% of global wine production. In Spain, the total surface occupied by vineyards is 1.048.104 ha (Ministry of Agriculture, Food and Environment, 2009), which is translated in a 13% of world total (Wine Institute, 2014). In terms of environmental factors, vineyards are a source of sediments and water due to the tillage and the soil compaction, the lack of vegetation cover and the soil organic matter depletion (Novara et al., 2011; Lieskovský et al., 2014; Rodrigo Comino et al., 2015). The infiltration capacity of soils is a key component of the hydrological cycle that can control the non-sustainable rates of runoff and erosion (Cerdà, 1997,1999). In this way research focused on the soil hydrological properties will bring knowledge on how to control the high erosion rates (Cammeraat et al., 2010).
Saturated hydraulic conductivity, ks, is the most determining physical parameter in terms of quantifying the components of the global water balance as it interferes in all those processes which are related with water and solute movement and transport through the soil. ks values are required for an adequate modelling of the infiltration and runoff generation processes. However, it is a variable with high variability when it comes to agricultural soils due to different soil managements and the fact that the soil is not a continuous media (Polo et al., 2003). For instance, Leonard and Andrieux (1998) reported in a study done in untilled vineyards in France high differences in infiltration rates through the use of rainfall simulations, which is also found in forest and degraded soils.
The aim of our work was to test two different ks measuring methodologies –the ring infiltrometer and the mini-disc infiltrometer (Decagon Devices, Pullman, WA.2005), in order to check how the differences in measuring affects to the ks calculations. This would give an idea of which methodology would be more appropriate to use regarding the time-consume, effort and costs of the measuring material.
The measurements were carried out during November 2015 at El Celler del Roure, a 25-years old vineyard located in Les Alcusses (Moixent, Spain). The soil managements selected for the study were Conventional Tillage (CT) and No Tillage (NT). A total of 18 infiltration measurements were performed (9 for CT and 9 for NT). In order to homogenize the measuring times, the measuring time for each methodology lasted 1 hour. ks values were calculated derived from Green and Ampt′s (1911) and Horton′s (1941) equations in order to discuss the impact of the methodologies applied. Statistically significant differences (p=.000) were found when applying both methodologies between CT and NT at both time and measures. However, there is still a need to understand how both methodologies influence in the variation of the parameters used for the Green and Ampt′s (1911) and Horton′s (1941) models.

Acknowledgements:

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 603498 (RECARE project).

References:

Cammeraat, E., Cerdà, A. and Imeson, A.C. 2010. Ecohydrological adaptation of soils following land abandonment in a semiarid environment. Ecohydrology, 3: 421-430. doi:10.1002/eco.161

Cerdà, A. 1997. Seasonal changes of the infiltration rates in a mediterranean scrubland on limestone. Journal of Hydrology, 198: 209-225. doi:10.1016/S0022-1694(96)03295-7

Cerdà, A. 1999. Seasonal and spatial variations in infiltration rates in badland surfaces under Mediterranean climatic conditions. Water Resources Research, 35 (1): 319-328. doi: 10.1029/98WR01659

Decagon Devices, Inc. 2005. Minidisk Infiltrometer, User's Manual.

Food and Agriculture Organization of the United Nations. 2010.

Green, W.H. and G. Ampt. 1911. Studies of soil physics, part I – the flow of air and water through soils. J. Ag. Sci. 4:1-24. Horton, R. 1941. An approach toward a physical interpretation of infiltration-capacity. Soil science society of America journal.

Leonard, J., Andrieux, P. 1998. Infiltration characteristics of soils in Mediterranean vineyards in Southern France. Catena, 32: 209-223. doi:10.1016/S0341-8162(98)00049-6

Lieskovský, J., Kenderessy, P. 2014. Modelling the effect of vegetation cover and different tillage practices on soil erosion in vineyards: A case study in vráble (Slovakia) using WATEM/SEDEM. Land Degradation and Development, 25 (3): 288-296. doi: 10.1002/ldr.2162

Ministry of Agriculture, Food and Environment. 2015. http://www.magrama.gob.es/es/

Novara, A., Gristina, L., Saladino, S.S., Santoro, A., Cerdà, A. 2011. Soil erosion assessment on tillage and alternative soil managements in a Sicilian vineyard. Soil & Tillage Research, 117: 140-147. doi:10.1016/j.still.2011.09.007

Polo, M.J., Lafuente, P., Giráldez, J.V. 2003. Variabilidad espacial de la conductividad hidráulica saturada en suelos de olivar y su influencia en el balance hidrológico global. Estudios de la Zona No Saturada del Suelo, Vol. VI, 209.

Rodrigo Comino, J., Brings, C., Lassu, T., Iserloh, T., Senciales, J. M., Martínez Murillo, J.F., Ruiz Sinoga, J.D., Seeger, M., Ries, J.B. 2015. Rainfall and human activity impacts on soil losses and rill erosion in vineyards (Ruwer Valley, Germany). Solid Earth 6: 823-837. doi:10.5194/se-6-823-2015

Wine Institute. 2014. http://www.wineinstitute.org/