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# ***Interactive comment on “Influence of hydropedology on viticulture and oenology of Sangiovese vine in the Chianti area (Central Italy)” by E. A. C. Costantini et al.***

**Anonymous Referee #2**

Received and published: 30 April 2009

General comments This paper presents a case study where some hydropedological concepts are used to explain the production and quality of wine in the Chianti area. The paper is clearly written, well-organised, and is based on numerous experimental data. But I think it is not valuable for publication in its actual state for the following reasons:

1- Aim of the study. It is not clear for me what is the effective objective of this paper. As a context, the authors write in the introduction: “The distinction of the soil cover into soil series has proved to be relevant for viticulture in different parts of the world, and some hydropedological models can be applied to a soil series to predict flow pathways

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through the soil and moisture profile distribution on hillslope." The objective is then defined as: "The general aim of this work was to test the prediction capacity of selected hydopedological models for two soil series cultivated with grape. [It was to] delineate hydrological functional units [...] that effectively determine differences of available water during vine growing [...]" From these two sentences, I do not see what is the added value of this study compared to what can be found in the literature.

2- Use of pedological models. The authors claim that they use the hydopedological model of Lin et al. (2006) and the Host classification of Boorman et al. (1995). They do not argue the use of the Lin model and they apply the Host classification of Boorman without any explanation. I wonder if such a classification, created for UK soils, is valuable for Mediterranean soils. Moreover, as I will discuss in the next paragraph, the authors use a huge amount of data that are used to characterise the soils. But all of them are probably not useful, and I am afraid that the concepts of hydopedology can be used as an excuse to present study cases with lots of data, even if all of them are not valuable. We all have to take care of this possible drift, to be sure that hydopedology stays pertinent.

3- Use of the data to reach the objective. The paper is organised in 13 pages. More than 6 pages are devoted to the material and methods part, and lots of measurements are described, that can be separated in three parts: -a- temporal monitoring or evaluation of state variables (rainfall, water content, runoff, evapotranspiration, transpirable soil water-TSW, temperature, Eh), -b- characterisation of the soils (bulk density, water content at saturation, saturated hydraulic conductivity, cone resistance, texture, CaCO<sub>3</sub>, C content, pH, electrical conductivity, CEC, contents in K, Na, Ca) –c- characterisation of the crop (dates of phonological phases, yield, sugar content of grapes, color density, phenolic content, delta C 13). Among these 27 (!) data, most of them are used to characterise the two studied sites and some of them are not discussed in the paper. The quality of the wine is mainly discussed by the help of transpirable soil water, and not with other data. In my opinion, the paper could then be considerably re-

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organised, shortened, and focused: I would suggest i) moving all the data that concern the description of the soils (unused information should be removed from the paper), from the results part to the material and methods part, ii) focusing the results part to the temporal monitoring of the data of interest and to the comparison between the wine quality and the TSW, which seems to be the parameter of interest. Indeed, in its actual state, the paper does not present the relationships between TSW and the wine quality parameters (qualitative and quantitative parameters), and the heart of the paper is only one page at its end, before the conclusion.

## Specific comments:

4- line 10 page 1199: you mention “main variables”: what do you mean ? For what purpose are they “main variables”? What is here specific to vineyards ?

5- line 22 page 1199: “The geographic pattern of hydrological functional units [...] cultivated with grape is particularly difficult to predict because of [...] pre-planting operations”. I do not think that grape is a specific crop. Indeed, the pre-planting operations can strongly modify the soil functioning because the depth of ploughing is usually of several tens of centimetres. But the influence of these operations attenuate with time and, finally, it depends on the age of the grape. You should mention the age of the vineyards you study and moderate your statement in consequence.

6- line 30 page 1199: “In addition, the hydropedology of a vineyard is above all important [...]. I do not understand the sentence “hydropedology is important”. Please rewrite.

7- line 18 page 1200: please explain “rootstock 420A”.

8- line 18 page 1200: “Both vineyards were deep ploughed up to 0.8-1.0 m before planting [...]. Please indicate the age of vineyards (see comment 5). It is particularly important in relationship with the equilibrium breakdown in soil water chemical and hydrological functioning due to ploughing.

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9- figures 1 and 2: please add a scale.

10- line 10 page 1201: I tried to find the Boorman et al (1995) paper but it is a UK report that is not easily reachable. Please cite another paper, or explain the main principles of this classification. Moreover, you must explain how you can use such a classification, that was created for UK soils, in a completely different geological, geomorphological and agronomic context.

11- lines 15 to 25 page 1201: In this paragraph, you classify the San Quirico and Pietrafitta soils according to the Host classification, mainly by using their hydrological functioning. How can you classify the soil before having studied the hydrology of these soils? As a consequence, is your last sentence ("we expected moister conditions and larger subsurface later flow in vineyard 1 than in vineyard 2") a hypothesis or a conclusion?

12- lines 7 to 15 page 1201: Please give more information about your survey with the SIS of John Deere. I do not understand how your soil moisture map is created: do you use only the 21 measurements of soil water content by FDR? If yes, what is the interpolation method? If no, what are the other geophysical measurements? My own experience with the SIS system is that it uses pedotransfer functions to transform EMI measurements into soil water content values. If you use this system, please explain your PTF. Finally, could you give some information about the "rooting depth", and the relationship between the map that is created "at rooting depth" at the bud bursting, and the maps of water content that you create each week from auger sampling?

13- line 18 page 1202: as far as I understand, you have dug 9 holes (3 on each slope position) every one/two weeks during 3 years, to determine the water content. It is perhaps about 1000 holes within 2 ha. Don't you think that the hydrological functioning of your studied area is modified by the soil sampling?

14- line 27 page 1202: please explain how you estimate runoff.

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15- line 20 page 1203: in the calculation of the daily transpirable soil water, I do not really understand why you use the minimum absolute value instead of the wilting point value. If the real soil water content is lower than the soil water content at the permanent wilting point, it could be due to evaporation and not evapotranspiration. Don't you think so?

16- line 21 page 1204: how do you estimate bulk density from water content?

17- line 25 page 1204: "Wilting point was the minimum soil water content recorded during the field core sampling during the whole trial". This sentence is in contradiction with what you said page 1203, line 22, isn't it?

18- line 17 page 1205: precise at what depth you have sampled the undisturbed soil for making thin sections.

19- lines 14 to 19 page 1206: at several parts in the paper, the authors mention that they have made maps. Unfortunately, we do not see any map, except the soil moisture at bud bursting. I would like to see some geographical results, or to know if it is necessary to draw maps.

20- lines 13 to 18 page 1207 and lines 1 to 19 page 1208: please move this paragraph to the material and methods sections. If the soil was ploughed down to 0.8 m before planting, I do not understand why you describe a Ap horizon in the table 1.

21- lines 19 to 28 page 1207: I do not understand what is the unit of soil moisture (mm ?). Could you explain why this map is useful for the interpretation of wine quality ?

22- Table 2: the saturated conductivity for the surface horizon seems really low (0.101 cm/h = 2.8 E-7 m/s).

23- line 9 page 1208: how do you estimate the root density?

24- line 23 page 1208: "There was a higher percentage of elongated and irregular pores, very important for vertical water movement". In my opinion, it would depend

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on the orientation of the thin section. But anyway, you can not conclude for water movement with only 2D images.

25- line 26 page 1208: "[...] in San Quirico, the decrease of porosity at 0.4-0.7 m reached 50 % with respect to the surface horizon". I do not see that on figure 6: porosity is equal to about 11 % in the first horizon and 9 % on the second horizon.

26- line 19 page 1209: "There was no relationship between the values of the monitored soil moisture and the percentage of tube discoloration". In fact, I do not see how you could compare these informations. As far as I understand, the IRIS tubes are installed at the beginning of the season and are removed at the end, giving an integrated idea of the reduction process. On the contrary, the monitoring of water content is a temporal information. 27- line 4 page 1211: "The same holds true for the panel test evaluation". I do not understand nor this sentence neither the figure 12.

28- line 4 page 1211: "Moreover, the evaluation of the wine produced in San Quirico showed a significant direct relationship with TSW". Could you explain what is "the evaluation of the wine"? How do you relate it with TSW if it is a qualitative information?

29- lines 8 to 20 page 1211: what the "particular" behaviour of the vineyards studied here? It seems that you expect a higher quality in the vineyard 1, but I do not clearly understand why.

30- line 21 page 1211: "The trial showed that the conceptual hydopedological model of Lin and the Host classification can be used for the prevision of the moisture status of vineyard soils during summertime". I do not think that you have demonstrated that statement in your paper. Please explain how you use the so-called "hydopedological model of Lin".

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 6, 1197, 2009.

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