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Hydrology and Earth System Sciences Discussions

Interactive comment on "The olive tree: a paradigm for drought tolerance in Mediterranean climates" *by* A. Sofo et al.

A. Sofo et al.

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First of all, we would like to acknowledge the great work made by both referees. Their comments and suggestions have been useful in order to improve the final quality of the paper. In the following, the reviewers comments are discussed one by one.

RC: However, my main suggestion would be to make Sections 3.2 and 3.3 more easily understood by a broad audience. I think the results of this paper are quite valuable and should be interesting to researchers in many areas, so it would be appropriate to write the paper in a way that allows a broad audience to benefit. Indeed, the authors have made most of the paper quite readable aside from these two sections. Perhaps the authors can include a little more explanation of their terminology.

AC: We agree with the reviewer. In the reviewed version of the paper, we have reorganized this two sections in order to better explaining the terminology without losing clarity and fluency of the text. We understand that the audience of HESS could be not familiar with the terms used in plant physiology and biochemistry and for this reason we included, in the text, simpler definitions and adopted symbols only when necessary.

RC: Also, it would help if the paper described the methods, results, and conclusions in a more thorough and sequential order. In Sections 3.2 and 3.3, it is difficult to determine which statements are based on the experiments and which statements are drawn from the literature.

AC: This paper represent a collection of results of years of experimentation on olive plants by our research group. The results have been re-elaborated in the present paper with the aim to describe the ensemble of mechanisms that this plant uses to cope with droughts.

RC: It is also difficult to determine the methods that were used in the experiments to obtain the results.

AC: We corrected the section of Materials and Methods including more details regarding all the procedures adopted. It is also necessary to remark that the paper analyses a broad range of physiological and biochemical parameters (but this is also the originality of the research), for this reason we tried to better explain the trial design (periods of drought stress and rewatering) common for all the measurements. We also gave more emphasis to the methods used for each single measurement providing the references when necessary.

RC: A more specific statement of the objectives would strengthen the paper. The objectives are currently stated quite broadly, which makes it more difficult to understand the choice of the experimental design, results, and conclusions.

AC: We agree with you. Unfortunately, it was not easy to organize the high number of

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results used in this paper, so in the introduction we tried to give more emphasis on the species studied than on the definition of work aims. Anyway, in this revision, we tried to strengthen the aims of the work at the end of introduction section.

RC: In section 2, more explanation about the experimental design would be valuable. For example, it was not obvious to me why these particular ages of plants were selected or why the second site was studied. Also, I would recommend stating the measurements that were made for each experiment and the method used to make each measurement. The description of the irrigation and drying schemes for the first experiment is difficult to understand in that section. They become clear later in the paper, but the text about this could be clarified a bit in Section 2.1.

AC: In the new version of the paper, we have described the methods for the measurements made for each experiment and clarified the experimental design. Regarding the second site, it was used to compare the physiological behavior of olive plants grown in vase (first experiment) with that in field. Measurements of physiological and biochemical parameters required a high number of uniform plants of the same age (that particular age was chosen because plants at that age are already completely developed and root system has already explored the available soil). Only in this way it was possible to carry out a controlled and uniform water deficit for all the plants and to do a reliable statistical analysis on at least three plant at the same water conditions for each measurement. For growth parameters, it is necessary to observe the behavior of plants in field because the vase could be a limiting factor for root growth. Thus, we did the second experiment to complete the picture of the responses of olive plants to drought.

RC: In Section 2.2, the modeling results are not fully described. Has the application of the model to this region been described elsewhere in the literature already? If so, a clearer citation is needed to support this section. If not, then a much more thorough explanation of the modeling is needed. For example, the authors do not describe the porosity (which directly affects the distribution in Figure 1) and other parameters in the

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model or their origins. Whether or not these results are new in this paper, I believe that another layer of detail is needed here to judge the significance of the results that are presented. Alternatively, the authors may wish to consider removing this figure and associated discussion because it does not seem central to the main thrust of the paper.

The graph reported in Figure 1 represents the PDF of the soil moisture obtained using a soil water balance equation applied at the local scale avoiding lateral exchanges. This was only briefly described because this simulation was only performed with the scope to display the fluctuations that soil moisture may have in the environmental condition of the second study case. In particular, the graph shows that plants in this area, under natural condition, are frequently under very dry conditions.

In Section 2.2, the authors provide soil texture results. Can the hydraulic characteristics be provided as well (porosity, unsaturated hydraulic conductivity, etc.)?

This information has been included in the caption of figure 1.

In Section 3, the authors state (page 2817 line 11), “…Eq. (1) should be applied accounting for this reduction in the potential transpiration rate.” Is it correct to consider this reduction in the potential transpiration rate? To me, this approach seems like a redefinition of the term. Also, for clarity, I suggest that the authors directly call Emax the potential transpiration rate because they imply their equivalence here.

The text have been changed in the following: "In this case, the olive tree is was able to recover its functionality within one month, but during this period transpiration was significantly reduced and equation (1) should be applied accounting for this reduction in the actual potential transpiration rate".

RC: The results described on page 2817 (lines 17-21)-are these also from Nuzzo et al. (1997) or based on the experiments? Please include a stronger justification here.

AC: No, there are not. The work of Nuzzo et al. (1997) refers only the similar data obtained from kiwifruit plants. This reference was only used to compare two tree cul-

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tures with a different strategy of drought resistance (tolerance for olive and avoidance for kiwifruit).

RC: Page 2818-line 1-2. Can the authors provide some brief basis for each of their assumptions?

AC: We decided to remove this paragraph because we think that the assumptions reported were not pertinent to data discussion.

RC: 2815, line 6, I&#8217 I'm not sure what “integrated&#

RC: We agree with you that this term was not clear. We changed the sentence in "...providing, every evening, the amount of water lost through transpiration during the day."

RC: 2815, line 7, why was 85% chosen? 2815, line 10, is optimal the same as 85% saturation?

AC: We chose a value of 85% of soil water holding capacity because from previous experiments we observed that for olive plants is a good compromise between water availability and root respiration. At higher values, the roots of olive, a species adapted to dry conditions, start to reduce growth and their respiration is partly compromised.

RC: line 22, I suggest “understanding plant-soil interactions” 2812, line 25, I suggest “forcing, producing” 2813, line 2, I suggest “climatic conditions” 2813, line 5, citation? 2813, line 12, In numerous places (like here) the authors say “olive tree.” I suggest “The olive tree” or “An olive tree” 2813, line 14 suggest “Mediterranean area, and “ 2813, line 16, suggest “the olive tree” 2813, line 18, suggest “response” rather than “reply” 2813, line 27, “Olive trees are” 2813, line 27, not sure what is meant by “sparing users of soil water.” 2813, line 29, “the olive tree” 2814, line 1, remove hyphen 2814, line 6 connect the two sentences

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“…hills (…,2005) because its culture…” 2815, line 1, replace “grew” with “grown”, “vases” with “pots” 2815, line 6, I’m not sure what “integrated” means here 2815, line 7, why was 85% chosen? 2815, line 9, replace “and successively” with “after which” 2815, line 10, is optimal the same as 85% saturation? 2816, line 19, I think the figure citation is incorrect 2817, line 16, “of about 55%” should be “by about” 2818, line 17, “recovering” should be “recovery” 2821, line 4, “The olive tree” 2822, line 24, “the olive tree”

AC: All these typing errors were properly corrected.

References Bohm, W: Methods of studying root systems. In: W.D. Bellings, F. Galleg, O. L. Lange and J. S. Olson (ed.) Ecological Studies, vol 33 Springer. Verlag New York, inc, New York: 116-117, 1979. Walters, R.G., Horton, P.: Resolution of components of non-photochemical chlorophyll fluorescence quenching in barley leaves, Photosynth. Res. 27, 121-133, 1991.

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