

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

A. Sofu 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.

General comments

RC: In this manuscript the Authors have studied some ecophysiological aspects of olive trees subjected to different irrigation regimes. The research has been carried out in a manner that was technically sound and there are elements of novelty in the results, which may be of practical interest to olive growers. However the paper is primarily descriptive and does not really address or challenge any fundamental question

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of how olive trees function in different soil moisture conditions. Indeed, there are no specific hypotheses posed and no new functional or structural questions addressed. In addition, the manuscript consists of two separate experiments that need to be better harmonized. The primary message appears to be that olive trees have developed a complete set of mechanisms to cope with drought stress in Mediterranean environments, which is an expected result. Because there were no specific questions when starting these experiments, the authors struggle to provide and discuss as many details without a take home message on challenging the traditional approach to study the response of olive trees to irrigation.

AC: Considering that most of the readers of HESS are hydrologists, the paper was made with the aim to describe the physiological mechanisms that olive plants use to cope with water stress that is becoming a challenging problem in hydrology. The paper represents a review of those processes in order to include a broad range of responses of olive tree to drought. In the revised paper, we tried to join the requirements of an audience having an expertise in hydrology and earth sciences with an audience closer to plant eco-physiology. We tried to re-organize the paper following the Journal suggestions aware that this is not the classic approach for plant physiologist. In order to clarify all the measurements, we corrected the section of Materials and Methods and included more details regarding the adopted procedures. We also tried to better explaining the trial design (periods of drought stress and rewatering) common for most of the measurements.

Specific comments

RC: The experimental approach is relatively standard and straightforward, and falls more into the category of confirming emerging consensus rather than breaking new ground. My impression is that insights on the effect of water deficit on olive tree behavior may hardly rely on the interaction between soil moisture availability and root system structure, when plants are left growing in pots. Whole plant transpiration was not measured on trees growing in the field and any conclusion on water consumption in olive

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tree plantation based on pot studies may be misleading. Also recovery effects may be biased because of the limited root volume.

AC: In fact for this reasons, we have organized the second experiment to study growth parameters because in this case the vase could be a limiting factor for root growth. By contrary, for measurements of physiological and biochemical parameters we needed a high number of uniform plants and a controlled water depletion and rewatering. For this reason, we preferred an experiment having plants grown in vases (first experiment).

Was the root system excavated in this experiment? Are these plants regularly pruned? This information is needed to comment on below- vs. above-ground relationships.

AC: In the first year, roots were extracted from the whole volume of soil explored, while in the following years, the total soil volume explored by the roots was divided into 30 cm layers using the trench method (Böhm, 1979). Roots were separated from the soil using sieves of 2 and 5 mm mesh. The dry weight of each plant part (fruits, leaves, shoots, trunk, stump and roots) was measured after drying plant tissues at 80 °C for 24 h. Plants were regularly pruned each year and the mean dry weight of pruning material per plant per year (period of seven years) was 1857.34 g plant⁻¹ year⁻¹. This aspects are now included in the description of the experiment.

RC: Most of results are quite obvious for potted plants, and conclusion on field grown trees is basically a repetition of previous studies, also conducted by the same Authors. Speculating on adaptive strategies through often spurious relationships between variables collected in a highly manipulated environment (pots) may be misleading and biased. The field experiment should be integrated with the pot study, for highlighting limitations or reinforcing results.

AC: As we said before, we needed a high number of uniform plants and controlled water depletion and rewatering for carrying out the measurements of physiological and biochemical parameters. For this reason, we preferred an experiment having plants grown in vases. We understand that pots are a manipulated environment if compared

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to field conditions, but this was the only way to perform all the analyses in plants at the same level of pre-dawn leaf water potential.

RC: Another limitation of the study which needs to be considered is the use of only one cultivar.

AC: We agree with the reviewer that a comparison with other cultivars is important for the selection of drought tolerant varieties of olive and it has a practical scope. Unfortunately, we have no a complete set of data for other olive cultivars (except for gas exchange and fluorescence) and we also think that it would be very difficult to organize the data from more cultivars in only one paper. For sure, in the future, we will focus our attention on the comparison between different tree species, focusing only on few parameters.

RC: What about non-stomatal (mesophyll) limitation to photosynthesis?

AC: We agree with the reviewer and so, throughout the text, we have included some data on the degree of photoinhibition obtained by relaxation curves of chlorophyll a fluorescence from olive leaves (using the method of Walters and Horton, 1991). Moreover, a supplementary table (Table 2) was designed to show this data.

Technical comments P. 2818, line 11: correct 8220;are have8221;

This point has been properly addressed.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 4, 2811, 2007.

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