Revision

11 Aug 2026

Topic editor decision: Publish subject to revisions (further review by editor and referees)

by David Dunkerley

Public justification (visible to the public if the article is accepted and published):

I acknowledge that the authors have made minor changes to their manuscript in developing the revised version. However, in my view the changes made are quite minimal, and have failed to address adequately the comments and suggestions made by the two reviewers.

Comments supplied by the Topical Editor highlighted several important issues that required attention. These are highlighted in bold in the text (below) that was sent to the authors.

Dear authors,

The two reviewers of your manuscript have raised a series of issues that it would be useful to consider in a revised paper. I now invite you to prepare and submit such a revised manuscript. Several key issues include (a) considerations of scale: considering the extent to which small-plot (40 x 40 cm) data might support understanding hydrologic response at larger spatial scales, and how key surface and subsurface processes might differ among spatial scales and topographic conditions different to those at the study site; (b) a discussion of how undocumented sub-surface processes such as macropore or preferential flow pathways, or sub-surface flow and percolation in general, might bear on the interpretation of your results; (c) what can be said about the practical application of moss-based methods beyond the study site, in terms of persistence of the mosses and management within the vineyard environment.

It may not be possible at this stage to collect additional data to address some of the issues raised by the reviewers, but it would be valuable for readers to have your comments on and assessment of these issues. Issues of scale for instance are fundamental in studies of this kind, and warrant serious consideration. Likewise, some discussion of the extent to which the present results are likely to be transferable to other sites with different environmental conditions would strengthen the paper.

Comments on the authors revised ms.:

The treatment of the scale issue is weak. The authors have added a mere 3 lines (lines 129-131) and simply claim that the 40 x 40 cm plots correspond to a ‘standard’ size used in some rainfall simulations. This claim is unreferenced. The reference to prior plot sizes that might have been used in other studies provides no assurance that they are relevant to the work described in the current ms. The important question is whether all relevant processes of infiltration and percolation can adequately be captured in study plots of such small dimensions. I doubt for instance that the throughfall under vines would be uniform across such scales. A more thorough response is needed.

Thank you for highlighting the importance of adequately discussing the plot size in the framework of our study. The 40 × 40 cm plot dimensions were originally established for rainfall simulation experiments conducted at the study site by Gall et al. (2025); 40 cm representing the width of a wine row. The TMS-4 dataloggers were installed within these plots to monitor soil moisture during the simulations. Subsequently, we left the sensors in place to record moisture dynamics under natural rainfall over the following two years, which forms the basis of the present study. We briefly outlined this in the Methods section and added the reference to Gall et al. (2025) (see markdown lines 132 – 139).

However, we believe that the plot size of 40 × 40 cm is also suited to detect the differences in topsoil moisture among our treatments. This small spatial extent represents a fine-scale observation at a fixed microsite, and so does the similarly local scale measurement of the TMS-4 dataloggers. They are microclimate loggers based on the time-domain transmission principle that were designed to mimic a small herbaceous plant, measuring the topsoil moisture in the root zone of approximately 14 cm soil depth (Wild et al., 2019). With this matching of spatial scales, we were able to assess the response of topsoil moisture between treatments, and we used four independent replicates for each treatment to account for spatial variability within treatments. Nevertheless, this study was not designed to capture the full spatial integration of infiltration and percolation processes across a vineyard row or hillslope. We clarified this in the Method section (see markdown lines 147-155).

We agree that throughfall beneath vine canopies is unlikely to be spatially uniform at these scales, as canopy interception, drip points, and stemflow generate marked small-scale heterogeneity in rainfall input. Plot locations were kept consistent (within the vine row and close to the vine trunk) across treatments, but our design cannot resolve how infiltration and percolation might differ among canopy positions, and we note this as a limitation in a separate chapter of the Discussion section (lines 605-610).

The treatment of possible sub-surface processes is also too brief. In line 131 the authors simply state that ‘unusual .. lateral water movements could not be observed’. In lines 141 – 143 the authors simply assert that they expected subsurface water movement to ‘ .. be within natural limits .. ‘. It is not made clear what ‘natural limits’ are, nor why they might be expected to apply to the experimental plots.

We agree that subsurface hydrological processes not directly measured in our study could influence the interpretation of the topsoil moisture patterns we observed. We have added a paragraph “4.5 Limitations of scale, subsurface processes, and transferability” to the Discussion section addressing three aspects: (1) the low likelihood of pronounced lateral subsurface flow given the gentle slope (5°) and the textural similarity between the two characterized horizons, while acknowledging this cannot be fully excluded (markdown, lines 605-610); (2) the plausibility of macropore/preferential flow given the low bulk density (0.96 g cm^{-3}) and clay-rich texture of the topsoil (markdown, lines 611- 619); and (3) the limitation that point-scale TMS-4 dataloggers cannot distinguish matrix from macropore flow induced topsoil moisture, which adds unresolved variance to the observed soil moisture dynamics independent of treatment effects (markdown, lines 619-631). Given the similar soil conditions and the proximity of the plot locations, we assume that this variance is likely comparable across treatments.

Finally, the consideration of what can be learned that might be applicable to the use of moss in the way that the authors proposed, but in other environments and vineyard conditions is also inadequate. The authors note that they deliberately chose a location with low slope gradient. Many vineyards are on steeper terrain – so the question remains how well the proposed use of moss might

be transferable to other environments. The authors should discuss this, and present their views. Their conclusions (lines 629-631) suggest confidence that the moss restoration can help to improve conditions in areas of vine cultivation. I could see not words of caution that all the presented results are from a site of low topographic gradient, and might not be applicable at all to other untested terrains.

We have expanded our discussion of moss persistence and management with additional evidence from the literature (markdown, lines 624-631). Studies establishing moss on steeper slopes report comparable establishment success under intensive management (Bu et al., 2018; Fan et al., 2025), supporting feasibility on terrain more comparable to steeper vineyards, but confirming that current cultivation protocols remain maintenance-intensive during establishment. We further note that mosses are known to be highly sensitive to physical disturbance such as trampling (Kuske et al., 2012; Yang et al., 2018), which is relevant to vineyard management. Moss cover is likely best suited to under-vine areas with limited traffic rather than heavily trafficked inter-row areas. We conclude that, while moss required no mowing or herbicide application once established in our own two-year study, the literature indicates that low-maintenance establishment and long-term persistence under realistic vineyard management remain to be demonstrated, and we identify this as a priority for future research (lines 651-660, 677-679).

Bu, C., Li, R., Wang, C., and Bowker, M. A.: Successful field cultivation of moss biocrusts on disturbed soil surfaces in the short term, Plant and Soil, 429, 227-240, https://doi.org/10.1007/s11104-017-3453-0, 2018.
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Gall, C., Oldenburg, S., Nebel, M., Scholten, T., and Seitz, S.: Effects of moss restoration on surface runoff and initial soil erosion in a temperate vineyard, SOIL, 11, 199-212, https://doi.org/10.5194/soil-11-199-2025, 2025.
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Yang, H., Liu, C., Liu, Y., and Xing, Z.: Impact of human trampling on biological soil crusts determined by soil microbial biomass, enzyme activities and nematode communities in a desert ecosystem, European Journal of Soil Biology, 87, 61-71, 2018.