

Hydrol. Earth Syst. Sci. Discuss., referee comment RC2
<https://doi.org/10.5194/hess-2021-351-RC2>, 2021
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Comment on hess-2021-351

Anonymous Referee #2

Referee comment on "Differential response of plant transpiration to uptake of rainwater-recharged soil water for dominant tree species in the semiarid Loess Plateau" by Yakun Tang et al., Hydrol. Earth Syst. Sci. Discuss.,
<https://doi.org/10.5194/hess-2021-351-RC2>, 2021

The paper entitled "Different responses of plant water consumption to rainwater uptake for dominant tree species in the semiarid Loess Plateau" investigates the response of *Hippophae rhamnoides* and *Populus davidiana*, in both pure and mixed plantations, to rain pulses. The topic is well within the scope of the journal. However, I have several concerns that need to be addressed before the manuscript can be accepted for publication (see my comments below). In general, I think the manuscript would benefit from some language editing as there are numerous language and grammar issues. Hence, my recommendation is that the authors conduct a major revision and resubmit the manuscript.

Main comments:

- Personally, I find the terms 'rainwater uptake' and 'water consumption' (both central to this manuscript) rather ambiguous. I would recommend using 'transpiration' instead of 'water consumption'. On the other hand, the term rainwater uptake can be confusing, as it seems to suggest that these trees take up water directly from rainfall. Some trees can indeed take up rainwater through their leaves, but this is not the case for the species included in this study. In my opinion, it would be better to refer instead to the 'uptake of recently recharged soil water' or similar (uptake of soil water that has been recharged from a recent rainfall event).
- It would be very helpful if the authors could provide some additional information on the two studied tree species. The authors write (L.82-84): 'Hippophae rhamnoides and Populus davidiana are typical dominant tree species, with high survival rate and drought tolerance, and occupy nearly 30% of the plantation area in this region (Liu et al., 2017; Tang et al., 2019)'. Could you give some species-specific information on e.g. their phenology or root system? How do the species differ, and are there any reasons to believe that they might respond differently to rain pulses in terms of transpiration and water source partitioning? Do you have any hypotheses? In addition, I would suggest the authors check the scientific names of the species. According to the World

Flora Online, *Hippophae rhamnoides* not an accepted name but a synonym of *Elaeagnus rhamnoides* (L.) A.Nelson.

- The authors have done extensive field and lab work, which is extremely valuable. However, I find the material and method section a bit hard to follow given not only the number of measurements but also the use of multiple approaches to address the same question (for example RUP – rainwater uptake proportion - vs MixSIR, or MIXSir with 7 soil depth intervals vs. MIXSir with 3 soil layers). This affects as well the interpretation of the results. Therefore, I would suggest the authors clarify the different steps in the methodology better, whether the chosen approaches are complementary, and how.
- Where are the plantations where you conducted the measurements located? It would be good if you could provide a map to illustrate this. Also, what is the slope? Are there any terraces or other soil and water conservation measures? Are soil properties and land-use history similar across all nine plots included in the study? Do you have any information on the physical characteristics of the soils?
- The authors selected 5 distinct rainfall events of varying magnitude (ranging from 3.4 mm to 35.2 mm) to study the response of the tree species (in both pure and mixed stands) and how this varies according to the magnitude of the event. As stated in L. 168-169, 'These rainfall events were selected with an interpulse period longer than 7 days to eliminate the potential influence of the previous rainfall event.'. However, I have serious doubts about this approach and the validity of the results from this specific analysis (e.g., L. 478-482: '*The increasing rainfall amount significantly decreased water source proportion from deep soil layer ($P < 0.05$) for *H. 480 rhamnoides* and *P. davidiana* in the mixed plantation (Table S3), with the corresponding values decreasing from $43.13 \pm 13.74\%$ and $47.07 \pm 5.39\%$ (both after 3.4 mm), respectively, to $21.54 \pm 8.9\%$ (after 35.2 mm) and $28.66 \pm 12.26\%$ (after 24 mm) (Fig 4)'). Unfortunately, the selected rainfall events not only differ in magnitude, but also in terms of antecedent conditions. For example, the 3.5 mm event (DOY 194) is the lowest rainfall event but also that following the most prolonged dry period (>30 days dry period from DOY 157 to 194). It is evident that when topsoil moisture content is low following a dry period, plants will tap into deeper, more reliable water sources. This is not so much related to a single rainfall event and its magnitude, but mostly to the antecedent conditions (prolonged dry period).*
- I would strongly recommend that the authors include a plot of the local meteoric water line (LMWL). This should be relatively straightforward as they have analyzed the 19 collected rainfall samples for both $\delta^{18}\text{O}$ and δH . On top of the LMWL I would then plot the signatures of the soil water at different depths. This would provide additional insights into the data and ease data interpretation (and can also be used to double-check that rainfall samples have not undergone evaporation). For instance, the rainfall signatures in Figure S5 could be visualized and interpreted much better in a dual-isotope plot.

Minor comments:

- In the study site description (section 2.1), it would be good if the authors could include a graph with the mean monthly rainfall throughout the year to get an overview of the rainfall seasonality in the study area. Right now, only the mean \pm SD annual rainfall is provided, but there is no information on rainfall seasonality.
- When Describing the soil texture (L.105) please indicate it is the texture you refer to and add the correct source (USDA). Besides the soil texture, kindly provide the soil class.
- L.131: Explain what VPD stands for after equation 1 and give its units (as you have

done for the other variable sin equation 1).

- L.145: What does the abbreviation TDPs mean?
- L.189, Formula 4: what is PAP?
- L.208-209: Kindly provide a reference that supports this assumption ('no fractionation was considered during water source uptake by plant roots')
- Figure 1: it would be helpful if the X axes could start earlier (about 20 days if possible) to be able to see if the first two rainfall events that are shown in panel a) are following a dry period or not.
- Figure 2: It would be good to show the precipitation bars in this plot too.
- L.321: in figure S5, kindly add the date of rainfall events. Moreover, the dD signature of rainwater for the 3.4 and 7.9 mm events is very enriched. Could it be that there has been some evaporation of the sample going on? In any case, as I mentioned earlier, it would be really good if the authors could provide a plot of the LMWL.
- L.395-396: have you measured the depth of the groundwater level?
- Figure 7: this is a very good overview, really clear!