

We thank Reviewer #1 for the positive assessment and the helpful suggestions, which we have all adopted.

Review 1:

“This is an interesting paper investigating boreal crop hydraulic traits and their relevance to productivity and drought resistance in Finland, focusing on both perennial forage grass and annual oat yield. The manuscript is well structured, fits within the scope of this journal, and presents the research in a logical and coherent manner with clear figures and sound data analysis. From my perspective, the paper is suitable for publication in BG. I do not have any major comments, but I would like to provide the following minor suggestions:

This manuscript focuses on both soil drought and atmospheric drought. However, the term “meteorological drought” is also mentioned in a few places. From my perspective, this may be somewhat misleading and could make the terminology unnecessarily complicated. I suggest consistently using either “soil drought” or “atmospheric drought” throughout the manuscript.”

Reply #1.1: We agree that the mixed terminology was potentially confusing. In the revised manuscript we will use “soil drought” and “atmospheric drought” consistently when referring to the two physical drivers we analyse. We will remove the term “meteorological drought” and instead refer to the Standardised Precipitation–Evapotranspiration Index (SPEI) explicitly when identifying drought events, to avoid ambiguity.

“I suggest combining paragraphs 3, 4, and 5 into a single paragraph, since they all describe the efficiency hypothesis, safety hypothesis, and plasticity hypothesis. Similarly, paragraphs 6, 7, and 8 could also be merged into one paragraph, as they collectively describe the aims of the manuscript.”

Reply #1.2: Thank you for this suggestion to improve the flow. We will merge the three paragraphs describing the efficiency, safety, and plasticity hypotheses into a single, coherent paragraph, and likewise merge the paragraphs describing the aims and the model-inversion rationale into one. This helps to present the study objectives more clearly and compactly, which is also in line with a request from Reviewer #2 (see our Reply #2.1).

“Lines 50-51: please provide a few specific examples of crops showing phenotypic plasticity under different environmental conditions.”

Reply #1.3: Thanks for the suggestion. We will add specific examples of crops showing phenotypic plasticity to this sentence using the studies from Matzner et al. (2014), Sun et al. (2021), and Alves et al. (2024). For instance, Sun et al. (2021) show that barley grown under conventional farming with no tillage was more vulnerable than under organic farming with intensive tillage as estimated by measuring the pressure inducing 50% loss of hydraulic conductivity (P50).

“As far as I understand, SPY-C is not a completely new model, but rather a coupled (integrated) modelling framework that combines several existing models into one system. Therefore, instead of stating “a newly developed SPY-C model,” I suggest using “a newly developed coupled modelling framework, SPY-C.”

Reply #1.4: This is correct, and we thank the reviewer for the precise wording. SPY-C integrates three existing modules (Phydro, SpaFHy, and YASSO) with a lightweight data-driven phenology and allocation module. We will replace “a newly developed SPY-C model” with “a newly developed coupled modelling framework, SPY-C” in the abstract, introduction, and conclusions, and will describe SPY-C consistently as a coupled framework throughout.

References:

- Alves, R., Menezes-Silva, P., Loram-Lourenço, L., Abreu, I., Alencar, K., Sousa, L., Almeida, S., Aun, M., Silva, M., Vasconcelos-Filho, S., Silva, F., Sales, J., Farnese, F., 2024. Exploring the coordinated hydraulic plasticity across organs in soybean plants exposed to drought cycles. *Environmental and Experimental Botany* 226, 105871. <https://doi.org/10.1016/j.envexpbot.2024.105871>
- Matzner, S.L., Rettedal, D.D., Harmon, D.A., Beukelman, M.R., 2014. Constraints to hydraulic acclimation under reduced light in two contrasting *Phaseolus vulgaris* cultivars. *J Exp Bot* 65, 4409–4418. <https://doi.org/10.1093/jxb/eru212>
- Sun, Q., Gilgen, A.K., Signarbieux, C., Klaus, V.H., Buchmann, N., 2021. Cropping systems alter hydraulic traits of barley but not pea grown in mixture. *Plant, Cell & Environment* 44, 2912–2924. <https://doi.org/10.1111/pce.14054>