The paper 'Shifts in controls and abundance of particulate and mineral associated organic matter fractions among subfield yield stability zones' deals with understanding the relationship between SOM and yield heterogeneity.

COMMENT: The repeated citation of a paper under review/submitted is not a minor drawback in this work. The accessibility of the information about the experimental design is lacking, making the paper really hard to understand. This "minor drawback" is even more exacerbated referring to other papers under review.

RESPONSE: We understand the inherent challenge of reviewing a paper that depends on materials that are being reviewed during the same period. However, we would like to point out that the key information regarding the experiment, including the methodology for the delineation of the yield zones, soil sampling approach, and soil analysis and processing methods were described in our manuscript, and relied on the work by Fowler et al. (2024) only for further detail we did not believe was necessary to the understanding of the work we present, but may be of interest to the reader. Further, of the three papers that are cited as, "In-Review", two have been published during the review period for this manuscript, including the Fowler et al. work. In the revised manuscript, we will update these citations, and we will remove any other "In-Review" citations from the text (i.e., Leuthold et al., in-review) unless is published in the meantime.

COMMENT: Moreover, the references section is incomplete and, among the citations, too many papers are authored or coauthored by the same authors of this paper.

RESPONSE: We apologize for any errors in the reference section and will update it with accurate citations upon revision. We have also provided the citations which were not present in the original text below:

Castellano, M. J., Mueller, K. E., Olk, D. C., Sawyer, J. E., and Six, J.: Integrating plant litter quality, soil organic matter stabilization, and the carbon saturation concept, Glob Change Biol, 21, 3200–3209, https://doi.org/10.1111/gcb.12982, 2015.

Just, C., Armbruster, M., Barkusky, D., Baumecker, M., Diepolder, M., Döring, T. F., Heigl, L., Honermeier, B., Jate, M., Merbach, I., Rusch, C., Schubert, D., Schulz, F., Schweitzer, K., Seidel, S., Sommer, M., Spiegel, H., Thumm, U., Urbatzka, P., Zimmer, J., Kögel-Knabner, I., and Wiesmeier, M.: Soil organic carbon sequestration in agricultural long-term field experiments as derived from particulate and mineral-associated organic matter, Geoderma, 434, 116472, https://doi.org/10.1016/j.geoderma.2023.116472, 2023.

King, A. E., Amsili, J. P., Córdova, S. C., Culman, S., Fonte, S. J., Kotcon, J., Liebig, M., Masters, M. D., McVay, K., Olk, D. C., Schipanski, M., Schneider, S. K., Stewart, C. E., and Cotrufo, M. F.: A soil matrix capacity index to predict mineral-associated but not particulate organic carbon across a range of climate and soil pH, Biogeochemistry, https://doi.org/10.1007/s10533-023-01066-3, 2023.

Prairie, A. M., King, A. E., and Cotrufo, M. F.: Restoring particulate and mineral-associated organic carbon through regenerative agriculture, Proceedings of the National Academy of Sciences, 120, e2217481120, https://doi.org/10.1073/pnas.2217481120, 2023.

Van Oost, K. and Six, J.: Reconciling the paradox of soil organic carbon erosion by water, Biogeosciences, 20, 635–646, https://doi.org/10.5194/bg-20-635-2023, 2023.

We also appreciate that there is a need for diversity in the references within the manuscript and can understand the reviewers concern that the paper as it stands now is overly self-referential. Upon revision we will add additional references that better dilute the citation pool and add further credence to the points made in the paper.

COMMENT: Another main drawback relates to the analysis performed, whereas organic C has been analyzed in the bulk soil, the fractions have been characterized only for total C content. It would have been useful to have data on the organic C content also in the fractions.

RESPONSE: The C values listed for the fractions do reflect organic C values, a fact which we will make explicit upon revision. As none of the samples in our sample set contained inorganic soil carbon (pH range from 5.68 – 6.49 and confirmed with spot testing via application of HCl), the reported values for total carbon in the fractions are interchangeable with organic carbon values. We would revise the text in Lines 138 – 140 as below upon revision:

Original Text: After weighing, samples were ground to a fine powder using a mortar and pestle and analyzed for C and nitrogen (N) concentrations via a VELP CN802 Carbon Nitrogen Analyzer (VELP Scientific, Deer Park, NY).

Revised Text: After weighing, samples were ground to a fine powder using a mortar and pestle and analyzed for C and nitrogen (N) concentrations via a VELP CN802 Carbon Nitrogen Analyzer (VELP Scientific, Deer Park, NY). As the soils contained no inorganic C, total C values obtained through elemental analysis reflect fraction organic C.

COMMENT: Moreover (Line 116) the authors should explain what the "Shimadzu method" is. The authors put a reference (Shimadzu, 2021) that is not available in the reference list. Are the authors sure this is a reference?

RESPONSE: We agree with the referee that the description of the organic carbon concentration in the bulk soil was incomplete and apologize for this oversight. In a revised manuscript, we will provide further details about the methodology and model, as detailed below—

Original Text: "Soils were analyzed for a range of properties including total soil organic C using the Shimadzu method with 900 °C combustion (Shimadzu, 2021), soil pH using a 1:1 soil:water extract and pH electrode method (Horton, 1995), Mehlich I and Mehlich III extracted nutrients (NCERA-13, 2015), and cation exchange capacity (Horton, 1995; NCERA-13 2015)."

Revised Text: "Soils were analyzed for a range of properties including soil pH using a 1:1 soil:water extract and pH electrode method (Horton, 1995), Mehlich I and Mehlich III extracted nutrients (NCERA-13, 2015), and cation exchange capacity (Horton, 1995; NCERA-13 2015). Total soil organic C was measured via dry combustion at 900 °C using a Shimadzu TOC-L coupled to a Solid Sample Dry Combustion Module SSM-5000A (Shimadzu Corporation, Kyoto, Japan), following manufacturer protocols (Shimdazu, 2017)."

Shimadzu. Total Organic Carbon Analysis. #638-94605C. Shimadzu User Manual. Shimadzu Scientific Instruments, Columbia MD. 2017.

COMMENT: Another analytical concern: how the authors measured the texture in a not direct way? And why?

RESPONSE: We chose to separate the texture into coarse and fine particles based on wet-sieving at 53 μm for a number of reasons. For one, we had a limited soil mass on which to complete our analyses (30-50 grams per plot). As texture measurement via the hydrometer method requires at least 40 grams of soil, we opted to only separate based on the size cut-off for sand grains, which coincided with our fractionation procedure. More conceptually though, as we assume that a first-order control on the concentration of mineral associated organic matter fraction in soil is the sum of the silt and clay particles (as demonstrated in Georgiou et al. (2022), Begill et al. (2023) and others), we were primarily interested in the abundance of this particle size fraction, rather than the explicit soil texture in our analysis. By understanding the relative proportion of silt + clay particles, we could begin to understand the sorption potential of the different yield stability zones and its interactions with erosive potential and landscape topography to determine MAOM concentrations. In a revised manuscript we will make this point more explicit, changing the text in lines 118 – 120 to specify our interest in the proportion of fine particles, rather than individual texture classes.

COMMENTS: The figure 5, that should present the core results of the paper, contains a legend that is not informative at all. The authors used different colors, without really clarifying the meanings.

REPSONSE: We agree that the conceptual figure can be improved, especially in regard to providing further information about the colors within the icons and what they indicate. As also specified in the response to reviewer 1, upon revision we plan to make substantial changes to this figure, including creating a more thorough legend, increasing the text size, and generally improving readability.

References

Georgiou, K., Jackson, R. B., Vindušková, O., Abramoff, R. Z., Ahlström, A., Feng, W., Harden, J. W., Pellegrini, A. F. A., Polley, H. W., Soong, J. L., Riley, W. J., and Torn, M. S.: Global stocks and capacity of mineral-associated soil organic carbon, Nat Commun, 13, 3797, https://doi.org/10.1038/s41467-022-31540-9, 2022.

Begill, N., Don, A., and Poeplau, C.: No detectable upper limit of mineral-associated organic carbon in temperate agricultural soils, Global Change Biology, 29, 4662–4669, https://doi.org/10.1111/gcb.16804, 2023.