We wish to thank the editor and the reviewers for this chance at improving our manuscript. Details of our adjustments and response to the comments follow below.

On behalf of all authors,

Daniela Guasconi

Report #1 (anonymous referee 3)

Abstract:

14: Compared to unfertilized controls or mineral fertilized control be specific.

Untreated controls, this was now specified in the text (L 14)

Introduction:

25-26: Transfer C to the soil via root exudates and decaying aboveground and belowground organic matter.

This was now added to the text

29: Consider introducing the concept 4/1000 to the reader.

We now added "initiatives aimed at increasing the C stored in soils, such as…"

29-30: Mitigating anthropogenic GHG emissions by restoring/enhancing soil C stocks.

The sentence was now changed to "These approaches include mitigating anthropogenic GHG emissions by restoring soil organic carbon (SOC) stocks, which can be achieved with decreasing tillage, cover crops, and with the use of soil C amendments like compost, biochar, and manure on croplands or grasslands"

31-32: It's not only about countering tillage, it's about minimizing all agricultural management strategies that could have negative impacts on SOC stocks. i.e., no/minimal-tillage, cover and catch crops, and organic soil amendments.

The sentence was now modified accordingly, see previous comment

33: Why do you research compost and not one of the other strategies for C sequestration? You can find sources that indicate the especially promising character of compost. Compost is enhancing several soil ecosystem services, often the decay of compost is necessary and inevitable; you are mainly interested in long term C sequestration. "The soil carbon dilemma: Shall we hoard it or use it?" Janzen 2006, maybe an interesting read.

Thank you for the suggested read. This experiment was not designed to test multiple strategies for C sequestration, but the initial idea was to use the same method as in Ryals and Silver (2013) and test its effect on vegetation, soil C and other variables. This was now made more explicit in the text (L 35).

37: Is SOC accrual and SOC sequestration not redundant? This paper is very relevant (Mointe 2023); however, the message is that the contribution of SOC sequestration to climate change mitigation are most likely insignificant. Not sure if this source is justifying your research in the way you write it right now.

While we argue that the concepts differ, in this case we propose to mention only sequestration and change the reference to Paltineanu et al (2024) https://doi.org/10.1016/j.catena.2024.108435

39: Typo, grasslands converted to grasslands? Don't think conversion of croplands to grasslands is a feasible strategy.

We argue that rather than a strategy proposed for the future, cropland conversion to grassland has occurred in many areas in Sweden in the past decades, hence the relevance to test for the effects of different management strategies (Johansson et al. 2023 - https://doi.org/10.1111/sum.13004). We propose to clarify this in the text and add the reference mentioned.

41: How does appropriate management look like?

We propose to reformulate to "with improved management"

45: Because the are not cultivated, no manipulation is feasible.

We argue that cultivation is not a necessary condition for improved management (ie pastures)

52: How much compost is leading to what increase in SOC stocks and where?

We added details to the text ("through an increase in plant biomass")

52-53: Source?

We propose to add Brown and Cotton (2011) https://doi.org/10.1080/1065657X.2011.10736983

55-59: It seems you are about to stage your research gap and objective, but then in the next paragraph you move on with aboveground and belowground interactions, consider to improve your logic.

Indeed, this sentence was meant to start framing the scope of our contribution. To clarify we added "Here we adopt this broad perspective and assess changes in C stocks in both soil and vegetation after C amendments." We also removed the following sentence on the use of isotopes, which only presented a methodology and not an addition concept.

58-59: How do you derive at isotope labelling, provide some context and sources.

We propose to remove the sentence

60: Why zoom out again on land management practices? You are already above mentioning that you focus is on compost.

To avoid giving the impression that we consider also other land managements, we would re-phrase as "Compost amendments can impact both above- and belowground plant biomass, but these plant components contribute differently to SOC storage."

60-66: Belowground biomass is more prone to be transformed in SOC pool, however also aboveground biomass has a significant effect on SOC stocks. Try to make this part more concise.

This section has been rephrased (L66-74)

69: Why is water availability mentioned here?

Water availability was removed from this part

74-75: How can compost mitigate drought?

We propose to modify this section by rephrasing: "Another promising application of soil organic amendments is their use to mitigate the negative effects of drought on vegetation and soil microbial communities by increasing soil's water-holding capacity (Fischer et al. 2019; Haque et al. 2021)"

75: You are researching compost not biochar.

Our rationale is to test whether the effect would be similar to that of compost.

78: In which direction is C allocation modified?

Reduced allocation to aboveground organs, this was added to the text (L 82)

80-81: Belongs above to 74-75

The paragraph was edited

81-82: Soil texture is not equivalent to SOM quality and quantity.

We agree it is not, and we argue that water holding capacity depends on 1) texture, 2) SOM, 3) chemical composition

84: Is moisture retention equivalent to WHC in your context?

We refer to soil moisture retention

87-90: This argumentation lacks logic, try to split into several clear sentences.

We have reformulated the paragraph as: "This variability derives partly from the different physical properties of soil. However, it can also be influenced by factors such as land use history and both small- and large-scale topography (Wang et al. 2020). These complexities highlight the need for more field-based data collections—in particular under experimental conditions that combine soil amendments and drought."

Methods:

111: The normal/control management practice in this area is no fertilization?

That is correct, "no compost treatment"

115-116: Is this the C:N and δ13C of the maize or of the final compost? Remove ambiguity.

These measurements refer to the final compost, as specified in the text

116-117: Summer 2019, be more specific, what month?

August, this was specified in the text

118: How big can I imagine the compost pile, was the composting done inside or outside in the rain? This can have significant effects on the resulting product.

Composting was done outside ("collected in an open field")

119: Why did you choose this application rate? It is quite high, likely about 500 kg of N per ha.

The method was based on "similar to the procedure described in Ryals and Silver (2013)". We followed their approach with the idea of assessing if their results are applicable to Swedish conditions.

120-121: How did you estimate the amount of C from wet weight compost?

This was estimated based on loss of ignition of the compost

151: How long at 960 °C?

2h, this was added to the text

177-222 Consider changing title to "Data analyses and statistics" since your statistics are only covered in the last part

This was changed as suggested

Results:

253-254: Over the whole soil profile or only in the in the top 10 cm?

Top 10cm, this was specified in the text

254-258: Confusing sentence.

The sentence was now split in two parts ("However, we note that mean soil C stocks in the compost-treated (ambient precipitation) plots were 6% higher in the first 15 cm, though this increase was not statistically significant. This increase is slightly higher than the percentage of compost-derived C found in that layer")

259-262: Try to formulate stronger that is easier to follow that there was no significant effect on biomass after the drought treatments.

We reformulated the sentence as "Experimental drought had no significant overall effect on aboveground biomass. Although biomass decreased by nearly 4% under rainout shelters (mean control plots = 642 g/m², SD = 129.23; mean drought plots = 617 g/m², SD = 180.25), this reduction was only statistically significant in compost-treated plots (P = 0.02) and not in untreated control plots."

Fig. 2: change color to black for soil bulk density 0-5 cm

This was changed

273-275: Make two sentences one about the effect of drought on root traits and one on the effect of compost on root traits.

We modified the sentence as "specific root length of coarse roots decreased under drought (P = 0.04). In contrast, after compost addition root tissue density (P = 0.02) and specific root length of all roots increased (P = 0.01)"

300-307: Are these changes significant or not? This paragraph is hard to follow, consider rephrasing.

They are significant, the paragraph was now rephrased: "Aboveground biomass, root biomass and soil C also differed significantly between sampling years (P < 0.05, Fig. 4, table S9). The largest change was observed in aboveground biomass, which was 53% higher in 2022 compared to 2019 (from 419.68 g m^{-2}, SD = 137.45 to 642.23 g m^{-2}, SD = 129.23). Conversely, total soil C contents and root biomass in the first 15 cm decreased by 21.5% (from 29.7 mg/g, SD = 0.73 to 23.3 mg/g, SD = 0.71) and 38.7% (from 1017.95 g m^{-2}, SD = 955.16 to 623.65 g m^{-2}, SD = 65.19), respectively."

303: Typo, decrease in C content from 33.5 to 2.99 mg/g?

This part was removed

Discussion:

319-320: Seems logical that you find not all C back after 3 years, but also, indirect effects are possible due to increased primary production that could lead to more OM supply to the soil over time.

We agree with the interpretation of the Reviewer, and we bring up this point in the same paragraph of the Discussion. No changes were made in response to this comment.

323-324: Obviously, if you add C to the soil, you will have more SOC, these SOC levels will decrease over time as there is no permanent stabilized C in soils.

Some of the compost C might be retained in the long-term, if stabilized in aggregates or on soil minerals, but we agree that this fraction is very small. In the Discussion, we argue that the chemically recalcitrant fraction of compost could remain in the soil for years, as also suggested by the C isotope analysis. No changes were made in response to this comment.

336: Be specific, you saw an increase in % C but not in C stocks.

This was now specified in the text

339-341: Also consider that these SOC changes only have a climate change mitigating effect if the C is not just transported from one place to another.

This was now specified in the text

352-353: See: “The soil carbon dilemma: Shall we hoard it or use it?” Janzen 2006

We added this relevant source

Conclusion:

437-440: You showed results on the impact of the catenary positions, however you miss to discuss these results and only mention them briefly in the conclusion. Consider removing them from your results and other parts of the previous text or add a sufficient discussion of these results.

The effect of catenary position is not our main focus in this contribution. Our hypotheses focus instead on the effect of our experimental treatments. The four sites thus mostly capture spatial variability in the landscape. We prefer to briefly show results about the spatial patterns for completeness, and some patterns are briefly mentioned in the first section of the Discussion, but we would not expand the Discussion on this point further. However, based on material presented in figure 3, we added more information in the Results (L 303) and Discussion (L 380).

General remaks: Be consistent with the naming of concepts. Refer to drought or reduced precipitation, not both people might think this are two different concepts. Same for water holding capacity, increased moisture retention and soil water retention.

We agree and have changed “precipitation reduction” to “experimental drought” where appropriate, and retained “soil water retention”.

Report #2 (anonymous referee 2)

Thank you for this thorough revision. Minor details that remain to be addressed are:

L170: Please provide information on scanner used (brand, model).

The details have now been added to the manuscript (Epson Expression 10000XL flatbed scanner).