

General comments

Soil texture is believed to have a strong impact on the response of biochar amendment on C sequestration, although little is known about the mechanisms involved. This short communication sheds light on potential mechanisms involved in the role of particle size and mineral composition on the early-stage decomposition of soil organic matter. The use of an artificial soil where particle size and mineral composition is fully controlled is, to my point of view, a relevant approach to focus on these specific mechanisms. Comparing the effect of biochar with soils from different textures is very interesting.

However, all parts could be improved since there are still some missing points and lack of precisions. In the results, it is not clear if the effect of biochar addition on the plant mineralization is due to the composition of biochar or to its particle size. Therefore, I think necessary to precise the size of biochar particles added and maybe to discuss this point.

To me, this study doesn't evidence a clear effect of the texture on plant respiration in the control soil (without biochar). It is written that there is a statistic effect, but (1) results from statistics made on very small samples (n=3) should be treated with caution, (2) I am not convinced by the choice of the statistic test and (3) the curve does not show a clear trend. Hence, the results and discussion should not emphasize too much on this small tendency and not consider it as a clear result.

In the discussion, only physical explanations are presented to explain the effect of pH on plant mineralization. Additional explanations should be proposed regarding the effect of pH changes on the microbial communities and on the nutrient availabilities from the plant for the microorganisms. The discussion should include more comparison with other studies using artificial soils. Indeed, the results from studies using artificial soils can be very different from studies using field soils (e.g. Gross et al. 2021). Although the approach of using artificial soil is relevant, the study should more emphasize on its limits to extend these results to real field soils.

Specific comments

Introduction

You write that the texture influences C mineralization. It would be interesting to develop a bit more about the type of effects. You should also introduce the known effects of biochar addition and texture change on soil pH, since you will then show results about pH.

If other studies used artificial soils to explore the effects of texture on soil respiration, please cite some of them and tell a bit more what has already be done.

You can eventually add a sentence and/or a reference to explain why you chose the hypothesis that "biochar could reduce organic soil mineralization, especially in coarser textured soils". Did previous article already find results in this sense? Because for example, Gross et al. 2021 (who you cited) found that "SOC increases after biochar application were higher in medium to fine grain textured soils than in soils with coarse grain sizes" and Wang et al. 2017 (who you also cited) concluded that "biochar had minimal impacts on microbial communities in a coarser textured soil". As far as I understand, both studies seem to go in the opposite direction of your hypothesis.

Material & methods

Artificial soil preparation: since the texture plays a central role in this study, you could add the limit sizes of each quartz grains fraction (sand, silt, clay). For instance, what are the maximal and minimal size of the sand particles? Did the added goethite, illite and bentonite particles have a specific size?

For the biochar used: how long was the Norwegian Spruce pyrolyzed under 700 °C? Was there a specific size of the biochar particles? I think that you could add the %C of biochar in the main text (not just in supplementary material) because then you will present results of C.

Incubation: Did you regularly adjust the water quantity during all the incubation experiment?

You should add in this part that you also measured the soil pH ! Give a short description of the method for pH measurement and/or the norm that you used.

Statistics: You used the LSD statistical test. Do you mean the Fisher's Least Significant Difference test? If yes, please precise it. For only 3 replicates, I would have rather used a non-parametric test because you cannot easily prove the normal distribution... Anyway, if you decided to use parametric tests, why did you not simply use the student t-test for each modality individually? Because then you always present each modality individually.

Results

3.1 Early plant mineralization affected by particle size and biochar application

Figure 1: I understand that you made 3 replicates for each modality. However, I see only 1 result per modality and time on your figure. Are the results means of the three replicates? It would be nice to have an idea of the variability among one modality on the graph.

Line 78: "Control samples' clay and silt content generally decreased C mineralization" → to me, it is not clearly shown by the figure 2. What I understand from the figure 2 is that the Clay+Silt content is positively correlated to the cumulative respiration in the modalities with biochar added, but I don't see any evident negative correlation with the control modalities (you could also add the equation + R² of the control modalities in figure 2).

You write that the texture has a significant impact. If yes, please give the p-value for both control and biochar modalities.

A thing that is interesting that you could tell more about, is the increase of cumulative respiration from the control in the first 33 hours of incubation (figure 1). The figure 1 clearly shows that the slope of the loamy sand control is lower than all the other soils. It would be interesting to compare this slope between all soils and emphasize this point. For that, a possibility could be to make a single graph with all results from cumulative respiration (if necessary, why not trying the logarithmic scale for the y-axis).

3.2 Soil pH affected by particle size and biochar application

Is there any effect of the texture on the soil pH? Why didn't you make statistical analysis about the texture effect, as for what you did in the 3.1?

Do you have significant differences between the modalities with biochar? For example, if the biochar modality with loamy sand significantly lower than the biochar with silty clay? If not, you can at least stress the tendency.

Discussion

Lines 97, 98: "The significant interaction ... plant residues depends on soil texture" → you can write that this confirms many other studies and cite some of them (for ex. The ones you cited in the introduction).

Lines 100, 101: "biochar had a higher impact on reducing early C-mineralization from clover residues 101 in sandier textures than in clay-rich soils" → is it coherent with other studies, and especially with the studies using artificial soils? Please compare with what is known and if it is different from most studies, please emphasize on it.

Lines 105-108: do you mean physicochemical protections through organo-mineral complexation? If yes, it would be especially promoted by the fact that you used ball-milled powder of organic matter. Hence, the surface of the organic matter is maximal.

Lines 110-112: "The biochar effect is probably ... physicochemical protection of OM" → Did other studies find that? Because as far as I know, the clay content is generally positively correlated with SOC content due to more organo-mineral complexes formations. Do you mean that clay surface competes with biochar surface for organo-mineral complexation?

Line 117: "Figure 1b" → Do you mean figure 2?

Lines 117-118: "Every mg of silt and clay size particles ... clover residue mineralization" → I don't see where it is clearly shown in your results...

Lines 120-121: "Our results suggest that the increase of clay ... early-stage C mineralization of crop residues" → repetition + idem comment as for lines 117-118

Lines 128-129: "The higher pH of the soil ... gas released from soils" → did previous studies find that? If yes, please cite them.

Very interesting propositions to explain how the change of pH may affect microbial respiration. But your explanations only consider the physical aspects of soil properties (CO₂ dissolution, CO₂ sorption on biochar's surface). Very important is also the effect on microbial communities! How do they react to a change of pH? Explanations could also relate to the availability of nutrients from the organic matter for the microorganisms...

You present the effect of biochar addition on the C-mineralization rate. But you also write that the texture had a significant impact. If you decide to speak about the effect of the texture, it would be logical to tell a bit more about the effect of the texture. For example, did the control present significant changes of C-mineralization depending on the texture? I think it is important to precise here. Otherwise, you don't know if the effect of biochar addition is due to its composition or to its particle size...

Gross et al. 2021 concluded that treatments conducted in greenhouses and laboratories can induce significantly higher responses in SOC sequestration potential when compared to treatments observed on a field scale. → Need to discuss the representativity of the artificial soil, as compared to soil in field.

Conclusions

Line 138: "significant effects of biochar" → "significant effects of biochar **content**"

Line 138: "soil texture in reducing early mineralization" → please precise which increase of which texture reduces the early mineralization. + I am not convinced by your conclusion that the silt+clay content is negatively correlated with soil respiration.

Line 141: "biochar may compensate for the lack of clay in sandy soils" → is it due to the particle size of the biochar?

Line 145: "Terra Preta soils » → the link is really not clear with your study, since you worked with an artificial soil and Terra Preta are real soils. Please precise the link.

Technical corrections

compact listing of purely technical corrections at the very end (typing errors, etc.).

line 53: "...according to (Pronk et al. 2012)" → "...according to Pronk et al. (2012)"

line 59: "CO2" → "CO₂"

Line 103: remove the dot after (Obia et al. 2016)

Line 111: "diminished with" → "reduced by"

Line 132: "can also be considered a mechanism" → "can also be considered **as** a mechanism"