Manuscript number: Soil-2021-108

Title: Rhizodeposition efficiency of pearl millet genotypes assessed on short growing period by carbon isotopes (δ13C and F14C)

#Referee 1 comment

General comment

Ndour and co-authors conducted an interesting study of rhizodeposition of pearl millet genotypes and net soil C-balance using natural 13C abundance by growing a C4 plant in a C3 soil. The findings are interesting, and the paper is generally well written. However, the authors should consider addressing the issues listed in specific comments below and some minor sentence construction/English language issues throughout the text.

> *Response: We thank #Referee 1 for his positive comments on our manuscript. We have considered the issues he listed and improved the construction of the sentences he pointed out.*

Specific comments

Comment 1: L21-22: In the abstract, provide information or explain what you mean by "low-aggregation lines" and "high-aggregation lines". Also, in L21 clarify what you mean by "was more important".

> *Response 1: We provide information in abstract to explain the mean of "low-aggregation lines" and "high-aggregation lines": "low aggregation" refers to "small rhizosheath" and "high aggregation" means "Large rhizosheath".*
>
> *We replaced "the priming effect amplitude was more important" buy "the priming effect amplitude (C_{lost}/C_{new} ratio) was higher …. "in the abstract.*

Comment 2: L26: "SOC" should be written in full here, followed by the acronym in parentheses.

> *Response 2: This suggestion was adopted*

Comment 3: L26-27: Clarify the text "increasing SOC content would have beneficial effects on agriculture by increasing soil fertility" as it implies a direct effect on soil fertility rather than indirect effect. For example, increasing SOC content would enhance soil fertility through improving physical and biological properties of the soil.

> *Response 3: The sentence was reformulated: "This will be particularly important as increasing soil organic carbon (SOC) content would enhance soil fertility through improving physical and biological properties of the soil and then would have beneficial effects on agriculture and improve food security (Lal et al., 2015) "*

Comment 4: L27-29: "Moreover, this strategy could be particularly relevant in the Sahel region of Africa, where very little above-ground cover remains after harvest, leading to soil carbon depletion". This sentence suggests it is difficult to increase SOC in this region. Perhaps add information in this first paragraph relating to increasing/maintaining SOC in this region of Africa.

Response 4: This information was provided in the third paragraph: lines L38-L41 "To simultaneously improve soil carbon sequestration through crop cultivation and ensure food security in Africa, a combination of plant breeding and the development of improved agricultural practices could be considered. Then, plant breeding for root traits (architecture and root exudation) could be an original strategy to improve water and mineral nutrition of crops and to enhance SOC sequestration".

We think it is better in this place because the strategy we propose tackle the two problematics developed in the two first paragraphs: C sequestration in the first one and the improving pearl millet productivity in the second.

Comment 5: L45: Rhizosheath is not a new trait per se.

Response 5: We replaced "new trait" by "emerging trait"

Comment 6: L53: "durability". Perhaps change this to a better term.

Response 6: We replaced "durability of new carbon" by "fate of new carbon" to improve the sentence

Comment 7: L74: "soil moistened to its water holding capacity". Do you mean 100% water holding capacity? If so, is this level of watering relevant to the Sahel region. Perhaps add information on why this level of watering was applied.

Response 7: Yes, soil was moistened to 100% of its water holding capacity. Information was added to explain why this level of watering was applied: "This watering level was adopted to have a good germination rate as the soil was sandy with a low water retention capacity, and we have used bottomless pots which allow water infiltration as in Ndour et al (2017)"

This information was added in "pearl millet cultivation" sub section.

Comment 8: L80: "Roots and RAS were separated by washing the roots in 50 mL". Clarify whether you mean 50 mL water.

*Response 8: We have clarified by adding the missing part of the sentence: "Roots and RAS were separated by washing the roots in 50 mL **Falcon tubes containing 40 mL of distilled water**"*

Comment 9: L83: Did you also measure root tissue ^{13}C?

Response 9: No, we measured ^{13}C only for shoot

Comment 10: L91: Perhaps delete "online".

Response 10: This suggestion was adopted

Comment 11: L104-119 Section 2.4: I suggest the authors should provide more details of statistical analyses here. Currently there is insufficient details of statistical analysis (only one sentence in L118-119).

*Response 11: We have provided more information about the statistical analysis in "**Calculations and statistical analyses**" sub section: "Statistical analysis was performed using R statistical environment (version 4.0.3). The normality of the data was tested using the Shapiro test (p < 0.05). To test the effects of pearl-millet line on the*

different parameters (SOC, $\delta^{13}C$, $F^{14}C$), general linear models (GLM) were constructed using the "quick linear regression" (glm) function in R. Each model was fitted by considering the distribution mode and using the corresponding link function i.e. Gaussian (link="identity") for normally distributed data and Poisson (link="log") for not normally distributed variables. Thereafter, analyses of variance (ANOVAs) were fitted to these models using the Chi square (Chisq) test, and Tukey Honest Significance Differences (TukeyHSD) post-hoc tests were performed (p < 0.05) to compare the mean of the different parameters for the four pearl millet lines using the library "multicomp" available in R."

Comment 12: L131: "priming effect". Perhaps here you describe net soil C-balance (i.e. negative net soil C-balance) rather than priming effect per se. Consider revising.

> ***Response 12**: we have adopted this suggestion*

Comment 13: L144: "On the contrary there is no significant difference between all four bulk soils and the control soil....". Clarify whether you mean no significant difference in delta 13C values.

> ***Response 13:** This was done: " On the contrary there is no significant difference **in $\delta^{13}C$** between all four bulk soils and the control…"*

Comment 14: L161: Change "unplanted soil control" to "unplanted control soil".

> ***Response 14:** This was done*

Comment 15: Fig 2C: Consider changing the unit for expressing "plant-derived C/plant biomass".

> ***Response 15**: That's the unit we chose but to avoid numbers with too many digits, we chose to express the ration in %wt. We think that this is relevant*

Comment 16: L178: "carbon cortege". Consider an alternative term.

> ***Response16**: We replaced "carbon cortege" by "carbon content"*

Comment 17: L181-182: "At this stage of plant growth, the trends showed a higher carbon loss vs gain (high Clost/Cnew ratio) for the low-aggregation and intermediary-aggregation lines L220 and L3 (4.4 and 3.5) compared to the two high-aggregation lines L132 and L253 (2.9 and 3.3) (Table 1)". This finding is interesting but there is little discussion on this in the Discussion section. Perhaps consider expanding the discussion on this.

> ***Response 17** : We have considered this suggestion and have added another discussion point: "Root exudates include low molecular weight molecules (sugars, amino acids, organic acids, phenolics) and high molecular weight molecules (proteins and mucilage) (Bais et al., 2006), which are probably subject to differential degradation capacity by soil microbiota. Therefore, the variation of soil C stabilization in these four pearl millet lines could be also related to a genotypic variation in the root exudates quality (biochemical composition), as reported in different plant species (Liu et al., 2019; Semchenko et al., 2021)."*

> ***References:***

Bais, H. P., Weir, T. L., Perry, L. G., Gilroy, S., and Vivanco, J. M.: The role of root exudates in rhizosphere interactions with plants and other organisms, Ann Rev of Plant Biol, 57, 233–266, https://doi.org/10.1146/annurev.arplant.57.032905.105159, 2006

Liu, T.-Y., Chen, M.-X., Zhang, Y., Zhu, F.-Y., Liu, Y.-G., Tian, Y., Fernie, A. R., Ye, N., and Zhang, J.: Comparative metabolite profiling of two switchgrass ecotypes reveals differences in drought stress responses and rhizosheath weight, Planta, https://doi.org/10.1007/s00425-019-03228-w, 2019

Semchenko, M., Xue, P., and Leigh, T.: Functional diversity and identity of plant genotypes regulate rhizodeposition and soil microbial activity, New Phytol, 232, 776–787, https://doi.org/10.1111/nph.17604, 2021.

Comment 18: Table 1 caption: "not solvable". Do you mean the hypothesis could not be proved?

Response 18: *yes, this means that our data did not confirm this hypothesis*