Egusphere-2022-905

Author’s response for reviewer #2

Dear reviewer,

Thank you for your valuable comments that help us to improve the manuscript. Below, we respond to your comments and explain how we plan to revise the manuscript.

Reviewer’s remarks highlighted in green:

General response:

The research motivation and research questions are sound and will be of interest to the broader community. The methods also appear sound, although I worry a bit about the sample size (see comments within). The addition of Si/Ca data for the various plant parts is a nice addition, as that data is fairly scarce in the literature.

Overall this is a robust study that eventually deserves publication. However, it needs more flushing out in terms of motivation for the study and relating the results to what others have found – many of the observations agree with what others have found in other systems, so this needs to be highlighted.

The text needs revision/editing throughout for ease of reading – I suggest a native English speaker help with the sentence structure and grammar throughout. Many of the sentences could use some revision for structure/grammar. I refrain from pointing out where because it was such a common issue.

Thank you for your overall positive feedback supporting the publication of our work. We will respond to the sample-size questions in detail in the detailed response section. Likewise, we would like to thank you for pointing out that we shall i) better highlight the motivation for this study, ii) compare our results to the work of other researchers and iii), have the manuscript edited for ease of reading and grammar. We completely agree and will revise the manuscript accordingly:

In the revised manuscript, we will highlight the motivation for this study more clearly in a new first paragraph within the introduction chapter. In this paragraph, we will discuss the importance of Si cycling under oil-palm cultivation in the context of sustainable plantation management. We will move the sentence “Yet quantitative Si data for Indonesia, one of the largest global palm-oil producers with ~16 million ha under oil-palm cultivation, is missing (Gaveau et al., 2022)” (lines 82-83) to this first paragraph. We will include outcomes of studies on other systems in the discussion, e.g., on crop straw management/recycling. We will also have the manuscript edited for grammar, structure, and ease of reading.

Detailed response:

Section 1

Line 47 – 48: it would be clearer to say “transported…to the shoot with water flow” rather than sap flow.

In the revised manuscript, we will change “sap flow” to “xylem flow” to make it clearer. From a plant-physiological perspective, “water flow” would not be a correct term for the xylem flow.

Line 48: need to clarify that the “increase in Si concentration” occurs in the leave tissue.

We will clarify this as suggested.

Line 53: clarifying these crops are classified as “high” or “active” Si accumulators, as all plants accumulate some amount of Si.

We agree that it would be more appropriate to name these crops “high accumulators” - or perhaps- “hyper accumulators”. In a revised manuscript, we would use the term “hyper accumulators” because Si that is dissolved as monosilicic acid in soil solution can also be taken up passively.

Line 58: point iv is true for all plants, not just high accumulators.

Yes, we agree that Si remains immobile in plant tissue of all plants. In the revised manuscript, we will therefore delete this point.

We will also use a different classification, which we believe is less confusing and clearer, starting this whole paragraph as follows:

"Plants can be grouped into three categories based on the Si concentration and Si/Ca ratio in their dry leaf tissue (Ma and Takahashi, 2002):
I) Non-accumulators or excluders (Si concentration < 0.5 wt.%; Si/Ca < 0.5)
II) Intermediate accumulators (Si concentration 0.5–1 wt.%; Si/Ca 0.5 –1)
III) Accumulators (Si concentration > 1 wt.%; Si/Ca > 1)

To better distinguish between plants belonging to group II and plants belonging to group III, we will use the term "hyper accumulators" for plants belonging to group III throughout this paper."

Line 61: this point about Si accumulating w/ plant age and not translocating is not specific to oil palms – this is true for all plants.

Yes, we agree. We will delete this sentence in a revised manuscript.

Line 65: again, specify "high" or "active" Si-accumulating crops (all plants accumulate some amt of Si so "Si-accumulating" is not a meaningful term). (I make this comment here but it applies throughout paper, including beginning of discussion – I'll stop making this comment now but I see this issue throughout the paper.)

We agree that the term Si accumulator - though well established and widely accepted - is actually not meaningful. Therefore, we will use the term "hyper accumulator" throughout a revised manuscript. We prefer not to use the term "active accumulator" for oil palms because we think that the use of such a term would require evidence for a transporter gene for active Si uptake and transport. We did not investigate this. To our knowledge, there are no published studies on Si transporter genes in oil palms. We will not introduce this discussion as the plant-physiological mechanisms are less relevant for the outcomes of our study.

Lines 65-67: this is a valid research question but it would be helpful to readers unfamiliar with Si literature to first point out that others (Clymans et al. 2011 for ex) has found soil Si depletion with continual plant harvest. Then your question here would make more sense and be more compelling.

We agree and will include such an additional sentence citing the suggested literature.

Line 71: add more refs to this sentence that plant Si returning to soil again b/c plant-available – many studies highlight this and your argument would be stronger with more refs.

We agree and will add more references.

Line 82: How important are oil palms relative to other crops globally and/or Asia? A bit more (1 sentence) motivation on why studying oil palms is important would be helpful.

We agree and will add a new first paragraph in the introduction that will highlight the global importance of oil-palm cultivation.

Section 2.2

Can you add rachis to the diagram of the oil palm parts? (Fig 1)

In Fig. 1a we have illustrated the rachis, leaflets, and petiole on a separate palm frond.

The frond numbers are confusing – how were those identified? You reference them like they frond 9 was the same on all the trees, but how was that number identified? Can you clarify your total sample size for each plant part in each plot type (riparian vs. upland)?

Thank you for mentioning that this is unclear to the reader. Indeed, palm frond no. 9 is always the same. We will make its position (and the positions of the other sampled palm fronds) clearer by including two additional illustrations in Fig. 1: one of the oil-palm phyllotaxis, another one of a palm crown.

We will clarify the total sample size for each plant and replicates in each plot type (riparian and well-drained) by adding a table providing an overview on these numbers:

Table 1 Sampling scheme and numbers of replicates, providing the statistical base of Figures 2 and 3

Oil-palm part	Water regime[b]	Palm trees (replicates per plot)	Plots (replicates per water regime)	Replicates of palm trees/plots used for Fig. 2	Replicates of palm trees/plots used for Fig. 3
Frond no. 9	WD	3	4	3/4	2 *(excl. tree 3)*/4
Frond no. 17	WD	3	4	3/4	2 *(excl. tree 3)*/4
Senescing frond	WD	3	4	3/4	2 *(excl. tree 3)*/4
Rachis	WD	3	4	3/4	***
Frond base	WD	3	4	3/4	***
Fruit-bunch stalk	WD	3	4	3/4	***
Fruit pulp	WD	3	4	3/4	***
Kernel	WD	3	4	3/4	***
Frond no. 22	WD	*2 (excl. tree 3)*	4	***	2 *(excl. tree 3)*/4
Frond no. 25	WD	*2 (excl. tree 3)*	4	***	2 *(excl. tree 3)*/4
Frond no. 9	RI	3	4	3/4	***
Frond no. 17	RI	3	4	3/4	***
Senescing frond[a]	RI	3	*3 (excl. HOr2)*	3/3	***
Rachis	RI	3	4	3/4	***
Frond base	RI	3	4	3/4	***
Fruit-bunch stalk	RI	3	4	3/4	***
Fruit pulp	RI	3	4	3/4	***
Kernel	RI	3	4	3/4	***

[a] only 3 replicate plots, as no senescing fronds were left hanging on palm trees at site HOr2 (differing management practice)
[b] WD = well-drained, RI = riparian / [c] Italics = differing from general sampling scheme / *** =

Section 2.3.1: the methods look good, although next time it's best to digest in a flat bottom tube, not a centrifuge tube to make sure material doesn't get stuck in bottom. But with the shaking and centrifuge, I imagine your digestion was complete.

Thank you for pointing this out. We ran pre-tests to ensure that the digestion was complete, by shaking the samples. In general, we agree that it would be better to use flat-bottom tubes.

Table 1b: I see some commas where periods should be I believe in the provided values. Also, can you add error terms to the Si concentrations or would it be correct to assume you only measured Si in 1 Frond no 9 in the WD, for example? (again, I'm confused on the sample size).

We will correct table 1b accordingly. We will clarify the sample size in the table, as well.

Fig 2: can you add sample size to legend or figure itself?

Yes, we will add the sample size to the figure caption.

Discussion

See comment above re: term "Si accumulator". Many others have found more Si in leaves relative to other plant parts…maybe have sentence saying that your results correspond to others and add appropriate refs.

Yes, we will follow your recommendation and use the term "hyper accumulator" for clarification throughout the text. We agree and will add references of studies that also found more Si in leaves than in other plant parts.

Line 347-348: your recommendation here is rationale and supported by the data. However, similar to my comment in the intro, the motivation for this comment is needed for readers unfamiliar with Si literature. Soil Si depletion with continual crop harvests have been observed (e.g. Clymans et al. 2011, Guntzer et al. 2012, Keller et al. (2012) are a few examples) so please highlight for readers that this is an serious issue…you might also want to add that because of that reason, people are now starting to fertilize certain crops with Si (see work by Datnoff I believe).

Thank you for pointing this out. In a revised version of the manuscript, we will start this paragraph by briefly highlighting the relevance of Si export through harvest as observed in other crop systems. We will add references accordingly, as well.

Line 382: The sentence, "these data suggest that Si cycling is maintained in this system" needs clarification – "Si cycling" is too vague. What you're saying is maintenance of a bio- available Si supply is maintained in this system. Please revise. (Similar comment for Line 24 in abstract – please revise for precision.)

We agree that the present statement is too vague. However, we also cannot say that the availability of bio-available Si is really maintained because a considerable amount is being lost through fruit-bunch harvest each year. In a revised version of the manuscript, we will rephrase the sentence to: "Although a large amount of Si is kept in the system through the practice of frond-pile stacking, the annual Si loss through fruit-bunch harvest is considerable. It could be substantially reduced by returning empty fruit bunches."

In general, the discussion is strong, especially the sections on straw management – and economic tradeoffs. It agrees with work by Guntzer et al. (2012) that suggest leaving the straw of crops on fields so I would reference that to show this alignment. (This is a different Guntzer et al. 2012 paper than the one you already reference.) Your conclusions also aligns with work of Carey & Fulweiler 2016 that highlights the importance of Si uptake by agricultural crops so I would also incorporate this agreement into the discussion.

Thank you for pointing to these works. We will for sure include them in the discussion.

References:

Carey, J. C., & Fulweiler, R. W. (2016). Human appropriation of biogenic silicon–the increasing role of agriculture. Functional Ecology, 30(8), 1331-1339.

Clymans, W., Struyf, E., Govers, G., Vandevenne, F., & Conley, D. J. (2011). Anthropogenic impact on amorphous silica pools in temperate soils. Biogeosciences, 8(8), 2281-2293.

Keller, C., Guntzer, F., Barboni, D., Labreuche, J., & Meunier, J. D. (2012). Impact of agriculture on the Si biogeochemical cycle: input from phytolith studies. Comptes Rendus Geoscience, 344(11-12), 739-746.

Guntzer, F., Keller, C., Poulton, P. R., McGrath, S. P., & Meunier, J. D. (2012). Long-term removal of wheat straw decreases soil amorphous silica at Broadbalk, Rothamsted. Plant and Soil, 352(1), 173-184.

Thank you very much for providing these references. They will be included in the manuscript.

In the revised manuscript, we will highlight all changes suggested by reviewer #1 in yellow, all changes suggested by reviewer #2 in green, and all general comments to improve the readability of this study in grey.