

Reply to the reviewers

MS Title: Development of soil biological quality index for soils of semi-arid tropics

Author(s): Selvaraj Aravindh et al.

MS No.: soil-2019-60

All the points mentioned in the interactive comment of **Anonymous referee #2** were carefully considered and suitable reply for each point is given (in red font). All the replies were compiled as Single PDF file and attached with this reply.

Anonymous referee #2

Writing in the manuscript is pretty good for non-native English speakers, but the manuscript needs English editing. I suggest the authors use an English editing service or ask for assistance from a native English speaking colleague. Lack of adequate explanation of the study design and the need for improved English in places make it difficult to fully evaluate this manuscript. I have done my best below to provide the authors with feedback to improve the manuscript, but the two points mentioned above need to be dealt with and the manuscript will need to be reviewed again.

Reply: As per the referee's suggestion, we will improve the English of the MS through native English speaker, so as to provide adequate explanation of the study design.

Line 33 – While I agree with the statement here about the lack of a common set of soil quality indicators, and I have a great deal of respect for Bouma's work, the paper cited here is nearly 20 years old. Many changes have occurred in the soil quality world over the last 20 years. It seems that a more recent reference would be well advised here, given that you are using it to support a statement about the current status of the field. Something from the last 3 years or so would be much more appropriate.

Reply: We will include recent references during revision.

Most of the references used in the introduction are more than 10 years old. This can leave one wondering if the topic of the paper is outdated. Can the author provide some more recent references for this section?

Reply: We will include recent references during revision.

Lines 63-65 – 11 references really are not needed here to support this idea, these should be reduced, at least cut in half.

Reply: We will reduce to 5 in the revised MS.

Lines 68-70, Again, 11 references are not needed.

Reply: We will reduce them in revised MS.

Lines 74-81 – This section belongs in Materials and Methods.

Reply: We will move to Materials and Methods during revision.

Lines 75-76 – Do not need six references here.

Reply: All the six references are our work which are essentially needed for describing the background.

Line 86 (and other places as appropriate) – I suggest using “manure trials” rather than “manurial trials”.

Reply: As per the suggestion, we will use “manure trials”

Line 90 – I would say that Table 1 gives the individual site characteristics. With the current wording “The details of long-term permanent manurial trials are described” I expected to see information on soil characteristics, such as organic matter content, various nutrient contents, infiltration rates, etc. The information given in Table 1 is completely appropriate and important, just mislabeled.

Reply: We will do correct labelling of Table 1 in revised MS.

Table 1 – The authors are using US Soil Taxonomy, but the soil types given do not correspond to any formal classification level in Soil Taxonomy. Should this be soil texture? All three entries carry textural information, although the “red” in the “red sandy loam” entry is irrelevant to texture. Is this a local Indian classification? If so, this should be made clear with a footnote at the bottom of the table. The soil order entry is not needed in the table, that information is already provided in the soil classification entry. Is it possible to be any more specific than “nutrient management” in the variables entry? What about nutrient management varied? And is this referring to different nutrient management within each site, or between sites?

Lines 90-93 – More detail is desirable here. What were the application rates (or ranges) of inorganic fertilizers at each site? What were the N-equivalent manure applications (or ranges) at each site? Etc.

Reply: We will include all the corrections/suggestions as pointed out by referee.

Lines 93-96 – We need more detail on the study design. Were the plots at each of the three research site, and if so, how many? Or was each research site treated as a single plot? How many soil samples were actually collected and analyzed, from each treatment and total for the study? What do you mean by “nine such replicates were maintained per soil”? Are you saying you broke the composite samples (from the 10 random cores) into 9 subsamples, or are you saying you collected 10 random cores from nine different sites at each of the study sites? Or maybe it is something else (I can come up with other possibilities). In short, the experimental design section needs to be expanded upon. I cannot picture the experimental design based on this description, and if readers cannot understand the experimental design nothing past this point matters, this manuscript is not publishable, because we cannot adequately evaluate the work and what the results actually mean.

Reply: As per the referee’s comment, all the information will be corrected / provided in the revised MS. We have all the information pertaining to the soil sampling. We will provide much more information in the revised MS.

Line 96 – Were samples stored on ice while in the field during collection?

Reply: Yes. All the samples were stored in the coolant box; brought to the lab on the same day and stored at -20°C. We will include it in the revised MS.

Line 121 – The process used to establish the SBQ values is critical to evaluating this work, both for the reviewers right now and for future readers. Supplementary Table 1 is critical to this, and should therefore not be a supplementary table. The process of developing these threshold values needs to be clearly and completely described, therefore this table needs to be part of the manuscript.

Reply: As referee's suggestion, we will include the Supplementary Table 1 in the part of MS during revision.

Lines 145-146 – Where did the four soil samples from the three locations come from? I assume the three locations are the three study sites, but where do the four soil samples come from. See comment above about the need to clearly and completely describe the experimental design.

Reply: As replied earlier, we will include all these information more clearly and completely in the revised MS.

Lines 150-153 – Source(s) of these formulae?

Reply: Appropriate reference will be included.

Line 158 – Again, I think this table is too important to understanding the manuscript to be a supplemental table.

Reply: As per the referee's suggestion, we will include the Supplementary Table in the main manuscript during revision.

Lines 161-162 – Why is “high for variable a and low for variable b” scored 3 while “low for variable a and high for variable a” scored 2?

Reply: In quadrant plot, we always kept major contributor variable in 'x axis', while the secondary contributor is in 'y axis'. Hence, High x and low y is 3 and low x and high y is 2.

Lines 166-171 – Where did the farmers' fields come from? How and why were they chosen? How do they compare to the three study sites (cropping systems, soils, climate, etc., see Table 1)? You cannot just randomly drop another set of variables into the middle of a scientific paper and not explain them.

Reply: Farmers' fields are randomly chosen to check whether the SBQIs being worked in the fields and also to assess the relatedness among the SBQIs. We aware that this is not the final solution for SBQI. This exercise is purely to reconfirm the stability of SBQIs calculation and their inter-relation. After calculating the SBQIs from long-term manure experimental soils, in order to confirm their consistency, this is the only option available. From this part of the experiment, we proved that the SBQIs scaled from long-term manure experimental soils had same level of resolution and correlation in the farmers' soil.

Table 2 – Using a symbol such as an * would be a better way to indicate significance than bold values. Bold may not translate well if the paper gets copied in the future. Table 3 – The p values (where appropriate) are <0.001, not 0.000. Same comment in Line 182.

Reply: We will correct it as per the referee's remarks.

Section 3.3 – Details of the farmers fields have not been provided, so we do not know what we are making comparisons to here and in Table 6. I see the reference in Table 6 to supplementary materials, but this is critical information. It needs to be part of the paper, not part of the supplementary materials.

Reply: As replied earlier, SBQIs were measured in the farmers' soil in order to validate the SBQIs derived from the long-term manure soils. Hence, this is not the final conclusion about the farmer's soil quality. We will include it in the revised MS.

Line 251 – I have already discussed the need to better explain the experimental design, but four distinct soil samples? Really? You have three study sites with four treatments at each study site, shouldn't you have, at a bare minimum, 12 samples?

Reply: As per the referee's remarks, the soil sampling strategy will be thoroughly revised to understand better.

Lines 254-255 – Now different cropping sequences are being brought in. I don't remember any previous mention of different cropping sequences. Explanation of the experimental design for this project is extremely confusing!

Reply: We will revise to avoid all the confusions. As referee pointed out, we have included the crop sequence here which is unnecessary to the discussion.

Lines 258-260 – Don't need six citations here.

Reply: We will reduce it.

Lines 260-262 – Are there works from other research groups (other than the authors) that would indicate the results found here are reasonable? How about results from other environmental settings? SOIL is an international journal, to be publishable in SOIL this work needs to be tied into the bigger picture, the authors need to show why there should be international interest and not just interest within India.

Reply: Few works at different locations are available. We will include it during revision.

Lines 269-273 – This is just a repeat of what has already been said in the Materials and Methods. Not needed here.

Reply: We will correct it.

All the SQIs were found capable of separating the soils and treatments studied, and each has its own strengths and weaknesses. So, which of the SQI approaches do the authors recommend based on this work? Did one perform better than the others based on some objective method, was one better than the others because of its simplicity, or independence from "expert" (subjective) opinion, etc.? You get at this in the Conclusion, but seem to indicate SQI5 is the best after saying in Lines 330-331 that SQI5 needs more investigation/development.

Reply: As pointed out by referee, I would prefer SBQI5, which will provide more information. We will explain the merits and demerits of each method during revision.

Starting on Line 332 – As previously mentioned, more information on the farmers' fields, how they were chosen, what their soils and management are, etc. needs to be supplied earlier in the manuscript.

Reply: We will include it in the revised MS.