

## Authors' responses to the comments provided by three anonymous Referees

Overall, the INNOVATIVE ASPECTS of our work include:

- Realizing a practice-oriented experimental set-up including intercropping of local, market-relevant crops instead of academic testing of well studied but rather irrelevant grasses.
- Advancing the practical application of known principles including biochar application, EcoSan practices, and utilizing biogas slurry, by focussing on first season, as its success is crucial for implementation into practice, especially in smallholder agriculture in Sub-Saharan Africa.
- Studying, if significant alteration of hydraulic soil properties were present or not present, an aspect often overlooked or neglected in research about soil amendments.

#	Comments of anonymous Referee #1 SOIL Discuss., 2, C670–C671, 2016	Our responses
1	The results are of interest and of certain scientific relevance, and fit the scope of the journal.	We appreciate the general positive evaluation of the work we provided. We agree with the Referee's statement that parts of our manuscript were too descriptive and revised the manuscript accordingly. Therefore, we reworked former section 1.3, section 1.2 (p. 2-3) to point out more precisely the rational of using the analysed soil amendments. In addition, we shifted details about the materials used as amendments from the introduction to the section 2.2 on soil amendments (p. 4, lines 10-22).
2	But this manuscript is too descriptive and sometimes it seems more a project report than a scientific publication. The topic has been correctly introduced, but before the aim of the work is described in the final part of the introduction, a rather personalized description of previous experiments run with the materials used as amendments in the present manuscript seems a bit unconventional for this type of publications.	
3	The description of the experimental design in the Materials and Methods section is not clear enough, and relies too much in that published in previous articles. This manuscript has to stand alone and a brief description of the amendments and a much clearer description of the experimental procedure have to be added to the text.	We agree and rephrased the chapter 2 on "Material and Methods" accordingly so that after this revision, the paper itself delivers all needed information. As above-mentioned, we described the soil amendments in more detail in section 2.2 (p. 4, lines 11-23).
4	For example, the <i>number of replicate plots per treatment</i> is not mentioned until page 1228, some <i>basic information about the different amendments</i> (pH, moisture/organic matter content, etc.) cannot be found throughout the manuscript, and the <i>description of the grass cover</i> used with that treatment is not clear.	After revising the manuscript, the number of replicates is given in the Abstract, in section 2.2. (p. 4, lines 4) and in section 2.7 (p. 7, lines 15-16). We added an additional table (Table 2) providing information about the amendment's chemical characteristics, nutrient contents, etc. We further agree that the description on the grass-cover in the biogas slurry treatment was rather difficult to understand so we rephrased it accordingly (p. 4, lines 11-13).
5	It is also strange the fact that two of the crops (African egg and pepper) are not used or mentioned in the results and discussion of the manuscript.	We planted African eggplant and pepper as part of the chosen intercropping system. The local agricultural expert recommended this be in line with local agricultural practices. However, these two plant species are perennial and harvesting started only in June 2014 when our experiment was finished. So we decided to integrate them in the intercropping but exclude them from analysis. We made this point clearer in our revised manuscript (p. 5, lines 3-6).
6	The latter section is too descriptive, and the text is quite difficult to read in a comprehensive way, as too many parameters are commented in too much detail.	We agree. To significantly improve the chapter "Results & Discussion", we changed the manuscript for the revised submission as follows:

		<ol style="list-style-type: none"> <li>1. We eliminated section 3.5 where we formerly provide an outlook on how the tested soil amendments can contribute to close nutrient cycles on small-scale farms in Karagwe. We assume, by withdrawing this section we will enhance the focus on the results of the field experiment. Nevertheless, we shortened this section and integrated it in the revised conclusions (p. 12, lines 5-8).</li> <li>2. We further eliminated section 3.6 for reducing the amount of information provided in chapter three and for supporting the readers' focus on the most important results of the experiment. (Please, also see our response to comment #10.)</li> <li>3. We completely rewrote the chapter and tried to improve readability markedly.</li> </ol>
7	The manuscript would benefit from a summarized results and discussion section, where the main effects of the different amendments are commented as a whole for the different crops.	We agree and adjusted the manuscript accordingly. We summarized the main results at the beginning of chapter 4 (p. 12, lines 2-5).
8	This part of the manuscript needs to read better and to include a deeper discussion of the results, which are simply compared to previous ones in the current version of the article. The effects observed in the soil and, especially, in the different crops, have to be related to the properties of the amendments and to the changes in the soil physico-chemical properties and nutritional status.	We agree that the observed effects need to be discussed in relation to the soil amendments. However, in our opinion we did so by discussing effects on plant growth, plant nutrition and changes in soil properties. For example, we discussed different P contents in the tested soil amendments and related them to the observed differences in CAL-extractable concentrations of soil P (p. 8, lines 12-22). Furthermore, we applied the vector nutrient analysis to identify the primary response of maize plants to improved P availability (p.10, lines 27-34). In addition, we discussed the different CaO-equivalents of the soil amendments in the context of the observed changes in soil pH (p.8, lines 23-34). We also discussed, that under the given tropical conditions, an increase in soil pH will positively affect the availability of nutrients in the soil, hence stimulate biomass growth. As typical for the local Andosol, nutrient deficiencies and acidity in the soil were most present on the unamend control plots, which depressed plant growth. Nevertheless, we worked on improving general comprehensibility of chapter four.
9	Section 3.4 (nutrient balancing) is not clear at the moment and may have to be reconsidered and rewritten by the authors in a more comprehensive way.	We agree and adjusted the text accordingly. We hope that now, section 3.4 is more comprehensible and can be better understood.
10	Section 3.6 (further aspects) is somehow speculative and may have to rely on the results of the present experiment.	We agree and reacted on this important comment by withdrawing section 3.6. We erased the subjective impressions and kept only two relevant aspects: (i) the effect of biogas slurry on beans plant was moved to section 3.2 (p. 10, lines 6-13), and (ii) the discussion of the practical application and the addition of urine to CaSa-compost, which are based on recent scientific results. The latter issue was shortened and moved to section 3.4 (p. 11, lines 24-30) hence integrated into the revised and improved discussion of nutrient balancing.

11	Once the manuscript is corrected, the conclusions of the article may have to be accordingly revised	We agree and reworked the conclusion when revising our manuscript.
12	The quality of figures 2-4 may have to be also improved and make them easier to understand. Move most of the information in the figure legends to the text (M&Ms) and leave only the basic information to understand and interpret the graphs there	We agree and changed the captions accordingly. For example, we moved information on the applied method from Fig. 2 to section 2.3 and the description of soil physical examinations (p. 5, lines 28-29).
#	<b>Response to Anonymous Referee #2</b> SOIL Discuss., 2, C676–C677, 2016	<b>Our responses</b>
1	The paper (...) deals with an interesting aspect that completely fits the scope of the journal, such as the effects of different soil amendments, mainly organic amendments, on a type of soil with requirements of P.	We appreciate the Referee's acknowledgement that our results are interesting and that our work fits the scope of SOIL journal.
2	However, I consider that this study does not represent an innovative contribution to the knowledge concerning soil management and constitutes a work mainly descriptive.	We agree that parts of the first manuscript were too descriptive. Consequently, we worked thoroughly on the revision of our manuscript. However, we don't agree with the lack of innovation in our work. We argue, that the innovative elements in our work are: <ol style="list-style-type: none"> <li>1. We conducted a field experiment using practice oriented intercropping system and field size.</li> <li>2. The design of our experiment was highly adapted to local practices so that results can be easier transferred to the real world, e.g. using local crop species and comparing locally available materials such as compost, biogas slurry, biochar, and sanitized human excreta.</li> <li>3. We chose a complex approach (to study a complex problem), which combines soil chemistry, soil physics and plant nutrition in one study.</li> <li>4. We conducted an experiment on a special and interesting soil, a tropical Andosol with high P requirements.</li> </ol> However, we interpreted this comment in the way, that we haven't justified sufficiently why our work is an innovative contribution to soil science. Hence, we reacted on this by (i) improving the Abstract, and (ii) adding a section to the introduction where we deduce the chosen research design from scientific results in the field of organic materials and biochar application of the past years (p. 3, lines 1-15).
3	The work is correctly outlined, but in some aspects ( <i>description of the soil amendments, discussion of the results</i> , etc.) is a little confusing. For this, the following comments are some suggestions to improve the work.	We are thankful for the provided comments, which were helpful for us when revising our manuscript. To improve comprehensiveness of the <i>description of the soil amendments</i> , we added an additional table to the manuscript providing general information about the amendment's chemical characteristics such as pH, moisture, C and nutrient contents etc. (Table 2). Furthermore, we assume that we provided too many details and combined too many aspects in the chapter four. To significantly improve the <i>discussion of the results</i> , we changed the manuscript for the revised submission as follows:

		<ol style="list-style-type: none"> <li>1. We eliminated section 3.5 where we formerly provide an outlook on how the tested soil amendments can contribute to close nutrient cycles on small-scale farms in Karagwe. We assume, by withdrawing this section we will enhance the focus on the results of the field experiment. Nevertheless, we shortened this section and integrated it in the revised conclusions (p. 12, lines 5-8).</li> <li>2. We further eliminated section 3.6 for reducing the amount of information provided in chapter three and for supporting the readers' focus on the most important results of the experiment.</li> <li>3. We completely rewrote the chapter and tried to improve readability markedly.</li> </ol>
4	In the Abstract is not clear the soil parameters determined and only after reading the Materials and Methods section I found that the authors have studied more parameters than physico-chemical parameters (pH and EC); please, specify the parameters studied in the abstract.	We rewrote the Abstract and included a selection of the examined parameters (p. 1, lines 7-9).
5	The introduction perfectly reflects the topic and the main objectives of the study; however, the authors should explain in more detail some aspects of the previous studies that are slightly mentioned, to justify the use of these specific soil amendments.	We highly appreciate the general evaluation of the introduction we provided. We worked on the suggested improvements and we changed section 1.3 accordingly (p. 2, lines 22-38).
6	In the Materials and Methods section, the experimental design is adequately explained, except for the characteristics and origin of the soil amendments used (only described for urine). The characteristics of the soil amendments used constitute an essential aspect to evaluate the effects of their use in the soil-plant system.	We agree and rephrased chapter 2 on "Material and Methods" accordingly. We hope that it is now more comprehensible and can be better understood, especially for the origin of the soil amendments (p. 4, lines 11-23). Furthermore, we added an additional table (Table 2) providing information about the amendments' nutrient contents, pH, etc.
7	In addition, the methods for the determination of several parameters are described in the table and figure legends; the authors should include this in the part of Materials and Methods, because it is a little confusing.	We agree and changed the captions accordingly. For example, we moved information on the applied method from Fig. 2 to section 2.3 and the description of soil physical examinations (p. 5, lines 28-29).
8	In the Statistical analysis section, the authors comment the number of replications of each treatment. I consider that this aspect should be moved to the section of the plot preparation.	In our opinion, it is appropriate to have an extra section on statistical analysis at the end of chapter 2 on "Material and Methods", which includes also the number of replications. We argue that, in section 2.2 on plot preparation and soil amendments, the number of replications is shortly mentioned in connection with the experimental design arranged as Latin rectangle. In section 2.7 ("statistical analysis") we further explain number of replications by elucidating according to different parameters, which were assessed.
9	Why is different the number of replications in the treatments?	We apologizes that this fact was not explained sufficiently and we tried to make this point clearer in the revised manuscript (p. 7, lines 15-21).
10	In general, the Results and Discussion section should be revised and clarified, because apart from being mainly descriptive, some aspects in the discussion of the parameters are difficult to	We agree with the Referee's comment and we improved comprehensibility of chapter "Results and Discussion" in the thorough revision of our manuscript. We further agree, that the observed effects need to be discussed in relation to the

	understand. As an example, it is not clear the effect of the properties of the soil amendments on the soil characteristics (see previous comment related to the characteristics of the soil amendments).	soil amendments. However, in our opinion we did so by discussing effects on plant growth, plant nutrition and changes in soil properties. For example we discussed different P contents in the tested soil amendments and related them to the observed differences in CAL-extractable concentrations of soil P (p. 8, lines 12-22). Furthermore, we applied the vector nutrient analysis to identify a primary response of maize plants to improved P availability (p.10, lines 27-34). In addition, we discussed the different CaO-equivalents of the soil amendments in the context of the observed changes in soil pH (p.8, lines 23-34). We also discussed, that under the given tropical conditions, an increase in soil pH will positively affect the availability of nutrients in the soil, hence stimulate biomass growth. As typical for the local Andosol, nutrient deficiencies and acidity in the soil were most present on the unamend control plots, which depressed plant growth.
11	Why were the crops African egg and pepper not harvested?	We planted African eggplant and pepper as part of the chosen intercropping system. The local agricultural expert recommended this to be in line with local agricultural practices. However, these two plant species are perennial and harvesting started only in June 2014 when our experiment was finished. So we decided to integrate them in the intercropping but exclude them from analysis. We made this point clearer in our revised manuscript (p. 5, lines 3-6).
12	Section 3.6 should be included in the discussion of the results, since it is not clear if it is part of the conclusions or of the discussion of the results.	We agree and reacted on this important comment by withdrawing section 3.6. We erased the subjective impressions and kept only two relevant aspects: (i) the effect of biogas slurry on beans plant was moved to section 3.2 (p. 10, lines 6-13), and (ii) the discussion of the practical application and the addition of urine to CaSa-compost, which are based on recent scientific results. The latter issue was shortened and moved to section 3.4 (p. 11, lines 24-30) hence integrated into the revised and improved discussion of nutrient balancing.
13	In addition, it would be interesting to include a figure with the climatic data at the experimental site during the period of study, which can help in the discussion of the effects of the treatments on the soil, instead of mentioning only average values.	In the supplements, we included figures providing data on humidity, temperature, and daily precipitation measured during the experiment (Fig. S7-S9).
14	The Conclusions section should be summarized, only including the main aspects found in the study, avoiding speculations and general ideas	We agree and improved our conclusions especially by focussing on the main aspects found in our study.
#	<b>Response to Anonymous Referee #3</b> SOIL Discuss., 2, C678–C678, 2016	<b>Our responses</b>
1	This manuscript is a very valuable contribution to validate improved management of biogenic wastes into African real cropping systems.	We are thankful for the recognition of our work as valuable contribution to the journal as well as to advance the practical application of known approaches for waste and nutrient management in the context of African agriculture.
2	The approach is very complex, considering several issues incl. nutrient balance, the use of liquid and solid waste fluxes compared to composted ones, etc.	We definitely agree with this comment and the fact that this is a complex study of a complex problem.

3	Some issues should be better explained, especially the application rates of compared treatments, the volatilization of ammonia especially in the urine treatment, etc.	<p>In our opinion, the application rates were sufficiently explained by mentioning them in section 2.2 as well as in Table 3. However, we agree that the readability of section 2.2 generally needed to be improved. We reacted on this by rephrasing this section and also worked on better explanation of the application rates (p. 4, lines 5-10).</p> <p>Concerning the ammonia volatilization when applying urine we agree, that this is an important parameter to consider. However, we erased all results of urine application from this manuscript, as these were not possible to evaluate because we had problems with the urine's quality. Nevertheless, in another part of our cumulative work we consider N-losses from ammonia volatilization, when applying material flow analysis and soil nutrient balancing to integrate the tested soil amendments into farm-scale nutrient management.</p>
4	The Carbon stock related to the treatments could be also a good point to go abroad especially to include the non-chemical fertility related to organic resources.	<p>We apologize but we didn't understand this comment very well. We evaluated changes in C stocks due to the used soil amendments. However, we did not observe any significant effect on soil carbon content. Hence, we did not further discuss results related to carbon provided by the treatments. We discussed the amount of biochar contained in CaSa-compost and the C content in comparison to other work to argue that is not likely to observe significant changes in the soil C stock in a short-term experiment and after only one application. However, we tried to make that point cleared in the revised manuscript (p. 8, line 35 to p. 9, line 3).</p>