

Interactive comment on “Nitrous oxide emission reduction in temperate biochar-amended soils” by R. Felber et al.

Anonymous Referee #1

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Title needs to be more descriptive of the experiment performed and reported on. E.g. ‘Green waste and coffee ground biochar effects on N₂O fluxes from repacked, temperate soils treated with glucose or glucose plus nitrate.’

Abstract

P152 L1 The word ‘is’ cannot be used. Instead it should state ‘Biochar, pyrolysed organic matter, has the potential to be an amendment. . .’

P152 L22 Try not to start a sentence with a chemical nomenclature i.e. N₂O. Use the full term at the start of a sentence ‘Nitrous oxide has a . . .’

P152 L23 I thought the latest IPCC GWP for N₂O was 298 ?

P153 L 1 Suggest ‘Biochar application to soil has been advocated as a strategy for improving soil productivity, sequestering atmospheric CO₂ (Lehmann et al. 2006) and mitigating N₂O

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emissions. Biochars are pyrolysed...feedstocks which are produced at temperatures of 400-900oC (Lehmann, 2007).'

P153 L10 Why is it necessary to first test effects of biochar application on N2O in the laboratory first ?

P153 L14 If it is the first use of the word nitrogen then '...nitrogen (N)...' and use abbreviation from then on. Hypothesis 2 is not clear.

P153 L26 onwards needs to be clearer. Suggest 'The main objective of this study was to assess if N2O and CO2 fluxes from temperate, nutrient rich, agricultural soils were affected following biochar application at rates similar to those applied to tropical soils. A further objective was to assess if any biochar effects persisted following the ageing of biochar in the soil. A factorial experiment utilising 2 biochars x 2 soils x 3 amendments was performed in the laboratory with gas fluxes assessed over 3 month periods. Amendments included no additional substrate addition, glucose addition and nitrate+glucose addition.'

P154 L8 Delete 'different'

P154 L11 Change to 'feedstocks'

P154 L12 Change to 'The maximum pyrolysis temperatures, estimated by the facility manager, are...'

P154 L19 Change to 'The biochar properties and their elemental compositions are shown...'

P155 L1 Change to '...was fertilized with slurry...'

P155 L3 'Ten litres of soil...collected on 26 October...12 l soil...site on 18 October.'

P155 L9 Change to '...was found to be a...and had shown effects...'

P155 L19 'Sieved soil samples were packed in steel...of 5.5 cm...4.2 cm...'

P155 L24 delete first occurrence of the word 'of'

P156 L19 Change 'aim' to 'aimed'

P156 L24 Change to 'chosen so that...'

P156 L128-129 Change 'trough' to 'trough'

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P157 L1 change ppm to SI units $\mu\text{L/L}$

P158 How can you possibly continue and perform statistical analyses (requiring a normal distribution of the data) on data that you know is not normally distributed!

I have a lot of trouble following/seeing a logical and clear presentation of the results section. P159 L10-15 is good. Succinct and to the point. As a reader all I want to know (with P values supplied) is: In the absence of amendments what happened when biochar was added to the soil – did gas fluxes go up or down? Did both soils behave the same? Did both biochars behave the same? Was the result the same in 2010 and 2011? Now tell me what happened when glucose was added. Did N_2O and CO_2 fluxes increase in the absence of biochar? Did both soils do the same? Did the same effects occur when biochar was present yes/no? Did both biochars have the same effect? Was there any soil x biochar interaction?

Likewise for the nitrate+glucose treatment.

P159 L26 I recall no mention of mineralization rate measurements in the materials and methods.

P159 L29 How can you say the N availability increased in the absence of plants? Plants were not a treatment.

The discussion needs to be more clearly focused on the results of the experiment.

I am concerned that relatively large N_2O reductions are being expressed, of the order of 62-98%, when as the authors state these numbers are based on relative reductions compared with the control BUT the reductions only appear large because the control fluxes were so low that any reduction becomes a large percentage. Really the treatments that should have been used to determine the effect of biochar on reducing N_2O emissions should have included a treatment where N_2O was readily able to be produced in a control situation i.e. a soil with adequate N substrate.

There is some confusion between the reporting of results and discussion in the discussion section. E.g. P160 L22-26.

P161 L1-6 Very confusing. Does it make sense?

Section 4.1 could be much more succinct.

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P161 L14 This is total speculation with regard to denitrifier numbers.

P161 L24-26 Speculation is exactly what this is and it cannot be rationalised. IF you had measured inorganic-N overtime during the incubation then you would be in a position to speculate on the results. But unfortunately you do not have this data and I do not believe you can speculate in this way.

P162 L25 How can you make this statement 'With ageing the effect of adsorbing nitrate at the biochar's surface seems to diminish. . .' Did you measure nitrate adsorption on your biochar materials before and after they had been in the soil for the period? If so how was this done. If not it is not correct to state what you have.

Did your biochars contribute C to the CO₂ flux? I.e. actually contribute C. Some recent studies have clearly shown biochar C can be partially available after addition to soil (e.g. Smith et al. SBB). I am uncomfortable with the speculation around this without good data.

Section 4.3 is too long and speculative given the relatively small laboratory incubation – without plants, using repacked soil, at limited moisture contents etc.

Abstract and Conclusions could be readdressed after tightening up presentation of results and discussion.

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