**Biogeosciences
Discussions**

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Interactive comment on "Mechanisms of soil carbon storage in experimental grasslands" by S. Steinbeiss et al.

Anonymous Referee #2

Received and published: 16 November 2007

This paper describes an experiment in which litter mass was removed or doubled to determine how litter mass influences recovery dynamics of soil C after conversion from cropland to grassland. The investigators measured soil C stocks and DOC concentrations at various depths. The investigators concluded that loss of soil C in the 2x litter treatment was due to priming caused by increased DOC flux to depth.

I was very interested to read this paper as this type of priming is quite interesting but poorly understood. However, in my opinion the data presented by the investigators can support their conclusion only through the use of unsubstantiated assumptions, inference and torturous logic. They seem to suggest that:

(1) In the surface horizons, more DOC is produced in the 2x litter than in the 0x litter.

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This seems reasonable, but is not supported by their data.

(2) This increased litter DOC production leads to more soil C loss in the surface horizons due to priming. Their data show no real differences in surface soil C content. It may be that C added from transport of DOC in the 2x experiment prompted loss and replacement of soil C leading to the same net change in both the 2x and 0x plots. This assumption is not well-supported by their data.

(3) In the next horizons (10-20cm), DOC must increase (as their data show - the only increase in DOC), without leading to priming, or prompting priming equivalent to soil C loss in that horizon.

(4) There must be more DOC flux into the 30cm horizon - though this was not observed in their measurements.

(5) That DOC prompts priming of soil C at that depth. This loss of soil C was observed.

Even if this chain of logic was more evidently supported by their data, those data are undermined by the fact that all of the measurements in the C4 PLOT are pseudo replicates. My reading of this manuscript is that there was no replication for the C4 treatment. This makes me question the fundamental validity of those data and further reduces confidence in their assertions based on those data (which already seem shaky even if the replication were robust).

There was poor description of how samples were composited/analyzed. One interpretation of what they've written is that there was a single soil sample for each depth increment/treatment combination.

There was no explanation of how the root data were collected. Changes in root inputs due to the litter treatment or inherent spatial variation not accounted for by replication could undermine all of their data.

1) Does the paper address relevant scientific questions within the scope of BG? YES

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2) Does the paper present novel concepts, ideas, tools, or data? YES

3) Are substantial conclusions reached? YES - the ideas are interesting and the conclusions would be very meaningful.

4) Are the scientific methods and assumptions valid and clearly outlined? NO

5) Are the results sufficient to support the interpretations and conclusions? NO - this is the main problem with this paper and why I have recommended rejection.

6) Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? NO

7) Do the authors give proper credit to related work and clearly indicate their own new/original contribution? YES

8) Does the title clearly reflect the contents of the paper? YES

9) Does the abstract provide a concise and complete summary? YES

10) Is the overall presentation well structured and clear? YES

11) Is the language fluent and precise? YES - the paper is well written and assembled.

12) Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? YES

13) Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? NO, this is not the problem with this manuscript.

14) Are the number and quality of references appropriate? YES

15) Is the amount and quality of supplementary material appropriate? N/A

Interactive comment on Biogeosciences Discuss., 4, 3829, 2007.

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