

Interactive comment on “Integrated management of a Swiss cropland is not sufficient to preserve its soil carbon pool in the long-term” by Carmen Emmel et al.

Anonymous Referee #1

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The manuscript describes the long-term C budget of a Swiss cropland field over thirteen years. CO₂ fluxes were measured by eddy covariance and import or export through harvest, organic amendments and seeds were registered by the farmer (and the C content analysed). There are to my knowledge only very few comparable studies in croplands and therefore this study is timely. In particular because there is political interest in the potential of C sequestration of croplands (launched at the COP in Paris; 4 per mille initiative). The C budget approach in croplands is rather sensitive to errors, and the authors estimate these errors based on literature references. The results of the study are compared to a more traditional approach of changes in soil C stocks before and after the thirteen years. These results compare rather well with the C budget.

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The paper is well-written and the experiments and data analysis is sound. My main remarks are on the context and on the implications of the study. The losses (in soil C) are rather large at 1.2 Mg C ha⁻¹ y⁻¹. It should be noted that such high losses are to a large extent a result of the initial conditions. The authors mention an 8 year rotation with 3 years of temporary grassland. This rotation is likely to reach a much higher soil C stock than the cropland rotation that followed. I would appreciate if this could be mentioned in the discussion. After all, a continuous loss of 1.2 mg C ha⁻¹ y⁻¹ seems unlikely, given that most croplands contain round 50 Mg C ha⁻¹ in the top 30 cm. Also for the context, there is a recent literature review on the potential of C sequestration by conservation agriculture (Chenu et al in press). Some of the measures (e.g. cover crops) are also discussed in this review and are reported to sequester C. I would appreciate your views on this paradox. Finally, you mention the application of manure as a measure to compensate C losses in the framework of the GHG reporting (page 17, lines 5-10 and Conclusion lines 18-19. There is some discussion on the role of organic amendments for the sequestration of atmospheric CO₂. Powlson et al (2011) argue that amendments transfer C from one location to another, but do not sequester CO₂ from the atmosphere. I believe Chenu et al (in press) also address this issue.

Chenu, C., Angers, D.A., Barré, P., Derrien, D., Arrouays, D., Balesdent, J. (in press) Increasing organic stocks in agricultural soils: Knowledge gaps and potential innovations. Soil and Tillage Research Powlson, D.S., Whitmore, A.P., Goulding, K.W.T. 2011. Soil carbon sequestration to mitigate climate change: A critical re-examination to identify the true and the false. European Journal of Soil Science, 62 (1), pp. 42-55.

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