

Comment on soil-2021-124

Anonymous Referee #2

Referee comment on "Soil nitrogen and water management by winter-killed catch crops" by Norman Gentsch et al., SOIL Discuss., <https://doi.org/10.5194/soil-2021-124-RC2>, 2022

General comments:

The article titled "Soil nitrogen and water management by winter-killed catch crops" is a research paper presenting results from a field experiment conducted in 2018-2019, investigating the effect of four single species and two mixtures of winter-killed catch crops (CC) on soil mineral N and soil water during their growth and after termination. All CC were sown in August 2018, were fertilized with 47 kg N/ha and were terminated in early November 2018. Cover crop residues were left as whole plants on the ground. The results show that all CC reduced soil mineral N compared to the fallow, and preserved soil during the following main cropping season. The topic addressed in the manuscript is relevant and the study shows potential for publication. However, several issues need to be addressed.

Specific comments:

- All CC were fertilized, including clover and the mixtures (containing legumes). Based on recommendations and previous studies, N fertilization was not only not needed, but can be expected to have affected the expression of species in the mixtures (see, for example, <https://doi.org/10.1371/journal.pone.0235868> and <https://doi.org/10.1016/j.agee.2020.107287>). In addition, you terminated all CC at the same time, which makes the comparison between different species and mixtures not realistic (and makes the discussion weak, e.g. lines 350-356).
- The methodology needs to be clarified substantially. It is important to include information on soil sampling, CC sampling and termination in the main text. How many times did you take soil samples, 9 (Figure S2) or 10 (line 148)? Why do you take root samples down to 100 cm (then present only aggregated results to 90 cm), and soil

samples to 80? In line 120-121, what do you mean by “ten randomly taken samples per soil depth”?

- In the modeling, why did you use a local polynomial regression model? How do you justify the modeled increase in soil N_{min} between April 11 (soil sampling) and April 24 (first maize N fertilization) (see Figure 5)?
- Your assessment of N leaching is based on monitoring of soil mineral N. It would be good to address other possible losses, and to discuss why you can assume that N losses from your system are not, for example, as N₂O.
- 2019 was not a dry year (Figure S1 and line 94), but this is not taken into account in the discussion. In addition, line 25 cannot be a conclusion from your study.
- Your conclusions on the effect of CC on growing conditions for the following crop are not based on maize growth (and this is not even discussed). If you have data, it would be a very good idea to include them.

Technical comments:

- Please do a careful revision of the language (especially in the discussion).
- Line 15: change to “and two catch crop mixtures with 4 and 12 plant species (Mix4 and Mix12) with a fallow treatment”
- Lines 31-40: this can be shortened
- Lines 45-49: what about legumes and mixtures with legumes?
- Line 56: redundancy of what?
- Lines 58-59: what do you mean by this?
- Line 64: change from “measure for” to “indicator of”
- Lines 64-67: please rephrase (this is not the discussion)
- Lines 68-71: there are a few more studies on “the potential for the reduction of winter N leaching losses of CC mixtures in comparison to single species”, and I encourage the authors to make one more search.
- Lines 78-79: I think the objectives of the study should be phrased in relation to the results. E.g., the objective is to determine the effect of something.
- Line 103: *Vicia pannonica* is a legume.
- Lines 224-234: I am not sure I understand this. Can you explain and discuss it (also in connection to other possible N losses)?
- Lines 281-281: what does this mean?
- Lines 283-287: what about maize growth? Could it explain some of this?
- Lines 309-310: why?
- Lines 311-313: unclear sentence
- Line 316: what previous studies?
- Line 334: “...have been found to determine a higher carbon-use efficiency”?
- Lines 336-337: unclear sentence (and see references suggested above)
- Conclusion: too long. All the first paragraph can be removed. The specific comments above should be taken into account also here.
- Figures: check that the text is in English, add a line for CC termination (figures 2, 3, 4 and 5). It would be good if dates in the x axis were the sampling dates (where relevant).
- Table 2: what do capital letters represent?