

Soil-2016-39 Review comments

General comments:

The article has investigated the effects of temporal plant diversification by rotating crop on soil microbial functions and activities, while many other studies focus on the above-ground spatial biodiversity on soil microbial functions. This study has comprehensively examined a suite of indexes of soil microbial activities (e.g., MBC, MBN, PMC, and PMN) and functions (e.g., EEA and CLPP) over one growing season. The introduction is clear, the methods are easy to follow although they need clarification, and the data interpretation is generally logic. But a couple of issues need to be addressed as follows:

Majors:

- 1) The main goal of this study was to investigate whether crop rotation can enhance soil microbial biomass and functions. Since the study has examine microbial biomass and functions (e.g., PMC, PMN, and EEA) over one growing season (i.e., in spring, summer, and fall), how confidently we can attribute enhanced microbial activities and functions to crop rotation rather than seasonality or their interactions? Can we confidently say that crop rotation is the main reason for changes in soil microbial functions and activities?
- 2) Were the crop rotation effects on microbial activities and functions general or unique, considering that all the measurements were for soils that have experienced an extreme drought the year before sampling? What the results will be if the sampling took place in a normal year? Particularly, the authors have discussed that the drying-rewetting effects on soil microbial community in the discussion (L339-359).

Minors:

- 1) Problems with the reference order in the main text: L27-28, L41-42, L50-51, L120, L157, 380, 381, 385-386, 398-399, 401-402, 423
- 2) L54-58, it is better to introduce the rationale of CLPP method and substrates used in this method, especially for readers who are not familiar with them. More references are needed about how this method works and how widely it has been used in studies to examine soil microbial catabolic functions.
- 3) Soil sampling issue. I am confused whether or not the measured soils were sampled under the same crop (maize) in all the three seasons. According the statement in L99-101, it is not the case. Soil sampling took place in April, July, and November, while corn was planted in June and before June some plots may be planted with other crops. Please clarify.
- 4) PMC and PMN measurements. How long did the incubation last? It is 6 months in line 122, but it is 120 days in line 129. How was PMC calculated according to cumulative respiration? In addition, how many times were the inorganic N extraction conducted to assess PMN during the entire period of incubation? And how was PMN calculated and what is the reference for it? I cannot find it (L117-131).
- 5) L198, 375 please use the multiple symbol instead of "X" letter.
- 6) Line 2013 should it be "P" rather than "Ps"?
- 7) L210-211, please clarify the relation between cumulative CO₂ respiration and PMC. Otherwise, the statement in these lines is not true.

- 8) L228-230, the text “increased crop diversity decreasing the qCO₂ by 16, 40, 28% in CSW, CSW1, and CSW2...’ does not match the results in Fig. 2. In CSW, qCO₂ was not always decreased compared to mC (i.e., the control) according to Fig. 2 in spring, summer, and fall. Moreover, is the difference statistically significant?
- 9) L291 “negative” should be “negatively”.
- 10) In the discussion, I would like to read the discussion of “crop diversity and soil microbial functions” before “seasonal dynamics and N limitation”, as the former is the focus of this study, and they directly answer the two questions asked in the introduction.
- 11) L448-453 the statement does not match Figure. S4. We cannot tell which data are from the less and which are from the more crop rotations from this Figure. Please clarify.
- 12) The statements in L399-400 and L411-412 are not clear to me. Which tables or figures can show the results? And what are the indexes of microbial catabolic evenness?
- 13) L471-472 as a main finding of this study, it should be discussed in details but it was not. Please specify or remove it.

Figures and tables

Tables 1 and 2: it is easy to read when all the contents of a table are in one page.

Table 3 caption. I do not understand why adding Fig. 5 at the end? What does it mean? This is no Fig. 5 in the manuscript.

Fig. 1: as mentioned before, cumulative respiration is different from potential mineralizable C, please clarify the relation between them.

Figs. 1 and 2: since seasonality has strong effects on soil microbial activity and functions, we need to know how crop rotation effects in each season. It is better to add the multiple comparison of soil microbial activity in each season in these two figures.