Note to myself: I don’t seem to have the most updated version of the paper that was submitted. Maybe I didn’t push it to github, need to check on my personal computer.

Reviewer comments:    
  
Reviewer #1: Summary: The authors investigate the rotation effect by comparing a short rotation (corn, soy) to an extended rotation (corn, soy, oat-alfalfa, alfalfa). Previous research demonstrated an increase in yield in the extended rotation compared to the short rotation. Differences in resource distribution, microbial activity, and nutrient cycling have previously been observed as well. In this study, the authors focus on maize root growth and its implication on yield. Maize yield is shown to be significantly higher in the extended rotation compared to the short rotation in 5 of the 8 years during this study. Root biomass data suggests maize grown in the extended rotation allocates more roots below 15 cm and increased rooting depth earlier in the season in some years when compared to maize grown in the short rotation. Measurements of soil penetration resistance and soil moisture do not indicate that differences in soil physical properties lead to maize in extended rotation growing more deep roots. The authors suggest that soil biological properties as studied previously may contribute to these differences.  
  
Comments:  
**1. The authors do a good job addressing my previous comments and concerns.**  
Thank you.

**2. I believe there is a typo on line 598; the publication year is in parentheses.**  
In the submitted copy we have, line 598 doesn’t contain a year. READ THROUGH AGAIN AND SEE IF I CAN FIND WHAT THEY ARE REFERRING TO

Reviewer #3:  
**This manuscript emphasizes that the whole extended rotation was responsible for the yield benefit and depth of root system of maize, rather than one or more specific features of the rotation. There is some acknowledgement that specific drivers may have contributed to the results (L102-105 and L441-445) but only as secondary drivers to the general effects of extended rotation. More emphasis should be given to the possible effects of the specific drivers.**

We feel that focusing on specificfeatures as drivers in this rotation would discount the complex interactions that are present. While individual characteristics such as manure application, tillage intensity, and legacies of deep-rooted crops such as alfalfa have all been studied in isolation and certainly each may contribute, we feel it is important to emphasize how the system is manifesting, rather than simplify it to the sum of its individual parts. In L105-108 we directly acknowledge this as an inherent difficulty in studying the impacts of complex rotations.  **It also emphasizes resource acquisition rather than resource supply (e.g.L381). Could the supply of mineralized N in the subsoil arise from the fine-root residues of alfalfa in the subsoil? If so, the proliferation of maize roots in the subsoil may reflect supply of mineral N that preceded its acquisition. Is there evidence of this in Midwest systems?**

Our study suggests consistent differences in the resource aquisiton hardware (e.g., roots) of the longer rotation, while the resource supply in the subsoil resulting from alfalfa legacies is likely variable both spatially and temporily, depending on the the growing conditions and root distribution of the previous alfalfa crop, as well as the subsoil conditions during the maize growing season. In 2018 the soils were saturated during the beginning of the growing season, which would likely inhibit alfalfa root decay and therefore limit its contributions to subsoil mineral N supply. We feel the consistency of the root characteristics suggest they are not responding to differences in resource availability per se, and the current state of the manuscript reflects that stance.  **How representative are the rotations and yield responses in this manuscript of previous reports? At L92-95, 13 papers report the continuous maize penalty and 3 papers at L101-102 report extended rotations that include small grains and legumes. Both responses are mentioned in 4 papers at L87&88. Rather than just referring to these papers, the authors should present a table showing the actual rotations and their effect on maize yield in the previous studies and in a form comparable with the presentation of their own data e.g. M S O/A A - 8%. Comparing the cropping patterns and yield responses in previous papers with the pattern in the current manuscript could help to identify mechanisms and drivers.**

While we agree such a comparison would be helpful, such a table would not be helpful in this instance. The four cited studies were chosen to reflect growing conditions (weather, soils) similar to those of the reported study, and the only peer-reviewed publications we are aware of that compare maize yields of extended and short rotations in this region are derived from the same study site the present manuscript is based on. There are extension publications concerning nitrogen responses of maize grown in various rotations which corroborate the findings reported in this manuscript, but these do not reflect realistic production contexts. Again, we emphasize the system as the unit of analysis, and not the impact of the individual management components considered in isolation, as the experimental design was not set up to investigate individual factors. Other studies have similarly looked at the impact of entire systems on maize yields (e.g. Bowles et al. 2020), as individual characteristics of systems are in danger of being confounded with other system aspects, and could lead to spurious correlations.

**The manuscript refers to extended rotations in many Midwest studies and the (singular) system reported in this manuscript. When reporting and discussing the results the manuscript should refer to the experiment, not the region's extended rotation.**

Without a specific instance cited, we are unsure what the reviewer is referring to.  **At ~L40, add to the sentence indicating that the extended rotation significantly (P<0.01) outyielded the short rotation in 5 of the 8 years.**Due to word limits in the abstract, we do not feel the addition of a p-value is needed in this instance. The majority of scientists will interpret the term ‘significantly higher’ as a p-value less than 0.05, and a p-value of 0.01 will not impact the interpretation of this statement.

**The reference to Sawyer and Mallarino. 2017, cited in Table 1 is not available on the web. Related papers report a soil-nitrate sampling depth of 30 cm. Please confirm the sampling depth and report the nitrate concentrations. Are there data from this or related studies on the mineral N amount between the sampling depth and the bottom of the root zone?**

We are unsure why the reviewer is not able to access the reference, which is a widely-downloaded extension publication and the PDF is available for download at the cited link as of 5 July 2024. However, we added the sampling depth (30 cm) to the table to ensure readers have access to that information. The spring soil-nitrate concentrations for the 8 years of this experiment were used for determining the amount of nitrogen applied at side-dress at maize stage V6 in an effort to equalize nitrogen availability in all treatments, and we do not feel these data provide information relevant to this study. Moreover, previous studies have shown nitrogen supply in the top 30 cm does not explain the maize yield differences in the short and extended rotation (Osterholz et al. 2018, cited as such in L91 and L118). We understand the reviewer’s point that nitrogen supply in deeper layers could be a factor in driving root growth, and have included that in other parts of the manuscript.  **Section 3.5: Please indicate whether the measurement of penetration resistance avoided wheel tracks and whether the short-rotation treatments incurred less compaction from vehicle movements than the long-rotation.**

We added text to the manuscript indicating wheel traffic was not controlled via GPS in this plot experiment, and measurements were taken randomly to account for any impact traffic may have on the system. The latter part of the comment is unclear, but we added text to the manuscript stating that over the entire rotation, the extended rotation saw similar numbers of field passes compared to the short rotation (the additional straw and hay harvesting activities in the extended rotation were offset by the decrease in planting and field preparation activities during the alfalfa phases).

**Why the difference in experimental seasons between Fig. 1 (6 years) and Fig. S2 (5 years)?**

Figure 1 shows eight years of yield and weather (not six as indicated by the reviewer). Figure S2 presents data from the five years where data *in addition* to yield was collected.  **All differences in yield and other properties should be accompanied by a report of statistical significance. This applies specially to the Abstract and Highlights. In parts of the manuscript before the Statistical analysis section the response should be accompanied by a simple indicator such as (P=0.03). Within the Statistical analysis section, add a sentence indicating that responses reported in the paper have e.g. p<0.05.**

In the body of the manuscript we fully agree, and it was our intention to include all p-values. To our knowledge we have; without specific lines where we failed to do so we cannot make the requested corrections. In the highlights, we do not believe including p-values is a good use of word count, and see numerous examples in previously published manuscripts in Field Crops Research that do not include p-values in their highlights. In the abstract we use the word ‘significantly’ when referring to the statistically significant differences in yields (L41), maximum rooting depth (L44), and amount of root biomass (L48). In the manuscript, L174 states ‘Significance thresholds for statistical tests were set at p=0.05 unless noted otherwise’.   
**Fig S7 reports maize yields of 1-2 t/ha. Please correct.**

The y axis is labeled ‘impact on maize yield’ - it is the change in maize yield, which is correctly presented as 1-2 t/ha.