

SOIL Discuss., referee comment RC2
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Comment on soil-2021-41

Anonymous Referee #2

Referee comment on "Long-term impact of cover crop and reduced disturbance tillage on soil pore size distribution and soil water storage" by Samuel N. Araya et al., SOIL Discuss., <https://doi.org/10.5194/soil-2021-41-RC2>, 2021

The manuscripts explore the effect of long-term reduced tillage and cover crops on soil hydraulic properties. Based on laboratory samples from a long-term experiment, they derived the water retention curve (WRC) parameters and the $K(h)$. Using these observations, they simulate in Hydrus 2D, the effect of an irrigation event and analyze the dynamic of the water storage that follows.

The fact that the samples came from a long-term experiment with a sound statistical design is a strength of the research. The analysis of the observed hydraulic parameters is also statistically sound. The use of a simulation to access some more dynamic information on the soil profiles is interesting. While I find it less valuable than direct field observations, it remains based on laboratory measurements ($K(h)$ and WRC). As such, it helps to assess the dynamics of water storage in the soil which is a valuable insight for the interpretation even if not confirmed by field measurements. The authors also discuss their results at the light of other works and seem well-informed of the work done in the area.

In general the manuscript is well written, the figures are clear and well-designed with good caption. The error bars are used to display uncertainty whenever possible. The abstract would gain to be a bit reworked so that the message and the findings of the work came through better. Also in several places, a bit more discussion is needed or further interpretation and hypothesis will deepen the discussion. Also, a discussion about the limitation of the modeling approach is needed.

General comments

The advantage of the simulation and its links with the observation doesn't come through easily as we read. It's difficult to see straight from the start why the simulations are needed and what they bring to the story. Maybe it can help to highlight, at the end of the introduction, the limitation of traditional PAW and field capacity to better highlight the need for simulation?

As mention by the authors, tillage can temporarily impact soil hydraulic parameters and soil properties. Potentially doesn't the growth of the (cover) crops also have an impact on WRC and $K(h)$? Given the study provides topsoil and subsoil samples, can you discuss more the expected dynamics of soil hydraulic properties expected from each depth through the growing season? A more global discussion on the effect of the sampling depth would be great.

The simulations bring insights into the dynamic water storage of the soil columns. However, I think it should be pointed out that these simulations are not backed up by observations of water content in the soil profile but only based on laboratory derived WRC and $K(h)$.

Specific comments

L14: "an improved structure" -> put it more explicitly: larger proportion of smaller pores?

L15: rephrase more simply: "The conventional measurement of water content at field capacity (water content at -33 kPa suction) and the associated plant available water (PAW) showed that NT and CC plots had lower water content at field capacity and lower PAW compared to standard-till (ST) and plots without cover crop (NO)" -> "NT and CC plots had lower water content at field capacity (-33 kPa suction) and lower plant available water (PAW) compared to standard-till (ST) and plots without cover crop (NO)"

L18: "higher profile-level water storage"? -> what does 'profile-level' mean? maybe rephrase more simply? (after reading the paper, I realized it was referring to the simulated provides but I didn't get it at first read, maybe drop 'profile-level'? You've already said it was in simulations)

fig1: missing north arrow

L60: < 9000 mm annual rainfall is drier? -> 900 in original paper

L65: 'individual and interactive impact'? -> 'individual impact and its interaction

L74: please also give GPS coordinates

L79: I though no-till was more absolute than reduced tillage. In reduced tillage, as you explain, there is a reduction of tillage operation, but no-till really means no-till no? If its a reduced tillage, maybe RT would be a better acronym. Also, what is the tillage depth? Does the reduced tillage involve a non-inversion tillage? What tools was used for the tillage (rotovator, harrow, chisel plow, moldboard plow) more explanation is needed here even if more details are published in Mitchell et al. previous papers.

L97: "months after tillage" -> how many months about?

fig2a: different colors of layers but no legend, also why a 3D schematic if the modeling is only in 2D, this is confusing, I would do a 2D schematic if only 2D modeling

fig2b: why no flux on the side? If it's in the field, it should be free flow no? Unless you simulate your cylindrical lysimeter

L188: why the spin-off has only 2.5 irrigation compared to the real simulation?

L196: equivalent water depth (change?) -> not sure I understand this, is it the water in the entire profile or at a specific depth? what does the 'water depth' means?

L205: seems sound. Do you also provide the .R file and the data as open-source attachment to the article?

L238: 'all the treatments had higher relative... compared to ... had the highest proportion'
-> rephrase

L260: 'discussed at section 0' -> 'section 3.1'?

fig7: why is NT-CC for K_s so much higher while there not such difference for K_{100cm} ?
Discuss

L300: "Our results showed that while this was the case with ST, it was not the case for NT" -> do you have an explanation/hypothesis?

L301: 'For the subsurface layer of NT treatments, θ_{FC} was significantly lower for the NT-CC compared with NT-NO treatments.' -> could this be that the roots of the CC are reaching deeper down? what is your hypothesis? discuss more

fig10: are these curves for one single plot/simulation? or averaged over all 4 plots for each treatment? Make this clear in the caption.

L344: "($P < 0.15$)" -> lower p for p-value (typo)

fig11: could it be plotted the same way as figure 8 with both top and subsoil in the same subplot? that will make comparison easier

figA4 and A5 shows the distribution for a set of 4 plots but you simulate 4*4 in total right? are these plots average per treatment or just one pick among the 4 replicates? Make this clear in caption

