General comment: This study investigated the changes of soil physical properties, i.e. soil water repellency, soil compaction, soil water conditions, on crop yield under different tillage managements in a semi-arid region in China. Generally, the successive field experiment was conducted systematically and the soil properties was measurement carefully. The data was reliable and the statically analysis was done properly. The tables and figures are clear. The discussion is the weak part and need to be improved.

Response: We appreciate you very much for these positive and constructive comments on our manuscript. Those comments are all valuable and very helpful for revising and improving our paper. We have studied your comments carefully and have made revisions which are marked in red in the revised manuscript. Sepecially, we have revised the discussion section that can be found in following responses about the discussion.

Comment 1: The SWR was characterized by the RI, which was calculated from sorptivity of water and ethanol in an infiltration measurement in the current study. The concerns is does the same undisturbed soil core was used for water and ethanol infiltration. If the water and ethanol infiltration measurements were conducted on the same soil core, it is necessary to provide detailed information on which liquid was applied first and what treatment was done to the wetted soil before second liquid was applied (if the wetted soil was air-dried again?). I may guess two different cores were used for the infiltration measurements of water and ethanol, respectively. If so, the difference of the soil pore structure between the two soil cores was purely neglected when calculated the RI by comparing the Se and Sw. This information should be provided clearly in the M&M part.

Response: Thank you for pointing this out. We used the same undisturbed soil core to measure water and ethanol infiltration. To avoid the influence on soil hydrophobic substances induced by ethanol, we carried out the water infiltration firstly and then made the soil sample air-dried to constant weight before the ethanol was applied. We have added this information in line 176-179. It is really necessary to provide the detailed information because it is important for results. In addition, as you said, we used the same soil core and the difference of soil pore structure could be neglected in this study.

Comment 2: The contact angle was mentioned in the manuscript in Lines 206-207. I am wondering why the SWR did not characterized by the contact angle measurements.

Response: We have compared different methods for measuring SWR before carried out the experiment. Although conservation tillage practices increase SWR compared with conventional tillage (Blanco-Canqui, 2011), the degree of SWR is still small (Lucas-Borja et al., 2019) and it is essential to adopt an effective measuring method of SWR in cultivated soils. Water drop penetrating time (WDPT), ethanol droplet (MED), and sorptivity are three common methods used to measure SWR (Behrends et al., 2019; Senani et al., 2016). The time, a water droplet infiltration into the soil, is short in subcritical water repellent soils when using the WDPT method, which makes it difficult to measure the small degree of SWR accurately (Czachor et al., 2010). The MED method only works for hydrophobic soils with contact angles greater than 90° (Carrillo et al., 1999), whereas the contact angles under conservation tillage management are generally smaller than 90° (Behrends et al., 2019). However, the sorptivity method can be adapted to calculate the degree of subcritical water repellency, even if the range of water contact angle is less than 90° (Tadayonnejad et al., 2017). In addition, it is more effective in explaining the impact of SWR on soil hydrological processes compared to WDPT and MED methods, because the method is more relevant to soil water infiltration and movement (Hunter et al., 2011). Therefore, using the sorptivity method to measure SWR is acceptable in cultivated soils. Furthermore, many previous studies have used the sorptivity method that was used in this study to calculate contact angle and it is efficiency. Contact angle measurement also need a special apparatus. Hence, we only used one method to study the effect of tillage management on SWR. The contact angle method is also a common method and we could consider it in future studies.

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Comment 3: Lines 179-187, what is the function of these sentences introducing the calculation of pressure head. It seems the pressure head parameter has no relation with the calculation of Se and Sw.

Response: Thank you for pointing this out. The value of pressure head at the soil surface was -2 cm in this study according to the previous study to avoid a saturated flow (Hallett and Young, 1999). Hence, we did not use the function to calculate the pressure head.

We have deleted it.

Comment 4: Line 218 and 245, it is necessary to give the value of the particle density in the calculation of total porosity and air-filled porosity.

Response: Thanks for your kind advice. We have added the information in line 215-217. “In this study, the pycnometer method was used to measure particle density (Klute and Page, 1986) and the range of its value was 2.58-2.76 mg m^{-3}.”

Comment 5: Line 252, it is necessary to provide the information of how the cumulative evapotranspirtion was measured or calculated in the field for the further calculation of WUE in the current study, and the equation of WUE calculation should be provided.

Response: Thanks for your kind advice. We have added detailed information about the evapotranspiration and WUE in line 256-266.

The cumulative evapotranspiration (ET) was calculated from rainfall and soil water consumption during the growth period as the following equation:

$$ET = SR + SWS - SWH$$

Where *SR* is the seasonal rainfall (mm) and *SWS* and *SWH* are the soil water storage (volumetric water content × thickness of soil layer) at seeding and harvest (mm), respectively. Soil samples were taken at the depths of 0–10, 10–20, 20–40, 40–60, 60–80, 80–100, 100–120, 120–140, 140–160, 160–180, and 180–200 cm to measure *SWS* and *SWH*.

The WUE (kg ha-1 mm-1) was calculated by the following equation and detailed information is given in Wang et al. (2011):

$$WUE = \frac{GY}{ET}$$

Comment 6: Soil samples were taken in 0-5, 5-10 and 10-20 cm soil depth. Why the soil depth in Table 1 are 0-10, 10-20 and 20-30?

Response: Table 1 shows soil primary chemical and physical properties in 2003 and soil depths are 0-10, 10-20, 20-30 cm. However, the effect of tillage management on soil physical properties in 0-5 and 5-10 cm are different. To better study the effect, we chose 0-5, 5-10, and 10-20 cm soil depth in this study.

Comment 7: Lines 237-242, Here, it is said LLWR could be calculated based on SWR at air-filled porosity of 10% or field capacity, PR (2 MPa) or PWP (-1500 kPa). It should be clear which criteria was used for the LLWR calculation but no using “or”. Line 238 and Line 241, what do you meaning by “smaller water content” and “higher water content"? It is quite confusing.

Response: Thank you for pointing this out. We have revised this part in line 235-240 and 244-249 as following:

The least limiting water range (LLWR) was determined by measuring the upper and lower limits of water content for normal plant growth. The upper limits are soil water content at an air-filled porosity of 10% (θ_{AFP}) and field capacity. Plant growth can be limited when PR exceeds 2 MPa (Bengough and Mullins, 1990), hence, the lower limits of the LLWR are soil water content at PR of 2 MPa (θ_{PR}) and the permanent wilting point. The field capacity (θ_{fc}, ψ=-33 kPa) and permanent wilting point (θ_{pwp}, ψ=-1500 kPa) were calculated from the soil water retention curve. The θ_{AFP} was obtained from the following equation (Asgarzadeh et al., 2011):

$$\theta_{AFP} = \left(1 - \frac{\rho_b}{Pd}\right) - 0.1$$

Where P_d is the particle density (g cm^{-3}) and ρ_b is bulk density (g cm^{-3}).

There are four possibilities for calculating LLWR according to the values of θ_{AFP}, θ_{PR}, θ_{fc}, and θ_{pwp} (Tormena et al., 2017):

If $\theta_{AFP} \geq \theta_{fc}$ and $\theta_{PR} \leq \theta_{pwp}$, then LLWR= θ_{fc} - θ_{pwp};

If $\theta_{AFP} \geq \theta_{fc}$ and $\theta_{PR} \geq \theta_{pwp}$, then LLWR= θ_{fc} - θ_{PR};

If $\theta_{AFP} \leq \theta_{fc}$ and $\theta_{PR} \leq \theta_{pwp}$, then LLWR= θ_{AFP} - θ_{pwp};

If $\theta_{AFP} \leq \theta_{fc}$ and $\theta_{PR} \geq \theta_{pwp}$, then LLWR= θ_{AFP} - θ_{PR}.

Comment 8: The biggest concern is that the discussion part is not concise and solid enough to make a good explanation for the large load of information provided by the measured data and statistically analysis. Many sentences is only a repetition of the results information, such as Lines 380-381, Lines 398-402, Lines 409-410, Lines 422-425, Lines 477-479.

Response: Thank you for pointing this out. We have simplified and revised the discussion, especially for the description of some results in lines 390, 397, 409-412, 423, 432, 459, 489, and 499. We also added three subheadings in the discussion section to make it more clear in lines 387, 435, and 486.

Comment 9: Lines 386, it is ambiguous to use the "improvement of soil pore structure". What is good pore structure and what is bad pore structure?

Response: Thanks for your kind advice. We have changed the "improvement of soil pore structure” to the “increase in soil porosity and pore connectivity” in line 398.

Comment 10: Lines 396-397, actually, the SWR is only not linearly correlated with the content of SOC.

Response: We agree with you completely. It’s true that there is not line correlation between SWR and SOC. However, some previous studies have shown that SWR increased with an increase in SOC (Jimenez-Morillo et al., 2016; Lozano et al., 2013; Roper et al., 2013). Hence, we revised the sentence in line 410. “because SWR could increase with an increase in SOC”.

Comment 11: Lines 435-436, Lines 461-462, Another big concern is that preferential flow caused by SWR could increase the spatial variation of SWC. Some place would have higher SWC but at the same time, some place may have lower SWC. The results should be largely depended on the sampling locations. It should not conclude that the preferential flow will increase the SWC in deeper depth.

Response: Thanks for your kind advice. We have deleted the conclusion in the two parts. The first part is that “This is a similar finding to previous studies because SWR can cause preferential flow and then increase the soil water content in a deeper depth (Lozano et al., 2013; Rye and Smettem, 2017)”. The second part is that “because increasing the degree of SWR could cause preferential flow, resulting in increasing soil water content in deeper soil depth”.

Comment 12: Lines 439-440, it is said here that the crop straw mulching was used under no-tillage. I think this is the main reason for the significantly higher SWC in no-tillage plots shown in Fig. 2, but not the effects of SWR as stated in Lines 449-453.

Response: It’s true that crop straw mulching under NT was the main reason for increasing soil water content. Hence, we added the information in line 456-457. “The crop straw mulching under NT was the main reason for increasing soil water content.” We also added another possible reason in line 456-459. “In addition, some previous studies have shown that the increase of SWR increased soil water content (Li et al., 2019; Rye and Smettem, 2017; Santos et al., 2013) and RI had a positive correlation with soil water content (Fig. 5.). Hence, we believe that SWR could have the ability to increase soil water content under conservation tillage practices.” According to your suggestion, we also added a suggestion in line 465-466. “Furthermore, these results suggested that it is necessary to distinguish the effects of crop straw mulching and SWR on soil water content in the future study.”

Comment 13: Lines 455-457, it is too general and should be moved to the introduction part.

Response: Thanks for your kind advice. We have moved the sentence to the introduction section in line 96-97.

Comment 14: Lines 489-491, Lines 545-547, this long sentence is confusing.

Response: We have revised the sentence to make it more clearer in line 499-500 and 554-555. “the S_w and S_e had a closer relationship with grain yield than RI under conservation tillage practices”.