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Interactive comment on "Preferential Flow Systems Amended with Biogeochemical Components: Imaging of a Two-Dimensional Study" *by* Ashley R. Pales et al.

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OVERVIEW COMMENTS

This paper focuses on the influence of the soil rhizosphere's plant exudates on soil wettability and infiltration. Specifically, the authors study the spatial and temporal development of unstable flow leading to preferential flow "fingering" and their relationship with those plant exudates and soil solution components. The authors propose that these compounds are responsible for keeping the soil around the roots moist by swelling and adsorbing water, and also to keep the contact between the roots and soil particles. To study the effect on preferential flow, the authors employ a 2D tank filled with silica sand

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Discussion paper

equipped with a rainfall simulator on the top of the apparatus in order to create the necessary flow conditions for the infiltration experiments. On the back of the experimental device, a light panel was place so the development of such “fingers” could be track by the so-called light transmission method (LTM). They also measured the contact angle and surface tension of the solutions in the soil by using a Kruss easy drop SA1. To simulate plant exudates they selected sodium citrate and sodium oxalate, as soil components they used Suwanee River Natural Organic matter (SRNOM) and tannic acid, and as a base solution NaCl+ a nutrient solution. Through these series of experiments, they analyzed (i) the number of fingers formed, (ii) the velocity of their propagation, and (iii) the vertical and horizontal water saturation profiles. This rich data set is used to test main relationships among water chemistry, the porous media properties and the flow dynamics of each individual solution and its effect on the soil infiltration process.

The manuscript is well posed and written and of interest to HESS readers. It is novel as it addresses an important topic for which there is limited knowledge to date. The work is consequential; if plant roots promote the creation of unstable soil water flow, many soil remediation applications will need to be reassessed. Previous literature has theorized these effects but none (or at least none to this reviewer knowledge) studied them experimentally. For instance, the work shows how the addition of surfactant exudates into the soil can alter the solution chemistry enough to produce a change in behavior of the porous media’s hydraulic properties, by exudates increase wettability and thus mobility of the soil solution in the porous media. I suggest minor revisions listed below.

Response: The authors thank Referee #1 for reviewing our manuscript and for the comments about our manuscript being “well posed and written and of interest to HESS readers” and “novel as it addresses an important topic for which there is limited knowledge to date.” The authors also thank the referee for the comments describing our research as: “The work is consequential; if plant roots promote the creation of unstable soil water flow, many soil remediation applications will need to be reassessed. Previous literature has theorized these effects but none (or at least none to this reviewer

knowledge) studied them experimentally."

SPECIFIC COMMENTS

Ln 12: Possible typo: 'though' instead of 'through' Ln 16: Possible typo: 'special' instead of 'spatial'

Response: The authors thank the reviewer for the comments. We will correct the text as suggested for Ln 12 and Ln 16.

Figures 5 and 6: Although the results are well presented in their corresponding tables, in the figures 5 and 6 it is very difficult to differentiate between the different components and their respective deviations.

Response: The authors thank the reviewer for the comments. We will check to see if using colors helps to distinguish among the different components and their respective deviations in these figures.

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