Comment on soil-2021-91
Paul Hallett (Referee)

Referee comment on "Potential effect of wetting agents added to agricultural sprays on the stability of soil aggregates" by Antonín Kintl et al., SOIL Discuss., https://doi.org/10.5194/soil-2021-91-RC1, 2021

The findings in this paper that destabilisation of soil by wetting agents varies considerably between wetting agents and that the impacts vary markedly across a broad range of soils is novel, important and very interesting. However, as it is written, this simple message is buried in cumbersome text that is difficult to follow. There is a large amount of redundant description or analysis that takes away from what should be the focus of this study. Simple information such as the general properties of the different wetting agents and why they were selected are not mentioned until the Discussion. When analysing the data, the interesting finding of differences between soils gets glossed over by simple statistical analysis that lumps everything together.

This paper needs a major rewrite. Think of what is important to get the message across. Just because something was measured does not mean it is of value to the paper. There is no mechanistic reason given for some of the chemical measurements. Site selection just states 9 sites, but there are some textural differences that would be useful to highlight. Figure 2 shows great data, but you then go on to overanalyse it but fail to really emphasise the soil specific differences. Your experimental design and the care taken in measurements and site selection are impressive.

There is some good text in the Discussion with clearly researched arguments to describe trends that were observed. Some of the basic description of wetting agents and soils that appears here needs to come earlier so that readers are aware of treatment selection. Lime application to D-I (which should be checked and not put in as speculative text), for instance, needs to be apparent before the Results are described.

Look back at what you see as important in the Discussion and revise the text so that the important trends jump out. The paper is very difficult to follow as it is currently presented.
The wetting agent application was not adequately described soil needs more detail.

With a substantial rewrite, this has the potential to be an important and exciting paper. At the moment it lacks focus and is difficult to read.

Abstract –

Descriptive but if the text was written more succinctly it would be possible to write more about the impacts of specific wetting agents. Trends appear to be consistent of the wetting agents with the greatest impact on aggregate stability.

First sentence simplify to: The potential effect of adjuvants/wetting agents (WA) added to the spray mixture on the stability of soil aggregates (SAS) in agricultural soil was studied.

SAS acronym not helpful. You could use WSA or just refer to aggregate stability.

Lines 18-21 all state almost the same thing. This could be more succinct.

Line 24 – \( C_{ox} \) needs to be defined.

Introduction –

This would benefit from much clearer arguments in a major rewrite. Up to line 54 is very basic information that is redundant for readers of this paper. Start with the prevalence of wetting agent use and the potential impacts on aggregate stability exacerbating negative impacts of already well studied impacts from C mineralisation and tillage. I suggest that you structure the Introduction as follows:

- Huge use of wetting agents in pesticide application and increased use to improve the wettability of soils in agriculture.
- In sprays, wetting agents improve dispersal so improve efficacy.
In soil wetting agents to improve water flow, the intended impact is an increased rate of water infiltration and improved retention.

Wetting agent use presents a potential threat to soil aggregate stability, as water repellency has been found to be a major driver of soil stability.

....and then much of your more descriptive will flow from here.

Line 69 – this is just an example, but ‘It is a known fact’ is too definitive and long-winded. You could just write ‘By accelerating penetration, adjuvants increase....’

Line 79 – a bigger impact of wetting agents would be more rapid wetting, which would increase risk of slaking.

You need to introduce some of the soil parameters that you measured along with aggregate stability. Relevance of glomalin etc. needs to be described.

Materials and Methods

Line 90 – throughout you are too wordy and the text can be more succinct. Here you can just write “Soil samples were taken at three regions of the Czech Republic, with three farms sampled in each, comprising a total of nine sites.”

Line 94 ‘pedological’

Line 96 - ISO 10381-6:2009 won’t be familiar to many readers so state what it is.

Line 98 – 100 – this text is hard to follow.

Figure 1 is possibly ok, but given you have supplementary text, it may be better to move. The lower part of this figure does not give much information and could be deleted.

Lines 115-220 – condense some of this information into a Table that appears in the main
text. Include important information for wettability such as pH, text and organic matter. Move other material such as Munsell colours to supplementary.

Section 1.2 – the wetting agent application approach is not clear. Did you spray onto the soil or use as the dispersing liquid in the aggregate stability test? If the latter then it represents a condition that would not occur in the field. The soil would never be this dry and wetted this quickly with a wetting agent. Details are needed either on how much was applied by a spray, per g of soil, or the concentration of liquid if they were used in the aggregate stability test. Write about the wetting agent treatments before describing the aggregate stability test that you used.

Section 1.3 – this should appear before Section 1.2. COx needs to be defined.

Line 280 – it won’t be clear to readers why you measured glomalin unless it appears in the introduction. Is there a specific hypothesis such as wetting agents having a greater impact in soils with more glomalin?

Section 1.4 – be more succinct. We know your treatment structure already. Its Principal Component Analysis.

Results

Section 2.1 – first paragraph is redundant.

Don’t start with Glomalin or other basic soil properties. Start with aggregate stability impacts, then move into the soil properties with an explanation that they are measured to explore soil properties that may drive the response.

Line 311 – mean COx is meaningless to interpreting your data. You are exploring impact on each of 9 different soils.

Up to line 338 is all secondary information. This level of detail is not needed. Much of this information could appear in supplementary text.

Start at Section 2.2
First sentence redundant.

Lines 360-365 – Put this text about site differences between controls first as it sets the scene about how the different respond.

Then you transition to how the wetting agents had an impact.

Line 341 – think of what readers will want to learn. Rather than emphasising the control in this sentence write “Many of the wetting agents decreased aggregate stability, with large differences found between soils.” It is really exciting that WA2, for instance, caused massive destabilisation of some soils but not others. You need to shout about this more.

When I look at Figure 2 I find myself going back to your lengthy text describing the soils to try to figure out the soil properties that could be driving the differences. You need to make the reader work less. Having key data such as texture, OM and pH in a Table would make it easier to refer back. You have some of this in Table 3, but it would be easier to follow if a more comprehensive summary table of the soil was included. Labelling as A-I is also unhelpful to the reader as you sampled 3 broadly different locations, so they could be indicated on the X axis label.

Line 365 to 370 – Think of what the reader wants to learn. WA3 consistently the worst and WA1 consistently the best across a broad range of soils. Here you also demonstrate the quality of your science by studying many soils, coming to the same conclusion for all of them. So to a reader you would argue that to retain soil aggregate stability, WA3 should be avoided.

Figure 3 is the same data presented in a different way. It should not be included.

Analyse the general impacts using only type of statistical test. You have not described site specific impacts in enough detail. What is about site D that makes it so much different from Site A. Why does I get affected by WA2 more than site A? If you described the basic soil properties more, something may jump out.

There is no mechanistic reason to explore a chemical properties like Mg and its impact on aggregate stability caused by wetting agent addition. This looks like a fishing exercise.
PCA would benefit from Clay being included. This is a major driver of both aggregate stability and hydrophobicity. Think of mechanisms.

Discussion

Start with your big finding, which is huge. Wetting agents destabilise soils and the effects vary considerably depending on soil type.

Earlier in the paper, readers need to be aware of the differences in Wetting Agents that you are describing here. Line 457 needs to appear in the Materials and Methods (and possibly Introduction) with clear text on the differences in chemistry and how this affects interfacial properties of soil. Throughout the Results readers need to be guided on C and texture of the different soils as this appears to be the major driver between sites, as would be expected from a large body of previous research.

There are too many papers cited. Only cite papers specifically needed for this study. There are general papers on erosion etc. that are not needed.

You are missing some important studies:

Lehrsch, G.A. 2013. Surfactant effects on the water-stable aggregation of wettable soils from the continental USA. Hydrological Processes, 27, 1739-1750.

Lehrsch, G.A., Sojka, R.E. & Koehn, A.C. 2012. Surfactant effects on soil aggregate tensile strength. Geoderma, 189, 199-206.