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Interactive comment on "Coffee husk mulch on soil erosion and runoff: experiences under rainfall simulation experiment" *by* H. Moreno-Ramón et al.

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Dear Referee, thank you for useful suggestions and corrections. We have rewritten the manuscript in accordance with your advices.

This study investigates the effect of adding coffee husk on runoff and soil erosion, in addition to the effect of soil crusts. It is within the scope of the journal and the results obtained are interesting. It combines, in one process, the solution to two environmental problems (soil erosion and coffee husk management). However, to be considered for publication, the manuscript needs a deep review. Main comments:

1. The only conclusion is that mulch reduces erosion and runoff. I think that more can be obtained from the results showed here. Clear objectives in the introduction, and

conclusions linked to them, should be provided, trying to emphasise the more relevant outputs.

Thanks for your suggestion. According to the defined objectives, we have rewritten the conclusions section. You can see the objectives in the second specific comment:

"The outcomes of this study show clearly that coffee husk could be used as a mulch to reduce soil erosion problems.

1.The coffee husk can be used as an erosion protector because it increases the infiltration rate, decreases the runoff amount, and the time to runoff is delayed. In the same way, soil loss and sediment concentration decrease after coffee husk application.

2.The residue shows a higher efficiency when it is buried because it stimulates an improvement in soil quality parameters and it obtains the best outcomes in all the studied variables. When the residue is spread on the surface, the soil quality is improved at lower degree and the results do not show a good improvement on runoff depth and infiltration rate. In these cases the soil response is similar to the control treatments.

3.Coffee husk cannot cushion the effect of crust. In crusted soils the action of burying or spreading the coffee husk does not get to maintain the same response of soil against the rainfall.

4.The differences among the studied soils (salinity, organic matter content, etc.) do not show statistically significant differences. However coffee husk improves the soil quality and therefore it has been a good improver for that type of soils.

As a general conclusion, on the one hand, coffee husk reduces soil losses, sediment concentration and runoff depth; and on the other hand, it increases the time to runoff and infiltration rates, so it can be used as mulch for soil protection against erosion. With low mulch application rates (1.6 kg m-2) and under loamy textured soils, the outcomes have been satisfactory. By these reasons, future detailed studies will be necessaries for determining the effectiveness of this byproduct in field conditions."

2. The discussion is not really a discussion. At the end of each section, the authors give some values found in the literature to prove that their measurements are in the same range, but they rarely give explanations to their findings. A clear example of what I mean can be found in the section 3.4: “Sediment concentration”. From P1136 L25 to P1137 L1 the authors say that “the presence or absence of the crust did not significant effect the sediment concentration”. I think that this would deserve some discussion. Instead, they only give some values of sediment concentration at the end of the section. This example is applicable to the full manuscript.

We have improved the text, and we have added more discussion according to your advice in relation to our soil conditions and results.

3. The quality of the redaction is poor, with abundant mistakes in the construction of the sentences that difficult the reading and thus the understanding of the paper. I really encourage to the authors the edition of the manuscript by an English speaker. I will not give a list of missing words or sentences that should be rewritten because I think that the authors should go through the whole manuscript.

We have improved the language throughout the paper and corrected all the mistakes.

Examples of modified errors:

P1128 Line 19: we have changed the terms: are having to “have”

P1129 lines 3-4: we have modified the sentence: “Different mulches have been tested to protect soil”

P1130 line 26 → we have changed the terms: Soil bare to “bare soil”

P1132 Lines 8-9 → we have changed the sentence for a better understanding: “Distilled water was sprayed on the soil surface to avoid the runoff generation.”

[. . .]

Specific comments:

P1128 L16 - P1130 L22: Introduction. The number of references seems rather excessive to me. For example, I do not think that the statement “Soil losses by water erosion occur by the detachment and transport of soil particles during the rainfall and runoff processes” (P1128 L23) needs four references.

We have revised the text and changed the order in the paragraphs according to the expressed ideas. In relation to the comment about the number of references, we wrote several references because the authors explained the idea that we wanted to express. However, a large number of citations could difficult the lecture, so we have removed some of them.

P1130 L20: Clear objectives should be established at the end of the introduction.

We have modified this paragraph.

“The main objectives are: i) Determine the capacity of coffee husk to reduce the erosion, ii) Determine which is the best location to apply the mulch with the same surface cover percentage, iii) Assess whether the mulch is able to cushion the effect of soil crust, and iv) Determine whether the soil characteristics can affect the behavior of the mulch in response to soil erosion parameters. To control hydrological and erosive soil variables, a laboratory rainfall simulation experiment on soil erosion trays was developed.”

P1131 L6: Please specify the units of measurements of the variables.

We have changed these sentence and added the units.

“The measured dependent variables were: time to runoff (min), runoff (mm), infiltration rate (mm h-1), soil loss (g m-2) and sediment concentration (g l-1)”

P1131 L14: More precise information of the soil preparation should be given. I miss some information about the sampling process: soil management, sampling depth, degree of soil mixing

In concordance with your advice, we have added more information.

“The soils were sampled in agriculture fields with conventional tillage. The upper 20 cm of the profile were taken and mixed in a big container in the greenhouse. After this step, they were deposited in galvanized aluminum trays (74.9 cm length x 67.9 cm width x 10 cm height).”

P1131 L13 – L28: Methodology for each soil property is explained and then the results are given in the same section. A decision must be taken. If the values of the soil properties contribute significantly to the discussion, they should be given in the Result and Discussion section. On the contrary, if they are considered only as supporting information, they can remain in the Material and Method section, but it is not necessary to explain the methodology. In addition, it is not necessary to repeat in the text what is given in a table. Only the most important values should be highlighted. The soil class is considered as a factor in our study and by this reason the analytical results were explained.

According to your advice, we have added a section inside RESULTS that explain the soil initial characteristics. The results are in table 1, and we have highlighted the main characteristics for each soil.

“3.1 Soil characteristics The analytical results of soil initial conditions are shown in Table 1, where the main characteristics are reflected. Soil III was the most saline (ECe= 7.89 dS m-1) whereas soil I had the highest content of organic matter (OM= 6.27 %). Soil II had the largest water storage capacity, in contrast with soil IV that showed the lowest (9.42 – 6.88 % respectively).”

P1132 L6 – L23: The Material and Methods section should be clear enough to allow reproducibility. How the buried coffee husk is incorporated to soil? I guess that is done before the crust creation. Could this time gap in mulch incorporation between the B and S treatment in crusted soils influence the results?

According to your doubts, we have added more information in the text.

“According to previous studies (Prats et al., 2012; Montenegro et al., 2013), the soil coverage percentage was 80-85 % in the S and B trays. To obtain the same cover, an amount of 0.73 kg m-2 of coffee residue on the S trays and a 1.6 kg m-2 on B trays (0.05 m of depth) were deposed and mixed respectively before the crust formation. [. . .. . ..] Once the trays were prepared, one of each treatment pair was periodically dampened for a period of 6 months to generate surface crusts (Figure 1). At least, 5 cycles of wetting-drying were applied monthly. Distilled water was sprayed on the soil surface to avoid the runoff generation.”

The trays were prepared at the same time. The soil was mixed with coffee husk (upper 5 cm) in buried treatments, whereas coffee husk was deposed on the surface in S treatments and control trays were prepared without residue. After that action, the crust was created by dry-wetting cycles.

The results showed that there were differences between the treatments (B WC, B WOC, S WC, S WOC and C WC, and C WOC). In that regard, 6 months were sufficient. We have added a new table 3 where you can see several soil physical properties and you can compare with the initial state (table 1). We have added these items to the discussion.

P1133 L12 – L18: This paragraph should be rewritten to provide a clearer explanation.

According to your suggestion, we have rewritten this paragraph:

“The runoff was picked up in plastic containers at intervals of 3 minutes. Seven volumes were taken during the 21 minutes of each rainfall simulation. Subsequently, the runoff was filtered in a calibrated paper that had been previously gauged and the solid losses were determined by the gravimetric method. The total runoff (mm) was calculated by adding the seven volumes generated. Both data, water volumes and sediment weight were used to calculate soil losses (g m-2) and sediment concentration (g l-1).”

P1133 L20: Check the position of the brackets.

Thank four your advice. We have changed the sentence and we have added the K1h definition:

“The Horton (1940) equation was used to estimate the infiltration rate (mm h-1), and the steady state infiltration rate after one hour (K1h) was calculated. This parameter is the infiltration rate when the soil is completely saturated under a constant rainfall intensity. In the experiment conditions, at 1 hour, all the erosion trays raise this situation. Previous studies have demonstrated the efficiency of Horton’s regression for the determination of the infiltration rate at saturation conditions (Ibáñez, 2001; Telis, 2001; Hsu et al., 2002).”

P1134 L27: To implement an ANOVA, homoscedasticity has to be checked. If data do not meet this condition, transformation or non-parametric test should be applied.

Thanks for your comment. As you says, the data are not normal, so in that situation is necessary to use non parametric methods. It was a mistake in our paper, but now we have used non parametric methods: Mann-Whitney and Kruskal-Wallis for determining the statistically significant influence among the factors and the measured variables. The values of statistically significance have been similar, and you can see in the table below.

Factors Levels Time to runoff Runoff Infiltration rate Soil loss Sediment Concentration (min) (mm) (mm h-1) (g m-2) (g l-1) Treatment Superficial 2.20 b* 20.87 a 47.98a 235.04 a 11.47 a Buried 2.69 b 12.48 b 77.09 b 121.92 b 10.63 a Control 0.62 a 23.24 a 46.10 a 1084.07 c 46.19 b Soil condition Without crust 2.25 a 15.57 a 65.94 a 389.50 a 22.43 a With crust 1.42 b 22.16 b 48.19 b 571.18 a 23.09 a Soil class I 1.99 a 18.19 a 55.89 a 644.07 a 30.66 a II 1.92 a 20.62 a 52.89 a 431.61 a 19.66 a III 1.5 a 16.52 a 65.52 a 334.26 a 16.26 a IV 1.97 a 20.14 a 53.94 a 511.44 a 24.48 a

The text in the discussion section is:

“The data were statistically analyzed by non parametric methods because the set of data did not show a normal behavior with the Shapiro–Wilk test. The Mann-Whitney and Kruskal-Wallis tests were applied to the data with the aim to find the relationships among the factors (categorical independent variables) and determined parameters (quantitative dependent variables). The statistical significant differences were tested at 0.05 and 0.01 level. The analyses were completed using the computer software package SPSS and Statgraphics Centurion XVI.I.”

P1134 L7- L8: The repetition of results given in a table should be avoided. Only the most important ones need to be highlighted. This can be applied to the whole Result and Discussion section.

Thanks for your suggestion. We have modified the results section according to your advice. This is an example:

“The average data of time to runoff (minutes) and runoff depth (mm) for the different factors (treatment, soil condition and soil class) are showed in table 2. The figure 2a shows the crust effect on the runoff values for the soil class-treatments combinations. Equally, the influence of crust absence is shown in figure 2b. S and B treatments delayed runoff generation by 3.5 and 4.3 times compared to Control (Table 2). C treatments showed signiiňĄcant difference from coffee husk incorporation (S or B) ($p < 0.01$). Also, the soil crusting was a significant influence over the time to runoff. The absence of soil crust increased a time to runoff by 1.58 times.”

P1134 L9: 1.2 should be changed to 3.5 (2.20 / 0.62).

It was a mistake. We have modified the sentence according to the

“S and B treatments delayed runoff generation by 3.5 and 4.3 times compared to Control (Table 2)”.

P1135 L6 – L11: Please avoid redundancies. This paragraph could be summarised in one sentence.

We have summarized the idea in a new paragraph.

“The infiltration rate showed a great increase in B treatments compared to S and C, and by this reason the treatment factor was statistically significant ($p<0.01$). S and C registered similar outcomes (Figure 2a and 2b) and B improved the infiltration rate by 60.7% and 67.2% (S and C respectively).”

P1135 L17 – L20: Again I miss some discussion here. This is the kind of sentences that should be supported with reference and in-deep discussed.

Thanks for your advice, we have improved the discussion about that idea. This is a part of this discussion point:

“Authors like Thierfelder and Wall, 2009 and Thierfelder et al., (2013), indicated that the non-tillage/mulch combination (surface application) resulted in the development of biological activity and the presence of roots, which increased the preferential flow and therefore the infiltration rate. In our study, the infiltration rates increased, but there were not vegetation and biological activity development in the simulation trays, so it did not generate preferential channels for water movement. The residue application improved soil quality as you see in the previous section, and by this reason the unique way for water infiltration was the increase of the matrix flow.” P1136 L17: “Superficial treatments exhibited the same trend as Buried”. This is not true according to Table 2.

We have reviewed it. The “trend” word did not express our idea. We wanted to express that in the figure 2 the S treatments showed the same graphical behavior/tendency than B treatments in all the soils, although the values are different. In that sense C and S showed higher values than B.

Now, this sentence has been modified and it has been included in a general discussion.

P1136 L25 – L27: This sentence is not clear. Does it mean that B mitigates the effect of WC?

As a general conclusion, we conclude that coffee husk does not modify the crust effect.

However, when you have a surface with crust, burying the residue improves the results. This was the sense that we wanted to express with this sentence.

Now, we have rewritten the idea in a new paragraph:

“Regarding the effect of the crust and runoff amount, the improving in the properties were quite good after the coffee husk application. B-WC trays showed a lower value than S-WOC and C-WOC. Specifically: B-WC (16.31 mm) <S-WOC (18.51 mm) and C-WOC (20.54 mm). Therefore, it would be highly recommended burying the residue in soils with a tendency to form crusts.”

P1138 L4-L5: According to Table 3, Soil Class did no affect sediment concentration. You have reason and we have changed these data with the Mann-Whitney and Kruskal-Wallis results. Figures 2 and 4: I am not sure about the need of representing the “soil class” factor. It can be checked in Table 3 that neither the factor itself no its interactions significantly affected any variable. Removing this factor from the figures would make the paper more understandable, removing some noise around, in my opinion, the most important outputs of the study: the effect of mulch and crust. Thanks for your suggestion. It is clear that location and crust presence are the most important factors in our experience. However, we considered three factors because we think that the differences in soil characteristics could affect the soil response. With these graphs you can see the combination of the three factors, and the variability of soils shows you the different response of the analyzed variables. For example is easy to see that coffee husk cannot avoid the crust effect, because the values of crusted and non-crusted cases are different in the same soil and for each treatment.

Please also note the supplement to this comment:
http://www.solid-earth-discuss.net/6/C591/2014/sed-6-C591-2014-supplement.pdf

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Interactive comment on Solid Earth Discuss., 6, 1127, 2014.