REPLIES TO REFEREES. - Anonymous Referee 1.

First of all, thank you for your comments and your suggestions that we have replied below one per one.

1. The major results of the paper are not novel (as expected): mulch cover can reduce soil and water losses effectively. It will be great if the authors could highlight the novel aspects of the study.

On the one hand, it is well known that mulch cover can reduce soil and water losses. On the other hand, there are not previous studies that define the real effectiveness of coffee husk as mulch. By these reasons, we decided to apply coffee husk on soil. With this action, we want to quantify the losses and determine the correct way to apply it (amount and the best position in the soil profile).

Coffee is one of the most consumed agricultural products in the world and therefore its production is constant and elevated. The residues in its processing are mainly eliminated by combustion with the environmental problems that this action produces. In that sense the novel aspect of this paper is: on the one hand, demonstrate that this byproduct could be used as a mulch and its effectiveness, and in the same way, demonstrate that it could reduce soil erosion. The results showed that it was feasible to use as mulch, and therefore could prevent the soil degradation and reduce the emissions of greenhouse gases.

We have added in the paper some items to highlight these aspects.

2. Authors are only list their data but in my view lacks a very critical an in-depth discussion of the results. Please present further explanation of the results and give deeper discussion!

Thanks for your suggestions. We have modified the discussion section and we have added aspects like the influence of soil characteristics on results. We have compared our data with the mulch data collected by other authors because there are not data about coffee husk uses.

3. There are a number of grammatical and spelling errors in the manuscript. Of more concern is the wordiness of a number of long sentences or inappropriate wording that diminishes its readability in places. I would recommend editing by a native English speaker.

Thanks for your advice. We have checked our text with a native English speaker and we have changed some errors and we have modified several sentences for its better understanding.

Examples of modified errors:

P1128 Line 19: we have changed the terms: are having → *"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 → *"bare soil"*

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

[…]

Other specific comments for the authors:

P1129, L25: Residues buried in soils may improve soil qualities, including the improvement of the capacity of soil resist to erosion. So the different effect between “applied on soil surface” and “buried” may be not due to changes of soil qualities. Please give accurate and further explanation.

The two ideas in the text are expressly related with the main conclusions that the cited authors stated in their papers. When we apply mulch on the soil surface (surface application), in the initial stages there is a protective action against kinetic energy which is more outstanding than the increase of soil organic matter content (quality improvement). The increase of organic content gradually occurs over time. By contrast, when the same doses of mulch are buried, protective action is lower because the surface cover percentage is lower too, so the behavior is different in the initial states.

We have completed and changed the order of the sentences for a better understanding.

“The research on mulch applications reveals that its efficiency depends on both, the residue quality and its management (Gangwar et al., 2006). If the residue is applied to the surface as mulch, the improvement of the soil physical properties and the increase of soil organic carbon (SOC) occur over time. In contrast when the residue is buried, there is a fast improvement of soil quality, but at the beginning its capacity to protect the soil surface seems less efficient. It is also clear that the best way to apply it to the soil and the precise incorporation rate are the keys to success (El Kateb et al., 2013; Ma and Li, 2011; Mashingaidze et al., 2012; Singh et al., 1994; Lee et al., 2013; Jiménez et al., 2013).”

P1130, L9-11: Mulch cover influences not only the formation of soil crust, but also the erosion forces, especially the raindrop kinetic energy and the stream power, which play an important role in soil erosion. Please add these information in this paragraph. It is recommended to read papers below: Shi, Z.H., Yue, B.J., Wang, L., Fang, N.F., Wang, D., Wu, F.Z., 2013. Effects of mulch cover rate on interrill erosion processes and the size selectivity of eroded sediment on steep slopes. Soil Sci. Soc. Am. J. 77, 257-267. Wang, L., Shi, Z.H., Wang, J., Fang, N.F., Wu, G.L., Zhang, H.Y., 2014. Rainfall kinetic energy controlling erosion processes and sediment sorting on steep hillslopes: A case study of clay loam soil from the Loess Plateau, China. J. Hydrol. 512, 168-176.

In our opinion, this idea is reflected in page 1128 lines 24-25.

P1130, L 12-22: These two paragraphs are very blurring, it should be rewritten, and give specific research objects.

We have changed this paragraph, and clarify our aim.

“In that regard, although the researchers have begun to explore the possibilities of recycling coffee husk in the last decade, there is not any research that has thought to use it as soil protector. The hypothesis of this paper is that coffee husk could be used as mulch to reduce soil erosion. In that regard, this agricultural resource could be a solution for soil erosion problems in coffee producing countries, and at the same time, it could reduce the environmental problems of its combustion. 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."

P1130, L25; P1131, L5: Please differentiate "factors" and "treatments" here. This problem exists in the abstract as well

We have reviewed all the text and we have made several changes.

> **Factors** are: Soil crusting, soil type and treatments.
>
> **Treatments** are the three conditions that the coffee husk can be located: On surface, buried or without coffee husk (control).

In several parts of the paper we had defined treatments like the combinations of three factors, but now it has been changed by the term "cases", so we have in our experience "48 experimental cases" (in the published document was written like "48 treatments").

P1133, L7: Why t the rainfall intensity of 122 mm h-1 have been selected in the paper?

The main item when we decided about rain was a high erosive rainfall. By this reason a high intensity rainfall simulator was used. This simulator was tested in previous researches and was completely defined by one of the research authors (Ibáñez, 2001)

The rainfall intensity value can be chosen using two criteria:

1) If the mulch will be used in one singular site, you must look for meteorological information about this area.
2) If the mulch will be used in different countries/areas, the approach to the problem is wider.

In any case, the relationship between kinetic energy and rainfall intensity is an exponential equation. In most climatic areas, above 110-125mm h^{-1} the rainfall kinetic energy has reached its highest value and it is approximately constant (Hudson, 1995; Van Dijk et al., 2002). Another question is the frequency as this rainfall intensity is produced.

A common problem in the producing coffee countries is the absence of climatic data series with high robustness. Therefore in these areas the developing intensity-duration-frequency curves must do using regional analysis. The coffee husk proceeded from Angola, so we look for information about rainfall characteristics of this country. In the *Maquela do Zombo* station, (coffee area in Angola) a rainfall intensity of 122 mm h^{-1} and 21 minutes of duration have a return period of 5 years (Awadallah et al. 2011).

In other climatic areas with a smaller aggressive rainfall than tropical zones, a 122 mm h^{-1} rainfall intensity is an extraordinary phenomenon. For example in a Mediterranean climate the return period is equal to 50 years (Gumbell statistic distribution. Alicante climatic station, Spain (Elias Castillo, 1979)).

Cites:

Awadallah, A., M. ElGamal, A. ElMostafa and H. ElBadry, "Developing Intensity-Duration-Frequency Curves in Scarce Data Region: An Approach using Regional Analysis and Satellite Data," Engineering, Vol. 3 No. 3, 2011, pp. 215-226. doi: 10.4236/eng.2011.33025.

Elías Castillo F. y Ruiz Beltrán L. 1979. "Precipitaciones máximas en España". Edit. Instituto Nacional para la Conservación de la Naturaleza, 545 pp.

Hudson, N. W. "Soil Conservation," B.T Brantford Ltd., London, 1989.

Van Dijk, A.I.J.M., L.A Bruijnzeel, C.J Rosewell, Rainfall intensity–kinetic energy relationships: a critical literature appraisal, Journal of Hydrology, Volume 261, Issues 1–4, 15 April 2002, Pages 1-23, ISSN 0022-1694, http://dx.doi.org/10.1016/S0022-1694(02)00020-3.

P1134, L10: Replace "C treatments showed $p < 0.01$ between coffee husk incorporation (S or B)" with "C treatments showed significant difference from coffee husk incorporation (S or B) ($p < 0.01$)".

We have changed this sentence in the text.

P1135, L15, 25: Can soil properties be changed in such a short time?

When you add organic matter in the soil, its properties change due to the action of organisms, natural decomposition.... In that sense, we added the coffee husk 6 months ago with the aim to favor that type of changes. In addition, the porosity and aggregate stability results registered an improvement in soil properties. These data can be shown in the new table 3.

P1137, L10: Please explain these results here.

Thanks for your specification. We have changed the discussion section and in that sense, we have rewritten the idea.

In the text we wanted to reflect that the mulch application did not cushion the crust effect, because it could not maintain the same results in non-crusted and crusted cases.

The new paragraph clearly expresses this idea:

"In crusted soils the action of burying the coffee husk did not get to maintain the runoff depth at the same levels of the non-crusted (figure 2a and 2c). In soils III and IV between B-WOC and B-WC there was a difference of 3 mm, in soil II of 8 mm and in soil I of 17 mm. The action of spreading the mulch on soil surface did not avoid the crust effect over runoff generation."

P1137, L25: In general, soil crust may influence sediment concentration effectively. Please explain why "the presence or absence of the crust did not significant effect the sediment concentration"

We have added more information and discussion points about this item. Sediment concentration did not show statistically significant differences on soil condition because is a ratio between sediment losses (g) and runoff generated (l). If sediment losses increases in the same way as runoff in both cases (WC and WOC) the ratios are similar.

In the discussion text, the idea has been reflected in this way:

"*In sediment concentrations, the smallest difference between WC and WOC (0.66 g l^{-1}) was determined by analogous decreases in both runoff volume and the amount of eroded sediment. In runoff depth the variation was 29.7%, whereas in soil loss was 31.8%, so in sediment concentration was only registered a modification of 2.45%. The sediment concentration was equal, so that fact revealed that the eroded response in WOC and WC was the same, but it was displaced in time*."