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BRIEF REPORT

REVISED Root mass may affect soil water infiltration more strongly than the incorporated residue [version 7; peer review: 2 not approved]

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Abstract

This Brief Report includes a single-finding that is reported with descriptions of an unexpected observation. Crop residue incorporation increases stable soil pores and soil water infiltration, consequently, reduces surface water runoff and soil erosion. However, to our knowledge, quantitative studies for the relation between incorporated residue and infiltration rate has not been conducted. To know the relation is important for avoiding soil erosion under crop rotation in practically. We continuously grew corn (cleaning crop), rhodes grass, and okra under greenhouses. The water infiltration rate was measured on the ridge at similar soil moisture conditions, on the day incorporating the prior crop residue. The simple linear regression analysis was conducted. The coefficient of determination R^2 was 0.91; however, that for aboveground dry matter of prior crop was 0.93, unexpectedly. Though, our experiment not designed for distinguish those effect; previous studies have revealed the positive relation between plant root mass and soil erosion resistance. Our data also show a positive relationship between resistance to erosion and root mass when assuming that the aboveground biomass is proportional to the root mass. The result also showed that the effect of the prior crop root mass disappears within the next crop period. This suggests that maintaining a large root mass is crucial for reducing soil erosion.

Open Peer Review

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version 7		
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1. Kae Miyazawa, University of Tokyo, Tokyo, Japan		

Keywords

Crop residue, Crop rotation, Soil erosion, Soil water infiltration, Sustainable agriculture

This article is included in the **Agriculture, Food and Nutrition** gateway.

2. **Bingcheng Xu** , Northwest A&F University, Yangling, China

Any reports and responses or comments on the article can be found at the end of the article.

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Author roles: **Oda M:** Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Writing – Original Draft Preparation; **Rasyid B:** Data Curation, Investigation; **Omae H:** Data Curation, Formal Analysis, Investigation, Methodology

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REVISED Amendments from Version 6

- 1) Correlation analysis was changed to regression analysis.
- 2) The manuscript was simplified and focused on the findings.
- 3) The figure was revised to easily understand the research question.
- 4) The method described the relation of the limitation and the analysis.

Any further responses from the reviewers can be found at the end of the article

Introduction

This Brief Report includes a single-finding that is reported with descriptions of an unexpected observation. Soil degradation is a major constraint of food security (Gomiero, 2016; Lal, 2015), and soil erosion represents one of the crucial intervention points for reversing soil degradation (Karlen & Rice, 2015). The Universal Soil Loss Equation (USLE) (Wischmeier & Smith, 1978), the standard for estimating erosion, shows that the risk of erosion is drastically reduced when a crop has covered soil surface. This emphasizes the importance of preventing erosion in the early stage of crop growth. There are two aspects to preventing erosion; the one is to fix soil, another is to increase the water infiltration rate. Especially, increasing infiltration rate has an additional benefit for water harvesting and reducing the surface runoff. Therefore, technologies increasing the water infiltration rate are critical to prevent soil erosion in tillage systems.

Tillage makes soil porous, but the physical properties are rapidly lost (Strudley *et al.*, 2008); however, organic matter application increases the stability of soil pores (Turmel *et al.*, 2015). Interestingly, Potter *et al.* (1995) reported that water infiltration of soil was higher under no-tillage than tillage conditions when the residue input was low, but the opposite result was shown when the residue input was high. All in all, the soil erosion decreased according to the degree of water infiltration (Potter *et al.*, 1995). However, to our knowledge, quantitative study for the relation between incorporated residue and infiltration rate has not been conducted. The amount of crop residue is largely different in the crop rotation in practical.

Therefore, we investigated the relation between the quantity of crop residue of the prior crop and the water infiltration rate in a crop rotation of corn, rhodes grass, and okra because crop rotation is practical and makes a large difference in the biomass. Though the data supported the relation, unexpectedly, the data also suggested that the relation between the quantity of remaining underground root mass of the prior crop and the infiltration rate was stronger.

Methods

The experiment was conducted in greenhouses to prevent the rainwater. We grew corn as a cleaning crop, then after 63 days fallow period grew rhodes grass, and okra sequentially under different nitrogen application levels and mulch conditions. All the

crop residues were collected in each greenhouse, and the equal amount was returned each plot but different amount between the greenhouses. The water infiltration rate was measured on the ridge at similar soil moisture conditions, on the day incorporating the prior crop residue.

Study site and treatment

We conducted the experiment in two greenhouses at the Japan International Research Center for Agricultural Sciences experimental field (24.38°N and 124.19°E) on Ishigaki Island. The climate is subtropical. The soil type was Ultisol (Soil Survey Staff, 2014) and the texture was sandy clay loam. The greenhouse was 5 m wide and 18 m long. We made three ridges (0.2 m high and 1 m wide) with a 0.5 m path on each side. We divided these ridges into three plots with 0.8 m paths between each plot. In this way, we created nine plots (1 m × 5.2 m) in each greenhouse and randomly assigned them with nine treatments (3 × 3 factorial design). These treatments comprised three nitrogen levels (0, 10, and 40 kg N ha⁻¹; slow-release-type urea only, no other fertilizers were used) and three mulching treatment (unmulched, weed barrier fabric, and black plastic film mulch). Although both nitrogen application and mulch treatment have impacts on the biomass, the treatments were expected to make differences on top-root ratios.

We replicated the treatments using two greenhouses (A and B). We cropped corn (*Zea mays*) without fertilizer as a cleaning crop and collected the residue, then chopped the residue into approximately 3 cm pieces using a chopper and dried it for two months under a roof. We adjusted the soil moisture of the greenhouse at a suitable level for tillage by irrigating (25–40 mm) with mist irrigation tubes (Kiriko; Mitsubishi Chemical Agri Dream Co., Ltd., Tokyo) and then removed the tubes. We scattered 2 Mg ha⁻¹ of the corn residue, tilled by a rotary tiller, made the ridges, measured the soil water infiltration, set the irrigation tubes again, set the mulch films, transplanted rhodes grass (*Chloris gayana*) seedlings with fertilizer, and irrigated up to the field capacity. Additional irrigation was not provided. After harvesting rhodes grass, the crop residues were collected in each greenhouse then evenly returned to the plots (each plot received the same amount of residue but the amount was different between the greenhouses). We grew okra (*Abelmoschus esculentus*) in the same way. All crops were planted 40 cm intervals of two rows. The growing season of corn, rhodes grass, and okra were 7 June to 10 August 2016, 14 October 2016 to 11 January 2017, and 12 January to 14 April 2017, respectively. An interval of 65 days was provided between the corn harvesting and the rhodes grass planting. There was no interval between rhodes grass harvesting and okra planting. (Oda, 2020)).

Infiltration rate measurement

We measured the soil water infiltration rate with Mariotte's bottle (20 cm high, 10 cm in diameter), with two holes in the bottom. Mariotte's bottle is a device that delivers a constant rate of flow. We inserted a plastic ring of the same diameter into the ridge to a 10 cm depth and then watered from a 1 m height to the ring at a 60 mm min⁻¹ rate. We recorded the time needed to waterlog 50% of the soil surface area. We measured infiltration

on the center of ridges at the initial stage (before the rhodes grass; with incorporated corn residue), after the rhodes grass (with incorporated rhodes grass residue), and after the okra (with incorporated okra residue).

Determination and analysis

The effect of the soil moisture difference treatment was determined at the end of okra cropping by extracting soil core samples from 0 to 5 cm soil depth on the ridge. Aboveground biomass was calculated by multiplying the plot's whole fresh biomass weight to the average moisture content of the air-dried samples' in each greenhouse. The simple linear regression analysis of the infiltration rate was conducted for the quantity of incorporated residue or for the aboveground biomass (dry weight) using MS Excel 2016. Because, the experiment design cannot distinguish the effect of input DM and prior crop root mass. The analysis was conducted for the mean values of nitrogen levels and for that of the mulch levels. The mean values of nitrogen levels show the effects of aboveground biomass, which averaged out the effect of soil moisture. By contrast, the mean values of mulch levels show the effect of soil moisture. The coefficient of determination (R^2) is expected to decrease because soil moisture affects to the top-root ratio.

Results

The R^2 values were high for both input DM and aboveground DM. The infiltration rate per incorporated residue of corn, had no prior crop, is two-fifth of other crops. By contrast, for the aboveground biomass of the prior crop showed a constant regression (Figure 1). These R^2 values decreased for the mulch level treatment (Figure 2). The soil moisture range of mulch treatment (6.5–9.7 %) was larger than that of nitrogen treatment (7.2–8.3 %).

Discussion and conclusions

The R^2 values were high for both input DM and aboveground DM. This means not only the input DM but also the aboveground biomass may affect the water infiltration rate. The question is of which is the real cause; although the experiment is not designed to distinguish it.

The first hint is that the infiltration rate per input DM of corn (2 Mg DW ha⁻¹) had no prior crop, is two-fifth of other crops. By contrast, for the aboveground DM shows no such outliers. The second hint is that the crop biomass is generally proportional to the crop root biomass but, the soil moisture strongly affects to top-root ratio. We can expect the lower R^2 value in terms of mulch

Figure 1. Regressions for the Means of the nitrogen-level treatment.

Figure 2. Regressions for the Means of the mulch treatment.

treatments; because the top-root ratio is more unstable in mulch treatment. In fact, the R^2 values were decreased by the treatment affected the soil moisture. This again supports the effect of the root mass.

We should consider the duration of the “after-effect” of the prior crop (Wischmeier & Smith, 1978). The outlier of corn for input DM is reasonable if the roots of rhodes grass affected on the soil water infiltration rate of after okra. However, the effect of the prior crop root mass almost disappears within the present crop growth period under the experimental conditions because the regression for the aboveground biomass on the infiltration rate is constant. Especially, the performance of the initial (63 days after corn) shows no after-effect.

The previous study reported the degree of water infiltration was related to the level of soil erosion (Potter *et al.*, 1995). Another study reveals the logarithmic relation between plant root mass and soil erosion resistance, although infiltration was not mentioned (Gyssels *et al.*, 2005). These studies support a positive relationship between resistance to erosion and root mass. To our knowledge, quantitative studies for the relation between incorporated residue and infiltration rate has not been conducted. This might be that researchers have published no negative data.

Finally, the key finding of this study is that the effect of above-ground residue quantity, more precisely root mass, was stronger than the incorporated residue. From a physical viewpoint, the area of residue surface is far smaller than that of the root surface

and the gap is easily clogged by sediment caused by rainfall. Therefore, the improvement of soil water infiltration probably comes from root mass (Gyssels *et al.*, 2005). In addition, our result also showed that the effect of the prior crop root mass disappears within the next crop period. This suggests that maintaining a large root mass is crucial for reducing soil erosion. Our results were obtained in greenhouses of the sub-tropical environment so the further study should be conducted in other conditions.

Data availability

Underlying data

Raw data of this article are presented in figshare: <https://doi.org/10.6084/m9.figshare.6741890.v1> (Oda *et al.*, 2018).

Extended data

Timeline of the experiment is present in figshare: <https://doi.org/10.6084/m9.figshare.11775003.v1> (Oda, 2020)

Data are available under the terms of the [Creative Commons Zero “No rights reserved” data waiver](#) (CC0 1.0 Public domain dedication).

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Reviewer Report 12 March 2020

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Kae Miyazawa

Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

The authors are claiming that their "Brief Report includes a single-finding that is reported with descriptions of an unexpected observation". However, unfortunately, what they have been claiming as "a single-finding" is not a "finding", but just one of the speculations they made to explain what they thought of as "unexpected results". Actually, it is not even "unexpected" to see proportionally lower infiltration rate after corn residue incorporation in comparison to other crops because 1) the corn residues were harvested and were completely dried before incorporation, whereas the residues of other crops were incorporated right after their growing period, and 2) there were 65 days of fallow period prior to the corn residue incorporation whereas there was no fallow period prior to the residue incorporation of other crops, which will affect the soil physical properties.

The authors also claimed that "the key finding of this study is that the effect of aboveground residue quantity, more precisely root mass, was stronger than the incorporated residue". However, this cannot be concluded from their data. First of all, their experimental design was not testing the effect of quantity of the residue nor root mass, but testing the effect of different crop residues (including roots), which are different not only in quantity but also in quality. On top of that, as mentioned above, the corn residue effect on infiltration rate cannot be compared with those of other crop residues because of the concomitant effects (only corn is different regarding the management of residue and fallow period). Finally, if "the soil moisture strongly affects to top-root ratio", and "(the) root mass (effect), was stronger than the incorporated residue", then there should to be a consistent effect of mulch treatment on infiltration rate*. However, it looks like the mulch treatment did not have any consistent effect, and even if it did, it might be just the direct effect of mulch on soil physical characteristics.

I also would like to respond to the authors' previous response, that was "It is reasonable that the original purpose or experimental design is not always suitable for clarifying the unexpected results. Because, the results were unexpected".

It does not matter what the original purpose was, and what the unexpected results was. When

writing a paper, the reasoning of the research purpose in the introduction has to match with the method used.

*To test the effect of mulch treatment on infiltration rate, a 3-way ANOVA (2 crops x 3 fertilization levels x 3 mulches with two blocks) is necessary. Depending on how the authors have assigned each treatment plot within each greenhouse, split-plot design, or strip plot design may need to be used to test the effect of each factor.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 14 Mar 2020

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

For the first, I have to confess that I deeply thank you because you are the first person to accept open review. I believe you have done a prominent contribution to open science as a frontier. On the other hand, I think your way of response is slightly different from the guideline of this platform (<https://f1000research.com/for-referees/peer-reviewing-tips>) in the following two points.

1. Stay in Scope: Keep comments within the scope of the paper.

"Root mass may affect soil water infiltration more strongly than the incorporated residue". That is our scope. We think that our data is enough to suggest the possibility, although not enough to conclude. The significance test using ANOVA is out of our scope; however, you can show your idea and your finding as a "Comments on this article" not a review. That is really expected in F1000Research.

2. Be Constructive: Be constructive, view your reviewer role as an opportunity to help improve the paper you are reviewing.

We feel that your latest criticisms are not constructive.

1) Effect of the moisture of residue.

The water infiltration measured on the day incorporating the crop residue. Dry residue has the advantage to absorb moisture. That is against the data of the fact of the low performance of corn residue.

2) Effect of the fallow period on soil physical properties

That is really what we indicated. The effect of the prior crop root mass and incorporated residue on the water infiltration rate disappears within the next crop period. The effect does not depend on with or without crops. Otherwise, the two factors show low R2 values.

3) The experiment has not uniformed conditions

That is true; however, a field experiment is something like that. The important thing is what

strong factors are. Of course, high R2 values possibly appear by chance. Researchers evaluate them by statistics and theoretical.

4) The mulch treatment did not have any consistent effect

The effect is large but unstable; however, the evaluation is out of our scope. We can expect the lower R2 value in terms of mulch treatments; because the top-root ratio is more unstable in mulch treatment. In fact, the R2 values were decreased by the treatment affected the soil moisture. The idea is hard to accept that the top-root ratio is not affected by mulch.

5) The direct effect of mulch

The main functions of mulch are keeping soil moisture and temperature. Rainfall protection is out of scope in this experiment. As you know the mean temperature is less affected by mulch. The average of the maximum soil temperature at 5 cm depth was 28.4–28.9°C among the treatments. By contrast, the seasonal range was 32.9–20.7°C for October to January. In our experiment, the main effect of mulch appeared on the soil moisture.

6) ANOVA or regression

Our conclusion comes from the graph, and we believe the graph is more suitable to show our findings. We changed the analysis from correlation to regression that is for considering ANOVA because ANOVA and regression analysis are equal in mathematical.

We are welcome that you express your findings by ANOVA in "Comments on this article" on the platform F1000Research.

Competing Interests: No competing interests were disclosed.

Author Response 13 Jul 2020

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

1) Predicting a result is more difficult than interpreting the result. You said the result is not "unexpected" because the fallow period will affect "the soil physical properties". That is the same as what we say. We assume the property is root mass.

2) You mentioned the difference in materials. Yes, there are no outliers in corn (see Figure 1 left); however, how should you interpret "the soil physical properties" that you say.

3) We concluded that the infiltration rate is affected by the root mass (see Figure 1 right) because we agree with you that "the soil physical properties" will affect the water infiltration. A law the more general is the more important.

4) Our interpretation suggests the plant residue incorporation doesn't improve the infiltration rate at tillage.

Competing Interests: No competing interests were disclosed.

Version 6

Reviewer Report 19 February 2020

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Kae Miyazawa

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- The purpose of this research was to "investigate(d) the relation between the quantity of crop residue of the prior crop and the water infiltration rate". However, "All the crop residues were collected in each greenhouse, and the equal amount was returned each plot but different amount between the greenhouses".
- Therefore, the authors are not investigating the relationship between quantity of crop residues and the water infiltration rate, since the equal amount of residues were returned to all the plots. Instead, what the authors have investigated was the infiltration rates after each crop cultivation (with the same amount of residues returned and incorporated for each crop) with the combinations of nitrogen and mulch treatments.
- The experimental design is inconsistent with the stated purpose, and the conclusion is flawed. As I have suggested before, a proper purpose (research question) must be set and analyzed according to the actual experimental design for this current data set.
- The authors may use this current data as preliminary data to construct a better experimental design for the next experiment to test their current hypothesis.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 21 Feb 2020

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

The criteria of the "Brief Reports" is as follows;

"Brief Reports (previously called Research Notes) include single-finding papers that can be reported with one or two illustrations (figures/tables), descriptions of unexpected observations, and lab protocols."

It is reasonable that the original purpose or experimental design is not always suitable for

clarifying the unexpected results. Because, the results were unexpected.

Finally, you recommend that "The authors may use this current data as preliminary data to construct a better experimental design for the next experiment to test their current hypothesis.". That is not only for authors but also for other researchers. That is the reason why the Brief Reports are in F1000Research which is enhancing open science.

We think now you and we have come to the agreement.

Competing Interests: No competing interests were disclosed.

Version 5

Reviewer Report 27 January 2020

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Kae Miyazawa

Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

The authors have not addressed my concerns from the previous version, and therefore my recommendation remains the same.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 30 Jan 2020

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

Please reconsider the revised version.

Competing Interests: No competing interests were disclosed.

Reviewer Report 23 January 2020

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Bingcheng Xu

State Key Laboratory of Soil Erosion and Dryland Farming on the Loess Plateau, Northwest A&F University, Yangling, China

Although it is a brief report, it has lethal shortcomings which cannot be revised. Thus I persist to the decision "Not approved".

1. There are some redundant presentations, such as "An interval of 65 days was provided between the corn harvesting and the rhodes grass planting. There was no interval between rhodes grass harvesting and okra planting" because it can be obtained from the growth periods descriptions, as shown in Supplementary figure 1. The first paragraph in the Results section can be deleted because it is not results, and is similar to those in the Methods section.
2. Lots of queries in Methods: because the ridge is 1-m wide, the reader wants to know the density for planting corn, grass and okra, respectively? How much was the field capacity and how to scale the irrigation? What are the positions for measuring infiltration rates? In the supplementary figure, the corn residue applied was 2t ha⁻¹, here it was 2 Mg ha⁻¹?
3. The data analysis description can be shortened and made more clear. In Figure 1, are the two greenhouses used as repeated experiments or independent experiments? If used as replicates, the data should be averagely analyzed and compared. By the way, it is better not to repeatedly use the same results in different figures. The data results for different nitrogen treatments cannot be seen here.
4. The results and explanations are mostly a concern. The authors measured the water infiltration just after the residue was incorporated in the field. During incorporating, the root biomass and distribution in the top soil was also disturbed and rotated. The author declared that soil erosion resistance was closely related with soil water content and crop root biomass. Actually, soil erosion resistance was correlated with lots of soil traits including physical, chemical and biological traits. Crop root can improve soil erosion resistance through its fixation ability, thus the actual traits were the root length, diameter and stretching resistance. Although the root:shoot ratio is relatively stable for different plants, such an index can vary differently in response to growth conditions for each crop, especially water and fertility.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 30 Jan 2020

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

1. Redundant presentation:
 - “An interval of ... planting”: I agree with you; however, this is an important point that makes the difference in the effect of applied residue. Unfortunately, we cannot expect all readers to be easily aware of the point.
 - The Results section: The method section is rather long so, unfortunately, not all readers are expected to read them. This is a popular way to improve readability.
2. Methods:
 - Plant density: Added.
 - Field capacity: We don't have the data; however, about 200 and 700 mm of water was irrigated.
 - How to scale the irrigation: The water meter in the greenhouse.
 - Positions for measuring infiltration rates: Center of the plot.
 - 2 t or 2 Mg: ton is megagram. The unit in the figure is corrected.
 - (Note, this response will be opened to readers)
3. Results:
 - Use of average of replicates in Figure 1: Revised.
 - The nitrogen treatment: That is Figure 1b.
4. Discussion:
 - Effects of lots of soil traits:

The first aim of our work is clarifying the relation between the amount of incorporated residue and water infiltration rate. Our conclusion is negative. To our knowledge, there is no publication for the quantitative study. The reason may be the results were negative, and so not published. The second aim is to show an assumption that in the title. But the experiment was not designed for the second aim. Because the conclusion had not been expected. We added the limitation in the head of the discussion.

Competing Interests: No competing interests were disclosed.

Version 4

Reviewer Report 26 November 2019

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Bingcheng Xu

State Key Laboratory of Soil Erosion and Dryland Farming on the Loess Plateau, Northwest A&F University, Yangling, China

After carefully checking the revision, I found that the manuscript was not sufficiently revised. In the current version, there are also many doubts about the details for the treatments, such as the amount of the residue applied. The conclusions cannot be obtained from the current results.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 28 Nov 2019

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

1) The amount of the residue applied.
They are shown in the figure.

2) The conclusions cannot be obtained from the current results.
Please explain the flaw of our logic.

Competing Interests: No competing interests were disclosed.

Reviewer Report 30 October 2019

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Kae Miyazawa

Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

The purpose and conclusion of this manuscript are not logically supported by the experimental design and statistical method the authors used. I have suggested to set a proper purpose and conduct the statistical analysis according to the actual experimental design, but unfortunately it seems it is not the authors' option.

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of

expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Author Response 01 Nov 2019

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

May I have the reason why you think the statistical analysis is not according to the actual experimental design? The ANOVA is used for the Nominal scale. The correlation is used for the quantitative scale. The amount of plant residue in the present study is the quantitative scale.

Competing Interests: No competing interests were disclosed.

Version 3

Reviewer Report 24 September 2019

<https://doi.org/10.5256/f1000research.22356.r54154>

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Bingcheng Xu

State Key Laboratory of Soil Erosion and Dryland Farming on the Loess Plateau, Northwest A&F University, Yangling, China

Title:

- Root mass was not investigated. "Crop" should be mentioned in the title to specify the plant type.

Abstract:

- Needs major modifications. The key information about this study should be clearly provided here, while not previous study results, which can be mentioned in the introduction section. Some redundant words can be deleted in the section, such as "without outliers", etc. The reader cannot obtain a clear take-home conclusion after reading the abstract.

Introduction:

- What are the relations between applied residue and root mass? Why choose the rotation system to take the study, but not focus on residue amount for same crop? The reasons for conducting such research were not fully and clearly introduced.

Methods:

- Better to give a schematic diagram showing the design and arrangement for treatments,

and also the positions for infiltration rate measurements and crop transplanting.

- How about the relations between mulching, N application and residue applied? More clear presentation about the treatments is needed.
- How were the residues of rose grass applied back?
- When was the okra residue incorporated?

Determination and analysis:

- Does the author think that soil moisture in 0-5cm soil layer can reflect the differences among treatments? How can the residue effect be diminished in the sampling?
- I cannot understand the last two sentences in this section.

Results:

- The first paragraph can be deleted.
- The last paragraph should be moved to the discussion section.
- The results in the figures were not fully described. For example, why are the data scattered and those for rose grass bigger than those of Okra? The data in House B were bigger than those in House A?

Discussion and conclusions:

- Some conclusions are arbitrary without direct data evidences, such as "Our data show a positive relationship between...to the underground biomass."
- The discussion and conclusion should be obtained based on the experimental results.
- It lacks a specific and clear conclusion now.

Others:

- The residues in different (N and corn residue application) treatments should be different and these should be considered.
- Mulching (plastic film or residue) would change soil conditions such as soil temperature and nutrient conditions, and these will affect crop growth and water requirement, while this was overlooked.
- The simulated lines should be drawn in the figures.
- How do the authors consider the differences between the two houses?
- It seems there is no direct relation with soil erosion, especially in the greenhouse, while connected with water transport and use.
- The writing and presentation need modification to make it more concise and logical.

Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

I cannot comment. A qualified statistician is required.

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Plant water use; Agronomy

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 25 Sep 2019

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

Thank you for your comment for improving our manuscript!

For the first, this Brief Report is a report of an unexpected observation. We clarified this point. We believe most of your questions would be resolved by this statement

For the second, F1000Research is not strict in the manner of description because of the broad scope. We followed a manner of a book, "Science Research Writing: A Guide for Non-Native Speakers of English"; because of the manner focusing on readability.

Introduction:

We added the reason for the rotation system.

Methods:

We think the description include sufficient information to allow others to reproduce the work. For the treatments, as we described, we just expected to make differences on top-root ratios.

Determination and analysis:

We think that soil moisture in 0-5cm soil layer can reflect the differences among treatments. The data shows the disturbs the relationship between the quantity of inputted residue and the infiltration rate; however, shows no clear tendency.

Results:

The potential yield are largely different by crop. The difference between House A and B is what we call brock effect.

Others:

The relation is at the moment of just applied residues so the purely physical.

Surprisingly, to our knowledge, no study exists that for quantitative study between the inputted residue and soil water infiltration.

The experiment was not completely controlled the input so we showed the correlation, not regression.

I hope you reread the revised manuscript.

Competing Interests: No competing interests were disclosed.

Reviewer Report 17 September 2019

<https://doi.org/10.5256/f1000research.22356.r52862>

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Kae Miyazawa

Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

Introduction:

- The structure of the introduction was greatly improved. However, my comments for the contents are almost the same as before. Although the authors responded that they could not find any other papers, there are papers that have investigated the effect of different residue amounts on infiltration rate, both tilled and non-tilled, and also with crop rotations (for example, Johnson *et al.*, 2016¹; Singh *et al.*, 2016², and other many references in the recent paper, Sindelar *et al.*, 2019³). Actually, the one the authors cited (from 1940) did not even investigate about “incorporated residue quantity”, but rather they left the residue on the surface. Therefore the author’s description such as “the relation between the quantity of applied residue and infiltration rate has been less studied” is not convincing, which makes this introduction fail to justify the importance of this study.

- The below are some new comments to the author's reply:

1. My previous comment: "Also the authors are mainly writing about no-tillage results in the introduction, and failed to summarize enough references that have investigated the effect of residues under tilled conditions. There are many papers on this topic (for example, the effect of organic matter or green manure application under tilled cropping system)."

- **Authors' reply:** I have no idea why you think so. We mentioned only about the tillage system in the second paragraph.
- **My new comments:** I do not consider that mentioning only one paper from 1940 is enough for "summarize enough references that have investigated the effect of residues under tilled condition".

2. My previous comment: "The experimental design has to match the aims stated in the introduction. For the 1st aim, it is necessary to compare the relationship between plant residue and infiltration rate under different cropping sequences (for example, consecutive corn cropping vs. corn-rose grass-okra cropping is necessary)."

- **Authors' reply:** I don't agree with you. It means that there is a relation in crop rotation if the relation was found in crop rotation. The same thing can be said to the cited study.
- **My new comments:** The 1st aim in the second version text was "to determine whether the relation between residue incorporation and infiltration holds under crop rotation". Since the question is whether or not the relation (under mono cropping) "holds" under crop rotation as well, and that "The effect of residue incorporation is unclear" according to your second version text, the relationship under mono cropping need to be investigated as well to answer the 1st aim.

3. My previous comment: "For the second aim, factorial design of different amounts of root mass, and different amounts of crop residue incorporation is needed. The experimental design described here is not suitable for the aims stated in the introduction."

- **Authors' reply:** We did. Unless, how can we show the figure 1 a)? However, we need to explain the outliers. The answer is figure 1 b).
- **My new comments:** The authors 2nd aim was "to determine whether the remaining underground root mass influences this relation". To do this, the interaction effect between the effect of residue amount, and the effect of root mass is to be tested. Correlation is just a correlation, and having any outlier cannot provide any evidence for causation.
- I think the data can be interesting if a proper purpose (research question) is set and analyzed according to the actual experimental design, but the current statistical analysis is just not working for the purpose stated in the introduction.

Results:

- The first sentence is not results, but methods.
- The second and third paragraph contains discussion and conclusion. Please do not include any interpretation in the results section.

Discussion:

- Expecting to have completely different discussion after re-considering the research purpose (research question) and the results with revised statistical analysis.

References

1. Johnson J, Strock J, Tallaksen J, Reese M: Corn stover harvest changes soil hydrology and soil aggregation. *Soil and Tillage Research*. 2016; **161**: 106-115 [Publisher Full Text](#)
2. Singh V, Yadvinder-Singh, Dwivedi B, Singh S, et al.: Soil physical properties, yield trends and economics after five years of conservation agriculture based rice-maize system in north-western India. *Soil and Tillage Research*. 2016; **155**: 133-148 [Publisher Full Text](#)
3. Sindelar M, Blanco-Canqui H, Jin V, Ferguson R: Cover Crops and Corn Residue Removal: Impacts on Soil Hydraulic Properties and Their Relationships with Carbon. *Soil Science Society of America Journal*. 2019; **83** (1). [Publisher Full Text](#)

Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

No

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: soil science, vegetable cultivation

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 20 Sep 2019

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

For the first, I thank you from the bottom of my heart for improving the manuscript.

1. As for the citations

The qualitative study and the quantitative study are quite different. We will add the description in the manuscript. All three studies you cited are qualitative study. In addition, Singh's doesn't aim to "infiltration" and Sindelar's (2019) is new than our manuscript (2018). We noticed Russell's study was also not suitable for citing; therefore, we will delete the citation and the related sentences.

2. About the needs of control plots

Do you think the relation between aboveground biomass of previous crop and soil water infiltration rate would be changed by the existence of mono-crop plots? Of course, doesn't! Note, we will delete the sentences that mention about mono-crop according to the change of the citation.

3. The "2nd aim"

Please read carefully the manuscript. "2nd aim" you call is not our 2nd aim but an unexpected result. As you've admitted, the data can be interesting. That is the reason we report as a "Brief report" (cf. F1000Research guideline, "descriptions of unexpected observations")

4. The writing style

The styles of F1000Research is not strict because of the wide scope. I believe readability is important to inform the findings. The concise summary of methods is helpful for understanding the results (cf. Science Research Writing: A Guide for Non-Native Speakers of English). The border of a section between "result" and "discussion" is obscure. Although, it is said that results are "what is that" and discussions are "what they mean". They are closely related, so the section "Results and discussion" is seen in some journals. In the present study, I tried to show the location of the present study in the research map in the discussion section.

5. Additional correction

We will correct the word "exponential" to "logistical" in the sentence of "A previous study has shown that the decrease in water erosion rates with increasing root mass is exponential". The correction does not change the direction of the discussion.

Competing Interests: No competing interests were disclosed.

Version 2

Reviewer Report 06 March 2019

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Kae Miyazawa

Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

Introduction:

- I could see some improvement in the introduction structure, however, it is still not structured enough to explain the importance of this research. For example, there is no explanation in the introduction about why it is important to investigate whether or not the relationship between residue incorporation and infiltration holds "under crop rotation" (which is stated as one of the aims of this research). I could not find from where this aim came from by reading this introduction. Similar comment for the other aim; the reference cited about wheat straw quantity and infiltration relationship under sub-tillage is way too old, and the description of plant root mass effect is unclear to support the importance of the second aim. Which kind of effect are you talking about by describing "that plant root mass is related to rill and ephemeral gully erosion"? Also what do you mean by "the effect of residue incorporation is unclear"? If it is not clear, then how do you define and evaluate whether or not 1) "the relation between residue incorporation and infiltration" holds under crop rotation, and 2) whether or not root mass influences "this relation"?
- Also the authors are mainly writing about no-tillage results in the introduction, and failed to summarize enough references that have investigated the effect of residues under tilled conditions. There are many papers on this topic (for example, the effect of organic matter or green manure application under tilled cropping system).

Methods:

- The experimental design has to match the aims stated in the introduction. For the 1st aim, it is necessary to compare the relationship between plant residue and infiltration rate under different cropping sequences (for example, consecutive corn cropping vs. corn-rose grass-okra cropping is necessary). For the second aim, factorial design of different amounts of root mass, and different amounts of crop residue incorporation is needed. The experimental design described here is not suitable for the aims stated in the introduction.

Results, discussion and conclusions:

- The same comments as the first review.

Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

No

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: soil science, vegetable cultivation

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 08 Mar 2019

Masato Oda, Japan International Research Center for Agricultural Sciences, Owashi, Japan

Thank you for the prompt response. However, I'm sorry that you didn't give me a response to our question about the outliers.

"the authors are mainly writing about no-tillage results in the introduction"

MO: I have no idea why you think so. We mentioned only about the tillage system in the second paragraph.

The importance of the water infiltration study of "under crop rotation" is not described. And, the reference is too old.

MO: The reference cited about wheat straw quantity and infiltration relationship is the only paper that we could find for "incorporated residue quantity and infiltration rate" although there are many papers on the effect of organic matter or green manure application under tilled cropping system. The study is for mono-crop, instead, our study is for the crop rotation.

Which kind of effect are you talking about by describing "that plant root mass is related to rill and ephemeral gully erosion"?

MO: This question was probably caused by the bad sentence. The following changes in those sentences will make it easy to understand:

"The relation between the quantity of applied residue and infiltration rate has been less studied, although, it is known that plant root mass is related to rill and ephemeral gully erosion (Gyssels et al., 2005)."

The last sentence is no longer needed.

For the 1st aim, it is necessary to compare ...(for example, consecutive corn cropping vs. corn-rose grass-okra cropping is necessary).

MO: I don't agree with you. It means that there is a relation in crop rotation if the relation was found in crop rotation. The same thing can be said to the cited study.

For the second aim, factorial design of different amounts of root mass, and different amounts of crop residue incorporation is needed.

MO: We did. Unless, how can we show the figure 1 a)? However, we need to explain the outliers. The answer is figure 1 b).

Competing Interests: No competing interests were disclosed.

Version 1

Reviewer Report 07 February 2019

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Kae Miyazawa

Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

This is a short report to investigate the infiltration rate under different treatments, conducted in 2 green houses. The treatments were 3 levels of urea input, and 3 ways for mulching. They have grown corn, rose grass, and okra, and incorporated them after each cropping season, and measured infiltration rates. Their conclusion is that the root mass affects infiltration more than incorporated residue amount, but it's flawed (details below).

Introduction:

- The introduction has to be revised. Right now, two paragraphs that are supposed to give the background for your research aim are not structured well. Right now, you have just put related information without considering logical order. It can be improved, for example, if the first paragraph is structured like this;
 1. Erosion is a major problem for the soil degradation.
 2. Erosion starts when rain hits the bare soil and form a crust by braking aggregates, which decreases infiltration and increase surface runoff.
 3. Therefore, to reduce soil erosion, protecting soil surface and improving infiltration rate are important.
- Then, in the second paragraph, you can talk about how to do that (no tillage, putting

residues, incorporating organic matter etc.). Also at the end, or the next paragraph, you can talk about what is still lacking and needs to be investigated to show the originality of this report.

- In the last paragraph of the introduction, you put your research aim. 1), and 2) are understandable, but the last sentence is not clear. Why can "ensuring growth of different crops for the same amount of input residue with different nutrition levels and different soil moisture levels" provide answer for those two questions?

Methods:

- You have N fertilizer treatment, and "soil moisture" treatment, but putting as "three soil moisture levels (un-mulched,)" is not really exact naming for your treatment, since you are not really controlling soil moisture alone (covering with mulch has a lot more effect other than soil moisture). Probably "mulching treatment"?
- Second paragraph: Please put the information in order. You are talking about the end of Okura cropping, then going back to the corn cropping next. Please make it easy for readers to understand by putting them in logical manner.
- "we repeated the above processes": What are the processes? There are so many processes in "above". Do you mean all including corn cropping?
- It is not clear whether you returned residues evenly among plots within the house, or across the houses.
- Data analysis: Since this experimental design is 2 factor, 3 levels, randomized block design with 2 replication (block), please conduct 2-way anova accordingly.

Results, Discussion and conclusions:

- If you use the 2-way ANOVA results, you might find something interesting. Since the residue amount increases as the crop biomass and crop root biomass increases, these results are basically showing the same thing. When you had more residue (for example, when you have grown rose grass), you also had more above ground and root biomass. So the Figure 1a result is concomitant with the crop biomass (and root biomass), and not purely showing the effect of the residue amount. If you want to compare the residue incorporation effect and crop biomass (and root biomass), you need to have plots with uniform root biomass condition, and incorporate residues in different levels.

Is the work clearly and accurately presented and does it cite the current literature?

Partly

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

Partly

If applicable, is the statistical analysis and its interpretation appropriate?

No

Are all the source data underlying the results available to ensure full reproducibility?

Partly

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: soil science, vegetable cultivation

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 22 Feb 2019

Masato Oda, Independent Scientist, Japan

First of all, we respect you for bravely participating in the open review. As you know, the open review has not been popular in our field of sciences. We are deeply thankful to you. And it is our pleasure to enjoy the discussion with you. We are also thinking that your comments are on behalf of many other readers. We understand that the discussion presents them with a correct understanding of our results by improving the manuscript.

Comment 1:

Introduction:

The introduction has to be revised. Right now, two paragraphs that are supposed to give the background for your research aim are not structured well. Right now, you have just put related information without considering logical order. It can be improved, for example, if the first paragraph is structured like this;

- 1. Erosion is a major problem for the soil degradation.**
- 2. Erosion starts when rain hits the bare soil and form a crust by braking aggregates, which decreases infiltration and increase surface runoff.**
- 3. Therefore, to reduce soil erosion, protecting soil surface and improving infiltration rate are important.**

MO: Yes, you are right. We need to revise the introduction. However, the order is different. We showed the importance of the infiltration rate from the holistic view of preventing soil erosion practically. For that purpose, we are referring USLE. From this point of view, we showed that erosion is a problem of mainly combined with tillage. We added a sentence as follows: "What is the point of preventing soil erosion in practical?". Although it is another story, we changed the duplicate use of "Therefore" to "Finally".

Comment 2:

Then, in the second paragraph, you can talk about how to do that (no tillage, putting residues, incorporating organic matter etc.). Also at the end, or the next paragraph, you can talk about what is still lacking and needs to be investigated to show the originality of this report.

MO: We agree with you. The second paragraph had not followed the previous paragraph. We think the problem is the first sentence and the last sentence. We deleted the first sentence and added the following sentence at the end of the paragraph: "The effect of residue incorporation is unclear".

Comment 3:

In the last paragraph of the introduction, you put your research aim. 1), and 2) are understandable, but the last sentence is not clear. Why can "ensuring growth of different crops for the same amount of input residue with different nutrition levels and different soil moisture levels" provide Response for those two questions?

MO: Yes, we agree with you. We need to describe more clearly the aim of the treatment rather than the treatment itself here. We revised the sentence as follows: "we determined water infiltration rates for different biomass levels under even amounts of residue incorporation in crop rotation."

Comment 4:

Methods:

You have N fertilizer treatment, and "soil moisture" treatment, but putting as "three soil moisture levels (un-mulched,)" is not really exact naming for your treatment, since you are not really controlling soil moisture alone (covering with mulch has a lot more effect other than soil moisture). Probably "mulching treatment"?

MO: You are right. We changed to "mulching treatment". We are also thinking about the same thing that you have mentioned. We added the following sentence at the end of the first paragraph: "Although both nitrogen application and mulch treatment have some impacts, we expected the changes in top-root ratios."

Comment 5:

Second paragraph: Please put the information in order. You are talking about the end of Okura cropping, then going back to the corn cropping next. Please make it easy for readers to understand by putting them in logical manner.

MO: We added a supplemental figure of the timeline. We moved the first sentence to the determination section.

Comment 6:

"we repeated the above processes": What are the processes? There are so many processes in "above". Do you mean all including corn cropping?

MO: Thank you for the suggestion. We cut the word "above" and added the "using rose grass residue" after the word "okra".

Comment 7:

It is not clear whether you returned residues evenly among plots within the house, or across the houses.

MO: See the sentence "(each plot received the same amount of residue for the next crop per house; the amount was different between the houses)". We think many readers will have the same question; however, now the added sentence at the end of the introduction and the supplemental figure will help their understanding.

Comment 8:

Data analysis: Since this experimental design is 2 factor, 3 levels, randomized block design with 2 replication (block), please conduct 2-way anova accordingly.

MO: This study conducted correlation analysis, and the strong correlation means significance. We believe, anova is not needed because the correlation analysis of this study gives much information.

Comment 9:

Results, Discussion and conclusions:

If you use the 2-way ANOVA results, you might find something interesting. Since the residue amount increases as the crop biomass and crop root biomass increases, these results are basically showing the same thing. When you had more residue (for example, when you have grown rose grass), you also had more above ground and root biomass. So the Figure 1a result is concomitant with the crop biomass (and root biomass), and not purely showing the effect of the residue amount. If you want to compare the residue incorporation effect and crop biomass (and root biomass), you need to have plots with uniform root biomass condition, and incorporate residues in different levels.

MO: Thank you for the important question! You mean that both the amount of residue and the above ground biomass is significant, don't you? We knew. We also knew they are concomitant. However, how do you think about the outlier? To tell the truth, we had expected that returning plant residue is effective for preventing soil erosion; however, it denied in another experiment (unpublished data). "the average infiltration rate of initial stage was almost the same as that of after okra, although the input quantity of the initial stage (2.0 Mg ha⁻¹) was a 2.5-fold higher than after okra (0.8 Mg ha⁻¹)". The DM amount, 2.0 Mg ha⁻¹ is a considerable amount. The necessity of having plots with "uniform root biomass" is quite agreeable for us too. Therefore, we titled our research as "may affect". This Research note discusses only unexpected results that come from an experiment that was carried out by our resources.

Competing Interests: No competing interests were disclosed.

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