

BRIEF REPORT

**REVISED** Root mass may affect soil water infiltration more strongly than the incorporated residue [version 4; peer review: 2 not approved]

Masato Oda <sup>1</sup>, Burhanuddin Rasyid<sup>2</sup>, Hide Omae<sup>1</sup>

<sup>1</sup>Japan International Research Center for Agricultural Sciences, Owashi, Japan

<sup>2</sup>Department of Soil Science, Faculty of Agriculture, Hasanuddin University, Jawa Barat, Indonesia

- V4** First published: 21 Sep 2018, 7:1523  
<https://doi.org/10.12688/f1000research.16242.1>
- Second version: 05 Mar 2019, 7:1523  
<https://doi.org/10.12688/f1000research.16242.2>
- Third version: 22 Aug 2019, 7:1523  
<https://doi.org/10.12688/f1000research.16242.3>
- Fourth version: 21 Oct 2019, 7:1523  
<https://doi.org/10.12688/f1000research.16242.4>
- Fifth version: 04 Dec 2019, 7:1523  
<https://doi.org/10.12688/f1000research.16242.5>
- Sixth version: 05 Feb 2020, 7:1523  
<https://doi.org/10.12688/f1000research.16242.6>
- Latest published: 05 Mar 2020, 7:1523  
<https://doi.org/10.12688/f1000research.16242.7>

**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 study for the relation between incorporated residue and infiltration rate has not been conducted. In this study, we examined the relationship between the quantity of crop residue of the prior crop and the water infiltration rate. We grew corn, rose grass, and okra in crop rotation under greenhouses and measured the water infiltration rate at the time of ridge making. A strong correlation was found between the quantity of applied residue and the soil water infiltration rate ( $r = 0.953$ ), although there were outliers in the case of no prior crop. By contrast, aboveground biomass of the prior crop showed a stronger correlation with water infiltration rate ( $r = 0.965$ ), without outliers. Previous studies have revealed the logistical relation between plant root mass and soil erosion. Our data also show a positive relationship between resistance to erosion and root mass when assuming that aboveground biomass is proportional to the underground biomass. 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

**Open Peer Review**

**Approval Status** XX

	1	2
<b>version 7</b>	<span style="color: red; font-size: 2em;">X</span>	
(revision)	<span style="color: red; font-size: 0.8em;">view</span>	
05 Mar 2020	↑	
<b>version 6</b>	<span style="color: red; font-size: 2em;">X</span>	
(revision)	<span style="color: red; font-size: 0.8em;">view</span>	
05 Feb 2020	↑	
<b>version 5</b>	<span style="color: red; font-size: 2em;">X</span>	<span style="color: red; font-size: 2em;">X</span>
(revision)	<span style="color: red; font-size: 0.8em;">view</span>	<span style="color: red; font-size: 0.8em;">view</span>
04 Dec 2019	↑	↑
<b>version 4</b>	<span style="color: red; font-size: 2em;">X</span>	<span style="color: red; font-size: 2em;">X</span>
(revision)	<span style="color: red; font-size: 0.8em;">view</span>	<span style="color: red; font-size: 0.8em;">view</span>
21 Oct 2019	↑	↑
<b>version 3</b>	<span style="color: green; font-size: 2em;">?</span>	<span style="color: green; font-size: 2em;">?</span>
(revision)	<span style="color: green; font-size: 0.8em;">view</span>	<span style="color: green; font-size: 0.8em;">view</span>
22 Aug 2019	↑	
<b>version 2</b>	<span style="color: green; font-size: 2em;">?</span>	
(revision)	<span style="color: green; font-size: 0.8em;">view</span>	
05 Mar 2019	↑	
<b>version 1</b>	<span style="color: green; font-size: 2em;">?</span>	
(revision)	<span style="color: green; font-size: 0.8em;">view</span>	
21 Sep 2018		

---

1. **Kae Miyazawa**, University of Tokyo, Tokyo, Japan

crucial for reducing soil erosion.

### 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.

**Corresponding author:** Masato Oda ([oda.masato@affrc.go.jp](mailto:oda.masato@affrc.go.jp))

**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

**Competing interests:** No competing interests were disclosed.

**Grant information:** The author(s) declared that no grants were involved in supporting this work.

**Copyright:** © 2019 Oda M *et al.* This is an open access article distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

**How to cite this article:** Oda M, Rasyid B and Omae H. **Root mass may affect soil water infiltration more strongly than the incorporated residue [version 4; peer review: 2 not approved]** F1000Research 2019, 7:1523 <https://doi.org/10.12688/f1000research.16242.4>

**First published:** 21 Sep 2018, 7:1523 <https://doi.org/10.12688/f1000research.16242.1>

**REVISED Amendments from Version 3**

Added a description that this is a brief report including an unexpected observation.

Deleting the inappropriate reference for mono-crop and the related sentences.

Correct the wrong term "exponential" to "logistical".

Added the reason for this study was done with crop rotation.

**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 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.

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, rose 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 grew rose 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<sup>-1</sup>; 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<sup>-1</sup> 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 rose grass (*Chloris gayana*) seedlings with fertilizer, and irrigated up to the field capacity. Additional irrigation was not provided. After harvesting rose 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*) by the same way. The growing season of corn, rose 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 rose grass planting. There was no interval between rose grass harvesting and okra planting. (Supplementary Figure 1).

## 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<sup>-1</sup> rate. We recorded the time needed to waterlog 50% of the soil surface area. We measured infiltration on the ridge at the initial stage (before the rose grass; with incorporated corn residue), after the rose grass (with incorporated rose 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. We performed Pearson's product moment correlation analysis of the infiltration rate for the quantity of incorporated residue or for the aboveground biomass (dry weight) using the "CORREL" function of MS Excel 2016. The correlation coefficients were calculated 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.

**Results**

We grew corn as a cleaning crop, then grew rose grass, and okra sequentially under different nitrogen application levels and mulch conditions. All the crop residues were collected in each greenhouse, then the equal amount was inputted to each plot. The water infiltration rate was measured on the ridge at similar soil moisture conditions, on the day incorporating the prior crop residue.

There was a strong correlation between the incorporated residue dry weight and soil water infiltration rate ( $r = 0.953$ ) in terms of nitrogen level treatment, even though initial corn residue showed outliers (Figure 1a). Although, our result is in line with a previous study (Turmel *et al.*, 2015), the outlier is not negligible because the almost same infiltration rate was observed for a 2.5-fold different input. By contrast, aboveground biomass of the prior crop showed a higher correlation with soil water infiltration rate ( $r = 0.965$ ), without outliers (Figure 1b). Since the crop biomass is generally proportional to the crop root biomass when the top-root ratio is stable; the absence of the outlier supports that the infiltration is essentially based on the root mass. Additionally, it is well known that soil moisture strongly affects to top-root ratio. The soil moisture range of mulch treatment (6.5–9.7 %) was larger than that of nitrogen treatment (7.2–8.3 %). This means that

the top-root ratio is more unstable in mulch treatment; as a result, the correlation coefficient of the infiltration rate and the aboveground weight must decrease. Actually, the correlation decreased to  $r = 0.872$  for the mulch level treatment (Figure 1c).

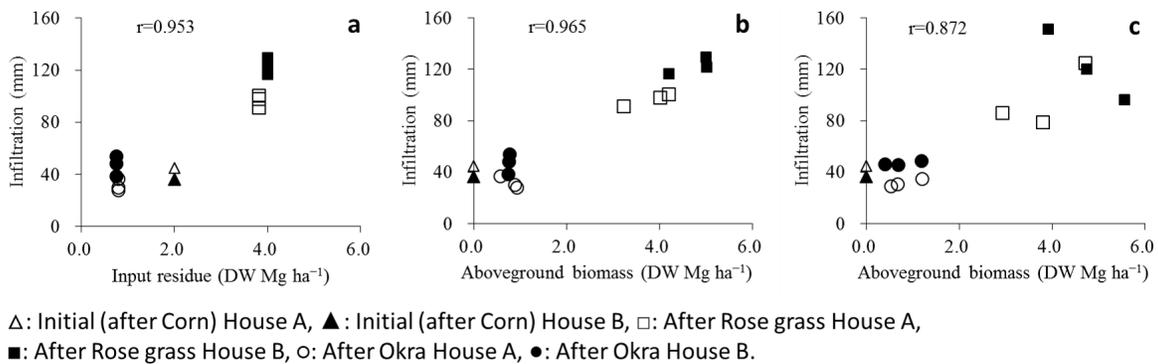
We should consider the duration of the "after-effect" of the prior crop (Wischmeier & Smith, 1978), such as the roots of rose grass on the soil water infiltration rate measurement of after okra. We conclude that the effect of the prior crop root mass almost disappears within the next crop growth period under the experimental conditions because the correlation between the aboveground biomass and the infiltration rate was stable and less was affected by a prior crop.

**Discussion and conclusions**

The previous study reported the degree of water infiltration was related to the level of soil erosion (Potter *et al.*, 1995).

We found a strong correlation between the incorporated prior crop residue and the infiltration rates in crop rotation. The result seems to indicate the relation between applied crop residue and soil erosion decrease is more common. However, the aboveground biomass of the prior crop showed a higher correlation to the infiltration rate more than the applied residue and that suggests the essence of the relation is based on the root mass. A previous study has shown that the decrease in water erosion rates with increasing root mass is logistical, although infiltration was not mentioned (Gyssels *et al.*, 2005). Our data show a positive relationship between resistance to erosion and root mass when assuming that aboveground biomass is proportional to the underground biomass.

Finally, the key finding of this study is that the effect of aboveground 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).



**Figure 1. Correlation between input residue or aboveground biomass and the soil water infiltration rate.** (a, b) Means of the nitrogen-level treatment. (c) Means of the mulch-level treatment. Crop rotation was conducted as follows: corn, rose grass, and okra in greenhouses. An interval of 65 days was provided between the corn harvesting and the rose grass planting. There was no interval between rose grass harvesting and okra planting. Greenhouses A and B are replicates. We measured the soil infiltration rates on the ridge using artificial rainfall equipment on the day of making the ridge. The values are the mean of three plots.

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

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

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

### Acknowledgments

We thank Masato Shimajiri, Yasuteru Shikina, Masashi Takahashi and Masahide Maetsu for their assistance with experiment. We thank Akiko Sawa for her assistance with the sample analysis.

### Supplementary material

**Supplementary Figure 1. Timeline of the experiment.** Cropping days and the residue input.

[Click here to access the data](#)

### References

- Gomiero T: **Soil Degradation, Land Scarcity and Food Security: Reviewing a Complex Challenge.** *Sustainability.* 2016; **8**(3): 281.  
[Publisher Full Text](#)
- Gyssels G, Poesen J, Bochet E, *et al.*: **Impact of plant roots on the resistance of soils to erosion by water: a review.** *Prog Phys Geogr.* 2005; **29**(2): 189–217.  
[Publisher Full Text](#)
- Karlen DL, Rice CW: **Soil Degradation: Will Humankind Ever Learn?** *Sustainability.* 2015; **7**(9): 12490–12501.  
[Publisher Full Text](#)
- Lal R: **Restoring Soil Quality to Mitigate Soil Degradation.** *Sustainability.* 2015; **7**(5): 5875–5895.  
[Publisher Full Text](#)
- Oda M, Rasyid B, Omae H: **Crop residue and soil water infiltration.** *figshare.* Dataset. 2018.  
<http://www.doi.org/10.6084/m9.figshare.6741890.v1>
- Potter KN, Torbert HA, Morrison JE Jr: **Tillage and residue effects on infiltration and sediment losses on Vertisols.** *Trans ASAE.* 1995; **38**(5): 1413–1419.  
[Publisher Full Text](#)
- Strudley MW, Green TR, Ascough JC: **Tillage effects on soil hydraulic properties in space and time: State of the science.** *Soil Tillage Res.* 2008; **99**(1): 4–48.  
[Publisher Full Text](#)
- Turmel MS, Speratti A, Baudron F, *et al.*: **Crop residue management and soil health: A systems analysis.** *Agric Syst.* 2015; **134**: 6–16.  
[Publisher Full Text](#)
- Wischmeier WH, Smith DD: **Predicting rainfall erosion losses.** USDA, Maryland. 1978.  
[Reference Source](#)

# Open Peer Review

Current Peer Review Status:  

Version 4

Reviewer Report 26 November 2019

<https://doi.org/10.5256/f1000research.22842.r55471>

© 2019 Xu B. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

 **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**

- 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

<https://doi.org/10.5256/f1000research.22842.r55472>

© 2019 Miyazawa K. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



### 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

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>

© 2019 Xu B. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



### Bingcheng Xu

<sup>1</sup> State Key Laboratory of Soil Erosion and Dryland Farming on the Loess Plateau, Northwest A&F University, Yangling, China

<sup>2</sup> 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**

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>

© 2019 Miyazawa K. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



## Kae Miyazawa

<sup>1</sup> Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

<sup>2</sup> 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.*, 2016<sup>1</sup>; Singh *et al.*, 2016<sup>2</sup>, and other many references in the recent paper, Sindelar *et al.*, 2019<sup>3</sup>). 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 1<sup>st</sup> 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 1<sup>st</sup> 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 2<sup>nd</sup> 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**

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

<https://doi.org/10.5256/f1000research.20109.r45282>

© 2019 Miyazawa K. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



#### Kae Miyazawa

<sup>1</sup> Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

<sup>2</sup> Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

<sup>3</sup> 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**

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

<https://doi.org/10.5256/f1000research.17738.r43591>

© 2019 Miyazawa K. This is an open access peer review report distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.



**Kae Miyazawa**

<sup>1</sup> Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

<sup>2</sup> Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

<sup>3</sup> Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, Japan

<sup>4</sup> 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**

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 Okra 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 ( $2.0 \text{ Mg ha}^{-1}$ ) was a 2.5-fold higher than after okra ( $0.8 \text{ Mg ha}^{-1}$ )". The DM amount,  $2.0 \text{ Mg ha}^{-1}$  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.

The benefits of publishing with F1000Research:

- Your article is published within days, with no editorial bias
- You can publish traditional articles, null/negative results, case reports, data notes and more
- The peer review process is transparent and collaborative
- Your article is indexed in PubMed after passing peer review
- Dedicated customer support at every stage

For pre-submission enquiries, contact [research@f1000.com](mailto:research@f1000.com)

**F1000Research**