BRIEF REPORT

REVISED Locally measured USLE K factor expands sustainable agricultural land in Palau [version 3; peer review: 3 approved with reservations]

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Abstract

From the viewpoint of sustainability, annual soil erosion should be controlled below an erosion level. Palau is an island in the Micronesia region of the western Pacific Ocean. The island receives heavy rainfall and has steep slopes, so 80% of the land is categorized within the most fragile rank (T factor = 1) in soil erosion. We tested several methods of preventing soil erosion on the land, with a slope of 15.4° (13.4°–17.3°), cultivated the land, planted sweet potatoes, and compared the amount of soil erosion. Surprisingly, there was no erosion at all in all plots (including control plots), although 24 rainfall events occurred and the USLE equation predicted 32 tons per ha of soil erosion in the cropping period. For the parameters of the USLE equation used in this study, only the K factor was not measured (cited from a USDA report). Namely, the K factor estimated by soil texture was larger than the actual value. Measuring the K factor in the fields can expand Palau's sustainable agricultural land.

Keywords

Babeldaob, hillside farming, island, tillage, mulching, USLE equation

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

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1. **Kathleen B. Boomer** , Foundation for Food and Agriculture Research, Washington, USA
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2. **Kebede Wolka**, Wondo Genet College of Forestry and Natural Resource, Hawassa University, Shashemene, Ethiopia
3. **Nor Rohaizah Jamil** , Universiti Putra Malaysia, Serdang, Malaysia

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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)

Author roles: **Oda M:** Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Writing – Original Draft Preparation; **Nwe YY:** Investigation, Resources, Writing – Original Draft Preparation; **Omae H:** Investigation, Project Administration, Writing – Original Draft Preparation

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REVISED Amendments from Version 2

1. We changed the title to a more accurate expression.
2. We made the method citation more faithful and detailed. We also clarified that the rainfall intensity was calculated according to the definition. Relatedly, we corrected the symbols in the formula.
3. We referred to that the K-factor was estimated based on soil texture and permeability.
4. We mentioned when the survey area was less than 10 m² may overestimate soil erosion.
5. We made the discussion more gradual and mentioned in the discussion that the number of events is considered to be large enough for the use of the USLE equation.

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

Introduction

From the viewpoint of sustainability, annual soil erosion should be controlled below an erosion level of the T factor (USDA Natural Resources Conservation Service). Although No-tillage farming is effective for preventing soil erosion (Zuazo & Pleguezuelo, 2009) but the use of herbicides is unfavorable from an ecological perspective; therefore, reducing soil erosion in tillage farming is needed. The erosion caused by tillage occurs with small vegetation coverage in the early stage of the crop (Wischmeier & Smith, 1978). It is essential to increase the water infiltration rate at this stage. The water infiltration rate is positively proportional to the root mass of the crop soil (Oda *et al.*, 2019). Therefore, we tried clarifying the risk of erosion and the effect of root mass for preventing soil erosion in a field with an incline typical for Palau in an area categorized as highly erodible. Surprisingly, there was no erosion at all in all plots. The results show that land at low risk of soil erosion can be found by determining site-specific K factor measurements. Although we failed to evaluate the effects of the treatments, this information is important for Palau's agricultural development.

Methods

Site description

Palau forms part of the Micronesia region in the western Pacific Ocean. Palau's economy is mainly due to tourism and the increase in tourists increases the consumption of agricultural products. Palau imports them, but it is preferable to produce them domestically. The agriculture in Palau is mainly taro cultivation at swamp by a traditional and environmentally friendly method. Before World War II, Japanese settlers developed agricultural land. In recent years, the redevelopment of these fields using modern farming methods has begun. Fields with inclines of more than 8° are unsuitable for growing crops, but most of the agricultural fields in Palau have slopes of more than 8°. The island is also subject to heavy rainfall (ca. 3300 mm – 3900 mm). USDA Natural Resources Conservation Service in 2009 categorized most of the land (80%) as the most fragile rank (T factor = 1). T Factor values range from 1 ton/acre/year for

the most fragile soils, to 5 tons/acre/year for soils that can sustain more erosion without losing significant productive potential (USDA Natural Resources Conservation Service). A study estimated the risk of soil erosion from agricultural land was reported to be from 720 to 813 tons per ha per year (Gavenda *et al.*, 2005).

The experiment was conducted at the Palau Community College Research and Development Station (N7.529694, E134.560522). The station is located in the interior of Babeldaob island, the second largest of the Micronesian islands, and is surrounded by forest. The field is one of the agricultural fields that were once used by the Japanese settlers. The soil here is Oxisol (ferralsols)—“Ngardmau-Bablethuap Complex,” which is characterized as a very gravelly loam with low organic matter content of between 1% and 4%. The permeability is moderately rapid (15–50 cm/hr) and very well drained. The available water capacity is between 0.05 and 0.10 cm/cm (Smith, 1983).

Treatments

We conducted the experiment from January to July 2019. The slope is 15.4° (13.4°–17.3°). The previous crop grown on the land was taro (*Colocasia esculenta*). The treatments were plants (with or without) × ridge (with or without) × 2 replications. We set these eight plots (2 × 10 m) randomly on the field (Table 1, Figure 1 and Figure 2). We tilled the field using a hand tractor on January 22, leveled the field, and covered half the plots with weed control fabric (polypropylene, 0.4-mm thick, 120 g m⁻²; I-Agri Corp., Tsuchiura) on 28 January. We cut weeds on April 16, blown off the residue, removed the weed control fabric on April 17 (Figure 3), then tilled each plot using the hand tractor up and down to keep the soil from moving the neighboring plots. The average thickness of the soil tilled was 16 cm. We made a 70 cm width of the monitoring areas in the center of the plots by ridges or wooden boards (for the no-ridge treatment). We transplanted sweet potatoes (*Ipomoea batatas*) at 70 cm intervals on April 17 (Figure 4). We dug trenches at the upper end of the fields to prevent rainwater inflow. We embanked the lower ends and added 1-m lengths of weed control fabric to trap any eroded soil. Fertilizer was not applied. Hand weeding was conducted on May 21 and June 6.

Table 1. Treatments.

Block	Plot ID	Plants	Ridge	Slope/°
Left	4			15.1
	7	+		17.3
Mid	1		+	14.2
	5	+	+	14.6
	6	+	+	15.7
Right	8	+		13.4
	2		+	16.1
	3			16.6

Figure 1. Location of plots. Green: No mulch treatment, Stripe: Ridge treatment.

Figure 2. Initial condition of the field.

Figure 3. Conditions before cultivation.

Figure 4. Initial conditions. The order of the plots is 4, 7, 1, 5, 6, 8, 2, 3.

Determination

We set up weed control fabric at the lower end of the ridge and fixed them to the ground with several wire bents into a U-shape (Figure 4). At the bottom of the rows, we raised the soil to a height of about 20 cm to create a weir to prevent the soil from flowing out. We collected precipitation data every 5 min via a weather station in the Palau Community College Research and Development Station (about 100 m from the experimental fields; Figure 1). The condition of the fields was recorded using an automatic camera.

Analysis

We identified rainfall events that caused severe erosion (more than 3 mm/10 min) (Onaga, 1969) and compared the amount of eroded soil of each event.

The amount of eroded soil was predicted with the Universal Soil Loss Equation (USLE) equation (Wischmeier & Smith, 1978) by the following formula using Microsoft Excel (Changed the original formula to meters).

$$A = R K L S P C \text{ metric ton ha}^{-1} \text{ year}^{-1}$$

Where A = computed soil loss per unit area, R = the rainfall and runoff factor, K = the soil erodibility factor, LS = the topographic factor, C = the cover and management factor, and P = the support practice factor.

Storm soil losses from cultivated fields are directly proportional to a rainstorm parameter defined as the EI, and the A of each storm can be obtained using EI instead of the R.

$$E = 210 + 89 \log_{10} I \text{ 100 metric ton ha}^{-1}$$

I cm h⁻¹: maximum rainfall in 30 min multiplied to 60 min; rainfall less than 1.27 cm is omitted, and the maximum value is 7.62 cm.

Soil erosion in a rainfall event is the cumulative value.

$$R = EI/100 \text{ metric ton ha}^{-1}$$

For the United States of America, for convenience, the average annual rainfall intensity for the region is prepared as a

table. In the case of Palau, the frequency of rainfall is extremely high, so the integrated values during this test period are considered to be sufficiently accurate.

Finally, the above equation was parameterized for each rainfall event as follows.

$$A = EI K L S P C / 100 \text{ metric ton ha}^{-1}$$

K = 0.05 (USDA Natural Resources Conservation Service; estimated based on percentage of silt, sand, and organic matter and on soil structure and permeability)

$$LS = (10/20.0)^{0.5} \cdot (68.19 \sin^2 15.4^\circ + 4.75 \sin 15.4^\circ + 0.068) = 4.34$$

C = 1.0; Tillage

P = 1.00; vertical ridge

Plot area = 7 m²

When the survey area is less than 10 m², the erosion rate is almost constant, but when the survey area exceeds 10 m², the erosion rate decreases linearly as the area increased (García-Ruiz *et al.*, 2015). Accordingly, this experiment may overestimate soil erosion.

Results

Precipitation

The field site received regular rainfall, with total precipitation of 992 mm during the experimental period, from 17 April to July 15 (Figure 5). The field had 46 days of erosive rainfall more than 3 mm per 10 min (Figure 6). The rainfall threshold where surface runoff occurs is 2–3 mm per 10 min on a 15° slope, although these values vary according to different soil characteristics (Onaga, 1969). Highly erosive rainfall events occurred on day 7 after planting (May 2). The following weeding, an erosive period, a heavy rainfall event of 17 mm per 10 min occurred on the next day after weeding occurred. The second weeding was conducted after seven days of intensive rainfall, with a further erosive rainfall event of 7 mm per 10 min that occurred after weeding took place. Thus, the rainfall conditions during the experimental period were expected to result in severe soil erosion.

Figure 5. Daily precipitation.

Soil loss prediction by USLE

The 24 rainfall events potentially caused erosion during the observation period (Table 2). The soil loss prediction for bare land conditions by USLE was 0.57 kg per plot on day 7 (the first rainfall event after transplanting) and 2.82 kg (after the first weeding).

Soil erosion

Despite the severe rainfall conditions, none of the plots had any erosion at all through the experimental period (Figure 7).

Vegetation coverage

Most of the soil surface was bare by day 14 (May 1). Small weeds covered the soil surface by on day 21 (May 8), the day of the first weeding. The vegetation coverage by visual inspection ranged from 15%–85% on day 54 (Jun 10), after the second weeding. The vegetation coverage was 100% by day 89 (July 15) (Figure 8).

Discussion and conclusion

We conducted an experiment to evaluate the effect of root mass on erosion reduction under tillage conditions. The experiment

Figure 6. Erosive rainfall events. The blocks show a rainfall event of more than 3 mm/10 min and the amount of precipitation. The colors distinguish the events.

Table 2. Soil loss prediction by USLE for each rainfall event.

Date	Day	I cm h ⁻¹	E	EI	A t ha ⁻¹	Erosion kg plot ⁻¹	Remark
8-Apr	-9	1.76	232	4.08	0.89	0.62	(Before planting)
24-Apr	7	1.64	229	3.76	0.82	0.57	1st rain
26-Apr	9	1.36	222	3.02	0.65	0.46	
1-May	14	2.76	249	6.88	1.49	1.05	
2-May	15	2.84	250	7.11	1.54	1.08	
6-May	19	1.52	226	3.44	0.75	0.52	
9-May	22	1.68	230	3.86	0.84	0.59	
10-May	23	2.92	251	7.34	1.59	1.12	
12-May	25	3.52	259	9.10	1.98	1.38	
18-May	31	2.92	251	7.34	1.59	1.12	
24-May	37	6.56	283	18.55	4.02	2.82	After weeding
2-Jun	46	1.56	227	3.54	0.77	0.54	
3-Jun	47	2.68	248	6.65	1.44	1.01	
5-Jun	49	2.68	248	6.65	1.44	1.01	
8-Jun	52	0.76	199	1.52	0.33	0.23	After weeding
8-Jun	52	2	237	4.74	1.03	0.72	
17-Jun	61	1.72	231	3.97	0.86	0.60	

Date	Day	I cm h ⁻¹	E	EI	A t ha ⁻¹	Erosion kg plot ⁻¹	Remark
21-Jun	65	1.12	214	2.40	0.52	0.36	
27-Jun	71	1.96	236	4.63	1.00	0.70	
29-Jun	73	1.6	228	3.65	0.79	0.55	
2-Jul	76	1.04	212	2.20	0.48	0.33	
10-Jul	84	5.36	275	14.73	3.20	2.24	
13-Jul	87	2.44	244	5.97	1.29	0.91	
14-Jul	88	4.32	267	11.52	2.50	1.75	
15-Jul	89	2.44	244	5.97	1.29	0.91	(End of observation)
19-Jul	93	1.96	236	4.63	1.00	0.70	
19-Jul	93	2.36	243	5.74	1.25	0.87	
25-Jul	99	3.04	253	7.69	1.67	1.17	
26-Jul	100	2	237	4.74	1.03	0.72	
27-Jul	101	5.4	275	14.86	3.22	2.26	
28-Jul	102	4.28	266	11.39	2.47	1.73	
30-Jul	104	1.4	223	3.12	0.68	0.47	
Sum of observation period (Day 7 to 89)					32.23	22.56

Figure 7. Zero erosion of the first rainfall event after transplanting. The predicted erosion was 0.57 kg per plot; however, the actual erosion was 0 kg in all plots.

Figure 8. Vegetation coverage. Top panel: day 14, Upper middle panel: day 21 (before the first weeding), Lower middle panel: day 54 (after second weeding), Bottom panel day 89.

was conducted under erosion-promoting conditions: a slope of about 15°, vertical ridges, and prior placement of weed control fabric (which is expected to erase the effect of root mass in preventing soil erosion). Many intense rainfall events occurred during the experimental period, and 32 metric ton ha⁻¹ of soil erosion was predicted. Nevertheless, no soil erosion occurred. Those fields have high soil erosion tolerance and tillable. The use of mulching material expected to erase the effect of root mass of weeds for preventing soil erosion; however, our results show still the use of mulching material is available. Interestingly, soil erosion occurred in another trial conducted in an adjacent plot. They used horizontal rows. We assumed the erosion caused by catch canals. Catch canals of the horizontal ridge are highly erosive (Shima *et al.*, 1991) but vertical ridge has no catch canals.

Precipitation of 992 mm during the three months of the experimental period was large and they included 46 days of

erosive rainfalls. The conditions were comparable enough to the average annual conditions of the US; therefore, the conditions were appropriate to apply the USLE equation. What is the reason for the no erosion under the condition of the large prediction and the measured eroded soil. For the parameters of the USLE equation in this study, only the K factor was not measured (cited from a USDA report). Namely, the K factor was larger than the actual value.

The estimates of K factors are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability (USDA Natural Resources Conservation Service in 2009). Many calculation methods have been proposed for K factor such as Revised Universal Soil Loss Equation (RUSLE2), Erosion Productivity Impact Calculator (EPIC), and Geometric Mean Diameter based (Dg) model; however, the versatility of USLE for some soils are higher than that of the new method (Wang *et al.*, 2016). Thus, there is a large room to

find suitable land for agriculture from the area of specified unsuitable for agriculture. Not erosion itself, but a related story, the use of USLE to predict sediment yields is not advisable despite their present widespread application (Boomer *et al.*, 2008).

Low erosion land for agriculture can be found by measuring erosion locally. Our results obtained from a limited field, still, this information is important for Palau's agricultural

development, and the results of this test can be regarded as an example.

Data availability

Underlying data

Figshare: Precipitation of Palau, <https://doi.org/10.6084/m9.figshare.11769909.v1> (Oda *et al.*, 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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Open Peer Review

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Version 3

Reviewer Report 15 December 2021

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Nor Rohaizah Jamil

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1. Please remove all the personal pronouns such as "we" in the text to make it scientifically and academically-sound paper rather than of popular writing articles. Use active or passive statement (whichever is deemed more appropriate) instead.

2. Some figures are combine-able such as Fig. 5 and 6. Suggest to consider combining them to optimize data visualisation and interpretation.

3. Suggest to standardize the unit of precipitation in text, figures and tables.

4. Suggested to add north arrow in the supporting figures (eg: study plot map) to enrich the information of the section.

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

Yes

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

Yes

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

Partly

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

Yes

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

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Ecohydrology, environmental flow, land use and soil erosion. I am also a certified professional for soil erosion and sediment control (CPESC).

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 28 Dec 2021

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

We would like to express our sincere gratitude for your review of our manuscript.

1. Removing all personal pronouns.

- All the Methods and the Result expressions were fixed. However, some sentences in the other sections have not been changed because they were considered appropriate (for example, for avoiding long subjects).

2. Combine-able figures.

- A part of illustration in Figure 1 was replaced with Figures.
- The illustration combined with Figures 4.
- Figure 5 was combined with Figure 6.

3. Standardize the unit of precipitation.

- The "cm" in the Methods and Analysis are citations, so we left them as they are. Using "mm" has a problem of accuracy. We added a footnote to Table 2.

4. Adding north arrow in the supporting figures (eg: study plot map).

- We added that to Figure 1.

5. Additional revise

- We found mistakes in the number of erosive rainfall events in the results section and the discussion section, and corrected them from 46 to 24.
- In addition, minor grammar corrections have been made.

Competing Interests: No competing interests were disclosed.

Reviewer Report 06 May 2021

<https://doi.org/10.5256/f1000research.27523.r83162>

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Kebede Wolka

Wondo Genet College of Forestry and Natural Resource, Hawassa University, Shashemene, Ethiopia

The research attempted to show the K-factor of the universal soil equation in Palau. In the study design, a small plot of about 20m² used to collect the eroded material, which the study reported no erosion despite a reasonable amount of rainfall. The study is conducted in areas where crop growth is less common. The research approach is good to show erosion under specific conditions. Like many other researches, it has shortcomings, specified below:

1. Method of calculation for USLE has not been mentioned clearly.
2. The study reported that the K-factor overestimated the soil loss in USLE. However, there are options to consider K-factor for different soil. The options followed to use K-factor has not been mentioned, which might be inappropriate that led to far overestimating result.
3. The plot considered in the experiment seems smaller.
4. Results of the study has not been discussed sufficiently and fully.
5. In most cases, the USLE is meant to estimate soil loss at annual base. The author estimated the soil loss for every rainfall event. How reliable is this method?
6. The paper has a few editing problems.

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?

Partly

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

No

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

Not applicable

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

Partly

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Erosion and soil and water conservation

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 17 Jun 2021

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

Thank you for reviewing our manuscript. We have dealt with the matters you pointed out as follows. Please check the revised manuscript.

1. *Method of calculation for USLE has not been mentioned clearly.*

A) We made the method citation more faithful and detailed. We also clarified that the rainfall intensity was calculated according to the definition. Relatedly, we corrected the symbols in the formula.

2. *The study reported that the K-factor overestimated the soil loss in USLE. However, there are options to consider the K-factor for different soil. The options followed to use K-factor have not been mentioned, which might be inappropriate that led to far overestimating the result.*

A) In the abstract, methods, and discussion sections, we referred to that the K-factor was estimated based on soil texture and permeability.

3. *The plot considered in the experiment seems smaller.*

A) When the survey area is less than 10 m², the erosion rate is almost constant, but when the survey area exceeds 10 m², the erosion rate decreases linearly as the area increased. Accordingly, this experiment may overestimate soil erosion. We quoted the literature in the method section.

4. *Results of the study has not been discussed sufficiently and fully.*

A) The flow of discussion has been improved as follows. 1) Summarizing the results of the experiment, 2) Considering that the experiment meets the conditions for applying the USLE prediction formula, 3) Pointing out the gap between the predicted value and the measured value, and that the gap is derived from K-factor, 4) Showing that various improvement proposals have been shown for K factor, but there are cases where the original is more accurate depending on the soil, and the definitive calculation method has not been determined. 5) As a result of the above, there is a good possibility of finding

suitable land in an unsuitable land for agriculture in Palau, and the results of this test can be regarded as an example.

5. *In most cases, the USLE is meant to estimate soil loss at annual base. The author estimated the soil loss for every rainfall event. How reliable is this method?*

A) Clarified in the method section that the calculation is based on the USLE forecast formula. We also mentioned in the discussion that the number of events is considered to be large enough.

Competing Interests: None

Version 1

Reviewer Report 30 April 2020

<https://doi.org/10.5256/f1000research.24517.r61753>

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Kathleen B. Boomer

¹ Foundation for Food and Agriculture Research, Washington, DC, USA

² CBP Scientific Technical Advisory Committee, Washington, DC, USA

Technical Review: Use of the K factor from the Universal Soil Loss Equation can show arable land in Palau by Oda *et al.*

General Comments:

The investigators report the results of measured and estimated soil erosion in the Micronesia region of the western Pacific Ocean. To compare how plantings and micro-tilling affects soil detachment and transport to field edges, they established eight plots within a single field, following as closely as possible (presumably) the original protocol of the USLE. Although the title indicates a focus on soil erodibility (K), the study design is more relevant to understanding practice effects on erosion. Given the importance of subsistence agriculture and the lack of studies specific to promoting sustainable practices in this region, this work calls attention to a critical information gap.

The manuscript requires extensive revisions to clarify and substantiate its contributions. It lacks a "story arc" that enables the reader to readily understand why this work is important, how the researchers tackled this knowledge gap, and how their results compare or contribute to the

existing body of research. For example, the authors might consider highlighting the importance of subsistence farming to the region and the challenge of soil erosion to sustainable agriculture, but the lack of technical guidance specific to the region. The USLE, which is based on a phenomenal US dataset, is a widely accepted tool to evaluate erosion potential based on landscape setting and management, but the empirical model ideally requires local testing and refinements for application to areas outside of its original US study area. The research objectives and methods also require clarification. Finally, the limited number of plots (8) and fields (1) raises concerns about the power of the study to detect differences among field practices. Given the difficulty and expense of field studies and the realities of scant data, however, the publication may be valuable.

Specific Comments:

- A large portion of the introduction includes study site information, which should go in the Methods section.
- Use the international the international system for classification of soils to describe site conditions.
- Define “T factor”.
- In the site description, add information about the landscape setting, outside of the study site boundaries. A study site topographic map would be helpful. Information about the distribution of croplands on the study island, as well as a brief description of how the island compares to others in the region, would be helpful to thinking about the value of information beyond the study site.
- In the methods section, add a paragraph describing how and where rainfall data were collected. Include this location on the study area map.
- It is not clear how tilling, even if by hand, does not mix soils.
- Elaborate on how soil erosion was measured. Reference methods to the extent possible.
- Elaborate on USLE application and parameterization. Use previous publications as examples.
- In the “Estimated erosion” section, define “That” in the last sentence on page 3.
- Consolidate Figure 6 into one panel.
- In the Discussion and Conclusions section, paragraph 1, reference to site conditions seem contradictory: “experiment was under sever conditions, with a slope of ... 15°” vs “risk of soil erosion was low for the experimental soil”.
- Convert Table 2 to graphical form. For example, plot A vs EI, observed vs predicted, grouped by practice.
- The pictures are difficult to interpret.

- The discussion needs to follow the same “story arc” presented in the introduction and used to organize the methods and results sections. The discussion also needs to compare the study results with the existing body of literature to assess whether findings to reinforce or challenge existing paradigms. The authors also need to acknowledge the limitations of their study design and ideally, discuss the relevance of their findings to management recommendations.

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?

Partly

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?

Partly

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Hydrology, soil biogeochemistry, and watershed modeling

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 May 2020

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

Thank you for the constructive comments.

We will accept almost of all the comments; however, before submitting a revised manuscript, may I clarify the following points?

1) Consolidate Figure 6 into one panel.

Is that mean combine Figure 6 and Figure 5?

2) Convert Table 2 to graphical form. For example, plot A vs EI, observed vs predicted,

grouped by practice.

This is less effective because the practical data were all zero.

Competing Interests: No competing interests were disclosed.

Author Response 02 Jun 2020

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

Define "T factor".

Now, I understood that I misunderstood the meaning of the "T factor".

Thank you so much.

Competing Interests: No competing interests were disclosed.

Author Response 19 Jun 2020

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

Clarified the "story arc" of the paper including the lack of technical guidance specific to the region, the research objectives, and methods.

1. The description of Palau was moved to the Methods section.
2. The international classification of soils was added.
3. Define of the "T factor" was corrected.
4. A Google map link was added as an alternative of the topographic map
5. The information on the experimental field was added.
6. The distance of the weather station was added.
7. The link of a picture of the hand tractor is added.
8. The method of collecting eroded soil was clarified more.
9. The application and parameterization of USLE were clarified more.
10. "That" in the last sentence on page 3 was clarified.
11. We couldn't understand the meaning of "Consolidate Figure 6 into one panel".
12. We improved the readability. The first paragraph pointed out a contradiction and interpreted that in the second and the third paragraph.
13. No erosion was observed so the changing Table 2 to graphical form is ineffective.
14. We corrected estimated → predicted, actual was zero.
15. The discussion section was improved.

Competing Interests: No competing interests were disclosed.

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