

Interactive comment on “Effects of land use changes on kinetics of potassium release in sweetpotato garden soils of the highlands, Papua New Guinea” by B. K. Rajashekhar Rao

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Final Author Response on “Effects of land use changes on kinetics of potassium release in sweetpotato garden soils of the highlands, Papua New Guinea“

Referee # 1: Prof. A Jordan

Comments from referee: I have read this manuscript carefully and with great interest, and I confess that I liked it very much. I have no objections to the experimental design and discussion of results. The manuscript falls within the scope of SE and publication is highly recommended. Author’s Response: Author thankfully acknowledges the kind & encouraging words of the referee. Comments from referee: I just think there is a

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little problem. Sometimes it seems that the authors only focus on the analyzed soils of PNG, but this work is valid globally. Especially, when the release of potassium is related to the different compartments of the exchange complex, results cannot be locally limited. Therefore, the authors recommend that give it another go to the document, emphasizing the relevance of the results, not only local implications in highlands of PNG. I strongly recommend changing the title to something similar to this: “Kinetics of potassium release in sweet potato-cropped soils. A case study in the highlands of Papua New Guinea”. Author’s Response: I agree with the opinion. Author’s changes to manuscript: Title is now changed as suggested and few sentences added now to the introduction part to depict a wider global perspective.

Comments from referee: I am not an English-native speaker, but “farm” sounds better than “garden” to me. Gardening refers to outdoor enjoyment with a particular design of planting and management, not food production. Author’s Response: I agree with the opinion. I chose to use the term ‘garden’ since in several literature the term ‘garden’ was used to refer the area under traditional/subsistence agricultural activities in PNG. Author’s changes to manuscript: Throughout the manuscript ‘farm’ replaces the ‘garden’.

Comments from referee: The difference between “old” and “new” gardens is not clear. It looks like you are talking about traditional/innovative management or simply before and after a certain date. I suppose, “new” means “after land use change”, but during how much time? Not clear. Concerning the abstract, I have found only a small problem. The objective of this research and a general overview of the necessity of studying K dynamics in the area are well depicted in the introduction. In contrast, the abstract does not refer to this (although general results and conclusions are well described). I suggest including some lines at the beginning focusing the problem and describing the objectives. Author’s Response: These terms are described very briefly in the manuscript. Kindly refer to page 2847 line 11. ‘New’ means the farms /gardens area which are ready to go for cropping after a following period. ‘Old’ gardens are

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those which have been cropped for several years and are due to go for fallowing. It is a very genuine concern about the abstract. Author's changes to manuscript: A remark on time (number of years) would be added to the revised manuscript. Also few lines added to abstract to reflect objectives/problem statement.

Comments from referee: My recommendation is "minor revision", as I do not find great problems in the manuscript. I have uploaded a doc with detailed comments. Congratulations to the authors. Author's Response: Thanks.

Detailed comments: Comments from referee: Page 2844 Line 5: It looks like 569 h was the only period for extraction, instead of sequential extraction at different periods between 1 and 569 h. Please, re-word this sentence. Author's Response: Agreed. Author's changes to manuscript: Sentence re-worded.

Comments from referee: Page 2845 Line 18: Re-write: "the Highland provinces of PNG (Southern. . .". Line 22: What do you mean with "old" and "new" gardens? Please, explain. So, the reader will not have to access the cited references. Author's Response: Agreed. Author's changes to manuscript: Sentence rewritten and information on old and new gardens added.

Comments from referee: Page 2846 Line 5: "How well it is replenished. . .": I suppose this is in absence of fertilization. Author's Response: Yes. Author's changes to manuscript: . . . 'in absence of fertilization'. . . inserted to the existing sentence to clarify.

Comments from referee: Page 2846 Line 15 Re-write: "kinetics have been". Author's Response: Agreed. Author's changes to manuscript: Rewritten.

Comments from referee :Page 2847 First paragraph: Please, add the classification system used for soil type. I suggest this citation: Soil Survey Staff. Keys to Soil Taxonomy, 12th ed. USDA-Natural Resources Conservation Service. Washington, DC. 2014. It is available at <http://www.nrcs.usda.gov/wps/portal/>

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[nrcs/detail/soils/survey/class/?cid=nrcs142p2_053580](http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/class/?cid=nrcs142p2_053580) Author's Response: Agreed. Author's changes to manuscript: Citation and reference added.

Comments from referee: Page 2847 Line 4: Commonly, readers outside PNG do not know much about lithological variability in the country. Add the main types (might be only the major groups) of volcanic (acid/basic lavas, basalts, sedimentary volcanic rocks. . .) and non-volcanic parent materials of your soils, which may be very different and relevant for this research. If possible, add this information to Table 1, instead of just volcanic/non-volcanic. Author's Response: Yes. Author's changes to manuscript: A line of explanation and a citation briefing the lithological variability in PNG added.

Comments from referee: Page 2847 Line 16: Please, specify why did you select these sampling depth. Are 0-10 and 10-20 cm layers related with any soil characteristic or soil root? Is soil depth limited by consolidated rock? The only information in table 1 is surface/sub-surface. Author's Response: The surface soil represented 'top soil' from which most of the plant nutrients could be obtained by crops and also maximum accumulation of organic matter could be seen. Soil profiles were not taken and sample collection was limited to two depths- 0-10 cm and 10-20 cm. There was no hard layers or consolidated rock. Author's changes to manuscript: No changes made.

Comments from referee: Page 2847 Line 16: The assessment of organic C by dry combustion may vary between simple combustion in furnace and collection of CO₂ (e.g. Tiessen and Moir, 1993) and neutron scattering (Wielopolski et al., 2000). Please, explain your method briefly or add a reference. Author's Response: Agreed. Author's changes to manuscript: A reference is added (Nelson and Sommers, 1996).

Comments from referee: Page 2847 Lines 23-24: Re-write: "was conducted, according to Jalali (2005)". Author's Response: Acceptable. Author's changes to manuscript: Rewritten.

Comments from referee: Page 2847 Lines 25-26: What periods? Author's Response: Yes. This part is unclear. Author's changes to manuscript:'periods ranging from' . . .

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deleted.

Comments from referee: Page 2849 Line 10: For homogeneous style, substitute “carbon” with “C”. Author’s Response: Agreed. Author’s changes to manuscript: Substituted ‘C’ for ‘carbon’.

Comments from referee: Page 2849 Line 14-19: I suggest including here the intervals. If not, it is necessary to access the references to know what do you mean with “low”, “medium” or “high” category. Author’s Response: Agreed. Author’s changes to manuscript: Value intervals provided. About 76% of the samples were ‘low’ (non-exchangeable K contents < 300 mg kg⁻¹) in non exchangeable K supply, while 20% samples were ‘medium’ (300-600 mg kg⁻¹) and only 4% samples were in ‘high’ (> 600 mg kg⁻¹) category. About 40% samples were ‘low’ in plant available K (exchangeable K content below 50 mg kg⁻¹), 40% samples were ‘medium’ (K content of 50-125 mg kg⁻¹) and only 20% samples were ‘high’ (K content > 125 mg kg⁻¹) in exchangeable K contents.

Comments from referee: Page 2850 Line 5: Re-write: “patterns”. Author’s Response: Agreed. Author’s changes to manuscript: Re-written as suggested.

Comments from referee: Page 2850 Line 24: Please, add a reference for this statement Author’s Response: This part is supported by Hartemink (2004). Author’s changes to manuscript: (Hartemink, 2004) is relocated to this statement from the later sentence.

Comments from referee: Figures 1 and 5: Why not color? In fig. 1, color has been added only to external line in the diamond series. I strongly recommend using color symbol ls, not a W/B graph. Substitute “t (h)” with “Time (h)”. One tip: It seems that the images have been elongated in the vertical direction, deforming letters, numbers and symbols. Just a comment: have you tried representing extraction periods in the X-axis (in a natural time scale) of fig. 1, instead of 100 h steps? Author’s Response: Yes. Care is taken now to avoid distortion as much as possible. Author’s changes to manuscript: All figures re-drawn in color, avoiding distortion. “t (h)” is substituted with

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“Time (h)” in Figure 1.

Comments from referee: Figures 2, 3 and 4: Color? P values (<0.05) in all cases may be moved to the caption. So, the figures looks cleaner. Author’s Response: Agreed. Author’s changes to manuscript: All figures re-drawn in color and P values (<0.05) moved to figure captions.

Comments from referee: Figure 4: Re-write: “Error bars indicate standards errors for...”. Author’s Response: Agreed. Author’s changes to manuscript: Re-written as suggested.

Anonymous Referee #2 Comments from referee: General comments: The paper submitted by Rao is interesting and it is under the scope of Solid Earth. I think it is a very good contribution. The paper is short, but very well organized, the results well discussed and the synthesised in the conclusions. Despite this there are few questions that need to be clarified. In the introduction, some background is missing regarding studies outside of PNG. This will put the study in a wider context. Other important question is the criteria for “new” and old “gardens” definition, as the low, medium and high K exchangeability. Overall I recommend a minor revision. Below I send some minor comments. Author’s Response: Thanks to the anonymous referee for the positive comments. Author will make every effort to clarify and update the missing information. Author’s changes to manuscript: Few lines on studies outside PNG regarding K release kinetics / K mining have been added in introduction as suggested. Also explanation on new/old farms (gardens) and also low/medium/high categorization added to the manuscript.

Comments from referee: Abstract Line 1: Change “K”, by “Potassium (K)” Line 2: Change “garden” by “Farm”. Please do it here and everywhere. Author’s Response: Accepted. Author’s changes to manuscript: Changes are done according to suggestion.

Comments from referee: Introduction Page 3 Line 23: Change “K”, by “Potassium”

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Author's Response: Agreed. Author's changes to manuscript: Change made as suggested.

Comments from referee: Page 4 Line 21: Change "Potassium", by "K" Author's Response: Fixed. Author's changes to manuscript: Change made as suggested.

Comments from referee: Materials and methods Page 5 Line 3-4: Can you provide the name of the four regions. Is it possible to write in the table 1 the region where the soils were collected? Line 5-6: Please describe the values for optimum to very deficient available K status. Line 7-11: Please provide the reference to the classification of these soils Line 17: Change "Total C" by "Total Carbon (C)". Author's Response: Agreed. Author's changes to manuscript: Information on 4 provincial regions added in text and in Table 1. Also values are now provided for deficient and optimum available K levels. A reference on classification system followed included. Changes to "Total C" made as suggested.

Comments from referee: Page 6 Line 25: Where the data normality and homoscedasticity evaluated previous to statistical analysis? Please explain. Author's Response: Yes. A normality test (Anderson-Darling test) was performed to the data sets on physico- chemical soil properties, K forms and K extracted. Author's changes to manuscript: No changes made.

Comments from referee: Page 7: Line 2: At which level differences were considered significantly different? At $p < 0.05$? If yes please write it. "Statistix" or "Statistica"? Please clarify. Author's Response: Yes. At $p < 0.05$ level differences were considered significantly different. The software used was "Statistix 8". Regrettably, there was a spelling error that caused the confusion. Author's changes to manuscript: Information on probability level added and spelling error rectified.

Comments from referee: Results and Discussion Line 7-8: This information should be placed in the item "study location and sampling sites" Line 8-9: Delete "About 48% samples were from old gardens and 52% were from new gardens" Line 10 and 11:

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Change "Total carbon" by "Total C". Line 11: Is there some reason that could explain the high content in Total C? Line 15-19: Is it possible to know the available K according to soil group, depth, type/origin? What was the criterion for you to classify "low", "medium" and "high" exchangeable K? Author's Response: Agreed. High content in total C in these soils could be due to : 1) Low temperatures retarding mineralization/decomposition in cooler altitudinal places of highlands 2) Possible inhibition of mineralization by allophone and its derivatives 3) Formation of stable allophone-humus complexes resistant to decomposition. (Sillitoe, P, 2013. A place against time: Land and environment in the Papua New Guinea Highlands, Routledge 450p) Author's changes to manuscript: "About 48% samples were from old gardens and 52% were from new gardens" is deleted. Line 7-8 is placed under materials and methods as suggested. Total 'carbon' modified according to the suggestion. Criterion on K classification furnished in the revised version.

Comments from referee: Page 8: Line 14: Change "greater K" by "greater cumulative K released". Author's Response: Acceptable. Author's changes to manuscript: Changes made to 'greater K'

Comments from referee: Page 10: Line 4: Change "K+ release" by "K release" Line 6: Change "K" by "Potassium" Author's Response: Agreed. Author's changes to manuscript: Both suggested changes acted.

Comments from referee: Figures: Use colours in the figures it will be easy for the reader to understand it. Author's Response: Agreed. Author's changes to manuscript: In the revised version of manuscript, all figures redrawn in colour.

Interactive comment on Solid Earth Discuss., 6, 2843, 2014.

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