

Interactive comment on “Elemental Composition, Leachability Assessment and Spatial Variability Analysis of Surface Soils in the Mugan Plain in the Republic of Azerbaijan” by Junho Han et al.

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Reviewer #1

C1-1) This manuscript reports the elemental composition and heavy metal content of 532 surface soils from the Mugan Plain in Azerbaijan. As recognized by the authors at the end of the text, “This study only provides fragmented information on the spatially resolved elemental concentration and leachability of surface soils in Mugan, and several assumptions and estimations were applied due to insufficient analytical resources and expertise...” I appreciate the effort and recognize the value of the data reported in this manuscript. These data are appropriate for a technical national report, but unfortu-

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nately. I cannot recommend this manuscript for publication in an international scientific journal like SOILS, since it fails to provide any new scientific insight into the soil system.

R1-1) We appreciate the reviewer’s valuable comments and helpful criticism of the manuscript, and we agreed that the initial manuscript was not sufficient to publish in the SOILS journal. After extensive and comprehensive revision based on the valuable comments from the reviewer, we improved the quality of the manuscript to provide new scientific insight for the Azerbaijani soils. Therefore, we revised the manuscript thoroughly. For examples, environmental risk assessment using two indexes were conducted, and new soil guideline value was scientifically proposed, and all figures and tables were reconstructed.

C1-2) L. 28. Define the abbreviations XRF and ICP-OES.

R1-2) We appreciate the reviewer’s appropriate comment. We defined the XRF and ICP-OES in the abstract and the introduction where they appear first.

C1-3) L. 32. What is the database for world soils?

R1-3) We appreciate the comment for the reference. We listed the reference of the database (line 291) and caption of table 1 (line 686).

C1-4) L. 35. Why these two were the most concerning elements?

R1-4) We agreed that there are no criteria to identify the most concerning elements. For that reason, we employed the geoaccumulation index and potentially ecological risk index for the identification. Based on the geoaccumulation index, the Ni was identified as moderately contaminated heavy metals while the Cr and Pb showed slightly contaminated heavy metals. Based on the toxicity data by potentially ecological risk index, the As was also possible toxic heavy metals.

C1-5) L. 43. How and why can this work help solve agriculture problems? No new insights or remediation strategies are provided.

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R1-5) We appreciate the critical comments from the reviewer. As the reviewer stated, this manuscript addresses and deals with the current Azerbaijan soil situations to diagnose and identify the agricultural problems of Azerbaijani soils. Before solving pending problems, we believe that it is essential to analyze and report the current situations by applying appropriate methods, and this manuscript serves as the starting point of understanding Azerbaijani soils and their remediation when and where necessary. For developed countries, it is easy to measure soil properties and analyze the data for developing solutions, but it is almost impossible in developing and underdeveloped countries. For that reason, this manuscript aims to diagnose and report the current problems of Azerbaijani soils using state-of-the-art appropriate methods. After continuous monitoring of the properties of soil samples in Azerbaijani soils, we believe this manuscript provides insight into appropriate remediation strategies. C1-7) L. 100. This study is focused only on an area of Azerbaijan.

R1-7) We appreciate the reviewer's comments. It is correct that this study is only focused on the Mugan plain not on entire Azerbaijan. For that reason, the expression of "Azerbaijani soils" was accordingly changed to agricultural soils of Azerbaijan. The reason for this change is that the sampling area was 1,778 km² while the national area was 86,600 km²; thus, only 2.05 % was included in this study. However, if we consider that 75.3 % of Azerbaijan land is mountainous, the Mugan plain covers the most important plain area for agricultural productivity.

C1-8) L. 100-101. What kind of evaluation?

R1-8) We agree that the sentence was not clear enough to present the objective of this study. The sentence was removed because the evaluation of the result between XRF and ICP-OES was not listed in the objectives.

C1-9) L. 102. How can binding mechanisms in soils be estimated just from leachates?

R1-9) We agree that the sentence was not appropriate to explain the objective of this study. The sentence was removed because the initial 5 objectives were reduced to 3

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objectives based on the comments from reviewer #2. In the manuscript, the sentences with binding mechanism were removed.

C1-10) L. 110. Is this the area of Azerbaijan or on the Mugan Plain sampled? Please clarify.

R1-10) We apologize for the insufficient description of the clarification of the study area. We modified the sentences as "All surface soil samples were collected from the Mugan Plain in Azerbaijan. The Mugan plain is geographically a part of the biggest lowland of the Caucasus region, Kur-Aras lowland. It is originally a large plain located in the southern part of Azerbaijan and the northern part of Iran (Fig. 1). Its main area is located within Azerbaijan (approximately 5,000 km²). The study area was located in the middle of four cities (Saati, Salyan, Bilasuvar and Imishli), and the perimeter and study area were 174 km and 1,760 km², respectively." (Line 107-111).

C1-11) L. 116. Which was the sampling plan then?

R1-11) We appreciate the appropriate comment on the manuscript, and the sentence was changed to "The grid sampling method was originally planned, but incomplete grid sampling was applied due to access limitations to private land, insufficient time and resources." (Line 119-121).

C1-12) L. 117. 532 or 632? L. 119. I suggest changing to "presence of crops".

R1-12) We appreciate the valuable suggestion on the manuscript. The presence of vegetation was corrected as the presence of crops as suggested (Lines 224, 242 and 446).

C1-13) L. 120. Were all non-agricultural soils salt-affected soils?

R1-13) It is a critical question and we appreciate the valuable question to improve our manuscript. Based on the salinity classification, all samples of salt-affected soils were not classified as sodic, saline or sodic-saline soils; thus, the salt-affected soils were changed to abandoned soils. We greatly appreciate the important comments on this

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matter.

C1-14) L. 126. What reference text? Why is this relevant for this study?

R1-14) We completely agree with the reviewer's comment. The sentence was not relevant for this study; thus, it was removed.

C1-15) L. 145. Which were the criteria to select these samples from the original set?

R1-15) We appreciate the appropriate comment on the criteria for selecting samples. Random sampling was applied for the criteria to select samples, and it was listed in the manuscript (Line 149).

C1-16) L. 172. The text "All measured data were arranged in CSV format" is not necessary.

R1-16) We appreciate the appropriate comment and the sentence was deleted as suggested.

C1-17) L. 187. Aren't salt soils classified based on EC? This information may be redundant.

R1-17) We appreciate the valuable comment of reviewers. The previous salt-affected soils were classified as the presence of crop, not the EC; thus, we changed the salt-affected soils to abandoned soils in R1-13 above. For that reason, the EC value is essential to describe the soil properties.

C1-18) L. 188. Agricultural soils should be cropped soil by definition. In other words, the presence of vegetation is because land-use decisions, so what information does the correlation between the presence of vegetation and salt concentration provide? Please clarify this sentence.

R1-18) We appreciate the critical comment on the manuscript. As mentioned in R1-13 and R1-17 above, the previous soil classification as agricultural and salt-affected soils was not appropriate, because the agricultural soil is by land-use decision while

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the salt-affected soil is the characteristics of soil chemical properties. For that reason, we changed the salt-affected soil as abandoned soil to match the concept of classification. The sentence was changed as "The Ab soils showed higher pH and EC values than the Ag soils, which implies that the presence of crop is highly correlated with salt concentration, and it was reasonable to presume that the land use decision was mainly attributed by the salt concentration."

C1-19) L. 189-191. These data should be reported only in tables or figures, not in the text.

R1-19) We completely agree with the reviewer's suggestion, and all sentences reporting values from the tables were removed.

C1-20) L. 195-196. "Cl and S could be the reason for the presence of vegetation"? The intended meaning here needs to be clarified.

R1-20) There was no enough description on the ratio of abandoned soils and agricultural soils. We deleted all paragraph and re-wrote the paragraph again as "Based on the history of soil in the Mugan plain, the alluvial deposition and uplift of marine sediment were the major mechanism for the soil formation, and it was reasonable to presume that the Ca, Mg, S and Cl elements were mainly attributed by the soil formation (Feyziyev et al., 2016; Oglu, 2018). The concentration of heavy metals was comprehensively discussed in the next section below. The heavy metals of As, Cr, Cu, Ni and Pb were higher than the median values of world soils while Cd and Zn were not significantly differed." (Lines 231-237).

C1-21) L. 200-211. There must be many studies in the literature comparing XRF and ICP. Do the present results differ from previous studies in the literature?

R1-21) We agree that there was no sufficient explanation of the result between the XRF and ICP-OES. For that reason, we completely re-wrote the section 3.2 with previous studies (Lines 244-285).

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C1-22) L. 212. What “white circles”?

R1-22) We apologize for the misuse of the word in the manuscript. We deleted the sentence.

C1-23) L. 225. What is reliability of estimating crystal mineral composition from this correlation matrix versus XRD?

R1-23) We agree that there is no sufficient reliability for presuming crystal mineral composition from the correlation matrix; thus, we moved the paragraph to supporting information as “Correlation among the elemental concentration to presume possible minerals in Azerbaijani soils.”

C1-24) L. 226-228. This kind of information is not needed in a journal article. Focus on what you did.

R1-24) We completely agree that the information was not appropriate for the journal articles. We deleted the section as suggested, and we deleted all unnecessary information to improve the readability and comprehensibility of the manuscript.

C1-25) L. 296-300, 304-306. . . . These data should be reported only in tables or figures, not in the text.

R1-25) We completely agree with the reviewer’s suggestion, and all sentences were deleted.

C1-26) L. 329-331. Again focus on what you did. This text suggests that the manuscript does not contain “the data required to interpret soil properties.”

R1-26) We completely agree with the reviewer’s suggestion, and the sentence was deleted and the paragraph was re-written.

C1-27) L. 404. Why are these guidelines appropriate and better than others?

R1-27) We appreciate the critical comment from the reviewer and there is no sufficient

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interpretation to describe the guidelines. For that reason, we developed the soil guideline values and compared the result with other guideline values from 7 countries, such as Canada, Czech Republic, Denmark, Georgia, New Zealand, South Korea and the USA (Table 2 and S4).

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