

Review of 'Grain size modulates volcanic ash retention on crop foliage and potential yield loss' Ligot, Bogaert, Biass, Guillaume, & Delmelle

This manuscript presents both an experimental methodology of determining the change in leaf area index (LAI) due to volcanic ashfall, as well as a quantification of the relationship between deposit grain size and foliar coverage for tomato and chilli pepper plants. This is of significant interest as we work towards improving our ability to quantify agricultural losses based on characteristics of the ashfall deposit that productive land is exposed to. As noted in the manuscript, these assessments rely primarily on ashfall thickness (and/or loading) despite increasing recognition that other ashfall properties also have significant influence on the impacts received.

The manuscript writing, structure, and figures are all of a high standard suitable for publication. There is a large amount of supplementary material referred to throughout the manuscript, some of this may be better displayed as in-text figures/tables.

However, it would benefit from some clarification on aspects of the methodology - particularly the timing and location of steps, and further justification of why certain actions were chosen. Additionally, the broader applications of this approach at a larger scale using remote sensing, and with varying ash deposit thicknesses and compositions is not clear. The use of this approach to inform mitigation strategies is also not explained, and it is not obvious how this work would add to or enhance current approaches to mitigation. Another limitation that needs acknowledging is the use of only one very thin ash thickness and the potential influence of leaf/plant orientation to prevailing winds and the volcano.

However, the methodology presented is novel and could be expanded upon to enhance our agricultural impact assessment capabilities. Therefore, I believe this manuscript should be accepted for publication in NHESS once minor to moderate revisions are undertaken.

Abstract

Line 15 and throughout: 'ash fall' is commonly one word 'ashfall'

Line 33: 'mean' should be 'means'

Introduction

Line 40: 'is' should be 'are'

Line 40: Define 'short-term'

Line 44: True in areas where cropping farming dominates (e.g., Indonesia) but not in other countries where pastoral farming of livestock dominates

Line 48: Also food security issues in areas where farming is subsistence

Line 63: Expand/give examples

Line 67: I think its fair to say that tropical and semi-arid areas are increasingly being considered

Line 72: Is there really no impact metric? Isn't thickness/loading used in this way currently? It's not perfect but it is still indicative of likely crop damage to some extent – as you use it to eliminate the possibility of structural damage later in the manuscript

Line 81: 'cm' to 'centimetres'

Line 84: Insert 'less severe' before 'disturbances'

Line 84: Change 'blankets' to 'deposits'
Line 85: Change 'km²' to 'square kilometres'
Line 85: Insert 'structural' before 'integrity'
Line 88: Is this always true? Reference? Wouldn't the depth of cover or leachable chemistry of the deposit sometimes be the mechanism of loss?
Lines 90-91: Evidence to support this point/reference needed

Materials and methods

Line 103: Rationale for choosing these two plant types needed
Line 108: Clarify that the experiments took place in Belgium
Line 112: Limitation that all plants the same age needs to be acknowledged. What height and leaf sizes?
Lines 119-128: What was the morphology of the particles in relation to natural ash deposits? No surface chemistry on synthetic ash material – does/does not influence ash retention and adherence?
Line 129: Only one very thin ash deposit thickness (~0.5 mm) tested. Ash thickness effect on retention not considered.
Line 131: Where is Fig. S1 in-text reference
Line 136: Did you immediately dose with ash after spraying?
Line 138: Were the plants moved between ashfall and photography? Or was the ash applied in the photography box?
Lines 138-156: How would this method scale up for use in a real-world situation? Needs to be included in discussion
Lines 161-164: Wouldn't this limitation apply to all measurements taken in this study? Any idea of the magnitude of this impact on the results? How is this accounted for?

Results

Line 173: How is leaf pubescence included in Fig. 1?
Line 176: Add 'significant' before 'effect'
Lines 183-184: Explain the points and boxplots in the caption
Line 201: Change 'that ash 63 µm in diameter' to 'that ash with a median of 63 µm in diameter'
Figure 2: Did leaf pubescence influence these curves? Was there enough data to quantify this?
Lines 219-220: Link this to the function of these parts of the leaves in the discussion
Figure 3: Could before photos be included too? The figure needs a scale

Discussion

Lines 233-236: Was this experimental or field data?
Line 243: Only true if considering a homogenous ash composition
Line 285: Is spraying the leaves with water an accurate representation of common humid environment?
Line 289: How does the density of the phonolite used compare to the density of other ash deposits?
Line 300: Change 'Recalling' to 'Considering'
Line 304 and elsewhere: Define the 'cm-thick deposit' threshold specifically
Line 317: How does the Q value for Belgium compare to Q values for more commonly volcanically active countries?
Line 320: Define 'harvest index'
Line 342: Evidence/reference that 'ash deposition on leaves neither halt plant growth nor production of new leaves...'

Lines 357-359: Why are these equal?

Figure 5: Show the same graphs for chilli pepper plants in this figure

Lines 379-381: Why were these distributions selected?

Line 405: Change 'in chilli pepper exposed' to 'and chilli pepper crops exposed'

Line 412: Change 'mean' to 'method'

Lines 414-419: More information on this is needed to demonstrate how the approach can be scaled up from a greenhouse set-up, please

Conclusions

Lines 489-492: It is unclear how this method and its results would add anything to existing mitigation efforts. Needs further explanation on the practical ways that this data could assist in an event