

## **Reviewer 2**

This study addresses the seasonal dynamics of molybdenum in apple leaves, with an emphasis on identifying the periods of greatest plant demand for this micronutrient over four years (2020 to 2023), using treatments with and without foliar fertilization. The issue is relevant because although the role of molybdenum is recognized in plant physiology, particularly in nitrogen assimilation and in the biosynthesis of phytohormones such as abscisic acid and auxin, its behavior in temperate fruit trees is still poorly understood. The article has merit for generating longitudinal data and proposing practical recommendations for nutritional management based on empirical evidence. However, some weaknesses limit the clarity and impact of the study, mainly in the style of scientific writing, logical structuring of ideas, and methodological precision.

**RESPONSE:** we appreciate the careful analysis and positive evaluation of our manuscript by the reviewer. Please see below our detailed responses to the comments made/questions raised by the reviewer.

The abstract presents the main points of the study, highlighting the importance of molybdenum and the proposal to monitor its foliar accumulation throughout the seasons. However, the text lacks cohesion, with long and redundant sentences. There is excessive use of generic terms such as “perhaps” and “possibly” without due empirical support. It is suggested that the abstract be reformulated with more objective sentences, present the main findings with quantitative data (e.g., average Mo levels with/without application) and clearly highlight the practical conclusion: foliar application in July is crucial. The expression “peak periods of apple tree demand remain unclear due to insufficient data” may be more assertive, given that the study itself proposes to fill this gap.

**RESPONSE:** we have edited the abstract in accordance with the recommendations of the reviewer and added the necessary information (highlighted in yellow).

The introduction provides good context regarding previous studies with macronutrients and the scarcity of information on molybdenum. The discussion on the limitations of non-destructive methods is positive, reinforcing the need for chemical analysis of leaves. However, the text is excessively long, repetitive and sometimes disorganized. Relevant references are cited, but there is a lack of logical transition between paragraphs. For example, the physiological functions of Mo (involvement in enzymes such as nitrate reductase and aldehyde oxidase) are mentioned very late. This part should precede the knowledge gaps, as it justifies the functional importance of the nutrient. It is recommended to restructure the introduction in a more concise way, with a clear focus on the scientific rationale, hypothesis and objectives of the study.

**RESPONSE:** we have edited the text of the introduction in accordance with the recommendations of the reviewer (highlighted in yellow).

## Materials and Methods

The methodological description fails to provide essential experimental information, compromising the reproducibility of the study and the interpretation of the results. There is no mention of the type of statistical design adopted (e.g. randomized blocks, split plots), nor the number of replicates per treatment. This raises doubts about the statistical robustness of the data. Without this information, it is not possible to guarantee that the observed effects are truly attributable to the molybdenum treatments.

**RESPONSE:** we have added the information about number of replicates in the text of Materials and Methods Section (highlighted in yellow).

Foliar application with fertilizers containing molybdenum is described in a generic way. The article refers to supplementary tables (S1 and S2), but these should be partially incorporated into the main text, especially:

The concentration of molybdenum (g/L or mg/L) in each product.

The volume of spray applied per plant or per hectare.

The number of applications per year, with exact dates or intervals between them.

The complete chemical composition of the products used (not just the Mo content).

The pH of the spray and spraying conditions (e.g., temperature and humidity at the time of application).

**RESPONSE:** we transferred tables from the supplementary files to the main text, Materials and Methods Section: with annual programs of foliar fertilizing, as well as with the content of nutrients in the applied products (highlighted in yellow). Also we added to the table 2 the concentration of molybdenum ( $\text{g l}^{-1}$ ). All of the foliar fertilizer applications are listed in the Table 2 with exact dates. In the Table 3 there is information about the complete chemical composition of the products used. Also we added data about working solution pH (we did not check the solution at each spraying in this experiment). Also we added weather conditions at spraying times. In Table 4.

Insufficient characterization of the orchard

Although the text provides information on the cultivar ('Bogatyr'), spacing and type of rootstock (B118), essential agronomic data are missing, such as:

Physiological age and vigor of the trees.

History of nutritional and phytosanitary management prior to the study.

History of productivity of the experimental area (to relate to physiological response to Mo).

Any pruning or thinning management that may influence nutrient demand.

**RESPONSE:** We have updated the article with improved orchard descriptions and more plant nutrition details, which are available. Other pre-study information is unavailable because it is a private commercial orchard.

The description of leaf collection is vague: The selection of positions on the plant (intermediate height and shoots of the year) is consistent, but standardization criteria are lacking — were damaged leaves avoided? Were they always collected at the same time The number of samples (60 leaves per treatment) seems sufficient, but it is not clear how many trees were sampled in each replicate, nor whether there was a subdivision into experimental plots.

**RESPONSE:** we have added the information about leaves sampling in the text of Materials and Methods Section according to the recommendations of the reviewer (highlighted in yellow).

There is no information on the dry mass used per analysis or the unit of expression of the results with methodological precision.

**RESPONSE:** we have added the information about leaf dry mass in the text of Materials and Methods Section (highlighted in yellow).

The determination of molybdenum by atomic absorption spectrometry is adequate, but lacks: Description of the method of digestion of the plant material (e.g.: dry route, wet route, use of  $\text{HNO}_3/\text{HClO}_4$ ?). Reference to the use of certified standards and limits of detection (LoD) and quantification (LoQ). Information on analytical quality control: were there replicates, use of reference material, recovery of the analyte?

**RESPONSE:** we have added the information about the method of digestion of the plant material to Materials and Methods Section (highlighted in yellow).

Although the use of ANOVA and the LSD (Fisher) test is indicated, the article does not specify: What statistical model was adopted? Whether there was data transformation. The statistical software used. ?????

**RESPONSE:** we have added the information about the statistical data processing to Materials and Methods Section (highlighted in yellow).

The results presents an interesting experimental basis, with four years of monitoring and use of comparative treatments, but it does not deliver the potential of the study due to lack of descriptive precision, quantitative analysis and comparative structure. To raise the level of the manuscript, the authors should thoroughly revise this section, incorporate statistical data and reorganize the results with clear visual and discursive synthesis.

Authors often use subjective terms such as “sharply increased”, “remained high”, “slightly decreased” or “very noticeable”, without presenting absolute or relative values (e.g.:  $\text{mg kg}^{-1}$  d.m., % variation). The interpretation becomes ambiguous and impossible to replicate. For example:

“The nutrient content here increased almost two times compared to the end of June”  
→ How much exactly?  $0.3$  to  $0.6 \text{ mg kg}^{-1}$ ? It should be expressed with data and standard error.

**RESPONSE:** we have added in the text of manuscript absolute values and digital value of LSD (highlighted in yellow).

The text addresses each year separately, which is justified by the type of longitudinal study. However, the authors do not make direct quantitative comparisons between years. This dilutes the strength of the main conclusion: that the seasonality of Mo is influenced by climatic factors and management. It would be essential to: Table with the average and maximum/minimum values of leaf Mo by year and treatment; Consolidated bar graph by year and phenological phase.

**RESPONSE:** we have added in the text of manuscript table with the average and maximum/minimum values of leaf Mo by year and treatment; graph with average values according to phenological phases (highlighted in yellow).

Considering that the agronomic justification for Mo application is linked to physiology and reproductive growth, it would be expected to present data on productivity, fruit quality, dry mass or leaf area. Even if the focus is only on nutritional status, it would be relevant to indicate whether the effects were only physiological or whether they implied productive benefits. What level of significance was adopted?

**RESPONSE:** we have added in the text of manuscript data on productivity (highlighted in yellow), because yield is an integral indicator and allows to assess the significance of any impact in terms of its usefulness and profitability. However, in this experiment, it is extremely difficult to isolate the effect of molybdenum in using a complex of micronutrients. Therefore, we focused on

assessing the nutrition and molybdenum status in the leaves as the most objective indicator showing the effect of the applied fertilizers. Since it is very difficult to distinguish the effect of molybdenum on the average weight of the fruits against the background of exposure to other trace elements, and the volume of the manuscript is already large, we did not add these data. For the same reason, we did not add data on the dry weight of leaves, especially since there were no significant differences between them in experimental variants. We clarified in the Materials and Methods section that a significance level of 5% (0.05) was adopted (highlighted in yellow) .