Reviewer 1

In this study, the authors show that preharvest foliar applications of L-α-amino acids combined with sorbitol (Sor-AA) effectively enhance both the productivity and the functional quality of 'Mollar de Elche' pomegranates. There remain some questions that the authors need to respond to before the paper can be published:

The authors express their gratitude for the reviewer's constructive and insightful comments. We have carefully addressed each point to ensure the manuscript accurately reflects the distinct and synergistic impacts of both the L-α-amino acid (AA) and the sorbitol-combined (Sor-AA) treatments. We believe these revisions have significantly strengthened the clarity and technical depth of the study.

Comments to the author:

Q1. Abstract: the abstract does not represent the observations reported in the manuscript. For example, In the summary of results, the author only discussed the outcomes of Sor-AA but did not include the results of AA.

R1. We have completely rewritten the abstract to ensure a more balanced summary of our observations. The new version now includes a direct comparison between the AA and Sor-AA treatments, specifically highlighting AA's effect on fruit quantity. This provides a clearer and more representative view of all the results reported in the study.

Lines 11-28: "*'Mollar de Elche' pomegranate is highly valued for its sweet flavour but faces significant commercial hurdles due to pale coloration and sensitivity to postharvest disorders. This study investigates the impact of preharvest foliar applications of L-α-amino acids, applied alone (AA) or combined with 2.5% sorbitol (Sor-AA), on secondary metabolism and physiological resilience, defined here as the fruit's capacity to maintain metabolic homeostasis and stabilize antioxidant pigments during cold storage (7 °C). Our results show that both treatments triggered a substantial shift in secondary metabolism, doubling anthocyanin concentrations at harvest and effectively overcoming the cultivar's color deficit. While the AA treatment maximized fruit quantity per tree, the Sor-AA combination achieved the highest total yield (83.58 ± 6.82 kg) and individual fruit weight (469.00 ± 16.00 g) through a 'metabolic bypass' that optimizes energy use. Crucially, the physiological resilience of the fruit was uniquely bolstered by the Sor-AA treatment, which was the only strategy to stabilize anthocyanin levels (~108 mg L^{-1}) and maximize free ellagic acid in the husk (371.72 mg kg^{-1}) throughout 42 days of storage. Multivariate PCA (explaining 79.79% of variance) con-firms that the synergy of amino acids and sorbitol triggers a systemic metabolic reprogramming. Consequently, this targeted agronomic approach could provide significant eco-nomic benefits by increasing the*

proportion of export-grade fruit and extending the commercial window for the pomegranate sector.”

Q2. Introduction: The author elaborates on the necessity of this study in the first three paragraphs but provides little review of the relevant research. Thus, it is necessary for the authors to provide more context that can help the reader clearly assess the impact of this work.

R2. We sincerely thank the reviewer for this valuable observation. We acknowledge that the initial version of the Introduction did not adequately contextualize our work within the existing body of research. In response, we have substantially revised the first three paragraphs to incorporate a comprehensive review of relevant literature, including: (lines 33-96)

- Recent advances in pomegranate cultivation and quality improvement strategies
- Previous research on biostimulant applications in fruit crops, particularly amino acid-based formulations
- Studies addressing the colour deficiency challenge in 'Mollar de Elche' cultivar
- The physiological basis of anthocyanin biosynthesis and postharvest disorders in pomegranate
- Evidence from recent work on amino acids and sorbitol effects in horticultural crops

These revisions now provide readers with the necessary context to understand how our study builds upon existing knowledge and addresses specific gaps in the literature. The revised Introduction clearly positions our research contribution within the current state of science and highlights its novelty and impact.

The modified text has been highlighted in the revised manuscript for easy identification.

Q3. The authors did not include a control group using sorbitol alone in the experimental design, and the function of sorbitol should be discussed in the Introduction or Discussion section.

R3. The authors appreciate the reviewer’s insightful comment regarding the experimental design. While we acknowledge that a sorbitol-only control group could provide additional baseline data, our study was specifically designed to investigate the synergistic interaction between L-α-amino acids and sorbitol as a high-efficiency metabolic complex. Based on previous research (e.g., Guirao et al., 2024; 2025) (lines 153-160), the individual role of sorbitol as a carbohydrate source

and translocation enhancer in deciduous species is well-documented. In this work, we selected sorbitol specifically to act as a metabolic "shuttle" to maximize the systemic transport and bioavailability of exogenously applied amino acids toward the fruit sinks. To address the reviewer's concern, we have significantly expanded the Introduction and Discussion sections to provide a deeper physiological context for sorbitol's function, emphasizing its dual role as a signalling molecule and a protective agent against postharvest pigment degradation.

Q4. 2.1. Plant Material and Experimental Design: How were the concentrations of sorbitol were used chosen?

R4. We appreciate the reviewer's query regarding the rationale for the sorbitol concentration. The selection of a 2.5% dose was not arbitrary but was based on extensive preliminary trials and our previously published research on other fruit species. Specifically, studies conducted by our group on blood oranges and nectarines (Guirao et al., 2025; Solana-Guilabert et al., 2026) demonstrated that 2.5% sorbitol is the optimal concentration for enhancing the systemic transport of carbon skeletons and stimulating the biosynthetic pathways of secondary metabolites, such as anthocyanins, without inducing any phytotoxic response in the foliage. We have now clarified this point in the Materials and Methods section (Section 2.1) to provide better context for the experimental design.

Lines 153-160. " *The sorbitol concentration (2.5%) was selected based on our previous findings in blood oranges and nectarines [31,32], where this specific dosage proved most effective in promoting nutrient translocation and secondary metabolism while maintaining excellent crop safety...*...."

Q5. 2.1. Plant Material and Experimental Design: In the case of experimental treatments consisted of foliar applications of a complex commercial formulations, is it appropriate to use water as controls?

R5. The authors thank the reviewer for this relevant methodological question. We agree that when using complex formulations, the choice of control is critical. To ensure the validity of our results, the Control group was not treated with water alone; instead, it consisted of water supplemented with the exact same non-ionic surfactant used in the AA and Sor-AA treatments. This approach follows the experimental design successfully employed by our research group in previous studies on other species, such as blood oranges (Guirao et al., 2025b) and nectarines (Solana-Guilabert et al., 2026). By including the surfactant in the control, we effectively isolated the metabolic effects of the L-α-amino acids and sorbitol,

ruling out any bias related to the surfactant's ability to improve leaf wetting or absorption. We have revised Section 2.1 to make this explicit for the reader.

Lines 157-160. "*Importantly, all treatments, including the control, were supplemented with the same non-ionic surfactant to ensure that any observed differences were strictly attributable to the biostimulant components rather than the surfactant's influence on foliar absorption.*"