The role of light intensity in mediating ascorbic acid content during postharvest tomato ripening: A transcriptomic analysis

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Postharvest Biology and Technology, Volume 180, October 2021, 111622

Abstract

Ascorbic acid (ASA) is an essential antioxidant, participating in diverse processes. In this study, tomato fruit at two maturity stages (mature-green, breaker) were first exposed to light at four photosynthetic photon flux density (PPFD) levels [0 (darkness), 50, 300, 600 μmol m^{-2} s^{-1}], and then to darkness. As PPFD increased, ASA content was enhanced. The light-induced ASA content increase was dependent on the maturity stage, and persisted following darkening. High PPFD up-regulated the expression of key genes of the D-mannose/L-galactose pathway, showing the biosynthesis contributed, while the ASA recycling had a limited contribution. Weighted correlation network analysis showed that high PPFD potentially enhances the photosynthetic photon transduction, especially cyclic electron flow to excess photons. High PPFD up-regulated the expression of genes encoding non-enzymatic antioxidant biosynthesis. We show that photosynthetic photon transduction mediates fruit adaptation to light intensity, and provides new insights into the interactive regulation of fruit ASA accumulation.