



Figure 1 Effects of storage temperature on flavor balance and metabolic regulation in peach fruit

4.2 Influence on fruit size, firmness, and texture

Temperature during on-tree development controls final size and basic texture attributes. In controlled environments, increasing growth temperature from 20°C to 30°C accelerated early fruit expansion and shortened the development period but reduced final fruit weight, size, and sweetness, indicating that high developmental temperatures hasten maturity at the expense of key quality traits. Under projected climate-change scenarios with elevated CO_2 , moderate warming ($+3.4^{\circ}\text{C}$) increased photosynthesis, carbohydrate content, and fruit weight, whereas stronger warming ($+5.7^{\circ}\text{C}$) decreased photosynthetic performance and was associated with poorer physiological status and reduced fruit quality in the subsequent year, emphasizing that beneficial temperature windows are narrow (Lee et al., 2022).

Postharvest temperature interacts with cell wall metabolism to determine firmness and textural defects. In stony-hard peaches, storage at intermediate temperatures (8°C – 15°C) induced substantial softening and strong expression of a polygalacturonase gene, whereas storage at 0°C or 20°C for extended periods prevented subsequent softening at 10°C , suggesting that specific temperature ranges activate pectin-degrading machinery independently of ethylene (Tatsuki et al., 2021). Conversely, in melting-flesh peaches, low-temperature storage at 6°C , compared with 25°C , inhibited softening by maintaining cell wall integrity: low temperature reduced the accumulation of water- and ion-soluble pectin and suppressed activities and expression of polygalacturonase, pectate lyase, and pectin methylesterase, effects linked to cold-induced CBF transcription factors that repress pectin-degradation genes (Guo et al., 2026).

4.3 Temperature-driven changes in aroma and phytochemicals

Aroma and phytochemical profiles of peach are highly temperature-dependent during storage and ripening. Cold storage at 1°C for 7 d significantly affected firmness, acidity, phenolics, vitamin C, and carotenoids across cultivars, with some sensory attributes (bitterness, astringency, crunchiness) increasing as firmness and acidity rose, while perceived harmony and sweetness were more closely related to $^{\circ}\text{Brix}$, β -carotene, and specific volatiles than to simple acidity measures (Muto et al., 2022). In another study, low-temperature storage at 0.5°C