

## Research Insight

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## Nutrient Management for Enhancing Sweet Cherry Fruit Firmness and Shelf Life

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**Abstract** Sweet cherry fruit are prone to softening, water loss, cracking, and decay after harvest, resulting in a short shelf life. Fruit firmness and storability directly affect commercial grading and market value. This study analyzes the improvement of sweet cherry fruit firmness and storage quality through nutrient management, focusing on the effects of key nutrients such as calcium, potassium, magnesium, and boron on cell wall stability, membrane integrity, and postharvest senescence, and proposes practical management strategies for production. The results indicate that calcium is the core element for maintaining fruit firmness and delaying softening. It can enhance calcium-pectate cross-linking, stabilize cell wall and membrane structures, and reduce the risks of cracking, decay, and weight loss. However, calcium uptake is restricted by fruit developmental stage, declining xylem function, and cultivar differences. Potassium promotes fruit enlargement, sugar accumulation, and ripening, but excessive application may increase the K:Ca ratio and weaken firmness retention. Magnesium improves fruit quality mainly by promoting photosynthesis and carbon assimilation, while boron participates in cell wall formation, fruit set, and calcium distribution. This study suggests that supplementation with a single nutrient is unlikely to consistently improve the storability of sweet cherry fruit. A stage-specific nutrient management model integrating early calcium supply, boron supplementation at flowering, moderate potassium and magnesium regulation, nitrogen control, and postharvest calcium treatment should therefore be established.

**Keywords** Sweet cherry (*Prunus avium* L.); Nutrient management; Fruit firmness; Calcium management; Shelf life; Postharvest preservation

### 1 Introduction

Sweet cherry (*Prunus avium* L.) is an important high-value horticultural crop with strong commercial relevance in the fresh-fruit market. Consumers generally evaluate its quality according to fruit appearance, flavor, texture, and nutritional value, among which fruit size, color, firmness, and freshness directly affect market grading and selling price (Correia et al., 2017; Çolak et al., 2025). Because sweet cherry has a concentrated harvest period, a short shelf life, and high requirements for maintaining class I fruit quality during distribution, its commercial competitiveness depends not only on yield but also on the stability of fruit quality during picking, grading, packaging, storage, and transportation (Ivanova et al., 2023). However, sweet cherry is a typical highly perishable fresh fruit. After harvest, it is prone to flesh softening, water loss, decay, and mechanical injury, which shorten shelf life and restrict long-distance transportation (Chockchaisawasdee et al., 2016; Çolak et al., 2025). Among these quality attributes, fruit firmness is particularly important. Firmer fruit can better withstand external damage during postharvest handling and logistics, while also meeting consumer demand for a crisp and tender texture (Blanco et al., 2021). Previous studies have shown that cherry firmness usually decreases continuously during storage, accompanied by changes in acidity, soluble solids balance, and other quality indices, ultimately affecting commercial life and market value (Blanco et al., 2021; Beinsan et al., 2025; Xing et al., 2025).

Sweet cherry fruit have a short developmental period, usually requiring only 60–80 days from bloom to harvest. During this stage, fruit compete strongly with vegetative organs such as leaves and shoots for carbohydrates and mineral nutrients. Therefore, source–sink relationships and nutrient supply have important effects on final fruit quality (Matteo et al., 2022; Santos et al., 2024). Appropriate crop load, sufficient assimilate supply, and suitable