

(Aglar et al., 2017). Postharvest CaCl_2 plus MAP reduced respiration and preserved quality traits and bioactive compounds better than untreated controls, with the lowest decay and weight loss generally occurring in the combined treatment during storage (Çolak et al., 2025). Optimized MAP also maintained firmness, acidity, vitamin C, and lower browning and decay over long cold storage, but its success depended on film permeability and gas composition, so nutrient benefits are contingent on a well-matched storage atmosphere rather than MAP alone (Cui et al., 2025).

6 Integrated Orchard Practices Supporting Nutrient Management

6.1 Irrigation and nutrient uptake coordination

Water management strongly conditions nutrient uptake because calcium transport depends on xylem flow, while potassium acquisition and distribution respond to root activity and soil solution dynamics (Figure 3). In sweet cherry, higher irrigation volumes were associated with lower cracking at harvest and were hypothesized to favor calcium uptake and incorporation into fruit cells, even though final fruit Ca concentration differences were not always significant (Measham et al., 2013). This inconsistency matches broader review evidence showing that calcium effects on cherry quality are often variable because Ca movement into fruit is physiologically constrained and sometimes erratic (Winkler and Knoche, 2019).

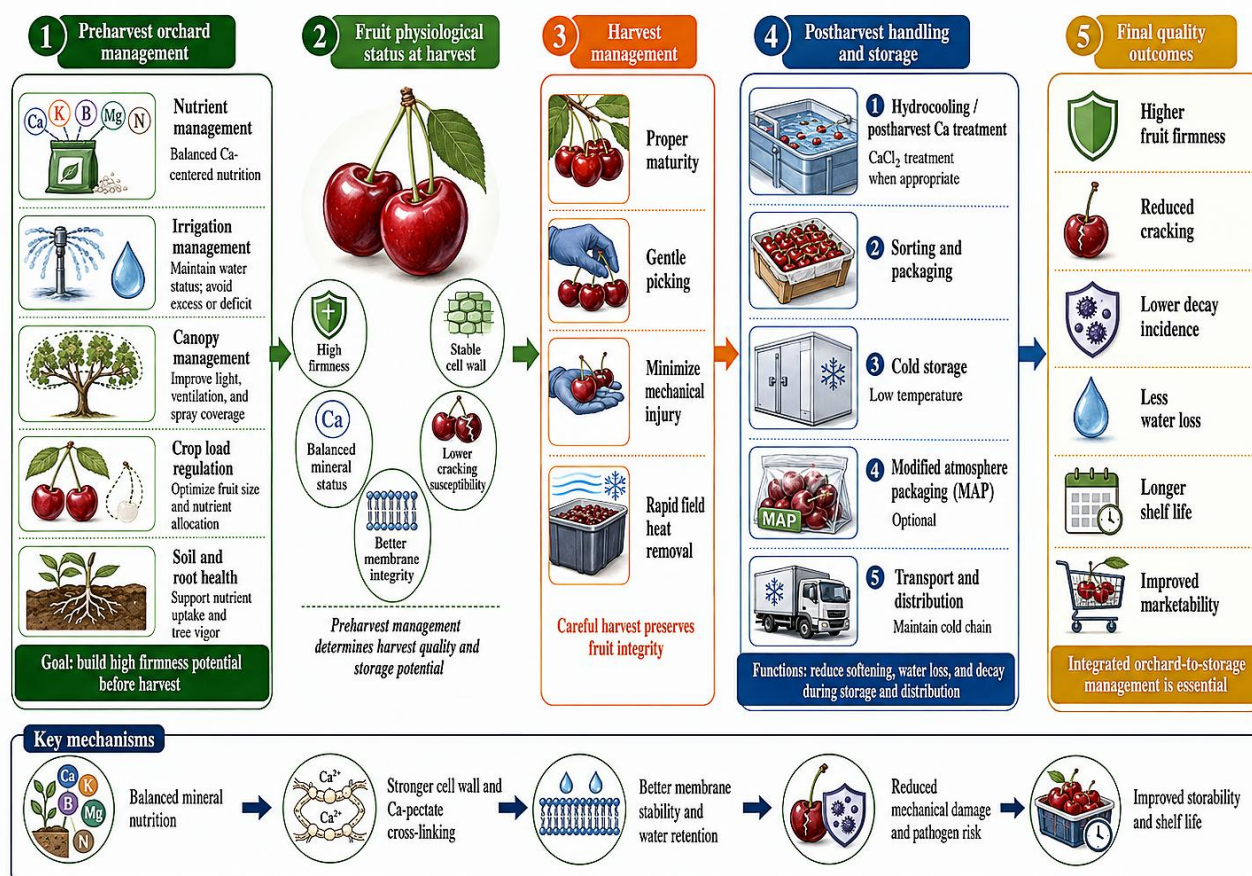


Figure 3 Integrated preharvest and postharvest management system for extending sweet cherry shelf life

Orchard nutrient management should be coordinated with irrigation, canopy structure, crop load regulation, soil health, postharvest calcium treatment, cold storage, and modified atmosphere packaging. This integrated system helps reduce softening, cracking, decay, water loss, and quality deterioration during storage and distribution

Soil moisture affects calcium most directly because Ca is xylem-mobile and fruit import declines as development proceeds, so sustained water supply early in fruit growth helps maintain transport to the fruit (Winkler and Knoche, 2019; Matteo et al., 2022). Potassium responds differently: K fertilization increased fruit size, weight, firmness, and soluble solids, but also reduced fruit Ca and Mg concentrations, showing that uptake benefits can be