8.2 Standardized harvesting methods to reduce damage

Due to the characteristics of bayberry fruit, including high respiration intensity, susceptibility to mechanical damage, and rapid softening, its harvesting method should be similar to that used for berry crops such as strawberries and raspberries, adopting gentle and standardized manual picking practices. Fruits intended for the fresh market should be hand-harvested at the target maturity stage. During harvesting, fruits should be handled carefully to avoid finger pressure damage, and a short fruit stalk should be retained by cutting or gently twisting the fruit during picking. After harvest, fruits should be graded directly in the field and packed into the final packaging containers to reduce repeated handling (Horvitz, 2017; Jain et al., 2023).

Harvesting should be carried out in the early morning or evening when temperatures are lower. Wet fruits should be avoided, because surface moisture increases friction damage and decay (Shah et al., 2023). Increasing harvest frequency (for example, harvesting blueberries every 2-3 days) can effectively reduce the proportion of overripe fruits, minimize cumulative mechanical damage, and significantly improve storage performance (Godara et al., 2025).

8.3 Sorting, packaging, and short-term storage

After harvest, bayberries should be sorted immediately. Fruits with mechanical damage, disease, or those that are immature or overripe should be removed, because mixed batches accelerate decay and act as sources of pathogen spread. Standard postharvest handling includes cleaning, grading, pre-cooling, proper packaging, and refrigerated storage. These steps are key to reducing losses.

For bayberry, shallow and rigid packaging containers should be used to limit stacking height and distribute weight evenly. This helps avoid compression and juice leakage, both of which accelerate microbial spoilage (Kunwar et al., 2024).

Temperature and relative humidity management are especially important. Rapid pre-cooling to the proper storage temperature after harvest is considered the most critical factor in delaying senescence and decay (Palumbo et al., 2022). In areas without a cold chain, low-cost cooling technologies such as zero-energy cooling chambers or “pot-in-pot” systems can be used to provide short-term preservation (Hassan et al., 2025).

8.4 Transportation and preservation technologies

Transportation is the stage where bayberry is most vulnerable. Vibration, collision, and poor temperature control can quickly offset the benefits of earlier careful handling. In many fruits, poor transport conditions and long distances are the main causes of mechanical damage and postharvest losses (Bisht and Singh, 2024).

For bayberry, maintaining a continuous cold chain, using vibration-resistant packaging, and delivering fruits quickly to the market are essential. During loading, transport, and distribution, temperature should be kept at 0 °C-4 °C with high relative humidity to suppress ethylene-induced ripening, softening, and decay (Saeed et al., 2024).

Advanced postharvest technologies provide more options to extend freshness during transportation. Slightly acidic electrolyzed water combined with ultrasound treatment (US + SAEW) can significantly reduce pesticide residues, dirt, larvae, and microorganisms on the fruit surface. It can delay the onset of decay by about 6 days, reduce weight loss and color changes, maintain fruit firmness, improve the sugar-acid ratio, and preserve phenolics, anthocyanins, and antioxidant capacity (Suo et al., 2023). In addition, applying hot air treatment at 48 °C for 3 hours before cold storage can significantly reduce decay by regulating fungal community structure (increasing beneficial endophytes and reducing pathogenic fungi), while maintaining fruit quality (Dai et al., 2021).

9 Practical Development Trends and Optimization Directions

9.1 Application of simple smart orchard tools (monitoring and irrigation control)

Multi-parameter IoT-based orchard monitoring platforms can track real-time data such as air temperature, soil moisture, light intensity, rainfall, and wind speed, and upload them to mobile terminal interfaces. Through more precise environmental regulation, these systems can reduce labor input, stabilize yields, and improve fruit quality (Hu et al., 2025).