usually only a few days. In many production areas, traditional orchard management still relies on high input levels, including heavy use of chemical fertilizers and frequent application of pesticides or even antibiotics to maintain yield and control pests and diseases (Yi et al., 2024). Problems such as a high proportion of small fruits, uneven coloration, unstable sweetness and flavor, serious fruit cracking, and significant pre- and post-harvest disease pressure are still common, limiting the improvement of economic benefits.

This study systematically integrates the biological characteristics, nutritional and medicinal values, and recent progress in orchard management of Chinese bayberry, and explains the theoretical basis and practical significance of integrated orchard management for achieving high-quality fruit production. It clarifies the important role of Chinese bayberry in regional and global fruit production systems, summarizes its nutritional, economic, and therapeutic values, and analyzes the main problems and limitations in current orchard and postharvest management. Based on research on Chinese bayberry and other fruit trees, this study discusses the key components, mechanisms, and practical effects of integrated orchard management. By identifying development directions, application potential, and research needs, this study provides a theoretical framework and technical reference for transforming the Chinese bayberry industry from a traditional high-input model to a high-quality, sustainable, and eco-friendly production system.

2 Orchard Site Selection and Establishment Techniques

2.1 Selection of suitable planting areas (slope, elevation, drainage)

Waxberry is suitable for growth in warm and humid subtropical climates, requiring sufficient sunlight, moderate rainfall, and good air circulation. In major production areas, it is usually planted on hilly or low mountain slopes (Chen et al., 2025). In the Taizhou region of Zhejiang Province, the most suitable areas are mainly distributed in mid-hill zones, while high mountains above about 800 m and low-lying plains prone to waterlogging or with high groundwater levels are not suitable for planting (Shou et al., 2011). Studies in ecologically fragile orchard areas show that gentle slopes of about 3-10° can achieve a good balance between drainage, erosion risk, and operational convenience, making them the most suitable for new orchard establishment (Hu et al., 2023). Elevation, slope, and aspect together determine temperature conditions, cold air movement, and solar radiation, all of which significantly affect flowering, fruit set, and fruit coloration of waxberry.

2.2 Soil improvement measures before orchard establishment

Surveys of waxberry orchards in Zhejiang Province show that local soils are generally acidic (pH 3.97~6.15), with low organic matter content. Phosphorus status is highly imbalanced, with low total phosphorus but very high available phosphorus. Available potassium is generally insufficient, and exchangeable magnesium deficiency is common, with some areas also showing calcium deficiency (Wang et al., 2019). These imbalances may lead to decline disease, weakened tree vigor, and reduced fruit quality.

The application of organic amendments such as farmyard manure, bio-organic fertilizers, and biochar has been proven to improve soil structure, increase organic matter content, raise pH, and enhance key nutrients (available N, P, K as well as Ca and Mg). At the same time, these practices can reshape the rhizosphere microbial community and metabolite composition (Ren et al., 2023). For compacted soils, deep plowing or subsoiling should be carried out, and organic amendments should be evenly incorporated into the planting zone. When soil pH or magnesium levels are too low, lime or magnesium fertilizers should be applied appropriately to create a deep and well-aerated root growth layer.

2.3 Orchard layout design (planting density, row spacing, roads, and drainage system)

Based on a 15-year study of waxberry orchards and decline disease trials in Zhejiang, a medium-density planting system with a spacing of about 4 m × 5 m (approximately 500 trees·hm^{-2}) can meet canopy growth needs while also facilitating mechanized operations (Ren et al., 2023).

For high-yield dwarf and dense planting systems, spacing should be adjusted according to variety vigor, rootstock type, and soil conditions to ensure good ventilation and light penetration. Planting patterns directly affect cultivation methods, plant health, yield, and fruit quality by regulating plant population per unit area and light