available nutrients before management optimization (Wu et al., 2022). Human factors are also central, because propagation methods, planting structure adjustment, and regional production decisions directly influence distribution and cultivation success. Under climate change, broader citrus studies also indicate possible shifts in suitable production areas, providing additional support for adapting fingered citron cultivation layout to local conditions and future environmental trends rather than relying on traditional planting experience alone (Yang et al., 2024).

Against this background, high-quality fingered citron seedlings are essential for reliable orchard establishment. Citrus nursery research emphasizes verified varietal identity, vigorous root systems, and freedom from important transmissible pathogens (Budiarto et al., 2024). Studies of the genus Citrus describe cuttings, grafting, and layering as possible vegetative approaches (Gogoi and Basumatary, 2017). Rooting under protected mist, suitable rooting substrates, and auxin treatment have improved cutting propagation in some citrus materials, but quantitative rooting rates are genotype-specific and must not be used as validated benchmarks for fingered citron. Likewise, rootstock choice, graft compatibility, nursery hygiene, and aftercare should be evaluated with locally available fingered citron materials before specific survival or yield benefits are claimed (Vashisth et al., 2020).

This study aims to establish a technical basis for the propagation of high-quality fingered citron seedlings and to provide a reference for the application of standardized orchard establishment techniques suited to its biological and ecological characteristics. This research has strong practical significance for production because, despite the high medicinal, edible, aromatic, and ornamental value of fingered citron, its cultivation still faces problems such as variation in habitat suitability, inconsistent nursery techniques, uneven seedling quality, and insufficient standardization of cultivation management. Even under favorable agro-climatic conditions, stable and healthy tree growth and satisfactory yields are difficult to achieve without standardized nursery practices and true-to-type, reliable-quality planting materials. Integrating climate, soil fertility, topography, propagation quality, and adaptive management into standardized orchard planning can help improve production efficiency and fruit quality while enhancing the adaptability of the production system to environmental and market changes. Therefore, research on the propagation of high-quality fingered citron seedlings and standardized orchard establishment is not only a technical requirement for the development of the fingered citron industry, but also an important approach to conserving germplasm resources, maintaining varietal authenticity, reducing production risks, and promoting the sustainable development of this distinctive citrus crop.

2 Selection of High-Quality Propagation Materials and Mother Plant Management

2.1 Selection of superior mother plants

Superior mother plants should first be identified as true-to-type elite trees that represent the target cultivar stably and can serve as the starting point for healthy propagation material production. Citrus mother tree systems are built around selected source plants that are registered, characterized, and maintained so that the genetic identity of propagated seedlings remains reliable across multiplication cycles. Because rootstock–scion choice strongly affects yield, fruit quality, and stress tolerance, mother plant selection should also consider compatibility and the intended production environment rather than visual vigor alone (Vashisth et al., 2020). Regional disease pressure, soil properties, and climate should be considered during source selection, because the best propagation parent is the one that combines varietal authenticity with adaptation to the pathogen and stress profile of the planting area (Wang et al., 2025).

The second core criterion is sanitary status. Candidate mother plants should be tested for systemic pathogens before they enter propagation programs, because latent infections can reduce productivity and shorten the longevity of all daughter plants (Ventura et al., 2019). Multiple citrus programs screen mother plants for graft-transmissible pathogens and maintain only disease-free source trees, with shoot-tip grafting and indexing used when sanitation is required. Shoot-tip grafting has been standardized to generate true-to-type, virus-free plants and then establish protected foundation blocks that continuously supply clean scion material. This emphasis is justified because certified disease-free planting material improves tree uniformity, early bearing, productive life,