and farm returns, while use of uncertified material increases biological and economic risk (Bhattacharyya et al., 2025).

2.2 Selection of propagation shoots and scions

Propagation shoots and scions should be collected from healthy, vigorous, and genetically verified mother plants, because the quality of the harvested budwood directly determines the quality of grafted seedlings (Wang et al., 2025). In citrus nursery systems, varietal purity must be guaranteed for both scion and rootstock materials, and off-type seedlings or shoots should be identified and discarded during propagation. For seed-propagated citrus rootstocks, the proportion of true-to-type seedlings differs among genotypes, so propagation strategy needs to match the biological behavior of the specific rootstock rather than assume that all citrus materials are equally suitable for seed multiplication (Bisi et al., 2020). Modern citrus rootstock breeding programs further highlight the need for authenticated and selected rootstock germplasm (Bowman et al., 2021). When nucellar seed supply is inadequate or uniform seed propagation is impossible, cuttings or tissue culture can provide genetically identical liners for later grafting (Albrecht et al., 2020). For fingered citron production, these findings should be treated as references for selecting and propagating rootstocks used in grafting, rather than as evidence that fingered citron itself must be propagated through seed-derived rootstocks.

For vegetative propagation, shoot maturity and handling are critical selection criteria. Reviews of citrus cutting propagation indicate that virus-free hard, semi-hard, and softwood cuttings can all be used, but rooting and uniformity depend strongly on cutting maturity, auxin treatment, season, growing medium, and microclimate. Semi-hardwood cuttings often perform best for rooting and survival, and mist-house conditions together with IBA treatment improve propagation success. Single-node cutting systems can propagate diverse citrus genotypes efficiently, with some rootstocks reaching 82~91% establishment of rooted, growing plants, although success still differs sharply by genotype (Bowman and Albrecht, 2017).

2.3 Standardized management of mother plant orchards

Standardized management of mother plant orchards depends on protected production systems, routine inspection, and documented certification procedures. Citrus programs in Brazil and elsewhere show that standardization and frequent nursery inspection are central to assuring the genetic and sanitary quality of mother trees and propagation materials. Protected environments are especially important because plants used in sanitation and mother-stock programs are commonly maintained under vector-exclusion conditions, and screen protection is a defining feature of many certified budwood and nursery tree systems (Zamzami et al., 2021). In certified citrus systems, planting disease-free trees, controlling psyllids, and removing infected trees form key elements of HLB management, while pathogen-free nurseries provide an important barrier against graft- and vector-transmitted diseases (Graham et al., 2024). These HLB-oriented measures are citrus examples; for fingered citron mother-stock management, the transferable principle is to maintain verified clean source plants and prevent the introduction or spread of graft- and vector-transmitted pathogens, rather than assuming an identical disease profile or regulatory system.

Standardized mother orchard management also requires regular renewal, clean handling, and optimized cultural care. Bud-stick multiplication blocks are periodically replanted from higher-order clean sources, and their maintenance under screens enables repeated budwood harvest while preserving sanitary quality and conformity to standards. Clean production further depends on disinfected facilities and tools, pathogen-free substrates and water, secure waste disposal, weed elimination, and routine operational records to reduce introduction and spread of inoculum (Ventura et al., 2019). Nursery and mother block performance is also strengthened by correct rootstock seed sowing, nucellar seedling selection, use of authorized budwood sources, appropriate grafting height, and optimum maintenance throughout production. In addition, improved substrates and nutrition can accelerate seedling growth and raise budding success, so standardized management should integrate sanitation with cultural practices that produce vigorous, field-ready plants efficiently.