of evidence in eggplant is better for drought and salinity than for all other stresses (Nadoda et al., 2024). Postharvest work also suggests that rootstock-mediated stress protection can persist after harvest, as grafting onto the cold-tolerant ‘Java’ rootstock reduced chilling injury, softening, and pulp browning during cold storage.

5.3 Improvement of resource use efficiency

A third major contribution of grafting is improved resource use efficiency, especially for water and nutrients. This effect is closely tied to the functional role of the rootstock, since vigorous root systems can enhance nutrient uptake, water transport, and osmoregulation under stress while sustaining productive growth (Musa et al., 2020). Root traits are central here: deep and robust roots improve access to soil water and nutrients, and anatomical studies in grafted eggplant show that *Solanum rootstocks* often produce greater root volume and wider xylem, traits that correlate positively with yield (Kappel et al., 2024). Water use efficiency is one of the best documented outcomes. In a Mediterranean greenhouse, the highest WUE for fruit production occurred in the IR50 treatment with To/Bb, showing that grafting onto *S. torvum* can convert moderate water limitation into more efficient yield formation rather than simply buffering damage (Argento et al., 2023). Under semi-arid deficit irrigation, SUR/SIS achieved 9.47 kg/m^3 water productivity and SUR/TOR 8.22 kg/m^3, both above the non-grafted control at 6.72 kg/m^3, confirming that rootstock choice can materially improve output per unit water (Khapte et al., 2025). These gains appear to arise from better soil-plant water balance, sustained PSII efficiency, and stronger antioxidative defense under water deficit (Nadoda et al., 2024).

Nutrient use efficiency also improves when grafting enhances root function and rhizosphere activity. Comparative studies report that grafting can increase tissue concentrations or uptake efficiency of major nutrients such as N, P, and K, while greater root activity and xylem development support more effective mineral translocation to the shoot (Yang et al., 2026). In grafted eggplant specifically, enhanced microbial biomass and enzyme activity in the rhizosphere indicate faster nutrient cycling and a more nutrient-rich root environment, which likely contributes to stronger growth and stress resilience (Argento et al., 2023). Resource-use benefits can be strengthened further when grafting is combined with complementary soil management. Integrating grafted plants with vermicompost under moderate drought increased shoot fresh weight by 48.81%, reduced yield loss by 96%, and improved irrigation water productivity by 62.79% in greenhouse conditions. Field and greenhouse evidence from the same research line also shows that the grafting-vermicompost combination improves soil moisture retention, mineral content, and total productivity under drought, making it a promising low-input strategy for climate-resilient eggplant production (Kıran et al., 2026).

6 Case Study: Evaluation of Grafting Effects on Eggplant Growth and Yield under Protected Cultivation

6.1 Experimental design and grafting treatments

Protected-cultivation studies on eggplant grafting generally use comparative designs that include non-grafted and self-grafted controls alongside one or more commercial or wild rootstocks, allowing the specific contribution of the rootstock to be separated from the grafting procedure itself (Sabatino et al., 2022). In unheated greenhouse and tunnel systems, common experimental materials include scions such as ‘Madonna’, ‘Birgah’, or locally adapted cultivars grafted onto *Solanum torvum*, allied *Solanum* species, or tomato rootstocks such as Optifort and Emperador (Argento et al., 2023). The cultivation environment is also a defined treatment component in these case studies. Greenhouse experiments have been conducted in soilless pot culture, polyethylene-covered tunnels, unheated plastic houses, and low-cost polyhouses, often with drip irrigation, mulching, and standardized fertigation so that treatment differences mainly reflect graft combination rather than uneven crop management (Sabatino et al., 2022). Some protected-cultivation studies explicitly add environmental or stress factors to the design, such as saline versus non-saline nutrient conditions or heated versus cold greenhouse and substrate regimes, in order to test whether grafting effects remain stable under suboptimal production environments (Mozafarian et al., 2023).

The grafting methods used are usually simple nursery techniques chosen for reproducibility and high survival. Tube grafting, splice grafting, cleft grafting, and clip fixation during healing are all represented in the eggplant