Not all rootstocks generate equally balanced growth responses. Some combinations stimulate desirable vigor and leaf development, while others induce excessive vegetative growth or functional imbalance, particularly when compatibility is weaker or when the rootstock is too vigorous for the scion (Argento et al., 2023). This makes rootstock selection a physiological decision as much as a disease-management one, because the best protected-cultivation combinations are those that enhance vigor without disrupting reproductive balance or plant architecture (Yan et al., 2022). Protected-cultivation studies also show that grafting can alter the rhizosphere and thereby indirectly affect plant physiology. In greenhouse trials, grafted eggplants had higher microbial biomass carbon, nitrogen, and phosphorus and higher enzyme activity in the rhizosphere, supporting a more active nutrient-cycling environment around the roots (Du et al., 2024). When grafting is combined with beneficial biological inputs such as arbuscular mycorrhiza, these physiological gains can extend to stronger nutrient assimilation and higher nitrogen use efficiency, reinforcing the functional advantage of grafted plants under protected production (Sabatino et al., 2020).

6.3 Effects on yield performance and production sustainability

Yield performance under protected cultivation generally improves when eggplant scions are grafted onto vigorous and compatible rootstocks. In an unheated polyethylene greenhouse, grafting ‘Madonna’ onto *S. torvum*, SH, or A increased total marketable yield markedly relative to self-rooted plants, with *S. torvum* reaching 3.94 kg/plant versus 1.65 kg/plant in the control (Mozafarian et al., 2023). Similarly, greenhouse work focused on rhizosphere microecology reported yield increases of up to 36.89% for plants grafted onto ‘Huimei Zhenba’ and substantial gains also for *S. torvum*, showing that the yield advantage persists across distinct protected-cropping systems (Du et al., 2024). Yield gains are usually expressed through more than one component. Depending on the graft combination, grafted plants can produce more marketable fruits, greater mean fruit weight, or both, and several studies show that the strongest rootstocks improve reproductive output without necessarily compromising apparent fruit quality (Sabatino et al., 2020). In some greenhouse studies, however, quality-related responses are mixed, with certain combinations lowering soluble solids or firmness, which means that higher yield does not automatically translate into better quality across all scion-rootstock pairs (Sabatino et al., 2022).

From a sustainability perspective, protected-cultivation grafting is valuable because it stabilizes production under disease pressure and reduces dependence on chemical soil disinfestation. Grafting emerged partly as a response to restrictions on soil fumigants, and in intensive greenhouse systems it functions as a non-chemical tool to sustain yield where continuous cropping and soil-borne diseases would otherwise reduce plant survival and marketable output (Kappel et al., 2024). This role is reinforced by direct disease outcomes in greenhouse eggplant, where superior rootstocks greatly lowered bacterial wilt incidence while simultaneously increasing yield, making grafting both a protective and productive intervention (Du et al., 2024). Production sustainability under protected cultivation also improves when grafting is integrated with complementary low-input practices. In greenhouse eggplant, combining grafting with microbial biostimulants, mycorrhiza, or vermicompost improved nitrogen use efficiency, marketable yield, and several nutritional traits, suggesting that grafting can serve as the structural platform for broader input-efficient production systems (Sabatino et al., 2020; Consentino et al., 2022).

Even so, the economic value of grafting remains treatment-dependent, because rootstock compatibility, seedling cost, and management complexity still determine whether the biological gains achieved in protected cultivation translate into a consistently scalable production strategy (Argento et al., 2023; Kıran et al., 2026). In protected cultivation, eggplant grafting is most effective when the experimental system uses well-matched rootstock-scion combinations and evaluates both yield and resource efficiency. Across the available case studies, the most reliable outcome is higher and more stable production, especially with *Solanum torvum* and related vigorous rootstocks.

7 Advances and Future Perspectives of Eggplant Grafting Technology

7.1 Optimization of rootstock selection and grafting methods

Future progress in eggplant grafting depends first on improving rootstock selection beyond the current reliance on a few standard materials. Reviews emphasize that the available rootstock pool remains narrow relative to the diversity of stresses growers face, and that rapid pathogen evolution and complex abiotic-stress traits make it