hemsleyanum, whose quality formation is sensitive to microecology, fungal composition, soil enzymes, and habitat-specific soil chemistry (Zhang et al., 2026).

Evidence from other medicinal-plant systems shows why this integrated approach matters. In a South China forest-medicine compound system, understory planting improved soil nutrient status, increased rhizosphere microbial communities, and enhanced microbial carbon-source utilization, indicating that compound management can generate both ecological and production benefits (Yu et al., 2023). Agroforestry trials in medicinal plants also show that management details shift outcomes: lower cocoa-tree density increased biomass and essential-oil yield for some species, whereas higher cocoa-tree density favored flavonoid accumulation in another species, showing that stand design must be linked to the target product trait rather than assumed uniform (Barazetti et al., 2022). Parallel understory studies found that inter-row positions can outperform under-canopy positions, with *Epimedium pubescens* yield increasing by 90~107% relative to under-canopy locations across three plantation types, and economic assessment identified a 75% shading treatment as optimal in one system (Zhang et al., 2025). For *T. hemsleyanum*, this implies that integrated management should include deliberate canopy regulation, stand selection, and soil amendment rather than simply planting beneath any available forest cover (Jaroszewicz et al., 2024).

4.3 Comprehensive comparison of different under-forest production models

Taken together, the main under-forest production options for *T. hemsleyanum* can be divided into a wild-simulated model, a more interventionist forest-medicinal integrated management model, and loosely managed or extensive under-canopy planting systems. Their strengths differ. Wild-simulated cultivation is closest to the species' native ecological niche and best aligned with market preferences for high-quality, near-natural products (Figure 1) (Shi et al., 2022; Wang et al., 2026). Integrated management is stronger for scaling, because it explicitly optimizes stand composition, light environment, fertilization, and forest-floor use efficiency (Barazetti et al., 2022). Extensive under-canopy planting has lower technical thresholds and can still be economically viable, but evidence from silvi-medicinal systems shows that open conditions often produce higher yields and returns than below-canopy conditions even when understory systems remain profitable, so low-input forest planting is not automatically the highest-performing option (Sanwal et al., 2016). Comparative work in other medicinal plants also shows that different planting environments can produce large differences in both quality and yield, and some forest types are clearly more suitable than others (Lan et al., 2023).

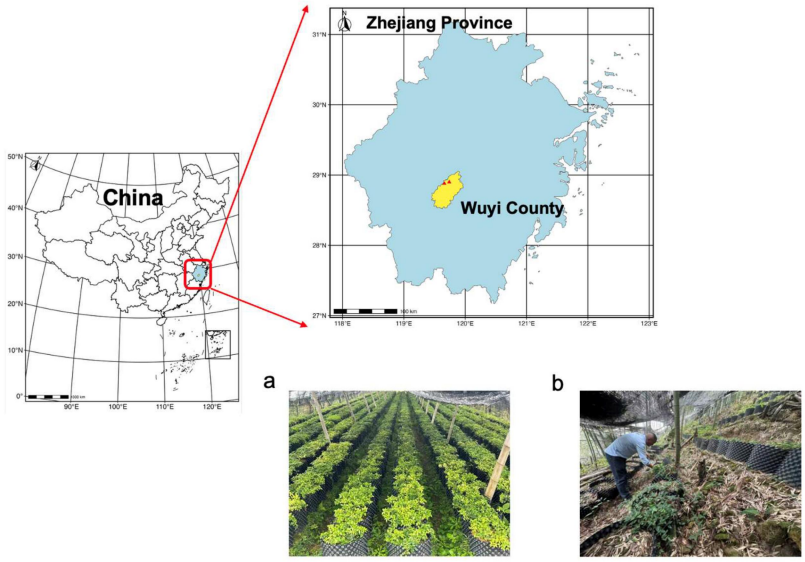

Figure 1 Location and set-up of the two cultivation sites for *Tetrastigma hemsleyanum* in Wuyi County, Zhejiang Province, East China (Adopted from Wang et al., 2026)

Image caption: (a) Greenhouse cultivation method; (b) simulated-wild cultivation method (Adopted from Wang et al., 2026)