

advantages in active compound accumulation and ecological characteristics. However, neither mode has absolute superiority, as quality formation is influenced by cultivation environment, evaluation indicators, and plant developmental stage. Therefore, differentiated development strategies should be adopted: facility cultivation should focus on large-scale, standardized, and functional-product supply, whereas wild-simulated cultivation should target quality-oriented, high-value, and ecologically distinctive products.

Future development of the *D. officinale* industry should emphasize the integration of advantages from both cultivation modes rather than expanding either system independently. A composite production strategy, such as “facility-based seedling propagation combined with ecological cultivation for quality improvement,” can effectively combine production efficiency with medicinal quality enhancement. Meanwhile, precision environmental regulation, green cultivation technologies, and intelligent management should be further applied to improve production stability and quality consistency. In addition, quality evaluation systems should move beyond reliance on a single polysaccharide indicator and develop comprehensive evaluation frameworks incorporating polysaccharides, flavonoids, alkaloids, metabolomic characteristics, and bioactivity-related parameters. By improving germplasm management, production standards, and quality traceability systems, the *D. officinale* industry can achieve sustainable development characterized by high quality, high efficiency, and ecological compatibility.

Conflict of Interest Disclosure

The author affirms that this research was conducted without any commercial or financial relationships that could be construed as a potential conflict of interest.

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