temperature and hormone stressors (Pan et al., 2023). Agronomic interventions can therefore alter both yield and quality: increasing branch number is crucial because flowers are borne on branch tops, but traditional manual decapitation is labor-intensive and raises disease risk, while growth-regulator treatments have increased yield and maintained medicinal quality above Pharmacopoeia standards. Virus-free rapid propagation and polyploid breeding technologies also reduce production cost and improve the prospects for standardized commercial cultivation.

Against this background, green production bases for Hangzhou White Chrysanthemum face stringent quality management requirements because product quality and safety are determined at the source and can be compromised by inappropriate input use and weak process control. Evidence from Chinese agriculture shows that excessive fertilizer and pesticide use may raise short-term output but creates long-term problems including resource-use decline, environmental pollution, and hidden risks to agricultural product quality and safety. This is why green production transition has become imperative, yet actual implementation remains incomplete, and compliance problems persist in practice, including failure to follow standard production requirements and illegal marketing of substandard products. Quality certification has emerged as an important governance tool because it strengthens quality monitoring, raises market access thresholds, and can create price premiums that encourage greener production behavior. Empirical evidence across multiple sectors shows that certification participation improves green or low-carbon production, increasing low-carbon production levels among rice farmers and raising eco-efficiency among vegetable farms, with stronger effects generally found for green and especially organic certification (Kang et al., 2023). At the same time, certification is not self-executing. Supervision can be imperfect, some producers may misuse the label while increasing chemical inputs, and many smallholders face financial, technical, and market barriers to obtaining and maintaining certification. Cooperative membership and technical training therefore matter because they improve certification adoption, support compliant production, and enhance the performance of certified farmers (Du et al., 2023). More broadly, certification standards establish key sustainability principles, but compliance remains uneven and under-studied in many value chains, reinforcing the need for operational management systems that convert standards into verifiable field records (Oppong and Bannor, 2022).

A quality traceability system is therefore a necessary extension of green base management for Hangzhou White Chrysanthemum, because traceability provides the information infrastructure needed to connect production behavior, quality formation, circulation, and accountability. Research on agri-food traceability consistently shows that reliable systems should record the whole chain, including production, processing, warehousing, transportation, sale, and supervision, so that specific batches can be tracked and problem sources rapidly identified. Traditional centralized systems are limited by data invisibility, tampering risk, fragmented information, and difficulty for downstream users or consumers to access complete origin data. For that reason, blockchain and IoT have become prominent technical routes because IoT devices can reduce manual recording and continuously collect environmental and process data, while blockchain can preserve data integrity, transparency, and cross-actor trust. Studies have proposed layered architectures that combine physical objects, IoT sensing, and blockchain nodes, and have shown that production, processing, distribution, sale, and supervision nodes can form a complete traceability chain. Consortium or alliance chains appear especially suitable for agricultural traceability because they offer faster transactions, stronger privacy control, and coordinated internal supervision among participating organizations. Recent digital traceability work also emphasizes parsimony and practicality: only key data linked to quality requirements, data certification, and product identification should be captured, including farming diaries, input records, environmental conditions, and certification documents for each batch (Lukács et al., 2025).

Accordingly, the objective of this study is to construct a quality traceability system for green production bases of Hangzhou White Chrysanthemum that starts from the characteristics of its field production and quality formation, identifies the key control points affecting product safety and medicinal quality, and establishes a verifiable information chain covering production and related downstream links. The system should integrate core elements of green base management, such as seedling or propagation source, variety information, field environment, water and fertilizer management, pest control, harvest timing, certification status, and batch identity, while using digital