6.2 Traceability data recording and abnormality early warning

Traceability data recording should cover the whole cultivation and circulation chain, because agricultural and herbal quality control depends on linked records from production, processing, warehousing, logistics, sales, and inspection (Jing and Li, 2024). In practice, growers should enter cultivation records, inspectors should enter testing and warehousing records, and processing or packaging operators should enter processing and package-identity records. For medicinal plants, species identity and lab quality indicators should also be anchored to the same batch, because DNA barcoding and laboratory results strengthen authenticity and whole-process supervision.

Abnormality early warning should be built on real-time sensor data and rule-based or predictive analytics rather than end-point inspection alone. IoT systems already monitor temperature, humidity, location, and other environmental factors during storage and transport, send these data to databases or dashboards, and compare them against preset safety limits (Gupta and Jain, 2026). When abnormalities are detected or forecast, systems can issue early warnings, record the event immutably, and support decisions such as holding, reinspection, or blocking circulation of compromised products.

6.3 Application of quality traceability in product grading and brand development

Quality traceability can be used directly in product grading, because quantified detection indices and batch-linked quality data allow agricultural products to be classified by measurable standards rather than appearance alone (Jing and Li, 2024). For Hangzhou White Chrysanthemum, this means linking each batch code to appearance grade, functional components, safety-test results, and origin or process records, so that higher-grade lots have verifiable evidence behind the label. Q-marker frameworks are especially useful here because they connect process control with final herbal quality from raw material to finished product.

The same traceability system can support brand development and premium pricing by turning verified production data into differentiated quality claims. Studies of agricultural branding report that traceability data can be mined into quantitative labels, cultural narratives, and provenance stories that improve repurchase, trust, and price premium (Chen and Lu, 2025). This function is especially relevant for regional products, because geographical indication and origin-authentication tools can protect brand value, distinguish authentic high-quality goods, and reinforce the market identity of traditional production areas.

7 Summary and Prospects

The quality traceability system for green production bases of Hangzhou White Chrysanthemum should consist of a whole-process information chain covering cultivation, processing, storage, transportation, sales, and supervision, because medicinal-material traceability is effective only when information is continuous from planting to circulation. At the data level, the system should integrate environmental information, seedling and cultivation records, processing parameters, logistics records, transaction data, and quality inspection results, with IoT devices used to capture temperature, humidity, location, and other key variables in real time. At the architecture level, a practical framework combines business activities, IoT sensing, blockchain storage, and application services, so that traceability information can be uploaded, stored, queried, and displayed to regulators, enterprises, and consumers. For product quality evaluation, the traceability system should be linked with measurable indicators such as appearance traits, polyphenol content, standard-decoction parameters, and fingerprint similarity, because these indices provide an operational basis for batch assessment and grading. Since *Chrysanthemum morifolium* is both medicinal and edible, its traceability system should also preserve evidence on flavonoids, phenolic acids, and other bioactive constituents that underlie its therapeutic and functional-food value.

Current application problems mainly arise from fragmented production, uneven standards, and limited data credibility. Chinese herbal medicines are often planted separately by many operators, which makes production quality and standardization difficult to control, and existing traceability systems remain incomplete enough that off-site cultivation, counterfeit origin claims, and fake or inferior products can still enter the traceability chain. Traditional traceability platforms also rely heavily on centralized databases, which create information islands and make records more vulnerable to opacity, tampering, and weak cross-link sharing. Even when blockchain is