propagation method, nursery or mother-stock source, virus-free certification, seedling age and specification, transplanting date, and receiving plot, so that any later difference in growth, flowering, or quality can be traced back to the original planting material (Pan et al., 2023).



Figure 1 Geographical regions for representative chrysanthemum samples (Adopted from Li and Wang, 2026)

3.2 Water and fertilizer management and green pest and disease control

Water and fertilizer management is the core control link in green cultivation traceability, because chrysanthemum growth, flowering, yield, and quality respond strongly to irrigation level, nutrient supply, and their timing. In field chrysanthemum, irrigation at 0.75 Epan repeatedly produced the best balance of yield and water-use efficiency, while 100% of the recommended fertilizer dose improved flowering, yield, quality parameters, and economic returns. Split NPK application through drip fertigation also improved bud diameter, inflorescence traits, chlorophyll content, and soil nutrient status, showing that fertilization records should capture not only total input but also stage-specific application (Choudhary et al., 2022). At the same time, fertilizer concentration cannot simply be increased without limit, because chrysanthemum growth improved with appropriate increases but declined when concentration was too high, and recent work on nitrogen management shows that fertilization beyond optimal demand induces luxury uptake and lowers nitrogen-use efficiency.

For that reason, the traceability system should record irrigation mode, irrigation frequency, water quantity, fertigation concentration, fertilizer formula, application stage, operator, and any sensor-based monitoring data, so that input behavior can be matched to plant performance and audited against green standards (He and Shi, 2021). Green pest and disease control should be traced with the same rigor, because excessive chemical dependence remains a known risk in medicinal-material production, while sustainable alternatives can support quality and soil health. For complementary soil biological management, PGPR such as *Bacillus subtilis* produced outcomes comparable to conventional fertilization while enriching beneficial soil microorganisms, and organic manures, bio-fertilizers, and bio-stimulants improved soil microbial activity and nutrient availability (Sarkar et al., 2024). Bio-enhancer systems such as Jeevamrit also increased rhizosphere microbial counts and enzymatic activity, and studies of planting dates and fertilizer modules have highlighted further links between cultivation practices, chrysanthemum yield, and soil health, so pesticide and disease-control records should include both chemical and ecological measures, their dosages, dates, targets, and residue-risk controls (Pathania et al., 2024).

3.3 Agricultural operations and production process records

Traceability in the cultivation process finally depends on complete agricultural operation records, because standardized production of Chinese herbal medicines requires quality control across planting, processing, purchasing, and selling, and separate planting by many operators makes quality harder to supervise without detailed records (He and Shi, 2021). For medicinal materials in China, policy has explicitly called for complete quality traceability across the whole supply chain and for technical standards covering collection, origin processing, ecological cultivation, and standardized cultivation. In Hangzhou White Chrysanthemum, these records should begin with branch pressing from April to May, transplanting, spacing arrangement, gap filling, topping or terminal-bud removal, and other key field operations, because these operations determine reproductive