opportunities in emerging northern regions and risks of degradation in traditional production areas. As a high-value crop with temperature-dependent growth, *P. lactiflora* requires worldwide production to satisfy year-round demand, motivating the development of perennial cultivation systems that can sustain productivity across diverse environments (Lewis et al., 2023).

Despite its economic importance, perennial cultivation of *P. lactiflora* faces multiple interconnected challenges. The species exhibits a characteristic double dormancy of both the hypocotyl and epicotyl, requiring a two-phase stratification-warm conditions for radicle elongation followed by cold conditions for shoot growth-that spans a prolonged winter period, resulting in an extended propagation cycle and low seedling emergence rates (Mu et al., 2026). Traditional seed reproduction entails a long cycle with a low reproduction coefficient, and plants grown from seed require four to five years before normal flowering, and their offspring may not retain the maternal cultivar's traits. Division propagation, the predominant method, is similarly constrained by a long cultivation period and low propagation rate, requiring more than three years from rhizomes and more than six years from seeds, making it difficult to propagate large numbers of plants within a short period (Yamamoto et al., 2025). A particularly severe problem is the replanting disease that occurs when ramet seedlings are planted at the original site: growth and flowering rates decline, quality deteriorates, and pests and diseases aggravate, eventually resulting in plant mortality (Li et al., 2023). Long-term replanting reduces soil pH, nutrient contents, enzyme activities, and the diversity and richness of fungal and bacterial communities, while increasing the relative abundance of harmful microorganisms such as *Gibberella* and reducing beneficial genera such as *Bacillus* (Li et al., 2023). This soil microecological imbalance damages normal growth and restricts the sustainable development of the industry. Additionally, insufficient chilling accumulation in warm-winter climates, exacerbated by global warming, severely hinders bud dormancy release and flowering, limiting cultivation at low latitudes (Wang et al., 2020). High temperatures and humidity in subtropical regions impede the "Southward Planting of Herbaceous Peony," and the lack of an efficient and stable regeneration system further restricts rapid propagation and large-scale production. Production planning for perennial crops also presents logistical challenges, as large variations in yield and demand across multiple growth cycles can lead to costly shortages or excess in seed stock (Van Der Kruk et al., 2024).

Given these multifaceted challenges, optimizing perennial cultivation models and continuous production management strategies for *P. lactiflora* is essential for sustaining industry growth. Recent advances offer promising directions. Tissue culture systems have been developed for efficient regeneration, with optimized media achieving germination rates up to 91.11% and shoot induction rates of 96.67%, providing a foundation for rapid propagation and germplasm conservation. Bio-nursery systems using diurnal temperature treatments and elevated calcium concentrations during root induction have improved acclimation success, contributing to a more stable seedling supply. For season extension, high-tunnel production has advanced initial harvest by 21~34 days compared with natural field conditions, and staggered planting across high-tunnel and field environments extended harvest duration up to 38 days. Multi-criteria decision-making models incorporating adaptability, ornamental features, and growth habits have been established to screen elite cultivars for low-latitude cultivation, identifying 'Hang Baishao' and 'Meiju' as strongly adaptive germplasms. The Utah model has been validated as optimal for evaluating chilling requirements, enabling cultivar selection tailored to specific climatic conditions. Wild-like cultivation environments have demonstrated that paeoniflorin content and product traits increase year by year, offering an alternative production approach. Optimal harvest timing-late September of the fourth growing year-and shade drying have been identified as the most suitable post-harvest strategy for maximizing bioactive compound yield. Integrated production-inventory planning using model predictive control has been proposed for perennial crop seeds, balancing inventory levels and anticipating future deliveries to reduce both shortages and surpluses. This article synthesizes these advances to provide a comprehensive framework for optimizing perennial cultivation models and continuous production management, aiming to address the propagation bottlenecks, soil health deterioration, climatic constraints, and logistical challenges that currently limit the sustainable development of the *P. lactiflora* industry.