technology and micro/nano-formulations have also been explored to enhance stability, reduce the environmental impact, and enable controlled release, reducing toxicity and enhancing efficacy (Campos et al., 2023; Yan et al., 2023; Chen et al., 2024).

7.2 Integration with loquat genomics and hormone signaling pathways

Intersecting PGR treatment with genomic and transcriptomic research is a direction of the future. Current studies have made headways in deciphering the molecular mechanism of PGR activity in loquat, such as modification of hormone signaling pathway and stress response gene. For instance, transcriptome profiling characterized candidate genes and transcription factors of hormone signaling and stress response, which can be used as a basis for precision breeding and targeted application of PGR (Wang et al., 2021; Dongariyal et al., 2024).

7.3 Construction of precision regulation models and integration with digital agriculture

The future of PGR use is in precision agriculture where computer models and digital technologies can more accurately tailor timing, rate, and combinations of PGRs. Advances in metabolomics, genomics, and digital sensing technologies can bring predictive modeling of PGR response, which can facilitate site-specific and cultivar-specific management. The integration will optimize fruit set, yield, and quality and reduce resource utilization and environmental footprint (Gugliuzza et al., 2020; Zhang et al., 2025).

7.4 Comprehensive regulation strategies based on coordinated improvement of fruit set, yield, and quality

Systems approach is needed, incorporating PGRs with other agronomics (e.g., fertilization, irrigation) and employing molecular information to steer increases in fruit set, yield, and quality. Multi-component approaches, e.g., combining PGRs with fertilizers or biostimulants, have been documented to show synergistic action on loquat growth and stress tolerance. Multi-factorial experiments and systems-level optimization are to be accorded importance in the future for high-quality and sustainable production (Surya et al., 2020; Surya et al., 2021; Campos et al., 2023).

8 Concluding Remarks

Modern research shows that PGRs such as auxins, gibberellins, cytokinins, and chemicals such as paclobutrazol are very effective in controlling fruit set, yield, and quality of loquat and other fruit trees. The regulators promote internal physiological processes, suppress fruit drop, and reverse the detrimental effects of abiotic stresses such that fruit retention and yield are enhanced.

The application of PGRs has become an essential component of modern fruit production, offering a practical means to boost productivity and fruit quality. By optimizing hormonal balance, PGRs not only increase fruit number and weight but also improve nutritional and market value, making them invaluable for efficient and sustainable loquat cultivation.

The application of PGRs has become an essential component of fruit production today, offering a feasible measure to enhance productivity and fruit quality. PGRs not only increase fruit quantity and weight but also improve nutritional and market value by regulating hormonal balance, making them indispensable for productive and sustainable loquat cultivation.

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Conflict of Interest Disclosure

The authors affirm 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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