

days after bloom resulted in optimal improvements in fruit weight and quality (Zhang et al., 2025). The concentration must be carefully optimized, as excessive doses can lead to phytotoxicity or abnormal fruit development, while suboptimal concentrations may yield negligible effects (Desta and Amare, 2021; Kumar et al., 2023; Zhang et al., 2025).

Smearing techniques involve the direct application of PGRs to specific plant tissues, such as inflorescences or young fruits, to maximize local absorption and minimize wastage. For loquat, smearing is typically performed on the panicles or young fruitlets during pre-anthesis or immediately after fruit set. This targeted approach ensures that the PGRs are delivered precisely where hormonal regulation is most needed, promoting cell division and fruit retention. Technical guidelines recommend using a fine brush or cotton swab to apply the solution evenly, avoiding runoff and ensuring thorough coverage. Smearing is particularly useful for high-value cultivars or in research settings where precise dosing is required.

## 5.2 Mixing and combination of different regulators

The combined application of auxins and gibberellins has been shown to produce a synergistic effect on fruit set and development in loquat. Auxins (such as NAA or its synthetic analogs) promote cell division and fruit initiation, while gibberellins (such as GA<sub>3</sub>) stimulate cell elongation and the formation of parthenocarpic fruits (Jiang et al., 2016; An et al., 2020; Jiang et al., 2020; He and Yamamuro, 2022). Studies have found that GA<sub>3</sub> treatment significantly increases the fruit set rate of triploid loquats, with fruits in the treated group retained and developing after three weeks, whereas those in the control group largely abscised (Figure 3). Transcriptomic and proteomic analyses revealed that GA-induced fruit set is accompanied by the upregulation of auxin biosynthesis genes and cell division-related genes, reflecting the synergistic interaction between these hormones (Jiang et al., 2016; Jiang et al., 2020). Experiments have demonstrated that mixing NAA, CPPU (a cytokinin), and GA<sub>3</sub> at specific concentrations (e.g., CPPU 40 mg/L + GA<sub>3</sub> 50 mg/L + NAA 16 mg/L) can significantly improve fruit enlargement and quality, with the ratio and timing of regulator application being critical to maximizing the synergistic effect.

Cytokinins, such as forchlorfenuron (CPPU), are often combined with nutrient solutions to further enhance fruit set and quality. Cytokinins promote cell division and expansion, while nutrient supplementation ensures that developing fruits have adequate resources for growth (Aremu et al., 2020; Surya et al., 2021; Zhang et al., 2025). Forchlorfenuron application at 20 mg/L, for instance, not only increased fruit weight but also improved sugar-to-acid ratio and bioactive compound accumulation in loquat (Zhang et al., 2025). The integration of cytokinins with balanced nutrient sprays (including magnesium, zinc, and boron) has been shown to optimize fruit nutritional quality and reduce physiological disorders (Ali et al., 2021; 2024). Such combined strategies are particularly effective in orchards facing nutrient limitations or environmental stress.

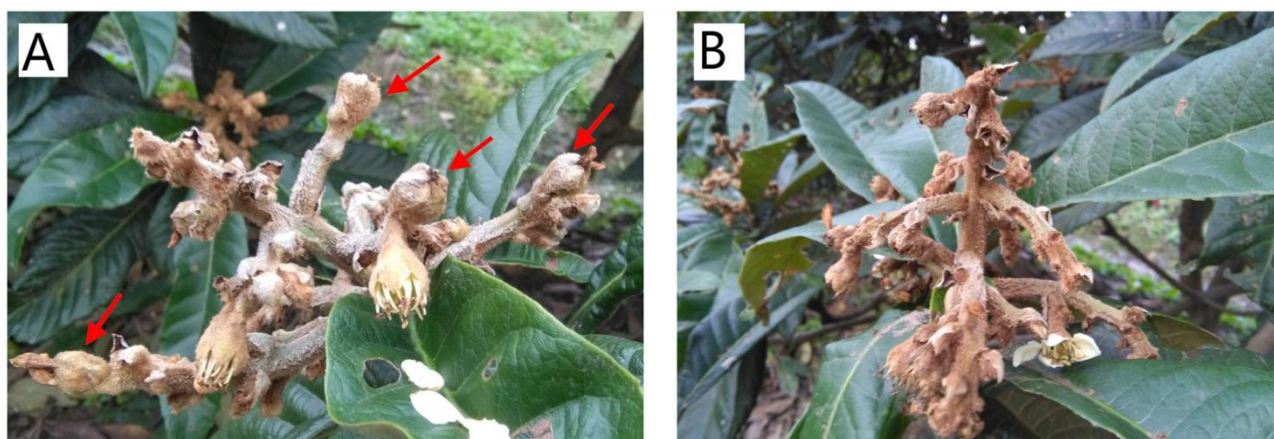


Figure 3 Development of the triploid loquat at 3 weeks after gibberellin (GA) treatment (Adopted from Jiang et al., 2016)  
 Image caption: A: GA treatment; B: Control (Adopted from Jiang et al., 2016)