heading" pruning method has been developed. This involves one heading cut on fruiting shoots after harvest, followed by a second heading when small inflorescences form at the shoot tips in late summer. This approach can produce more vigorous new shoots. These shoots are usually thicker and have darker green leaves, indicating stronger photosynthetic capacity and higher vegetative vigor. Compared with the traditional single heading method, the effect is more obvious. The pruning intensity on a single shoot can regulate the total number of new shoots, shoot length, and leaf size. A moderate pruning level (removal of about 0.79~1.07 cm of woody tissue) is most favorable for new shoot formation and leaf development. Too light pruning cannot effectively stimulate renewal, while too heavy pruning may suppress inflorescence formation and reduce subsequent yield (Liu et al., 2008). For weakened or declining trees, heavy heading of large branches can reduce tree height and induce strong shoot regeneration. However, this vigorous vegetative growth may also divert nutrients in the short term and suppress reproductive growth.

4.2 Effects on canopy density and light distribution

Pruning also reshapes canopy density and internal light conditions by changing the number, length, and spatial distribution of branches. Branch angle and branch number are key factors determining light interception within the canopy. Without pruning, loquat trees often become too tall and overly dense, with leaves concentrated in the upper outer canopy. This leads to poor ventilation and insufficient light inside the canopy, resulting in low fruit set and higher disease risk. Through structural pruning and branch training (widening branch angles), a lower and more open canopy structure can be maintained. This reduces canopy volume and porosity gradients and improves light use efficiency both on the canopy surface and inside. Studies on other evergreen fruit trees support this pattern: although heavy pruning can quickly stimulate vegetative recovery, moderate pruning combined with proper pruning position is more beneficial for maintaining a compact canopy with good ventilation and light penetration in the long term (Jiménez-Brenes et al., 2017; Lodolini et al., 2023).

4.3 Regulation of the balance between vegetative and reproductive growth

Loquat fruit develops over a long period, from flowering in autumn–winter to harvest in late spring. The fruit clusters act as strong sinks and can suppress bud sprouting and limit shoot elongation. Comparisons between fruiting and defruited trees show that the presence of fruit significantly reduces bud sprouting in winter and early spring and shortens shoot length. In contrast, removing inflorescences or fruits promotes earlier bud sprouting and enhances vegetative growth across different seasons (Reig et al., 2014). This "sink effect" is partly mediated by hormonal changes. In fruiting trees, buds have higher levels of indole-3-acetic acid (IAA) and lower levels of zeatin, leading to a higher IAA/zeatin ratio, which is associated with suppressed bud growth. When the sink is removed, this ratio decreases, which favors the activation of vegetative buds. Excessive pruning may push the tree toward overly vigorous vegetative growth, delaying or reducing flower bud differentiation.

In loquat, genes such as *EjTFL1* and *EjRAV1/2* promote vegetative growth and branching while inhibiting flowering integrators (EjFTs and EjSOC1s). High expression of these genes can extend the juvenile phase or delay flowering transition (Jiang et al., 2020; Peng et al., 2021). By adjusting pruning intensity and timing (such as post-harvest heading and late-summer secondary heading), and by controlling shoot vigor and crop load, pruning systems can indirectly influence the expression window of these regulatory networks. This helps maintain a functional balance in the tree, ensuring both adequate vegetative renewal and stable reproductive capacity.

5 Effects of Pruning Systems on Fruit Yield

5.1 Effects on flower bud formation

The pruning system of loquat mainly regulates fruit production by controlling flower bud formation, fruit set and retention, and the final balance between fruit number and size. Heading-back pruning and its timing determine the vigor and leaf area of fruiting shoots (inflorescence-bearing shoots), thereby affecting the differentiation and development of flower buds. Strong shoots produced under an annual double-heading pruning system usually have thicker stems, more leaves, and significantly larger inflorescences compared with those under traditional single heading-back pruning. This indicates that enhanced cell division and floral organ growth during the flower bud stage are key driving factors for later fruit enlargement. Regulation of inflorescence "sink strength" also