In pear-jujube, regulated deficit irrigation applied during the germination stage and fruit maturation stage increased SSC, vitamin C, and the sugar-acid ratio, while only slightly reducing fruit water content (Cui et al., 2008).

4.3 Changes in flavor and texture quality

In 'Conference' pear, preharvest stage II deficit treatment (no irrigation followed by 20% ETc) increased firmness, SSC, and acidity at harvest. This higher SSC/TA combination corresponds to a more complex and pronounced flavor. These advantages were maintained during storage, and fruit thinning under deficit conditions further increased SSC and promoted ripening, allowing earlier harvest of high-flavor fruit (López et al., 2011).

In 'Williams' pear, continuous irrigation increased fruit size but reduced SSC, monosaccharides, and organic acids. In contrast, non-irrigated fruits were smaller but had stronger flavor and higher sweetness (Hudina and Stampar, 2005).

4.4 Effects on aroma-related compounds

In 'Triunfo de Viena', the effects of irrigation levels at 100%, 74%, and 48% ETc during the rapid fruit expansion stage (with full irrigation at other stages) on aroma were evaluated. Moderate RDI had no significant effect on firmness, SSC, acidity, pigments, or phenolic compounds at harvest, and yield was similar to the control, but it altered the temporal dynamics of volatile compound release during ripening (Vélez et al., 2019).

Esters are the main components of pear aroma and showed a continuous increase during the climacteric stage under all treatments. Under moderate water limitation, RDI maintained or slightly increased ester formation without causing off-flavors, provided that the deficit occurred at less water-sensitive growth stages and did not exceed the stress threshold.

5 Yield–Quality Relationship under Moderate Deficit Conditions

5.1 Changes in total yield and yield stability

In 'Yali' pear, both early and late RDI significantly suppressed vegetative growth and reduced irrigation water use. However, over two consecutive growing seasons, there were no significant differences in fruit yield at harvest or average single fruit weight compared with the control. This indicates that yield remains stable when stress is applied from bud break to 25 days after full bloom (pullulation-25 DAFB) or during the last month before harvest (Cheng et al., 2012).

Responses of roots and canopy also support yield stability. In mature 'Sinkiang' pear, moderate RDI (60% Ep) during the early fruit development stage had no effect on final yield compared with full irrigation. Although more severe or longer deficits altered fine root distribution, they did not produce clear positive or negative effects on yield (Wu et al., 2021).

In pear–jujube systems, applying light to moderate water deficit at the bud stage or maturity stage increased yield by 13%~32% or kept it similar to full irrigation, while reducing irrigation water use by up to 18% (Cui et al., 2008; 2009).

5.2 Balance between yield reduction and quality improvement

In 'Yali' pear, late-season RDI improved SSC, sugar content, and dry matter without reducing yield (Cheng et al., 2012).

For 'Triunfo de Viena', applying RDI during the rapid fruit growth stage maintained yield and standard quality traits, with the main effect being water saving. Even under stronger deficits at this stage (25% ETc or no irrigation), yield still did not decrease (Moreno-Hernández et al., 2017).

5.3 Suitable deficit thresholds in production practice

Appropriate deficit thresholds for pear come from pear trials and broader studies on woody fruit trees. For 'Triunfo de Viena', applying RDI at 60%~74% ETc (and even 48% ETc in wet years) during the rapid fruit growth stage can achieve 26%~73% seasonal water savings without affecting yield or quality (Moreno-Hernández et al., 2017).