6.2 Optimization of tree training systems

Selecting an appropriate training system is essential for efficient use of light and labor, as well as for adapting to local climate conditions and protective structures. Planar training systems (such as UFO, super slender spindle, or tall spindle) form narrow fruiting walls that can intercept 60%-70% of incoming light and provide relatively uniform light distribution. This is especially beneficial in high-radiation areas or under rain shelters where photosynthetically active radiation (PAR) is reduced (Anthony and Minas, 2021; Stone et al., 2022).

Bush-type systems (such as KGB) develop multi-leader, compact canopies. Under conditions with sufficient light, low humidity, and lower risks of cracking and disease, these systems can achieve high yields and efficient harvesting (Lang et al., 2019; Soysal et al., 2019).

Training systems should match site conditions, tree vigor, climate characteristics, and the design of rain protection structures. Otherwise, problems such as excessive shading, increased blind wood, and stronger competition between trees may occur (Yan et al., 2025).

Tree height management is also important. Moderately taller trees that remain “pedestrian” or “semi-pedestrian” in height can improve light interception and make it easier to install rain covers and protective nets evenly. In contrast, overly tall trees increase shading in the lower canopy, complicate facility management, and create uneven fruit growing conditions.

6.3 Fruiting zone management

Active management of the fruiting zone can optimize fruit distribution within the canopy, improving light exposure and air movement. In high-density systems, proper branch structure and renewal pruning can promote fruiting on well-lit and accessible positions along the trunk and upright shoots, while avoiding fruiting in deeply shaded areas. This reduces the occurrence of poorly colored and low-quality fruit (Ayala and Lang, 2017; Yin et al., 2023).

In planar systems, maintaining proper spacing between upright shoots is critical for light penetration and uniform fruit quality. Excessively dense upright shoots increase shading and reduce soluble solids and dry matter content.

Crop load should be regulated not only at the whole-tree level but also in terms of spatial distribution within the canopy. Excessive crop load, especially when concentrated in shaded areas, is negatively correlated with fruit dry matter and soluble solids content. In contrast, a more balanced distribution of crop load helps improve overall fruit quality consistency (Yin et al., 2023).

Therefore, integrating pruning, training system management, and crop load regulation can create an open and evenly distributed fruiting wall or bush canopy. Such structures can operate efficiently under rain shelters, achieving better light use efficiency, faster drying, and reduced risks of fruit cracking and disease.

7 Comprehensive Measures to Reduce Fruit Cracking in Cherry Production

7.1 Rain-shelter systems

Plastic rain shelters, elevated tunnels, and net or tent systems form a physical barrier that prevents or reduces direct contact between rainfall and the fruit surface, making them one of the most effective measures to control fruit cracking. Multi-span elevated tunnels and pole-wire rain shelters can reduce natural cracking rates by more than 40% and are widely used in high-rainfall regions. However, their high cost and the alteration of the microclimate (such as increased temperature and humidity, and reduced light) are important limiting factors (Lang, 2014).

The interaction between canopy structure and rain-shelter systems is critical. Planar fruiting walls and pedestrian training systems facilitate uniform installation of rain covers and allow good ventilation. In contrast, under enclosed plastic covers, large and dense canopies tend to accumulate humidity, increase disease incidence, and may even lead to fruit cracking without obvious surface wetness (Blanco et al., 2021). In addition, net covering can also reduce cracking to some extent, while moderately regulating the microclimate and promoting fruit enlargement (Gonçalves et al., 2023) (Figure 2).