

In addition to final fruit weight, the rate of fruit enlargement, its day-night variation, and its developmental dynamics also profoundly influence yield formation. Inter-canopy LED supplemental lighting can increase the relative growth rate of fruits at night and raise the final weight of fruits in middle and later fruit positions, thereby improving fruit size uniformity within the same truss. In contrast, when fruit sink number is increased by increasing branch number, average single fruit weight often declines, even when carbon supply per unit leaf area does not decrease synchronously. This suggests that smaller fruits are not necessarily caused by source limitation, but may also result from reduced sink capacity of individual fruits or intensified competition among multiple fruit sinks. In addition, fruit enlargement rate is jointly influenced by plant hydraulic status and hormonal regulation, further indicating that single fruit weight formation is the result of the coordinated action of carbon assimilation, transport efficiency, and sink activity.



Figure 2 Maturation and attachment characteristics of long-elliptical tomato fruits under facility cultivation condition

4.2 Roles of fruit shape and fruit uniformity in marketability

Fruit shape and uniformity are important appearance traits affecting the marketability of protected tomatoes. For fresh-market tomatoes and cluster-harvested tomatoes, yield does not necessarily equate to high commercial value. Whether fruits are well rounded, whether the shoulders are symmetrical, whether the fruit shape index is stable, and whether fruit size is uniform all directly affect grading, packaging efficiency, transportation damage rates, and consumer acceptance. Traits such as fruit weight, shoulder height, and height-to-width ratio are closely related to commercial classification. Although environmental effects on fruit shape parameters are usually smaller than their effects on chemical traits such as sugar content and dry matter, clear genotype \times environment interactions still exist for fruit size and shape stability. Therefore, under protected cultivation conditions, selecting varieties with stable fruit-shape performance is of great significance for maintaining consistent market quality. Fruit uniformity is not only related to appearance, but also directly affects harvest rhythm and commercial management efficiency.