This case is valuable for another reason. It shows that, in humid and commercially intensive protected systems, the question is rarely whether less water improves sweetness. The real question is how to avoid the common farmer tendency toward excessive irrigation and fertilization while still keeping yield high enough for commercial greenhouse production. The Haining results suggest that irrigation in this region should be moderate rather than maximal, and that water scheduling should be coupled with nutrient management instead of treated independently. That conclusion fits well with the production realities of Zhejiang, where growers often target appearance and quality premiums in protected fruit (Yue et al., 2023).

6.2 Greenhouse melon irrigation management in the yangtze river delta region

Direct English-language field studies explicitly framed as "Yangtze River Delta melon irrigation" are still relatively limited, which is itself an important observation. However, existing evidence from the broader region still gives a useful picture. The Haining greenhouse case already belongs to the Delta's eastern protected-horticulture context, and a Shanghai-based study on greenhouse netted muskmelon demonstrated that plant phenotyping and random-forest modeling could forecast substrate water status with high stage-specific accuracy, reaching 77.60%, 94.37%, and 90.01% at seedling, vine elongation, and fruit development stages, respectively. That work matters because greenhouse melon systems in the Delta are often technologically intensive and quality-oriented, making plant-based irrigation decision tools especially relevant (Chang et al., 2019; Yue et al., 2023).

The practical lesson for the Yangtze River Delta is not that every farm should adopt machine learning immediately. It is that regional melon systems are well suited to dynamic irrigation scheduling because they combine protected cultivation, high fruit value, and relatively strong technical infrastructure. In such a context, irrigation frequency can reasonably move away from fixed grower habit toward stage-specific decision rules tied to substrate water status, crop growth stage, and desired fruit quality. What is still missing is more field-validated, English-language, region-specific work that links these tools to final fruit quality and economic return under Delta humidity and greenhouse conditions (Chang et al., 2019; Fang et al., 2026).

6.3 Deficit irrigation practices in northwestern china

Northwestern China provides a contrasting environment in which water scarcity, salinity risk, and greenhouse or substrate production make irrigation frequency an even more technical issue. Sun and colleagues, working in high-EC irrigation water regions, evaluated irrigation amount, nutrient solution EC, and irrigation frequency together and found that integrated growth and efficiency rose and then fell with frequency, with seven irrigations per day emerging as the best option in their studied conditions. This is a clear case where pulsed irrigation is not merely a convenience; it is a way to manage salinity, root-zone conditions, and plant performance simultaneously (Sun et al., 2024).

Another northwestern case comes from soil-moisture-based furrow irrigation scheduling for melon in an arid region, which showed that moisture-based scheduling can improve the balance between yield and quality under water limitation. More recently, greenhouse substrate work found that mild deficit during fruit maturity significantly reduced cracking and improved fruit quality. Together, these studies show that northwestern systems often need two things at once: water-saving delivery and stage-targeted quality management. The frequency question therefore becomes highly practical—how small and how often should irrigation events be when water is limited but fruit quality must remain premium? (Wang et al., 2017; Xue et al., 2025).

6.4 Lessons from regional melon production systems

Across regions, one broad lesson stands out: irrigation frequency is not transferable in a simple calendar form. Humid eastern greenhouses, high-tech Delta systems, arid northwestern greenhouses, Mediterranean open fields, and North American semi-arid field systems all respond differently because evaporative demand, rooting volume, salinity, and market goals differ. Yet a common rule still emerges. Fruit set and enlargement need stable moisture; ripening can tolerate, and often benefit from, controlled reduction (Fabeiro et al., 2002; Kuscu and Turhan, 2022; Fang et al., 2026).