

pears have more soluble solids, more vitamin C, and a better sugar–acid balance. They also save money on fertilizer and are better for the environment (Shen et al., 2018). For example, studies show that bagged controlled-release fertilizers, compared to regular compound fertilizers, make the fruit taste better and boost its nutrition, giving farmers a good option for growing high-quality pears.

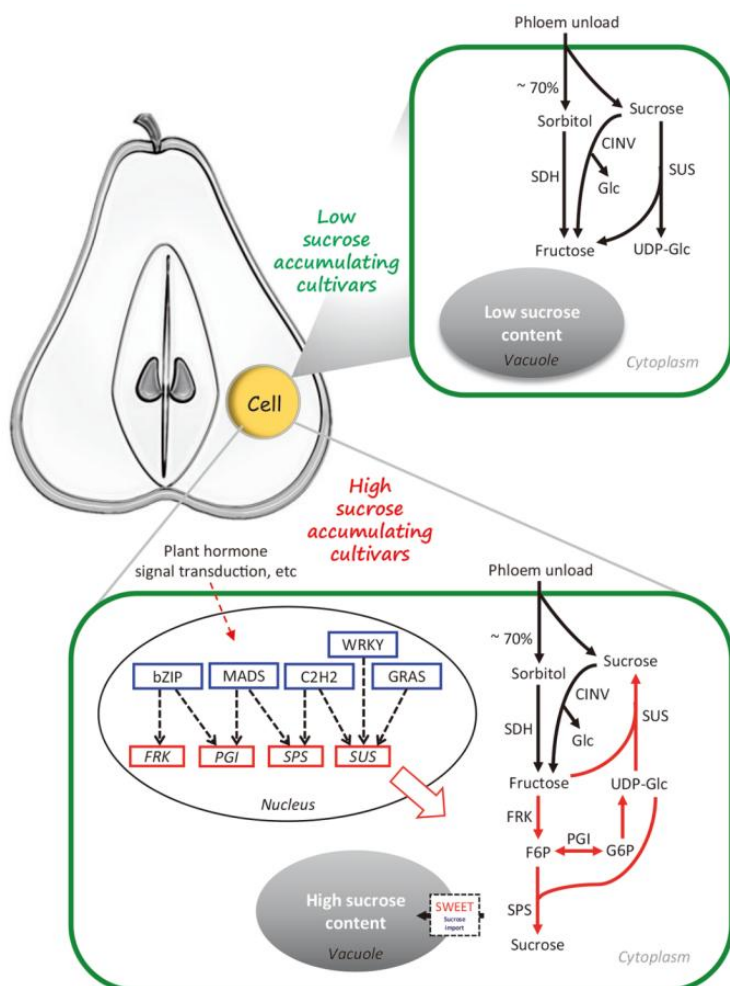


Figure 1 A proposed model of sucrose content difference in pear fruits. Several types of TFs are involved in the upregulated transcription of *FRK*, *PGI*, *SPS* and *SUS* genes in the nucleus, and high sucrose then accumulates in vacuoles. Sucrose accumulation is affected by multiple signals, such as plant hormones. CINV, cytoplasmic invertase or neutral invertase; Glc, glucose; SDH, sorbitol dehydrogenase (Adopted from Lü et al., 2020)

Image caption: The figure illustrates the metabolic pathways at the cellular level in high- and low-sucrose cultivars. In high-sucrose types, the upregulation of genes such as *SPS*, *SUS*, *FRK*, and *PGI* promotes sucrose synthesis and its accumulation in vacuoles within fruit cells, while being regulated by transcription factors like bZIP and WRKY as well as plant hormone signals. In contrast, low-sucrose types lack this efficient pathway, resulting in limited sucrose deposition (Adapted from Lü et al., 2020)

5.2 Timing and methods of nutrient application

The advantages of foliar fertilization are quite obvious, especially when there is a deficiency of trace elements. It works quickly and can also enhance the hardness, sugar content and soluble solids of fruits. It works best during critical periods, when the fruit is developing (Gilani et al., 2021; Sajid et al., 2022; Seo et al., 2024; Yuan et al., 2024). However, root (soil) fertilization remains the main force. It provides a large amount of nutrients and supports the entire process of pear trees from vegetative growth to reproductive growth (Jiang et al., 2020; Colpaert et al., 2021). When the two methods are used in combination, the improvement of nutrient absorption and fruit quality will be more obvious. When soil nutrient supply is insufficient or stress occurs, foliar spraying becomes more important (Zargar et al., 2019).