

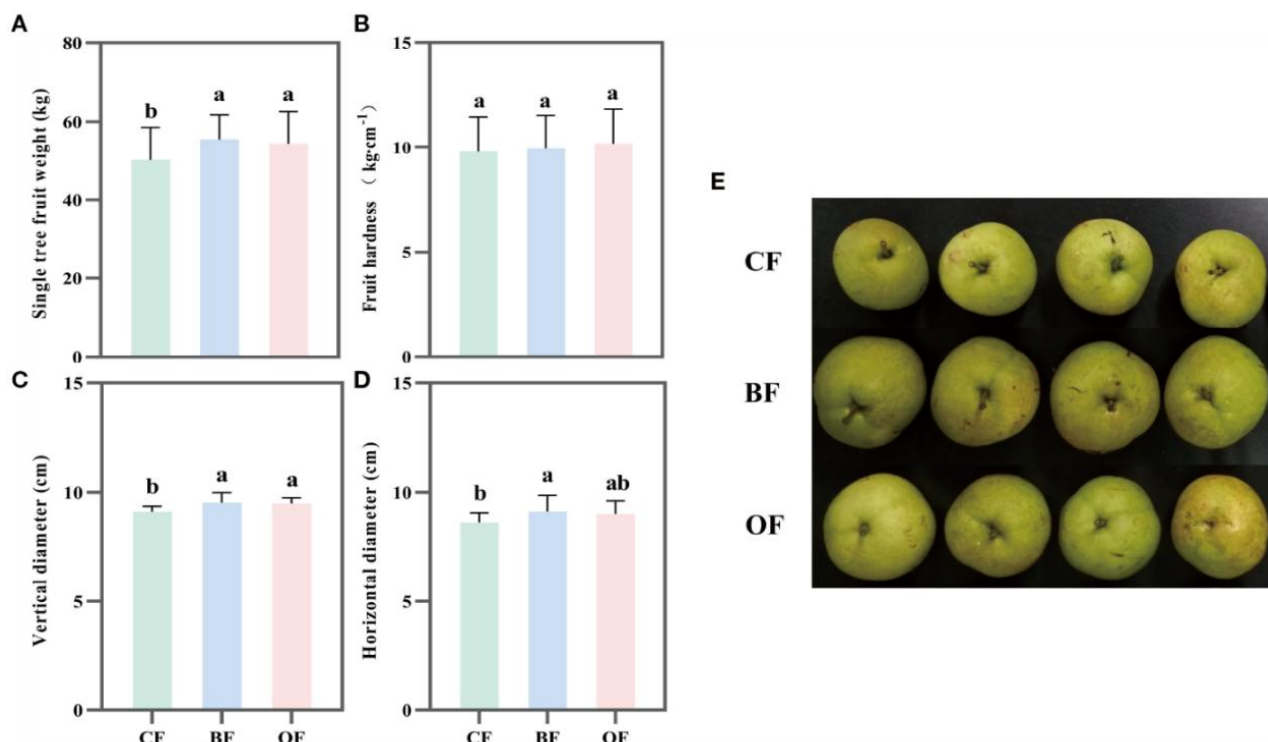


Figure 2 Effect of different fertilization treatments on fruit weight per tree (A), fruit hardness (B), fruit vertical (C), horizontal (D) diameter and phenotype (E) of Pear. CF: chemical fertilizers application; BF: bio-organic fertilizers application; OF: organic fertilizers application. Values followed by different letters differ significantly (Duncan's test, $P < 0.05$, $n=5$) (Adopted from Wang et al., 2022a)

7.2 Enhancement of pear flavor quality

The flavor and commercial value of pears mainly depend on the balance of sugar and acid, as well as the accumulation of secondary metabolites. In recent years, the role of transcription factors in the regulation of fruit quality has attracted much attention. As research has found, PpbZIP44, a member of the S1-bZIP family, plays a key role in the multiple metabolic regulation of fruits.

Wang et al. (2023) demonstrated that PpbZIP44 can alter the accumulation patterns of sugars, organic acids, amino acids, and flavonoids by transient overexpression and RNA interference in pear fruit, as well as by establishing a stable transgenic system in tomatoes. The experiments showed that overexpression of PpbZIP44 increased fructose in the fruit by 38%, decreased sorbitol by 26%, and reduced citric acid and malic acid by nearly 40% and 30%, respectively. This significantly increased the sugar-acid ratio, thereby improving flavor and marketability (Figure 3).

More importantly, PpbZIP44 regulates sugar conversion, proline decomposition, and the synthesis of aromatic amino acids and flavonoids by directly binding to the promoters of genes (e.g., *PpSDH9*, *PpProDH1*, *PpADT*, and *PpF3H*), promoting the flow of carbon towards fructose and flavonoid accumulation, while weakening the formation of some lignin. Thereby reducing the negative impact of "stone cells" on the taste. Metabolomic and transcriptomic analyses further confirmed that these treatments could enhance gene expression related to carbohydrate metabolism, ultimately achieving sweeter fruits and higher market acceptance (Wang et al., 2022a; Wang et al., 2023; Jia et al., 2024).