

Research Insight

Open Access

Variation in Fruit Quality Traits of Peach (*Prunus persica*) Under Different Cultivation Conditions and Its Evaluation Methods

Yan Chen ¹, Jie Zhang ² ✉¹ Xiantaoyuan Farm, Ganpu Town, Haiyan County, Jiaxing, 314301, Zhejiang, China² Modern Agricultural Research Center, Cuixi Academy of Biotechnology, Zhuji, 311800, Zhejiang, China✉ Corresponding email: 3246196019@qq.comPlant Gene and Trait, 2026, Vol.17, No.2 doi: [10.5376/pgt.2026.17.0007](https://doi.org/10.5376/pgt.2026.17.0007)

Received: 5 Mar., 2026

Accepted: 31 Mar., 2026

Published: 20 Apr., 2026

Copyright © 2026 Chen and Zhang, This is an open access article published under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Preferred citation for this article:

Chen Y., and Zhang J., 2026, Variation in fruit quality traits of peach (*Prunus persica*) under different cultivation conditions and its evaluation methods, Plant Gene and Trait, 17(2): 92-111 (doi: [10.5376/pgt.2026.17.0007](https://doi.org/10.5376/pgt.2026.17.0007))

Abstract This study summarizes the composition, variation patterns, and evaluation methods of fruit quality traits in peach (*Prunus persica*) under different cultivation conditions. Peach fruit quality is multidimensional, encompassing external, internal, and nutritional attributes, among which sugar-acid composition, texture, and aroma are key determinants of eating quality. Environmental factors (light, temperature, and water) and cultivation practices (fertilization, pruning, crop load regulation, etc.) significantly regulate fruit quality by influencing metabolic processes and interacting with genotype. In terms of evaluation methods, traditional physicochemical and sensory assessments remain fundamental, while modern chromatographic, spectroscopic, and non-destructive techniques (e.g., Vis/NIR and hyperspectral imaging) enable rapid and accurate quality evaluation. Meanwhile, multi-index comprehensive evaluation models (such as PCA and AHP) improve the scientific robustness and practical applicability of quality assessment. Future research should focus on integrating multi-omics and intelligent detection technologies, promoting standardized evaluation systems and precision regulation to achieve stable improvement of peach fruit quality.

Keywords *Prunus persica*; Fruit quality; Cultivation conditions; Non-destructive detection; Comprehensive evaluation

1 Introduction

Peach (*Prunus persica*) is one of the most widely cultivated temperate fruit trees worldwide, characterized by early ripening, desirable flavor, rich nutritional value, and high economic importance. It plays a significant role in both fresh consumption and processing markets. In China, the peach industry contributes substantially to agricultural structural optimization, regional brand development, and farmers' income growth. With rising living standards and shifts in consumption patterns, market demand has gradually transitioned from a focus on yield to a model emphasizing "high quality, safety, and distinctiveness." However, in some high-yield regions, per capita consumption has declined, mainly due to unstable eating quality and generally low fruit quality, such as insufficient sweetness, weak flavor, and suboptimal ripening characteristics. Therefore, improving and stabilizing peach fruit quality under diverse environments and production systems has become a key issue for industry development (Mosie et al., 2025).

Peach fruit quality is multidimensional and integrative, typically encompassing external, internal, and nutritional attributes. External quality mainly includes fruit shape, size, color, and uniformity, which directly influence consumer purchasing decisions. Internal quality involves flesh texture, firmness, soluble solids content (SSC), titratable acidity (TA), sugar-acid ratio, and volatile aroma compounds, which are the core determinants of taste and flavor; among these, SSC, TA, and their ratio are key indicators of sweetness-acidity balance. Nutritional quality is reflected by the content of functional components such as vitamin C, polyphenols, carotenoids, and mineral elements, which are associated with antioxidant capacity and overall health benefits (Mosie et al., 2025). In addition, with the advancement of evaluation systems, attributes such as storability, resistance to internal disorders, and transport tolerance have gradually been incorporated into quality assessment frameworks.

The formation of peach fruit quality is jointly regulated by genetic factors and environmental conditions, among which cultivation conditions represent important controllable factors. Environmental variables such as light, temperature, water availability, soil properties, and nutrient status influence photosynthesis and metabolic