Functional Components Changes of Kiwifruit at Different Harvesting Time

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Abstract: In recent years, kiwifruit has been loved by consumers because of its juicy meat and storage resistance. During the ripening of kiwi fruit, people cannot judge its maturity through appearance traits. Kiwifruit harvest maturity is closely related to fruit ripening quality, but there is still no effective standard for judging kiwifruit harvest maturity. Based on this, the effects of different harvesting time on fruit quality were analyzed by measuring the changes of kiwifruit hardness, dry matter content, total phenolic content, titratable acid and soluble sugar. The aim is to provide a reference for the scientific development of kiwifruit harvesting plan and storage and preservation program.

1. Research background

1.1 Literature review

Chen Zhaodi, Chen Yiting and Chen Ting proposed that kiwifruit has many components such as vitamins, dietary fiber, trace elements, polysaccharides, flavonoids and polyphenols, and has good development prospects in storage, processing and application of health care drugs (Chen Et al., 2014). Zhou Yuan, Yan Hao and Fu Hongfei believe that the aroma of kiwi fruit wine is closely related to the yeast strain for fermentation. After research, it was found that there were differences in the composition and content of aroma components of fruit wines produced by different yeast strains (Zhou et al., 2014). Pang Rong, Ren Yamei and Yuan Chunlong et al. studied the effects of swelling treatment on the sensory quality of different varieties of kiwifruit, and proposed that the hardness, titratable acid and chlorophyll content of the control fruit were significantly higher than that of the swelling agent when harvested (Pang et al., 2017). Wang Jing, Feng Meifeng and Yang Bimin analyzed the development status of kiwifruit fruit postharvest preservation technology at home and abroad. On this basis, it pointed out that preservation technology includes calcium treatment, oxalic acid treatment, low temperature refrigeration and modified atmosphere storage (Wang et al., 2014). Yao Chunchao, Liu Zhande and Long Zhouxia used “Xuxiang” kiwifruit as experimental materials to study the effects of harvest time on the taste and physicochemical properties of kiwifruit fruit, and proposed that premature harvesting would result in soluble solids and dry matter content in kiwifruit. Low and at the same time cause high titratable acid content (Yao et al., 2013).

1.2 Purposes of research

Kiwifruit is native to China and has the advantages of storage tolerance and high yield. The harvesting period is an important factor affecting the final ripening quality of kiwifruit. The ripening quality of kiwifruit fruit is different during different harvesting periods. During the Mid-Autumn National Day, fruit farmers often harvest kiwifruit in advance to seize the market. In order to find out the effect of harvest time on the functional components of kiwifruit and determine the optimal harvest time of kiwifruit, this paper takes “Cuixiang” kiwifruit as the research object, and carries out experiments on the effects of different harvesting time on the functional components of kiwifruit, in order to make the kiwifruit reasonable. Provide theoretical basis for the development of harvesting and storage preservation technology.

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2. Materials and methods

2.1 Experimental materials

"Cuixiang" kiwifruit is produced in Daiyue District, Tai'an City, Shandong Province, and is produced in Heji Garden, Beijipo, Tai'an High-tech Zone. The average elevation of the place of origin is 1260m, the annual average temperature is 16°C, and the annual rainfall is about 1293mm.

2.2 Reagents and instruments

The reagents used in this experiment were phenolphthalein, 80% acetone, sodium nitrite, methanol, concentrated sulfuric acid, oxalic acid, aluminum trichloride, sodium hydroxide, sodium carbonate, florin reagent, sodium nitrite, catechin. The instrument uses digital fruit hardness tester (Hangzhou Zhuoju Co., Ltd.), WZS80 hand-held refractometer (Shanghai Reunion Scientific Instrument Co., Ltd.), ultraviolet spectrophotometer (Wuxi Baitek Biotechnology Co., Ltd.), low-speed centrifuge (Jinan Xin Beisi) Biotechnology Co., Ltd., Electronic Balance (Ohaus, USA), electric thermostatic water bath (Nantong Runfeng Petrochemical Co., Ltd.).

2.3 Experimental methods

The experiment first carried out sample collection and processing, and set 8 harvesting periods (I, II, III, IV, V, VI, VII, VIII), and the interval between different harvesting periods was 3 days. Five normal kiwi fruit trees were set in each harvesting period, and 120 fruits were randomly collected. After collection, they were sent to the laboratory for storage at room temperature. After each fruit harvest, the quality of the test fruit, dry matter content, respiration rate, total phenol content, total flavonoid content, titratable acid and soluble solid content were measured and the data were recorded. At the same time, the physical and chemical indicators of kiwifruit were measured every 3 days, and the data were recorded in the initial indicator record table. The fruit firmness was measured by a digital fruit hardness tester, and the soluble solid content was measured by a WZS80 hand-held refractometer (Zhang et al., 2018). The dry matter content was determined by the dry weighing method, and the titratable acid and soluble sugar were determined by acid-base titration and anthrone reagent respectively (Xiao et al., 2013). In this experiment, the content of vitamin C in kiwifruit was determined by 2,6-dichlorophenol indophenol titration, and the total phenolic content was determined by the forinol method (Ma et al., 2016). The Excel software was used to calculate the mean value and variance, and the results were plotted. Finally, the SPSS statistical software was used for variance analysis.

3. Experimental results

3.1 Effects of harvesting time on fruit firmness, dry matter, titratable acid, soluble sugar and soluble solids in kiwifruit

The experimental results showed that the kiwifruit in different harvesting periods showed a decreasing trend with the prolongation of storage time. At the same time, the data showed that the dry matter content of kiwifruit in each harvest period was positively correlated with the storage time. Soluble solids consist of fructose, tannins, organic acids and some water-soluble pigments, minerals and other ingredients, and its compositional changes directly affect the taste of the fruit. As the kiwifruit harvest time is delayed, the soluble solids content continues to increase. The titratable acid is one of the important indicators affecting the taste of kiwifruit. During storage at room temperature, the titratable acid is slowly degraded as a cellular respiratory matrix, thereby causing a gradual decrease in the content. Compared with the previous soluble sugar content, the kiwifruit harvested in the later stage was significantly higher, indicating that the appropriate harvesting period can effectively alleviate the loss of soluble sugar.

3.2 Effects of harvesting time on vitamin C, total phenolic content and total flavonoids in kiwifruit

Vitamin C is an important component of fruit nutrition, has strong antioxidant properties, and is extremely rich in kiwifruit. After data analysis, it was found that the content of vitamin C in kiwifruit increased first and then decreased, indicating that premature or over-harvesting had an effect on vitamin C content in kiwifruit. Moreover, too early or too late harvesting will cause a decrease in vitamin C content in kiwifruit. Polyphenols are widely found in various fruits and vegetables, and are limited by conditions such as storage conditions and maturity of plants. As the harvesting time point shifted backward, the total phenolic content in kiwifruit increased first and then decreased, and the total phenolic content reached the maximum at the peak of fluctuation. Flavonoids are widely found in fruits, vegetables, tea and other plants, and are an important secondary metabolite of plants. In the experiment, with the prolongation of storage time, the total flavonoids of kiwifruit in different harvesting stages increased gradually, and the growth rate was small.

3.3 Effect of harvesting time on weight loss rate and rot rate of kiwifruit

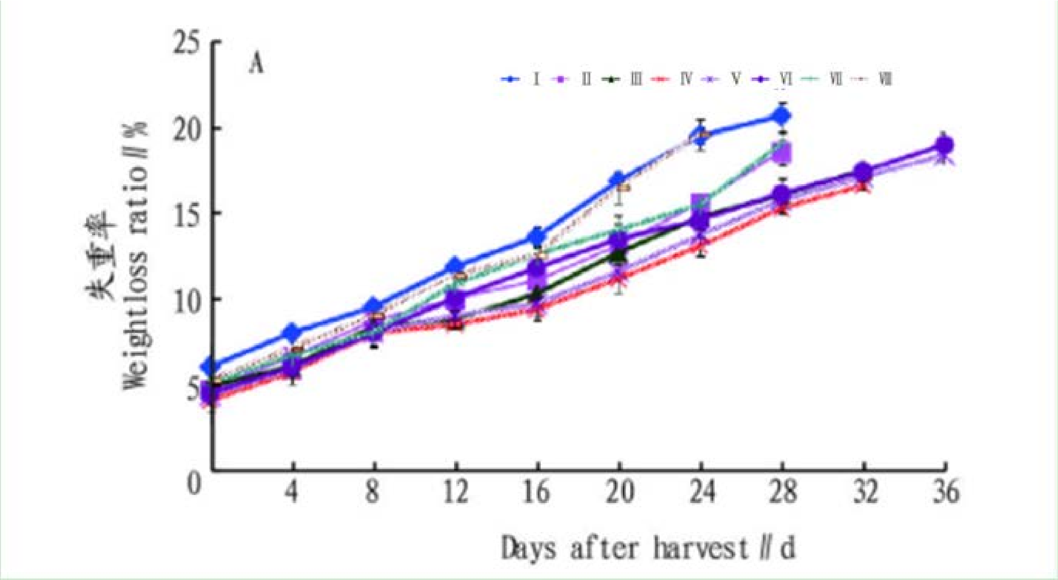

Figure 1.Curve of Weight Loss Rate of Kiwi Fruit in Different Harvesting Periods

With the prolongation of storage time, the weight loss rate and rot rate of kiwi fruit in different harvesting periods showed an upward trend. The weight loss rate of kiwifruit in different harvesting periods is different. As shown in Figure 1, during the storage period, the weight loss rate of the harvesting stage IV and the harvesting stage V is always lower than the other stages. The weight loss rate of kiwifruit in stage IV was the smallest, 4.04%, followed by stage V, and the weight loss rate was 4.36%. At the same time, the weight loss rate of fruit in harvesting stage I and harvesting stage VIII was significantly higher than that in other harvesting stages. In the earliest and latest experimental groups, the weight loss rate of kiwifruit was always higher than that of other control groups, indicating that collecting kiwifruit too early or too late would increase its weight loss rate during storage. At the same time, the rot rate of kiwifruit was different at different harvesting time, and the decay rate of the earliest and the last harvested experimental group was significantly higher than that of other groups.

4. Analysis of results

Formulating an appropriate harvesting period is one of the important prerequisites for ensuring the good quality of kiwifruit. If the kiwifruit harvest time is too early, the fruit maturity is low, the expected fruit quality and eating quality have not yet reached, and it is difficult to store for a long time. If the harvesting time is too late, the kiwifruit is too mature, the hardness is low, and the storage time is short. Therefore, the development of appropriate harvesting time plays an important role in maintaining the quality of single fruit, ensuring good flavor and prolonging storage time. Kiwifruit is difficult to judge whether it is mature or mature from the size and color of the fruit. Therefore, it is also difficult to determine the appropriate harvesting period of kiwifruit. At this stage, soluble solids can be used as an indicator to measure the maturity of kiwifruit, and it is judged whether it can effectively prolong the storage period of kiwifruit. The determination of the harvesting period of kiwifruit is closely related to the geographical location, climate, altitude and annual average precipitation of the orchard. There are also differences in the ripening period of kiwifruit in different regions, different orchards and the same variety. Even if the same species of kiwifruit is in the same orchard in the same area, there are large differences between years. In this experiment, the physicochemical properties of the "Cuixiang" kiwifruit collected in stages were determined and analyzed. It was found that the hardness and titratable acid content of different kiwifruits gradually decreased with the backward storage time, and the total phenolic content was The content of dry matter, soluble sugar, total flavonoids and soluble solids increased gradually, and the total flavonoid content also increased. And the kiwifruit fruit hardness decline curve harvested in stage IV tends to be stable. After 16 days of harvest, the soluble sugar curve of kiwifruit harvested in stages IV and V was higher than other harvesting stages, and peaked at 24 days of harvest. The solid-acid ratio and the ratio of sugar to acid in the experimental group harvested in the IV and V stages increased steadily. The vitamin C content of kiwifruit harvested in stage IV and V was significantly higher than that in other experimental groups. The total phenolic content of kiwifruit harvested in stages IV and V showed a downward trend and was lower than other stages. The weight loss rate and decay rate of fruits harvested in stages IV and V were significantly lower than those in other stages.In summary, the suitable picking period of "Cuixiang" kiwifruit is IV-V, from mid-September to early October. Harvesting at this stage is conducive to maintaining the quality of the fruit, hardness, etc. It can store for the longest time and has a high commercial value.

References

[1] Chen Z.D., Chen Y.T., Chen T., et al. (2014). The Main Functional Components of Kiwifruit and its Development and Utilization, Tropical Agricultural Science, 34 (8), 104-108.

[2] Zhou Y., Yan H., Fu H.F. (2014). The Effect of Yeast Strain on the Aroma Components of Kiwi Fruit Wine, Modern Food Science and Technology, 35 (12), 263-270.

[3] Pang R., Ren Y.M., Yuan C.L., et al. (2017). Effects of Swelling Agent Treatment on the Quality of Six Kiwifruit Harvesting and Soft Ripening, Modern Food Science and Technology, 35 (8), 235-242.

[4] Wang J., Feng M.F., Yang B.M., et al. (2014). Research Progress on Postharvest Physiology, Postharvest Diseases and Preservation Techniques of Kiwifruit, Packaging and Food Machinery, 37 (4), 53-57.

[5] Yao C.C., Liu Z.D., Long Z.X. (2013). Effects of Harvesting Period on the Fruit Quality of "Xuxiang" Kiwifruit, Northern Horticulture, 43 (8), 36-38.

[6] Zhang C., Wang Q.P., Qi F., et al. (2018). Determination of Suitable Picking Period of Kiwifruit and Its Storage Performance, Journal of Agricultural Engineering, 34 (17), 266-275.

[7] Xiao Z.W., Wang R.C., Luo H.B., et al. (2013). Principal Component Analysis of Physiological and Biochemical Indexes of Kiwi Fruit During Storage, Hunan Agricultural Science, 49 (15), 90-93.

[8] Ma F.G., Wu D.L., Xu F.Q., et al. (2016). Studies on the Chemical Constituents of Chinese Kiwifruit, Chinese Patent Medicine, 38 (3), 591-593.