The Influence of Different Harvest Time of Quality of ‘Bashan’ Plum

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Abstract. This paper studied the qualities of ‘Bashan’ plum of 9 different harvest times, changes of several indices were measured periodically at normal temperature after fruit picking. The results showed that from July 10th to 26th, as the harvest time of Bashan crisp plum was delayed, the fruit size gradually increased, acidity decreased and sugar content increased, hardness decreased, and the color of the peel changed from green to yellow-green. According to the standardized production of ‘Bashan’ plum, and the environment and climate conditions in this region, different harvesting dates should be used for different uses of ‘Bashan’ plum, in order to achieve the best fruit, high quality and maximum economic benefits.

1. Introduction

Dazhou green crisp plum is an excellent local fruit tree formed by directional cultivation in the production practice of long-term plum cultivation. It is a unique brand of Dazhou plum. "Bashan crisp plum" passed the certification of crop varieties in Sichuan in December 2011. With crispy and sweet taste, high content of soluble solids, and unique flavor, it has become the second largest fruit planted in Dazhou City\textsuperscript{[1]}. With the continuous expansion of the cultivation area and the young trees gradually entering the fruiting period, their yield will also increase significantly. However, in actual production, the quality of “Bashan crispy plum” is very different. In addition to the cultivation management, the harvest time is also an important influencing factor. At present, the harvest of crispy plums in Dazhou is mainly affected by market sales and caregiving capacity. Human factors have a greater impact on the harvest period. The maturity at the time of fruit harvesting is not only related to the post-harvest quality and storage performance, but also to the fruit yield and economic benefits\textsuperscript{[2]}. Early harvest, insufficient fruit development and insufficient internal material accumulation cannot show the inherent good traits and qualities of the variety; late harvest, fleshy flesh, poor disease resistance, and intolerance to storage. Therefore, only the proper harvest can achieve the best appearance characteristics, the best internal quality, and the longest storage life, so as to obtain the highest economic benefits\textsuperscript{[3]}. In this paper, “Bashan crisp plum” was used as the test material to study the variation of fruit quality content in different picking periods, and to carry out research on the monitoring and harvesting standards of Dazhou crisp plum in the mature period, and to provide a theoretical basis for timely harvesting of crisp plums in production.

2. Materials and methods

This paper was conducted in Huaguoshan, Miao'an Township, Tongchuan District, Dazhou City. Five trees with similar growth, balanced growth and normal growth were selected as test materials. On July 10, 12, 14, 14, 16, 18, 20, 22, 24, and 26 on the marked fruit trees in the east, south, west, north, and middle directions, respectively 4 green and crisp plums were picked on each of them, each with a total
of 100 fruits, the fruit size was uniform, the maturity was the same, and there was no mechanical damage and pests. Immediately after harvest, the fruits were returned to the laboratory, numbered, and their physiological indicators determined.

Fruit size was measured by using a digital vernier caliper; acidity was measured using a pH meter; sugar was measured using a hand-held sugar meter; hardness was measured using a GY-1 fruit hardness meter; color difference was measured using a 3nh precision color difference meter.

The data of each measurement is clearly recorded according to the number, and the data is sorted after all the measurements are completed, the average value is calculated, and then the result analysis is performed.

3. Results and analysis

3.1 Changes in fruit size of ‘Bashan’ plum in different picking periods

![Fig. 1. Changes in fruit size of ‘Bashan’ plum in different picking periods](image)

The change in fruit size of ‘Bashan’ Plum at different picking periods is shown in Figure 1. It can be seen from Fig. 1 that between July 10 and July 26, the fruit size of Bashan crisp plum showed a significant increase. The size of the fruits harvested before July 18 increased significantly, with an average daily increase of 0.54cm; the size of fruits harvested after July 18 increased slightly from the previous harvest, but the increase was not significant. Fruit size can reflect the yield of the orchard. Therefore, fruit size is a very important indicator when monitoring during maturity.

3.2 Changes in fruit acidity of ‘Bashan’ plum in different picking periods

![Fig. 2. Changes in acidity of ‘Bashan’ plum in different picking periods](image)
The acidity of the fruit determines the flavor and taste of the fruit. The change in acidity of ‘Bashan’ Plum fruit at different picking periods is shown in Figure 2. It can be seen from FIG. 2 that with the delay of the harvest time, the pH value of ‘Bashan’ Plum gradually increases, from 2.29 to 3.21, indicating that the sour taste of crispy plum gradually decreases. Among them, from July 10 to July 22, the pH increased slowly, from 2.29 to 2.54, an increase of 10.92%; after July 22, the pH increased most significantly, from 2.54 to 3.21, Increased by 26.38%.

3.3 Changes in fruit sugar of ‘Bashan’ plum in different picking periods

The change of sugar content of ‘Bashan’ Plum fruit at different picking periods is shown in Figure 3. It can be seen from FIG. 3 that with the delay of the harvest time, the sugar content of ‘Bashan’ Plum gradually increased from 6.66 to 8.43, indicating that the sweetness of crispy plum gradually increased. Among them, from July 10th to 14th, the sweetness of green crispy plums increased rapidly, from 6.66 to 7.94, an increase of 19.22%; after July 14th, the sweetness of green crispy plums increased slowly. It can also be seen from FIG. 3 that after July 22, ‘Bashan’ Plum has less acidity. Therefore, according to the required requirements, fruits that meet the sugar content requirements can be picked. If it is stored in the warehouse or long-distance transportation, it can be harvested as early as possible. It is recommended that it be harvested around July 14 in Xuanhan, Dazhou. If it is immediately eaten or the consumer enters the garden, it should be harvested around July 22.

Fig. 3. Changes in fruit sugar of ‘Bashan’ plum in different picking periods

3.4 Changes in fruit firmness of ‘Bashan’ plum in different picking periods

The change of fruit firmness of ‘Bashan’ Plum at different picking periods is shown in Figure 4. It can be seen from FIG. 4 that the firmness of the fruit changes with the harvesting time, and the earlier the harvesting, the greater the fruit firmness. From July 10th to 26th, the firmness of the fruit dropped from 2.76 to 2.03. Fruits that meet the firmness requirements can be picked according to the required requirements. If it is stored in the warehouse or long-distance transportation, it can be harvested as early as possible. It is recommended that it be harvested around July 15 in Xuanhan, Dazhou. If it is immediately eaten or the consumer enters the garden, it should be harvested around July 22.
Changes in firmness of ‘Bashan’ plum in different picking periods

Fig. 4. Changes in firmness of ‘Bashan’ plum in different picking periods

3.5 Changes in fruit color of ‘Bashan’ plum in different picking periods

Table. 1 Changes in fruit color of ‘Bashan’ plum in different picking periods

| Sample time | With fruit powder |   |   |
|-------------|------------------|---|---|
|             | L*               | a* | b* |
| 2019.7.10   | 58.58±2.11       | -12.04±1.29 | 28.07±2.52 |
| 2019.7.12   | 58.72±2.58       | -11.89±1.07 | 28.49±3.08 |
| 2019.7.14   | 58.80±2.05       | -11.56±1.10 | 29.35±2.95 |
| 2019.7.16   | 59.24±1.96       | -10.80±1.22 | 30.64±3.49 |
| 2019.7.18   | 59.37±2.01       | -10.69±0.88 | 30.86±3.33 |
| 2019.7.20   | 59.62±2.86       | -10.61±1.08 | 31.29±3.82 |
| 2019.7.22   | 59.83±2.68       | -10.21±0.55 | 32.52±2.28 |
| 2019.7.24   | 59.96±1.99       | -9.51±1.10  | 32.66±2.06 |
| 2019.7.26   | 60.17±2.56       | -9.39±1.37  | 33.85±3.21 |

The change of peel color of ‘Bashan’ Plum in different picking periods is shown in Table 1. It can be known from Table 1 that with the delay of the harvest time, the color parameters $L^*$, $a^*$, and $b^*$ of ‘Bashan’ Plum peel all show an upward trend. $L^*$ represents the brightness of the object. As can be seen from Table 1, the $L^*$ value of crispy plums during the entire harvest period has not changed much, only an increase of 2.71%; $a^*$ represents the red and green of the object, a positive value indicates red, and a negative value indicates Green, as can be seen from Table 1, throughout the harvest period, $a^*$ is negative and shows an upward trend, indicating that with the delay of the harvest period, crisp plums gradually change from green to yellow; $b^*$ represents the yellow-blue of the object, positive values indicate yellow and negative values indicate blue. As can be seen from Table 1, $b^*$ is a positive number throughout the harvest period, rising from 28.07 to 33.85, an increase of 20.59%, indicating that the color of crispy plum peel gradually turns yellow.

4. Summary and discussion

The fruit growth process can be divided into five stages: growing period, maturity period, physiological maturity period, maturity period and senescence period. It is difficult to distinguish the various periods in production, especially the physiological maturity period and maturity period[4]. During the physiological maturity period, the fruit is fully grown and the nutrients are fully accumulated. For some fruits, it has reached the harvestable and edible stage, while the mature period is the period when the fruit reaches full maturity, namely, the late stage of fruit maturity.
The harvest time of the fruit depends on the maturity of the fruit, product characteristics and marketing strategies. The fruit determines its appropriate harvest maturity according to its own species, variety and other biological characteristics, post-harvest use, and processing and storage conditions. Fruits used for fresh food supply or processing require high sugar content and suitable firmness from the aspect of flavor, namely, harvested when the edible quality reaches the best. Fruits used for long-term storage or long-distance transportation have a more stringent requirement, and early or late harvest will affect fruit quality.

In this test, the fruits harvested around July 15 are of moderate size, moderate hardness, moderate sugar and acidity, the color of the peel is turquoise, and the value of the product is high. Therefore, the harvest time in this period is suitable for long stored over time or transported over long distances. Fruits harvested around July 22 have larger fruit shape, lower firmness, better sugar and acidity, and the best edible quality. Therefore, the harvest time in this period is suitable for fresh fruit.

In summary, the most suitable harvesting period can be determined according to the use of the fruit in production, but due to different climate conditions, cultivation management, and soil cultivation conditions, fruit growth and maturity vary greatly, so other indicators should be combined make judgments. Moreover, the optimal harvest time of the fruit will also be affected by climatic conditions and regional scope. The results of this paper are only of certain reference value in Xuanhan area of Dazhou City.

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