Effects of different puffing measures on the fruit quality of 'summer black' grapes

Ting Peng¹, Chao Liu², San-Lin Wu², Jing Bai Li³, Fang Liu²*

¹College of Life Science, Leshan Normal University, Leshan, Sichuan 614000, China
²Innovative Research Center for Applied Biotechnology, Leshan Normal University, Leshan, Sichuan 614000, China
³College of Tourism, Leshan Normal University, Leshan, Sichuan 614000, China
*Corresponding author’s e-mail:Fang Liu, 38013604@qq.com

Abstract: In this experiment, the effect of GA₃ + CPPU on the quality of 'summer black' grape was studied. The results showed that the combination of GA₃ and CPPU (1-2d: 40ppm GA₃ + 2ppm CPPU, 12-14d: 50ppm GA₃ + 6ppm CPPU) was better than the combination of GA₃ and CPPU (12-14d: 50ppm GA₃ + 6ppm CPPU), which could increase the weight of ear and single fruit, increase the vertical and horizontal diameter of fruit grain and fruit shape index, and had better coloring, but decreased the fruit shape index Solid acid ratio.

1. Introduction

'Summer Black' grape belongs to europe and the United States tridolic non-nuclear varieties, introduced in 1998 in China. Because it has the advantages of being nuclear-free and mature early, disease-resistant and high quality, productive and resistant to storage and transportation, it is favored by people[1]. However, at present, due to the shortcomings of 'Summer Black' grape in natural conditions, such as small fruit, low fruit setting rate, weak growth, poor coloring, etc. Under natural conditions, and in the process of grape fruit growth and development, chlorpyrifos (CPPU) and erythromycin (GA₃) overall showed a downward trend, not easy to sit fruit. GA₃ and CPPU have more applications in grape varieties such as 'Cresson', 'Giant Rose' and 'Summer Black'[2-5], the results show that: GA₃ and CPPU two kinds of plant growth regulator, through treatment can effectively improve the appearance quality of fruit, increase the weight of fruit, improve the commodity of grapes. However, the period of suitable use and use of plant growth regulators and concentrations vary according to the variety and environmental conditions. At present, large grain and non-nuclear has become the overall trend of grape production and consumption, but the blind pursuit of large fruit, so that the quality of fruit decline, crack fruit increase, seriously affect the planting efficiency.

This experiment explores the effect of different concentrations of GA₃ and CPPU treatment on the fruit quality of 'summer black' grapes, and determines the quality of ripe fruits in order to obtain a more suitable treatment concentration, and provides theoretical basis and technical guidance for the high quality and high yield of 'summer black' grapes.
2. Materials and methods

2.1 Test materials
In Leshan City, Jiajiang County, Ganlin Town Grape Test Base selected the same 4a raw 'Summer Black' grapes as the test material. The planting specification is 1.0m x 2.0m, V-frame. The 'summer black' grape soil fertilizer water and pest management in the test base are the same as the usual.

2.2 Test method
The trial began on 10 April 2019. Randomly selected flower spikes with growth potential and flower order amount were basically the same for experiments. Flower order lengthened, flower 10d (GA3 5.0mg/L); after the flower, according to Table 1 for puffing fruit treatment, which is controlled by water treatment, each time the drug treatment time is 4 to 5s, each treatment selected 5 fruit spike, each test repeated treatment 3 times, a total of 45 spike. After the fruit is stable, the fruit is dredged, so that the grain grains between the grains, do not squeeze each other. Fruit spike in late May unified bag.

Table 1. Different treatment of ‘summer black’ grape fruit spike GA3 and CPPU application period and dosage

| Processing groups | 1-2d after anthesis | 12-14d after anthesis |
|-------------------|---------------------|-----------------------|
| CK                | Water               | Water                 |
| 1                 | 0                   | 50ppmGA3+6ppmCPPU     |
| 2                 | 40ppmGA3+2ppmCPPU   | 50ppmGA3+6ppmCPPU     |

2.3 Measure stoyitems and methods

2.3.1 Appearance quality measurement

2.3.1.1 Determination of the size of fruit spike shoand and grain
Each processing randomly selected 3 fruit spikes, using the electronic balance to weigh the fruit spike and the weight of single fruit, measuring the length and width of the fruit spike, and each fruit spike randomly taking 9 grains with an electronic cursor caliper to measure its vertical and horizontal diameter, to calculate the fruit index. Each processing is repeated 3 times, averaging.

2.3.1.2 Determination of the color of the peel
The use of portable color color aberration (model: WR-10, origin: Guangdong) to determine the color of the peel. Wash the fruit and dry, and measure the two points of symmetry in the horizontal direction of the grain and the symmetrical in the vertical direction. Each treatment was randomly selected 20 fruit grains, repeated 3 times, respectively, to determine their L, a, b values. Where in it, the L value represents the brightness of the color, the value is small means the color of the measured object is black, the value is large, the color of the measured is bright, the a value is red, negative value is green, the absolute value is red or the darker, b value is yellow, the negative value is blue, the greater the absolute value, the darker the yellow or blue[^6].

2.4 Intrinsic quality determination
The handheld sugar gauge[^7] measures the content of soluble solids, NaOH titration determines[^8] the titration acid content, and the 2,6-dichlorophenol ithane[^9] method measures the vitamin C content. 3 repeated measurements for each indicator, 3 times for each processing.
3. Results and analysis

3.1 Effect of different combinations of GA3 and CPPU on the appearance quality of 'Summer Black' grapes

As can be seen from Table 2, the treatment of 1 and 2 of spike weight, single fruit weight, fruit spike length, fruit grain cross-section, fruit index, etc. are higher than CK, and the treatment of 2 is higher than the treatment 1. The increase in the weight of the treated 1 fruit spike increased by 417.29g compared to CK, with an increase of 61.9%, the weight of the single fruit increased by 2.48g, the increase ratio was 38.3%, and the fruit spike length increased by 9.02cm, with an increase of 34.7%; treatment 2 increased by 479.75g, an increase of 65.1%, and single fruit weight increased by 3.00g, an increase of 42.6%, and fruit spike length increased by 10.14cm, an increase of 37.5%. The fruit index, which is the ratio of the cross-sectional area of the fruit grain, can describe the shape of the fruit's appearance objectively. Treatment 1 and 2 both increased the fruit-grain diameter of the 'summer black' grape, and the vertical diameter increased by more than the horizontal diameter, and the fruit index increased accordingly.

Table 2. Effect of different combination of GA3 and CPPU on the appearance quality of 'summer black' grape

| Processing groups | Spike weight (g) | Single fruit weight (g) | Fruit spike length (cm) | Fruit-grain diameter (cm) | Fruit-grain cross-path (cm) | Fruit Index |
|-------------------|------------------|-------------------------|-------------------------|---------------------------|---------------------------|------------|
| CK                | 256.83           | 4.00                    | 16.92                   | 1.60                      | 1.69                      | 0.95       |
| 1                 | 674.12           | 6.48                    | 25.94                   | 2.30                      | 2.24                      | 1.03       |
| 2                 | 736.58           | 7.00                    | 27.06                   | 2.37                      | 2.13                      | 1.11       |

As can be seen from Table 3, the L-value of each treatment of 'summer black' grape fruit color is not very different, indicating that the effect on the brightness of the fruit is not great, but the a value of treatment 1 and 2 is higher than CK, indicating that the fruit color of the treatment 1 and 2 is generally redder; The b value between the processing is quite different, the b value of the treatment 1 is greater than the processing 2, is larger than the large CK, indicating that CK's fruit blue is the deepest, the most shallow treatment 1; as can be seen from Table 3, the a/b value of treatment 1 is greater than the a/b of treatment 2, greater than CK's a/b, indicating that the overall color of the fruit of treatment 1 tends to be red, in line with the actual observation results, indicating that it does not reflect the inherent appearance of the 'Summer Black' grape color, and CK, process 2 fruit color is closer to the actual color of the 'Summer Black' grape (see Table 3).

Table 3. Effects of different combinations of GA3 and CPPU on the color of 'summer black' grape peels

| Processing groups | L value          | a value          | b value          | a/b value         |
|-------------------|------------------|------------------|------------------|-------------------|
| CK                | (29.54±1.12)     | (4.58±1.18)      | (-1.73±0.12)     | (-2.48±0.42)      |
| 1                 | (28.45±0.78)     | (9.35±0.48)      | (-0.84±0.38)     | (-12.27±4.54)     |
| 2                 | (28.17±0.65)     | (7.15±1.11)      | (-1.22±0.19)     | (-5.78±0.60)      |

3.2 Effect of different combinations of GA3 and CPPU on the intrinsic quality of 'summer black' grapes

Table 4 can be seen: the soluble solid content of treatment 1 is 5.74% lower than CK, the treatment 2 is 4.53% lower than CK, while the content of titration acid in treatment 1 is 0.06% higher than CK, and the processing 2 is 0.15% higher than CK. In addition, the fruit solidity ratio can be used to describe the flavor of the fruit. The test results show edgtosis ratio of CK higher than treatment 1 and treatment 2, which shows that the soluble solids of 'summer black' grapes are reduced and the content of titration acid is increased under the action of GA3-CPPU combination reagents. Vitamin C in grape
fruit is also the key basis for evaluating the chemical quality of grapes. As shown in Table 4, the treatment of 1 and treatment of 2 vitamin C content was 32IU and 18IU lower than CK, indicating that plant growth regulators had little effect on vitamin C content in the fruit of 'summer black' grapes.

| Processing groups | Soluble solid content (%) | Can titrate acid content (%) | Solid acid ratio | Vitamin C content (IU) |
|-------------------|---------------------------|------------------------------|------------------|------------------------|
| CK                | 19.80                     | 0.51                         | 38.82; 1         | 2.85                   |
| 1                 | 14.06                     | 0.57                         | 24.67; 1         | 2.69                   |
| 2                 | 15.27                     | 0.66                         | 23.14; 1         | 2.76                   |

4. Summary
The first group of this test selected 12-14d puffing fruit once after thank flower, the second group chose to use different concentrations of GA$_3$-CPPU combination for two consecutive times after 1-2d after thank flowers and 12-14d after thank flowers. The results showed that the appearance quality and intrinsic quality of 'summer black' grapes were improved to varying degrees using GA$_3$-CPPU, which improved the weight of 'summer black' grapes, fruit spike weight, fruit spike length, fruit grain cross-section, but the effect on the fruit index was small, while the fruit color of the 2 groups was closer to the actual color of the 'Summer Black' grape. However, treatment 1 and 2 both reduced the soluble solid content of 'summer black' grapes, the content of titration acid increased, and the content of vitamin C was slightly reduced. Taken together, the effect of applying the GA$_3$-CPPU combination reagent fruit bulge is best for two consecutive applications.

5. Analysis
The study showed that the two treatments had little effect on the 'summer black' grape fruit index, which was consistent with the findings of Wu Xiaohua\cite{10} et al. The study showed that there was no large difference in the L values of each group, indicating that the brightness of the 'summer black' grape skin had little effect on each group, the test results show that the a/b value of treatment 1 is the smallest, and the difference with CK is large, indicating that the fruit color of treatment 1 is red, and therefore can not reflect the actual appearance color of the 'summer black' grape, which is in line with the actual observation results, it is also shown that CK and the fruit color of the treatment 2 are closer to the actual color of the 'summer black' grape than treatment 1, this is consistent with the results of the study by Yu Yu\cite{4} and others.GA$_3$+CPPU combined with treatment, the weight of single fruit, the weight of fruit spike and the cross-section of the fruit spike increased, but also the content of soluble solids decreased, can be titrate acid content increased, affecting the intrinsic quality and flavor of the fruit. This is consistent with the results of researchers such as Liu Jia, Wan Huimin and Xu Shiyian\cite{11-13}, may be due to a variety of plant growth regulator treatment, so that the plant's seating rate increased, fruit grain smaller, resulting in the provision of insufficient organic matter, but also may be related to the experimental varieties, processing time, frequency and regional environmental climate. A comprehensive analysis suggests that this experiment can filter out the scientific and reasonable fig management technique suitable for the 'summer black' grapes in Leshan area, and provide a certain theoretical basis and factual basis for the rational application of plant growth regulator in 'summer black' grape cultivation.

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