

# The effect of Different degree of Fruit thinning on the Quality of ‘Summer Black’ Grape

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**Abstract.** In order to study the effect of the number of grape fruit retained on the fruit quality of fruit, different degree of fruit thinning were carried out (keep 80, 90, 100, and 110 grapes) on the ‘Summer Black’ grape, and the fruit quality was analyzed. 100 grapes per bunch was the most significant for improving the quality of grape. It could significantly increase single panicle weight, single grain weight, the horizontal and vertical diameter, soluble solids, total sugar and the content of VC, while decreased titratable acid content. Thus proper fruit thinning can not only guarantee the yield but also improve the quality, achieve the purpose of high quality, stable production and high efficiency.

## Introduction

Grapes are one of the most widely cultivated and widely distributed fruit trees in the world. And the yield of grapes is second only to citrus [1,2]. Grapes planting area accounts for more than 10% of global fruits [3]. Grapes are not only diverse in shape, but also beautiful in shape, rich in nutrition and high in economic benefits. They are deeply loved by consumers all over the world [4,5,6]. ‘Summer Black’ seedless grape originated in Japan and was later introduced to China [7,8]. At present, it is one of the main varieties of grapes growing in China. The main problems in the development of the ‘Summer Black’ seedless grape in the South is too much fruits under natural growth and the uneven fruit density and particle size, which will cause fruit extrusion and deformation. These have seriously affected the quality of the fruit and reduced the commerciality. Good quality is an important factor in attracting consumers and maintaining the competitiveness of the fresh grape market [9]. Grapes management is an important means of controlling grapes production. Fruit quality can be improved by thinning and thinning fruits [10,11]. In this study, using artificial fruit thinning method to adjust the amount of fruits retention and exploring the effects of different fruit thinning treatments on the fruit quality of ‘Summer Black’ grape.

## Materials and Methods

**Materials.** Using three-year-old ‘Summer Black’ grape as experimental material in this study. The experiment site is the modern agricultural research and development base of Sichuan Agricultural University. The soil is sandy loam soil with the plant spacing is 1.5 m × 3.0 m.

**Experimental Design.** In May 2017, four different amounts of fruit thinning were selected for A, B, C, and D (80, 90, 100, and 110 grapes), and five plants per treatment as a repeat. The control

group was not treated with fruit thinning. After fruits matured (July 2017), 10 strings of grapes and 45 grapes were randomly taken from each treatment. The morphological and physiological indicators of the grapes were measured [12,13,14].

**Statistical Analyses.** Data was analyzed using Microsoft Excel 2010 and SPSS 19.0 statistical software (IBM, Chicago, IL, USA).

## Results and Analysis

**Effect of Different degree of Fruit retention treatment on the external quality of Fruit.** The single panicle weight of each treatment was lower than that the control and the single grain weight of each treatment was higher than that of the control. The less the number of retained fruits, the more obvious the weight gain of single grain. The single grain weight of treatment A was the highest, which was 8.20 g, and an increase of 1.21 g over the control. Compared to the control, the vertical and horizontal diameters of each treatment have a different degrees of increase, with the most significant increase in treatment C. It's not obvious to difference in fruit shape index. The hardness of the fruit reflects the storage and transport performance of grapes. The hardness of each treatment was higher than that the control group. The fruit of the treatment C had the highest hardness, with 0.73 Pa higher than the control group.

Table 1 Effect of Different degree of Fruit retention treatment on the external Quality of Fruit

Treat-ments	Single panicle weight [g]	Single grain weight [g]	Horizontal diameter [mm]	Vertical diameter [mm]	Fruit shape index	Hardness [Pa]
A	686±42.5c	8.20±0.17a	22.16±0.21b	24.21±0.24bc	1.09±0.01a	1.62±0.06bc
B	743.25±56.25bc	8.08±0.15a	23.21±0.17a	24.71±0.21ab	1.07±0.01a	1.69±0.06bc
C	812.75±8.75bc	7.95±0.12a	23.42±0.2a	24.92±0.22a	1.07±0.01a	2.24±0.11a
D	823.28±47b	7.35±0.19b	22.98±0.15a	24.76±0.22ab	1.08±0.01a	1.80±0.08b
CK	925.75±15.75a	6.99±0.15b	22.12±0.19b	23.78±0.2c	1.08±0.01a	1.51±0.07c

Note: Different lowercase letters indicate significant differences ( $P<0.05$ ), the same as the following table.

**Effect of Different degree of Fruit retention Treatment on the inner Quality of Fruit.** There was a significant difference in the soluble solids content between treatments. The treatment C showed the most significant difference, and the soluble solids content increased by 1.07% compared with the control. The content of acid each treatment was lower than that of the control and there was no significant difference. The total sugar content of each treatment gradually decreased with the increase in the number of fruits. Treatment A had the highest total sugar content, 4.15% higher than the control group. Except for treatment A, the remaining VC content was higher than the control group. The VC content of treatment C increased by  $0.24 \text{ mg} \cdot 100 \text{ mL}^{-1}$  compared to the control.

Table 2 Effect of Different degree of Fruit retention Treatment on the inner Quality of Fruit

Treatments	Soluble solids [%]	Titrateable acid [g · mL <sup>-1</sup> ]	Total sugar [%]	VC [mg · 100 mL <sup>-1</sup> ]
A	18.27±0.12d	0.32±0.01a	9.23±0.71a	0.75±0.03b
B	19.07±0.15b	0.39±0.07a	8.31±0.42ab	0.85±0.07ab
C	19.39±0.1a	0.35±0.03a	7.63±1.53ab	1.07±0.19a
D	18.69±0.08c	0.36±0.03a	6.3±0.79ab	0.97±0.03ab
CK	18.32±0.1d	0.4±0.05a	5.08±0.4b	0.83±0.03ab

## Discussion

The appearance quality of grapes is an important basis for direct judgment of fruit quality, which directly affects economic benefits [15]. Reasonable fruit retention increased the single grain weight and single panicle weight of fruits and increased the vertical and horizontal diameters of the fruit, which is consistent with previous research results [16]. As the number of retained fruits increases, the yield of grapes increases and the grain weight of the fruits decreases. Soluble solids content is one of the important indicators to evaluate grape fruit quality. The content of soluble solids in grape can be increased by keeping the quantity of grape fruit reasonably. This is consistent with previous research results [17,18,19,20]. The level of acid directly affects the quality of the fruit. The higher the acid content, the worse the quality.

The content of sugar and acid in fruit is an important index to evaluate grape quality and its content directly affects the taste, flavor and commerciality of the fruit [21]. The content of soluble solids in treatment C was the highest, and the content of titrateable acid and total sugar in the fruits showed different differences due to the different number of fruit remaining fruits. The level of VC in fruits determines its nutritional value. The higher the content, the higher the nutritional value. The treatment C had the highest VC content and the treatment A was lowest.

## Conclusions

In this study, proper fruit thinning can improve the quality of single grain, increase the content of soluble solid and sugar and reduce the content of acid. Thus improve the external and internal quality of grape. The treatment of retention 100 grapes performed best in all aspect. This treatment can not only ensure the yield, but also improve the comprehensive quality of the fruit and improve the economic benefits.

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