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Comparative Study on Effect of Ethephon Treatment on Growth of Two Grape Varieties Kyoho and Shine-Muscat

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Abstract [**Objectives**] This study aimed to study the effect of ethephon treatment on the growth of two main grape varieties Kyoho and Shine-Muscat. [**Methods**] Two-year-old Kyoho and Shine-Muscat grape plants transplanted in the film-covered steel-framed greenhouse were used as the test materials. They were pruned horizontally and linearly. In the late growth period, the new shoots were sprayed with ethephon (1 500 ×). During the germination period, 10 plants were randomly selected for each variety to investigate the germination situation. Before flowering, 20 new shoots with uniform growth were randomly selected for each variety to investigate the growth. During the fruit maturity period, 10 clusters of fruits were randomly selected for each variety to determine the related indices of fruit quality. [**Results**] After the treatment with ethephon, the germination, new shoot growth and fruit quality differed between the two varieties. Overall, the thickness of main stem, main vine and new shoot of Shine-Muscat was greater than that of Kyoho, and the length of new shoot of Kyoho was significantly greater than that of Shine-Muscat. [**Conclusions**] The growth of Shine-Muscat was more robust. There was little difference in the ear weight of natural fruit setting between the two varieties. Shine-Muscat showed high sugar and low acid contents than Kyoho.

Key words Kyoho, Shine-Muscat, Ethephon, Yellowing

1 Introduction

Two-harvest-a-year grape cultivation has been carried out in Southern Guangxi. Due to the hot and humid climate, it is difficult for the grapes to naturally lie dormant after harvest, and their vegetative growth does not stop, and new shoots continue to germinate. The new shoots are thin and weak, with small and yellow leaves and short internodes, and eventually become into useless branches, affecting the nutrient return of plants, causing nutrient waste, and leading to problems such as fewer fruit and flower buds. This is particularly serious in grape cultivation. In actual production, measures such as artificial leaf picking, re-cutting roots, stopping irrigation and spraying growth inhibitors are usually used to promote tree dormancy, but spraying dormancy promoting agent ethephon is the most time-saving and labor-saving measure. Ethephon has obvious promoting effect in fruit maturation, defoliation, fruit loss, plant dwarfing and increase in the number of female flowers of melons. It is currently widely used in agricultural production[1]. There are also related reports on promoting dormancy of fallen leaves[2-3].

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2 Materials and methods

The experiment was carried out at the test base of the Viticulture and Wine Research Institute, Guangxi Academy of Agricultural Sciences. In April, 2017, two grape varieties of Kyoho and Shine-Muscat were planted in film-covered steel-framed greenhouse. Horizontal and linear trellises were prepared. The plant and row spacing was 1 m × 3 m. On December 17, 2017 in the later stage of growth, ethephon[1 500 ×, Shanghai Huayi Group Huayuan Chemical Co., Ltd. (formerly Pengpu Chemical Plant), active content 40%] was sprayed on the new shoots of the grape, and 4 rows, 24 plants in each row, were selected for each variety. On February 24, 2018, 10 plants with uniform growth were selected randomly for each grape variety to investigate the natural budding situation. On March 21 in the early blooming period (inflorescence spreading completely), 20 new shoots with uniform and moderate growth were selected randomly for each variety to investigate the growth of new shoots. On April 29 in the fruit maturity period, 10 ears of natural fruit setting were selected randomly for each variety to investigate the quality of the fruits. Each data was measured 3 times as repetitions. The data was processed using MATLAB 7.0 software, and the significance of the differences at the 0.05 and 0.01 levels was analyzed, respectively.

3 Results and analysis

3.1 Effect of ethephon on the germination of the two grape varieties The effect of ethephon on the germination of the two grape varieties is shown in Table 1. The germination rate of the

main stem of Kyoho was significantly lower than that of Shine-Muscat ($P<0.05$); the main stem of Kyoho was significantly thinner than that of Shine-Muscat ($P<0.01$); there was no significant in main vine thickness or main vine germination rate between the two varieties ($P>0.05$); the secondary shoot formation rate of Kyoho was zero, and that of Shine-Muscat reached 98.46%; and the flowering rate of Kyoho was significantly higher than that of Shine-Muscat ($P<0.05$).

Table 1 Effect of ethephon on germination of the two grape varieties

Variety	Main stem germination rate//%	Main stem thickness//mm	Main vine thickness//mm	Main vine germination rate//%	Secondary shoot formation rate//%	Flowering rate//%
Kyoho	14.23±10.04 aA	8.24±0.45 aA	7.28±0.86 aA	78.98±4.90 aA	0.00±0.00 aA	36.48±22.49 bA
Shine-Muscat	63.28±30.25 bA	9.90±0.64 bB	8.19±0.46 aA	52.52±34.47 aA	98.46±3.44 bB	10.18±6.22 aA

Note: Different lowercase letters in the same column indicate a significant difference at the 0.05 level, and different capital letters in the same column indicate a significant difference at the 0.01 level.

3.2 Effect of ethephon on the growth of new shoots of the two grape varieties The effect of ethephon on the growth of new shoots of the two grape varieties is shown in Table 2. The new shoots of Kyoho were significantly longer than those of Shine-Muscat ($P<0.01$); the base of the new shoots of Kyoho was significantly thinner than that of Shine-Muscat ($P<0.05$); the longest internode of Kyoho was significantly shorter than that of Shine-Muscat ($P<0.05$); the largest midrib of Kyoho was significantly smaller than that of Shine-Muscat ($P<0.01$); the number of leaves of Kyoho was significantly more than that of Shine-Muscat ($P<0.01$); and there was no significant difference in inflorescence length between the two varieties ($P>0.05$).

Table 2 Effect of ethephon on new shoot growth of the two grape varieties

Variety	New shoot length//cm	Thickness of new shoot base//mm	Length of longest internode//cm	Length of largest midrib//cm	Number of leaves (>1/3)	Length of fluorescence//cm
Kyoho	104.43±9.14 aA	6.92±1.31 aA	11.07±0.66 aA	13.90±2.69 aA	10.14±0.69 aA	18.96±2.99 aA
Shine-Muscat	73.56±9.22 bB	8.59±1.39 bA	14.14±2.87 bA	20.30±1.68 bB	8.43±0.53 bB	20.74±4.04 aA

3.3 Effect of ethephon on the fruit quality of the two grape varieties The effect of ethephon on the fruit quality of the two grape varieties is shown in Table 3. There was no significant difference in ear weight between the two varieties ($P>0.05$); the single fruit weight of Kyoho was significantly greater than that of Shine-Muscat ($P<0.05$); the soluble solids content of Shine-Muscat was significantly higher than that of Kyoho ($P<0.01$); and titratable acid content of Kyoho was significantly higher than that of Shine-Muscat ($P<0.01$).

Table 3 Effect of ethephon on fruit quality of the two grape varieties

Variety	Ear weight//g	Single fruit weight//g	Soluble solids content//%	Titratable acid content//g/L
Kyoho	418.42±104.35 aA	8.40±0.80 bA	17.76±0.47 aA	2.69±0.20 bB
Shine-Muscat	381.92±55.24 aA	7.19±0.80 aA	19.96±0.29 bB	1.88±0.09 aA

4 Discussion

Among the grape varieties in the two-harvest-a-year cultivation test in southern Guangxi, Kyoho accounts for about 70%, and Shine-Muscat is currently the fastest growing variety with the best prospects. Studying the dormancy-promoting effect of ethephon to conduct off-season cultivation and diversify time to market has a positive effect. In this study, it was found through field observation that compared with the control without spraying of ethephon, Kyoho and Shine-Muscat germinated about 20 d earlier, and their germination was neat without using the germination-promoting agent. The results show that after the treatment with ethephon in the late growth period, the germination, new shoot growth and fruit quality of Kyoho and Shine-Muscat differed significantly. Overall, the main stem, main vine and new shoot thickness of Shine-Muscat was greater than that of Kyoho, and the new shoots of Kyoho were significantly longer than those of Shine-Muscat, indicating that the growth of Shine-Muscat was relatively robust. It is speculated that the apical dominance Kyoho is stronger than that of Shine-Muscat. There was little difference in the ear weight of natural fruit setting between the two. Compared with Kyoho, Shine-Muscat was higher in sugar content and lower in acid content.

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