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Effect of Potassium Sulphate on Fruit Quality of 'Black Baraldo' Grape

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Abstract. In order to discuss the effects of applying different proportions of potassium sulfate on grape fruit quality, 10 different potassium sulfate proportions were applied. The result was that the treatment 6 had the best effect, and both the intrinsic and the external quality of the fruit were improved, and the effect was most significant. Therefore, applying suitable potassium fertilizer can improve the quality of grape fruit.

Introduction

In the production of grapes, many producers rely on experience in fertilizing and applying large amounts of fertilizer at one time, resulting in the loss or excess of certain elements [1,2]. This can not achieve the purpose of fertilization in each period, but also cause the loss of production [3]. It also has different degrees of impact on grape yield and quality [4]. Therefore, we must use scientific fertilization to improve grape yield and fruit quality [5]. In the middle and late stages of grape growth and development, the absorption of potassium fertilizer increased significantly [6]. Topdressing potassium fertilizer can improve the quality of the fruit [7]. In this study, the effect of applying different proportions of potassium sulfate on grape fruit quality was explored in order to determine the optimal ratio for improving grape fruit quality.

Materials and Methods

Materials. Using three-year-old 'Black Baraldo' 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. Using different concentrations of potassium sulfate in May (coloring 5% to 10%) and June 2017 (coloring 70% to 80%). Each treatment was repeated five plants. Treatment 1: 0.11 kg/plant+0.11 kg/plant, Treatment 2: 0.11 kg/plant+0.14 kg/plant, Treatment 3: 0.11 kg/plant+0.17 kg/plant, Treatment 4: 0.14 kg/plant+0.11 kg/plant, Treatment 5: 0.14 kg/plant+0.14 kg/plant, Treatment 6: 0.14 kg/plant+0.17 kg/plant, Treatment 7: 0.17 kg/plant+0.11 kg/plant, Treatment 8: 0.17 kg/plant+0.14 kg/plant, Treatment 9: 0.17 kg/plant+0.17 kg/plant and CK: 0.13 kg/plant+0.13 kg/plant. The fruit quality was measured when the fruit matures (July 2017). Single panicle weight and single grain weight were determined. The longitudinal and horizontal diameters of fruit, the fruit hardness, the soluble solids, total sugar, titratable acid and the content of VC were determined [8,9,10].

Statistical Analyses. Data was analyed using Microsoft Excel 2010 and SPSS 19.0 statistical

software (IBM, Chicago, IL, USA).

Results and Analysis

Effects of Different Ratios of Potassium Sulfate on the External Quality of Grape. The longitudinal and horizontal diameters and fruit shape index of the other treatments were significantly higher than the control, except for treatment 1, treatment 2 and treatment 3. Compared with the control, the longitudinal and horizontal diameter and fruit shape index of the treatment of 6 were the most significant, which was increased by 2.61 mm, 1.64 mm and 0.02. The single panicle weight and single grain weight of other treatments were significantly higher than the control, except for treatment 1, treatment 2 and Ttreatment 3. Compared with the control, the single panicle weight and single grain weight of the treatment 6 were the most significant, which was increase by 75.64 g and 1.73 g.

Table 1 Effects of Different Ratios of Potassium Sulfate on the External Quality of Grape

Treat-ments	Longitudinal diameter [mm]	Horizontal diameter [mm]	Fruit shape index	Single panicle weight [g]	Single grain weight [g]
1	21.13 ± 0.99de	15.76 ± 0.55e	1.34 ± 0.03b	445.52 ± 12.64e	8.22 ± 0.52d
2	22.07 ± 0.65d	16.35 ± 0.23e	1.35 ± 0.04ab	479.77 ± 17.57de	8.53 ± 0.55cd
3	23.41 ± 0.74d	17.34 ± 0.37de	1.35 ± 0.03a	493.52 ± 20.48c	8.61 ± 0.51cd
4	24.73 ± 1.04c	18.92 ± 0.94cd	1.36 ± 0.03b	556.23 ± 15.23bc	8.96 ± 0.50c
5	25.33 ± 1.20bc	18.49 ± 0.48c	1.37 ± 0.02a	572.33 ± 14.56b	9.89 ± 0.34ab
6	26.87 ± 0.20a	19.61 ± 0.18ab	1.37 ± 0.02a	596.43 ± 21.69a	10.43 ± 0.13a
7	25.37 ± 1.88cd	18.65 ± 0.71cd	1.36 ± 0.01b	543.63 ± 40.40b	9.47 ± 0.17b
8	26.63 ± 0.27bc	19.44 ± 0.15bc	1.37 ± 0.02a	562.78 ± 27.76bc	9.94 ± 0.52ab
9	26.83 ± 1.28ab	19.58 ± 0.51bc	1.37 ± 0.03a	583.62 ± 19.11ab	10.03 ± 0.42a
CK	24.26 ± 0.33ab	17.97 ± 0.12ab	1.35 ± 0.03b	520.79 ± 19.40cd	8.70 ± 0.53d

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

Compared with the control, the difference in the hardness of the treatment 6 was the most significant and was increase 6.67% than the control.

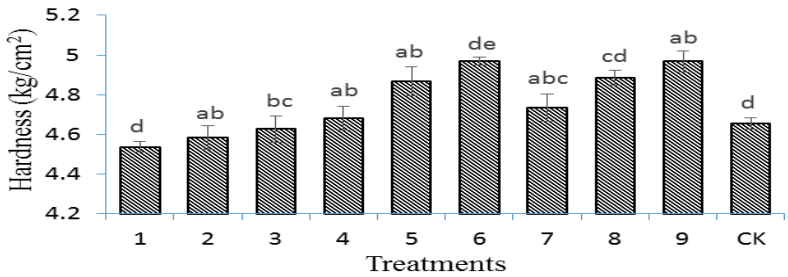

Fig.1 Effect of different ratio of potassium sulfate on the hardness of grape

Effects of Different Ratios of Potassium Sulfate on the Inherent Quality of Grape. The Soluble solids content of other treatments were all higher than the control except for the Treatment

1, Treatment 2 and Treatment 3. The Soluble solids content of the treatment 6 was the highest, which was increased by 1.37% than the control. The titratable acid of other treatments were lower than the control except for treatment 1, treatment 3, and treatment 4. The titratable acid content of the treatment 9 (0.36 g · 100 mL^{-1}) was the lowest, which was reduced by 0.06 g · 100 mL^{-1}. The total sugar and Vc were lower than the control except treatment 1, treatment 2 and treatment 3. The total sugar content of treatment 9 (13.25%) was the highest and increased by 0.55% than the control (12.70%). The treatment 6 had the highest Vc content (5.39 g · 100 mL^{-1}), which was increased by 0.73 g · 100 mL^{-1} compared to the control.

Table 2 Effects of Different Concentrations of Potassium Sulfate on the Intrinsic Quality of Grape

Treatmens	Soluble solids [%]	Titratable acid [g · 100mL^{-1}]	Total sugar [%]	Vc [mg · 100mL^{-1}]
1	17.23 ± 0.18e	0.42 ± 0.01c	11.91 ± 0.18c	4.13 ± 0.14c
2	17.51 ± 0.35de	0.41 ± 0.01bc	12.55 ± 0.15cd	4.26 ± 0.12c
3	18.17 ± 0.19d	0.44 ± 0.02a	12.66 ± 0.26cd	4.62 ± 0.20bc
4	18.43 ± 0.25cd	0.42 ± 0.01b	12.90 ± 0.21bc	4.84 ± 0.11b
5	19.33 ± 0.26bc	0.37 ± 0.01cd	12.97 ± 0.13b	5.07 ± 0.11ab
6	19.60 ± 0.17a	0.37 ± 0.02cd	13.17 ± 0.24ab	5.39 ± 0.22a
7	18.94 ± 0.20bc	0.39 ± 0.01c	12.82 ± 0.27bc	4.98 ± 0.25b
8	19.17 ± 0.40bc	0.37 ± 0.02cd	13.10 ± 0.13b	5.08 ± 0.12ab
9	19.48 ± 0.33ab	0.36 ± 0.02d	13.25 ± 0.34a	5.23 ± 0.28a
CK	18.23 ± 0.34cd	0.42 ± 0.02bc	12.70 ± 0.20c	4.66 ± 0.21bc

Discussion

Reasonable application of potash fertilizer has a significant effect on grapes [11]. Topdressing potassium fertilizer can increase the longitudinal diameter and horizontal diameter, hardness, single grain weight and single grain weight of ‘Black Baraldo’ grape, but it has no obvious effect on the fruit shape index. The increase of fruit firmness can improve fruit flavor and storage, which is consistent with the findings of Ma Zhenfeng [12]. It can also increase the soluble solids, total sugar and VC content and reduce the total acid content. The sugar and acid content of grapes determine the economic value of grapes. The increase of sugar is decided to the amount of fertilizer, the increase in acid is inversely proportional. Topdressing potassium fertilizer can increase the sugar content, which is consistent with the research of Ma Chunhua [13]. The topdressing of potassium fertilizer during grape coloration increased the Vc content, and the content of treatment 6 was the highest. However, Treatment 1, Treatment 2 and Treatment 3 were all lower than the control group. Excessive application of potash will not only cause waste, but also reduce the effect of potash application [14]. Treatment 9 has a higher potassium sulfate concentration than treatment 6, but the external quality is lower than the treatment 6. It may be related to the application of high-potash potassium fertilizer in the fruit coloring in the early stage, which inhibits the growth of the fruit. Appropriate application of potassium fertilizer can improve fruit quality, which is consistent with previous studies [15].

Conclusions

In this study, the quality of the grape fruit was explored by applying different proportions of

potassium sulphate fertilizer at two different stages of fruit coloration. With the increase of potassium sulfate application concentration, both the intrinsic and extrinsic quality of the fruit were improved to varying degrees. The ratio of potassium sulfate applied in treatment 6 was the best, and the quality of grapes was the most significant. It provides a reference for the efficient and reasonable application of potash fertilizer with 'Black Baraldo' grape.

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