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Changes in Quality of Cabernet Sauvignon Grapes from Three Plots in Shihezi Production Area during the Ripening

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Abstract. In order to explore effect of different soil sediment concentration on the quality change of Cabernet Sauvignon grapes, during the mature period, Cabernet Sauvignon grapes in three plots. S plot with 100% sandy soil, SC plot with 70% sandy soil +30% clay, and CS plot with70% clay +30% sandy soil (sediment concentration of S ≥ that of SC and CS, respectively) were selected in Shihezi region during the mature period respectively, determined regularly variation of indicators, such as pH, total acid, total sugar, chromaticity, anthocyanins, total phenol and tannin. The results showed that total acid of S grape decreased from 7.7 g/L to 5.3 g/L, that of SC plot declined from 7.5 g/L to 5.9 g/L, and CS from 8.6 g/L to 6.0 g/L. The pH on S increased from 3.47 to 3.66, SC from 3.47 to 3.71, and CS from 3.40 to 3.74. Total sugar rose from 191.9 g/L to 228.7 g/L in S, from 194.2 g/L to 262.5 g/L in SC, and from 207.9 g/L to 243.0 g/L in CS. The content of anthocyanin in SC was higher than that of S and CS, while the difference between S and CS was only 1.36-8.4 mg/100 mL. Chromaticity in S increased from 10.31 to 15.236, SC from 11.7 to 17.3, and CS from 9.975 to 16.6. Total phenol of skin in S increased from 1.5 to 2.07 g/L, SC from 2.06 to 3.93 g/L, and CS from 2.02 to 2.54 g/L. Tannin content of skin in S increased from 133.024 to 145.495 mg/100 g, SC from 141.338 to 162.123 mg/100 g, and CS from 145.495 to 157.966 mg/100 g. By the time of harvest, the sequence, from the high to the low, of total acid and pH was CS>SC>S, respectively, the accumulation of chroma and anthocyanin was characterized by SC>S >CS. The trend of total sugar in fruit, total phenol and tannin in seedcase was SC>CS>S. Conclusion: SC was beneficial to the accumulation of characteristic material in Cabernet Sauvignon grapes. Soil sediment concentration had important effect on the quality improvement of Cabernet Sauvignon grapes during the ripening.

INTRODUCTION

Shihezi, "gold belt" for grape growing, is in the middle section of northern piedmonts of Tianshan mountains, south margin of the Quasi-geer basin (85° - 86° 30' E, 43°30'- 45°40'N), has become a key production area in Xinjiang in recent years. Grapes in Shihezi region, a typical middle temperate arid desert climate, had accumulated abundant sugar and pigment due to the larger difference of diurnal temperature. Whereas the special climate, such as mulching soil in winter to prevent cold, reduced the occurrence of diseases and pests.

Cabernet Sauvignon usually grew in the sandy soil, adequate sunlight and larger temperature difference endowed higher content of pigment, tannin and sugar to grape. Soil in Shihezi region was characterized by silty loam, sandy soil and gray desert soil, anthropogenic - alluvial soil, as well as hot climate, the highest temperature up to 42 °C in summer, could just meet the demand of grape to the soil and climate, which brought up splendid quality of Cabernet

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Sauvignon in Shihezi region [1-2], afforded simultaneously a premium ingredient for brewing high-quality wines [3]. Different soil conditions and management methods could produce grapes with disparate quality. So, it was very important to study the change in quality of Cabernet Sauvignon grapes at different plots in Shihezi region during the veraison and maturity.

There was obvious variation, for instance the increased sugar and decreased acid level rapidly, and the anthocyanin content increased gradually after veraison for Cabernet Sauvignon grape berries [4]. At home and abroad, there were many studies in the aspect of maturity, phenolic substances, sugars, acids and tannins on the Cabernet Sauvignon fruit [5-7]. At present, the research on Cabernet Sauvignon grapes in Shihezi region included mainly the influence of different tree structure, training systems and endophytic fungi on the quality. The advantages, such as climate, light, heat, soil and water, on Shihezi region could reduce effectively the occurrence of diseases and insect pests and the use of pesticides, and meet the natural growth conditions of Cabernet Sauvignon. Therefore, there was the higher content of sugar and tannin and excellent comprehensive characteristics [8].

There were extensive planting area and higher quality and adaptability on Cabernet Sauvignon in Shihezi [8], which was a necessary raw material for high-quality wine. So it was imperative to study the qualitative variation of Cabernet Sauvignon grape. A key period for the accumulation of nutrients and flavor in grapes was from coloring to ripening. There was discrepancy from soil characteristics of different plots, which effected the accumulation of flavor. The management method and sediment concentration of the soil were different in three plots (S, SC, CS) of Shihezi region, and 133400 m^2 per site, hedge cultivation of grapevine was from south to north for cut short about 45° of single tendril. Therefore, this project collected Cabernet Sauvignon grapes from three blocks in Shihezi region during colouring and ripening period (23 August, 28 August, 2 September, 7 September and 14 September), determined sugar, acid, pH, tannins, anthocyanins, chromaticity, and total phenol, compared the change and difference of quality, explored the influence of soil sediment concentration and different farm management to quality of Cabernet Sauvignon, in order to provide certain reference for planting and collection of Cabernet Sauvignon grape in Shihezi.

MATERIALS AND METHODS

Materials

Cabernet Sauvignon were collected from plots S, SC and CS in the quality vineyard of Xinjiang western region pearl wine industry Co. LTD in Shihezi region from 8 a.m. to 10 a.m. on 23 August, 28 August, 2 September, 7 September and 14 September, 2017 and 2018, respectively. The collected samples were immediately stored in a refrigerator before being measured in October 2017 and 2018, respectively. The experimental results were averaged for two years.

Instrument

Refrigerator (BCD-416KZ58, TCL Corporation), electronic balance (Quinti x 224-1CN, Shanghai Shangtian precision instrument Co., LTD), spectrophotometer (UV -5500, Shanghai Yuanxi instrument Co., LTD), pH meter (PB-10, cedorus scientific instrument Co., LTD).

METHODS

PH, Total Sugar and Total Acid

50 g of Cabernet Sauvignon juice, kneaded with clean gauze, was put in a beaker and measured pH with pH meter. Total sugar was measured by Philin reagent titration (as glucose). NaOH standard solution titration (as tartaric acid) was employed.

Chroma

Color evaluation of the samples was performed by using a spectrophotometer (Spectronic Unicam EMEA, Unicam Helios alpha, Leeds, UK). Optical density of undiluted wine samples was measured at 420, 520, and 620 nm, using a

1 mmoptical path glass cell. Colorimetric calculations were performed according to the formulas proposed by Glories [9]:

$$\text{Color Intensity (CI)} = A420 + A520 + A620 \quad (1)$$

Where A420, A520 and A620 are the absorbance values at 420, 520 and 620 nm, respectively.

Anthocyanin

1 mL sample taken was diluted to 10 mL with buffer solutions of pH1.0 and pH4.5 respectively, and absorbance was measured immediately at 520 nm and 700 nm after reaching equilibrium.

Total Phenol

Total phenol content (TPC) in each extract was determined using the Folin-Ciocalteu (FC) method described by McDonald et al., [10], with minor modifications. The freeze-dried extract was dissolved in distilled water to a concentration of 50 μg/mL. The calibration curve was established using gallic acid (0-60 μg/mL). The diluted extract or gallic acid (1.6 mL) was added to 0.2 mL FC reagent (5-fold diluted with distilled water) and mixed thoroughly for 3 minutes. Sodium carbonate (0.2 mL, 10% w/v) was added to the mixture and the mixture was allowed to stand for 30 minutes at room temperature. The absorbance of the mixture was measured at 760 nm using a UV-VIS spectrophotometer V-550 model. TPC was expressed as milligram gallic acid equivalent per gram defatted *L. aromatica* (mg GAE/g DFLA).

Tannin

Sample treatment: 5 g of skin were weighed and ground into homogenate in a mortar, and transferred to a volumetric flask with a funnel, which was mixed after being dissolved to 100 mL with double distilled water, and the filtrate was retained, respectively.

Sample titration: 5.0 mL of the filtrate was blended and heated in a water bath for 5 min under 50 °C after adding 10 mL of double distilled water and 5 mL of 2.5 mol/L H_2SO_4. The end point was demanded by pale pink maintaining for 30 s under the titration of 0.01 mol/L $KMnO_4$ standard solution. Consumed volume was recorded.

Blank titration: 3 g activated carbon was added in 5.0 mL of filtrate and stirred for 10 min with heating. 5 mL 2.5 mol/L H_2SO_4 was added after being filtrated again, and the volume was recorded after the end point of titration by 0.01 mol/L $KMnO_4$ standard solution. The content of tannin in skin was calculated.

Statistical Analyses

All analyses were done at least in triplicate, and these values were then presented as average values along with their standard derivations. Data were analyzed using the Excel 2000 software. Statistical comparisons were performed with one-way analysis of variance, and p values < 0.05 were regarded as significant.

RESULTS AND DISCUSSIONS

PH and Total Acid

PH value of berries, within the optimal pH between 3.00 and 3.60, will increase with the improvement of maturity. A higher pH would increase the relative activity of microorganisms, reduce the color rendering ability of anthocyanin and the effective dosage of free SO_2, and the aging potential of wines finally [4]. In Figure 1, the three plots of pH showed all an upward trend, especially the most obvious CS, from the lowest to the highest (3.4 - 3.74), SC kept at the medium level, while S remained relatively gentle trend from the highest to the lowest value, which was related to the soil structure of block. Soil structure of plot S is the most uniform sandy loam with the consistent effect on heat dissipation and heat absorption, which led to the light and heat recourse distributed uniformly radiating to the grape surface from the ground, so pH accumulation of grape fruit displayed uniformity. There was great difference in soil structure between plots SC and CS. CS contained a large amount of clay except for part of sandy soil (with uneven absorption and dissipation to heat). SC contained more sandy soil than CS and less clay than CS. Namely, the structure trait of sand soil was S > SC > CS and the clay feature was CS > SC > S. By September 14, S pH rose from 3.47 to 3.66, SC from 3.47 to 3.71, and CS from 3.40 to 3.74. It could be found that pH value was higher on September 14, which was related to the characteristics of grape varieties [11].

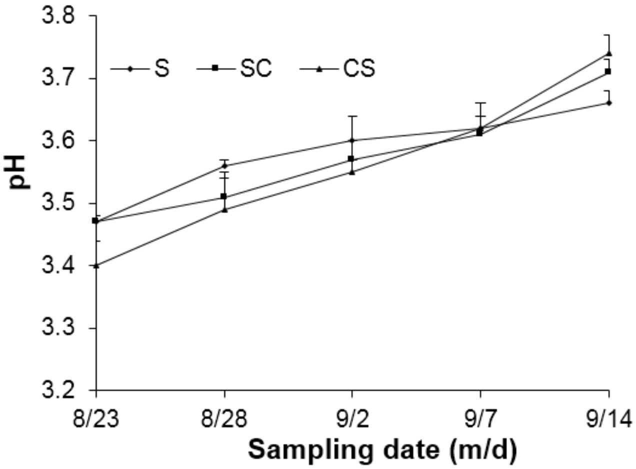

FIGURE 1. Changes of pH on Cabernet Sauvignon in three plots.

At the same time, pH of Cabernet Sauvignon grapes in different plots varied by 0.02 to 0.15. With the increase of berries maturity, the rising trend of CS pH was the most obvious and there was the highest appreciation, which was not only related to soil structure, but also related to field management measures. CS has the least sandy soil and the most clay. Up to September 14, high temperature period had passed little by little out, thus the temperature began to drop. Therefore, the sandy soil had heat dissipation stage rapidly, while the relatively warm and cool clay resulted in fast rise of pH. In contrast, S had the sandiest soil and the least clay, which caused a slow rise in pH until September 14. Therefore, the variation trend of grape pH in the three plots was CS > SC > S.

The variation trend of total acid was opposite to that of total sugar during the ripeness of Cabernet Sauvignon. After the veraison, the total sugar and total acid content of fruit was improving rapidly with the increase of total sugar content and the decrease of total acid content continually [8]. In Figure 2, total acid in S displayed lower level, SC value was up from the lowest to the highest level before lowering to the medium level, while CS was always higher relatively in the whole mature period, which had a direct relationship with the soil structure. Sand soil helped to promote the rapid maturity of grapes, accelerate the decrease of acidity. As mentioned above, the amount of sand soil in the three plots was S>SC>CS, therefore, total acid was reduced according to S>SC>CS (Figure 2).

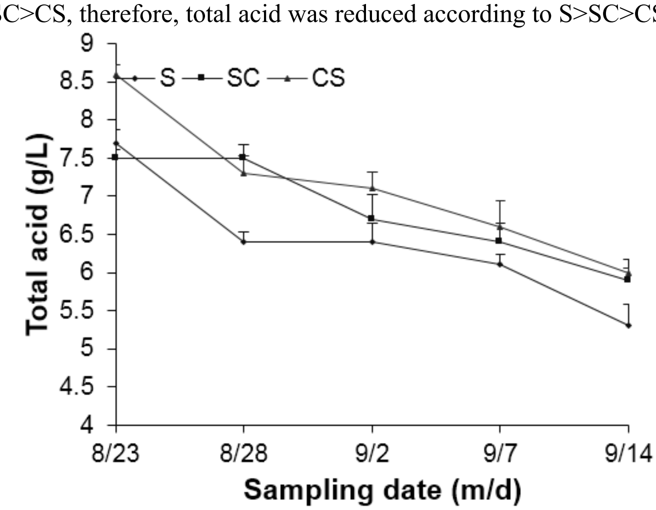

FIGURE 2. Changes of total acid on Cabernet Sauvignon in three plots.

On August 23, total acid was the highest in CS, and the lowest in SC. While on August 28, the highest value in SC, the lowest in S. By September 14, the arguments in SC and CS accumulated to the almost same, S, nevertheless, was still the lowest, which had a large relationship with the soil structure, including some personal factors, such as the management level and method of field manager (the cultural level, technical level and responsibility of the manager, the shearing and distribution of leaf and shoot in tree body. Therefore, it was vital to choose the appropriate technical manager. When the maturity level of berry was approaching complete ripeness, the decline trend of total acid tended to be stable, which was determined by the characteristics of grape variety itself. By September 14, total acid of S decreased from 7.7 g/L to 5.3 g/L, SC from 7.5 g/L to 5.9 g/L, while CS from 8.6 g/L to 6.0 g/L. Therefore, total acid of S was relatively lower during the ripeness. The appropriate acidity of vinifera should be usually maintained in 6-10 g/L, the lower acid made wine dull, the opposite was hard to wine. All the total acids were within this range in this experiment. Overall, the accumulated case of total acid concentration was CS>SC>S.

Total Sugar

The total sugar content of grape berry was on the rise after the veraison. Total sugar was an important quality index and the basis of pigment and flavor substances [12]. The similar results were obtained in this experiment. During the whole experiment, accumulation of total sugar showed an uptrend tendency (Figure 3). Although total sugar content of S presented uptrend, which was always the lowest (191.9 g /L - 228.7 g /L) with a relatively gentle rising speed. SC total sugar climbed obviously from the lower level on August 23 to the highest level when sampling (194.2 g/L - 262.5 g/L). However, CS climbed down from the highest level to the middle level (207.9 g/L - 243.0 g/L) with a relatively gradual promotion during August 23 and final sampling. This variational trend was significantly different from the conventional one, indicating that the appropriate amount of sandy soil was beneficial to the growth of grapes [13-15].

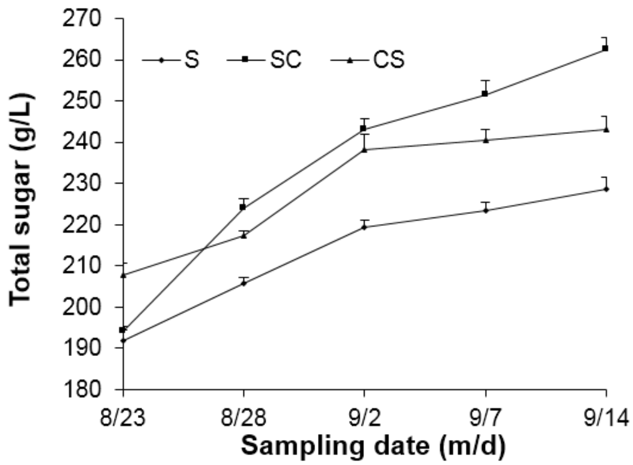

FIGURE 3. Changes of total sugar on Cabernet Sauvignon in three plots.

Soil of more sand and less clay with less impoundage were not conducive to nutrient transport and photosynthesis between trees and fruits, which could delay fruit ripening, or prone to premature aging [16-17]. On the contrary, soil with less sand and more clay could store a lot of water, promote higher redox potential, the root system was prone to form toxic phenomena, which affected the nutrient transport and photosynthesis between tree and fruit [18-20] and delayed similarly the coming of fruit ripening or premature aging. Soil characteristics of plot SC fell in between above, and nutrient transport was relatively smooth, so accumulation of total sugar was the fastest and also the most. With the increase of berry maturity, the total sugar content in the three plots increased continuously, especially the most obvious SC, whereas the least up from CS, and almost parallel upward trend along with that of S. In general, the mutative trend of total sugar in three sampling site was distinguished by SC>CS>S.

Anthocyanin

Anthocyanin was the main color substance in red wine, content of which determined the chrominance and hue of the fruit and wine [21].The sugar content increased rapidly, while the anthocyanins content augmented gradually after berries turned color. Anthocyanin was decomposed gradually at maturity, and then lifted to a higher level compared with the veraison. Therefore, the variation of anthocyanin content could also be used to measure the maturity level of berries [21].

In Figure 4, the anthocyanin content of Cabernet Sauvignon berries in three plots had all generally increased. A critical period for the rapid accumulation of anthocyanin in grape skin was August 23 - August 28. The accumulation of anthocyanin in grape skins in blocks S and CS showed a parallel change trend during the whole trial (kept at about 118 mg/100mL and 116 mg/100mL on 28 August and 14 September, respectively), which became gentle after rising rapidly. As the fruit matured, it was finally maintained at a higher level. Thus, the accumulation of anthocyanins had no direct relationship with the soil structure, which was the result of joint action between the soil characteristics of plot and management measures. Anthocyanin in grape skin in block SC was at a relatively higher level during the whole experiment, rising rapidly before August 28, however decreasing slightly on August 28 and September 2, and then rising rapidly again, which had much to do with the distribution of grape canopy and the light received by the fruit.

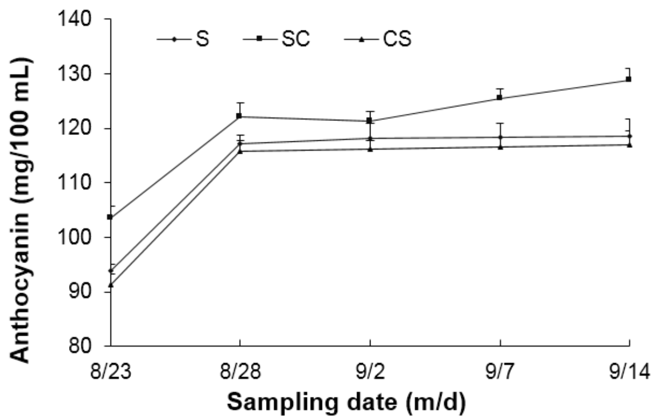

FIGURE 4. Change of anthocyanin on Cabernet Sauvignon pericarp in the three plots.

With the supersedure of season and time, the angle of light on the surface of grape was inclined, which was consistent with the canopy of grape after September 2, in a word, grape was exposed fully under the light. Therefore, anthocyanin started to accumulate rapidly after September 2. It could be seen from Figure 4 that the trend of small change in the anthocyanins content of berries became smooth after August 28. The anthocyanin content of SC berries was higher than those of S and CS, while the difference between S and CS was only between 1.36 - 8.4 mg/100 mL, indicating that SC plot was the most suitable for anthocyanin accumulation, and the accumulation level of anthocyanin in grape skins was consistent between S and CS plots. In summary, accumulation characteristics of anthocyanin content was SC>S>CS.

Chroma

Generally, the chroma would rise with the increase of fruit ripeness, which could reflect directly the frugivorous maturity level from the senses [12]. Figure 5 showed that the chroma of Cabernet Sauvignon grape skins in the three plots were almost the same on August 23. As the fruit matured, the chromas of grape skins in the three plots were changing significantly. The chroma of grape skins in block S increased gradually at the initial stage of colouring, which was related to the soil structure. S soil texture contained more sandy soil components with stronger capacity of decalescence and heat dissipation, which led to slow accumulation of chroma (anthocyanin, tannin, etc.) during this period [22]. While the gradual decline in ripening period was mainly due to the drop in temperature, together with the rain, which diluted the chroma of grapes, meanwhile led to a decrease in chroma [23]. There was a rapid upward trend only in the process of colouring (28 August solstice September 2), which was related to the climate at this time. This period was just the second growing period of grapes. The suitable range of temperature under clear weather was exactly within the grapes growth, which promoted the rapid increase of chroma [23]. The chroma of grape skins in SC and CS rose in parallel until 28 August.

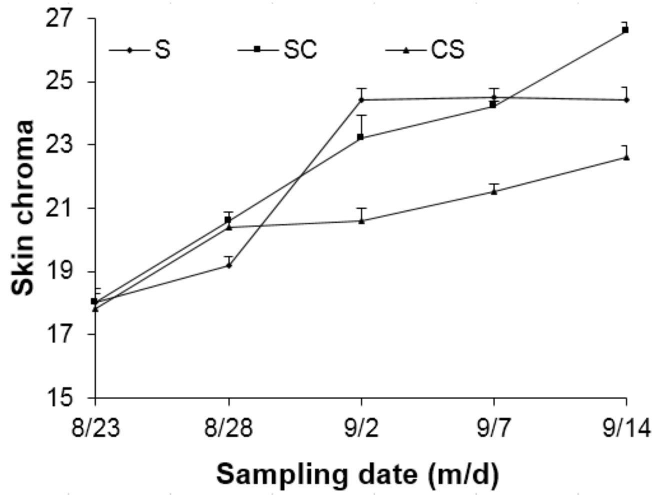

FIGURE 5. Change of skin chroma on Cabernet Sauvignon in three plots.

During the entire experiment, the chromaticity of grape skins in block SC showed a linear upward trend due to the suitable proportion of the soil structure and properties in the plot, which was conducive to the uniform photosynthesis and material transportation of grape skins, and the even light reception of grapes under the reasonable pruning [24-26]. The chromaticity of grape skins in CS plot were slowly raising trend at the early veraison and maturity stage. However, there was no obvious change in coloring process (from August 28 to September 2), one of the main reasons was that it was the second growing season for grapes except for the factors above, the sunny weather accelerated the growth of the leaves and shoots and enlargement of fruit, reduced the accumulated ratio and speed of anthocyanins in grape skins, and led to the gradual accumulation finally. By 14 September, the colorimetric relationship of the three plots was identified as SC > S > CS. The chroma of grape skins in S plot increased from 18.0 to 24.4, the SC chroma increased from 18.0 to 26.6, while that in CS from 17.8 to 22.6. Therefore, the lowest chroma was in CS plots among three sampling plots. Through comprehensive analysis, the accumulation law of chromaticity on grape skins included SC>S>CS.

Total Phenols

The content of phenols increased continually with improvement of maturity. Phenols constituted the skeleton of wine and also affected the taste of wine, which were one of the important indicators to measure wine quality [21].

As shown in Figure 6, in general, the total phenol content of Cabernet Sauvignon grape skins in the three plots showed an escalating trend. The total phenol accumulation in S grape skins presented a slow and steady upward trend, but were lower than those in SC and CS, implying that sandy soil went against the accumulation of total phenol. Before August 28, the accumulation of total phenol was consistent between SC and CS plots, which meant that the effect of the clay and the mixture of clay and sandy soil on accumulation of total phenol was the same at the initial stage of coloring. After that, both total phenol content began to vary significantly, and the variational trend of CS total phenol content, the same as S, was raising steadily, but lower than that in SC plot, which manifested that S and CS plots of grape skins could accumulate total phenol stably, only the two accumulational levels was not consistent. The total phenol content of grape skins in SC plot began to increase rapidly after September 2 and reached the highest level on September 14, indicating that the optimal period of accumulation for total phenol in grape skins of Cabernet Sauvignon in Shihezi region began on September 2 [27]. During the experiment, the total phenol content of grape skins in S plot rose from 1.5 g /L to 2.07 g/L, SC plot did from 2.06 g/L to 3.93 g/L, and CS from 2.02 g/L to 2.54 g/L. The trend of total phenol on grape skins was equal with CS=SC>S during the veraison, and SC>CS>S during the mature period. Overall, the variational trend of total phenol in grape skins was that total phenol of SC exceeded those of S and CS, respectively.

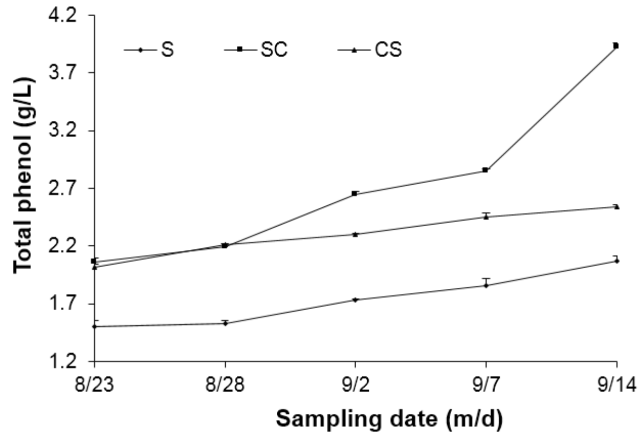

FIGURE 6. Changes of total phenol on Cabernet Sauvignon fruit peel in three plots.

Tannin

The high concentration of tannin in wine originated from grape skins, and the color and quality of grape berries affected indirectly the color of wine, including the content and quality of tannin [28-30], so the character of Cabernet Sauvignon berries was crucial to wine quality.

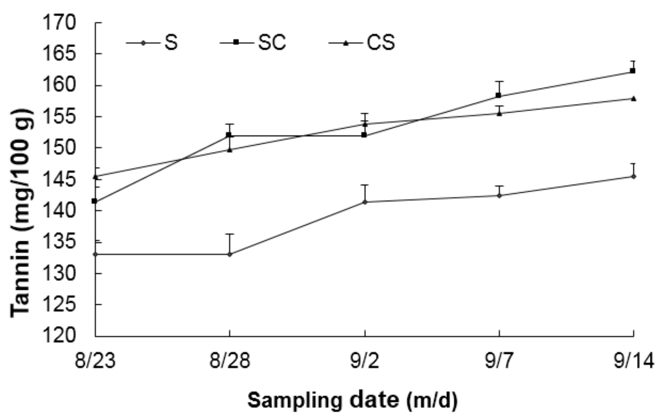

FIGURE 7. Changes of tannin content on Cabernet Sauvignon fruit peel in three plots.

As shown in Figure 7, the tannin content in the grape skins of Cabernet Sauvignon as a whole presented an upward trend during the whole experiment. The tannin content of grape skins in S block was at a low accumulation level (stable accumulation before August 28), which implied that the ability of sandy land to accumulate tannin was limited. The variation trend and level of tannin content in grape skins in SC and CS blocks were basically consistent, which manifested that mixed soil was suitable for the accumulation of tannin in grape skins, but there was a certain difference in tannin level between the two owe to the different proportion of sandy soil and clay in soil. The tannin content of grape skins in SC block decreased slightly after increasing, and went again up finally. The uptrend was related to soil structure. The SC plot contained more sandy soil and little clay, which increased the accumulation of tannin content. The tannin content in CS showed a slow rising trend (slower than that in SC block), mainly because CS contained more clay and part of sandy soil. Sandy soil, usually with better drainage, tend to obtain wines with more balanced acidity, lower and smoother tannins, as wet soils give rise to high acidity, high tannin content and low alcohol [31]. However, the accumulation of tannin needed the corporate effect of mixed soil, especially more suitable for sandy soil in the trial, therefore there was subtle difference on proportion of sandy soil with the research results of Wang et al., Choné et al., and Ramos and Martínez [31-33]. By September 14, the tannin content in grape skins of Cabernet

Sauvignon in S block rose from 133.024 mg/100 g to 145.495 mg/100 g, that value in SC block heaped up from 141.338 mg/100 g to 162.123 mg/100 g, and the CS tannin amassed from 145.495 mg/100 g to 157.966 mg/100 g. Generally, the relationship between SC > CS > S reflected accurately the variational trend of tannin content in grape skins of Cabernet Sauvignon in the trial.

Three test sites, 133400 m^2 per block, chose in the superior vineyard of Xinjiang western region pearl wine industry Co. LTD in Shihezi region. Soil sediment concentration in S block was higher than those of SC and CS, respectively. There was different peasant household to manage in SC and CS blocks. Grape samples were collected once a week during the transition to ripening stages. It was found that the patterns of variation among various indexes were significantly different with the improvement of fruit maturity by measuring the relevant indexes of Cabernet Sauvignon grape in S, SC and CS plots collected on August 23 and 28, September 2, 7 and 14, respectively. The increased sugar content as well as decreased after ascending anthocyanin content in grape berries appeared after the veraison. But anthocyanin content at full maturity was higher than that in the initial phase of color transformation (Figure 4). The high concentration of tannin in wine came from grape skin. The color and quality of grape skin affected indirectly the color and quality of wine, so the maturity of berries determined the wine quality [34-36].

The berry quality could be determined by comparing the maturity index of Cabernet Sauvignon grapes. Experiments found that these basic indexes, such as the content of pH, total sugar, chroma, anthocyanin, total phenol and tannin, increased, while the content of total acid decreased with the ripening of grapes. From August 23 to August 28, the content of pH, anthocyanin, and total phenol rose obviously, and the declining rate of total acid was the maximum. August 28 to September 2, the largest increased rate belonged to tannin and chroma, which rooted from the soil structure (mainly the appropriate ratio of sand and clay). Whereas the variational trend of indicators were gradually flatten out after September 2, which attributed to the variation of temperature at that time although the different soil structure. Lower temperatures had inhibited the rise of these indicators [37]. Through comparison among the indicators, the motorial trajectory of total acid content abide by CS>SC>S, the kinetic characteristic of total sugar content adhered to SC>CS>S, total sugar and total acid were always relatively low in S block, which made clear that a high concentration of sandy soil was not suitable the accumulation of total sugar and total acid compared with mixed soil, there was different effect of soil proportion on the accumulation of total sugar and total acid in the fruit. In addition, management measures were also an important factor. Cabernet Sauvignon grapes had obtained a more favorable pH and total acidity, and the berries had entered an appropriate harvest period on September 2. The principles of accumulation were SC>S>CS for chroma and anthocyanin content, respectively, the law of SC>CS>S as for three blocks of grapes belonged to total phenol and tannin content. The overall analysis showed that the quality of Cabernet Sauvignon grape in SC block was superior to ones in S and CS blocks.

The content and species of phenolic, tannin and anthocyanin in berries determined the color, aroma and body of the wine, which were important indicators of wine quality. Cabernet Sauvignon was suitable for growth in hot sandy soil, and the plots S, SC and CS in Shihezi region met just demand growing Cabernet Sauvignon grapes. There were significant differences in the physical and chemical indexes of Cabernet Sauvignon grapes when the soil sediment content in S block was higher than those in SC and CS. These indices of Cabernet Sauvignon grape in SC, such as tannin, anthocyanin, total phenol and total sugar, were all higher than those of S and CS, which meant that the sediment concentration had an important influence on the berry quality of Cabernet Sauvignon grapes. The higher sand content was not representative of excellent quality for Cabernet Sauvignon grape, and the indicators corresponded to the corresponding soil structures. Therefore, soil conditions were an important factor to obtain superior grape raw materials.

CONCLUSION

By comparing the difference of physical and chemical indexes, conclusions were drawn as follows: There was a slight difference in quality of Cabernet Sauvignon grapes between S and CS, and SC grape had better quality because of different soil sediment content. Appropriate soil quality was an important way to obtain high-quality of grape raw materials. In the case that the content of sandy soil was S > SC > CS, and the clay content was CS > SC > S, the berry quality of SC Cabernet Sauvignon was slightly better than that of S, indicating that the soil sediment content affected the quality of Cabernet Sauvignon grape. It was not that the higher the sand content was, the better grape character would, the suitable proportion of clay was necessary to be thought about. By the time of harvest, the tactic sequence of total acid and pH in fruit from the high to the low was CS>SC>S, and the accumulation of chroma and anthocyanin in pericarp was characterized by SC>S >CS. The mutative relationship of total sugar, total phenol and tannin in fruit was SC>CS>S. Therefore, SC block was conducive to the accumulation of characteristic substances (chroma, anthocyanin, total sugar, total phenol and tannin) in Cabernet Sauvignon grape, and CS one promoted the promotion of total acid and pH. In general, soil sediment concentration had important influence on the quality improvement of Cabernet Sauvignon grape during the ripening.

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