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Physicochemical characteristics of clusters vine cv. Sugrathirteen (Midnight Beauty®)

Carlos Augusto Menezes Feitosa[1], Alessandro Carlos Mesquita[1], Kécio Emanuel dos Santos Silva[1], Daniel Nunes Sodré Rocha[1], Andrea Pavesi[1]

[1] Universidade do Estado da Bahia, Juazeiro, BA, Brasil. E-mail: menefe@bol.com.br (ORCID: 0000-0003-0901-6415); alessandro.mesq@yahoo.com.br (ORCID: 0000-0002-9754-1676); kecio_emanuel@hotmail.com (ORCID: 0000-0002-2816-6737); danielnunessif@yahoo.com.br (ORCID: 0000-0002-8415-1644); andreapavesi@hotmail.com (ORCID: 0000-0003-3089-4044)

ABSTRACT: With the growing expansion of viticulture, the northeastern region in particular, the Submédio Vale do São Francisco, stands out in the cultivation of grapes. With the introduction of new cultivars in this region, there is a need to improve pruning management for the adaptation of these varieties. The objective of this work was to evaluate the influence of different bud loads on the management of the canopy for the post harvest quality of the fruits of cv. Sugrathirteen (Midnight Beauty®). The research was carried out in two years (2014 and 2015), using the DBC design in a factorial scheme, being two seasons and five treatments (6, 8, 10, 12 and 14 buds) distributed in four blocks, considering 5 plants by repetition. It can be observed that, in relation to the chemical characteristics of the fruit, the time of pruning significantly affected the content of soluble solids and total acidity. There was no influence of the yolk load on the soluble solids content, however, in the two years, they reached levels above 15 0Brix, considered adequate for this cultivar. It was also concluded that the choice of the pruning system as a function of the yolk load and the genetic characteristics of the cultivar, provided higher yields in pruning with 10 buds, without negatively affecting the quality of the grapes.

Key words: Brix; post-harvest; pruning; semiarid

Características físico-químicas dos cachos da videira cv. Sugrathirteen (Midnight Beauty®)

RESUMO: Com a crescente expansão da viticultura, a região Nordeste, em especial o Submédio Vale do São Francisco, destaca-se no cultivo de uvas. Com a introdução de novas cultivares nessa região, existe a necessidade de aperfeiçoar o manejo da poda para a adaptação dessas variedades. O objetivo do trabalho foi avaliar a influência de diferentes cargas de gemas, no manejo da copa para a qualidade pós-colheita dos frutos da cv. Sugrathirteen (Midnight Beauty®). A pesquisa foi realizada em dois anos (2014 e 2015), sendo utilizado o delineamento DBC em esquema fatorial, sendo duas épocas e cinco tratamentos (6, 8, 10, 12 e 14 gemas) distribuídos em quatro blocos, considerando-se cinco plantas por repetição. Pode-se observar que, com relação às características químicas da fruta, a época da poda afetou significativamente ($p < 0,05$) o teor de sólidos solúveis e acidez total. Não houve influência da carga de gemas no teor de sólidos solúveis. Contudo, nos dois anos alcançaram níveis acima de 15 0Brix, considerados adequados para a referida cultivar. Conclui-se também que a escolha do sistema de poda em função da carga de gemas e das características genéticas da cultivar, proporcionou maiores produtividades na poda com 10 gemas, sem afetar negativamente a qualidade das uvas.

Palavras-chave: Brix; pós-colheita; poda; semiárido

Introduction

Viticulture is an important activity for the sustainability of smallholdings in Brazil, which has become equally relevant in the development of some regions, with the generation of jobs in large enterprises, which produce table grapes and grapes for processing (Mello, 2015). This economic activity has grown in several regions of the country, reaching an area of approximately 82.5 thousand hectares of vineyards planted, producing about 1,388,859 tons in total grapes in 2014 (Agrianual, 2015). Of this volume, approximately 48% is destined to the processing for the elaboration of wines, juices and other derivatives and 52% is marketed as table grapes.

Primarily, the Italia variety has maintained an almost absolute predominance of the cultivated areas, which is about 90%, and the other areas correspond to the cultivation of the variety Piratininga. From the end of the 1980s onwards, a phase of viticulture diversification began in the Submédio do Vale do São Francisco, seeking new alternatives for varieties as good as the traditional ' Italia'. For this purpose, grapes with seeds of the varieties Benitaka, Patrícia, Red Globe and Brasil were introduced, being the two latter natural somatic mutations of Italia and Benitaka, respectively (Maia et al., 2009).

In order to follow this line of supply of new cultivars, the cultivar Sugrathirteen (Midnight Beauty®), launched by the breeding program of Sun World International, LLC (Coachella, California, USA), presents a low cost in manual thinning due to natural abortion of the flowers, lower fertilizer demand when compared to traditional cultivars and, in Brazilian tropical conditions, productivity may exceed 40 $t.ha^{-1}$, with two crops per year. In the city of Petrolina/PE, the plantations were carried out in the middle of 2008 on an experimental basis, and in 2010 only the first commercial vineyards were established with the authorized producers.

Currently, the cultivar is widely used by farmers authorized in countries such as South Africa, and cultivated under license by the producers of the USA, Chile, Brazil, Peru, Australia, Portugal, Italy, Israel, Mexico, Portugal and Spain (Sun World - Brazil, 2012).

And when it comes to cultivation in a new region, a careful evaluation of the climatic requirements of each phase is necessary since the vines change the phenological behavior and the thermal accumulation necessary to complete the cycle when cultivated in places with different meteorological conditions (Neis et al., 2010), which may interfere positively or negatively in the growth and development of the plants and also in the productive and qualitative characteristics of the fruit (Mascarenhas et al., 2013).

In this sense, we must consider that the edaphoclimatic conditions influence the development of the fruit, being directly related to the viticultural ecosystem (climate, soil, cultivar, rootstock) and cultural techniques (irrigation, pest and disease control, fertilization (Ubalde et al., 2007). Thus, by modifying the content of constituents, such as soluble solids and organic acids present in both seeds and pulps, these modifications have repercussions on the sensorial characteristics (Moussaoui & Varela, 2010) and physicochemical characteristics of the grapes (Ferrer-Gallego et al., 2010).

The objective of this work was to verify the influence of different bud loads on the management of the top of vine cv. Sugrathirteen, aiming to increase the productivity and quality of the grape.

Material and Methods

The field study was carried out at Fazenda Prodomo, in the experimental field of seedless cultivars of Sun World International, LLC, with a 1.0 hectare area located in the city of Petrolina-PE, in a vineyard of the cv. Sugrathirteen (Midnight Beauty®) grafted on the rootstock Paulsen 1103 (*Vitis berlandieri* x *Vitis rupestris*). Planting of seedlings was carried out in 2008.

The region of the Submédio do Vale do São Francisco is located between parallels 8° and 9° S, whose climate, BSh according to Köppen classification, is characterized as semi-arid tropical, with average annual temperature around 26° C, rainfall of approximately 500 mm and altitude of 330 m in relation to sea level.

In the first production cycle, pruning was performed in mid-November 2013, with pruning in the crown buds or basal buds, where 2% hydrogenated cyanamide (Dormex®) was applied to standardize sprouting. In this cycle, all inflorescences were eliminated, forming only productive branches.

From July 2014 on, with the lignified branches, the production pruning and harvesting took place in October 2014. In the second year, in 2015, the formative and production pruning and harvesting were carried out in the same months of the year 2014, November, July and October, respectively.

The plants were conducted in the trellis system, with a density of 1428 plants ha^{-1} and spacing of 3.5 m x 2.0 m. During the conduction of the experiments, the operations of management, phytosanitary control, irrigation and fertilization were made, according to the requirements of the cultivar. The irrigation system adopted was the single-line drip irrigation with microperforated polyethylene hoses.

All plants were submitted to dormancy by applying 5% hydrogenated cyanamide in the production pruning with the commercial product Dormex®, which contains 49% of the active principle, sprayed on all buds of each twig, applied 24 hours after pruning. In all vintages, all treatments of the experiments were pruned in one day.

A randomized experimental block design and a 2x5 factorial design were used, with two seasons and five treatments distributed in four blocks, considering five plants per replicate. The vines were submitted to different **bud loads** with the following treatments: pruning with 6 buds (17 buds m^{-2}), 8 buds (23 buds m^{-2}), 10 buds (29 buds m^{-2}), 12 buds s (34 buds m^{-2}) and 14 buds (40 buds m^{-2}).

The standardization of the number of branches at the moment of the production pruning was carried out, selecting 20 plant branches^{-1} in all treatments.

Chemical evaluations of the grapes harvested in the experiments were made, and the following variables were determined: total soluble solids (TSS), total titratable acidity (TTA), TSS/TTA ratio. The criterion adopted for the harvesting of the plots was from the finding that the soluble solids content reached 16° Brix or at the end of the harvest cycle of the cultivar, which was 110 days after the production pruning.

The total soluble solids content was obtained by refractometry, using ATAGO® N1 portable refractometer, with reading in the range of 0 to 32° Brix. Prior to its use, it was calibrated at 0° Brix with distilled water. The readings were made in juice samples of the pulp composed of four berries, one of the basal part, two of the medial part and one of the apex of the bunch, extracted by manual pressing; 20 bunches per treatment were evaluated.

To obtain the total titratable acidity, berries were removed from the proximal, medial and distal portions of the bunches, forming five samples composed of 20 berries per replicate. The TSS/TTA ratio was calculated by dividing the results of total soluble solids content by the total titratable acidity content.

For statistical analysis, the data were submitted to analysis of variance (F test) and the means were compared by the Tukey test at 5% probability, as well as polynomial regression analysis, and the regression coefficient estimates were tested by Student's t test at 5% probability, using the Assistat® software version.7.7.

Results and Discussion

The analysis of variance revealed significant differences ($p < 0.05$) in relation to the pruning times in all the mentioned variables (TSS, TTA and TSS/TTA). However, only the characteristics related to total titratable acidity (TTA) and TSS/TTA ratio presented significant differences ($p < 0.05$) with respect to the treatment described for the bud loads. As for the interaction between buds and seasons, there was significance only for the titratable total acidity (TTA) variable.

During the initial stages of fruit growth, Togores & Fernández-Cano (2011) observed that the soluble solids content is found in low concentrations, generally around 2% of the fresh berries mass and from the beginning of ripening, sugar concentration increases rapidly and can reach more than 25% at the time of harvesting, as grape berries have the capacity to accumulate higher sugar concentrations during the ripening phase.

According to Miele & Rizzon (2013), the main sugars of the grape, glucose and fructose, are synthesized in the vine leaf by the process of photosynthesis and their concentration in the fruit depends on several factors. It is known that the ideal harvesting point for table grapes can be determined by the association of some indicators of maturation stage, such as number of days after sprouting, degree-day index, berries size, color evolution peel, soluble solids content (°Brix) and soluble solids/titratable acidity ratio. Thus, these characteristics may vary according to the cultivar.

Based on the results obtained, we can observe in the data shown in Table 1 that all the variables related to the chemical characteristics had a significant effect ($p < 0.05$) in relation to the production times. The total solids (TSS) and the TSS/TTA ratio had higher values in 2015, with a mean in treatments of (15.61 and 17.97 °Brix) and (19.68 and 29.84), respectively, in the years 2014 and 2015.

However, when we analyzed titratable total acidity (TTA), the highest values were obtained in the first year of evaluation (Table 1). When analyzing the results obtained by Mascarenhas et al. (2010), where the °Brix levels were between 13.63 and 15.97 °Brix for the varieties Benitaka, Italia, Festival and Isabel, marketed in the state of Paraíba, we can infer that the values shown in Table 1 for the year 2014 were similar, and in the year 2015, they were superior.

The total soluble solids contents of 15.8, 16.4, 16.5 and 16.0 ° Brix for the cultivars Brasil, Benitaka, Italia and Red Globe, respectively, are reported by Mascarenhas et al. (2013). These values were lower than those shown in the second year of cultivation (Table 1).

Some influence is exerted by the pruning times on the chemical composition of the grapes and by the change of the vegetative cycle. However, the present work found statistical differences ($p < 0.05$) between the pruning seasons of 2014 and 2015, (15.61 and 17.97 °Brix), respectively (Table 1). A greater difference was expected because these characteristics depend directly on the interaction of the plant with the environment. There was an average increase of 15.1% in 2015 compared to 2014.

On the other hand, Neis et al. (2010), in studies with the Niagra rosada vine, did not observe significant differences ($p < 0.05$) between the four pruning seasons, for the soluble solids variable.

In recent works, researchers report that the sugar content of the grape, usually expressed in total soluble solids (ºBrix), generally shows a negative correlation with the productivity

Table 1. Evaluations of the chemical characteristics of total solids (TSS), titratable total acidity (TTA), TSS/TTA ratio in cv. Sugrathirteen (Midnight Beauty®) submitted to different bud loads in the 2014/2015 season, Petrolina, PE, Brazil.

Seasons	Total Solubles (TSS) (°Brix)	Titratable total acidity (TTA) (% of tartaric acid)	TSS/TTA ratio
2014	15.61 B	0.81 A	19.68 B
2015	17.97 A	0.61 B	29.84 A

Means followed by the same letter in the column do not differ from each other by the F test at 5% probability.

of the vineyard (Pastore et al., 2011; Santesteban et al., 2011; Sun et al., 2012).

According to Bordelon et al. (2008), it is possible, in part, that the high yields cause a delay in the accumulation of soluble solids in the fruit, when compared to plants with lower load.

The climatic conditions of the region where the research was conducted favored the maturation of the berries in the two seasons, having as a complement date the average temperatures observed in the month of October (harvest), which were 28.05 and 28.35 °C, in the years 2014/2015, respectively. It can then be suggested that there was no climatic interference in the accumulation of soluble solids in the harvests of 2014 and 2015.

For table vines, according to Keller (2010), high sugar contents are desirable and these are reached with high air temperature values. This temperature affects the physiology of the grapevine and the quality of the grapes, with the sugar concentration increasing and the acid concentration decreasing, simultaneously, when the vines are cultivated under high thermal conditions, influencing the quality of the grapes (Keller, 2010).

It is important to highlight that the selections of bunches were made after the fruit fixation in the two production seasons (2014 and 2015), with 6.94 bunches m^{-2} and 7.02 bunches m^{-2}, respectively, thus not interfering with the soluble solids content.

The density of bunches per square meter can be adjusted so that the physical-chemical quality of the bunches and berries is not affected and the characteristics inherent to the cultivar produced are maintained. This management practice has been explored for vine grapes (Santos et al., 2010; Pastore et al., 2011). However, for table grapes, the information is scarce.

It should be noted that the mean value for total soluble solids (TSS) of Sugrathirteen cultivar (Midnight Beauty®) was higher than 15 °Brix in both cycles (Table 1), which can be considered satisfactory for this cultivar. It is known that in the region of Petrolina (PE), this cultivar is considered suitable for harvesting when the percentage of soluble solids (°Brix) in the berries reaches 15 to 16, which are composed of reducing sugars (glucose and fructose).

The interaction between the plant and the environment is crucial to determine the acid contents present in the berries after maturation. According to Manfroi et al. (2004), the two main organic acids found in mature grapes are tartaric acid and malic acid; however, according to Assis et al. (2011), the concentration of these acids decreases whenever there is a maturation evolution due to the increase in energy demand.

Table 2 shows that, for the titratable total acidity (ATT) variable, there was a significance for the interaction between the factors ($p < 0.05$).

The pruning times also showed significant differences ($p < 0.05$), with mean values of treatments of 0.81 and 0.61 g of tartaric acid per 100 mL of juice, in 2014 and 2015, respectively (Table 2).

As shown in Table 2, evaluating only the individual load, comparing the two seasons, it can be observed that there was a significant difference ($p < 0.01$) in all treatments, with higher values in the year 2014.

Figure 1 shows that the variation in the bud load affected significantly ($p < 0.01$) the total acidity in the two years, showing a linear increase in the acidity content in 2014 and a trend of reduction in the values for the year of 2015, after the loading of 10 buds.

Contrasting results were reported by Abdel-Mohsen (2013) for the Crimson Seedless cultivar, where no statistical differences ($p > 0.05$) were observed in the different types of pruning (2, 4, 6, 8, 10 and 12 buds $stick^{-1}$) in the two harvests for the total acidity characteristic. On the other hand, Kohale et al. (2013) observed that in cv. Sharad Seedless the highest acidity was recorded when the sticks were pruned with 8 buds in both seasons.

According to Brazilian legislation, the grape pulp must comply with the characteristics and composition of the total acidity content of at least 0.41 g $100g^{-1}$ of tartaric acid (Brazil, 2000). As shown in Figure 1, the lowest value was observed in 2015 in the pruning of 6 buds with 0.58 and the highest value of 0.93 in the pruning with 14 buds. Thus, the range of values in both treatments, and in both cycles of production, is within the values normally described for the Brazilian conditions.

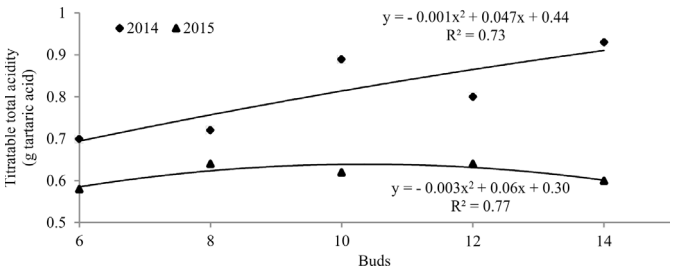

Figure 1. Influence of harvests on titratable total acidity (TTA) in cv. Sugrathirteen (Midnight Beauty®) submitted to different bud loads in the 2014/2015 season, Petrolina, PE, Brazil.

Table 2. Interaction between pruning times in total titratable acidity (TTA) in cv. Sugrathirteen (Midnight Beauty®) submitted to different bud loads in the 2014/2015 season, Petrolina, PE, Brazil.

Seasons	6 buds (17 buds m^{-2})	8 buds (23 buds m^{-2})	10 buds (29 buds m^{-2})	12 buds (34 buds m^{-2})	14 buds (40 buds m^{-2})	Mean
2014	0.70 A	0.72 A	0.89 A	0.80 A	0.93 A	0.812 A
2015	0.58 B	0.64 B	0.62 B	0.64 B	0.60 B	0.619 B

Means followed by the same letter in the column do not differ from each other by the F test at 5% probability.

The ratio between the total soluble solids content and the total titratable acidity, known as the ratio, represents the balance between the sweet and acid taste of the juice, therefore, an indication of the quality of this product (Miele & Rizzon, 2013).

The grape is a non-climacteric fruit that has a low rate of respiratory activity and does not mature after harvested (Manica & Pommer, 2006). Therefore, it should be harvested only when it reaches the desired maturation point and is compatible with its intended use.

According to Sato et al. (2009), it is only after the beginning of maturation that a metabolic modification occurs in the sugar translocation, causing a large accumulation of this component in the berries, this stage known as "*véraison*". Since it is an inverse evolution relationship between soluble solids (SS) and titratable acidity (TA), the maturation index tends to be similar in relation to the evolution of the SS content, that is, with low levels at the beginning of the maturation and progressive increase until the period close to harvest.

Khamis et al. report that the flavor of the grapes occurs through the relationship between soluble solids content (SST) and titratable total acidity (TTA), and this relationship is considered an important factor for the standardization of quality, especially for exportation. In this study, this relationship, or covariation between SST and/or TTA (Table 1), showed a significant difference ($p < 0.01$) between harvesting times, being higher in 2015.

It is worth mentioning that the pruning season can exert a great influence on the chemical composition of the fruit due to the influence of time conditions throughout the cycle of the plants (Silva, 2009).

When evaluating the effect of the bud load on the SST/TTA ratio (Figure 2), it was possible to observe a convex parabolic function ($p < 0.05$) with a minimum point between 10 and 12 buds, that is, the number of buds was increased from 6 to 8 buds (27.65 and 25.46 respectively).

Similar results were found by Fawzi et al. (2015), where the Brix/acidity ratio decreased with higher number of buds stick^{-1} in several cultivars.

Khamis et al. (2017) studied the effect of the bud load on the Brix/acidity ratio for the cv. Sugraone (Superior Seedless®), performing prunings with 8, 10 and 12 buds stick^{-1}. They concluded that the treatment with 8 buds

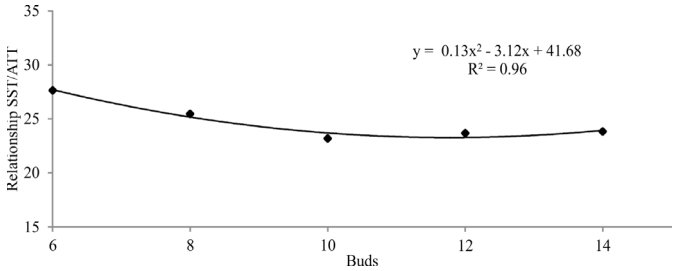

Figure 2. Evaluation of the bud load on the average Brix/acidity ratio in cv. Sugrathirteen (Midnight Beauty®) submitted to different bud loads in the 2014/2015 season, Petrolina, PE, Brazil.

stick^{-1} was superior to the others, with a value of 25.71, corroborating with the results obtained in this work, in which the treatment containing only 8 buds had the value of the Brix/acidity ratio of 25.46.

The SST/TTA ratio was satisfactory for the cultivar in all treatments, being desirable for its *in natura* consumption, mainly in the fruit of the 2015 harvest (Table 1). Brazilian legislation establishes the limits of this relationship between 15 and 45 (Brazil, 2000). According to the Chilean Exporters Association, the ratio of 20:1 (°Brix/acidity) is considered within the standards (Benato, 2003).

Regarding the physical characteristics of the grapes (Table 3), we can observe that, as the number of buds stick^{-1} increased, a linear trend was observed in the growth of the bunches in the year 2014 ($y = 0.4585x + 20.307$; $R^2 = 0.87^{**}$). However, in 2015 there was this same trend of growth only until pruning with 10 buds, with a decrease from pruning of 12 buds ($y = -0.1505x^2 + 3.0727x + 9.18115$; $R^2 = 0.97^{**}$).

The lowest length of bunch was observed in pruning with 6 buds (22.43 cm and 22.07 cm), in 2014 and 2015 respectively. The highest values were observed in 2014 (26.67 cm) in pruning with 14 buds, and in 2015 (24.83 cm) in pruning with 10 buds, being classified as large bunches for all treatments.

The apical dominance is a variable that is expressed as a function of the cultivar, being its high vegetative vigor one of the characteristics of cv. Sugrathirteen (Midnight Beauty®). The shorter pruning, with 6 buds, increased the vigor of the branches, which resulted in a higher speed of growth of the branches in detriment to the size of the bunches. In a similar study, different results were found by Fawzi et al. (2015)

Table 3. Physical characteristics of the grapes for the variables length and width of the bunch (cm), and productivity (t ha^{-1}) in cv. Sugrathirteen (Midnight Beauty®) submitted to different bud loads in the 2014/2015 season, Petrolina, PE, Brazil.

Variables	6 buds	8 buds	10 buds	12 buds	14 buds	Mean
			2014			
Length of bunch (cm)	22.43	24.82	25.01	25.52	26.67	24.89 A
Width of bunch (cm)	9.64	10.99	10.43	11.55	11.85	10.89 B
Productivity (t ha^{-1})	22.65	29.63	36.22	31.93	30.06	30.10 A
			2015			
Length of bunch (cm)	22.07	24.39	24.83	24.11	22.82	23.66 B
Width of bunch (cm)	14.19	15.02	15.20	13.93	14.58	14.58 A
Productivity (t ha^{-1})	21.02	30.08	28.57	26.20	22.68	25.71 B

Means followed by the same letter in the column do not differ from each other by the Tukey test at 5% probability.

in the cultivar Superior Seedless®, where, as the bud load increased in the plant, there was a decrease in the length of bunches. In this work, the lowest values of bunch length (17.33 cm and 18.90 cm) were obtained with prunings of 15 buds stick^{-1}, while the highest values were found in pruning with 9 buds stick^{-1} (31.16 cm and 33.10 cm), referring to two years of research.

Table 3 shows that there were significant differences in the length of the bunches in relation to the pruning seasons, obtaining higher values in the year 2014 (24.89 cm) and 2015 (23.66 cm).

When we analyzed the factor related to the width of the bunches, we can verify that a linear growth occurred as a function of the bud load in the first year of evaluation ($y = 0.2547x + 8.326$; R^2=0.83*), presenting higher values in pruning with 14 buds (11.85 cm), that is, as the bud load increased, there was a gradual increase in the width of the bunches. For the second year of evaluation, this significance did not occur in relation to the bud load. Superior results regarding the width of bunches were reported by Fawzi et al. (2015), when studying the cultivar Superior Seedless® in two periods. The authors pointed out that the highest values (21.76 cm and 22.22 cm) were obtained in the treatment with 9-bud pruning, however, in the pruning with 15 buds stick^{-1}, there was a reduction in the width of the bunches (16.93 cm and 18.03 cm) in the two periods, respectively.

In relation to the results obtained with regard to yield as a function of the bud load treatments between two pruning seasons (Table 3), there were significant statistical differences ($p < 0.05$) between the seasons of (30,10 and 25.71 t ha^{-1}) in 2014 and 2015, respectively. According to Neis et al. (2010), one of the factors of greater relevance in grape production is related to its pruning season. Fawzi et al. (2015), observed in the Crimson Seedless cultivar that the yield was significantly increased by the increase of the bud load. The highest yield was (13.25 and 13.57 kg plant^{-1}) and (15.28 and 16.14 kg plant^{-1}) with 104 buds plant^{-1} (equivalent to 17.3 buds m^{-2}) and with 117 buds plant^{-1} (equivalent to 19.5 buds m^{-2}) in the two years, respectively.

Conclusion

For cv. Sugrathirteen (Midnight Beauty®), under cultivation conditions in the semi-arid region of the Vale São Francisco, the bud load did not influence total soluble solids contents. However, there was a significant effect for total titratable acidity and Brix/acidity ratio. The bud load influenced the length and width of the bunches, as well as the yield, and a direct relation with the bud load (10 buds stick^{-1}) could be established because it presented the best results.

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Literature Cited

Abdel-Mohsen, M.A. Application of various pruning treatments for improving productivity and fruit quality of crimson seedless grapevine. World Journal Agricultural Science, v.9, n.5, p. 377-382, 2013. https://doi.org/10.5829/idosi.wjas.2013.9.5.1766.

Agrianual**.** Anuário da Agricultura Brasileira. Uva: produção brasileira. São Paulo: Agrianual, 2015. 464 p. http://www.agrianual.com.br. 25 Ago. 2017.

Assis, A. M. de; Yamamoto, L. Y.; Souza, F. S. de; Borges, R. S.; Roberto, S. R. Evolução da maturação e características físico-químicas e produtivas das videiras 'BRS Carmen' e 'Isabel'. Revista Brasileira de Fruticultura, v.33, número especial, p.493-498, 2011. https://doi.org/10.1590/S0100-29452011000500066.

Benato, E. Tecnologia, Fisiologia e doenças pós-colheita de uvas de mesa. In: Pommer, C. V. (Ed.) Uva: tecnologia de produção, pós-colheita, mercado. Porto Alegre: Cinco Continentes. 2003. p.635 - 723.

Bordelon, B.; Skinkis, A.; Howard, P. Impact of training system on vine perfomance and fruit composition of Traminette. American Journal of Enology and Viticulture, v.59, n. 1, p.39-46, 2008. http://www.ajevonline.org/content/59/1/39.full. 12 sep. 2017.

Brasil. Ministério da Agricultura e do Abastecimento. Instrução Normativa n. 01, de 07 de janeiro de 2000. Aprova o regulamento técnico geral para fixação dos padrões de identidade e qualidade para polpa de fruta. Diário Oficial da União, v.138, n. 6, Seção 1, p. 259-263, 2000.

Fawzi, M.I.F.; Laila, F.; Shahin, M.F.M.; Merwad, M.A.; Genaidy, E.A.E. Effect of vine bud load on bud behavior, yield, fruit quality and wood ripening of superior grape cultivar. International Journal of Agricultural Technology, v.11, n.5, p.1275-1284, 2015. https://www.cabdirect.org/cabdirect/FullTextPDF/2015/20153272890.pdf. 06 Sep. 2017.

Ferrer-Gallego, R.; García-Marino, M.; Hernández-Hierro, J. M.; Rivas-Gonzalo, J. C.; Escribano-Bailón, M.T. Statistical correlation between flavanolic composition, colour and sensorial parameters in grape seed during ripening. Analytica Chimica Acta, v.66, n.1, p.22-28, 2010. https://doi.org/10.1016/j.aca.2009.09.039.

Keller, M. Managing grapevines to optimize fruit development in a challenging environment: A climate change primer for viticulturists. Australian Journal of Grape and Wine Research, v. 16, n. s1, p.56-69, 2010. https://doi.org/10.1111/j.1755-0238.2009.00077.x.

Khamis, M.A.; Atawia, A.A.R.; El-Badawy, H. E.M.; Abd El-Samea, A.A.M. Effect of buds load on growth, yield and fruit quality of superior grapevines. Middle East Journal of Agriculture Research, v.6, n.1, p.152-160, 2017. http://www.curresweb.com/mejar/mejar/2017/152-160.pdf. 17 Sep. 2017.

Kohale, V.S.; Kulkarni, S.S.; Ranpise, S.A.; Garad, B.V. Effect of pruning on fruiting of Sharad Seedless grapes. Bioinfolet, v.10, n.1, p. 300-302, 2013. http://www.indianjournals.com/ijor.aspx?target=ijor:bil&volume=10&issue=1b&article=033. 22 Sep. 2017.

Maia, S.H.Z.; Mangolin, C.A.; Collet, S.A.O.; Machado, M.F.P.S. Genetic diversity in somatic mutants of grape (*Vitis vinifera*) cultivar Italia based on random amplified polymorphic DNA. Genetics and Molecular Research, v.8, n. 1, p. 28-38, 2009. http://www.funpecrp.com.br/gmr/year2009/vol8-1/pdf/gmr536.pdf. 07 Oct. 2017.

Manfroi, L.; Miele, L.; Rizzon, L.A.; Barradas, C.I.N.; Souza, P.V.D. Evolução da maturação da uva 'Cabernet Franc' conduzida no sistema lira aberta. Ciência Agrotecnica, v. 28, n.2, p. 306-313, 2004. https://doi.org/10.1590/S1413-70542004000200009.

Manica, I.; Pommer, C.V. Uva: do plantio a produção, pós-colheita e mercado. Porto Alegre: Cinco Continentes, 2006. 185 p.

Mascarenhas, R. J.; Silva, S. M.; Lopes, J. D.; Lima, M.A.C. Avaliação sensorial de uvas de mesa produzidas no vale do São Francisco e comercializadas em João Pessoa – PB. Revista Brasileira de Fruticultura, v.32, n.4, p. 993-1000, 2010. https://doi.org/10.1590/S0100-29452011005000012.

Mascarenhas, R.J.; Guerra, N.B.; Aquino, J.S.; Leão, P.C.S. Qualidade sensorial e físico-química de uvas finas de mesa cultivadas no submédio São Francisco. Revista Brasileira de Fruticultura, v. 35, n. 2, p. 546-554, 2013. https://doi.org/10.1590/S0100-29452013000200025.

Mello, L. M. R. Panorama da vitivinicultura brasileira 2014. Bento Gonçalves: Embrapa Uva e Vinho, 2015. 6p. (Embrapa Uva e Vinho. Comunicado Técnico, 175). https://ainfo.cnptia.embrapa.br/digital/bitstream/item/130803/1/Comunicado-Tecnico-175.pdf. 10 Set. 2017.

Miele, A.; Rizzon, L.A. Intensidades da poda seca e do desbaste de cacho na composição da uva Cabernet Sauvignon. Revista Brasileira de Fruticultura, v. 35, n. 4, p. 1081-1092, 2013. https://doi.org/10.1590/S0100-29452013000400020.

Moussaoui, K.A.; Varela, P. Exploring consumer product profiling techniques and their linkage to a quantitative descriptive analysis. Food Quality and Preference, v. 21, n.8, p. 1088-1099, 2010. https://doi.org/10.1016/j.foodqual.2010.09.005.

Neis, S.; Reis, E.F.; Santos, S.C. Produção e qualidade da videira cv. Niágara rosada em diferentes épocas de poda no sudoeste goiano. Revista Brasileira de Fruticultura, v. 32, n. 4, p. 1146-1153, 2010. https://doi.org/10.1590/S0100-29452010000400024.

Pastore, C.; Zenoni, S.; Tornielli, G. B.; Allegro, G.; Dal Santo, S.; Valentini, G.; Intrieri, C.; Pezzotti, M.; Filippetti, I. Increasing the source/sink ratio in *Vitis vinifera* (cv Sangiovese) induces extensive transcriptome reprogramming and modifies berry ripening. BMC Genomics, v. 12, p. 631-653, 2011. https://doi.org/10.1186/1471-2164-12-631.

Sun World – Brasil. Recomendações técnicas de cultivo: Sugrathirteen (Midnight Beauty®). Petrolina: Sun World - Brasil, 2012.

Santesteban, L.G.; Miranda, C.; Royo, J.B. Thinning intensity and water regime affect the impact cluster thinning has on grape quality. Vitis, v.50, n. 4, p. 159-165, 2011. https://ojs.openagrar.de/index.php/VITIS/article/view/4084/4050. 10 Sep. 2017.

Santos, H. P.; Amarante, C. V. T.; Steffens, C. A.; Ventura, D. W.; Miqueloto, A. Qualidade da uva 'Cabernet Sauvignon' submetida ao raleio de cachos no sistema de condução latada. Revista de Ciências Agroveterinárias, v.9, n. 2, p.160-168, 2010. http://revistas.udesc.br/index.php/agroveterinaria/article/view/5296. 07 Out. 2017.

Sato, A.J.; Silva, B.J.; Bertolucci, R.; Carielo, M.; Guiraud, M.C.; Fonseca, I.C.B.; Roberto, S.R. Evolução da maturação e características fisico-químicas de uvas da cultivar Isabel sobre diferentes porta-enxertos na Região Norte do Paraná. Semina, v. 30, n. 1, p. 11-20, 2009. https://doi.org/10.5433/1679-0359.2009v30n1p11.

Silva, R.J.L.; Lima, L.C.O.; Chalfun, N.N.J. Efeito da poda antecipada e regime de irrigação nos teores de açúcares em uvas Niágara Rosada. Ciência e Agrotecnologia, v.33, n.3, p. 844-847, 2009. https://doi.org/10.1590/S1413-70542009000300025.

Sun, Q.; Sacks, G.L.; Lerch, S.D.; Heuvel, J. E.V. Impact of shoot and cluster thinning on yield, fruit composition, and wine quality of Corot noir. American Journal of Enology and Viticulture, v. 63, p. 49-56, 2012. http://doi.org/10.5344/ajev.2011.11029.

Togores, J.Y.; Fernández-Cano, L. Tratado de viticultura general. 4.ed. Madrid: Ediciones Mundi-Prensa, 2011. 405p.

Ubalde, J.M.; Sort, X.; Poch, R. M.; Porta, M. Influence of edapho-climatic factors on grape quality in Conca de Barberà Vineyards (Catalonia, Spain). Journal International des Sciences de la Vigne et du Vin, v. 41, n. 1, p. 33-41, 2007. https://oeno-one.eu/article/view/859/928. 12 Oct. 2017.