



Article

Phenology and Yield of the Hybrid Seedless Grape ‘BRS Melodia’ Grown in an Annual Double Cropping System in a Subtropical Area

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Abstract: The development and evaluation of new cultivars of seedless grapes (*Vitis* spp.) with good yield and adapted to different edaphoclimatic conditions are essential to increase the competitiveness of the productive system. The present work had the objective to characterize the phenology and the yield of the new hybrid seedless grape ‘BRS Melodia’, grown in an annual double cropping system in a subtropical region. The evaluations were carried out during the 2013 summer cropping period and the 2014 off-season cropping period in a commercial area located in Marialva, PR, Brazil. The ‘BRS Melodia’ scions were grafted onto ‘IAC 766 Campinas’ rootstocks, trained in an overhead trellis system spaced at 2.5 × 2.5 m. In both seasons, the duration in days of the main phenological phases of the vines, as well as their thermal demand and their physicochemical and productive characteristics were evaluated. The ‘BRS Melodia’ seedless grapevines presented a cycle of 138 days and yield of 23.85 tons.ha⁻¹ in the summer season, and 121 days and yield of 19.4 tons.ha⁻¹ in the off-season crop. The soluble solids, titratable acidity, and maturation index were 15.1 °Brix, 0.5% tartaric acid and 28.5, respectively, in the summer season and 15.4 °Brix, 0.6% tartaric acid and 25.6 in the off-season crop, indicating a possibility of cultivate this new hybrid seedless grape under an annual double cropping system in subtropical conditions.

Keywords: hybrid seedless grape; off-season crop; summer crop; pruning; grapevine

1. Introduction

Until the end of the 1990s, the Brazilian production of table grapes (*Vitis* spp.) remained limited to seeded cultivars. However, in order to attend the overseas market, several seedless grapes, such as ‘Superior Seedless’, ‘Thompson Seedless’ and ‘Crimson Seedless’, were introduced in the country. However, all of these cultivars were brought from temperate regions and, for this reason, most of them presented difficulties in achieving sustainable and high yields. To address this, Embrapa Grape and Wine started the Grape Breeding Program in 1997 aiming to develop hybrid seedless table cultivars adapted to tropical and subtropical conditions with the quality required by the international and domestic markets [1,2].

In 2003, the first seedless grape cultivars were released, among them the ‘BRS Morena’, ‘BRS Clara’ and ‘BRS Linda’, which present high bud fertility for tropical and subtropical conditions. More recently, in 2012 and 2013, the ‘BRS Vitoria’ and ‘BRS Isis’ seedless grape cultivars, respectively, were released, which are tolerant to downy mildew, one of the main grape diseases in humid regions [2,3].

More recently, the 'BRS Melodia' seedless grape has been released [4]. The hybrid cultivar presented medium tolerance to downy mildew, powdery mildew and cluster rot, and high tolerance to anthracnosis. It is an interspecific hybrid, and like the 'BRS Isis' seedless grape, which is considered a standard reference cultivar, it is the result of the cross between CNPUV 681-29 [Arkansas 1976 × CNPUV 147-3 ('White Niagara' × 'Venus')] × 'BRS Linda'. The bunches of 'BRS Melodia' have conic-cylindrical shape, are medium-compact, and are pink in color like 'BRS Isis', while the berries are medium in size and elliptical in shape. One of the main features of 'BRS Melodia' is its 'tutti frutti' flavor, while 'BRS Isis' is neutral. However, because it is a released seedless grape cultivar, its phenological and productive behavior grown in an annual double cropping system in the subtropics hasn't been evaluated to date.

In some Brazilian subtropical regions, it is possible to obtain two table grape crops per year, allowing the commercialization of fresh grapes during the off-season [5]. In this production system, different pruning periods exert influences on the phenological behavior of the grapevines [6]. Thus, knowledge of the duration of the main phenological stages and the thermal demands of the grapevine allows an understanding of the relationship between the duration of the plant development phases and seasonal variation. In addition, it also allows the rationalization and optimization of cultural practices, estimating the periods of labor demand and the probable dates of harvest and commercialization [7]. Thus, the objective of this work was to characterize the phenological and productive behavior of the new hybrid seedless grape 'BRS Melodia', grown in an annual double cropping system in the subtropical region of Brazil.

2. Materials and Methods

The trial was conducted in a commercial production area of 'BRS Melodia' seedless table grape, grafted on 'IAC 766 Campinas' rootstock, trained in an overhead trellis system, spaced at 2.5 × 2.5 m, and grown in an annual double cropping system. The experimental vineyard was located at Marialva, PR, Brazil (23°29'52.8" S and 51°47'58.0" W, elevation 570 m). According to the classification of Köppen, the climate of the region is Cfa with annual rainfall of 1600 mm, average annual temperature of 20.7 °C, and average relative humidity of 73% [8]. The soil of this region is classified as a dystrophic red latosol [9]. Climatic conditions related to the period studied are in Appendix A.

The phenological and productive behavior of 'BRS Melodia' seedless grape was evaluated using representative grapevines (n = 10) of the experimental area. The duration, in days of the main phenological stages and the thermal requirement, from pruning to harvest, was determined in the summer cropping period of 2013, from the winter pruning performed on July 22th, and in the subsequent off-season cropping period of 2014, occurring after summer, pruned on January 6th. For both crops, the number of canes per vine was uniformly adjusted to 40. Pruning left four to five buds per cane for the summer crop and from eight to ten buds for the off-season crop for all canes, followed by application of 3% hydrogenated cyanamide (*w/v*) to provide a uniform budburst.

The other cultural treatments were the common ones adopted in the region for table grapes, mainly regarding phytosanitary control [10], since this new grape cultivar resembles fine table grapes, such as 'Italia' (*Vitis vinifera* L.) in its susceptibility to the mildew caused by *Plasmopora viticola*, the most important grapevine disease in humid subtropical climatic conditions.

In order to characterize the duration of the phenological stages of 'BRS Melodia' in the summer and in the off-season, two canes were recorded per vine, which were evaluated by means of visual observations from the pruning (PR), considering the following stages, according to [11,12]. Bud swell (BS): when 50% of the buds had reached the second stage of development of the vine, that is, when the scales were broken and green tissue was visible; sprouting or bud burst (SP): when 50% of buds reached the fourth stage, i.e., leaf production; emergence of the inflorescence (EI): when 50% of the shoots presented the inflorescence, with clusters visible; flowering (FL): when 50% of flowers were open, with visible flowers; véraison (VE): when 50% of berries had changed color to red and when they started softening; and harvest or full ripe (HA): when 100% of the grapes showed intense color, with a

high total soluble solids content (Figure 1). From these data, diagrams representing the duration in days of each phenological stage, as well as the cycle of the grapevine, were created.



Figure 1. Phenological phases of 'BRS Melodia' seedless grape. (A) Bud-swell; (B) sprouting or budburst; (C) emergence of the inflorescence; (D) flowering; (E) véraison; (F) harvest or full ripe.

To characterize the thermal demands of 'BRS Melodia' seedless grape, the degree day (DD) summation from pruning to harvest was calculated, as well as for each phenological subperiod, using climate data from the National Institute of Meteorology (INMET), according to the following equations proposed by Villa Nova [13]:

- (a) $DD = (T_m - T_b) + (TM - T_m)/2$, when $T_m > T_b$;
- (b) $DD = (TM - T_b)^2/2(TM - T_m)$, when $T_m < T_b$; and
- (c) $DD = 0$, when $T_b > TM$

where TM = maximum daily temperature ($^{\circ}C$); T_m = Minimum daily temperature ($^{\circ}C$); and T_b = base temperature ($10^{\circ}C$).

For the physicochemical and productive characterization of the 'BRS Melodia' seedless grape from the summer and the off-season crops, 4 bunches per vine were collected and 3 berries were collected per bunch to determine the following variables: CIELab color attributes— L^* (brightness), C^* (saturation), hue angle (h°) and color index (CI), mass, length, berry diameter and firmness, mass and length of bunches, yield, soluble solids content (SS), titratable acidity (AT) and maturation index (SS/AT) of the berries. The bunches were manually harvested, using appropriate shears, and then subjected to cleaning, removing the damaged berries.

The evaluation of the color attributes was performed using the Minolta CR-10[®] colorimeter, and the variables of its equatorial portion were obtained: L^* , C^* and h° ($n = 10$ berries/plot). The L^* values range from 0 (black) to 100 (white). The C^* indicates the purity or intensity of the color, the distance from gray (achromatic) towards a pure color, and is calculated from the a^* and b^* values of the CIELab color scale, ranging from 0 to a completely neutral color, and does not have an arbitrary end, but the intensity increases with magnitude. The hue angle (h°) refers to the color wheel and is measured

at angles. Green, yellow, and red, correspond to 180°, 90° and 0°, respectively [14–16]. The color index (CI) of the grapes was obtained from the variables measured on their equatorial portion: L^* , C^* and h° , and later the CI of the berries was determined using the formula: $CI = (180 - h^\circ)/(L^* + C^*)$ [14].

The berry diameter was determined with a digital caliper, the length of the bunches with a graduated scale, and the mass of the bunches and berries with an analytical balance ($n = 10/\text{plot}$).

The firmness of the berries (N) was evaluated using a TAXT2i Texture Analyzer (Stable MicroSystems, Surrey, UK) at 25 ± 1 °C ($n = 10$ berries/plot). Each berry was placed on the base of the texturometer and compressed with a cylindrical probe with a flat section tip 35 mm in diameter and parallel to the base. The compression was in the direction of the equatorial portion of the berries up to 8 mm, with a force of 0.05 N, at the speed of $1 \text{ mm}\cdot\text{s}^{-1}$, sufficient to cause the skin to rupture [17].

The estimates of production per plant and yield were obtained as a function of the average number of bunches per vine, the average mass of the bunches, and the number of vines per hectare [18].

The SS content of the berry juice was determined as °Brix using a digital refractometer with automatic temperature compensation (Model DR301-95, Krüss Optronic, Germany) ($n = 10$ berries/plot). The juice was created by crushing the berries. Titratable acidity (AT) was determined by titration of the juice with a standard solution of 0.1N NaOH in a digital potentiometric titrator (Model Tritoline Easy, Schott Geräte, Germany), and the result was expressed as % tartaric acid [18]. The maturation index of the berries was then obtained by the SS/AT ratio.

The physicochemical and productive characteristics of 'BRS Melodia' seedless grape are presented as means and standard deviations of each variable for the summer and off-season harvests, as well as according to the means and general standard deviations of the two harvests evaluated.

3. Results and Discussion

The total length of the 'BRS Melodia' cycle was 138 d for the summer crop, while the durations of the subperiods from pruning to bud swelling (PR–BS), pruning to sprouting (PR–SP), pruning to emergence of inflorescence (PR–EI), pruning to flowering (PR–FL) and pruning to véraison (PR–VE) were 14, 17, 31, 53 and 102 d, respectively. In the off-season cropping period, the duration of the cycle was shorter, 121 d, while the durations of the PR–BS, PR–SP, PR–EI, PR–FL and PR–VE subperiods were 6, 9, 22, 43 and 85 d, respectively (Figure 2).

In viticulture, the knowledge of the duration of phenological phases can be used for selection of cultivars, vineyard planning, planning of the use of manpower and equipment, and a schedule of cultural practices as part of grapevine management. In a system of intensive production of table grapes, with annual double cropping systems in subtropical regions, the cycle of vines is generally reduced in the off-season crop due to climatic conditions, mainly by air temperature, since the vine has an intense metabolism leading to budburst following summer pruning, unlike budburst following winter pruning when the grapevines are dormant [10]. In addition, during this period, the average temperatures are higher than at the end of winter, which provides a higher rate of vegetative growth.

Photoperiod and temperature can alter hormone levels by inducing or inhibiting the expression of genes encoding enzymes involved in plant growth hormone biosynthesis [19]. Long days may lead to the endogenous synthesis of gibberellins, which are known to antagonize the effects of abscisic acid (ABA) and promote budburst. In off-season cropping, grapevines have photosynthetically-active leaves during the cycle [10,20]. Thus, it can be inferred that the reduction of the cycle length in this period is related to the timing of pruning of the vines.

There was a period of low rainfall incidence in the summer cropping period at the beginning of maturation (VE), with cumulative rainfall of only 13.6 mm and a dry period of 35 days, while in the off-season crop, rainfall accumulation was 229.4 mm, with a maximum period of 10 days with no rain (Appendix A). The maximum water demand of grapevines occurs in the phenological period from flowering to fruit set [21], and drought for long periods can delay the formation of bunches.

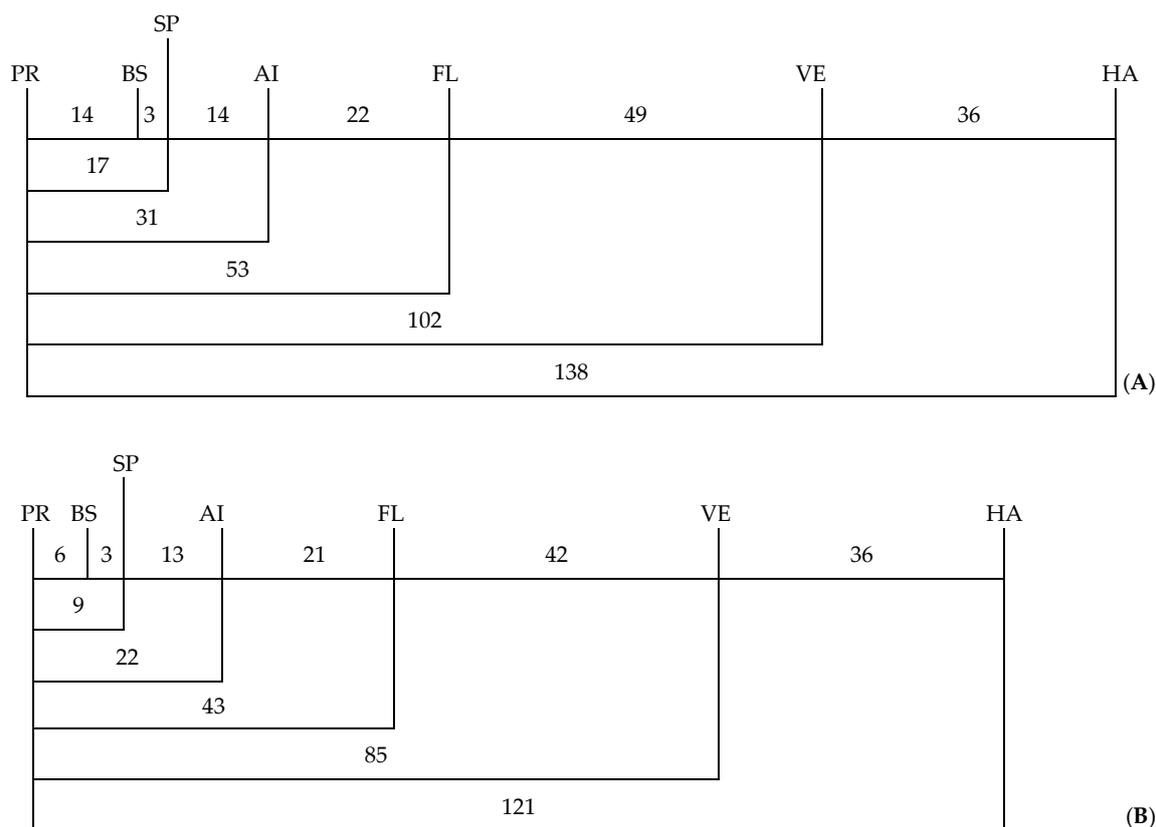


Figure 2. Duration in days of the main phenological stages of ‘BRS Melodia’ seedless grape in a subtropical region. (A) Summer cropping season 2013 and (B) off-season 2014. Pruning (PR); bud-swelling (BS); Sprouting (SP); Appearance of the inflorescence (AI); Flowering (FL); Véraison (VE); and Harvest (HA).

The duration of the productive cycle of the vines also varies according to the canopy/rootstock combination, plant vigor in a given edaphoclimatic condition and yield [10]. An example is the ‘BRS Clara’ seedless grape that, when cultivated in a subtropical region, presented a production cycle for the off-season crop of 120 d [2], while the cycle duration may be reduced to 97 d when grown in a semi-arid region [22].

The thermal requirement for the total cycle (PR–HA) of the summer cropping period was 1744.1 DD, while the subperiods PR–BS, BS–SP, FL–VE and VE–HA were 110.5; 44.4; 125.7; 273.8; 340.2 and 549.6 DD, respectively. For the off-season cropping period, the thermal requirement for the total cycle was 1845.0 DD, while the subperiods PR–BS, BS–SP, FL–VE and VE–HA were 99.5; 40.4; 214.6; 380.3; 640.2; 480.2 DD (Table 1).

Subtropical areas are colder than tropical areas and warmer than temperate zones, with winter generally being slightly cool and with unpredictable temperatures. Thus, unstable winter conditions can result in a different accumulation of DD over several years in the same place, which may accelerate or delay the onset of plant development [23].

The periods with the highest thermal demand were FL–VE and VE–HA, in both cropping periods. The thermal demands of ‘BRS Melodia’ seedless grape were similar to those described for ‘Crimson Seedless’ grown in a semi-arid climate region [24], where the thermal demand was 1726 and 1788 DD in the first and second cycles, respectively. The thermal requirements of FL–VE in the two cropping periods were similar, which illustrated a slightly longer duration of this subperiod in the summer season, requiring a longer time to reach the amount of energy required to complete this phase of the cycle.

Table 1. Thermal demand in degree days (DD) (mean \pm standard deviation) for each phenological phase of ‘BRS Melodia’ grapevine grown in an annual double cropping system in a subtropical region with a summer cropping period in 2013 and a subsequent off-season cropping period in 2014.

Phenological Subperiods	Degree Day ^z	
	Summer Crop 2013	Off-season Crop 2014
PR–BS ^y	110.5 \pm 0.8	99.5 \pm 0.1
BS–SP	44.4 \pm 0.1	40.4 \pm 0.1
SP–EI	125.7 \pm 0.5	214.6 \pm 0.1
EI–FL	273.8 \pm 0.4	380.3 \pm 0.1
FL–VE	640.2 \pm 0.3	630.1 \pm 0.1
VE–HA	549.6 \pm 0.1	480.3 \pm 0.2
PR–HA	1744.1 \pm 0.4	1845.0 \pm 0.2

^z Temperature-base = 10 °C. ^y PR–BS: pruning–bud swelling; BS–SP: bud swelling–sprouting; SP–EI: sprouting–emergence of inflorescence; EI–FL: emergence of inflorescence–flowering; FL–VE: flowering–véraison; VE–HA: véraison–harvest; PR–HA: pruning–harvest.

According to the duration of both cycles evaluated, the annual double cropping system can be easily achieved for ‘BRS Melodia’ seedless grape grown under subtropical conditions, but it is important to highlight that this aspect is considered preliminary as the long-term potential for this cultivar in this system has not yet been assessed.

Regarding the color attributes of the berries (L^* , C^* and h°), the averages were 34.2, 13.9, and 106.5, respectively, in the summer season crop and 36.4, 11.1 and 96.8 in the off-season crop, while the average color index (CI) obtained (1.5 and 1.8 in summer and off-seasons, respectively) means that the berries had a color ranging from green/yellow to pink [14] (Table 2). At the end of maturation, berry color was not very intense or uniform (Figure 1), which is a characteristic genetic characteristic of this cultivar, since in both the summer and the off-seasons the CI was low (<1.80). Color is one of the most important visual characteristics in table grapes, and this attribute is commonly associated with bunch quality and is directly related to consumer acceptance, being one of the main determining factors in the commercial value of table grapes.

Table 2. Physical characteristics of ‘BRS Melodia’ seedless grape grown under an annual double cropping system in a subtropical region. Summer crop of 2013 and subsequent off-season crop of 2014.

Physical Characteristics ^z	Summer Crop 2013	Off-Season Crop 2014
L^*	34.2 \pm 1.1	36.4 \pm 0.5
C^*	13.9 \pm 1.3	11.1 \pm 0.2
h°	106.5 \pm 7.6	96.8 \pm 5.2
CI	1.5 \pm 0.5	1.8 \pm 0.1
Berry mass (g)	4.3 \pm 0.3	3.7 \pm 0.2
Berry diameter (mm)	17.5 \pm 0.1	16.3 \pm 0.1
Berry length (mm)	22.2 \pm 0.4	19.7 \pm 0.3
Berry firmness (N)	33.9 \pm 5.0	25.3 \pm 2.5
Bunch mass (g)	573.8 \pm 30.1	360.9 \pm 13.9
Bunch length (cm)	20.4 \pm 0.6	18.4 \pm 0.2
Number of bunches per vine	30.8 \pm 7.9	33.7 \pm 5.0
Production per vine (kg/vine)	17.7 \pm 4.6	12.2 \pm 1.8
Yield (tons.ha ⁻¹)	28.3 \pm 4.2	19.4 \pm 2.4

^z L^* : lightness; C^* : saturation; h° : hue angle; CI: color index of red grapes.

The use of specific techniques aiming at improving ‘BRS Melodia’ berry color, such as exogenous application of (*S*)-*cis*-abscisic acid (*S*-ABA) to increase color intensity and to standardize berry color, may be successful, as described by Koyama et al. [25] and others [18,26–28]. In addition, the use of other

techniques such as defoliation for better light exposure in the vineyard and crop load adjustment may also be applied for color improvement [10]. For 'BRS Isis' seedless grape, climatic conditions, especially air temperature, exert a great influence on berry color. When cultivated under high temperatures in a semi-arid region, especially in the second half of the growing season, 'BRS Isis' grape did not exhibit adequate red color, but had high yield [3]. The color of red grapes is due to the anthocyanins present in the berries. The accumulation of anthocyanins in grapes begins in VE and their biosynthesis is controlled by the MYB transcription factors, which modulate the expression of structural genes and are responsive to ABA concentrations in the tissues [29].

The mean maximum air temperatures recorded in the region one week after the beginning of VE were 31 and 28 °C in the summer and off-season crops, respectively (Appendix A). It is known that in regions with higher temperatures during the ripening stage, berries tend to have a less intense color due to a lower accumulation of anthocyanins in the skin, and therefore, the berries do not reach sufficiently intense and uniform color, adversely affecting their visual appearance [30]. High air temperatures (>30 °C) decrease anthocyanin synthesis in grape berries [31].

As for the mass, diameter and length of the berries, the means were 4.3 g, 17.5 mm and 22.2 mm, respectively, in summer season, and 3.7 g, 16.3 mm and 19.7 mm, respectively, in the off-season crop (Table 2). The minimum diameter required for the Brazilian market is 12 mm, and averages between 14 and 17 mm are recommended for good commercial acceptance of table grapes [22]. The 'BRS Melodia' seedless grape berries fit into subclass 16 (diameter between 16 and 18 mm), within the standard required for the domestic market [32].

The diameter or caliber standards for the berries is also used for the export market of table grapes [7]. The berries of 'BRS Vitoria' and 'BRS Isis' seedless grapes, from the same breeding program, present diameters of 16.05 and 20.05 mm, respectively [3]. These grapes have been successfully cultivated in a semi-arid climate, especially for export. As for the firmness of the berries, a mean of 29.56 N (Table 2), similar to that observed for the seedless 'BRS Vitoria' seedless grape (25.5 N) [33] was observed.

'BRS Melodia' seedless grape berries have a conic-cylindrical shape, with medium dense bunches (Figure 1). However, it is desirable to perform individual berry thinning (removal) when berries are between 7 and 18 mm in diameter to obtain looser bunches [34], since, from the phytosanitary point of view, very compact bunches have a greater susceptibility to the attack of pathogens, especially *Botrytis cinerea* [33].

In contrast, grapes derived from the same cross, such as 'BRS Vitoria' and 'BRS Isis' seedless grapes, present very dense bunches, making berry-cluster thinning mandatory to avoid bunch compactness [3,34]. However, 'BRS Vitoria' and 'BRS Isis' seedless grapes are considered tolerant to downy mildew (*Plasmopora viticola*) [3,35], the main fungal disease of grape under humid subtropical conditions, a characteristic not observed in 'BRS Melodia' seedless grape, requiring systematic applications of fungicides for their efficient control, similar to that performed in fine table grapes, especially in the off-season crop, when disease incidence is higher [10].

The 'BRS Melodia' bunches presented masses and lengths of 573.8 g and 20.4 cm, respectively, in the summer season and 360.9 and 18.4 cm, respectively, in the off-season crop (Table 2), falling within Class 2 in the table grape classification system (200–500 g) [32]. Thus, it is a cultivar with heavier and larger bunches when compared to 'BRS Vitoria' and 'BRS Isis' seedless grapes (290.00 and 329.45 g, and 17.50 and 18.40 cm, respectively) [3,35], which makes it very competitive in the domestic and export markets.

In the present study, a lower mass of the bunches was observed in the off-season crop compared to the summer crop (Table 2), the same as with 'BRS Vitoria' grape [34]. In the off-season crop, the vine is forced to grow and bear fruit under entirely different weather conditions than in the summer crop [10]. As described by Anzanello and Souza [36], the shoots originating with the off-season crop of table grape cultivars may cause changes in the leaf area index and affect the synthesis and dynamics of carbohydrate reserve storage and consumption in the canes, influencing the mass of the bunches.

Regarding the number of bunches per vine, production per vine and yield, means were 30.8, 17.7 kg per vine, and 28.3 tons·ha⁻¹, respectively, for the summer crop, and 33.7, 12.2 kg per vine and 19.4 tons·ha⁻¹, for the off-season crop (Table 2). The total annual yield was high (47.7 tons·ha⁻¹), compared to production of some seedless grapes such as ‘Superior Seedless’, ‘Thompson Seedless’, ‘Crimson Seedless’ and ‘BRS Isis’ grown in a semi-arid or subtropical regions under annual double cropping systems [36–38]. In addition, it is important to highlight that these productive characteristics of ‘BRS Melodia’ seedless grape are similar to those observed for vinifera table grapes under the same cultivation system in subtropical region [2,10].

The soluble solids (SS), titratable acidity (TA) and maturation index (SS/TA) were 15.1 °Brix, 0.5% tartaric acid, and 28.5, respectively, for the summer crop, and 15.4 °Brix, 0.6% tartaric acid and 25.6 for the off-season crop (Table 3), meeting the standards recommended by national and international standards for the marketing of table grapes (SS ≥ 14.0 °Brix and SS/TA ≥ 20.0) [32].

Table 3. Chemical characteristics of ‘BRS Melodia’ seedless grape grown under an annual double cropping system in a subtropical region. Summer season crop of 2013 and subsequent off-season crop of 2014.

Chemical Characteristics	Summer Crop 2013	Off-Season Crop 2014
Soluble solids-SS (°Brix)	15.1 ± 0.4	15.4 ± 0.3
Titratable acidity-TA (% tartaric acid)	0.5 ± 0.1	0.6 ± 0.0
Maturation index-SS/TA	28.5 ± 0.3	25.6 ± 0.2

Therefore, BRS Melodia is a new seedless grape cultivar whose bunches have physicochemical characteristics within the standards that meet the internal and external markets. Besides presenting some characteristics similar to the cultivars originating from the same cross in the breeding program such as ‘BRS Isis’ [38], considered as a standard reference cultivar, and well accepted in the grape market, ‘BRS Melodia’ presents itself as an alternative for vineyard diversification, with a special ‘tutti frutti’ flavor [4], quite different from the neutral flavor of ‘BRS Isis’. In addition, it was possible to demonstrate that the annual double cropping system can be easily achieved for this cultivar grown under subtropical conditions. However, the lack of color of its berries will require the application of specific techniques to overcome this difficulty, since an intense and uniform color of the berries is highly valued in the commercialization of table grapes. Finally, the information regarding its phenological and productive behavior may be useful for optimizing the distribution of labor that is required for management practices, i.e., pruning, harvest, cultural treatments, and the application of phytosanitary products

4. Conclusions

The ‘BRS Melodia’ seedless grape presents phenological and productive characteristics within the standards required by the domestic and foreign markets, especially the cycle of 138 days and yield of 23.85 tons·ha⁻¹ for the summer crop and the cycle of 121 days and yield of 19.4 tons·ha⁻¹ for the off-season crop. The soluble solids, titratable acidity and maturation index were 15.1 °Brix, 0.5% tartaric acid and 28.5, respectively, for the summer crop, and 15.4 °Brix, 0.6% tartaric acid and 25.6 for the off-season crop, making it possible to cultivate it in an annual double cropping system under subtropical conditions. However, the lack of color of its berries will require the development of some techniques to improve color, such as the exogenous application of S-ABA at véraison.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

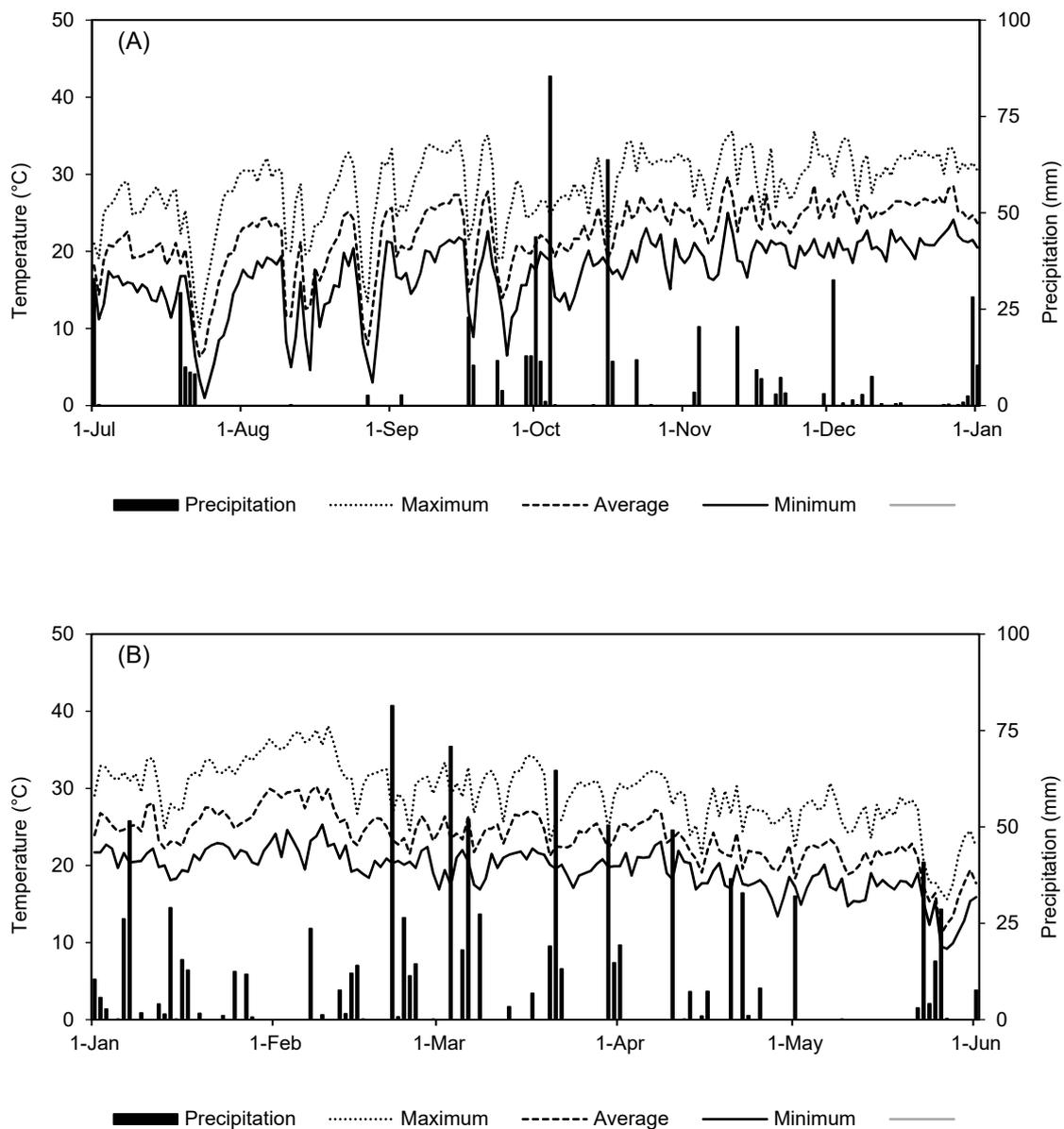


Figure A1. Precipitation (mm), maximum, average and minimum temperature during (A) the summer crop season 2013, and (B) off-season 2014. Source: Instituto Nacional de Meteorologia–INMET.

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