

BRS Isis: new seedless grape cultivar for the tropical viticulture in Northeastern of Brazil

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Abstract. The aim of this study was to characterize the yield components of the grape BRS Isis grown in tropical conditions of the São Francisco Valley. The work was carried out during five growing seasons (2013-2015) in Petrolina, PE. The phenological cycle was 127 days between pruning to harvest. It was obtained 65.8% of sprouting on the rootstock IAC 313 and 60.4% on 'SO4'. The bud fertility rates were high, around 1.00 bunches per shoot. The average production per plant was 20.63 kg on 'SO4' and 18.34 kg on 'IAC 313', corresponding to an yield at 29.45 ton/ha/season on 'SO4' and 26.19 ton/ha/season on 'IAC 313'. The bunches are medium in size and cylindrical shaped with mass of 400 g on 'SO4' and 370 g on 'IAC 313'. The bunch length and width were also slightly higher on 'SO4' (21.32 cm x 11.89 cm) compared to 'IAC 313' (20.42 cm x 11.50 cm). The berries are large, elliptical shaped, crunchy with a neutral flavor. The grape presented SS content around 16.0° Brix and low TA (0.44 and 0.49%), giving an appropriate SS/TA ratio and pleasant taste. The results showed that 'BRS Isis' can be considered as a new option of seedless grape for the tropical viticulture in the Northeastern of Brazil.

1. Introduction

The São Francisco River Valley around the cities of Petrolina, PE and Juazeiro, BA is the main Brazilian region for production and export of table grapes. In 2015, the Brazilian grape production was 1,505,654 tons and of this total, 315,338 tons were produced in this region (Agrianual, 2016). The average yield was 32.5 tons/ha, which results in higher yields, about 67% compared to the national average, demonstrating the high level of technology employed by the grape industry in this region.

The first initiatives for the production of seedless grapes in the São Francisco Valley were held in the 1980s, haphazardly and without the necessary technical knowledge of the needs and requirements of the vine and specifically for each one of the cultivars. Over the past decades, there was expansion of cultivated areas with cultivars Thompson Seedless, Crimson Seedless and Sugaone but they have shown little adaptation to the tropical and semi-arid environment of São Francisco Valley which have resulted in low productivity and higher production costs.

Therefore one of the most important research demands for the grape growers was the development of

more adapted seedless table grape cultivars, which must have the following characteristics: high bud fertility, medium loose clusters, large natural berries, undemanding in thinning, pleasant or exotic taste, uniform color, resistance to diseases, pests and crack berries, good adhesion to the pedicel and high post-harvest conservation. Cultivar table grapes coming from private breeding programs in several countries have been introduced in recent years, but these were restricted to a limited group of grape growers and they are subjected to agreements that restrict the growing areas, the amount sales and still demanding payment of royalties.

Some table grape cultivars were released in recent years by the breeding program of EMBRAPA Grapes and Wine that meet the demands of different production regions into the country. 'BRS Isis' was released in 2013 resulting from the crossing CNPUV 681-29 [Arkansas 1976 X CNPUV 147-3 (Niagara White X Venus)] and BRS Linda, held in 2004 at Embrapa Grapes & Wine, Experimental Station for Tropical Viticulture located in Jales, São Paulo (Ritschel et al., 2013).

This study aimed to characterize the agronomic performance, yield potential and quality attributes of

seedless table grape BRS Ísis in tropical environment of São Francisco River Valley, Northeastern of Brazil.

2. Material and Methods

The study was carried out in a commercial vineyard in Petrolina, PE, during five consecutive cropping seasons in the period 2013-2015. The dates of pruning, harvesting and duration of the production cycle are presented in Table 1.

The vines are spaced 3.5 X 2.0 m (density 1428 plants.ha⁻¹), training in a horizontal trellis system and drip irrigated. Two rootstocks were evaluated: IAC 313, which vines were one year old and SO4, with two years old in 2013, at the beginning of the study.

During the initial growth and canopy training, the selection of branches was carried to hold 10 lateral spurs per vine. The pruning was a mixed pruning type with canes containing 5 to 6 buds and two buds spurs. The thinning was made to keep about 5-6 fruitful shoots on each branch pruned.

The management of clusters was performed with some variations in each cycle: in the 2nd half of 2013 season, clusters were treated with 1 mg l⁻¹ of gibberellic acid (GA3) and acadian® (5 ml/20L) for elongation and two applications of 6 mg l⁻¹ GA3 for berry growth. First application was made at 8 mm berry size and the second one after five days. In the seasons of 2014, the clusters were treated with GA3 (1 mg l⁻¹) when they were about 5 cm long for bunch elongation and four applications of 8 mg l⁻¹, 4-day intervals, when the berries were about 8 mm in diameter, for berry growth. 'BRS Ísis' required a moderate cluster thinning compared to other traditional table grapes cultivars such as 'Italia', 'Benitaka', 'Thompson Seedless', 'Sugraone' and 'Crimson Seedless'.

Table 1. Dates (mm/dd/yy) of pruning, harvesting and duration of five production cycles of BRS Ísis, Petrolina, Pernambuco State, Brazil.

Year/ Semester	Pruning Date	Harvesting Date	Duration (Cycle)
2013.1	05.08.2013	12.02.2013	119
2014.1	02.09.2014	06.13.2014	124
2014.2	01.09.2014	01.07.2015	128
2015.1	02.15.2015	06.25.2015	130
2015.2	08.12.2015	12.17.2015	127

The following variables were evaluated in four plants: a) percentage of sprouting (%); b) bud fertility rate (cluster/shoot); c) Yield (kg.planta⁻¹); d) number of bunches per plant; e) weight(g), length and width of bunch (cm); f) mass (g), length and diameter of berry (mm); g) soluble solids content, SS (°Brix); h) titratable acidity, TA (% tartaric acid).and ratio (SS/TA).

3. Results and Discussion

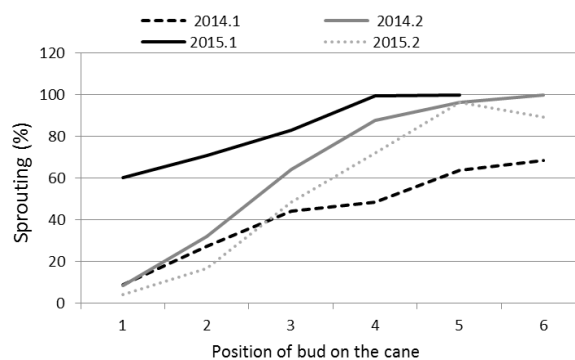
3.1. Duration of phenological cycle

The number of days between pruning and harvesting dates showed small variations, since 119 to 130 days, depending on the semester and year (Table 1). 'BRS Ísis' required an average of 127 days from pruning to harvest and can be classified as a late cultivar, similar to 'Crimson Seedless in São Francisco Valley (LEÃO et al., 2009). The bunches should be harvested after 125 days after pruning to promote the full development of uniform red color, berries with crunchy texture and good.

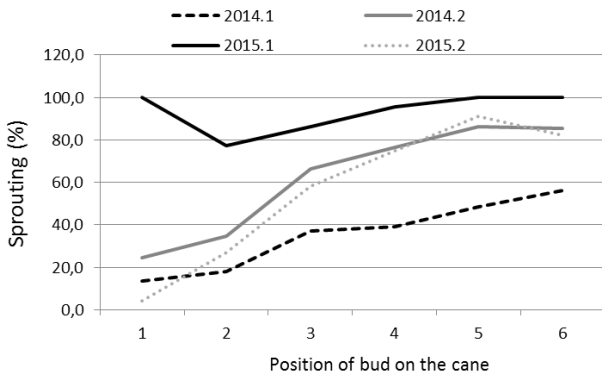
3.2 Sprouting and Bud Fertility

'BRS Ísis' presented an average of sprouting of 65.8% in the vines grafted on the rootstock IAC 313 and 60.4% on 'SO4'. The sprouting was growing since basal buds up to apical buds of the cane. One hundred percent of sprouting was obtained in the 4th bud of the cane on both rootstocks in the 1st half 2015 season, while in the season before, this same percentage of sprouting was reached in 6th and 7th bud of the cane on the rootstocks 'SO4' and 'IAC 313' respectively. The 1st half of 2015 season favoured the highest percentage of sprouting on the vines grafted on both rootstocks (Figure 1).

Figure 1. Sprouting percentage of BRS Ísis on the rootstocks IAC 313 (A) and SO4 (B) in four consecutive growing seasons, Petrolina, Pernambuco state, Brazil, 2014 to 2015.



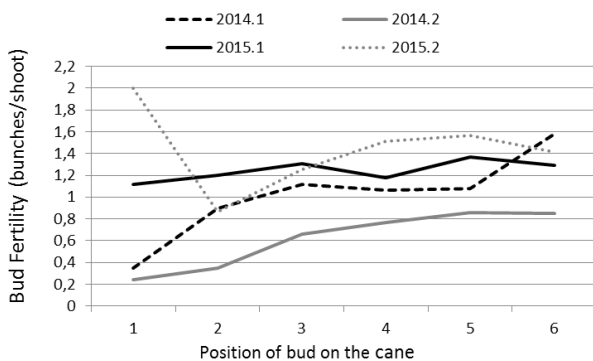
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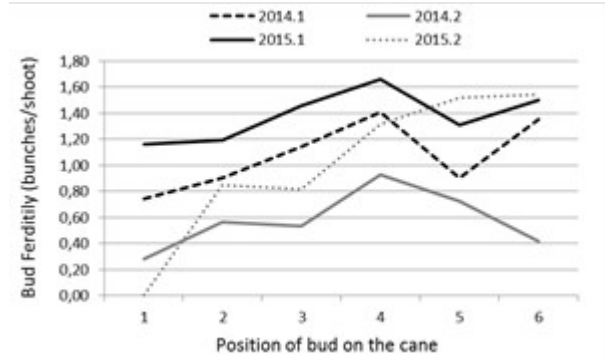
B

The vines of the cultivar BRS Isis confirmed their high bud fertility described as 2 to 3 bunches per shoot (RITSCHHEL et al., 2013). In this study it was observed high bud fertility in both rootstocks averaging 1.17 bunches per shoot on 'IAC 313' rootstock and 1.00 bunches per shoot on 'SO4'. However, environmental conditions that characterize each season of the year, has great influence on the differentiation of the buds, then the 2nd half of 2014 season resulted the lowest bud fertility rates. These values ranging from 0.25 to 1.8 bunches per shoot according to the bud position in the cane on rootstock 'IAC 313' (Figure 2A) and between 0.28 and 0.93 bunches per shoot on 'SO4' (Figure 2B). So 'BRS Isis' presented bud fertility rates greater than 1.0 bunches per shoot in 3rd bud in the cane, which shows that can be performed a medium pruning between the 3rd and 5th bud. Long pruning should be avoided as this cultivar is characterized by high apical dominance, which can reduce sprouting and vigour of the shoots in the basal buds, becoming complicated the canopy management.

Figure 2. Bud fertility rates (bunches/shoot) of the cultivar BRS Isis on rootstock IAC 313 (A) and SO4 (B) in four consecutive growing seasons, Petrolina, Pernambuco state, Brazil, 2014 to 2015.



A

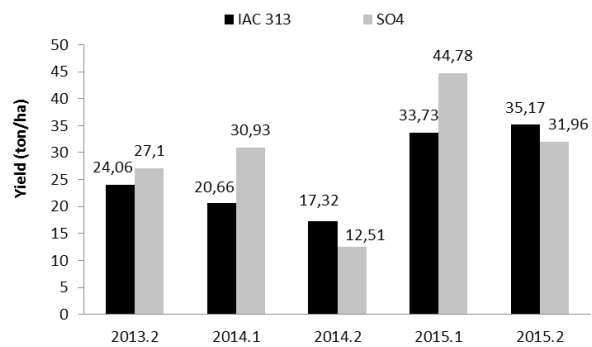


B

3.3. Yield

The estimated average yield was 43.44 ton/ha on SO4 rootstock and 37.98 ton / ha on 'IAC 313' in 2014, increasing in 2015 to 76.74 ton/ha on 'SO4' and 68.9 ton/ha on 'IAC 313'. However, the vines showed alternating yields among growing seasons (Figure 3) influenced by the environmental conditions and crop management. The results demonstrate the high yield potential of 'BRS Isis' grown in the São Francisco Valley, higher than the one described for this cultivar by RITSCHHEL et al. (2013) of 26 ton/ha/cycle in the same region, and even higher than the cultivar Crimson Seedless which is around 25 to 30 ton/ha/year (LEÃO et al., 2009).

Figure 3. Yield of 'BRS Isis' on SO4 and IAC 313 rootstocks in five consecutive growing seasons, Petrolina, Pernambuco state, Brazil, 2013 to 2015.



Tables 2 to 5 show the mean values and standard deviation of production, number of bunches per plant and physicochemical characteristics of bunches and berries of 'BRS Isis' vines grafted on SO4 and IAC 313 rootstocks, respectively. It can be observed a general tendency to superior results over the rootstock SO4 to all variables, which effect can be influenced by the rootstock or age of the vines.

The number of bunches varied according growing seasons which indicates that it has not been made the control of the same amount of bunches per plant. The highest number of bunches per plant was harvested in the

growing season of 1st half 2015, when it was obtained an average of 79 bunches in the vines grafted on 'SO4' and 75 bunches on 'IAC 313' rootstocks.

The determination of the most appropriate density of bunches requires further studies, since very high densities may result in damage to the grape quality, reducing the development of color and ripening.

Semester	(g)		(cm)	
	SO4	IAC 313	SO4	IAC 313
2013.2	335 ± 25,69	360 ± 23,00	19,41 ± 1,22	22,25 ± 0,79
2014.1	347 ± 9,57	312 ± 71,12	20,82 ± 1,19	18,86 ± 2,32
2014.2	350 ± 5,93	347 ± 50,01	20,18 ± 1,29	17,94 ± 2,01
2015.1	574 ± 104,40	430 ± 13,51	23,57 ± 1,43	20,4 ± 1,88
2015.2	388 ± 18,67	397 ± 46,42	22,64 ± 0,29	22,67 ± 1,25
Mean	399	369	21,32	20,42

The berry has medium sized, wide elliptical, firm and colorless pulp and neutral flavor. It has big seed traces that can develop normal seeds. The berries had similar mean of weight around 6.4g, in both rootstocks, however there was a trend of greater length and diameter in vines grafted on 'SO4' compared to those on 'IAC 313' rootstock (Table 4).

Table 2. Mean values and standard deviation of production and number of bunches per plant of 'BRS Ísis' vines grafted on SO4 and IAC 313 rootstocks in five growing seasons, 2013 to 2015.

Year/ Semester	Production per plant (kg)		Number of bunches	
	SO4	IAC 313	SO4	IAC 313
2013.2	18,98 ± 1,18	16,85 ± 2,00	57 ± 6,68	47,00 ± 6,98
2014.1	21,66 ± 3,01	14,47 ± 2,84	69 ± 8,58	68 ± 4,32
2014.2	8,76 ± 1,05	12,13 ± 2,34	30 ± 3,86	38 ± 5,83
2015.1	31,3 ± 6,99	23,6 ± 2,34	79 ± 9,57	75 ± 9,85
2015.2	22,38 ± 2,10	24,63 ± 2,14	56 ± 6,45	52 ± 6,95
Mean	20,63	18,34	58,20	56,00

Bunches of cultivar BRS Isis are characterized by medium sized and cylindrical shape. The size of bunches tended to be larger on the rootstock SO4 with mean weight of 399 g, length of 21.32 cm and width of 11.89 cm compared to those vines grafted on 'IAC 313' (369g, 20.42 cm X 11.50 cm). The bunches has moderate compactness and demand less thinning of berries than other traditional seedless grape cultivar .

Table 3. Mean values and standard deviation of weight and width of bunches of 'BRS Ísis' vines grafted on SO4 and IAC 313 rootstocks in five growing seasons, 2013 to 2015

Year/	Bunch Weight	Bunch Length
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Table 4. Mean values and standard deviation of weight and diameter of berry of 'BRS Ísis' vines grafted on SO4 and IAC 313 rootstocks in five growing seasons, 2013 to 2015

Year/ Semester	Berry Weight (g)		Berry Diameter (cm)	
	SO4	IAC 313	SO4	IAC 313
2013.2	5,97 ± 0,16	5,39 ± 0,52	19,17 ± 0,30	18,16 ± 0,50
2014.1	5,66 ± 0,32	6,20 ± 0,48	19,10 ± 0,51	19,75 ± 0,79
2014.2	7,27 ± 0,75	6,99 ± 0,27	20,77 ± 0,62	20,31 ± 0,25
2015.1	6,95 ± 8,15	7,32 ± 0,45	19,61 ± 18,72	21,1 ± 0,48
2015.2	6,43 ± 0,49	6,13 ± 0,33	20,15 ± 0,92	20,55 ± 0,84
Mean	6,46	6,41	19,76	19,97

There was a downward trend in soluble solids content of the grapes in the 2nd half of 2014 and first half of 2015. Mean values for soluble solids content was around 16,0°Brix in the both rootstocks while for titratable acidity was 0,49% and 0,44% respectively on 'SO4' and 'IAC 313' rootstocks (Table 5). Although grapes have been harvested with relatively low content of sugars, total acidity was low to moderate resulting in SS/TA between 35 and 38 depending on the rootstock and growing season, which corresponded a satisfactory SS/TA ratio and good taste for consumption of 'BRS Ísis' table grapes .

Table 5. Mean values and standard deviation of soluble solid content and of ‘BRS Ísis’ vines grafted on SO4 and IAC 313 rootstocks in five growing seasons, 2013 to 2015.

Year/ Semester	SS (°Brix)		TA (%)	
	SO4	IAC 313	SO4	IAC 313
2013.2	16,40 ± 0,39	16,48 ± 1,01	0,39 ± 0,02	0,38 ± 0,02
2014.1	16,80 ± 0,52	16,30 ± 1,00	0,53 ± 0,04	0,53 ± 0,04
2014.2	15,65 ± 0,53	15,68 ± 0,84	0,62 ± 0,09	0,53 ± 0,03
2015.1	15,85 ± 0,37	15,9 ± 0,50	0,55 ± 0,06	0,50 ± 0,06
2015.2	16,88 ± 0,33	15,35 ± 0,83	0,36 ± 0,02	0,28 ± 0,02
Mean	16,32	15,94	0,49	0,44

Figure 4. Bunches of cultivar ‘BRS Ísis’, Petrolina, Pernambuco state, Brazil, 2014. Foto: Patrícia Coelho de Souza Leão.



4. Conclusions

The results of this study for five consecutive growing seasons have identified high bud fertility, yield potential and desirable characteristics of bunches for ‘BRS Ísis’ table grape which meet the most demanding markets, consolidating this new cultivar of Embrapa Grape & Wine breeding program as a good option for tropical viticulture in São Francisco Valley, Northeastern of Brazil.

5. References

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