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Research Paper

PLANT GROWTH REGULATORS IN THE PHYSICAL CHARACTERISTICS OF BUNCHES AND BERRIES OF GRAPE

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Abstract

The experiment was conducted in order to evaluate the effect of Stimulate® and X-Cyte® associated with a new formulation of gibberellin (N-Large®) and Pro-Gibb® in clusters of enlargement and development of berries grape Superior Seedless. The following treatments were used: T1: Pro-Gibb®; T2: Stimulate® (Dose 1); T3: Stimulate® (Dose 2); T4: Stimulate® (Dose 3); T5: Pro-Gibb® + X-Cyte® (Low Dose - DB); T6: Pro-Gibb® + X-Cyte® (Average Dose - DM); T7: Pro-Gibb® + X-Cyte® (High Dose - DA); T8: N-Large®; T9: N-Large® + X-Cyte® (DB); T10: N + X-Cyte® Large® (DM); T11: N + X-Cyte® Large® (DA). To compare the effect of treatments, were recorded in the field fortnightly data length and width of clusters. In the post-harvest was evaluated the number of bunches per plant; size bunches, berries and stalks (weight, length and width); number of berries per cluster; the length/diameter of the berries. The experimental design was a randomized block with four replications, with three plants. The evaluated plant growth regulators did not provide significant change in the physical characteristics of grapes and grape berries' Superior Seedless, however, N-Large® statistically showed superior results or equal to Pro-Gibb®, product usually employed in viticulture. Data from this study allowed the definition of new products that can increase productivity and quality of seedless grape cultivars, alternatively the conventionally employed, providing new options for wine growers of the São Francisco River Valley.

Key words: *post-harvest, plant growth regulators, Vitis vinifera L.*

INTRODUCTION

The semi-arid region of northeastern Brazil has competitive advantages over other producing regions of the country grapes due to climatic conditions, where the hot and dry climate combined with the use of modern irrigation technology allow the production of the fruit almost all year round being the pole Juazeiro/Petrolina in the São Francisco River Valley the highlight in growing and exporting of fine table grapes.

For a grape farming economically viable, we need to be productive and have good quality locks. Size and weight of the bunches are important components production to maximize profits and reduce costs. In marketing, size, appearance and taste of berries are decisive factors in the increased demand and therefore prices.

Studies indicate that the best quality product is what has the greatest potential for growth, such as seedless grapes (seedless), so it is essential to the sector be fully aware that the challenge of quality in table viticulture is permanent.However, the seedless grape growing has found difficulties in downtown shifting function and productivity, however, the Superior Seedless cultivar may, according to the management, presenting bunches and berries satisfactory sizes. In this sense, new research methods that seek to standardize and increase the productivity of this cultivar, with invaluable for export potential.

The plant regulators with similar function to auxins, cytokinins and gibberellins have been used to improve the characteristics of the clusters, such as increased size and thinning of berries, stems elongation, production of larger berries, delayed maturation, improved post-harvest, thickening pedicel, improved fertilization of flowers, removing seeds, etc. However, results with the use of plant growth regulators are dispersed, requiring more specific studies.

Considering the current importance of seedless grape growing, the need for increased productivity and quality of the berries and the search for alternatives to the use of Pro-Gibb®, product traditionally used in viticulture, this study aimed to assess the effects of bioregulators Stimulate®, X-Cyte® and N-Large® in the development of berries and quality of bunches of cultivar Superior Seedless grape.

MATERIAL AND METHODS

The experiment was conducted in wine-growing region of Vale do Rio São Francisco, pole Juazeiro (BA) -Petrolina (PE). The climate is classified by Köppen as Bswh type, which corresponds to very hot semi-arid region. Annual rainfall is 571.5 mm, distributed between the months of December to April. The average annual temperature is 26.4 °C, with average minimum of 20.6 °C and 31.7 °C average of the maximum. The soil of the experimental area is classified, according to [1] as Vertisol and its chemical properties at 0-20 cm depth were: pH in CaCl2: 6.42; Al: 0.0 cmolc dm^{-3}; Ca: 17.1 cmolc dm^{-3}; Mg: 5.2 cmolc dm^{-3}; P: 3528.3 mg dm^{-3}, K: 3.79 cmolc dm^{-3}; M.O.: 66.23 g kg^{-1}; CTC: 29.4 and base saturation of 88.8%.

The experiment was carried in commercial vineyard Superior Seedless crop or Festival (*Vitis vinifera* L.), in the process of full production, with about four years of age, using as rootstock cultivar IAC 313 'Tropical' ('Golia 'x Vitis cinerea). The trellis is the driving system employed in the area, with spacing of 4 x 2 m (1,250 plants ha^{-1}), with conduct of plants in a "herring-bone" or irrigation system located, drip, frequently and water volume according to the growth stage and climatic conditions. Other cultural employee treatment during the experiment were the conventionally adopted in the region and used by the producer. The plants were subjected to pruning the mixed type, with sticks (branches of the year) and grandchildren (secondary branches), with an average length of pruning a gem grandchildren and around fifteen gems in the sticks, according to the criterion the pruner, based on the production capacity of the plant, location and distribution of the rods in relation to the mooring wires. The period considered in the study corresponded to the 2nd half of the crop of 2006 and pruning was held on 15 May.

In order to provide the increased size of the bunches and berries, Stimulate® (0.009% kinetin - cytokinin, 0.005% gibberellic acid - GA3, 0.005% indole butyiric acid/IBA - auxin and 99.981% of inert ingredients) and X-Cyte® (0.04% kinetin - cytokinin) associated with a new commercial formulation of gibberellic acid (N-Large® - 4% of gibberellic acid (GA 3) and 96% inert ingredients) and the Pro-Gibb® (10% gibberellic acid - GA3), a product commonly used as a source of gibberellin whose doses were those conventionally employed by the manufacturer, were applied through spraying on berries development phase (18, 21, 51 and 56 days after pruning production). The treatments were: T1: Pro-Gibb® - control; T2: Stimulate® (D1) *; T3: Stimulate® (D2); T4: Stimulate® (D3); T5: Pro-Gibb® + X-Cyte® (DB); T6: Pro-Gibb® + X-Cyte® (DM); T7: Pro-Gibb® + X-Cyte® (DA); T8: N-Large®; T9: N-Large® + X-Cyte® (DB); T10: N + X-

Cyte® Large® (DM); T11: N-Large® + X-Cyte® (DA); * D1 = dose 1, dose 2 = D2, D3 dose = 3, DB = low dose, medium and DM = DA = high dose dose.

There were four applications, two order to stretch the stem and two in order to increase the size of the berries, the first two when the clusters showed from 2 to 5 cm long (18 and 21 days after pruning production, respectively), third on the phase "BB" (berries 6 to 8 mm in diameter), or 51 days after pruning production and the last at the stage of "pea" (berries with 15 mm diameter) corresponding to 56 days after pruning production when applied 1; 0.5; 10 and 10 mg L^{-1} GA3, respectively, corresponding to 0.01; 0.005; 0.1 and 0.1 g L-Pro-Gibb® 1 (T1) and 0.025; 0.0125; 0.25 and 0.25 U ml^{-1} N-Large® (T8). In turn, Stimulate® was applied in doses of 0.01; 0.005; 0.05 to 0.05% (D1) 0.05; 0.025; 0.1 to 0.1% (D2) and 0.075; 0.0375; 0.25 and 0.25% (D3), corresponding to the treatments T2, T3 and T4, respectively. The treatments T5 to T7 and T9 to T11, Pro-Gibb® or N-Large® were applied at doses of 1 and 0.5 mg L^{-1} GA3 at 18 and 21 days after pruning production, respectively and 51 and 56 days was applied 0.0004; 0.0008 and 0.0016% kinetin, respectively, corresponding to doses of 10 U ml^{-1} (DB), 20 ml L^{-1} (DM) and 40 U ml^{-1} (AD) X- Cyte®.

The treatments T2 and T11 was added Natural Óleo® 0.5%. The solutions were prepared on the same day of treatment, and applied by spraying directed to clusters using a conventional backpack sprayer, equipped with conical type nozzle. The spray volume used was an average of 90 mL per plant, approximately equivalent to 110 liters per hectare.

The experimental design was a randomized block with four replications, where each plot was considered a repeat with three plants in the same row of plants and separated by a plant either side of the line and spacing, making the border.

On the field proceeded fortnightly reviews of length and width of clusters (from the first application of plant growth regulators). For such evaluations, marked up 15 bunches per plot.

The right time for harvesting was considered when the average of curls had higher soluble solids content to 15 °Brix. At harvest, they evaluated the length, width and the average number of bunches per plant. Then picked up a representative grapes per plot, which was packed in polyethylene bag, properly identified and maintained at a temperature of 1 °C during the evaluation period, when he was taken to the State University Laboratory Bahia - UNEB, in Juazeiro/BA, where the following physical analyzes were performed: fresh weight of clusters, berries and stems, given directly into semi-analytical balance (g); length and width of clusters, rachis and berries, determined with the aid of a graduated ruler (cm). For measuring the dimensions of the berries (length and width/diameter) was used sample of a soft portion of each bunch, calculating thereafter the average of each berry; the length/diameter and berries; number of berries per cluster.

The data were submitted to variance analysis and the averages compared by Tukey test at 5% probability. We used the SigmaStat 2.0 statistical software for data analysis.

RESULTS AND DISCUSSION

Length of the bunches in the field

According to Table 1, bunches treated with N-Large® in order to stretch the rachis, if the longer-presented at 30 days after production pruning (DAP); no difference, however, the clusters treated with Pro-Gibb® or Stimulate® D3. Shorter curls were obtained by applying Stimulate® in D2, which did not differ from other treatments where employed the Stimulate® (St and St D1 D3). However, this effect was diluted during the development of clusters and, at harvest, only bunches treated with Pro-Gibb® the elongation phase of more X-Cyte® DM in stems of berries development phase (189.00 mm) differed from those treated with Pro-Gibb® (138.25 mm) (Table 3). In Table 1, we note that the 44 DAP and 58 DAP, there was no influence of plant bioregulators in length bunches.

Therefore, the plant growth regulator Stimulate® (D3) was sufficient to further stretching the curls to 44 DAP. These items are important and justified the application of plant growth regulator, which is an association between the three main growth regulators metabolism

promoters, which are auxins, gibberellins and cytokinins, essential throughout the development of the plant.

Other studies also show the importance of plant growth regulators along the stalk stretching grape clusters. Highest increase in the length of the bunches of "King's Ruby" was obtained by applying 50 mg l^{-1} GA3 alone or in combination with 50 mg L^{-1} of NAA. In turn, the NAA 50 mg L^{-1} used alone resulted in a clear reduction in the length of the bunches **[2].** According **[3]** 'Thompson Seedless' grapes portion of the young bunch (4 cm) would be more responsive to gibberellin. The authors found that every bunch portions treated with gibberellic acid increased rapidly in length.

Table 1. Length (mm) of grape bunches 'Superior Seedless' (Vitis vinifera L.) under different treatments Pro-Gibb®, Stimulate®, X-Cyte® and N-Large®, Juazeiro/BA. 2006.

		X-Cyte®			
		0,00	DB	DM	DA
1ª Evaluation 30 DAP[w]	N-Large®	119.48 a [y]	-	-	-
	Pro-Gibb®	117.36 ab	-	-	-
	St D1	94.47 bc			
	St D2	89.27 c			
	St D3	98.15 abc			
CV (%) = 26.58		*F* = 6.692 *[z]			
		0,00	DB	DM	DA
2ª Evaluation 44 DAP	N-Large®	142.77	-	-	-
	Pro-Gibb®	137.54	-	-	-
	St D1	125.57			
	St D2	118.23			
	St D3	133.64			
CV (%) = 14.80		*F* = 1.876 ns			
		0,00	DB	DM	DA
3ª Evaluation 58 DAP	N-Large®	163.88	167.84	177.27	175.79
	Pro-Gibb®	155.12	168.05	173.71	176.02
	St D1	165.05			
	St D2	148.59			
	St D3	166.85			
CV (%) = 10.42		*F* = 1.426 ns			

w DAP = days after pruning production.

y Average four replications. Means followed by the same letter do not differ statistically to each other (Tukey P≤0,05).

z significance of the F test analysis of variance for the effect of treatments on the length of curls, ns = Not significant, * = significant at the 5% probability, respectively.

CV (%) = coefficient of variation

Width of clusters in the field

In width (mm) of grape clusters 'Superior Seedless', the analysis of variance showed no significant difference at 5% (Table 2) for any of the dates of assessment, meaning that the clusters also responded to the application of different bioregulators applied during elongation of stems and subsequently, in order to increase the size of the berries.

[4] found in clusters of 'Centennial Seedless' which CPPU (cytokinin) in doses of 5.0; 7.5; 10.0; 12.5; 15.0 and 17.5 mg L^{-1} applied 14 days after full bloom, increased width of clusters. **[5]** observed an increase in the width of grape clusters 'Tieta' treated 15 days after flowering, with aqueous Stimulate® to 112 mL L^{-1}.

Table 2. Width (mm) of grape bunches 'Superior Seedless' (*Vitis vinifera* L.) under different treatments Pro-Gibb®, Stimulate®, X-Cyte® and N-Large®, Juazeiro/BA. 2006.

			X-Cyte		
		0,00	DB	DM	DA
1ª Evaluation 30 DAP [w]	N-Large	44.82 [y]	-	-	-
	Pro-Gibb	41.14	-	-	-
	St D1	39.13			
	St D2	35.67			
	St D3	39.17			
CV (%) = 16.73			*F* = 3.002 ns[z]		
		0,00	DB	DM	DA
2ª Evaluation 44 DAP	N-Large	61.03	-	-	-
	Pro-Gibb	58.82	-	-	-
	St D1	57.37			
	St D2	51.87			
	St D3	62.00			
CV (%) = 13.70			*F* = 2.182 ns		
		0.00	DB	DM	DA
3ª Evaluation 58 DAP	N-Large	92.22	87.39	94.18	96.41
	Pro-Gibb	88.48	90.38	96.56	95.03
	St D1	89.01			
	St D2	82.05			
	St D3	89.70			
CV (%) = 9.46			*F* = 1.583 ns		

w DAP = days after pruning production.
y Average four replications. Average scores were not statistically different from each other (Tukey P≤0,05).
z test F Significance analysis of variance for the effect of treatments on the width of clusters, we = Not significant.
CV (%) = coefficient of variation

Length, width, number of bunches and berries and cluster weight at harvest

With respect to the application of plant growth regulators in order to change physical characteristics of the clusters (Table 3) was observed at harvest, significant increase in length, when employed Pro-Gibb® targeting the stalk elongation associated with the X-Cyte® (DM) to increase the size of the berries, which differed only isolated use of Pro-Gibb®. It obtained also increase in width of clusters by employing Stimulate® (D3) and Pro-X-Cyte® Gibb® + (DB) which only differed statistically Pro-Gibb®. The increase in length and width was 36.71 and 43.47%, respectively.

Note that, with the application Pro-Gibb® commercially used product in order to stretch the grape stalks, both the length and the width of the bunches at harvest had lower values compared to the other treatments, although not significantly different from all. It is important to remember that the concentration of GA3 was the same as was used Gibb®-Pro or N-Large® both the stalk elongation as increasing the size of the berries, but, once again highlights the effect of N-Large®, but no significant difference in the physical characteristics of the grape clusters 'Superior Seedless'.

The number of bunches per plant at harvest was influenced by the application of plant growth regulators, as visualized in Table 3, where there is significant difference between the

number of clusters treated with N-Large® (36.50) of those which we used Stimulate® D3 (106.25). The other treatments had intermediate behavior. The desirable number of bunches for the cultivar Superior Seedless is in practice around 80 per plant **[6]**. Aside from plants treated with N-Large® + X-Cyte® DA and Stimulate® D3, 97.25 and 106.25 bunches per plant, respectively, the other treatments showed number of clusters below the recommended for cultivation Superior Seedless; however, it is difficult to conclude whether the low number of clusters was obtained as a result of the treatment.

The yield per plant in number and weight of clusters, is directly related to the number of productive shoots **[7]**. As the bud fertility depends on the conditions observed during the growth period of the previous cycle, the time of occurrence of flower differentiation, lack of tendency of the results with the application of the bioregulators, can be linked to the fact that the number of clusters flower had already been set in the previous cycle.

When assessing the number of berries per bunch and the mean cluster weight (g), it was found that they did not show significant difference between treatments employed; however, bunches treated with Pro-Gibb® showed the worst results in the number of berries per cluster. **[8]** had little effect on the number of berries with the application of gibberellic acid in grape clusters Niagara Rosada.

The mean cluster weight ranges from 232.26 g to bunches treated with N-Large® in stalk elongation phase plus X-Cyte® (DM) increasing the berries 346.35 g when applied without N-Large® combination, i.e., a variation of 49.12%. Vieira et al. (2008a) state that although obtain greater increases in mass clusters of 'Niagara Rosada' with applications of 30 mg L^{-1} TDZ (cytokinin), six days after flowering, the harvested fruits showed uneven ripeness, compact clusters and with low commercial value, due to the increase in the number of berries provided by TDZ.

[9] obtained an increase of 116.04; 177.12; 123.61 and 108.11 mass in 100% berries of 'Thompson Seedless' treated with 50, 100, 200 and 500 mg l-1 GA3, respectively, compared to untreated bunches obtained from berries. The same authors also mention that the effect of GA3 in increasing the mass of berries was more pronounced in the grape 'Thompson Seedless' than in 'Delight Seedless'; there is therefore no difference in the response of different varieties of seedless grapes for the application of GA3 on the average mass of berries. There is still, in the case of grapes' Thompson Seedless a maximum point in response to GA3, where higher doses cause an antagonistic effect, reducing the size of the berries.

Bunch weight increase in the grapes treated with gibberellic acid was also verified by **[10]** and **[8].**

Table 3. Length, width, number of bunches and berries and mass of grape bunches 'Superior Seedless' (Vitis vinifera L.) under different treatments Pro-Gibb®, Stimulate®, X-Cyte®and N-Large® at the time of harvest, Juazeiro/BA. 2006.

			X-Cyte		
		0,00	DB	DM	DA
	N-Large	158.25 ab[y]	166.75	185.50	156.00 ab
	Pro-Gibb	138.25 b	168.50	189.00 a	169.50 ab
Lenght	St D1	177.75 ab			
(mm)	St D2	154.00 ab			
	St D3	168.00 ab			
CV (%) = 17.58			*F* = 2.183 *[z]		
		0.00	DB	DM	DA
	N-Large	106.25 ab	104.50	93.50 ab	104.75 ab
	Pro-Gibb	82.25 b	116.00 a	105.75	103.00 ab
Width	St D1	107.75 ab			
(mm)	St D2	96.75 ab			

	St D3	118.00 a			
CV (%) = 19.30			*F* = 2.549 *		
		0,00	DB	DM	DA
Number of	N-Large	36.50 b [y]	69,.25 ab	57.25 ab	97.25 ab
	Pro-Gibb	50.75 ab	54.75 ab	57.00 ab	71.50 ab
	St D1	68.00 ab			
	St D2	69.50 ab			
	St D3	106.25 a			
CV (%) = 59.83			*F* = 2.570 *[z]		
		0,00	DB	DM	DA
No. berries/bunch	N-Large	48.25	47.25	47.25	47.50
	Pro-Gibb	41.00	57.75	45.50	47.00
	St D1	53.25			
	St D2	46.75			
	St D3	51.50			
CV (%) = 18.07			*F* = 0.857 ns		
		0,00	DB	DM	DA
Average mass (g)	N-Large	346.35	249.20	232.26	278.02
	Pro-Gibb	307.22	247.79	236.01	280.81
	St D1	305.33			
	St D2	243.92			
	St D3	294.83			
CV (%) = 26.45			*F* = 1.137 ns		

y Average four replications. Means followed by the same letter do not differ statistically to each other (Tukey P≤0,05).
z significance of the F test analysis of variance for the effect of treatments on the length, width, number of berries and average weight of the bunches, ns = Not significant, * = significant at the 5% probability, respectively.
CV (%) = coefficient of variation

[11] found in grape Niagara Rosada that the smaller the number of bunches per plant, average greater the mass thereof, which may have probably occurred in less competition function in the plant. The data from this study confirm that obtained by Vieira, where the fewest number of clusters obtained on plants treated with N-Large® can in part be contributed to which they presented the highest mass amount of curl (Table 3) .
Two factors influence the mass of grape clusters, the number and mass of berries. In general, when the number of berries increases, there is a reduction in size thereof. However, this work did not exist a direct relationship between treatment and the intensity of the effect produced.
The low average cluster weight in this experiment (Table 3) was mainly due to the excessive floral abortion due to the occurrence of a physiological disorder known as "the", where flowers and small berries fall early. This symptom, which generated malformed curls, was shown on the plot where this experiment was, from the flowering stage to the fruit set Berries ("BB"), possibly due to the large number of cloudy days that may have caused deficiency carbon skeleton, associated with some nutritional imbalance, as was observed regular budding and no symptoms of phytotoxicity with the use of plant growth regulators.
Like other production characteristics, the mass of the cluster is determined by plant genetics. However, it is observed that due to weather conditions, handling and use of chemicals, can be variable as found in this work.
To have their genetic origin based on the cultivar Thompson Seedless, the grape 'Superior Seedless' shows excessive force, which can lead to imbalance through excessive vegetation at

the expense of the development of inflorescences, summing up the production in a few small clusters. As the phenotype, in this case, the production is the expression of the interaction between the genotype and the environment and without possibility of modifying the genotype ('Superior Seedless') can work by changing the environmental conditions, such as in this work where plant growth regulators used to achieve gains in productivity by increasing the size of bunches and berries.

Length, width and weight of rachis

The data relating to the characteristics of the stalks are presented in Table 4. It is observed that the treatments did not promote significant increases in the characteristics of stems of grape clusters 'Superior Seedless' subjected to treatments with Pro-Gibb®, Stimulate® and N-Large® order to stretch the stem and Pro-Gibb®, Stimulate®, N-Large® and X-Cyte® to increase the size of the grape berries. The length of the stems ranged from 119.0 mm with the application of N-Large® to 163.5 mm with the use of N-Large® + X-Cyte® (DM). In turn, the width of the stems ranged from 60.5 mm using Pro-Gibb® to 76.5 mm to be used Gibb® + X-Pro-Cyte® (DB). In rachis weight range was 4.46 g (N-Large® + X-Cyte® DB) to 7.13 g (N-Large®).

So, as the appraised in length and width of clusters, the data obtained allow us to state that the application of Pro-Gibb®, the length and width of stems at harvest had lower values compared to the other treatments , although not statistically significant difference.

Table 4. Length, width and weight of stems of grape bunches 'Superior Seedless' (Vitis vinifera L.) under different treatments Pro-Gibb®, Stimulate®, X-Cyte® and N-Large®, Juazeiro/BA . 2006.

		X-Cyte			
		0,00	DB	DM	DA
	N-Large	119.00 [y]	126.50	163.50	128.00
	Pro-Gibb	121.50	141.50	152.25	143.25
Length	St D1	142.75			
(mm)	St D2	133.50			
	St D3	144.00			
CV (%) = 19.67		*F* = 1.618 ns[z]			
		0,00	DB	DM	DA
	N-Large	69.25	63.25	65.50	62.75
	Pro-Gibb	60.50	72.00	76.50	65.00
Width	St D1	65.00			
(mm)	St D2	71.25			
	St D3	71.25			
CV (%) = 14.48		*F* = 0.451 ns			
		0,00	DB	DM	DA
	N-Large	7.13	4.46	5.82	4.75
	Pro-Gibb	5.63	5.53	6.27	4.57
Mass	St D1	6.31			
(g)	St D2	5.64			
	St D3	5.91			
CV (%) = 28.69		*F* = 1.806 ns			

y Average four replications. Averages do not differ statistically to each other (Tukey P≤0,05).
z significance of the F test analysis of variance for the effect of treatments on the length, width and weight of stems, ns = Not significant.
CV (%) = coefficient of variation

The length of the stems is important, especially when treatment increases the number of berries per bunch. The reduced size of the stalk can not afford enough space for the development of a greater number of berries, developing the tight curl, allowing the bad formation and crack the same, as well as favoring the development of diseases.
The absence of significant differences between the treatments of this experiment may be due to lack of treatment control, so employees treatments may have increased the size of the stems proportionally. **[12]** working with the application of gibberellic acid with or without the CPPU (forchlorfenuron - cytokinin) in order to increase the size of the berries of 'Italy' in the San Francisco Valley region nor obtain differences between treatments with regard to Weight stems. **[8]** observed that gibberellic acid applications in grape Niagara Rosada at doses of 0; 15; 30; 45; 60; 75 and 90 mg L^{-1} in the flowering phase of the bunches increased linearly weight of rachis. The same authors found that grape clusters Niagara Rosada treated with thidiazuron showed increased attachment berries, resulting in increased cluster weight and the significant thickening of rachis.
According **[13]** the auxin produced by flowers and gibberellins produced by the vine berries have an important role in the development of pedicel, showing the importance of the application of exogenous regulators along the stalk elongation.

Length, diameter, mass and length / diameter of berries
It is noted from Table 5 that, in general, application by spraying Stimulate® D3 of 'Superior Seedless' locks in pre-flowering stage (0.0375 and 0.075%), berries 6 to 8 mm diameter (0.25%) and again in the berries with 15 mm diameter (0.25%) resulted in the greatest value berry size (length, diameter and weight), although it has not been statistically superior to the other treatments.
[14] and **[8]** observed that gibberellic acid applications were not efficient to promote increasing the size of the berries of 'Niagara Rosada'. The plunge grape clusters 'Tieta' 15 days after flowering in aqueous Stimulate® 0; 28; 56; 84 and 112 mL L^{-1} provided an increased number of berries, decreasing, however, the size and weight thereof **[5]** Tecchio et al., 2005). The association of girdling + gibberellic acid (5 + 40 mg L^{-1}) + the biostimulant Crop Set® (consisting of agave and micronutrients extracts with similar action to cytokinins) 0.2%, seedless grapes in 'Marroo Seedless 'cultivated in the Valley of the São Francisco River, generated the best result for length of berries, where we got berries with an average length of 23.09 mm **[15]** lower than that obtained in this experiment.

[16] work with 'Superior Seedless' in the region of the São Francisco Valley in 1999 and 2000, obtained an average weight of 280 g bunches, while the length and average diameter of berries were respectively 22.33 and 19.10 mm. According to the author, this cultivar presents as great differential advantage the size of the berries, whose diameter is superior to other varieties of seedless grapes and can still be high with the use of plant growth regulators and stem girdling. This statement could be proven in this work, where with the use of plant growth regulators was obtained average length of berries ranging from 25.3 to 26.8 mm diameter and 20.0 to 21.4 mm.

The berries diameter of results obtained in this study (Table 5) are similar to those found in other grape cultivars seeded in the same region. **[16, 17, 18]** obtained the following results, respectively for length and average diameter of berries for three varieties of seedless grapes tested in different regions of the country, including in the Valley of the São Francisco River: 26.0 and 19.9 mm in 'BRS Linda', 21.8 and 16.3 mm in the 'BRS Clara' and 23.6 and 19.9 mm in the 'BRS Morena', with the application of GA3 at doses of 10, 60 and 40 mg L^{-1}, BRS Linda ',' BRS Clara 'and' BRS Morena ', respectively, in phase "BB" (berries with an average diameter of 5 to 6 mm).

In the region of Porto Feliz/SP mixing 20 mg L^{-1} GA3 10 mg L^{-1} CPPU promoted the increase of the length and diameter of the berries of 'Italy' without prejudice to the mass of curls, resulting in improved the quality **[20]**. The estimated dose of 5 mg L^{-1} forchlorfenuron

associated with the dose of 5 mg L^{-1} GA3 significantly increased the mass and width of Centennial Seedless grape berries **[21]**.

The diameter is typically the primary variable used as a measure for evaluating the size of berries given cultivar. The quality standards for export table grapes to the United States require minimal berries diameter of 17 mm for the cultivar Superior Seedless. According to the results shown in Table 6, grape clusters' Superior Seedless treated with the plant growth regulators tested responded to these quality standards.

With respect to the effect of the treatments in the length / diameter of the berries, they do not statistically differ in format from the same, where the lower the ratio, the more rounded presents the berries. **[22]** studied the mode of action of gibberellins and auxin in grapes 'Sultanina' ('Thompson Seedless') and 'Black Corinth', both seeded. They concluded that berries treated with gibberellic acid have a higher length/diameter ratio when compared to the control or berries treated with auxin. In 'Black Corinth' grapes, the application of 4-CPA (auxin) at 30 mg L^{-1} soon after flowering, provided greater fixation of berries with nearly round shape, when compared to the application of gibberellic acid **[3]**.

Cytokinins are adenine purine-derived substances which have the function within other to promote cell division, nutrient mobilization, cell elongation, development of fruit, the hydrolysis of starch reserves etc. Since auxins increase the extensibility of the cell wall to promote cell division, growth of leaves and roots, and regulates the development of the fruit **[24]**. **[25]** studied the effect of cytokinins (thidiazuron) and auxin (quinmerac) the number and size of cells in the berries of 'Niagara Rosada' concluded that the number of cells was higher with two applications of thidiazuron at four days before anthesis and repeated six days after flowering, and reduced to a single application at six days after flowering, and this reduction was offset by an increase in cell size. In turn, the quinmerac, when applied at flowering and repeated at 14 days, increases number, but reduction of cell size. The opposite occurred when only made an application quinmerac, at 14 days after flowering.

Table 5. Length, diameter, weight and length/diameter ratio of vine berries 'Superior Seedless' (*Vitis vinifera* L.) under different treatments Pro-Gibb®, Stimulate®, X-Cyte® and N-Large®, Juazeiro/BA. 2006.

		X-Cyte			
		0.00	DB	DM	DA
	N-Large	26.5 [y]	25.8	25.3	25.6
	Pro-Gibb	26.5	25.6	25.4	25.9
Length	St D1	26.3			
(mm)	St D2	26.0			
	St D3	26.8			
CV (%) = 3.79		*F* = 1.220 ns[z]			
		0.00	DB	DM	DA
	N-Large	20.6	20.3	20.5	21.2
	Pro-Gibb	20.4	20.2	20.3	20.5
Diameter	St D1	20.7			
(mm)	St D2	20.0			
	St D3	21.4			
CV (%) = 4.16		*F* = 1.319 ns			
		0,00	DB	DM	DA
	N-Large	6.70	6.32	5.92	6.41
	Pro-Gibb	6.44	6.17	6.16	6.24
Weight	St D1	6.74			
(g)	St D2	6.16			

	St D3	6.88			
CV (%) = 9.22			*F* = 1.712 ns		
		0.00	DB	DM	DA
	N-Large	1.29	1.27	1.24	1.21
	Pro-Gibb	1.30	1.27	1.26	1.27
Length/Diameter	St D1	1.27			
	St D2	1.30			
	St D3	1.26			
CV (%) = 4.43			*F* = 1.964 ns		

[3] found that gibberellin stimulates the growth of berries in length, which would lead to an increase in the length/diameter ratio of the same, however, as mentioned in this work, this was not the answer cultivar Superior Seedless to bioregulators used, and Stimulate® and mainly Pro-Gibb® and N-Large®, gibberellin based products. Although no significant effect, it is important to note that curls receiving cytokinin (X-Cyte®) showed more rounded shape of berries (lower length/diameter) compared to those that received only gibberellin as Pro-Gibb® or N-Large® ; corroborating the data of the above authors.

The physiological changes that occur during the application of GA3 are associated with increases in the rate of cell division or increased cell. The pericarp increases with gibberellic acid, resulting from changes in partitioning of assimilates **[25]** or the cell wall plasticity of the cells **[26]**.

One symptom of excess GA3 is the formation of small seedless berries. Increasing the number of unviable berries (undeveloped), is undesirable whole, due to the final appearance of the clusters, reducing their marketability, therefore, do not contribute to crop yield, however, this undesirable effect of excess GA3 not It was observed in this experiment.

CONCLUSION

The lack of significant difference between commercially used product (Pro-Gibb®) and others tested (Stimulate®, X-Cyte® and N-Large®) with respect to the weight of berries and clusters, as well as the size of the berries, rachis and cluster as a result of the application of plant growth regulators, show promise in the cultivation of grape 'Superior Seedless', providing more alternatives to producers**.**

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