

  10.56238/tfidwv1-027

Débora Cavalcante dos Santos Carneiro

Agronomist, Master's Student in Agronomy (Horticulture)
Paulista State University 'Júlio de Mesquita Filho'

Harleson Sidney Almeida Monteiro

Agronomist Engineer, Master in Agronomy (Horticulture)
Paulista State University 'Júlio de Mesquita Filho'

Sinara de Nazaré Santana Brito

Agronomist, Master's Student in Agronomy (Horticulture)
Paulista State University 'Júlio de Mesquita Filho'

Carolina Ragoni Maniero

Agronomist, Master's Student in Agronomy (Horticulture)
Paulista State University 'Júlio de Mesquita Filho'

Pedro Hugo Vieira

Agronomist
Unifio University Center

Jose Antonio Ribeiro de Carvalho

Agronomist Engineer, Master in Agronomy (Horticulture)
Paulista State University 'Júlio de Mesquita Filho'

Juan Carlos Alonso

Graduating in Agronomist Engineering
Paulista State University 'Júlio de Mesquita Filho'

Antonia Benedita da Silva Bronze

PhD in Agrarian Sciences
Federal Rural University of the Amazon

Giuseppina Pace Pereira Lima

PhD in Biological Sciences
Paulista State University 'Júlio de Mesquita Filho'

Marco Antonio Tecchio

PhD in Agronomy (Horticulture)
Paulista State University 'Júlio de Mesquita Filho'

ABSTRACT

Viticulture has great expressiveness within the world and national fruit sector, being able to generate

employment and income in the most diverse regions of the world, and the world production of grapes, is around 77 tons of fruits. Brazil is among the world's largest grape producers, allowing to highlight the agroecological perspectives that are favorable to the exploration of numerous activities related to fruit growing tropical, subtropical and temperate climates. The objective of this work was to analyze grape production in the Southeast region of Brazil, in the period from 2016 to 2020, based on agricultural production data. The study focuses on the Southeast region of Brazil, considering for this study the states of Espírito Santo, Minas Gerais, Rio de Janeiro and São Paulo. The data to generate the results were obtained from the research of municipal agricultural production, during the years 2016 to 2020, where data were obtained regarding the indices of: harvested area, in hectare (ha); quantity produced, in kg/ha; and average yield of production, in Kg/ha⁻¹, from also calculated the rate of variation in percentage and arithmetic rate of creation, for the states and municipalities producing grape in the Southeast region of Brazil. From the data obtained, it is understood that viticulture has in the Southeast region of Brazil, edaphoclimatic conditions favorable to its cultivation and production, besides having a consumer market that is traditional and established, in the region itself, and the area harvested in hectare, jumped from 8,694, to 9,473 ha. This growth occurred mainly by the states of São Paulo and Minas Gerais, which had 8,018 and 1,223 hectares of harvested area, respectively. Followed by Espírito Santo and Rio de Janeiro, with the smallest harvest area, in the 2016-2020 harvests. As well as, for the arithmetic growth rate of the municipality of João Pinheiro, in the State of Minas Gerais, it presented the highest production rate, which is equivalent to 286.7% p.a. It is concluded that, in the Southeast region of Brazil, a viticulture grows based on small properties, with solid family labor, whose objective is lucratividade and on production, and having a destination mainly for the internal market.

Keywords: Fruit growing, Handling, Market, Production, *Vitis*.

1 INTRODUCTION

Viticulture has great expressiveness within the world and national fruit sector, being able to generate employment and income in the most diverse regions of the world (TEIXEIRA et al., 2014; MELLO; MACHADO, 2020). The world production of grapes is around 77 tons of fruits, the world's largest producers of this fruit, are: China, Italy, United States, Spain, France, Turkey, India, Chile, Argentina, South Africa and Brazil (AGRIANUAL, 2020; FAO, 2021).

Brazil is among the world's largest grape producers, allowing the agroecological perspectives that are favorable to the exploration of numerous activities related to fruit growing tropical, subtropical and temperate climates. So far, the country has its participation in a marginal way, as to the production and foreign trade of grapes (OIV, 2022).

Brazilian table grape production quantifies 1,435,387 tons in 2020. This production is concentrated in the South, Southeast and Northeast regions of Brazil, mainly in the states of Rio Grande do Sul, Pernambuco, São Paulo and the São Francisco Valley region (Bahia/Pernambuco). Southeastern Brazil, in 2020, represented 12.65% of the wine-growing area of the country, with a reduction of about 0.53% in the area with vines (IBGE, 2020).

The supply of fruits produced in brasileiro territory for the foreign market occurs in much of the year, and this is due to the territorial dimension that the country has, in addition to its geographical position, climatic conditions and soil conditions and types (DERAL, 2020). In turn, the cultivation of the vine can occur for different purposes, aiming at the destination of production (DA SILVA, 2020).

The grape grown in Brazilian territory is reserved for two markets that are: *grapes for fresh consumption and grape for processing* – juices; wines; raisins; and by-products (Brazilian Yearbook of Fruit, 2018; CARVALHO, 2018; PEREIRA et al., 2020).

The State of São Paulo, as the largest grape producer in the region, showed a reduction in the area, by about 1.74%, registering an area of 8,022 ha of vines. In Minas Gerais, the 7.83% increase in the area planted with vines and in the State of Espírito Santo increased the area by 2.48%; in the contrast of the states of the region, there is a significant reduction in the cultivation area of Rio de Janeiro, in 4.17% (MELLO; MACHADO, 2021).

In this way, the domestic consumer market of grapes, is highlighted by the State of São Paulo as the main grape negotiator in Brazil, and the occurrence of significant growth of vine fruits, especially seedless fruits, has been observed.

And this requirement of the national consumer, has encouraged countless producers to cultivate and produce cultivars of grapes without seeds, such as 'BRS Isis' and 'BRS Vitória' (DE ALMEIDA, 2017; MAYAN; RITSCHER; LAZZAROTTO, 2018). Therefore, the objective of this work was to analyze grape production in the Southeast region of Brazil, in the period from 2016 to 2020, based on agricultural production data.

2 MATERIAL AND METHODS

The study focuses on the Southeast region of Brazil, considering for this study the states of Espírito Santo (ES), Minas Gerais (MG), Rio de Janeiro (RJ) and São Paulo (SP). The climate that predominates in the region is tropical, presenting characteristics of humid summer and dry winter. So that if dstake also the humid subtropical climate, by various influences.

The data to generate the results was based on the research of municipal agricultural production (PAM, from 2016 to 2020, of the Brazilian Institute of Geography and Statistics - IBGE), providing and making available production, productivity and economic data of grape.

Data were processed regarding the indices of: harvested area, in hectare (ha); quantity produced, in kg/ha; and average yield, in Kg/ha⁻¹, in the states and grape producing municipalities of the Southeast region of Brazil. The Rate of Change in Percentage and Arianmetic Growth Rate were calculated.

To calculate grape production in percentage, the Percentage Change Rate (DVT) was used for the period 2016-2020, from Formula 1.

$$TVP = \frac{(PA-Pa)}{Pa} \times 100 \quad (1)$$

Where

DVT= Percentage production change rate;

PA= Final annual production; and

Pa= Initial annual production.

The calculation for the Aritmetic Growth Rates (TAC) of the production of the states with the highest grape production in the Southeast region of Brazil, in the last 5 years, were obtained from Formula 2.

$$TAC = \left(\frac{Vn - V0}{n} \right) \times 100 \quad (2)$$

Where

TAC= Growth Arianitetic Rate;

Vn= Last year's value;

V0= Base year value; and

n= Number of years.

The research carried out is considered qualitative explanatory. According to Marconi and Lakatos (2004), the explanatory research seeks to exemplify and facilitate the understanding of the results of the statistical survey, addressing more deeply what the data alone cannot demonstrate, through clear and

objective information. Thus, for this type of research establish cause-effect relationships, through the direct manipulation of the relative variables of the object of study.

It is considered a quantitative research. According to Malhotra et al. (2012), quantitative research is the intention to qualify the data, through results, structured data collection and with statistical rigor.

The Microsoft Office Excel computer program and the statistical program Minitab 18 were used in the preparation and organization of the tables, and the preparation of the graphs, respectively. In order to express the results and variation of these in the years evaluated, how much, the temporal evolution of the planted area, production and productivity of the grape crop.

3 RESULTS AND DISCUSSION

From the data obtained, it is understood that viticulture has in the Southeast region of Brazil, edaphoclimatic conditions favorable to its cultivation and production, besides having a consumer market that is traditional and established, in the region itself.

Based on Table 1, the area harvested in hectare (ha) jumped from 8,694 to 9,473 ha. This growth occurred mainly in the states of São Paulo and Minas Gerais, which had 8,018 and 1,223 hectare harvested area, respectively. Followed by Espírito Santo and Rio de Janeiro, with the smallest harvest area, in the 2016-2020 harvests.

Table 1 – Area harvested in hectare and quantity produced in ton produced by the states of the Southeast region of Brazil, in the period 2016/2020.

State/Year	Harvested Area (ha)					Quantity Produced (kg/ha)				
	2016	2017	2018	2019	2020	2016	2017	2018	2019	2020
Espirito Santo	154	196	198	188	212	2.509	3.468	3.194	2.727	3.257
Minas Gerais	830	889	1.088	1.213	1223	11.224	13.685	15.800	17.424	18.780
Rio de Janeiro	16	17	17	20	20	258	302	169	168	191
Sao Paulo	7.694	7.348	7.238	8.023	8018	140.613	133.261	138.055	149.064	149.803
Southeast Region	8.694	8.450	8.541	9.444	9.473	17.783	17.836	18.407	17.936	18.160
Brazil	77.164	75.734	74.477	74.611	73.726	14.428	23.020	21.376	19.914	19.472

Source: Prepared by the authors, based on MAP/IBGE (2022).

The State of São Paulo was the largest producer of grapes in the Southeast region of Brazil, in the 2016-2020 harvests (Table 1). In 2016, São Paulo produced 140,613 kg/ha, and in 2020, it produced 149,803 kg/ha, which represents a 7% growth when compared to the production of grape in the Southeast region of Brazil. Followed by the states of Minas Gerais, Espírito Santo and Rio de Janeiro, respectively.

The factors that contribute to the State of São Paulo, being the largest grape producer in the Southeast region, is being a traditional activity in much of the state. Like, it is a region that latitude is compensated by altitude, which adapts viticulture to be a practice of temperate climate; mild winter, with low precipitation and frost occurrence; summer is already quite hot and rainy, which favors the incidence

of various fungal diseases (PROTAS; CAMARGO; NETO, 2006; CAMARGO; TONIETTO; HOFFMANN, 2011; CAPPELLO; SPÓSITO; OSAKI, 2017).

From Table 2, we can see a fall in regional grape production (-2.51%) between 2016 and 2017. This fall can be explained possibly by replacing area with grape cultivation, especially by other crops that require less manpower. In addition to the climatic conditions, which caused the region to present a dry and hot period and the cost of inputs (MELLO, 2017).

Table 2. Variation in grape production in the Southeast region of Brazil in the period 2016/2020.

Southeast Region	Grape	Year	Production (kg/ha)	Variation (%)
		2016-2017	154.604 - 150.716	-2,51
		2017-2018	150.716 - 157.218	4,31
		2018-2019	157.218 - 169.383	7,74
		2019-2020	169.383 - 172.031	1,56

Source: Prepared by the authors, based on MAP/IBGE (2022).

Thus, the primary factor for this reduction to occur was a set of climatic factors, such as those mentioned above, in addition to early spring, late frost and excessive amount of rainfall in the sprouting phase (MELLO, 2017; OAK, 2018).

However, cultivation can occur in the most diverse regions and municipalities and, consequently, generate greater production amplitude, providing different harvest times and management of the grape fruit (BUENO, 2010).

In relation to the production of municipalities that cover the Southeast region of Brazil, between 2016 and 2020, São Miguel Arcanjo and Jundiaí, both in the State of São Paulo, stand out as the largest grape producers, as shown in Table 3.

Table 3 – Main municipalities in the Southeast region of Brazil, in quantity of grapes produced, in the period 2016/2020.

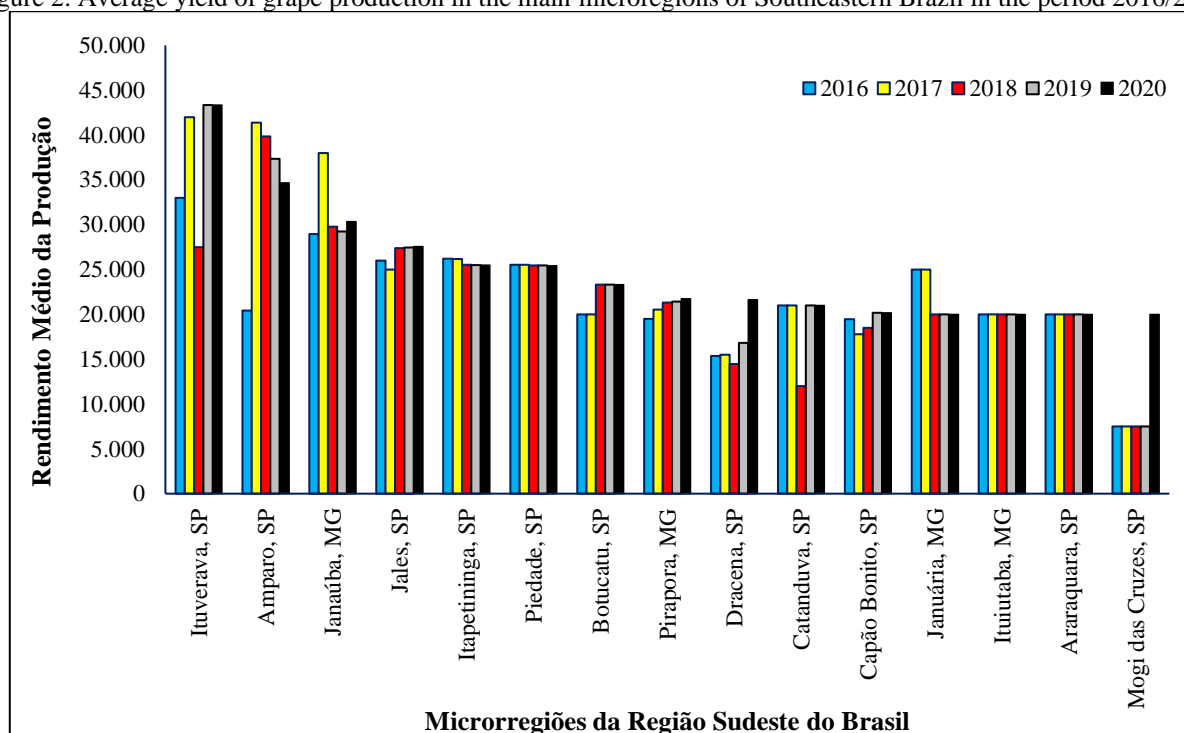
Municipalities	Quantity (kg/ha)				
	2016	2017	2018	2019	2020
São Miguel Arcanjo, SP	32.500	32.500	37.500	37.500	37.500
Jundiaí, SP	17.827	19.500	19.500	27.000	27.000
Pilar do Sul, SP	16.200	15.660	14.580	14.580	13.770
Palmeira d'Oeste, SP	9.686	2.842	8.961	8.961	8.961
Indaiatuba, SP	6.440	6.720	6.720	6.240	6.760
Pirapora, MG	2.500	3.059	3.400	3.510	3.967
São Gonçalo do Sapucaí, MG	979	1.182	1.670	1.845	2.781
João Pinheiro, MG	120	874	1.840	1.702	1.840
Nova Porteirinha, MG	1.200	1.560	1.540	1.600	1.613
Várzea da Palma MG	450	323	180	1.200	1.500
Venda Nova do Imigrante, ES	255	210	228	240	240
Domingos Martins, ES	132	172	172	198	222
Alfredo Chaves, ES	284	284	210	210	210
Vargem Alta, ES	202	202	202	198	198
Santa Maria de Jetibá, ES	96	160	160	160	162
Bom Jesus do Itabapoana, RJ	108	108	45	43	64
Cardoso Moreira, RJ	117	117	40	56	56

Source: Prepared by the authors, based on MAP/IBGE (2022).

It is noteworthy that the states of São Paulo and Minas Gerais are implementing grape production for fine wines, with differentiated quality and working wine tourism, from the installation of vineyards with production system with late harvest. Thus, it is understood that current viticulture has sought to understand several quality attributes that are required by the domestic or external consumer market of the fruit, in the question of appearance, taste and food safety (MONTEIRO et al., 2022).

The Southeast region of Brazil stands out with an average yield of 18,160 kg/ha. Having the microregions of Ituverava, Amparo and Janaúba, in the states of São Paulo and Minas Gerais, respectively with the highest average yields of production, in the 2016, 2017, 2018, 2019 and 2020 harvests, with Figure 1.

Figure 2. Average yield of grape production in the main microregions of Southeastern Brazil in the period 2016/2020.



Source: Prepared by the authors, based on MAP/IBGE (2022).

Translation:

Microregions of southeastern Brazil – Microregiões da Região Sudeste do Brasil

Rendimento Médio da produção - Average yield of production

The other microregions in the face of contrary climatic events, which affected most of the parreirais, especially in the 2016 harvest, led to a reduction in the average yield of production.

According to Table 4, the arithmetic growth rate of the municipality of João Pinheiro, in the State of Minas Gerais, presented the highest production rate, which is equivalent to 286.7% p.a. The municipality of São Miguel Arcanjo, in the State of São Paulo, despite having the highest production, had a growth of only 3.1% p.a.

Table 4 – Arianitic growth rate per year of the production of the largest grape producing municipalities in the Southeast region of Brazil, in the period 2016/2020.

Municipalities	Production (kg/ha)	Production (%)	TAC (% a.a)
São Miguel Arcanjo, SP	37.500	25,03	3,1
Jundiaí, SP	27.000	18,02	10,3
Pilar do Sul, SP	13.770	9,19	-3,0
Pirapora, MG	3.967	21,12	11,7
São Gonçalo do Sapucaí, MG	2.781	14,81	36,8
João Pinheiro, MG	1.840	9,80	286,7
Venda Nova do Imigrante, ES	240	7,37	-1,2
Domingos Martins, ES	222	6,82	13,6
Alfredo Chaves, ES	210	6,45	-5,2
Bom Jesus do Itabapoana, RJ	64	33,51	-8,1
Cardoso Moreira, RJ	56	29,32	-10,4
States	Production (kg/ha)	Production (%)	TAC (% a.a)
Espírito Santo (ES)	3.257	100	-
Minas Gerais (MG)	18.780	100	-
Rio de Janeiro (RJ)	191	100	-
São Paulo (SP)	149.803	100	-

Source: Prepared by the authors, based on MAP/IBGE (2022).

Demonstrating the need for the adoption of technologies, cultural activities, more efficient and appropriate agricultural practices, by most producers, to boost the productivity of viticulture.

The municipalities of Pilar do Sul (SP); New Sale of Immigrants, Alfredo Chaves (ES), showed a decrease of 3% p.a.; 1.2, 5.2% p.a.; the municipalities of Bom Jesus do Itabapoana and Cardoso Moreira, in the State of Rio de Janeiro, showed the largest decrease in production in the region, with 8.1 and 10.4% p.a.

It is understood that grape production in the Southeast region of Brazil has the influence of several factors, however two of them are of great importance for the production of quality grapes, which are: cultivar cup and rootstock. And this interaction between canopy and rootstock influences the vigor, production, size of bunches and berries, color, sugar content and fruit acidity, these agronomic and physiological characteristics are responsible for the quality of fruits that are produced and marketed in the region (LEÃO et al., 2020; MONTEIRO et al., 2022).

4 FINAL CONSIDERATIONS

Based on the data presented, grape production in the Southeast region of Brazil remained at about 172,000 tons, and with significant growth over the five years.

Ituverava and Amparo, in the State of São Paulo, present themselves as the largest microregions of grape producers in Southeastern Brazil.

The municipalities of São Miguel Arcanjo and Jundiaí, both in the state of São Paulo, stand out as the largest producers in the Southeast region, but with low annual growth in their production.

And note, that grape production is evolving more strongly due to production in areas of altitude and favorable climates.

And in the Southeast region of Brazil, a viticulture grows based on small properties, with solid family labor, whose objective is profitability over production, and having its production, as destination to mainly the domestic market.

REFERENCES

- AGRIANUAL. Anuário da Agricultura Brasileira, São Paulo, SP. p. 464. 2020.
- ANUÁRIO BRASILEIRO DA FRUTICULTURA 2018. ed. Gazeta, 2018.
- CAMARGO, A.; TONIETTO, J.; HOFFMANN, A. Progressos na Viticultura Brasileira. Revista Brasileira de Fruticultura, v. Esp., p. 144-140, 2011.
- CAPPELLO, F. P.; SPÓSITO, M. B.; OSAKI, M. Production costs and profitability of 'niagara rosada' table grape grown in different regions of São Paulo State. Revista Brasileira de Fruticultura, 39, p. 1-10, 2017.
- CARVALHO, K. N. P. Análise da viabilidade econômica da produção de uva de mesa. Universidade de Brasília, Brasília, 2018.
- DA SILVA, J. N. Viabilidade agroeconômica da viticultura nas Regiões Norte e Noroeste Fluminense. Universidade Estadual do Norte Fluminense Darcy Ribeiro, Campos dos Goytacazes, RJ, 2020.
- DE ALMEIDA, G. V. B. Uvas sem semente: uma tendência. Ellu Agronegócio. São Paulo, 2017.
- FAO. FAOSTAT. Crops and livestock products. Disponível em: <http://www.fao.org/faostat/en/#data/TP>. Acesso em: 23 out. 2022.
- IBGE. Instituto Brasileiro de Geografia e Estatística. Levantamento Sistemático da Produção Agrícola 2020. Disponível em: <<https://sidra.ibge.gov.br/pesquisa/pam/tabelas>> Acesso em: 12 out. 2022.
- LEÃO, P. C. S. et al. Yield components of the new seedless table grape "BRS Ísis" as affected by the rootstock under semi-arid tropical conditions. Scientia Horticulturae, v. 263. p. 109-114, jan. 2020.
- MAIA, J. D. G.; RITSCHER, P.; LAZZAROTTO, J. J. A viticultura de mesa no Brasil: produção para o mercado nacional e internacional. Embrapa uva e Vinho, Bento Gonçalves, RS, 2018.
- MALHOTRA, N. K. Pesquisa de Marketing: Uma orientação aplicada. Tradução: Lene Belon Ribeiro, Monica Stefani. 6. ed. Bookman, Porto Alegre, 2012.
- MARCONI, M. A.; LAKATOS, E. V. Metodologia científica. Editora Atlas, São Paulo, 2004.
- MELLO, L. M. R. de. Panorama da produção de uvas e vinhos no Brasil. Embrapa Uva e Vinho, Bento Gonçalves, RS, 2017.
- MELLO, L. M. R.; MACHADO, C. A. E. Cenário da Viticultura Nacional. Embrapa Uva e Vinho, Bento Gonçalves, RS, 2021.
- MELLO, L. M. R. et al. Vitivinicultura brasileira: panorama 2019. Bento Gonçalves, RS: Embrapa Uva e Vinho. Comunicado Técnico, n. 214, 21 p. 2020.
- MONTEIRO, H. S. A.; BASÍLIO, L. S.P.; BRITO, S. de N. S.; MONTEIRO, G. C.; LIMA, G. P. P.; TECCHIO, M. A. Uso de porta-enxerto em videira influencia a produção e a qualidade dos frutos da variedade copa: uma revisão narrativa. In: Editora Científica Digital (Org.). Open science research VI. Guarujá: Editora Científica Digital, 2022, p. 111-128.
- OIV – Organisation Internationale De La Vigne Et Du Vin. Statistiques du secteur vitivinicole mondial. Disponível em: <<http://www.oiv.int/>>. Acesso em: 20 out. 2022.
- PEREIRA, G. E.; TONIETTO, J.; ZANUS, M. C.; SANTOS, H. P. dos; PROTAS, J. F. da S.; MELLO, L. M. R. de. Vinhos do Brasil: contrastes na geografia e no manejo das videiras nas três viticulturas do país. Embrapa Uva e Vinho, Bento Gonçalves, RS, 2020.
- PROTAS, J. F. S. et al. Vitivinicultura brasileira: regiões tradicionais e pólos emergentes. Informe Agropecuário, Belo Horizonte, MG, v. 27, n. 234, p. 7, set./out. 2006.
- TEIXEIRA, A. et al. Natural bioactive compounds from winery by-products as health promoters: a review. International Journal of Molecular Sciences, v. 15, n. 9, p. 15638-15678, sep. 2014.